

notebook_task1

September 24, 2020

0.0.1 Summary

This is my submission towards the QOSF September 2020 screening task. I have attempted task 1, which involves optimizing the parameters of a variational circuit so that its output comes as close as possible to a random quantum state. The effect of increasing the number of layers in the ansatz is to be shown via a plot.

0.0.2 Author

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0.0.3 Solution description

This solution: * Uses a base class to simplify experimenting with different types of circuits * Implements gradient descent for the optimization with a decay policy for the learning rate * Compares different types of circuits in terms of simulating the target state

0.0.4 Requirements

This notebook uses

- Qiskit (version 0.19.6) for the quantum simulation
- numpy for array calculations
- pyplot from matplotlib for plotting
- Python's random module.

0.0.5 Problem statement

The problem statement for task 1 (developed by QOSF) is given below:

Task 1 Implement, on a quantum simulator of your choice, the following 4 qubits state $|\psi(\theta)\rangle$:

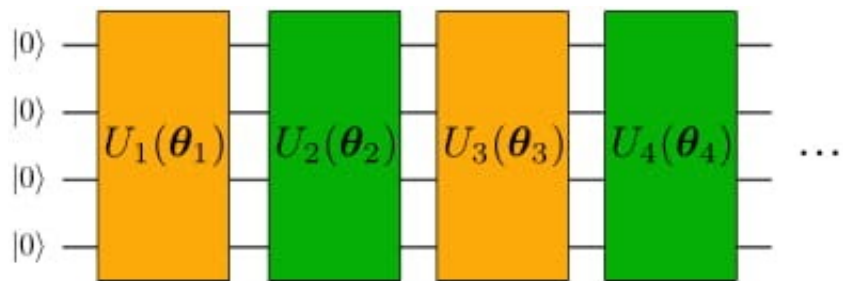
Where the number of layers, denoted with L , has to be considered as a parameter. We call 1 layer the combination of 1 yellow + 1 green block, so, for example, $U1 + U2$ is a layer. The odd/even variational blocks are given by:

Even block:

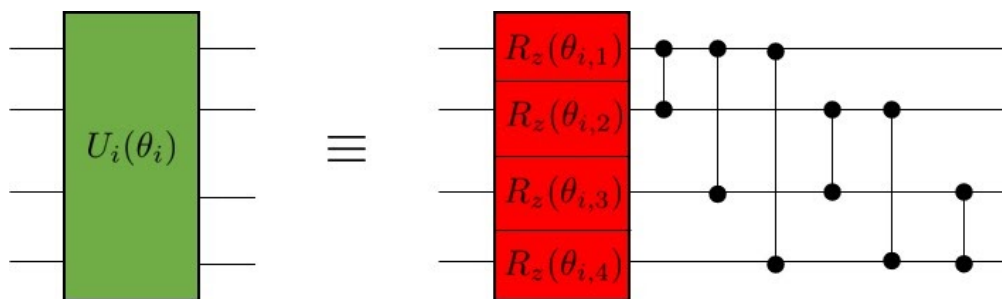
Odd block:

The angles $\theta_{i,n}$ are variational parameters, lying in the interval $(0, 2\pi)$, initialized at random. Double qubit gates are CZ gates.

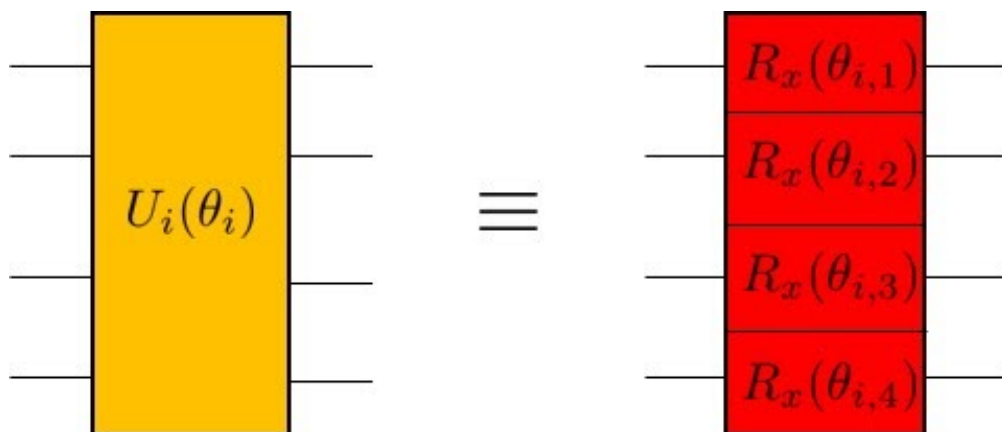
Report with a plot, as a function of the number of layers, L , the minimum distance



Circuit Ansatz



Even block



Odd block

$$= \min_{\theta} || |\psi(\theta)\rangle - |\phi\rangle ||$$

Where $|\phi\rangle$ is a randomly generated vector on 4 qubits and the norm $|| |\psi\rangle ||$, of a state $|\psi\rangle$, simply denotes the square root of the sum of the modulus square of the components of $|\psi\rangle$. The right set of parameters $\theta_{i,n}$ can be found via any method of choice (e.g. grid-search or gradient descent)

Bonus question:

Try using other gates for the parametrized gates and see what happens.

0.0.6 Solution

First, we import the required packages.

```
In [6]: import qiskit
        qiskit.__qiskit_version__

Out[6]: {'qiskit-terra': '0.14.2',
        'qiskit-aer': '0.5.2',
        'qiskit-ignis': '0.3.3',
        'qiskit-ibmq-provider': '0.7.2',
        'qiskit-aqua': '0.7.3',
        'qiskit': '0.19.6'}

In [7]: from qiskit import QuantumCircuit, QuantumRegister, ClassicalRegister
        from qiskit.circuit import ParameterVector, Parameter
        from qiskit import Aer, execute

        import numpy as np
        import random
        from matplotlib import pyplot as plt
```

Next, we define a base class for the parametric circuits ansatz. This base class, “parametric_ckt”, implements several useful methods like building the required quantum circuit for specified number of layers, gradient descent algorithm for the optimization, cost function, and virtual methods for the odd and even layers. A plot generating function is also included.

A run method is provided to implement the optimization for multiple circuits up to the specified number of maximum layers. Once the circuit ansatz is defined, the run method will optimize the parametric circuits with different number of layers for the same randomly-generated quantum state (here, it is called the target state).

The idea behind developing this base class is to be able to focus on developing the odd and even layer circuits by extending this class as many times as desired. Therefore, in this notebook, this class will be extended several times with the desired odd- and even-layer circuits. Other methods, like the gradient descent, can be reused for circuits with different number of parameters! Besides this, this class is highly configurable, including the ability to generate target state and the circuit for the number of qubits not equal to 4 as well.

```
In [8]: class parametric_ckt:
        """
```

Base class for parametric or variational circuits used for this task.

Provides useful methods like initializing target quantum state randomly, building circuit with specified odd and even layers, gradient descent to optimize variational circuit to result in a state as close as possible to the target state.

"""

```
def __init__(self, num_qubits):
    """Constructor for the class parametric_ckt. It initializes member variables t

    self.num_qubits = num_qubits
    self.barriers_on = False
    self.alpha = 0.01
    self.max_iter = 1000
    self.theta_step = 0.01
    self.target_cost = 0.05
    self.max_layers = 7
    self.current_layers = 1
    self.qc = QuantumCircuit(num_qubits)
    self.name = 'Circuit'

def init_ckt(self):
    """Creates a data member quantum circuit with number of qubits taken from clas

    self.qc = QuantumCircuit(self.num_qubits)

def init_target_state(self):
    """Initializes the target state variable randomly to a complex vector with uni

    random.seed(10598)
    self.target_state = np.zeros(2**self.num_qubits) + 1.0j*np.zeros(2**self.num_q
    for i in range(2**self.num_qubits):
        self.target_state[i] = random.random() + 1.0j*random.random()
    self.target_state = self.target_state/np.linalg.norm(self.target_state)
    print("-----")
    print("Initializing the target quantum state of ", self.num_qubits, " qubit(s)
    print("Norm of the above vector is ", np.linalg.norm(self.target_state))

def append_odd_layer(self, sub_layer_id):
    """Used to specify the quantum circuit for the odd layer. Useful for inherited

    #dummy identity gate implementation for this base class
    for i in range(self.num_qubits):
        self.qc.i(i)

def append_even_layer(self, sub_layer_id):
    """Used to specify the quantum circuit for the even layer. Useful for inherite
```

```

        #dummy identity gate implementation for this base class
        for i in range(self.num_qubits):
            self.qc.i(i)

def build_ckt(self, num_layers):
    """Builds the variational quantum circuit with odd and even layers as specified"""

    self.init_ckt()
    for i in range(num_layers):
        self.append_odd_layer(2*i + 1)
        if(self.barriers_on):
            self.qc.barrier()
        self.append_even_layer(2*i + 2)
        if(self.barriers_on):
            self.qc.barrier()

    print("-----")
    print("Circuit ", self.name, " constructed with ", num_layers, " layers. Number of parameters: ", self.num_params)

def get_ckt(self):
    """Returns the quantum circuit member."""

    return self.qc

def simulate_state(self, theta):
    """
    Returns the statevector after performing statevector simulation on
    member quantum circuit with the given parameters.
    """

    d = {}
    for val in self.qc.parameters:
        d[val] = theta[val]
    local_qc = self.qc.copy('local_qc')
    #Deep copying the circuit as qiskit doesn't seem to support binding parameters
    #to the same parametric circuit
    local_qc = local_qc.bind_parameters(d)
    simulator_sv = Aer.get_backend('statevector_simulator')
    result_sv = execute(local_qc, simulator_sv).result()
    statevector_sv = result_sv.get_statevector(local_qc)
    return statevector_sv

def get_cost(self, theta):
    """
    Returns the cost defined by 2-norm of difference between simulated state vector
    and target state vector.
    """

```

```

statevector_sv = self.simulate_state(theta)
return np.linalg.norm(statevector_sv - self.target_state)

def grad_descent(self):
    """
    Implements gradient descent algorithm to optimize the member quantum circuit
    to achieve the target state, and saves the optimal parameters.
    """

    #Initializing stuff related to the optimization
    iter_cnt = 0
    learning_rate = self.alpha
    reduced = 0
    self.theta_opt = {}
    random.seed(10598)

    #Initializing circuit parameters with random values
    params = {}
    for idx in self.qc.parameters:
        params[idx] = 0.05*random.random()
    print("-----")
    print("Initialized circuit parameters prior to gradient descent randomly as follows")
    for idx in self.qc.parameters:
        print("idx = ", idx, "params = ", params[idx])

    #calculate original cost(theta)
    f_orig = self.get_cost(params)

    #while((convergence_not_achieved) and (iter < max_iter))
    while((f_orig > self.target_cost) and (iter_cnt < self.max_iter)):
        #Empty dict to store gradient for this iteration
        grad = {}

        #for each parameter
        for idx in self.qc.parameters:
            #create grad_calc_param_dict initialized with original parameters for
            grad_calc_params = params.copy()

            #only 1 parameter replaced by theta_i + step, used to calculate partial
            #respect to that parameter
            grad_calc_params[idx] += self.theta_step

            #calculate cost(theta_i + step, rest_theta_unchanged)
            f_new_theta_i = self.get_cost(grad_calc_params)

            #calculate gradient wrt theta_i = (cost(theta_i + step, rest_theta) -
            #thereby obtaining the gradient wrt all parameters for this iteration

```

```

        grad[idx] = (f_new_theta_i - f_orig)/self.theta_step

    #for each parameter:
    for idx in self.qc.parameters:
        #update each parameter as follows: theta_i = theta_i - (learning_rate
        params[idx] -= learning_rate*grad[idx]

    #calculate cost(theta), where theta is updated theta after this iteration
    f_orig = self.get_cost(params)

    iter_cnt += 1

    #This is a policy to reduce the learning rate based on current iteration
    #this reduces the learning rate as iterations increase, so that oscillation
    #large learning rate gets avoided.
    #this has been figured out after several trials; more sophisticated strateg
    if((iter_cnt % 40) == 0) and (iter_cnt < 140)):
        learning_rate /= np.sqrt(10)
        print("-----")
        print("REDUCING ALPHA TO ", learning_rate, " at iteration = ", iter_cnt)

    #Print coverage related information at the end of every iteration
    print("-----")
    print("Circuit = ", self.name, "| Layers = ", self.current_layers, " | At e

    #Print completion message
    print("-----")
    print("Optimization complete.")

    #return optimum parameters
    self.theta_opt = params.copy()
    print("After optimization, the optimal parameters are \n", self.theta_opt, "\n")

def run(self):
    """Optimizes parametric quantum circuits upto given maximum number of layers."""

    #Initializing the target quantum state once
    #same state will be used while optimizing circuits of different layers
    self.init_target_state()

    #Useful for plotting
    self.cost_arr = np.zeros((self.max_layers))
    self.layer_arr = np.linspace(1,self.max_layers,self.max_layers)

    #Building the circuit for differet layers and optimizing
    for i in range(1, self.max_layers+1):
        self.current_layers = i
        self.build_ckt(i)

```

```

        self.grad_descent()

        #Print cost after optimization is complete.
        print("-----")
        print("Circuit = ", self.name, " Layers = ", i, " Cost after optimization = ", self.cost_arr[i-1])
        self.cost_arr[i-1] = self.get_cost(self.theta_opt)
        print("-----")
        print("After optimization for all specified layers, the respective minimum cost is: ", self.cost_arr[-1])

    def show_plot(self):
        """Used to plot variation of minimum cost/error after optimization vs number of layers"""

        plt.figure(figsize=(7,7))
        plt.plot(self.layer_arr, self.cost_arr, '--bo', label=self.name)
        plt.xlabel("Number of layers")
        plt.ylabel("Minimum cost after optimization of "+self.name)
        plt.title("Variation of minimum error vs number of layers for "+self.name)
        plt.legend()
        plt.show()

```

0.0.7 Author's note on the gradient descent implementation

For the gradient descent implementation here, the initial learning rate (alpha) can be specified, but a policy based on the number of iterations to modify the learning rate has been implemented. As the number of iterations increase, the learning rate is decreased periodically. This was figured out because a fixed learning rate was either found to be too high and leading to an oscillation of the cost about the minima, or it was too low, thereby slowing down the optimization. A gradual decay is found to be a good approach to cover the initial reduction in the cost quickly, while reducing the learning rate later to be able to reach the minima carefully.

While experimenting with different number of layers, I observed that perhaps the choice of initial learning rate (or decay thereof) which might be suitable to a particular number of layers (say, number of layers = 4) may not be suitable for a different number of layers (say, number of layers = 8). A possible reason for this could be that the “loss landscapes” for different number of layers vary significantly. The currently chosen combination of learning rate and step size for θ has been found by trying various combinations; more sophisticated strategies for learning rate decay can be explored.

0.0.8 Using the developed class

As a sanity check, we will try to generate a quantum circuit of 4 qubits and 2 layers from this base class. The odd and even (sub)layers will both turn out to be the identity gates (as defined):

```

In [9]: c0 = parametric_ckt(4)
        c0.name = 'trial_ckt'
        c0.barriers_on = True
        c0.build_ckt(2)

```



```
qc0 = c0.get_ckt()
qc0.draw(output='text')
```

Circuit trial_ckt constructed with 2 layers. Number of parameters = 0 .

Out [9]:

```
q_0:  I  I  I  I
q_1:  I  I  I  I
q_2:  I  I  I  I
q_3:  I  I  I  I
```

Next, we extend the base class to implement the even and odd sub layers of the circuit ansatz given in the problem statement.

```
In [10]: class problem_ckt(parametric_ckt):
    def append_odd_layer(self, sub_layer_id):
        theta = ParameterVector('theta'+str(sub_layer_id), length=self.num_qubits)
        for i in range(self.num_qubits):
            self.qc.rx(theta[i], i)

    def append_even_layer(self, sub_layer_id):
        theta = ParameterVector('theta'+str(sub_layer_id), length=self.num_qubits)
        for i in range(self.num_qubits):
            self.qc.rz(theta[i], i)
        for i in range(self.num_qubits):
            for j in range(i+1, self.num_qubits):
                self.qc.cz(i, j)
```

To check this circuit, we will draw the 2 layer version below. The labelling convention for the parameters has been selected to be consistent with the figures in the problem statement.

```
In [11]: c1 = problem_ckt(4)
    c1.name = 'problem_ckt'
    c1.barriers_on = True
    c1.build_ckt(2)
    qc1 = c1.get_ckt()
    qc1.draw(output='text')
```

Circuit problem_ckt constructed with 2 layers. Number of parameters = 16 .

```

Out [11]:
      z
q_0:  RX(theta1[0])  RZ(theta2[0]) z
      z
q_1:  RX(theta1[1])  RZ(theta2[1]) z
      z
q_2:  RX(theta1[2])  RZ(theta2[2]) z
      z
q_3:  RX(theta1[3])  RZ(theta2[3]) z
      z
n
nq_0:  RX(theta3[0])  RZ(theta4[0])
n
nq_1:  RX(theta3[1])  RZ(theta4[1])
n
nq_2:  RX(theta3[2])  RZ(theta4[2])
n
nq_3:  RX(theta3[3])  RZ(theta4[3])
n

```

We will create a new object and execute the run method for maximum layers = 7. This will initialize the target quantum state randomly, and sequentially build and optimize the circuits with odd and even layers as defined above, and with the number of layers 1 upto (and including) 7.

```

In [12]: c2 = problem_ckt(4)
          c2.name = 'problem_ckt'
          c2.max_iter = 300
          c2.theta_step = 0.1
          c2.alpha = 1
          c2.max_layers = 7
          c2.run()

```

```

-----
Initializing the target quantum state of 4 qubit(s) randomly as =
[[0.23159775+0.26854207j]
 [0.00311054+0.21447093j]
 [0.29194447+0.13477361j]
 [0.17650717+0.08413362j]
 [0.14187615+0.0357318j ]
 [0.24618063+0.11442822j]
 [0.15077095+0.10407606j]
 [0.03843793+0.10371948j]
 [0.29033053+0.05840304j]
 [0.18982017+0.03884797j]
 [0.28842729+0.01764276j]
 [0.05958415+0.02353189j]
 [0.29649158+0.18139203j]
 [0.20412371+0.00778893j]
 [0.20336406+0.26472618j]

```

```
[0.18037261+0.16232797j]]
Norm of the above vector is 1.0
```

```
-----
Circuit  problem_ckt  constructed with  1  layers. Number of parameters =  8 .
-----
```

```
Initialized circuit parameters prior to gradient descent randomly as follows:
```

```
idx =  theta2[2]  params =  0.03719052023213644
idx =  theta1[3]  params =  0.04312312828020062
idx =  theta2[1]  params =  0.0004994971757621869
idx =  theta1[2]  params =  0.03444025418170515
idx =  theta2[3]  params =  0.046881140646663634
idx =  theta1[0]  params =  0.02164226791611938
idx =  theta2[0]  params =  0.028343942770291508
idx =  theta1[1]  params =  0.013510378554063363
-----
```

```
Circuit =  problem_ckt | Layers =  1  | At end of iteration =  1  | cost =  1.2330120201662398
-----
```

```
Circuit =  problem_ckt | Layers =  1  | At end of iteration =  2  | cost =  1.2219140243337006
-----
```

```
Circuit =  problem_ckt | Layers =  1  | At end of iteration =  3  | cost =  1.2095452008643437
-----
```

```
Circuit =  problem_ckt | Layers =  1  | At end of iteration =  4  | cost =  1.195324728666118
-----
```

```
Circuit =  problem_ckt | Layers =  1  | At end of iteration =  5  | cost =  1.1785953330432042
-----
```

```
Circuit =  problem_ckt | Layers =  1  | At end of iteration =  6  | cost =  1.1586573327569192
-----
```

```
Circuit =  problem_ckt | Layers =  1  | At end of iteration =  7  | cost =  1.1348549355691424
-----
```

```
Circuit =  problem_ckt | Layers =  1  | At end of iteration =  8  | cost =  1.1067438718988016
-----
```

```
Circuit =  problem_ckt | Layers =  1  | At end of iteration =  9  | cost =  1.0743559589401293
-----
```

```
Circuit =  problem_ckt | Layers =  1  | At end of iteration = 10  | cost =  1.038513230678746
-----
```

```
Circuit =  problem_ckt | Layers =  1  | At end of iteration = 11  | cost =  1.001009799709077
-----
```

```
Circuit =  problem_ckt | Layers =  1  | At end of iteration = 12  | cost =  0.964358164199413
-----
```

```
Circuit =  problem_ckt | Layers =  1  | At end of iteration = 13  | cost =  0.930971057524495
-----
```

```
Circuit =  problem_ckt | Layers =  1  | At end of iteration = 14  | cost =  0.902258902766357
-----
```

```
Circuit =  problem_ckt | Layers =  1  | At end of iteration = 15  | cost =  0.878442170080357
-----
```

```
Circuit =  problem_ckt | Layers =  1  | At end of iteration = 16  | cost =  0.859111555227701
-----
```

```
Circuit =  problem_ckt | Layers =  1  | At end of iteration = 17  | cost =  0.84375855151488
-----
```

```

-----
Circuit =  problem_ckt | Layers =  1 | At end of iteration = 18 | cost = 0.831880890925805
-----
Circuit =  problem_ckt | Layers =  1 | At end of iteration = 19 | cost = 0.822923527953041
-----
Circuit =  problem_ckt | Layers =  1 | At end of iteration = 20 | cost = 0.816296760505891
-----
Circuit =  problem_ckt | Layers =  1 | At end of iteration = 21 | cost = 0.811450738374082
-----
Circuit =  problem_ckt | Layers =  1 | At end of iteration = 22 | cost = 0.807927855384624
-----
Circuit =  problem_ckt | Layers =  1 | At end of iteration = 23 | cost = 0.805374191734372
-----
Circuit =  problem_ckt | Layers =  1 | At end of iteration = 24 | cost = 0.803526659020989
-----
Circuit =  problem_ckt | Layers =  1 | At end of iteration = 25 | cost = 0.802193097128835
-----
Circuit =  problem_ckt | Layers =  1 | At end of iteration = 26 | cost = 0.801233914642611
-----
Circuit =  problem_ckt | Layers =  1 | At end of iteration = 27 | cost = 0.800547692923426
-----
Circuit =  problem_ckt | Layers =  1 | At end of iteration = 28 | cost = 0.800060579218429
-----
Circuit =  problem_ckt | Layers =  1 | At end of iteration = 29 | cost = 0.799718642561966
-----
Circuit =  problem_ckt | Layers =  1 | At end of iteration = 30 | cost = 0.799482396437333
-----
Circuit =  problem_ckt | Layers =  1 | At end of iteration = 31 | cost = 0.799322870082056
-----
Circuit =  problem_ckt | Layers =  1 | At end of iteration = 32 | cost = 0.799218779626448
-----
Circuit =  problem_ckt | Layers =  1 | At end of iteration = 33 | cost = 0.799154480961146
-----
Circuit =  problem_ckt | Layers =  1 | At end of iteration = 34 | cost = 0.799118480586789
-----
Circuit =  problem_ckt | Layers =  1 | At end of iteration = 35 | cost = 0.799102347024317
-----
Circuit =  problem_ckt | Layers =  1 | At end of iteration = 36 | cost = 0.799099911545142
-----
Circuit =  problem_ckt | Layers =  1 | At end of iteration = 37 | cost = 0.799106679119201
-----
Circuit =  problem_ckt | Layers =  1 | At end of iteration = 38 | cost = 0.799119392941853
-----
Circuit =  problem_ckt | Layers =  1 | At end of iteration = 39 | cost = 0.799135711706154
-----
REDUCING ALPHA TO 0.31622776601683794 at iteration = 40
-----
Circuit =  problem_ckt | Layers =  1 | At end of iteration = 40 | cost = 0.799153969992570

```

```

-----
Circuit =  problem_ckt | Layers =  1 | At end of iteration = 41 | cost = 0.799159613599687
-----
Circuit =  problem_ckt | Layers =  1 | At end of iteration = 42 | cost = 0.799165306054671
-----
Circuit =  problem_ckt | Layers =  1 | At end of iteration = 43 | cost = 0.799171025838123
-----
Circuit =  problem_ckt | Layers =  1 | At end of iteration = 44 | cost = 0.799176753407837
-----
Circuit =  problem_ckt | Layers =  1 | At end of iteration = 45 | cost = 0.799182471163247
-----
Circuit =  problem_ckt | Layers =  1 | At end of iteration = 46 | cost = 0.799188163364758
-----
Circuit =  problem_ckt | Layers =  1 | At end of iteration = 47 | cost = 0.799193816027585
-----
Circuit =  problem_ckt | Layers =  1 | At end of iteration = 48 | cost = 0.799199416802917
-----
Circuit =  problem_ckt | Layers =  1 | At end of iteration = 49 | cost = 0.799204954854632
-----
Circuit =  problem_ckt | Layers =  1 | At end of iteration = 50 | cost = 0.799210420736788
-----
Circuit =  problem_ckt | Layers =  1 | At end of iteration = 51 | cost = 0.799215806275053
-----
Circuit =  problem_ckt | Layers =  1 | At end of iteration = 52 | cost = 0.799221104453936
-----
Circuit =  problem_ckt | Layers =  1 | At end of iteration = 53 | cost = 0.799226309310800
-----
Circuit =  problem_ckt | Layers =  1 | At end of iteration = 54 | cost = 0.799231415837076
-----
Circuit =  problem_ckt | Layers =  1 | At end of iteration = 55 | cost = 0.799236419886724
-----
Circuit =  problem_ckt | Layers =  1 | At end of iteration = 56 | cost = 0.799241318091791
-----
Circuit =  problem_ckt | Layers =  1 | At end of iteration = 57 | cost = 0.799246107784761
-----
Circuit =  problem_ckt | Layers =  1 | At end of iteration = 58 | cost = 0.799250786927334
-----
Circuit =  problem_ckt | Layers =  1 | At end of iteration = 59 | cost = 0.799255354045211
-----
Circuit =  problem_ckt | Layers =  1 | At end of iteration = 60 | cost = 0.799259808168499
-----
Circuit =  problem_ckt | Layers =  1 | At end of iteration = 61 | cost = 0.799264148777293
-----
Circuit =  problem_ckt | Layers =  1 | At end of iteration = 62 | cost = 0.799268375752065
-----
Circuit =  problem_ckt | Layers =  1 | At end of iteration = 63 | cost = 0.799272489328459
-----
Circuit =  problem_ckt | Layers =  1 | At end of iteration = 64 | cost = 0.799276490056168
-----

```

```

-----
Circuit =  problem_ckt | Layers =  1 | At end of iteration = 65 | cost = 0.7992803787615200
-----
Circuit =  problem_ckt | Layers =  1 | At end of iteration = 66 | cost = 0.7992841565135080
-----
Circuit =  problem_ckt | Layers =  1 | At end of iteration = 67 | cost = 0.7992878245929460
-----
Circuit =  problem_ckt | Layers =  1 | At end of iteration = 68 | cost = 0.7992913844645110
-----
Circuit =  problem_ckt | Layers =  1 | At end of iteration = 69 | cost = 0.7992948377514030
-----
Circuit =  problem_ckt | Layers =  1 | At end of iteration = 70 | cost = 0.7992981862124330
-----
Circuit =  problem_ckt | Layers =  1 | At end of iteration = 71 | cost = 0.7993014317212960
-----
Circuit =  problem_ckt | Layers =  1 | At end of iteration = 72 | cost = 0.7993045762478730
-----
Circuit =  problem_ckt | Layers =  1 | At end of iteration = 73 | cost = 0.7993076218413650
-----
Circuit =  problem_ckt | Layers =  1 | At end of iteration = 74 | cost = 0.7993105706151130
-----
Circuit =  problem_ckt | Layers =  1 | At end of iteration = 75 | cost = 0.7993134247329530
-----
Circuit =  problem_ckt | Layers =  1 | At end of iteration = 76 | cost = 0.7993161863969710
-----
Circuit =  problem_ckt | Layers =  1 | At end of iteration = 77 | cost = 0.7993188578365370
-----
Circuit =  problem_ckt | Layers =  1 | At end of iteration = 78 | cost = 0.7993214412985080
-----
Circuit =  problem_ckt | Layers =  1 | At end of iteration = 79 | cost = 0.7993239390384900
-----
REDUCING ALPHA TO 0.09999999999999999 at iteration = 80
-----
Circuit =  problem_ckt | Layers =  1 | At end of iteration = 80 | cost = 0.7993263533130640
-----
Circuit =  problem_ckt | Layers =  1 | At end of iteration = 81 | cost = 0.7993270893679500
-----
Circuit =  problem_ckt | Layers =  1 | At end of iteration = 82 | cost = 0.7993278176019490
-----
Circuit =  problem_ckt | Layers =  1 | At end of iteration = 83 | cost = 0.7993285380830790
-----
Circuit =  problem_ckt | Layers =  1 | At end of iteration = 84 | cost = 0.7993292508791560
-----
Circuit =  problem_ckt | Layers =  1 | At end of iteration = 85 | cost = 0.7993299560577800
-----
Circuit =  problem_ckt | Layers =  1 | At end of iteration = 86 | cost = 0.7993306536863370
-----
Circuit =  problem_ckt | Layers =  1 | At end of iteration = 87 | cost = 0.7993313438319800

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-----
Circuit =  problem_ckt | Layers =  1 | At end of iteration =  88 | cost =  0.7993320265616305
-----
Circuit =  problem_ckt | Layers =  1 | At end of iteration =  89 | cost =  0.7993327019419625
-----
Circuit =  problem_ckt | Layers =  1 | At end of iteration =  90 | cost =  0.7993333700394
-----
Circuit =  problem_ckt | Layers =  1 | At end of iteration =  91 | cost =  0.799334030920106
-----
Circuit =  problem_ckt | Layers =  1 | At end of iteration =  92 | cost =  0.799334684649977
-----
Circuit =  problem_ckt | Layers =  1 | At end of iteration =  93 | cost =  0.799335331294631
-----
Circuit =  problem_ckt | Layers =  1 | At end of iteration =  94 | cost =  0.799335970919404
-----
Circuit =  problem_ckt | Layers =  1 | At end of iteration =  95 | cost =  0.799336603589339
-----
Circuit =  problem_ckt | Layers =  1 | At end of iteration =  96 | cost =  0.799337229369182
-----
Circuit =  problem_ckt | Layers =  1 | At end of iteration =  97 | cost =  0.799337848323370
-----
Circuit =  problem_ckt | Layers =  1 | At end of iteration =  98 | cost =  0.799338460516030
-----
Circuit =  problem_ckt | Layers =  1 | At end of iteration =  99 | cost =  0.799339066010967
-----
Circuit =  problem_ckt | Layers =  1 | At end of iteration = 100 | cost =  0.79933966487166
-----
Circuit =  problem_ckt | Layers =  1 | At end of iteration = 101 | cost =  0.79934025716125
-----
Circuit =  problem_ckt | Layers =  1 | At end of iteration = 102 | cost =  0.79934084294256
-----
Circuit =  problem_ckt | Layers =  1 | At end of iteration = 103 | cost =  0.79934142227803
-----
Circuit =  problem_ckt | Layers =  1 | At end of iteration = 104 | cost =  0.79934199522979
-----
Circuit =  problem_ckt | Layers =  1 | At end of iteration = 105 | cost =  0.79934256185959
-----
Circuit =  problem_ckt | Layers =  1 | At end of iteration = 106 | cost =  0.79934312222882
-----
Circuit =  problem_ckt | Layers =  1 | At end of iteration = 107 | cost =  0.79934367639852
-----
Circuit =  problem_ckt | Layers =  1 | At end of iteration = 108 | cost =  0.79934422442933
-----
Circuit =  problem_ckt | Layers =  1 | At end of iteration = 109 | cost =  0.79934476638155
-----
Circuit =  problem_ckt | Layers =  1 | At end of iteration = 110 | cost =  0.79934530231507
-----
Circuit =  problem_ckt | Layers =  1 | At end of iteration = 111 | cost =  0.79934583228943
-----

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-----
Circuit =  problem_ckt | Layers =  1 | At end of iteration = 112 | cost = 0.79934635636374
-----
Circuit =  problem_ckt | Layers =  1 | At end of iteration = 113 | cost = 0.79934687459677
-----
Circuit =  problem_ckt | Layers =  1 | At end of iteration = 114 | cost = 0.79934738704684
-----
Circuit =  problem_ckt | Layers =  1 | At end of iteration = 115 | cost = 0.79934789377193
-----
Circuit =  problem_ckt | Layers =  1 | At end of iteration = 116 | cost = 0.79934839482958
-----
Circuit =  problem_ckt | Layers =  1 | At end of iteration = 117 | cost = 0.79934889027695
-----
Circuit =  problem_ckt | Layers =  1 | At end of iteration = 118 | cost = 0.79934938017078
-----
Circuit =  problem_ckt | Layers =  1 | At end of iteration = 119 | cost = 0.79934986456742
-----
REDUCING ALPHA TO 0.03162277660168379 at iteration = 120
-----
Circuit =  problem_ckt | Layers =  1 | At end of iteration = 120 | cost = 0.79935034352279
-----
Circuit =  problem_ckt | Layers =  1 | At end of iteration = 121 | cost = 0.79935049321196
-----
Circuit =  problem_ckt | Layers =  1 | At end of iteration = 122 | cost = 0.79935064236901
-----
Circuit =  problem_ckt | Layers =  1 | At end of iteration = 123 | cost = 0.79935079099567
-----
Circuit =  problem_ckt | Layers =  1 | At end of iteration = 124 | cost = 0.79935093909364
-----
Circuit =  problem_ckt | Layers =  1 | At end of iteration = 125 | cost = 0.79935108666465
-----
Circuit =  problem_ckt | Layers =  1 | At end of iteration = 126 | cost = 0.79935123371040
-----
Circuit =  problem_ckt | Layers =  1 | At end of iteration = 127 | cost = 0.79935138023259
-----
Circuit =  problem_ckt | Layers =  1 | At end of iteration = 128 | cost = 0.79935152623293
-----
Circuit =  problem_ckt | Layers =  1 | At end of iteration = 129 | cost = 0.79935167171312
-----
Circuit =  problem_ckt | Layers =  1 | At end of iteration = 130 | cost = 0.79935181667483
-----
Circuit =  problem_ckt | Layers =  1 | At end of iteration = 131 | cost = 0.79935196111977
-----
Circuit =  problem_ckt | Layers =  1 | At end of iteration = 132 | cost = 0.79935210504961
-----
Circuit =  problem_ckt | Layers =  1 | At end of iteration = 133 | cost = 0.79935224846603
-----
Circuit =  problem_ckt | Layers =  1 | At end of iteration = 134 | cost = 0.79935239137071

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-----
Circuit =  problem_ckt | Layers =  1 | At end of iteration = 135 | cost = 0.79935253376533
-----
Circuit =  problem_ckt | Layers =  1 | At end of iteration = 136 | cost = 0.79935267565154
-----
Circuit =  problem_ckt | Layers =  1 | At end of iteration = 137 | cost = 0.79935281703101
-----
Circuit =  problem_ckt | Layers =  1 | At end of iteration = 138 | cost = 0.79935295790540
-----
Circuit =  problem_ckt | Layers =  1 | At end of iteration = 139 | cost = 0.79935309827637
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Circuit =  problem_ckt | Layers =  1 | At end of iteration = 140 | cost = 0.79935323814556
-----
Circuit =  problem_ckt | Layers =  1 | At end of iteration = 141 | cost = 0.79935337751462
-----
Circuit =  problem_ckt | Layers =  1 | At end of iteration = 142 | cost = 0.79935351638520
-----
Circuit =  problem_ckt | Layers =  1 | At end of iteration = 143 | cost = 0.79935365475892
-----
Circuit =  problem_ckt | Layers =  1 | At end of iteration = 144 | cost = 0.79935379263743
-----
Circuit =  problem_ckt | Layers =  1 | At end of iteration = 145 | cost = 0.79935393002236
-----
Circuit =  problem_ckt | Layers =  1 | At end of iteration = 146 | cost = 0.79935406691533
-----
Circuit =  problem_ckt | Layers =  1 | At end of iteration = 147 | cost = 0.79935420331795
-----
Circuit =  problem_ckt | Layers =  1 | At end of iteration = 148 | cost = 0.79935433923186
-----
Circuit =  problem_ckt | Layers =  1 | At end of iteration = 149 | cost = 0.79935447465866
-----
Circuit =  problem_ckt | Layers =  1 | At end of iteration = 150 | cost = 0.79935460959996
-----
Circuit =  problem_ckt | Layers =  1 | At end of iteration = 151 | cost = 0.79935474405737
-----
Circuit =  problem_ckt | Layers =  1 | At end of iteration = 152 | cost = 0.79935487803249
-----
Circuit =  problem_ckt | Layers =  1 | At end of iteration = 153 | cost = 0.79935501152690
-----
Circuit =  problem_ckt | Layers =  1 | At end of iteration = 154 | cost = 0.79935514454222
-----
Circuit =  problem_ckt | Layers =  1 | At end of iteration = 155 | cost = 0.79935527708002
-----
Circuit =  problem_ckt | Layers =  1 | At end of iteration = 156 | cost = 0.79935540914189
-----
Circuit =  problem_ckt | Layers =  1 | At end of iteration = 157 | cost = 0.79935554072940
-----
Circuit =  problem_ckt | Layers =  1 | At end of iteration = 158 | cost = 0.79935567184415
-----

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-----
Circuit =  problem_ckt | Layers =  1 | At end of iteration = 159 | cost = 0.799355802487689
-----
Circuit =  problem_ckt | Layers =  1 | At end of iteration = 160 | cost = 0.799355932661592
-----
Circuit =  problem_ckt | Layers =  1 | At end of iteration = 161 | cost = 0.799356062367423
-----
Circuit =  problem_ckt | Layers =  1 | At end of iteration = 162 | cost = 0.799356191606741
-----
Circuit =  problem_ckt | Layers =  1 | At end of iteration = 163 | cost = 0.799356320381102
-----
Circuit =  problem_ckt | Layers =  1 | At end of iteration = 164 | cost = 0.799356448692051
-----
Circuit =  problem_ckt | Layers =  1 | At end of iteration = 165 | cost = 0.799356576541151
-----
Circuit =  problem_ckt | Layers =  1 | At end of iteration = 166 | cost = 0.799356703929921
-----
Circuit =  problem_ckt | Layers =  1 | At end of iteration = 167 | cost = 0.799356830859931
-----
Circuit =  problem_ckt | Layers =  1 | At end of iteration = 168 | cost = 0.799356957332681
-----
Circuit =  problem_ckt | Layers =  1 | At end of iteration = 169 | cost = 0.799357083349731
-----
Circuit =  problem_ckt | Layers =  1 | At end of iteration = 170 | cost = 0.799357208912591
-----
Circuit =  problem_ckt | Layers =  1 | At end of iteration = 171 | cost = 0.799357334022781
-----
Circuit =  problem_ckt | Layers =  1 | At end of iteration = 172 | cost = 0.799357458681831
-----
Circuit =  problem_ckt | Layers =  1 | At end of iteration = 173 | cost = 0.799357582891251
-----
Circuit =  problem_ckt | Layers =  1 | At end of iteration = 174 | cost = 0.799357706652551
-----
Circuit =  problem_ckt | Layers =  1 | At end of iteration = 175 | cost = 0.799357829967231
-----
Circuit =  problem_ckt | Layers =  1 | At end of iteration = 176 | cost = 0.799357952836791
-----
Circuit =  problem_ckt | Layers =  1 | At end of iteration = 177 | cost = 0.799358075262741
-----
Circuit =  problem_ckt | Layers =  1 | At end of iteration = 178 | cost = 0.799358197246571
-----
Circuit =  problem_ckt | Layers =  1 | At end of iteration = 179 | cost = 0.799358318789761
-----
Circuit =  problem_ckt | Layers =  1 | At end of iteration = 180 | cost = 0.799358439893811
-----
Circuit =  problem_ckt | Layers =  1 | At end of iteration = 181 | cost = 0.799358560560191
-----
Circuit =  problem_ckt | Layers =  1 | At end of iteration = 182 | cost = 0.799358680790381
-----

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-----
Circuit =  problem_ckt | Layers =  1 | At end of iteration = 183 | cost = 0.799358800585860
-----
Circuit =  problem_ckt | Layers =  1 | At end of iteration = 184 | cost = 0.799358919948087
-----
Circuit =  problem_ckt | Layers =  1 | At end of iteration = 185 | cost = 0.799359038878537
-----
Circuit =  problem_ckt | Layers =  1 | At end of iteration = 186 | cost = 0.799359157378650
-----
Circuit =  problem_ckt | Layers =  1 | At end of iteration = 187 | cost = 0.799359275449911
-----
Circuit =  problem_ckt | Layers =  1 | At end of iteration = 188 | cost = 0.799359393093767
-----
Circuit =  problem_ckt | Layers =  1 | At end of iteration = 189 | cost = 0.799359510311640
-----
Circuit =  problem_ckt | Layers =  1 | At end of iteration = 190 | cost = 0.799359627105011
-----
Circuit =  problem_ckt | Layers =  1 | At end of iteration = 191 | cost = 0.799359743475301
-----
Circuit =  problem_ckt | Layers =  1 | At end of iteration = 192 | cost = 0.799359859423941
-----
Circuit =  problem_ckt | Layers =  1 | At end of iteration = 193 | cost = 0.799359974952387
-----
Circuit =  problem_ckt | Layers =  1 | At end of iteration = 194 | cost = 0.799360090062041
-----
Circuit =  problem_ckt | Layers =  1 | At end of iteration = 195 | cost = 0.799360204754341
-----
Circuit =  problem_ckt | Layers =  1 | At end of iteration = 196 | cost = 0.799360319030711
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Circuit =  problem_ckt | Layers =  1 | At end of iteration = 197 | cost = 0.799360432892561
-----
Circuit =  problem_ckt | Layers =  1 | At end of iteration = 198 | cost = 0.799360546341301
-----
Circuit =  problem_ckt | Layers =  1 | At end of iteration = 199 | cost = 0.799360659378351
-----
Circuit =  problem_ckt | Layers =  1 | At end of iteration = 200 | cost = 0.799360772005091
-----
Circuit =  problem_ckt | Layers =  1 | At end of iteration = 201 | cost = 0.799360884222951
-----
Circuit =  problem_ckt | Layers =  1 | At end of iteration = 202 | cost = 0.799360996033311
-----
Circuit =  problem_ckt | Layers =  1 | At end of iteration = 203 | cost = 0.799361107437561
-----
Circuit =  problem_ckt | Layers =  1 | At end of iteration = 204 | cost = 0.799361218437101
-----
Circuit =  problem_ckt | Layers =  1 | At end of iteration = 205 | cost = 0.799361329033311
-----
Circuit =  problem_ckt | Layers =  1 | At end of iteration = 206 | cost = 0.799361439227561
-----

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-----
Circuit =  problem_ckt | Layers =  1 | At end of iteration = 207 | cost = 0.79936154902124
-----
Circuit =  problem_ckt | Layers =  1 | At end of iteration = 208 | cost = 0.79936165841571
-----
Circuit =  problem_ckt | Layers =  1 | At end of iteration = 209 | cost = 0.79936176741235
-----
Circuit =  problem_ckt | Layers =  1 | At end of iteration = 210 | cost = 0.79936187601252
-----
Circuit =  problem_ckt | Layers =  1 | At end of iteration = 211 | cost = 0.79936198421757
-----
Circuit =  problem_ckt | Layers =  1 | At end of iteration = 212 | cost = 0.79936209202888
-----
Circuit =  problem_ckt | Layers =  1 | At end of iteration = 213 | cost = 0.79936219944778
-----
Circuit =  problem_ckt | Layers =  1 | At end of iteration = 214 | cost = 0.79936230647563
-----
Circuit =  problem_ckt | Layers =  1 | At end of iteration = 215 | cost = 0.79936241311378
-----
Circuit =  problem_ckt | Layers =  1 | At end of iteration = 216 | cost = 0.79936251936355
-----
Circuit =  problem_ckt | Layers =  1 | At end of iteration = 217 | cost = 0.79936262522630
-----
Circuit =  problem_ckt | Layers =  1 | At end of iteration = 218 | cost = 0.79936273070335
-----
Circuit =  problem_ckt | Layers =  1 | At end of iteration = 219 | cost = 0.79936283579603
-----
Circuit =  problem_ckt | Layers =  1 | At end of iteration = 220 | cost = 0.79936294050567
-----
Circuit =  problem_ckt | Layers =  1 | At end of iteration = 221 | cost = 0.79936304483358
-----
Circuit =  problem_ckt | Layers =  1 | At end of iteration = 222 | cost = 0.79936314878109
-----
Circuit =  problem_ckt | Layers =  1 | At end of iteration = 223 | cost = 0.79936325234951
-----
Circuit =  problem_ckt | Layers =  1 | At end of iteration = 224 | cost = 0.79936335554014
-----
Circuit =  problem_ckt | Layers =  1 | At end of iteration = 225 | cost = 0.79936345835430
-----
Circuit =  problem_ckt | Layers =  1 | At end of iteration = 226 | cost = 0.79936356079329
-----
Circuit =  problem_ckt | Layers =  1 | At end of iteration = 227 | cost = 0.79936366285840
-----
Circuit =  problem_ckt | Layers =  1 | At end of iteration = 228 | cost = 0.79936376455092
-----
Circuit =  problem_ckt | Layers =  1 | At end of iteration = 229 | cost = 0.79936386587215
-----
Circuit =  problem_ckt | Layers =  1 | At end of iteration = 230 | cost = 0.79936396682337
-----

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-----
Circuit =  problem_ckt | Layers =  1 | At end of iteration = 231 | cost = 0.799364067405878
-----
Circuit =  problem_ckt | Layers =  1 | At end of iteration = 232 | cost = 0.79936416762093
-----
Circuit =  problem_ckt | Layers =  1 | At end of iteration = 233 | cost = 0.79936426746981
-----
Circuit =  problem_ckt | Layers =  1 | At end of iteration = 234 | cost = 0.79936436695379
-----
Circuit =  problem_ckt | Layers =  1 | At end of iteration = 235 | cost = 0.79936446607414
-----
Circuit =  problem_ckt | Layers =  1 | At end of iteration = 236 | cost = 0.79936456483212
-----
Circuit =  problem_ckt | Layers =  1 | At end of iteration = 237 | cost = 0.79936466322898
-----
Circuit =  problem_ckt | Layers =  1 | At end of iteration = 238 | cost = 0.79936476126599
-----
Circuit =  problem_ckt | Layers =  1 | At end of iteration = 239 | cost = 0.79936485894440
-----
Circuit =  problem_ckt | Layers =  1 | At end of iteration = 240 | cost = 0.79936495626545
-----
Circuit =  problem_ckt | Layers =  1 | At end of iteration = 241 | cost = 0.79936505323040
-----
Circuit =  problem_ckt | Layers =  1 | At end of iteration = 242 | cost = 0.79936514984047
-----
Circuit =  problem_ckt | Layers =  1 | At end of iteration = 243 | cost = 0.79936524609690
-----
Circuit =  problem_ckt | Layers =  1 | At end of iteration = 244 | cost = 0.79936534200094
-----
Circuit =  problem_ckt | Layers =  1 | At end of iteration = 245 | cost = 0.79936543755380
-----
Circuit =  problem_ckt | Layers =  1 | At end of iteration = 246 | cost = 0.79936553275672
-----
Circuit =  problem_ckt | Layers =  1 | At end of iteration = 247 | cost = 0.79936562761091
-----
Circuit =  problem_ckt | Layers =  1 | At end of iteration = 248 | cost = 0.79936572211759
-----
Circuit =  problem_ckt | Layers =  1 | At end of iteration = 249 | cost = 0.79936581627799
-----
Circuit =  problem_ckt | Layers =  1 | At end of iteration = 250 | cost = 0.79936591009330
-----
Circuit =  problem_ckt | Layers =  1 | At end of iteration = 251 | cost = 0.79936600356473
-----
Circuit =  problem_ckt | Layers =  1 | At end of iteration = 252 | cost = 0.79936609669349
-----
Circuit =  problem_ckt | Layers =  1 | At end of iteration = 253 | cost = 0.79936618948078
-----
Circuit =  problem_ckt | Layers =  1 | At end of iteration = 254 | cost = 0.79936628192779
-----

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-----
Circuit =  problem_ckt | Layers =  1 | At end of iteration = 255 | cost = 0.79936637403571
-----
Circuit =  problem_ckt | Layers =  1 | At end of iteration = 256 | cost = 0.79936646580574
-----
Circuit =  problem_ckt | Layers =  1 | At end of iteration = 257 | cost = 0.79936655723905
-----
Circuit =  problem_ckt | Layers =  1 | At end of iteration = 258 | cost = 0.79936664833683
-----
Circuit =  problem_ckt | Layers =  1 | At end of iteration = 259 | cost = 0.79936673910025
-----
Circuit =  problem_ckt | Layers =  1 | At end of iteration = 260 | cost = 0.79936682953050
-----
Circuit =  problem_ckt | Layers =  1 | At end of iteration = 261 | cost = 0.79936691962873
-----
Circuit =  problem_ckt | Layers =  1 | At end of iteration = 262 | cost = 0.79936700939612
-----
Circuit =  problem_ckt | Layers =  1 | At end of iteration = 263 | cost = 0.79936709883382
-----
Circuit =  problem_ckt | Layers =  1 | At end of iteration = 264 | cost = 0.79936718794300
-----
Circuit =  problem_ckt | Layers =  1 | At end of iteration = 265 | cost = 0.79936727672482
-----
Circuit =  problem_ckt | Layers =  1 | At end of iteration = 266 | cost = 0.79936736518042
-----
Circuit =  problem_ckt | Layers =  1 | At end of iteration = 267 | cost = 0.79936745331094
-----
Circuit =  problem_ckt | Layers =  1 | At end of iteration = 268 | cost = 0.79936754111755
-----
Circuit =  problem_ckt | Layers =  1 | At end of iteration = 269 | cost = 0.79936762860137
-----
Circuit =  problem_ckt | Layers =  1 | At end of iteration = 270 | cost = 0.79936771576355
-----
Circuit =  problem_ckt | Layers =  1 | At end of iteration = 271 | cost = 0.79936780260522
-----
Circuit =  problem_ckt | Layers =  1 | At end of iteration = 272 | cost = 0.79936788912750
-----
Circuit =  problem_ckt | Layers =  1 | At end of iteration = 273 | cost = 0.79936797533153
-----
Circuit =  problem_ckt | Layers =  1 | At end of iteration = 274 | cost = 0.79936806121844
-----
Circuit =  problem_ckt | Layers =  1 | At end of iteration = 275 | cost = 0.79936814678932
-----
Circuit =  problem_ckt | Layers =  1 | At end of iteration = 276 | cost = 0.79936823204532
-----
Circuit =  problem_ckt | Layers =  1 | At end of iteration = 277 | cost = 0.79936831698753
-----
Circuit =  problem_ckt | Layers =  1 | At end of iteration = 278 | cost = 0.79936840161706
-----

```

```

-----
Circuit =  problem_ckt | Layers =  1 | At end of iteration =  279 | cost =  0.79936848593503
-----
Circuit =  problem_ckt | Layers =  1 | At end of iteration =  280 | cost =  0.79936856994253
-----
Circuit =  problem_ckt | Layers =  1 | At end of iteration =  281 | cost =  0.79936865364067
-----
Circuit =  problem_ckt | Layers =  1 | At end of iteration =  282 | cost =  0.79936873703053
-----
Circuit =  problem_ckt | Layers =  1 | At end of iteration =  283 | cost =  0.79936882011321
-----
Circuit =  problem_ckt | Layers =  1 | At end of iteration =  284 | cost =  0.7993689028890
-----
Circuit =  problem_ckt | Layers =  1 | At end of iteration =  285 | cost =  0.79936898536138
-----
Circuit =  problem_ckt | Layers =  1 | At end of iteration =  286 | cost =  0.79936906752903
-----
Circuit =  problem_ckt | Layers =  1 | At end of iteration =  287 | cost =  0.79936914939383
-----
Circuit =  problem_ckt | Layers =  1 | At end of iteration =  288 | cost =  0.79936923095685
-----
Circuit =  problem_ckt | Layers =  1 | At end of iteration =  289 | cost =  0.79936931221917
-----
Circuit =  problem_ckt | Layers =  1 | At end of iteration =  290 | cost =  0.79936939318186
-----
Circuit =  problem_ckt | Layers =  1 | At end of iteration =  291 | cost =  0.79936947384597
-----
Circuit =  problem_ckt | Layers =  1 | At end of iteration =  292 | cost =  0.79936955421256
-----
Circuit =  problem_ckt | Layers =  1 | At end of iteration =  293 | cost =  0.79936963428270
-----
Circuit =  problem_ckt | Layers =  1 | At end of iteration =  294 | cost =  0.79936971405744
-----
Circuit =  problem_ckt | Layers =  1 | At end of iteration =  295 | cost =  0.79936979353783
-----
Circuit =  problem_ckt | Layers =  1 | At end of iteration =  296 | cost =  0.79936987272491
-----
Circuit =  problem_ckt | Layers =  1 | At end of iteration =  297 | cost =  0.79936995161973
-----
Circuit =  problem_ckt | Layers =  1 | At end of iteration =  298 | cost =  0.79937003022332
-----
Circuit =  problem_ckt | Layers =  1 | At end of iteration =  299 | cost =  0.79937010853674
-----
Circuit =  problem_ckt | Layers =  1 | At end of iteration =  300 | cost =  0.79937018656100
-----

```

Optimization complete.

After optimization, the optimal parameters are

```
{Parameter(theta2[2]): 0.2206478866338697, Parameter(theta1[3]): -1.7375253043334702, Paramet
```

The output state for these parameters is

```
[ [ 0.24673296+0.j          ]
 [-0.02830298+0.17308299j]
 [ 0.05804278+0.27729528j]
 [ 0.20118058-0.00890815j]
 [-0.05298952+0.23624416j]
 [ 0.15964663+0.06427191j]
 [ 0.27797279+0.00397788j]
 [-0.03467702+0.1945414j ]
 [ 0.10126355+0.27358635j]
 [ 0.20353667-0.03965295j]
 [ 0.28365316-0.17816679j]
 [ 0.09244574+0.21942018j]
 [ 0.28370382-0.03820209j]
 [-0.00574521+0.20340023j]
 [ 0.10967411+0.30985878j]
 [ 0.22994654-0.0413921j ]]
```

Circuit = problem_ckt Layers = 1 Cost after optimization = 0.799370186561004

Circuit problem_ckt constructed with 2 layers. Number of parameters = 16 .

Initialized circuit parameters prior to gradient descent randomly as follows:

```
idx = theta2[2] params = 0.03719052023213644
idx = theta3[0] params = 0.04312312828020062
idx = theta3[1] params = 0.0004994971757621869
idx = theta3[2] params = 0.03444025418170515
idx = theta3[3] params = 0.046881140646663634
idx = theta2[1] params = 0.02164226791611938
idx = theta2[3] params = 0.028343942770291508
idx = theta1[3] params = 0.013510378554063363
idx = theta1[2] params = 0.022782810868909098
idx = theta1[0] params = 0.00573789773068969
idx = theta4[0] params = 0.039532273767073196
idx = theta4[1] params = 0.018375156312795238
idx = theta4[2] params = 0.02421115885861306
idx = theta4[3] params = 0.01671278315727628
idx = theta2[0] params = 0.006172454610576922
idx = theta1[1] params = 0.016655522656847783
```

Circuit = problem_ckt | Layers = 2 | At end of iteration = 1 | cost = 1.2264919590178074

Circuit = problem_ckt | Layers = 2 | At end of iteration = 2 | cost = 1.206254783905879

Circuit = problem_ckt | Layers = 2 | At end of iteration = 3 | cost = 1.1837077270160317

Circuit = problem_ckt | Layers = 2 | At end of iteration = 4 | cost = 1.1567809169613334

Circuit =	problem_ckt		Layers =	2		At end of iteration =	5		cost =	1.1234611530663774

Circuit =	problem_ckt		Layers =	2		At end of iteration =	6		cost =	1.0822450841342925

Circuit =	problem_ckt		Layers =	2		At end of iteration =	7		cost =	1.0331608815942184

Circuit =	problem_ckt		Layers =	2		At end of iteration =	8		cost =	0.979195198020167

Circuit =	problem_ckt		Layers =	2		At end of iteration =	9		cost =	0.926687289883256

Circuit =	problem_ckt		Layers =	2		At end of iteration =	10		cost =	0.8823581147554574

Circuit =	problem_ckt		Layers =	2		At end of iteration =	11		cost =	0.848561362399365

Circuit =	problem_ckt		Layers =	2		At end of iteration =	12		cost =	0.8232581633930908

Circuit =	problem_ckt		Layers =	2		At end of iteration =	13		cost =	0.803958786345165

Circuit =	problem_ckt		Layers =	2		At end of iteration =	14		cost =	0.789159418936125

Circuit =	problem_ckt		Layers =	2		At end of iteration =	15		cost =	0.777719943715314

Circuit =	problem_ckt		Layers =	2		At end of iteration =	16		cost =	0.768641074388180

Circuit =	problem_ckt		Layers =	2		At end of iteration =	17		cost =	0.761176202885260

Circuit =	problem_ckt		Layers =	2		At end of iteration =	18		cost =	0.754843904738041

Circuit =	problem_ckt		Layers =	2		At end of iteration =	19		cost =	0.749349270550790

Circuit =	problem_ckt		Layers =	2		At end of iteration =	20		cost =	0.744504964259945

Circuit =	problem_ckt		Layers =	2		At end of iteration =	21		cost =	0.740181749740327

Circuit =	problem_ckt		Layers =	2		At end of iteration =	22		cost =	0.736283062274293

Circuit =	problem_ckt		Layers =	2		At end of iteration =	23		cost =	0.732732856573906

Circuit =	problem_ckt		Layers =	2		At end of iteration =	24		cost =	0.729469617966221

Circuit =	problem_ckt		Layers =	2		At end of iteration =	25		cost =	0.726442965198794

Circuit =	problem_ckt		Layers =	2		At end of iteration =	26		cost =	0.723611269234642

Circuit =	problem_ckt		Layers =	2		At end of iteration =	27		cost =	0.720939665470536

Circuit =	problem_ckt		Layers =	2		At end of iteration =	28		cost =	0.718398257635304

```

Circuit = problem_ckt | Layers = 2 | At end of iteration = 29 | cost = 0.715960481474086
-----
Circuit = problem_ckt | Layers = 2 | At end of iteration = 30 | cost = 0.713601649999109
-----
Circuit = problem_ckt | Layers = 2 | At end of iteration = 31 | cost = 0.711297702916335
-----
Circuit = problem_ckt | Layers = 2 | At end of iteration = 32 | cost = 0.709024162014464
-----
Circuit = problem_ckt | Layers = 2 | At end of iteration = 33 | cost = 0.706755268247891
-----
Circuit = problem_ckt | Layers = 2 | At end of iteration = 34 | cost = 0.704463253627368
-----
Circuit = problem_ckt | Layers = 2 | At end of iteration = 35 | cost = 0.702117685732405
-----
Circuit = problem_ckt | Layers = 2 | At end of iteration = 36 | cost = 0.699684815432176
-----
Circuit = problem_ckt | Layers = 2 | At end of iteration = 37 | cost = 0.697126858213773
-----
Circuit = problem_ckt | Layers = 2 | At end of iteration = 38 | cost = 0.694401144799644
-----
Circuit = problem_ckt | Layers = 2 | At end of iteration = 39 | cost = 0.691459086558348
-----
REDUCING ALPHA TO 0.31622776601683794 at iteration = 40
-----
Circuit = problem_ckt | Layers = 2 | At end of iteration = 40 | cost = 0.688244916394243
-----
Circuit = problem_ckt | Layers = 2 | At end of iteration = 41 | cost = 0.687142310378982
-----
Circuit = problem_ckt | Layers = 2 | At end of iteration = 42 | cost = 0.686000891923047
-----
Circuit = problem_ckt | Layers = 2 | At end of iteration = 43 | cost = 0.684818443051028
-----
Circuit = problem_ckt | Layers = 2 | At end of iteration = 44 | cost = 0.683592481795283
-----
Circuit = problem_ckt | Layers = 2 | At end of iteration = 45 | cost = 0.682320311546309
-----
Circuit = problem_ckt | Layers = 2 | At end of iteration = 46 | cost = 0.680999047160343
-----
Circuit = problem_ckt | Layers = 2 | At end of iteration = 47 | cost = 0.679625627620784
-----
Circuit = problem_ckt | Layers = 2 | At end of iteration = 48 | cost = 0.678196821139992
-----
Circuit = problem_ckt | Layers = 2 | At end of iteration = 49 | cost = 0.6767092226266487
-----
Circuit = problem_ckt | Layers = 2 | At end of iteration = 50 | cost = 0.675159271210042
-----
Circuit = problem_ckt | Layers = 2 | At end of iteration = 51 | cost = 0.673543212828013
-----

```

Circuit =	problem_ckt		Layers =	2		At end of iteration =	52		cost =	0.671857136295995

Circuit =	problem_ckt		Layers =	2		At end of iteration =	53		cost =	0.670096956274574

Circuit =	problem_ckt		Layers =	2		At end of iteration =	54		cost =	0.668258420298484

Circuit =	problem_ckt		Layers =	2		At end of iteration =	55		cost =	0.666337115105666

Circuit =	problem_ckt		Layers =	2		At end of iteration =	56		cost =	0.6643284766623

Circuit =	problem_ckt		Layers =	2		At end of iteration =	57		cost =	0.662227804707559

Circuit =	problem_ckt		Layers =	2		At end of iteration =	58		cost =	0.660030282726638

Circuit =	problem_ckt		Layers =	2		At end of iteration =	59		cost =	0.657731004352857

Circuit =	problem_ckt		Layers =	2		At end of iteration =	60		cost =	0.655325007290898

Circuit =	problem_ckt		Layers =	2		At end of iteration =	61		cost =	0.652807315933572

Circuit =	problem_ckt		Layers =	2		At end of iteration =	62		cost =	0.650172993902827

Circuit =	problem_ckt		Layers =	2		At end of iteration =	63		cost =	0.647417207767781

Circuit =	problem_ckt		Layers =	2		At end of iteration =	64		cost =	0.644535303161333

Circuit =	problem_ckt		Layers =	2		At end of iteration =	65		cost =	0.641522894411687

Circuit =	problem_ckt		Layers =	2		At end of iteration =	66		cost =	0.638375968601959

Circuit =	problem_ckt		Layers =	2		At end of iteration =	67		cost =	0.635091004643166

Circuit =	problem_ckt		Layers =	2		At end of iteration =	68		cost =	0.631665107465172

Circuit =	problem_ckt		Layers =	2		At end of iteration =	69		cost =	0.628096156769351

Circuit =	problem_ckt		Layers =	2		At end of iteration =	70		cost =	0.624382968923156

Circuit =	problem_ckt		Layers =	2		At end of iteration =	71		cost =	0.620525469497017

Circuit =	problem_ckt		Layers =	2		At end of iteration =	72		cost =	0.616524872650830

Circuit =	problem_ckt		Layers =	2		At end of iteration =	73		cost =	0.612383862096603

Circuit =	problem_ckt		Layers =	2		At end of iteration =	74		cost =	0.608106766753720

Circuit =	problem_ckt		Layers =	2		At end of iteration =	75		cost =	0.603699722571084

```

Circuit = problem_ckt | Layers = 2 | At end of iteration = 76 | cost = 0.599170810458804
-----
Circuit = problem_ckt | Layers = 2 | At end of iteration = 77 | cost = 0.594530159039414
-----
Circuit = problem_ckt | Layers = 2 | At end of iteration = 78 | cost = 0.589790000222498
-----
Circuit = problem_ckt | Layers = 2 | At end of iteration = 79 | cost = 0.584964665676819
-----
REDUCING ALPHA TO 0.099999999999999999 at iteration = 80
-----
Circuit = problem_ckt | Layers = 2 | At end of iteration = 80 | cost = 0.580070513363332
-----
Circuit = problem_ckt | Layers = 2 | At end of iteration = 81 | cost = 0.578508709224028
-----
Circuit = problem_ckt | Layers = 2 | At end of iteration = 82 | cost = 0.576942823137994
-----
Circuit = problem_ckt | Layers = 2 | At end of iteration = 83 | cost = 0.575373471937115
-----
Circuit = problem_ckt | Layers = 2 | At end of iteration = 84 | cost = 0.573801290523228
-----
Circuit = problem_ckt | Layers = 2 | At end of iteration = 85 | cost = 0.572226929811862
-----
Circuit = problem_ckt | Layers = 2 | At end of iteration = 86 | cost = 0.570651054779313
-----
Circuit = problem_ckt | Layers = 2 | At end of iteration = 87 | cost = 0.569074342582188
-----
Circuit = problem_ckt | Layers = 2 | At end of iteration = 88 | cost = 0.567497480725820
-----
Circuit = problem_ckt | Layers = 2 | At end of iteration = 89 | cost = 0.565921165263966
-----
Circuit = problem_ckt | Layers = 2 | At end of iteration = 90 | cost = 0.564346099017135
-----
Circuit = problem_ckt | Layers = 2 | At end of iteration = 91 | cost = 0.562772989801052
-----
Circuit = problem_ckt | Layers = 2 | At end of iteration = 92 | cost = 0.561202548660159
-----
Circuit = problem_ckt | Layers = 2 | At end of iteration = 93 | cost = 0.559635488103908
-----
Circuit = problem_ckt | Layers = 2 | At end of iteration = 94 | cost = 0.558072520345944
-----
Circuit = problem_ckt | Layers = 2 | At end of iteration = 95 | cost = 0.556514355548216
-----
Circuit = problem_ckt | Layers = 2 | At end of iteration = 96 | cost = 0.554961700073634
-----
Circuit = problem_ckt | Layers = 2 | At end of iteration = 97 | cost = 0.553415254752156
-----
Circuit = problem_ckt | Layers = 2 | At end of iteration = 98 | cost = 0.551875713166187
-----

```

```

Circuit = problem_ckt | Layers = 2 | At end of iteration = 99 | cost = 0.550343759961934
-----
Circuit = problem_ckt | Layers = 2 | At end of iteration = 100 | cost = 0.54882006919390
-----
Circuit = problem_ckt | Layers = 2 | At end of iteration = 101 | cost = 0.54730530271010
-----
Circuit = problem_ckt | Layers = 2 | At end of iteration = 102 | cost = 0.54580010858563
-----
Circuit = problem_ckt | Layers = 2 | At end of iteration = 103 | cost = 0.54430511961244
-----
Circuit = problem_ckt | Layers = 2 | At end of iteration = 104 | cost = 0.54282095185284
-----
Circuit = problem_ckt | Layers = 2 | At end of iteration = 105 | cost = 0.54134820326426
-----
Circuit = problem_ckt | Layers = 2 | At end of iteration = 106 | cost = 0.53988745240204
-----
Circuit = problem_ckt | Layers = 2 | At end of iteration = 107 | cost = 0.53843925720704
-----
Circuit = problem_ckt | Layers = 2 | At end of iteration = 108 | cost = 0.53700415388385
-----
Circuit = problem_ckt | Layers = 2 | At end of iteration = 109 | cost = 0.53558265587510
-----
Circuit = problem_ckt | Layers = 2 | At end of iteration = 110 | cost = 0.53417525293634
-----
Circuit = problem_ckt | Layers = 2 | At end of iteration = 111 | cost = 0.53278241031552
-----
Circuit = problem_ckt | Layers = 2 | At end of iteration = 112 | cost = 0.53140456803995
-----
Circuit = problem_ckt | Layers = 2 | At end of iteration = 113 | cost = 0.53004214031315
-----
Circuit = problem_ckt | Layers = 2 | At end of iteration = 114 | cost = 0.52869551502287
-----
Circuit = problem_ckt | Layers = 2 | At end of iteration = 115 | cost = 0.52736505336080
-----
Circuit = problem_ckt | Layers = 2 | At end of iteration = 116 | cost = 0.52605108955367
-----
Circuit = problem_ckt | Layers = 2 | At end of iteration = 117 | cost = 0.52475393070462
-----
Circuit = problem_ckt | Layers = 2 | At end of iteration = 118 | cost = 0.52347385674282
-----
Circuit = problem_ckt | Layers = 2 | At end of iteration = 119 | cost = 0.52221112047865
-----
REDUCING ALPHA TO 0.03162277660168379 at iteration = 120
-----
Circuit = problem_ckt | Layers = 2 | At end of iteration = 120 | cost = 0.52096594776102
-----
Circuit = problem_ckt | Layers = 2 | At end of iteration = 121 | cost = 0.52057682689093
-----

```

Circuit =	problem_ckt		Layers =	2		At end of iteration =	122		cost =	0.520189489384011

Circuit =	problem_ckt		Layers =	2		At end of iteration =	123		cost =	0.519803939978821

Circuit =	problem_ckt		Layers =	2		At end of iteration =	124		cost =	0.519420183207041

Circuit =	problem_ckt		Layers =	2		At end of iteration =	125		cost =	0.519038223390611

Circuit =	problem_ckt		Layers =	2		At end of iteration =	126		cost =	0.518658064639241

Circuit =	problem_ckt		Layers =	2		At end of iteration =	127		cost =	0.518279710848461

Circuit =	problem_ckt		Layers =	2		At end of iteration =	128		cost =	0.517903165697901

Circuit =	problem_ckt		Layers =	2		At end of iteration =	129		cost =	0.517528432650111

Circuit =	problem_ckt		Layers =	2		At end of iteration =	130		cost =	0.517155514949561

Circuit =	problem_ckt		Layers =	2		At end of iteration =	131		cost =	0.516784415622041

Circuit =	problem_ckt		Layers =	2		At end of iteration =	132		cost =	0.516415137474361

Circuit =	problem_ckt		Layers =	2		At end of iteration =	133		cost =	0.516047683094251

Circuit =	problem_ckt		Layers =	2		At end of iteration =	134		cost =	0.515682054850561

Circuit =	problem_ckt		Layers =	2		At end of iteration =	135		cost =	0.515318254893691

Circuit =	problem_ckt		Layers =	2		At end of iteration =	136		cost =	0.514956285156211

Circuit =	problem_ckt		Layers =	2		At end of iteration =	137		cost =	0.514596147353741

Circuit =	problem_ckt		Layers =	2		At end of iteration =	138		cost =	0.514237842985911

Circuit =	problem_ckt		Layers =	2		At end of iteration =	139		cost =	0.513881373337621

Circuit =	problem_ckt		Layers =	2		At end of iteration =	140		cost =	0.513526739480351

Circuit =	problem_ckt		Layers =	2		At end of iteration =	141		cost =	0.513173942273701

Circuit =	problem_ckt		Layers =	2		At end of iteration =	142		cost =	0.512822982367001

Circuit =	problem_ckt		Layers =	2		At end of iteration =	143		cost =	0.512473860201151

Circuit =	problem_ckt		Layers =	2		At end of iteration =	144		cost =	0.512126576010411

Circuit =	problem_ckt		Layers =	2		At end of iteration =	145		cost =	0.511781129824511

Circuit =	problem_ckt		Layers =	2		At end of iteration =	146		cost =	0.51143752147068

Circuit =	problem_ckt		Layers =	2		At end of iteration =	147		cost =	0.51109575057587

Circuit =	problem_ckt		Layers =	2		At end of iteration =	148		cost =	0.51075581656906

Circuit =	problem_ckt		Layers =	2		At end of iteration =	149		cost =	0.51041771868359

Circuit =	problem_ckt		Layers =	2		At end of iteration =	150		cost =	0.51008145595962

Circuit =	problem_ckt		Layers =	2		At end of iteration =	151		cost =	0.50974702724665

Circuit =	problem_ckt		Layers =	2		At end of iteration =	152		cost =	0.50941443120606

Circuit =	problem_ckt		Layers =	2		At end of iteration =	153		cost =	0.50908366631376

Circuit =	problem_ckt		Layers =	2		At end of iteration =	154		cost =	0.50875473086286

Circuit =	problem_ckt		Layers =	2		At end of iteration =	155		cost =	0.50842762296642

Circuit =	problem_ckt		Layers =	2		At end of iteration =	156		cost =	0.50810234056019

Circuit =	problem_ckt		Layers =	2		At end of iteration =	157		cost =	0.50777888140544

Circuit =	problem_ckt		Layers =	2		At end of iteration =	158		cost =	0.50745724309179

Circuit =	problem_ckt		Layers =	2		At end of iteration =	159		cost =	0.50713742304009

Circuit =	problem_ckt		Layers =	2		At end of iteration =	160		cost =	0.50681941850533

Circuit =	problem_ckt		Layers =	2		At end of iteration =	161		cost =	0.50650322657957

Circuit =	problem_ckt		Layers =	2		At end of iteration =	162		cost =	0.50618884419487

Circuit =	problem_ckt		Layers =	2		At end of iteration =	163		cost =	0.50587626812626

Circuit =	problem_ckt		Layers =	2		At end of iteration =	164		cost =	0.50556549499473

Circuit =	problem_ckt		Layers =	2		At end of iteration =	165		cost =	0.50525652127020

Circuit =	problem_ckt		Layers =	2		At end of iteration =	166		cost =	0.50494934327455

Circuit =	problem_ckt		Layers =	2		At end of iteration =	167		cost =	0.50464395718459

Circuit =	problem_ckt		Layers =	2		At end of iteration =	168		cost =	0.50434035903512

Circuit =	problem_ckt		Layers =	2		At end of iteration =	169		cost =	0.50403854472189

Circuit = problem_ckt Layers = 2 At end of iteration = 170 cost = 0.50373851000465
Circuit = problem_ckt Layers = 2 At end of iteration = 171 cost = 0.50344025051014
Circuit = problem_ckt Layers = 2 At end of iteration = 172 cost = 0.50314376173510
Circuit = problem_ckt Layers = 2 At end of iteration = 173 cost = 0.50284903904929
Circuit = problem_ckt Layers = 2 At end of iteration = 174 cost = 0.50255607769843
Circuit = problem_ckt Layers = 2 At end of iteration = 175 cost = 0.50226487280726
Circuit = problem_ckt Layers = 2 At end of iteration = 176 cost = 0.50197541938241
Circuit = problem_ckt Layers = 2 At end of iteration = 177 cost = 0.50168771231545
Circuit = problem_ckt Layers = 2 At end of iteration = 178 cost = 0.50140174638577
Circuit = problem_ckt Layers = 2 At end of iteration = 179 cost = 0.50111751626352
Circuit = problem_ckt Layers = 2 At end of iteration = 180 cost = 0.50083501651253
Circuit = problem_ckt Layers = 2 At end of iteration = 181 cost = 0.50055424159318
Circuit = problem_ckt Layers = 2 At end of iteration = 182 cost = 0.50027518586528
Circuit = problem_ckt Layers = 2 At end of iteration = 183 cost = 0.49999784359090
Circuit = problem_ckt Layers = 2 At end of iteration = 184 cost = 0.49972220893722
Circuit = problem_ckt Layers = 2 At end of iteration = 185 cost = 0.49944827597929
Circuit = problem_ckt Layers = 2 At end of iteration = 186 cost = 0.49917603870285
Circuit = problem_ckt Layers = 2 At end of iteration = 187 cost = 0.49890549100702
Circuit = problem_ckt Layers = 2 At end of iteration = 188 cost = 0.49863662670708
Circuit = problem_ckt Layers = 2 At end of iteration = 189 cost = 0.49836943953714
Circuit = problem_ckt Layers = 2 At end of iteration = 190 cost = 0.49810392315278
Circuit = problem_ckt Layers = 2 At end of iteration = 191 cost = 0.49784007113372
Circuit = problem_ckt Layers = 2 At end of iteration = 192 cost = 0.49757787698643
Circuit = problem_ckt Layers = 2 At end of iteration = 193 cost = 0.49731733414665

Circuit =	problem_ckt		Layers =	2		At end of iteration =	194		cost =	0.497058435982007
Circuit =	problem_ckt		Layers =	2		At end of iteration =	195		cost =	0.496801175794460
Circuit =	problem_ckt		Layers =	2		At end of iteration =	196		cost =	0.496545546822820
Circuit =	problem_ckt		Layers =	2		At end of iteration =	197		cost =	0.496291542245200
Circuit =	problem_ckt		Layers =	2		At end of iteration =	198		cost =	0.496039155181370
Circuit =	problem_ckt		Layers =	2		At end of iteration =	199		cost =	0.495788378695210
Circuit =	problem_ckt		Layers =	2		At end of iteration =	200		cost =	0.495539205796990
Circuit =	problem_ckt		Layers =	2		At end of iteration =	201		cost =	0.495291629445710
Circuit =	problem_ckt		Layers =	2		At end of iteration =	202		cost =	0.495045642551380
Circuit =	problem_ckt		Layers =	2		At end of iteration =	203		cost =	0.494801237977220
Circuit =	problem_ckt		Layers =	2		At end of iteration =	204		cost =	0.494558408541900
Circuit =	problem_ckt		Layers =	2		At end of iteration =	205		cost =	0.494317147021680
Circuit =	problem_ckt		Layers =	2		At end of iteration =	206		cost =	0.494077446152540
Circuit =	problem_ckt		Layers =	2		At end of iteration =	207		cost =	0.493839298632310
Circuit =	problem_ckt		Layers =	2		At end of iteration =	208		cost =	0.493602697122650
Circuit =	problem_ckt		Layers =	2		At end of iteration =	209		cost =	0.493367634251150
Circuit =	problem_ckt		Layers =	2		At end of iteration =	210		cost =	0.493134102613250
Circuit =	problem_ckt		Layers =	2		At end of iteration =	211		cost =	0.492902094774240
Circuit =	problem_ckt		Layers =	2		At end of iteration =	212		cost =	0.492671603271110
Circuit =	problem_ckt		Layers =	2		At end of iteration =	213		cost =	0.492442620614480
Circuit =	problem_ckt		Layers =	2		At end of iteration =	214		cost =	0.492215139290360
Circuit =	problem_ckt		Layers =	2		At end of iteration =	215		cost =	0.491989151762050
Circuit =	problem_ckt		Layers =	2		At end of iteration =	216		cost =	0.491764650471810
Circuit =	problem_ckt		Layers =	2		At end of iteration =	217		cost =	0.491541627842620

Circuit =	problem_ckt		Layers =	2		At end of iteration =	218		cost =	0.49132007627988

Circuit =	problem_ckt		Layers =	2		At end of iteration =	219		cost =	0.49109998817304

Circuit =	problem_ckt		Layers =	2		At end of iteration =	220		cost =	0.49088135589723

Circuit =	problem_ckt		Layers =	2		At end of iteration =	221		cost =	0.49066417181482

Circuit =	problem_ckt		Layers =	2		At end of iteration =	222		cost =	0.49044842827700

Circuit =	problem_ckt		Layers =	2		At end of iteration =	223		cost =	0.49023411762524

Circuit =	problem_ckt		Layers =	2		At end of iteration =	224		cost =	0.49002123219281

Circuit =	problem_ckt		Layers =	2		At end of iteration =	225		cost =	0.48980976430617

Circuit =	problem_ckt		Layers =	2		At end of iteration =	226		cost =	0.48959970628641

Circuit =	problem_ckt		Layers =	2		At end of iteration =	227		cost =	0.48939105045061

Circuit =	problem_ckt		Layers =	2		At end of iteration =	228		cost =	0.48918378911316

Circuit =	problem_ckt		Layers =	2		At end of iteration =	229		cost =	0.48897791458708

Circuit =	problem_ckt		Layers =	2		At end of iteration =	230		cost =	0.48877341918525

Circuit =	problem_ckt		Layers =	2		At end of iteration =	231		cost =	0.48857029522169

Circuit =	problem_ckt		Layers =	2		At end of iteration =	232		cost =	0.48836853501272

Circuit =	problem_ckt		Layers =	2		At end of iteration =	233		cost =	0.48816813087816

Circuit =	problem_ckt		Layers =	2		At end of iteration =	234		cost =	0.48796907514243

Circuit =	problem_ckt		Layers =	2		At end of iteration =	235		cost =	0.48777136013568

Circuit =	problem_ckt		Layers =	2		At end of iteration =	236		cost =	0.48757497819485

Circuit =	problem_ckt		Layers =	2		At end of iteration =	237		cost =	0.48737992166471

Circuit =	problem_ckt		Layers =	2		At end of iteration =	238		cost =	0.48718618289888

Circuit =	problem_ckt		Layers =	2		At end of iteration =	239		cost =	0.48699375426080

Circuit =	problem_ckt		Layers =	2		At end of iteration =	240		cost =	0.48680262812467

Circuit =	problem_ckt		Layers =	2		At end of iteration =	241		cost =	0.48661279687640

Circuit =	problem_ckt		Layers =	2		At end of iteration =	242		cost =	0.486424252914468

Circuit =	problem_ckt		Layers =	2		At end of iteration =	243		cost =	0.48623698865079

Circuit =	problem_ckt		Layers =	2		At end of iteration =	244		cost =	0.48605099651159

Circuit =	problem_ckt		Layers =	2		At end of iteration =	245		cost =	0.48586626893817

Circuit =	problem_ckt		Layers =	2		At end of iteration =	246		cost =	0.48568279838767

Circuit =	problem_ckt		Layers =	2		At end of iteration =	247		cost =	0.48550057733389

Circuit =	problem_ckt		Layers =	2		At end of iteration =	248		cost =	0.48531959826795

Circuit =	problem_ckt		Layers =	2		At end of iteration =	249		cost =	0.48513985369903

Circuit =	problem_ckt		Layers =	2		At end of iteration =	250		cost =	0.48496133615504

Circuit =	problem_ckt		Layers =	2		At end of iteration =	251		cost =	0.48478403818324

Circuit =	problem_ckt		Layers =	2		At end of iteration =	252		cost =	0.48460795235092

Circuit =	problem_ckt		Layers =	2		At end of iteration =	253		cost =	0.48443307124595

Circuit =	problem_ckt		Layers =	2		At end of iteration =	254		cost =	0.48425938747739

Circuit =	problem_ckt		Layers =	2		At end of iteration =	255		cost =	0.48408689367604

Circuit =	problem_ckt		Layers =	2		At end of iteration =	256		cost =	0.48391558249498

Circuit =	problem_ckt		Layers =	2		At end of iteration =	257		cost =	0.48374544661005

Circuit =	problem_ckt		Layers =	2		At end of iteration =	258		cost =	0.48357647872038

Circuit =	problem_ckt		Layers =	2		At end of iteration =	259		cost =	0.48340867154884

Circuit =	problem_ckt		Layers =	2		At end of iteration =	260		cost =	0.48324201784247

Circuit =	problem_ckt		Layers =	2		At end of iteration =	261		cost =	0.48307651037296

Circuit =	problem_ckt		Layers =	2		At end of iteration =	262		cost =	0.48291214193699

Circuit =	problem_ckt		Layers =	2		At end of iteration =	263		cost =	0.48274890535666

Circuit =	problem_ckt		Layers =	2		At end of iteration =	264		cost =	0.48258679347988

Circuit =	problem_ckt		Layers =	2		At end of iteration =	265		cost =	0.48242579918065

Circuit =	problem_ckt		Layers =	2		At end of iteration =	266		cost =	0.482265915359473

Circuit =	problem_ckt		Layers =	2		At end of iteration =	267		cost =	0.482107134943609

Circuit =	problem_ckt		Layers =	2		At end of iteration =	268		cost =	0.481949450887400

Circuit =	problem_ckt		Layers =	2		At end of iteration =	269		cost =	0.48179285617257

Circuit =	problem_ckt		Layers =	2		At end of iteration =	270		cost =	0.481637343808451

Circuit =	problem_ckt		Layers =	2		At end of iteration =	271		cost =	0.481482906832266

Circuit =	problem_ckt		Layers =	2		At end of iteration =	272		cost =	0.481329538309338

Circuit =	problem_ckt		Layers =	2		At end of iteration =	273		cost =	0.481177231333333

Circuit =	problem_ckt		Layers =	2		At end of iteration =	274		cost =	0.481025979026441

Circuit =	problem_ckt		Layers =	2		At end of iteration =	275		cost =	0.480875774539599

Circuit =	problem_ckt		Layers =	2		At end of iteration =	276		cost =	0.480726611052620

Circuit =	problem_ckt		Layers =	2		At end of iteration =	277		cost =	0.480578481774414

Circuit =	problem_ckt		Layers =	2		At end of iteration =	278		cost =	0.480431379943099

Circuit =	problem_ckt		Layers =	2		At end of iteration =	279		cost =	0.480285298826134

Circuit =	problem_ckt		Layers =	2		At end of iteration =	280		cost =	0.480140231720490

Circuit =	problem_ckt		Layers =	2		At end of iteration =	281		cost =	0.479996171952711

Circuit =	problem_ckt		Layers =	2		At end of iteration =	282		cost =	0.479853112879069

Circuit =	problem_ckt		Layers =	2		At end of iteration =	283		cost =	0.479711047885599

Circuit =	problem_ckt		Layers =	2		At end of iteration =	284		cost =	0.479569970388209

Circuit =	problem_ckt		Layers =	2		At end of iteration =	285		cost =	0.479429873832770

Circuit =	problem_ckt		Layers =	2		At end of iteration =	286		cost =	0.479290751695159

Circuit =	problem_ckt		Layers =	2		At end of iteration =	287		cost =	0.479152597481289

Circuit =	problem_ckt		Layers =	2		At end of iteration =	288		cost =	0.479015404727160

Circuit =	problem_ckt		Layers =	2		At end of iteration =	289		cost =	0.478879166998950

```

idx = theta2[1] params = 0.03719052023213644
idx = theta4[2] params = 0.04312312828020062
idx = theta2[0] params = 0.0004994971757621869
idx = theta3[0] params = 0.03444025418170515
idx = theta3[1] params = 0.046881140646663634
idx = theta5[0] params = 0.02164226791611938
idx = theta4[1] params = 0.028343942770291508
idx = theta2[3] params = 0.013510378554063363
idx = theta2[2] params = 0.022782810868909098
idx = theta3[2] params = 0.00573789773068969
idx = theta1[0] params = 0.039532273767073196
idx = theta5[2] params = 0.018375156312795238
idx = theta6[1] params = 0.02421115885861306
idx = theta6[0] params = 0.01671278315727628
idx = theta1[3] params = 0.006172454610576922
idx = theta5[3] params = 0.016655522656847783
idx = theta1[2] params = 0.04662197117509747
idx = theta4[0] params = 0.009378499198132518
idx = theta1[1] params = 0.030481776612878
idx = theta3[3] params = 0.006238299240088347
idx = theta6[3] params = 0.046316344013782464
idx = theta4[3] params = 0.002833116050508433
idx = theta6[2] params = 0.009568165097689485
idx = theta5[1] params = 0.003778807686699465

```

```

-----
Circuit = problem_ckt | Layers = 3 | At end of iteration = 1 | cost = 1.222102015028581
-----
Circuit = problem_ckt | Layers = 3 | At end of iteration = 2 | cost = 1.1942369105137494
-----
Circuit = problem_ckt | Layers = 3 | At end of iteration = 3 | cost = 1.1637172683980348
-----
Circuit = problem_ckt | Layers = 3 | At end of iteration = 4 | cost = 1.1254024389127486
-----
Circuit = problem_ckt | Layers = 3 | At end of iteration = 5 | cost = 1.0748685618102958
-----
Circuit = problem_ckt | Layers = 3 | At end of iteration = 6 | cost = 1.0105282385672454
-----
Circuit = problem_ckt | Layers = 3 | At end of iteration = 7 | cost = 0.938820341226965
-----
Circuit = problem_ckt | Layers = 3 | At end of iteration = 8 | cost = 0.8760005018714688
-----
Circuit = problem_ckt | Layers = 3 | At end of iteration = 9 | cost = 0.8330481053091343
-----
Circuit = problem_ckt | Layers = 3 | At end of iteration = 10 | cost = 0.804438962905546
-----
Circuit = problem_ckt | Layers = 3 | At end of iteration = 11 | cost = 0.783395824851413
-----
Circuit = problem_ckt | Layers = 3 | At end of iteration = 12 | cost = 0.767489547891416

```

```

-----
Circuit =  problem_ckt | Layers =  3 | At end of iteration = 13 | cost =  0.75496387205363
-----
Circuit =  problem_ckt | Layers =  3 | At end of iteration = 14 | cost =  0.744157798424676
-----
Circuit =  problem_ckt | Layers =  3 | At end of iteration = 15 | cost =  0.733791316272037
-----
Circuit =  problem_ckt | Layers =  3 | At end of iteration = 16 | cost =  0.722953646840635
-----
Circuit =  problem_ckt | Layers =  3 | At end of iteration = 17 | cost =  0.710971287727829
-----
Circuit =  problem_ckt | Layers =  3 | At end of iteration = 18 | cost =  0.697295663963914
-----
Circuit =  problem_ckt | Layers =  3 | At end of iteration = 19 | cost =  0.681445046518325
-----
Circuit =  problem_ckt | Layers =  3 | At end of iteration = 20 | cost =  0.663004751576948
-----
Circuit =  problem_ckt | Layers =  3 | At end of iteration = 21 | cost =  0.641684632758135
-----
Circuit =  problem_ckt | Layers =  3 | At end of iteration = 22 | cost =  0.617429525517737
-----
Circuit =  problem_ckt | Layers =  3 | At end of iteration = 23 | cost =  0.590558793817243
-----
Circuit =  problem_ckt | Layers =  3 | At end of iteration = 24 | cost =  0.561867720716512
-----
Circuit =  problem_ckt | Layers =  3 | At end of iteration = 25 | cost =  0.532575302445246
-----
Circuit =  problem_ckt | Layers =  3 | At end of iteration = 26 | cost =  0.504022956657796
-----
Circuit =  problem_ckt | Layers =  3 | At end of iteration = 27 | cost =  0.477205051216646
-----
Circuit =  problem_ckt | Layers =  3 | At end of iteration = 28 | cost =  0.452452108573059
-----
Circuit =  problem_ckt | Layers =  3 | At end of iteration = 29 | cost =  0.429543892001438
-----
Circuit =  problem_ckt | Layers =  3 | At end of iteration = 30 | cost =  0.408138849730261
-----
Circuit =  problem_ckt | Layers =  3 | At end of iteration = 31 | cost =  0.388144050168511
-----
Circuit =  problem_ckt | Layers =  3 | At end of iteration = 32 | cost =  0.369844521400301
-----
Circuit =  problem_ckt | Layers =  3 | At end of iteration = 33 | cost =  0.353675322405151
-----
Circuit =  problem_ckt | Layers =  3 | At end of iteration = 34 | cost =  0.340403944034598
-----
Circuit =  problem_ckt | Layers =  3 | At end of iteration = 35 | cost =  0.328535358666237
-----
Circuit =  problem_ckt | Layers =  3 | At end of iteration = 36 | cost =  0.331962310147880
-----

```

```

-----
Circuit =  problem_ckt | Layers =  3 | At end of iteration =  37 | cost =  0.4137462845391770
-----
Circuit =  problem_ckt | Layers =  3 | At end of iteration =  38 | cost =  1.207125395721913
-----
Circuit =  problem_ckt | Layers =  3 | At end of iteration =  39 | cost =  0.356823777289886
-----
REDUCING ALPHA TO  0.31622776601683794  at iteration =  40
-----
Circuit =  problem_ckt | Layers =  3 | At end of iteration =  40 | cost =  0.653620457424547
-----
Circuit =  problem_ckt | Layers =  3 | At end of iteration =  41 | cost =  0.313033862486080
-----
Circuit =  problem_ckt | Layers =  3 | At end of iteration =  42 | cost =  0.315396778635506
-----
Circuit =  problem_ckt | Layers =  3 | At end of iteration =  43 | cost =  0.305430564185098
-----
Circuit =  problem_ckt | Layers =  3 | At end of iteration =  44 | cost =  0.317378253507068
-----
Circuit =  problem_ckt | Layers =  3 | At end of iteration =  45 | cost =  0.303790857524968
-----
Circuit =  problem_ckt | Layers =  3 | At end of iteration =  46 | cost =  0.330886119918251
-----
Circuit =  problem_ckt | Layers =  3 | At end of iteration =  47 | cost =  0.311204113204242
-----
Circuit =  problem_ckt | Layers =  3 | At end of iteration =  48 | cost =  0.362574099830442
-----
Circuit =  problem_ckt | Layers =  3 | At end of iteration =  49 | cost =  0.329546125191439
-----
Circuit =  problem_ckt | Layers =  3 | At end of iteration =  50 | cost =  0.392672507318905
-----
Circuit =  problem_ckt | Layers =  3 | At end of iteration =  51 | cost =  0.338367980633035
-----
Circuit =  problem_ckt | Layers =  3 | At end of iteration =  52 | cost =  0.401046895684408
-----
Circuit =  problem_ckt | Layers =  3 | At end of iteration =  53 | cost =  0.339319007350042
-----
Circuit =  problem_ckt | Layers =  3 | At end of iteration =  54 | cost =  0.402601739948628
-----
Circuit =  problem_ckt | Layers =  3 | At end of iteration =  55 | cost =  0.339393866274846
-----
Circuit =  problem_ckt | Layers =  3 | At end of iteration =  56 | cost =  0.403559668492035
-----
Circuit =  problem_ckt | Layers =  3 | At end of iteration =  57 | cost =  0.339443340166558
-----
Circuit =  problem_ckt | Layers =  3 | At end of iteration =  58 | cost =  0.404453431580969
-----
Circuit =  problem_ckt | Layers =  3 | At end of iteration =  59 | cost =  0.339492062128984
-----

```



```

-----
Circuit =  problem_ckt | Layers =  3 | At end of iteration = 60 | cost = 0.4052838674828715
-----
Circuit =  problem_ckt | Layers =  3 | At end of iteration = 61 | cost = 0.3395278563647635
-----
Circuit =  problem_ckt | Layers =  3 | At end of iteration = 62 | cost = 0.4060419200817380
-----
Circuit =  problem_ckt | Layers =  3 | At end of iteration = 63 | cost = 0.3395446887343245
-----
Circuit =  problem_ckt | Layers =  3 | At end of iteration = 64 | cost = 0.4067277808098450
-----
Circuit =  problem_ckt | Layers =  3 | At end of iteration = 65 | cost = 0.3395404866731945
-----
Circuit =  problem_ckt | Layers =  3 | At end of iteration = 66 | cost = 0.4073459529779480
-----
Circuit =  problem_ckt | Layers =  3 | At end of iteration = 67 | cost = 0.3395150537076910
-----
Circuit =  problem_ckt | Layers =  3 | At end of iteration = 68 | cost = 0.4079024679644890
-----
Circuit =  problem_ckt | Layers =  3 | At end of iteration = 69 | cost = 0.3394690729074740
-----
Circuit =  problem_ckt | Layers =  3 | At end of iteration = 70 | cost = 0.4084036467615435
-----
Circuit =  problem_ckt | Layers =  3 | At end of iteration = 71 | cost = 0.3394036322972390
-----
Circuit =  problem_ckt | Layers =  3 | At end of iteration = 72 | cost = 0.4088555629539160
-----
Circuit =  problem_ckt | Layers =  3 | At end of iteration = 73 | cost = 0.3393199909142120
-----
Circuit =  problem_ckt | Layers =  3 | At end of iteration = 74 | cost = 0.4092638246987960
-----
Circuit =  problem_ckt | Layers =  3 | At end of iteration = 75 | cost = 0.3392194602234600
-----
Circuit =  problem_ckt | Layers =  3 | At end of iteration = 76 | cost = 0.4096335049589410
-----
Circuit =  problem_ckt | Layers =  3 | At end of iteration = 77 | cost = 0.3391033428631070
-----
Circuit =  problem_ckt | Layers =  3 | At end of iteration = 78 | cost = 0.4099691406987660
-----
Circuit =  problem_ckt | Layers =  3 | At end of iteration = 79 | cost = 0.3389729007277100
-----
REDUCING ALPHA TO 0.09999999999999999 at iteration = 80
-----
Circuit =  problem_ckt | Layers =  3 | At end of iteration = 80 | cost = 0.4102747630267480
-----
Circuit =  problem_ckt | Layers =  3 | At end of iteration = 81 | cost = 0.3218907070418190
-----
Circuit =  problem_ckt | Layers =  3 | At end of iteration = 82 | cost = 0.2948589135129020

```

```

-----
Circuit =  problem_ckt | Layers =  3 | At end of iteration =  83 | cost =  0.290923452730590
-----
Circuit =  problem_ckt | Layers =  3 | At end of iteration =  84 | cost =  0.290321846556420
-----
Circuit =  problem_ckt | Layers =  3 | At end of iteration =  85 | cost =  0.29018765484301
-----
Circuit =  problem_ckt | Layers =  3 | At end of iteration =  86 | cost =  0.290134293560327
-----
Circuit =  problem_ckt | Layers =  3 | At end of iteration =  87 | cost =  0.290099065413055
-----
Circuit =  problem_ckt | Layers =  3 | At end of iteration =  88 | cost =  0.290070174864544
-----
Circuit =  problem_ckt | Layers =  3 | At end of iteration =  89 | cost =  0.290044469729503
-----
Circuit =  problem_ckt | Layers =  3 | At end of iteration =  90 | cost =  0.290020502131813
-----
Circuit =  problem_ckt | Layers =  3 | At end of iteration =  91 | cost =  0.289997329495053
-----
Circuit =  problem_ckt | Layers =  3 | At end of iteration =  92 | cost =  0.289974266021490
-----
Circuit =  problem_ckt | Layers =  3 | At end of iteration =  93 | cost =  0.289950801457175
-----
Circuit =  problem_ckt | Layers =  3 | At end of iteration =  94 | cost =  0.289926556911155
-----
Circuit =  problem_ckt | Layers =  3 | At end of iteration =  95 | cost =  0.289901254135570
-----
Circuit =  problem_ckt | Layers =  3 | At end of iteration =  96 | cost =  0.289874692553363
-----
Circuit =  problem_ckt | Layers =  3 | At end of iteration =  97 | cost =  0.289846731711072
-----
Circuit =  problem_ckt | Layers =  3 | At end of iteration =  98 | cost =  0.289817277754429
-----
Circuit =  problem_ckt | Layers =  3 | At end of iteration =  99 | cost =  0.289786272942916
-----
Circuit =  problem_ckt | Layers =  3 | At end of iteration = 100 | cost =  0.28975368748176
-----
Circuit =  problem_ckt | Layers =  3 | At end of iteration = 101 | cost =  0.28971951313363
-----
Circuit =  problem_ckt | Layers =  3 | At end of iteration = 102 | cost =  0.28968375820550
-----
Circuit =  problem_ckt | Layers =  3 | At end of iteration = 103 | cost =  0.28964644360395
-----
Circuit =  problem_ckt | Layers =  3 | At end of iteration = 104 | cost =  0.28960759972488
-----
Circuit =  problem_ckt | Layers =  3 | At end of iteration = 105 | cost =  0.28956726399777
-----
Circuit =  problem_ckt | Layers =  3 | At end of iteration = 106 | cost =  0.28952547894568
-----

