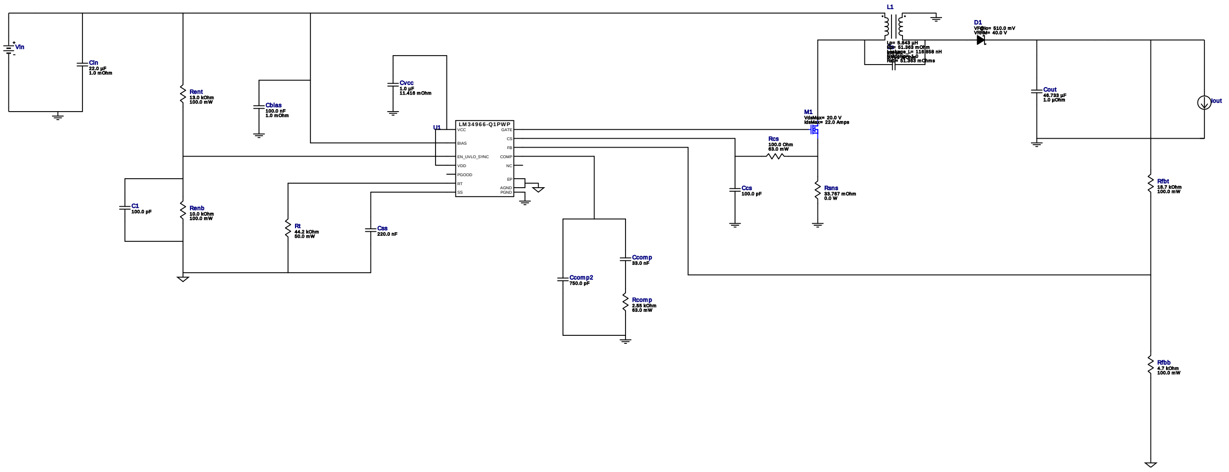
VinMin = 3.7V
VinMax = 4.2V
Vout = 5.0V
Iout = 0.8A

Device = LM34966QPWPRQ1
Topology = SEPIC
Created = 2023-03-09 10:53:28.034
BOM Cost = NA
BOM Count = 22
Total Pd = 0.42W

WEBENCH ® Design Report

Design : 1 LM34966QPWPRQ1
LM34966QPWPRQ1 3.7V-4.2V to 5.00V @ 0.8A



Design Alerts

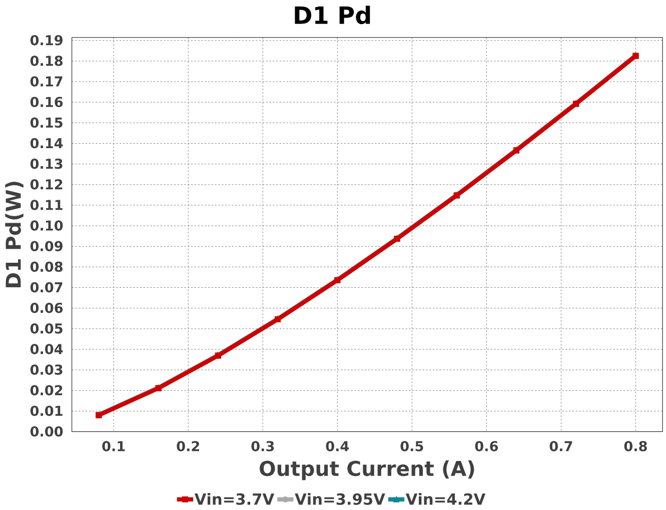
Component Selection Information

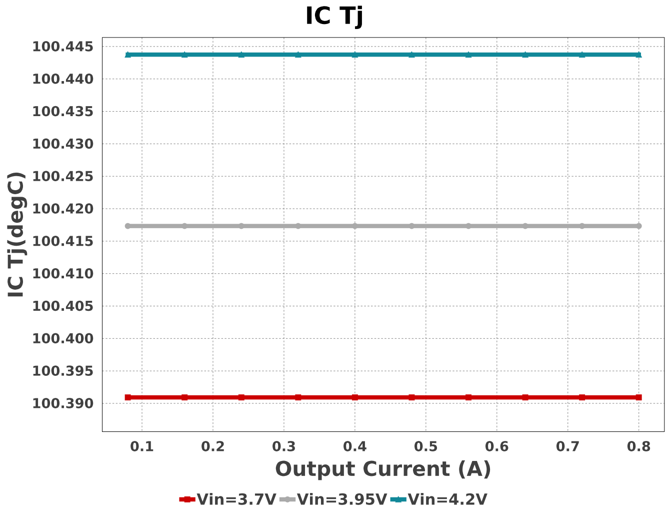
The LM34966-Q1 is qualified for Automotive applications. All passives and other components selected in this design may not be qualified for Automotive applications. The user is required to verify that all components in the design meet the qualification and safety requirements for their specific application. View WEBENCH(R) Disclaimer

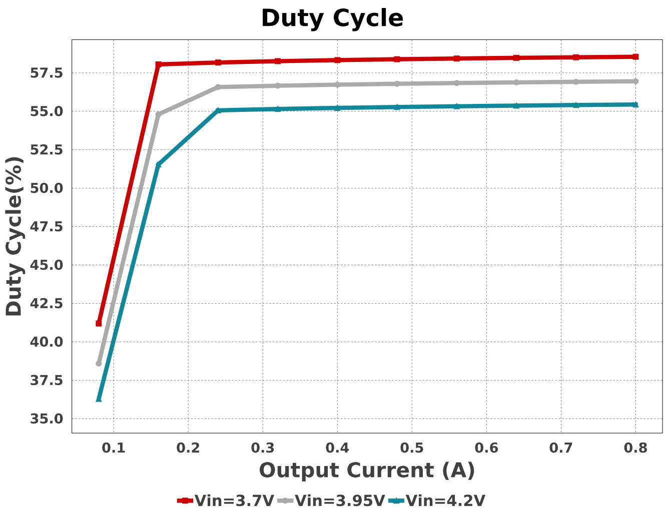
Electrical BOM

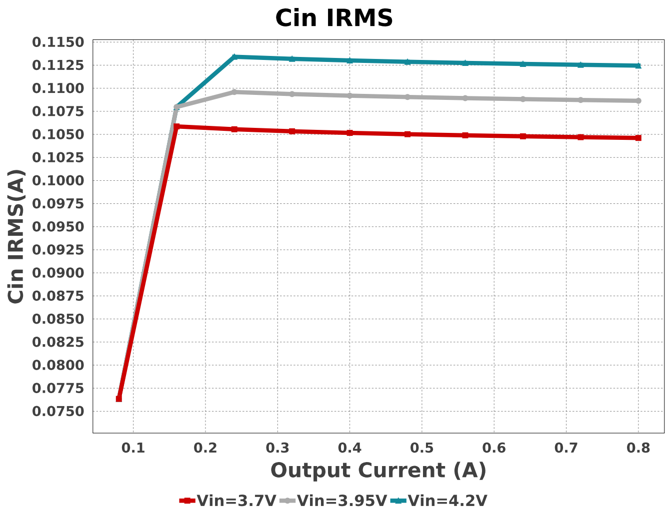
Name	Manufacturer	Part Number	Properties	Qty	Price	Footprint
C1	TDK	C0402C0G1C101J020BC Series= C0G/NP0	Cap= 100.0 pF VDC= 16.0 V IRMS= 0.0 A	1	$0.03	01005 2 mm^2
Cbias	MuRata	GRM155R70J104KA01D Series= X7R	Cap= 100.0 nF ESR= 1.0 mOhm VDC= 6.3 V IRMS= 0.0 A	1	$0.01	0402 3 mm^2
Ccomp	TDK	CGA4J2C0G1H333J125AA Series= C0G/NP0	Cap= 33.0 nF VDC= 50.0 V IRMS= 0.0 A	1	$0.08	0805 7 mm^2
Ccomp2	MuRata	GRM1555C1H751GA01D Series= C0G/NP0	Cap= 750.0 pF VDC= 50.0 V IRMS= 0.0 A	1	$0.04	0402 3 mm^2
Ccs	TDK	C0402C0G1C101J020BC Series= C0G/NP0	Cap= 100.0 pF VDC= 16.0 V IRMS= 0.0 A	1	$0.03	01005 2 mm^2
Cin	TDK	C2012X7S1A226M125AC Series= X7S	Cap= 22.0 uF ESR= 1.0 mOhm VDC= 10.0 V IRMS= 0.0 A	1	$0.26	0805 7 mm^2
Cout	CUSTOM	CUSTOM Series= ?	Cap= 46.733 uF ESR= 1.0 uOhm VDC= 10.0 V IRMS= 1.1651 A	1	NA	CUSTOM 0 mm^2
Cs	TDK	C2012X6S1C685K125AC Series= X6S	Cap= 6.8 uF ESR= 3.795 mOhm VDC= 16.0 V IRMS= 3.3493 A	1	$0.11	0805 7 mm^2