```

```

-----
Circuit =  problem_ckt | Layers =  3 | At end of iteration = 107 | cost = 0.28948229065296
-----
Circuit =  problem_ckt | Layers =  3 | At end of iteration = 108 | cost = 0.28943774755645
-----
Circuit =  problem_ckt | Layers =  3 | At end of iteration = 109 | cost = 0.28939189949415
-----
Circuit =  problem_ckt | Layers =  3 | At end of iteration = 110 | cost = 0.28934479695902
-----
Circuit =  problem_ckt | Layers =  3 | At end of iteration = 111 | cost = 0.28929649051707
-----
Circuit =  problem_ckt | Layers =  3 | At end of iteration = 112 | cost = 0.28924703035652
-----
Circuit =  problem_ckt | Layers =  3 | At end of iteration = 113 | cost = 0.28919646594243
-----
Circuit =  problem_ckt | Layers =  3 | At end of iteration = 114 | cost = 0.28914484575544
-----
Circuit =  problem_ckt | Layers =  3 | At end of iteration = 115 | cost = 0.28909221709828
-----
Circuit =  problem_ckt | Layers =  3 | At end of iteration = 116 | cost = 0.28903862595631
-----
Circuit =  problem_ckt | Layers =  3 | At end of iteration = 117 | cost = 0.28898411690141
-----
Circuit =  problem_ckt | Layers =  3 | At end of iteration = 118 | cost = 0.28892873303029
-----
Circuit =  problem_ckt | Layers =  3 | At end of iteration = 119 | cost = 0.28887251593031
-----
REDUCING ALPHA TO 0.03162277660168379 at iteration = 120
-----
Circuit =  problem_ckt | Layers =  3 | At end of iteration = 120 | cost = 0.28881550566694
-----
Circuit =  problem_ckt | Layers =  3 | At end of iteration = 121 | cost = 0.28879719571362
-----
Circuit =  problem_ckt | Layers =  3 | At end of iteration = 122 | cost = 0.28877881416220
-----
Circuit =  problem_ckt | Layers =  3 | At end of iteration = 123 | cost = 0.28876036234857
-----
Circuit =  problem_ckt | Layers =  3 | At end of iteration = 124 | cost = 0.28874184152997
-----
Circuit =  problem_ckt | Layers =  3 | At end of iteration = 125 | cost = 0.28872325290278
-----
Circuit =  problem_ckt | Layers =  3 | At end of iteration = 126 | cost = 0.28870459761544
-----
Circuit =  problem_ckt | Layers =  3 | At end of iteration = 127 | cost = 0.28868587677797
-----
Circuit =  problem_ckt | Layers =  3 | At end of iteration = 128 | cost = 0.28866709146887
-----
Circuit =  problem_ckt | Layers =  3 | At end of iteration = 129 | cost = 0.28864824274021
-----

```

```

-----
Circuit =  problem_ckt | Layers =  3 | At end of iteration = 130 | cost = 0.28862933162138
-----
Circuit =  problem_ckt | Layers =  3 | At end of iteration = 131 | cost = 0.28861035912188
-----
Circuit =  problem_ckt | Layers =  3 | At end of iteration = 132 | cost = 0.28859132623332
-----
Circuit =  problem_ckt | Layers =  3 | At end of iteration = 133 | cost = 0.28857223393100
-----
Circuit =  problem_ckt | Layers =  3 | At end of iteration = 134 | cost = 0.28855308317505
-----
Circuit =  problem_ckt | Layers =  3 | At end of iteration = 135 | cost = 0.28853387491133
-----
Circuit =  problem_ckt | Layers =  3 | At end of iteration = 136 | cost = 0.28851461007209
-----
Circuit =  problem_ckt | Layers =  3 | At end of iteration = 137 | cost = 0.28849528957653
-----
Circuit =  problem_ckt | Layers =  3 | At end of iteration = 138 | cost = 0.28847591433122
-----
Circuit =  problem_ckt | Layers =  3 | At end of iteration = 139 | cost = 0.28845648523047
-----
Circuit =  problem_ckt | Layers =  3 | At end of iteration = 140 | cost = 0.28843700315663
-----
Circuit =  problem_ckt | Layers =  3 | At end of iteration = 141 | cost = 0.28841746898036
-----
Circuit =  problem_ckt | Layers =  3 | At end of iteration = 142 | cost = 0.28839788356082
-----
Circuit =  problem_ckt | Layers =  3 | At end of iteration = 143 | cost = 0.28837824774591
-----
Circuit =  problem_ckt | Layers =  3 | At end of iteration = 144 | cost = 0.28835856237249
-----
Circuit =  problem_ckt | Layers =  3 | At end of iteration = 145 | cost = 0.28833882826648
-----
Circuit =  problem_ckt | Layers =  3 | At end of iteration = 146 | cost = 0.28831904624312
-----
Circuit =  problem_ckt | Layers =  3 | At end of iteration = 147 | cost = 0.28829921710706
-----
Circuit =  problem_ckt | Layers =  3 | At end of iteration = 148 | cost = 0.28827934165257
-----
Circuit =  problem_ckt | Layers =  3 | At end of iteration = 149 | cost = 0.28825942066368
-----
Circuit =  problem_ckt | Layers =  3 | At end of iteration = 150 | cost = 0.28823945491432
-----
Circuit =  problem_ckt | Layers =  3 | At end of iteration = 151 | cost = 0.28821944516847
-----
Circuit =  problem_ckt | Layers =  3 | At end of iteration = 152 | cost = 0.28819939218033
-----
Circuit =  problem_ckt | Layers =  3 | At end of iteration = 153 | cost = 0.28817929669442
-----

```

```

-----
Circuit =  problem_ckt | Layers =  3 | At end of iteration = 154 | cost = 0.28815915944576
-----
Circuit =  problem_ckt | Layers =  3 | At end of iteration = 155 | cost = 0.28813898116002
-----
Circuit =  problem_ckt | Layers =  3 | At end of iteration = 156 | cost = 0.28811876255361
-----
Circuit =  problem_ckt | Layers =  3 | At end of iteration = 157 | cost = 0.28809850433385
-----
Circuit =  problem_ckt | Layers =  3 | At end of iteration = 158 | cost = 0.28807820719910
-----
Circuit =  problem_ckt | Layers =  3 | At end of iteration = 159 | cost = 0.28805787183891
-----
Circuit =  problem_ckt | Layers =  3 | At end of iteration = 160 | cost = 0.28803749893411
-----
Circuit =  problem_ckt | Layers =  3 | At end of iteration = 161 | cost = 0.28801708915698
-----
Circuit =  problem_ckt | Layers =  3 | At end of iteration = 162 | cost = 0.28799664317136
-----
Circuit =  problem_ckt | Layers =  3 | At end of iteration = 163 | cost = 0.28797616163281
-----
Circuit =  problem_ckt | Layers =  3 | At end of iteration = 164 | cost = 0.28795564518866
-----
Circuit =  problem_ckt | Layers =  3 | At end of iteration = 165 | cost = 0.28793509447822
-----
Circuit =  problem_ckt | Layers =  3 | At end of iteration = 166 | cost = 0.28791451013287
-----
Circuit =  problem_ckt | Layers =  3 | At end of iteration = 167 | cost = 0.28789389277615
-----
Circuit =  problem_ckt | Layers =  3 | At end of iteration = 168 | cost = 0.28787324302393
-----
Circuit =  problem_ckt | Layers =  3 | At end of iteration = 169 | cost = 0.28785256148450
-----
Circuit =  problem_ckt | Layers =  3 | At end of iteration = 170 | cost = 0.28783184875869
-----
Circuit =  problem_ckt | Layers =  3 | At end of iteration = 171 | cost = 0.28781110543999
-----
Circuit =  problem_ckt | Layers =  3 | At end of iteration = 172 | cost = 0.28779033211466
-----
Circuit =  problem_ckt | Layers =  3 | At end of iteration = 173 | cost = 0.28776952936184
-----
Circuit =  problem_ckt | Layers =  3 | At end of iteration = 174 | cost = 0.28774869775366
-----
Circuit =  problem_ckt | Layers =  3 | At end of iteration = 175 | cost = 0.28772783785538
-----
Circuit =  problem_ckt | Layers =  3 | At end of iteration = 176 | cost = 0.28770695022541
-----
Circuit =  problem_ckt | Layers =  3 | At end of iteration = 177 | cost = 0.28768603541554
-----

```

```

-----
Circuit =  problem_ckt | Layers =  3 | At end of iteration = 178 | cost = 0.28766509397093
-----
Circuit =  problem_ckt | Layers =  3 | At end of iteration = 179 | cost = 0.28764412643028
-----
Circuit =  problem_ckt | Layers =  3 | At end of iteration = 180 | cost = 0.28762313332591
-----
Circuit =  problem_ckt | Layers =  3 | At end of iteration = 181 | cost = 0.28760211518385
-----
Circuit =  problem_ckt | Layers =  3 | At end of iteration = 182 | cost = 0.28758107252397
-----
Circuit =  problem_ckt | Layers =  3 | At end of iteration = 183 | cost = 0.28756000586003
-----
Circuit =  problem_ckt | Layers =  3 | At end of iteration = 184 | cost = 0.28753891569981
-----
Circuit =  problem_ckt | Layers =  3 | At end of iteration = 185 | cost = 0.28751780254519
-----
Circuit =  problem_ckt | Layers =  3 | At end of iteration = 186 | cost = 0.28749666689226
-----
Circuit =  problem_ckt | Layers =  3 | At end of iteration = 187 | cost = 0.28747550923136
-----
Circuit =  problem_ckt | Layers =  3 | At end of iteration = 188 | cost = 0.28745433004724
-----
Circuit =  problem_ckt | Layers =  3 | At end of iteration = 189 | cost = 0.28743312981909
-----
Circuit =  problem_ckt | Layers =  3 | At end of iteration = 190 | cost = 0.28741190902066
-----
Circuit =  problem_ckt | Layers =  3 | At end of iteration = 191 | cost = 0.28739066812032
-----
Circuit =  problem_ckt | Layers =  3 | At end of iteration = 192 | cost = 0.28736940758115
-----
Circuit =  problem_ckt | Layers =  3 | At end of iteration = 193 | cost = 0.28734812786105
-----
Circuit =  problem_ckt | Layers =  3 | At end of iteration = 194 | cost = 0.28732682941278
-----
Circuit =  problem_ckt | Layers =  3 | At end of iteration = 195 | cost = 0.28730551268407
-----
Circuit =  problem_ckt | Layers =  3 | At end of iteration = 196 | cost = 0.28728417811767
-----
Circuit =  problem_ckt | Layers =  3 | At end of iteration = 197 | cost = 0.28726282615145
-----
Circuit =  problem_ckt | Layers =  3 | At end of iteration = 198 | cost = 0.28724145721846
-----
Circuit =  problem_ckt | Layers =  3 | At end of iteration = 199 | cost = 0.28722007174703
-----
Circuit =  problem_ckt | Layers =  3 | At end of iteration = 200 | cost = 0.28719867016080
-----
Circuit =  problem_ckt | Layers =  3 | At end of iteration = 201 | cost = 0.28717725287883
-----

```

```

-----
Circuit =  problem_ckt | Layers =  3 | At end of iteration = 202 | cost = 0.28715582031566
-----
Circuit =  problem_ckt | Layers =  3 | At end of iteration = 203 | cost = 0.28713437288137
-----
Circuit =  problem_ckt | Layers =  3 | At end of iteration = 204 | cost = 0.28711291098163
-----
Circuit =  problem_ckt | Layers =  3 | At end of iteration = 205 | cost = 0.28709143501784
-----
Circuit =  problem_ckt | Layers =  3 | At end of iteration = 206 | cost = 0.28706994538710
-----
Circuit =  problem_ckt | Layers =  3 | At end of iteration = 207 | cost = 0.28704844248234
-----
Circuit =  problem_ckt | Layers =  3 | At end of iteration = 208 | cost = 0.28702692669238
-----
Circuit =  problem_ckt | Layers =  3 | At end of iteration = 209 | cost = 0.28700539840193
-----
Circuit =  problem_ckt | Layers =  3 | At end of iteration = 210 | cost = 0.28698385799175
-----
Circuit =  problem_ckt | Layers =  3 | At end of iteration = 211 | cost = 0.28696230583862
-----
Circuit =  problem_ckt | Layers =  3 | At end of iteration = 212 | cost = 0.28694074231545
-----
Circuit =  problem_ckt | Layers =  3 | At end of iteration = 213 | cost = 0.28691916779134
-----
Circuit =  problem_ckt | Layers =  3 | At end of iteration = 214 | cost = 0.28689758263159
-----
Circuit =  problem_ckt | Layers =  3 | At end of iteration = 215 | cost = 0.28687598719782
-----
Circuit =  problem_ckt | Layers =  3 | At end of iteration = 216 | cost = 0.28685438184798
-----
Circuit =  problem_ckt | Layers =  3 | At end of iteration = 217 | cost = 0.28683276693640
-----
Circuit =  problem_ckt | Layers =  3 | At end of iteration = 218 | cost = 0.28681114281390
-----
Circuit =  problem_ckt | Layers =  3 | At end of iteration = 219 | cost = 0.28678950982776
-----
Circuit =  problem_ckt | Layers =  3 | At end of iteration = 220 | cost = 0.28676786832185
-----
Circuit =  problem_ckt | Layers =  3 | At end of iteration = 221 | cost = 0.28674621863663
-----
Circuit =  problem_ckt | Layers =  3 | At end of iteration = 222 | cost = 0.28672456110920
-----
Circuit =  problem_ckt | Layers =  3 | At end of iteration = 223 | cost = 0.28670289607338
-----
Circuit =  problem_ckt | Layers =  3 | At end of iteration = 224 | cost = 0.28668122385975
-----
Circuit =  problem_ckt | Layers =  3 | At end of iteration = 225 | cost = 0.28665954479566
-----

```

```

-----
Circuit =  problem_ckt | Layers =  3 | At end of iteration = 226 | cost = 0.28663785920532
-----
Circuit =  problem_ckt | Layers =  3 | At end of iteration = 227 | cost = 0.28661616740984
-----
Circuit =  problem_ckt | Layers =  3 | At end of iteration = 228 | cost = 0.28659446972723
-----
Circuit =  problem_ckt | Layers =  3 | At end of iteration = 229 | cost = 0.28657276647251
-----
Circuit =  problem_ckt | Layers =  3 | At end of iteration = 230 | cost = 0.28655105795770
-----
Circuit =  problem_ckt | Layers =  3 | At end of iteration = 231 | cost = 0.28652934449190
-----
Circuit =  problem_ckt | Layers =  3 | At end of iteration = 232 | cost = 0.28650762638128
-----
Circuit =  problem_ckt | Layers =  3 | At end of iteration = 233 | cost = 0.28648590392920
-----
Circuit =  problem_ckt | Layers =  3 | At end of iteration = 234 | cost = 0.28646417743616
-----
Circuit =  problem_ckt | Layers =  3 | At end of iteration = 235 | cost = 0.28644244719991
-----
Circuit =  problem_ckt | Layers =  3 | At end of iteration = 236 | cost = 0.28642071351546
-----
Circuit =  problem_ckt | Layers =  3 | At end of iteration = 237 | cost = 0.28639897667510
-----
Circuit =  problem_ckt | Layers =  3 | At end of iteration = 238 | cost = 0.28637723696847
-----
Circuit =  problem_ckt | Layers =  3 | At end of iteration = 239 | cost = 0.28635549468258
-----
Circuit =  problem_ckt | Layers =  3 | At end of iteration = 240 | cost = 0.28633375010186
-----
Circuit =  problem_ckt | Layers =  3 | At end of iteration = 241 | cost = 0.28631200350816
-----
Circuit =  problem_ckt | Layers =  3 | At end of iteration = 242 | cost = 0.28629025518083
-----
Circuit =  problem_ckt | Layers =  3 | At end of iteration = 243 | cost = 0.28626850539671
-----
Circuit =  problem_ckt | Layers =  3 | At end of iteration = 244 | cost = 0.28624675443021
-----
Circuit =  problem_ckt | Layers =  3 | At end of iteration = 245 | cost = 0.28622500255329
-----
Circuit =  problem_ckt | Layers =  3 | At end of iteration = 246 | cost = 0.28620325003555
-----
Circuit =  problem_ckt | Layers =  3 | At end of iteration = 247 | cost = 0.28618149714420
-----
Circuit =  problem_ckt | Layers =  3 | At end of iteration = 248 | cost = 0.28615974414415
-----
Circuit =  problem_ckt | Layers =  3 | At end of iteration = 249 | cost = 0.28613799129799
-----

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```

-----
Circuit =  problem_ckt | Layers =  3 | At end of iteration = 250 | cost = 0.28611623886605
-----
Circuit =  problem_ckt | Layers =  3 | At end of iteration = 251 | cost = 0.28609448710644
-----
Circuit =  problem_ckt | Layers =  3 | At end of iteration = 252 | cost = 0.28607273627502
-----
Circuit =  problem_ckt | Layers =  3 | At end of iteration = 253 | cost = 0.28605098662551
-----
Circuit =  problem_ckt | Layers =  3 | At end of iteration = 254 | cost = 0.28602923840945
-----
Circuit =  problem_ckt | Layers =  3 | At end of iteration = 255 | cost = 0.28600749187625
-----
Circuit =  problem_ckt | Layers =  3 | At end of iteration = 256 | cost = 0.28598574727325
-----
Circuit =  problem_ckt | Layers =  3 | At end of iteration = 257 | cost = 0.28596400484569
-----
Circuit =  problem_ckt | Layers =  3 | At end of iteration = 258 | cost = 0.28594226483676
-----
Circuit =  problem_ckt | Layers =  3 | At end of iteration = 259 | cost = 0.28592052748765
-----
Circuit =  problem_ckt | Layers =  3 | At end of iteration = 260 | cost = 0.28589879303752
-----
Circuit =  problem_ckt | Layers =  3 | At end of iteration = 261 | cost = 0.28587706172359
-----
Circuit =  problem_ckt | Layers =  3 | At end of iteration = 262 | cost = 0.28585533378112
-----
Circuit =  problem_ckt | Layers =  3 | At end of iteration = 263 | cost = 0.28583360944341
-----
Circuit =  problem_ckt | Layers =  3 | At end of iteration = 264 | cost = 0.28581188894192
-----
Circuit =  problem_ckt | Layers =  3 | At end of iteration = 265 | cost = 0.28579017250617
-----
Circuit =  problem_ckt | Layers =  3 | At end of iteration = 266 | cost = 0.28576846036386
-----
Circuit =  problem_ckt | Layers =  3 | At end of iteration = 267 | cost = 0.28574675274083
-----
Circuit =  problem_ckt | Layers =  3 | At end of iteration = 268 | cost = 0.28572504986113
-----
Circuit =  problem_ckt | Layers =  3 | At end of iteration = 269 | cost = 0.28570335194700
-----
Circuit =  problem_ckt | Layers =  3 | At end of iteration = 270 | cost = 0.28568165921889
-----
Circuit =  problem_ckt | Layers =  3 | At end of iteration = 271 | cost = 0.28565997189554
-----
Circuit =  problem_ckt | Layers =  3 | At end of iteration = 272 | cost = 0.28563829019393
-----
Circuit =  problem_ckt | Layers =  3 | At end of iteration = 273 | cost = 0.28561661432932
-----

```

```

-----
Circuit =  problem_ckt | Layers =  3 | At end of iteration = 274 | cost = 0.28559494451529
-----
Circuit =  problem_ckt | Layers =  3 | At end of iteration = 275 | cost = 0.28557328096375
-----
Circuit =  problem_ckt | Layers =  3 | At end of iteration = 276 | cost = 0.28555162388494
-----
Circuit =  problem_ckt | Layers =  3 | At end of iteration = 277 | cost = 0.28552997348746
-----
Circuit =  problem_ckt | Layers =  3 | At end of iteration = 278 | cost = 0.28550832997831
-----
Circuit =  problem_ckt | Layers =  3 | At end of iteration = 279 | cost = 0.28548669356287
-----
Circuit =  problem_ckt | Layers =  3 | At end of iteration = 280 | cost = 0.28546506444494
-----
Circuit =  problem_ckt | Layers =  3 | At end of iteration = 281 | cost = 0.28544344282674
-----
Circuit =  problem_ckt | Layers =  3 | At end of iteration = 282 | cost = 0.28542182890896
-----
Circuit =  problem_ckt | Layers =  3 | At end of iteration = 283 | cost = 0.28540022289075
-----
Circuit =  problem_ckt | Layers =  3 | At end of iteration = 284 | cost = 0.28537862496971
-----
Circuit =  problem_ckt | Layers =  3 | At end of iteration = 285 | cost = 0.28535703534198
-----
Circuit =  problem_ckt | Layers =  3 | At end of iteration = 286 | cost = 0.28533545420219
-----
Circuit =  problem_ckt | Layers =  3 | At end of iteration = 287 | cost = 0.28531388174349
-----
Circuit =  problem_ckt | Layers =  3 | At end of iteration = 288 | cost = 0.28529231815759
-----
Circuit =  problem_ckt | Layers =  3 | At end of iteration = 289 | cost = 0.28527076363474
-----
Circuit =  problem_ckt | Layers =  3 | At end of iteration = 290 | cost = 0.28524921836378
-----
Circuit =  problem_ckt | Layers =  3 | At end of iteration = 291 | cost = 0.28522768253211
-----
Circuit =  problem_ckt | Layers =  3 | At end of iteration = 292 | cost = 0.28520615632576
-----
Circuit =  problem_ckt | Layers =  3 | At end of iteration = 293 | cost = 0.28518463992934
-----
Circuit =  problem_ckt | Layers =  3 | At end of iteration = 294 | cost = 0.28516313352611
-----
Circuit =  problem_ckt | Layers =  3 | At end of iteration = 295 | cost = 0.28514163729797
-----
Circuit =  problem_ckt | Layers =  3 | At end of iteration = 296 | cost = 0.28512015142545
-----
Circuit =  problem_ckt | Layers =  3 | At end of iteration = 297 | cost = 0.28509867608777
-----

```



```

idx = theta6[2] params = 0.016655522656847783
idx = theta3[2] params = 0.04662197117509747
idx = theta4[2] params = 0.009378499198132518
idx = theta7[0] params = 0.030481776612878
idx = theta5[1] params = 0.006238299240088347
idx = theta7[1] params = 0.046316344013782464
idx = theta3[3] params = 0.002833116050508433
idx = theta4[3] params = 0.009568165097689485
idx = theta1[2] params = 0.003778807686699465
idx = theta7[3] params = 0.04761132655555178
idx = theta4[1] params = 0.02912836626547597
idx = theta2[1] params = 0.03277867333581935
idx = theta8[2] params = 0.0012507649722014293
idx = theta6[0] params = 0.03265668670981592
idx = theta3[1] params = 0.042510362504139115
idx = theta2[0] params = 0.028964664980450857
idx = theta6[1] params = 0.02606701333987876

```

```

-----
Circuit = problem_ckt | Layers = 4 | At end of iteration = 1 | cost = 1.2181207951801687
-----

```

```

Circuit = problem_ckt | Layers = 4 | At end of iteration = 2 | cost = 1.1879315878882681
-----

```

```

Circuit = problem_ckt | Layers = 4 | At end of iteration = 3 | cost = 1.1529637909784016
-----

```

```

Circuit = problem_ckt | Layers = 4 | At end of iteration = 4 | cost = 1.1039248865526363
-----

```

```

Circuit = problem_ckt | Layers = 4 | At end of iteration = 5 | cost = 1.0330967424713415
-----

```

```

Circuit = problem_ckt | Layers = 4 | At end of iteration = 6 | cost = 0.9433751043124539
-----

```

```

Circuit = problem_ckt | Layers = 4 | At end of iteration = 7 | cost = 0.8629995375720513
-----

```

```

Circuit = problem_ckt | Layers = 4 | At end of iteration = 8 | cost = 0.8150564205926695
-----

```

```

Circuit = problem_ckt | Layers = 4 | At end of iteration = 9 | cost = 0.7860027395528587
-----

```

```

Circuit = problem_ckt | Layers = 4 | At end of iteration = 10 | cost = 0.767299558053625
-----

```

```

Circuit = problem_ckt | Layers = 4 | At end of iteration = 11 | cost = 0.754269259243273
-----

```

```

Circuit = problem_ckt | Layers = 4 | At end of iteration = 12 | cost = 0.743220129604901
-----

```

```

Circuit = problem_ckt | Layers = 4 | At end of iteration = 13 | cost = 0.732122434704894
-----

```

```

Circuit = problem_ckt | Layers = 4 | At end of iteration = 14 | cost = 0.720014611489674
-----

```

```

Circuit = problem_ckt | Layers = 4 | At end of iteration = 15 | cost = 0.706494004750440
-----

```

Circuit = problem_ckt Layers = 4 At end of iteration = 16 cost = 0.691362192247266
Circuit = problem_ckt Layers = 4 At end of iteration = 17 cost = 0.674585550485636
Circuit = problem_ckt Layers = 4 At end of iteration = 18 cost = 0.656242455636992
Circuit = problem_ckt Layers = 4 At end of iteration = 19 cost = 0.636605085418129
Circuit = problem_ckt Layers = 4 At end of iteration = 20 cost = 0.616089947024267
Circuit = problem_ckt Layers = 4 At end of iteration = 21 cost = 0.595311711657796
Circuit = problem_ckt Layers = 4 At end of iteration = 22 cost = 0.574802712181253
Circuit = problem_ckt Layers = 4 At end of iteration = 23 cost = 0.555118343620237
Circuit = problem_ckt Layers = 4 At end of iteration = 24 cost = 0.536091712858546
Circuit = problem_ckt Layers = 4 At end of iteration = 25 cost = 0.518362934491009
Circuit = problem_ckt Layers = 4 At end of iteration = 26 cost = 0.499612193325220
Circuit = problem_ckt Layers = 4 At end of iteration = 27 cost = 0.488163306584664
Circuit = problem_ckt Layers = 4 At end of iteration = 28 cost = 0.480637644312495
Circuit = problem_ckt Layers = 4 At end of iteration = 29 cost = 0.722245139578571
Circuit = problem_ckt Layers = 4 At end of iteration = 30 cost = 0.996210806572250
Circuit = problem_ckt Layers = 4 At end of iteration = 31 cost = 0.713522244516050
Circuit = problem_ckt Layers = 4 At end of iteration = 32 cost = 0.880928221399518
Circuit = problem_ckt Layers = 4 At end of iteration = 33 cost = 0.782073960353202
Circuit = problem_ckt Layers = 4 At end of iteration = 34 cost = 0.786653381559901
Circuit = problem_ckt Layers = 4 At end of iteration = 35 cost = 0.817790876390688
Circuit = problem_ckt Layers = 4 At end of iteration = 36 cost = 0.726822839569121
Circuit = problem_ckt Layers = 4 At end of iteration = 37 cost = 0.828328310968321
Circuit = problem_ckt Layers = 4 At end of iteration = 38 cost = 0.703496739550723
Circuit = problem_ckt Layers = 4 At end of iteration = 39 cost = 0.827689735605185

REDUCING ALPHA TO 0.31622776601683794 at iteration = 40

Circuit =	problem_ckt		Layers =	4		At end of iteration =	40		cost =	0.6955611006479053
Circuit =	problem_ckt		Layers =	4		At end of iteration =	41		cost =	0.4749626268046534
Circuit =	problem_ckt		Layers =	4		At end of iteration =	42		cost =	0.4441048165612307
Circuit =	problem_ckt		Layers =	4		At end of iteration =	43		cost =	0.4290376893442078
Circuit =	problem_ckt		Layers =	4		At end of iteration =	44		cost =	0.4204108400771320
Circuit =	problem_ckt		Layers =	4		At end of iteration =	45		cost =	0.4121640049222557
Circuit =	problem_ckt		Layers =	4		At end of iteration =	46		cost =	0.4056552679406807
Circuit =	problem_ckt		Layers =	4		At end of iteration =	47		cost =	0.3995398361573821
Circuit =	problem_ckt		Layers =	4		At end of iteration =	48		cost =	0.3941728269640570
Circuit =	problem_ckt		Layers =	4		At end of iteration =	49		cost =	0.3890471722107380
Circuit =	problem_ckt		Layers =	4		At end of iteration =	50		cost =	0.3843361069666953
Circuit =	problem_ckt		Layers =	4		At end of iteration =	51		cost =	0.3797926193977562
Circuit =	problem_ckt		Layers =	4		At end of iteration =	52		cost =	0.3755410333135011
Circuit =	problem_ckt		Layers =	4		At end of iteration =	53		cost =	0.3714341665082320
Circuit =	problem_ckt		Layers =	4		At end of iteration =	54		cost =	0.3675805168672280
Circuit =	problem_ckt		Layers =	4		At end of iteration =	55		cost =	0.3638720610330379
Circuit =	problem_ckt		Layers =	4		At end of iteration =	56		cost =	0.3604134782070793
Circuit =	problem_ckt		Layers =	4		At end of iteration =	57		cost =	0.3571053979466280
Circuit =	problem_ckt		Layers =	4		At end of iteration =	58		cost =	0.3540568578756230
Circuit =	problem_ckt		Layers =	4		At end of iteration =	59		cost =	0.3511566363740680
Circuit =	problem_ckt		Layers =	4		At end of iteration =	60		cost =	0.3485290948432750
Circuit =	problem_ckt		Layers =	4		At end of iteration =	61		cost =	0.3460319265050970
Circuit =	problem_ckt		Layers =	4		At end of iteration =	62		cost =	0.3438233822503120

```

Circuit = problem_ckt | Layers = 4 | At end of iteration = 63 | cost = 0.3417047675391053
-----
Circuit = problem_ckt | Layers = 4 | At end of iteration = 64 | cost = 0.3399008872336353
-----
Circuit = problem_ckt | Layers = 4 | At end of iteration = 65 | cost = 0.3381148009579944
-----
Circuit = problem_ckt | Layers = 4 | At end of iteration = 66 | cost = 0.3366966713511211
-----
Circuit = problem_ckt | Layers = 4 | At end of iteration = 67 | cost = 0.3351742980220283
-----
Circuit = problem_ckt | Layers = 4 | At end of iteration = 68 | cost = 0.3341325086238996
-----
Circuit = problem_ckt | Layers = 4 | At end of iteration = 69 | cost = 0.3327757774130102
-----
Circuit = problem_ckt | Layers = 4 | At end of iteration = 70 | cost = 0.3321335890786181
-----
Circuit = problem_ckt | Layers = 4 | At end of iteration = 71 | cost = 0.3307957035563811
-----
Circuit = problem_ckt | Layers = 4 | At end of iteration = 72 | cost = 0.3306511569308711
-----
Circuit = problem_ckt | Layers = 4 | At end of iteration = 73 | cost = 0.3290914276268021
-----
Circuit = problem_ckt | Layers = 4 | At end of iteration = 74 | cost = 0.3297037286346911
-----
Circuit = problem_ckt | Layers = 4 | At end of iteration = 75 | cost = 0.3274956928896167
-----
Circuit = problem_ckt | Layers = 4 | At end of iteration = 76 | cost = 0.3294803071504361
-----
Circuit = problem_ckt | Layers = 4 | At end of iteration = 77 | cost = 0.3258503556760501
-----
Circuit = problem_ckt | Layers = 4 | At end of iteration = 78 | cost = 0.3306569083499671
-----
Circuit = problem_ckt | Layers = 4 | At end of iteration = 79 | cost = 0.3243040975387831
-----
REDUCING ALPHA TO 0.09999999999999999 at iteration = 80
-----
Circuit = problem_ckt | Layers = 4 | At end of iteration = 80 | cost = 0.3354327258985567
-----
Circuit = problem_ckt | Layers = 4 | At end of iteration = 81 | cost = 0.3277014952144431
-----
Circuit = problem_ckt | Layers = 4 | At end of iteration = 82 | cost = 0.3263090231159931
-----
Circuit = problem_ckt | Layers = 4 | At end of iteration = 83 | cost = 0.3259421188058251
-----
Circuit = problem_ckt | Layers = 4 | At end of iteration = 84 | cost = 0.3257794104378231
-----
Circuit = problem_ckt | Layers = 4 | At end of iteration = 85 | cost = 0.3256619671453091
-----

```

Circuit =	problem_ckt		Layers =	4		At end of iteration =	86		cost =	0.325555126729611

Circuit =	problem_ckt		Layers =	4		At end of iteration =	87		cost =	0.325451024603122

Circuit =	problem_ckt		Layers =	4		At end of iteration =	88		cost =	0.325347799353110

Circuit =	problem_ckt		Layers =	4		At end of iteration =	89		cost =	0.325244944522627

Circuit =	problem_ckt		Layers =	4		At end of iteration =	90		cost =	0.325142259897503

Circuit =	problem_ckt		Layers =	4		At end of iteration =	91		cost =	0.325039614954490

Circuit =	problem_ckt		Layers =	4		At end of iteration =	92		cost =	0.324936895712219

Circuit =	problem_ckt		Layers =	4		At end of iteration =	93		cost =	0.324833992919008

Circuit =	problem_ckt		Layers =	4		At end of iteration =	94		cost =	0.324730799524850

Circuit =	problem_ckt		Layers =	4		At end of iteration =	95		cost =	0.324627210221061

Circuit =	problem_ckt		Layers =	4		At end of iteration =	96		cost =	0.324523121426632

Circuit =	problem_ckt		Layers =	4		At end of iteration =	97		cost =	0.324418431358576

Circuit =	problem_ckt		Layers =	4		At end of iteration =	98		cost =	0.324313040106098

Circuit =	problem_ckt		Layers =	4		At end of iteration =	99		cost =	0.324206849691867

Circuit =	problem_ckt		Layers =	4		At end of iteration =	100		cost =	0.32409976411793

Circuit =	problem_ckt		Layers =	4		At end of iteration =	101		cost =	0.32399168939708

Circuit =	problem_ckt		Layers =	4		At end of iteration =	102		cost =	0.32388253357100

Circuit =	problem_ckt		Layers =	4		At end of iteration =	103		cost =	0.32377220671681

Circuit =	problem_ckt		Layers =	4		At end of iteration =	104		cost =	0.32366062094349

Circuit =	problem_ckt		Layers =	4		At end of iteration =	105		cost =	0.32354769037938

Circuit =	problem_ckt		Layers =	4		At end of iteration =	106		cost =	0.32343333115217

Circuit =	problem_ckt		Layers =	4		At end of iteration =	107		cost =	0.32331746136230

Circuit =	problem_ckt		Layers =	4		At end of iteration =	108		cost =	0.32320000105097

Circuit =	problem_ckt		Layers =	4		At end of iteration =	109		cost =	0.32308087216338

```

Circuit = problem_ckt | Layers = 4 | At end of iteration = 110 | cost = 0.32295999850824
-----
Circuit = problem_ckt | Layers = 4 | At end of iteration = 111 | cost = 0.32283730571406
-----
Circuit = problem_ckt | Layers = 4 | At end of iteration = 112 | cost = 0.32271272118289
-----
Circuit = problem_ckt | Layers = 4 | At end of iteration = 113 | cost = 0.32258617404204
-----
Circuit = problem_ckt | Layers = 4 | At end of iteration = 114 | cost = 0.32245759509432
-----
Circuit = problem_ckt | Layers = 4 | At end of iteration = 115 | cost = 0.32232691676705
-----
Circuit = problem_ckt | Layers = 4 | At end of iteration = 116 | cost = 0.32219407306049
-----
Circuit = problem_ckt | Layers = 4 | At end of iteration = 117 | cost = 0.32205899949573
-----
Circuit = problem_ckt | Layers = 4 | At end of iteration = 118 | cost = 0.32192163306262
-----
Circuit = problem_ckt | Layers = 4 | At end of iteration = 119 | cost = 0.32178191216779
-----
REDUCING ALPHA TO 0.03162277660168379 at iteration = 120
-----
Circuit = problem_ckt | Layers = 4 | At end of iteration = 120 | cost = 0.32163977658325
-----
Circuit = problem_ckt | Layers = 4 | At end of iteration = 121 | cost = 0.32159424001557
-----
Circuit = problem_ckt | Layers = 4 | At end of iteration = 122 | cost = 0.32154844365272
-----
Circuit = problem_ckt | Layers = 4 | At end of iteration = 123 | cost = 0.32150238689133
-----
Circuit = problem_ckt | Layers = 4 | At end of iteration = 124 | cost = 0.32145606887400
-----
Circuit = problem_ckt | Layers = 4 | At end of iteration = 125 | cost = 0.32140948855388
-----
Circuit = problem_ckt | Layers = 4 | At end of iteration = 126 | cost = 0.32136264474328
-----
Circuit = problem_ckt | Layers = 4 | At end of iteration = 127 | cost = 0.32131553615006
-----
Circuit = problem_ckt | Layers = 4 | At end of iteration = 128 | cost = 0.32126816140513
-----
Circuit = problem_ckt | Layers = 4 | At end of iteration = 129 | cost = 0.32122051908300
-----
Circuit = problem_ckt | Layers = 4 | At end of iteration = 130 | cost = 0.32117260771729
-----
Circuit = problem_ckt | Layers = 4 | At end of iteration = 131 | cost = 0.32112442581236
-----
Circuit = problem_ckt | Layers = 4 | At end of iteration = 132 | cost = 0.32107597185211
-----

```

Circuit = problem_ckt Layers = 4 At end of iteration = 133 cost = 0.32102724430653
Circuit = problem_ckt Layers = 4 At end of iteration = 134 cost = 0.32097824163673
Circuit = problem_ckt Layers = 4 At end of iteration = 135 cost = 0.32092896229861
Circuit = problem_ckt Layers = 4 At end of iteration = 136 cost = 0.32087940474574
Circuit = problem_ckt Layers = 4 At end of iteration = 137 cost = 0.32082956743147
Circuit = problem_ckt Layers = 4 At end of iteration = 138 cost = 0.32077944881055
Circuit = problem_ckt Layers = 4 At end of iteration = 139 cost = 0.32072904734033
Circuit = problem_ckt Layers = 4 At end of iteration = 140 cost = 0.32067836148171
Circuit = problem_ckt Layers = 4 At end of iteration = 141 cost = 0.32062738969983
Circuit = problem_ckt Layers = 4 At end of iteration = 142 cost = 0.32057613046459
Circuit = problem_ckt Layers = 4 At end of iteration = 143 cost = 0.32052458225108
Circuit = problem_ckt Layers = 4 At end of iteration = 144 cost = 0.32047274353987
Circuit = problem_ckt Layers = 4 At end of iteration = 145 cost = 0.32042061281725
Circuit = problem_ckt Layers = 4 At end of iteration = 146 cost = 0.32036818857542
Circuit = problem_ckt Layers = 4 At end of iteration = 147 cost = 0.32031546931262
Circuit = problem_ckt Layers = 4 At end of iteration = 148 cost = 0.32026245353325
Circuit = problem_ckt Layers = 4 At end of iteration = 149 cost = 0.32020913974795
Circuit = problem_ckt Layers = 4 At end of iteration = 150 cost = 0.32015552647363
Circuit = problem_ckt Layers = 4 At end of iteration = 151 cost = 0.32010161223358
Circuit = problem_ckt Layers = 4 At end of iteration = 152 cost = 0.32004739555745
Circuit = problem_ckt Layers = 4 At end of iteration = 153 cost = 0.31999287498134
Circuit = problem_ckt Layers = 4 At end of iteration = 154 cost = 0.31993804904776
Circuit = problem_ckt Layers = 4 At end of iteration = 155 cost = 0.31988291630571
Circuit = problem_ckt Layers = 4 At end of iteration = 156 cost = 0.31982747531064

Circuit = problem_ckt Layers = 4 At end of iteration = 157 cost = 0.31977172462451
Circuit = problem_ckt Layers = 4 At end of iteration = 158 cost = 0.31971566281579
Circuit = problem_ckt Layers = 4 At end of iteration = 159 cost = 0.31965928845944
Circuit = problem_ckt Layers = 4 At end of iteration = 160 cost = 0.31960260013695
Circuit = problem_ckt Layers = 4 At end of iteration = 161 cost = 0.31954559643636
Circuit = problem_ckt Layers = 4 At end of iteration = 162 cost = 0.31948827595225
Circuit = problem_ckt Layers = 4 At end of iteration = 163 cost = 0.31943063728572
Circuit = problem_ckt Layers = 4 At end of iteration = 164 cost = 0.31937267904450
Circuit = problem_ckt Layers = 4 At end of iteration = 165 cost = 0.31931439984283
Circuit = problem_ckt Layers = 4 At end of iteration = 166 cost = 0.31925579830160
Circuit = problem_ckt Layers = 4 At end of iteration = 167 cost = 0.31919687304827
Circuit = problem_ckt Layers = 4 At end of iteration = 168 cost = 0.31913762271696
Circuit = problem_ckt Layers = 4 At end of iteration = 169 cost = 0.31907804594841
Circuit = problem_ckt Layers = 4 At end of iteration = 170 cost = 0.31901814139004
Circuit = problem_ckt Layers = 4 At end of iteration = 171 cost = 0.31895790769596
Circuit = problem_ckt Layers = 4 At end of iteration = 172 cost = 0.31889734352701
Circuit = problem_ckt Layers = 4 At end of iteration = 173 cost = 0.31883644755077
Circuit = problem_ckt Layers = 4 At end of iteration = 174 cost = 0.31877521844160
Circuit = problem_ckt Layers = 4 At end of iteration = 175 cost = 0.31871365488070
Circuit = problem_ckt Layers = 4 At end of iteration = 176 cost = 0.31865175555609
Circuit = problem_ckt Layers = 4 At end of iteration = 177 cost = 0.31858951916272
Circuit = problem_ckt Layers = 4 At end of iteration = 178 cost = 0.31852694440247
Circuit = problem_ckt Layers = 4 At end of iteration = 179 cost = 0.31846402998421
Circuit = problem_ckt Layers = 4 At end of iteration = 180 cost = 0.31840077462385

Circuit = problem_ckt Layers = 4 At end of iteration = 181 cost = 0.31833717704442
Circuit = problem_ckt Layers = 4 At end of iteration = 182 cost = 0.31827323597608
Circuit = problem_ckt Layers = 4 At end of iteration = 183 cost = 0.31820895015625
Circuit = problem_ckt Layers = 4 At end of iteration = 184 cost = 0.31814431832960
Circuit = problem_ckt Layers = 4 At end of iteration = 185 cost = 0.31807933924820
Circuit = problem_ckt Layers = 4 At end of iteration = 186 cost = 0.31801401167153
Circuit = problem_ckt Layers = 4 At end of iteration = 187 cost = 0.31794833436661
Circuit = problem_ckt Layers = 4 At end of iteration = 188 cost = 0.31788230610806
Circuit = problem_ckt Layers = 4 At end of iteration = 189 cost = 0.31781592567818
Circuit = problem_ckt Layers = 4 At end of iteration = 190 cost = 0.31774919186707
Circuit = problem_ckt Layers = 4 At end of iteration = 191 cost = 0.31768210347272
Circuit = problem_ckt Layers = 4 At end of iteration = 192 cost = 0.31761465930110
Circuit = problem_ckt Layers = 4 At end of iteration = 193 cost = 0.31754685816628
Circuit = problem_ckt Layers = 4 At end of iteration = 194 cost = 0.31747869889055
Circuit = problem_ckt Layers = 4 At end of iteration = 195 cost = 0.31741018030450
Circuit = problem_ckt Layers = 4 At end of iteration = 196 cost = 0.31734130124720
Circuit = problem_ckt Layers = 4 At end of iteration = 197 cost = 0.31727206056630
Circuit = problem_ckt Layers = 4 At end of iteration = 198 cost = 0.31720245711813
Circuit = problem_ckt Layers = 4 At end of iteration = 199 cost = 0.31713248976790
Circuit = problem_ckt Layers = 4 At end of iteration = 200 cost = 0.31706215738980
Circuit = problem_ckt Layers = 4 At end of iteration = 201 cost = 0.31699145886718
Circuit = problem_ckt Layers = 4 At end of iteration = 202 cost = 0.31692039309266
Circuit = problem_ckt Layers = 4 At end of iteration = 203 cost = 0.31684895896832
Circuit = problem_ckt Layers = 4 At end of iteration = 204 cost = 0.31677715540587

Circuit =	problem_ckt		Layers =	4		At end of iteration =	205		cost =	0.31670498132682

Circuit =	problem_ckt		Layers =	4		At end of iteration =	206		cost =	0.31663243566261

Circuit =	problem_ckt		Layers =	4		At end of iteration =	207		cost =	0.31655951735485

Circuit =	problem_ckt		Layers =	4		At end of iteration =	208		cost =	0.31648622535548

Circuit =	problem_ckt		Layers =	4		At end of iteration =	209		cost =	0.31641255862697

Circuit =	problem_ckt		Layers =	4		At end of iteration =	210		cost =	0.31633851614249

Circuit =	problem_ckt		Layers =	4		At end of iteration =	211		cost =	0.31626409688614

Circuit =	problem_ckt		Layers =	4		At end of iteration =	212		cost =	0.31618929985318

Circuit =	problem_ckt		Layers =	4		At end of iteration =	213		cost =	0.31611412405017

Circuit =	problem_ckt		Layers =	4		At end of iteration =	214		cost =	0.31603856849528

Circuit =	problem_ckt		Layers =	4		At end of iteration =	215		cost =	0.31596263221843

Circuit =	problem_ckt		Layers =	4		At end of iteration =	216		cost =	0.31588631426159

Circuit =	problem_ckt		Layers =	4		At end of iteration =	217		cost =	0.31580961367898

Circuit =	problem_ckt		Layers =	4		At end of iteration =	218		cost =	0.31573252953730

Circuit =	problem_ckt		Layers =	4		At end of iteration =	219		cost =	0.31565506091602

Circuit =	problem_ckt		Layers =	4		At end of iteration =	220		cost =	0.31557720690759

Circuit =	problem_ckt		Layers =	4		At end of iteration =	221		cost =	0.31549896661772

Circuit =	problem_ckt		Layers =	4		At end of iteration =	222		cost =	0.31542033916564

Circuit =	problem_ckt		Layers =	4		At end of iteration =	223		cost =	0.31534132368436

Circuit =	problem_ckt		Layers =	4		At end of iteration =	224		cost =	0.31526191932095

Circuit =	problem_ckt		Layers =	4		At end of iteration =	225		cost =	0.31518212523683

Circuit =	problem_ckt		Layers =	4		At end of iteration =	226		cost =	0.31510194060803

Circuit =	problem_ckt		Layers =	4		At end of iteration =	227		cost =	0.31502136462549

Circuit =	problem_ckt		Layers =	4		At end of iteration =	228		cost =	0.31494039649537

Circuit =	problem_ckt		Layers =	4		At end of iteration =	229		cost =	0.31485903543932
Circuit =	problem_ckt		Layers =	4		At end of iteration =	230		cost =	0.31477728069482
Circuit =	problem_ckt		Layers =	4		At end of iteration =	231		cost =	0.31469513151546
Circuit =	problem_ckt		Layers =	4		At end of iteration =	232		cost =	0.31461258717125
Circuit =	problem_ckt		Layers =	4		At end of iteration =	233		cost =	0.31452964694897
Circuit =	problem_ckt		Layers =	4		At end of iteration =	234		cost =	0.31444631015247
Circuit =	problem_ckt		Layers =	4		At end of iteration =	235		cost =	0.31436257610302
Circuit =	problem_ckt		Layers =	4		At end of iteration =	236		cost =	0.31427844413959
Circuit =	problem_ckt		Layers =	4		At end of iteration =	237		cost =	0.31419391361926
Circuit =	problem_ckt		Layers =	4		At end of iteration =	238		cost =	0.31410898391750
Circuit =	problem_ckt		Layers =	4		At end of iteration =	239		cost =	0.31402365442857
Circuit =	problem_ckt		Layers =	4		At end of iteration =	240		cost =	0.31393792456581
Circuit =	problem_ckt		Layers =	4		At end of iteration =	241		cost =	0.31385179376203
Circuit =	problem_ckt		Layers =	4		At end of iteration =	242		cost =	0.31376526146988
Circuit =	problem_ckt		Layers =	4		At end of iteration =	243		cost =	0.31367832716216
Circuit =	problem_ckt		Layers =	4		At end of iteration =	244		cost =	0.31359099033223
Circuit =	problem_ckt		Layers =	4		At end of iteration =	245		cost =	0.31350325049438
Circuit =	problem_ckt		Layers =	4		At end of iteration =	246		cost =	0.31341510718417
Circuit =	problem_ckt		Layers =	4		At end of iteration =	247		cost =	0.31332655995879
Circuit =	problem_ckt		Layers =	4		At end of iteration =	248		cost =	0.31323760839752
Circuit =	problem_ckt		Layers =	4		At end of iteration =	249		cost =	0.31314825210201
Circuit =	problem_ckt		Layers =	4		At end of iteration =	250		cost =	0.31305849069673
Circuit =	problem_ckt		Layers =	4		At end of iteration =	251		cost =	0.31296832382933
Circuit =	problem_ckt		Layers =	4		At end of iteration =	252		cost =	0.31287775117103

Circuit =	problem_ckt		Layers =	4		At end of iteration =	253		cost =	0.31278677241699

Circuit =	problem_ckt		Layers =	4		At end of iteration =	254		cost =	0.31269538728675

Circuit =	problem_ckt		Layers =	4		At end of iteration =	255		cost =	0.31260359552457

Circuit =	problem_ckt		Layers =	4		At end of iteration =	256		cost =	0.31251139689987

Circuit =	problem_ckt		Layers =	4		At end of iteration =	257		cost =	0.31241879120757

Circuit =	problem_ckt		Layers =	4		At end of iteration =	258		cost =	0.31232577826856

Circuit =	problem_ckt		Layers =	4		At end of iteration =	259		cost =	0.31223235793002

Circuit =	problem_ckt		Layers =	4		At end of iteration =	260		cost =	0.31213853006589

Circuit =	problem_ckt		Layers =	4		At end of iteration =	261		cost =	0.31204429457722

Circuit =	problem_ckt		Layers =	4		At end of iteration =	262		cost =	0.31194965139258

Circuit =	problem_ckt		Layers =	4		At end of iteration =	263		cost =	0.31185460046848

Circuit =	problem_ckt		Layers =	4		At end of iteration =	264		cost =	0.31175914178973

Circuit =	problem_ckt		Layers =	4		At end of iteration =	265		cost =	0.31166327536989

Circuit =	problem_ckt		Layers =	4		At end of iteration =	266		cost =	0.31156700125163

Circuit =	problem_ckt		Layers =	4		At end of iteration =	267		cost =	0.31147031950713

Circuit =	problem_ckt		Layers =	4		At end of iteration =	268		cost =	0.31137323023848

Circuit =	problem_ckt		Layers =	4		At end of iteration =	269		cost =	0.31127573357810

Circuit =	problem_ckt		Layers =	4		At end of iteration =	270		cost =	0.31117782968909

Circuit =	problem_ckt		Layers =	4		At end of iteration =	271		cost =	0.31107951876565

Circuit =	problem_ckt		Layers =	4		At end of iteration =	272		cost =	0.31098080103346

Circuit =	problem_ckt		Layers =	4		At end of iteration =	273		cost =	0.31088167675006

Circuit =	problem_ckt		Layers =	4		At end of iteration =	274		cost =	0.31078214620525

Circuit =	problem_ckt		Layers =	4		At end of iteration =	275		cost =	0.31068220972145

Circuit =	problem_ckt		Layers =	4		At end of iteration =	276		cost =	0.31058186765409

Circuit =	problem_ckt		Layers =	4		At end of iteration =	277		cost =	0.310481120391979

Circuit =	problem_ckt		Layers =	4		At end of iteration =	278		cost =	0.310379968357660

Circuit =	problem_ckt		Layers =	4		At end of iteration =	279		cost =	0.310278412007821

Circuit =	problem_ckt		Layers =	4		At end of iteration =	280		cost =	0.310176451833601

Circuit =	problem_ckt		Layers =	4		At end of iteration =	281		cost =	0.310074088360960

Circuit =	problem_ckt		Layers =	4		At end of iteration =	282		cost =	0.309971322151073

Circuit =	problem_ckt		Layers =	4		At end of iteration =	283		cost =	0.309868153800600

Circuit =	problem_ckt		Layers =	4		At end of iteration =	284		cost =	0.309764583942087

Circuit =	problem_ckt		Layers =	4		At end of iteration =	285		cost =	0.309660613244270

Circuit =	problem_ckt		Layers =	4		At end of iteration =	286		cost =	0.309556242412423

Circuit =	problem_ckt		Layers =	4		At end of iteration =	287		cost =	0.309451472188630

Circuit =	problem_ckt		Layers =	4		At end of iteration =	288		cost =	0.309346303352188

Circuit =	problem_ckt		Layers =	4		At end of iteration =	289		cost =	0.309240736719780

Circuit =	problem_ckt		Layers =	4		At end of iteration =	290		cost =	0.309134773145921

Circuit =	problem_ckt		Layers =	4		At end of iteration =	291		cost =	0.309028413523143

Circuit =	problem_ckt		Layers =	4		At end of iteration =	292		cost =	0.308921658782300

Circuit =	problem_ckt		Layers =	4		At end of iteration =	293		cost =	0.308814509892870

Circuit =	problem_ckt		Layers =	4		At end of iteration =	294		cost =	0.308706967863193

Circuit =	problem_ckt		Layers =	4		At end of iteration =	295		cost =	0.308599033740733

Circuit =	problem_ckt		Layers =	4		At end of iteration =	296		cost =	0.308490708612310

Circuit =	problem_ckt		Layers =	4		At end of iteration =	297		cost =	0.308381993604380

Circuit =	problem_ckt		Layers =	4		At end of iteration =	298		cost =	0.308272889883193

Circuit =	problem_ckt		Layers =	4		At end of iteration =	299		cost =	0.308163398655040

Circuit =	problem_ckt		Layers =	4		At end of iteration =	300		cost =	0.308053521166490

```

idx = theta7[0] params = 0.009568165097689485
idx = theta8[2] params = 0.003778807686699465
idx = theta8[3] params = 0.04761132655555178
idx = theta7[1] params = 0.02912836626547597
idx = theta8[1] params = 0.03277867333581935
idx = theta10[3] params = 0.0012507649722014293
idx = theta3[3] params = 0.03265668670981592
idx = theta4[0] params = 0.042510362504139115
idx = theta10[1] params = 0.028964664980450857
idx = theta3[0] params = 0.02606701333987876
idx = theta9[2] params = 0.04507588560641085
idx = theta1[2] params = 0.01594882076679191
idx = theta3[2] params = 0.03973242205283862
idx = theta2[1] params = 0.009337792350935193
idx = theta10[0] params = 0.0032829280606491377
idx = theta2[0] params = 0.019944497772341908
idx = theta2[2] params = 0.040543302128205796
idx = theta6[1] params = 0.018661219094017113

```

```

-----
Circuit = problem_ckt | Layers = 5 | At end of iteration = 1 | cost = 1.2118539295824555
-----
Circuit = problem_ckt | Layers = 5 | At end of iteration = 2 | cost = 1.1793254442999426
-----
Circuit = problem_ckt | Layers = 5 | At end of iteration = 3 | cost = 1.1398028169787273
-----
Circuit = problem_ckt | Layers = 5 | At end of iteration = 4 | cost = 1.0799711440206743
-----
Circuit = problem_ckt | Layers = 5 | At end of iteration = 5 | cost = 0.989607056672626
-----
Circuit = problem_ckt | Layers = 5 | At end of iteration = 6 | cost = 0.8847147876832796
-----
Circuit = problem_ckt | Layers = 5 | At end of iteration = 7 | cost = 0.8171574996518061
-----
Circuit = problem_ckt | Layers = 5 | At end of iteration = 8 | cost = 0.7807931366632868
-----
Circuit = problem_ckt | Layers = 5 | At end of iteration = 9 | cost = 0.758195664660679
-----
Circuit = problem_ckt | Layers = 5 | At end of iteration = 10 | cost = 0.7426330644838308
-----
Circuit = problem_ckt | Layers = 5 | At end of iteration = 11 | cost = 0.729010335743719
-----
Circuit = problem_ckt | Layers = 5 | At end of iteration = 12 | cost = 0.714329297255615
-----
Circuit = problem_ckt | Layers = 5 | At end of iteration = 13 | cost = 0.697832963765809
-----
Circuit = problem_ckt | Layers = 5 | At end of iteration = 14 | cost = 0.678578760281399
-----
Circuit = problem_ckt | Layers = 5 | At end of iteration = 15 | cost = 0.656880628349453

```

Circuit =	problem_ckt		Layers =	5		At end of iteration =	16		cost =	0.631617156923196
Circuit =	problem_ckt		Layers =	5		At end of iteration =	17		cost =	0.604710687547845
Circuit =	problem_ckt		Layers =	5		At end of iteration =	18		cost =	0.573151875372130
Circuit =	problem_ckt		Layers =	5		At end of iteration =	19		cost =	0.549312645876271
Circuit =	problem_ckt		Layers =	5		At end of iteration =	20		cost =	0.530876097490386
Circuit =	problem_ckt		Layers =	5		At end of iteration =	21		cost =	0.728052125080242
Circuit =	problem_ckt		Layers =	5		At end of iteration =	22		cost =	0.963240360545779
Circuit =	problem_ckt		Layers =	5		At end of iteration =	23		cost =	0.719980531546854
Circuit =	problem_ckt		Layers =	5		At end of iteration =	24		cost =	0.839607895541859
Circuit =	problem_ckt		Layers =	5		At end of iteration =	25		cost =	0.798491153336797
Circuit =	problem_ckt		Layers =	5		At end of iteration =	26		cost =	0.768983230780367
Circuit =	problem_ckt		Layers =	5		At end of iteration =	27		cost =	0.807498401312121
Circuit =	problem_ckt		Layers =	5		At end of iteration =	28		cost =	0.735234339894754
Circuit =	problem_ckt		Layers =	5		At end of iteration =	29		cost =	0.809932281572589
Circuit =	problem_ckt		Layers =	5		At end of iteration =	30		cost =	0.719441793105562
Circuit =	problem_ckt		Layers =	5		At end of iteration =	31		cost =	0.809768307944327
Circuit =	problem_ckt		Layers =	5		At end of iteration =	32		cost =	0.709538701090626
Circuit =	problem_ckt		Layers =	5		At end of iteration =	33		cost =	0.810554933003648
Circuit =	problem_ckt		Layers =	5		At end of iteration =	34		cost =	0.702718137392210
Circuit =	problem_ckt		Layers =	5		At end of iteration =	35		cost =	0.812214285591807
Circuit =	problem_ckt		Layers =	5		At end of iteration =	36		cost =	0.698107739327875
Circuit =	problem_ckt		Layers =	5		At end of iteration =	37		cost =	0.814345045514758
Circuit =	problem_ckt		Layers =	5		At end of iteration =	38		cost =	0.695106447065537
Circuit =	problem_ckt		Layers =	5		At end of iteration =	39		cost =	0.816604965137347

REDUCING ALPHA TO 0.31622776601683794 at iteration = 40

Circuit =	problem_ckt		Layers =	5		At end of iteration =	40		cost =	0.693306405642523
Circuit =	problem_ckt		Layers =	5		At end of iteration =	41		cost =	0.456349721223017
Circuit =	problem_ckt		Layers =	5		At end of iteration =	42		cost =	0.419876755189240
Circuit =	problem_ckt		Layers =	5		At end of iteration =	43		cost =	0.403381227166151
Circuit =	problem_ckt		Layers =	5		At end of iteration =	44		cost =	0.394831525665219
Circuit =	problem_ckt		Layers =	5		At end of iteration =	45		cost =	0.384969743796336
Circuit =	problem_ckt		Layers =	5		At end of iteration =	46		cost =	0.376873595812981
Circuit =	problem_ckt		Layers =	5		At end of iteration =	47		cost =	0.368460332622387
Circuit =	problem_ckt		Layers =	5		At end of iteration =	48		cost =	0.360882400544439
Circuit =	problem_ckt		Layers =	5		At end of iteration =	49		cost =	0.353185249951696
Circuit =	problem_ckt		Layers =	5		At end of iteration =	50		cost =	0.346036981448649
Circuit =	problem_ckt		Layers =	5		At end of iteration =	51		cost =	0.338803734020261
Circuit =	problem_ckt		Layers =	5		At end of iteration =	52		cost =	0.332037417786095
Circuit =	problem_ckt		Layers =	5		At end of iteration =	53		cost =	0.325161066382481
Circuit =	problem_ckt		Layers =	5		At end of iteration =	54		cost =	0.318775841432517
Circuit =	problem_ckt		Layers =	5		At end of iteration =	55		cost =	0.312186017695329
Circuit =	problem_ckt		Layers =	5		At end of iteration =	56		cost =	0.306225698251192
Circuit =	problem_ckt		Layers =	5		At end of iteration =	57		cost =	0.299821214663629
Circuit =	problem_ckt		Layers =	5		At end of iteration =	58		cost =	0.294419266428751
Circuit =	problem_ckt		Layers =	5		At end of iteration =	59		cost =	0.287958173404733
Circuit =	problem_ckt		Layers =	5		At end of iteration =	60		cost =	0.283527442878509
Circuit =	problem_ckt		Layers =	5		At end of iteration =	61		cost =	0.276308585327056
Circuit =	problem_ckt		Layers =	5		At end of iteration =	62		cost =	0.274334532024517

```

-----
Circuit =  problem_ckt | Layers =  5 | At end of iteration = 63 | cost = 0.2642472047276745
-----
Circuit =  problem_ckt | Layers =  5 | At end of iteration = 64 | cost = 0.2715085646148375
-----
Circuit =  problem_ckt | Layers =  5 | At end of iteration = 65 | cost = 0.2551396261224908
-----
Circuit =  problem_ckt | Layers =  5 | At end of iteration = 66 | cost = 0.3104663979210155
-----
Circuit =  problem_ckt | Layers =  5 | At end of iteration = 67 | cost = 0.3029860220465467
-----
Circuit =  problem_ckt | Layers =  5 | At end of iteration = 68 | cost = 0.4254411641848587
-----
Circuit =  problem_ckt | Layers =  5 | At end of iteration = 69 | cost = 0.3243528514554355
-----
Circuit =  problem_ckt | Layers =  5 | At end of iteration = 70 | cost = 0.43254417298507
-----
Circuit =  problem_ckt | Layers =  5 | At end of iteration = 71 | cost = 0.3214099812746325
-----
Circuit =  problem_ckt | Layers =  5 | At end of iteration = 72 | cost = 0.436153112474858
-----
Circuit =  problem_ckt | Layers =  5 | At end of iteration = 73 | cost = 0.3200800442752778
-----
Circuit =  problem_ckt | Layers =  5 | At end of iteration = 74 | cost = 0.4399779612849445
-----
Circuit =  problem_ckt | Layers =  5 | At end of iteration = 75 | cost = 0.3188096972835925
-----
Circuit =  problem_ckt | Layers =  5 | At end of iteration = 76 | cost = 0.4439317712701395
-----
Circuit =  problem_ckt | Layers =  5 | At end of iteration = 77 | cost = 0.3174821835035755
-----
Circuit =  problem_ckt | Layers =  5 | At end of iteration = 78 | cost = 0.4479340500172525
-----
Circuit =  problem_ckt | Layers =  5 | At end of iteration = 79 | cost = 0.3160681250154645
-----
REDUCING ALPHA TO 0.09999999999999999 at iteration = 80
-----
Circuit =  problem_ckt | Layers =  5 | At end of iteration = 80 | cost = 0.4519515180377785
-----
Circuit =  problem_ckt | Layers =  5 | At end of iteration = 81 | cost = 0.2934819627171065
-----
Circuit =  problem_ckt | Layers =  5 | At end of iteration = 82 | cost = 0.2222085205970355
-----
Circuit =  problem_ckt | Layers =  5 | At end of iteration = 83 | cost = 0.2166683237527845
-----
Circuit =  problem_ckt | Layers =  5 | At end of iteration = 84 | cost = 0.2161952303414355
-----
Circuit =  problem_ckt | Layers =  5 | At end of iteration = 85 | cost = 0.2149991338844305

```

```

-----
Circuit =  problem_ckt | Layers =  5 | At end of iteration =  86 | cost =  0.2138612355987862
-----
Circuit =  problem_ckt | Layers =  5 | At end of iteration =  87 | cost =  0.2126722195900840
-----
Circuit =  problem_ckt | Layers =  5 | At end of iteration =  88 | cost =  0.2114703081371700
-----
Circuit =  problem_ckt | Layers =  5 | At end of iteration =  89 | cost =  0.210262079660088
-----
Circuit =  problem_ckt | Layers =  5 | At end of iteration =  90 | cost =  0.2090556471717149
-----
Circuit =  problem_ckt | Layers =  5 | At end of iteration =  91 | cost =  0.2078555259985453
-----
Circuit =  problem_ckt | Layers =  5 | At end of iteration =  92 | cost =  0.2066646659391923
-----
Circuit =  problem_ckt | Layers =  5 | At end of iteration =  93 | cost =  0.2054847773777378
-----
Circuit =  problem_ckt | Layers =  5 | At end of iteration =  94 | cost =  0.2043167953255173
-----
Circuit =  problem_ckt | Layers =  5 | At end of iteration =  95 | cost =  0.2031611409459051
-----
Circuit =  problem_ckt | Layers =  5 | At end of iteration =  96 | cost =  0.2020179070753840
-----
Circuit =  problem_ckt | Layers =  5 | At end of iteration =  97 | cost =  0.2008869769589730
-----
Circuit =  problem_ckt | Layers =  5 | At end of iteration =  98 | cost =  0.1997681021557741
-----
Circuit =  problem_ckt | Layers =  5 | At end of iteration =  99 | cost =  0.1986609526545711
-----
Circuit =  problem_ckt | Layers =  5 | At end of iteration = 100 | cost =  0.1975651491267300
-----
Circuit =  problem_ckt | Layers =  5 | At end of iteration = 101 | cost =  0.1964802835579700
-----
Circuit =  problem_ckt | Layers =  5 | At end of iteration = 102 | cost =  0.1954059324324700
-----
Circuit =  problem_ckt | Layers =  5 | At end of iteration = 103 | cost =  0.1943416651575200
-----
Circuit =  problem_ckt | Layers =  5 | At end of iteration = 104 | cost =  0.1932870494752900
-----
Circuit =  problem_ckt | Layers =  5 | At end of iteration = 105 | cost =  0.1922416549845100
-----
Circuit =  problem_ckt | Layers =  5 | At end of iteration = 106 | cost =  0.1912050554939000
-----
Circuit =  problem_ckt | Layers =  5 | At end of iteration = 107 | cost =  0.1901768306691600
-----
Circuit =  problem_ckt | Layers =  5 | At end of iteration = 108 | cost =  0.1891565672682800
-----
Circuit =  problem_ckt | Layers =  5 | At end of iteration = 109 | cost =  0.1881438601526800
-----

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```

-----
Circuit =  problem_ckt | Layers =  5 | At end of iteration = 110 | cost = 0.187138313192563
-----
Circuit =  problem_ckt | Layers =  5 | At end of iteration = 111 | cost = 0.18613954014079
-----
Circuit =  problem_ckt | Layers =  5 | At end of iteration = 112 | cost = 0.18514716552107
-----
Circuit =  problem_ckt | Layers =  5 | At end of iteration = 113 | cost = 0.18416082555786
-----
Circuit =  problem_ckt | Layers =  5 | At end of iteration = 114 | cost = 0.18318016916356
-----
Circuit =  problem_ckt | Layers =  5 | At end of iteration = 115 | cost = 0.18220485899048
-----
Circuit =  problem_ckt | Layers =  5 | At end of iteration = 116 | cost = 0.18123457255012
-----
Circuit =  problem_ckt | Layers =  5 | At end of iteration = 117 | cost = 0.18026900339842
-----
Circuit =  problem_ckt | Layers =  5 | At end of iteration = 118 | cost = 0.17930786238308
-----
Circuit =  problem_ckt | Layers =  5 | At end of iteration = 119 | cost = 0.17835087894707
-----
REDUCING ALPHA TO 0.03162277660168379 at iteration = 120
-----
Circuit =  problem_ckt | Layers =  5 | At end of iteration = 120 | cost = 0.17739780248088
-----
Circuit =  problem_ckt | Layers =  5 | At end of iteration = 121 | cost = 0.17709795296407
-----
Circuit =  problem_ckt | Layers =  5 | At end of iteration = 122 | cost = 0.17679836633589
-----
Circuit =  problem_ckt | Layers =  5 | At end of iteration = 123 | cost = 0.17649903843863
-----
Circuit =  problem_ckt | Layers =  5 | At end of iteration = 124 | cost = 0.17619996844345
-----
Circuit =  problem_ckt | Layers =  5 | At end of iteration = 125 | cost = 0.17590115686463
-----
Circuit =  problem_ckt | Layers =  5 | At end of iteration = 126 | cost = 0.17560260458577
-----
Circuit =  problem_ckt | Layers =  5 | At end of iteration = 127 | cost = 0.17530431240975
-----
Circuit =  problem_ckt | Layers =  5 | At end of iteration = 128 | cost = 0.17500628087611
-----
Circuit =  problem_ckt | Layers =  5 | At end of iteration = 129 | cost = 0.17470851021219
-----
Circuit =  problem_ckt | Layers =  5 | At end of iteration = 130 | cost = 0.17441100034844
-----
Circuit =  problem_ckt | Layers =  5 | At end of iteration = 131 | cost = 0.17411375096230
-----
Circuit =  problem_ckt | Layers =  5 | At end of iteration = 132 | cost = 0.17381676153269

```

```

-----
Circuit =  problem_ckt | Layers =  5 | At end of iteration = 133 | cost = 0.17352003139612
-----
Circuit =  problem_ckt | Layers =  5 | At end of iteration = 134 | cost = 0.17322355980042
-----
Circuit =  problem_ckt | Layers =  5 | At end of iteration = 135 | cost = 0.17292734595420
-----
Circuit =  problem_ckt | Layers =  5 | At end of iteration = 136 | cost = 0.17263138907173
-----
Circuit =  problem_ckt | Layers =  5 | At end of iteration = 137 | cost = 0.17233568841311
-----
Circuit =  problem_ckt | Layers =  5 | At end of iteration = 138 | cost = 0.17204024332000
-----
Circuit =  problem_ckt | Layers =  5 | At end of iteration = 139 | cost = 0.17174505324752
-----
Circuit =  problem_ckt | Layers =  5 | At end of iteration = 140 | cost = 0.17145011779255
-----
Circuit =  problem_ckt | Layers =  5 | At end of iteration = 141 | cost = 0.17115543671886
-----
Circuit =  problem_ckt | Layers =  5 | At end of iteration = 142 | cost = 0.17086100997953
-----
Circuit =  problem_ckt | Layers =  5 | At end of iteration = 143 | cost = 0.17056683773692
-----
Circuit =  problem_ckt | Layers =  5 | At end of iteration = 144 | cost = 0.17027292038041
-----
Circuit =  problem_ckt | Layers =  5 | At end of iteration = 145 | cost = 0.16997925854238
-----
Circuit =  problem_ckt | Layers =  5 | At end of iteration = 146 | cost = 0.16968585311243
-----
Circuit =  problem_ckt | Layers =  5 | At end of iteration = 147 | cost = 0.16939270525013
-----
Circuit =  problem_ckt | Layers =  5 | At end of iteration = 148 | cost = 0.16909981639651
-----
Circuit =  problem_ckt | Layers =  5 | At end of iteration = 149 | cost = 0.16880718828434
-----
Circuit =  problem_ckt | Layers =  5 | At end of iteration = 150 | cost = 0.16851482294746
-----
Circuit =  problem_ckt | Layers =  5 | At end of iteration = 151 | cost = 0.16822272272907
-----
Circuit =  problem_ckt | Layers =  5 | At end of iteration = 152 | cost = 0.16793089028930
-----
Circuit =  problem_ckt | Layers =  5 | At end of iteration = 153 | cost = 0.16763932861198
-----
Circuit =  problem_ckt | Layers =  5 | At end of iteration = 154 | cost = 0.16734804101078
-----
Circuit =  problem_ckt | Layers =  5 | At end of iteration = 155 | cost = 0.16705703113467
-----
Circuit =  problem_ckt | Layers =  5 | At end of iteration = 156 | cost = 0.16676630297287
-----

```



```

-----
Circuit =  problem_ckt | Layers =  5 | At end of iteration = 157 | cost = 0.16647586085925
-----
Circuit =  problem_ckt | Layers =  5 | At end of iteration = 158 | cost = 0.16618570947633
-----
Circuit =  problem_ckt | Layers =  5 | At end of iteration = 159 | cost = 0.16589585385865
-----
Circuit =  problem_ckt | Layers =  5 | At end of iteration = 160 | cost = 0.16560629939596
-----
Circuit =  problem_ckt | Layers =  5 | At end of iteration = 161 | cost = 0.16531705183576
-----
Circuit =  problem_ckt | Layers =  5 | At end of iteration = 162 | cost = 0.16502811728567
-----
Circuit =  problem_ckt | Layers =  5 | At end of iteration = 163 | cost = 0.16473950221529
-----
Circuit =  problem_ckt | Layers =  5 | At end of iteration = 164 | cost = 0.16445121345776
-----
Circuit =  problem_ckt | Layers =  5 | At end of iteration = 165 | cost = 0.16416325821098
-----
Circuit =  problem_ckt | Layers =  5 | At end of iteration = 166 | cost = 0.16387564403846
-----
Circuit =  problem_ckt | Layers =  5 | At end of iteration = 167 | cost = 0.16358837886991
-----
Circuit =  problem_ckt | Layers =  5 | At end of iteration = 168 | cost = 0.16330147100139
-----
Circuit =  problem_ckt | Layers =  5 | At end of iteration = 169 | cost = 0.16301492909525
-----
Circuit =  problem_ckt | Layers =  5 | At end of iteration = 170 | cost = 0.16272876217968
-----
Circuit =  problem_ckt | Layers =  5 | At end of iteration = 171 | cost = 0.16244297964797
-----
Circuit =  problem_ckt | Layers =  5 | At end of iteration = 172 | cost = 0.16215759125744
-----
Circuit =  problem_ckt | Layers =  5 | At end of iteration = 173 | cost = 0.16187260712809
-----
Circuit =  problem_ckt | Layers =  5 | At end of iteration = 174 | cost = 0.16158803774083
-----
Circuit =  problem_ckt | Layers =  5 | At end of iteration = 175 | cost = 0.16130389393554
-----
Circuit =  problem_ckt | Layers =  5 | At end of iteration = 176 | cost = 0.16102018690869
-----
Circuit =  problem_ckt | Layers =  5 | At end of iteration = 177 | cost = 0.16073692821069
-----
Circuit =  problem_ckt | Layers =  5 | At end of iteration = 178 | cost = 0.16045412974294
-----
Circuit =  problem_ckt | Layers =  5 | At end of iteration = 179 | cost = 0.16017180375449
-----
Circuit =  problem_ckt | Layers =  5 | At end of iteration = 180 | cost = 0.15988996283844
-----

```

```

-----
Circuit =  problem_ckt | Layers =  5 | At end of iteration = 181 | cost = 0.15960861992802
-----
Circuit =  problem_ckt | Layers =  5 | At end of iteration = 182 | cost = 0.15932778829231
-----
Circuit =  problem_ckt | Layers =  5 | At end of iteration = 183 | cost = 0.15904748153162
-----
Circuit =  problem_ckt | Layers =  5 | At end of iteration = 184 | cost = 0.15876771357265
-----
Circuit =  problem_ckt | Layers =  5 | At end of iteration = 185 | cost = 0.15848849866318
-----
Circuit =  problem_ckt | Layers =  5 | At end of iteration = 186 | cost = 0.15820985136658
-----
Circuit =  problem_ckt | Layers =  5 | At end of iteration = 187 | cost = 0.15793178655590
-----
Circuit =  problem_ckt | Layers =  5 | At end of iteration = 188 | cost = 0.15765431940769
-----
Circuit =  problem_ckt | Layers =  5 | At end of iteration = 189 | cost = 0.15737746539548
-----
Circuit =  problem_ckt | Layers =  5 | At end of iteration = 190 | cost = 0.15710124028300
-----
Circuit =  problem_ckt | Layers =  5 | At end of iteration = 191 | cost = 0.15682566011699
-----
Circuit =  problem_ckt | Layers =  5 | At end of iteration = 192 | cost = 0.15655074121980
-----
Circuit =  problem_ckt | Layers =  5 | At end of iteration = 193 | cost = 0.15627650018165
-----
Circuit =  problem_ckt | Layers =  5 | At end of iteration = 194 | cost = 0.15600295385259
-----
Circuit =  problem_ckt | Layers =  5 | At end of iteration = 195 | cost = 0.15573011933419
-----
Circuit =  problem_ckt | Layers =  5 | At end of iteration = 196 | cost = 0.15545801397089
-----
Circuit =  problem_ckt | Layers =  5 | At end of iteration = 197 | cost = 0.15518665534118
-----
Circuit =  problem_ckt | Layers =  5 | At end of iteration = 198 | cost = 0.15491606124838
-----
Circuit =  problem_ckt | Layers =  5 | At end of iteration = 199 | cost = 0.15464624971125
-----
Circuit =  problem_ckt | Layers =  5 | At end of iteration = 200 | cost = 0.15437723895434
-----
Circuit =  problem_ckt | Layers =  5 | At end of iteration = 201 | cost = 0.15410904739804
-----
Circuit =  problem_ckt | Layers =  5 | At end of iteration = 202 | cost = 0.15384169364844
-----
Circuit =  problem_ckt | Layers =  5 | At end of iteration = 203 | cost = 0.15357519648700
-----
Circuit =  problem_ckt | Layers =  5 | At end of iteration = 204 | cost = 0.15330957485991
-----

```

```

-----
Circuit =  problem_ckt | Layers =  5 | At end of iteration = 205 | cost = 0.15304484786737
-----
Circuit =  problem_ckt | Layers =  5 | At end of iteration = 206 | cost = 0.15278103475256
-----
Circuit =  problem_ckt | Layers =  5 | At end of iteration = 207 | cost = 0.15251815489059
-----
Circuit =  problem_ckt | Layers =  5 | At end of iteration = 208 | cost = 0.15225622777710
-----
Circuit =  problem_ckt | Layers =  5 | At end of iteration = 209 | cost = 0.15199527301691
-----
Circuit =  problem_ckt | Layers =  5 | At end of iteration = 210 | cost = 0.15173531031241
-----
Circuit =  problem_ckt | Layers =  5 | At end of iteration = 211 | cost = 0.15147635945186
-----
Circuit =  problem_ckt | Layers =  5 | At end of iteration = 212 | cost = 0.15121844029763
-----
Circuit =  problem_ckt | Layers =  5 | At end of iteration = 213 | cost = 0.15096157277433
-----
Circuit =  problem_ckt | Layers =  5 | At end of iteration = 214 | cost = 0.15070577685690
-----
Circuit =  problem_ckt | Layers =  5 | At end of iteration = 215 | cost = 0.15045107255859
-----
Circuit =  problem_ckt | Layers =  5 | At end of iteration = 216 | cost = 0.15019747991900
-----
Circuit =  problem_ckt | Layers =  5 | At end of iteration = 217 | cost = 0.14994501899203
-----
Circuit =  problem_ckt | Layers =  5 | At end of iteration = 218 | cost = 0.14969370983389
-----
Circuit =  problem_ckt | Layers =  5 | At end of iteration = 219 | cost = 0.14944357249110
-----
Circuit =  problem_ckt | Layers =  5 | At end of iteration = 220 | cost = 0.14919462698856
-----
Circuit =  problem_ckt | Layers =  5 | At end of iteration = 221 | cost = 0.14894689331767
-----
Circuit =  problem_ckt | Layers =  5 | At end of iteration = 222 | cost = 0.14870039142451
-----
Circuit =  problem_ckt | Layers =  5 | At end of iteration = 223 | cost = 0.14845514119820
-----
Circuit =  problem_ckt | Layers =  5 | At end of iteration = 224 | cost = 0.14821116245924
-----
Circuit =  problem_ckt | Layers =  5 | At end of iteration = 225 | cost = 0.14796847494814
-----
Circuit =  problem_ckt | Layers =  5 | At end of iteration = 226 | cost = 0.14772709831414
-----
Circuit =  problem_ckt | Layers =  5 | At end of iteration = 227 | cost = 0.14748705210406
-----
Circuit =  problem_ckt | Layers =  5 | At end of iteration = 228 | cost = 0.14724835575141
-----

```

```

-----
Circuit =  problem_ckt | Layers =  5 | At end of iteration = 229 | cost = 0.14701102856572
-----
Circuit =  problem_ckt | Layers =  5 | At end of iteration = 230 | cost = 0.14677508972204
-----
Circuit =  problem_ckt | Layers =  5 | At end of iteration = 231 | cost = 0.14654055825077
-----
Circuit =  problem_ckt | Layers =  5 | At end of iteration = 232 | cost = 0.14630745302763
-----
Circuit =  problem_ckt | Layers =  5 | At end of iteration = 233 | cost = 0.14607579276408
-----
Circuit =  problem_ckt | Layers =  5 | At end of iteration = 234 | cost = 0.14584559599790
-----
Circuit =  problem_ckt | Layers =  5 | At end of iteration = 235 | cost = 0.14561688108414
-----
Circuit =  problem_ckt | Layers =  5 | At end of iteration = 236 | cost = 0.14538966618637
-----
Circuit =  problem_ckt | Layers =  5 | At end of iteration = 237 | cost = 0.14516396926835
-----
Circuit =  problem_ckt | Layers =  5 | At end of iteration = 238 | cost = 0.14493980808594
-----
Circuit =  problem_ckt | Layers =  5 | At end of iteration = 239 | cost = 0.14471720017946
-----
Circuit =  problem_ckt | Layers =  5 | At end of iteration = 240 | cost = 0.14449616286640
-----
Circuit =  problem_ckt | Layers =  5 | At end of iteration = 241 | cost = 0.14427671323453
-----
Circuit =  problem_ckt | Layers =  5 | At end of iteration = 242 | cost = 0.14405886813539
-----
Circuit =  problem_ckt | Layers =  5 | At end of iteration = 243 | cost = 0.14384264417821
-----
Circuit =  problem_ckt | Layers =  5 | At end of iteration = 244 | cost = 0.14362805772424
-----
Circuit =  problem_ckt | Layers =  5 | At end of iteration = 245 | cost = 0.14341512488147
-----
Circuit =  problem_ckt | Layers =  5 | At end of iteration = 246 | cost = 0.14320386149985
-----
Circuit =  problem_ckt | Layers =  5 | At end of iteration = 247 | cost = 0.14299428316686
-----
Circuit =  problem_ckt | Layers =  5 | At end of iteration = 248 | cost = 0.14278640520359
-----
Circuit =  problem_ckt | Layers =  5 | At end of iteration = 249 | cost = 0.14258024266115
-----
Circuit =  problem_ckt | Layers =  5 | At end of iteration = 250 | cost = 0.14237581031769
-----
Circuit =  problem_ckt | Layers =  5 | At end of iteration = 251 | cost = 0.14217312267566
-----
Circuit =  problem_ckt | Layers =  5 | At end of iteration = 252 | cost = 0.14197219395966
-----

```

```

-----
Circuit =  problem_ckt | Layers =  5 | At end of iteration = 253 | cost = 0.14177303811462
-----
Circuit =  problem_ckt | Layers =  5 | At end of iteration = 254 | cost = 0.14157566880452
-----
Circuit =  problem_ckt | Layers =  5 | At end of iteration = 255 | cost = 0.14138009941139
-----
Circuit =  problem_ckt | Layers =  5 | At end of iteration = 256 | cost = 0.14118634303486
-----
Circuit =  problem_ckt | Layers =  5 | At end of iteration = 257 | cost = 0.14099441249206
-----
Circuit =  problem_ckt | Layers =  5 | At end of iteration = 258 | cost = 0.14080432031791
-----
Circuit =  problem_ckt | Layers =  5 | At end of iteration = 259 | cost = 0.14061607876586
-----
Circuit =  problem_ckt | Layers =  5 | At end of iteration = 260 | cost = 0.14042969980892
-----
Circuit =  problem_ckt | Layers =  5 | At end of iteration = 261 | cost = 0.14024519514118
-----
Circuit =  problem_ckt | Layers =  5 | At end of iteration = 262 | cost = 0.14006257617957
-----
Circuit =  problem_ckt | Layers =  5 | At end of iteration = 263 | cost = 0.13988185406605
-----
Circuit =  problem_ckt | Layers =  5 | At end of iteration = 264 | cost = 0.13970303967010
-----
Circuit =  problem_ckt | Layers =  5 | At end of iteration = 265 | cost = 0.13952614359148
-----
Circuit =  problem_ckt | Layers =  5 | At end of iteration = 266 | cost = 0.13935117616337
-----
Circuit =  problem_ckt | Layers =  5 | At end of iteration = 267 | cost = 0.13917814745573
-----
Circuit =  problem_ckt | Layers =  5 | At end of iteration = 268 | cost = 0.13900706727896
-----
Circuit =  problem_ckt | Layers =  5 | At end of iteration = 269 | cost = 0.13883794518775
-----
Circuit =  problem_ckt | Layers =  5 | At end of iteration = 270 | cost = 0.13867079048522
-----
Circuit =  problem_ckt | Layers =  5 | At end of iteration = 271 | cost = 0.13850561222720
-----
Circuit =  problem_ckt | Layers =  5 | At end of iteration = 272 | cost = 0.13834241922679
-----
Circuit =  problem_ckt | Layers =  5 | At end of iteration = 273 | cost = 0.13818122005895
-----
Circuit =  problem_ckt | Layers =  5 | At end of iteration = 274 | cost = 0.13802202306537
-----
Circuit =  problem_ckt | Layers =  5 | At end of iteration = 275 | cost = 0.13786483635935
-----
Circuit =  problem_ckt | Layers =  5 | At end of iteration = 276 | cost = 0.13770966783087
-----

```

```

-----
Circuit =  problem_ckt | Layers =  5 | At end of iteration =  277 | cost =  0.13755652515168
-----
Circuit =  problem_ckt | Layers =  5 | At end of iteration =  278 | cost =  0.13740541578047
-----
Circuit =  problem_ckt | Layers =  5 | At end of iteration =  279 | cost =  0.13725634696807
-----
Circuit =  problem_ckt | Layers =  5 | At end of iteration =  280 | cost =  0.13710932576269
-----
Circuit =  problem_ckt | Layers =  5 | At end of iteration =  281 | cost =  0.13696435901511
-----
Circuit =  problem_ckt | Layers =  5 | At end of iteration =  282 | cost =  0.13682145338388
-----
Circuit =  problem_ckt | Layers =  5 | At end of iteration =  283 | cost =  0.13668061534045
-----
Circuit =  problem_ckt | Layers =  5 | At end of iteration =  284 | cost =  0.13654185117425
-----
Circuit =  problem_ckt | Layers =  5 | At end of iteration =  285 | cost =  0.13640516699767
-----
Circuit =  problem_ckt | Layers =  5 | At end of iteration =  286 | cost =  0.13627056875090
-----
Circuit =  problem_ckt | Layers =  5 | At end of iteration =  287 | cost =  0.13613806220673
-----
Circuit =  problem_ckt | Layers =  5 | At end of iteration =  288 | cost =  0.13600765297510
-----
Circuit =  problem_ckt | Layers =  5 | At end of iteration =  289 | cost =  0.13587934650758
-----
Circuit =  problem_ckt | Layers =  5 | At end of iteration =  290 | cost =  0.13575314810159
-----
Circuit =  problem_ckt | Layers =  5 | At end of iteration =  291 | cost =  0.13562906290447
-----
Circuit =  problem_ckt | Layers =  5 | At end of iteration =  292 | cost =  0.13550709591732
-----
Circuit =  problem_ckt | Layers =  5 | At end of iteration =  293 | cost =  0.13538725199865
-----
Circuit =  problem_ckt | Layers =  5 | At end of iteration =  294 | cost =  0.13526953586772
-----
Circuit =  problem_ckt | Layers =  5 | At end of iteration =  295 | cost =  0.13515395210770
-----
Circuit =  problem_ckt | Layers =  5 | At end of iteration =  296 | cost =  0.13504050516847
-----
Circuit =  problem_ckt | Layers =  5 | At end of iteration =  297 | cost =  0.13492919936929
-----
Circuit =  problem_ckt | Layers =  5 | At end of iteration =  298 | cost =  0.13482003890101
-----
Circuit =  problem_ckt | Layers =  5 | At end of iteration =  299 | cost =  0.13471302782815
-----
Circuit =  problem_ckt | Layers =  5 | At end of iteration =  300 | cost =  0.13460817009053
-----

```

Optimization complete.

After optimization, the optimal parameters are

{Parameter(theta10[2]): 0.01848623272707346, Parameter(theta5[1]): -1.64044587928512, Parameter(theta10[3]): 0.006238299240088347, Parameter(theta6[2]): 0.030481776612878, Parameter(theta10[1]): 0.028343942770291508, Parameter(theta12[3]): 0.006172454610576922, Parameter(theta6[3]): 0.01671278315727628, Parameter(theta2[0]): 0.02421115885861306, Parameter(theta7[2]): 0.018375156312795238, Parameter(theta3[0]): 0.039532273767073196, Parameter(theta12[1]): 0.00573789773068969, Parameter(theta2[2]): 0.022782810868909098, Parameter(theta1[3]): 0.013510378554063363, Parameter(theta10[1]): 0.028343942770291508, Parameter(theta6[1]): 0.02164226791611938, Parameter(theta12[0]): 0.046881140646663634, Parameter(theta3[1]): 0.03444025418170515, Parameter(theta8[3]): 0.0004994971757621869, Parameter(theta8[0]): 0.04312312828020062, Parameter(theta4[3]): 0.03719052023213644}

The output state for these parameters is

```
[[0.2009429 +0.27140123j]
 [0.0282416 +0.24112485j]
 [0.25652636+0.10012247j]
 [0.2018891 +0.09415601j]
 [0.18533337+0.03465212j]
 [0.2244804 +0.08973871j]
 [0.12969625+0.07701097j]
 [0.07060067+0.10641728j]
 [0.29868947+0.01732645j]
 [0.18422453+0.05342751j]
 [0.28235553+0.00648536j]
 [0.05069459+0.00652359j]
 [0.34178918+0.16889552j]
 [0.16291917-0.00277357j]
 [0.22480423+0.28222335j]
 [0.1857689 +0.15242756j]]
```

Circuit = problem_ckt Layers = 5 Cost after optimization = 0.13460817009053208

Circuit problem_ckt constructed with 6 layers. Number of parameters = 48 .