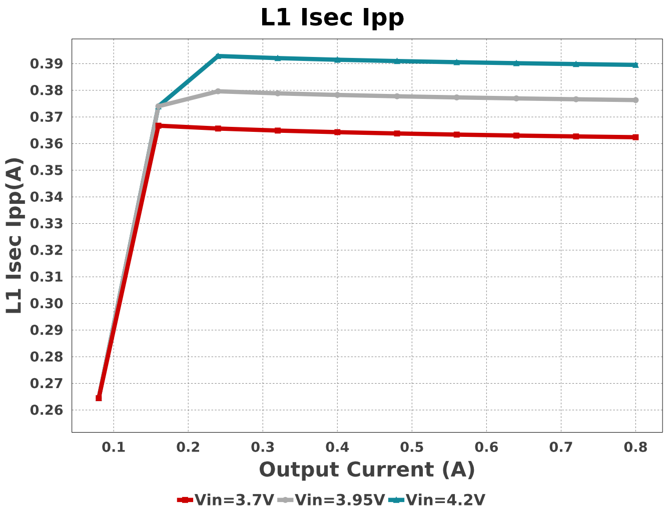
Name	Manufacturer	Part Number	Properties	Qty	Price	Footprint
Css	Kemet	C1210C224J3GACTU Series= C0G/NP0	Cap= 220.0 nF VDC= 5.0 V IRMS= 0.0 A	1	$1.63	1210 15 mm^2
Cvcc	TDK	C1005X6S1C105K050BC Series= X6S	Cap= 1.0 uF ESR= 11.416 mOhm VDC= 16.0 V IRMS= 1.483 A	1	$0.02	0402 3 mm^2
D1	Vishay-Semiconductor	50WQ04FNPBF	VF@Io= 510.0 mV VRRM= 40.0 V	1	$0.40	DPAK 102 mm^2
L1	CUSTOM	CUSTOM	Lp= 5.843 µH Rp= 51.363 mOhm Leakage_L= 116.858 nH Ns1toNp= 1.0 Rs1= 51.363 mOhms	1	NA	CUSTOM 0 mm^2
M1	Texas Instruments	CSD15571Q2	VdsMax= 20.0 V IdsMax= 22.0 Amps	1	$0.10	DQK0006C 9 mm^2
Rcomp	Vishay-Dale	CRCW04022K55FKED Series= CRCW..e3	Res= 2.55 kOhm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	0402 3 mm^2
Rcs	Vishay-Dale	CRCW0402100RFKED Series= CRCW..e3	Res= 100.0 Ohm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	0402 3 mm^2
Renb	Susumu Co Ltd	RG1608P-103-B-T5 Series= RG1608	Res= 10.0 kOhm Power= 100.0 mW Tolerance= 0.1%	1	$0.04	0603 5 mm^2
Rent	Yageo	RT0603BRD0713KL Series= ?	Res= 13.0 kOhm Power= 100.0 mW Tolerance= 0.1%	1	$0.04	0603 5 mm^2
Rfbb	Susumu Co Ltd	RG1608P-472-B-T5 Series= RG1608	Res= 4.7 kOhm Power= 100.0 mW Tolerance= 0.1%	1	$0.04	0603 5 mm^2
Rfbt	Susumu Co Ltd	RG1608P-1872-B-T5 Series= RG1608	Res= 18.7 kOhm Power= 100.0 mW Tolerance= 0.1%	1	$0.06	0603 5 mm^2
Rsns	CUSTOM	CUSTOM Series= ?	Res= 33.767 mOhm Power= 0.0 W Tolerance= 0.0%	1	NA	CUSTOM 0 mm^2
Rt	Vishay-Dale	CRCW020144K2FNED Series= ?	Res= 44.2 kOhm Power= 50.0 mW Tolerance= 1.0%	1	$0.01	0201 2 mm^2
U1	Texas Instruments	LM34966QPWPRQ1	Switcher	1	$0.83	PWP0014H 59 mm^2

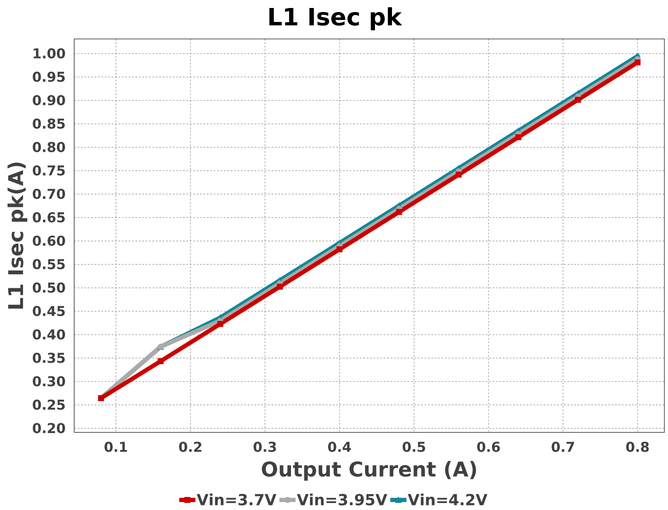

D1 Pd
D1 Pd(W)
Output Current (A)
Vin=3.7V Vin=3.95V Vin=4.2V


IC Tj
IC Tj(degC)
Output Current (A)
Vin=3.7V Vin=3.95V Vin=4.2V

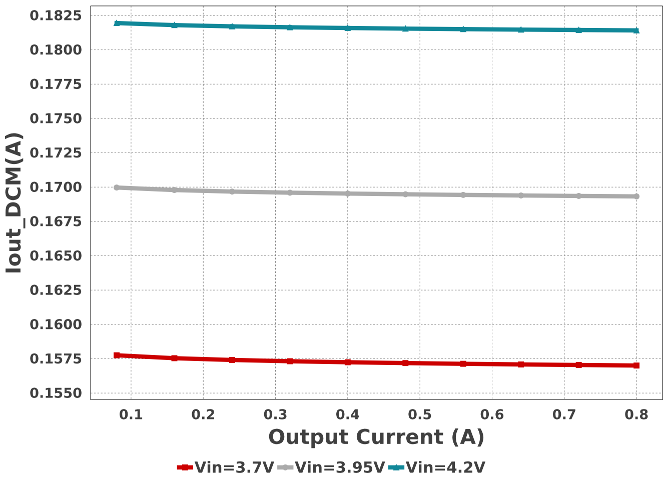

Duty Cycle
Duty Cycle(%)
Output Current (A)
Vin=3.7V Vin=3.95V Vin=4.2V


Cin IRMS
Cin IRMS(A)
Output Current (A)