Initialized circuit parameters prior to gradient descent randomly as follows:

```
idx = theta4[3] params = 0.03719052023213644
idx = theta8[0] params = 0.04312312828020062
idx = theta8[3] params = 0.0004994971757621869
idx = theta3[1] params = 0.03444025418170515
idx = theta12[0] params = 0.046881140646663634
idx = theta6[1] params = 0.02164226791611938
idx = theta10[1] params = 0.028343942770291508
idx = theta1[3] params = 0.013510378554063363
idx = theta2[2] params = 0.022782810868909098
idx = theta12[1] params = 0.00573789773068969
idx = theta3[0] params = 0.039532273767073196
idx = theta7[2] params = 0.018375156312795238
idx = theta2[0] params = 0.02421115885861306
idx = theta6[3] params = 0.01671278315727628
idx = theta12[3] params = 0.006172454610576922
idx = theta11[2] params = 0.016655522656847783
idx = theta5[3] params = 0.04662197117509747
idx = theta1[0] params = 0.009378499198132518
idx = theta6[2] params = 0.030481776612878
idx = theta10[3] params = 0.006238299240088347
idx = theta10[2] params = 0.046316344013782464
```

```

idx = theta9[0] params = 0.002833116050508433
idx = theta8[1] params = 0.009568165097689485
idx = theta12[2] params = 0.003778807686699465
idx = theta1[2] params = 0.04761132655555178
idx = theta7[0] params = 0.02912836626547597
idx = theta3[3] params = 0.03277867333581935
idx = theta9[1] params = 0.0012507649722014293
idx = theta11[3] params = 0.03265668670981592
idx = theta7[1] params = 0.042510362504139115
idx = theta4[2] params = 0.028964664980450857
idx = theta5[1] params = 0.02606701333987876
idx = theta5[2] params = 0.04507588560641085
idx = theta5[0] params = 0.01594882076679191
idx = theta3[2] params = 0.03973242205283862
idx = theta7[3] params = 0.009337792350935193
idx = theta4[1] params = 0.0032829280606491377
idx = theta2[1] params = 0.019944497772341908
idx = theta11[1] params = 0.040543302128205796
idx = theta6[0] params = 0.018661219094017113
idx = theta8[2] params = 0.022765429249395765
idx = theta9[2] params = 0.04496189581938223
idx = theta2[3] params = 0.04421309636000539
idx = theta11[0] params = 0.032067148697469475
idx = theta1[1] params = 0.03316055200997197
idx = theta10[0] params = 0.038381406528673896
idx = theta4[0] params = 0.014346822771396907
idx = theta9[3] params = 0.017358921226698288

```

```

-----
Circuit = problem_ckt | Layers = 6 | At end of iteration = 1 | cost = 1.2068884715472294

```

```

-----
Circuit = problem_ckt | Layers = 6 | At end of iteration = 2 | cost = 1.1710760793031851

```

```

-----
Circuit = problem_ckt | Layers = 6 | At end of iteration = 3 | cost = 1.124439868546212

```

```

-----
Circuit = problem_ckt | Layers = 6 | At end of iteration = 4 | cost = 1.0501607551667393

```

```

-----
Circuit = problem_ckt | Layers = 6 | At end of iteration = 5 | cost = 0.9419640183676548

```

```

-----
Circuit = problem_ckt | Layers = 6 | At end of iteration = 6 | cost = 0.8454977909454928

```

```

-----
Circuit = problem_ckt | Layers = 6 | At end of iteration = 7 | cost = 0.7907854362080627

```

```

-----
Circuit = problem_ckt | Layers = 6 | At end of iteration = 8 | cost = 0.7540653661851371

```

```

-----
Circuit = problem_ckt | Layers = 6 | At end of iteration = 9 | cost = 0.733774765330313

```

```

-----
Circuit = problem_ckt | Layers = 6 | At end of iteration = 10 | cost = 0.718203528557262

```


Circuit =	problem_ckt		Layers =	6		At end of iteration =	11		cost =	0.704071702885856

Circuit =	problem_ckt		Layers =	6		At end of iteration =	12		cost =	0.686478386940766

Circuit =	problem_ckt		Layers =	6		At end of iteration =	13		cost =	0.671006098685174

Circuit =	problem_ckt		Layers =	6		At end of iteration =	14		cost =	0.649119440972335

Circuit =	problem_ckt		Layers =	6		At end of iteration =	15		cost =	0.652190883097411

Circuit =	problem_ckt		Layers =	6		At end of iteration =	16		cost =	0.685219796738247

Circuit =	problem_ckt		Layers =	6		At end of iteration =	17		cost =	0.879027731225333

Circuit =	problem_ckt		Layers =	6		At end of iteration =	18		cost =	0.846490462884226

Circuit =	problem_ckt		Layers =	6		At end of iteration =	19		cost =	0.785207814661647

Circuit =	problem_ckt		Layers =	6		At end of iteration =	20		cost =	0.787870854234663

Circuit =	problem_ckt		Layers =	6		At end of iteration =	21		cost =	0.800973587603143

Circuit =	problem_ckt		Layers =	6		At end of iteration =	22		cost =	0.776581812407780

Circuit =	problem_ckt		Layers =	6		At end of iteration =	23		cost =	0.781033215263139

Circuit =	problem_ckt		Layers =	6		At end of iteration =	24		cost =	0.760668431533972

Circuit =	problem_ckt		Layers =	6		At end of iteration =	25		cost =	0.779571581457054

Circuit =	problem_ckt		Layers =	6		At end of iteration =	26		cost =	0.746906765692865

Circuit =	problem_ckt		Layers =	6		At end of iteration =	27		cost =	0.777032570499389

Circuit =	problem_ckt		Layers =	6		At end of iteration =	28		cost =	0.737184211807327

Circuit =	problem_ckt		Layers =	6		At end of iteration =	29		cost =	0.776664149154963

Circuit =	problem_ckt		Layers =	6		At end of iteration =	30		cost =	0.730314571524928

Circuit =	problem_ckt		Layers =	6		At end of iteration =	31		cost =	0.777312500408257

Circuit =	problem_ckt		Layers =	6		At end of iteration =	32		cost =	0.726019473181671

Circuit =	problem_ckt		Layers =	6		At end of iteration =	33		cost =	0.778645359771149

Circuit =	problem_ckt		Layers =	6		At end of iteration =	34		cost =	0.723421509274728

```

Circuit = problem_ckt | Layers = 6 | At end of iteration = 35 | cost = 0.780318138255022
-----
Circuit = problem_ckt | Layers = 6 | At end of iteration = 36 | cost = 0.722041419206888
-----
Circuit = problem_ckt | Layers = 6 | At end of iteration = 37 | cost = 0.781953370962028
-----
Circuit = problem_ckt | Layers = 6 | At end of iteration = 38 | cost = 0.721530526132024
-----
Circuit = problem_ckt | Layers = 6 | At end of iteration = 39 | cost = 0.783289313083261
-----
REDUCING ALPHA TO 0.31622776601683794 at iteration = 40
-----
Circuit = problem_ckt | Layers = 6 | At end of iteration = 40 | cost = 0.721625747446971
-----
Circuit = problem_ckt | Layers = 6 | At end of iteration = 41 | cost = 0.478033430249118
-----
Circuit = problem_ckt | Layers = 6 | At end of iteration = 42 | cost = 0.424023612504557
-----
Circuit = problem_ckt | Layers = 6 | At end of iteration = 43 | cost = 0.408430927550434
-----
Circuit = problem_ckt | Layers = 6 | At end of iteration = 44 | cost = 0.398521494932852
-----
Circuit = problem_ckt | Layers = 6 | At end of iteration = 45 | cost = 0.388289385841737
-----
Circuit = problem_ckt | Layers = 6 | At end of iteration = 46 | cost = 0.379553778514734
-----
Circuit = problem_ckt | Layers = 6 | At end of iteration = 47 | cost = 0.370932592255781
-----
Circuit = problem_ckt | Layers = 6 | At end of iteration = 48 | cost = 0.363055444478343
-----
Circuit = problem_ckt | Layers = 6 | At end of iteration = 49 | cost = 0.355306206549304
-----
Circuit = problem_ckt | Layers = 6 | At end of iteration = 50 | cost = 0.348065351048884
-----
Circuit = problem_ckt | Layers = 6 | At end of iteration = 51 | cost = 0.340930709833921
-----
Circuit = problem_ckt | Layers = 6 | At end of iteration = 52 | cost = 0.334218118072708
-----
Circuit = problem_ckt | Layers = 6 | At end of iteration = 53 | cost = 0.327559395227539
-----
Circuit = problem_ckt | Layers = 6 | At end of iteration = 54 | cost = 0.321297129923219
-----
Circuit = problem_ckt | Layers = 6 | At end of iteration = 55 | cost = 0.314990671867469
-----
Circuit = problem_ckt | Layers = 6 | At end of iteration = 56 | cost = 0.309117590498797
-----
Circuit = problem_ckt | Layers = 6 | At end of iteration = 57 | cost = 0.303016623500372
-----

```

```

Circuit = problem_ckt | Layers = 6 | At end of iteration = 58 | cost = 0.297519619967086
-----
Circuit = problem_ckt | Layers = 6 | At end of iteration = 59 | cost = 0.291402314060635
-----
Circuit = problem_ckt | Layers = 6 | At end of iteration = 60 | cost = 0.286426882158010
-----
Circuit = problem_ckt | Layers = 6 | At end of iteration = 61 | cost = 0.279825432239723
-----
Circuit = problem_ckt | Layers = 6 | At end of iteration = 62 | cost = 0.27608039000397
-----
Circuit = problem_ckt | Layers = 6 | At end of iteration = 63 | cost = 0.267669388631601
-----
Circuit = problem_ckt | Layers = 6 | At end of iteration = 64 | cost = 0.268339396251134
-----
Circuit = problem_ckt | Layers = 6 | At end of iteration = 65 | cost = 0.254415095659583
-----
Circuit = problem_ckt | Layers = 6 | At end of iteration = 66 | cost = 0.277917707254325
-----
Circuit = problem_ckt | Layers = 6 | At end of iteration = 67 | cost = 0.262934600542926
-----
Circuit = problem_ckt | Layers = 6 | At end of iteration = 68 | cost = 0.388035171684357
-----
Circuit = problem_ckt | Layers = 6 | At end of iteration = 69 | cost = 0.330608286443289
-----
Circuit = problem_ckt | Layers = 6 | At end of iteration = 70 | cost = 0.437312923685434
-----
Circuit = problem_ckt | Layers = 6 | At end of iteration = 71 | cost = 0.317794561600466
-----
Circuit = problem_ckt | Layers = 6 | At end of iteration = 72 | cost = 0.442555816488881
-----
Circuit = problem_ckt | Layers = 6 | At end of iteration = 73 | cost = 0.315212691998424
-----
Circuit = problem_ckt | Layers = 6 | At end of iteration = 74 | cost = 0.447208570941912
-----
Circuit = problem_ckt | Layers = 6 | At end of iteration = 75 | cost = 0.312966971108275
-----
Circuit = problem_ckt | Layers = 6 | At end of iteration = 76 | cost = 0.452179356699763
-----
Circuit = problem_ckt | Layers = 6 | At end of iteration = 77 | cost = 0.310572763898411
-----
Circuit = problem_ckt | Layers = 6 | At end of iteration = 78 | cost = 0.457336762496995
-----
Circuit = problem_ckt | Layers = 6 | At end of iteration = 79 | cost = 0.308000380528984
-----
REDUCING ALPHA TO 0.0999999999999999 at iteration = 80
-----
Circuit = problem_ckt | Layers = 6 | At end of iteration = 80 | cost = 0.462626248845267
-----

```

Circuit =	problem_ckt		Layers =	6		At end of iteration =	81		cost =	0.295101821042148

Circuit =	problem_ckt		Layers =	6		At end of iteration =	82		cost =	0.213118762197187

Circuit =	problem_ckt		Layers =	6		At end of iteration =	83		cost =	0.206205329508802

Circuit =	problem_ckt		Layers =	6		At end of iteration =	84		cost =	0.205590802020014

Circuit =	problem_ckt		Layers =	6		At end of iteration =	85		cost =	0.203700107768849

Circuit =	problem_ckt		Layers =	6		At end of iteration =	86		cost =	0.202045598414667

Circuit =	problem_ckt		Layers =	6		At end of iteration =	87		cost =	0.200307894071406

Circuit =	problem_ckt		Layers =	6		At end of iteration =	88		cost =	0.198594998357426

Circuit =	problem_ckt		Layers =	6		At end of iteration =	89		cost =	0.196892318187796

Circuit =	problem_ckt		Layers =	6		At end of iteration =	90		cost =	0.195210987589602

Circuit =	problem_ckt		Layers =	6		At end of iteration =	91		cost =	0.193550832826138

Circuit =	problem_ckt		Layers =	6		At end of iteration =	92		cost =	0.191913190864365

Circuit =	problem_ckt		Layers =	6		At end of iteration =	93		cost =	0.190298059393003

Circuit =	problem_ckt		Layers =	6		At end of iteration =	94		cost =	0.188705540097658

Circuit =	problem_ckt		Layers =	6		At end of iteration =	95		cost =	0.187135602719517

Circuit =	problem_ckt		Layers =	6		At end of iteration =	96		cost =	0.185588277272904

Circuit =	problem_ckt		Layers =	6		At end of iteration =	97		cost =	0.184063625319685

Circuit =	problem_ckt		Layers =	6		At end of iteration =	98		cost =	0.182561760994594

Circuit =	problem_ckt		Layers =	6		At end of iteration =	99		cost =	0.181082838785978

Circuit =	problem_ckt		Layers =	6		At end of iteration =	100		cost =	0.17962704912520

Circuit =	problem_ckt		Layers =	6		At end of iteration =	101		cost =	0.17819460917765

Circuit =	problem_ckt		Layers =	6		At end of iteration =	102		cost =	0.17678575590434

Circuit =	problem_ckt		Layers =	6		At end of iteration =	103		cost =	0.17540073903764

Circuit =	problem_ckt		Layers =	6		At end of iteration =	104		cost =	0.17403981527550

```

Circuit = problem_ckt | Layers = 6 | At end of iteration = 105 | cost = 0.17270324311502
-----
Circuit = problem_ckt | Layers = 6 | At end of iteration = 106 | cost = 0.17139127854182
-----
Circuit = problem_ckt | Layers = 6 | At end of iteration = 107 | cost = 0.17010417136927
-----
Circuit = problem_ckt | Layers = 6 | At end of iteration = 108 | cost = 0.16884216222264
-----
Circuit = problem_ckt | Layers = 6 | At end of iteration = 109 | cost = 0.16760548005930
-----
Circuit = problem_ckt | Layers = 6 | At end of iteration = 110 | cost = 0.16639434017570
-----
Circuit = problem_ckt | Layers = 6 | At end of iteration = 111 | cost = 0.16520894262506
-----
Circuit = problem_ckt | Layers = 6 | At end of iteration = 112 | cost = 0.16404947099134
-----
Circuit = problem_ckt | Layers = 6 | At end of iteration = 113 | cost = 0.16291609145864
-----
Circuit = problem_ckt | Layers = 6 | At end of iteration = 114 | cost = 0.16180895212524
-----
Circuit = problem_ckt | Layers = 6 | At end of iteration = 115 | cost = 0.16072818251093
-----
Circuit = problem_ckt | Layers = 6 | At end of iteration = 116 | cost = 0.15967389321206
-----
Circuit = problem_ckt | Layers = 6 | At end of iteration = 117 | cost = 0.15864617566068
-----
Circuit = problem_ckt | Layers = 6 | At end of iteration = 118 | cost = 0.15764510194809
-----
Circuit = problem_ckt | Layers = 6 | At end of iteration = 119 | cost = 0.15667072467625
-----
REDUCING ALPHA TO 0.03162277660168379 at iteration = 120
-----
Circuit = problem_ckt | Layers = 6 | At end of iteration = 120 | cost = 0.15572307680436
-----
Circuit = problem_ckt | Layers = 6 | At end of iteration = 121 | cost = 0.15543050202790
-----
Circuit = problem_ckt | Layers = 6 | At end of iteration = 122 | cost = 0.15514033499716
-----
Circuit = problem_ckt | Layers = 6 | At end of iteration = 123 | cost = 0.15485264931511
-----
Circuit = problem_ckt | Layers = 6 | At end of iteration = 124 | cost = 0.15456748888055
-----
Circuit = problem_ckt | Layers = 6 | At end of iteration = 125 | cost = 0.15428488201032
-----
Circuit = problem_ckt | Layers = 6 | At end of iteration = 126 | cost = 0.15400484821862
-----
Circuit = problem_ckt | Layers = 6 | At end of iteration = 127 | cost = 0.15372740159635
-----

```

Circuit =	problem_ckt		Layers =	6		At end of iteration =	128		cost =	0.15345255259305

Circuit =	problem_ckt		Layers =	6		At end of iteration =	129		cost =	0.15318030902884

Circuit =	problem_ckt		Layers =	6		At end of iteration =	130		cost =	0.15291067671903

Circuit =	problem_ckt		Layers =	6		At end of iteration =	131		cost =	0.15264365989150

Circuit =	problem_ckt		Layers =	6		At end of iteration =	132		cost =	0.15237926148424

Circuit =	problem_ckt		Layers =	6		At end of iteration =	133		cost =	0.15211748336712

Circuit =	problem_ckt		Layers =	6		At end of iteration =	134		cost =	0.15185832651226

Circuit =	problem_ckt		Layers =	6		At end of iteration =	135		cost =	0.15160179112688

Circuit =	problem_ckt		Layers =	6		At end of iteration =	136		cost =	0.15134787675801

Circuit =	problem_ckt		Layers =	6		At end of iteration =	137		cost =	0.15109658237521

Circuit =	problem_ckt		Layers =	6		At end of iteration =	138		cost =	0.15084790643601

Circuit =	problem_ckt		Layers =	6		At end of iteration =	139		cost =	0.15060184693766

Circuit =	problem_ckt		Layers =	6		At end of iteration =	140		cost =	0.15035840145784

Circuit =	problem_ckt		Layers =	6		At end of iteration =	141		cost =	0.15011756718656

Circuit =	problem_ckt		Layers =	6		At end of iteration =	142		cost =	0.14987934095108

Circuit =	problem_ckt		Layers =	6		At end of iteration =	143		cost =	0.14964371923509

Circuit =	problem_ckt		Layers =	6		At end of iteration =	144		cost =	0.14941069819339

Circuit =	problem_ckt		Layers =	6		At end of iteration =	145		cost =	0.14918027366289

Circuit =	problem_ckt		Layers =	6		At end of iteration =	146		cost =	0.14895244117073

Circuit =	problem_ckt		Layers =	6		At end of iteration =	147		cost =	0.14872719594000

Circuit =	problem_ckt		Layers =	6		At end of iteration =	148		cost =	0.14850453289362

Circuit =	problem_ckt		Layers =	6		At end of iteration =	149		cost =	0.14828444466567

Circuit =	problem_ckt		Layers =	6		At end of iteration =	150		cost =	0.14806693155779

Circuit =	problem_ckt		Layers =	6		At end of iteration =	151		cost =	0.14785198162889

Circuit = problem_ckt Layers = 6 At end of iteration = 152 cost = 0.14763959060510
Circuit = problem_ckt Layers = 6 At end of iteration = 153 cost = 0.14742975192338
Circuit = problem_ckt Layers = 6 At end of iteration = 154 cost = 0.14722245872091
Circuit = problem_ckt Layers = 6 At end of iteration = 155 cost = 0.14701770383315
Circuit = problem_ckt Layers = 6 At end of iteration = 156 cost = 0.14681547979153
Circuit = problem_ckt Layers = 6 At end of iteration = 157 cost = 0.14661577882096
Circuit = problem_ckt Layers = 6 At end of iteration = 158 cost = 0.14641859283722
Circuit = problem_ckt Layers = 6 At end of iteration = 159 cost = 0.14622391344419
Circuit = problem_ckt Layers = 6 At end of iteration = 160 cost = 0.14603173193105
Circuit = problem_ckt Layers = 6 At end of iteration = 161 cost = 0.14584203926944
Circuit = problem_ckt Layers = 6 At end of iteration = 162 cost = 0.14565482611057
Circuit = problem_ckt Layers = 6 At end of iteration = 163 cost = 0.14547008278247
Circuit = problem_ckt Layers = 6 At end of iteration = 164 cost = 0.14528779928713
Circuit = problem_ckt Layers = 6 At end of iteration = 165 cost = 0.14510796529782
Circuit = problem_ckt Layers = 6 At end of iteration = 166 cost = 0.14493057015640
Circuit = problem_ckt Layers = 6 At end of iteration = 167 cost = 0.14475560287078
Circuit = problem_ckt Layers = 6 At end of iteration = 168 cost = 0.14458305211247
Circuit = problem_ckt Layers = 6 At end of iteration = 169 cost = 0.14441290621423
Circuit = problem_ckt Layers = 6 At end of iteration = 170 cost = 0.14424515316783
Circuit = problem_ckt Layers = 6 At end of iteration = 171 cost = 0.14407978062200
Circuit = problem_ckt Layers = 6 At end of iteration = 172 cost = 0.14391677588046
Circuit = problem_ckt Layers = 6 At end of iteration = 173 cost = 0.14375612590016
Circuit = problem_ckt Layers = 6 At end of iteration = 174 cost = 0.14359781728963
Circuit = problem_ckt Layers = 6 At end of iteration = 175 cost = 0.14344183630755

Circuit = problem_ckt Layers = 6 At end of iteration = 176 cost = 0.14328816886139
Circuit = problem_ckt Layers = 6 At end of iteration = 177 cost = 0.14313680050639
Circuit = problem_ckt Layers = 6 At end of iteration = 178 cost = 0.14298771644456
Circuit = problem_ckt Layers = 6 At end of iteration = 179 cost = 0.14284090152397
Circuit = problem_ckt Layers = 6 At end of iteration = 180 cost = 0.14269634023819
Circuit = problem_ckt Layers = 6 At end of iteration = 181 cost = 0.14255401672592
Circuit = problem_ckt Layers = 6 At end of iteration = 182 cost = 0.14241391477089
Circuit = problem_ckt Layers = 6 At end of iteration = 183 cost = 0.14227601780181
Circuit = problem_ckt Layers = 6 At end of iteration = 184 cost = 0.14214030889270
Circuit = problem_ckt Layers = 6 At end of iteration = 185 cost = 0.14200677076330
Circuit = problem_ckt Layers = 6 At end of iteration = 186 cost = 0.14187538577973
Circuit = problem_ckt Layers = 6 At end of iteration = 187 cost = 0.14174613595534
Circuit = problem_ckt Layers = 6 At end of iteration = 188 cost = 0.14161900295181
Circuit = problem_ckt Layers = 6 At end of iteration = 189 cost = 0.14149396808037
Circuit = problem_ckt Layers = 6 At end of iteration = 190 cost = 0.14137101230332
Circuit = problem_ckt Layers = 6 At end of iteration = 191 cost = 0.14125011623569
Circuit = problem_ckt Layers = 6 At end of iteration = 192 cost = 0.14113126014712
Circuit = problem_ckt Layers = 6 At end of iteration = 193 cost = 0.14101442396395
Circuit = problem_ckt Layers = 6 At end of iteration = 194 cost = 0.14089958727147
Circuit = problem_ckt Layers = 6 At end of iteration = 195 cost = 0.14078672931643
Circuit = problem_ckt Layers = 6 At end of iteration = 196 cost = 0.14067582900964
Circuit = problem_ckt Layers = 6 At end of iteration = 197 cost = 0.14056686492890
Circuit = problem_ckt Layers = 6 At end of iteration = 198 cost = 0.14045981532194
Circuit = problem_ckt Layers = 6 At end of iteration = 199 cost = 0.14035465810969

Circuit = problem_ckt Layers = 6 At end of iteration = 200 cost = 0.14025137088962
Circuit = problem_ckt Layers = 6 At end of iteration = 201 cost = 0.14014993093932
Circuit = problem_ckt Layers = 6 At end of iteration = 202 cost = 0.14005031522019
Circuit = problem_ckt Layers = 6 At end of iteration = 203 cost = 0.13995250038132
Circuit = problem_ckt Layers = 6 At end of iteration = 204 cost = 0.13985646276348
Circuit = problem_ckt Layers = 6 At end of iteration = 205 cost = 0.13976217840332
Circuit = problem_ckt Layers = 6 At end of iteration = 206 cost = 0.13966962303767
Circuit = problem_ckt Layers = 6 At end of iteration = 207 cost = 0.13957877210796
Circuit = problem_ckt Layers = 6 At end of iteration = 208 cost = 0.13948960076478
Circuit = problem_ckt Layers = 6 At end of iteration = 209 cost = 0.13940208387261
Circuit = problem_ckt Layers = 6 At end of iteration = 210 cost = 0.13931619601454
Circuit = problem_ckt Layers = 6 At end of iteration = 211 cost = 0.13923191149725
Circuit = problem_ckt Layers = 6 At end of iteration = 212 cost = 0.13914920435596
Circuit = problem_ckt Layers = 6 At end of iteration = 213 cost = 0.13906804835956
Circuit = problem_ckt Layers = 6 At end of iteration = 214 cost = 0.13898841701577
Circuit = problem_ckt Layers = 6 At end of iteration = 215 cost = 0.13891028357642
Circuit = problem_ckt Layers = 6 At end of iteration = 216 cost = 0.13883362104277
Circuit = problem_ckt Layers = 6 At end of iteration = 217 cost = 0.13875840217094
Circuit = problem_ckt Layers = 6 At end of iteration = 218 cost = 0.13868459947732
Circuit = problem_ckt Layers = 6 At end of iteration = 219 cost = 0.13861218524414
Circuit = problem_ckt Layers = 6 At end of iteration = 220 cost = 0.13854113152500
Circuit = problem_ckt Layers = 6 At end of iteration = 221 cost = 0.13847141015048
Circuit = problem_ckt Layers = 6 At end of iteration = 222 cost = 0.13840299273381
Circuit = problem_ckt Layers = 6 At end of iteration = 223 cost = 0.13833585067647

Circuit =	problem_ckt		Layers =	6		At end of iteration =	224		cost =	0.13826995517394

Circuit =	problem_ckt		Layers =	6		At end of iteration =	225		cost =	0.13820527722141

Circuit =	problem_ckt		Layers =	6		At end of iteration =	226		cost =	0.13814178761946

Circuit =	problem_ckt		Layers =	6		At end of iteration =	227		cost =	0.13807945697986

Circuit =	problem_ckt		Layers =	6		At end of iteration =	228		cost =	0.13801825573124

Circuit =	problem_ckt		Layers =	6		At end of iteration =	229		cost =	0.13795815412489

Circuit =	problem_ckt		Layers =	6		At end of iteration =	230		cost =	0.13789912224047

Circuit =	problem_ckt		Layers =	6		At end of iteration =	231		cost =	0.13784112999172

Circuit =	problem_ckt		Layers =	6		At end of iteration =	232		cost =	0.13778414713223

Circuit =	problem_ckt		Layers =	6		At end of iteration =	233		cost =	0.13772814326111

Circuit =	problem_ckt		Layers =	6		At end of iteration =	234		cost =	0.13767308782869

Circuit =	problem_ckt		Layers =	6		At end of iteration =	235		cost =	0.13761895014221

Circuit =	problem_ckt		Layers =	6		At end of iteration =	236		cost =	0.13756569937147

Circuit =	problem_ckt		Layers =	6		At end of iteration =	237		cost =	0.13751330455444

Circuit =	problem_ckt		Layers =	6		At end of iteration =	238		cost =	0.13746173460295

Circuit =	problem_ckt		Layers =	6		At end of iteration =	239		cost =	0.13741095830820

Circuit =	problem_ckt		Layers =	6		At end of iteration =	240		cost =	0.13736094434640

Circuit =	problem_ckt		Layers =	6		At end of iteration =	241		cost =	0.13731166128427

Circuit =	problem_ckt		Layers =	6		At end of iteration =	242		cost =	0.13726307758461

Circuit =	problem_ckt		Layers =	6		At end of iteration =	243		cost =	0.13721516161184

Circuit =	problem_ckt		Layers =	6		At end of iteration =	244		cost =	0.13716788163740

Circuit =	problem_ckt		Layers =	6		At end of iteration =	245		cost =	0.13712120584536

Circuit =	problem_ckt		Layers =	6		At end of iteration =	246		cost =	0.13707510233777

Circuit =	problem_ckt		Layers =	6		At end of iteration =	247		cost =	0.13702953914023

Circuit =	problem_ckt		Layers =	6		At end of iteration =	248		cost =	0.136984484207268

Circuit =	problem_ckt		Layers =	6		At end of iteration =	249		cost =	0.13693990542781

Circuit =	problem_ckt		Layers =	6		At end of iteration =	250		cost =	0.13689577063067

Circuit =	problem_ckt		Layers =	6		At end of iteration =	251		cost =	0.13685204759000

Circuit =	problem_ckt		Layers =	6		At end of iteration =	252		cost =	0.13680870403074

Circuit =	problem_ckt		Layers =	6		At end of iteration =	253		cost =	0.13676570763415

Circuit =	problem_ckt		Layers =	6		At end of iteration =	254		cost =	0.13672302604335

Circuit =	problem_ckt		Layers =	6		At end of iteration =	255		cost =	0.13668062686882

Circuit =	problem_ckt		Layers =	6		At end of iteration =	256		cost =	0.13663847769405

Circuit =	problem_ckt		Layers =	6		At end of iteration =	257		cost =	0.13659654608118

Circuit =	problem_ckt		Layers =	6		At end of iteration =	258		cost =	0.13655479957667

Circuit =	problem_ckt		Layers =	6		At end of iteration =	259		cost =	0.13651320571712

Circuit =	problem_ckt		Layers =	6		At end of iteration =	260		cost =	0.13647173203508

Circuit =	problem_ckt		Layers =	6		At end of iteration =	261		cost =	0.13643034606502

Circuit =	problem_ckt		Layers =	6		At end of iteration =	262		cost =	0.13638901534932

Circuit =	problem_ckt		Layers =	6		At end of iteration =	263		cost =	0.13634770744442

Circuit =	problem_ckt		Layers =	6		At end of iteration =	264		cost =	0.13630638992712

Circuit =	problem_ckt		Layers =	6		At end of iteration =	265		cost =	0.13626503040091

Circuit =	problem_ckt		Layers =	6		At end of iteration =	266		cost =	0.13622359650255

Circuit =	problem_ckt		Layers =	6		At end of iteration =	267		cost =	0.13618205590874

Circuit =	problem_ckt		Layers =	6		At end of iteration =	268		cost =	0.13614037634303

Circuit =	problem_ckt		Layers =	6		At end of iteration =	269		cost =	0.13609852558282

Circuit =	problem_ckt		Layers =	6		At end of iteration =	270		cost =	0.13605647146667

Circuit =	problem_ckt		Layers =	6		At end of iteration =	271		cost =	0.13601418190176

Circuit = problem_ckt Layers = 6 At end of iteration = 272 cost = 0.13597162487161
Circuit = problem_ckt Layers = 6 At end of iteration = 273 cost = 0.13592876844406
Circuit = problem_ckt Layers = 6 At end of iteration = 274 cost = 0.13588558077950
Circuit = problem_ckt Layers = 6 At end of iteration = 275 cost = 0.13584203013941
Circuit = problem_ckt Layers = 6 At end of iteration = 276 cost = 0.13579808489517
Circuit = problem_ckt Layers = 6 At end of iteration = 277 cost = 0.13575371353731
Circuit = problem_ckt Layers = 6 At end of iteration = 278 cost = 0.13570888468494
Circuit = problem_ckt Layers = 6 At end of iteration = 279 cost = 0.13566356709569
Circuit = problem_ckt Layers = 6 At end of iteration = 280 cost = 0.13561772967600
Circuit = problem_ckt Layers = 6 At end of iteration = 281 cost = 0.13557134149177
Circuit = problem_ckt Layers = 6 At end of iteration = 282 cost = 0.13552437177955
Circuit = problem_ckt Layers = 6 At end of iteration = 283 cost = 0.13547678995815
Circuit = problem_ckt Layers = 6 At end of iteration = 284 cost = 0.13542856564065
Circuit = problem_ckt Layers = 6 At end of iteration = 285 cost = 0.13537966864710
Circuit = problem_ckt Layers = 6 At end of iteration = 286 cost = 0.13533006901759
Circuit = problem_ckt Layers = 6 At end of iteration = 287 cost = 0.13527973702599
Circuit = problem_ckt Layers = 6 At end of iteration = 288 cost = 0.13522864319425
Circuit = problem_ckt Layers = 6 At end of iteration = 289 cost = 0.13517675830732
Circuit = problem_ckt Layers = 6 At end of iteration = 290 cost = 0.13512405342872
Circuit = problem_ckt Layers = 6 At end of iteration = 291 cost = 0.13507049991681
Circuit = problem_ckt Layers = 6 At end of iteration = 292 cost = 0.13501606944175
Circuit = problem_ckt Layers = 6 At end of iteration = 293 cost = 0.13496073400321
Circuit = problem_ckt Layers = 6 At end of iteration = 294 cost = 0.13490446594887
Circuit = problem_ckt Layers = 6 At end of iteration = 295 cost = 0.13484723799368

```

Circuit = problem_ckt | Layers = 6 | At end of iteration = 296 | cost = 0.13478902324003
-----
Circuit = problem_ckt | Layers = 6 | At end of iteration = 297 | cost = 0.13472979519874
-----
Circuit = problem_ckt | Layers = 6 | At end of iteration = 298 | cost = 0.13466952781097
-----
Circuit = problem_ckt | Layers = 6 | At end of iteration = 299 | cost = 0.13460819547108
-----
Circuit = problem_ckt | Layers = 6 | At end of iteration = 300 | cost = 0.13454577305048
-----

```

Optimization complete.

After optimization, the optimal parameters are

```
{Parameter(theta4[3]): 0.3324573424146226, Parameter(theta8[0]): 0.0778292669181762, Parameter(theta1[1]): 0.018375156312795238}
```

The output state for these parameters is

```

[[0.22816476+0.30351394j]
 [0.03285292+0.25312515j]
 [0.24499715+0.08000385j]
 [0.18761711+0.05394073j]
 [0.17753778+0.02024175j]
 [0.23406964+0.11205456j]
 [0.14266447+0.09578635j]
 [0.04596833+0.09500792j]
 [0.28684595+0.01572477j]
 [0.18036756+0.05206034j]
 [0.28401548+0.02399212j]
 [0.05905942+0.02042634j]
 [0.32168522+0.1428192j ]
 [0.22423234-0.00034561j]
 [0.22333128+0.27416704j]
 [0.15604849+0.14043398j]]

```

```

Circuit = problem_ckt Layers = 6 Cost after optimization = 0.13454577305048004
-----

```

```
Circuit problem_ckt constructed with 7 layers. Number of parameters = 56 .
```

Initialized circuit parameters prior to gradient descent randomly as follows:

```

idx = theta4[2] params = 0.03719052023213644
idx = theta7[2] params = 0.04312312828020062
idx = theta12[2] params = 0.0004994971757621869
idx = theta5[2] params = 0.03444025418170515
idx = theta9[1] params = 0.046881140646663634
idx = theta13[3] params = 0.02164226791611938
idx = theta14[2] params = 0.028343942770291508
idx = theta8[0] params = 0.013510378554063363
idx = theta5[0] params = 0.022782810868909098
idx = theta4[3] params = 0.00573789773068969
idx = theta11[3] params = 0.039532273767073196
idx = theta1[1] params = 0.018375156312795238

```

```

idx = theta2[3] params = 0.02421115885861306
idx = theta3[0] params = 0.01671278315727628
idx = theta9[2] params = 0.006172454610576922
idx = theta6[1] params = 0.016655522656847783
idx = theta11[1] params = 0.04662197117509747
idx = theta4[0] params = 0.009378499198132518
idx = theta11[2] params = 0.030481776612878
idx = theta2[1] params = 0.006238299240088347
idx = theta7[1] params = 0.046316344013782464
idx = theta10[3] params = 0.002833116050508433
idx = theta10[1] params = 0.009568165097689485
idx = theta3[2] params = 0.003778807686699465
idx = theta1[0] params = 0.04761132655555178
idx = theta3[3] params = 0.02912836626547597
idx = theta11[0] params = 0.03277867333581935
idx = theta2[0] params = 0.0012507649722014293
idx = theta8[3] params = 0.03265668670981592
idx = theta12[3] params = 0.042510362504139115
idx = theta7[0] params = 0.028964664980450857
idx = theta1[2] params = 0.02606701333987876
idx = theta2[2] params = 0.04507588560641085
idx = theta13[2] params = 0.01594882076679191
idx = theta14[0] params = 0.03973242205283862
idx = theta12[0] params = 0.009337792350935193
idx = theta10[0] params = 0.0032829280606491377
idx = theta5[3] params = 0.019944497772341908
idx = theta8[2] params = 0.040543302128205796
idx = theta14[1] params = 0.018661219094017113
idx = theta12[1] params = 0.022765429249395765
idx = theta6[2] params = 0.04496189581938223
idx = theta7[3] params = 0.04421309636000539
idx = theta5[1] params = 0.032067148697469475
idx = theta6[3] params = 0.03316055200997197
idx = theta3[1] params = 0.038381406528673896
idx = theta8[1] params = 0.014346822771396907
idx = theta9[3] params = 0.017358921226698288
idx = theta14[3] params = 0.036248132522104036
idx = theta4[1] params = 0.03539050548659198
idx = theta9[0] params = 0.01607370215812653
idx = theta10[2] params = 0.007381200069874755
idx = theta1[3] params = 0.02358393517371811
idx = theta13[1] params = 0.0009009332204443055
idx = theta13[0] params = 0.015027195664715637
idx = theta6[0] params = 0.037934352344020754

```

```

-----
Circuit = problem_ckt | Layers = 7 | At end of iteration = 1 | cost = 1.2016418961726745
-----

```

```

Circuit = problem_ckt | Layers = 7 | At end of iteration = 2 | cost = 1.161380649922135

```

```

-----
Circuit =  problem_ckt | Layers =  7 | At end of iteration =  3 | cost =  1.1057183934226538
-----
Circuit =  problem_ckt | Layers =  7 | At end of iteration =  4 | cost =  1.0122621913441965
-----
Circuit =  problem_ckt | Layers =  7 | At end of iteration =  5 | cost =  0.8882940396839857
-----
Circuit =  problem_ckt | Layers =  7 | At end of iteration =  6 | cost =  0.8162644100730813
-----
Circuit =  problem_ckt | Layers =  7 | At end of iteration =  7 | cost =  0.7724442080959418
-----
Circuit =  problem_ckt | Layers =  7 | At end of iteration =  8 | cost =  0.7477528057057257
-----
Circuit =  problem_ckt | Layers =  7 | At end of iteration =  9 | cost =  0.7252042272247589
-----
Circuit =  problem_ckt | Layers =  7 | At end of iteration = 10 | cost =  0.728291260896249
-----
Circuit =  problem_ckt | Layers =  7 | At end of iteration = 11 | cost =  0.753306994276193
-----
Circuit =  problem_ckt | Layers =  7 | At end of iteration = 12 | cost =  0.898522685472273
-----
Circuit =  problem_ckt | Layers =  7 | At end of iteration = 13 | cost =  0.879471364102955
-----
Circuit =  problem_ckt | Layers =  7 | At end of iteration = 14 | cost =  0.823796158906413
-----
Circuit =  problem_ckt | Layers =  7 | At end of iteration = 15 | cost =  0.795807229418515
-----
Circuit =  problem_ckt | Layers =  7 | At end of iteration = 16 | cost =  0.820766285027012
-----
Circuit =  problem_ckt | Layers =  7 | At end of iteration = 17 | cost =  0.783104208022949
-----
Circuit =  problem_ckt | Layers =  7 | At end of iteration = 18 | cost =  0.789319512098688
-----
Circuit =  problem_ckt | Layers =  7 | At end of iteration = 19 | cost =  0.752113041235324
-----
Circuit =  problem_ckt | Layers =  7 | At end of iteration = 20 | cost =  0.782234144533742
-----
Circuit =  problem_ckt | Layers =  7 | At end of iteration = 21 | cost =  0.731605230818486
-----
Circuit =  problem_ckt | Layers =  7 | At end of iteration = 22 | cost =  0.775537354900229
-----
Circuit =  problem_ckt | Layers =  7 | At end of iteration = 23 | cost =  0.720128328480710
-----
Circuit =  problem_ckt | Layers =  7 | At end of iteration = 24 | cost =  0.7720110291654
-----
Circuit =  problem_ckt | Layers =  7 | At end of iteration = 25 | cost =  0.717989219028779
-----
Circuit =  problem_ckt | Layers =  7 | At end of iteration = 26 | cost =  0.767970347950649
-----

```

```

-----
Circuit =  problem_ckt | Layers =  7 | At end of iteration =  27 | cost =  0.7207155074595145
-----
Circuit =  problem_ckt | Layers =  7 | At end of iteration =  28 | cost =  0.7653045749486203
-----
Circuit =  problem_ckt | Layers =  7 | At end of iteration =  29 | cost =  0.7241163263089888
-----
Circuit =  problem_ckt | Layers =  7 | At end of iteration =  30 | cost =  0.7640582689854575
-----
Circuit =  problem_ckt | Layers =  7 | At end of iteration =  31 | cost =  0.7275159955187489
-----
Circuit =  problem_ckt | Layers =  7 | At end of iteration =  32 | cost =  0.762868448496664
-----
Circuit =  problem_ckt | Layers =  7 | At end of iteration =  33 | cost =  0.7304820944858476
-----
Circuit =  problem_ckt | Layers =  7 | At end of iteration =  34 | cost =  0.7615073490232289
-----
Circuit =  problem_ckt | Layers =  7 | At end of iteration =  35 | cost =  0.7327132124208213
-----
Circuit =  problem_ckt | Layers =  7 | At end of iteration =  36 | cost =  0.7600976540754603
-----
Circuit =  problem_ckt | Layers =  7 | At end of iteration =  37 | cost =  0.7341583231387433
-----
Circuit =  problem_ckt | Layers =  7 | At end of iteration =  38 | cost =  0.7588194608885103
-----
Circuit =  problem_ckt | Layers =  7 | At end of iteration =  39 | cost =  0.7348512062995498
-----
REDUCING ALPHA TO  0.31622776601683794  at iteration =  40
-----
Circuit =  problem_ckt | Layers =  7 | At end of iteration =  40 | cost =  0.7578666811670909
-----
Circuit =  problem_ckt | Layers =  7 | At end of iteration =  41 | cost =  0.4791665056252063
-----
Circuit =  problem_ckt | Layers =  7 | At end of iteration =  42 | cost =  0.3959783274811076
-----
Circuit =  problem_ckt | Layers =  7 | At end of iteration =  43 | cost =  0.3827588379838933
-----
Circuit =  problem_ckt | Layers =  7 | At end of iteration =  44 | cost =  0.3657598606779603
-----
Circuit =  problem_ckt | Layers =  7 | At end of iteration =  45 | cost =  0.3543295757477215
-----
Circuit =  problem_ckt | Layers =  7 | At end of iteration =  46 | cost =  0.3414057324164664
-----
Circuit =  problem_ckt | Layers =  7 | At end of iteration =  47 | cost =  0.3315136473795196
-----
Circuit =  problem_ckt | Layers =  7 | At end of iteration =  48 | cost =  0.3202033499620533
-----
Circuit =  problem_ckt | Layers =  7 | At end of iteration =  49 | cost =  0.3116708204954822

```



```

-----
Circuit =  problem_ckt | Layers =  7 | At end of iteration = 50 | cost = 0.3010171410346043
-----
Circuit =  problem_ckt | Layers =  7 | At end of iteration = 51 | cost = 0.2941267334596588
-----
Circuit =  problem_ckt | Layers =  7 | At end of iteration = 52 | cost = 0.2829844935896117
-----
Circuit =  problem_ckt | Layers =  7 | At end of iteration = 53 | cost = 0.2793012878793448
-----
Circuit =  problem_ckt | Layers =  7 | At end of iteration = 54 | cost = 0.26512589228327
-----
Circuit =  problem_ckt | Layers =  7 | At end of iteration = 55 | cost = 0.272405135844331
-----
Circuit =  problem_ckt | Layers =  7 | At end of iteration = 56 | cost = 0.251524837510152
-----
Circuit =  problem_ckt | Layers =  7 | At end of iteration = 57 | cost = 0.314849959435090
-----
Circuit =  problem_ckt | Layers =  7 | At end of iteration = 58 | cost = 0.301209409082398
-----
Circuit =  problem_ckt | Layers =  7 | At end of iteration = 59 | cost = 0.428193261735604
-----
Circuit =  problem_ckt | Layers =  7 | At end of iteration = 60 | cost = 0.311749381642923
-----
Circuit =  problem_ckt | Layers =  7 | At end of iteration = 61 | cost = 0.434424829024726
-----
Circuit =  problem_ckt | Layers =  7 | At end of iteration = 62 | cost = 0.308748094741125
-----
Circuit =  problem_ckt | Layers =  7 | At end of iteration = 63 | cost = 0.440376098877554
-----
Circuit =  problem_ckt | Layers =  7 | At end of iteration = 64 | cost = 0.306175803465365
-----
Circuit =  problem_ckt | Layers =  7 | At end of iteration = 65 | cost = 0.446594719569577
-----
Circuit =  problem_ckt | Layers =  7 | At end of iteration = 66 | cost = 0.303383165592772
-----
Circuit =  problem_ckt | Layers =  7 | At end of iteration = 67 | cost = 0.452804709372656
-----
Circuit =  problem_ckt | Layers =  7 | At end of iteration = 68 | cost = 0.300410414496703
-----
Circuit =  problem_ckt | Layers =  7 | At end of iteration = 69 | cost = 0.458936831663974
-----
Circuit =  problem_ckt | Layers =  7 | At end of iteration = 70 | cost = 0.297292953907077
-----
Circuit =  problem_ckt | Layers =  7 | At end of iteration = 71 | cost = 0.464972177844071
-----
Circuit =  problem_ckt | Layers =  7 | At end of iteration = 72 | cost = 0.294063576001382
-----
Circuit =  problem_ckt | Layers =  7 | At end of iteration = 73 | cost = 0.470904564700093
-----

```

```

-----
Circuit =  problem_ckt | Layers =  7 | At end of iteration = 74 | cost = 0.2907523299960552
-----
Circuit =  problem_ckt | Layers =  7 | At end of iteration = 75 | cost = 0.4767333345144945
-----
Circuit =  problem_ckt | Layers =  7 | At end of iteration = 76 | cost = 0.2873855548307130
-----
Circuit =  problem_ckt | Layers =  7 | At end of iteration = 77 | cost = 0.4824623859454511
-----
Circuit =  problem_ckt | Layers =  7 | At end of iteration = 78 | cost = 0.2839846907535022
-----
Circuit =  problem_ckt | Layers =  7 | At end of iteration = 79 | cost = 0.4881003770875811
-----
REDUCING ALPHA TO 0.09999999999999999 at iteration = 80
-----
Circuit =  problem_ckt | Layers =  7 | At end of iteration = 80 | cost = 0.2805653951652150
-----
Circuit =  problem_ckt | Layers =  7 | At end of iteration = 81 | cost = 0.1781524874950430
-----
Circuit =  problem_ckt | Layers =  7 | At end of iteration = 82 | cost = 0.1885909478901870
-----
Circuit =  problem_ckt | Layers =  7 | At end of iteration = 83 | cost = 0.1812555909710700
-----
Circuit =  problem_ckt | Layers =  7 | At end of iteration = 84 | cost = 0.1822534595734790
-----
Circuit =  problem_ckt | Layers =  7 | At end of iteration = 85 | cost = 0.1800015056297490
-----
Circuit =  problem_ckt | Layers =  7 | At end of iteration = 86 | cost = 0.1791512533399100
-----
Circuit =  problem_ckt | Layers =  7 | At end of iteration = 87 | cost = 0.1777383938600710
-----
Circuit =  problem_ckt | Layers =  7 | At end of iteration = 88 | cost = 0.1766455344978910
-----
Circuit =  problem_ckt | Layers =  7 | At end of iteration = 89 | cost = 0.1754636198316900
-----
Circuit =  problem_ckt | Layers =  7 | At end of iteration = 90 | cost = 0.1743812567018060
-----
Circuit =  problem_ckt | Layers =  7 | At end of iteration = 91 | cost = 0.1733003026347760
-----
Circuit =  problem_ckt | Layers =  7 | At end of iteration = 92 | cost = 0.1722647610617810
-----
Circuit =  problem_ckt | Layers =  7 | At end of iteration = 93 | cost = 0.1712471610083390
-----
Circuit =  problem_ckt | Layers =  7 | At end of iteration = 94 | cost = 0.1702577881500890
-----
Circuit =  problem_ckt | Layers =  7 | At end of iteration = 95 | cost = 0.1692872027418530
-----
Circuit =  problem_ckt | Layers =  7 | At end of iteration = 96 | cost = 0.1683371062743780
-----

```

```

-----
Circuit =  problem_ckt | Layers =  7 | At end of iteration =  97 | cost =  0.1674032571959977
-----
Circuit =  problem_ckt | Layers =  7 | At end of iteration =  98 | cost =  0.1664850710499921
-----
Circuit =  problem_ckt | Layers =  7 | At end of iteration =  99 | cost =  0.1655800469308511
-----
Circuit =  problem_ckt | Layers =  7 | At end of iteration = 100 | cost =  0.1646870351216311
-----
Circuit =  problem_ckt | Layers =  7 | At end of iteration = 101 | cost =  0.1638042512282901
-----
Circuit =  problem_ckt | Layers =  7 | At end of iteration = 102 | cost =  0.1629304888753111
-----
Circuit =  problem_ckt | Layers =  7 | At end of iteration = 103 | cost =  0.1620643503827701
-----
Circuit =  problem_ckt | Layers =  7 | At end of iteration = 104 | cost =  0.1612047365557101
-----
Circuit =  problem_ckt | Layers =  7 | At end of iteration = 105 | cost =  0.1603505239926101
-----
Circuit =  problem_ckt | Layers =  7 | At end of iteration = 106 | cost =  0.1595007802419201
-----
Circuit =  problem_ckt | Layers =  7 | At end of iteration = 107 | cost =  0.1586546177473001
-----
Circuit =  problem_ckt | Layers =  7 | At end of iteration = 108 | cost =  0.1578112965508101
-----
Circuit =  problem_ckt | Layers =  7 | At end of iteration = 109 | cost =  0.1569701529739701
-----
Circuit =  problem_ckt | Layers =  7 | At end of iteration = 110 | cost =  0.1561306526089601
-----
Circuit =  problem_ckt | Layers =  7 | At end of iteration = 111 | cost =  0.1552923524187201
-----
Circuit =  problem_ckt | Layers =  7 | At end of iteration = 112 | cost =  0.1544549297943401
-----
Circuit =  problem_ckt | Layers =  7 | At end of iteration = 113 | cost =  0.1536181600578601
-----
Circuit =  problem_ckt | Layers =  7 | At end of iteration = 114 | cost =  0.1527819327234501
-----
Circuit =  problem_ckt | Layers =  7 | At end of iteration = 115 | cost =  0.1519462359212401
-----
Circuit =  problem_ckt | Layers =  7 | At end of iteration = 116 | cost =  0.1511111648663801
-----
Circuit =  problem_ckt | Layers =  7 | At end of iteration = 117 | cost =  0.1502769088947601
-----
Circuit =  problem_ckt | Layers =  7 | At end of iteration = 118 | cost =  0.1494437544905101
-----
Circuit =  problem_ckt | Layers =  7 | At end of iteration = 119 | cost =  0.1486120726367901
-----
REDUCING ALPHA TO  0.03162277660168379  at iteration = 120

```

```

-----
Circuit =  problem_ckt | Layers =  7 | At end of iteration = 120 | cost = 0.147782317658011
-----
Circuit =  problem_ckt | Layers =  7 | At end of iteration = 121 | cost = 0.147522154678663
-----
Circuit =  problem_ckt | Layers =  7 | At end of iteration = 122 | cost = 0.147261765197721
-----
Circuit =  problem_ckt | Layers =  7 | At end of iteration = 123 | cost = 0.147001265466679
-----
Circuit =  problem_ckt | Layers =  7 | At end of iteration = 124 | cost = 0.146740754336418
-----
Circuit =  problem_ckt | Layers =  7 | At end of iteration = 125 | cost = 0.146480314261511
-----
Circuit =  problem_ckt | Layers =  7 | At end of iteration = 126 | cost = 0.146220014066641
-----
Circuit =  problem_ckt | Layers =  7 | At end of iteration = 127 | cost = 0.145959911824461
-----
Circuit =  problem_ckt | Layers =  7 | At end of iteration = 128 | cost = 0.145700057333781
-----
Circuit =  problem_ckt | Layers =  7 | At end of iteration = 129 | cost = 0.145440494104951
-----
Circuit =  problem_ckt | Layers =  7 | At end of iteration = 130 | cost = 0.145181260898581
-----
Circuit =  problem_ckt | Layers =  7 | At end of iteration = 131 | cost = 0.144922392898191
-----
Circuit =  problem_ckt | Layers =  7 | At end of iteration = 132 | cost = 0.144663922595601
-----
Circuit =  problem_ckt | Layers =  7 | At end of iteration = 133 | cost = 0.144405880455341
-----
Circuit =  problem_ckt | Layers =  7 | At end of iteration = 134 | cost = 0.144148295411151
-----
Circuit =  problem_ckt | Layers =  7 | At end of iteration = 135 | cost = 0.143891195235181
-----
Circuit =  problem_ckt | Layers =  7 | At end of iteration = 136 | cost = 0.143634606811271
-----
Circuit =  problem_ckt | Layers =  7 | At end of iteration = 137 | cost = 0.143378556335971
-----
Circuit =  problem_ckt | Layers =  7 | At end of iteration = 138 | cost = 0.143123069465231
-----
Circuit =  problem_ckt | Layers =  7 | At end of iteration = 139 | cost = 0.142868171420331
-----
Circuit =  problem_ckt | Layers =  7 | At end of iteration = 140 | cost = 0.142613887063361
-----
Circuit =  problem_ckt | Layers =  7 | At end of iteration = 141 | cost = 0.142360240950041
-----
Circuit =  problem_ckt | Layers =  7 | At end of iteration = 142 | cost = 0.142107257365671
-----
Circuit =  problem_ckt | Layers =  7 | At end of iteration = 143 | cost = 0.141854960348921

```

```

-----
Circuit =  problem_ckt | Layers =  7 | At end of iteration = 144 | cost = 0.14160337370668
-----
Circuit =  problem_ckt | Layers =  7 | At end of iteration = 145 | cost = 0.14135252102272
-----
Circuit =  problem_ckt | Layers =  7 | At end of iteration = 146 | cost = 0.14110242566219
-----
Circuit =  problem_ckt | Layers =  7 | At end of iteration = 147 | cost = 0.14085311077346
-----
Circuit =  problem_ckt | Layers =  7 | At end of iteration = 148 | cost = 0.14060459928858
-----
Circuit =  problem_ckt | Layers =  7 | At end of iteration = 149 | cost = 0.14035691392336
-----
Circuit =  problem_ckt | Layers =  7 | At end of iteration = 150 | cost = 0.14011007717767
-----
Circuit =  problem_ckt | Layers =  7 | At end of iteration = 151 | cost = 0.13986411133680
-----
Circuit =  problem_ckt | Layers =  7 | At end of iteration = 152 | cost = 0.13961903847424
-----
Circuit =  problem_ckt | Layers =  7 | At end of iteration = 153 | cost = 0.13937488045618
-----
Circuit =  problem_ckt | Layers =  7 | At end of iteration = 154 | cost = 0.13913165894838
-----
Circuit =  problem_ckt | Layers =  7 | At end of iteration = 155 | cost = 0.13888939542527
-----
Circuit =  problem_ckt | Layers =  7 | At end of iteration = 156 | cost = 0.13864811118178
-----
Circuit =  problem_ckt | Layers =  7 | At end of iteration = 157 | cost = 0.13840782734808
-----
Circuit =  problem_ckt | Layers =  7 | At end of iteration = 158 | cost = 0.13816856490711
-----
Circuit =  problem_ckt | Layers =  7 | At end of iteration = 159 | cost = 0.13793034471539
-----
Circuit =  problem_ckt | Layers =  7 | At end of iteration = 160 | cost = 0.13769318752682
-----
Circuit =  problem_ckt | Layers =  7 | At end of iteration = 161 | cost = 0.13745711401985
-----
Circuit =  problem_ckt | Layers =  7 | At end of iteration = 162 | cost = 0.13722214482782
-----
Circuit =  problem_ckt | Layers =  7 | At end of iteration = 163 | cost = 0.13698830057262
-----
Circuit =  problem_ckt | Layers =  7 | At end of iteration = 164 | cost = 0.13675560190159
-----
Circuit =  problem_ckt | Layers =  7 | At end of iteration = 165 | cost = 0.13652406952763
-----
Circuit =  problem_ckt | Layers =  7 | At end of iteration = 166 | cost = 0.13629372427250
-----
Circuit =  problem_ckt | Layers =  7 | At end of iteration = 167 | cost = 0.13606458711323
-----

```

```

-----
Circuit =  problem_ckt | Layers =  7 | At end of iteration = 168 | cost = 0.135836679231452
-----
Circuit =  problem_ckt | Layers =  7 | At end of iteration = 169 | cost = 0.13561002206562
-----
Circuit =  problem_ckt | Layers =  7 | At end of iteration = 170 | cost = 0.13538463736601
-----
Circuit =  problem_ckt | Layers =  7 | At end of iteration = 171 | cost = 0.13516054725218
-----
Circuit =  problem_ckt | Layers =  7 | At end of iteration = 172 | cost = 0.13493777427282
-----
Circuit =  problem_ckt | Layers =  7 | At end of iteration = 173 | cost = 0.13471634146781
-----
Circuit =  problem_ckt | Layers =  7 | At end of iteration = 174 | cost = 0.13449627243211
-----
Circuit =  problem_ckt | Layers =  7 | At end of iteration = 175 | cost = 0.13427759138138
-----
Circuit =  problem_ckt | Layers =  7 | At end of iteration = 176 | cost = 0.13406032321900
-----
Circuit =  problem_ckt | Layers =  7 | At end of iteration = 177 | cost = 0.13384449360417
-----
Circuit =  problem_ckt | Layers =  7 | At end of iteration = 178 | cost = 0.13363012902081
-----
Circuit =  problem_ckt | Layers =  7 | At end of iteration = 179 | cost = 0.13341725684697
-----
Circuit =  problem_ckt | Layers =  7 | At end of iteration = 180 | cost = 0.13320590542429
-----
Circuit =  problem_ckt | Layers =  7 | At end of iteration = 181 | cost = 0.13299610412734
-----
Circuit =  problem_ckt | Layers =  7 | At end of iteration = 182 | cost = 0.13278788343223
-----
Circuit =  problem_ckt | Layers =  7 | At end of iteration = 183 | cost = 0.13258127498428
-----
Circuit =  problem_ckt | Layers =  7 | At end of iteration = 184 | cost = 0.13237631166429
-----
Circuit =  problem_ckt | Layers =  7 | At end of iteration = 185 | cost = 0.13217302765300
-----
Circuit =  problem_ckt | Layers =  7 | At end of iteration = 186 | cost = 0.13197145849324
-----
Circuit =  problem_ckt | Layers =  7 | At end of iteration = 187 | cost = 0.13177164114951
-----
Circuit =  problem_ckt | Layers =  7 | At end of iteration = 188 | cost = 0.13157361406435
-----
Circuit =  problem_ckt | Layers =  7 | At end of iteration = 189 | cost = 0.13137741721128
-----
Circuit =  problem_ckt | Layers =  7 | At end of iteration = 190 | cost = 0.13118309214364
-----
Circuit =  problem_ckt | Layers =  7 | At end of iteration = 191 | cost = 0.13099068203900
-----

```

```

-----
Circuit =  problem_ckt | Layers =  7 | At end of iteration = 192 | cost = 0.13080023173879
-----
Circuit =  problem_ckt | Layers =  7 | At end of iteration = 193 | cost = 0.13061178778248
-----
Circuit =  problem_ckt | Layers =  7 | At end of iteration = 194 | cost = 0.13042539843613
-----
Circuit =  problem_ckt | Layers =  7 | At end of iteration = 195 | cost = 0.13024111371464
-----
Circuit =  problem_ckt | Layers =  7 | At end of iteration = 196 | cost = 0.13005898539755
-----
Circuit =  problem_ckt | Layers =  7 | At end of iteration = 197 | cost = 0.12987906703776
-----
Circuit =  problem_ckt | Layers =  7 | At end of iteration = 198 | cost = 0.12970141396292
-----
Circuit =  problem_ckt | Layers =  7 | At end of iteration = 199 | cost = 0.12952608326915
-----
Circuit =  problem_ckt | Layers =  7 | At end of iteration = 200 | cost = 0.12935313380660
-----
Circuit =  problem_ckt | Layers =  7 | At end of iteration = 201 | cost = 0.12918262615672
-----
Circuit =  problem_ckt | Layers =  7 | At end of iteration = 202 | cost = 0.12901462260088
-----
Circuit =  problem_ckt | Layers =  7 | At end of iteration = 203 | cost = 0.12884918708002
-----
Circuit =  problem_ckt | Layers =  7 | At end of iteration = 204 | cost = 0.12868638514520
-----
Circuit =  problem_ckt | Layers =  7 | At end of iteration = 205 | cost = 0.12852628389889
-----
Circuit =  problem_ckt | Layers =  7 | At end of iteration = 206 | cost = 0.12836895192676
-----
Circuit =  problem_ckt | Layers =  7 | At end of iteration = 207 | cost = 0.12821445921992
-----
Circuit =  problem_ckt | Layers =  7 | At end of iteration = 208 | cost = 0.12806287708757
-----
Circuit =  problem_ckt | Layers =  7 | At end of iteration = 209 | cost = 0.12791427806002
-----
Circuit =  problem_ckt | Layers =  7 | At end of iteration = 210 | cost = 0.12776873578217
-----
Circuit =  problem_ckt | Layers =  7 | At end of iteration = 211 | cost = 0.12762632489750
-----
Circuit =  problem_ckt | Layers =  7 | At end of iteration = 212 | cost = 0.12748712092268
-----
Circuit =  problem_ckt | Layers =  7 | At end of iteration = 213 | cost = 0.12735120011313
-----
Circuit =  problem_ckt | Layers =  7 | At end of iteration = 214 | cost = 0.12721863931962
-----
Circuit =  problem_ckt | Layers =  7 | At end of iteration = 215 | cost = 0.12708951583641
-----

```

```

-----
Circuit =  problem_ckt | Layers =  7 | At end of iteration = 216 | cost = 0.12696390724114
-----
Circuit =  problem_ckt | Layers =  7 | At end of iteration = 217 | cost = 0.12684189122695
-----
Circuit =  problem_ckt | Layers =  7 | At end of iteration = 218 | cost = 0.12672354542740
-----
Circuit =  problem_ckt | Layers =  7 | At end of iteration = 219 | cost = 0.12660894723465
-----
Circuit =  problem_ckt | Layers =  7 | At end of iteration = 220 | cost = 0.12649817361143
-----
Circuit =  problem_ckt | Layers =  7 | At end of iteration = 221 | cost = 0.12639130089771
-----
Circuit =  problem_ckt | Layers =  7 | At end of iteration = 222 | cost = 0.12628840461245
-----
Circuit =  problem_ckt | Layers =  7 | At end of iteration = 223 | cost = 0.12618955925145
-----
Circuit =  problem_ckt | Layers =  7 | At end of iteration = 224 | cost = 0.12609483808194
-----
Circuit =  problem_ckt | Layers =  7 | At end of iteration = 225 | cost = 0.12600431293479
-----
Circuit =  problem_ckt | Layers =  7 | At end of iteration = 226 | cost = 0.12591805399533
-----
Circuit =  problem_ckt | Layers =  7 | At end of iteration = 227 | cost = 0.12583612959343
-----
Circuit =  problem_ckt | Layers =  7 | At end of iteration = 228 | cost = 0.12575860599410
-----
Circuit =  problem_ckt | Layers =  7 | At end of iteration = 229 | cost = 0.12568554718930
-----
Circuit =  problem_ckt | Layers =  7 | At end of iteration = 230 | cost = 0.12561701469208
-----
Circuit =  problem_ckt | Layers =  7 | At end of iteration = 231 | cost = 0.12555306733397
-----
Circuit =  problem_ckt | Layers =  7 | At end of iteration = 232 | cost = 0.12549376106668
-----
Circuit =  problem_ckt | Layers =  7 | At end of iteration = 233 | cost = 0.12543914876891
-----
Circuit =  problem_ckt | Layers =  7 | At end of iteration = 234 | cost = 0.12538928005949
-----
Circuit =  problem_ckt | Layers =  7 | At end of iteration = 235 | cost = 0.12534420111755
-----
Circuit =  problem_ckt | Layers =  7 | At end of iteration = 236 | cost = 0.12530395451079
-----
Circuit =  problem_ckt | Layers =  7 | At end of iteration = 237 | cost = 0.12526857903266
-----
Circuit =  problem_ckt | Layers =  7 | At end of iteration = 238 | cost = 0.12523810954932
-----
Circuit =  problem_ckt | Layers =  7 | At end of iteration = 239 | cost = 0.12521257685719
-----

```



```

-----
Circuit =  problem_ckt | Layers =  7 | At end of iteration = 240 | cost = 0.12519200755171
-----
Circuit =  problem_ckt | Layers =  7 | At end of iteration = 241 | cost = 0.12517642390816
-----
Circuit =  problem_ckt | Layers =  7 | At end of iteration = 242 | cost = 0.12516584377498
-----
Circuit =  problem_ckt | Layers =  7 | At end of iteration = 243 | cost = 0.12516028048029
-----
Circuit =  problem_ckt | Layers =  7 | At end of iteration = 244 | cost = 0.12515974275187
-----
Circuit =  problem_ckt | Layers =  7 | At end of iteration = 245 | cost = 0.12516423465118
-----
Circuit =  problem_ckt | Layers =  7 | At end of iteration = 246 | cost = 0.12517375552154
-----
Circuit =  problem_ckt | Layers =  7 | At end of iteration = 247 | cost = 0.12518829995085
-----
Circuit =  problem_ckt | Layers =  7 | At end of iteration = 248 | cost = 0.12520785774883
-----
Circuit =  problem_ckt | Layers =  7 | At end of iteration = 249 | cost = 0.12523241393887
-----
Circuit =  problem_ckt | Layers =  7 | At end of iteration = 250 | cost = 0.12526194876449
-----
Circuit =  problem_ckt | Layers =  7 | At end of iteration = 251 | cost = 0.12529643771018
-----
Circuit =  problem_ckt | Layers =  7 | At end of iteration = 252 | cost = 0.12533585153649
-----
Circuit =  problem_ckt | Layers =  7 | At end of iteration = 253 | cost = 0.12538015632899
-----
Circuit =  problem_ckt | Layers =  7 | At end of iteration = 254 | cost = 0.12542931356083
-----
Circuit =  problem_ckt | Layers =  7 | At end of iteration = 255 | cost = 0.12548328016833
-----
Circuit =  problem_ckt | Layers =  7 | At end of iteration = 256 | cost = 0.12554200863911
-----
Circuit =  problem_ckt | Layers =  7 | At end of iteration = 257 | cost = 0.12560544711233
-----
Circuit =  problem_ckt | Layers =  7 | At end of iteration = 258 | cost = 0.12567353949008
-----
Circuit =  problem_ckt | Layers =  7 | At end of iteration = 259 | cost = 0.12574622555960
-----
Circuit =  problem_ckt | Layers =  7 | At end of iteration = 260 | cost = 0.12582344112532
-----
Circuit =  problem_ckt | Layers =  7 | At end of iteration = 261 | cost = 0.12590511815005
-----
Circuit =  problem_ckt | Layers =  7 | At end of iteration = 262 | cost = 0.12599118490452
-----
Circuit =  problem_ckt | Layers =  7 | At end of iteration = 263 | cost = 0.12608156612440
-----

```

```

-----
Circuit =  problem_ckt | Layers =  7 | At end of iteration = 264 | cost = 0.12617618317402
-----
Circuit =  problem_ckt | Layers =  7 | At end of iteration = 265 | cost = 0.12627495421581
-----
Circuit =  problem_ckt | Layers =  7 | At end of iteration = 266 | cost = 0.12637779438475
-----
Circuit =  problem_ckt | Layers =  7 | At end of iteration = 267 | cost = 0.12648461596687
-----
Circuit =  problem_ckt | Layers =  7 | At end of iteration = 268 | cost = 0.12659532858091
-----
Circuit =  problem_ckt | Layers =  7 | At end of iteration = 269 | cost = 0.12670983936242
-----
Circuit =  problem_ckt | Layers =  7 | At end of iteration = 270 | cost = 0.12682805314946
-----
Circuit =  problem_ckt | Layers =  7 | At end of iteration = 271 | cost = 0.12694987266897
-----
Circuit =  problem_ckt | Layers =  7 | At end of iteration = 272 | cost = 0.12707519872321
-----
Circuit =  problem_ckt | Layers =  7 | At end of iteration = 273 | cost = 0.12720393037550
-----
Circuit =  problem_ckt | Layers =  7 | At end of iteration = 274 | cost = 0.12733596513443
-----
Circuit =  problem_ckt | Layers =  7 | At end of iteration = 275 | cost = 0.12747119913614
-----
Circuit =  problem_ckt | Layers =  7 | At end of iteration = 276 | cost = 0.12760952732380
-----
Circuit =  problem_ckt | Layers =  7 | At end of iteration = 277 | cost = 0.12775084362385
-----
Circuit =  problem_ckt | Layers =  7 | At end of iteration = 278 | cost = 0.12789504111855
-----
Circuit =  problem_ckt | Layers =  7 | At end of iteration = 279 | cost = 0.12804201221411
-----
Circuit =  problem_ckt | Layers =  7 | At end of iteration = 280 | cost = 0.12819164880427
-----
Circuit =  problem_ckt | Layers =  7 | At end of iteration = 281 | cost = 0.12834384242876
-----
Circuit =  problem_ckt | Layers =  7 | At end of iteration = 282 | cost = 0.12849848442631
-----
Circuit =  problem_ckt | Layers =  7 | At end of iteration = 283 | cost = 0.12865546608201
-----
Circuit =  problem_ckt | Layers =  7 | At end of iteration = 284 | cost = 0.12881467876874
-----
Circuit =  problem_ckt | Layers =  7 | At end of iteration = 285 | cost = 0.12897601408236
-----
Circuit =  problem_ckt | Layers =  7 | At end of iteration = 286 | cost = 0.12913936397071
-----
Circuit =  problem_ckt | Layers =  7 | At end of iteration = 287 | cost = 0.12930462085610
-----

```

```

-----
Circuit =  problem_ckt | Layers =  7  | At end of iteration =  288  | cost =  0.12947167775132
-----
Circuit =  problem_ckt | Layers =  7  | At end of iteration =  289  | cost =  0.12964042836912
-----
Circuit =  problem_ckt | Layers =  7  | At end of iteration =  290  | cost =  0.12981076722511
-----
Circuit =  problem_ckt | Layers =  7  | At end of iteration =  291  | cost =  0.12998258973414
-----
Circuit =  problem_ckt | Layers =  7  | At end of iteration =  292  | cost =  0.13015579230016
-----
Circuit =  problem_ckt | Layers =  7  | At end of iteration =  293  | cost =  0.13033027239973
-----
Circuit =  problem_ckt | Layers =  7  | At end of iteration =  294  | cost =  0.13050592865917
-----
Circuit =  problem_ckt | Layers =  7  | At end of iteration =  295  | cost =  0.13068266092560
-----
Circuit =  problem_ckt | Layers =  7  | At end of iteration =  296  | cost =  0.13086037033190
-----
Circuit =  problem_ckt | Layers =  7  | At end of iteration =  297  | cost =  0.13103895935583
-----
Circuit =  problem_ckt | Layers =  7  | At end of iteration =  298  | cost =  0.13121833187343
-----
Circuit =  problem_ckt | Layers =  7  | At end of iteration =  299  | cost =  0.13139839320699
-----
Circuit =  problem_ckt | Layers =  7  | At end of iteration =  300  | cost =  0.13157905016768
-----

```

Optimization complete.

After optimization, the optimal parameters are

```
{Parameter(theta4[2]): -0.09806401490902161, Parameter(theta7[2]): -0.7668060489728658, Param
```

The output state for these parameters is

```

[[0.22045873+0.27510119j]
 [0.03626389+0.21838023j]
 [0.28643973+0.09647536j]
 [0.18881541+0.06621663j]
 [0.1630005 -0.0146729j ]
 [0.2518562 +0.12056059j]
 [0.13677367+0.08570329j]
 [0.05097904+0.07970165j]
 [0.29954625+0.00584102j]
 [0.18819896+0.04471756j]
 [0.28316725+0.01535484j]
 [0.07949637+0.02529292j]
 [0.31993862+0.17124898j]
 [0.26127832-0.00805123j]
 [0.20311432+0.23571048j]
 [0.14399995+0.15309672j]]

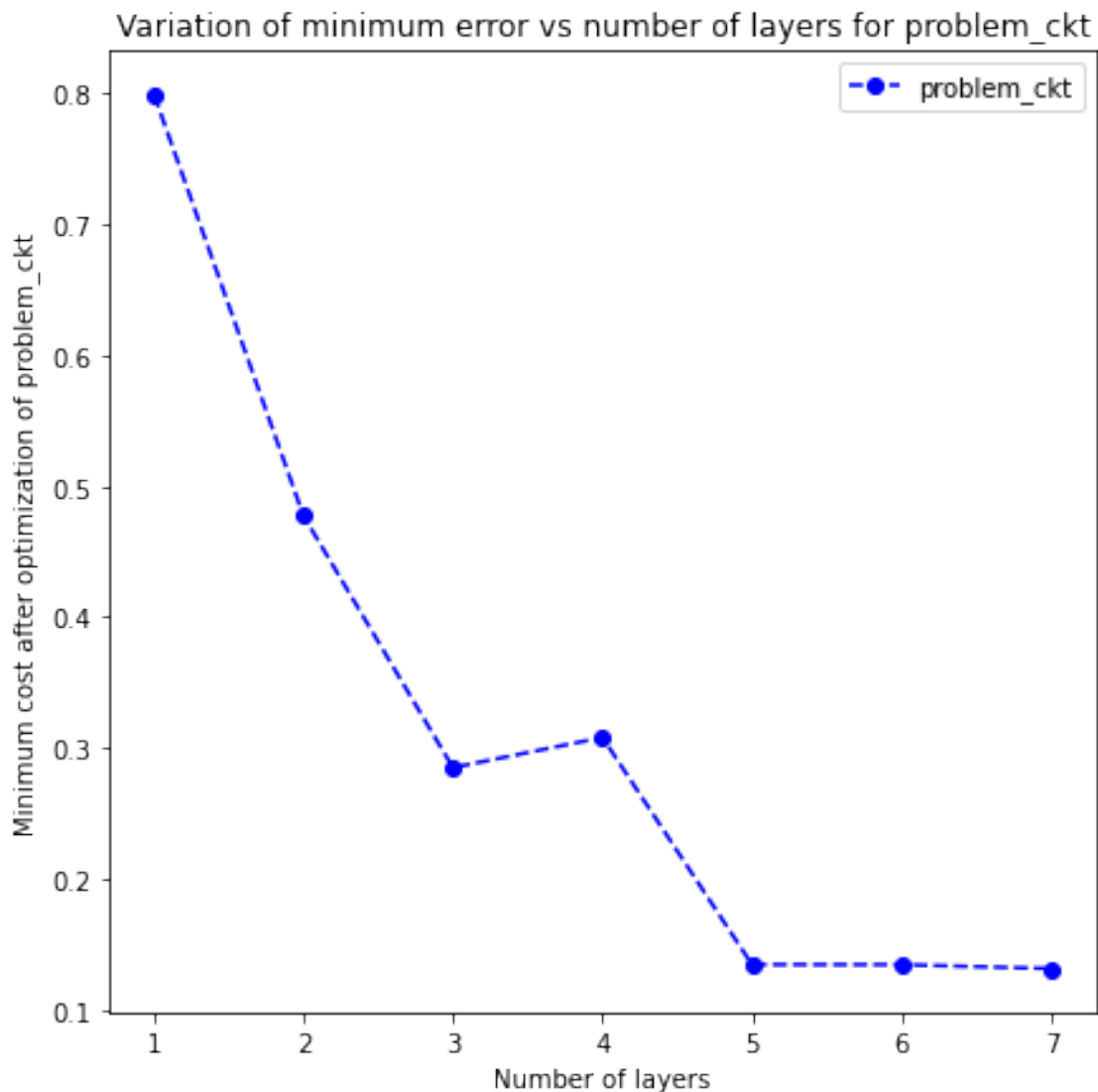
```

```
Circuit = problem_ckt Layers = 7 Cost after optimization = 0.1315790501676838
```

```
-----  
After optimization for all specified layers, the respective minimum costs for problem_ckt are  
[0.79937019 0.47744177 0.28503432 0.30805352 0.13460817 0.13454577  
0.13157905]
```

After the optimization is done, we will plot the minimum error after optimization vs the number of layers below.

```
In [13]: c2.show_plot()
```



From the above plot, it seems that at least for this chosen circuit ansatz, the circuit with lower number of layers is not able to achieve the target quantum state very well (eg cost is very high for layers = 1).

The cost initially falls with a large rate as the number of layers increases from 1, indicating that circuits with larger number of layers are able to achieve the random target quantum state much more closely than 1-layered circuit.

However, once the number of layers has increase up to 6 or 7, the cost does not fall much, which likely means that the expressing power of the circuit has saturated as layers are increased beyond a point.

0.0.9 Some alternative parametrized circuits

0.0.10 Alternative 1 - Odd layer with both RX and RZ gates, instead of only RX gates.

Let us hypothesize as follows: perhaps increasing the variety of rotations in the odd layer could improve the cost. To that end, let us try a different ansatz: the first attempt being the odd layer having both RX and RZ gates. The number of parameters (for the same number of layers) will now increase as compared to the previous circuit.

```
In [14]: class alternative_ckt_1(parametric_ckt):
    def append_odd_layer(self, sub_layer_id):
        thetax = ParameterVector('thetax'+str(sub_layer_id), length=self.num_qubits)
        thetaz = ParameterVector('thetaz'+str(sub_layer_id), length=self.num_qubits)
        for i in range(self.num_qubits):
            self.qc.rx(thetax[i], i)
            self.qc.rz(thetaz[i], i)

    def append_even_layer(self, sub_layer_id):
        theta = ParameterVector('theta'+str(sub_layer_id), length=self.num_qubits)
        for i in range(self.num_qubits):
            self.qc.rz(theta[i], i)
        for i in range(self.num_qubits):
            for j in range(i+1, self.num_qubits):
                self.qc.cz(i, j)
```

As before, let us try to visualize the circuit for 4 qubits and 2 layers:

```
In [15]: c3 = alternative_ckt_1(4)
c3.name = 'alternative_ckt_1'
c3.barriers_on = True
c3.build_ckt(2)
qc3 = c3.get_ckt()
qc3.draw(output='text')
```

Circuit alternative_ckt_1 constructed with 2 layers. Number of parameters = 24 .

```
Out[15]:
      z
q_0:  RX(thetax1[0])  RZ(thetaz1[0])  RZ(theta2[0])  z
      z
q_1:  RX(thetax1[1])  RZ(thetaz1[1])  RZ(theta2[1])  z
```

```

q_2:  RX(thetax1[2])  RZ(thetaz1[2])  RZ(theta2[2])  z
q_3:  RX(thetax1[3])  RZ(thetaz1[3])  RZ(theta2[3])  z
n
nq_0:  RX(thetax3[0])  RZ(thetaz3[0])  RZ(theta4[0])  z
n
nq_1:  RX(thetax3[1])  RZ(thetaz3[1])  RZ(theta4[1])  z
n
nq_2:  RX(thetax3[2])  RZ(thetaz3[2])  RZ(theta4[2])  z
n
nq_3:  RX(thetax3[3])  RZ(thetaz3[3])  RZ(theta4[3])  z
n
nq_0:
n
nq_1:
n
nq_2:
n
nq_3:
n

```

Optimizing these circuits upto maximum layers = 7:

```

In [16]: c4 = alternative_ckt_1(4)
c4.name = 'alternative_ckt_1'
c4.max_iter = 300
c4.theta_step = 0.1
c4.alpha = 1
c4.max_layers = 7
c4.run()

```

```

Initializing the target quantum state of 4 qubit(s) randomly as =
[[0.23159775+0.26854207j]
 [0.00311054+0.21447093j]
 [0.29194447+0.13477361j]
 [0.17650717+0.08413362j]
 [0.14187615+0.0357318j ]
 [0.24618063+0.11442822j]
 [0.15077095+0.10407606j]
 [0.03843793+0.10371948j]
 [0.29033053+0.05840304j]
 [0.18982017+0.03884797j]
 [0.28842729+0.01764276j]
 [0.05958415+0.02353189j]

```

```

[0.29649158+0.18139203j]
[0.20412371+0.00778893j]
[0.20336406+0.26472618j]
[0.18037261+0.16232797j]]
Norm of the above vector is 1.0
-----
Circuit  alternative_ckt_1  constructed with  1  layers. Number of parameters =  12 .
-----
Initialized circuit parameters prior to gradient descent randomly as follows:
idx =  thetaz1[0]  params =  0.03719052023213644
idx =  thetaz1[3]  params =  0.04312312828020062
idx =  thetax1[0]  params =  0.0004994971757621869
idx =  thetaz1[2]  params =  0.03444025418170515
idx =  thetax1[2]  params =  0.046881140646663634
idx =  theta2[0]   params =  0.02164226791611938
idx =  theta2[2]   params =  0.028343942770291508
idx =  theta2[1]   params =  0.013510378554063363
idx =  thetax1[1]  params =  0.022782810868909098
idx =  thetax1[3]  params =  0.00573789773068969
idx =  thetaz1[1]  params =  0.039532273767073196
idx =  theta2[3]   params =  0.018375156312795238
-----
Circuit =  alternative_ckt_1 | Layers =  1  | At end of iteration =  1  | cost =  1.2316162923
-----
Circuit =  alternative_ckt_1 | Layers =  1  | At end of iteration =  2  | cost =  1.2211033038
-----
Circuit =  alternative_ckt_1 | Layers =  1  | At end of iteration =  3  | cost =  1.2092033053
-----
Circuit =  alternative_ckt_1 | Layers =  1  | At end of iteration =  4  | cost =  1.1950925737
-----
Circuit =  alternative_ckt_1 | Layers =  1  | At end of iteration =  5  | cost =  1.1777891910
-----
Circuit =  alternative_ckt_1 | Layers =  1  | At end of iteration =  6  | cost =  1.1562234805
-----
Circuit =  alternative_ckt_1 | Layers =  1  | At end of iteration =  7  | cost =  1.1294751403
-----
Circuit =  alternative_ckt_1 | Layers =  1  | At end of iteration =  8  | cost =  1.0972651544
-----
Circuit =  alternative_ckt_1 | Layers =  1  | At end of iteration =  9  | cost =  1.0606270757
-----
Circuit =  alternative_ckt_1 | Layers =  1  | At end of iteration = 10  | cost =  1.022214598
-----
Circuit =  alternative_ckt_1 | Layers =  1  | At end of iteration = 11  | cost =  0.985362059
-----
Circuit =  alternative_ckt_1 | Layers =  1  | At end of iteration = 12  | cost =  0.952158438
-----
Circuit =  alternative_ckt_1 | Layers =  1  | At end of iteration = 13  | cost =  0.922771260
-----

```

Circuit =	alternative_ckt_1		Layers =	1		At end of iteration =	14		cost =	0.896813162
Circuit =	alternative_ckt_1		Layers =	1		At end of iteration =	15		cost =	0.874398562
Circuit =	alternative_ckt_1		Layers =	1		At end of iteration =	16		cost =	0.855815746
Circuit =	alternative_ckt_1		Layers =	1		At end of iteration =	17		cost =	0.841027654
Circuit =	alternative_ckt_1		Layers =	1		At end of iteration =	18		cost =	0.829644015
Circuit =	alternative_ckt_1		Layers =	1		At end of iteration =	19		cost =	0.821102295
Circuit =	alternative_ckt_1		Layers =	1		At end of iteration =	20		cost =	0.814814115
Circuit =	alternative_ckt_1		Layers =	1		At end of iteration =	21		cost =	0.810245091
Circuit =	alternative_ckt_1		Layers =	1		At end of iteration =	22		cost =	0.806953583
Circuit =	alternative_ckt_1		Layers =	1		At end of iteration =	23		cost =	0.804595830
Circuit =	alternative_ckt_1		Layers =	1		At end of iteration =	24		cost =	0.802913981
Circuit =	alternative_ckt_1		Layers =	1		At end of iteration =	25		cost =	0.801718827
Circuit =	alternative_ckt_1		Layers =	1		At end of iteration =	26		cost =	0.800873245
Circuit =	alternative_ckt_1		Layers =	1		At end of iteration =	27		cost =	0.800278487
Circuit =	alternative_ckt_1		Layers =	1		At end of iteration =	28		cost =	0.799863633
Circuit =	alternative_ckt_1		Layers =	1		At end of iteration =	29		cost =	0.799577755
Circuit =	alternative_ckt_1		Layers =	1		At end of iteration =	30		cost =	0.799384246
Circuit =	alternative_ckt_1		Layers =	1		At end of iteration =	31		cost =	0.799256744
Circuit =	alternative_ckt_1		Layers =	1		At end of iteration =	32		cost =	0.799176236
Circuit =	alternative_ckt_1		Layers =	1		At end of iteration =	33		cost =	0.799128979
Circuit =	alternative_ckt_1		Layers =	1		At end of iteration =	34		cost =	0.799105036
Circuit =	alternative_ckt_1		Layers =	1		At end of iteration =	35		cost =	0.799097217
Circuit =	alternative_ckt_1		Layers =	1		At end of iteration =	36		cost =	0.799100330
Circuit =	alternative_ckt_1		Layers =	1		At end of iteration =	37		cost =	0.799110631


```

Circuit = alternative_ckt_1 | Layers = 1 | At end of iteration = 38 | cost = 0.799125439
-----
Circuit = alternative_ckt_1 | Layers = 1 | At end of iteration = 39 | cost = 0.799142839
-----
REDUCING ALPHA TO 0.31622776601683794 at iteration = 40
-----
Circuit = alternative_ckt_1 | Layers = 1 | At end of iteration = 40 | cost = 0.799161488
-----
Circuit = alternative_ckt_1 | Layers = 1 | At end of iteration = 41 | cost = 0.799167143
-----
Circuit = alternative_ckt_1 | Layers = 1 | At end of iteration = 42 | cost = 0.799172811
-----
Circuit = alternative_ckt_1 | Layers = 1 | At end of iteration = 43 | cost = 0.799178478
-----
Circuit = alternative_ckt_1 | Layers = 1 | At end of iteration = 44 | cost = 0.799184128
-----
Circuit = alternative_ckt_1 | Layers = 1 | At end of iteration = 45 | cost = 0.799189747
-----
Circuit = alternative_ckt_1 | Layers = 1 | At end of iteration = 46 | cost = 0.799195321
-----
Circuit = alternative_ckt_1 | Layers = 1 | At end of iteration = 47 | cost = 0.799200840
-----
Circuit = alternative_ckt_1 | Layers = 1 | At end of iteration = 48 | cost = 0.799206294
-----
Circuit = alternative_ckt_1 | Layers = 1 | At end of iteration = 49 | cost = 0.799211674
-----
Circuit = alternative_ckt_1 | Layers = 1 | At end of iteration = 50 | cost = 0.799216972
-----
Circuit = alternative_ckt_1 | Layers = 1 | At end of iteration = 51 | cost = 0.799222183
-----
Circuit = alternative_ckt_1 | Layers = 1 | At end of iteration = 52 | cost = 0.799227301
-----
Circuit = alternative_ckt_1 | Layers = 1 | At end of iteration = 53 | cost = 0.799232321
-----
Circuit = alternative_ckt_1 | Layers = 1 | At end of iteration = 54 | cost = 0.799237239
-----
Circuit = alternative_ckt_1 | Layers = 1 | At end of iteration = 55 | cost = 0.799242054
-----
Circuit = alternative_ckt_1 | Layers = 1 | At end of iteration = 56 | cost = 0.799246762
-----
Circuit = alternative_ckt_1 | Layers = 1 | At end of iteration = 57 | cost = 0.799251361
-----
Circuit = alternative_ckt_1 | Layers = 1 | At end of iteration = 58 | cost = 0.799255851
-----
Circuit = alternative_ckt_1 | Layers = 1 | At end of iteration = 59 | cost = 0.799260231
-----
Circuit = alternative_ckt_1 | Layers = 1 | At end of iteration = 60 | cost = 0.799264500
-----

```

```

Circuit = alternative_ckt_1 | Layers = 1 | At end of iteration = 61 | cost = 0.799268658
-----
Circuit = alternative_ckt_1 | Layers = 1 | At end of iteration = 62 | cost = 0.799272705
-----
Circuit = alternative_ckt_1 | Layers = 1 | At end of iteration = 63 | cost = 0.799276643
-----
Circuit = alternative_ckt_1 | Layers = 1 | At end of iteration = 64 | cost = 0.799280472
-----
Circuit = alternative_ckt_1 | Layers = 1 | At end of iteration = 65 | cost = 0.799284193
-----
Circuit = alternative_ckt_1 | Layers = 1 | At end of iteration = 66 | cost = 0.799287808
-----
Circuit = alternative_ckt_1 | Layers = 1 | At end of iteration = 67 | cost = 0.799291317
-----
Circuit = alternative_ckt_1 | Layers = 1 | At end of iteration = 68 | cost = 0.799294722
-----
Circuit = alternative_ckt_1 | Layers = 1 | At end of iteration = 69 | cost = 0.799298026
-----
Circuit = alternative_ckt_1 | Layers = 1 | At end of iteration = 70 | cost = 0.799301230
-----
Circuit = alternative_ckt_1 | Layers = 1 | At end of iteration = 71 | cost = 0.799304335
-----
Circuit = alternative_ckt_1 | Layers = 1 | At end of iteration = 72 | cost = 0.799307344
-----
Circuit = alternative_ckt_1 | Layers = 1 | At end of iteration = 73 | cost = 0.799310259
-----
Circuit = alternative_ckt_1 | Layers = 1 | At end of iteration = 74 | cost = 0.799313082
-----
Circuit = alternative_ckt_1 | Layers = 1 | At end of iteration = 75 | cost = 0.799315815
-----
Circuit = alternative_ckt_1 | Layers = 1 | At end of iteration = 76 | cost = 0.799318460
-----
Circuit = alternative_ckt_1 | Layers = 1 | At end of iteration = 77 | cost = 0.799321020
-----
Circuit = alternative_ckt_1 | Layers = 1 | At end of iteration = 78 | cost = 0.799323495
-----
Circuit = alternative_ckt_1 | Layers = 1 | At end of iteration = 79 | cost = 0.799325890
-----
REDUCING ALPHA TO 0.09999999999999999 at iteration = 80
-----
Circuit = alternative_ckt_1 | Layers = 1 | At end of iteration = 80 | cost = 0.799328205
-----
Circuit = alternative_ckt_1 | Layers = 1 | At end of iteration = 81 | cost = 0.799328911
-----
Circuit = alternative_ckt_1 | Layers = 1 | At end of iteration = 82 | cost = 0.799329610
-----
Circuit = alternative_ckt_1 | Layers = 1 | At end of iteration = 83 | cost = 0.799330302
-----

```

Circuit = alternative_ckt_1 Layers = 1 At end of iteration = 84 cost = 0.7993309863
Circuit = alternative_ckt_1 Layers = 1 At end of iteration = 85 cost = 0.7993316633
Circuit = alternative_ckt_1 Layers = 1 At end of iteration = 86 cost = 0.7993323323
Circuit = alternative_ckt_1 Layers = 1 At end of iteration = 87 cost = 0.7993329953
Circuit = alternative_ckt_1 Layers = 1 At end of iteration = 88 cost = 0.7993336513
Circuit = alternative_ckt_1 Layers = 1 At end of iteration = 89 cost = 0.7993342993
Circuit = alternative_ckt_1 Layers = 1 At end of iteration = 90 cost = 0.7993349413
Circuit = alternative_ckt_1 Layers = 1 At end of iteration = 91 cost = 0.7993355763
Circuit = alternative_ckt_1 Layers = 1 At end of iteration = 92 cost = 0.7993362043
Circuit = alternative_ckt_1 Layers = 1 At end of iteration = 93 cost = 0.7993368253
Circuit = alternative_ckt_1 Layers = 1 At end of iteration = 94 cost = 0.7993374403
Circuit = alternative_ckt_1 Layers = 1 At end of iteration = 95 cost = 0.7993380483
Circuit = alternative_ckt_1 Layers = 1 At end of iteration = 96 cost = 0.7993386493
Circuit = alternative_ckt_1 Layers = 1 At end of iteration = 97 cost = 0.7993392453
Circuit = alternative_ckt_1 Layers = 1 At end of iteration = 98 cost = 0.7993398333
Circuit = alternative_ckt_1 Layers = 1 At end of iteration = 99 cost = 0.7993404153
Circuit = alternative_ckt_1 Layers = 1 At end of iteration = 100 cost = 0.7993409933
Circuit = alternative_ckt_1 Layers = 1 At end of iteration = 101 cost = 0.7993415633
Circuit = alternative_ckt_1 Layers = 1 At end of iteration = 102 cost = 0.7993421233
Circuit = alternative_ckt_1 Layers = 1 At end of iteration = 103 cost = 0.7993426833
Circuit = alternative_ckt_1 Layers = 1 At end of iteration = 104 cost = 0.7993432333
Circuit = alternative_ckt_1 Layers = 1 At end of iteration = 105 cost = 0.7993437733
Circuit = alternative_ckt_1 Layers = 1 At end of iteration = 106 cost = 0.7993443133
Circuit = alternative_ckt_1 Layers = 1 At end of iteration = 107 cost = 0.7993448533

```

Circuit = alternative_ckt_1 | Layers = 1 | At end of iteration = 108 | cost = 0.799345379
-----
Circuit = alternative_ckt_1 | Layers = 1 | At end of iteration = 109 | cost = 0.799345903
-----
Circuit = alternative_ckt_1 | Layers = 1 | At end of iteration = 110 | cost = 0.799346418
-----
Circuit = alternative_ckt_1 | Layers = 1 | At end of iteration = 111 | cost = 0.799346928
-----
Circuit = alternative_ckt_1 | Layers = 1 | At end of iteration = 112 | cost = 0.799347438
-----
Circuit = alternative_ckt_1 | Layers = 1 | At end of iteration = 113 | cost = 0.799347938
-----
Circuit = alternative_ckt_1 | Layers = 1 | At end of iteration = 114 | cost = 0.799348428
-----
Circuit = alternative_ckt_1 | Layers = 1 | At end of iteration = 115 | cost = 0.799348918
-----
Circuit = alternative_ckt_1 | Layers = 1 | At end of iteration = 116 | cost = 0.799349398
-----
Circuit = alternative_ckt_1 | Layers = 1 | At end of iteration = 117 | cost = 0.799349878
-----
Circuit = alternative_ckt_1 | Layers = 1 | At end of iteration = 118 | cost = 0.799350348
-----
Circuit = alternative_ckt_1 | Layers = 1 | At end of iteration = 119 | cost = 0.799350818
-----
REDUCING ALPHA TO 0.03162277660168379 at iteration = 120
-----
Circuit = alternative_ckt_1 | Layers = 1 | At end of iteration = 120 | cost = 0.799351278
-----
Circuit = alternative_ckt_1 | Layers = 1 | At end of iteration = 121 | cost = 0.799351428
-----
Circuit = alternative_ckt_1 | Layers = 1 | At end of iteration = 122 | cost = 0.799351568
-----
Circuit = alternative_ckt_1 | Layers = 1 | At end of iteration = 123 | cost = 0.799351708
-----
Circuit = alternative_ckt_1 | Layers = 1 | At end of iteration = 124 | cost = 0.799351858
-----
Circuit = alternative_ckt_1 | Layers = 1 | At end of iteration = 125 | cost = 0.799351998
-----
Circuit = alternative_ckt_1 | Layers = 1 | At end of iteration = 126 | cost = 0.799352138
-----
Circuit = alternative_ckt_1 | Layers = 1 | At end of iteration = 127 | cost = 0.799352278
-----
Circuit = alternative_ckt_1 | Layers = 1 | At end of iteration = 128 | cost = 0.799352418
-----
Circuit = alternative_ckt_1 | Layers = 1 | At end of iteration = 129 | cost = 0.799352558
-----
Circuit = alternative_ckt_1 | Layers = 1 | At end of iteration = 130 | cost = 0.799352698
-----

```

Circuit = alternative_ckt_1 Layers = 1 At end of iteration = 131 cost = 0.79935283
Circuit = alternative_ckt_1 Layers = 1 At end of iteration = 132 cost = 0.79935297
Circuit = alternative_ckt_1 Layers = 1 At end of iteration = 133 cost = 0.79935311
Circuit = alternative_ckt_1 Layers = 1 At end of iteration = 134 cost = 0.79935325
Circuit = alternative_ckt_1 Layers = 1 At end of iteration = 135 cost = 0.79935339
Circuit = alternative_ckt_1 Layers = 1 At end of iteration = 136 cost = 0.79935352
Circuit = alternative_ckt_1 Layers = 1 At end of iteration = 137 cost = 0.79935366
Circuit = alternative_ckt_1 Layers = 1 At end of iteration = 138 cost = 0.79935380
Circuit = alternative_ckt_1 Layers = 1 At end of iteration = 139 cost = 0.79935393
Circuit = alternative_ckt_1 Layers = 1 At end of iteration = 140 cost = 0.79935407
Circuit = alternative_ckt_1 Layers = 1 At end of iteration = 141 cost = 0.79935420
Circuit = alternative_ckt_1 Layers = 1 At end of iteration = 142 cost = 0.79935434
Circuit = alternative_ckt_1 Layers = 1 At end of iteration = 143 cost = 0.79935447
Circuit = alternative_ckt_1 Layers = 1 At end of iteration = 144 cost = 0.79935460
Circuit = alternative_ckt_1 Layers = 1 At end of iteration = 145 cost = 0.79935473
Circuit = alternative_ckt_1 Layers = 1 At end of iteration = 146 cost = 0.79935487
Circuit = alternative_ckt_1 Layers = 1 At end of iteration = 147 cost = 0.79935500
Circuit = alternative_ckt_1 Layers = 1 At end of iteration = 148 cost = 0.79935513
Circuit = alternative_ckt_1 Layers = 1 At end of iteration = 149 cost = 0.79935526
Circuit = alternative_ckt_1 Layers = 1 At end of iteration = 150 cost = 0.79935539
Circuit = alternative_ckt_1 Layers = 1 At end of iteration = 151 cost = 0.79935552
Circuit = alternative_ckt_1 Layers = 1 At end of iteration = 152 cost = 0.79935565
Circuit = alternative_ckt_1 Layers = 1 At end of iteration = 153 cost = 0.79935578
Circuit = alternative_ckt_1 Layers = 1 At end of iteration = 154 cost = 0.79935591

Circuit = alternative_ckt_1 Layers = 1 At end of iteration = 155 cost = 0.79935604
Circuit = alternative_ckt_1 Layers = 1 At end of iteration = 156 cost = 0.79935616
Circuit = alternative_ckt_1 Layers = 1 At end of iteration = 157 cost = 0.79935629
Circuit = alternative_ckt_1 Layers = 1 At end of iteration = 158 cost = 0.79935642
Circuit = alternative_ckt_1 Layers = 1 At end of iteration = 159 cost = 0.79935654
Circuit = alternative_ckt_1 Layers = 1 At end of iteration = 160 cost = 0.79935667
Circuit = alternative_ckt_1 Layers = 1 At end of iteration = 161 cost = 0.79935680
Circuit = alternative_ckt_1 Layers = 1 At end of iteration = 162 cost = 0.79935692
Circuit = alternative_ckt_1 Layers = 1 At end of iteration = 163 cost = 0.79935704
Circuit = alternative_ckt_1 Layers = 1 At end of iteration = 164 cost = 0.79935717
Circuit = alternative_ckt_1 Layers = 1 At end of iteration = 165 cost = 0.79935729
Circuit = alternative_ckt_1 Layers = 1 At end of iteration = 166 cost = 0.79935742
Circuit = alternative_ckt_1 Layers = 1 At end of iteration = 167 cost = 0.79935754
Circuit = alternative_ckt_1 Layers = 1 At end of iteration = 168 cost = 0.79935766
Circuit = alternative_ckt_1 Layers = 1 At end of iteration = 169 cost = 0.79935778
Circuit = alternative_ckt_1 Layers = 1 At end of iteration = 170 cost = 0.79935790
Circuit = alternative_ckt_1 Layers = 1 At end of iteration = 171 cost = 0.79935803
Circuit = alternative_ckt_1 Layers = 1 At end of iteration = 172 cost = 0.79935815
Circuit = alternative_ckt_1 Layers = 1 At end of iteration = 173 cost = 0.79935827
Circuit = alternative_ckt_1 Layers = 1 At end of iteration = 174 cost = 0.79935839
Circuit = alternative_ckt_1 Layers = 1 At end of iteration = 175 cost = 0.79935850
Circuit = alternative_ckt_1 Layers = 1 At end of iteration = 176 cost = 0.79935862
Circuit = alternative_ckt_1 Layers = 1 At end of iteration = 177 cost = 0.79935874
Circuit = alternative_ckt_1 Layers = 1 At end of iteration = 178 cost = 0.79935886

Circuit = alternative_ckt_1 Layers = 1 At end of iteration = 179 cost = 0.79935898
Circuit = alternative_ckt_1 Layers = 1 At end of iteration = 180 cost = 0.79935909
Circuit = alternative_ckt_1 Layers = 1 At end of iteration = 181 cost = 0.79935921
Circuit = alternative_ckt_1 Layers = 1 At end of iteration = 182 cost = 0.79935933
Circuit = alternative_ckt_1 Layers = 1 At end of iteration = 183 cost = 0.79935944
Circuit = alternative_ckt_1 Layers = 1 At end of iteration = 184 cost = 0.79935956
Circuit = alternative_ckt_1 Layers = 1 At end of iteration = 185 cost = 0.79935967
Circuit = alternative_ckt_1 Layers = 1 At end of iteration = 186 cost = 0.79935979
Circuit = alternative_ckt_1 Layers = 1 At end of iteration = 187 cost = 0.79935990
Circuit = alternative_ckt_1 Layers = 1 At end of iteration = 188 cost = 0.79936002
Circuit = alternative_ckt_1 Layers = 1 At end of iteration = 189 cost = 0.79936013
Circuit = alternative_ckt_1 Layers = 1 At end of iteration = 190 cost = 0.79936024
Circuit = alternative_ckt_1 Layers = 1 At end of iteration = 191 cost = 0.79936036
Circuit = alternative_ckt_1 Layers = 1 At end of iteration = 192 cost = 0.79936047
Circuit = alternative_ckt_1 Layers = 1 At end of iteration = 193 cost = 0.79936058
Circuit = alternative_ckt_1 Layers = 1 At end of iteration = 194 cost = 0.79936069
Circuit = alternative_ckt_1 Layers = 1 At end of iteration = 195 cost = 0.79936080
Circuit = alternative_ckt_1 Layers = 1 At end of iteration = 196 cost = 0.79936091
Circuit = alternative_ckt_1 Layers = 1 At end of iteration = 197 cost = 0.79936102
Circuit = alternative_ckt_1 Layers = 1 At end of iteration = 198 cost = 0.79936113
Circuit = alternative_ckt_1 Layers = 1 At end of iteration = 199 cost = 0.79936124
Circuit = alternative_ckt_1 Layers = 1 At end of iteration = 200 cost = 0.79936135
Circuit = alternative_ckt_1 Layers = 1 At end of iteration = 201 cost = 0.79936146
Circuit = alternative_ckt_1 Layers = 1 At end of iteration = 202 cost = 0.79936157

Circuit = alternative_ckt_1 Layers = 1 At end of iteration = 203 cost = 0.79936168
Circuit = alternative_ckt_1 Layers = 1 At end of iteration = 204 cost = 0.79936179
Circuit = alternative_ckt_1 Layers = 1 At end of iteration = 205 cost = 0.79936189
Circuit = alternative_ckt_1 Layers = 1 At end of iteration = 206 cost = 0.79936200
Circuit = alternative_ckt_1 Layers = 1 At end of iteration = 207 cost = 0.79936211
Circuit = alternative_ckt_1 Layers = 1 At end of iteration = 208 cost = 0.79936221
Circuit = alternative_ckt_1 Layers = 1 At end of iteration = 209 cost = 0.79936232
Circuit = alternative_ckt_1 Layers = 1 At end of iteration = 210 cost = 0.79936242
Circuit = alternative_ckt_1 Layers = 1 At end of iteration = 211 cost = 0.79936253
Circuit = alternative_ckt_1 Layers = 1 At end of iteration = 212 cost = 0.79936263
Circuit = alternative_ckt_1 Layers = 1 At end of iteration = 213 cost = 0.79936274
Circuit = alternative_ckt_1 Layers = 1 At end of iteration = 214 cost = 0.79936284
Circuit = alternative_ckt_1 Layers = 1 At end of iteration = 215 cost = 0.79936294
Circuit = alternative_ckt_1 Layers = 1 At end of iteration = 216 cost = 0.79936305
Circuit = alternative_ckt_1 Layers = 1 At end of iteration = 217 cost = 0.79936315
Circuit = alternative_ckt_1 Layers = 1 At end of iteration = 218 cost = 0.79936325
Circuit = alternative_ckt_1 Layers = 1 At end of iteration = 219 cost = 0.79936335
Circuit = alternative_ckt_1 Layers = 1 At end of iteration = 220 cost = 0.79936345
Circuit = alternative_ckt_1 Layers = 1 At end of iteration = 221 cost = 0.79936356
Circuit = alternative_ckt_1 Layers = 1 At end of iteration = 222 cost = 0.79936366
Circuit = alternative_ckt_1 Layers = 1 At end of iteration = 223 cost = 0.79936376
Circuit = alternative_ckt_1 Layers = 1 At end of iteration = 224 cost = 0.79936386
Circuit = alternative_ckt_1 Layers = 1 At end of iteration = 225 cost = 0.79936396
Circuit = alternative_ckt_1 Layers = 1 At end of iteration = 226 cost = 0.79936406

Circuit = alternative_ckt_1 Layers = 1 At end of iteration = 227 cost = 0.79936415
Circuit = alternative_ckt_1 Layers = 1 At end of iteration = 228 cost = 0.79936425
Circuit = alternative_ckt_1 Layers = 1 At end of iteration = 229 cost = 0.79936435
Circuit = alternative_ckt_1 Layers = 1 At end of iteration = 230 cost = 0.79936445
Circuit = alternative_ckt_1 Layers = 1 At end of iteration = 231 cost = 0.79936455
Circuit = alternative_ckt_1 Layers = 1 At end of iteration = 232 cost = 0.79936464
Circuit = alternative_ckt_1 Layers = 1 At end of iteration = 233 cost = 0.79936474
Circuit = alternative_ckt_1 Layers = 1 At end of iteration = 234 cost = 0.79936484
Circuit = alternative_ckt_1 Layers = 1 At end of iteration = 235 cost = 0.79936493
Circuit = alternative_ckt_1 Layers = 1 At end of iteration = 236 cost = 0.79936503
Circuit = alternative_ckt_1 Layers = 1 At end of iteration = 237 cost = 0.79936513
Circuit = alternative_ckt_1 Layers = 1 At end of iteration = 238 cost = 0.79936522
Circuit = alternative_ckt_1 Layers = 1 At end of iteration = 239 cost = 0.79936532
Circuit = alternative_ckt_1 Layers = 1 At end of iteration = 240 cost = 0.79936541
Circuit = alternative_ckt_1 Layers = 1 At end of iteration = 241 cost = 0.79936550
Circuit = alternative_ckt_1 Layers = 1 At end of iteration = 242 cost = 0.79936560
Circuit = alternative_ckt_1 Layers = 1 At end of iteration = 243 cost = 0.79936569
Circuit = alternative_ckt_1 Layers = 1 At end of iteration = 244 cost = 0.79936578
Circuit = alternative_ckt_1 Layers = 1 At end of iteration = 245 cost = 0.79936588
Circuit = alternative_ckt_1 Layers = 1 At end of iteration = 246 cost = 0.79936597
Circuit = alternative_ckt_1 Layers = 1 At end of iteration = 247 cost = 0.79936606
Circuit = alternative_ckt_1 Layers = 1 At end of iteration = 248 cost = 0.79936615
Circuit = alternative_ckt_1 Layers = 1 At end of iteration = 249 cost = 0.79936625
Circuit = alternative_ckt_1 Layers = 1 At end of iteration = 250 cost = 0.79936634

Circuit = alternative_ckt_1 Layers = 1 At end of iteration = 251 cost = 0.79936643
Circuit = alternative_ckt_1 Layers = 1 At end of iteration = 252 cost = 0.79936652
Circuit = alternative_ckt_1 Layers = 1 At end of iteration = 253 cost = 0.79936661
Circuit = alternative_ckt_1 Layers = 1 At end of iteration = 254 cost = 0.79936670
Circuit = alternative_ckt_1 Layers = 1 At end of iteration = 255 cost = 0.79936679
Circuit = alternative_ckt_1 Layers = 1 At end of iteration = 256 cost = 0.79936688
Circuit = alternative_ckt_1 Layers = 1 At end of iteration = 257 cost = 0.79936696
Circuit = alternative_ckt_1 Layers = 1 At end of iteration = 258 cost = 0.79936705
Circuit = alternative_ckt_1 Layers = 1 At end of iteration = 259 cost = 0.79936714
Circuit = alternative_ckt_1 Layers = 1 At end of iteration = 260 cost = 0.79936723
Circuit = alternative_ckt_1 Layers = 1 At end of iteration = 261 cost = 0.79936732
Circuit = alternative_ckt_1 Layers = 1 At end of iteration = 262 cost = 0.79936740
Circuit = alternative_ckt_1 Layers = 1 At end of iteration = 263 cost = 0.79936749
Circuit = alternative_ckt_1 Layers = 1 At end of iteration = 264 cost = 0.79936758
Circuit = alternative_ckt_1 Layers = 1 At end of iteration = 265 cost = 0.79936766
Circuit = alternative_ckt_1 Layers = 1 At end of iteration = 266 cost = 0.79936775
Circuit = alternative_ckt_1 Layers = 1 At end of iteration = 267 cost = 0.79936784
Circuit = alternative_ckt_1 Layers = 1 At end of iteration = 268 cost = 0.79936792
Circuit = alternative_ckt_1 Layers = 1 At end of iteration = 269 cost = 0.79936801
Circuit = alternative_ckt_1 Layers = 1 At end of iteration = 270 cost = 0.79936809
Circuit = alternative_ckt_1 Layers = 1 At end of iteration = 271 cost = 0.79936818
Circuit = alternative_ckt_1 Layers = 1 At end of iteration = 272 cost = 0.79936826
Circuit = alternative_ckt_1 Layers = 1 At end of iteration = 273 cost = 0.79936834
Circuit = alternative_ckt_1 Layers = 1 At end of iteration = 274 cost = 0.79936843

Circuit = alternative_ckt_1 Layers = 1 At end of iteration = 275 cost = 0.79936851
Circuit = alternative_ckt_1 Layers = 1 At end of iteration = 276 cost = 0.79936859
Circuit = alternative_ckt_1 Layers = 1 At end of iteration = 277 cost = 0.79936868
Circuit = alternative_ckt_1 Layers = 1 At end of iteration = 278 cost = 0.79936876
Circuit = alternative_ckt_1 Layers = 1 At end of iteration = 279 cost = 0.79936884
Circuit = alternative_ckt_1 Layers = 1 At end of iteration = 280 cost = 0.79936892
Circuit = alternative_ckt_1 Layers = 1 At end of iteration = 281 cost = 0.79936900
Circuit = alternative_ckt_1 Layers = 1 At end of iteration = 282 cost = 0.79936908
Circuit = alternative_ckt_1 Layers = 1 At end of iteration = 283 cost = 0.79936916
Circuit = alternative_ckt_1 Layers = 1 At end of iteration = 284 cost = 0.79936925
Circuit = alternative_ckt_1 Layers = 1 At end of iteration = 285 cost = 0.79936933
Circuit = alternative_ckt_1 Layers = 1 At end of iteration = 286 cost = 0.79936941
Circuit = alternative_ckt_1 Layers = 1 At end of iteration = 287 cost = 0.79936949
Circuit = alternative_ckt_1 Layers = 1 At end of iteration = 288 cost = 0.79936956
Circuit = alternative_ckt_1 Layers = 1 At end of iteration = 289 cost = 0.79936964
Circuit = alternative_ckt_1 Layers = 1 At end of iteration = 290 cost = 0.79936972
Circuit = alternative_ckt_1 Layers = 1 At end of iteration = 291 cost = 0.79936980
Circuit = alternative_ckt_1 Layers = 1 At end of iteration = 292 cost = 0.79936988
Circuit = alternative_ckt_1 Layers = 1 At end of iteration = 293 cost = 0.79936996
Circuit = alternative_ckt_1 Layers = 1 At end of iteration = 294 cost = 0.79937003
Circuit = alternative_ckt_1 Layers = 1 At end of iteration = 295 cost = 0.79937011
Circuit = alternative_ckt_1 Layers = 1 At end of iteration = 296 cost = 0.79937019
Circuit = alternative_ckt_1 Layers = 1 At end of iteration = 297 cost = 0.79937027
Circuit = alternative_ckt_1 Layers = 1 At end of iteration = 298 cost = 0.79937034

Circuit = alternative_ckt_1 | Layers = 1 | At end of iteration = 299 | cost = 0.79937042

Circuit = alternative_ckt_1 | Layers = 1 | At end of iteration = 300 | cost = 0.79937049

Optimization complete.