Vin=3.7V Vin=3.95V Vin=4.2V

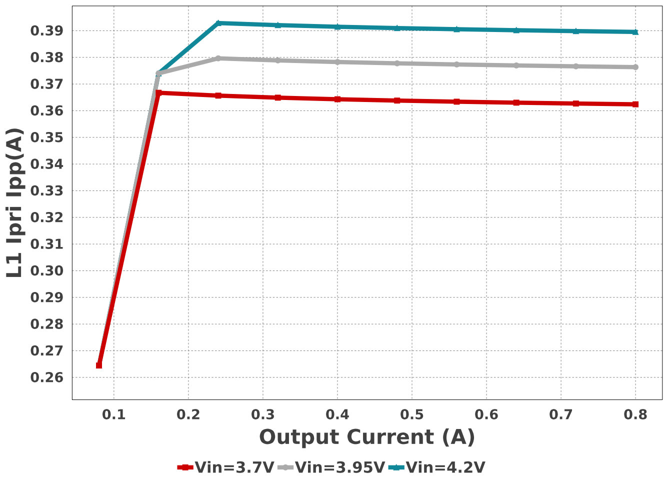

L1 Isec Ipp
L1 Isec Ipp(A)
Output Current (A)
Vin=3.7V Vin=3.95V Vin=4.2V


L1 Isec pk
L1 Isec pk(A)
Output Current (A)
Vin=3.7V Vin=3.95V Vin=4.2V

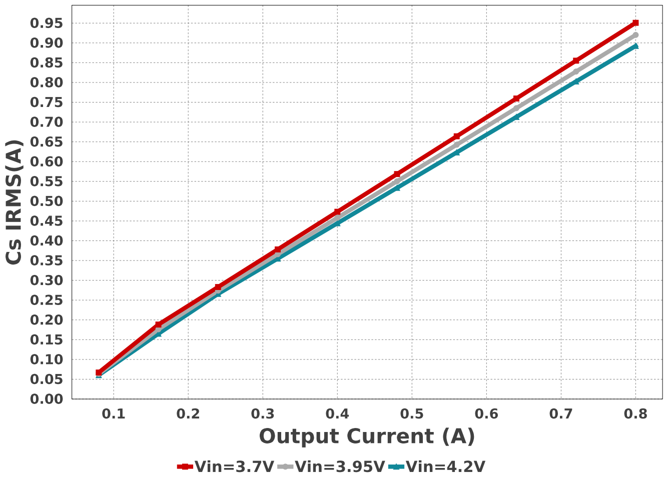
Iout_DCM



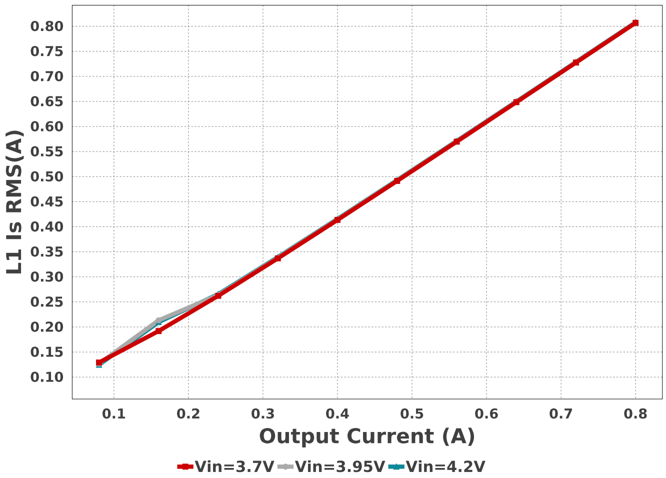
L1 Ipri Ipp



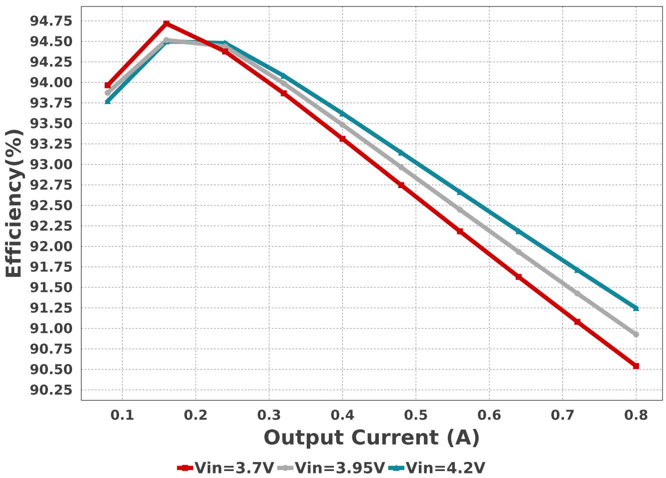
Cs IRMS



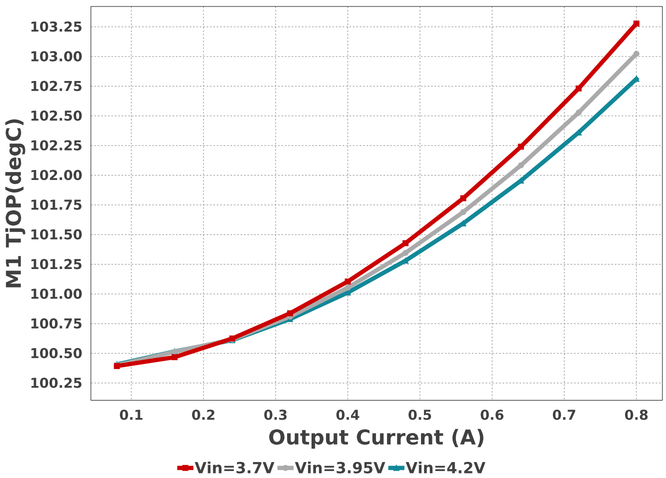
L1 Is RMS

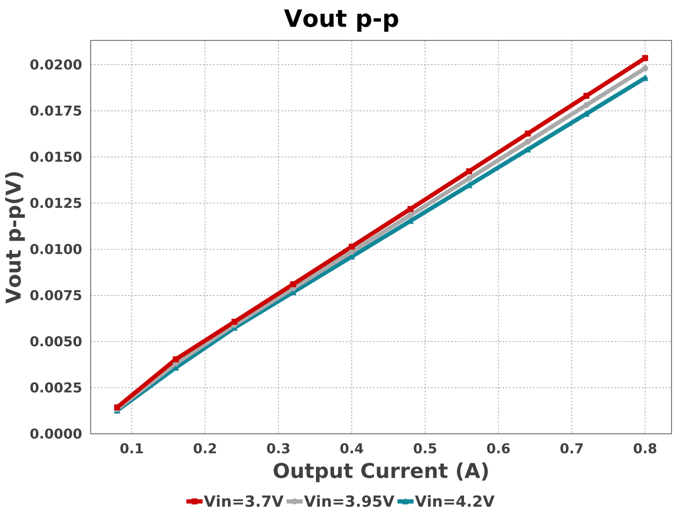


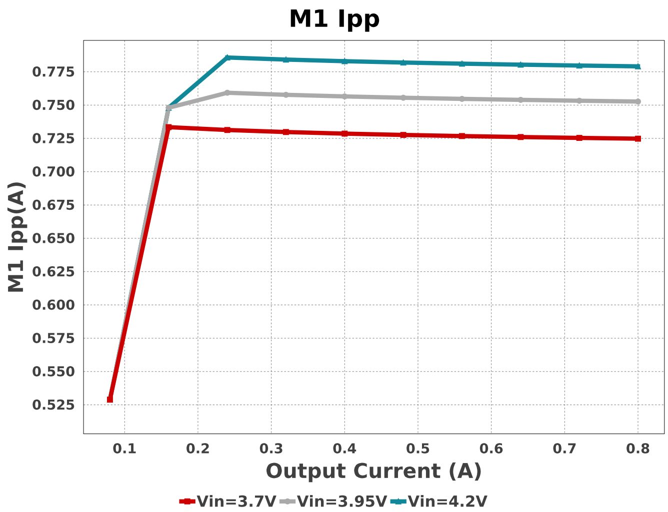
Efficiency

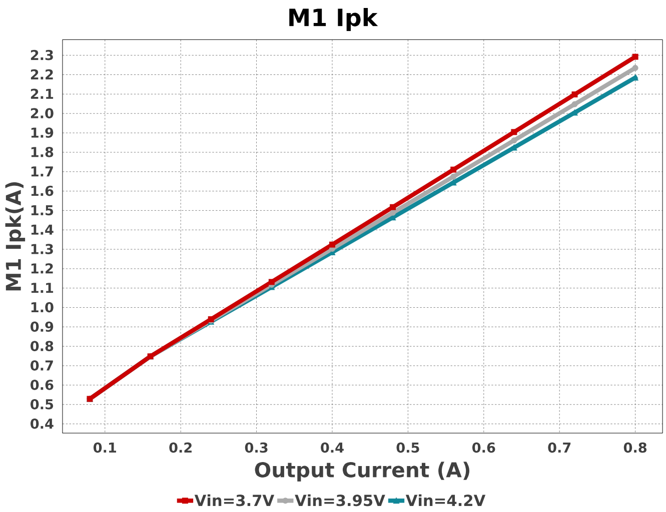


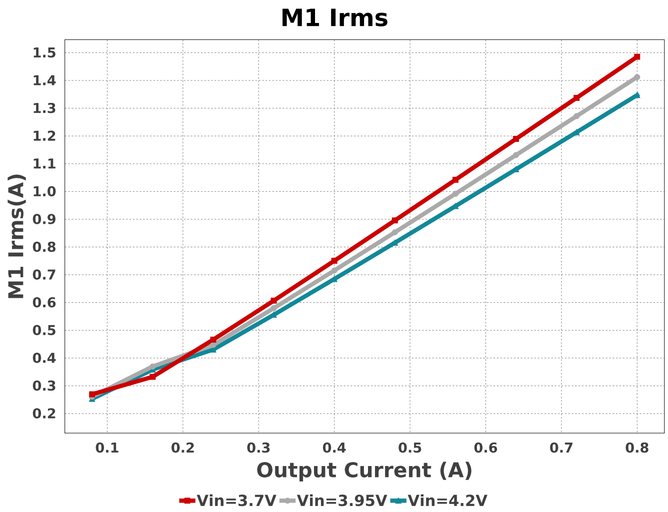
M1 TjOP

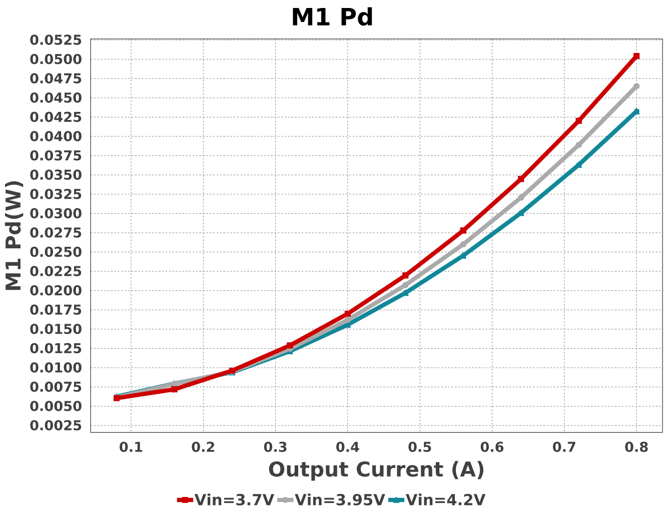