After optimization, the optimal parameters are

{Parameter(thetaz1[0]): 0.08879778004420927, Parameter(thetaz1[3]): -0.16490463365134908, Par

The output state for these parameters is

```
[[ 0.24671964+0.j          ]
 [-0.02829093+0.17305352j]
 [ 0.05806597+0.27727543j]
 [ 0.20114422-0.00893379j]
 [-0.053041  +0.23623213j]
 [ 0.15961527+0.06429224j]
 [ 0.27797238+0.00401232j]
 [-0.03468894+0.19451466j]
 [ 0.10128629+0.27359766j]
 [ 0.20352057-0.03967102j]
 [ 0.28364432-0.1782222j ]
 [ 0.09248319+0.21938958j]
 [ 0.28374266-0.03816147j]
 [-0.00576916+0.20339803j]
 [ 0.10966711+0.30990231j]
 [ 0.22994631-0.04138648j]]
```

Circuit = alternative_ckt_1 Layers = 1 Cost after optimization = 0.7993704996919874

Circuit alternative_ckt_1 constructed with 2 layers. Number of parameters = 24 .

Initialized circuit parameters prior to gradient descent randomly as follows:

```
idx = thetax3[2] params = 0.03719052023213644
idx = thetax1[3] params = 0.04312312828020062
idx = theta4[1] params = 0.0004994971757621869
idx = thetax1[2] params = 0.03444025418170515
idx = theta4[0] params = 0.046881140646663634
idx = theta2[2] params = 0.02164226791611938
idx = thetaz1[3] params = 0.028343942770291508
idx = thetax1[0] params = 0.013510378554063363
idx = thetaz1[0] params = 0.022782810868909098
idx = thetax1[1] params = 0.00573789773068969
idx = thetaz3[3] params = 0.039532273767073196
idx = thetax3[3] params = 0.018375156312795238
idx = theta2[0] params = 0.02421115885861306
idx = theta4[3] params = 0.01671278315727628
idx = theta2[3] params = 0.006172454610576922
idx = thetaz3[1] params = 0.016655522656847783
idx = theta2[1] params = 0.04662197117509747
idx = thetaz1[2] params = 0.009378499198132518
```

```

idx = thetax3[1] params = 0.030481776612878
idx = thetax3[2] params = 0.006238299240088347
idx = thetax3[0] params = 0.046316344013782464
idx = thetax1[1] params = 0.002833116050508433
idx = thetax4[2] params = 0.009568165097689485
idx = thetax3[0] params = 0.003778807686699465

```

```

-----
Circuit = alternative_ckt_1 | Layers = 2 | At end of iteration = 1 | cost = 1.2284683998
-----
Circuit = alternative_ckt_1 | Layers = 2 | At end of iteration = 2 | cost = 1.2089894193
-----
Circuit = alternative_ckt_1 | Layers = 2 | At end of iteration = 3 | cost = 1.1870746220
-----
Circuit = alternative_ckt_1 | Layers = 2 | At end of iteration = 4 | cost = 1.1599487509
-----
Circuit = alternative_ckt_1 | Layers = 2 | At end of iteration = 5 | cost = 1.1248781635
-----
Circuit = alternative_ckt_1 | Layers = 2 | At end of iteration = 6 | cost = 1.0803462954
-----
Circuit = alternative_ckt_1 | Layers = 2 | At end of iteration = 7 | cost = 1.0285170214
-----
Circuit = alternative_ckt_1 | Layers = 2 | At end of iteration = 8 | cost = 0.9765245112
-----
Circuit = alternative_ckt_1 | Layers = 2 | At end of iteration = 9 | cost = 0.9314104553
-----
Circuit = alternative_ckt_1 | Layers = 2 | At end of iteration = 10 | cost = 0.893491109
-----
Circuit = alternative_ckt_1 | Layers = 2 | At end of iteration = 11 | cost = 0.860167830
-----
Circuit = alternative_ckt_1 | Layers = 2 | At end of iteration = 12 | cost = 0.831221061
-----
Circuit = alternative_ckt_1 | Layers = 2 | At end of iteration = 13 | cost = 0.807399645
-----
Circuit = alternative_ckt_1 | Layers = 2 | At end of iteration = 14 | cost = 0.788633670
-----
Circuit = alternative_ckt_1 | Layers = 2 | At end of iteration = 15 | cost = 0.774127630
-----
Circuit = alternative_ckt_1 | Layers = 2 | At end of iteration = 16 | cost = 0.762924103
-----
Circuit = alternative_ckt_1 | Layers = 2 | At end of iteration = 17 | cost = 0.754185719
-----
Circuit = alternative_ckt_1 | Layers = 2 | At end of iteration = 18 | cost = 0.747269356
-----
Circuit = alternative_ckt_1 | Layers = 2 | At end of iteration = 19 | cost = 0.741692222
-----
Circuit = alternative_ckt_1 | Layers = 2 | At end of iteration = 20 | cost = 0.737089900
-----
Circuit = alternative_ckt_1 | Layers = 2 | At end of iteration = 21 | cost = 0.733185820

```

```

-----
Circuit = alternative_ckt_1 | Layers = 2 | At end of iteration = 22 | cost = 0.7297750011
-----
Circuit = alternative_ckt_1 | Layers = 2 | At end of iteration = 23 | cost = 0.7267096603
-----
Circuit = alternative_ckt_1 | Layers = 2 | At end of iteration = 24 | cost = 0.7238884997
-----
Circuit = alternative_ckt_1 | Layers = 2 | At end of iteration = 25 | cost = 0.7212437201
-----
Circuit = alternative_ckt_1 | Layers = 2 | At end of iteration = 26 | cost = 0.7187325333
-----
Circuit = alternative_ckt_1 | Layers = 2 | At end of iteration = 27 | cost = 0.7163266364
-----
Circuit = alternative_ckt_1 | Layers = 2 | At end of iteration = 28 | cost = 0.7140080674
-----
Circuit = alternative_ckt_1 | Layers = 2 | At end of iteration = 29 | cost = 0.7117609733
-----
Circuit = alternative_ckt_1 | Layers = 2 | At end of iteration = 30 | cost = 0.7095719011
-----
Circuit = alternative_ckt_1 | Layers = 2 | At end of iteration = 31 | cost = 0.7074214497
-----
Circuit = alternative_ckt_1 | Layers = 2 | At end of iteration = 32 | cost = 0.7052895500
-----
Circuit = alternative_ckt_1 | Layers = 2 | At end of iteration = 33 | cost = 0.7031433061
-----
Circuit = alternative_ckt_1 | Layers = 2 | At end of iteration = 34 | cost = 0.7009505888
-----
Circuit = alternative_ckt_1 | Layers = 2 | At end of iteration = 35 | cost = 0.6986566633
-----
Circuit = alternative_ckt_1 | Layers = 2 | At end of iteration = 36 | cost = 0.6962158341
-----
Circuit = alternative_ckt_1 | Layers = 2 | At end of iteration = 37 | cost = 0.6935384691
-----
Circuit = alternative_ckt_1 | Layers = 2 | At end of iteration = 38 | cost = 0.6905686211
-----
Circuit = alternative_ckt_1 | Layers = 2 | At end of iteration = 39 | cost = 0.6871502411
-----
REDUCING ALPHA TO 0.31622776601683794 at iteration = 40
-----
Circuit = alternative_ckt_1 | Layers = 2 | At end of iteration = 40 | cost = 0.6832375111
-----
Circuit = alternative_ckt_1 | Layers = 2 | At end of iteration = 41 | cost = 0.6817904421
-----
Circuit = alternative_ckt_1 | Layers = 2 | At end of iteration = 42 | cost = 0.6802737871
-----
Circuit = alternative_ckt_1 | Layers = 2 | At end of iteration = 43 | cost = 0.6786683841
-----
Circuit = alternative_ckt_1 | Layers = 2 | At end of iteration = 44 | cost = 0.6769651801

```

```

-----
Circuit = alternative_ckt_1 | Layers = 2 | At end of iteration = 45 | cost = 0.6751558570
-----
Circuit = alternative_ckt_1 | Layers = 2 | At end of iteration = 46 | cost = 0.6732316597
-----
Circuit = alternative_ckt_1 | Layers = 2 | At end of iteration = 47 | cost = 0.6711832404
-----
Circuit = alternative_ckt_1 | Layers = 2 | At end of iteration = 48 | cost = 0.6690006311
-----
Circuit = alternative_ckt_1 | Layers = 2 | At end of iteration = 49 | cost = 0.6666732437
-----
Circuit = alternative_ckt_1 | Layers = 2 | At end of iteration = 50 | cost = 0.6641898851
-----
Circuit = alternative_ckt_1 | Layers = 2 | At end of iteration = 51 | cost = 0.6615387963
-----
Circuit = alternative_ckt_1 | Layers = 2 | At end of iteration = 52 | cost = 0.6587077211
-----
Circuit = alternative_ckt_1 | Layers = 2 | At end of iteration = 53 | cost = 0.6556840010
-----
Circuit = alternative_ckt_1 | Layers = 2 | At end of iteration = 54 | cost = 0.6524547307
-----
Circuit = alternative_ckt_1 | Layers = 2 | At end of iteration = 55 | cost = 0.6490069470
-----
Circuit = alternative_ckt_1 | Layers = 2 | At end of iteration = 56 | cost = 0.6453278980
-----
Circuit = alternative_ckt_1 | Layers = 2 | At end of iteration = 57 | cost = 0.6414053770
-----
Circuit = alternative_ckt_1 | Layers = 2 | At end of iteration = 58 | cost = 0.6372281387
-----
Circuit = alternative_ckt_1 | Layers = 2 | At end of iteration = 59 | cost = 0.6327864030
-----
Circuit = alternative_ckt_1 | Layers = 2 | At end of iteration = 60 | cost = 0.6280724590
-----
Circuit = alternative_ckt_1 | Layers = 2 | At end of iteration = 61 | cost = 0.6230813447
-----
Circuit = alternative_ckt_1 | Layers = 2 | At end of iteration = 62 | cost = 0.6178116020
-----
Circuit = alternative_ckt_1 | Layers = 2 | At end of iteration = 63 | cost = 0.6122660920
-----
Circuit = alternative_ckt_1 | Layers = 2 | At end of iteration = 64 | cost = 0.6064528030
-----
Circuit = alternative_ckt_1 | Layers = 2 | At end of iteration = 65 | cost = 0.6003856260
-----
Circuit = alternative_ckt_1 | Layers = 2 | At end of iteration = 66 | cost = 0.5940850000
-----
Circuit = alternative_ckt_1 | Layers = 2 | At end of iteration = 67 | cost = 0.5875783690
-----
Circuit = alternative_ckt_1 | Layers = 2 | At end of iteration = 68 | cost = 0.5809003370
-----

```

```

-----
Circuit = alternative_ckt_1 | Layers = 2 | At end of iteration = 69 | cost = 0.574092448
-----
Circuit = alternative_ckt_1 | Layers = 2 | At end of iteration = 70 | cost = 0.567202529
-----
Circuit = alternative_ckt_1 | Layers = 2 | At end of iteration = 71 | cost = 0.560283553
-----
Circuit = alternative_ckt_1 | Layers = 2 | At end of iteration = 72 | cost = 0.553392046
-----
Circuit = alternative_ckt_1 | Layers = 2 | At end of iteration = 73 | cost = 0.546586121
-----
Circuit = alternative_ckt_1 | Layers = 2 | At end of iteration = 74 | cost = 0.539923255
-----
Circuit = alternative_ckt_1 | Layers = 2 | At end of iteration = 75 | cost = 0.533458014
-----
Circuit = alternative_ckt_1 | Layers = 2 | At end of iteration = 76 | cost = 0.527239905
-----
Circuit = alternative_ckt_1 | Layers = 2 | At end of iteration = 77 | cost = 0.521311551
-----
Circuit = alternative_ckt_1 | Layers = 2 | At end of iteration = 78 | cost = 0.515707360
-----
Circuit = alternative_ckt_1 | Layers = 2 | At end of iteration = 79 | cost = 0.510452746
-----
REDUCING ALPHA TO 0.09999999999999999 at iteration = 80
-----
Circuit = alternative_ckt_1 | Layers = 2 | At end of iteration = 80 | cost = 0.505563942
-----
Circuit = alternative_ckt_1 | Layers = 2 | At end of iteration = 81 | cost = 0.504115270
-----
Circuit = alternative_ckt_1 | Layers = 2 | At end of iteration = 82 | cost = 0.502703908
-----
Circuit = alternative_ckt_1 | Layers = 2 | At end of iteration = 83 | cost = 0.501329413
-----
Circuit = alternative_ckt_1 | Layers = 2 | At end of iteration = 84 | cost = 0.499991516
-----
Circuit = alternative_ckt_1 | Layers = 2 | At end of iteration = 85 | cost = 0.498689974
-----
Circuit = alternative_ckt_1 | Layers = 2 | At end of iteration = 86 | cost = 0.497424514
-----
Circuit = alternative_ckt_1 | Layers = 2 | At end of iteration = 87 | cost = 0.496194822
-----
Circuit = alternative_ckt_1 | Layers = 2 | At end of iteration = 88 | cost = 0.495000530
-----
Circuit = alternative_ckt_1 | Layers = 2 | At end of iteration = 89 | cost = 0.493841224
-----
Circuit = alternative_ckt_1 | Layers = 2 | At end of iteration = 90 | cost = 0.492716444
-----
Circuit = alternative_ckt_1 | Layers = 2 | At end of iteration = 91 | cost = 0.491625685
-----

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```

-----
Circuit = alternative_ckt_1 | Layers = 2 | At end of iteration = 92 | cost = 0.4905684067
-----
Circuit = alternative_ckt_1 | Layers = 2 | At end of iteration = 93 | cost = 0.4895440313
-----
Circuit = alternative_ckt_1 | Layers = 2 | At end of iteration = 94 | cost = 0.4885519503
-----
Circuit = alternative_ckt_1 | Layers = 2 | At end of iteration = 95 | cost = 0.4875915299
-----
Circuit = alternative_ckt_1 | Layers = 2 | At end of iteration = 96 | cost = 0.4866621074
-----
Circuit = alternative_ckt_1 | Layers = 2 | At end of iteration = 97 | cost = 0.4857630033
-----
Circuit = alternative_ckt_1 | Layers = 2 | At end of iteration = 98 | cost = 0.4848935189
-----
Circuit = alternative_ckt_1 | Layers = 2 | At end of iteration = 99 | cost = 0.4840529406
-----
Circuit = alternative_ckt_1 | Layers = 2 | At end of iteration = 100 | cost = 0.4832405431
-----
Circuit = alternative_ckt_1 | Layers = 2 | At end of iteration = 101 | cost = 0.4824555931
-----
Circuit = alternative_ckt_1 | Layers = 2 | At end of iteration = 102 | cost = 0.4816973501
-----
Circuit = alternative_ckt_1 | Layers = 2 | At end of iteration = 103 | cost = 0.4809650701
-----
Circuit = alternative_ckt_1 | Layers = 2 | At end of iteration = 104 | cost = 0.4802580091
-----
Circuit = alternative_ckt_1 | Layers = 2 | At end of iteration = 105 | cost = 0.4795754101
-----
Circuit = alternative_ckt_1 | Layers = 2 | At end of iteration = 106 | cost = 0.4789165411
-----
Circuit = alternative_ckt_1 | Layers = 2 | At end of iteration = 107 | cost = 0.4782806611
-----
Circuit = alternative_ckt_1 | Layers = 2 | At end of iteration = 108 | cost = 0.4776670311
-----
Circuit = alternative_ckt_1 | Layers = 2 | At end of iteration = 109 | cost = 0.4770749211
-----
Circuit = alternative_ckt_1 | Layers = 2 | At end of iteration = 110 | cost = 0.4765036311
-----
Circuit = alternative_ckt_1 | Layers = 2 | At end of iteration = 111 | cost = 0.4759524311
-----
Circuit = alternative_ckt_1 | Layers = 2 | At end of iteration = 112 | cost = 0.4754206411
-----
Circuit = alternative_ckt_1 | Layers = 2 | At end of iteration = 113 | cost = 0.4749075611
-----
Circuit = alternative_ckt_1 | Layers = 2 | At end of iteration = 114 | cost = 0.4744125211
-----
Circuit = alternative_ckt_1 | Layers = 2 | At end of iteration = 115 | cost = 0.4739348711
-----

```

```

-----
Circuit = alternative_ckt_1 | Layers = 2 | At end of iteration = 116 | cost = 0.47347395
-----
Circuit = alternative_ckt_1 | Layers = 2 | At end of iteration = 117 | cost = 0.47302914
-----
Circuit = alternative_ckt_1 | Layers = 2 | At end of iteration = 118 | cost = 0.47259981
-----
Circuit = alternative_ckt_1 | Layers = 2 | At end of iteration = 119 | cost = 0.47218537
-----
REDUCING ALPHA TO 0.03162277660168379 at iteration = 120
-----
Circuit = alternative_ckt_1 | Layers = 2 | At end of iteration = 120 | cost = 0.47178524
-----
Circuit = alternative_ckt_1 | Layers = 2 | At end of iteration = 121 | cost = 0.47166234
-----
Circuit = alternative_ckt_1 | Layers = 2 | At end of iteration = 122 | cost = 0.47154079
-----
Circuit = alternative_ckt_1 | Layers = 2 | At end of iteration = 123 | cost = 0.47142056
-----
Circuit = alternative_ckt_1 | Layers = 2 | At end of iteration = 124 | cost = 0.47130162
-----
Circuit = alternative_ckt_1 | Layers = 2 | At end of iteration = 125 | cost = 0.47118397
-----
Circuit = alternative_ckt_1 | Layers = 2 | At end of iteration = 126 | cost = 0.47106759
-----
Circuit = alternative_ckt_1 | Layers = 2 | At end of iteration = 127 | cost = 0.47095246
-----
Circuit = alternative_ckt_1 | Layers = 2 | At end of iteration = 128 | cost = 0.47083857
-----
Circuit = alternative_ckt_1 | Layers = 2 | At end of iteration = 129 | cost = 0.47072589
-----
Circuit = alternative_ckt_1 | Layers = 2 | At end of iteration = 130 | cost = 0.47061442
-----
Circuit = alternative_ckt_1 | Layers = 2 | At end of iteration = 131 | cost = 0.47050413
-----
Circuit = alternative_ckt_1 | Layers = 2 | At end of iteration = 132 | cost = 0.47039501
-----
Circuit = alternative_ckt_1 | Layers = 2 | At end of iteration = 133 | cost = 0.47028704
-----
Circuit = alternative_ckt_1 | Layers = 2 | At end of iteration = 134 | cost = 0.47018022
-----
Circuit = alternative_ckt_1 | Layers = 2 | At end of iteration = 135 | cost = 0.47007452
-----
Circuit = alternative_ckt_1 | Layers = 2 | At end of iteration = 136 | cost = 0.46996992
-----
Circuit = alternative_ckt_1 | Layers = 2 | At end of iteration = 137 | cost = 0.46986643
-----
Circuit = alternative_ckt_1 | Layers = 2 | At end of iteration = 138 | cost = 0.46976400
-----

```

```

-----
Circuit = alternative_ckt_1 | Layers = 2 | At end of iteration = 139 | cost = 0.469662653
-----
Circuit = alternative_ckt_1 | Layers = 2 | At end of iteration = 140 | cost = 0.469562347
-----
Circuit = alternative_ckt_1 | Layers = 2 | At end of iteration = 141 | cost = 0.469463070
-----
Circuit = alternative_ckt_1 | Layers = 2 | At end of iteration = 142 | cost = 0.469364821
-----
Circuit = alternative_ckt_1 | Layers = 2 | At end of iteration = 143 | cost = 0.469267584
-----
Circuit = alternative_ckt_1 | Layers = 2 | At end of iteration = 144 | cost = 0.469171333
-----
Circuit = alternative_ckt_1 | Layers = 2 | At end of iteration = 145 | cost = 0.469076063
-----
Circuit = alternative_ckt_1 | Layers = 2 | At end of iteration = 146 | cost = 0.468981763
-----
Circuit = alternative_ckt_1 | Layers = 2 | At end of iteration = 147 | cost = 0.468888411
-----
Circuit = alternative_ckt_1 | Layers = 2 | At end of iteration = 148 | cost = 0.468795993
-----
Circuit = alternative_ckt_1 | Layers = 2 | At end of iteration = 149 | cost = 0.468704513
-----
Circuit = alternative_ckt_1 | Layers = 2 | At end of iteration = 150 | cost = 0.468613941
-----
Circuit = alternative_ckt_1 | Layers = 2 | At end of iteration = 151 | cost = 0.468524268
-----
Circuit = alternative_ckt_1 | Layers = 2 | At end of iteration = 152 | cost = 0.468435483
-----
Circuit = alternative_ckt_1 | Layers = 2 | At end of iteration = 153 | cost = 0.468347574
-----
Circuit = alternative_ckt_1 | Layers = 2 | At end of iteration = 154 | cost = 0.468260520
-----
Circuit = alternative_ckt_1 | Layers = 2 | At end of iteration = 155 | cost = 0.468174323
-----
Circuit = alternative_ckt_1 | Layers = 2 | At end of iteration = 156 | cost = 0.468088971
-----
Circuit = alternative_ckt_1 | Layers = 2 | At end of iteration = 157 | cost = 0.468004438
-----
Circuit = alternative_ckt_1 | Layers = 2 | At end of iteration = 158 | cost = 0.467920719
-----
Circuit = alternative_ckt_1 | Layers = 2 | At end of iteration = 159 | cost = 0.467837803
-----
Circuit = alternative_ckt_1 | Layers = 2 | At end of iteration = 160 | cost = 0.467755678
-----
Circuit = alternative_ckt_1 | Layers = 2 | At end of iteration = 161 | cost = 0.467674333
-----
Circuit = alternative_ckt_1 | Layers = 2 | At end of iteration = 162 | cost = 0.467593756
-----

```

```

-----
Circuit = alternative_ckt_1 | Layers = 2 | At end of iteration = 163 | cost = 0.46751393
-----
Circuit = alternative_ckt_1 | Layers = 2 | At end of iteration = 164 | cost = 0.46743486
-----
Circuit = alternative_ckt_1 | Layers = 2 | At end of iteration = 165 | cost = 0.46735652
-----
Circuit = alternative_ckt_1 | Layers = 2 | At end of iteration = 166 | cost = 0.46727890
-----
Circuit = alternative_ckt_1 | Layers = 2 | At end of iteration = 167 | cost = 0.46720200
-----
Circuit = alternative_ckt_1 | Layers = 2 | At end of iteration = 168 | cost = 0.46712580
-----
Circuit = alternative_ckt_1 | Layers = 2 | At end of iteration = 169 | cost = 0.46705030
-----
Circuit = alternative_ckt_1 | Layers = 2 | At end of iteration = 170 | cost = 0.46697547
-----
Circuit = alternative_ckt_1 | Layers = 2 | At end of iteration = 171 | cost = 0.46690132
-----
Circuit = alternative_ckt_1 | Layers = 2 | At end of iteration = 172 | cost = 0.46682783
-----
Circuit = alternative_ckt_1 | Layers = 2 | At end of iteration = 173 | cost = 0.46675500
-----
Circuit = alternative_ckt_1 | Layers = 2 | At end of iteration = 174 | cost = 0.46668280
-----
Circuit = alternative_ckt_1 | Layers = 2 | At end of iteration = 175 | cost = 0.46661124
-----
Circuit = alternative_ckt_1 | Layers = 2 | At end of iteration = 176 | cost = 0.46654031
-----
Circuit = alternative_ckt_1 | Layers = 2 | At end of iteration = 177 | cost = 0.46646998
-----
Circuit = alternative_ckt_1 | Layers = 2 | At end of iteration = 178 | cost = 0.46640026
-----
Circuit = alternative_ckt_1 | Layers = 2 | At end of iteration = 179 | cost = 0.46633114
-----
Circuit = alternative_ckt_1 | Layers = 2 | At end of iteration = 180 | cost = 0.46626260
-----
Circuit = alternative_ckt_1 | Layers = 2 | At end of iteration = 181 | cost = 0.46619464
-----
Circuit = alternative_ckt_1 | Layers = 2 | At end of iteration = 182 | cost = 0.46612725
-----
Circuit = alternative_ckt_1 | Layers = 2 | At end of iteration = 183 | cost = 0.46606042
-----
Circuit = alternative_ckt_1 | Layers = 2 | At end of iteration = 184 | cost = 0.46599414
-----
Circuit = alternative_ckt_1 | Layers = 2 | At end of iteration = 185 | cost = 0.46592840
-----
Circuit = alternative_ckt_1 | Layers = 2 | At end of iteration = 186 | cost = 0.46586320
-----

```

Circuit = alternative_ckt_1 Layers = 2 At end of iteration = 187 cost = 0.46579852
Circuit = alternative_ckt_1 Layers = 2 At end of iteration = 188 cost = 0.46573437
Circuit = alternative_ckt_1 Layers = 2 At end of iteration = 189 cost = 0.46567072
Circuit = alternative_ckt_1 Layers = 2 At end of iteration = 190 cost = 0.46560757
Circuit = alternative_ckt_1 Layers = 2 At end of iteration = 191 cost = 0.46554492
Circuit = alternative_ckt_1 Layers = 2 At end of iteration = 192 cost = 0.46548275
Circuit = alternative_ckt_1 Layers = 2 At end of iteration = 193 cost = 0.46542106
Circuit = alternative_ckt_1 Layers = 2 At end of iteration = 194 cost = 0.46535984
Circuit = alternative_ckt_1 Layers = 2 At end of iteration = 195 cost = 0.46529909
Circuit = alternative_ckt_1 Layers = 2 At end of iteration = 196 cost = 0.46523879
Circuit = alternative_ckt_1 Layers = 2 At end of iteration = 197 cost = 0.46517894
Circuit = alternative_ckt_1 Layers = 2 At end of iteration = 198 cost = 0.46511953
Circuit = alternative_ckt_1 Layers = 2 At end of iteration = 199 cost = 0.46506056
Circuit = alternative_ckt_1 Layers = 2 At end of iteration = 200 cost = 0.46500201
Circuit = alternative_ckt_1 Layers = 2 At end of iteration = 201 cost = 0.46494388
Circuit = alternative_ckt_1 Layers = 2 At end of iteration = 202 cost = 0.46488617
Circuit = alternative_ckt_1 Layers = 2 At end of iteration = 203 cost = 0.46482887
Circuit = alternative_ckt_1 Layers = 2 At end of iteration = 204 cost = 0.46477196
Circuit = alternative_ckt_1 Layers = 2 At end of iteration = 205 cost = 0.46471545
Circuit = alternative_ckt_1 Layers = 2 At end of iteration = 206 cost = 0.46465933
Circuit = alternative_ckt_1 Layers = 2 At end of iteration = 207 cost = 0.46460358
Circuit = alternative_ckt_1 Layers = 2 At end of iteration = 208 cost = 0.46454822
Circuit = alternative_ckt_1 Layers = 2 At end of iteration = 209 cost = 0.46449322
Circuit = alternative_ckt_1 Layers = 2 At end of iteration = 210 cost = 0.46443858

Circuit = alternative_ckt_1 Layers = 2 At end of iteration = 211 cost = 0.464384302
Circuit = alternative_ckt_1 Layers = 2 At end of iteration = 212 cost = 0.46433037
Circuit = alternative_ckt_1 Layers = 2 At end of iteration = 213 cost = 0.46427678
Circuit = alternative_ckt_1 Layers = 2 At end of iteration = 214 cost = 0.46422353
Circuit = alternative_ckt_1 Layers = 2 At end of iteration = 215 cost = 0.46417062
Circuit = alternative_ckt_1 Layers = 2 At end of iteration = 216 cost = 0.46411803
Circuit = alternative_ckt_1 Layers = 2 At end of iteration = 217 cost = 0.46406577
Circuit = alternative_ckt_1 Layers = 2 At end of iteration = 218 cost = 0.46401382
Circuit = alternative_ckt_1 Layers = 2 At end of iteration = 219 cost = 0.46396218
Circuit = alternative_ckt_1 Layers = 2 At end of iteration = 220 cost = 0.46391084
Circuit = alternative_ckt_1 Layers = 2 At end of iteration = 221 cost = 0.46385981
Circuit = alternative_ckt_1 Layers = 2 At end of iteration = 222 cost = 0.46380907
Circuit = alternative_ckt_1 Layers = 2 At end of iteration = 223 cost = 0.46375862
Circuit = alternative_ckt_1 Layers = 2 At end of iteration = 224 cost = 0.46370846
Circuit = alternative_ckt_1 Layers = 2 At end of iteration = 225 cost = 0.46365858
Circuit = alternative_ckt_1 Layers = 2 At end of iteration = 226 cost = 0.46360897
Circuit = alternative_ckt_1 Layers = 2 At end of iteration = 227 cost = 0.46355963
Circuit = alternative_ckt_1 Layers = 2 At end of iteration = 228 cost = 0.46351055
Circuit = alternative_ckt_1 Layers = 2 At end of iteration = 229 cost = 0.46346174
Circuit = alternative_ckt_1 Layers = 2 At end of iteration = 230 cost = 0.46341318
Circuit = alternative_ckt_1 Layers = 2 At end of iteration = 231 cost = 0.46336487
Circuit = alternative_ckt_1 Layers = 2 At end of iteration = 232 cost = 0.46331681
Circuit = alternative_ckt_1 Layers = 2 At end of iteration = 233 cost = 0.46326899
Circuit = alternative_ckt_1 Layers = 2 At end of iteration = 234 cost = 0.46322141

Circuit = alternative_ckt_1 Layers = 2 At end of iteration = 235 cost = 0.463174061
Circuit = alternative_ckt_1 Layers = 2 At end of iteration = 236 cost = 0.463126941
Circuit = alternative_ckt_1 Layers = 2 At end of iteration = 237 cost = 0.463080051
Circuit = alternative_ckt_1 Layers = 2 At end of iteration = 238 cost = 0.463033371
Circuit = alternative_ckt_1 Layers = 2 At end of iteration = 239 cost = 0.462986911
Circuit = alternative_ckt_1 Layers = 2 At end of iteration = 240 cost = 0.462940671
Circuit = alternative_ckt_1 Layers = 2 At end of iteration = 241 cost = 0.462894631
Circuit = alternative_ckt_1 Layers = 2 At end of iteration = 242 cost = 0.462848791
Circuit = alternative_ckt_1 Layers = 2 At end of iteration = 243 cost = 0.462803161
Circuit = alternative_ckt_1 Layers = 2 At end of iteration = 244 cost = 0.462757721
Circuit = alternative_ckt_1 Layers = 2 At end of iteration = 245 cost = 0.462712481
Circuit = alternative_ckt_1 Layers = 2 At end of iteration = 246 cost = 0.462667421
Circuit = alternative_ckt_1 Layers = 2 At end of iteration = 247 cost = 0.462622551
Circuit = alternative_ckt_1 Layers = 2 At end of iteration = 248 cost = 0.462577861
Circuit = alternative_ckt_1 Layers = 2 At end of iteration = 249 cost = 0.462533351
Circuit = alternative_ckt_1 Layers = 2 At end of iteration = 250 cost = 0.462489011
Circuit = alternative_ckt_1 Layers = 2 At end of iteration = 251 cost = 0.462444841
Circuit = alternative_ckt_1 Layers = 2 At end of iteration = 252 cost = 0.462400841
Circuit = alternative_ckt_1 Layers = 2 At end of iteration = 253 cost = 0.462357011
Circuit = alternative_ckt_1 Layers = 2 At end of iteration = 254 cost = 0.462313331
Circuit = alternative_ckt_1 Layers = 2 At end of iteration = 255 cost = 0.462269811
Circuit = alternative_ckt_1 Layers = 2 At end of iteration = 256 cost = 0.462226451
Circuit = alternative_ckt_1 Layers = 2 At end of iteration = 257 cost = 0.462183241
Circuit = alternative_ckt_1 Layers = 2 At end of iteration = 258 cost = 0.462140171

```

-----
Circuit = alternative_ckt_1 | Layers = 2 | At end of iteration = 259 | cost = 0.462097250
-----
Circuit = alternative_ckt_1 | Layers = 2 | At end of iteration = 260 | cost = 0.462054468
-----
Circuit = alternative_ckt_1 | Layers = 2 | At end of iteration = 261 | cost = 0.462011823
-----
Circuit = alternative_ckt_1 | Layers = 2 | At end of iteration = 262 | cost = 0.461969310
-----
Circuit = alternative_ckt_1 | Layers = 2 | At end of iteration = 263 | cost = 0.461926930
-----
Circuit = alternative_ckt_1 | Layers = 2 | At end of iteration = 264 | cost = 0.461884690
-----
Circuit = alternative_ckt_1 | Layers = 2 | At end of iteration = 265 | cost = 0.461842570
-----
Circuit = alternative_ckt_1 | Layers = 2 | At end of iteration = 266 | cost = 0.461800570
-----
Circuit = alternative_ckt_1 | Layers = 2 | At end of iteration = 267 | cost = 0.461758690
-----
Circuit = alternative_ckt_1 | Layers = 2 | At end of iteration = 268 | cost = 0.461716930
-----
Circuit = alternative_ckt_1 | Layers = 2 | At end of iteration = 269 | cost = 0.461675280
-----
Circuit = alternative_ckt_1 | Layers = 2 | At end of iteration = 270 | cost = 0.461633750
-----
Circuit = alternative_ckt_1 | Layers = 2 | At end of iteration = 271 | cost = 0.461592320
-----
Circuit = alternative_ckt_1 | Layers = 2 | At end of iteration = 272 | cost = 0.461551010
-----
Circuit = alternative_ckt_1 | Layers = 2 | At end of iteration = 273 | cost = 0.461509790
-----
Circuit = alternative_ckt_1 | Layers = 2 | At end of iteration = 274 | cost = 0.461468680
-----
Circuit = alternative_ckt_1 | Layers = 2 | At end of iteration = 275 | cost = 0.461427670
-----
Circuit = alternative_ckt_1 | Layers = 2 | At end of iteration = 276 | cost = 0.461386750
-----
Circuit = alternative_ckt_1 | Layers = 2 | At end of iteration = 277 | cost = 0.461345920
-----
Circuit = alternative_ckt_1 | Layers = 2 | At end of iteration = 278 | cost = 0.461305190
-----
Circuit = alternative_ckt_1 | Layers = 2 | At end of iteration = 279 | cost = 0.461264550
-----
Circuit = alternative_ckt_1 | Layers = 2 | At end of iteration = 280 | cost = 0.461223990
-----
Circuit = alternative_ckt_1 | Layers = 2 | At end of iteration = 281 | cost = 0.461183520
-----
Circuit = alternative_ckt_1 | Layers = 2 | At end of iteration = 282 | cost = 0.461143130
-----

```



```

-----
Circuit = alternative_ckt_1 | Layers = 2 | At end of iteration = 283 | cost = 0.46110282
-----
Circuit = alternative_ckt_1 | Layers = 2 | At end of iteration = 284 | cost = 0.46106259
-----
Circuit = alternative_ckt_1 | Layers = 2 | At end of iteration = 285 | cost = 0.46102243
-----
Circuit = alternative_ckt_1 | Layers = 2 | At end of iteration = 286 | cost = 0.46098234
-----
Circuit = alternative_ckt_1 | Layers = 2 | At end of iteration = 287 | cost = 0.46094233
-----
Circuit = alternative_ckt_1 | Layers = 2 | At end of iteration = 288 | cost = 0.46090238
-----
Circuit = alternative_ckt_1 | Layers = 2 | At end of iteration = 289 | cost = 0.46086250
-----
Circuit = alternative_ckt_1 | Layers = 2 | At end of iteration = 290 | cost = 0.46082269
-----
Circuit = alternative_ckt_1 | Layers = 2 | At end of iteration = 291 | cost = 0.46078293
-----
Circuit = alternative_ckt_1 | Layers = 2 | At end of iteration = 292 | cost = 0.46074324
-----
Circuit = alternative_ckt_1 | Layers = 2 | At end of iteration = 293 | cost = 0.46070360
-----
Circuit = alternative_ckt_1 | Layers = 2 | At end of iteration = 294 | cost = 0.46066402
-----
Circuit = alternative_ckt_1 | Layers = 2 | At end of iteration = 295 | cost = 0.46062450
-----
Circuit = alternative_ckt_1 | Layers = 2 | At end of iteration = 296 | cost = 0.46058502
-----
Circuit = alternative_ckt_1 | Layers = 2 | At end of iteration = 297 | cost = 0.46054560
-----
Circuit = alternative_ckt_1 | Layers = 2 | At end of iteration = 298 | cost = 0.46050623
-----
Circuit = alternative_ckt_1 | Layers = 2 | At end of iteration = 299 | cost = 0.46046690
-----
Circuit = alternative_ckt_1 | Layers = 2 | At end of iteration = 300 | cost = 0.46042761
-----

```

Optimization complete.

After optimization, the optimal parameters are

```
{Parameter(thetax3[2]): -1.7698339072917262, Parameter(thetax1[3]): -1.6669989210516791, Parameter(thetax2[2]): -1.6669989210516791, Parameter(thetax1[2]): -1.6669989210516791, Parameter(thetax3[3]): -1.6669989210516791, Parameter(thetax2[3]): -1.6669989210516791, Parameter(thetax1[1]): -1.6669989210516791, Parameter(thetax2[1]): -1.6669989210516791, Parameter(thetax3[1]): -1.6669989210516791, Parameter(thetax1[0]): -1.6669989210516791, Parameter(thetax2[0]): -1.6669989210516791, Parameter(thetax3[0]): -1.6669989210516791}
```

The output state for these parameters is

```

[[0.2705457 +0.11375049j]
 [0.19478162+0.04984466j]
 [0.25989088+0.10791235j]
 [0.15878944+0.0498695j ]
 [0.24306826+0.05239008j]
 [0.17100314+0.11511206j]
 [0.31621713+0.10743847j]

```

```

[0.06373 +0.18514865j]
[0.29441942-0.08145751j]
[0.16501012+0.10637454j]
[0.27898563+0.07023291j]
[0.13814451+0.11839889j]
[0.33444206+0.15078344j]
[0.13191887+0.07833785j]
[0.15030299+0.17177541j]
[0.19785972+0.12349838j]]

```

```

-----
Circuit = alternative_ckt_1 Layers = 2 Cost after optimization = 0.46042761977861707
-----

```

```

Circuit alternative_ckt_1 constructed with 3 layers. Number of parameters = 36 .
-----

```

Initialized circuit parameters prior to gradient descent randomly as follows:

```

idx = theta4[3] params = 0.03719052023213644
idx = thetax5[2] params = 0.04312312828020062
idx = theta6[2] params = 0.0004994971757621869
idx = thetax1[3] params = 0.03444025418170515
idx = thetax3[2] params = 0.046881140646663634
idx = theta6[1] params = 0.02164226791611938
idx = theta6[3] params = 0.028343942770291508
idx = theta4[2] params = 0.013510378554063363
idx = theta2[0] params = 0.022782810868909098
idx = theta2[2] params = 0.00573789773068969
idx = thetax5[0] params = 0.039532273767073196
idx = thetax1[1] params = 0.018375156312795238
idx = thetax3[1] params = 0.02421115885861306
idx = thetax1[0] params = 0.01671278315727628
idx = thetax5[2] params = 0.006172454610576922
idx = thetax1[0] params = 0.016655522656847783
idx = theta4[0] params = 0.04662197117509747
idx = thetax3[0] params = 0.009378499198132518
idx = thetax3[1] params = 0.030481776612878
idx = thetax5[0] params = 0.006238299240088347
idx = theta6[0] params = 0.046316344013782464
idx = thetax1[1] params = 0.002833116050508433
idx = theta4[1] params = 0.009568165097689485
idx = thetax1[2] params = 0.003778807686699465
idx = theta2[1] params = 0.04761132655555178
idx = thetax5[1] params = 0.02912836626547597
idx = thetax1[3] params = 0.03277867333581935
idx = thetax5[3] params = 0.0012507649722014293
idx = thetax3[0] params = 0.03265668670981592
idx = thetax3[2] params = 0.042510362504139115
idx = thetax5[1] params = 0.028964664980450857
idx = thetax1[2] params = 0.02606701333987876
idx = thetax3[3] params = 0.04507588560641085

```

```

idx = thetaz3[3] params = 0.01594882076679191
idx = thetaz5[3] params = 0.03973242205283862
idx = theta2[3] params = 0.009337792350935193

```

```

-----
Circuit = alternative_ckt_1 | Layers = 3 | At end of iteration = 1 | cost = 1.2230009842
-----
Circuit = alternative_ckt_1 | Layers = 3 | At end of iteration = 2 | cost = 1.1972866012
-----
Circuit = alternative_ckt_1 | Layers = 3 | At end of iteration = 3 | cost = 1.1679430697
-----
Circuit = alternative_ckt_1 | Layers = 3 | At end of iteration = 4 | cost = 1.1287367484
-----
Circuit = alternative_ckt_1 | Layers = 3 | At end of iteration = 5 | cost = 1.0746026887
-----
Circuit = alternative_ckt_1 | Layers = 3 | At end of iteration = 6 | cost = 1.0082735553
-----
Circuit = alternative_ckt_1 | Layers = 3 | At end of iteration = 7 | cost = 0.9465933599
-----
Circuit = alternative_ckt_1 | Layers = 3 | At end of iteration = 8 | cost = 0.9006409342
-----
Circuit = alternative_ckt_1 | Layers = 3 | At end of iteration = 9 | cost = 0.8632053512
-----
Circuit = alternative_ckt_1 | Layers = 3 | At end of iteration = 10 | cost = 0.830036197
-----
Circuit = alternative_ckt_1 | Layers = 3 | At end of iteration = 11 | cost = 0.800471428
-----
Circuit = alternative_ckt_1 | Layers = 3 | At end of iteration = 12 | cost = 0.774374391
-----
Circuit = alternative_ckt_1 | Layers = 3 | At end of iteration = 13 | cost = 0.751485186
-----
Circuit = alternative_ckt_1 | Layers = 3 | At end of iteration = 14 | cost = 0.730492166
-----
Circuit = alternative_ckt_1 | Layers = 3 | At end of iteration = 15 | cost = 0.709755106
-----
Circuit = alternative_ckt_1 | Layers = 3 | At end of iteration = 16 | cost = 0.687738414
-----
Circuit = alternative_ckt_1 | Layers = 3 | At end of iteration = 17 | cost = 0.664437708
-----
Circuit = alternative_ckt_1 | Layers = 3 | At end of iteration = 18 | cost = 0.638949437
-----
Circuit = alternative_ckt_1 | Layers = 3 | At end of iteration = 19 | cost = 0.613895544
-----
Circuit = alternative_ckt_1 | Layers = 3 | At end of iteration = 20 | cost = 0.583022078
-----
Circuit = alternative_ckt_1 | Layers = 3 | At end of iteration = 21 | cost = 0.620248589
-----
Circuit = alternative_ckt_1 | Layers = 3 | At end of iteration = 22 | cost = 1.038652003
-----

```

```

Circuit = alternative_ckt_1 | Layers = 3 | At end of iteration = 23 | cost = 1.118428423
-----
Circuit = alternative_ckt_1 | Layers = 3 | At end of iteration = 24 | cost = 0.660302344
-----
Circuit = alternative_ckt_1 | Layers = 3 | At end of iteration = 25 | cost = 1.092314392
-----
Circuit = alternative_ckt_1 | Layers = 3 | At end of iteration = 26 | cost = 0.689093184
-----
Circuit = alternative_ckt_1 | Layers = 3 | At end of iteration = 27 | cost = 1.129357212
-----
Circuit = alternative_ckt_1 | Layers = 3 | At end of iteration = 28 | cost = 0.603733016
-----
Circuit = alternative_ckt_1 | Layers = 3 | At end of iteration = 29 | cost = 0.921979301
-----
Circuit = alternative_ckt_1 | Layers = 3 | At end of iteration = 30 | cost = 1.023816691
-----
Circuit = alternative_ckt_1 | Layers = 3 | At end of iteration = 31 | cost = 0.949228558
-----
Circuit = alternative_ckt_1 | Layers = 3 | At end of iteration = 32 | cost = 0.827706922
-----
Circuit = alternative_ckt_1 | Layers = 3 | At end of iteration = 33 | cost = 1.025301983
-----
Circuit = alternative_ckt_1 | Layers = 3 | At end of iteration = 34 | cost = 0.696503946
-----
Circuit = alternative_ckt_1 | Layers = 3 | At end of iteration = 35 | cost = 0.974674359
-----
Circuit = alternative_ckt_1 | Layers = 3 | At end of iteration = 36 | cost = 0.802350794
-----
Circuit = alternative_ckt_1 | Layers = 3 | At end of iteration = 37 | cost = 1.049226772
-----
Circuit = alternative_ckt_1 | Layers = 3 | At end of iteration = 38 | cost = 0.666146566
-----
Circuit = alternative_ckt_1 | Layers = 3 | At end of iteration = 39 | cost = 0.955964810
-----
REDUCING ALPHA TO 0.31622776601683794 at iteration = 40
-----
Circuit = alternative_ckt_1 | Layers = 3 | At end of iteration = 40 | cost = 0.854212804
-----
Circuit = alternative_ckt_1 | Layers = 3 | At end of iteration = 41 | cost = 0.562855030
-----
Circuit = alternative_ckt_1 | Layers = 3 | At end of iteration = 42 | cost = 0.534147340
-----
Circuit = alternative_ckt_1 | Layers = 3 | At end of iteration = 43 | cost = 0.502449467
-----
Circuit = alternative_ckt_1 | Layers = 3 | At end of iteration = 44 | cost = 0.486324637
-----
Circuit = alternative_ckt_1 | Layers = 3 | At end of iteration = 45 | cost = 0.462038780
-----

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Circuit =	alternative_ckt_1		Layers =	3		At end of iteration =	46		cost =	0.4497275750
Circuit =	alternative_ckt_1		Layers =	3		At end of iteration =	47		cost =	0.4268694360
Circuit =	alternative_ckt_1		Layers =	3		At end of iteration =	48		cost =	0.4279178530
Circuit =	alternative_ckt_1		Layers =	3		At end of iteration =	49		cost =	0.4096820610
Circuit =	alternative_ckt_1		Layers =	3		At end of iteration =	50		cost =	0.4864904570
Circuit =	alternative_ckt_1		Layers =	3		At end of iteration =	51		cost =	0.5129392370
Circuit =	alternative_ckt_1		Layers =	3		At end of iteration =	52		cost =	0.6446617740
Circuit =	alternative_ckt_1		Layers =	3		At end of iteration =	53		cost =	0.5008796150
Circuit =	alternative_ckt_1		Layers =	3		At end of iteration =	54		cost =	0.6530922210
Circuit =	alternative_ckt_1		Layers =	3		At end of iteration =	55		cost =	0.4980319950
Circuit =	alternative_ckt_1		Layers =	3		At end of iteration =	56		cost =	0.6617434420
Circuit =	alternative_ckt_1		Layers =	3		At end of iteration =	57		cost =	0.4943831330
Circuit =	alternative_ckt_1		Layers =	3		At end of iteration =	58		cost =	0.6694216450
Circuit =	alternative_ckt_1		Layers =	3		At end of iteration =	59		cost =	0.4907703600
Circuit =	alternative_ckt_1		Layers =	3		At end of iteration =	60		cost =	0.6762904270
Circuit =	alternative_ckt_1		Layers =	3		At end of iteration =	61		cost =	0.4872107040
Circuit =	alternative_ckt_1		Layers =	3		At end of iteration =	62		cost =	0.6824304870
Circuit =	alternative_ckt_1		Layers =	3		At end of iteration =	63		cost =	0.4837621760
Circuit =	alternative_ckt_1		Layers =	3		At end of iteration =	64		cost =	0.6879209300
Circuit =	alternative_ckt_1		Layers =	3		At end of iteration =	65		cost =	0.4804591940
Circuit =	alternative_ckt_1		Layers =	3		At end of iteration =	66		cost =	0.6928297910
Circuit =	alternative_ckt_1		Layers =	3		At end of iteration =	67		cost =	0.4773236190
Circuit =	alternative_ckt_1		Layers =	3		At end of iteration =	68		cost =	0.6972165950
Circuit =	alternative_ckt_1		Layers =	3		At end of iteration =	69		cost =	0.4743674720

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Circuit = alternative_ckt_1 | Layers = 3 | At end of iteration = 70 | cost = 0.701133902
-----
Circuit = alternative_ckt_1 | Layers = 3 | At end of iteration = 71 | cost = 0.471595619
-----
Circuit = alternative_ckt_1 | Layers = 3 | At end of iteration = 72 | cost = 0.704628449
-----
Circuit = alternative_ckt_1 | Layers = 3 | At end of iteration = 73 | cost = 0.469007857
-----
Circuit = alternative_ckt_1 | Layers = 3 | At end of iteration = 74 | cost = 0.707741968
-----
Circuit = alternative_ckt_1 | Layers = 3 | At end of iteration = 75 | cost = 0.466600527
-----
Circuit = alternative_ckt_1 | Layers = 3 | At end of iteration = 76 | cost = 0.710511802
-----
Circuit = alternative_ckt_1 | Layers = 3 | At end of iteration = 77 | cost = 0.464367711
-----
Circuit = alternative_ckt_1 | Layers = 3 | At end of iteration = 78 | cost = 0.712971413
-----
Circuit = alternative_ckt_1 | Layers = 3 | At end of iteration = 79 | cost = 0.462302096
-----
REDUCING ALPHA TO 0.09999999999999999 at iteration = 80
-----
Circuit = alternative_ckt_1 | Layers = 3 | At end of iteration = 80 | cost = 0.715150807
-----
Circuit = alternative_ckt_1 | Layers = 3 | At end of iteration = 81 | cost = 0.478900824
-----
Circuit = alternative_ckt_1 | Layers = 3 | At end of iteration = 82 | cost = 0.336596458
-----
Circuit = alternative_ckt_1 | Layers = 3 | At end of iteration = 83 | cost = 0.324236125
-----
Circuit = alternative_ckt_1 | Layers = 3 | At end of iteration = 84 | cost = 0.323783515
-----
Circuit = alternative_ckt_1 | Layers = 3 | At end of iteration = 85 | cost = 0.321046470
-----
Circuit = alternative_ckt_1 | Layers = 3 | At end of iteration = 86 | cost = 0.319403954
-----
Circuit = alternative_ckt_1 | Layers = 3 | At end of iteration = 87 | cost = 0.317609354
-----
Circuit = alternative_ckt_1 | Layers = 3 | At end of iteration = 88 | cost = 0.316071230
-----
Circuit = alternative_ckt_1 | Layers = 3 | At end of iteration = 89 | cost = 0.314612901
-----
Circuit = alternative_ckt_1 | Layers = 3 | At end of iteration = 90 | cost = 0.313285354
-----
Circuit = alternative_ckt_1 | Layers = 3 | At end of iteration = 91 | cost = 0.312051581
-----
Circuit = alternative_ckt_1 | Layers = 3 | At end of iteration = 92 | cost = 0.310913260
-----

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Circuit = alternative_ckt_1 Layers = 3 At end of iteration = 93 cost = 0.309857019
Circuit = alternative_ckt_1 Layers = 3 At end of iteration = 94 cost = 0.308877635
Circuit = alternative_ckt_1 Layers = 3 At end of iteration = 95 cost = 0.307967340
Circuit = alternative_ckt_1 Layers = 3 At end of iteration = 96 cost = 0.307120649
Circuit = alternative_ckt_1 Layers = 3 At end of iteration = 97 cost = 0.306331907
Circuit = alternative_ckt_1 Layers = 3 At end of iteration = 98 cost = 0.305596388
Circuit = alternative_ckt_1 Layers = 3 At end of iteration = 99 cost = 0.304909641
Circuit = alternative_ckt_1 Layers = 3 At end of iteration = 100 cost = 0.30426773
Circuit = alternative_ckt_1 Layers = 3 At end of iteration = 101 cost = 0.30366706
Circuit = alternative_ckt_1 Layers = 3 At end of iteration = 102 cost = 0.30310438
Circuit = alternative_ckt_1 Layers = 3 At end of iteration = 103 cost = 0.30257671
Circuit = alternative_ckt_1 Layers = 3 At end of iteration = 104 cost = 0.30208137
Circuit = alternative_ckt_1 Layers = 3 At end of iteration = 105 cost = 0.30161588
Circuit = alternative_ckt_1 Layers = 3 At end of iteration = 106 cost = 0.30117800
Circuit = alternative_ckt_1 Layers = 3 At end of iteration = 107 cost = 0.30076565
Circuit = alternative_ckt_1 Layers = 3 At end of iteration = 108 cost = 0.30037695
Circuit = alternative_ckt_1 Layers = 3 At end of iteration = 109 cost = 0.30001016
Circuit = alternative_ckt_1 Layers = 3 At end of iteration = 110 cost = 0.29966367
Circuit = alternative_ckt_1 Layers = 3 At end of iteration = 111 cost = 0.29933600
Circuit = alternative_ckt_1 Layers = 3 At end of iteration = 112 cost = 0.29902580
Circuit = alternative_ckt_1 Layers = 3 At end of iteration = 113 cost = 0.29873180
Circuit = alternative_ckt_1 Layers = 3 At end of iteration = 114 cost = 0.29845284
Circuit = alternative_ckt_1 Layers = 3 At end of iteration = 115 cost = 0.29818784
Circuit = alternative_ckt_1 Layers = 3 At end of iteration = 116 cost = 0.29793579

```

Circuit = alternative_ckt_1 | Layers = 3 | At end of iteration = 117 | cost = 0.297695779
-----
Circuit = alternative_ckt_1 | Layers = 3 | At end of iteration = 118 | cost = 0.297466925
-----
Circuit = alternative_ckt_1 | Layers = 3 | At end of iteration = 119 | cost = 0.297248431
-----
REDUCING ALPHA TO 0.03162277660168379 at iteration = 120
-----
Circuit = alternative_ckt_1 | Layers = 3 | At end of iteration = 120 | cost = 0.297039551
-----
Circuit = alternative_ckt_1 | Layers = 3 | At end of iteration = 121 | cost = 0.296975331
-----
Circuit = alternative_ckt_1 | Layers = 3 | At end of iteration = 122 | cost = 0.296911970
-----
Circuit = alternative_ckt_1 | Layers = 3 | At end of iteration = 123 | cost = 0.296849451
-----
Circuit = alternative_ckt_1 | Layers = 3 | At end of iteration = 124 | cost = 0.296787751
-----
Circuit = alternative_ckt_1 | Layers = 3 | At end of iteration = 125 | cost = 0.296726851
-----
Circuit = alternative_ckt_1 | Layers = 3 | At end of iteration = 126 | cost = 0.296666741
-----
Circuit = alternative_ckt_1 | Layers = 3 | At end of iteration = 127 | cost = 0.296607381
-----
Circuit = alternative_ckt_1 | Layers = 3 | At end of iteration = 128 | cost = 0.296548771
-----
Circuit = alternative_ckt_1 | Layers = 3 | At end of iteration = 129 | cost = 0.296490891
-----
Circuit = alternative_ckt_1 | Layers = 3 | At end of iteration = 130 | cost = 0.296433721
-----
Circuit = alternative_ckt_1 | Layers = 3 | At end of iteration = 131 | cost = 0.296377251
-----
Circuit = alternative_ckt_1 | Layers = 3 | At end of iteration = 132 | cost = 0.296321451
-----
Circuit = alternative_ckt_1 | Layers = 3 | At end of iteration = 133 | cost = 0.296266311
-----
Circuit = alternative_ckt_1 | Layers = 3 | At end of iteration = 134 | cost = 0.296211831
-----
Circuit = alternative_ckt_1 | Layers = 3 | At end of iteration = 135 | cost = 0.296157971
-----
Circuit = alternative_ckt_1 | Layers = 3 | At end of iteration = 136 | cost = 0.296104731
-----
Circuit = alternative_ckt_1 | Layers = 3 | At end of iteration = 137 | cost = 0.296052091
-----
Circuit = alternative_ckt_1 | Layers = 3 | At end of iteration = 138 | cost = 0.296000041
-----
Circuit = alternative_ckt_1 | Layers = 3 | At end of iteration = 139 | cost = 0.295948571
-----

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Circuit = alternative_ckt_1 Layers = 3 At end of iteration = 140 cost = 0.29589765
Circuit = alternative_ckt_1 Layers = 3 At end of iteration = 141 cost = 0.29584728
Circuit = alternative_ckt_1 Layers = 3 At end of iteration = 142 cost = 0.29579745
Circuit = alternative_ckt_1 Layers = 3 At end of iteration = 143 cost = 0.29574814
Circuit = alternative_ckt_1 Layers = 3 At end of iteration = 144 cost = 0.29569933
Circuit = alternative_ckt_1 Layers = 3 At end of iteration = 145 cost = 0.29565102
Circuit = alternative_ckt_1 Layers = 3 At end of iteration = 146 cost = 0.29560320
Circuit = alternative_ckt_1 Layers = 3 At end of iteration = 147 cost = 0.29555585
Circuit = alternative_ckt_1 Layers = 3 At end of iteration = 148 cost = 0.29550896
Circuit = alternative_ckt_1 Layers = 3 At end of iteration = 149 cost = 0.29546252
Circuit = alternative_ckt_1 Layers = 3 At end of iteration = 150 cost = 0.29541651
Circuit = alternative_ckt_1 Layers = 3 At end of iteration = 151 cost = 0.29537094
Circuit = alternative_ckt_1 Layers = 3 At end of iteration = 152 cost = 0.29532579
Circuit = alternative_ckt_1 Layers = 3 At end of iteration = 153 cost = 0.29528104
Circuit = alternative_ckt_1 Layers = 3 At end of iteration = 154 cost = 0.29523669
Circuit = alternative_ckt_1 Layers = 3 At end of iteration = 155 cost = 0.29519273
Circuit = alternative_ckt_1 Layers = 3 At end of iteration = 156 cost = 0.29514914
Circuit = alternative_ckt_1 Layers = 3 At end of iteration = 157 cost = 0.29510593
Circuit = alternative_ckt_1 Layers = 3 At end of iteration = 158 cost = 0.29506307
Circuit = alternative_ckt_1 Layers = 3 At end of iteration = 159 cost = 0.29502057
Circuit = alternative_ckt_1 Layers = 3 At end of iteration = 160 cost = 0.29497840
Circuit = alternative_ckt_1 Layers = 3 At end of iteration = 161 cost = 0.29493657
Circuit = alternative_ckt_1 Layers = 3 At end of iteration = 162 cost = 0.29489507
Circuit = alternative_ckt_1 Layers = 3 At end of iteration = 163 cost = 0.29485388

Circuit = alternative_ckt_1 Layers = 3 At end of iteration = 164 cost = 0.29481300
Circuit = alternative_ckt_1 Layers = 3 At end of iteration = 165 cost = 0.29477241
Circuit = alternative_ckt_1 Layers = 3 At end of iteration = 166 cost = 0.29473213
Circuit = alternative_ckt_1 Layers = 3 At end of iteration = 167 cost = 0.29469212
Circuit = alternative_ckt_1 Layers = 3 At end of iteration = 168 cost = 0.29465240
Circuit = alternative_ckt_1 Layers = 3 At end of iteration = 169 cost = 0.29461295
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Circuit = alternative_ckt_1 Layers = 3 At end of iteration = 171 cost = 0.29453482
Circuit = alternative_ckt_1 Layers = 3 At end of iteration = 172 cost = 0.29449614
Circuit = alternative_ckt_1 Layers = 3 At end of iteration = 173 cost = 0.29445770
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Circuit = alternative_ckt_1 Layers = 3 At end of iteration = 175 cost = 0.29438152
Circuit = alternative_ckt_1 Layers = 3 At end of iteration = 176 cost = 0.29434377
Circuit = alternative_ckt_1 Layers = 3 At end of iteration = 177 cost = 0.29430624
Circuit = alternative_ckt_1 Layers = 3 At end of iteration = 178 cost = 0.29426893
Circuit = alternative_ckt_1 Layers = 3 At end of iteration = 179 cost = 0.29423182
Circuit = alternative_ckt_1 Layers = 3 At end of iteration = 180 cost = 0.29419491
Circuit = alternative_ckt_1 Layers = 3 At end of iteration = 181 cost = 0.29415820
Circuit = alternative_ckt_1 Layers = 3 At end of iteration = 182 cost = 0.29412167
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Circuit = alternative_ckt_1 Layers = 3 At end of iteration = 186 cost = 0.29397738
Circuit = alternative_ckt_1 Layers = 3 At end of iteration = 187 cost = 0.29394173

Circuit = alternative_ckt_1 Layers = 3 At end of iteration = 188 cost = 0.29390625
Circuit = alternative_ckt_1 Layers = 3 At end of iteration = 189 cost = 0.29387092
Circuit = alternative_ckt_1 Layers = 3 At end of iteration = 190 cost = 0.29383574
Circuit = alternative_ckt_1 Layers = 3 At end of iteration = 191 cost = 0.29380071
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Circuit = alternative_ckt_1 Layers = 3 At end of iteration = 199 cost = 0.29352526
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Circuit = alternative_ckt_1 Layers = 3 At end of iteration = 213 cost = 0.29305961
Circuit = alternative_ckt_1 Layers = 3 At end of iteration = 214 cost = 0.29302696
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Circuit = alternative_ckt_1 Layers = 3 At end of iteration = 216 cost = 0.29296189
Circuit = alternative_ckt_1 Layers = 3 At end of iteration = 217 cost = 0.29292944
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Circuit = alternative_ckt_1 Layers = 3 At end of iteration = 220 cost = 0.29283248
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Circuit = alternative_ckt_1 Layers = 3 At end of iteration = 223 cost = 0.29273601
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Circuit = alternative_ckt_1 Layers = 3 At end of iteration = 226 cost = 0.29263999
Circuit = alternative_ckt_1 Layers = 3 At end of iteration = 227 cost = 0.29260807
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Circuit = alternative_ckt_1 Layers = 3 At end of iteration = 233 cost = 0.29241739
Circuit = alternative_ckt_1 Layers = 3 At end of iteration = 234 cost = 0.29238573
Circuit = alternative_ckt_1 Layers = 3 At end of iteration = 235 cost = 0.29235410

Circuit = alternative_ckt_1 Layers = 3 At end of iteration = 236 cost = 0.29232251
Circuit = alternative_ckt_1 Layers = 3 At end of iteration = 237 cost = 0.29229094
Circuit = alternative_ckt_1 Layers = 3 At end of iteration = 238 cost = 0.29225940
Circuit = alternative_ckt_1 Layers = 3 At end of iteration = 239 cost = 0.29222789
Circuit = alternative_ckt_1 Layers = 3 At end of iteration = 240 cost = 0.29219639
Circuit = alternative_ckt_1 Layers = 3 At end of iteration = 241 cost = 0.29216493
Circuit = alternative_ckt_1 Layers = 3 At end of iteration = 242 cost = 0.29213348
Circuit = alternative_ckt_1 Layers = 3 At end of iteration = 243 cost = 0.29210206
Circuit = alternative_ckt_1 Layers = 3 At end of iteration = 244 cost = 0.29207066
Circuit = alternative_ckt_1 Layers = 3 At end of iteration = 245 cost = 0.29203927
Circuit = alternative_ckt_1 Layers = 3 At end of iteration = 246 cost = 0.29200790
Circuit = alternative_ckt_1 Layers = 3 At end of iteration = 247 cost = 0.29197655
Circuit = alternative_ckt_1 Layers = 3 At end of iteration = 248 cost = 0.29194522
Circuit = alternative_ckt_1 Layers = 3 At end of iteration = 249 cost = 0.29191390
Circuit = alternative_ckt_1 Layers = 3 At end of iteration = 250 cost = 0.29188260
Circuit = alternative_ckt_1 Layers = 3 At end of iteration = 251 cost = 0.29185130
Circuit = alternative_ckt_1 Layers = 3 At end of iteration = 252 cost = 0.29182003
Circuit = alternative_ckt_1 Layers = 3 At end of iteration = 253 cost = 0.29178876
Circuit = alternative_ckt_1 Layers = 3 At end of iteration = 254 cost = 0.29175750
Circuit = alternative_ckt_1 Layers = 3 At end of iteration = 255 cost = 0.29172625
Circuit = alternative_ckt_1 Layers = 3 At end of iteration = 256 cost = 0.29169501
Circuit = alternative_ckt_1 Layers = 3 At end of iteration = 257 cost = 0.29166378
Circuit = alternative_ckt_1 Layers = 3 At end of iteration = 258 cost = 0.29163256
Circuit = alternative_ckt_1 Layers = 3 At end of iteration = 259 cost = 0.29160134

Circuit = alternative_ckt_1 Layers = 3 At end of iteration = 260 cost = 0.29157014
Circuit = alternative_ckt_1 Layers = 3 At end of iteration = 261 cost = 0.29153893
Circuit = alternative_ckt_1 Layers = 3 At end of iteration = 262 cost = 0.29150773
Circuit = alternative_ckt_1 Layers = 3 At end of iteration = 263 cost = 0.29147654
Circuit = alternative_ckt_1 Layers = 3 At end of iteration = 264 cost = 0.29144535
Circuit = alternative_ckt_1 Layers = 3 At end of iteration = 265 cost = 0.29141416
Circuit = alternative_ckt_1 Layers = 3 At end of iteration = 266 cost = 0.29138298
Circuit = alternative_ckt_1 Layers = 3 At end of iteration = 267 cost = 0.29135179
Circuit = alternative_ckt_1 Layers = 3 At end of iteration = 268 cost = 0.29132061
Circuit = alternative_ckt_1 Layers = 3 At end of iteration = 269 cost = 0.29128944
Circuit = alternative_ckt_1 Layers = 3 At end of iteration = 270 cost = 0.29125826
Circuit = alternative_ckt_1 Layers = 3 At end of iteration = 271 cost = 0.29122708
Circuit = alternative_ckt_1 Layers = 3 At end of iteration = 272 cost = 0.29119590
Circuit = alternative_ckt_1 Layers = 3 At end of iteration = 273 cost = 0.29116472
Circuit = alternative_ckt_1 Layers = 3 At end of iteration = 274 cost = 0.29113354
Circuit = alternative_ckt_1 Layers = 3 At end of iteration = 275 cost = 0.29110236
Circuit = alternative_ckt_1 Layers = 3 At end of iteration = 276 cost = 0.29107118
Circuit = alternative_ckt_1 Layers = 3 At end of iteration = 277 cost = 0.29104000
Circuit = alternative_ckt_1 Layers = 3 At end of iteration = 278 cost = 0.29100881
Circuit = alternative_ckt_1 Layers = 3 At end of iteration = 279 cost = 0.29097762
Circuit = alternative_ckt_1 Layers = 3 At end of iteration = 280 cost = 0.29094643
Circuit = alternative_ckt_1 Layers = 3 At end of iteration = 281 cost = 0.29091524
Circuit = alternative_ckt_1 Layers = 3 At end of iteration = 282 cost = 0.29088404
Circuit = alternative_ckt_1 Layers = 3 At end of iteration = 283 cost = 0.29085284

```

Circuit = alternative_ckt_1 | Layers = 3 | At end of iteration = 284 | cost = 0.29082163
-----
Circuit = alternative_ckt_1 | Layers = 3 | At end of iteration = 285 | cost = 0.29079042
-----
Circuit = alternative_ckt_1 | Layers = 3 | At end of iteration = 286 | cost = 0.29075921
-----
Circuit = alternative_ckt_1 | Layers = 3 | At end of iteration = 287 | cost = 0.29072799
-----
Circuit = alternative_ckt_1 | Layers = 3 | At end of iteration = 288 | cost = 0.29069676
-----
Circuit = alternative_ckt_1 | Layers = 3 | At end of iteration = 289 | cost = 0.29066553
-----
Circuit = alternative_ckt_1 | Layers = 3 | At end of iteration = 290 | cost = 0.29063430
-----
Circuit = alternative_ckt_1 | Layers = 3 | At end of iteration = 291 | cost = 0.29060306
-----
Circuit = alternative_ckt_1 | Layers = 3 | At end of iteration = 292 | cost = 0.29057181
-----
Circuit = alternative_ckt_1 | Layers = 3 | At end of iteration = 293 | cost = 0.29054056
-----
Circuit = alternative_ckt_1 | Layers = 3 | At end of iteration = 294 | cost = 0.29050931
-----
Circuit = alternative_ckt_1 | Layers = 3 | At end of iteration = 295 | cost = 0.29047805
-----
Circuit = alternative_ckt_1 | Layers = 3 | At end of iteration = 296 | cost = 0.29044678
-----
Circuit = alternative_ckt_1 | Layers = 3 | At end of iteration = 297 | cost = 0.29041550
-----
Circuit = alternative_ckt_1 | Layers = 3 | At end of iteration = 298 | cost = 0.29038422
-----
Circuit = alternative_ckt_1 | Layers = 3 | At end of iteration = 299 | cost = 0.29035294
-----
Circuit = alternative_ckt_1 | Layers = 3 | At end of iteration = 300 | cost = 0.29032164
-----

```

Optimization complete.

After optimization, the optimal parameters are

```
{Parameter(theta4[3]): -0.14023722611345146, Parameter(thetax5[2]): -0.1772558951827734, Parameter(theta5[3]): 0.1772558951827734, Parameter(theta4[2]): 0.14023722611345146}
```

The output state for these parameters is

```

[[ 0.21595143+0.29690479j]
 [ 0.04329391+0.24429156j]
 [ 0.23465501+0.08929304j]
 [ 0.17826677+0.14883703j]
 [ 0.15241225+0.06910397j]
 [ 0.17020295+0.10281237j]
 [ 0.18601774+0.17700612j]
 [-0.03294627+0.10429992j]
 [ 0.27339806+0.03881535j]
 [ 0.22416927+0.07434487j]

```

```
[ 0.31223418+0.07939734j]
[ 0.05749473-0.01745088j]
[ 0.25785481+0.18345397j]
[ 0.19647101+0.03297137j]
[ 0.23534733+0.23583193j]
[ 0.2236651 -0.03082322j]]
```

```
-----
Circuit = alternative_ckt_1 Layers = 3 Cost after optimization = 0.29032164685481143
-----
```

```
Circuit alternative_ckt_1 constructed with 4 layers. Number of parameters = 48 .
-----
```

Initialized circuit parameters prior to gradient descent randomly as follows:

```
idx = thetaz3[0] params = 0.03719052023213644
idx = thetax1[0] params = 0.04312312828020062
idx = thetaz1[0] params = 0.0004994971757621869
idx = thetaz5[3] params = 0.03444025418170515
idx = thetaz3[1] params = 0.046881140646663634
idx = theta6[1] params = 0.02164226791611938
idx = thetax7[2] params = 0.028343942770291508
idx = theta8[3] params = 0.013510378554063363
idx = theta6[0] params = 0.022782810868909098
idx = thetaz1[1] params = 0.00573789773068969
idx = theta4[0] params = 0.039532273767073196
idx = thetaz1[3] params = 0.018375156312795238
idx = theta2[3] params = 0.02421115885861306
idx = thetax5[0] params = 0.01671278315727628
idx = thetax5[1] params = 0.006172454610576922
idx = thetaz1[2] params = 0.016655522656847783
idx = thetaz5[2] params = 0.04662197117509747
idx = theta8[1] params = 0.009378499198132518
idx = thetax7[3] params = 0.030481776612878
idx = theta4[3] params = 0.006238299240088347
idx = theta6[2] params = 0.046316344013782464
idx = thetax7[1] params = 0.002833116050508433
idx = thetax3[0] params = 0.009568165097689485
idx = theta4[1] params = 0.003778807686699465
idx = theta8[2] params = 0.04761132655555178
idx = thetaz3[2] params = 0.02912836626547597
idx = theta4[2] params = 0.03277867333581935
idx = thetax1[2] params = 0.0012507649722014293
idx = theta2[0] params = 0.03265668670981592
idx = theta2[2] params = 0.042510362504139115
idx = thetaz5[0] params = 0.028964664980450857
idx = thetaz5[1] params = 0.02606701333987876
idx = thetaz7[1] params = 0.04507588560641085
idx = thetax5[2] params = 0.01594882076679191
idx = thetaz7[2] params = 0.03973242205283862
idx = thetax1[3] params = 0.009337792350935193
```



```

idx = thetax5[3] params = 0.0032829280606491377
idx = theta6[3] params = 0.019944497772341908
idx = thetax3[3] params = 0.040543302128205796
idx = theta8[0] params = 0.018661219094017113
idx = thetax3[2] params = 0.022765429249395765
idx = thetax1[1] params = 0.04496189581938223
idx = thetax7[0] params = 0.04421309636000539
idx = thetax7[0] params = 0.032067148697469475
idx = theta2[1] params = 0.03316055200997197
idx = thetax3[3] params = 0.038381406528673896
idx = thetax3[1] params = 0.014346822771396907
idx = thetax7[3] params = 0.017358921226698288

```

```

-----
Circuit = alternative_ckt_1 | Layers = 4 | At end of iteration = 1 | cost = 1.21786504207
-----
Circuit = alternative_ckt_1 | Layers = 4 | At end of iteration = 2 | cost = 1.1909526488
-----
Circuit = alternative_ckt_1 | Layers = 4 | At end of iteration = 3 | cost = 1.1611704174
-----
Circuit = alternative_ckt_1 | Layers = 4 | At end of iteration = 4 | cost = 1.1205133942
-----
Circuit = alternative_ckt_1 | Layers = 4 | At end of iteration = 5 | cost = 1.0609222513
-----
Circuit = alternative_ckt_1 | Layers = 4 | At end of iteration = 6 | cost = 0.9825066766
-----
Circuit = alternative_ckt_1 | Layers = 4 | At end of iteration = 7 | cost = 0.9102601951
-----
Circuit = alternative_ckt_1 | Layers = 4 | At end of iteration = 8 | cost = 0.8563247292
-----
Circuit = alternative_ckt_1 | Layers = 4 | At end of iteration = 9 | cost = 0.8084775297
-----
Circuit = alternative_ckt_1 | Layers = 4 | At end of iteration = 10 | cost = 0.771699340
-----
Circuit = alternative_ckt_1 | Layers = 4 | At end of iteration = 11 | cost = 0.746698024
-----
Circuit = alternative_ckt_1 | Layers = 4 | At end of iteration = 12 | cost = 0.729127270
-----
Circuit = alternative_ckt_1 | Layers = 4 | At end of iteration = 13 | cost = 0.709446306
-----
Circuit = alternative_ckt_1 | Layers = 4 | At end of iteration = 14 | cost = 0.691269006
-----
Circuit = alternative_ckt_1 | Layers = 4 | At end of iteration = 15 | cost = 0.663559166
-----
Circuit = alternative_ckt_1 | Layers = 4 | At end of iteration = 16 | cost = 0.702746158
-----
Circuit = alternative_ckt_1 | Layers = 4 | At end of iteration = 17 | cost = 0.912107128
-----
Circuit = alternative_ckt_1 | Layers = 4 | At end of iteration = 18 | cost = 1.046336707
-----

```

```

-----
Circuit = alternative_ckt_1 | Layers = 4 | At end of iteration = 19 | cost = 0.717812772
-----
Circuit = alternative_ckt_1 | Layers = 4 | At end of iteration = 20 | cost = 0.865318487
-----
Circuit = alternative_ckt_1 | Layers = 4 | At end of iteration = 21 | cost = 0.919321996
-----
Circuit = alternative_ckt_1 | Layers = 4 | At end of iteration = 22 | cost = 0.866854423
-----
Circuit = alternative_ckt_1 | Layers = 4 | At end of iteration = 23 | cost = 0.795984028
-----
Circuit = alternative_ckt_1 | Layers = 4 | At end of iteration = 24 | cost = 0.860743057
-----
Circuit = alternative_ckt_1 | Layers = 4 | At end of iteration = 25 | cost = 0.819342843
-----
Circuit = alternative_ckt_1 | Layers = 4 | At end of iteration = 26 | cost = 0.850540068
-----
Circuit = alternative_ckt_1 | Layers = 4 | At end of iteration = 27 | cost = 0.803816640
-----
Circuit = alternative_ckt_1 | Layers = 4 | At end of iteration = 28 | cost = 0.834561645
-----
Circuit = alternative_ckt_1 | Layers = 4 | At end of iteration = 29 | cost = 0.810715750
-----
Circuit = alternative_ckt_1 | Layers = 4 | At end of iteration = 30 | cost = 0.823856561
-----
Circuit = alternative_ckt_1 | Layers = 4 | At end of iteration = 31 | cost = 0.809174954
-----
Circuit = alternative_ckt_1 | Layers = 4 | At end of iteration = 32 | cost = 0.813890999
-----
Circuit = alternative_ckt_1 | Layers = 4 | At end of iteration = 33 | cost = 0.812737268
-----
Circuit = alternative_ckt_1 | Layers = 4 | At end of iteration = 34 | cost = 0.806017251
-----
Circuit = alternative_ckt_1 | Layers = 4 | At end of iteration = 35 | cost = 0.815527962
-----
Circuit = alternative_ckt_1 | Layers = 4 | At end of iteration = 36 | cost = 0.799846705
-----
Circuit = alternative_ckt_1 | Layers = 4 | At end of iteration = 37 | cost = 0.819125266
-----
Circuit = alternative_ckt_1 | Layers = 4 | At end of iteration = 38 | cost = 0.795338798
-----
Circuit = alternative_ckt_1 | Layers = 4 | At end of iteration = 39 | cost = 0.822437180
-----
REDUCING ALPHA TO 0.31622776601683794 at iteration = 40
-----
Circuit = alternative_ckt_1 | Layers = 4 | At end of iteration = 40 | cost = 0.792289073
-----
Circuit = alternative_ckt_1 | Layers = 4 | At end of iteration = 41 | cost = 0.585135603

```

```

-----
Circuit = alternative_ckt_1 | Layers = 4 | At end of iteration = 42 | cost = 0.5395701009
-----
Circuit = alternative_ckt_1 | Layers = 4 | At end of iteration = 43 | cost = 0.5266138334
-----
Circuit = alternative_ckt_1 | Layers = 4 | At end of iteration = 44 | cost = 0.5149398557
-----
Circuit = alternative_ckt_1 | Layers = 4 | At end of iteration = 45 | cost = 0.5048784879
-----
Circuit = alternative_ckt_1 | Layers = 4 | At end of iteration = 46 | cost = 0.4953255979
-----
Circuit = alternative_ckt_1 | Layers = 4 | At end of iteration = 47 | cost = 0.4863043394
-----
Circuit = alternative_ckt_1 | Layers = 4 | At end of iteration = 48 | cost = 0.4776031114
-----
Circuit = alternative_ckt_1 | Layers = 4 | At end of iteration = 49 | cost = 0.4692922479
-----
Circuit = alternative_ckt_1 | Layers = 4 | At end of iteration = 50 | cost = 0.4613100999
-----
Circuit = alternative_ckt_1 | Layers = 4 | At end of iteration = 51 | cost = 0.4537193099
-----
Circuit = alternative_ckt_1 | Layers = 4 | At end of iteration = 52 | cost = 0.4464752869
-----
Circuit = alternative_ckt_1 | Layers = 4 | At end of iteration = 53 | cost = 0.4396292859
-----
Circuit = alternative_ckt_1 | Layers = 4 | At end of iteration = 54 | cost = 0.4331192519
-----
Circuit = alternative_ckt_1 | Layers = 4 | At end of iteration = 55 | cost = 0.4269984419
-----
Circuit = alternative_ckt_1 | Layers = 4 | At end of iteration = 56 | cost = 0.4211644079
-----
Circuit = alternative_ckt_1 | Layers = 4 | At end of iteration = 57 | cost = 0.4157058259
-----
Circuit = alternative_ckt_1 | Layers = 4 | At end of iteration = 58 | cost = 0.4104348209
-----
Circuit = alternative_ckt_1 | Layers = 4 | At end of iteration = 59 | cost = 0.4055634709
-----
Circuit = alternative_ckt_1 | Layers = 4 | At end of iteration = 60 | cost = 0.4006805849
-----
Circuit = alternative_ckt_1 | Layers = 4 | At end of iteration = 61 | cost = 0.3963904889
-----
Circuit = alternative_ckt_1 | Layers = 4 | At end of iteration = 62 | cost = 0.3915754559
-----
Circuit = alternative_ckt_1 | Layers = 4 | At end of iteration = 63 | cost = 0.3882003509
-----
Circuit = alternative_ckt_1 | Layers = 4 | At end of iteration = 64 | cost = 0.3825882729
-----
Circuit = alternative_ckt_1 | Layers = 4 | At end of iteration = 65 | cost = 0.3821945529
-----

```

```

-----
Circuit = alternative_ckt_1 | Layers = 4 | At end of iteration = 66 | cost = 0.373438624
-----
Circuit = alternative_ckt_1 | Layers = 4 | At end of iteration = 67 | cost = 0.391647055
-----
Circuit = alternative_ckt_1 | Layers = 4 | At end of iteration = 68 | cost = 0.393293833
-----
Circuit = alternative_ckt_1 | Layers = 4 | At end of iteration = 69 | cost = 0.539115290
-----
Circuit = alternative_ckt_1 | Layers = 4 | At end of iteration = 70 | cost = 0.515738184
-----
Circuit = alternative_ckt_1 | Layers = 4 | At end of iteration = 71 | cost = 0.625984354
-----
Circuit = alternative_ckt_1 | Layers = 4 | At end of iteration = 72 | cost = 0.470649718
-----
Circuit = alternative_ckt_1 | Layers = 4 | At end of iteration = 73 | cost = 0.618112543
-----
Circuit = alternative_ckt_1 | Layers = 4 | At end of iteration = 74 | cost = 0.472228968
-----
Circuit = alternative_ckt_1 | Layers = 4 | At end of iteration = 75 | cost = 0.617394047
-----
Circuit = alternative_ckt_1 | Layers = 4 | At end of iteration = 76 | cost = 0.471418181
-----
Circuit = alternative_ckt_1 | Layers = 4 | At end of iteration = 77 | cost = 0.617767674
-----
Circuit = alternative_ckt_1 | Layers = 4 | At end of iteration = 78 | cost = 0.470987876
-----
Circuit = alternative_ckt_1 | Layers = 4 | At end of iteration = 79 | cost = 0.619195614
-----
REDUCING ALPHA TO 0.09999999999999999 at iteration = 80
-----
Circuit = alternative_ckt_1 | Layers = 4 | At end of iteration = 80 | cost = 0.470441135
-----
Circuit = alternative_ckt_1 | Layers = 4 | At end of iteration = 81 | cost = 0.355820118
-----
Circuit = alternative_ckt_1 | Layers = 4 | At end of iteration = 82 | cost = 0.353921674
-----
Circuit = alternative_ckt_1 | Layers = 4 | At end of iteration = 83 | cost = 0.351796863
-----
Circuit = alternative_ckt_1 | Layers = 4 | At end of iteration = 84 | cost = 0.350432278
-----
Circuit = alternative_ckt_1 | Layers = 4 | At end of iteration = 85 | cost = 0.349182428
-----
Circuit = alternative_ckt_1 | Layers = 4 | At end of iteration = 86 | cost = 0.348037642
-----
Circuit = alternative_ckt_1 | Layers = 4 | At end of iteration = 87 | cost = 0.346961699
-----
Circuit = alternative_ckt_1 | Layers = 4 | At end of iteration = 88 | cost = 0.345933969
-----

```

```

-----
Circuit = alternative_ckt_1 | Layers = 4 | At end of iteration = 89 | cost = 0.3449404411
-----
Circuit = alternative_ckt_1 | Layers = 4 | At end of iteration = 90 | cost = 0.3439717564
-----
Circuit = alternative_ckt_1 | Layers = 4 | At end of iteration = 91 | cost = 0.3430216023
-----
Circuit = alternative_ckt_1 | Layers = 4 | At end of iteration = 92 | cost = 0.3420857367
-----
Circuit = alternative_ckt_1 | Layers = 4 | At end of iteration = 93 | cost = 0.3411613300
-----
Circuit = alternative_ckt_1 | Layers = 4 | At end of iteration = 94 | cost = 0.3402465299
-----
Circuit = alternative_ckt_1 | Layers = 4 | At end of iteration = 95 | cost = 0.3393401567
-----
Circuit = alternative_ckt_1 | Layers = 4 | At end of iteration = 96 | cost = 0.3384414989
-----
Circuit = alternative_ckt_1 | Layers = 4 | At end of iteration = 97 | cost = 0.3375501719
-----
Circuit = alternative_ckt_1 | Layers = 4 | At end of iteration = 98 | cost = 0.3366660100
-----
Circuit = alternative_ckt_1 | Layers = 4 | At end of iteration = 99 | cost = 0.3357890049
-----
Circuit = alternative_ckt_1 | Layers = 4 | At end of iteration = 100 | cost = 0.3349192449
-----
Circuit = alternative_ckt_1 | Layers = 4 | At end of iteration = 101 | cost = 0.3340568849
-----
Circuit = alternative_ckt_1 | Layers = 4 | At end of iteration = 102 | cost = 0.3332021249
-----
Circuit = alternative_ckt_1 | Layers = 4 | At end of iteration = 103 | cost = 0.3323551749
-----
Circuit = alternative_ckt_1 | Layers = 4 | At end of iteration = 104 | cost = 0.3315162749
-----
Circuit = alternative_ckt_1 | Layers = 4 | At end of iteration = 105 | cost = 0.3306856349
-----
Circuit = alternative_ckt_1 | Layers = 4 | At end of iteration = 106 | cost = 0.3298634949
-----
Circuit = alternative_ckt_1 | Layers = 4 | At end of iteration = 107 | cost = 0.3290500649
-----
Circuit = alternative_ckt_1 | Layers = 4 | At end of iteration = 108 | cost = 0.3282455249
-----
Circuit = alternative_ckt_1 | Layers = 4 | At end of iteration = 109 | cost = 0.3274500849
-----
Circuit = alternative_ckt_1 | Layers = 4 | At end of iteration = 110 | cost = 0.3266638849
-----
Circuit = alternative_ckt_1 | Layers = 4 | At end of iteration = 111 | cost = 0.3258870849
-----
Circuit = alternative_ckt_1 | Layers = 4 | At end of iteration = 112 | cost = 0.3251198249
-----

```

```

-----
Circuit = alternative_ckt_1 | Layers = 4 | At end of iteration = 113 | cost = 0.32436221
-----
Circuit = alternative_ckt_1 | Layers = 4 | At end of iteration = 114 | cost = 0.32361434
-----
Circuit = alternative_ckt_1 | Layers = 4 | At end of iteration = 115 | cost = 0.32287629
-----
Circuit = alternative_ckt_1 | Layers = 4 | At end of iteration = 116 | cost = 0.32214814
-----
Circuit = alternative_ckt_1 | Layers = 4 | At end of iteration = 117 | cost = 0.32142993
-----
Circuit = alternative_ckt_1 | Layers = 4 | At end of iteration = 118 | cost = 0.32072169
-----
Circuit = alternative_ckt_1 | Layers = 4 | At end of iteration = 119 | cost = 0.32002345
-----
REDUCING ALPHA TO 0.03162277660168379 at iteration = 120
-----
Circuit = alternative_ckt_1 | Layers = 4 | At end of iteration = 120 | cost = 0.31933522
-----
Circuit = alternative_ckt_1 | Layers = 4 | At end of iteration = 121 | cost = 0.31912008
-----
Circuit = alternative_ckt_1 | Layers = 4 | At end of iteration = 122 | cost = 0.31890591
-----
Circuit = alternative_ckt_1 | Layers = 4 | At end of iteration = 123 | cost = 0.31869271
-----
Circuit = alternative_ckt_1 | Layers = 4 | At end of iteration = 124 | cost = 0.31848050
-----
Circuit = alternative_ckt_1 | Layers = 4 | At end of iteration = 125 | cost = 0.31826928
-----
Circuit = alternative_ckt_1 | Layers = 4 | At end of iteration = 126 | cost = 0.31805904
-----
Circuit = alternative_ckt_1 | Layers = 4 | At end of iteration = 127 | cost = 0.31784980
-----
Circuit = alternative_ckt_1 | Layers = 4 | At end of iteration = 128 | cost = 0.31764154
-----
Circuit = alternative_ckt_1 | Layers = 4 | At end of iteration = 129 | cost = 0.31743426
-----
Circuit = alternative_ckt_1 | Layers = 4 | At end of iteration = 130 | cost = 0.31722797
-----
Circuit = alternative_ckt_1 | Layers = 4 | At end of iteration = 131 | cost = 0.31702266
-----
Circuit = alternative_ckt_1 | Layers = 4 | At end of iteration = 132 | cost = 0.31681834
-----
Circuit = alternative_ckt_1 | Layers = 4 | At end of iteration = 133 | cost = 0.31661500
-----
Circuit = alternative_ckt_1 | Layers = 4 | At end of iteration = 134 | cost = 0.31641263
-----
Circuit = alternative_ckt_1 | Layers = 4 | At end of iteration = 135 | cost = 0.31621124

```

```

-----
Circuit = alternative_ckt_1 | Layers = 4 | At end of iteration = 136 | cost = 0.31601083
-----
Circuit = alternative_ckt_1 | Layers = 4 | At end of iteration = 137 | cost = 0.31581139
-----
Circuit = alternative_ckt_1 | Layers = 4 | At end of iteration = 138 | cost = 0.31561293
-----
Circuit = alternative_ckt_1 | Layers = 4 | At end of iteration = 139 | cost = 0.31541543
-----
Circuit = alternative_ckt_1 | Layers = 4 | At end of iteration = 140 | cost = 0.31521890
-----
Circuit = alternative_ckt_1 | Layers = 4 | At end of iteration = 141 | cost = 0.31502333
-----
Circuit = alternative_ckt_1 | Layers = 4 | At end of iteration = 142 | cost = 0.31482872
-----
Circuit = alternative_ckt_1 | Layers = 4 | At end of iteration = 143 | cost = 0.31463508
-----
Circuit = alternative_ckt_1 | Layers = 4 | At end of iteration = 144 | cost = 0.31444239
-----
Circuit = alternative_ckt_1 | Layers = 4 | At end of iteration = 145 | cost = 0.31425066
-----
Circuit = alternative_ckt_1 | Layers = 4 | At end of iteration = 146 | cost = 0.31405987
-----
Circuit = alternative_ckt_1 | Layers = 4 | At end of iteration = 147 | cost = 0.31387004
-----
Circuit = alternative_ckt_1 | Layers = 4 | At end of iteration = 148 | cost = 0.31368115
-----
Circuit = alternative_ckt_1 | Layers = 4 | At end of iteration = 149 | cost = 0.31349321
-----
Circuit = alternative_ckt_1 | Layers = 4 | At end of iteration = 150 | cost = 0.31330620
-----
Circuit = alternative_ckt_1 | Layers = 4 | At end of iteration = 151 | cost = 0.31312013
-----
Circuit = alternative_ckt_1 | Layers = 4 | At end of iteration = 152 | cost = 0.31293500
-----
Circuit = alternative_ckt_1 | Layers = 4 | At end of iteration = 153 | cost = 0.31275079
-----
Circuit = alternative_ckt_1 | Layers = 4 | At end of iteration = 154 | cost = 0.31256751
-----
Circuit = alternative_ckt_1 | Layers = 4 | At end of iteration = 155 | cost = 0.31238516
-----
Circuit = alternative_ckt_1 | Layers = 4 | At end of iteration = 156 | cost = 0.31220373
-----
Circuit = alternative_ckt_1 | Layers = 4 | At end of iteration = 157 | cost = 0.31202321
-----
Circuit = alternative_ckt_1 | Layers = 4 | At end of iteration = 158 | cost = 0.31184361
-----
Circuit = alternative_ckt_1 | Layers = 4 | At end of iteration = 159 | cost = 0.31166492
-----

```

```

-----
Circuit = alternative_ckt_1 | Layers = 4 | At end of iteration = 160 | cost = 0.31148713
-----
Circuit = alternative_ckt_1 | Layers = 4 | At end of iteration = 161 | cost = 0.31131024
-----
Circuit = alternative_ckt_1 | Layers = 4 | At end of iteration = 162 | cost = 0.31113426
-----
Circuit = alternative_ckt_1 | Layers = 4 | At end of iteration = 163 | cost = 0.31095917
-----
Circuit = alternative_ckt_1 | Layers = 4 | At end of iteration = 164 | cost = 0.31078497
-----
Circuit = alternative_ckt_1 | Layers = 4 | At end of iteration = 165 | cost = 0.31061166
-----
Circuit = alternative_ckt_1 | Layers = 4 | At end of iteration = 166 | cost = 0.31043923
-----
Circuit = alternative_ckt_1 | Layers = 4 | At end of iteration = 167 | cost = 0.31026768
-----
Circuit = alternative_ckt_1 | Layers = 4 | At end of iteration = 168 | cost = 0.31009700
-----
Circuit = alternative_ckt_1 | Layers = 4 | At end of iteration = 169 | cost = 0.30992720
-----
Circuit = alternative_ckt_1 | Layers = 4 | At end of iteration = 170 | cost = 0.30975827
-----
Circuit = alternative_ckt_1 | Layers = 4 | At end of iteration = 171 | cost = 0.30959019
-----
Circuit = alternative_ckt_1 | Layers = 4 | At end of iteration = 172 | cost = 0.30942298
-----
Circuit = alternative_ckt_1 | Layers = 4 | At end of iteration = 173 | cost = 0.30925662
-----
Circuit = alternative_ckt_1 | Layers = 4 | At end of iteration = 174 | cost = 0.30909111
-----
Circuit = alternative_ckt_1 | Layers = 4 | At end of iteration = 175 | cost = 0.30892645
-----
Circuit = alternative_ckt_1 | Layers = 4 | At end of iteration = 176 | cost = 0.30876263
-----
Circuit = alternative_ckt_1 | Layers = 4 | At end of iteration = 177 | cost = 0.30859964
-----
Circuit = alternative_ckt_1 | Layers = 4 | At end of iteration = 178 | cost = 0.30843749
-----
Circuit = alternative_ckt_1 | Layers = 4 | At end of iteration = 179 | cost = 0.30827617
-----
Circuit = alternative_ckt_1 | Layers = 4 | At end of iteration = 180 | cost = 0.30811567
-----
Circuit = alternative_ckt_1 | Layers = 4 | At end of iteration = 181 | cost = 0.30795599
-----
Circuit = alternative_ckt_1 | Layers = 4 | At end of iteration = 182 | cost = 0.30779713
-----
Circuit = alternative_ckt_1 | Layers = 4 | At end of iteration = 183 | cost = 0.30763908
-----

```


Circuit = alternative_ckt_1 Layers = 4 At end of iteration = 184 cost = 0.30748183
Circuit = alternative_ckt_1 Layers = 4 At end of iteration = 185 cost = 0.30732538
Circuit = alternative_ckt_1 Layers = 4 At end of iteration = 186 cost = 0.30716973
Circuit = alternative_ckt_1 Layers = 4 At end of iteration = 187 cost = 0.30701487
Circuit = alternative_ckt_1 Layers = 4 At end of iteration = 188 cost = 0.30686080
Circuit = alternative_ckt_1 Layers = 4 At end of iteration = 189 cost = 0.30670752
Circuit = alternative_ckt_1 Layers = 4 At end of iteration = 190 cost = 0.30655501
Circuit = alternative_ckt_1 Layers = 4 At end of iteration = 191 cost = 0.30640327
Circuit = alternative_ckt_1 Layers = 4 At end of iteration = 192 cost = 0.30625230
Circuit = alternative_ckt_1 Layers = 4 At end of iteration = 193 cost = 0.30610210
Circuit = alternative_ckt_1 Layers = 4 At end of iteration = 194 cost = 0.30595265
Circuit = alternative_ckt_1 Layers = 4 At end of iteration = 195 cost = 0.30580396
Circuit = alternative_ckt_1 Layers = 4 At end of iteration = 196 cost = 0.30565602
Circuit = alternative_ckt_1 Layers = 4 At end of iteration = 197 cost = 0.30550882
Circuit = alternative_ckt_1 Layers = 4 At end of iteration = 198 cost = 0.30536236
Circuit = alternative_ckt_1 Layers = 4 At end of iteration = 199 cost = 0.30521663
Circuit = alternative_ckt_1 Layers = 4 At end of iteration = 200 cost = 0.30507163
Circuit = alternative_ckt_1 Layers = 4 At end of iteration = 201 cost = 0.30492736
Circuit = alternative_ckt_1 Layers = 4 At end of iteration = 202 cost = 0.30478381
Circuit = alternative_ckt_1 Layers = 4 At end of iteration = 203 cost = 0.30464097
Circuit = alternative_ckt_1 Layers = 4 At end of iteration = 204 cost = 0.30449884
Circuit = alternative_ckt_1 Layers = 4 At end of iteration = 205 cost = 0.30435742
Circuit = alternative_ckt_1 Layers = 4 At end of iteration = 206 cost = 0.30421670
Circuit = alternative_ckt_1 Layers = 4 At end of iteration = 207 cost = 0.30407667

```

-----
Circuit = alternative_ckt_1 | Layers = 4 | At end of iteration = 208 | cost = 0.30393733
-----
Circuit = alternative_ckt_1 | Layers = 4 | At end of iteration = 209 | cost = 0.30379867
-----
Circuit = alternative_ckt_1 | Layers = 4 | At end of iteration = 210 | cost = 0.30366069
-----
Circuit = alternative_ckt_1 | Layers = 4 | At end of iteration = 211 | cost = 0.30352339
-----
Circuit = alternative_ckt_1 | Layers = 4 | At end of iteration = 212 | cost = 0.30338676
-----
Circuit = alternative_ckt_1 | Layers = 4 | At end of iteration = 213 | cost = 0.30325079
-----
Circuit = alternative_ckt_1 | Layers = 4 | At end of iteration = 214 | cost = 0.30311548
-----
Circuit = alternative_ckt_1 | Layers = 4 | At end of iteration = 215 | cost = 0.30298082
-----
Circuit = alternative_ckt_1 | Layers = 4 | At end of iteration = 216 | cost = 0.30284682
-----
Circuit = alternative_ckt_1 | Layers = 4 | At end of iteration = 217 | cost = 0.30271345
-----
Circuit = alternative_ckt_1 | Layers = 4 | At end of iteration = 218 | cost = 0.30258073
-----
Circuit = alternative_ckt_1 | Layers = 4 | At end of iteration = 219 | cost = 0.30244863
-----
Circuit = alternative_ckt_1 | Layers = 4 | At end of iteration = 220 | cost = 0.30231717
-----
Circuit = alternative_ckt_1 | Layers = 4 | At end of iteration = 221 | cost = 0.30218633
-----
Circuit = alternative_ckt_1 | Layers = 4 | At end of iteration = 222 | cost = 0.30205610
-----
Circuit = alternative_ckt_1 | Layers = 4 | At end of iteration = 223 | cost = 0.30192649
-----
Circuit = alternative_ckt_1 | Layers = 4 | At end of iteration = 224 | cost = 0.30179749
-----
Circuit = alternative_ckt_1 | Layers = 4 | At end of iteration = 225 | cost = 0.30166909
-----
Circuit = alternative_ckt_1 | Layers = 4 | At end of iteration = 226 | cost = 0.30154128
-----
Circuit = alternative_ckt_1 | Layers = 4 | At end of iteration = 227 | cost = 0.30141407
-----
Circuit = alternative_ckt_1 | Layers = 4 | At end of iteration = 228 | cost = 0.30128745
-----
Circuit = alternative_ckt_1 | Layers = 4 | At end of iteration = 229 | cost = 0.30116140
-----
Circuit = alternative_ckt_1 | Layers = 4 | At end of iteration = 230 | cost = 0.30103593
-----
Circuit = alternative_ckt_1 | Layers = 4 | At end of iteration = 231 | cost = 0.30091104
-----

```

Circuit = alternative_ckt_1 Layers = 4 At end of iteration = 232 cost = 0.30078671
Circuit = alternative_ckt_1 Layers = 4 At end of iteration = 233 cost = 0.30066294
Circuit = alternative_ckt_1 Layers = 4 At end of iteration = 234 cost = 0.30053972
Circuit = alternative_ckt_1 Layers = 4 At end of iteration = 235 cost = 0.30041706
Circuit = alternative_ckt_1 Layers = 4 At end of iteration = 236 cost = 0.30029493
Circuit = alternative_ckt_1 Layers = 4 At end of iteration = 237 cost = 0.30017335
Circuit = alternative_ckt_1 Layers = 4 At end of iteration = 238 cost = 0.30005231
Circuit = alternative_ckt_1 Layers = 4 At end of iteration = 239 cost = 0.29993179
Circuit = alternative_ckt_1 Layers = 4 At end of iteration = 240 cost = 0.29981180
Circuit = alternative_ckt_1 Layers = 4 At end of iteration = 241 cost = 0.29969232
Circuit = alternative_ckt_1 Layers = 4 At end of iteration = 242 cost = 0.29957336
Circuit = alternative_ckt_1 Layers = 4 At end of iteration = 243 cost = 0.29945491
Circuit = alternative_ckt_1 Layers = 4 At end of iteration = 244 cost = 0.29933696
Circuit = alternative_ckt_1 Layers = 4 At end of iteration = 245 cost = 0.29921950
Circuit = alternative_ckt_1 Layers = 4 At end of iteration = 246 cost = 0.29910254
Circuit = alternative_ckt_1 Layers = 4 At end of iteration = 247 cost = 0.29898607
Circuit = alternative_ckt_1 Layers = 4 At end of iteration = 248 cost = 0.29887008
Circuit = alternative_ckt_1 Layers = 4 At end of iteration = 249 cost = 0.29875456
Circuit = alternative_ckt_1 Layers = 4 At end of iteration = 250 cost = 0.29863952
Circuit = alternative_ckt_1 Layers = 4 At end of iteration = 251 cost = 0.29852494
Circuit = alternative_ckt_1 Layers = 4 At end of iteration = 252 cost = 0.29841082
Circuit = alternative_ckt_1 Layers = 4 At end of iteration = 253 cost = 0.29829716
Circuit = alternative_ckt_1 Layers = 4 At end of iteration = 254 cost = 0.29818395
Circuit = alternative_ckt_1 Layers = 4 At end of iteration = 255 cost = 0.29807118

Circuit = alternative_ckt_1 Layers = 4 At end of iteration = 256 cost = 0.29795885
Circuit = alternative_ckt_1 Layers = 4 At end of iteration = 257 cost = 0.29784696
Circuit = alternative_ckt_1 Layers = 4 At end of iteration = 258 cost = 0.29773550
Circuit = alternative_ckt_1 Layers = 4 At end of iteration = 259 cost = 0.29762446
Circuit = alternative_ckt_1 Layers = 4 At end of iteration = 260 cost = 0.29751384
Circuit = alternative_ckt_1 Layers = 4 At end of iteration = 261 cost = 0.29740363
Circuit = alternative_ckt_1 Layers = 4 At end of iteration = 262 cost = 0.29729383
Circuit = alternative_ckt_1 Layers = 4 At end of iteration = 263 cost = 0.29718443
Circuit = alternative_ckt_1 Layers = 4 At end of iteration = 264 cost = 0.29707543
Circuit = alternative_ckt_1 Layers = 4 At end of iteration = 265 cost = 0.29696682
Circuit = alternative_ckt_1 Layers = 4 At end of iteration = 266 cost = 0.29685860
Circuit = alternative_ckt_1 Layers = 4 At end of iteration = 267 cost = 0.29675077
Circuit = alternative_ckt_1 Layers = 4 At end of iteration = 268 cost = 0.29664330
Circuit = alternative_ckt_1 Layers = 4 At end of iteration = 269 cost = 0.29653621
Circuit = alternative_ckt_1 Layers = 4 At end of iteration = 270 cost = 0.29642949
Circuit = alternative_ckt_1 Layers = 4 At end of iteration = 271 cost = 0.29632312
Circuit = alternative_ckt_1 Layers = 4 At end of iteration = 272 cost = 0.29621712
Circuit = alternative_ckt_1 Layers = 4 At end of iteration = 273 cost = 0.29611146
Circuit = alternative_ckt_1 Layers = 4 At end of iteration = 274 cost = 0.29600615
Circuit = alternative_ckt_1 Layers = 4 At end of iteration = 275 cost = 0.29590117
Circuit = alternative_ckt_1 Layers = 4 At end of iteration = 276 cost = 0.29579653
Circuit = alternative_ckt_1 Layers = 4 At end of iteration = 277 cost = 0.29569222
Circuit = alternative_ckt_1 Layers = 4 At end of iteration = 278 cost = 0.29558824
Circuit = alternative_ckt_1 Layers = 4 At end of iteration = 279 cost = 0.29548457

```

-----
Circuit = alternative_ckt_1 | Layers = 4 | At end of iteration = 280 | cost = 0.29538122
-----
Circuit = alternative_ckt_1 | Layers = 4 | At end of iteration = 281 | cost = 0.29527818
-----
Circuit = alternative_ckt_1 | Layers = 4 | At end of iteration = 282 | cost = 0.29517543
-----
Circuit = alternative_ckt_1 | Layers = 4 | At end of iteration = 283 | cost = 0.29507299
-----
Circuit = alternative_ckt_1 | Layers = 4 | At end of iteration = 284 | cost = 0.29497084
-----
Circuit = alternative_ckt_1 | Layers = 4 | At end of iteration = 285 | cost = 0.29486898
-----
Circuit = alternative_ckt_1 | Layers = 4 | At end of iteration = 286 | cost = 0.29476740
-----
Circuit = alternative_ckt_1 | Layers = 4 | At end of iteration = 287 | cost = 0.29466609
-----
Circuit = alternative_ckt_1 | Layers = 4 | At end of iteration = 288 | cost = 0.29456506
-----
Circuit = alternative_ckt_1 | Layers = 4 | At end of iteration = 289 | cost = 0.29446430
-----
Circuit = alternative_ckt_1 | Layers = 4 | At end of iteration = 290 | cost = 0.29436379
-----
Circuit = alternative_ckt_1 | Layers = 4 | At end of iteration = 291 | cost = 0.29426355
-----
Circuit = alternative_ckt_1 | Layers = 4 | At end of iteration = 292 | cost = 0.29416355
-----
Circuit = alternative_ckt_1 | Layers = 4 | At end of iteration = 293 | cost = 0.29406380
-----
Circuit = alternative_ckt_1 | Layers = 4 | At end of iteration = 294 | cost = 0.29396429
-----
Circuit = alternative_ckt_1 | Layers = 4 | At end of iteration = 295 | cost = 0.29386502
-----
Circuit = alternative_ckt_1 | Layers = 4 | At end of iteration = 296 | cost = 0.29376597
-----
Circuit = alternative_ckt_1 | Layers = 4 | At end of iteration = 297 | cost = 0.29366716
-----
Circuit = alternative_ckt_1 | Layers = 4 | At end of iteration = 298 | cost = 0.29356856
-----
Circuit = alternative_ckt_1 | Layers = 4 | At end of iteration = 299 | cost = 0.29347018
-----
Circuit = alternative_ckt_1 | Layers = 4 | At end of iteration = 300 | cost = 0.29337200
-----

```

Optimization complete.