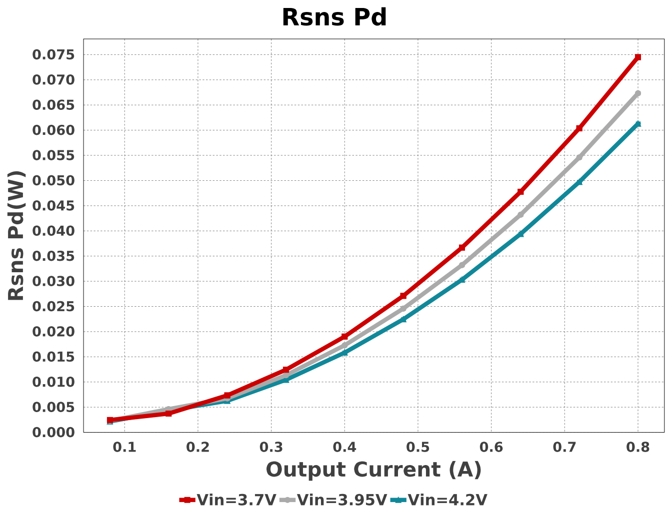

Vout p-p
Vout p-p(V)
Output Current (A)
Vin=3.7V Vin=3.95V Vin=4.2V

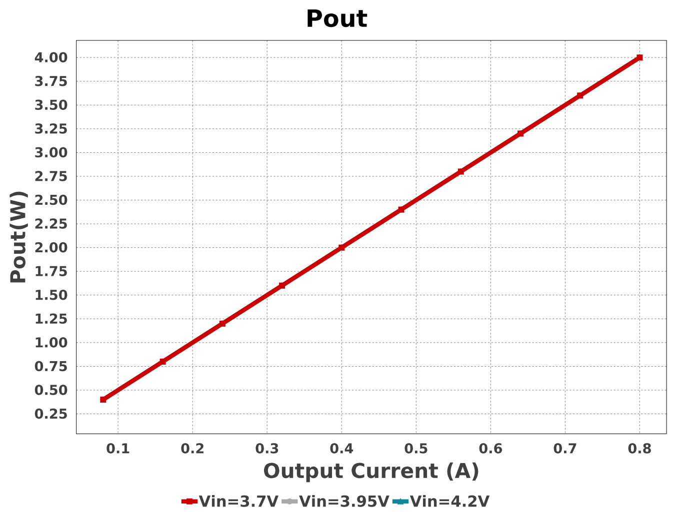

M1 Ipp
M1 Ipp(A)
Output Current (A)
Vin=3.7V Vin=3.95V Vin=4.2V

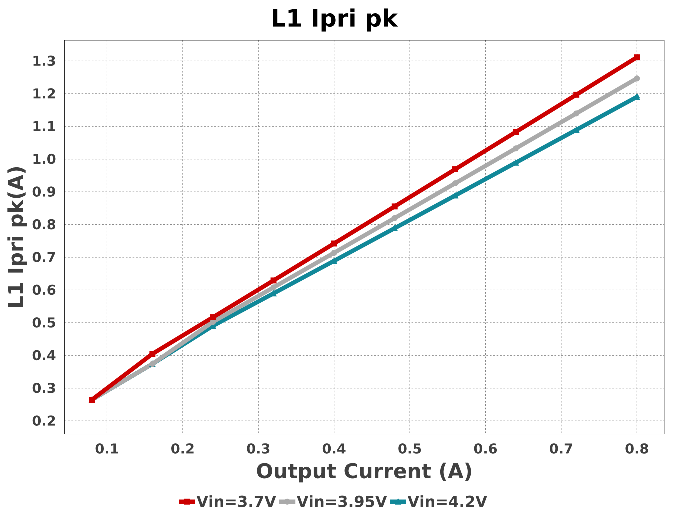

M1 Ipk
M1 Ipk(A)
Output Current (A)
Vin=3.7V Vin=3.95V Vin=4.2V