After optimization, the optimal parameters are

```
{Parameter(thetaz3[0]): -0.2023889018505058, Parameter(thetax1[0]): -0.15590100242134144, Par
```

The output state for these parameters is

```
[[ 0.19903574+0.28880572j]
```

```
[ 0.04239721+0.2247168j ]
[ 0.28499285+0.0746045j ]
[ 0.17432456+0.2040536j ]
[ 0.18394516+0.0902319j ]
[ 0.16941993+0.10722114j]
[ 0.17954964+0.10573258j]
[ 0.02502341+0.04534729j]
[ 0.2886245 +0.03002551j]
[ 0.16548758+0.02178114j]
[ 0.28128577+0.07178384j]
[-0.00575121+0.03134499j]
[ 0.27989827+0.20216748j]
[ 0.10714815+0.01526899j]
[ 0.23681445+0.29391055j]
[ 0.25825465+0.01204762j]]
```

```
-----
Circuit = alternative_ckt_1 Layers = 4 Cost after optimization = 0.2933720080316503
-----
```

```
Circuit alternative_ckt_1 constructed with 5 layers. Number of parameters = 60 .
-----
```

Initialized circuit parameters prior to gradient descent randomly as follows:

```
idx = theta4[0] params = 0.03719052023213644
idx = thetaz7[0] params = 0.04312312828020062
idx = theta2[0] params = 0.0004994971757621869
idx = theta8[0] params = 0.03444025418170515
idx = theta2[1] params = 0.046881140646663634
idx = thetaz7[3] params = 0.02164226791611938
idx = thetax7[1] params = 0.028343942770291508
idx = thetaz7[1] params = 0.013510378554063363
idx = thetax5[1] params = 0.022782810868909098
idx = theta4[3] params = 0.00573789773068969
idx = thetaz5[1] params = 0.039532273767073196
idx = thetax5[2] params = 0.018375156312795238
idx = thetax7[2] params = 0.02421115885861306
idx = thetax5[3] params = 0.01671278315727628
idx = thetaz7[2] params = 0.006172454610576922
idx = thetaz1[0] params = 0.016655522656847783
idx = thetax1[1] params = 0.04662197117509747
idx = theta6[0] params = 0.009378499198132518
idx = thetaz3[0] params = 0.030481776612878
idx = thetaz3[3] params = 0.006238299240088347
idx = theta10[1] params = 0.046316344013782464
idx = thetax3[0] params = 0.002833116050508433
idx = theta6[2] params = 0.009568165097689485
idx = thetaz1[1] params = 0.003778807686699465
idx = thetaz9[0] params = 0.04761132655555178
idx = theta10[3] params = 0.02912836626547597
idx = theta2[2] params = 0.03277867333581935
```

```

idx = theta6[1] params = 0.0012507649722014293
idx = theta10[0] params = 0.03265668670981592
idx = theta8[3] params = 0.042510362504139115
idx = theta8[1] params = 0.028964664980450857
idx = thetax1[2] params = 0.02606701333987876
idx = thetax7[0] params = 0.04507588560641085
idx = thetax9[0] params = 0.01594882076679191
idx = theta4[2] params = 0.03973242205283862
idx = theta6[3] params = 0.009337792350935193
idx = theta10[2] params = 0.0032829280606491377
idx = thetax1[2] params = 0.019944497772341908
idx = theta4[1] params = 0.040543302128205796
idx = thetax9[1] params = 0.018661219094017113
idx = thetax9[3] params = 0.022765429249395765
idx = thetax5[0] params = 0.04496189581938223
idx = thetax9[3] params = 0.04421309636000539
idx = thetax9[1] params = 0.032067148697469475
idx = thetax1[0] params = 0.03316055200997197
idx = theta2[3] params = 0.038381406528673896
idx = thetax5[2] params = 0.014346822771396907
idx = thetax9[2] params = 0.017358921226698288
idx = thetax5[0] params = 0.036248132522104036
idx = thetax3[2] params = 0.03539050548659198
idx = thetax3[2] params = 0.01607370215812653
idx = thetax3[3] params = 0.007381200069874755
idx = theta8[2] params = 0.02358393517371811
idx = thetax5[3] params = 0.0009009332204443055
idx = thetax7[3] params = 0.015027195664715637
idx = thetax9[2] params = 0.037934352344020754
idx = thetax3[1] params = 0.02983057071232084
idx = thetax1[3] params = 0.023111461319399895
idx = thetax3[1] params = 0.02586128220807936
idx = thetax1[3] params = 0.002230543419827341

```

```

-----
Circuit = alternative_ckt_1 | Layers = 5 | At end of iteration = 1 | cost = 1.2151522076

```

```

-----
Circuit = alternative_ckt_1 | Layers = 5 | At end of iteration = 2 | cost = 1.1869132990

```

```

-----
Circuit = alternative_ckt_1 | Layers = 5 | At end of iteration = 3 | cost = 1.1554857239

```

```

-----
Circuit = alternative_ckt_1 | Layers = 5 | At end of iteration = 4 | cost = 1.1121301926

```

```

-----
Circuit = alternative_ckt_1 | Layers = 5 | At end of iteration = 5 | cost = 1.0456093997

```

```

-----
Circuit = alternative_ckt_1 | Layers = 5 | At end of iteration = 6 | cost = 0.9452391955

```

```

-----
Circuit = alternative_ckt_1 | Layers = 5 | At end of iteration = 7 | cost = 0.8482414159
-----

```

Circuit =	alternative_ckt_1		Layers =	5		At end of iteration =	8		cost =	0.7897398632
Circuit =	alternative_ckt_1		Layers =	5		At end of iteration =	9		cost =	0.7545327474
Circuit =	alternative_ckt_1		Layers =	5		At end of iteration =	10		cost =	0.732466249
Circuit =	alternative_ckt_1		Layers =	5		At end of iteration =	11		cost =	0.715713539
Circuit =	alternative_ckt_1		Layers =	5		At end of iteration =	12		cost =	0.694204644
Circuit =	alternative_ckt_1		Layers =	5		At end of iteration =	13		cost =	0.706523280
Circuit =	alternative_ckt_1		Layers =	5		At end of iteration =	14		cost =	0.863545846
Circuit =	alternative_ckt_1		Layers =	5		At end of iteration =	15		cost =	1.211657767
Circuit =	alternative_ckt_1		Layers =	5		At end of iteration =	16		cost =	0.727820178
Circuit =	alternative_ckt_1		Layers =	5		At end of iteration =	17		cost =	0.802630521
Circuit =	alternative_ckt_1		Layers =	5		At end of iteration =	18		cost =	1.092809679
Circuit =	alternative_ckt_1		Layers =	5		At end of iteration =	19		cost =	0.867975107
Circuit =	alternative_ckt_1		Layers =	5		At end of iteration =	20		cost =	0.947280474
Circuit =	alternative_ckt_1		Layers =	5		At end of iteration =	21		cost =	0.903549917
Circuit =	alternative_ckt_1		Layers =	5		At end of iteration =	22		cost =	0.883935033
Circuit =	alternative_ckt_1		Layers =	5		At end of iteration =	23		cost =	0.894786124
Circuit =	alternative_ckt_1		Layers =	5		At end of iteration =	24		cost =	0.899548222
Circuit =	alternative_ckt_1		Layers =	5		At end of iteration =	25		cost =	0.871833787
Circuit =	alternative_ckt_1		Layers =	5		At end of iteration =	26		cost =	0.887755385
Circuit =	alternative_ckt_1		Layers =	5		At end of iteration =	27		cost =	0.864924221
Circuit =	alternative_ckt_1		Layers =	5		At end of iteration =	28		cost =	0.894564855
Circuit =	alternative_ckt_1		Layers =	5		At end of iteration =	29		cost =	0.848461086
Circuit =	alternative_ckt_1		Layers =	5		At end of iteration =	30		cost =	0.896842249
Circuit =	alternative_ckt_1		Layers =	5		At end of iteration =	31		cost =	0.841302017


```

Circuit = alternative_ckt_1 | Layers = 5 | At end of iteration = 32 | cost = 0.902581132
-----
Circuit = alternative_ckt_1 | Layers = 5 | At end of iteration = 33 | cost = 0.828314220
-----
Circuit = alternative_ckt_1 | Layers = 5 | At end of iteration = 34 | cost = 0.905965041
-----
Circuit = alternative_ckt_1 | Layers = 5 | At end of iteration = 35 | cost = 0.822086225
-----
Circuit = alternative_ckt_1 | Layers = 5 | At end of iteration = 36 | cost = 0.911471712
-----
Circuit = alternative_ckt_1 | Layers = 5 | At end of iteration = 37 | cost = 0.810739122
-----
Circuit = alternative_ckt_1 | Layers = 5 | At end of iteration = 38 | cost = 0.913742754
-----
Circuit = alternative_ckt_1 | Layers = 5 | At end of iteration = 39 | cost = 0.806522007
-----
REDUCING ALPHA TO 0.31622776601683794 at iteration = 40
-----
Circuit = alternative_ckt_1 | Layers = 5 | At end of iteration = 40 | cost = 0.918768751
-----
Circuit = alternative_ckt_1 | Layers = 5 | At end of iteration = 41 | cost = 0.681079323
-----
Circuit = alternative_ckt_1 | Layers = 5 | At end of iteration = 42 | cost = 0.560848133
-----
Circuit = alternative_ckt_1 | Layers = 5 | At end of iteration = 43 | cost = 0.534942795
-----
Circuit = alternative_ckt_1 | Layers = 5 | At end of iteration = 44 | cost = 0.510012405
-----
Circuit = alternative_ckt_1 | Layers = 5 | At end of iteration = 45 | cost = 0.490079473
-----
Circuit = alternative_ckt_1 | Layers = 5 | At end of iteration = 46 | cost = 0.469728955
-----
Circuit = alternative_ckt_1 | Layers = 5 | At end of iteration = 47 | cost = 0.452689784
-----
Circuit = alternative_ckt_1 | Layers = 5 | At end of iteration = 48 | cost = 0.433972344
-----
Circuit = alternative_ckt_1 | Layers = 5 | At end of iteration = 49 | cost = 0.420834728
-----
Circuit = alternative_ckt_1 | Layers = 5 | At end of iteration = 50 | cost = 0.402273495
-----
Circuit = alternative_ckt_1 | Layers = 5 | At end of iteration = 51 | cost = 0.402941067
-----
Circuit = alternative_ckt_1 | Layers = 5 | At end of iteration = 52 | cost = 0.391901747
-----
Circuit = alternative_ckt_1 | Layers = 5 | At end of iteration = 53 | cost = 0.505213423
-----
Circuit = alternative_ckt_1 | Layers = 5 | At end of iteration = 54 | cost = 0.560119055
-----

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Circuit =	alternative_ckt_1		Layers =	5		At end of iteration =	55		cost =	0.641663740
Circuit =	alternative_ckt_1		Layers =	5		At end of iteration =	56		cost =	0.518197115
Circuit =	alternative_ckt_1		Layers =	5		At end of iteration =	57		cost =	0.646896418
Circuit =	alternative_ckt_1		Layers =	5		At end of iteration =	58		cost =	0.507867866
Circuit =	alternative_ckt_1		Layers =	5		At end of iteration =	59		cost =	0.648668132
Circuit =	alternative_ckt_1		Layers =	5		At end of iteration =	60		cost =	0.503673882
Circuit =	alternative_ckt_1		Layers =	5		At end of iteration =	61		cost =	0.652031455
Circuit =	alternative_ckt_1		Layers =	5		At end of iteration =	62		cost =	0.499918271
Circuit =	alternative_ckt_1		Layers =	5		At end of iteration =	63		cost =	0.656148228
Circuit =	alternative_ckt_1		Layers =	5		At end of iteration =	64		cost =	0.496183800
Circuit =	alternative_ckt_1		Layers =	5		At end of iteration =	65		cost =	0.660380517
Circuit =	alternative_ckt_1		Layers =	5		At end of iteration =	66		cost =	0.492523663
Circuit =	alternative_ckt_1		Layers =	5		At end of iteration =	67		cost =	0.664438846
Circuit =	alternative_ckt_1		Layers =	5		At end of iteration =	68		cost =	0.489003648
Circuit =	alternative_ckt_1		Layers =	5		At end of iteration =	69		cost =	0.668208935
Circuit =	alternative_ckt_1		Layers =	5		At end of iteration =	70		cost =	0.485665561
Circuit =	alternative_ckt_1		Layers =	5		At end of iteration =	71		cost =	0.671656351
Circuit =	alternative_ckt_1		Layers =	5		At end of iteration =	72		cost =	0.482530507
Circuit =	alternative_ckt_1		Layers =	5		At end of iteration =	73		cost =	0.674782112
Circuit =	alternative_ckt_1		Layers =	5		At end of iteration =	74		cost =	0.479605623
Circuit =	alternative_ckt_1		Layers =	5		At end of iteration =	75		cost =	0.677602405
Circuit =	alternative_ckt_1		Layers =	5		At end of iteration =	76		cost =	0.476889355
Circuit =	alternative_ckt_1		Layers =	5		At end of iteration =	77		cost =	0.680139269
Circuit =	alternative_ckt_1		Layers =	5		At end of iteration =	78		cost =	0.474375019

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Circuit = alternative_ckt_1 | Layers = 5 | At end of iteration = 79 | cost = 0.682416288
-----
REDUCING ALPHA TO 0.09999999999999999 at iteration = 80
-----
Circuit = alternative_ckt_1 | Layers = 5 | At end of iteration = 80 | cost = 0.472053084
-----
Circuit = alternative_ckt_1 | Layers = 5 | At end of iteration = 81 | cost = 0.325310783
-----
Circuit = alternative_ckt_1 | Layers = 5 | At end of iteration = 82 | cost = 0.325558868
-----
Circuit = alternative_ckt_1 | Layers = 5 | At end of iteration = 83 | cost = 0.320734502
-----
Circuit = alternative_ckt_1 | Layers = 5 | At end of iteration = 84 | cost = 0.320135151
-----
Circuit = alternative_ckt_1 | Layers = 5 | At end of iteration = 85 | cost = 0.318898355
-----
Circuit = alternative_ckt_1 | Layers = 5 | At end of iteration = 86 | cost = 0.318116297
-----
Circuit = alternative_ckt_1 | Layers = 5 | At end of iteration = 87 | cost = 0.317339092
-----
Circuit = alternative_ckt_1 | Layers = 5 | At end of iteration = 88 | cost = 0.316648472
-----
Circuit = alternative_ckt_1 | Layers = 5 | At end of iteration = 89 | cost = 0.315978985
-----
Circuit = alternative_ckt_1 | Layers = 5 | At end of iteration = 90 | cost = 0.315331255
-----
Circuit = alternative_ckt_1 | Layers = 5 | At end of iteration = 91 | cost = 0.314692630
-----
Circuit = alternative_ckt_1 | Layers = 5 | At end of iteration = 92 | cost = 0.314061278
-----
Circuit = alternative_ckt_1 | Layers = 5 | At end of iteration = 93 | cost = 0.313434894
-----
Circuit = alternative_ckt_1 | Layers = 5 | At end of iteration = 94 | cost = 0.312813328
-----
Circuit = alternative_ckt_1 | Layers = 5 | At end of iteration = 95 | cost = 0.312196600
-----
Circuit = alternative_ckt_1 | Layers = 5 | At end of iteration = 96 | cost = 0.311585092
-----
Circuit = alternative_ckt_1 | Layers = 5 | At end of iteration = 97 | cost = 0.310979130
-----
Circuit = alternative_ckt_1 | Layers = 5 | At end of iteration = 98 | cost = 0.310378977
-----
Circuit = alternative_ckt_1 | Layers = 5 | At end of iteration = 99 | cost = 0.309784747
-----
Circuit = alternative_ckt_1 | Layers = 5 | At end of iteration = 100 | cost = 0.309196411
-----
Circuit = alternative_ckt_1 | Layers = 5 | At end of iteration = 101 | cost = 0.30861380
-----

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```

Circuit = alternative_ckt_1 | Layers = 5 | At end of iteration = 102 | cost = 0.30803663
-----
Circuit = alternative_ckt_1 | Layers = 5 | At end of iteration = 103 | cost = 0.30746449
-----
Circuit = alternative_ckt_1 | Layers = 5 | At end of iteration = 104 | cost = 0.30689690
-----
Circuit = alternative_ckt_1 | Layers = 5 | At end of iteration = 105 | cost = 0.30633333
-----
Circuit = alternative_ckt_1 | Layers = 5 | At end of iteration = 106 | cost = 0.30577316
-----
Circuit = alternative_ckt_1 | Layers = 5 | At end of iteration = 107 | cost = 0.30521577
-----
Circuit = alternative_ckt_1 | Layers = 5 | At end of iteration = 108 | cost = 0.30466048
-----
Circuit = alternative_ckt_1 | Layers = 5 | At end of iteration = 109 | cost = 0.30410663
-----
Circuit = alternative_ckt_1 | Layers = 5 | At end of iteration = 110 | cost = 0.30355353
-----
Circuit = alternative_ckt_1 | Layers = 5 | At end of iteration = 111 | cost = 0.30300048
-----
Circuit = alternative_ckt_1 | Layers = 5 | At end of iteration = 112 | cost = 0.30244678
-----
Circuit = alternative_ckt_1 | Layers = 5 | At end of iteration = 113 | cost = 0.30189176
-----
Circuit = alternative_ckt_1 | Layers = 5 | At end of iteration = 114 | cost = 0.30133473
-----
Circuit = alternative_ckt_1 | Layers = 5 | At end of iteration = 115 | cost = 0.30077500
-----
Circuit = alternative_ckt_1 | Layers = 5 | At end of iteration = 116 | cost = 0.30021191
-----
Circuit = alternative_ckt_1 | Layers = 5 | At end of iteration = 117 | cost = 0.29964479
-----
Circuit = alternative_ckt_1 | Layers = 5 | At end of iteration = 118 | cost = 0.29907299
-----
Circuit = alternative_ckt_1 | Layers = 5 | At end of iteration = 119 | cost = 0.29849585
-----
REDUCING ALPHA TO 0.03162277660168379 at iteration = 120
-----
Circuit = alternative_ckt_1 | Layers = 5 | At end of iteration = 120 | cost = 0.29791274
-----
Circuit = alternative_ckt_1 | Layers = 5 | At end of iteration = 121 | cost = 0.29772678
-----
Circuit = alternative_ckt_1 | Layers = 5 | At end of iteration = 122 | cost = 0.29754014
-----
Circuit = alternative_ckt_1 | Layers = 5 | At end of iteration = 123 | cost = 0.29735279
-----
Circuit = alternative_ckt_1 | Layers = 5 | At end of iteration = 124 | cost = 0.29716472
-----

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Circuit = alternative_ckt_1 Layers = 5 At end of iteration = 125 cost = 0.29697588
Circuit = alternative_ckt_1 Layers = 5 At end of iteration = 126 cost = 0.29678627
Circuit = alternative_ckt_1 Layers = 5 At end of iteration = 127 cost = 0.29659586
Circuit = alternative_ckt_1 Layers = 5 At end of iteration = 128 cost = 0.29640463
Circuit = alternative_ckt_1 Layers = 5 At end of iteration = 129 cost = 0.29621256
Circuit = alternative_ckt_1 Layers = 5 At end of iteration = 130 cost = 0.29601963
Circuit = alternative_ckt_1 Layers = 5 At end of iteration = 131 cost = 0.29582582
Circuit = alternative_ckt_1 Layers = 5 At end of iteration = 132 cost = 0.29563111
Circuit = alternative_ckt_1 Layers = 5 At end of iteration = 133 cost = 0.29543549
Circuit = alternative_ckt_1 Layers = 5 At end of iteration = 134 cost = 0.29523893
Circuit = alternative_ckt_1 Layers = 5 At end of iteration = 135 cost = 0.29504142
Circuit = alternative_ckt_1 Layers = 5 At end of iteration = 136 cost = 0.29484293
Circuit = alternative_ckt_1 Layers = 5 At end of iteration = 137 cost = 0.29464344
Circuit = alternative_ckt_1 Layers = 5 At end of iteration = 138 cost = 0.29444295
Circuit = alternative_ckt_1 Layers = 5 At end of iteration = 139 cost = 0.29424141
Circuit = alternative_ckt_1 Layers = 5 At end of iteration = 140 cost = 0.29403883
Circuit = alternative_ckt_1 Layers = 5 At end of iteration = 141 cost = 0.29383518
Circuit = alternative_ckt_1 Layers = 5 At end of iteration = 142 cost = 0.29363044
Circuit = alternative_ckt_1 Layers = 5 At end of iteration = 143 cost = 0.29342458
Circuit = alternative_ckt_1 Layers = 5 At end of iteration = 144 cost = 0.29321760
Circuit = alternative_ckt_1 Layers = 5 At end of iteration = 145 cost = 0.29300948
Circuit = alternative_ckt_1 Layers = 5 At end of iteration = 146 cost = 0.29280018
Circuit = alternative_ckt_1 Layers = 5 At end of iteration = 147 cost = 0.29258971
Circuit = alternative_ckt_1 Layers = 5 At end of iteration = 148 cost = 0.29237803

Circuit = alternative_ckt_1 Layers = 5 At end of iteration = 149 cost = 0.29216512
Circuit = alternative_ckt_1 Layers = 5 At end of iteration = 150 cost = 0.29195098
Circuit = alternative_ckt_1 Layers = 5 At end of iteration = 151 cost = 0.29173558
Circuit = alternative_ckt_1 Layers = 5 At end of iteration = 152 cost = 0.29151890
Circuit = alternative_ckt_1 Layers = 5 At end of iteration = 153 cost = 0.29130092
Circuit = alternative_ckt_1 Layers = 5 At end of iteration = 154 cost = 0.29108162
Circuit = alternative_ckt_1 Layers = 5 At end of iteration = 155 cost = 0.29086099
Circuit = alternative_ckt_1 Layers = 5 At end of iteration = 156 cost = 0.29063901
Circuit = alternative_ckt_1 Layers = 5 At end of iteration = 157 cost = 0.29041566
Circuit = alternative_ckt_1 Layers = 5 At end of iteration = 158 cost = 0.29019092
Circuit = alternative_ckt_1 Layers = 5 At end of iteration = 159 cost = 0.28996476
Circuit = alternative_ckt_1 Layers = 5 At end of iteration = 160 cost = 0.28973719
Circuit = alternative_ckt_1 Layers = 5 At end of iteration = 161 cost = 0.28950816
Circuit = alternative_ckt_1 Layers = 5 At end of iteration = 162 cost = 0.28927767
Circuit = alternative_ckt_1 Layers = 5 At end of iteration = 163 cost = 0.28904571
Circuit = alternative_ckt_1 Layers = 5 At end of iteration = 164 cost = 0.28881224
Circuit = alternative_ckt_1 Layers = 5 At end of iteration = 165 cost = 0.28857725
Circuit = alternative_ckt_1 Layers = 5 At end of iteration = 166 cost = 0.28834072
Circuit = alternative_ckt_1 Layers = 5 At end of iteration = 167 cost = 0.28810264
Circuit = alternative_ckt_1 Layers = 5 At end of iteration = 168 cost = 0.28786299
Circuit = alternative_ckt_1 Layers = 5 At end of iteration = 169 cost = 0.28762175
Circuit = alternative_ckt_1 Layers = 5 At end of iteration = 170 cost = 0.28737890
Circuit = alternative_ckt_1 Layers = 5 At end of iteration = 171 cost = 0.28713442
Circuit = alternative_ckt_1 Layers = 5 At end of iteration = 172 cost = 0.28688830

Circuit = alternative_ckt_1 Layers = 5 At end of iteration = 173 cost = 0.28664051
Circuit = alternative_ckt_1 Layers = 5 At end of iteration = 174 cost = 0.28639105
Circuit = alternative_ckt_1 Layers = 5 At end of iteration = 175 cost = 0.28613988
Circuit = alternative_ckt_1 Layers = 5 At end of iteration = 176 cost = 0.28588701
Circuit = alternative_ckt_1 Layers = 5 At end of iteration = 177 cost = 0.28563240
Circuit = alternative_ckt_1 Layers = 5 At end of iteration = 178 cost = 0.28537604
Circuit = alternative_ckt_1 Layers = 5 At end of iteration = 179 cost = 0.28511791
Circuit = alternative_ckt_1 Layers = 5 At end of iteration = 180 cost = 0.28485801
Circuit = alternative_ckt_1 Layers = 5 At end of iteration = 181 cost = 0.28459629
Circuit = alternative_ckt_1 Layers = 5 At end of iteration = 182 cost = 0.28433277
Circuit = alternative_ckt_1 Layers = 5 At end of iteration = 183 cost = 0.28406740
Circuit = alternative_ckt_1 Layers = 5 At end of iteration = 184 cost = 0.28380019
Circuit = alternative_ckt_1 Layers = 5 At end of iteration = 185 cost = 0.28353111
Circuit = alternative_ckt_1 Layers = 5 At end of iteration = 186 cost = 0.28326014
Circuit = alternative_ckt_1 Layers = 5 At end of iteration = 187 cost = 0.28298727
Circuit = alternative_ckt_1 Layers = 5 At end of iteration = 188 cost = 0.28271248
Circuit = alternative_ckt_1 Layers = 5 At end of iteration = 189 cost = 0.28243576
Circuit = alternative_ckt_1 Layers = 5 At end of iteration = 190 cost = 0.28215710
Circuit = alternative_ckt_1 Layers = 5 At end of iteration = 191 cost = 0.28187646
Circuit = alternative_ckt_1 Layers = 5 At end of iteration = 192 cost = 0.28159385
Circuit = alternative_ckt_1 Layers = 5 At end of iteration = 193 cost = 0.28130924
Circuit = alternative_ckt_1 Layers = 5 At end of iteration = 194 cost = 0.28102262
Circuit = alternative_ckt_1 Layers = 5 At end of iteration = 195 cost = 0.28073397
Circuit = alternative_ckt_1 Layers = 5 At end of iteration = 196 cost = 0.28044329

Circuit = alternative_ckt_1 Layers = 5 At end of iteration = 197 cost = 0.28015054
Circuit = alternative_ckt_1 Layers = 5 At end of iteration = 198 cost = 0.27985573
Circuit = alternative_ckt_1 Layers = 5 At end of iteration = 199 cost = 0.27955883
Circuit = alternative_ckt_1 Layers = 5 At end of iteration = 200 cost = 0.27925983
Circuit = alternative_ckt_1 Layers = 5 At end of iteration = 201 cost = 0.27895872
Circuit = alternative_ckt_1 Layers = 5 At end of iteration = 202 cost = 0.27865548
Circuit = alternative_ckt_1 Layers = 5 At end of iteration = 203 cost = 0.27835011
Circuit = alternative_ckt_1 Layers = 5 At end of iteration = 204 cost = 0.27804257
Circuit = alternative_ckt_1 Layers = 5 At end of iteration = 205 cost = 0.27773288
Circuit = alternative_ckt_1 Layers = 5 At end of iteration = 206 cost = 0.27742100
Circuit = alternative_ckt_1 Layers = 5 At end of iteration = 207 cost = 0.27710694
Circuit = alternative_ckt_1 Layers = 5 At end of iteration = 208 cost = 0.27679067
Circuit = alternative_ckt_1 Layers = 5 At end of iteration = 209 cost = 0.27647219
Circuit = alternative_ckt_1 Layers = 5 At end of iteration = 210 cost = 0.27615148
Circuit = alternative_ckt_1 Layers = 5 At end of iteration = 211 cost = 0.27582853
Circuit = alternative_ckt_1 Layers = 5 At end of iteration = 212 cost = 0.27550333
Circuit = alternative_ckt_1 Layers = 5 At end of iteration = 213 cost = 0.27517588
Circuit = alternative_ckt_1 Layers = 5 At end of iteration = 214 cost = 0.27484615
Circuit = alternative_ckt_1 Layers = 5 At end of iteration = 215 cost = 0.27451415
Circuit = alternative_ckt_1 Layers = 5 At end of iteration = 216 cost = 0.27417985
Circuit = alternative_ckt_1 Layers = 5 At end of iteration = 217 cost = 0.27384326
Circuit = alternative_ckt_1 Layers = 5 At end of iteration = 218 cost = 0.27350436
Circuit = alternative_ckt_1 Layers = 5 At end of iteration = 219 cost = 0.27316315
Circuit = alternative_ckt_1 Layers = 5 At end of iteration = 220 cost = 0.27281961

Circuit = alternative_ckt_1 Layers = 5 At end of iteration = 221 cost = 0.27247374
Circuit = alternative_ckt_1 Layers = 5 At end of iteration = 222 cost = 0.27212553
Circuit = alternative_ckt_1 Layers = 5 At end of iteration = 223 cost = 0.27177498
Circuit = alternative_ckt_1 Layers = 5 At end of iteration = 224 cost = 0.27142208
Circuit = alternative_ckt_1 Layers = 5 At end of iteration = 225 cost = 0.27106682
Circuit = alternative_ckt_1 Layers = 5 At end of iteration = 226 cost = 0.27070919
Circuit = alternative_ckt_1 Layers = 5 At end of iteration = 227 cost = 0.27034920
Circuit = alternative_ckt_1 Layers = 5 At end of iteration = 228 cost = 0.26998683
Circuit = alternative_ckt_1 Layers = 5 At end of iteration = 229 cost = 0.26962209
Circuit = alternative_ckt_1 Layers = 5 At end of iteration = 230 cost = 0.26925496
Circuit = alternative_ckt_1 Layers = 5 At end of iteration = 231 cost = 0.26888546
Circuit = alternative_ckt_1 Layers = 5 At end of iteration = 232 cost = 0.26851356
Circuit = alternative_ckt_1 Layers = 5 At end of iteration = 233 cost = 0.26813928
Circuit = alternative_ckt_1 Layers = 5 At end of iteration = 234 cost = 0.26776261
Circuit = alternative_ckt_1 Layers = 5 At end of iteration = 235 cost = 0.26738355
Circuit = alternative_ckt_1 Layers = 5 At end of iteration = 236 cost = 0.26700210
Circuit = alternative_ckt_1 Layers = 5 At end of iteration = 237 cost = 0.26661826
Circuit = alternative_ckt_1 Layers = 5 At end of iteration = 238 cost = 0.26623202
Circuit = alternative_ckt_1 Layers = 5 At end of iteration = 239 cost = 0.26584340
Circuit = alternative_ckt_1 Layers = 5 At end of iteration = 240 cost = 0.26545239
Circuit = alternative_ckt_1 Layers = 5 At end of iteration = 241 cost = 0.26505900
Circuit = alternative_ckt_1 Layers = 5 At end of iteration = 242 cost = 0.26466323
Circuit = alternative_ckt_1 Layers = 5 At end of iteration = 243 cost = 0.26426508
Circuit = alternative_ckt_1 Layers = 5 At end of iteration = 244 cost = 0.26386456

Circuit = alternative_ckt_1 Layers = 5 At end of iteration = 245 cost = 0.26346167
Circuit = alternative_ckt_1 Layers = 5 At end of iteration = 246 cost = 0.26305642
Circuit = alternative_ckt_1 Layers = 5 At end of iteration = 247 cost = 0.26264882
Circuit = alternative_ckt_1 Layers = 5 At end of iteration = 248 cost = 0.26223886
Circuit = alternative_ckt_1 Layers = 5 At end of iteration = 249 cost = 0.26182657
Circuit = alternative_ckt_1 Layers = 5 At end of iteration = 250 cost = 0.26141195
Circuit = alternative_ckt_1 Layers = 5 At end of iteration = 251 cost = 0.26099501
Circuit = alternative_ckt_1 Layers = 5 At end of iteration = 252 cost = 0.26057575
Circuit = alternative_ckt_1 Layers = 5 At end of iteration = 253 cost = 0.26015420
Circuit = alternative_ckt_1 Layers = 5 At end of iteration = 254 cost = 0.25973035
Circuit = alternative_ckt_1 Layers = 5 At end of iteration = 255 cost = 0.25930423
Circuit = alternative_ckt_1 Layers = 5 At end of iteration = 256 cost = 0.25887584
Circuit = alternative_ckt_1 Layers = 5 At end of iteration = 257 cost = 0.25844521
Circuit = alternative_ckt_1 Layers = 5 At end of iteration = 258 cost = 0.25801234
Circuit = alternative_ckt_1 Layers = 5 At end of iteration = 259 cost = 0.25757725
Circuit = alternative_ckt_1 Layers = 5 At end of iteration = 260 cost = 0.25713996
Circuit = alternative_ckt_1 Layers = 5 At end of iteration = 261 cost = 0.25670048
Circuit = alternative_ckt_1 Layers = 5 At end of iteration = 262 cost = 0.25625883
Circuit = alternative_ckt_1 Layers = 5 At end of iteration = 263 cost = 0.25581503
Circuit = alternative_ckt_1 Layers = 5 At end of iteration = 264 cost = 0.25536910
Circuit = alternative_ckt_1 Layers = 5 At end of iteration = 265 cost = 0.25492106
Circuit = alternative_ckt_1 Layers = 5 At end of iteration = 266 cost = 0.25447094
Circuit = alternative_ckt_1 Layers = 5 At end of iteration = 267 cost = 0.25401874
Circuit = alternative_ckt_1 Layers = 5 At end of iteration = 268 cost = 0.25356450

Circuit = alternative_ckt_1 Layers = 5 At end of iteration = 269 cost = 0.25310824
Circuit = alternative_ckt_1 Layers = 5 At end of iteration = 270 cost = 0.25264999
Circuit = alternative_ckt_1 Layers = 5 At end of iteration = 271 cost = 0.25218976
Circuit = alternative_ckt_1 Layers = 5 At end of iteration = 272 cost = 0.25172759
Circuit = alternative_ckt_1 Layers = 5 At end of iteration = 273 cost = 0.25126350
Circuit = alternative_ckt_1 Layers = 5 At end of iteration = 274 cost = 0.25079752
Circuit = alternative_ckt_1 Layers = 5 At end of iteration = 275 cost = 0.25032967
Circuit = alternative_ckt_1 Layers = 5 At end of iteration = 276 cost = 0.24986000
Circuit = alternative_ckt_1 Layers = 5 At end of iteration = 277 cost = 0.24938853
Circuit = alternative_ckt_1 Layers = 5 At end of iteration = 278 cost = 0.24891528
Circuit = alternative_ckt_1 Layers = 5 At end of iteration = 279 cost = 0.24844029
Circuit = alternative_ckt_1 Layers = 5 At end of iteration = 280 cost = 0.24796360
Circuit = alternative_ckt_1 Layers = 5 At end of iteration = 281 cost = 0.24748524
Circuit = alternative_ckt_1 Layers = 5 At end of iteration = 282 cost = 0.24700524
Circuit = alternative_ckt_1 Layers = 5 At end of iteration = 283 cost = 0.24652364
Circuit = alternative_ckt_1 Layers = 5 At end of iteration = 284 cost = 0.24604047
Circuit = alternative_ckt_1 Layers = 5 At end of iteration = 285 cost = 0.24555577
Circuit = alternative_ckt_1 Layers = 5 At end of iteration = 286 cost = 0.24506958
Circuit = alternative_ckt_1 Layers = 5 At end of iteration = 287 cost = 0.24458194
Circuit = alternative_ckt_1 Layers = 5 At end of iteration = 288 cost = 0.24409288
Circuit = alternative_ckt_1 Layers = 5 At end of iteration = 289 cost = 0.24360245
Circuit = alternative_ckt_1 Layers = 5 At end of iteration = 290 cost = 0.24311068
Circuit = alternative_ckt_1 Layers = 5 At end of iteration = 291 cost = 0.24261762
Circuit = alternative_ckt_1 Layers = 5 At end of iteration = 292 cost = 0.24212331

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Circuit = alternative_ckt_1 | Layers = 5 | At end of iteration = 293 | cost = 0.24162780
-----
Circuit = alternative_ckt_1 | Layers = 5 | At end of iteration = 294 | cost = 0.24113112
-----
Circuit = alternative_ckt_1 | Layers = 5 | At end of iteration = 295 | cost = 0.24063332
-----
Circuit = alternative_ckt_1 | Layers = 5 | At end of iteration = 296 | cost = 0.24013445
-----
Circuit = alternative_ckt_1 | Layers = 5 | At end of iteration = 297 | cost = 0.23963455
-----
Circuit = alternative_ckt_1 | Layers = 5 | At end of iteration = 298 | cost = 0.23913366
-----
Circuit = alternative_ckt_1 | Layers = 5 | At end of iteration = 299 | cost = 0.23863184
-----
Circuit = alternative_ckt_1 | Layers = 5 | At end of iteration = 300 | cost = 0.23812913
-----

```

Optimization complete.

After optimization, the optimal parameters are

```
{Parameter(theta4[0]): -0.092210982202382, Parameter(thetaz7[0]): -0.2865922374190828, Parameter(theta8[2]): 0.02164226791611938}
```

The output state for these parameters is

```

[[0.18714969+2.87841700e-01j]
 [0.03017539+2.58338177e-01j]
 [0.27688212+1.06723122e-01j]
 [0.20818443+1.35627933e-01j]
 [0.13627114+5.14297613e-02j]
 [0.2024884 +1.26229631e-01j]
 [0.19426167+1.06069129e-01j]
 [0.05726972+1.11303247e-01j]
 [0.28808425+1.93616019e-02j]
 [0.17985703+1.86757989e-02j]
 [0.33064013+4.94148869e-02j]
 [0.05147818-1.43097299e-02j]
 [0.33131351+1.77870789e-01j]
 [0.13591114+5.20177101e-02j]
 [0.20020741+2.63744512e-01j]
 [0.13771045-1.78617468e-04j]]

```

```

-----
Circuit = alternative_ckt_1 Layers = 5 Cost after optimization = 0.23812913981011485
-----

```

```

Circuit alternative_ckt_1 constructed with 6 layers. Number of parameters = 72 .
-----

```

Initialized circuit parameters prior to gradient descent randomly as follows:

```

idx = thetaz3[2] params = 0.03719052023213644
idx = thetax9[2] params = 0.04312312828020062
idx = thetax7[0] params = 0.0004994971757621869
idx = theta6[1] params = 0.03444025418170515
idx = theta10[2] params = 0.046881140646663634
idx = theta8[2] params = 0.02164226791611938

```

```

idx = thetax5[3] params = 0.028343942770291508
idx = thetax9[1] params = 0.013510378554063363
idx = thetax9[0] params = 0.022782810868909098
idx = thetax9[1] params = 0.00573789773068969
idx = thetax5[1] params = 0.039532273767073196
idx = thetax5[0] params = 0.018375156312795238
idx = thetax5[2] params = 0.02421115885861306
idx = thetax1[2] params = 0.01671278315727628
idx = thetax2[0] params = 0.006172454610576922
idx = thetax5[3] params = 0.016655522656847783
idx = thetax7[0] params = 0.04662197117509747
idx = thetax4[1] params = 0.009378499198132518
idx = thetax9[2] params = 0.030481776612878
idx = thetax10[3] params = 0.006238299240088347
idx = thetax3[0] params = 0.046316344013782464
idx = thetax7[2] params = 0.002833116050508433
idx = thetax3[1] params = 0.009568165097689485
idx = thetax1[0] params = 0.003778807686699465
idx = thetax6[2] params = 0.04761132655555178
idx = thetax3[1] params = 0.02912836626547597
idx = thetax1[1] params = 0.03277867333581935
idx = thetax7[1] params = 0.0012507649722014293
idx = thetax9[3] params = 0.03265668670981592
idx = thetax6[0] params = 0.042510362504139115
idx = thetax3[3] params = 0.028964664980450857
idx = thetax1[3] params = 0.02606701333987876
idx = thetax2[2] params = 0.04507588560641085
idx = thetax11[3] params = 0.01594882076679191
idx = thetax1[1] params = 0.03973242205283862
idx = thetax3[2] params = 0.009337792350935193
idx = thetax8[3] params = 0.0032829280606491377
idx = thetax1[3] params = 0.019944497772341908
idx = thetax4[0] params = 0.040543302128205796
idx = thetax9[3] params = 0.018661219094017113
idx = thetax12[0] params = 0.022765429249395765
idx = thetax7[3] params = 0.04496189581938223
idx = thetax2[1] params = 0.04421309636000539
idx = thetax11[2] params = 0.032067148697469475
idx = thetax12[1] params = 0.03316055200997197
idx = thetax7[2] params = 0.038381406528673896
idx = thetax7[3] params = 0.014346822771396907
idx = thetax5[1] params = 0.017358921226698288
idx = thetax5[0] params = 0.036248132522104036
idx = thetax8[1] params = 0.03539050548659198
idx = thetax10[0] params = 0.01607370215812653
idx = thetax12[2] params = 0.007381200069874755
idx = thetax6[3] params = 0.02358393517371811
idx = thetax1[2] params = 0.0009009332204443055

```

```

idx = theta8[0] params = 0.015027195664715637
idx = thetaz11[0] params = 0.037934352344020754
idx = thetax11[1] params = 0.02983057071232084
idx = thetaz11[2] params = 0.023111461319399895
idx = theta12[3] params = 0.02586128220807936
idx = theta4[3] params = 0.002230543419827341
idx = theta2[3] params = 0.021152548385698113
idx = theta4[2] params = 0.017680671110920827
idx = theta10[1] params = 0.04880350842240636
idx = thetaz11[3] params = 0.04861089868928858
idx = thetaz3[3] params = 0.02746088848176321
idx = thetaz7[1] params = 0.03249126248776906
idx = thetax11[0] params = 0.007806656503289816
idx = thetaz11[1] params = 0.022429303882508935
idx = thetax5[2] params = 0.04195594056468582
idx = thetax9[0] params = 0.03308231488975027
idx = thetax3[0] params = 0.016403579248805207
idx = thetax1[0] params = 0.035403385349937436

```

```

-----
Circuit = alternative_ckt_1 | Layers = 6 | At end of iteration = 1 | cost = 1.2085930368
-----
Circuit = alternative_ckt_1 | Layers = 6 | At end of iteration = 2 | cost = 1.1796831434
-----
Circuit = alternative_ckt_1 | Layers = 6 | At end of iteration = 3 | cost = 1.1473507396
-----
Circuit = alternative_ckt_1 | Layers = 6 | At end of iteration = 4 | cost = 1.1055931158
-----
Circuit = alternative_ckt_1 | Layers = 6 | At end of iteration = 5 | cost = 1.0475254774
-----
Circuit = alternative_ckt_1 | Layers = 6 | At end of iteration = 6 | cost = 0.9633702438
-----
Circuit = alternative_ckt_1 | Layers = 6 | At end of iteration = 7 | cost = 0.8649066686
-----
Circuit = alternative_ckt_1 | Layers = 6 | At end of iteration = 8 | cost = 0.7804680876
-----
Circuit = alternative_ckt_1 | Layers = 6 | At end of iteration = 9 | cost = 0.7058601314
-----
Circuit = alternative_ckt_1 | Layers = 6 | At end of iteration = 10 | cost = 0.661635656
-----
Circuit = alternative_ckt_1 | Layers = 6 | At end of iteration = 11 | cost = 0.664575768
-----
Circuit = alternative_ckt_1 | Layers = 6 | At end of iteration = 12 | cost = 1.164770918
-----
Circuit = alternative_ckt_1 | Layers = 6 | At end of iteration = 13 | cost = 0.823818801
-----
Circuit = alternative_ckt_1 | Layers = 6 | At end of iteration = 14 | cost = 1.172623775
-----
Circuit = alternative_ckt_1 | Layers = 6 | At end of iteration = 15 | cost = 0.711940400

```

```

-----
Circuit = alternative_ckt_1 | Layers = 6 | At end of iteration = 16 | cost = 1.003789137
-----
Circuit = alternative_ckt_1 | Layers = 6 | At end of iteration = 17 | cost = 1.050601453
-----
Circuit = alternative_ckt_1 | Layers = 6 | At end of iteration = 18 | cost = 0.822354280
-----
Circuit = alternative_ckt_1 | Layers = 6 | At end of iteration = 19 | cost = 0.940733292
-----
Circuit = alternative_ckt_1 | Layers = 6 | At end of iteration = 20 | cost = 0.862297498
-----
Circuit = alternative_ckt_1 | Layers = 6 | At end of iteration = 21 | cost = 0.934561246
-----
Circuit = alternative_ckt_1 | Layers = 6 | At end of iteration = 22 | cost = 0.784109625
-----
Circuit = alternative_ckt_1 | Layers = 6 | At end of iteration = 23 | cost = 0.920497045
-----
Circuit = alternative_ckt_1 | Layers = 6 | At end of iteration = 24 | cost = 0.801613193
-----
Circuit = alternative_ckt_1 | Layers = 6 | At end of iteration = 25 | cost = 0.918121198
-----
Circuit = alternative_ckt_1 | Layers = 6 | At end of iteration = 26 | cost = 0.764535495
-----
Circuit = alternative_ckt_1 | Layers = 6 | At end of iteration = 27 | cost = 0.900885158
-----
Circuit = alternative_ckt_1 | Layers = 6 | At end of iteration = 28 | cost = 0.790357217
-----
Circuit = alternative_ckt_1 | Layers = 6 | At end of iteration = 29 | cost = 0.904949062
-----
Circuit = alternative_ckt_1 | Layers = 6 | At end of iteration = 30 | cost = 0.752045531
-----
Circuit = alternative_ckt_1 | Layers = 6 | At end of iteration = 31 | cost = 0.885408889
-----
Circuit = alternative_ckt_1 | Layers = 6 | At end of iteration = 32 | cost = 0.791727634
-----
Circuit = alternative_ckt_1 | Layers = 6 | At end of iteration = 33 | cost = 0.893774298
-----
Circuit = alternative_ckt_1 | Layers = 6 | At end of iteration = 34 | cost = 0.742770531
-----
Circuit = alternative_ckt_1 | Layers = 6 | At end of iteration = 35 | cost = 0.871744949
-----
Circuit = alternative_ckt_1 | Layers = 6 | At end of iteration = 36 | cost = 0.798617644
-----
Circuit = alternative_ckt_1 | Layers = 6 | At end of iteration = 37 | cost = 0.882518935
-----
Circuit = alternative_ckt_1 | Layers = 6 | At end of iteration = 38 | cost = 0.736608415
-----
Circuit = alternative_ckt_1 | Layers = 6 | At end of iteration = 39 | cost = 0.861307134
-----

```

REDUCING ALPHA TO 0.31622776601683794 at iteration = 40

Circuit =	alternative_ckt_1		Layers =	6		At end of iteration =	40		cost =	0.804484464
Circuit =	alternative_ckt_1		Layers =	6		At end of iteration =	41		cost =	0.581767946
Circuit =	alternative_ckt_1		Layers =	6		At end of iteration =	42		cost =	0.531004508
Circuit =	alternative_ckt_1		Layers =	6		At end of iteration =	43		cost =	0.515130466
Circuit =	alternative_ckt_1		Layers =	6		At end of iteration =	44		cost =	0.502751014
Circuit =	alternative_ckt_1		Layers =	6		At end of iteration =	45		cost =	0.493002702
Circuit =	alternative_ckt_1		Layers =	6		At end of iteration =	46		cost =	0.482996064
Circuit =	alternative_ckt_1		Layers =	6		At end of iteration =	47		cost =	0.473591356
Circuit =	alternative_ckt_1		Layers =	6		At end of iteration =	48		cost =	0.463851292
Circuit =	alternative_ckt_1		Layers =	6		At end of iteration =	49		cost =	0.454535517
Circuit =	alternative_ckt_1		Layers =	6		At end of iteration =	50		cost =	0.444919026
Circuit =	alternative_ckt_1		Layers =	6		At end of iteration =	51		cost =	0.435786679
Circuit =	alternative_ckt_1		Layers =	6		At end of iteration =	52		cost =	0.426235701
Circuit =	alternative_ckt_1		Layers =	6		At end of iteration =	53		cost =	0.417420412
Circuit =	alternative_ckt_1		Layers =	6		At end of iteration =	54		cost =	0.407752757
Circuit =	alternative_ckt_1		Layers =	6		At end of iteration =	55		cost =	0.399628023
Circuit =	alternative_ckt_1		Layers =	6		At end of iteration =	56		cost =	0.389238905
Circuit =	alternative_ckt_1		Layers =	6		At end of iteration =	57		cost =	0.383474896
Circuit =	alternative_ckt_1		Layers =	6		At end of iteration =	58		cost =	0.370539018
Circuit =	alternative_ckt_1		Layers =	6		At end of iteration =	59		cost =	0.379025588
Circuit =	alternative_ckt_1		Layers =	6		At end of iteration =	60		cost =	0.373160822
Circuit =	alternative_ckt_1		Layers =	6		At end of iteration =	61		cost =	0.503215809
Circuit =	alternative_ckt_1		Layers =	6		At end of iteration =	62		cost =	0.521188979


```

-----
Circuit = alternative_ckt_1 | Layers = 6 | At end of iteration = 63 | cost = 0.6109711365
-----
Circuit = alternative_ckt_1 | Layers = 6 | At end of iteration = 64 | cost = 0.476206983
-----
Circuit = alternative_ckt_1 | Layers = 6 | At end of iteration = 65 | cost = 0.610995673
-----
Circuit = alternative_ckt_1 | Layers = 6 | At end of iteration = 66 | cost = 0.474307560
-----
Circuit = alternative_ckt_1 | Layers = 6 | At end of iteration = 67 | cost = 0.613954832
-----
Circuit = alternative_ckt_1 | Layers = 6 | At end of iteration = 68 | cost = 0.471964485
-----
Circuit = alternative_ckt_1 | Layers = 6 | At end of iteration = 69 | cost = 0.617759398
-----
Circuit = alternative_ckt_1 | Layers = 6 | At end of iteration = 70 | cost = 0.469535165
-----
Circuit = alternative_ckt_1 | Layers = 6 | At end of iteration = 71 | cost = 0.621860039
-----
Circuit = alternative_ckt_1 | Layers = 6 | At end of iteration = 72 | cost = 0.467008562
-----
Circuit = alternative_ckt_1 | Layers = 6 | At end of iteration = 73 | cost = 0.626044693
-----
Circuit = alternative_ckt_1 | Layers = 6 | At end of iteration = 74 | cost = 0.464391727
-----
Circuit = alternative_ckt_1 | Layers = 6 | At end of iteration = 75 | cost = 0.630229425
-----
Circuit = alternative_ckt_1 | Layers = 6 | At end of iteration = 76 | cost = 0.461685556
-----
Circuit = alternative_ckt_1 | Layers = 6 | At end of iteration = 77 | cost = 0.634374361
-----
Circuit = alternative_ckt_1 | Layers = 6 | At end of iteration = 78 | cost = 0.458893782
-----
Circuit = alternative_ckt_1 | Layers = 6 | At end of iteration = 79 | cost = 0.638460100
-----
REDUCING ALPHA TO 0.09999999999999999 at iteration = 80
-----
Circuit = alternative_ckt_1 | Layers = 6 | At end of iteration = 80 | cost = 0.456021635
-----
Circuit = alternative_ckt_1 | Layers = 6 | At end of iteration = 81 | cost = 0.316579868
-----
Circuit = alternative_ckt_1 | Layers = 6 | At end of iteration = 82 | cost = 0.312864455
-----
Circuit = alternative_ckt_1 | Layers = 6 | At end of iteration = 83 | cost = 0.306150708
-----
Circuit = alternative_ckt_1 | Layers = 6 | At end of iteration = 84 | cost = 0.303504957
-----
Circuit = alternative_ckt_1 | Layers = 6 | At end of iteration = 85 | cost = 0.300588592
-----

```

```

-----
Circuit = alternative_ckt_1 | Layers = 6 | At end of iteration = 86 | cost = 0.298185677
-----
Circuit = alternative_ckt_1 | Layers = 6 | At end of iteration = 87 | cost = 0.295886954
-----
Circuit = alternative_ckt_1 | Layers = 6 | At end of iteration = 88 | cost = 0.293741091
-----
Circuit = alternative_ckt_1 | Layers = 6 | At end of iteration = 89 | cost = 0.291679225
-----
Circuit = alternative_ckt_1 | Layers = 6 | At end of iteration = 90 | cost = 0.289696247
-----
Circuit = alternative_ckt_1 | Layers = 6 | At end of iteration = 91 | cost = 0.287773419
-----
Circuit = alternative_ckt_1 | Layers = 6 | At end of iteration = 92 | cost = 0.285903879
-----
Circuit = alternative_ckt_1 | Layers = 6 | At end of iteration = 93 | cost = 0.284079326
-----
Circuit = alternative_ckt_1 | Layers = 6 | At end of iteration = 94 | cost = 0.282294364
-----
Circuit = alternative_ckt_1 | Layers = 6 | At end of iteration = 95 | cost = 0.280543723
-----
Circuit = alternative_ckt_1 | Layers = 6 | At end of iteration = 96 | cost = 0.278823126
-----
Circuit = alternative_ckt_1 | Layers = 6 | At end of iteration = 97 | cost = 0.277128616
-----
Circuit = alternative_ckt_1 | Layers = 6 | At end of iteration = 98 | cost = 0.275456754
-----
Circuit = alternative_ckt_1 | Layers = 6 | At end of iteration = 99 | cost = 0.273804430
-----
Circuit = alternative_ckt_1 | Layers = 6 | At end of iteration = 100 | cost = 0.27216892
-----
Circuit = alternative_ckt_1 | Layers = 6 | At end of iteration = 101 | cost = 0.27054783
-----
Circuit = alternative_ckt_1 | Layers = 6 | At end of iteration = 102 | cost = 0.26893910
-----
Circuit = alternative_ckt_1 | Layers = 6 | At end of iteration = 103 | cost = 0.26734098
-----
Circuit = alternative_ckt_1 | Layers = 6 | At end of iteration = 104 | cost = 0.26575206
-----
Circuit = alternative_ckt_1 | Layers = 6 | At end of iteration = 105 | cost = 0.26417119
-----
Circuit = alternative_ckt_1 | Layers = 6 | At end of iteration = 106 | cost = 0.26259756
-----
Circuit = alternative_ckt_1 | Layers = 6 | At end of iteration = 107 | cost = 0.26103060
-----
Circuit = alternative_ckt_1 | Layers = 6 | At end of iteration = 108 | cost = 0.25947001
-----
Circuit = alternative_ckt_1 | Layers = 6 | At end of iteration = 109 | cost = 0.25791576
-----

```

```

-----
Circuit = alternative_ckt_1 | Layers = 6 | At end of iteration = 110 | cost = 0.256368009
-----
Circuit = alternative_ckt_1 | Layers = 6 | At end of iteration = 111 | cost = 0.254827143
-----
Circuit = alternative_ckt_1 | Layers = 6 | At end of iteration = 112 | cost = 0.253293723
-----
Circuit = alternative_ckt_1 | Layers = 6 | At end of iteration = 113 | cost = 0.251768476
-----
Circuit = alternative_ckt_1 | Layers = 6 | At end of iteration = 114 | cost = 0.250252243
-----
Circuit = alternative_ckt_1 | Layers = 6 | At end of iteration = 115 | cost = 0.248745983
-----
Circuit = alternative_ckt_1 | Layers = 6 | At end of iteration = 116 | cost = 0.247250733
-----
Circuit = alternative_ckt_1 | Layers = 6 | At end of iteration = 117 | cost = 0.245767577
-----
Circuit = alternative_ckt_1 | Layers = 6 | At end of iteration = 118 | cost = 0.244297613
-----
Circuit = alternative_ckt_1 | Layers = 6 | At end of iteration = 119 | cost = 0.242841943
-----
REDUCING ALPHA TO 0.03162277660168379 at iteration = 120
-----
Circuit = alternative_ckt_1 | Layers = 6 | At end of iteration = 120 | cost = 0.241401633
-----
Circuit = alternative_ckt_1 | Layers = 6 | At end of iteration = 121 | cost = 0.240950593
-----
Circuit = alternative_ckt_1 | Layers = 6 | At end of iteration = 122 | cost = 0.240501513
-----
Circuit = alternative_ckt_1 | Layers = 6 | At end of iteration = 123 | cost = 0.240054203
-----
Circuit = alternative_ckt_1 | Layers = 6 | At end of iteration = 124 | cost = 0.239608613
-----
Circuit = alternative_ckt_1 | Layers = 6 | At end of iteration = 125 | cost = 0.239164743
-----
Circuit = alternative_ckt_1 | Layers = 6 | At end of iteration = 126 | cost = 0.238722603
-----
Circuit = alternative_ckt_1 | Layers = 6 | At end of iteration = 127 | cost = 0.238282223
-----
Circuit = alternative_ckt_1 | Layers = 6 | At end of iteration = 128 | cost = 0.237843623
-----
Circuit = alternative_ckt_1 | Layers = 6 | At end of iteration = 129 | cost = 0.237406823
-----
Circuit = alternative_ckt_1 | Layers = 6 | At end of iteration = 130 | cost = 0.236971863
-----
Circuit = alternative_ckt_1 | Layers = 6 | At end of iteration = 131 | cost = 0.236538753
-----
Circuit = alternative_ckt_1 | Layers = 6 | At end of iteration = 132 | cost = 0.236107523
-----

```

Circuit = alternative_ckt_1 Layers = 6 At end of iteration = 133 cost = 0.235678179
Circuit = alternative_ckt_1 Layers = 6 At end of iteration = 134 cost = 0.235250747
Circuit = alternative_ckt_1 Layers = 6 At end of iteration = 135 cost = 0.234825247
Circuit = alternative_ckt_1 Layers = 6 At end of iteration = 136 cost = 0.234401679
Circuit = alternative_ckt_1 Layers = 6 At end of iteration = 137 cost = 0.233980079
Circuit = alternative_ckt_1 Layers = 6 At end of iteration = 138 cost = 0.233560429
Circuit = alternative_ckt_1 Layers = 6 At end of iteration = 139 cost = 0.233142769
Circuit = alternative_ckt_1 Layers = 6 At end of iteration = 140 cost = 0.232727089
Circuit = alternative_ckt_1 Layers = 6 At end of iteration = 141 cost = 0.232313399
Circuit = alternative_ckt_1 Layers = 6 At end of iteration = 142 cost = 0.231901699
Circuit = alternative_ckt_1 Layers = 6 At end of iteration = 143 cost = 0.231492009
Circuit = alternative_ckt_1 Layers = 6 At end of iteration = 144 cost = 0.231084309
Circuit = alternative_ckt_1 Layers = 6 At end of iteration = 145 cost = 0.230678619
Circuit = alternative_ckt_1 Layers = 6 At end of iteration = 146 cost = 0.230274929
Circuit = alternative_ckt_1 Layers = 6 At end of iteration = 147 cost = 0.229873229
Circuit = alternative_ckt_1 Layers = 6 At end of iteration = 148 cost = 0.229473529
Circuit = alternative_ckt_1 Layers = 6 At end of iteration = 149 cost = 0.229075809
Circuit = alternative_ckt_1 Layers = 6 At end of iteration = 150 cost = 0.228680069
Circuit = alternative_ckt_1 Layers = 6 At end of iteration = 151 cost = 0.228286289
Circuit = alternative_ckt_1 Layers = 6 At end of iteration = 152 cost = 0.227894469
Circuit = alternative_ckt_1 Layers = 6 At end of iteration = 153 cost = 0.227504599
Circuit = alternative_ckt_1 Layers = 6 At end of iteration = 154 cost = 0.227116659
Circuit = alternative_ckt_1 Layers = 6 At end of iteration = 155 cost = 0.226730629
Circuit = alternative_ckt_1 Layers = 6 At end of iteration = 156 cost = 0.226346499

```

-----
Circuit = alternative_ckt_1 | Layers = 6 | At end of iteration = 157 | cost = 0.22596424
-----
Circuit = alternative_ckt_1 | Layers = 6 | At end of iteration = 158 | cost = 0.22558385
-----
Circuit = alternative_ckt_1 | Layers = 6 | At end of iteration = 159 | cost = 0.22520529
-----
Circuit = alternative_ckt_1 | Layers = 6 | At end of iteration = 160 | cost = 0.22482856
-----
Circuit = alternative_ckt_1 | Layers = 6 | At end of iteration = 161 | cost = 0.22445361
-----
Circuit = alternative_ckt_1 | Layers = 6 | At end of iteration = 162 | cost = 0.22408044
-----
Circuit = alternative_ckt_1 | Layers = 6 | At end of iteration = 163 | cost = 0.22370901
-----
Circuit = alternative_ckt_1 | Layers = 6 | At end of iteration = 164 | cost = 0.22333929
-----
Circuit = alternative_ckt_1 | Layers = 6 | At end of iteration = 165 | cost = 0.22297126
-----
Circuit = alternative_ckt_1 | Layers = 6 | At end of iteration = 166 | cost = 0.22260489
-----
Circuit = alternative_ckt_1 | Layers = 6 | At end of iteration = 167 | cost = 0.22224014
-----
Circuit = alternative_ckt_1 | Layers = 6 | At end of iteration = 168 | cost = 0.22187700
-----
Circuit = alternative_ckt_1 | Layers = 6 | At end of iteration = 169 | cost = 0.22151542
-----
Circuit = alternative_ckt_1 | Layers = 6 | At end of iteration = 170 | cost = 0.22115537
-----
Circuit = alternative_ckt_1 | Layers = 6 | At end of iteration = 171 | cost = 0.22079682
-----
Circuit = alternative_ckt_1 | Layers = 6 | At end of iteration = 172 | cost = 0.22043974
-----
Circuit = alternative_ckt_1 | Layers = 6 | At end of iteration = 173 | cost = 0.22008409
-----
Circuit = alternative_ckt_1 | Layers = 6 | At end of iteration = 174 | cost = 0.21972983
-----
Circuit = alternative_ckt_1 | Layers = 6 | At end of iteration = 175 | cost = 0.21937694
-----
Circuit = alternative_ckt_1 | Layers = 6 | At end of iteration = 176 | cost = 0.21902537
-----
Circuit = alternative_ckt_1 | Layers = 6 | At end of iteration = 177 | cost = 0.21867509
-----
Circuit = alternative_ckt_1 | Layers = 6 | At end of iteration = 178 | cost = 0.21832606
-----
Circuit = alternative_ckt_1 | Layers = 6 | At end of iteration = 179 | cost = 0.21797825
-----
Circuit = alternative_ckt_1 | Layers = 6 | At end of iteration = 180 | cost = 0.21763161
-----

```

```

-----
Circuit = alternative_ckt_1 | Layers = 6 | At end of iteration = 181 | cost = 0.21728611
-----
Circuit = alternative_ckt_1 | Layers = 6 | At end of iteration = 182 | cost = 0.21694172
-----
Circuit = alternative_ckt_1 | Layers = 6 | At end of iteration = 183 | cost = 0.21659839
-----
Circuit = alternative_ckt_1 | Layers = 6 | At end of iteration = 184 | cost = 0.21625609
-----
Circuit = alternative_ckt_1 | Layers = 6 | At end of iteration = 185 | cost = 0.21591478
-----
Circuit = alternative_ckt_1 | Layers = 6 | At end of iteration = 186 | cost = 0.21557442
-----
Circuit = alternative_ckt_1 | Layers = 6 | At end of iteration = 187 | cost = 0.21523499
-----
Circuit = alternative_ckt_1 | Layers = 6 | At end of iteration = 188 | cost = 0.21489643
-----
Circuit = alternative_ckt_1 | Layers = 6 | At end of iteration = 189 | cost = 0.21455872
-----
Circuit = alternative_ckt_1 | Layers = 6 | At end of iteration = 190 | cost = 0.21422182
-----
Circuit = alternative_ckt_1 | Layers = 6 | At end of iteration = 191 | cost = 0.21388569
-----
Circuit = alternative_ckt_1 | Layers = 6 | At end of iteration = 192 | cost = 0.21355031
-----
Circuit = alternative_ckt_1 | Layers = 6 | At end of iteration = 193 | cost = 0.21321563
-----
Circuit = alternative_ckt_1 | Layers = 6 | At end of iteration = 194 | cost = 0.21288162
-----
Circuit = alternative_ckt_1 | Layers = 6 | At end of iteration = 195 | cost = 0.21254826
-----
Circuit = alternative_ckt_1 | Layers = 6 | At end of iteration = 196 | cost = 0.21221551
-----
Circuit = alternative_ckt_1 | Layers = 6 | At end of iteration = 197 | cost = 0.21188333
-----
Circuit = alternative_ckt_1 | Layers = 6 | At end of iteration = 198 | cost = 0.21155171
-----
Circuit = alternative_ckt_1 | Layers = 6 | At end of iteration = 199 | cost = 0.21122060
-----
Circuit = alternative_ckt_1 | Layers = 6 | At end of iteration = 200 | cost = 0.21088999
-----
Circuit = alternative_ckt_1 | Layers = 6 | At end of iteration = 201 | cost = 0.21055985
-----
Circuit = alternative_ckt_1 | Layers = 6 | At end of iteration = 202 | cost = 0.21023014
-----
Circuit = alternative_ckt_1 | Layers = 6 | At end of iteration = 203 | cost = 0.20990085
-----
Circuit = alternative_ckt_1 | Layers = 6 | At end of iteration = 204 | cost = 0.20957196
-----

```

Circuit = alternative_ckt_1 Layers = 6 At end of iteration = 205 cost = 0.20924343
Circuit = alternative_ckt_1 Layers = 6 At end of iteration = 206 cost = 0.20891526
Circuit = alternative_ckt_1 Layers = 6 At end of iteration = 207 cost = 0.20858741
Circuit = alternative_ckt_1 Layers = 6 At end of iteration = 208 cost = 0.20825988
Circuit = alternative_ckt_1 Layers = 6 At end of iteration = 209 cost = 0.20793264
Circuit = alternative_ckt_1 Layers = 6 At end of iteration = 210 cost = 0.20760568
Circuit = alternative_ckt_1 Layers = 6 At end of iteration = 211 cost = 0.20727899
Circuit = alternative_ckt_1 Layers = 6 At end of iteration = 212 cost = 0.20695255
Circuit = alternative_ckt_1 Layers = 6 At end of iteration = 213 cost = 0.20662636
Circuit = alternative_ckt_1 Layers = 6 At end of iteration = 214 cost = 0.20630039
Circuit = alternative_ckt_1 Layers = 6 At end of iteration = 215 cost = 0.20597466
Circuit = alternative_ckt_1 Layers = 6 At end of iteration = 216 cost = 0.20564914
Circuit = alternative_ckt_1 Layers = 6 At end of iteration = 217 cost = 0.20532384
Circuit = alternative_ckt_1 Layers = 6 At end of iteration = 218 cost = 0.20499875
Circuit = alternative_ckt_1 Layers = 6 At end of iteration = 219 cost = 0.20467387
Circuit = alternative_ckt_1 Layers = 6 At end of iteration = 220 cost = 0.20434920
Circuit = alternative_ckt_1 Layers = 6 At end of iteration = 221 cost = 0.20402474
Circuit = alternative_ckt_1 Layers = 6 At end of iteration = 222 cost = 0.20370049
Circuit = alternative_ckt_1 Layers = 6 At end of iteration = 223 cost = 0.20337646
Circuit = alternative_ckt_1 Layers = 6 At end of iteration = 224 cost = 0.20305266
Circuit = alternative_ckt_1 Layers = 6 At end of iteration = 225 cost = 0.20272909
Circuit = alternative_ckt_1 Layers = 6 At end of iteration = 226 cost = 0.20240576
Circuit = alternative_ckt_1 Layers = 6 At end of iteration = 227 cost = 0.20208269
Circuit = alternative_ckt_1 Layers = 6 At end of iteration = 228 cost = 0.20175987

Circuit = alternative_ckt_1 Layers = 6 At end of iteration = 229 cost = 0.20143734
Circuit = alternative_ckt_1 Layers = 6 At end of iteration = 230 cost = 0.20111510
Circuit = alternative_ckt_1 Layers = 6 At end of iteration = 231 cost = 0.20079317
Circuit = alternative_ckt_1 Layers = 6 At end of iteration = 232 cost = 0.20047157
Circuit = alternative_ckt_1 Layers = 6 At end of iteration = 233 cost = 0.20015032
Circuit = alternative_ckt_1 Layers = 6 At end of iteration = 234 cost = 0.19982943
Circuit = alternative_ckt_1 Layers = 6 At end of iteration = 235 cost = 0.19950894
Circuit = alternative_ckt_1 Layers = 6 At end of iteration = 236 cost = 0.19918886
Circuit = alternative_ckt_1 Layers = 6 At end of iteration = 237 cost = 0.19886921
Circuit = alternative_ckt_1 Layers = 6 At end of iteration = 238 cost = 0.19855003
Circuit = alternative_ckt_1 Layers = 6 At end of iteration = 239 cost = 0.19823133
Circuit = alternative_ckt_1 Layers = 6 At end of iteration = 240 cost = 0.19791315
Circuit = alternative_ckt_1 Layers = 6 At end of iteration = 241 cost = 0.19759552
Circuit = alternative_ckt_1 Layers = 6 At end of iteration = 242 cost = 0.19727846
Circuit = alternative_ckt_1 Layers = 6 At end of iteration = 243 cost = 0.19696200
Circuit = alternative_ckt_1 Layers = 6 At end of iteration = 244 cost = 0.19664618
Circuit = alternative_ckt_1 Layers = 6 At end of iteration = 245 cost = 0.19633103
Circuit = alternative_ckt_1 Layers = 6 At end of iteration = 246 cost = 0.19601657
Circuit = alternative_ckt_1 Layers = 6 At end of iteration = 247 cost = 0.19570284
Circuit = alternative_ckt_1 Layers = 6 At end of iteration = 248 cost = 0.19538988
Circuit = alternative_ckt_1 Layers = 6 At end of iteration = 249 cost = 0.19507772
Circuit = alternative_ckt_1 Layers = 6 At end of iteration = 250 cost = 0.19476639
Circuit = alternative_ckt_1 Layers = 6 At end of iteration = 251 cost = 0.19445593
Circuit = alternative_ckt_1 Layers = 6 At end of iteration = 252 cost = 0.19414636

Circuit = alternative_ckt_1 Layers = 6 At end of iteration = 253 cost = 0.19383774
Circuit = alternative_ckt_1 Layers = 6 At end of iteration = 254 cost = 0.19353008
Circuit = alternative_ckt_1 Layers = 6 At end of iteration = 255 cost = 0.19322344
Circuit = alternative_ckt_1 Layers = 6 At end of iteration = 256 cost = 0.19291783
Circuit = alternative_ckt_1 Layers = 6 At end of iteration = 257 cost = 0.19261330
Circuit = alternative_ckt_1 Layers = 6 At end of iteration = 258 cost = 0.19230988
Circuit = alternative_ckt_1 Layers = 6 At end of iteration = 259 cost = 0.19200760
Circuit = alternative_ckt_1 Layers = 6 At end of iteration = 260 cost = 0.19170651
Circuit = alternative_ckt_1 Layers = 6 At end of iteration = 261 cost = 0.19140663
Circuit = alternative_ckt_1 Layers = 6 At end of iteration = 262 cost = 0.19110799
Circuit = alternative_ckt_1 Layers = 6 At end of iteration = 263 cost = 0.19081063
Circuit = alternative_ckt_1 Layers = 6 At end of iteration = 264 cost = 0.19051459
Circuit = alternative_ckt_1 Layers = 6 At end of iteration = 265 cost = 0.19021989
Circuit = alternative_ckt_1 Layers = 6 At end of iteration = 266 cost = 0.18992656
Circuit = alternative_ckt_1 Layers = 6 At end of iteration = 267 cost = 0.18963464
Circuit = alternative_ckt_1 Layers = 6 At end of iteration = 268 cost = 0.18934415
Circuit = alternative_ckt_1 Layers = 6 At end of iteration = 269 cost = 0.18905512
Circuit = alternative_ckt_1 Layers = 6 At end of iteration = 270 cost = 0.18876759
Circuit = alternative_ckt_1 Layers = 6 At end of iteration = 271 cost = 0.18848157
Circuit = alternative_ckt_1 Layers = 6 At end of iteration = 272 cost = 0.18819710
Circuit = alternative_ckt_1 Layers = 6 At end of iteration = 273 cost = 0.18791420
Circuit = alternative_ckt_1 Layers = 6 At end of iteration = 274 cost = 0.18763290
Circuit = alternative_ckt_1 Layers = 6 At end of iteration = 275 cost = 0.18735321
Circuit = alternative_ckt_1 Layers = 6 At end of iteration = 276 cost = 0.18707517

```

-----
Circuit = alternative_ckt_1 | Layers = 6 | At end of iteration = 277 | cost = 0.18679878
-----
Circuit = alternative_ckt_1 | Layers = 6 | At end of iteration = 278 | cost = 0.18652408
-----
Circuit = alternative_ckt_1 | Layers = 6 | At end of iteration = 279 | cost = 0.18625108
-----
Circuit = alternative_ckt_1 | Layers = 6 | At end of iteration = 280 | cost = 0.18597980
-----
Circuit = alternative_ckt_1 | Layers = 6 | At end of iteration = 281 | cost = 0.18571025
-----
Circuit = alternative_ckt_1 | Layers = 6 | At end of iteration = 282 | cost = 0.18544246
-----
Circuit = alternative_ckt_1 | Layers = 6 | At end of iteration = 283 | cost = 0.18517644
-----
Circuit = alternative_ckt_1 | Layers = 6 | At end of iteration = 284 | cost = 0.18491220
-----
Circuit = alternative_ckt_1 | Layers = 6 | At end of iteration = 285 | cost = 0.18464975
-----
Circuit = alternative_ckt_1 | Layers = 6 | At end of iteration = 286 | cost = 0.18438911
-----
Circuit = alternative_ckt_1 | Layers = 6 | At end of iteration = 287 | cost = 0.18413029
-----
Circuit = alternative_ckt_1 | Layers = 6 | At end of iteration = 288 | cost = 0.18387330
-----
Circuit = alternative_ckt_1 | Layers = 6 | At end of iteration = 289 | cost = 0.18361814
-----
Circuit = alternative_ckt_1 | Layers = 6 | At end of iteration = 290 | cost = 0.18336483
-----
Circuit = alternative_ckt_1 | Layers = 6 | At end of iteration = 291 | cost = 0.18311337
-----
Circuit = alternative_ckt_1 | Layers = 6 | At end of iteration = 292 | cost = 0.18286376
-----
Circuit = alternative_ckt_1 | Layers = 6 | At end of iteration = 293 | cost = 0.18261602
-----
Circuit = alternative_ckt_1 | Layers = 6 | At end of iteration = 294 | cost = 0.18237015
-----
Circuit = alternative_ckt_1 | Layers = 6 | At end of iteration = 295 | cost = 0.18212614
-----
Circuit = alternative_ckt_1 | Layers = 6 | At end of iteration = 296 | cost = 0.18188400
-----
Circuit = alternative_ckt_1 | Layers = 6 | At end of iteration = 297 | cost = 0.18164374
-----
Circuit = alternative_ckt_1 | Layers = 6 | At end of iteration = 298 | cost = 0.18140535
-----
Circuit = alternative_ckt_1 | Layers = 6 | At end of iteration = 299 | cost = 0.18116884
-----
Circuit = alternative_ckt_1 | Layers = 6 | At end of iteration = 300 | cost = 0.18093420
-----

```

Optimization complete.

After optimization, the optimal parameters are

{Parameter(thetaz3[2]): -0.5658806043243951, Parameter(thetax9[2]): 0.7991190703796711, Param

The output state for these parameters is

```
[[ 0.20433535+0.30932483j]
 [-0.02743041+0.2179169j ]
 [ 0.25704439+0.12889818j]
 [ 0.18880386+0.09879343j]
 [ 0.11099798+0.05000954j]
 [ 0.25674337+0.04728047j]
 [ 0.16478251+0.16152825j]
 [ 0.05196265+0.15053134j]
 [ 0.33546145+0.07508754j]
 [ 0.20635701+0.08105412j]
 [ 0.27651629-0.03842677j]
 [ 0.0448455 +0.01900261j]
 [ 0.30290241+0.14815319j]
 [ 0.19730538+0.0138848j ]
 [ 0.15859224+0.21815709j]
 [ 0.19727165+0.11196293j]]
```

Circuit = alternative_ckt_1 Layers = 6 Cost after optimization = 0.18093420354648612

Circuit alternative_ckt_1 constructed with 7 layers. Number of parameters = 84 .

Initialized circuit parameters prior to gradient descent randomly as follows:

```
idx = thetaz1[0] params = 0.03719052023213644
idx = thetax5[0] params = 0.04312312828020062
idx = thetaz7[1] params = 0.0004994971757621869
idx = theta14[1] params = 0.03444025418170515
idx = thetax3[3] params = 0.046881140646663634
idx = thetax5[2] params = 0.02164226791611938
idx = thetax11[0] params = 0.028343942770291508
idx = theta12[0] params = 0.013510378554063363
idx = thetax7[3] params = 0.022782810868909098
idx = thetaz3[1] params = 0.00573789773068969
idx = thetaz7[2] params = 0.039532273767073196
idx = thetax11[1] params = 0.018375156312795238
idx = theta14[2] params = 0.02421115885861306
idx = theta4[1] params = 0.01671278315727628
idx = thetax5[1] params = 0.006172454610576922
idx = thetax13[2] params = 0.016655522656847783
idx = thetax7[1] params = 0.04662197117509747
idx = theta4[2] params = 0.009378499198132518
idx = thetaz3[3] params = 0.030481776612878
idx = theta10[2] params = 0.006238299240088347
idx = thetax5[3] params = 0.046316344013782464
```

```

idx = thetaz3[0] params = 0.002833116050508433
idx = thetaz11[2] params = 0.009568165097689485
idx = thetaz3[2] params = 0.003778807686699465
idx = thetax3[2] params = 0.04761132655555178
idx = thetax3[0] params = 0.02912836626547597
idx = theta4[3] params = 0.03277867333581935
idx = theta8[2] params = 0.0012507649722014293
idx = theta6[1] params = 0.03265668670981592
idx = theta2[0] params = 0.042510362504139115
idx = thetaz13[2] params = 0.028964664980450857
idx = theta14[3] params = 0.02606701333987876
idx = theta8[0] params = 0.04507588560641085
idx = thetaz9[0] params = 0.01594882076679191
idx = theta10[1] params = 0.03973242205283862
idx = theta2[2] params = 0.009337792350935193
idx = thetaz5[2] params = 0.0032829280606491377
idx = thetax1[3] params = 0.019944497772341908
idx = thetaz5[1] params = 0.040543302128205796
idx = theta12[1] params = 0.018661219094017113
idx = theta8[3] params = 0.022765429249395765
idx = theta8[1] params = 0.04496189581938223
idx = thetax3[1] params = 0.04421309636000539
idx = theta6[0] params = 0.032067148697469475
idx = thetax7[0] params = 0.03316055200997197
idx = thetaz9[1] params = 0.038381406528673896
idx = theta6[2] params = 0.014346822771396907
idx = thetaz1[2] params = 0.017358921226698288
idx = thetax1[0] params = 0.036248132522104036
idx = thetaz1[3] params = 0.03539050548659198
idx = thetaz9[3] params = 0.01607370215812653
idx = theta12[3] params = 0.007381200069874755
idx = thetaz1[1] params = 0.02358393517371811
idx = thetax9[2] params = 0.0009009332204443055
idx = theta10[3] params = 0.015027195664715637
idx = theta12[2] params = 0.037934352344020754
idx = theta2[1] params = 0.02983057071232084
idx = thetax13[0] params = 0.023111461319399895
idx = thetaz13[0] params = 0.02586128220807936
idx = thetaz9[2] params = 0.002230543419827341
idx = thetax13[3] params = 0.021152548385698113
idx = thetaz7[3] params = 0.017680671110920827
idx = thetaz5[0] params = 0.04880350842240636
idx = thetax11[3] params = 0.04861089868928858
idx = thetaz13[3] params = 0.02746088848176321
idx = thetax9[3] params = 0.03249126248776906
idx = theta10[0] params = 0.007806656503289816
idx = thetax9[0] params = 0.022429303882508935
idx = thetaz5[3] params = 0.04195594056468582

```

```

idx = theta6[3] params = 0.03308231488975027
idx = theta14[0] params = 0.016403579248805207
idx = theta2[3] params = 0.035403385349937436
idx = thetaz11[0] params = 0.045163503496595245
idx = theta4[0] params = 0.01075507702770715
idx = thetaz13[1] params = 0.03733005507245125
idx = thetax11[2] params = 0.016534010021804213
idx = thetax13[1] params = 0.03418145346493542
idx = thetax1[1] params = 0.026502847987510094
idx = thetax1[2] params = 0.04614732179238628
idx = thetaz11[1] params = 0.04692583576726641
idx = thetaz11[3] params = 0.026220746451517597
idx = thetaz7[0] params = 0.015518672083128078
idx = thetax7[2] params = 0.010878167160222746
idx = thetax9[1] params = 0.015612322743962653

```

```

-----
Circuit = alternative_ckt_1 | Layers = 7 | At end of iteration = 1 | cost = 1.2047303081
-----
Circuit = alternative_ckt_1 | Layers = 7 | At end of iteration = 2 | cost = 1.1687751399
-----
Circuit = alternative_ckt_1 | Layers = 7 | At end of iteration = 3 | cost = 1.1241764823
-----
Circuit = alternative_ckt_1 | Layers = 7 | At end of iteration = 4 | cost = 1.0607857974
-----
Circuit = alternative_ckt_1 | Layers = 7 | At end of iteration = 5 | cost = 0.9755990581
-----
Circuit = alternative_ckt_1 | Layers = 7 | At end of iteration = 6 | cost = 0.8676103384
-----
Circuit = alternative_ckt_1 | Layers = 7 | At end of iteration = 7 | cost = 0.7547658220
-----
Circuit = alternative_ckt_1 | Layers = 7 | At end of iteration = 8 | cost = 0.6787926046
-----
Circuit = alternative_ckt_1 | Layers = 7 | At end of iteration = 9 | cost = 0.6646993216
-----
Circuit = alternative_ckt_1 | Layers = 7 | At end of iteration = 10 | cost = 1.125372978
-----
Circuit = alternative_ckt_1 | Layers = 7 | At end of iteration = 11 | cost = 1.307115525
-----
Circuit = alternative_ckt_1 | Layers = 7 | At end of iteration = 12 | cost = 0.762206014
-----
Circuit = alternative_ckt_1 | Layers = 7 | At end of iteration = 13 | cost = 1.030324320
-----
Circuit = alternative_ckt_1 | Layers = 7 | At end of iteration = 14 | cost = 1.250577386
-----
Circuit = alternative_ckt_1 | Layers = 7 | At end of iteration = 15 | cost = 0.753908152
-----
Circuit = alternative_ckt_1 | Layers = 7 | At end of iteration = 16 | cost = 0.692679090
-----

```

```

Circuit = alternative_ckt_1 | Layers = 7 | At end of iteration = 17 | cost = 0.8939542963
-----
Circuit = alternative_ckt_1 | Layers = 7 | At end of iteration = 18 | cost = 1.0082658599
-----
Circuit = alternative_ckt_1 | Layers = 7 | At end of iteration = 19 | cost = 1.1561640851
-----
Circuit = alternative_ckt_1 | Layers = 7 | At end of iteration = 20 | cost = 0.7018069071
-----
Circuit = alternative_ckt_1 | Layers = 7 | At end of iteration = 21 | cost = 0.7054513621
-----
Circuit = alternative_ckt_1 | Layers = 7 | At end of iteration = 22 | cost = 1.1766203150
-----
Circuit = alternative_ckt_1 | Layers = 7 | At end of iteration = 23 | cost = 0.8332863451
-----
Circuit = alternative_ckt_1 | Layers = 7 | At end of iteration = 24 | cost = 0.9733295941
-----
Circuit = alternative_ckt_1 | Layers = 7 | At end of iteration = 25 | cost = 0.9376194001
-----
Circuit = alternative_ckt_1 | Layers = 7 | At end of iteration = 26 | cost = 0.8452897801
-----
Circuit = alternative_ckt_1 | Layers = 7 | At end of iteration = 27 | cost = 0.9419623871
-----
Circuit = alternative_ckt_1 | Layers = 7 | At end of iteration = 28 | cost = 0.8371141251
-----
Circuit = alternative_ckt_1 | Layers = 7 | At end of iteration = 29 | cost = 0.9089084851
-----
Circuit = alternative_ckt_1 | Layers = 7 | At end of iteration = 30 | cost = 0.8270301630
-----
Circuit = alternative_ckt_1 | Layers = 7 | At end of iteration = 31 | cost = 0.8962947621
-----
Circuit = alternative_ckt_1 | Layers = 7 | At end of iteration = 32 | cost = 0.8162630100
-----
Circuit = alternative_ckt_1 | Layers = 7 | At end of iteration = 33 | cost = 0.8832807551
-----
Circuit = alternative_ckt_1 | Layers = 7 | At end of iteration = 34 | cost = 0.8107168761
-----
Circuit = alternative_ckt_1 | Layers = 7 | At end of iteration = 35 | cost = 0.8738143141
-----
Circuit = alternative_ckt_1 | Layers = 7 | At end of iteration = 36 | cost = 0.8001573500
-----
Circuit = alternative_ckt_1 | Layers = 7 | At end of iteration = 37 | cost = 0.8660504621
-----
Circuit = alternative_ckt_1 | Layers = 7 | At end of iteration = 38 | cost = 0.8008738181
-----
Circuit = alternative_ckt_1 | Layers = 7 | At end of iteration = 39 | cost = 0.8582067441
-----
REDUCING ALPHA TO 0.31622776601683794 at iteration = 40
-----

```

Circuit = alternative_ckt_1 Layers = 7 At end of iteration = 40 cost = 0.7907951468
Circuit = alternative_ckt_1 Layers = 7 At end of iteration = 41 cost = 0.5953921270
Circuit = alternative_ckt_1 Layers = 7 At end of iteration = 42 cost = 0.5435624683
Circuit = alternative_ckt_1 Layers = 7 At end of iteration = 43 cost = 0.5235552607
Circuit = alternative_ckt_1 Layers = 7 At end of iteration = 44 cost = 0.5068171170
Circuit = alternative_ckt_1 Layers = 7 At end of iteration = 45 cost = 0.4915142890
Circuit = alternative_ckt_1 Layers = 7 At end of iteration = 46 cost = 0.4762296058
Circuit = alternative_ckt_1 Layers = 7 At end of iteration = 47 cost = 0.4614274203
Circuit = alternative_ckt_1 Layers = 7 At end of iteration = 48 cost = 0.4467945333
Circuit = alternative_ckt_1 Layers = 7 At end of iteration = 49 cost = 0.4329461448
Circuit = alternative_ckt_1 Layers = 7 At end of iteration = 50 cost = 0.4195339764
Circuit = alternative_ckt_1 Layers = 7 At end of iteration = 51 cost = 0.4073780620
Circuit = alternative_ckt_1 Layers = 7 At end of iteration = 52 cost = 0.3955065653
Circuit = alternative_ckt_1 Layers = 7 At end of iteration = 53 cost = 0.3857068234
Circuit = alternative_ckt_1 Layers = 7 At end of iteration = 54 cost = 0.3747612534
Circuit = alternative_ckt_1 Layers = 7 At end of iteration = 55 cost = 0.3693893397
Circuit = alternative_ckt_1 Layers = 7 At end of iteration = 56 cost = 0.3571965079
Circuit = alternative_ckt_1 Layers = 7 At end of iteration = 57 cost = 0.3785223007
Circuit = alternative_ckt_1 Layers = 7 At end of iteration = 58 cost = 0.4026971863
Circuit = alternative_ckt_1 Layers = 7 At end of iteration = 59 cost = 0.6001823971
Circuit = alternative_ckt_1 Layers = 7 At end of iteration = 60 cost = 0.5009010349
Circuit = alternative_ckt_1 Layers = 7 At end of iteration = 61 cost = 0.6121468824
Circuit = alternative_ckt_1 Layers = 7 At end of iteration = 62 cost = 0.4763059763
Circuit = alternative_ckt_1 Layers = 7 At end of iteration = 63 cost = 0.6028646003

```

Circuit = alternative_ckt_1 | Layers = 7 | At end of iteration = 64 | cost = 0.479960443
-----
Circuit = alternative_ckt_1 | Layers = 7 | At end of iteration = 65 | cost = 0.605593852
-----
Circuit = alternative_ckt_1 | Layers = 7 | At end of iteration = 66 | cost = 0.476623070
-----
Circuit = alternative_ckt_1 | Layers = 7 | At end of iteration = 67 | cost = 0.607055683
-----
Circuit = alternative_ckt_1 | Layers = 7 | At end of iteration = 68 | cost = 0.475049764
-----
Circuit = alternative_ckt_1 | Layers = 7 | At end of iteration = 69 | cost = 0.609630030
-----
Circuit = alternative_ckt_1 | Layers = 7 | At end of iteration = 70 | cost = 0.473018578
-----
Circuit = alternative_ckt_1 | Layers = 7 | At end of iteration = 71 | cost = 0.612389308
-----
Circuit = alternative_ckt_1 | Layers = 7 | At end of iteration = 72 | cost = 0.471098014
-----
Circuit = alternative_ckt_1 | Layers = 7 | At end of iteration = 73 | cost = 0.615415806
-----
Circuit = alternative_ckt_1 | Layers = 7 | At end of iteration = 74 | cost = 0.469121501
-----
Circuit = alternative_ckt_1 | Layers = 7 | At end of iteration = 75 | cost = 0.618598490
-----
Circuit = alternative_ckt_1 | Layers = 7 | At end of iteration = 76 | cost = 0.467118381
-----
Circuit = alternative_ckt_1 | Layers = 7 | At end of iteration = 77 | cost = 0.621907235
-----
Circuit = alternative_ckt_1 | Layers = 7 | At end of iteration = 78 | cost = 0.465070132
-----
Circuit = alternative_ckt_1 | Layers = 7 | At end of iteration = 79 | cost = 0.625309563
-----
REDUCING ALPHA TO 0.09999999999999999 at iteration = 80
-----
Circuit = alternative_ckt_1 | Layers = 7 | At end of iteration = 80 | cost = 0.462974274
-----
Circuit = alternative_ckt_1 | Layers = 7 | At end of iteration = 81 | cost = 0.321982981
-----
Circuit = alternative_ckt_1 | Layers = 7 | At end of iteration = 82 | cost = 0.314512534
-----
Circuit = alternative_ckt_1 | Layers = 7 | At end of iteration = 83 | cost = 0.306966556
-----
Circuit = alternative_ckt_1 | Layers = 7 | At end of iteration = 84 | cost = 0.303548838
-----
Circuit = alternative_ckt_1 | Layers = 7 | At end of iteration = 85 | cost = 0.300246996
-----
Circuit = alternative_ckt_1 | Layers = 7 | At end of iteration = 86 | cost = 0.297576592
-----

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Circuit = alternative_ckt_1 Layers = 7 At end of iteration = 87 cost = 0.295116847
Circuit = alternative_ckt_1 Layers = 7 At end of iteration = 88 cost = 0.292865275
Circuit = alternative_ckt_1 Layers = 7 At end of iteration = 89 cost = 0.290738374
Circuit = alternative_ckt_1 Layers = 7 At end of iteration = 90 cost = 0.288715747
Circuit = alternative_ckt_1 Layers = 7 At end of iteration = 91 cost = 0.286770583
Circuit = alternative_ckt_1 Layers = 7 At end of iteration = 92 cost = 0.284889362
Circuit = alternative_ckt_1 Layers = 7 At end of iteration = 93 cost = 0.283059384
Circuit = alternative_ckt_1 Layers = 7 At end of iteration = 94 cost = 0.281271876
Circuit = alternative_ckt_1 Layers = 7 At end of iteration = 95 cost = 0.279519198
Circuit = alternative_ckt_1 Layers = 7 At end of iteration = 96 cost = 0.277795322
Circuit = alternative_ckt_1 Layers = 7 At end of iteration = 97 cost = 0.276095047
Circuit = alternative_ckt_1 Layers = 7 At end of iteration = 98 cost = 0.274414019
Circuit = alternative_ckt_1 Layers = 7 At end of iteration = 99 cost = 0.272748449
Circuit = alternative_ckt_1 Layers = 7 At end of iteration = 100 cost = 0.27109506
Circuit = alternative_ckt_1 Layers = 7 At end of iteration = 101 cost = 0.26945097
Circuit = alternative_ckt_1 Layers = 7 At end of iteration = 102 cost = 0.26781363
Circuit = alternative_ckt_1 Layers = 7 At end of iteration = 103 cost = 0.26618075
Circuit = alternative_ckt_1 Layers = 7 At end of iteration = 104 cost = 0.26455027
Circuit = alternative_ckt_1 Layers = 7 At end of iteration = 105 cost = 0.26292031
Circuit = alternative_ckt_1 Layers = 7 At end of iteration = 106 cost = 0.26128915
Circuit = alternative_ckt_1 Layers = 7 At end of iteration = 107 cost = 0.25965519
Circuit = alternative_ckt_1 Layers = 7 At end of iteration = 108 cost = 0.25801692
Circuit = alternative_ckt_1 Layers = 7 At end of iteration = 109 cost = 0.25637295
Circuit = alternative_ckt_1 Layers = 7 At end of iteration = 110 cost = 0.25472191

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Circuit = alternative_ckt_1 | Layers = 7 | At end of iteration = 111 | cost = 0.25306254
-----
Circuit = alternative_ckt_1 | Layers = 7 | At end of iteration = 112 | cost = 0.25139357
-----
Circuit = alternative_ckt_1 | Layers = 7 | At end of iteration = 113 | cost = 0.24971381
-----
Circuit = alternative_ckt_1 | Layers = 7 | At end of iteration = 114 | cost = 0.24802208
-----
Circuit = alternative_ckt_1 | Layers = 7 | At end of iteration = 115 | cost = 0.24631720
-----
Circuit = alternative_ckt_1 | Layers = 7 | At end of iteration = 116 | cost = 0.24459802
-----
Circuit = alternative_ckt_1 | Layers = 7 | At end of iteration = 117 | cost = 0.24286341
-----
Circuit = alternative_ckt_1 | Layers = 7 | At end of iteration = 118 | cost = 0.24111222
-----
Circuit = alternative_ckt_1 | Layers = 7 | At end of iteration = 119 | cost = 0.23934331
-----
REDUCING ALPHA TO 0.03162277660168379 at iteration = 120
-----
Circuit = alternative_ckt_1 | Layers = 7 | At end of iteration = 120 | cost = 0.23755551
-----
Circuit = alternative_ckt_1 | Layers = 7 | At end of iteration = 121 | cost = 0.23698477
-----
Circuit = alternative_ckt_1 | Layers = 7 | At end of iteration = 122 | cost = 0.23641211
-----
Circuit = alternative_ckt_1 | Layers = 7 | At end of iteration = 123 | cost = 0.23583739
-----
Circuit = alternative_ckt_1 | Layers = 7 | At end of iteration = 124 | cost = 0.23526050
-----
Circuit = alternative_ckt_1 | Layers = 7 | At end of iteration = 125 | cost = 0.23468140
-----
Circuit = alternative_ckt_1 | Layers = 7 | At end of iteration = 126 | cost = 0.23410005
-----
Circuit = alternative_ckt_1 | Layers = 7 | At end of iteration = 127 | cost = 0.23351639
-----
Circuit = alternative_ckt_1 | Layers = 7 | At end of iteration = 128 | cost = 0.23293040
-----
Circuit = alternative_ckt_1 | Layers = 7 | At end of iteration = 129 | cost = 0.23234203
-----
Circuit = alternative_ckt_1 | Layers = 7 | At end of iteration = 130 | cost = 0.23175125
-----
Circuit = alternative_ckt_1 | Layers = 7 | At end of iteration = 131 | cost = 0.23115803
-----
Circuit = alternative_ckt_1 | Layers = 7 | At end of iteration = 132 | cost = 0.23056231
-----
Circuit = alternative_ckt_1 | Layers = 7 | At end of iteration = 133 | cost = 0.22996407
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Circuit = alternative_ckt_1 Layers = 7 At end of iteration = 134 cost = 0.22936326
Circuit = alternative_ckt_1 Layers = 7 At end of iteration = 135 cost = 0.22875984
Circuit = alternative_ckt_1 Layers = 7 At end of iteration = 136 cost = 0.22815378
Circuit = alternative_ckt_1 Layers = 7 At end of iteration = 137 cost = 0.22754503
Circuit = alternative_ckt_1 Layers = 7 At end of iteration = 138 cost = 0.22693356
Circuit = alternative_ckt_1 Layers = 7 At end of iteration = 139 cost = 0.22631932
Circuit = alternative_ckt_1 Layers = 7 At end of iteration = 140 cost = 0.22570228
Circuit = alternative_ckt_1 Layers = 7 At end of iteration = 141 cost = 0.22508239
Circuit = alternative_ckt_1 Layers = 7 At end of iteration = 142 cost = 0.22445961
Circuit = alternative_ckt_1 Layers = 7 At end of iteration = 143 cost = 0.22383390
Circuit = alternative_ckt_1 Layers = 7 At end of iteration = 144 cost = 0.22320522
Circuit = alternative_ckt_1 Layers = 7 At end of iteration = 145 cost = 0.22257354
Circuit = alternative_ckt_1 Layers = 7 At end of iteration = 146 cost = 0.22193880
Circuit = alternative_ckt_1 Layers = 7 At end of iteration = 147 cost = 0.22130096
Circuit = alternative_ckt_1 Layers = 7 At end of iteration = 148 cost = 0.22065999
Circuit = alternative_ckt_1 Layers = 7 At end of iteration = 149 cost = 0.22001585
Circuit = alternative_ckt_1 Layers = 7 At end of iteration = 150 cost = 0.21936849
Circuit = alternative_ckt_1 Layers = 7 At end of iteration = 151 cost = 0.21871787
Circuit = alternative_ckt_1 Layers = 7 At end of iteration = 152 cost = 0.21806395
Circuit = alternative_ckt_1 Layers = 7 At end of iteration = 153 cost = 0.21740670
Circuit = alternative_ckt_1 Layers = 7 At end of iteration = 154 cost = 0.21674606
Circuit = alternative_ckt_1 Layers = 7 At end of iteration = 155 cost = 0.21608200
Circuit = alternative_ckt_1 Layers = 7 At end of iteration = 156 cost = 0.21541449
Circuit = alternative_ckt_1 Layers = 7 At end of iteration = 157 cost = 0.21474347

Circuit = alternative_ckt_1 Layers = 7 At end of iteration = 158 cost = 0.21406891
Circuit = alternative_ckt_1 Layers = 7 At end of iteration = 159 cost = 0.21339078
Circuit = alternative_ckt_1 Layers = 7 At end of iteration = 160 cost = 0.21270902
Circuit = alternative_ckt_1 Layers = 7 At end of iteration = 161 cost = 0.21202362
Circuit = alternative_ckt_1 Layers = 7 At end of iteration = 162 cost = 0.21133452
Circuit = alternative_ckt_1 Layers = 7 At end of iteration = 163 cost = 0.21064170
Circuit = alternative_ckt_1 Layers = 7 At end of iteration = 164 cost = 0.20994512
Circuit = alternative_ckt_1 Layers = 7 At end of iteration = 165 cost = 0.20924473
Circuit = alternative_ckt_1 Layers = 7 At end of iteration = 166 cost = 0.20854052
Circuit = alternative_ckt_1 Layers = 7 At end of iteration = 167 cost = 0.20783245
Circuit = alternative_ckt_1 Layers = 7 At end of iteration = 168 cost = 0.20712048
Circuit = alternative_ckt_1 Layers = 7 At end of iteration = 169 cost = 0.20640459
Circuit = alternative_ckt_1 Layers = 7 At end of iteration = 170 cost = 0.20568475
Circuit = alternative_ckt_1 Layers = 7 At end of iteration = 171 cost = 0.20496092
Circuit = alternative_ckt_1 Layers = 7 At end of iteration = 172 cost = 0.20423310
Circuit = alternative_ckt_1 Layers = 7 At end of iteration = 173 cost = 0.20350124
Circuit = alternative_ckt_1 Layers = 7 At end of iteration = 174 cost = 0.20276534
Circuit = alternative_ckt_1 Layers = 7 At end of iteration = 175 cost = 0.20202536
Circuit = alternative_ckt_1 Layers = 7 At end of iteration = 176 cost = 0.20128130
Circuit = alternative_ckt_1 Layers = 7 At end of iteration = 177 cost = 0.20053313
Circuit = alternative_ckt_1 Layers = 7 At end of iteration = 178 cost = 0.19978085
Circuit = alternative_ckt_1 Layers = 7 At end of iteration = 179 cost = 0.19902444
Circuit = alternative_ckt_1 Layers = 7 At end of iteration = 180 cost = 0.19826389
Circuit = alternative_ckt_1 Layers = 7 At end of iteration = 181 cost = 0.19749920

Circuit = alternative_ckt_1 Layers = 7 At end of iteration = 182 cost = 0.19673038
Circuit = alternative_ckt_1 Layers = 7 At end of iteration = 183 cost = 0.19595741
Circuit = alternative_ckt_1 Layers = 7 At end of iteration = 184 cost = 0.19518030
Circuit = alternative_ckt_1 Layers = 7 At end of iteration = 185 cost = 0.19439907
Circuit = alternative_ckt_1 Layers = 7 At end of iteration = 186 cost = 0.19361372
Circuit = alternative_ckt_1 Layers = 7 At end of iteration = 187 cost = 0.19282427
Circuit = alternative_ckt_1 Layers = 7 At end of iteration = 188 cost = 0.19203075
Circuit = alternative_ckt_1 Layers = 7 At end of iteration = 189 cost = 0.19123316
Circuit = alternative_ckt_1 Layers = 7 At end of iteration = 190 cost = 0.19043155
Circuit = alternative_ckt_1 Layers = 7 At end of iteration = 191 cost = 0.18962595
Circuit = alternative_ckt_1 Layers = 7 At end of iteration = 192 cost = 0.18881639
Circuit = alternative_ckt_1 Layers = 7 At end of iteration = 193 cost = 0.18800292
Circuit = alternative_ckt_1 Layers = 7 At end of iteration = 194 cost = 0.18718559
Circuit = alternative_ckt_1 Layers = 7 At end of iteration = 195 cost = 0.18636446
Circuit = alternative_ckt_1 Layers = 7 At end of iteration = 196 cost = 0.18553958
Circuit = alternative_ckt_1 Layers = 7 At end of iteration = 197 cost = 0.18471103
Circuit = alternative_ckt_1 Layers = 7 At end of iteration = 198 cost = 0.18387887
Circuit = alternative_ckt_1 Layers = 7 At end of iteration = 199 cost = 0.18304319
Circuit = alternative_ckt_1 Layers = 7 At end of iteration = 200 cost = 0.18220408
Circuit = alternative_ckt_1 Layers = 7 At end of iteration = 201 cost = 0.18136162
Circuit = alternative_ckt_1 Layers = 7 At end of iteration = 202 cost = 0.18051592
Circuit = alternative_ckt_1 Layers = 7 At end of iteration = 203 cost = 0.17966710
Circuit = alternative_ckt_1 Layers = 7 At end of iteration = 204 cost = 0.17881526
Circuit = alternative_ckt_1 Layers = 7 At end of iteration = 205 cost = 0.17796053

Circuit = alternative_ckt_1 Layers = 7 At end of iteration = 206 cost = 0.17710305
Circuit = alternative_ckt_1 Layers = 7 At end of iteration = 207 cost = 0.17624296
Circuit = alternative_ckt_1 Layers = 7 At end of iteration = 208 cost = 0.17538041
Circuit = alternative_ckt_1 Layers = 7 At end of iteration = 209 cost = 0.17451556
Circuit = alternative_ckt_1 Layers = 7 At end of iteration = 210 cost = 0.17364858
Circuit = alternative_ckt_1 Layers = 7 At end of iteration = 211 cost = 0.17277965
Circuit = alternative_ckt_1 Layers = 7 At end of iteration = 212 cost = 0.17190896
Circuit = alternative_ckt_1 Layers = 7 At end of iteration = 213 cost = 0.17103671
Circuit = alternative_ckt_1 Layers = 7 At end of iteration = 214 cost = 0.17016310
Circuit = alternative_ckt_1 Layers = 7 At end of iteration = 215 cost = 0.16928836
Circuit = alternative_ckt_1 Layers = 7 At end of iteration = 216 cost = 0.16841272
Circuit = alternative_ckt_1 Layers = 7 At end of iteration = 217 cost = 0.16753641
Circuit = alternative_ckt_1 Layers = 7 At end of iteration = 218 cost = 0.16665970
Circuit = alternative_ckt_1 Layers = 7 At end of iteration = 219 cost = 0.16578283
Circuit = alternative_ckt_1 Layers = 7 At end of iteration = 220 cost = 0.16490608
Circuit = alternative_ckt_1 Layers = 7 At end of iteration = 221 cost = 0.16402975
Circuit = alternative_ckt_1 Layers = 7 At end of iteration = 222 cost = 0.16315411
Circuit = alternative_ckt_1 Layers = 7 At end of iteration = 223 cost = 0.16227949
Circuit = alternative_ckt_1 Layers = 7 At end of iteration = 224 cost = 0.16140619
Circuit = alternative_ckt_1 Layers = 7 At end of iteration = 225 cost = 0.16053455
Circuit = alternative_ckt_1 Layers = 7 At end of iteration = 226 cost = 0.15966490
Circuit = alternative_ckt_1 Layers = 7 At end of iteration = 227 cost = 0.15879760
Circuit = alternative_ckt_1 Layers = 7 At end of iteration = 228 cost = 0.15793301
Circuit = alternative_ckt_1 Layers = 7 At end of iteration = 229 cost = 0.15707150

Circuit = alternative_ckt_1 Layers = 7 At end of iteration = 230 cost = 0.15621345
Circuit = alternative_ckt_1 Layers = 7 At end of iteration = 231 cost = 0.15535925
Circuit = alternative_ckt_1 Layers = 7 At end of iteration = 232 cost = 0.15450930
Circuit = alternative_ckt_1 Layers = 7 At end of iteration = 233 cost = 0.15366402
Circuit = alternative_ckt_1 Layers = 7 At end of iteration = 234 cost = 0.15282383
Circuit = alternative_ckt_1 Layers = 7 At end of iteration = 235 cost = 0.15198914
Circuit = alternative_ckt_1 Layers = 7 At end of iteration = 236 cost = 0.15116041
Circuit = alternative_ckt_1 Layers = 7 At end of iteration = 237 cost = 0.15033807
Circuit = alternative_ckt_1 Layers = 7 At end of iteration = 238 cost = 0.14952258
Circuit = alternative_ckt_1 Layers = 7 At end of iteration = 239 cost = 0.14871438
Circuit = alternative_ckt_1 Layers = 7 At end of iteration = 240 cost = 0.14791395
Circuit = alternative_ckt_1 Layers = 7 At end of iteration = 241 cost = 0.14712173
Circuit = alternative_ckt_1 Layers = 7 At end of iteration = 242 cost = 0.14633821
Circuit = alternative_ckt_1 Layers = 7 At end of iteration = 243 cost = 0.14556386
Circuit = alternative_ckt_1 Layers = 7 At end of iteration = 244 cost = 0.14479914
Circuit = alternative_ckt_1 Layers = 7 At end of iteration = 245 cost = 0.14404453
Circuit = alternative_ckt_1 Layers = 7 At end of iteration = 246 cost = 0.14330051
Circuit = alternative_ckt_1 Layers = 7 At end of iteration = 247 cost = 0.14256753
Circuit = alternative_ckt_1 Layers = 7 At end of iteration = 248 cost = 0.14184607
Circuit = alternative_ckt_1 Layers = 7 At end of iteration = 249 cost = 0.14113659
Circuit = alternative_ckt_1 Layers = 7 At end of iteration = 250 cost = 0.14043955
Circuit = alternative_ckt_1 Layers = 7 At end of iteration = 251 cost = 0.13975539
Circuit = alternative_ckt_1 Layers = 7 At end of iteration = 252 cost = 0.13908456
Circuit = alternative_ckt_1 Layers = 7 At end of iteration = 253 cost = 0.13842748

Circuit = alternative_ckt_1 Layers = 7 At end of iteration = 254 cost = 0.13778458
Circuit = alternative_ckt_1 Layers = 7 At end of iteration = 255 cost = 0.13715626
Circuit = alternative_ckt_1 Layers = 7 At end of iteration = 256 cost = 0.13654292
Circuit = alternative_ckt_1 Layers = 7 At end of iteration = 257 cost = 0.13594493
Circuit = alternative_ckt_1 Layers = 7 At end of iteration = 258 cost = 0.13536265
Circuit = alternative_ckt_1 Layers = 7 At end of iteration = 259 cost = 0.13479642
Circuit = alternative_ckt_1 Layers = 7 At end of iteration = 260 cost = 0.13424657
Circuit = alternative_ckt_1 Layers = 7 At end of iteration = 261 cost = 0.13371340
Circuit = alternative_ckt_1 Layers = 7 At end of iteration = 262 cost = 0.13319718
Circuit = alternative_ckt_1 Layers = 7 At end of iteration = 263 cost = 0.13269817
Circuit = alternative_ckt_1 Layers = 7 At end of iteration = 264 cost = 0.13221660
Circuit = alternative_ckt_1 Layers = 7 At end of iteration = 265 cost = 0.13175269
Circuit = alternative_ckt_1 Layers = 7 At end of iteration = 266 cost = 0.13130660
Circuit = alternative_ckt_1 Layers = 7 At end of iteration = 267 cost = 0.13087851
Circuit = alternative_ckt_1 Layers = 7 At end of iteration = 268 cost = 0.13046852
Circuit = alternative_ckt_1 Layers = 7 At end of iteration = 269 cost = 0.13007675
Circuit = alternative_ckt_1 Layers = 7 At end of iteration = 270 cost = 0.12970326
Circuit = alternative_ckt_1 Layers = 7 At end of iteration = 271 cost = 0.12934811
Circuit = alternative_ckt_1 Layers = 7 At end of iteration = 272 cost = 0.12901129
Circuit = alternative_ckt_1 Layers = 7 At end of iteration = 273 cost = 0.12869281
Circuit = alternative_ckt_1 Layers = 7 At end of iteration = 274 cost = 0.12839262
Circuit = alternative_ckt_1 Layers = 7 At end of iteration = 275 cost = 0.12811065
Circuit = alternative_ckt_1 Layers = 7 At end of iteration = 276 cost = 0.12784681
Circuit = alternative_ckt_1 Layers = 7 At end of iteration = 277 cost = 0.12760097

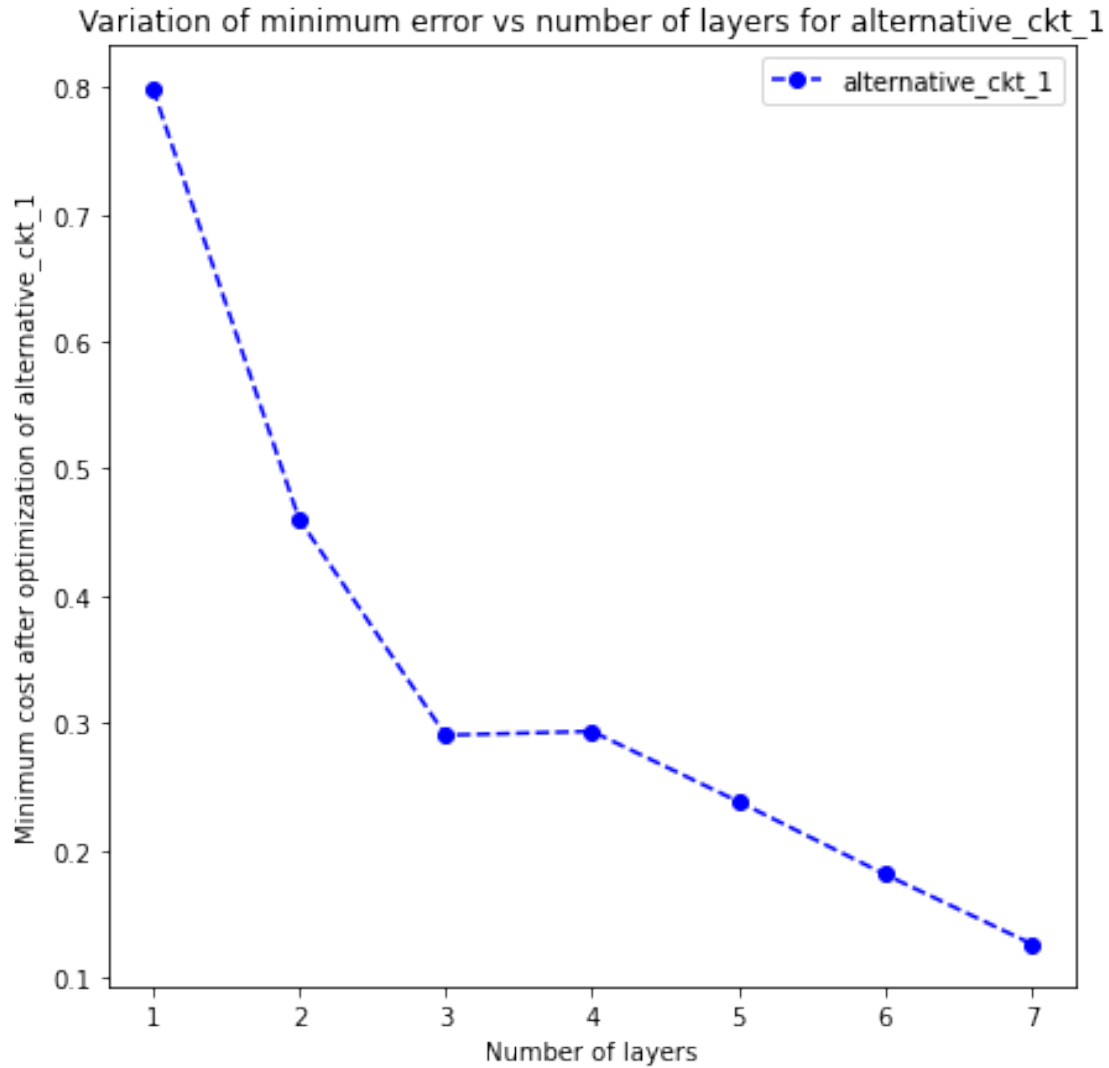

```

Circuit = alternative_ckt_1 | Layers = 7 | At end of iteration = 278 | cost = 0.12737299
-----
Circuit = alternative_ckt_1 | Layers = 7 | At end of iteration = 279 | cost = 0.12716270
-----
Circuit = alternative_ckt_1 | Layers = 7 | At end of iteration = 280 | cost = 0.12696990
-----
Circuit = alternative_ckt_1 | Layers = 7 | At end of iteration = 281 | cost = 0.12679437
-----
Circuit = alternative_ckt_1 | Layers = 7 | At end of iteration = 282 | cost = 0.12663587
-----
Circuit = alternative_ckt_1 | Layers = 7 | At end of iteration = 283 | cost = 0.12649413
-----
Circuit = alternative_ckt_1 | Layers = 7 | At end of iteration = 284 | cost = 0.12636889
-----
Circuit = alternative_ckt_1 | Layers = 7 | At end of iteration = 285 | cost = 0.12625983
-----
Circuit = alternative_ckt_1 | Layers = 7 | At end of iteration = 286 | cost = 0.12616665
-----
Circuit = alternative_ckt_1 | Layers = 7 | At end of iteration = 287 | cost = 0.12608901
-----
Circuit = alternative_ckt_1 | Layers = 7 | At end of iteration = 288 | cost = 0.12602656
-----
Circuit = alternative_ckt_1 | Layers = 7 | At end of iteration = 289 | cost = 0.12597896
-----
Circuit = alternative_ckt_1 | Layers = 7 | At end of iteration = 290 | cost = 0.12594584
-----
Circuit = alternative_ckt_1 | Layers = 7 | At end of iteration = 291 | cost = 0.12592681
-----
Circuit = alternative_ckt_1 | Layers = 7 | At end of iteration = 292 | cost = 0.12592150
-----
Circuit = alternative_ckt_1 | Layers = 7 | At end of iteration = 293 | cost = 0.12592951
-----
Circuit = alternative_ckt_1 | Layers = 7 | At end of iteration = 294 | cost = 0.12595044
-----
Circuit = alternative_ckt_1 | Layers = 7 | At end of iteration = 295 | cost = 0.12598390
-----
Circuit = alternative_ckt_1 | Layers = 7 | At end of iteration = 296 | cost = 0.12602949
-----
Circuit = alternative_ckt_1 | Layers = 7 | At end of iteration = 297 | cost = 0.12608678
-----
Circuit = alternative_ckt_1 | Layers = 7 | At end of iteration = 298 | cost = 0.12615540
-----
Circuit = alternative_ckt_1 | Layers = 7 | At end of iteration = 299 | cost = 0.12623491
-----
Circuit = alternative_ckt_1 | Layers = 7 | At end of iteration = 300 | cost = 0.12632494
-----

```

Optimization complete.

After optimization, the optimal parameters are



A similar behaviour can be seen: as the number of layers increases, the circuit is able to simulate the random target quantum state more closely than before, but once the number of layers increases to a point, the reduction in cost seems to saturate.

Towards the end of the notebook, a comparative plot of these minimum costs will be constructed for the different types of ansatze considered.

0.0.11 Alternative 2 - Odd layer with general U3 gates

As a final attempt, let us construct the odd layer with U3 gates for which three parameters (rotation angles) can be specified.

```
In [18]: class alternative_ckt_2(parametric_ckt):
def append_odd_layer(self, sub_layer_id):
    theta = ParameterVector('theta'+str(sub_layer_id), length=self.num_qubits)
    phi = ParameterVector('phi'+str(sub_layer_id), length=self.num_qubits)
```

```

        lambda = ParameterVector('lambda'+str(sub_layer_id), length=self.num_qubits)
        for i in range(self.num_qubits):
            self.qc.u3(theta[i], phi[i], lambda[i], i)

    def append_even_layer(self, sub_layer_id):
        theta = ParameterVector('theta'+str(sub_layer_id), length=self.num_qubits)
        for i in range(self.num_qubits):
            self.qc.rz(theta[i], i)
        for i in range(self.num_qubits):
            for j in range(i+1, self.num_qubits):
                self.qc.cz(i, j)

```

Visualizing the circuit for 2 layers gives:

```

In [19]: c5 = alternative_ckt_2(4)
         c5.barriers_on = True
         c5.build_ckt(2)
         qc5 = c5.get_ckt()
         qc5.draw(output='text')

```

Circuit Circuit constructed with 2 layers. Number of parameters = 32 .

```

Out[19]:
      z
q_0:  U3(theta1[0],phi1[0],lambda1[0])  RZ(theta2[0])  z
      z
q_1:  U3(theta1[1],phi1[1],lambda1[1])  RZ(theta2[1])  z
      z
q_2:  U3(theta1[2],phi1[2],lambda1[2])  RZ(theta2[2])  z
      z
q_3:  U3(theta1[3],phi1[3],lambda1[3])  RZ(theta2[3])  z
      z
ñ      z
ñq_0:  U3(theta3[0],phi3[0],lambda3[0])  RZ(theta4[0])  z
ñ      z
ñq_1:  U3(theta3[1],phi3[1],lambda3[1])  RZ(theta4[1])  z
ñ      z
ñq_2:  U3(theta3[2],phi3[2],lambda3[2])  RZ(theta4[2])  z
ñ      z
ñq_3:  U3(theta3[3],phi3[3],lambda3[3])  RZ(theta4[3])  z
ñ      z
ñq_0:
ñ
ñq_1:
ñ
ñq_2:
ñ

```

```
nq_3:
n
```

Let us run the optimization routine as before:

```
In [20]: c6 = alternative_ckt_2(4)
         c6.name = 'alternative_ckt_2'
         c6.max_iter = 300
         c6.theta_step = 0.1
         c6.alpha = 1
         c6.max_layers = 7
         c6.run()
```

Initializing the target quantum state of 4 qubit(s) randomly as =

```
[[0.23159775+0.26854207j]
 [0.00311054+0.21447093j]
 [0.29194447+0.13477361j]
 [0.17650717+0.08413362j]
 [0.14187615+0.0357318j ]
 [0.24618063+0.11442822j]
 [0.15077095+0.10407606j]
 [0.03843793+0.10371948j]
 [0.29033053+0.05840304j]
 [0.18982017+0.03884797j]
 [0.28842729+0.01764276j]
 [0.05958415+0.02353189j]
 [0.29649158+0.18139203j]
 [0.20412371+0.00778893j]
 [0.20336406+0.26472618j]
 [0.18037261+0.16232797j]]
```

Norm of the above vector is 1.0

Circuit alternative_ckt_2 constructed with 1 layers. Number of parameters = 16 .

Initialized circuit parameters prior to gradient descent randomly as follows:

```
idx = phi1[2] params = 0.03719052023213644
idx = theta2[0] params = 0.04312312828020062
idx = theta1[3] params = 0.0004994971757621869
idx = phi1[3] params = 0.03444025418170515
idx = phi1[1] params = 0.046881140646663634
idx = phi1[0] params = 0.02164226791611938
idx = theta1[0] params = 0.028343942770291508
idx = theta1[2] params = 0.013510378554063363
idx = theta2[1] params = 0.022782810868909098
idx = lambda1[3] params = 0.00573789773068969
idx = theta2[2] params = 0.039532273767073196
idx = theta2[3] params = 0.018375156312795238
```

```

idx = lambda1[2] params = 0.02421115885861306
idx = lambda1[1] params = 0.01671278315727628
idx = theta1[1] params = 0.006172454610576922
idx = lambda1[0] params = 0.016655522656847783

```

```

-----
Circuit = alternative_ckt_2 | Layers = 1 | At end of iteration = 1 | cost = 1.2095231619
-----
Circuit = alternative_ckt_2 | Layers = 1 | At end of iteration = 2 | cost = 1.1880208707
-----
Circuit = alternative_ckt_2 | Layers = 1 | At end of iteration = 3 | cost = 1.1716992067
-----
Circuit = alternative_ckt_2 | Layers = 1 | At end of iteration = 4 | cost = 1.1589558426
-----
Circuit = alternative_ckt_2 | Layers = 1 | At end of iteration = 5 | cost = 1.1485603484
-----
Circuit = alternative_ckt_2 | Layers = 1 | At end of iteration = 6 | cost = 1.1396492321
-----
Circuit = alternative_ckt_2 | Layers = 1 | At end of iteration = 7 | cost = 1.1316364457
-----
Circuit = alternative_ckt_2 | Layers = 1 | At end of iteration = 8 | cost = 1.1241203637
-----
Circuit = alternative_ckt_2 | Layers = 1 | At end of iteration = 9 | cost = 1.1168139699
-----
Circuit = alternative_ckt_2 | Layers = 1 | At end of iteration = 10 | cost = 1.109500493
-----
Circuit = alternative_ckt_2 | Layers = 1 | At end of iteration = 11 | cost = 1.102009210
-----
Circuit = alternative_ckt_2 | Layers = 1 | At end of iteration = 12 | cost = 1.094205362
-----
Circuit = alternative_ckt_2 | Layers = 1 | At end of iteration = 13 | cost = 1.085989170
-----
Circuit = alternative_ckt_2 | Layers = 1 | At end of iteration = 14 | cost = 1.077299923
-----
Circuit = alternative_ckt_2 | Layers = 1 | At end of iteration = 15 | cost = 1.068121496
-----
Circuit = alternative_ckt_2 | Layers = 1 | At end of iteration = 16 | cost = 1.058485437
-----
Circuit = alternative_ckt_2 | Layers = 1 | At end of iteration = 17 | cost = 1.048467490
-----
Circuit = alternative_ckt_2 | Layers = 1 | At end of iteration = 18 | cost = 1.038173738
-----
Circuit = alternative_ckt_2 | Layers = 1 | At end of iteration = 19 | cost = 1.027714434
-----
Circuit = alternative_ckt_2 | Layers = 1 | At end of iteration = 20 | cost = 1.017167184
-----
Circuit = alternative_ckt_2 | Layers = 1 | At end of iteration = 21 | cost = 1.006535788
-----
Circuit = alternative_ckt_2 | Layers = 1 | At end of iteration = 22 | cost = 0.995714827

```

```

-----
Circuit = alternative_ckt_2 | Layers = 1 | At end of iteration = 23 | cost = 0.9844720250
-----
Circuit = alternative_ckt_2 | Layers = 1 | At end of iteration = 24 | cost = 0.9724608711
-----
Circuit = alternative_ckt_2 | Layers = 1 | At end of iteration = 25 | cost = 0.9592762754
-----
Circuit = alternative_ckt_2 | Layers = 1 | At end of iteration = 26 | cost = 0.9445633991
-----
Circuit = alternative_ckt_2 | Layers = 1 | At end of iteration = 27 | cost = 0.9281753180
-----
Circuit = alternative_ckt_2 | Layers = 1 | At end of iteration = 28 | cost = 0.9103392321
-----
Circuit = alternative_ckt_2 | Layers = 1 | At end of iteration = 29 | cost = 0.8917452320
-----
Circuit = alternative_ckt_2 | Layers = 1 | At end of iteration = 30 | cost = 0.8734638600
-----
Circuit = alternative_ckt_2 | Layers = 1 | At end of iteration = 31 | cost = 0.8566742884
-----
Circuit = alternative_ckt_2 | Layers = 1 | At end of iteration = 32 | cost = 0.8423116750
-----
Circuit = alternative_ckt_2 | Layers = 1 | At end of iteration = 33 | cost = 0.8308173660
-----
Circuit = alternative_ckt_2 | Layers = 1 | At end of iteration = 34 | cost = 0.8221186391
-----
Circuit = alternative_ckt_2 | Layers = 1 | At end of iteration = 35 | cost = 0.8158031934
-----
Circuit = alternative_ckt_2 | Layers = 1 | At end of iteration = 36 | cost = 0.8113398410
-----
Circuit = alternative_ckt_2 | Layers = 1 | At end of iteration = 37 | cost = 0.8082306791
-----
Circuit = alternative_ckt_2 | Layers = 1 | At end of iteration = 38 | cost = 0.8060752381
-----
Circuit = alternative_ckt_2 | Layers = 1 | At end of iteration = 39 | cost = 0.8045774440
-----
REDUCING ALPHA TO 0.31622776601683794 at iteration = 40
-----
Circuit = alternative_ckt_2 | Layers = 1 | At end of iteration = 40 | cost = 0.8035285051
-----
Circuit = alternative_ckt_2 | Layers = 1 | At end of iteration = 41 | cost = 0.8032790731
-----
Circuit = alternative_ckt_2 | Layers = 1 | At end of iteration = 42 | cost = 0.8030534031
-----
Circuit = alternative_ckt_2 | Layers = 1 | At end of iteration = 43 | cost = 0.8028489461
-----
Circuit = alternative_ckt_2 | Layers = 1 | At end of iteration = 44 | cost = 0.8026634460
-----
Circuit = alternative_ckt_2 | Layers = 1 | At end of iteration = 45 | cost = 0.8024949000

```

```

-----
Circuit = alternative_ckt_2 | Layers = 1 | At end of iteration = 46 | cost = 0.8023415270
-----
Circuit = alternative_ckt_2 | Layers = 1 | At end of iteration = 47 | cost = 0.8022017421
-----
Circuit = alternative_ckt_2 | Layers = 1 | At end of iteration = 48 | cost = 0.8020741344
-----
Circuit = alternative_ckt_2 | Layers = 1 | At end of iteration = 49 | cost = 0.8019574463
-----
Circuit = alternative_ckt_2 | Layers = 1 | At end of iteration = 50 | cost = 0.8018505613
-----
Circuit = alternative_ckt_2 | Layers = 1 | At end of iteration = 51 | cost = 0.8017524814
-----
Circuit = alternative_ckt_2 | Layers = 1 | At end of iteration = 52 | cost = 0.8016623190
-----
Circuit = alternative_ckt_2 | Layers = 1 | At end of iteration = 53 | cost = 0.8015792851
-----
Circuit = alternative_ckt_2 | Layers = 1 | At end of iteration = 54 | cost = 0.8015026744
-----
Circuit = alternative_ckt_2 | Layers = 1 | At end of iteration = 55 | cost = 0.8014318570
-----
Circuit = alternative_ckt_2 | Layers = 1 | At end of iteration = 56 | cost = 0.8013662753
-----
Circuit = alternative_ckt_2 | Layers = 1 | At end of iteration = 57 | cost = 0.8013054270
-----
Circuit = alternative_ckt_2 | Layers = 1 | At end of iteration = 58 | cost = 0.8012488663
-----
Circuit = alternative_ckt_2 | Layers = 1 | At end of iteration = 59 | cost = 0.8011961953
-----
Circuit = alternative_ckt_2 | Layers = 1 | At end of iteration = 60 | cost = 0.8011470563
-----
Circuit = alternative_ckt_2 | Layers = 1 | At end of iteration = 61 | cost = 0.8011011321
-----
Circuit = alternative_ckt_2 | Layers = 1 | At end of iteration = 62 | cost = 0.8010581372
-----
Circuit = alternative_ckt_2 | Layers = 1 | At end of iteration = 63 | cost = 0.8010178154
-----
Circuit = alternative_ckt_2 | Layers = 1 | At end of iteration = 64 | cost = 0.8009799381
-----
Circuit = alternative_ckt_2 | Layers = 1 | At end of iteration = 65 | cost = 0.8009443000
-----
Circuit = alternative_ckt_2 | Layers = 1 | At end of iteration = 66 | cost = 0.8009107163
-----
Circuit = alternative_ckt_2 | Layers = 1 | At end of iteration = 67 | cost = 0.8008790211
-----
Circuit = alternative_ckt_2 | Layers = 1 | At end of iteration = 68 | cost = 0.8008490663
-----
Circuit = alternative_ckt_2 | Layers = 1 | At end of iteration = 69 | cost = 0.8008207163
-----

```



```

-----
Circuit = alternative_ckt_2 | Layers = 1 | At end of iteration = 70 | cost = 0.800793850
-----
Circuit = alternative_ckt_2 | Layers = 1 | At end of iteration = 71 | cost = 0.800768358
-----
Circuit = alternative_ckt_2 | Layers = 1 | At end of iteration = 72 | cost = 0.800744141
-----
Circuit = alternative_ckt_2 | Layers = 1 | At end of iteration = 73 | cost = 0.800721110
-----
Circuit = alternative_ckt_2 | Layers = 1 | At end of iteration = 74 | cost = 0.800699183
-----
Circuit = alternative_ckt_2 | Layers = 1 | At end of iteration = 75 | cost = 0.800678287
-----
Circuit = alternative_ckt_2 | Layers = 1 | At end of iteration = 76 | cost = 0.800658353
-----
Circuit = alternative_ckt_2 | Layers = 1 | At end of iteration = 77 | cost = 0.800639322
-----
Circuit = alternative_ckt_2 | Layers = 1 | At end of iteration = 78 | cost = 0.800621136
-----
Circuit = alternative_ckt_2 | Layers = 1 | At end of iteration = 79 | cost = 0.800603745
-----
REDUCING ALPHA TO 0.09999999999999999 at iteration = 80
-----
Circuit = alternative_ckt_2 | Layers = 1 | At end of iteration = 80 | cost = 0.800587102
-----
Circuit = alternative_ckt_2 | Layers = 1 | At end of iteration = 81 | cost = 0.800582039
-----
Circuit = alternative_ckt_2 | Layers = 1 | At end of iteration = 82 | cost = 0.800577044
-----
Circuit = alternative_ckt_2 | Layers = 1 | At end of iteration = 83 | cost = 0.800572115
-----
Circuit = alternative_ckt_2 | Layers = 1 | At end of iteration = 84 | cost = 0.800567252
-----
Circuit = alternative_ckt_2 | Layers = 1 | At end of iteration = 85 | cost = 0.800562453
-----
Circuit = alternative_ckt_2 | Layers = 1 | At end of iteration = 86 | cost = 0.800557717
-----
Circuit = alternative_ckt_2 | Layers = 1 | At end of iteration = 87 | cost = 0.800553044
-----
Circuit = alternative_ckt_2 | Layers = 1 | At end of iteration = 88 | cost = 0.800548431
-----
Circuit = alternative_ckt_2 | Layers = 1 | At end of iteration = 89 | cost = 0.800543878
-----
Circuit = alternative_ckt_2 | Layers = 1 | At end of iteration = 90 | cost = 0.800539384
-----
Circuit = alternative_ckt_2 | Layers = 1 | At end of iteration = 91 | cost = 0.800534949
-----
Circuit = alternative_ckt_2 | Layers = 1 | At end of iteration = 92 | cost = 0.800530570
-----

```

```

-----
Circuit = alternative_ckt_2 | Layers = 1 | At end of iteration = 93 | cost = 0.8005262479
-----
Circuit = alternative_ckt_2 | Layers = 1 | At end of iteration = 94 | cost = 0.8005219800
-----
Circuit = alternative_ckt_2 | Layers = 1 | At end of iteration = 95 | cost = 0.8005177674
-----
Circuit = alternative_ckt_2 | Layers = 1 | At end of iteration = 96 | cost = 0.8005136070
-----
Circuit = alternative_ckt_2 | Layers = 1 | At end of iteration = 97 | cost = 0.8005095007
-----
Circuit = alternative_ckt_2 | Layers = 1 | At end of iteration = 98 | cost = 0.8005054453
-----
Circuit = alternative_ckt_2 | Layers = 1 | At end of iteration = 99 | cost = 0.8005014409
-----
Circuit = alternative_ckt_2 | Layers = 1 | At end of iteration = 100 | cost = 0.8004974830
-----
Circuit = alternative_ckt_2 | Layers = 1 | At end of iteration = 101 | cost = 0.8004935830
-----
Circuit = alternative_ckt_2 | Layers = 1 | At end of iteration = 102 | cost = 0.8004897230
-----
Circuit = alternative_ckt_2 | Layers = 1 | At end of iteration = 103 | cost = 0.8004859130
-----
Circuit = alternative_ckt_2 | Layers = 1 | At end of iteration = 104 | cost = 0.8004821530
-----
Circuit = alternative_ckt_2 | Layers = 1 | At end of iteration = 105 | cost = 0.8004784330
-----
Circuit = alternative_ckt_2 | Layers = 1 | At end of iteration = 106 | cost = 0.8004747730
-----
Circuit = alternative_ckt_2 | Layers = 1 | At end of iteration = 107 | cost = 0.8004711430
-----
Circuit = alternative_ckt_2 | Layers = 1 | At end of iteration = 108 | cost = 0.8004675630
-----
Circuit = alternative_ckt_2 | Layers = 1 | At end of iteration = 109 | cost = 0.8004640230
-----
Circuit = alternative_ckt_2 | Layers = 1 | At end of iteration = 110 | cost = 0.8004605330
-----
Circuit = alternative_ckt_2 | Layers = 1 | At end of iteration = 111 | cost = 0.8004570830
-----
Circuit = alternative_ckt_2 | Layers = 1 | At end of iteration = 112 | cost = 0.8004536730
-----
Circuit = alternative_ckt_2 | Layers = 1 | At end of iteration = 113 | cost = 0.8004503030
-----
Circuit = alternative_ckt_2 | Layers = 1 | At end of iteration = 114 | cost = 0.8004469730
-----
Circuit = alternative_ckt_2 | Layers = 1 | At end of iteration = 115 | cost = 0.8004436930
-----
Circuit = alternative_ckt_2 | Layers = 1 | At end of iteration = 116 | cost = 0.8004404430
-----

```

```

-----
Circuit = alternative_ckt_2 | Layers = 1 | At end of iteration = 117 | cost = 0.80043723
-----
Circuit = alternative_ckt_2 | Layers = 1 | At end of iteration = 118 | cost = 0.80043406
-----
Circuit = alternative_ckt_2 | Layers = 1 | At end of iteration = 119 | cost = 0.80043092
-----
REDUCING ALPHA TO 0.03162277660168379 at iteration = 120
-----
Circuit = alternative_ckt_2 | Layers = 1 | At end of iteration = 120 | cost = 0.80042783
-----
Circuit = alternative_ckt_2 | Layers = 1 | At end of iteration = 121 | cost = 0.80042686
-----
Circuit = alternative_ckt_2 | Layers = 1 | At end of iteration = 122 | cost = 0.80042589
-----
Circuit = alternative_ckt_2 | Layers = 1 | At end of iteration = 123 | cost = 0.80042493
-----
Circuit = alternative_ckt_2 | Layers = 1 | At end of iteration = 124 | cost = 0.80042398
-----
Circuit = alternative_ckt_2 | Layers = 1 | At end of iteration = 125 | cost = 0.80042302
-----
Circuit = alternative_ckt_2 | Layers = 1 | At end of iteration = 126 | cost = 0.80042207
-----
Circuit = alternative_ckt_2 | Layers = 1 | At end of iteration = 127 | cost = 0.80042113
-----
Circuit = alternative_ckt_2 | Layers = 1 | At end of iteration = 128 | cost = 0.80042018
-----
Circuit = alternative_ckt_2 | Layers = 1 | At end of iteration = 129 | cost = 0.80041924
-----
Circuit = alternative_ckt_2 | Layers = 1 | At end of iteration = 130 | cost = 0.80041831
-----
Circuit = alternative_ckt_2 | Layers = 1 | At end of iteration = 131 | cost = 0.80041737
-----
Circuit = alternative_ckt_2 | Layers = 1 | At end of iteration = 132 | cost = 0.80041644
-----
Circuit = alternative_ckt_2 | Layers = 1 | At end of iteration = 133 | cost = 0.80041552
-----
Circuit = alternative_ckt_2 | Layers = 1 | At end of iteration = 134 | cost = 0.80041460
-----
Circuit = alternative_ckt_2 | Layers = 1 | At end of iteration = 135 | cost = 0.80041368
-----
Circuit = alternative_ckt_2 | Layers = 1 | At end of iteration = 136 | cost = 0.80041276
-----
Circuit = alternative_ckt_2 | Layers = 1 | At end of iteration = 137 | cost = 0.80041185
-----
Circuit = alternative_ckt_2 | Layers = 1 | At end of iteration = 138 | cost = 0.80041094
-----
Circuit = alternative_ckt_2 | Layers = 1 | At end of iteration = 139 | cost = 0.80041004
-----

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```

-----
Circuit = alternative_ckt_2 | Layers = 1 | At end of iteration = 140 | cost = 0.80040914
-----
Circuit = alternative_ckt_2 | Layers = 1 | At end of iteration = 141 | cost = 0.80040824
-----
Circuit = alternative_ckt_2 | Layers = 1 | At end of iteration = 142 | cost = 0.80040734
-----
Circuit = alternative_ckt_2 | Layers = 1 | At end of iteration = 143 | cost = 0.80040645
-----
Circuit = alternative_ckt_2 | Layers = 1 | At end of iteration = 144 | cost = 0.80040556
-----
Circuit = alternative_ckt_2 | Layers = 1 | At end of iteration = 145 | cost = 0.80040468
-----
Circuit = alternative_ckt_2 | Layers = 1 | At end of iteration = 146 | cost = 0.80040379
-----
Circuit = alternative_ckt_2 | Layers = 1 | At end of iteration = 147 | cost = 0.80040292
-----
Circuit = alternative_ckt_2 | Layers = 1 | At end of iteration = 148 | cost = 0.80040204
-----
Circuit = alternative_ckt_2 | Layers = 1 | At end of iteration = 149 | cost = 0.80040117
-----
Circuit = alternative_ckt_2 | Layers = 1 | At end of iteration = 150 | cost = 0.80040030
-----
Circuit = alternative_ckt_2 | Layers = 1 | At end of iteration = 151 | cost = 0.80039943
-----
Circuit = alternative_ckt_2 | Layers = 1 | At end of iteration = 152 | cost = 0.80039857
-----
Circuit = alternative_ckt_2 | Layers = 1 | At end of iteration = 153 | cost = 0.80039771
-----
Circuit = alternative_ckt_2 | Layers = 1 | At end of iteration = 154 | cost = 0.80039686
-----
Circuit = alternative_ckt_2 | Layers = 1 | At end of iteration = 155 | cost = 0.80039600
-----
Circuit = alternative_ckt_2 | Layers = 1 | At end of iteration = 156 | cost = 0.80039515
-----
Circuit = alternative_ckt_2 | Layers = 1 | At end of iteration = 157 | cost = 0.80039431
-----
Circuit = alternative_ckt_2 | Layers = 1 | At end of iteration = 158 | cost = 0.80039346
-----
Circuit = alternative_ckt_2 | Layers = 1 | At end of iteration = 159 | cost = 0.80039262
-----
Circuit = alternative_ckt_2 | Layers = 1 | At end of iteration = 160 | cost = 0.80039178
-----
Circuit = alternative_ckt_2 | Layers = 1 | At end of iteration = 161 | cost = 0.80039095
-----
Circuit = alternative_ckt_2 | Layers = 1 | At end of iteration = 162 | cost = 0.80039012
-----
Circuit = alternative_ckt_2 | Layers = 1 | At end of iteration = 163 | cost = 0.80038929
-----

```

```

-----
Circuit = alternative_ckt_2 | Layers = 1 | At end of iteration = 164 | cost = 0.80038847
-----
Circuit = alternative_ckt_2 | Layers = 1 | At end of iteration = 165 | cost = 0.80038764
-----
Circuit = alternative_ckt_2 | Layers = 1 | At end of iteration = 166 | cost = 0.80038682
-----
Circuit = alternative_ckt_2 | Layers = 1 | At end of iteration = 167 | cost = 0.80038601
-----
Circuit = alternative_ckt_2 | Layers = 1 | At end of iteration = 168 | cost = 0.80038520
-----
Circuit = alternative_ckt_2 | Layers = 1 | At end of iteration = 169 | cost = 0.80038439
-----
Circuit = alternative_ckt_2 | Layers = 1 | At end of iteration = 170 | cost = 0.80038358
-----
Circuit = alternative_ckt_2 | Layers = 1 | At end of iteration = 171 | cost = 0.80038277
-----
Circuit = alternative_ckt_2 | Layers = 1 | At end of iteration = 172 | cost = 0.80038197
-----
Circuit = alternative_ckt_2 | Layers = 1 | At end of iteration = 173 | cost = 0.80038117
-----
Circuit = alternative_ckt_2 | Layers = 1 | At end of iteration = 174 | cost = 0.80038038
-----
Circuit = alternative_ckt_2 | Layers = 1 | At end of iteration = 175 | cost = 0.80037959
-----
Circuit = alternative_ckt_2 | Layers = 1 | At end of iteration = 176 | cost = 0.80037880
-----
Circuit = alternative_ckt_2 | Layers = 1 | At end of iteration = 177 | cost = 0.80037801
-----
Circuit = alternative_ckt_2 | Layers = 1 | At end of iteration = 178 | cost = 0.80037723
-----
Circuit = alternative_ckt_2 | Layers = 1 | At end of iteration = 179 | cost = 0.80037645
-----
Circuit = alternative_ckt_2 | Layers = 1 | At end of iteration = 180 | cost = 0.80037567
-----
Circuit = alternative_ckt_2 | Layers = 1 | At end of iteration = 181 | cost = 0.80037489
-----
Circuit = alternative_ckt_2 | Layers = 1 | At end of iteration = 182 | cost = 0.80037412
-----
Circuit = alternative_ckt_2 | Layers = 1 | At end of iteration = 183 | cost = 0.80037335
-----
Circuit = alternative_ckt_2 | Layers = 1 | At end of iteration = 184 | cost = 0.80037258
-----
Circuit = alternative_ckt_2 | Layers = 1 | At end of iteration = 185 | cost = 0.80037182
-----
Circuit = alternative_ckt_2 | Layers = 1 | At end of iteration = 186 | cost = 0.80037106
-----
Circuit = alternative_ckt_2 | Layers = 1 | At end of iteration = 187 | cost = 0.80037030
-----

```

Circuit = alternative_ckt_2 Layers = 1 At end of iteration = 188 cost = 0.80036954
Circuit = alternative_ckt_2 Layers = 1 At end of iteration = 189 cost = 0.80036879
Circuit = alternative_ckt_2 Layers = 1 At end of iteration = 190 cost = 0.80036804
Circuit = alternative_ckt_2 Layers = 1 At end of iteration = 191 cost = 0.80036729
Circuit = alternative_ckt_2 Layers = 1 At end of iteration = 192 cost = 0.80036655
Circuit = alternative_ckt_2 Layers = 1 At end of iteration = 193 cost = 0.80036581
Circuit = alternative_ckt_2 Layers = 1 At end of iteration = 194 cost = 0.80036507
Circuit = alternative_ckt_2 Layers = 1 At end of iteration = 195 cost = 0.80036433
Circuit = alternative_ckt_2 Layers = 1 At end of iteration = 196 cost = 0.80036360
Circuit = alternative_ckt_2 Layers = 1 At end of iteration = 197 cost = 0.80036286
Circuit = alternative_ckt_2 Layers = 1 At end of iteration = 198 cost = 0.80036214
Circuit = alternative_ckt_2 Layers = 1 At end of iteration = 199 cost = 0.80036141
Circuit = alternative_ckt_2 Layers = 1 At end of iteration = 200 cost = 0.80036069
Circuit = alternative_ckt_2 Layers = 1 At end of iteration = 201 cost = 0.80035997
Circuit = alternative_ckt_2 Layers = 1 At end of iteration = 202 cost = 0.80035925
Circuit = alternative_ckt_2 Layers = 1 At end of iteration = 203 cost = 0.80035853
Circuit = alternative_ckt_2 Layers = 1 At end of iteration = 204 cost = 0.80035782
Circuit = alternative_ckt_2 Layers = 1 At end of iteration = 205 cost = 0.80035711
Circuit = alternative_ckt_2 Layers = 1 At end of iteration = 206 cost = 0.80035640
Circuit = alternative_ckt_2 Layers = 1 At end of iteration = 207 cost = 0.80035569
Circuit = alternative_ckt_2 Layers = 1 At end of iteration = 208 cost = 0.80035499
Circuit = alternative_ckt_2 Layers = 1 At end of iteration = 209 cost = 0.80035429
Circuit = alternative_ckt_2 Layers = 1 At end of iteration = 210 cost = 0.80035359
Circuit = alternative_ckt_2 Layers = 1 At end of iteration = 211 cost = 0.80035290

Circuit = alternative_ckt_2 Layers = 1 At end of iteration = 212 cost = 0.80035221
Circuit = alternative_ckt_2 Layers = 1 At end of iteration = 213 cost = 0.80035152
Circuit = alternative_ckt_2 Layers = 1 At end of iteration = 214 cost = 0.80035083
Circuit = alternative_ckt_2 Layers = 1 At end of iteration = 215 cost = 0.80035014
Circuit = alternative_ckt_2 Layers = 1 At end of iteration = 216 cost = 0.80034946
Circuit = alternative_ckt_2 Layers = 1 At end of iteration = 217 cost = 0.80034878
Circuit = alternative_ckt_2 Layers = 1 At end of iteration = 218 cost = 0.80034810
Circuit = alternative_ckt_2 Layers = 1 At end of iteration = 219 cost = 0.80034743
Circuit = alternative_ckt_2 Layers = 1 At end of iteration = 220 cost = 0.80034675
Circuit = alternative_ckt_2 Layers = 1 At end of iteration = 221 cost = 0.80034608
Circuit = alternative_ckt_2 Layers = 1 At end of iteration = 222 cost = 0.80034542
Circuit = alternative_ckt_2 Layers = 1 At end of iteration = 223 cost = 0.80034475
Circuit = alternative_ckt_2 Layers = 1 At end of iteration = 224 cost = 0.80034409
Circuit = alternative_ckt_2 Layers = 1 At end of iteration = 225 cost = 0.80034343
Circuit = alternative_ckt_2 Layers = 1 At end of iteration = 226 cost = 0.80034277
Circuit = alternative_ckt_2 Layers = 1 At end of iteration = 227 cost = 0.80034211
Circuit = alternative_ckt_2 Layers = 1 At end of iteration = 228 cost = 0.80034146
Circuit = alternative_ckt_2 Layers = 1 At end of iteration = 229 cost = 0.80034081
Circuit = alternative_ckt_2 Layers = 1 At end of iteration = 230 cost = 0.80034016
Circuit = alternative_ckt_2 Layers = 1 At end of iteration = 231 cost = 0.80033951
Circuit = alternative_ckt_2 Layers = 1 At end of iteration = 232 cost = 0.80033887
Circuit = alternative_ckt_2 Layers = 1 At end of iteration = 233 cost = 0.80033822
Circuit = alternative_ckt_2 Layers = 1 At end of iteration = 234 cost = 0.80033758
Circuit = alternative_ckt_2 Layers = 1 At end of iteration = 235 cost = 0.80033695

```

-----
Circuit = alternative_ckt_2 | Layers = 1 | At end of iteration = 236 | cost = 0.80033631
-----
Circuit = alternative_ckt_2 | Layers = 1 | At end of iteration = 237 | cost = 0.80033568
-----
Circuit = alternative_ckt_2 | Layers = 1 | At end of iteration = 238 | cost = 0.80033505
-----
Circuit = alternative_ckt_2 | Layers = 1 | At end of iteration = 239 | cost = 0.80033442
-----
Circuit = alternative_ckt_2 | Layers = 1 | At end of iteration = 240 | cost = 0.80033379
-----
Circuit = alternative_ckt_2 | Layers = 1 | At end of iteration = 241 | cost = 0.80033317
-----
Circuit = alternative_ckt_2 | Layers = 1 | At end of iteration = 242 | cost = 0.80033255
-----
Circuit = alternative_ckt_2 | Layers = 1 | At end of iteration = 243 | cost = 0.80033193
-----
Circuit = alternative_ckt_2 | Layers = 1 | At end of iteration = 244 | cost = 0.80033131
-----
Circuit = alternative_ckt_2 | Layers = 1 | At end of iteration = 245 | cost = 0.80033070
-----
Circuit = alternative_ckt_2 | Layers = 1 | At end of iteration = 246 | cost = 0.80033008
-----
Circuit = alternative_ckt_2 | Layers = 1 | At end of iteration = 247 | cost = 0.80032947
-----
Circuit = alternative_ckt_2 | Layers = 1 | At end of iteration = 248 | cost = 0.80032886
-----
Circuit = alternative_ckt_2 | Layers = 1 | At end of iteration = 249 | cost = 0.80032826
-----
Circuit = alternative_ckt_2 | Layers = 1 | At end of iteration = 250 | cost = 0.80032765
-----
Circuit = alternative_ckt_2 | Layers = 1 | At end of iteration = 251 | cost = 0.80032705
-----
Circuit = alternative_ckt_2 | Layers = 1 | At end of iteration = 252 | cost = 0.80032645
-----
Circuit = alternative_ckt_2 | Layers = 1 | At end of iteration = 253 | cost = 0.80032585
-----
Circuit = alternative_ckt_2 | Layers = 1 | At end of iteration = 254 | cost = 0.80032526
-----
Circuit = alternative_ckt_2 | Layers = 1 | At end of iteration = 255 | cost = 0.80032467
-----
Circuit = alternative_ckt_2 | Layers = 1 | At end of iteration = 256 | cost = 0.80032407
-----
Circuit = alternative_ckt_2 | Layers = 1 | At end of iteration = 257 | cost = 0.80032348
-----
Circuit = alternative_ckt_2 | Layers = 1 | At end of iteration = 258 | cost = 0.80032290
-----
Circuit = alternative_ckt_2 | Layers = 1 | At end of iteration = 259 | cost = 0.80032231
-----

```



```

-----
Circuit = alternative_ckt_2 | Layers = 1 | At end of iteration = 260 | cost = 0.80032173
-----
Circuit = alternative_ckt_2 | Layers = 1 | At end of iteration = 261 | cost = 0.80032115
-----
Circuit = alternative_ckt_2 | Layers = 1 | At end of iteration = 262 | cost = 0.80032057
-----
Circuit = alternative_ckt_2 | Layers = 1 | At end of iteration = 263 | cost = 0.80031999
-----
Circuit = alternative_ckt_2 | Layers = 1 | At end of iteration = 264 | cost = 0.80031942
-----
Circuit = alternative_ckt_2 | Layers = 1 | At end of iteration = 265 | cost = 0.80031885
-----
Circuit = alternative_ckt_2 | Layers = 1 | At end of iteration = 266 | cost = 0.80031828
-----
Circuit = alternative_ckt_2 | Layers = 1 | At end of iteration = 267 | cost = 0.80031771
-----
Circuit = alternative_ckt_2 | Layers = 1 | At end of iteration = 268 | cost = 0.80031714
-----
Circuit = alternative_ckt_2 | Layers = 1 | At end of iteration = 269 | cost = 0.80031658
-----
Circuit = alternative_ckt_2 | Layers = 1 | At end of iteration = 270 | cost = 0.80031602
-----
Circuit = alternative_ckt_2 | Layers = 1 | At end of iteration = 271 | cost = 0.80031545
-----
Circuit = alternative_ckt_2 | Layers = 1 | At end of iteration = 272 | cost = 0.80031490
-----
Circuit = alternative_ckt_2 | Layers = 1 | At end of iteration = 273 | cost = 0.80031434
-----
Circuit = alternative_ckt_2 | Layers = 1 | At end of iteration = 274 | cost = 0.80031379
-----
Circuit = alternative_ckt_2 | Layers = 1 | At end of iteration = 275 | cost = 0.80031323
-----
Circuit = alternative_ckt_2 | Layers = 1 | At end of iteration = 276 | cost = 0.80031268
-----
Circuit = alternative_ckt_2 | Layers = 1 | At end of iteration = 277 | cost = 0.80031213
-----
Circuit = alternative_ckt_2 | Layers = 1 | At end of iteration = 278 | cost = 0.80031159
-----
Circuit = alternative_ckt_2 | Layers = 1 | At end of iteration = 279 | cost = 0.80031104
-----
Circuit = alternative_ckt_2 | Layers = 1 | At end of iteration = 280 | cost = 0.80031050
-----
Circuit = alternative_ckt_2 | Layers = 1 | At end of iteration = 281 | cost = 0.80030996
-----
Circuit = alternative_ckt_2 | Layers = 1 | At end of iteration = 282 | cost = 0.80030942
-----
Circuit = alternative_ckt_2 | Layers = 1 | At end of iteration = 283 | cost = 0.80030888
-----

```



```
[ 0.21765002-0.04762325j]
[ 0.24872414-0.15918159j]
[ 0.09118008+0.20442672j]
[ 0.27251407-0.04278652j]
[ 0.00124902+0.2090939j ]
[ 0.0975956 +0.25938752j]
[ 0.20545399-0.04381412j]]
```

```
-----
Circuit = alternative_ckt_2 Layers = 1 Cost after optimization = 0.8003000497252322
-----
```

```
Circuit alternative_ckt_2 constructed with 2 layers. Number of parameters = 32 .
-----
```

Initialized circuit parameters prior to gradient descent randomly as follows:

```
idx = theta1[3] params = 0.03719052023213644
idx = theta4[2] params = 0.04312312828020062
idx = theta3[1] params = 0.0004994971757621869
idx = phi1[1] params = 0.03444025418170515
idx = theta1[0] params = 0.046881140646663634
idx = theta2[0] params = 0.02164226791611938
idx = lambda1[0] params = 0.028343942770291508
idx = theta2[3] params = 0.013510378554063363
idx = lambda3[1] params = 0.022782810868909098
idx = theta1[1] params = 0.00573789773068969
idx = phi1[2] params = 0.039532273767073196
idx = theta3[3] params = 0.018375156312795238
idx = theta3[0] params = 0.02421115885861306
idx = phi3[0] params = 0.01671278315727628
idx = phi3[2] params = 0.006172454610576922
idx = phi3[3] params = 0.016655522656847783
idx = theta4[3] params = 0.04662197117509747
idx = lambda1[2] params = 0.009378499198132518
idx = theta3[2] params = 0.030481776612878
idx = lambda3[0] params = 0.006238299240088347
idx = theta2[2] params = 0.046316344013782464
idx = lambda3[3] params = 0.002833116050508433
idx = phi1[3] params = 0.009568165097689485
idx = phi3[1] params = 0.003778807686699465
idx = theta2[1] params = 0.04761132655555178
idx = lambda1[3] params = 0.02912836626547597
idx = theta4[1] params = 0.03277867333581935
idx = theta1[2] params = 0.0012507649722014293
idx = theta4[0] params = 0.03265668670981592
idx = lambda1[1] params = 0.042510362504139115
idx = lambda3[2] params = 0.028964664980450857
idx = phi1[0] params = 0.02606701333987876
```

```
-----
Circuit = alternative_ckt_2 | Layers = 2 | At end of iteration = 1 | cost = 1.1751133913
-----
```

Circuit = alternative_ckt_2		Layers = 2		At end of iteration = 2		cost = 1.1333235642
Circuit = alternative_ckt_2		Layers = 2		At end of iteration = 3		cost = 1.0958706163
Circuit = alternative_ckt_2		Layers = 2		At end of iteration = 4		cost = 1.0548935723
Circuit = alternative_ckt_2		Layers = 2		At end of iteration = 5		cost = 1.0040917057
Circuit = alternative_ckt_2		Layers = 2		At end of iteration = 6		cost = 0.9384476879
Circuit = alternative_ckt_2		Layers = 2		At end of iteration = 7		cost = 0.8554442249
Circuit = alternative_ckt_2		Layers = 2		At end of iteration = 8		cost = 0.7584252893
Circuit = alternative_ckt_2		Layers = 2		At end of iteration = 9		cost = 0.6590088184
Circuit = alternative_ckt_2		Layers = 2		At end of iteration = 10		cost = 0.572235555
Circuit = alternative_ckt_2		Layers = 2		At end of iteration = 11		cost = 0.510552910
Circuit = alternative_ckt_2		Layers = 2		At end of iteration = 12		cost = 0.472180014
Circuit = alternative_ckt_2		Layers = 2		At end of iteration = 13		cost = 0.666558733
Circuit = alternative_ckt_2		Layers = 2		At end of iteration = 14		cost = 1.492888577
Circuit = alternative_ckt_2		Layers = 2		At end of iteration = 15		cost = 1.445236646
Circuit = alternative_ckt_2		Layers = 2		At end of iteration = 16		cost = 1.390937766
Circuit = alternative_ckt_2		Layers = 2		At end of iteration = 17		cost = 1.329299201
Circuit = alternative_ckt_2		Layers = 2		At end of iteration = 18		cost = 1.255327216
Circuit = alternative_ckt_2		Layers = 2		At end of iteration = 19		cost = 1.153427554
Circuit = alternative_ckt_2		Layers = 2		At end of iteration = 20		cost = 0.993864085
Circuit = alternative_ckt_2		Layers = 2		At end of iteration = 21		cost = 0.820512669
Circuit = alternative_ckt_2		Layers = 2		At end of iteration = 22		cost = 0.749826640
Circuit = alternative_ckt_2		Layers = 2		At end of iteration = 23		cost = 0.684719344
Circuit = alternative_ckt_2		Layers = 2		At end of iteration = 24		cost = 0.650345901
Circuit = alternative_ckt_2		Layers = 2		At end of iteration = 25		cost = 0.635808757

```

Circuit = alternative_ckt_2 | Layers = 2 | At end of iteration = 26 | cost = 0.9525734163
-----
Circuit = alternative_ckt_2 | Layers = 2 | At end of iteration = 27 | cost = 1.0283410711
-----
Circuit = alternative_ckt_2 | Layers = 2 | At end of iteration = 28 | cost = 0.6793707263
-----
Circuit = alternative_ckt_2 | Layers = 2 | At end of iteration = 29 | cost = 0.7667724863
-----
Circuit = alternative_ckt_2 | Layers = 2 | At end of iteration = 30 | cost = 1.0364512743
-----
Circuit = alternative_ckt_2 | Layers = 2 | At end of iteration = 31 | cost = 0.8317570934
-----
Circuit = alternative_ckt_2 | Layers = 2 | At end of iteration = 32 | cost = 0.8680279203
-----
Circuit = alternative_ckt_2 | Layers = 2 | At end of iteration = 33 | cost = 0.8671713014
-----
Circuit = alternative_ckt_2 | Layers = 2 | At end of iteration = 34 | cost = 0.7994391123
-----
Circuit = alternative_ckt_2 | Layers = 2 | At end of iteration = 35 | cost = 0.8349165894
-----
Circuit = alternative_ckt_2 | Layers = 2 | At end of iteration = 36 | cost = 0.8285716843
-----
Circuit = alternative_ckt_2 | Layers = 2 | At end of iteration = 37 | cost = 0.8466678943
-----
Circuit = alternative_ckt_2 | Layers = 2 | At end of iteration = 38 | cost = 0.8074566973
-----
Circuit = alternative_ckt_2 | Layers = 2 | At end of iteration = 39 | cost = 0.8339351073
-----
REDUCING ALPHA TO 0.31622776601683794 at iteration = 40
-----
Circuit = alternative_ckt_2 | Layers = 2 | At end of iteration = 40 | cost = 0.8165246263
-----
Circuit = alternative_ckt_2 | Layers = 2 | At end of iteration = 41 | cost = 0.6590635283
-----
Circuit = alternative_ckt_2 | Layers = 2 | At end of iteration = 42 | cost = 0.6266510834
-----
Circuit = alternative_ckt_2 | Layers = 2 | At end of iteration = 43 | cost = 0.6142551633
-----
Circuit = alternative_ckt_2 | Layers = 2 | At end of iteration = 44 | cost = 0.6025897513
-----
Circuit = alternative_ckt_2 | Layers = 2 | At end of iteration = 45 | cost = 0.5913994853
-----
Circuit = alternative_ckt_2 | Layers = 2 | At end of iteration = 46 | cost = 0.5806819763
-----
Circuit = alternative_ckt_2 | Layers = 2 | At end of iteration = 47 | cost = 0.5704249293
-----
Circuit = alternative_ckt_2 | Layers = 2 | At end of iteration = 48 | cost = 0.5606303383
-----

```

Circuit = alternative_ckt_2 Layers = 2 At end of iteration = 49 cost = 0.551303899
Circuit = alternative_ckt_2 Layers = 2 At end of iteration = 50 cost = 0.542454757
Circuit = alternative_ckt_2 Layers = 2 At end of iteration = 51 cost = 0.534091981
Circuit = alternative_ckt_2 Layers = 2 At end of iteration = 52 cost = 0.526223381
Circuit = alternative_ckt_2 Layers = 2 At end of iteration = 53 cost = 0.518853514
Circuit = alternative_ckt_2 Layers = 2 At end of iteration = 54 cost = 0.511983037
Circuit = alternative_ckt_2 Layers = 2 At end of iteration = 55 cost = 0.505607716
Circuit = alternative_ckt_2 Layers = 2 At end of iteration = 56 cost = 0.499718591
Circuit = alternative_ckt_2 Layers = 2 At end of iteration = 57 cost = 0.494301727
Circuit = alternative_ckt_2 Layers = 2 At end of iteration = 58 cost = 0.489339159
Circuit = alternative_ckt_2 Layers = 2 At end of iteration = 59 cost = 0.484808927
Circuit = alternative_ckt_2 Layers = 2 At end of iteration = 60 cost = 0.480686736
Circuit = alternative_ckt_2 Layers = 2 At end of iteration = 61 cost = 0.476945565
Circuit = alternative_ckt_2 Layers = 2 At end of iteration = 62 cost = 0.473558349
Circuit = alternative_ckt_2 Layers = 2 At end of iteration = 63 cost = 0.470495817
Circuit = alternative_ckt_2 Layers = 2 At end of iteration = 64 cost = 0.467731919
Circuit = alternative_ckt_2 Layers = 2 At end of iteration = 65 cost = 0.465236300
Circuit = alternative_ckt_2 Layers = 2 At end of iteration = 66 cost = 0.462988760
Circuit = alternative_ckt_2 Layers = 2 At end of iteration = 67 cost = 0.460954387
Circuit = alternative_ckt_2 Layers = 2 At end of iteration = 68 cost = 0.459129950
Circuit = alternative_ckt_2 Layers = 2 At end of iteration = 69 cost = 0.457457281
Circuit = alternative_ckt_2 Layers = 2 At end of iteration = 70 cost = 0.455989363
Circuit = alternative_ckt_2 Layers = 2 At end of iteration = 71 cost = 0.454566684
Circuit = alternative_ckt_2 Layers = 2 At end of iteration = 72 cost = 0.453458740

```

Circuit = alternative_ckt_2 | Layers = 2 | At end of iteration = 73 | cost = 0.452075492
-----
Circuit = alternative_ckt_2 | Layers = 2 | At end of iteration = 74 | cost = 0.451599946
-----
Circuit = alternative_ckt_2 | Layers = 2 | At end of iteration = 75 | cost = 0.449589604
-----
Circuit = alternative_ckt_2 | Layers = 2 | At end of iteration = 76 | cost = 0.451379934
-----
Circuit = alternative_ckt_2 | Layers = 2 | At end of iteration = 77 | cost = 0.446752289
-----
Circuit = alternative_ckt_2 | Layers = 2 | At end of iteration = 78 | cost = 0.462417038
-----
Circuit = alternative_ckt_2 | Layers = 2 | At end of iteration = 79 | cost = 0.463570406
-----
REDUCING ALPHA TO 0.09999999999999999 at iteration = 80
-----
Circuit = alternative_ckt_2 | Layers = 2 | At end of iteration = 80 | cost = 0.579450036
-----
Circuit = alternative_ckt_2 | Layers = 2 | At end of iteration = 81 | cost = 0.460205269
-----
Circuit = alternative_ckt_2 | Layers = 2 | At end of iteration = 82 | cost = 0.447054882
-----
Circuit = alternative_ckt_2 | Layers = 2 | At end of iteration = 83 | cost = 0.446729484
-----
Circuit = alternative_ckt_2 | Layers = 2 | At end of iteration = 84 | cost = 0.446522050
-----
Circuit = alternative_ckt_2 | Layers = 2 | At end of iteration = 85 | cost = 0.446319217
-----
Circuit = alternative_ckt_2 | Layers = 2 | At end of iteration = 86 | cost = 0.446121210
-----
Circuit = alternative_ckt_2 | Layers = 2 | At end of iteration = 87 | cost = 0.445927794
-----
Circuit = alternative_ckt_2 | Layers = 2 | At end of iteration = 88 | cost = 0.445738763
-----
Circuit = alternative_ckt_2 | Layers = 2 | At end of iteration = 89 | cost = 0.445553922
-----
Circuit = alternative_ckt_2 | Layers = 2 | At end of iteration = 90 | cost = 0.445373094
-----
Circuit = alternative_ckt_2 | Layers = 2 | At end of iteration = 91 | cost = 0.445196113
-----
Circuit = alternative_ckt_2 | Layers = 2 | At end of iteration = 92 | cost = 0.445022823
-----
Circuit = alternative_ckt_2 | Layers = 2 | At end of iteration = 93 | cost = 0.444853077
-----
Circuit = alternative_ckt_2 | Layers = 2 | At end of iteration = 94 | cost = 0.444686737
-----
Circuit = alternative_ckt_2 | Layers = 2 | At end of iteration = 95 | cost = 0.444523671
-----

```

Circuit = alternative_ckt_2 Layers = 2 At end of iteration = 96 cost = 0.444363757
Circuit = alternative_ckt_2 Layers = 2 At end of iteration = 97 cost = 0.444206875
Circuit = alternative_ckt_2 Layers = 2 At end of iteration = 98 cost = 0.444052917
Circuit = alternative_ckt_2 Layers = 2 At end of iteration = 99 cost = 0.443901774
Circuit = alternative_ckt_2 Layers = 2 At end of iteration = 100 cost = 0.44375334
Circuit = alternative_ckt_2 Layers = 2 At end of iteration = 101 cost = 0.44360754
Circuit = alternative_ckt_2 Layers = 2 At end of iteration = 102 cost = 0.44346426
Circuit = alternative_ckt_2 Layers = 2 At end of iteration = 103 cost = 0.44332343
Circuit = alternative_ckt_2 Layers = 2 At end of iteration = 104 cost = 0.44318495
Circuit = alternative_ckt_2 Layers = 2 At end of iteration = 105 cost = 0.44304876
Circuit = alternative_ckt_2 Layers = 2 At end of iteration = 106 cost = 0.44291478
Circuit = alternative_ckt_2 Layers = 2 At end of iteration = 107 cost = 0.44278293
Circuit = alternative_ckt_2 Layers = 2 At end of iteration = 108 cost = 0.44265314
Circuit = alternative_ckt_2 Layers = 2 At end of iteration = 109 cost = 0.44252536
Circuit = alternative_ckt_2 Layers = 2 At end of iteration = 110 cost = 0.44239952
Circuit = alternative_ckt_2 Layers = 2 At end of iteration = 111 cost = 0.44227556
Circuit = alternative_ckt_2 Layers = 2 At end of iteration = 112 cost = 0.44215342
Circuit = alternative_ckt_2 Layers = 2 At end of iteration = 113 cost = 0.44203305
Circuit = alternative_ckt_2 Layers = 2 At end of iteration = 114 cost = 0.44191439
Circuit = alternative_ckt_2 Layers = 2 At end of iteration = 115 cost = 0.44179741
Circuit = alternative_ckt_2 Layers = 2 At end of iteration = 116 cost = 0.44168204
Circuit = alternative_ckt_2 Layers = 2 At end of iteration = 117 cost = 0.44156824
Circuit = alternative_ckt_2 Layers = 2 At end of iteration = 118 cost = 0.44145597
Circuit = alternative_ckt_2 Layers = 2 At end of iteration = 119 cost = 0.44134519

REDUCING ALPHA TO 0.03162277660168379 at iteration = 120

Circuit =	alternative_ckt_2		Layers =	2		At end of iteration =	120		cost =	0.44123586
Circuit =	alternative_ckt_2		Layers =	2		At end of iteration =	121		cost =	0.44120170
Circuit =	alternative_ckt_2		Layers =	2		At end of iteration =	122		cost =	0.44116767
Circuit =	alternative_ckt_2		Layers =	2		At end of iteration =	123		cost =	0.44113378
Circuit =	alternative_ckt_2		Layers =	2		At end of iteration =	124		cost =	0.44110002
Circuit =	alternative_ckt_2		Layers =	2		At end of iteration =	125		cost =	0.44106640
Circuit =	alternative_ckt_2		Layers =	2		At end of iteration =	126		cost =	0.44103291
Circuit =	alternative_ckt_2		Layers =	2		At end of iteration =	127		cost =	0.44099955
Circuit =	alternative_ckt_2		Layers =	2		At end of iteration =	128		cost =	0.44096633
Circuit =	alternative_ckt_2		Layers =	2		At end of iteration =	129		cost =	0.44093323
Circuit =	alternative_ckt_2		Layers =	2		At end of iteration =	130		cost =	0.44090026
Circuit =	alternative_ckt_2		Layers =	2		At end of iteration =	131		cost =	0.44086742
Circuit =	alternative_ckt_2		Layers =	2		At end of iteration =	132		cost =	0.44083471
Circuit =	alternative_ckt_2		Layers =	2		At end of iteration =	133		cost =	0.44080213
Circuit =	alternative_ckt_2		Layers =	2		At end of iteration =	134		cost =	0.44076967
Circuit =	alternative_ckt_2		Layers =	2		At end of iteration =	135		cost =	0.44073733
Circuit =	alternative_ckt_2		Layers =	2		At end of iteration =	136		cost =	0.44070512
Circuit =	alternative_ckt_2		Layers =	2		At end of iteration =	137		cost =	0.44067303
Circuit =	alternative_ckt_2		Layers =	2		At end of iteration =	138		cost =	0.44064106
Circuit =	alternative_ckt_2		Layers =	2		At end of iteration =	139		cost =	0.44060921
Circuit =	alternative_ckt_2		Layers =	2		At end of iteration =	140		cost =	0.44057748
Circuit =	alternative_ckt_2		Layers =	2		At end of iteration =	141		cost =	0.44054587
Circuit =	alternative_ckt_2		Layers =	2		At end of iteration =	142		cost =	0.44051438

Circuit = alternative_ckt_2 Layers = 2 At end of iteration = 143 cost = 0.440483009
Circuit = alternative_ckt_2 Layers = 2 At end of iteration = 144 cost = 0.440451753
Circuit = alternative_ckt_2 Layers = 2 At end of iteration = 145 cost = 0.440420608
Circuit = alternative_ckt_2 Layers = 2 At end of iteration = 146 cost = 0.440389579
Circuit = alternative_ckt_2 Layers = 2 At end of iteration = 147 cost = 0.440358664
Circuit = alternative_ckt_2 Layers = 2 At end of iteration = 148 cost = 0.440327863
Circuit = alternative_ckt_2 Layers = 2 At end of iteration = 149 cost = 0.440297173
Circuit = alternative_ckt_2 Layers = 2 At end of iteration = 150 cost = 0.440266594
Circuit = alternative_ckt_2 Layers = 2 At end of iteration = 151 cost = 0.440236123
Circuit = alternative_ckt_2 Layers = 2 At end of iteration = 152 cost = 0.440205763
Circuit = alternative_ckt_2 Layers = 2 At end of iteration = 153 cost = 0.440175513
Circuit = alternative_ckt_2 Layers = 2 At end of iteration = 154 cost = 0.440145373
Circuit = alternative_ckt_2 Layers = 2 At end of iteration = 155 cost = 0.440115343
Circuit = alternative_ckt_2 Layers = 2 At end of iteration = 156 cost = 0.440085423
Circuit = alternative_ckt_2 Layers = 2 At end of iteration = 157 cost = 0.440055603
Circuit = alternative_ckt_2 Layers = 2 At end of iteration = 158 cost = 0.440025883
Circuit = alternative_ckt_2 Layers = 2 At end of iteration = 159 cost = 0.439996273
Circuit = alternative_ckt_2 Layers = 2 At end of iteration = 160 cost = 0.439966773
Circuit = alternative_ckt_2 Layers = 2 At end of iteration = 161 cost = 0.439937373
Circuit = alternative_ckt_2 Layers = 2 At end of iteration = 162 cost = 0.439908073
Circuit = alternative_ckt_2 Layers = 2 At end of iteration = 163 cost = 0.439878873
Circuit = alternative_ckt_2 Layers = 2 At end of iteration = 164 cost = 0.439849773
Circuit = alternative_ckt_2 Layers = 2 At end of iteration = 165 cost = 0.439820783
Circuit = alternative_ckt_2 Layers = 2 At end of iteration = 166 cost = 0.439791883

Circuit = alternative_ckt_2 Layers = 2 At end of iteration = 167 cost = 0.43976309
Circuit = alternative_ckt_2 Layers = 2 At end of iteration = 168 cost = 0.43973439
Circuit = alternative_ckt_2 Layers = 2 At end of iteration = 169 cost = 0.43970580
Circuit = alternative_ckt_2 Layers = 2 At end of iteration = 170 cost = 0.43967730
Circuit = alternative_ckt_2 Layers = 2 At end of iteration = 171 cost = 0.43964889
Circuit = alternative_ckt_2 Layers = 2 At end of iteration = 172 cost = 0.43962059
Circuit = alternative_ckt_2 Layers = 2 At end of iteration = 173 cost = 0.43959238
Circuit = alternative_ckt_2 Layers = 2 At end of iteration = 174 cost = 0.43956426
Circuit = alternative_ckt_2 Layers = 2 At end of iteration = 175 cost = 0.43953624
Circuit = alternative_ckt_2 Layers = 2 At end of iteration = 176 cost = 0.43950832
Circuit = alternative_ckt_2 Layers = 2 At end of iteration = 177 cost = 0.43948049
Circuit = alternative_ckt_2 Layers = 2 At end of iteration = 178 cost = 0.43945275
Circuit = alternative_ckt_2 Layers = 2 At end of iteration = 179 cost = 0.43942510
Circuit = alternative_ckt_2 Layers = 2 At end of iteration = 180 cost = 0.43939755
Circuit = alternative_ckt_2 Layers = 2 At end of iteration = 181 cost = 0.43937009
Circuit = alternative_ckt_2 Layers = 2 At end of iteration = 182 cost = 0.43934272
Circuit = alternative_ckt_2 Layers = 2 At end of iteration = 183 cost = 0.43931544
Circuit = alternative_ckt_2 Layers = 2 At end of iteration = 184 cost = 0.43928825
Circuit = alternative_ckt_2 Layers = 2 At end of iteration = 185 cost = 0.43926115
Circuit = alternative_ckt_2 Layers = 2 At end of iteration = 186 cost = 0.43923413
Circuit = alternative_ckt_2 Layers = 2 At end of iteration = 187 cost = 0.43920721
Circuit = alternative_ckt_2 Layers = 2 At end of iteration = 188 cost = 0.43918038
Circuit = alternative_ckt_2 Layers = 2 At end of iteration = 189 cost = 0.43915363
Circuit = alternative_ckt_2 Layers = 2 At end of iteration = 190 cost = 0.43912697

Circuit = alternative_ckt_2 Layers = 2 At end of iteration = 191 cost = 0.439100403
Circuit = alternative_ckt_2 Layers = 2 At end of iteration = 192 cost = 0.439073917
Circuit = alternative_ckt_2 Layers = 2 At end of iteration = 193 cost = 0.439047511
Circuit = alternative_ckt_2 Layers = 2 At end of iteration = 194 cost = 0.439021203
Circuit = alternative_ckt_2 Layers = 2 At end of iteration = 195 cost = 0.438994977
Circuit = alternative_ckt_2 Layers = 2 At end of iteration = 196 cost = 0.438968823
Circuit = alternative_ckt_2 Layers = 2 At end of iteration = 197 cost = 0.438942766
Circuit = alternative_ckt_2 Layers = 2 At end of iteration = 198 cost = 0.438916780
Circuit = alternative_ckt_2 Layers = 2 At end of iteration = 199 cost = 0.438890895
Circuit = alternative_ckt_2 Layers = 2 At end of iteration = 200 cost = 0.438865080
Circuit = alternative_ckt_2 Layers = 2 At end of iteration = 201 cost = 0.438839355
Circuit = alternative_ckt_2 Layers = 2 At end of iteration = 202 cost = 0.438813709
Circuit = alternative_ckt_2 Layers = 2 At end of iteration = 203 cost = 0.438788140
Circuit = alternative_ckt_2 Layers = 2 At end of iteration = 204 cost = 0.438762656
Circuit = alternative_ckt_2 Layers = 2 At end of iteration = 205 cost = 0.438737253
Circuit = alternative_ckt_2 Layers = 2 At end of iteration = 206 cost = 0.438711193
Circuit = alternative_ckt_2 Layers = 2 At end of iteration = 207 cost = 0.438686689
Circuit = alternative_ckt_2 Layers = 2 At end of iteration = 208 cost = 0.438661520
Circuit = alternative_ckt_2 Layers = 2 At end of iteration = 209 cost = 0.438636443
Circuit = alternative_ckt_2 Layers = 2 At end of iteration = 210 cost = 0.438611440
Circuit = alternative_ckt_2 Layers = 2 At end of iteration = 211 cost = 0.438586511
Circuit = alternative_ckt_2 Layers = 2 At end of iteration = 212 cost = 0.438561668
Circuit = alternative_ckt_2 Layers = 2 At end of iteration = 213 cost = 0.438536899
Circuit = alternative_ckt_2 Layers = 2 At end of iteration = 214 cost = 0.438512200

Circuit = alternative_ckt_2 Layers = 2 At end of iteration = 215 cost = 0.43848759
Circuit = alternative_ckt_2 Layers = 2 At end of iteration = 216 cost = 0.43846305
Circuit = alternative_ckt_2 Layers = 2 At end of iteration = 217 cost = 0.43843859
Circuit = alternative_ckt_2 Layers = 2 At end of iteration = 218 cost = 0.43841421
Circuit = alternative_ckt_2 Layers = 2 At end of iteration = 219 cost = 0.43838990
Circuit = alternative_ckt_2 Layers = 2 At end of iteration = 220 cost = 0.43836567
Circuit = alternative_ckt_2 Layers = 2 At end of iteration = 221 cost = 0.43834151
Circuit = alternative_ckt_2 Layers = 2 At end of iteration = 222 cost = 0.43831743
Circuit = alternative_ckt_2 Layers = 2 At end of iteration = 223 cost = 0.43829342
Circuit = alternative_ckt_2 Layers = 2 At end of iteration = 224 cost = 0.43826949
Circuit = alternative_ckt_2 Layers = 2 At end of iteration = 225 cost = 0.43824563
Circuit = alternative_ckt_2 Layers = 2 At end of iteration = 226 cost = 0.43822185
Circuit = alternative_ckt_2 Layers = 2 At end of iteration = 227 cost = 0.43819814
Circuit = alternative_ckt_2 Layers = 2 At end of iteration = 228 cost = 0.43817450
Circuit = alternative_ckt_2 Layers = 2 At end of iteration = 229 cost = 0.43815094
Circuit = alternative_ckt_2 Layers = 2 At end of iteration = 230 cost = 0.43812744
Circuit = alternative_ckt_2 Layers = 2 At end of iteration = 231 cost = 0.43810402
Circuit = alternative_ckt_2 Layers = 2 At end of iteration = 232 cost = 0.43808068
Circuit = alternative_ckt_2 Layers = 2 At end of iteration = 233 cost = 0.43805740
Circuit = alternative_ckt_2 Layers = 2 At end of iteration = 234 cost = 0.43803420
Circuit = alternative_ckt_2 Layers = 2 At end of iteration = 235 cost = 0.43801106
Circuit = alternative_ckt_2 Layers = 2 At end of iteration = 236 cost = 0.43798800
Circuit = alternative_ckt_2 Layers = 2 At end of iteration = 237 cost = 0.43796501
Circuit = alternative_ckt_2 Layers = 2 At end of iteration = 238 cost = 0.43794209

Circuit = alternative_ckt_2 Layers = 2 At end of iteration = 239 cost = 0.43791924
Circuit = alternative_ckt_2 Layers = 2 At end of iteration = 240 cost = 0.43789646
Circuit = alternative_ckt_2 Layers = 2 At end of iteration = 241 cost = 0.43787375
Circuit = alternative_ckt_2 Layers = 2 At end of iteration = 242 cost = 0.43785111
Circuit = alternative_ckt_2 Layers = 2 At end of iteration = 243 cost = 0.43782854
Circuit = alternative_ckt_2 Layers = 2 At end of iteration = 244 cost = 0.43780603
Circuit = alternative_ckt_2 Layers = 2 At end of iteration = 245 cost = 0.43778360
Circuit = alternative_ckt_2 Layers = 2 At end of iteration = 246 cost = 0.43776124
Circuit = alternative_ckt_2 Layers = 2 At end of iteration = 247 cost = 0.43773894
Circuit = alternative_ckt_2 Layers = 2 At end of iteration = 248 cost = 0.43771671
Circuit = alternative_ckt_2 Layers = 2 At end of iteration = 249 cost = 0.43769455
Circuit = alternative_ckt_2 Layers = 2 At end of iteration = 250 cost = 0.43767245
Circuit = alternative_ckt_2 Layers = 2 At end of iteration = 251 cost = 0.43765043
Circuit = alternative_ckt_2 Layers = 2 At end of iteration = 252 cost = 0.43762847
Circuit = alternative_ckt_2 Layers = 2 At end of iteration = 253 cost = 0.43760658
Circuit = alternative_ckt_2 Layers = 2 At end of iteration = 254 cost = 0.43758475
Circuit = alternative_ckt_2 Layers = 2 At end of iteration = 255 cost = 0.43756299
Circuit = alternative_ckt_2 Layers = 2 At end of iteration = 256 cost = 0.43754130
Circuit = alternative_ckt_2 Layers = 2 At end of iteration = 257 cost = 0.43751967
Circuit = alternative_ckt_2 Layers = 2 At end of iteration = 258 cost = 0.43749811
Circuit = alternative_ckt_2 Layers = 2 At end of iteration = 259 cost = 0.43747661
Circuit = alternative_ckt_2 Layers = 2 At end of iteration = 260 cost = 0.43745518
Circuit = alternative_ckt_2 Layers = 2 At end of iteration = 261 cost = 0.43743382
Circuit = alternative_ckt_2 Layers = 2 At end of iteration = 262 cost = 0.43741252

Circuit = alternative_ckt_2 Layers = 2 At end of iteration = 263 cost = 0.43739128
Circuit = alternative_ckt_2 Layers = 2 At end of iteration = 264 cost = 0.43737011
Circuit = alternative_ckt_2 Layers = 2 At end of iteration = 265 cost = 0.43734901
Circuit = alternative_ckt_2 Layers = 2 At end of iteration = 266 cost = 0.43732797
Circuit = alternative_ckt_2 Layers = 2 At end of iteration = 267 cost = 0.43730699
Circuit = alternative_ckt_2 Layers = 2 At end of iteration = 268 cost = 0.43728607
Circuit = alternative_ckt_2 Layers = 2 At end of iteration = 269 cost = 0.43726522
Circuit = alternative_ckt_2 Layers = 2 At end of iteration = 270 cost = 0.43724444
Circuit = alternative_ckt_2 Layers = 2 At end of iteration = 271 cost = 0.43722371
Circuit = alternative_ckt_2 Layers = 2 At end of iteration = 272 cost = 0.43720305
Circuit = alternative_ckt_2 Layers = 2 At end of iteration = 273 cost = 0.43718245
Circuit = alternative_ckt_2 Layers = 2 At end of iteration = 274 cost = 0.43716192
Circuit = alternative_ckt_2 Layers = 2 At end of iteration = 275 cost = 0.43714145
Circuit = alternative_ckt_2 Layers = 2 At end of iteration = 276 cost = 0.43712104
Circuit = alternative_ckt_2 Layers = 2 At end of iteration = 277 cost = 0.43710069
Circuit = alternative_ckt_2 Layers = 2 At end of iteration = 278 cost = 0.43708040
Circuit = alternative_ckt_2 Layers = 2 At end of iteration = 279 cost = 0.43706018
Circuit = alternative_ckt_2 Layers = 2 At end of iteration = 280 cost = 0.43704002
Circuit = alternative_ckt_2 Layers = 2 At end of iteration = 281 cost = 0.43701991
Circuit = alternative_ckt_2 Layers = 2 At end of iteration = 282 cost = 0.43699987
Circuit = alternative_ckt_2 Layers = 2 At end of iteration = 283 cost = 0.43697990
Circuit = alternative_ckt_2 Layers = 2 At end of iteration = 284 cost = 0.43695998
Circuit = alternative_ckt_2 Layers = 2 At end of iteration = 285 cost = 0.43694012
Circuit = alternative_ckt_2 Layers = 2 At end of iteration = 286 cost = 0.43692033

Circuit = alternative_ckt_2 Layers = 2 Cost after optimization = 0.4366494633692935

Circuit alternative_ckt_2 constructed with 3 layers. Number of parameters = 48 .

Initialized circuit parameters prior to gradient descent randomly as follows:

```
idx = lmbda3[0] params = 0.03719052023213644
idx = phi1[1] params = 0.04312312828020062
idx = phi5[3] params = 0.0004994971757621869
idx = theta2[0] params = 0.03444025418170515
idx = theta2[1] params = 0.046881140646663634
idx = phi5[0] params = 0.02164226791611938
idx = theta6[2] params = 0.028343942770291508
idx = theta3[2] params = 0.013510378554063363
idx = theta5[3] params = 0.022782810868909098
idx = theta6[3] params = 0.00573789773068969
idx = lmbda3[1] params = 0.039532273767073196
idx = theta1[0] params = 0.018375156312795238
idx = theta1[3] params = 0.02421115885861306
idx = theta6[0] params = 0.01671278315727628
idx = theta3[0] params = 0.006172454610576922
idx = phi3[3] params = 0.016655522656847783
idx = lmbda5[2] params = 0.04662197117509747
idx = lmbda5[3] params = 0.009378499198132518
idx = theta4[3] params = 0.030481776612878
idx = phi5[2] params = 0.006238299240088347
idx = phi5[1] params = 0.046316344013782464
idx = lmbda3[2] params = 0.002833116050508433
idx = lmbda3[3] params = 0.009568165097689485
idx = theta6[1] params = 0.003778807686699465
idx = theta5[2] params = 0.04761132655555178
idx = lmbda1[0] params = 0.02912836626547597
idx = theta3[1] params = 0.03277867333581935
idx = theta1[1] params = 0.0012507649722014293
idx = phi3[1] params = 0.03265668670981592
idx = theta5[0] params = 0.042510362504139115
idx = lmbda5[0] params = 0.028964664980450857
idx = theta3[3] params = 0.02606701333987876
idx = theta2[2] params = 0.04507588560641085
idx = lmbda1[3] params = 0.01594882076679191
idx = lmbda1[2] params = 0.03973242205283862
idx = lmbda1[1] params = 0.009337792350935193
idx = theta5[1] params = 0.0032829280606491377
idx = theta4[0] params = 0.019944497772341908
idx = lmbda5[1] params = 0.040543302128205796
idx = theta4[2] params = 0.018661219094017113
idx = phi1[0] params = 0.022765429249395765
idx = phi1[3] params = 0.04496189581938223
```

```

idx = phi3[0] params = 0.04421309636000539
idx = phi3[2] params = 0.032067148697469475
idx = phi1[2] params = 0.03316055200997197
idx = theta1[2] params = 0.038381406528673896
idx = theta2[3] params = 0.014346822771396907
idx = theta4[1] params = 0.017358921226698288

```

```

-----
Circuit = alternative_ckt_2 | Layers = 3 | At end of iteration = 1 | cost = 1.1430553719
-----
Circuit = alternative_ckt_2 | Layers = 3 | At end of iteration = 2 | cost = 1.0830463544
-----
Circuit = alternative_ckt_2 | Layers = 3 | At end of iteration = 3 | cost = 1.0166145163
-----
Circuit = alternative_ckt_2 | Layers = 3 | At end of iteration = 4 | cost = 0.9280985095
-----
Circuit = alternative_ckt_2 | Layers = 3 | At end of iteration = 5 | cost = 0.8122563370
-----
Circuit = alternative_ckt_2 | Layers = 3 | At end of iteration = 6 | cost = 0.6850802971
-----
Circuit = alternative_ckt_2 | Layers = 3 | At end of iteration = 7 | cost = 0.5821568016
-----
Circuit = alternative_ckt_2 | Layers = 3 | At end of iteration = 8 | cost = 0.5101326847
-----
Circuit = alternative_ckt_2 | Layers = 3 | At end of iteration = 9 | cost = 0.5001651316
-----
Circuit = alternative_ckt_2 | Layers = 3 | At end of iteration = 10 | cost = 1.096707132
-----
Circuit = alternative_ckt_2 | Layers = 3 | At end of iteration = 11 | cost = 1.345733434
-----
Circuit = alternative_ckt_2 | Layers = 3 | At end of iteration = 12 | cost = 0.581618106
-----
Circuit = alternative_ckt_2 | Layers = 3 | At end of iteration = 13 | cost = 0.945348057
-----
Circuit = alternative_ckt_2 | Layers = 3 | At end of iteration = 14 | cost = 1.365670027
-----
Circuit = alternative_ckt_2 | Layers = 3 | At end of iteration = 15 | cost = 0.862675717
-----
Circuit = alternative_ckt_2 | Layers = 3 | At end of iteration = 16 | cost = 1.080225296
-----
Circuit = alternative_ckt_2 | Layers = 3 | At end of iteration = 17 | cost = 0.839810279
-----
Circuit = alternative_ckt_2 | Layers = 3 | At end of iteration = 18 | cost = 0.962044094
-----
Circuit = alternative_ckt_2 | Layers = 3 | At end of iteration = 19 | cost = 0.906600105
-----
Circuit = alternative_ckt_2 | Layers = 3 | At end of iteration = 20 | cost = 0.872638093
-----
Circuit = alternative_ckt_2 | Layers = 3 | At end of iteration = 21 | cost = 0.894005323
-----

```

```

-----
Circuit = alternative_ckt_2 | Layers = 3 | At end of iteration = 22 | cost = 0.872651072
-----
Circuit = alternative_ckt_2 | Layers = 3 | At end of iteration = 23 | cost = 0.883594059
-----
Circuit = alternative_ckt_2 | Layers = 3 | At end of iteration = 24 | cost = 0.863466694
-----
Circuit = alternative_ckt_2 | Layers = 3 | At end of iteration = 25 | cost = 0.872799077
-----
Circuit = alternative_ckt_2 | Layers = 3 | At end of iteration = 26 | cost = 0.861633547
-----
Circuit = alternative_ckt_2 | Layers = 3 | At end of iteration = 27 | cost = 0.866078448
-----
Circuit = alternative_ckt_2 | Layers = 3 | At end of iteration = 28 | cost = 0.856923299
-----
Circuit = alternative_ckt_2 | Layers = 3 | At end of iteration = 29 | cost = 0.859952221
-----
Circuit = alternative_ckt_2 | Layers = 3 | At end of iteration = 30 | cost = 0.854341771
-----
Circuit = alternative_ckt_2 | Layers = 3 | At end of iteration = 31 | cost = 0.855549872
-----
Circuit = alternative_ckt_2 | Layers = 3 | At end of iteration = 32 | cost = 0.850851485
-----
Circuit = alternative_ckt_2 | Layers = 3 | At end of iteration = 33 | cost = 0.851396360
-----
Circuit = alternative_ckt_2 | Layers = 3 | At end of iteration = 34 | cost = 0.848012379
-----
Circuit = alternative_ckt_2 | Layers = 3 | At end of iteration = 35 | cost = 0.847864340
-----
Circuit = alternative_ckt_2 | Layers = 3 | At end of iteration = 36 | cost = 0.844839016
-----
Circuit = alternative_ckt_2 | Layers = 3 | At end of iteration = 37 | cost = 0.844383409
-----
Circuit = alternative_ckt_2 | Layers = 3 | At end of iteration = 38 | cost = 0.841852958
-----
Circuit = alternative_ckt_2 | Layers = 3 | At end of iteration = 39 | cost = 0.841083764
-----
REDUCING ALPHA TO 0.31622776601683794 at iteration = 40
-----
Circuit = alternative_ckt_2 | Layers = 3 | At end of iteration = 40 | cost = 0.838730661
-----
Circuit = alternative_ckt_2 | Layers = 3 | At end of iteration = 41 | cost = 0.660278813
-----
Circuit = alternative_ckt_2 | Layers = 3 | At end of iteration = 42 | cost = 0.612047975
-----
Circuit = alternative_ckt_2 | Layers = 3 | At end of iteration = 43 | cost = 0.592188313
-----
Circuit = alternative_ckt_2 | Layers = 3 | At end of iteration = 44 | cost = 0.574175293

```

Circuit = alternative_ckt_2 Layers = 3 At end of iteration = 45 cost = 0.557376284
Circuit = alternative_ckt_2 Layers = 3 At end of iteration = 46 cost = 0.541742439
Circuit = alternative_ckt_2 Layers = 3 At end of iteration = 47 cost = 0.527143296
Circuit = alternative_ckt_2 Layers = 3 At end of iteration = 48 cost = 0.513520086
Circuit = alternative_ckt_2 Layers = 3 At end of iteration = 49 cost = 0.500795639
Circuit = alternative_ckt_2 Layers = 3 At end of iteration = 50 cost = 0.488925882
Circuit = alternative_ckt_2 Layers = 3 At end of iteration = 51 cost = 0.477844734
Circuit = alternative_ckt_2 Layers = 3 At end of iteration = 52 cost = 0.467516876
Circuit = alternative_ckt_2 Layers = 3 At end of iteration = 53 cost = 0.457867782
Circuit = alternative_ckt_2 Layers = 3 At end of iteration = 54 cost = 0.448880312
Circuit = alternative_ckt_2 Layers = 3 At end of iteration = 55 cost = 0.440442957
Circuit = alternative_ckt_2 Layers = 3 At end of iteration = 56 cost = 0.432610520
Circuit = alternative_ckt_2 Layers = 3 At end of iteration = 57 cost = 0.425122639
Circuit = alternative_ckt_2 Layers = 3 At end of iteration = 58 cost = 0.418363284
Circuit = alternative_ckt_2 Layers = 3 At end of iteration = 59 cost = 0.411341214
Circuit = alternative_ckt_2 Layers = 3 At end of iteration = 60 cost = 0.406243278
Circuit = alternative_ckt_2 Layers = 3 At end of iteration = 61 cost = 0.397995875
Circuit = alternative_ckt_2 Layers = 3 At end of iteration = 62 cost = 0.401713198
Circuit = alternative_ckt_2 Layers = 3 At end of iteration = 63 cost = 0.395837827
Circuit = alternative_ckt_2 Layers = 3 At end of iteration = 64 cost = 0.528669804
Circuit = alternative_ckt_2 Layers = 3 At end of iteration = 65 cost = 0.646760790
Circuit = alternative_ckt_2 Layers = 3 At end of iteration = 66 cost = 0.681789730
Circuit = alternative_ckt_2 Layers = 3 At end of iteration = 67 cost = 0.603164638
Circuit = alternative_ckt_2 Layers = 3 At end of iteration = 68 cost = 0.686091143

```

-----
Circuit = alternative_ckt_2 | Layers = 3 | At end of iteration = 69 | cost = 0.5835862300
-----
Circuit = alternative_ckt_2 | Layers = 3 | At end of iteration = 70 | cost = 0.6799203680
-----
Circuit = alternative_ckt_2 | Layers = 3 | At end of iteration = 71 | cost = 0.5762693990
-----
Circuit = alternative_ckt_2 | Layers = 3 | At end of iteration = 72 | cost = 0.6731052470
-----
Circuit = alternative_ckt_2 | Layers = 3 | At end of iteration = 73 | cost = 0.5730106380
-----
Circuit = alternative_ckt_2 | Layers = 3 | At end of iteration = 74 | cost = 0.6684468750
-----
Circuit = alternative_ckt_2 | Layers = 3 | At end of iteration = 75 | cost = 0.5709341530
-----
Circuit = alternative_ckt_2 | Layers = 3 | At end of iteration = 76 | cost = 0.6657984520
-----
Circuit = alternative_ckt_2 | Layers = 3 | At end of iteration = 77 | cost = 0.5693314710
-----
Circuit = alternative_ckt_2 | Layers = 3 | At end of iteration = 78 | cost = 0.6645368170
-----
Circuit = alternative_ckt_2 | Layers = 3 | At end of iteration = 79 | cost = 0.5679954260
-----
REDUCING ALPHA TO 0.09999999999999999 at iteration = 80
-----
Circuit = alternative_ckt_2 | Layers = 3 | At end of iteration = 80 | cost = 0.6641759680
-----
Circuit = alternative_ckt_2 | Layers = 3 | At end of iteration = 81 | cost = 0.4556483160
-----
Circuit = alternative_ckt_2 | Layers = 3 | At end of iteration = 82 | cost = 0.3848027410
-----
Circuit = alternative_ckt_2 | Layers = 3 | At end of iteration = 83 | cost = 0.3787222370
-----
Circuit = alternative_ckt_2 | Layers = 3 | At end of iteration = 84 | cost = 0.3746197240
-----
Circuit = alternative_ckt_2 | Layers = 3 | At end of iteration = 85 | cost = 0.3706523860
-----
Circuit = alternative_ckt_2 | Layers = 3 | At end of iteration = 86 | cost = 0.3669953470
-----
Circuit = alternative_ckt_2 | Layers = 3 | At end of iteration = 87 | cost = 0.3635829050
-----
Circuit = alternative_ckt_2 | Layers = 3 | At end of iteration = 88 | cost = 0.3603932120
-----
Circuit = alternative_ckt_2 | Layers = 3 | At end of iteration = 89 | cost = 0.3573999580
-----
Circuit = alternative_ckt_2 | Layers = 3 | At end of iteration = 90 | cost = 0.3545813330
-----
Circuit = alternative_ckt_2 | Layers = 3 | At end of iteration = 91 | cost = 0.3519177120
-----

```

```

-----
Circuit = alternative_ckt_2 | Layers = 3 | At end of iteration = 92 | cost = 0.3493918963
-----
Circuit = alternative_ckt_2 | Layers = 3 | At end of iteration = 93 | cost = 0.3469887442
-----
Circuit = alternative_ckt_2 | Layers = 3 | At end of iteration = 94 | cost = 0.3446949778
-----
Circuit = alternative_ckt_2 | Layers = 3 | At end of iteration = 95 | cost = 0.3424989642
-----
Circuit = alternative_ckt_2 | Layers = 3 | At end of iteration = 96 | cost = 0.3403905218
-----
Circuit = alternative_ckt_2 | Layers = 3 | At end of iteration = 97 | cost = 0.3383607409
-----
Circuit = alternative_ckt_2 | Layers = 3 | At end of iteration = 98 | cost = 0.3364018248
-----
Circuit = alternative_ckt_2 | Layers = 3 | At end of iteration = 99 | cost = 0.3345069442
-----
Circuit = alternative_ckt_2 | Layers = 3 | At end of iteration = 100 | cost = 0.3326701121
-----
Circuit = alternative_ckt_2 | Layers = 3 | At end of iteration = 101 | cost = 0.3308860771
-----
Circuit = alternative_ckt_2 | Layers = 3 | At end of iteration = 102 | cost = 0.3291501971
-----
Circuit = alternative_ckt_2 | Layers = 3 | At end of iteration = 103 | cost = 0.3274584081
-----
Circuit = alternative_ckt_2 | Layers = 3 | At end of iteration = 104 | cost = 0.3258070991
-----
Circuit = alternative_ckt_2 | Layers = 3 | At end of iteration = 105 | cost = 0.3241930691
-----
Circuit = alternative_ckt_2 | Layers = 3 | At end of iteration = 106 | cost = 0.3226134791
-----
Circuit = alternative_ckt_2 | Layers = 3 | At end of iteration = 107 | cost = 0.3210657791
-----
Circuit = alternative_ckt_2 | Layers = 3 | At end of iteration = 108 | cost = 0.3195476891
-----
Circuit = alternative_ckt_2 | Layers = 3 | At end of iteration = 109 | cost = 0.3180571691
-----
Circuit = alternative_ckt_2 | Layers = 3 | At end of iteration = 110 | cost = 0.3165923791
-----
Circuit = alternative_ckt_2 | Layers = 3 | At end of iteration = 111 | cost = 0.3151516291
-----
Circuit = alternative_ckt_2 | Layers = 3 | At end of iteration = 112 | cost = 0.3137334091
-----
Circuit = alternative_ckt_2 | Layers = 3 | At end of iteration = 113 | cost = 0.3123363091
-----
Circuit = alternative_ckt_2 | Layers = 3 | At end of iteration = 114 | cost = 0.3109590691
-----
Circuit = alternative_ckt_2 | Layers = 3 | At end of iteration = 115 | cost = 0.3096004991
-----

```

```

-----
Circuit = alternative_ckt_2 | Layers = 3 | At end of iteration = 116 | cost = 0.30825951
-----
Circuit = alternative_ckt_2 | Layers = 3 | At end of iteration = 117 | cost = 0.30693510
-----
Circuit = alternative_ckt_2 | Layers = 3 | At end of iteration = 118 | cost = 0.30562634
-----
Circuit = alternative_ckt_2 | Layers = 3 | At end of iteration = 119 | cost = 0.30433235
-----
REDUCING ALPHA TO 0.03162277660168379 at iteration = 120
-----
Circuit = alternative_ckt_2 | Layers = 3 | At end of iteration = 120 | cost = 0.30305230
-----
Circuit = alternative_ckt_2 | Layers = 3 | At end of iteration = 121 | cost = 0.30265132
-----
Circuit = alternative_ckt_2 | Layers = 3 | At end of iteration = 122 | cost = 0.30225159
-----
Circuit = alternative_ckt_2 | Layers = 3 | At end of iteration = 123 | cost = 0.30185309
-----
Circuit = alternative_ckt_2 | Layers = 3 | At end of iteration = 124 | cost = 0.30145578
-----
Circuit = alternative_ckt_2 | Layers = 3 | At end of iteration = 125 | cost = 0.30105965
-----
Circuit = alternative_ckt_2 | Layers = 3 | At end of iteration = 126 | cost = 0.30066467
-----
Circuit = alternative_ckt_2 | Layers = 3 | At end of iteration = 127 | cost = 0.30027084
-----
Circuit = alternative_ckt_2 | Layers = 3 | At end of iteration = 128 | cost = 0.29987812
-----
Circuit = alternative_ckt_2 | Layers = 3 | At end of iteration = 129 | cost = 0.29948649
-----
Circuit = alternative_ckt_2 | Layers = 3 | At end of iteration = 130 | cost = 0.29909595
-----
Circuit = alternative_ckt_2 | Layers = 3 | At end of iteration = 131 | cost = 0.29870646
-----
Circuit = alternative_ckt_2 | Layers = 3 | At end of iteration = 132 | cost = 0.29831801
-----
Circuit = alternative_ckt_2 | Layers = 3 | At end of iteration = 133 | cost = 0.29793059
-----
Circuit = alternative_ckt_2 | Layers = 3 | At end of iteration = 134 | cost = 0.29754417
-----
Circuit = alternative_ckt_2 | Layers = 3 | At end of iteration = 135 | cost = 0.29715874
-----
Circuit = alternative_ckt_2 | Layers = 3 | At end of iteration = 136 | cost = 0.29677428
-----
Circuit = alternative_ckt_2 | Layers = 3 | At end of iteration = 137 | cost = 0.29639078
-----
Circuit = alternative_ckt_2 | Layers = 3 | At end of iteration = 138 | cost = 0.29600821

```

```

-----
Circuit = alternative_ckt_2 | Layers = 3 | At end of iteration = 139 | cost = 0.29562656
-----
Circuit = alternative_ckt_2 | Layers = 3 | At end of iteration = 140 | cost = 0.29524582
-----
Circuit = alternative_ckt_2 | Layers = 3 | At end of iteration = 141 | cost = 0.29486596
-----
Circuit = alternative_ckt_2 | Layers = 3 | At end of iteration = 142 | cost = 0.29448698
-----
Circuit = alternative_ckt_2 | Layers = 3 | At end of iteration = 143 | cost = 0.29410885
-----
Circuit = alternative_ckt_2 | Layers = 3 | At end of iteration = 144 | cost = 0.29373157
-----
Circuit = alternative_ckt_2 | Layers = 3 | At end of iteration = 145 | cost = 0.29335512
-----
Circuit = alternative_ckt_2 | Layers = 3 | At end of iteration = 146 | cost = 0.29297947
-----
Circuit = alternative_ckt_2 | Layers = 3 | At end of iteration = 147 | cost = 0.29260463
-----
Circuit = alternative_ckt_2 | Layers = 3 | At end of iteration = 148 | cost = 0.29223057
-----
Circuit = alternative_ckt_2 | Layers = 3 | At end of iteration = 149 | cost = 0.29185728
-----
Circuit = alternative_ckt_2 | Layers = 3 | At end of iteration = 150 | cost = 0.29148475
-----
Circuit = alternative_ckt_2 | Layers = 3 | At end of iteration = 151 | cost = 0.29111296
-----
Circuit = alternative_ckt_2 | Layers = 3 | At end of iteration = 152 | cost = 0.29074190
-----
Circuit = alternative_ckt_2 | Layers = 3 | At end of iteration = 153 | cost = 0.29037156
-----
Circuit = alternative_ckt_2 | Layers = 3 | At end of iteration = 154 | cost = 0.29000192
-----
Circuit = alternative_ckt_2 | Layers = 3 | At end of iteration = 155 | cost = 0.28963298
-----
Circuit = alternative_ckt_2 | Layers = 3 | At end of iteration = 156 | cost = 0.28926471
-----
Circuit = alternative_ckt_2 | Layers = 3 | At end of iteration = 157 | cost = 0.28889711
-----
Circuit = alternative_ckt_2 | Layers = 3 | At end of iteration = 158 | cost = 0.28853016
-----
Circuit = alternative_ckt_2 | Layers = 3 | At end of iteration = 159 | cost = 0.28816386
-----
Circuit = alternative_ckt_2 | Layers = 3 | At end of iteration = 160 | cost = 0.28779818
-----
Circuit = alternative_ckt_2 | Layers = 3 | At end of iteration = 161 | cost = 0.28743313
-----
Circuit = alternative_ckt_2 | Layers = 3 | At end of iteration = 162 | cost = 0.28706868
-----

```


Circuit = alternative_ckt_2 Layers = 3 At end of iteration = 163 cost = 0.28670483
Circuit = alternative_ckt_2 Layers = 3 At end of iteration = 164 cost = 0.28634157
Circuit = alternative_ckt_2 Layers = 3 At end of iteration = 165 cost = 0.28597888
Circuit = alternative_ckt_2 Layers = 3 At end of iteration = 166 cost = 0.28561675
Circuit = alternative_ckt_2 Layers = 3 At end of iteration = 167 cost = 0.28525518
Circuit = alternative_ckt_2 Layers = 3 At end of iteration = 168 cost = 0.28489415
Circuit = alternative_ckt_2 Layers = 3 At end of iteration = 169 cost = 0.28453365
Circuit = alternative_ckt_2 Layers = 3 At end of iteration = 170 cost = 0.28417368
Circuit = alternative_ckt_2 Layers = 3 At end of iteration = 171 cost = 0.28381422
Circuit = alternative_ckt_2 Layers = 3 At end of iteration = 172 cost = 0.28345526
Circuit = alternative_ckt_2 Layers = 3 At end of iteration = 173 cost = 0.28309680
Circuit = alternative_ckt_2 Layers = 3 At end of iteration = 174 cost = 0.28273882
Circuit = alternative_ckt_2 Layers = 3 At end of iteration = 175 cost = 0.28238131
Circuit = alternative_ckt_2 Layers = 3 At end of iteration = 176 cost = 0.28202427
Circuit = alternative_ckt_2 Layers = 3 At end of iteration = 177 cost = 0.28166769
Circuit = alternative_ckt_2 Layers = 3 At end of iteration = 178 cost = 0.28131155
Circuit = alternative_ckt_2 Layers = 3 At end of iteration = 179 cost = 0.28095585
Circuit = alternative_ckt_2 Layers = 3 At end of iteration = 180 cost = 0.28060058
Circuit = alternative_ckt_2 Layers = 3 At end of iteration = 181 cost = 0.28024574
Circuit = alternative_ckt_2 Layers = 3 At end of iteration = 182 cost = 0.27989130
Circuit = alternative_ckt_2 Layers = 3 At end of iteration = 183 cost = 0.27953727
Circuit = alternative_ckt_2 Layers = 3 At end of iteration = 184 cost = 0.27918364
Circuit = alternative_ckt_2 Layers = 3 At end of iteration = 185 cost = 0.27883039
Circuit = alternative_ckt_2 Layers = 3 At end of iteration = 186 cost = 0.27847753

```

-----
Circuit = alternative_ckt_2 | Layers = 3 | At end of iteration = 187 | cost = 0.27812503
-----
Circuit = alternative_ckt_2 | Layers = 3 | At end of iteration = 188 | cost = 0.27777290
-----
Circuit = alternative_ckt_2 | Layers = 3 | At end of iteration = 189 | cost = 0.27742112
-----
Circuit = alternative_ckt_2 | Layers = 3 | At end of iteration = 190 | cost = 0.27706970
-----
Circuit = alternative_ckt_2 | Layers = 3 | At end of iteration = 191 | cost = 0.27671861
-----
Circuit = alternative_ckt_2 | Layers = 3 | At end of iteration = 192 | cost = 0.27636786
-----
Circuit = alternative_ckt_2 | Layers = 3 | At end of iteration = 193 | cost = 0.27601743
-----
Circuit = alternative_ckt_2 | Layers = 3 | At end of iteration = 194 | cost = 0.27566732
-----
Circuit = alternative_ckt_2 | Layers = 3 | At end of iteration = 195 | cost = 0.27531752
-----
Circuit = alternative_ckt_2 | Layers = 3 | At end of iteration = 196 | cost = 0.27496803
-----
Circuit = alternative_ckt_2 | Layers = 3 | At end of iteration = 197 | cost = 0.27461883
-----
Circuit = alternative_ckt_2 | Layers = 3 | At end of iteration = 198 | cost = 0.27426992
-----
Circuit = alternative_ckt_2 | Layers = 3 | At end of iteration = 199 | cost = 0.27392130
-----
Circuit = alternative_ckt_2 | Layers = 3 | At end of iteration = 200 | cost = 0.27357294
-----
Circuit = alternative_ckt_2 | Layers = 3 | At end of iteration = 201 | cost = 0.27322486
-----
Circuit = alternative_ckt_2 | Layers = 3 | At end of iteration = 202 | cost = 0.27287704
-----
Circuit = alternative_ckt_2 | Layers = 3 | At end of iteration = 203 | cost = 0.27252947
-----
Circuit = alternative_ckt_2 | Layers = 3 | At end of iteration = 204 | cost = 0.27218215
-----
Circuit = alternative_ckt_2 | Layers = 3 | At end of iteration = 205 | cost = 0.27183507
-----
Circuit = alternative_ckt_2 | Layers = 3 | At end of iteration = 206 | cost = 0.27148822
-----
Circuit = alternative_ckt_2 | Layers = 3 | At end of iteration = 207 | cost = 0.27114160
-----
Circuit = alternative_ckt_2 | Layers = 3 | At end of iteration = 208 | cost = 0.27079520
-----
Circuit = alternative_ckt_2 | Layers = 3 | At end of iteration = 209 | cost = 0.27044901
-----
Circuit = alternative_ckt_2 | Layers = 3 | At end of iteration = 210 | cost = 0.27010303
-----

```

```

-----
Circuit = alternative_ckt_2 | Layers = 3 | At end of iteration = 211 | cost = 0.26975725
-----
Circuit = alternative_ckt_2 | Layers = 3 | At end of iteration = 212 | cost = 0.26941166
-----
Circuit = alternative_ckt_2 | Layers = 3 | At end of iteration = 213 | cost = 0.26906625
-----
Circuit = alternative_ckt_2 | Layers = 3 | At end of iteration = 214 | cost = 0.26872103
-----
Circuit = alternative_ckt_2 | Layers = 3 | At end of iteration = 215 | cost = 0.26837598
-----
Circuit = alternative_ckt_2 | Layers = 3 | At end of iteration = 216 | cost = 0.26803110
-----
Circuit = alternative_ckt_2 | Layers = 3 | At end of iteration = 217 | cost = 0.26768637
-----
Circuit = alternative_ckt_2 | Layers = 3 | At end of iteration = 218 | cost = 0.26734180
-----
Circuit = alternative_ckt_2 | Layers = 3 | At end of iteration = 219 | cost = 0.26699738
-----
Circuit = alternative_ckt_2 | Layers = 3 | At end of iteration = 220 | cost = 0.26665309
-----
Circuit = alternative_ckt_2 | Layers = 3 | At end of iteration = 221 | cost = 0.26630893
-----
Circuit = alternative_ckt_2 | Layers = 3 | At end of iteration = 222 | cost = 0.26596491
-----
Circuit = alternative_ckt_2 | Layers = 3 | At end of iteration = 223 | cost = 0.26562100
-----
Circuit = alternative_ckt_2 | Layers = 3 | At end of iteration = 224 | cost = 0.26527720
-----
Circuit = alternative_ckt_2 | Layers = 3 | At end of iteration = 225 | cost = 0.26493351
-----
Circuit = alternative_ckt_2 | Layers = 3 | At end of iteration = 226 | cost = 0.26458992
-----
Circuit = alternative_ckt_2 | Layers = 3 | At end of iteration = 227 | cost = 0.26424641
-----
Circuit = alternative_ckt_2 | Layers = 3 | At end of iteration = 228 | cost = 0.26390300
-----
Circuit = alternative_ckt_2 | Layers = 3 | At end of iteration = 229 | cost = 0.26355966
-----
Circuit = alternative_ckt_2 | Layers = 3 | At end of iteration = 230 | cost = 0.26321639
-----
Circuit = alternative_ckt_2 | Layers = 3 | At end of iteration = 231 | cost = 0.26287319
-----
Circuit = alternative_ckt_2 | Layers = 3 | At end of iteration = 232 | cost = 0.26253004
-----
Circuit = alternative_ckt_2 | Layers = 3 | At end of iteration = 233 | cost = 0.26218694
-----
Circuit = alternative_ckt_2 | Layers = 3 | At end of iteration = 234 | cost = 0.26184389
-----

```

Circuit = alternative_ckt_2 Layers = 3 At end of iteration = 235 cost = 0.26150087
Circuit = alternative_ckt_2 Layers = 3 At end of iteration = 236 cost = 0.26115788
Circuit = alternative_ckt_2 Layers = 3 At end of iteration = 237 cost = 0.26081491
Circuit = alternative_ckt_2 Layers = 3 At end of iteration = 238 cost = 0.26047195
Circuit = alternative_ckt_2 Layers = 3 At end of iteration = 239 cost = 0.26012901
Circuit = alternative_ckt_2 Layers = 3 At end of iteration = 240 cost = 0.25978606
Circuit = alternative_ckt_2 Layers = 3 At end of iteration = 241 cost = 0.25944310
Circuit = alternative_ckt_2 Layers = 3 At end of iteration = 242 cost = 0.25910013
Circuit = alternative_ckt_2 Layers = 3 At end of iteration = 243 cost = 0.25875714
Circuit = alternative_ckt_2 Layers = 3 At end of iteration = 244 cost = 0.25841412
Circuit = alternative_ckt_2 Layers = 3 At end of iteration = 245 cost = 0.25807106
Circuit = alternative_ckt_2 Layers = 3 At end of iteration = 246 cost = 0.25772796
Circuit = alternative_ckt_2 Layers = 3 At end of iteration = 247 cost = 0.25738480
Circuit = alternative_ckt_2 Layers = 3 At end of iteration = 248 cost = 0.25704159
Circuit = alternative_ckt_2 Layers = 3 At end of iteration = 249 cost = 0.25669831
Circuit = alternative_ckt_2 Layers = 3 At end of iteration = 250 cost = 0.25635495
Circuit = alternative_ckt_2 Layers = 3 At end of iteration = 251 cost = 0.25601152
Circuit = alternative_ckt_2 Layers = 3 At end of iteration = 252 cost = 0.25566799
Circuit = alternative_ckt_2 Layers = 3 At end of iteration = 253 cost = 0.25532437
Circuit = alternative_ckt_2 Layers = 3 At end of iteration = 254 cost = 0.25498064
Circuit = alternative_ckt_2 Layers = 3 At end of iteration = 255 cost = 0.25463680
Circuit = alternative_ckt_2 Layers = 3 At end of iteration = 256 cost = 0.25429284
Circuit = alternative_ckt_2 Layers = 3 At end of iteration = 257 cost = 0.25394875
Circuit = alternative_ckt_2 Layers = 3 At end of iteration = 258 cost = 0.25360453

```

-----
Circuit = alternative_ckt_2 | Layers = 3 | At end of iteration = 259 | cost = 0.25326017
-----
Circuit = alternative_ckt_2 | Layers = 3 | At end of iteration = 260 | cost = 0.25291566
-----
Circuit = alternative_ckt_2 | Layers = 3 | At end of iteration = 261 | cost = 0.25257099
-----
Circuit = alternative_ckt_2 | Layers = 3 | At end of iteration = 262 | cost = 0.25222616
-----
Circuit = alternative_ckt_2 | Layers = 3 | At end of iteration = 263 | cost = 0.25188115
-----
Circuit = alternative_ckt_2 | Layers = 3 | At end of iteration = 264 | cost = 0.25153597
-----
Circuit = alternative_ckt_2 | Layers = 3 | At end of iteration = 265 | cost = 0.25119060
-----
Circuit = alternative_ckt_2 | Layers = 3 | At end of iteration = 266 | cost = 0.25084503
-----
Circuit = alternative_ckt_2 | Layers = 3 | At end of iteration = 267 | cost = 0.25049927
-----
Circuit = alternative_ckt_2 | Layers = 3 | At end of iteration = 268 | cost = 0.25015330
-----
Circuit = alternative_ckt_2 | Layers = 3 | At end of iteration = 269 | cost = 0.24980711
-----
Circuit = alternative_ckt_2 | Layers = 3 | At end of iteration = 270 | cost = 0.24946070
-----
Circuit = alternative_ckt_2 | Layers = 3 | At end of iteration = 271 | cost = 0.24911407
-----
Circuit = alternative_ckt_2 | Layers = 3 | At end of iteration = 272 | cost = 0.24876719
-----
Circuit = alternative_ckt_2 | Layers = 3 | At end of iteration = 273 | cost = 0.24842008
-----
Circuit = alternative_ckt_2 | Layers = 3 | At end of iteration = 274 | cost = 0.24807272
-----
Circuit = alternative_ckt_2 | Layers = 3 | At end of iteration = 275 | cost = 0.24772510
-----
Circuit = alternative_ckt_2 | Layers = 3 | At end of iteration = 276 | cost = 0.24737722
-----
Circuit = alternative_ckt_2 | Layers = 3 | At end of iteration = 277 | cost = 0.24702907
-----
Circuit = alternative_ckt_2 | Layers = 3 | At end of iteration = 278 | cost = 0.24668066
-----
Circuit = alternative_ckt_2 | Layers = 3 | At end of iteration = 279 | cost = 0.24633196
-----
Circuit = alternative_ckt_2 | Layers = 3 | At end of iteration = 280 | cost = 0.24598297
-----
Circuit = alternative_ckt_2 | Layers = 3 | At end of iteration = 281 | cost = 0.24563370
-----
Circuit = alternative_ckt_2 | Layers = 3 | At end of iteration = 282 | cost = 0.24528414
-----

```

```

-----
Circuit = alternative_ckt_2 | Layers = 3 | At end of iteration = 283 | cost = 0.244934277
-----
Circuit = alternative_ckt_2 | Layers = 3 | At end of iteration = 284 | cost = 0.244584099
-----
Circuit = alternative_ckt_2 | Layers = 3 | At end of iteration = 285 | cost = 0.244233611
-----
Circuit = alternative_ckt_2 | Layers = 3 | At end of iteration = 286 | cost = 0.243882821
-----
Circuit = alternative_ckt_2 | Layers = 3 | At end of iteration = 287 | cost = 0.243531707
-----
Circuit = alternative_ckt_2 | Layers = 3 | At end of iteration = 288 | cost = 0.243180277
-----
Circuit = alternative_ckt_2 | Layers = 3 | At end of iteration = 289 | cost = 0.242828509
-----
Circuit = alternative_ckt_2 | Layers = 3 | At end of iteration = 290 | cost = 0.242476419
-----
Circuit = alternative_ckt_2 | Layers = 3 | At end of iteration = 291 | cost = 0.242123999
-----
Circuit = alternative_ckt_2 | Layers = 3 | At end of iteration = 292 | cost = 0.241771249
-----
Circuit = alternative_ckt_2 | Layers = 3 | At end of iteration = 293 | cost = 0.241418149
-----
Circuit = alternative_ckt_2 | Layers = 3 | At end of iteration = 294 | cost = 0.241064719
-----
Circuit = alternative_ckt_2 | Layers = 3 | At end of iteration = 295 | cost = 0.240710949
-----
Circuit = alternative_ckt_2 | Layers = 3 | At end of iteration = 296 | cost = 0.240356839
-----
Circuit = alternative_ckt_2 | Layers = 3 | At end of iteration = 297 | cost = 0.240002389
-----
Circuit = alternative_ckt_2 | Layers = 3 | At end of iteration = 298 | cost = 0.239647589
-----
Circuit = alternative_ckt_2 | Layers = 3 | At end of iteration = 299 | cost = 0.239292449
-----
Circuit = alternative_ckt_2 | Layers = 3 | At end of iteration = 300 | cost = 0.238936969
-----

```

Optimization complete.

After optimization, the optimal parameters are

```
{Parameter(lmbda3[0]): 0.18456275435040778, Parameter(phi1[1]): -0.3756637123014897, Parameter
```

The output state for these parameters is

```

[[0.31712545+0.25298107j]
 [0.03839293+0.1100361j ]
 [0.25115732+0.14782667j]
 [0.19569191+0.0538065j ]
 [0.22554333+0.04298814j]
 [0.16267493+0.09418496j]
 [0.17603379+0.13556857j]

```

```

[0.06206541+0.10629012j]
[0.30173792+0.05345683j]
[0.22034198+0.04092517j]
[0.29584408+0.03135403j]
[0.08751417+0.02078559j]
[0.31610914+0.1622061j ]
[0.13290419+0.06224438j]
[0.21180496+0.19743118j]
[0.22306164+0.14512649j]]

```

```

-----
Circuit =  alternative_ckt_2  Layers =  3  Cost after optimization =  0.23893696338547912
-----

```

```

Circuit  alternative_ckt_2  constructed with  4  layers. Number of parameters =  64 .
-----

```

Initialized circuit parameters prior to gradient descent randomly as follows:

```

idx =  theta6[3]  params =  0.03719052023213644
idx =  theta2[1]  params =  0.04312312828020062
idx =  lambda7[1]  params =  0.0004994971757621869
idx =  phi1[2]  params =  0.03444025418170515
idx =  theta4[0]  params =  0.046881140646663634
idx =  phi7[1]  params =  0.02164226791611938
idx =  lambda5[3]  params =  0.028343942770291508
idx =  theta8[2]  params =  0.013510378554063363
idx =  lambda1[3]  params =  0.022782810868909098
idx =  theta4[2]  params =  0.00573789773068969
idx =  lambda3[2]  params =  0.039532273767073196
idx =  phi1[1]  params =  0.018375156312795238
idx =  theta4[3]  params =  0.02421115885861306
idx =  theta8[3]  params =  0.01671278315727628
idx =  theta5[3]  params =  0.006172454610576922
idx =  theta3[3]  params =  0.016655522656847783
idx =  lambda3[1]  params =  0.04662197117509747
idx =  theta7[1]  params =  0.009378499198132518
idx =  lambda7[2]  params =  0.030481776612878
idx =  lambda1[1]  params =  0.006238299240088347
idx =  phi7[0]  params =  0.046316344013782464
idx =  theta8[1]  params =  0.002833116050508433
idx =  phi3[3]  params =  0.009568165097689485
idx =  lambda5[0]  params =  0.003778807686699465
idx =  phi5[2]  params =  0.04761132655555178
idx =  theta5[1]  params =  0.02912836626547597
idx =  theta6[2]  params =  0.03277867333581935
idx =  lambda1[2]  params =  0.0012507649722014293
idx =  phi5[3]  params =  0.03265668670981592
idx =  theta3[2]  params =  0.042510362504139115
idx =  phi5[1]  params =  0.028964664980450857
idx =  theta6[0]  params =  0.02606701333987876
idx =  theta1[1]  params =  0.04507588560641085

```

```

idx = theta7[2] params = 0.01594882076679191
idx = theta7[3] params = 0.03973242205283862
idx = lambda3[0] params = 0.009337792350935193
idx = theta3[0] params = 0.0032829280606491377
idx = theta5[0] params = 0.019944497772341908
idx = theta7[0] params = 0.040543302128205796
idx = theta8[0] params = 0.018661219094017113
idx = phi3[0] params = 0.022765429249395765
idx = theta3[1] params = 0.04496189581938223
idx = phi3[2] params = 0.04421309636000539
idx = lambda3[3] params = 0.032067148697469475
idx = phi7[3] params = 0.03316055200997197
idx = theta2[2] params = 0.038381406528673896
idx = phi5[0] params = 0.014346822771396907
idx = theta5[2] params = 0.017358921226698288
idx = lambda7[0] params = 0.036248132522104036
idx = lambda5[1] params = 0.03539050548659198
idx = theta1[2] params = 0.01607370215812653
idx = theta1[3] params = 0.007381200069874755
idx = theta1[0] params = 0.02358393517371811
idx = theta2[3] params = 0.0009009332204443055
idx = lambda5[2] params = 0.015027195664715637
idx = phi1[3] params = 0.037934352344020754
idx = lambda1[0] params = 0.02983057071232084
idx = lambda7[3] params = 0.023111461319399895
idx = theta4[1] params = 0.02586128220807936
idx = phi1[0] params = 0.002230543419827341
idx = theta6[1] params = 0.021152548385698113
idx = phi3[1] params = 0.017680671110920827
idx = theta2[0] params = 0.04880350842240636
idx = phi7[2] params = 0.04861089868928858

```

```

-----
Circuit = alternative_ckt_2 | Layers = 4 | At end of iteration = 1 | cost = 1.1106064167

```

```

-----
Circuit = alternative_ckt_2 | Layers = 4 | At end of iteration = 2 | cost = 1.0260088135

```

```

-----
Circuit = alternative_ckt_2 | Layers = 4 | At end of iteration = 3 | cost = 0.9111320603

```

```

-----
Circuit = alternative_ckt_2 | Layers = 4 | At end of iteration = 4 | cost = 0.7522593921

```

```

-----
Circuit = alternative_ckt_2 | Layers = 4 | At end of iteration = 5 | cost = 0.5849217786

```

```

-----
Circuit = alternative_ckt_2 | Layers = 4 | At end of iteration = 6 | cost = 0.4944939227

```

```

-----
Circuit = alternative_ckt_2 | Layers = 4 | At end of iteration = 7 | cost = 1.0233278170

```

```

-----
Circuit = alternative_ckt_2 | Layers = 4 | At end of iteration = 8 | cost = 1.4624696616

```


Circuit = alternative_ckt_2 Layers = 4 At end of iteration = 9 cost = 1.3004879070
Circuit = alternative_ckt_2 Layers = 4 At end of iteration = 10 cost = 1.032622649
Circuit = alternative_ckt_2 Layers = 4 At end of iteration = 11 cost = 0.783649486
Circuit = alternative_ckt_2 Layers = 4 At end of iteration = 12 cost = 0.727807171
Circuit = alternative_ckt_2 Layers = 4 At end of iteration = 13 cost = 1.276158730
Circuit = alternative_ckt_2 Layers = 4 At end of iteration = 14 cost = 0.643023252
Circuit = alternative_ckt_2 Layers = 4 At end of iteration = 15 cost = 1.027400583
Circuit = alternative_ckt_2 Layers = 4 At end of iteration = 16 cost = 1.230348405
Circuit = alternative_ckt_2 Layers = 4 At end of iteration = 17 cost = 0.622257367
Circuit = alternative_ckt_2 Layers = 4 At end of iteration = 18 cost = 0.885180536
Circuit = alternative_ckt_2 Layers = 4 At end of iteration = 19 cost = 1.358254368
Circuit = alternative_ckt_2 Layers = 4 At end of iteration = 20 cost = 0.822481255
Circuit = alternative_ckt_2 Layers = 4 At end of iteration = 21 cost = 1.113340237
Circuit = alternative_ckt_2 Layers = 4 At end of iteration = 22 cost = 0.730202957
Circuit = alternative_ckt_2 Layers = 4 At end of iteration = 23 cost = 1.083307073
Circuit = alternative_ckt_2 Layers = 4 At end of iteration = 24 cost = 0.812292209
Circuit = alternative_ckt_2 Layers = 4 At end of iteration = 25 cost = 1.116580458
Circuit = alternative_ckt_2 Layers = 4 At end of iteration = 26 cost = 0.686541395
Circuit = alternative_ckt_2 Layers = 4 At end of iteration = 27 cost = 1.011234857
Circuit = alternative_ckt_2 Layers = 4 At end of iteration = 28 cost = 0.966481584
Circuit = alternative_ckt_2 Layers = 4 At end of iteration = 29 cost = 0.977657052
Circuit = alternative_ckt_2 Layers = 4 At end of iteration = 30 cost = 0.832822712
Circuit = alternative_ckt_2 Layers = 4 At end of iteration = 31 cost = 1.027210546
Circuit = alternative_ckt_2 Layers = 4 At end of iteration = 32 cost = 0.783546067

```

Circuit = alternative_ckt_2 | Layers = 4 | At end of iteration = 33 | cost = 1.030388706
-----
Circuit = alternative_ckt_2 | Layers = 4 | At end of iteration = 34 | cost = 0.796080101
-----
Circuit = alternative_ckt_2 | Layers = 4 | At end of iteration = 35 | cost = 1.038808572
-----
Circuit = alternative_ckt_2 | Layers = 4 | At end of iteration = 36 | cost = 0.765512835
-----
Circuit = alternative_ckt_2 | Layers = 4 | At end of iteration = 37 | cost = 1.028513141
-----
Circuit = alternative_ckt_2 | Layers = 4 | At end of iteration = 38 | cost = 0.794347252
-----
Circuit = alternative_ckt_2 | Layers = 4 | At end of iteration = 39 | cost = 1.036470542
-----
REDUCING ALPHA TO 0.31622776601683794 at iteration = 40
-----
Circuit = alternative_ckt_2 | Layers = 4 | At end of iteration = 40 | cost = 0.752983954
-----
Circuit = alternative_ckt_2 | Layers = 4 | At end of iteration = 41 | cost = 0.579769068
-----
Circuit = alternative_ckt_2 | Layers = 4 | At end of iteration = 42 | cost = 0.528974744
-----
Circuit = alternative_ckt_2 | Layers = 4 | At end of iteration = 43 | cost = 0.482032199
-----
Circuit = alternative_ckt_2 | Layers = 4 | At end of iteration = 44 | cost = 0.447117823
-----
Circuit = alternative_ckt_2 | Layers = 4 | At end of iteration = 45 | cost = 0.411634747
-----
Circuit = alternative_ckt_2 | Layers = 4 | At end of iteration = 46 | cost = 0.393295926
-----
Circuit = alternative_ckt_2 | Layers = 4 | At end of iteration = 47 | cost = 0.366306215
-----
Circuit = alternative_ckt_2 | Layers = 4 | At end of iteration = 48 | cost = 0.460540891
-----
Circuit = alternative_ckt_2 | Layers = 4 | At end of iteration = 49 | cost = 0.584996996
-----
Circuit = alternative_ckt_2 | Layers = 4 | At end of iteration = 50 | cost = 0.676924421
-----
Circuit = alternative_ckt_2 | Layers = 4 | At end of iteration = 51 | cost = 0.520180564
-----
Circuit = alternative_ckt_2 | Layers = 4 | At end of iteration = 52 | cost = 0.696347281
-----
Circuit = alternative_ckt_2 | Layers = 4 | At end of iteration = 53 | cost = 0.493699833
-----
Circuit = alternative_ckt_2 | Layers = 4 | At end of iteration = 54 | cost = 0.700307202
-----
Circuit = alternative_ckt_2 | Layers = 4 | At end of iteration = 55 | cost = 0.486464683
-----

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Circuit = alternative_ckt_2 Layers = 4 At end of iteration = 56 cost = 0.7053691008
Circuit = alternative_ckt_2 Layers = 4 At end of iteration = 57 cost = 0.4803478568
Circuit = alternative_ckt_2 Layers = 4 At end of iteration = 58 cost = 0.7121752941
Circuit = alternative_ckt_2 Layers = 4 At end of iteration = 59 cost = 0.4734987198
Circuit = alternative_ckt_2 Layers = 4 At end of iteration = 60 cost = 0.7197395583
Circuit = alternative_ckt_2 Layers = 4 At end of iteration = 61 cost = 0.4663089623
Circuit = alternative_ckt_2 Layers = 4 At end of iteration = 62 cost = 0.7275771488
Circuit = alternative_ckt_2 Layers = 4 At end of iteration = 63 cost = 0.4589838711
Circuit = alternative_ckt_2 Layers = 4 At end of iteration = 64 cost = 0.7354329504
Circuit = alternative_ckt_2 Layers = 4 At end of iteration = 65 cost = 0.4516506541
Circuit = alternative_ckt_2 Layers = 4 At end of iteration = 66 cost = 0.7431754388
Circuit = alternative_ckt_2 Layers = 4 At end of iteration = 67 cost = 0.4443835514
Circuit = alternative_ckt_2 Layers = 4 At end of iteration = 68 cost = 0.7507371311
Circuit = alternative_ckt_2 Layers = 4 At end of iteration = 69 cost = 0.4372261338
Circuit = alternative_ckt_2 Layers = 4 At end of iteration = 70 cost = 0.7580841138
Circuit = alternative_ckt_2 Layers = 4 At end of iteration = 71 cost = 0.4302045702
Circuit = alternative_ckt_2 Layers = 4 At end of iteration = 72 cost = 0.7652000888
Circuit = alternative_ckt_2 Layers = 4 At end of iteration = 73 cost = 0.4233355276
Circuit = alternative_ckt_2 Layers = 4 At end of iteration = 74 cost = 0.7720780457
Circuit = alternative_ckt_2 Layers = 4 At end of iteration = 75 cost = 0.4166306011
Circuit = alternative_ckt_2 Layers = 4 At end of iteration = 76 cost = 0.7787158811
Circuit = alternative_ckt_2 Layers = 4 At end of iteration = 77 cost = 0.4100986968
Circuit = alternative_ckt_2 Layers = 4 At end of iteration = 78 cost = 0.7851141188
Circuit = alternative_ckt_2 Layers = 4 At end of iteration = 79 cost = 0.4037471833

REDUCING ALPHA TO 0.09999999999999999 at iteration = 80

Circuit = alternative_ckt_2	Layers = 4	At end of iteration = 80	cost = 0.791274753
Circuit = alternative_ckt_2	Layers = 4	At end of iteration = 81	cost = 0.516835101
Circuit = alternative_ckt_2	Layers = 4	At end of iteration = 82	cost = 0.286350590
Circuit = alternative_ckt_2	Layers = 4	At end of iteration = 83	cost = 0.254406770
Circuit = alternative_ckt_2	Layers = 4	At end of iteration = 84	cost = 0.256698084
Circuit = alternative_ckt_2	Layers = 4	At end of iteration = 85	cost = 0.238780694
Circuit = alternative_ckt_2	Layers = 4	At end of iteration = 86	cost = 0.242694908
Circuit = alternative_ckt_2	Layers = 4	At end of iteration = 87	cost = 0.227736548
Circuit = alternative_ckt_2	Layers = 4	At end of iteration = 88	cost = 0.235029069
Circuit = alternative_ckt_2	Layers = 4	At end of iteration = 89	cost = 0.219304230
Circuit = alternative_ckt_2	Layers = 4	At end of iteration = 90	cost = 0.232837355
Circuit = alternative_ckt_2	Layers = 4	At end of iteration = 91	cost = 0.213395468
Circuit = alternative_ckt_2	Layers = 4	At end of iteration = 92	cost = 0.238606576
Circuit = alternative_ckt_2	Layers = 4	At end of iteration = 93	cost = 0.212561041
Circuit = alternative_ckt_2	Layers = 4	At end of iteration = 94	cost = 0.255427010
Circuit = alternative_ckt_2	Layers = 4	At end of iteration = 95	cost = 0.218399386
Circuit = alternative_ckt_2	Layers = 4	At end of iteration = 96	cost = 0.274351776
Circuit = alternative_ckt_2	Layers = 4	At end of iteration = 97	cost = 0.222765879
Circuit = alternative_ckt_2	Layers = 4	At end of iteration = 98	cost = 0.282956940
Circuit = alternative_ckt_2	Layers = 4	At end of iteration = 99	cost = 0.223226523
Circuit = alternative_ckt_2	Layers = 4	At end of iteration = 100	cost = 0.28621695
Circuit = alternative_ckt_2	Layers = 4	At end of iteration = 101	cost = 0.22286510
Circuit = alternative_ckt_2	Layers = 4	At end of iteration = 102	cost = 0.28853182

```

Circuit = alternative_ckt_2 | Layers = 4 | At end of iteration = 103 | cost = 0.22243640
-----
Circuit = alternative_ckt_2 | Layers = 4 | At end of iteration = 104 | cost = 0.29059386
-----
Circuit = alternative_ckt_2 | Layers = 4 | At end of iteration = 105 | cost = 0.22200282
-----
Circuit = alternative_ckt_2 | Layers = 4 | At end of iteration = 106 | cost = 0.29246977
-----
Circuit = alternative_ckt_2 | Layers = 4 | At end of iteration = 107 | cost = 0.22157144
-----
Circuit = alternative_ckt_2 | Layers = 4 | At end of iteration = 108 | cost = 0.29418400
-----
Circuit = alternative_ckt_2 | Layers = 4 | At end of iteration = 109 | cost = 0.22114661
-----
Circuit = alternative_ckt_2 | Layers = 4 | At end of iteration = 110 | cost = 0.29575691
-----
Circuit = alternative_ckt_2 | Layers = 4 | At end of iteration = 111 | cost = 0.22073144
-----
Circuit = alternative_ckt_2 | Layers = 4 | At end of iteration = 112 | cost = 0.29720560
-----
Circuit = alternative_ckt_2 | Layers = 4 | At end of iteration = 113 | cost = 0.22032785
-----
Circuit = alternative_ckt_2 | Layers = 4 | At end of iteration = 114 | cost = 0.29854436
-----
Circuit = alternative_ckt_2 | Layers = 4 | At end of iteration = 115 | cost = 0.21993688
-----
Circuit = alternative_ckt_2 | Layers = 4 | At end of iteration = 116 | cost = 0.29978529
-----
Circuit = alternative_ckt_2 | Layers = 4 | At end of iteration = 117 | cost = 0.21955884
-----
Circuit = alternative_ckt_2 | Layers = 4 | At end of iteration = 118 | cost = 0.30093867
-----
Circuit = alternative_ckt_2 | Layers = 4 | At end of iteration = 119 | cost = 0.21919356
-----
REDUCING ALPHA TO 0.03162277660168379 at iteration = 120
-----
Circuit = alternative_ckt_2 | Layers = 4 | At end of iteration = 120 | cost = 0.30201342
-----
Circuit = alternative_ckt_2 | Layers = 4 | At end of iteration = 121 | cost = 0.21893178
-----
Circuit = alternative_ckt_2 | Layers = 4 | At end of iteration = 122 | cost = 0.18702622
-----
Circuit = alternative_ckt_2 | Layers = 4 | At end of iteration = 123 | cost = 0.18218704
-----
Circuit = alternative_ckt_2 | Layers = 4 | At end of iteration = 124 | cost = 0.18135057
-----
Circuit = alternative_ckt_2 | Layers = 4 | At end of iteration = 125 | cost = 0.18086863
-----

```

Circuit = alternative_ckt_2 Layers = 4 At end of iteration = 126 cost = 0.18043892
Circuit = alternative_ckt_2 Layers = 4 At end of iteration = 127 cost = 0.18003364
Circuit = alternative_ckt_2 Layers = 4 At end of iteration = 128 cost = 0.17964775
Circuit = alternative_ckt_2 Layers = 4 At end of iteration = 129 cost = 0.17927862
Circuit = alternative_ckt_2 Layers = 4 At end of iteration = 130 cost = 0.17892424
Circuit = alternative_ckt_2 Layers = 4 At end of iteration = 131 cost = 0.17858299
Circuit = alternative_ckt_2 Layers = 4 At end of iteration = 132 cost = 0.17825351
Circuit = alternative_ckt_2 Layers = 4 At end of iteration = 133 cost = 0.17793462
Circuit = alternative_ckt_2 Layers = 4 At end of iteration = 134 cost = 0.17762534
Circuit = alternative_ckt_2 Layers = 4 At end of iteration = 135 cost = 0.17732479
Circuit = alternative_ckt_2 Layers = 4 At end of iteration = 136 cost = 0.17703219
Circuit = alternative_ckt_2 Layers = 4 At end of iteration = 137 cost = 0.17674689
Circuit = alternative_ckt_2 Layers = 4 At end of iteration = 138 cost = 0.17646827
Circuit = alternative_ckt_2 Layers = 4 At end of iteration = 139 cost = 0.17619579
Circuit = alternative_ckt_2 Layers = 4 At end of iteration = 140 cost = 0.17592900
Circuit = alternative_ckt_2 Layers = 4 At end of iteration = 141 cost = 0.17566744
Circuit = alternative_ckt_2 Layers = 4 At end of iteration = 142 cost = 0.17541075
Circuit = alternative_ckt_2 Layers = 4 At end of iteration = 143 cost = 0.17515858
Circuit = alternative_ckt_2 Layers = 4 At end of iteration = 144 cost = 0.17491061
Circuit = alternative_ckt_2 Layers = 4 At end of iteration = 145 cost = 0.17466657
Circuit = alternative_ckt_2 Layers = 4 At end of iteration = 146 cost = 0.17442620
Circuit = alternative_ckt_2 Layers = 4 At end of iteration = 147 cost = 0.17418927
Circuit = alternative_ckt_2 Layers = 4 At end of iteration = 148 cost = 0.17395558
Circuit = alternative_ckt_2 Layers = 4 At end of iteration = 149 cost = 0.17372492

Circuit = alternative_ckt_2 Layers = 4 At end of iteration = 150 cost = 0.17349714
Circuit = alternative_ckt_2 Layers = 4 At end of iteration = 151 cost = 0.17327206
Circuit = alternative_ckt_2 Layers = 4 At end of iteration = 152 cost = 0.17304955
Circuit = alternative_ckt_2 Layers = 4 At end of iteration = 153 cost = 0.17282947
Circuit = alternative_ckt_2 Layers = 4 At end of iteration = 154 cost = 0.17261170
Circuit = alternative_ckt_2 Layers = 4 At end of iteration = 155 cost = 0.17239612
Circuit = alternative_ckt_2 Layers = 4 At end of iteration = 156 cost = 0.17218263
Circuit = alternative_ckt_2 Layers = 4 At end of iteration = 157 cost = 0.17197113
Circuit = alternative_ckt_2 Layers = 4 At end of iteration = 158 cost = 0.17176153
Circuit = alternative_ckt_2 Layers = 4 At end of iteration = 159 cost = 0.17155374
Circuit = alternative_ckt_2 Layers = 4 At end of iteration = 160 cost = 0.17134768
Circuit = alternative_ckt_2 Layers = 4 At end of iteration = 161 cost = 0.17114328
Circuit = alternative_ckt_2 Layers = 4 At end of iteration = 162 cost = 0.17094048
Circuit = alternative_ckt_2 Layers = 4 At end of iteration = 163 cost = 0.17073919
Circuit = alternative_ckt_2 Layers = 4 At end of iteration = 164 cost = 0.17053936
Circuit = alternative_ckt_2 Layers = 4 At end of iteration = 165 cost = 0.17034093
Circuit = alternative_ckt_2 Layers = 4 At end of iteration = 166 cost = 0.17014385
Circuit = alternative_ckt_2 Layers = 4 At end of iteration = 167 cost = 0.16994805
Circuit = alternative_ckt_2 Layers = 4 At end of iteration = 168 cost = 0.16975349
Circuit = alternative_ckt_2 Layers = 4 At end of iteration = 169 cost = 0.16956011
Circuit = alternative_ckt_2 Layers = 4 At end of iteration = 170 cost = 0.16936788
Circuit = alternative_ckt_2 Layers = 4 At end of iteration = 171 cost = 0.16917674
Circuit = alternative_ckt_2 Layers = 4 At end of iteration = 172 cost = 0.16898665
Circuit = alternative_ckt_2 Layers = 4 At end of iteration = 173 cost = 0.16879757

Circuit = alternative_ckt_2 Layers = 4 At end of iteration = 174 cost = 0.16860945
Circuit = alternative_ckt_2 Layers = 4 At end of iteration = 175 cost = 0.16842226
Circuit = alternative_ckt_2 Layers = 4 At end of iteration = 176 cost = 0.16823597
Circuit = alternative_ckt_2 Layers = 4 At end of iteration = 177 cost = 0.16805052
Circuit = alternative_ckt_2 Layers = 4 At end of iteration = 178 cost = 0.16786589
Circuit = alternative_ckt_2 Layers = 4 At end of iteration = 179 cost = 0.16768205
Circuit = alternative_ckt_2 Layers = 4 At end of iteration = 180 cost = 0.16749895
Circuit = alternative_ckt_2 Layers = 4 At end of iteration = 181 cost = 0.16731657
Circuit = alternative_ckt_2 Layers = 4 At end of iteration = 182 cost = 0.16713487
Circuit = alternative_ckt_2 Layers = 4 At end of iteration = 183 cost = 0.16695383
Circuit = alternative_ckt_2 Layers = 4 At end of iteration = 184 cost = 0.16677341
Circuit = alternative_ckt_2 Layers = 4 At end of iteration = 185 cost = 0.16659358
Circuit = alternative_ckt_2 Layers = 4 At end of iteration = 186 cost = 0.16641432
Circuit = alternative_ckt_2 Layers = 4 At end of iteration = 187 cost = 0.16623559
Circuit = alternative_ckt_2 Layers = 4 At end of iteration = 188 cost = 0.16605737
Circuit = alternative_ckt_2 Layers = 4 At end of iteration = 189 cost = 0.16587964
Circuit = alternative_ckt_2 Layers = 4 At end of iteration = 190 cost = 0.16570236
Circuit = alternative_ckt_2 Layers = 4 At end of iteration = 191 cost = 0.16552552
Circuit = alternative_ckt_2 Layers = 4 At end of iteration = 192 cost = 0.16534908
Circuit = alternative_ckt_2 Layers = 4 At end of iteration = 193 cost = 0.16517303
Circuit = alternative_ckt_2 Layers = 4 At end of iteration = 194 cost = 0.16499734
Circuit = alternative_ckt_2 Layers = 4 At end of iteration = 195 cost = 0.16482199
Circuit = alternative_ckt_2 Layers = 4 At end of iteration = 196 cost = 0.16464695
Circuit = alternative_ckt_2 Layers = 4 At end of iteration = 197 cost = 0.16447221

Circuit = alternative_ckt_2 Layers = 4 At end of iteration = 198 cost = 0.16429774
Circuit = alternative_ckt_2 Layers = 4 At end of iteration = 199 cost = 0.16412352
Circuit = alternative_ckt_2 Layers = 4 At end of iteration = 200 cost = 0.16394954
Circuit = alternative_ckt_2 Layers = 4 At end of iteration = 201 cost = 0.16377578
Circuit = alternative_ckt_2 Layers = 4 At end of iteration = 202 cost = 0.16360221
Circuit = alternative_ckt_2 Layers = 4 At end of iteration = 203 cost = 0.16342882
Circuit = alternative_ckt_2 Layers = 4 At end of iteration = 204 cost = 0.16325559
Circuit = alternative_ckt_2 Layers = 4 At end of iteration = 205 cost = 0.16308250
Circuit = alternative_ckt_2 Layers = 4 At end of iteration = 206 cost = 0.16290954
Circuit = alternative_ckt_2 Layers = 4 At end of iteration = 207 cost = 0.16273669
Circuit = alternative_ckt_2 Layers = 4 At end of iteration = 208 cost = 0.16256394
Circuit = alternative_ckt_2 Layers = 4 At end of iteration = 209 cost = 0.16239127
Circuit = alternative_ckt_2 Layers = 4 At end of iteration = 210 cost = 0.16221867
Circuit = alternative_ckt_2 Layers = 4 At end of iteration = 211 cost = 0.16204612
Circuit = alternative_ckt_2 Layers = 4 At end of iteration = 212 cost = 0.16187360
Circuit = alternative_ckt_2 Layers = 4 At end of iteration = 213 cost = 0.16170112
Circuit = alternative_ckt_2 Layers = 4 At end of iteration = 214 cost = 0.16152865
Circuit = alternative_ckt_2 Layers = 4 At end of iteration = 215 cost = 0.16135618
Circuit = alternative_ckt_2 Layers = 4 At end of iteration = 216 cost = 0.16118370
Circuit = alternative_ckt_2 Layers = 4 At end of iteration = 217 cost = 0.16101120
Circuit = alternative_ckt_2 Layers = 4 At end of iteration = 218 cost = 0.16083867
Circuit = alternative_ckt_2 Layers = 4 At end of iteration = 219 cost = 0.16066610
Circuit = alternative_ckt_2 Layers = 4 At end of iteration = 220 cost = 0.16049349
Circuit = alternative_ckt_2 Layers = 4 At end of iteration = 221 cost = 0.16032081

Circuit = alternative_ckt_2 Layers = 4 At end of iteration = 222 cost = 0.16014806
Circuit = alternative_ckt_2 Layers = 4 At end of iteration = 223 cost = 0.15997524
Circuit = alternative_ckt_2 Layers = 4 At end of iteration = 224 cost = 0.15980234
Circuit = alternative_ckt_2 Layers = 4 At end of iteration = 225 cost = 0.15962934
Circuit = alternative_ckt_2 Layers = 4 At end of iteration = 226 cost = 0.15945625
Circuit = alternative_ckt_2 Layers = 4 At end of iteration = 227 cost = 0.15928306
Circuit = alternative_ckt_2 Layers = 4 At end of iteration = 228 cost = 0.15910975
Circuit = alternative_ckt_2 Layers = 4 At end of iteration = 229 cost = 0.15893634
Circuit = alternative_ckt_2 Layers = 4 At end of iteration = 230 cost = 0.15876280
Circuit = alternative_ckt_2 Layers = 4 At end of iteration = 231 cost = 0.15858914
Circuit = alternative_ckt_2 Layers = 4 At end of iteration = 232 cost = 0.15841535
Circuit = alternative_ckt_2 Layers = 4 At end of iteration = 233 cost = 0.15824142
Circuit = alternative_ckt_2 Layers = 4 At end of iteration = 234 cost = 0.15806737
Circuit = alternative_ckt_2 Layers = 4 At end of iteration = 235 cost = 0.15789317
Circuit = alternative_ckt_2 Layers = 4 At end of iteration = 236 cost = 0.15771884
Circuit = alternative_ckt_2 Layers = 4 At end of iteration = 237 cost = 0.15754436
Circuit = alternative_ckt_2 Layers = 4 At end of iteration = 238 cost = 0.15736974
Circuit = alternative_ckt_2 Layers = 4 At end of iteration = 239 cost = 0.15719497
Circuit = alternative_ckt_2 Layers = 4 At end of iteration = 240 cost = 0.15702006
Circuit = alternative_ckt_2 Layers = 4 At end of iteration = 241 cost = 0.15684500
Circuit = alternative_ckt_2 Layers = 4 At end of iteration = 242 cost = 0.15666980
Circuit = alternative_ckt_2 Layers = 4 At end of iteration = 243 cost = 0.15649445
Circuit = alternative_ckt_2 Layers = 4 At end of iteration = 244 cost = 0.15631895
Circuit = alternative_ckt_2 Layers = 4 At end of iteration = 245 cost = 0.15614331

Circuit = alternative_ckt_2 Layers = 4 At end of iteration = 246 cost = 0.15596753
Circuit = alternative_ckt_2 Layers = 4 At end of iteration = 247 cost = 0.15579161
Circuit = alternative_ckt_2 Layers = 4 At end of iteration = 248 cost = 0.15561556
Circuit = alternative_ckt_2 Layers = 4 At end of iteration = 249 cost = 0.15543936
Circuit = alternative_ckt_2 Layers = 4 At end of iteration = 250 cost = 0.15526304
Circuit = alternative_ckt_2 Layers = 4 At end of iteration = 251 cost = 0.15508659
Circuit = alternative_ckt_2 Layers = 4 At end of iteration = 252 cost = 0.15491001
Circuit = alternative_ckt_2 Layers = 4 At end of iteration = 253 cost = 0.15473331
Circuit = alternative_ckt_2 Layers = 4 At end of iteration = 254 cost = 0.15455650
Circuit = alternative_ckt_2 Layers = 4 At end of iteration = 255 cost = 0.15437958
Circuit = alternative_ckt_2 Layers = 4 At end of iteration = 256 cost = 0.15420255
Circuit = alternative_ckt_2 Layers = 4 At end of iteration = 257 cost = 0.15402542
Circuit = alternative_ckt_2 Layers = 4 At end of iteration = 258 cost = 0.15384819
Circuit = alternative_ckt_2 Layers = 4 At end of iteration = 259 cost = 0.15367088
Circuit = alternative_ckt_2 Layers = 4 At end of iteration = 260 cost = 0.15349349
Circuit = alternative_ckt_2 Layers = 4 At end of iteration = 261 cost = 0.15331602
Circuit = alternative_ckt_2 Layers = 4 At end of iteration = 262 cost = 0.15313849
Circuit = alternative_ckt_2 Layers = 4 At end of iteration = 263 cost = 0.15296089
Circuit = alternative_ckt_2 Layers = 4 At end of iteration = 264 cost = 0.15278325
Circuit = alternative_ckt_2 Layers = 4 At end of iteration = 265 cost = 0.15260556
Circuit = alternative_ckt_2 Layers = 4 At end of iteration = 266 cost = 0.15242783
Circuit = alternative_ckt_2 Layers = 4 At end of iteration = 267 cost = 0.15225008
Circuit = alternative_ckt_2 Layers = 4 At end of iteration = 268 cost = 0.15207231
Circuit = alternative_ckt_2 Layers = 4 At end of iteration = 269 cost = 0.15189453

Circuit = alternative_ckt_2 Layers = 4 At end of iteration = 270 cost = 0.15171676
Circuit = alternative_ckt_2 Layers = 4 At end of iteration = 271 cost = 0.15153899
Circuit = alternative_ckt_2 Layers = 4 At end of iteration = 272 cost = 0.15136125
Circuit = alternative_ckt_2 Layers = 4 At end of iteration = 273 cost = 0.15118354
Circuit = alternative_ckt_2 Layers = 4 At end of iteration = 274 cost = 0.15100587
Circuit = alternative_ckt_2 Layers = 4 At end of iteration = 275 cost = 0.15082825
Circuit = alternative_ckt_2 Layers = 4 At end of iteration = 276 cost = 0.15065070
Circuit = alternative_ckt_2 Layers = 4 At end of iteration = 277 cost = 0.15047323
Circuit = alternative_ckt_2 Layers = 4 At end of iteration = 278 cost = 0.15029584
Circuit = alternative_ckt_2 Layers = 4 At end of iteration = 279 cost = 0.15011855
Circuit = alternative_ckt_2 Layers = 4 At end of iteration = 280 cost = 0.14994137
Circuit = alternative_ckt_2 Layers = 4 At end of iteration = 281 cost = 0.14976432
Circuit = alternative_ckt_2 Layers = 4 At end of iteration = 282 cost = 0.14958740
Circuit = alternative_ckt_2 Layers = 4 At end of iteration = 283 cost = 0.14941063
Circuit = alternative_ckt_2 Layers = 4 At end of iteration = 284 cost = 0.14923402
Circuit = alternative_ckt_2 Layers = 4 At end of iteration = 285 cost = 0.14905759
Circuit = alternative_ckt_2 Layers = 4 At end of iteration = 286 cost = 0.14888134
Circuit = alternative_ckt_2 Layers = 4 At end of iteration = 287 cost = 0.14870530
Circuit = alternative_ckt_2 Layers = 4 At end of iteration = 288 cost = 0.14852947
Circuit = alternative_ckt_2 Layers = 4 At end of iteration = 289 cost = 0.14835387
Circuit = alternative_ckt_2 Layers = 4 At end of iteration = 290 cost = 0.14817851
Circuit = alternative_ckt_2 Layers = 4 At end of iteration = 291 cost = 0.14800340
Circuit = alternative_ckt_2 Layers = 4 At end of iteration = 292 cost = 0.14782857
Circuit = alternative_ckt_2 Layers = 4 At end of iteration = 293 cost = 0.14765402

```

Circuit = alternative_ckt_2 | Layers = 4 | At end of iteration = 294 | cost = 0.14747977
-----
Circuit = alternative_ckt_2 | Layers = 4 | At end of iteration = 295 | cost = 0.14730584
-----
Circuit = alternative_ckt_2 | Layers = 4 | At end of iteration = 296 | cost = 0.14713223
-----
Circuit = alternative_ckt_2 | Layers = 4 | At end of iteration = 297 | cost = 0.14695896
-----
Circuit = alternative_ckt_2 | Layers = 4 | At end of iteration = 298 | cost = 0.14678606
-----
Circuit = alternative_ckt_2 | Layers = 4 | At end of iteration = 299 | cost = 0.14661352
-----
Circuit = alternative_ckt_2 | Layers = 4 | At end of iteration = 300 | cost = 0.14644137
-----

```

Optimization complete.

After optimization, the optimal parameters are

```
{Parameter(theta6[3]): 0.09816467227043306, Parameter(theta2[1]): -0.30754582249049145, Param
```

The output state for these parameters is

```

[[0.28786697+0.26971621j]
 [0.0094015 +0.18238115j]
 [0.27566047+0.09245153j]
 [0.20377218+0.0971554j ]
 [0.15839036+0.03761694j]
 [0.1934222 +0.09866678j]
 [0.17578541+0.1094108j ]
 [0.06791775+0.08051096j]
 [0.3191239 +0.0280347j ]
 [0.19598197-0.00056631j]
 [0.2629024 +0.03944599j]
 [0.03634622+0.04064524j]
 [0.33368278+0.19192704j]
 [0.19225575+0.00490104j]
 [0.21098569+0.2323306j ]
 [0.17792152+0.1338781j ]]

```

```

Circuit = alternative_ckt_2 Layers = 4 Cost after optimization = 0.14644137536666998
-----

```

```
Circuit alternative_ckt_2 constructed with 5 layers. Number of parameters = 80 .
```

Initialized circuit parameters prior to gradient descent randomly as follows:

```

idx = lmbda9[1] params = 0.03719052023213644
idx = phi5[2] params = 0.04312312828020062
idx = phi7[3] params = 0.0004994971757621869
idx = phi1[3] params = 0.03444025418170515
idx = phi7[0] params = 0.046881140646663634
idx = theta6[3] params = 0.02164226791611938
idx = theta4[1] params = 0.028343942770291508
idx = theta4[0] params = 0.013510378554063363

```

```

idx = theta6[1] params = 0.022782810868909098
idx = lambda7[2] params = 0.00573789773068969
idx = phi5[0] params = 0.039532273767073196
idx = theta8[3] params = 0.018375156312795238
idx = lambda3[3] params = 0.02421115885861306
idx = lambda9[0] params = 0.01671278315727628
idx = theta2[3] params = 0.006172454610576922
idx = lambda5[3] params = 0.016655522656847783
idx = phi3[1] params = 0.04662197117509747
idx = theta3[0] params = 0.009378499198132518
idx = lambda3[0] params = 0.030481776612878
idx = lambda5[2] params = 0.006238299240088347
idx = theta9[3] params = 0.046316344013782464
idx = lambda5[1] params = 0.002833116050508433
idx = theta10[1] params = 0.009568165097689485
idx = lambda7[3] params = 0.003778807686699465
idx = phi3[3] params = 0.04761132655555178
idx = phi1[0] params = 0.02912836626547597
idx = lambda7[0] params = 0.03277867333581935
idx = phi9[2] params = 0.0012507649722014293
idx = phi9[0] params = 0.03265668670981592
idx = theta1[0] params = 0.042510362504139115
idx = phi7[2] params = 0.028964664980450857
idx = theta2[0] params = 0.02606701333987876
idx = lambda9[2] params = 0.04507588560641085
idx = theta1[3] params = 0.01594882076679191
idx = phi9[1] params = 0.03973242205283862
idx = lambda3[1] params = 0.009337792350935193
idx = theta9[2] params = 0.0032829280606491377
idx = phi1[2] params = 0.019944497772341908
idx = theta6[2] params = 0.040543302128205796
idx = theta3[1] params = 0.018661219094017113
idx = phi5[3] params = 0.022765429249395765
idx = lambda1[3] params = 0.04496189581938223
idx = theta7[3] params = 0.04421309636000539
idx = lambda9[3] params = 0.032067148697469475
idx = theta8[1] params = 0.03316055200997197
idx = theta7[2] params = 0.038381406528673896
idx = theta1[2] params = 0.014346822771396907
idx = theta9[0] params = 0.017358921226698288
idx = lambda1[2] params = 0.036248132522104036
idx = theta2[1] params = 0.03539050548659198
idx = theta4[2] params = 0.01607370215812653
idx = theta4[3] params = 0.007381200069874755
idx = theta9[1] params = 0.02358393517371811
idx = lambda3[2] params = 0.0009009332204443055
idx = theta10[3] params = 0.015027195664715637
idx = theta5[0] params = 0.037934352344020754

```

```

idx = lmbda1[1] params = 0.02983057071232084
idx = phi3[2] params = 0.023111461319399895
idx = theta1[1] params = 0.02586128220807936
idx = phi7[1] params = 0.002230543419827341
idx = theta7[1] params = 0.021152548385698113
idx = phi3[0] params = 0.017680671110920827
idx = theta6[0] params = 0.04880350842240636
idx = theta5[2] params = 0.04861089868928858
idx = lmbda5[0] params = 0.02746088848176321
idx = theta8[0] params = 0.03249126248776906
idx = lmbda1[0] params = 0.007806656503289816
idx = theta8[2] params = 0.022429303882508935
idx = phi5[1] params = 0.04195594056468582
idx = theta10[0] params = 0.03308231488975027
idx = theta7[0] params = 0.016403579248805207
idx = theta5[1] params = 0.035403385349937436
idx = phi1[1] params = 0.045163503496595245
idx = lmbda7[1] params = 0.01075507702770715
idx = theta3[3] params = 0.03733005507245125
idx = theta5[3] params = 0.016534010021804213
idx = theta10[2] params = 0.03418145346493542
idx = theta3[2] params = 0.026502847987510094
idx = phi9[3] params = 0.04614732179238628
idx = theta2[2] params = 0.04692583576726641

```

```

-----
Circuit = alternative_ckt_2 | Layers = 5 | At end of iteration = 1 | cost = 1.0676537893

```

```

-----
Circuit = alternative_ckt_2 | Layers = 5 | At end of iteration = 2 | cost = 0.9378250941

```

```

-----
Circuit = alternative_ckt_2 | Layers = 5 | At end of iteration = 3 | cost = 0.7461388340

```

```

-----
Circuit = alternative_ckt_2 | Layers = 5 | At end of iteration = 4 | cost = 0.5530790108

```

```

-----
Circuit = alternative_ckt_2 | Layers = 5 | At end of iteration = 5 | cost = 0.5281493351

```

```

-----
Circuit = alternative_ckt_2 | Layers = 5 | At end of iteration = 6 | cost = 1.5512370212

```

```

-----
Circuit = alternative_ckt_2 | Layers = 5 | At end of iteration = 7 | cost = 1.4152741622

```

```

-----
Circuit = alternative_ckt_2 | Layers = 5 | At end of iteration = 8 | cost = 1.1643338192

```

```

-----
Circuit = alternative_ckt_2 | Layers = 5 | At end of iteration = 9 | cost = 0.9337876451

```

```

-----
Circuit = alternative_ckt_2 | Layers = 5 | At end of iteration = 10 | cost = 0.746711653

```

```

-----
Circuit = alternative_ckt_2 | Layers = 5 | At end of iteration = 11 | cost = 0.993033344

```

```

-----
Circuit = alternative_ckt_2 | Layers = 5 | At end of iteration = 12 | cost = 1.186877783

```

```

-----
Circuit = alternative_ckt_2 | Layers = 5 | At end of iteration = 13 | cost = 0.7577930382
-----
Circuit = alternative_ckt_2 | Layers = 5 | At end of iteration = 14 | cost = 0.7318043203
-----
Circuit = alternative_ckt_2 | Layers = 5 | At end of iteration = 15 | cost = 1.3081465430
-----
Circuit = alternative_ckt_2 | Layers = 5 | At end of iteration = 16 | cost = 0.6741304531
-----
Circuit = alternative_ckt_2 | Layers = 5 | At end of iteration = 17 | cost = 0.5464067268
-----
Circuit = alternative_ckt_2 | Layers = 5 | At end of iteration = 18 | cost = 1.0213858611
-----
Circuit = alternative_ckt_2 | Layers = 5 | At end of iteration = 19 | cost = 1.1463322067
-----
Circuit = alternative_ckt_2 | Layers = 5 | At end of iteration = 20 | cost = 0.7236422681
-----
Circuit = alternative_ckt_2 | Layers = 5 | At end of iteration = 21 | cost = 0.7126110830
-----
Circuit = alternative_ckt_2 | Layers = 5 | At end of iteration = 22 | cost = 1.3269139384
-----
Circuit = alternative_ckt_2 | Layers = 5 | At end of iteration = 23 | cost = 0.6775524080
-----
Circuit = alternative_ckt_2 | Layers = 5 | At end of iteration = 24 | cost = 0.5986889483
-----
Circuit = alternative_ckt_2 | Layers = 5 | At end of iteration = 25 | cost = 1.1693578550
-----
Circuit = alternative_ckt_2 | Layers = 5 | At end of iteration = 26 | cost = 0.8210523280
-----
Circuit = alternative_ckt_2 | Layers = 5 | At end of iteration = 27 | cost = 1.0605000497
-----
Circuit = alternative_ckt_2 | Layers = 5 | At end of iteration = 28 | cost = 0.9138513281
-----
Circuit = alternative_ckt_2 | Layers = 5 | At end of iteration = 29 | cost = 0.8948147127
-----
Circuit = alternative_ckt_2 | Layers = 5 | At end of iteration = 30 | cost = 0.9125910480
-----
Circuit = alternative_ckt_2 | Layers = 5 | At end of iteration = 31 | cost = 0.9063948521
-----
Circuit = alternative_ckt_2 | Layers = 5 | At end of iteration = 32 | cost = 0.8759039374
-----
Circuit = alternative_ckt_2 | Layers = 5 | At end of iteration = 33 | cost = 0.8613616697
-----
Circuit = alternative_ckt_2 | Layers = 5 | At end of iteration = 34 | cost = 0.8962111801
-----
Circuit = alternative_ckt_2 | Layers = 5 | At end of iteration = 35 | cost = 0.8663852768
-----
Circuit = alternative_ckt_2 | Layers = 5 | At end of iteration = 36 | cost = 0.8588993381
-----

```



```

-----
Circuit = alternative_ckt_2 | Layers = 5 | At end of iteration = 37 | cost = 0.871363222
-----
Circuit = alternative_ckt_2 | Layers = 5 | At end of iteration = 38 | cost = 0.872015155
-----
Circuit = alternative_ckt_2 | Layers = 5 | At end of iteration = 39 | cost = 0.844181026
-----
REDUCING ALPHA TO 0.31622776601683794 at iteration = 40
-----
Circuit = alternative_ckt_2 | Layers = 5 | At end of iteration = 40 | cost = 0.854057228
-----
Circuit = alternative_ckt_2 | Layers = 5 | At end of iteration = 41 | cost = 0.644627327
-----
Circuit = alternative_ckt_2 | Layers = 5 | At end of iteration = 42 | cost = 0.573088798
-----
Circuit = alternative_ckt_2 | Layers = 5 | At end of iteration = 43 | cost = 0.544314475
-----
Circuit = alternative_ckt_2 | Layers = 5 | At end of iteration = 44 | cost = 0.521755937
-----
Circuit = alternative_ckt_2 | Layers = 5 | At end of iteration = 45 | cost = 0.502789503
-----
Circuit = alternative_ckt_2 | Layers = 5 | At end of iteration = 46 | cost = 0.485986664
-----
Circuit = alternative_ckt_2 | Layers = 5 | At end of iteration = 47 | cost = 0.470700485
-----
Circuit = alternative_ckt_2 | Layers = 5 | At end of iteration = 48 | cost = 0.456459222
-----
Circuit = alternative_ckt_2 | Layers = 5 | At end of iteration = 49 | cost = 0.443142148
-----
Circuit = alternative_ckt_2 | Layers = 5 | At end of iteration = 50 | cost = 0.430457176
-----
Circuit = alternative_ckt_2 | Layers = 5 | At end of iteration = 51 | cost = 0.418606394
-----
Circuit = alternative_ckt_2 | Layers = 5 | At end of iteration = 52 | cost = 0.407004336
-----
Circuit = alternative_ckt_2 | Layers = 5 | At end of iteration = 53 | cost = 0.396788139
-----
Circuit = alternative_ckt_2 | Layers = 5 | At end of iteration = 54 | cost = 0.385347253
-----
Circuit = alternative_ckt_2 | Layers = 5 | At end of iteration = 55 | cost = 0.379759181
-----
Circuit = alternative_ckt_2 | Layers = 5 | At end of iteration = 56 | cost = 0.366088399
-----
Circuit = alternative_ckt_2 | Layers = 5 | At end of iteration = 57 | cost = 0.420362398
-----
Circuit = alternative_ckt_2 | Layers = 5 | At end of iteration = 58 | cost = 0.538949786
-----
Circuit = alternative_ckt_2 | Layers = 5 | At end of iteration = 59 | cost = 0.744912696
-----

```

```

-----
Circuit = alternative_ckt_2 | Layers = 5 | At end of iteration = 60 | cost = 0.522444694
-----
Circuit = alternative_ckt_2 | Layers = 5 | At end of iteration = 61 | cost = 0.696750536
-----
Circuit = alternative_ckt_2 | Layers = 5 | At end of iteration = 62 | cost = 0.539677878
-----
Circuit = alternative_ckt_2 | Layers = 5 | At end of iteration = 63 | cost = 0.678212679
-----
Circuit = alternative_ckt_2 | Layers = 5 | At end of iteration = 64 | cost = 0.542907167
-----
Circuit = alternative_ckt_2 | Layers = 5 | At end of iteration = 65 | cost = 0.672695390
-----
Circuit = alternative_ckt_2 | Layers = 5 | At end of iteration = 66 | cost = 0.542244450
-----
Circuit = alternative_ckt_2 | Layers = 5 | At end of iteration = 67 | cost = 0.672566598
-----
Circuit = alternative_ckt_2 | Layers = 5 | At end of iteration = 68 | cost = 0.540102971
-----
Circuit = alternative_ckt_2 | Layers = 5 | At end of iteration = 69 | cost = 0.674485710
-----
Circuit = alternative_ckt_2 | Layers = 5 | At end of iteration = 70 | cost = 0.537404437
-----
Circuit = alternative_ckt_2 | Layers = 5 | At end of iteration = 71 | cost = 0.677242869
-----
Circuit = alternative_ckt_2 | Layers = 5 | At end of iteration = 72 | cost = 0.534444277
-----
Circuit = alternative_ckt_2 | Layers = 5 | At end of iteration = 73 | cost = 0.680394791
-----
Circuit = alternative_ckt_2 | Layers = 5 | At end of iteration = 74 | cost = 0.531319341
-----
Circuit = alternative_ckt_2 | Layers = 5 | At end of iteration = 75 | cost = 0.683766985
-----
Circuit = alternative_ckt_2 | Layers = 5 | At end of iteration = 76 | cost = 0.528058479
-----
Circuit = alternative_ckt_2 | Layers = 5 | At end of iteration = 77 | cost = 0.687281461
-----
Circuit = alternative_ckt_2 | Layers = 5 | At end of iteration = 78 | cost = 0.524667761
-----
Circuit = alternative_ckt_2 | Layers = 5 | At end of iteration = 79 | cost = 0.690896250
-----
REDUCING ALPHA TO 0.09999999999999999 at iteration = 80
-----
Circuit = alternative_ckt_2 | Layers = 5 | At end of iteration = 80 | cost = 0.521146901
-----
Circuit = alternative_ckt_2 | Layers = 5 | At end of iteration = 81 | cost = 0.353110181
-----
Circuit = alternative_ckt_2 | Layers = 5 | At end of iteration = 82 | cost = 0.340391218

```

```

-----
Circuit = alternative_ckt_2 | Layers = 5 | At end of iteration = 83 | cost = 0.328010992
-----
Circuit = alternative_ckt_2 | Layers = 5 | At end of iteration = 84 | cost = 0.322270206
-----
Circuit = alternative_ckt_2 | Layers = 5 | At end of iteration = 85 | cost = 0.316676290
-----
Circuit = alternative_ckt_2 | Layers = 5 | At end of iteration = 86 | cost = 0.312708265
-----
Circuit = alternative_ckt_2 | Layers = 5 | At end of iteration = 87 | cost = 0.309201559
-----
Circuit = alternative_ckt_2 | Layers = 5 | At end of iteration = 88 | cost = 0.306340184
-----
Circuit = alternative_ckt_2 | Layers = 5 | At end of iteration = 89 | cost = 0.303770276
-----
Circuit = alternative_ckt_2 | Layers = 5 | At end of iteration = 90 | cost = 0.301505505
-----
Circuit = alternative_ckt_2 | Layers = 5 | At end of iteration = 91 | cost = 0.299412140
-----
Circuit = alternative_ckt_2 | Layers = 5 | At end of iteration = 92 | cost = 0.297482421
-----
Circuit = alternative_ckt_2 | Layers = 5 | At end of iteration = 93 | cost = 0.295658648
-----
Circuit = alternative_ckt_2 | Layers = 5 | At end of iteration = 94 | cost = 0.293933194
-----
Circuit = alternative_ckt_2 | Layers = 5 | At end of iteration = 95 | cost = 0.292278536
-----
Circuit = alternative_ckt_2 | Layers = 5 | At end of iteration = 96 | cost = 0.290689434
-----
Circuit = alternative_ckt_2 | Layers = 5 | At end of iteration = 97 | cost = 0.289151607
-----
Circuit = alternative_ckt_2 | Layers = 5 | At end of iteration = 98 | cost = 0.287661655
-----
Circuit = alternative_ckt_2 | Layers = 5 | At end of iteration = 99 | cost = 0.286211574
-----
Circuit = alternative_ckt_2 | Layers = 5 | At end of iteration = 100 | cost = 0.28479910
-----
Circuit = alternative_ckt_2 | Layers = 5 | At end of iteration = 101 | cost = 0.28341938
-----
Circuit = alternative_ckt_2 | Layers = 5 | At end of iteration = 102 | cost = 0.28207080
-----
Circuit = alternative_ckt_2 | Layers = 5 | At end of iteration = 103 | cost = 0.28075014
-----
Circuit = alternative_ckt_2 | Layers = 5 | At end of iteration = 104 | cost = 0.27945610
-----
Circuit = alternative_ckt_2 | Layers = 5 | At end of iteration = 105 | cost = 0.27818634
-----
Circuit = alternative_ckt_2 | Layers = 5 | At end of iteration = 106 | cost = 0.27693974
-----

```

```

-----
Circuit = alternative_ckt_2 | Layers = 5 | At end of iteration = 107 | cost = 0.275714392
-----
Circuit = alternative_ckt_2 | Layers = 5 | At end of iteration = 108 | cost = 0.27450924
-----
Circuit = alternative_ckt_2 | Layers = 5 | At end of iteration = 109 | cost = 0.27332263
-----
Circuit = alternative_ckt_2 | Layers = 5 | At end of iteration = 110 | cost = 0.27215353
-----
Circuit = alternative_ckt_2 | Layers = 5 | At end of iteration = 111 | cost = 0.271000402
-----
Circuit = alternative_ckt_2 | Layers = 5 | At end of iteration = 112 | cost = 0.26986219
-----
Circuit = alternative_ckt_2 | Layers = 5 | At end of iteration = 113 | cost = 0.26873747
-----
Circuit = alternative_ckt_2 | Layers = 5 | At end of iteration = 114 | cost = 0.26762516
-----
Circuit = alternative_ckt_2 | Layers = 5 | At end of iteration = 115 | cost = 0.26652385
-----
Circuit = alternative_ckt_2 | Layers = 5 | At end of iteration = 116 | cost = 0.26543249
-----
Circuit = alternative_ckt_2 | Layers = 5 | At end of iteration = 117 | cost = 0.26434971
-----
Circuit = alternative_ckt_2 | Layers = 5 | At end of iteration = 118 | cost = 0.26327444
-----
Circuit = alternative_ckt_2 | Layers = 5 | At end of iteration = 119 | cost = 0.26220534
-----
REDUCING ALPHA TO 0.03162277660168379 at iteration = 120
-----
Circuit = alternative_ckt_2 | Layers = 5 | At end of iteration = 120 | cost = 0.26114139
-----
Circuit = alternative_ckt_2 | Layers = 5 | At end of iteration = 121 | cost = 0.26080620
-----
Circuit = alternative_ckt_2 | Layers = 5 | At end of iteration = 122 | cost = 0.26047114
-----
Circuit = alternative_ckt_2 | Layers = 5 | At end of iteration = 123 | cost = 0.26013626
-----
Circuit = alternative_ckt_2 | Layers = 5 | At end of iteration = 124 | cost = 0.25980157
-----
Circuit = alternative_ckt_2 | Layers = 5 | At end of iteration = 125 | cost = 0.25946703
-----
Circuit = alternative_ckt_2 | Layers = 5 | At end of iteration = 126 | cost = 0.25913261
-----
Circuit = alternative_ckt_2 | Layers = 5 | At end of iteration = 127 | cost = 0.25879829
-----
Circuit = alternative_ckt_2 | Layers = 5 | At end of iteration = 128 | cost = 0.25846404
-----
Circuit = alternative_ckt_2 | Layers = 5 | At end of iteration = 129 | cost = 0.25812981

```

```

-----
Circuit = alternative_ckt_2 | Layers = 5 | At end of iteration = 130 | cost = 0.25779558
-----
Circuit = alternative_ckt_2 | Layers = 5 | At end of iteration = 131 | cost = 0.25746132
-----
Circuit = alternative_ckt_2 | Layers = 5 | At end of iteration = 132 | cost = 0.25712699
-----
Circuit = alternative_ckt_2 | Layers = 5 | At end of iteration = 133 | cost = 0.25679256
-----
Circuit = alternative_ckt_2 | Layers = 5 | At end of iteration = 134 | cost = 0.25645799
-----
Circuit = alternative_ckt_2 | Layers = 5 | At end of iteration = 135 | cost = 0.25612327
-----
Circuit = alternative_ckt_2 | Layers = 5 | At end of iteration = 136 | cost = 0.25578834
-----
Circuit = alternative_ckt_2 | Layers = 5 | At end of iteration = 137 | cost = 0.25545320
-----
Circuit = alternative_ckt_2 | Layers = 5 | At end of iteration = 138 | cost = 0.25511779
-----
Circuit = alternative_ckt_2 | Layers = 5 | At end of iteration = 139 | cost = 0.25478209
-----
Circuit = alternative_ckt_2 | Layers = 5 | At end of iteration = 140 | cost = 0.25444607
-----
Circuit = alternative_ckt_2 | Layers = 5 | At end of iteration = 141 | cost = 0.25410971
-----
Circuit = alternative_ckt_2 | Layers = 5 | At end of iteration = 142 | cost = 0.25377296
-----
Circuit = alternative_ckt_2 | Layers = 5 | At end of iteration = 143 | cost = 0.25343580
-----
Circuit = alternative_ckt_2 | Layers = 5 | At end of iteration = 144 | cost = 0.25309820
-----
Circuit = alternative_ckt_2 | Layers = 5 | At end of iteration = 145 | cost = 0.25276013
-----
Circuit = alternative_ckt_2 | Layers = 5 | At end of iteration = 146 | cost = 0.25242157
-----
Circuit = alternative_ckt_2 | Layers = 5 | At end of iteration = 147 | cost = 0.25208247
-----
Circuit = alternative_ckt_2 | Layers = 5 | At end of iteration = 148 | cost = 0.25174282
-----
Circuit = alternative_ckt_2 | Layers = 5 | At end of iteration = 149 | cost = 0.25140258
-----
Circuit = alternative_ckt_2 | Layers = 5 | At end of iteration = 150 | cost = 0.25106174
-----
Circuit = alternative_ckt_2 | Layers = 5 | At end of iteration = 151 | cost = 0.25072025
-----
Circuit = alternative_ckt_2 | Layers = 5 | At end of iteration = 152 | cost = 0.25037809
-----
Circuit = alternative_ckt_2 | Layers = 5 | At end of iteration = 153 | cost = 0.25003524
-----

```

```

-----
Circuit = alternative_ckt_2 | Layers = 5 | At end of iteration = 154 | cost = 0.249691679
-----
Circuit = alternative_ckt_2 | Layers = 5 | At end of iteration = 155 | cost = 0.249347362
-----
Circuit = alternative_ckt_2 | Layers = 5 | At end of iteration = 156 | cost = 0.249002272
-----
Circuit = alternative_ckt_2 | Layers = 5 | At end of iteration = 157 | cost = 0.248656383
-----
Circuit = alternative_ckt_2 | Layers = 5 | At end of iteration = 158 | cost = 0.248309671
-----
Circuit = alternative_ckt_2 | Layers = 5 | At end of iteration = 159 | cost = 0.247962111
-----
Circuit = alternative_ckt_2 | Layers = 5 | At end of iteration = 160 | cost = 0.247613678
-----
Circuit = alternative_ckt_2 | Layers = 5 | At end of iteration = 161 | cost = 0.247264344
-----
Circuit = alternative_ckt_2 | Layers = 5 | At end of iteration = 162 | cost = 0.246914098
-----
Circuit = alternative_ckt_2 | Layers = 5 | At end of iteration = 163 | cost = 0.246562901
-----
Circuit = alternative_ckt_2 | Layers = 5 | At end of iteration = 164 | cost = 0.246210744
-----
Circuit = alternative_ckt_2 | Layers = 5 | At end of iteration = 165 | cost = 0.245857600
-----
Circuit = alternative_ckt_2 | Layers = 5 | At end of iteration = 166 | cost = 0.245503441
-----
Circuit = alternative_ckt_2 | Layers = 5 | At end of iteration = 167 | cost = 0.245148256
-----
Circuit = alternative_ckt_2 | Layers = 5 | At end of iteration = 168 | cost = 0.244792018
-----
Circuit = alternative_ckt_2 | Layers = 5 | At end of iteration = 169 | cost = 0.244434708
-----
Circuit = alternative_ckt_2 | Layers = 5 | At end of iteration = 170 | cost = 0.244076300
-----
Circuit = alternative_ckt_2 | Layers = 5 | At end of iteration = 171 | cost = 0.243716791
-----
Circuit = alternative_ckt_2 | Layers = 5 | At end of iteration = 172 | cost = 0.243356154
-----
Circuit = alternative_ckt_2 | Layers = 5 | At end of iteration = 173 | cost = 0.242994366
-----
Circuit = alternative_ckt_2 | Layers = 5 | At end of iteration = 174 | cost = 0.242631411
-----
Circuit = alternative_ckt_2 | Layers = 5 | At end of iteration = 175 | cost = 0.242267280
-----
Circuit = alternative_ckt_2 | Layers = 5 | At end of iteration = 176 | cost = 0.241901941
-----
Circuit = alternative_ckt_2 | Layers = 5 | At end of iteration = 177 | cost = 0.241535400
-----

```

Circuit = alternative_ckt_2 Layers = 5 At end of iteration = 178 cost = 0.24116763
Circuit = alternative_ckt_2 Layers = 5 At end of iteration = 179 cost = 0.24079862
Circuit = alternative_ckt_2 Layers = 5 At end of iteration = 180 cost = 0.24042835
Circuit = alternative_ckt_2 Layers = 5 At end of iteration = 181 cost = 0.24005681
Circuit = alternative_ckt_2 Layers = 5 At end of iteration = 182 cost = 0.23968399
Circuit = alternative_ckt_2 Layers = 5 At end of iteration = 183 cost = 0.23930988
Circuit = alternative_ckt_2 Layers = 5 At end of iteration = 184 cost = 0.23893447
Circuit = alternative_ckt_2 Layers = 5 At end of iteration = 185 cost = 0.23855775
Circuit = alternative_ckt_2 Layers = 5 At end of iteration = 186 cost = 0.23817970
Circuit = alternative_ckt_2 Layers = 5 At end of iteration = 187 cost = 0.23780033
Circuit = alternative_ckt_2 Layers = 5 At end of iteration = 188 cost = 0.23741962
Circuit = alternative_ckt_2 Layers = 5 At end of iteration = 189 cost = 0.23703757
Circuit = alternative_ckt_2 Layers = 5 At end of iteration = 190 cost = 0.23665416
Circuit = alternative_ckt_2 Layers = 5 At end of iteration = 191 cost = 0.23626941
Circuit = alternative_ckt_2 Layers = 5 At end of iteration = 192 cost = 0.23588329
Circuit = alternative_ckt_2 Layers = 5 At end of iteration = 193 cost = 0.23549582
Circuit = alternative_ckt_2 Layers = 5 At end of iteration = 194 cost = 0.23510699
Circuit = alternative_ckt_2 Layers = 5 At end of iteration = 195 cost = 0.23471679
Circuit = alternative_ckt_2 Layers = 5 At end of iteration = 196 cost = 0.23432523
Circuit = alternative_ckt_2 Layers = 5 At end of iteration = 197 cost = 0.23393230
Circuit = alternative_ckt_2 Layers = 5 At end of iteration = 198 cost = 0.23353802
Circuit = alternative_ckt_2 Layers = 5 At end of iteration = 199 cost = 0.23314238
Circuit = alternative_ckt_2 Layers = 5 At end of iteration = 200 cost = 0.23274539
Circuit = alternative_ckt_2 Layers = 5 At end of iteration = 201 cost = 0.23234706

```

-----
Circuit = alternative_ckt_2 | Layers = 5 | At end of iteration = 202 | cost = 0.23194738
-----
Circuit = alternative_ckt_2 | Layers = 5 | At end of iteration = 203 | cost = 0.23154637
-----
Circuit = alternative_ckt_2 | Layers = 5 | At end of iteration = 204 | cost = 0.23114403
-----
Circuit = alternative_ckt_2 | Layers = 5 | At end of iteration = 205 | cost = 0.23074038
-----
Circuit = alternative_ckt_2 | Layers = 5 | At end of iteration = 206 | cost = 0.23033543
-----
Circuit = alternative_ckt_2 | Layers = 5 | At end of iteration = 207 | cost = 0.22992919
-----
Circuit = alternative_ckt_2 | Layers = 5 | At end of iteration = 208 | cost = 0.22952167
-----
Circuit = alternative_ckt_2 | Layers = 5 | At end of iteration = 209 | cost = 0.22911288
-----
Circuit = alternative_ckt_2 | Layers = 5 | At end of iteration = 210 | cost = 0.22870285
-----
Circuit = alternative_ckt_2 | Layers = 5 | At end of iteration = 211 | cost = 0.22829159
-----
Circuit = alternative_ckt_2 | Layers = 5 | At end of iteration = 212 | cost = 0.22787911
-----
Circuit = alternative_ckt_2 | Layers = 5 | At end of iteration = 213 | cost = 0.22746545
-----
Circuit = alternative_ckt_2 | Layers = 5 | At end of iteration = 214 | cost = 0.22705061
-----
Circuit = alternative_ckt_2 | Layers = 5 | At end of iteration = 215 | cost = 0.22663462
-----
Circuit = alternative_ckt_2 | Layers = 5 | At end of iteration = 216 | cost = 0.22621750
-----
Circuit = alternative_ckt_2 | Layers = 5 | At end of iteration = 217 | cost = 0.22579929
-----
Circuit = alternative_ckt_2 | Layers = 5 | At end of iteration = 218 | cost = 0.22537999
-----
Circuit = alternative_ckt_2 | Layers = 5 | At end of iteration = 219 | cost = 0.22495965
-----
Circuit = alternative_ckt_2 | Layers = 5 | At end of iteration = 220 | cost = 0.22453828
-----
Circuit = alternative_ckt_2 | Layers = 5 | At end of iteration = 221 | cost = 0.22411593
-----
Circuit = alternative_ckt_2 | Layers = 5 | At end of iteration = 222 | cost = 0.22369261
-----
Circuit = alternative_ckt_2 | Layers = 5 | At end of iteration = 223 | cost = 0.22326836
-----
Circuit = alternative_ckt_2 | Layers = 5 | At end of iteration = 224 | cost = 0.22284322
-----
Circuit = alternative_ckt_2 | Layers = 5 | At end of iteration = 225 | cost = 0.22241721
-----

```



```

-----
Circuit = alternative_ckt_2 | Layers = 5 | At end of iteration = 226 | cost = 0.22199038
-----
Circuit = alternative_ckt_2 | Layers = 5 | At end of iteration = 227 | cost = 0.22156275
-----
Circuit = alternative_ckt_2 | Layers = 5 | At end of iteration = 228 | cost = 0.22113438
-----
Circuit = alternative_ckt_2 | Layers = 5 | At end of iteration = 229 | cost = 0.22070529
-----
Circuit = alternative_ckt_2 | Layers = 5 | At end of iteration = 230 | cost = 0.22027553
-----
Circuit = alternative_ckt_2 | Layers = 5 | At end of iteration = 231 | cost = 0.21984513
-----
Circuit = alternative_ckt_2 | Layers = 5 | At end of iteration = 232 | cost = 0.21941415
-----
Circuit = alternative_ckt_2 | Layers = 5 | At end of iteration = 233 | cost = 0.21898261
-----
Circuit = alternative_ckt_2 | Layers = 5 | At end of iteration = 234 | cost = 0.21855058
-----
Circuit = alternative_ckt_2 | Layers = 5 | At end of iteration = 235 | cost = 0.21811808
-----
Circuit = alternative_ckt_2 | Layers = 5 | At end of iteration = 236 | cost = 0.21768517
-----
Circuit = alternative_ckt_2 | Layers = 5 | At end of iteration = 237 | cost = 0.21725190
-----
Circuit = alternative_ckt_2 | Layers = 5 | At end of iteration = 238 | cost = 0.21681831
-----
Circuit = alternative_ckt_2 | Layers = 5 | At end of iteration = 239 | cost = 0.21638444
-----
Circuit = alternative_ckt_2 | Layers = 5 | At end of iteration = 240 | cost = 0.21595036
-----
Circuit = alternative_ckt_2 | Layers = 5 | At end of iteration = 241 | cost = 0.21551610
-----
Circuit = alternative_ckt_2 | Layers = 5 | At end of iteration = 242 | cost = 0.21508172
-----
Circuit = alternative_ckt_2 | Layers = 5 | At end of iteration = 243 | cost = 0.21464727
-----
Circuit = alternative_ckt_2 | Layers = 5 | At end of iteration = 244 | cost = 0.21421280
-----
Circuit = alternative_ckt_2 | Layers = 5 | At end of iteration = 245 | cost = 0.21377836
-----
Circuit = alternative_ckt_2 | Layers = 5 | At end of iteration = 246 | cost = 0.21334401
-----
Circuit = alternative_ckt_2 | Layers = 5 | At end of iteration = 247 | cost = 0.21290979
-----
Circuit = alternative_ckt_2 | Layers = 5 | At end of iteration = 248 | cost = 0.21247575
-----
Circuit = alternative_ckt_2 | Layers = 5 | At end of iteration = 249 | cost = 0.21204196
-----

```

Circuit = alternative_ckt_2 Layers = 5 At end of iteration = 250 cost = 0.21160847
Circuit = alternative_ckt_2 Layers = 5 At end of iteration = 251 cost = 0.21117531
Circuit = alternative_ckt_2 Layers = 5 At end of iteration = 252 cost = 0.21074256
Circuit = alternative_ckt_2 Layers = 5 At end of iteration = 253 cost = 0.21031026
Circuit = alternative_ckt_2 Layers = 5 At end of iteration = 254 cost = 0.20987847
Circuit = alternative_ckt_2 Layers = 5 At end of iteration = 255 cost = 0.20944723
Circuit = alternative_ckt_2 Layers = 5 At end of iteration = 256 cost = 0.20901660
Circuit = alternative_ckt_2 Layers = 5 At end of iteration = 257 cost = 0.20858663
Circuit = alternative_ckt_2 Layers = 5 At end of iteration = 258 cost = 0.20815737
Circuit = alternative_ckt_2 Layers = 5 At end of iteration = 259 cost = 0.20772887
Circuit = alternative_ckt_2 Layers = 5 At end of iteration = 260 cost = 0.20730118
Circuit = alternative_ckt_2 Layers = 5 At end of iteration = 261 cost = 0.20687436
Circuit = alternative_ckt_2 Layers = 5 At end of iteration = 262 cost = 0.20644844
Circuit = alternative_ckt_2 Layers = 5 At end of iteration = 263 cost = 0.20602348
Circuit = alternative_ckt_2 Layers = 5 At end of iteration = 264 cost = 0.20559952
Circuit = alternative_ckt_2 Layers = 5 At end of iteration = 265 cost = 0.20517661
Circuit = alternative_ckt_2 Layers = 5 At end of iteration = 266 cost = 0.20475479
Circuit = alternative_ckt_2 Layers = 5 At end of iteration = 267 cost = 0.20433411
Circuit = alternative_ckt_2 Layers = 5 At end of iteration = 268 cost = 0.20391460
Circuit = alternative_ckt_2 Layers = 5 At end of iteration = 269 cost = 0.20349632
Circuit = alternative_ckt_2 Layers = 5 At end of iteration = 270 cost = 0.20307929
Circuit = alternative_ckt_2 Layers = 5 At end of iteration = 271 cost = 0.20266356
Circuit = alternative_ckt_2 Layers = 5 At end of iteration = 272 cost = 0.20224917
Circuit = alternative_ckt_2 Layers = 5 At end of iteration = 273 cost = 0.20183615

Circuit = alternative_ckt_2 Layers = 5 At end of iteration = 274 cost = 0.20142452
Circuit = alternative_ckt_2 Layers = 5 At end of iteration = 275 cost = 0.20101434
Circuit = alternative_ckt_2 Layers = 5 At end of iteration = 276 cost = 0.20060562
Circuit = alternative_ckt_2 Layers = 5 At end of iteration = 277 cost = 0.20019840
Circuit = alternative_ckt_2 Layers = 5 At end of iteration = 278 cost = 0.19979269
Circuit = alternative_ckt_2 Layers = 5 At end of iteration = 279 cost = 0.19938854
Circuit = alternative_ckt_2 Layers = 5 At end of iteration = 280 cost = 0.19898596
Circuit = alternative_ckt_2 Layers = 5 At end of iteration = 281 cost = 0.19858497
Circuit = alternative_ckt_2 Layers = 5 At end of iteration = 282 cost = 0.19818560
Circuit = alternative_ckt_2 Layers = 5 At end of iteration = 283 cost = 0.19778786
Circuit = alternative_ckt_2 Layers = 5 At end of iteration = 284 cost = 0.19739176
Circuit = alternative_ckt_2 Layers = 5 At end of iteration = 285 cost = 0.19699733
Circuit = alternative_ckt_2 Layers = 5 At end of iteration = 286 cost = 0.19660458
Circuit = alternative_ckt_2 Layers = 5 At end of iteration = 287 cost = 0.19621351
Circuit = alternative_ckt_2 Layers = 5 At end of iteration = 288 cost = 0.19582414
Circuit = alternative_ckt_2 Layers = 5 At end of iteration = 289 cost = 0.19543648
Circuit = alternative_ckt_2 Layers = 5 At end of iteration = 290 cost = 0.19505052
Circuit = alternative_ckt_2 Layers = 5 At end of iteration = 291 cost = 0.19466628
Circuit = alternative_ckt_2 Layers = 5 At end of iteration = 292 cost = 0.19428374
Circuit = alternative_ckt_2 Layers = 5 At end of iteration = 293 cost = 0.19390293
Circuit = alternative_ckt_2 Layers = 5 At end of iteration = 294 cost = 0.19352383
Circuit = alternative_ckt_2 Layers = 5 At end of iteration = 295 cost = 0.19314643
Circuit = alternative_ckt_2 Layers = 5 At end of iteration = 296 cost = 0.19277074
Circuit = alternative_ckt_2 Layers = 5 At end of iteration = 297 cost = 0.19239675

Circuit = alternative_ckt_2 | Layers = 5 | At end of iteration = 298 | cost = 0.19202445

Circuit = alternative_ckt_2 | Layers = 5 | At end of iteration = 299 | cost = 0.19165382

Circuit = alternative_ckt_2 | Layers = 5 | At end of iteration = 300 | cost = 0.19128487

Optimization complete.

After optimization, the optimal parameters are

{Parameter(lmbda9[1]): -0.09018834232552221, Parameter(phi5[2]): 0.1052103491731224, Parameter

The output state for these parameters is

```
[[ 0.28943043+0.22411604j]
 [-0.01780977+0.21367376j]
 [ 0.26311816+0.09997093j]
 [ 0.22539585+0.06419348j]
 [ 0.17222781+0.05656591j]
 [ 0.19737351+0.13221636j]
 [ 0.18512088+0.12663772j]
 [ 0.07936434+0.09990048j]
 [ 0.33796599+0.02896087j]
 [ 0.2252136 +0.03287433j]
 [ 0.25613404+0.06878094j]
 [ 0.02690631+0.04077148j]
 [ 0.30603911+0.15935609j]
 [ 0.1649056 -0.00159481j]
 [ 0.19446119+0.24424107j]
 [ 0.19892879+0.08436883j]]
```

Circuit = alternative_ckt_2 Layers = 5 Cost after optimization = 0.19128487405126465

Circuit alternative_ckt_2 constructed with 6 layers. Number of parameters = 96 .

Initialized circuit parameters prior to gradient descent randomly as follows:

```
idx = lmbda5[1] params = 0.03719052023213644
idx = lmbda11[2] params = 0.04312312828020062
idx = phi5[1] params = 0.0004994971757621869
idx = phi9[3] params = 0.03444025418170515
idx = theta11[3] params = 0.046881140646663634
idx = phi9[0] params = 0.02164226791611938
idx = phi9[2] params = 0.028343942770291508
idx = lmbda11[3] params = 0.013510378554063363
idx = lmbda5[3] params = 0.022782810868909098
idx = lmbda7[3] params = 0.00573789773068969
idx = theta3[0] params = 0.039532273767073196
idx = lmbda9[1] params = 0.018375156312795238
idx = theta11[2] params = 0.02421115885861306
idx = theta8[2] params = 0.01671278315727628
idx = lmbda7[0] params = 0.006172454610576922
```

```

idx = theta6[1] params = 0.016655522656847783
idx = lambda3[0] params = 0.04662197117509747
idx = theta1[3] params = 0.009378499198132518
idx = theta1[1] params = 0.030481776612878
idx = lambda9[3] params = 0.006238299240088347
idx = phi3[0] params = 0.046316344013782464
idx = theta9[3] params = 0.002833116050508433
idx = lambda5[2] params = 0.009568165097689485
idx = theta5[2] params = 0.003778807686699465
idx = phi3[1] params = 0.04761132655555178
idx = theta5[1] params = 0.02912836626547597
idx = theta7[3] params = 0.03277867333581935
idx = phi11[3] params = 0.0012507649722014293
idx = theta12[0] params = 0.03265668670981592
idx = phi7[2] params = 0.042510362504139115
idx = theta10[3] params = 0.028964664980450857
idx = phi3[2] params = 0.02606701333987876
idx = theta2[3] params = 0.04507588560641085
idx = lambda11[0] params = 0.01594882076679191
idx = theta12[2] params = 0.03973242205283862
idx = lambda3[1] params = 0.009337792350935193
idx = theta12[3] params = 0.0032829280606491377
idx = phi11[1] params = 0.019944497772341908
idx = theta3[2] params = 0.040543302128205796
idx = theta1[0] params = 0.018661219094017113
idx = lambda11[1] params = 0.022765429249395765
idx = lambda9[2] params = 0.04496189581938223
idx = phi11[0] params = 0.04421309636000539
idx = theta5[3] params = 0.032067148697469475
idx = theta4[2] params = 0.03316055200997197
idx = theta6[2] params = 0.038381406528673896
idx = theta7[0] params = 0.014346822771396907
idx = theta1[2] params = 0.017358921226698288
idx = theta5[0] params = 0.036248132522104036
idx = theta11[0] params = 0.03539050548659198
idx = phi11[2] params = 0.01607370215812653
idx = theta2[1] params = 0.007381200069874755
idx = theta10[1] params = 0.02358393517371811
idx = phi9[1] params = 0.0009009332204443055
idx = theta9[2] params = 0.015027195664715637
idx = theta2[0] params = 0.037934352344020754
idx = theta6[3] params = 0.02983057071232084
idx = lambda1[1] params = 0.023111461319399895
idx = lambda1[3] params = 0.02586128220807936
idx = lambda1[0] params = 0.002230543419827341
idx = phi7[0] params = 0.021152548385698113
idx = lambda3[2] params = 0.017680671110920827
idx = theta4[3] params = 0.04880350842240636

```

```

idx = phi7[1] params = 0.04861089868928858
idx = theta2[2] params = 0.02746088848176321
idx = theta7[1] params = 0.03249126248776906
idx = phi7[3] params = 0.007806656503289816
idx = lambda9[0] params = 0.022429303882508935
idx = theta8[0] params = 0.04195594056468582
idx = phi1[0] params = 0.03308231488975027
idx = lambda3[3] params = 0.016403579248805207
idx = lambda7[1] params = 0.035403385349937436
idx = phi5[3] params = 0.045163503496595245
idx = phi5[0] params = 0.01075507702770715
idx = phi1[2] params = 0.03733005507245125
idx = phi1[3] params = 0.016534010021804213
idx = lambda1[2] params = 0.03418145346493542
idx = theta3[3] params = 0.026502847987510094
idx = theta3[1] params = 0.04614732179238628
idx = phi1[1] params = 0.04692583576726641
idx = theta9[0] params = 0.026220746451517597
idx = theta12[1] params = 0.015518672083128078
idx = theta4[0] params = 0.010878167160222746
idx = lambda7[2] params = 0.015612322743962653
idx = phi3[3] params = 0.0024157614500938344
idx = phi5[2] params = 0.023981173135572128
idx = theta8[1] params = 0.04523500780118273
idx = theta11[1] params = 0.012050754423305133
idx = lambda5[0] params = 0.04521585983196552
idx = theta8[3] params = 0.03149947936189306
idx = theta10[0] params = 0.04380287779412437
idx = theta9[1] params = 0.001203332701694726
idx = theta6[0] params = 0.025269329959903733
idx = theta7[2] params = 0.01342326236339151
idx = theta4[1] params = 0.0060618064135906265
idx = theta10[2] params = 0.020028446138650742

```

```

-----
Circuit = alternative_ckt_2 | Layers = 6 | At end of iteration = 1 | cost = 1.0546153050

```

```

-----
Circuit = alternative_ckt_2 | Layers = 6 | At end of iteration = 2 | cost = 0.8942497371

```

```

-----
Circuit = alternative_ckt_2 | Layers = 6 | At end of iteration = 3 | cost = 0.6577641650

```

```

-----
Circuit = alternative_ckt_2 | Layers = 6 | At end of iteration = 4 | cost = 0.5014553399

```

```

-----
Circuit = alternative_ckt_2 | Layers = 6 | At end of iteration = 5 | cost = 1.4549508234

```

```

-----
Circuit = alternative_ckt_2 | Layers = 6 | At end of iteration = 6 | cost = 1.1899209804

```

```

-----
Circuit = alternative_ckt_2 | Layers = 6 | At end of iteration = 7 | cost = 0.7454717795
-----

```

Circuit =	alternative_ckt_2		Layers =	6		At end of iteration =	8		cost =	0.6392344244

Circuit =	alternative_ckt_2		Layers =	6		At end of iteration =	9		cost =	1.1622733105

Circuit =	alternative_ckt_2		Layers =	6		At end of iteration =	10		cost =	1.091995133

Circuit =	alternative_ckt_2		Layers =	6		At end of iteration =	11		cost =	1.021630598

Circuit =	alternative_ckt_2		Layers =	6		At end of iteration =	12		cost =	1.108587617

Circuit =	alternative_ckt_2		Layers =	6		At end of iteration =	13		cost =	0.757227827

Circuit =	alternative_ckt_2		Layers =	6		At end of iteration =	14		cost =	1.027657664

Circuit =	alternative_ckt_2		Layers =	6		At end of iteration =	15		cost =	1.153780190

Circuit =	alternative_ckt_2		Layers =	6		At end of iteration =	16		cost =	0.821384064

Circuit =	alternative_ckt_2		Layers =	6		At end of iteration =	17		cost =	0.963771234

Circuit =	alternative_ckt_2		Layers =	6		At end of iteration =	18		cost =	1.083117494

Circuit =	alternative_ckt_2		Layers =	6		At end of iteration =	19		cost =	0.821280187

Circuit =	alternative_ckt_2		Layers =	6		At end of iteration =	20		cost =	1.010478704

Circuit =	alternative_ckt_2		Layers =	6		At end of iteration =	21		cost =	0.970644045

Circuit =	alternative_ckt_2		Layers =	6		At end of iteration =	22		cost =	0.917722357

Circuit =	alternative_ckt_2		Layers =	6		At end of iteration =	23		cost =	0.898461732

Circuit =	alternative_ckt_2		Layers =	6		At end of iteration =	24		cost =	0.960421651

Circuit =	alternative_ckt_2		Layers =	6		At end of iteration =	25		cost =	0.912081836

Circuit =	alternative_ckt_2		Layers =	6		At end of iteration =	26		cost =	0.893554867

Circuit =	alternative_ckt_2		Layers =	6		At end of iteration =	27		cost =	0.914197732

Circuit =	alternative_ckt_2		Layers =	6		At end of iteration =	28		cost =	0.903401444

Circuit =	alternative_ckt_2		Layers =	6		At end of iteration =	29		cost =	0.897000888

Circuit =	alternative_ckt_2		Layers =	6		At end of iteration =	30		cost =	0.891659892

Circuit =	alternative_ckt_2		Layers =	6		At end of iteration =	31		cost =	0.894631205

```

Circuit = alternative_ckt_2 | Layers = 6 | At end of iteration = 32 | cost = 0.887702429
-----
Circuit = alternative_ckt_2 | Layers = 6 | At end of iteration = 33 | cost = 0.881286520
-----
Circuit = alternative_ckt_2 | Layers = 6 | At end of iteration = 34 | cost = 0.890206845
-----
Circuit = alternative_ckt_2 | Layers = 6 | At end of iteration = 35 | cost = 0.874829322
-----
Circuit = alternative_ckt_2 | Layers = 6 | At end of iteration = 36 | cost = 0.885584074
-----
Circuit = alternative_ckt_2 | Layers = 6 | At end of iteration = 37 | cost = 0.866335919
-----
Circuit = alternative_ckt_2 | Layers = 6 | At end of iteration = 38 | cost = 0.888272738
-----
Circuit = alternative_ckt_2 | Layers = 6 | At end of iteration = 39 | cost = 0.859305622
-----
REDUCING ALPHA TO 0.31622776601683794 at iteration = 40
-----
Circuit = alternative_ckt_2 | Layers = 6 | At end of iteration = 40 | cost = 0.886081754
-----
Circuit = alternative_ckt_2 | Layers = 6 | At end of iteration = 41 | cost = 0.664036524
-----
Circuit = alternative_ckt_2 | Layers = 6 | At end of iteration = 42 | cost = 0.583927871
-----
Circuit = alternative_ckt_2 | Layers = 6 | At end of iteration = 43 | cost = 0.552102650
-----
Circuit = alternative_ckt_2 | Layers = 6 | At end of iteration = 44 | cost = 0.523337898
-----
Circuit = alternative_ckt_2 | Layers = 6 | At end of iteration = 45 | cost = 0.495618743
-----
Circuit = alternative_ckt_2 | Layers = 6 | At end of iteration = 46 | cost = 0.468376240
-----
Circuit = alternative_ckt_2 | Layers = 6 | At end of iteration = 47 | cost = 0.441222199
-----
Circuit = alternative_ckt_2 | Layers = 6 | At end of iteration = 48 | cost = 0.414244935
-----
Circuit = alternative_ckt_2 | Layers = 6 | At end of iteration = 49 | cost = 0.387327344
-----
Circuit = alternative_ckt_2 | Layers = 6 | At end of iteration = 50 | cost = 0.361166719
-----
Circuit = alternative_ckt_2 | Layers = 6 | At end of iteration = 51 | cost = 0.334956693
-----
Circuit = alternative_ckt_2 | Layers = 6 | At end of iteration = 52 | cost = 0.312672709
-----
Circuit = alternative_ckt_2 | Layers = 6 | At end of iteration = 53 | cost = 0.285226118
-----
Circuit = alternative_ckt_2 | Layers = 6 | At end of iteration = 54 | cost = 0.342457649
-----

```


Circuit = alternative_ckt_2 Layers = 6 At end of iteration = 55 cost = 0.628115938
Circuit = alternative_ckt_2 Layers = 6 At end of iteration = 56 cost = 0.731199079
Circuit = alternative_ckt_2 Layers = 6 At end of iteration = 57 cost = 0.508721745
Circuit = alternative_ckt_2 Layers = 6 At end of iteration = 58 cost = 0.786201087
Circuit = alternative_ckt_2 Layers = 6 At end of iteration = 59 cost = 0.425627517
Circuit = alternative_ckt_2 Layers = 6 At end of iteration = 60 cost = 0.803696945
Circuit = alternative_ckt_2 Layers = 6 At end of iteration = 61 cost = 0.403922069
Circuit = alternative_ckt_2 Layers = 6 At end of iteration = 62 cost = 0.817263360
Circuit = alternative_ckt_2 Layers = 6 At end of iteration = 63 cost = 0.386360088
Circuit = alternative_ckt_2 Layers = 6 At end of iteration = 64 cost = 0.824907502
Circuit = alternative_ckt_2 Layers = 6 At end of iteration = 65 cost = 0.377275909
Circuit = alternative_ckt_2 Layers = 6 At end of iteration = 66 cost = 0.834855273
Circuit = alternative_ckt_2 Layers = 6 At end of iteration = 67 cost = 0.364849653
Circuit = alternative_ckt_2 Layers = 6 At end of iteration = 68 cost = 0.840560163
Circuit = alternative_ckt_2 Layers = 6 At end of iteration = 69 cost = 0.358704640
Circuit = alternative_ckt_2 Layers = 6 At end of iteration = 70 cost = 0.850537146
Circuit = alternative_ckt_2 Layers = 6 At end of iteration = 71 cost = 0.346271946
Circuit = alternative_ckt_2 Layers = 6 At end of iteration = 72 cost = 0.853552922
Circuit = alternative_ckt_2 Layers = 6 At end of iteration = 73 cost = 0.344075301
Circuit = alternative_ckt_2 Layers = 6 At end of iteration = 74 cost = 0.866182954
Circuit = alternative_ckt_2 Layers = 6 At end of iteration = 75 cost = 0.327621893
Circuit = alternative_ckt_2 Layers = 6 At end of iteration = 76 cost = 0.861657692
Circuit = alternative_ckt_2 Layers = 6 At end of iteration = 77 cost = 0.336555337
Circuit = alternative_ckt_2 Layers = 6 At end of iteration = 78 cost = 0.885846583

```

Circuit = alternative_ckt_2 | Layers = 6 | At end of iteration = 79 | cost = 0.3031342703
-----
REDUCING ALPHA TO 0.09999999999999999 at iteration = 80
-----
Circuit = alternative_ckt_2 | Layers = 6 | At end of iteration = 80 | cost = 0.8514131479
-----
Circuit = alternative_ckt_2 | Layers = 6 | At end of iteration = 81 | cost = 0.5472781633
-----
Circuit = alternative_ckt_2 | Layers = 6 | At end of iteration = 82 | cost = 0.2418474241
-----
Circuit = alternative_ckt_2 | Layers = 6 | At end of iteration = 83 | cost = 0.2081680193
-----
Circuit = alternative_ckt_2 | Layers = 6 | At end of iteration = 84 | cost = 0.2481531374
-----
Circuit = alternative_ckt_2 | Layers = 6 | At end of iteration = 85 | cost = 0.2100581293
-----
Circuit = alternative_ckt_2 | Layers = 6 | At end of iteration = 86 | cost = 0.2734064500
-----
Circuit = alternative_ckt_2 | Layers = 6 | At end of iteration = 87 | cost = 0.2164025883
-----
Circuit = alternative_ckt_2 | Layers = 6 | At end of iteration = 88 | cost = 0.2872540949
-----
Circuit = alternative_ckt_2 | Layers = 6 | At end of iteration = 89 | cost = 0.2165559514
-----
Circuit = alternative_ckt_2 | Layers = 6 | At end of iteration = 90 | cost = 0.2923305583
-----
Circuit = alternative_ckt_2 | Layers = 6 | At end of iteration = 91 | cost = 0.2159436243
-----
Circuit = alternative_ckt_2 | Layers = 6 | At end of iteration = 92 | cost = 0.2961494511
-----
Circuit = alternative_ckt_2 | Layers = 6 | At end of iteration = 93 | cost = 0.2152659179
-----
Circuit = alternative_ckt_2 | Layers = 6 | At end of iteration = 94 | cost = 0.2993977144
-----
Circuit = alternative_ckt_2 | Layers = 6 | At end of iteration = 95 | cost = 0.2145502320
-----
Circuit = alternative_ckt_2 | Layers = 6 | At end of iteration = 96 | cost = 0.3022209343
-----
Circuit = alternative_ckt_2 | Layers = 6 | At end of iteration = 97 | cost = 0.2138217000
-----
Circuit = alternative_ckt_2 | Layers = 6 | At end of iteration = 98 | cost = 0.3047130153
-----
Circuit = alternative_ckt_2 | Layers = 6 | At end of iteration = 99 | cost = 0.2130944621
-----
Circuit = alternative_ckt_2 | Layers = 6 | At end of iteration = 100 | cost = 0.3069365400
-----
Circuit = alternative_ckt_2 | Layers = 6 | At end of iteration = 101 | cost = 0.2123772300
-----

```

```

Circuit = alternative_ckt_2 | Layers = 6 | At end of iteration = 102 | cost = 0.30893646
-----
Circuit = alternative_ckt_2 | Layers = 6 | At end of iteration = 103 | cost = 0.21167545
-----
Circuit = alternative_ckt_2 | Layers = 6 | At end of iteration = 104 | cost = 0.31074677
-----
Circuit = alternative_ckt_2 | Layers = 6 | At end of iteration = 105 | cost = 0.21099245
-----
Circuit = alternative_ckt_2 | Layers = 6 | At end of iteration = 106 | cost = 0.31239412
-----
Circuit = alternative_ckt_2 | Layers = 6 | At end of iteration = 107 | cost = 0.21033022
-----
Circuit = alternative_ckt_2 | Layers = 6 | At end of iteration = 108 | cost = 0.31389998
-----
Circuit = alternative_ckt_2 | Layers = 6 | At end of iteration = 109 | cost = 0.20968982
-----
Circuit = alternative_ckt_2 | Layers = 6 | At end of iteration = 110 | cost = 0.31528202
-----
Circuit = alternative_ckt_2 | Layers = 6 | At end of iteration = 111 | cost = 0.20907169
-----
Circuit = alternative_ckt_2 | Layers = 6 | At end of iteration = 112 | cost = 0.31655494
-----
Circuit = alternative_ckt_2 | Layers = 6 | At end of iteration = 113 | cost = 0.20847586
-----
Circuit = alternative_ckt_2 | Layers = 6 | At end of iteration = 114 | cost = 0.31773118
-----
Circuit = alternative_ckt_2 | Layers = 6 | At end of iteration = 115 | cost = 0.20790204
-----
Circuit = alternative_ckt_2 | Layers = 6 | At end of iteration = 116 | cost = 0.31882131
-----
Circuit = alternative_ckt_2 | Layers = 6 | At end of iteration = 117 | cost = 0.20734976
-----
Circuit = alternative_ckt_2 | Layers = 6 | At end of iteration = 118 | cost = 0.31983443
-----
Circuit = alternative_ckt_2 | Layers = 6 | At end of iteration = 119 | cost = 0.20681839
-----
REDUCING ALPHA TO 0.03162277660168379 at iteration = 120
-----
Circuit = alternative_ckt_2 | Layers = 6 | At end of iteration = 120 | cost = 0.32077839
-----
Circuit = alternative_ckt_2 | Layers = 6 | At end of iteration = 121 | cost = 0.21224362
-----
Circuit = alternative_ckt_2 | Layers = 6 | At end of iteration = 122 | cost = 0.15969386
-----
Circuit = alternative_ckt_2 | Layers = 6 | At end of iteration = 123 | cost = 0.15351653
-----
Circuit = alternative_ckt_2 | Layers = 6 | At end of iteration = 124 | cost = 0.15320465
-----

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Circuit = alternative_ckt_2 Layers = 6 At end of iteration = 125 cost = 0.15255806
Circuit = alternative_ckt_2 Layers = 6 At end of iteration = 126 cost = 0.15201814
Circuit = alternative_ckt_2 Layers = 6 At end of iteration = 127 cost = 0.15151956
Circuit = alternative_ckt_2 Layers = 6 At end of iteration = 128 cost = 0.15105829
Circuit = alternative_ckt_2 Layers = 6 At end of iteration = 129 cost = 0.15062651
Circuit = alternative_ckt_2 Layers = 6 At end of iteration = 130 cost = 0.15021900
Circuit = alternative_ckt_2 Layers = 6 At end of iteration = 131 cost = 0.14983166
Circuit = alternative_ckt_2 Layers = 6 At end of iteration = 132 cost = 0.14946128
Circuit = alternative_ckt_2 Layers = 6 At end of iteration = 133 cost = 0.14910530
Circuit = alternative_ckt_2 Layers = 6 At end of iteration = 134 cost = 0.14876165
Circuit = alternative_ckt_2 Layers = 6 At end of iteration = 135 cost = 0.14842868
Circuit = alternative_ckt_2 Layers = 6 At end of iteration = 136 cost = 0.14810504
Circuit = alternative_ckt_2 Layers = 6 At end of iteration = 137 cost = 0.14778962
Circuit = alternative_ckt_2 Layers = 6 At end of iteration = 138 cost = 0.14748154
Circuit = alternative_ckt_2 Layers = 6 At end of iteration = 139 cost = 0.14718007
Circuit = alternative_ckt_2 Layers = 6 At end of iteration = 140 cost = 0.14688462
Circuit = alternative_ckt_2 Layers = 6 At end of iteration = 141 cost = 0.14659470
Circuit = alternative_ckt_2 Layers = 6 At end of iteration = 142 cost = 0.14630991
Circuit = alternative_ckt_2 Layers = 6 At end of iteration = 143 cost = 0.14602994
Circuit = alternative_ckt_2 Layers = 6 At end of iteration = 144 cost = 0.14575450
Circuit = alternative_ckt_2 Layers = 6 At end of iteration = 145 cost = 0.14548338
Circuit = alternative_ckt_2 Layers = 6 At end of iteration = 146 cost = 0.14521638
Circuit = alternative_ckt_2 Layers = 6 At end of iteration = 147 cost = 0.14495335
Circuit = alternative_ckt_2 Layers = 6 At end of iteration = 148 cost = 0.14469415

Circuit = alternative_ckt_2 Layers = 6 At end of iteration = 149 cost = 0.14443866
Circuit = alternative_ckt_2 Layers = 6 At end of iteration = 150 cost = 0.14418677
Circuit = alternative_ckt_2 Layers = 6 At end of iteration = 151 cost = 0.14393841
Circuit = alternative_ckt_2 Layers = 6 At end of iteration = 152 cost = 0.14369347
Circuit = alternative_ckt_2 Layers = 6 At end of iteration = 153 cost = 0.14345190
Circuit = alternative_ckt_2 Layers = 6 At end of iteration = 154 cost = 0.14321362
Circuit = alternative_ckt_2 Layers = 6 At end of iteration = 155 cost = 0.14297856
Circuit = alternative_ckt_2 Layers = 6 At end of iteration = 156 cost = 0.14274667
Circuit = alternative_ckt_2 Layers = 6 At end of iteration = 157 cost = 0.14251788
Circuit = alternative_ckt_2 Layers = 6 At end of iteration = 158 cost = 0.14229215
Circuit = alternative_ckt_2 Layers = 6 At end of iteration = 159 cost = 0.14206942
Circuit = alternative_ckt_2 Layers = 6 At end of iteration = 160 cost = 0.14184964
Circuit = alternative_ckt_2 Layers = 6 At end of iteration = 161 cost = 0.14163276
Circuit = alternative_ckt_2 Layers = 6 At end of iteration = 162 cost = 0.14141873
Circuit = alternative_ckt_2 Layers = 6 At end of iteration = 163 cost = 0.14120750
Circuit = alternative_ckt_2 Layers = 6 At end of iteration = 164 cost = 0.14099904
Circuit = alternative_ckt_2 Layers = 6 At end of iteration = 165 cost = 0.14079329
Circuit = alternative_ckt_2 Layers = 6 At end of iteration = 166 cost = 0.14059021
Circuit = alternative_ckt_2 Layers = 6 At end of iteration = 167 cost = 0.14038975
Circuit = alternative_ckt_2 Layers = 6 At end of iteration = 168 cost = 0.14019188
Circuit = alternative_ckt_2 Layers = 6 At end of iteration = 169 cost = 0.13999656
Circuit = alternative_ckt_2 Layers = 6 At end of iteration = 170 cost = 0.13980374
Circuit = alternative_ckt_2 Layers = 6 At end of iteration = 171 cost = 0.13961339
Circuit = alternative_ckt_2 Layers = 6 At end of iteration = 172 cost = 0.13942546

Circuit = alternative_ckt_2 Layers = 6 At end of iteration = 173 cost = 0.13923992
Circuit = alternative_ckt_2 Layers = 6 At end of iteration = 174 cost = 0.13905674
Circuit = alternative_ckt_2 Layers = 6 At end of iteration = 175 cost = 0.13887587
Circuit = alternative_ckt_2 Layers = 6 At end of iteration = 176 cost = 0.13869728
Circuit = alternative_ckt_2 Layers = 6 At end of iteration = 177 cost = 0.13852094
Circuit = alternative_ckt_2 Layers = 6 At end of iteration = 178 cost = 0.13834681
Circuit = alternative_ckt_2 Layers = 6 At end of iteration = 179 cost = 0.13817486
Circuit = alternative_ckt_2 Layers = 6 At end of iteration = 180 cost = 0.13800506
Circuit = alternative_ckt_2 Layers = 6 At end of iteration = 181 cost = 0.13783738
Circuit = alternative_ckt_2 Layers = 6 At end of iteration = 182 cost = 0.13767178
Circuit = alternative_ckt_2 Layers = 6 At end of iteration = 183 cost = 0.13750824
Circuit = alternative_ckt_2 Layers = 6 At end of iteration = 184 cost = 0.13734673
Circuit = alternative_ckt_2 Layers = 6 At end of iteration = 185 cost = 0.13718722
Circuit = alternative_ckt_2 Layers = 6 At end of iteration = 186 cost = 0.13702968
Circuit = alternative_ckt_2 Layers = 6 At end of iteration = 187 cost = 0.13687409
Circuit = alternative_ckt_2 Layers = 6 At end of iteration = 188 cost = 0.13672042
Circuit = alternative_ckt_2 Layers = 6 At end of iteration = 189 cost = 0.13656864
Circuit = alternative_ckt_2 Layers = 6 At end of iteration = 190 cost = 0.13641873
Circuit = alternative_ckt_2 Layers = 6 At end of iteration = 191 cost = 0.13627067
Circuit = alternative_ckt_2 Layers = 6 At end of iteration = 192 cost = 0.13612443
Circuit = alternative_ckt_2 Layers = 6 At end of iteration = 193 cost = 0.13597998
Circuit = alternative_ckt_2 Layers = 6 At end of iteration = 194 cost = 0.13583732
Circuit = alternative_ckt_2 Layers = 6 At end of iteration = 195 cost = 0.13569641
Circuit = alternative_ckt_2 Layers = 6 At end of iteration = 196 cost = 0.13555724

Circuit = alternative_ckt_2 Layers = 6 At end of iteration = 197 cost = 0.13541978
Circuit = alternative_ckt_2 Layers = 6 At end of iteration = 198 cost = 0.13528401
Circuit = alternative_ckt_2 Layers = 6 At end of iteration = 199 cost = 0.13514992
Circuit = alternative_ckt_2 Layers = 6 At end of iteration = 200 cost = 0.13501748
Circuit = alternative_ckt_2 Layers = 6 At end of iteration = 201 cost = 0.13488668
Circuit = alternative_ckt_2 Layers = 6 At end of iteration = 202 cost = 0.13475750
Circuit = alternative_ckt_2 Layers = 6 At end of iteration = 203 cost = 0.13462991
Circuit = alternative_ckt_2 Layers = 6 At end of iteration = 204 cost = 0.13450392
Circuit = alternative_ckt_2 Layers = 6 At end of iteration = 205 cost = 0.13437948
Circuit = alternative_ckt_2 Layers = 6 At end of iteration = 206 cost = 0.13425660
Circuit = alternative_ckt_2 Layers = 6 At end of iteration = 207 cost = 0.13413526
Circuit = alternative_ckt_2 Layers = 6 At end of iteration = 208 cost = 0.13401543
Circuit = alternative_ckt_2 Layers = 6 At end of iteration = 209 cost = 0.13389711
Circuit = alternative_ckt_2 Layers = 6 At end of iteration = 210 cost = 0.13378028
Circuit = alternative_ckt_2 Layers = 6 At end of iteration = 211 cost = 0.13366492
Circuit = alternative_ckt_2 Layers = 6 At end of iteration = 212 cost = 0.13355102
Circuit = alternative_ckt_2 Layers = 6 At end of iteration = 213 cost = 0.13343858
Circuit = alternative_ckt_2 Layers = 6 At end of iteration = 214 cost = 0.13332756
Circuit = alternative_ckt_2 Layers = 6 At end of iteration = 215 cost = 0.13321797
Circuit = alternative_ckt_2 Layers = 6 At end of iteration = 216 cost = 0.13310978
Circuit = alternative_ckt_2 Layers = 6 At end of iteration = 217 cost = 0.13300299
Circuit = alternative_ckt_2 Layers = 6 At end of iteration = 218 cost = 0.13289758
Circuit = alternative_ckt_2 Layers = 6 At end of iteration = 219 cost = 0.13279355
Circuit = alternative_ckt_2 Layers = 6 At end of iteration = 220 cost = 0.13269087

Circuit =	alternative_ckt_2		Layers =	6		At end of iteration =	221		cost =	0.13258955
Circuit =	alternative_ckt_2		Layers =	6		At end of iteration =	222		cost =	0.13248956
Circuit =	alternative_ckt_2		Layers =	6		At end of iteration =	223		cost =	0.13239089
Circuit =	alternative_ckt_2		Layers =	6		At end of iteration =	224		cost =	0.13229354
Circuit =	alternative_ckt_2		Layers =	6		At end of iteration =	225		cost =	0.13219750
Circuit =	alternative_ckt_2		Layers =	6		At end of iteration =	226		cost =	0.13210276
Circuit =	alternative_ckt_2		Layers =	6		At end of iteration =	227		cost =	0.13200929
Circuit =	alternative_ckt_2		Layers =	6		At end of iteration =	228		cost =	0.13191711
Circuit =	alternative_ckt_2		Layers =	6		At end of iteration =	229		cost =	0.13182618
Circuit =	alternative_ckt_2		Layers =	6		At end of iteration =	230		cost =	0.13173652
Circuit =	alternative_ckt_2		Layers =	6		At end of iteration =	231		cost =	0.13164810
Circuit =	alternative_ckt_2		Layers =	6		At end of iteration =	232		cost =	0.13156092
Circuit =	alternative_ckt_2		Layers =	6		At end of iteration =	233		cost =	0.13147496
Circuit =	alternative_ckt_2		Layers =	6		At end of iteration =	234		cost =	0.13139023
Circuit =	alternative_ckt_2		Layers =	6		At end of iteration =	235		cost =	0.13130670
Circuit =	alternative_ckt_2		Layers =	6		At end of iteration =	236		cost =	0.13122438
Circuit =	alternative_ckt_2		Layers =	6		At end of iteration =	237		cost =	0.13114326
Circuit =	alternative_ckt_2		Layers =	6		At end of iteration =	238		cost =	0.13106331
Circuit =	alternative_ckt_2		Layers =	6		At end of iteration =	239		cost =	0.13098455
Circuit =	alternative_ckt_2		Layers =	6		At end of iteration =	240		cost =	0.13090695
Circuit =	alternative_ckt_2		Layers =	6		At end of iteration =	241		cost =	0.13083052
Circuit =	alternative_ckt_2		Layers =	6		At end of iteration =	242		cost =	0.13075524
Circuit =	alternative_ckt_2		Layers =	6		At end of iteration =	243		cost =	0.13068110
Circuit =	alternative_ckt_2		Layers =	6		At end of iteration =	244		cost =	0.13060810

Circuit = alternative_ckt_2 Layers = 6 At end of iteration = 245 cost = 0.13053624
Circuit = alternative_ckt_2 Layers = 6 At end of iteration = 246 cost = 0.13046549
Circuit = alternative_ckt_2 Layers = 6 At end of iteration = 247 cost = 0.13039586
Circuit = alternative_ckt_2 Layers = 6 At end of iteration = 248 cost = 0.13032734
Circuit = alternative_ckt_2 Layers = 6 At end of iteration = 249 cost = 0.13025992
Circuit = alternative_ckt_2 Layers = 6 At end of iteration = 250 cost = 0.13019359
Circuit = alternative_ckt_2 Layers = 6 At end of iteration = 251 cost = 0.13012835
Circuit = alternative_ckt_2 Layers = 6 At end of iteration = 252 cost = 0.13006419
Circuit = alternative_ckt_2 Layers = 6 At end of iteration = 253 cost = 0.13000109
Circuit = alternative_ckt_2 Layers = 6 At end of iteration = 254 cost = 0.12993907
Circuit = alternative_ckt_2 Layers = 6 At end of iteration = 255 cost = 0.12987810
Circuit = alternative_ckt_2 Layers = 6 At end of iteration = 256 cost = 0.12981818
Circuit = alternative_ckt_2 Layers = 6 At end of iteration = 257 cost = 0.12975930
Circuit = alternative_ckt_2 Layers = 6 At end of iteration = 258 cost = 0.12970146
Circuit = alternative_ckt_2 Layers = 6 At end of iteration = 259 cost = 0.12964465
Circuit = alternative_ckt_2 Layers = 6 At end of iteration = 260 cost = 0.12958873
Circuit = alternative_ckt_2 Layers = 6 At end of iteration = 261 cost = 0.12953410
Circuit = alternative_ckt_2 Layers = 6 At end of iteration = 262 cost = 0.12948034
Circuit = alternative_ckt_2 Layers = 6 At end of iteration = 263 cost = 0.12942758
Circuit = alternative_ckt_2 Layers = 6 At end of iteration = 264 cost = 0.12937581
Circuit = alternative_ckt_2 Layers = 6 At end of iteration = 265 cost = 0.12932503
Circuit = alternative_ckt_2 Layers = 6 At end of iteration = 266 cost = 0.12927524
Circuit = alternative_ckt_2 Layers = 6 At end of iteration = 267 cost = 0.12922642
Circuit = alternative_ckt_2 Layers = 6 At end of iteration = 268 cost = 0.12917856

Circuit = alternative_ckt_2	Layers = 6	At end of iteration = 269	cost = 0.12913167
Circuit = alternative_ckt_2	Layers = 6	At end of iteration = 270	cost = 0.12908573
Circuit = alternative_ckt_2	Layers = 6	At end of iteration = 271	cost = 0.12904074
Circuit = alternative_ckt_2	Layers = 6	At end of iteration = 272	cost = 0.12899668
Circuit = alternative_ckt_2	Layers = 6	At end of iteration = 273	cost = 0.12895356
Circuit = alternative_ckt_2	Layers = 6	At end of iteration = 274	cost = 0.12891136
Circuit = alternative_ckt_2	Layers = 6	At end of iteration = 275	cost = 0.12887008
Circuit = alternative_ckt_2	Layers = 6	At end of iteration = 276	cost = 0.12882971
Circuit = alternative_ckt_2	Layers = 6	At end of iteration = 277	cost = 0.12879025
Circuit = alternative_ckt_2	Layers = 6	At end of iteration = 278	cost = 0.12875168
Circuit = alternative_ckt_2	Layers = 6	At end of iteration = 279	cost = 0.12871400
Circuit = alternative_ckt_2	Layers = 6	At end of iteration = 280	cost = 0.12867720
Circuit = alternative_ckt_2	Layers = 6	At end of iteration = 281	cost = 0.12864127
Circuit = alternative_ckt_2	Layers = 6	At end of iteration = 282	cost = 0.12860621
Circuit = alternative_ckt_2	Layers = 6	At end of iteration = 283	cost = 0.12857201
Circuit = alternative_ckt_2	Layers = 6	At end of iteration = 284	cost = 0.12853866
Circuit = alternative_ckt_2	Layers = 6	At end of iteration = 285	cost = 0.12850616
Circuit = alternative_ckt_2	Layers = 6	At end of iteration = 286	cost = 0.12847449
Circuit = alternative_ckt_2	Layers = 6	At end of iteration = 287	cost = 0.12844365
Circuit = alternative_ckt_2	Layers = 6	At end of iteration = 288	cost = 0.12841362
Circuit = alternative_ckt_2	Layers = 6	At end of iteration = 289	cost = 0.12838441
Circuit = alternative_ckt_2	Layers = 6	At end of iteration = 290	cost = 0.12835600
Circuit = alternative_ckt_2	Layers = 6	At end of iteration = 291	cost = 0.12832839
Circuit = alternative_ckt_2	Layers = 6	At end of iteration = 292	cost = 0.12830157


```

idx = theta6[3] params = 0.028343942770291508
idx = theta5[0] params = 0.013510378554063363
idx = lambda7[2] params = 0.022782810868909098
idx = theta11[2] params = 0.00573789773068969
idx = theta7[1] params = 0.039532273767073196
idx = phi13[2] params = 0.018375156312795238
idx = theta10[1] params = 0.02421115885861306
idx = theta10[3] params = 0.01671278315727628
idx = theta8[0] params = 0.006172454610576922
idx = theta3[2] params = 0.016655522656847783
idx = phi13[1] params = 0.04662197117509747
idx = theta7[0] params = 0.009378499198132518
idx = lambda11[0] params = 0.030481776612878
idx = lambda9[2] params = 0.006238299240088347
idx = theta14[0] params = 0.046316344013782464
idx = lambda1[2] params = 0.002833116050508433
idx = lambda5[2] params = 0.009568165097689485
idx = phi5[3] params = 0.003778807686699465
idx = phi3[0] params = 0.04761132655555178
idx = theta13[3] params = 0.02912836626547597
idx = lambda13[0] params = 0.03277867333581935
idx = lambda11[1] params = 0.0012507649722014293
idx = phi1[2] params = 0.03265668670981592
idx = phi7[2] params = 0.042510362504139115
idx = theta13[2] params = 0.028964664980450857
idx = lambda7[0] params = 0.02606701333987876
idx = theta12[1] params = 0.04507588560641085
idx = lambda9[3] params = 0.01594882076679191
idx = theta13[0] params = 0.03973242205283862
idx = lambda5[0] params = 0.009337792350935193
idx = theta9[1] params = 0.0032829280606491377
idx = theta9[0] params = 0.019944497772341908
idx = theta3[3] params = 0.040543302128205796
idx = lambda3[0] params = 0.018661219094017113
idx = lambda5[3] params = 0.022765429249395765
idx = phi1[1] params = 0.04496189581938223
idx = theta6[1] params = 0.04421309636000539
idx = theta12[0] params = 0.032067148697469475
idx = lambda13[3] params = 0.03316055200997197
idx = lambda1[3] params = 0.038381406528673896
idx = lambda13[2] params = 0.014346822771396907
idx = phi11[2] params = 0.017358921226698288
idx = theta8[1] params = 0.036248132522104036
idx = theta3[0] params = 0.03539050548659198
idx = phi5[1] params = 0.01607370215812653
idx = lambda1[1] params = 0.007381200069874755
idx = lambda5[1] params = 0.02358393517371811
idx = theta11[0] params = 0.0009009332204443055

```

```

idx = theta3[1] params = 0.015027195664715637
idx = phi7[3] params = 0.037934352344020754
idx = theta12[2] params = 0.02983057071232084
idx = theta14[3] params = 0.023111461319399895
idx = lambda3[3] params = 0.02586128220807936
idx = lambda11[2] params = 0.002230543419827341
idx = theta5[2] params = 0.021152548385698113
idx = theta11[1] params = 0.017680671110920827
idx = theta4[2] params = 0.04880350842240636
idx = theta8[2] params = 0.04861089868928858
idx = theta11[3] params = 0.02746088848176321
idx = lambda7[3] params = 0.03249126248776906
idx = phi11[1] params = 0.007806656503289816
idx = phi9[1] params = 0.022429303882508935
idx = theta13[1] params = 0.04195594056468582
idx = phi3[3] params = 0.03308231488975027
idx = phi3[1] params = 0.016403579248805207
idx = phi5[2] params = 0.035403385349937436
idx = theta1[0] params = 0.045163503496595245
idx = phi5[0] params = 0.01075507702770715
idx = lambda11[3] params = 0.03733005507245125
idx = lambda1[0] params = 0.016534010021804213
idx = theta7[2] params = 0.03418145346493542
idx = theta1[3] params = 0.026502847987510094
idx = theta4[0] params = 0.04614732179238628
idx = lambda7[1] params = 0.04692583576726641
idx = theta6[2] params = 0.026220746451517597
idx = lambda13[1] params = 0.015518672083128078
idx = theta5[3] params = 0.010878167160222746
idx = phi1[3] params = 0.015612322743962653
idx = phi7[1] params = 0.0024157614500938344
idx = theta8[3] params = 0.023981173135572128
idx = phi13[3] params = 0.04523500780118273
idx = theta6[0] params = 0.012050754423305133
idx = theta7[3] params = 0.04521585983196552
idx = phi3[2] params = 0.03149947936189306
idx = lambda3[2] params = 0.04380287779412437
idx = theta9[2] params = 0.001203332701694726
idx = theta4[3] params = 0.025269329959903733
idx = phi7[0] params = 0.01342326236339151
idx = phi13[0] params = 0.0060618064135906265
idx = theta2[2] params = 0.020028446138650742
idx = lambda3[1] params = 0.03459764142307546
idx = theta9[3] params = 0.040789679762803004
idx = phi11[3] params = 0.03772672053935456
idx = theta2[0] params = 0.04556170765428924
idx = phi9[0] params = 0.04143107779406905
idx = theta10[2] params = 0.020368304039082803

```

```

idx = theta4[1] params = 0.032620155037841374
idx = theta14[1] params = 0.007399585619202726
idx = theta5[1] params = 0.004990795188253411
idx = theta1[1] params = 0.002031185751059933
idx = phi1[0] params = 0.014423742695140886
idx = phi9[3] params = 0.03244910509278613
idx = theta1[2] params = 0.03425617183716739
idx = lambda9[0] params = 0.020949797007256177
idx = theta2[1] params = 0.0018680628994633963
idx = theta14[2] params = 0.036288393074495565

```

```

-----
Circuit = alternative_ckt_2 | Layers = 7 | At end of iteration = 1 | cost = 1.0243202654
-----
Circuit = alternative_ckt_2 | Layers = 7 | At end of iteration = 2 | cost = 0.8127214673
-----
Circuit = alternative_ckt_2 | Layers = 7 | At end of iteration = 3 | cost = 0.5451496542
-----
Circuit = alternative_ckt_2 | Layers = 7 | At end of iteration = 4 | cost = 1.2391724260
-----
Circuit = alternative_ckt_2 | Layers = 7 | At end of iteration = 5 | cost = 1.3766292095
-----
Circuit = alternative_ckt_2 | Layers = 7 | At end of iteration = 6 | cost = 0.7839409843
-----
Circuit = alternative_ckt_2 | Layers = 7 | At end of iteration = 7 | cost = 0.5981486499
-----
Circuit = alternative_ckt_2 | Layers = 7 | At end of iteration = 8 | cost = 1.4840686880
-----
Circuit = alternative_ckt_2 | Layers = 7 | At end of iteration = 9 | cost = 1.3099691946
-----
Circuit = alternative_ckt_2 | Layers = 7 | At end of iteration = 10 | cost = 1.161188265
-----
Circuit = alternative_ckt_2 | Layers = 7 | At end of iteration = 11 | cost = 1.027561801
-----
Circuit = alternative_ckt_2 | Layers = 7 | At end of iteration = 12 | cost = 0.869929642
-----
Circuit = alternative_ckt_2 | Layers = 7 | At end of iteration = 13 | cost = 0.662101585
-----
Circuit = alternative_ckt_2 | Layers = 7 | At end of iteration = 14 | cost = 0.492444949
-----
Circuit = alternative_ckt_2 | Layers = 7 | At end of iteration = 15 | cost = 1.427270984
-----
Circuit = alternative_ckt_2 | Layers = 7 | At end of iteration = 16 | cost = 0.571756209
-----
Circuit = alternative_ckt_2 | Layers = 7 | At end of iteration = 17 | cost = 1.424432342
-----
Circuit = alternative_ckt_2 | Layers = 7 | At end of iteration = 18 | cost = 0.676107898
-----
Circuit = alternative_ckt_2 | Layers = 7 | At end of iteration = 19 | cost = 1.403440825

```

```

-----
Circuit = alternative_ckt_2 | Layers = 7 | At end of iteration = 20 | cost = 1.065218794
-----
Circuit = alternative_ckt_2 | Layers = 7 | At end of iteration = 21 | cost = 0.775619487
-----
Circuit = alternative_ckt_2 | Layers = 7 | At end of iteration = 22 | cost = 0.557962196
-----
Circuit = alternative_ckt_2 | Layers = 7 | At end of iteration = 23 | cost = 0.758953064
-----
Circuit = alternative_ckt_2 | Layers = 7 | At end of iteration = 24 | cost = 1.477646669
-----
Circuit = alternative_ckt_2 | Layers = 7 | At end of iteration = 25 | cost = 1.300009077
-----
Circuit = alternative_ckt_2 | Layers = 7 | At end of iteration = 26 | cost = 1.090152997
-----
Circuit = alternative_ckt_2 | Layers = 7 | At end of iteration = 27 | cost = 0.881512791
-----
Circuit = alternative_ckt_2 | Layers = 7 | At end of iteration = 28 | cost = 0.697486455
-----
Circuit = alternative_ckt_2 | Layers = 7 | At end of iteration = 29 | cost = 0.640753662
-----
Circuit = alternative_ckt_2 | Layers = 7 | At end of iteration = 30 | cost = 1.345720269
-----
Circuit = alternative_ckt_2 | Layers = 7 | At end of iteration = 31 | cost = 0.859154839
-----
Circuit = alternative_ckt_2 | Layers = 7 | At end of iteration = 32 | cost = 0.922137635
-----
Circuit = alternative_ckt_2 | Layers = 7 | At end of iteration = 33 | cost = 1.401471184
-----
Circuit = alternative_ckt_2 | Layers = 7 | At end of iteration = 34 | cost = 0.995902817
-----
Circuit = alternative_ckt_2 | Layers = 7 | At end of iteration = 35 | cost = 0.969101331
-----
Circuit = alternative_ckt_2 | Layers = 7 | At end of iteration = 36 | cost = 1.066980544
-----
Circuit = alternative_ckt_2 | Layers = 7 | At end of iteration = 37 | cost = 1.289145184
-----
Circuit = alternative_ckt_2 | Layers = 7 | At end of iteration = 38 | cost = 0.929399191
-----
Circuit = alternative_ckt_2 | Layers = 7 | At end of iteration = 39 | cost = 0.610727327
-----
REDUCING ALPHA TO 0.31622776601683794 at iteration = 40
-----
Circuit = alternative_ckt_2 | Layers = 7 | At end of iteration = 40 | cost = 0.812627217
-----
Circuit = alternative_ckt_2 | Layers = 7 | At end of iteration = 41 | cost = 0.577988277
-----
Circuit = alternative_ckt_2 | Layers = 7 | At end of iteration = 42 | cost = 0.698058097

```

```

-----
Circuit = alternative_ckt_2 | Layers = 7 | At end of iteration = 43 | cost = 0.6428633130
-----
Circuit = alternative_ckt_2 | Layers = 7 | At end of iteration = 44 | cost = 0.7132324289
-----
Circuit = alternative_ckt_2 | Layers = 7 | At end of iteration = 45 | cost = 0.6194825593
-----
Circuit = alternative_ckt_2 | Layers = 7 | At end of iteration = 46 | cost = 0.7170207929
-----
Circuit = alternative_ckt_2 | Layers = 7 | At end of iteration = 47 | cost = 0.6086562090
-----
Circuit = alternative_ckt_2 | Layers = 7 | At end of iteration = 48 | cost = 0.7207141997
-----
Circuit = alternative_ckt_2 | Layers = 7 | At end of iteration = 49 | cost = 0.5978401329
-----
Circuit = alternative_ckt_2 | Layers = 7 | At end of iteration = 50 | cost = 0.7248800783
-----
Circuit = alternative_ckt_2 | Layers = 7 | At end of iteration = 51 | cost = 0.5867478900
-----
Circuit = alternative_ckt_2 | Layers = 7 | At end of iteration = 52 | cost = 0.7293051704
-----
Circuit = alternative_ckt_2 | Layers = 7 | At end of iteration = 53 | cost = 0.5754575120
-----
Circuit = alternative_ckt_2 | Layers = 7 | At end of iteration = 54 | cost = 0.7339727933
-----
Circuit = alternative_ckt_2 | Layers = 7 | At end of iteration = 55 | cost = 0.5640536900
-----
Circuit = alternative_ckt_2 | Layers = 7 | At end of iteration = 56 | cost = 0.7389321689
-----
Circuit = alternative_ckt_2 | Layers = 7 | At end of iteration = 57 | cost = 0.5525854783
-----
Circuit = alternative_ckt_2 | Layers = 7 | At end of iteration = 58 | cost = 0.7442403411
-----
Circuit = alternative_ckt_2 | Layers = 7 | At end of iteration = 59 | cost = 0.5410741133
-----
Circuit = alternative_ckt_2 | Layers = 7 | At end of iteration = 60 | cost = 0.7499415049
-----
Circuit = alternative_ckt_2 | Layers = 7 | At end of iteration = 61 | cost = 0.5295249849
-----
Circuit = alternative_ckt_2 | Layers = 7 | At end of iteration = 62 | cost = 0.7560603743
-----
Circuit = alternative_ckt_2 | Layers = 7 | At end of iteration = 63 | cost = 0.5179381502
-----
Circuit = alternative_ckt_2 | Layers = 7 | At end of iteration = 64 | cost = 0.7626007829
-----
Circuit = alternative_ckt_2 | Layers = 7 | At end of iteration = 65 | cost = 0.5063161968
-----
Circuit = alternative_ckt_2 | Layers = 7 | At end of iteration = 66 | cost = 0.7695463968
-----

```



```

-----
Circuit = alternative_ckt_2 | Layers = 7 | At end of iteration = 67 | cost = 0.494669384
-----
Circuit = alternative_ckt_2 | Layers = 7 | At end of iteration = 68 | cost = 0.776862555
-----
Circuit = alternative_ckt_2 | Layers = 7 | At end of iteration = 69 | cost = 0.483018264
-----
Circuit = alternative_ckt_2 | Layers = 7 | At end of iteration = 70 | cost = 0.784498907
-----
Circuit = alternative_ckt_2 | Layers = 7 | At end of iteration = 71 | cost = 0.471394145
-----
Circuit = alternative_ckt_2 | Layers = 7 | At end of iteration = 72 | cost = 0.792392674
-----
Circuit = alternative_ckt_2 | Layers = 7 | At end of iteration = 73 | cost = 0.459837920
-----
Circuit = alternative_ckt_2 | Layers = 7 | At end of iteration = 74 | cost = 0.800472307
-----
Circuit = alternative_ckt_2 | Layers = 7 | At end of iteration = 75 | cost = 0.448397853
-----
Circuit = alternative_ckt_2 | Layers = 7 | At end of iteration = 76 | cost = 0.808661210
-----
Circuit = alternative_ckt_2 | Layers = 7 | At end of iteration = 77 | cost = 0.437126951
-----
Circuit = alternative_ckt_2 | Layers = 7 | At end of iteration = 78 | cost = 0.816881225
-----
Circuit = alternative_ckt_2 | Layers = 7 | At end of iteration = 79 | cost = 0.426080398
-----
REDUCING ALPHA TO 0.09999999999999999 at iteration = 80
-----
Circuit = alternative_ckt_2 | Layers = 7 | At end of iteration = 80 | cost = 0.825055692
-----
Circuit = alternative_ckt_2 | Layers = 7 | At end of iteration = 81 | cost = 0.535279246
-----
Circuit = alternative_ckt_2 | Layers = 7 | At end of iteration = 82 | cost = 0.288591069
-----
Circuit = alternative_ckt_2 | Layers = 7 | At end of iteration = 83 | cost = 0.254746625
-----
Circuit = alternative_ckt_2 | Layers = 7 | At end of iteration = 84 | cost = 0.257478101
-----
Circuit = alternative_ckt_2 | Layers = 7 | At end of iteration = 85 | cost = 0.235066975
-----
Circuit = alternative_ckt_2 | Layers = 7 | At end of iteration = 86 | cost = 0.245004519
-----
Circuit = alternative_ckt_2 | Layers = 7 | At end of iteration = 87 | cost = 0.222136021
-----
Circuit = alternative_ckt_2 | Layers = 7 | At end of iteration = 88 | cost = 0.247501977
-----
Circuit = alternative_ckt_2 | Layers = 7 | At end of iteration = 89 | cost = 0.220056480
-----

```

```

-----
Circuit = alternative_ckt_2 | Layers = 7 | At end of iteration = 90 | cost = 0.2741276422
-----
Circuit = alternative_ckt_2 | Layers = 7 | At end of iteration = 91 | cost = 0.2327164374
-----
Circuit = alternative_ckt_2 | Layers = 7 | At end of iteration = 92 | cost = 0.3025010954
-----
Circuit = alternative_ckt_2 | Layers = 7 | At end of iteration = 93 | cost = 0.2368921401
-----
Circuit = alternative_ckt_2 | Layers = 7 | At end of iteration = 94 | cost = 0.3111385671
-----
Circuit = alternative_ckt_2 | Layers = 7 | At end of iteration = 95 | cost = 0.2366808404
-----
Circuit = alternative_ckt_2 | Layers = 7 | At end of iteration = 96 | cost = 0.3162362301
-----
Circuit = alternative_ckt_2 | Layers = 7 | At end of iteration = 97 | cost = 0.2364817701
-----
Circuit = alternative_ckt_2 | Layers = 7 | At end of iteration = 98 | cost = 0.3207761611
-----
Circuit = alternative_ckt_2 | Layers = 7 | At end of iteration = 99 | cost = 0.2362527231
-----
Circuit = alternative_ckt_2 | Layers = 7 | At end of iteration = 100 | cost = 0.3248708511
-----
Circuit = alternative_ckt_2 | Layers = 7 | At end of iteration = 101 | cost = 0.2360156111
-----
Circuit = alternative_ckt_2 | Layers = 7 | At end of iteration = 102 | cost = 0.3286317111
-----
Circuit = alternative_ckt_2 | Layers = 7 | At end of iteration = 103 | cost = 0.2357795611
-----
Circuit = alternative_ckt_2 | Layers = 7 | At end of iteration = 104 | cost = 0.3321436811
-----
Circuit = alternative_ckt_2 | Layers = 7 | At end of iteration = 105 | cost = 0.2355476911
-----
Circuit = alternative_ckt_2 | Layers = 7 | At end of iteration = 106 | cost = 0.3354723411
-----
Circuit = alternative_ckt_2 | Layers = 7 | At end of iteration = 107 | cost = 0.2353195211
-----
Circuit = alternative_ckt_2 | Layers = 7 | At end of iteration = 108 | cost = 0.3386686611
-----
Circuit = alternative_ckt_2 | Layers = 7 | At end of iteration = 109 | cost = 0.2350926811
-----
Circuit = alternative_ckt_2 | Layers = 7 | At end of iteration = 110 | cost = 0.3417724611
-----
Circuit = alternative_ckt_2 | Layers = 7 | At end of iteration = 111 | cost = 0.2348638711
-----
Circuit = alternative_ckt_2 | Layers = 7 | At end of iteration = 112 | cost = 0.3448148211
-----
Circuit = alternative_ckt_2 | Layers = 7 | At end of iteration = 113 | cost = 0.2346295611
-----

```

```

-----
Circuit = alternative_ckt_2 | Layers = 7 | At end of iteration = 114 | cost = 0.34781991
-----
Circuit = alternative_ckt_2 | Layers = 7 | At end of iteration = 115 | cost = 0.23438625
-----
Circuit = alternative_ckt_2 | Layers = 7 | At end of iteration = 116 | cost = 0.35080634
-----
Circuit = alternative_ckt_2 | Layers = 7 | At end of iteration = 117 | cost = 0.23413079
-----
Circuit = alternative_ckt_2 | Layers = 7 | At end of iteration = 118 | cost = 0.35378815
-----
Circuit = alternative_ckt_2 | Layers = 7 | At end of iteration = 119 | cost = 0.23386044
-----
REDUCING ALPHA TO 0.03162277660168379 at iteration = 120
-----
Circuit = alternative_ckt_2 | Layers = 7 | At end of iteration = 120 | cost = 0.35677571
-----
Circuit = alternative_ckt_2 | Layers = 7 | At end of iteration = 121 | cost = 0.22704504
-----
Circuit = alternative_ckt_2 | Layers = 7 | At end of iteration = 122 | cost = 0.16342905
-----
Circuit = alternative_ckt_2 | Layers = 7 | At end of iteration = 123 | cost = 0.15797589
-----
Circuit = alternative_ckt_2 | Layers = 7 | At end of iteration = 124 | cost = 0.15773004
-----
Circuit = alternative_ckt_2 | Layers = 7 | At end of iteration = 125 | cost = 0.15669942
-----
Circuit = alternative_ckt_2 | Layers = 7 | At end of iteration = 126 | cost = 0.15591858
-----
Circuit = alternative_ckt_2 | Layers = 7 | At end of iteration = 127 | cost = 0.15514258
-----
Circuit = alternative_ckt_2 | Layers = 7 | At end of iteration = 128 | cost = 0.15441397
-----
Circuit = alternative_ckt_2 | Layers = 7 | At end of iteration = 129 | cost = 0.15371319
-----
Circuit = alternative_ckt_2 | Layers = 7 | At end of iteration = 130 | cost = 0.15303795
-----
Circuit = alternative_ckt_2 | Layers = 7 | At end of iteration = 131 | cost = 0.15238339
-----
Circuit = alternative_ckt_2 | Layers = 7 | At end of iteration = 132 | cost = 0.15174655
-----
Circuit = alternative_ckt_2 | Layers = 7 | At end of iteration = 133 | cost = 0.15112494
-----
Circuit = alternative_ckt_2 | Layers = 7 | At end of iteration = 134 | cost = 0.15051666
-----
Circuit = alternative_ckt_2 | Layers = 7 | At end of iteration = 135 | cost = 0.14992021
-----
Circuit = alternative_ckt_2 | Layers = 7 | At end of iteration = 136 | cost = 0.14933444
-----

```

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-----
Circuit = alternative_ckt_2 | Layers = 7 | At end of iteration = 137 | cost = 0.14875843
-----
Circuit = alternative_ckt_2 | Layers = 7 | At end of iteration = 138 | cost = 0.14819153
-----
Circuit = alternative_ckt_2 | Layers = 7 | At end of iteration = 139 | cost = 0.14763321
-----
Circuit = alternative_ckt_2 | Layers = 7 | At end of iteration = 140 | cost = 0.14708312
-----
Circuit = alternative_ckt_2 | Layers = 7 | At end of iteration = 141 | cost = 0.14654103
-----
Circuit = alternative_ckt_2 | Layers = 7 | At end of iteration = 142 | cost = 0.14600680
-----
Circuit = alternative_ckt_2 | Layers = 7 | At end of iteration = 143 | cost = 0.14548039
-----
Circuit = alternative_ckt_2 | Layers = 7 | At end of iteration = 144 | cost = 0.14496183
-----
Circuit = alternative_ckt_2 | Layers = 7 | At end of iteration = 145 | cost = 0.14445122
-----
Circuit = alternative_ckt_2 | Layers = 7 | At end of iteration = 146 | cost = 0.14394872
-----
Circuit = alternative_ckt_2 | Layers = 7 | At end of iteration = 147 | cost = 0.14345452
-----
Circuit = alternative_ckt_2 | Layers = 7 | At end of iteration = 148 | cost = 0.14296888
-----
Circuit = alternative_ckt_2 | Layers = 7 | At end of iteration = 149 | cost = 0.14249209
-----
Circuit = alternative_ckt_2 | Layers = 7 | At end of iteration = 150 | cost = 0.14202447
-----
Circuit = alternative_ckt_2 | Layers = 7 | At end of iteration = 151 | cost = 0.14156638
-----
Circuit = alternative_ckt_2 | Layers = 7 | At end of iteration = 152 | cost = 0.14111821
-----
Circuit = alternative_ckt_2 | Layers = 7 | At end of iteration = 153 | cost = 0.14068038
-----
Circuit = alternative_ckt_2 | Layers = 7 | At end of iteration = 154 | cost = 0.14025330
-----
Circuit = alternative_ckt_2 | Layers = 7 | At end of iteration = 155 | cost = 0.13983745
-----
Circuit = alternative_ckt_2 | Layers = 7 | At end of iteration = 156 | cost = 0.13943329
-----
Circuit = alternative_ckt_2 | Layers = 7 | At end of iteration = 157 | cost = 0.13904130
-----
Circuit = alternative_ckt_2 | Layers = 7 | At end of iteration = 158 | cost = 0.13866199
-----
Circuit = alternative_ckt_2 | Layers = 7 | At end of iteration = 159 | cost = 0.13829586
-----
Circuit = alternative_ckt_2 | Layers = 7 | At end of iteration = 160 | cost = 0.13794342
-----

```

```

-----
Circuit = alternative_ckt_2 | Layers = 7 | At end of iteration = 161 | cost = 0.13760519
-----
Circuit = alternative_ckt_2 | Layers = 7 | At end of iteration = 162 | cost = 0.13728168
-----
Circuit = alternative_ckt_2 | Layers = 7 | At end of iteration = 163 | cost = 0.13697340
-----
Circuit = alternative_ckt_2 | Layers = 7 | At end of iteration = 164 | cost = 0.13668085
-----
Circuit = alternative_ckt_2 | Layers = 7 | At end of iteration = 165 | cost = 0.13640453
-----
Circuit = alternative_ckt_2 | Layers = 7 | At end of iteration = 166 | cost = 0.13614489
-----
Circuit = alternative_ckt_2 | Layers = 7 | At end of iteration = 167 | cost = 0.13590242
-----
Circuit = alternative_ckt_2 | Layers = 7 | At end of iteration = 168 | cost = 0.13567754
-----
Circuit = alternative_ckt_2 | Layers = 7 | At end of iteration = 169 | cost = 0.13547065
-----
Circuit = alternative_ckt_2 | Layers = 7 | At end of iteration = 170 | cost = 0.13528215
-----
Circuit = alternative_ckt_2 | Layers = 7 | At end of iteration = 171 | cost = 0.13511238
-----
Circuit = alternative_ckt_2 | Layers = 7 | At end of iteration = 172 | cost = 0.13496165
-----
Circuit = alternative_ckt_2 | Layers = 7 | At end of iteration = 173 | cost = 0.13483024
-----
Circuit = alternative_ckt_2 | Layers = 7 | At end of iteration = 174 | cost = 0.13471838
-----
Circuit = alternative_ckt_2 | Layers = 7 | At end of iteration = 175 | cost = 0.13462626
-----
Circuit = alternative_ckt_2 | Layers = 7 | At end of iteration = 176 | cost = 0.13455402
-----
Circuit = alternative_ckt_2 | Layers = 7 | At end of iteration = 177 | cost = 0.13450176
-----
Circuit = alternative_ckt_2 | Layers = 7 | At end of iteration = 178 | cost = 0.13446953
-----
Circuit = alternative_ckt_2 | Layers = 7 | At end of iteration = 179 | cost = 0.13445731
-----
Circuit = alternative_ckt_2 | Layers = 7 | At end of iteration = 180 | cost = 0.13446505
-----
Circuit = alternative_ckt_2 | Layers = 7 | At end of iteration = 181 | cost = 0.13449266
-----
Circuit = alternative_ckt_2 | Layers = 7 | At end of iteration = 182 | cost = 0.13453996
-----
Circuit = alternative_ckt_2 | Layers = 7 | At end of iteration = 183 | cost = 0.13460677
-----
Circuit = alternative_ckt_2 | Layers = 7 | At end of iteration = 184 | cost = 0.13469282
-----

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-----
Circuit = alternative_ckt_2 | Layers = 7 | At end of iteration = 185 | cost = 0.13479782
-----
Circuit = alternative_ckt_2 | Layers = 7 | At end of iteration = 186 | cost = 0.13492141
-----
Circuit = alternative_ckt_2 | Layers = 7 | At end of iteration = 187 | cost = 0.13506322
-----
Circuit = alternative_ckt_2 | Layers = 7 | At end of iteration = 188 | cost = 0.13522281
-----
Circuit = alternative_ckt_2 | Layers = 7 | At end of iteration = 189 | cost = 0.13539973
-----
Circuit = alternative_ckt_2 | Layers = 7 | At end of iteration = 190 | cost = 0.13559347
-----
Circuit = alternative_ckt_2 | Layers = 7 | At end of iteration = 191 | cost = 0.13580350
-----
Circuit = alternative_ckt_2 | Layers = 7 | At end of iteration = 192 | cost = 0.13602928
-----
Circuit = alternative_ckt_2 | Layers = 7 | At end of iteration = 193 | cost = 0.13627022
-----
Circuit = alternative_ckt_2 | Layers = 7 | At end of iteration = 194 | cost = 0.13652572
-----
Circuit = alternative_ckt_2 | Layers = 7 | At end of iteration = 195 | cost = 0.13679516
-----
Circuit = alternative_ckt_2 | Layers = 7 | At end of iteration = 196 | cost = 0.13707793
-----
Circuit = alternative_ckt_2 | Layers = 7 | At end of iteration = 197 | cost = 0.13737337
-----
Circuit = alternative_ckt_2 | Layers = 7 | At end of iteration = 198 | cost = 0.13768085
-----
Circuit = alternative_ckt_2 | Layers = 7 | At end of iteration = 199 | cost = 0.13799971
-----
Circuit = alternative_ckt_2 | Layers = 7 | At end of iteration = 200 | cost = 0.13832930
-----
Circuit = alternative_ckt_2 | Layers = 7 | At end of iteration = 201 | cost = 0.13866898
-----
Circuit = alternative_ckt_2 | Layers = 7 | At end of iteration = 202 | cost = 0.13901810
-----
Circuit = alternative_ckt_2 | Layers = 7 | At end of iteration = 203 | cost = 0.13937603
-----
Circuit = alternative_ckt_2 | Layers = 7 | At end of iteration = 204 | cost = 0.13974214
-----
Circuit = alternative_ckt_2 | Layers = 7 | At end of iteration = 205 | cost = 0.14011581
-----
Circuit = alternative_ckt_2 | Layers = 7 | At end of iteration = 206 | cost = 0.14049645
-----
Circuit = alternative_ckt_2 | Layers = 7 | At end of iteration = 207 | cost = 0.14088347
-----
Circuit = alternative_ckt_2 | Layers = 7 | At end of iteration = 208 | cost = 0.14127629
-----

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-----
Circuit = alternative_ckt_2 | Layers = 7 | At end of iteration = 209 | cost = 0.14167437
-----
Circuit = alternative_ckt_2 | Layers = 7 | At end of iteration = 210 | cost = 0.14207716
-----
Circuit = alternative_ckt_2 | Layers = 7 | At end of iteration = 211 | cost = 0.14248414
-----
Circuit = alternative_ckt_2 | Layers = 7 | At end of iteration = 212 | cost = 0.14289483
-----
Circuit = alternative_ckt_2 | Layers = 7 | At end of iteration = 213 | cost = 0.14330874
-----
Circuit = alternative_ckt_2 | Layers = 7 | At end of iteration = 214 | cost = 0.14372542
-----
Circuit = alternative_ckt_2 | Layers = 7 | At end of iteration = 215 | cost = 0.14414443
-----
Circuit = alternative_ckt_2 | Layers = 7 | At end of iteration = 216 | cost = 0.14456534
-----
Circuit = alternative_ckt_2 | Layers = 7 | At end of iteration = 217 | cost = 0.14498778
-----
Circuit = alternative_ckt_2 | Layers = 7 | At end of iteration = 218 | cost = 0.14541135
-----
Circuit = alternative_ckt_2 | Layers = 7 | At end of iteration = 219 | cost = 0.14583571
-----
Circuit = alternative_ckt_2 | Layers = 7 | At end of iteration = 220 | cost = 0.14626052
-----
Circuit = alternative_ckt_2 | Layers = 7 | At end of iteration = 221 | cost = 0.14668546
-----
Circuit = alternative_ckt_2 | Layers = 7 | At end of iteration = 222 | cost = 0.14711023
-----
Circuit = alternative_ckt_2 | Layers = 7 | At end of iteration = 223 | cost = 0.14753456
-----
Circuit = alternative_ckt_2 | Layers = 7 | At end of iteration = 224 | cost = 0.14795819
-----
Circuit = alternative_ckt_2 | Layers = 7 | At end of iteration = 225 | cost = 0.14838087
-----
Circuit = alternative_ckt_2 | Layers = 7 | At end of iteration = 226 | cost = 0.14880237
-----
Circuit = alternative_ckt_2 | Layers = 7 | At end of iteration = 227 | cost = 0.14922249
-----
Circuit = alternative_ckt_2 | Layers = 7 | At end of iteration = 228 | cost = 0.14964103
-----
Circuit = alternative_ckt_2 | Layers = 7 | At end of iteration = 229 | cost = 0.15005781
-----
Circuit = alternative_ckt_2 | Layers = 7 | At end of iteration = 230 | cost = 0.15047267
-----
Circuit = alternative_ckt_2 | Layers = 7 | At end of iteration = 231 | cost = 0.15088546
-----
Circuit = alternative_ckt_2 | Layers = 7 | At end of iteration = 232 | cost = 0.15129604
-----

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Circuit = alternative_ckt_2 Layers = 7 At end of iteration = 233 cost = 0.15170428
Circuit = alternative_ckt_2 Layers = 7 At end of iteration = 234 cost = 0.15211007
Circuit = alternative_ckt_2 Layers = 7 At end of iteration = 235 cost = 0.15251332
Circuit = alternative_ckt_2 Layers = 7 At end of iteration = 236 cost = 0.15291392
Circuit = alternative_ckt_2 Layers = 7 At end of iteration = 237 cost = 0.15331181
Circuit = alternative_ckt_2 Layers = 7 At end of iteration = 238 cost = 0.15370691
Circuit = alternative_ckt_2 Layers = 7 At end of iteration = 239 cost = 0.15409916
Circuit = alternative_ckt_2 Layers = 7 At end of iteration = 240 cost = 0.15448852
Circuit = alternative_ckt_2 Layers = 7 At end of iteration = 241 cost = 0.15487492
Circuit = alternative_ckt_2 Layers = 7 At end of iteration = 242 cost = 0.15525835
Circuit = alternative_ckt_2 Layers = 7 At end of iteration = 243 cost = 0.15563878
Circuit = alternative_ckt_2 Layers = 7 At end of iteration = 244 cost = 0.15601617
Circuit = alternative_ckt_2 Layers = 7 At end of iteration = 245 cost = 0.15639052
Circuit = alternative_ckt_2 Layers = 7 At end of iteration = 246 cost = 0.15676181
Circuit = alternative_ckt_2 Layers = 7 At end of iteration = 247 cost = 0.15713005
Circuit = alternative_ckt_2 Layers = 7 At end of iteration = 248 cost = 0.15749524
Circuit = alternative_ckt_2 Layers = 7 At end of iteration = 249 cost = 0.15785737
Circuit = alternative_ckt_2 Layers = 7 At end of iteration = 250 cost = 0.15821647
Circuit = alternative_ckt_2 Layers = 7 At end of iteration = 251 cost = 0.15857255
Circuit = alternative_ckt_2 Layers = 7 At end of iteration = 252 cost = 0.15892562
Circuit = alternative_ckt_2 Layers = 7 At end of iteration = 253 cost = 0.15927572
Circuit = alternative_ckt_2 Layers = 7 At end of iteration = 254 cost = 0.15962285
Circuit = alternative_ckt_2 Layers = 7 At end of iteration = 255 cost = 0.15996706
Circuit = alternative_ckt_2 Layers = 7 At end of iteration = 256 cost = 0.16030838


```

-----
Circuit = alternative_ckt_2 | Layers = 7 | At end of iteration = 257 | cost = 0.16064682
-----
Circuit = alternative_ckt_2 | Layers = 7 | At end of iteration = 258 | cost = 0.16098244
-----
Circuit = alternative_ckt_2 | Layers = 7 | At end of iteration = 259 | cost = 0.16131527
-----
Circuit = alternative_ckt_2 | Layers = 7 | At end of iteration = 260 | cost = 0.16164534
-----
Circuit = alternative_ckt_2 | Layers = 7 | At end of iteration = 261 | cost = 0.16197270
-----
Circuit = alternative_ckt_2 | Layers = 7 | At end of iteration = 262 | cost = 0.16229738
-----
Circuit = alternative_ckt_2 | Layers = 7 | At end of iteration = 263 | cost = 0.16261944
-----
Circuit = alternative_ckt_2 | Layers = 7 | At end of iteration = 264 | cost = 0.16293890
-----
Circuit = alternative_ckt_2 | Layers = 7 | At end of iteration = 265 | cost = 0.16325581
-----
Circuit = alternative_ckt_2 | Layers = 7 | At end of iteration = 266 | cost = 0.16357022
-----
Circuit = alternative_ckt_2 | Layers = 7 | At end of iteration = 267 | cost = 0.16388216
-----
Circuit = alternative_ckt_2 | Layers = 7 | At end of iteration = 268 | cost = 0.16419169
-----
Circuit = alternative_ckt_2 | Layers = 7 | At end of iteration = 269 | cost = 0.16449884
-----
Circuit = alternative_ckt_2 | Layers = 7 | At end of iteration = 270 | cost = 0.16480365
-----
Circuit = alternative_ckt_2 | Layers = 7 | At end of iteration = 271 | cost = 0.16510617
-----
Circuit = alternative_ckt_2 | Layers = 7 | At end of iteration = 272 | cost = 0.16540644
-----
Circuit = alternative_ckt_2 | Layers = 7 | At end of iteration = 273 | cost = 0.16570450
-----
Circuit = alternative_ckt_2 | Layers = 7 | At end of iteration = 274 | cost = 0.16600039
-----
Circuit = alternative_ckt_2 | Layers = 7 | At end of iteration = 275 | cost = 0.16629415
-----
Circuit = alternative_ckt_2 | Layers = 7 | At end of iteration = 276 | cost = 0.16658581
-----
Circuit = alternative_ckt_2 | Layers = 7 | At end of iteration = 277 | cost = 0.16687541
-----
Circuit = alternative_ckt_2 | Layers = 7 | At end of iteration = 278 | cost = 0.16716299
-----
Circuit = alternative_ckt_2 | Layers = 7 | At end of iteration = 279 | cost = 0.16744858
-----
Circuit = alternative_ckt_2 | Layers = 7 | At end of iteration = 280 | cost = 0.16773222
-----

```



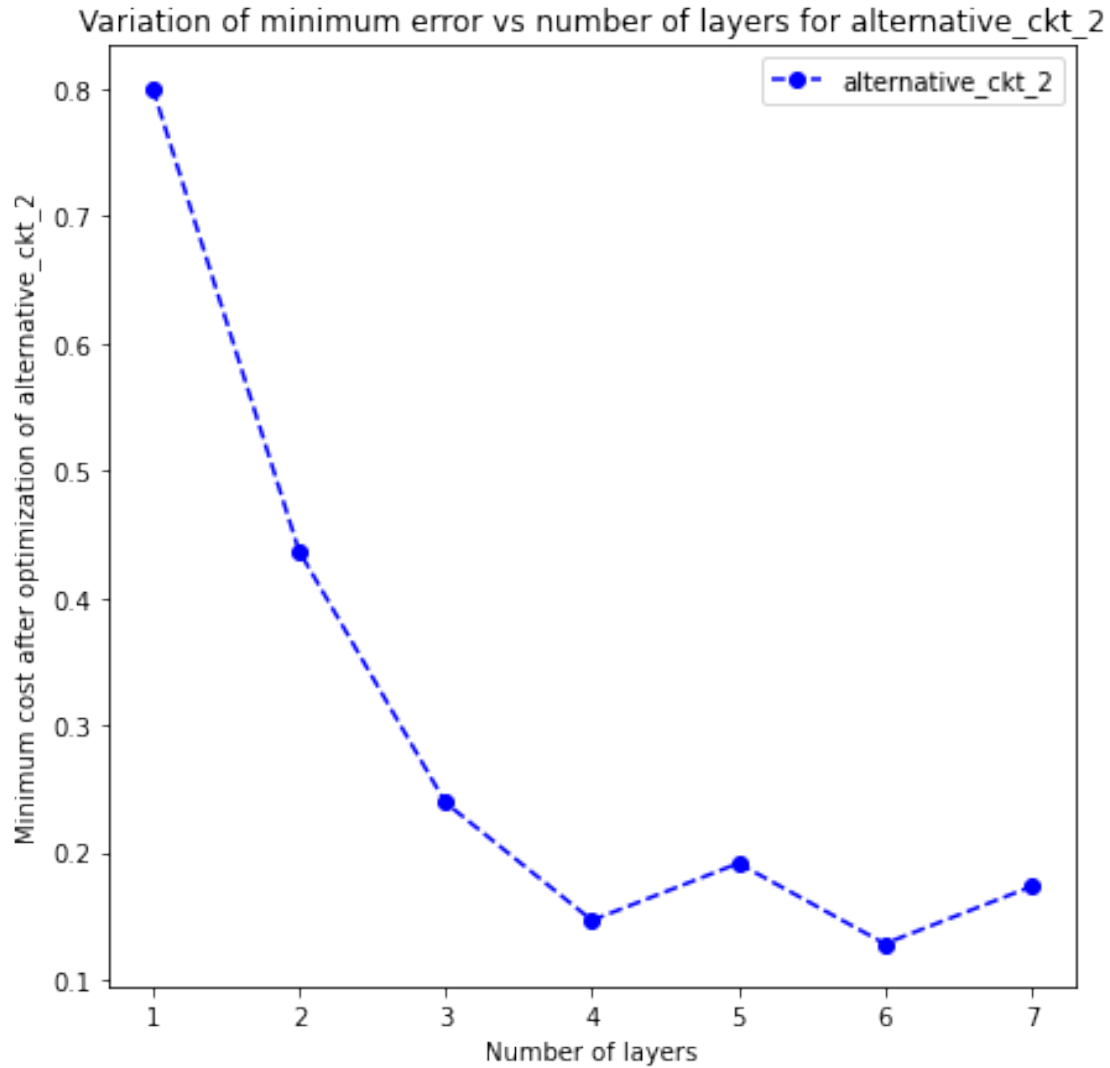
```
[ 0.15627801+0.07934794j]
[ 0.19918423-0.01031588j]
[ 0.22234576+0.1332216j ]
[ 0.13144201+0.08460837j]
[-0.00685954+0.08882205j]
[ 0.28560482+0.04331183j]
[ 0.18052815+0.05885869j]
[ 0.27402116+0.02997563j]
[ 0.09672445+0.02431024j]
[ 0.29860958+0.21387487j]
[ 0.16694684-0.04983384j]
[ 0.23716386+0.24963819j]
[ 0.2294394 +0.14175837j]]
```

```
-----
Circuit = alternative_ckt_2 Layers = 7 Cost after optimization = 0.17302879526937998
-----
```

```
After optimization for all specified layers, the respective minimum costs for alternative_ckt.
[0.80030005 0.43664946 0.23893696 0.14644138 0.19128487 0.12811426
0.1730288 ]
```

Plotting the cost vs number of layers gives a similar plot:

```
In [21]: c6.show_plot()
```

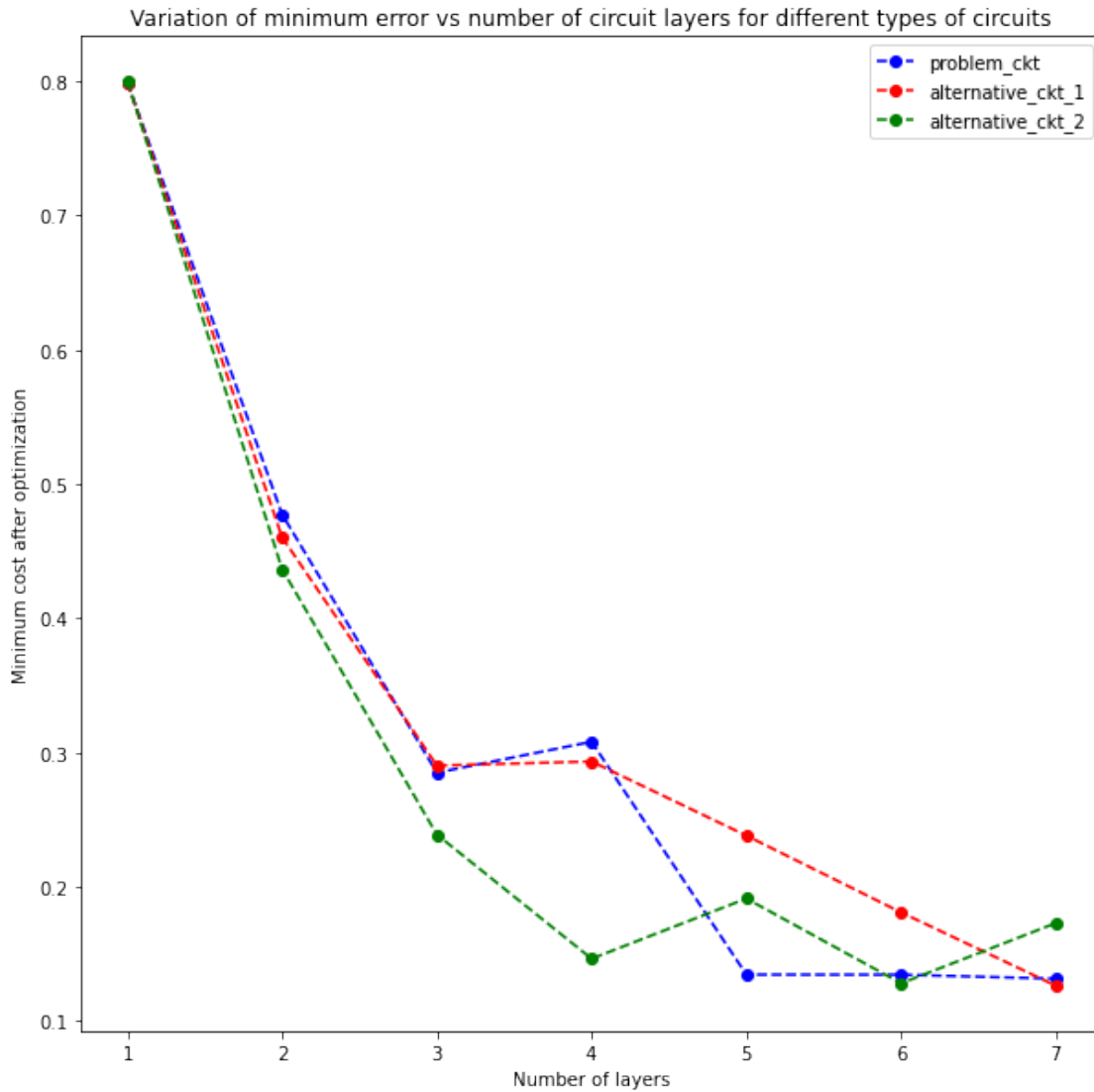


0.0.12 A comparison

Plotting the results for all three types of circuits on the same scale gives the following:

```
In [22]: xa1 = c2.layer_arr
         ya1 = c2.cost_arr
         plt.figure(figsize=(10,10))
         plt.plot(xa1,ya1,'--bo', label='problem_ckt')
         ya2 = c4.cost_arr
         plt.plot(xa1, ya2, '--ro', label='alternative_ckt_1')
         ya3 = c6.cost_arr
         plt.plot(xa1, ya3, '--go', label='alternative_ckt_2')
         plt.legend()
         plt.xlabel("Number of layers")
```

```
plt.ylabel("Minimum cost after optimization")
plt.title("Variation of minimum error vs number of circuit layers for different types")
plt.show()
```



From this graph, it seems that the following can be concluded:

- For all three types of circuits considered here, the reduction and then saturation of the error while simulating a random quantum state seems to be a general trend.
- For the three and four layer cases, out of the three types of circuits, alternative_ckt_2 (the one with U3 gates) seems to give a lower error than the other two.

0.0.13 Conclusion

- The minimum error while simulating a random quantum state from a variational circuit (of such a type) initially reduces sharply, and then the rate of reduction slows down, as

the number of layers is increased. This reduction and then saturation of the error while simulating a random quantum state seems to be a general trend, at least for this class of circuits which have layers of alternating rotation and entanglement blocks.

- The circuit which uses U3 gates (alternative_ckt_2) gives lower error than the other 2 types of circuits when the number of layers is three and four. Therefore, it is possible that some types of circuit choices can approximate the arbitrary quantum state much more closely than others. In applications where circuit depth is a constraint, such circuits might be useful.
- The learning rate is an important parameter which can impact the optimization process.

0.0.14 Scope for further exploration

- Different types of entanglement mapping in the even layer could be explored and may lead to circuits which can simulate the target state well even with less number of layers than the ones studied here.
- The behaviour of minimum error can be studied for even higher number of layers.
- Optimization techniques with adaptive learning rates could be tried.