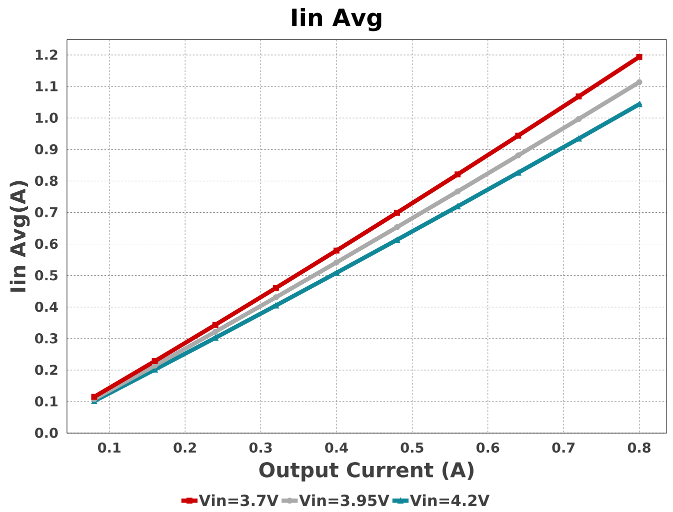

M1 Irms
M1 Irms(A)
Output Current (A)
Vin=3.7V Vin=3.95V Vin=4.2V

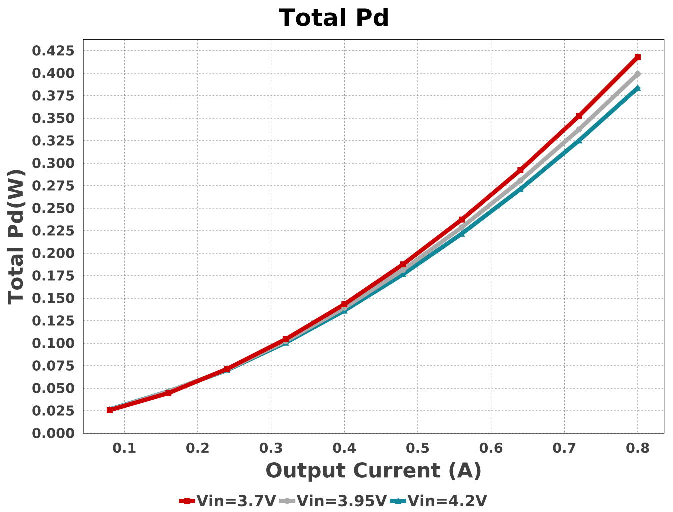

M1 Pd
M1 Pd(W)
Output Current (A)
Vin=3.7V Vin=3.95V Vin=4.2V

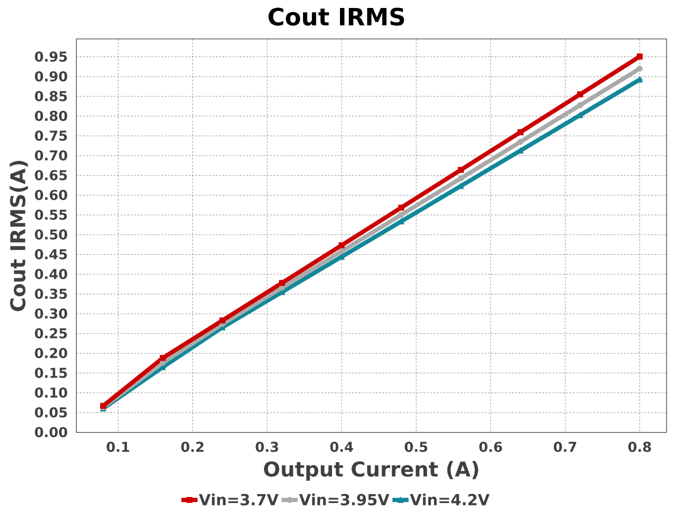

Rsns Pd
Rsns Pd(W)
Output Current (A)
Vin=3.7V Vin=3.95V Vin=4.2V

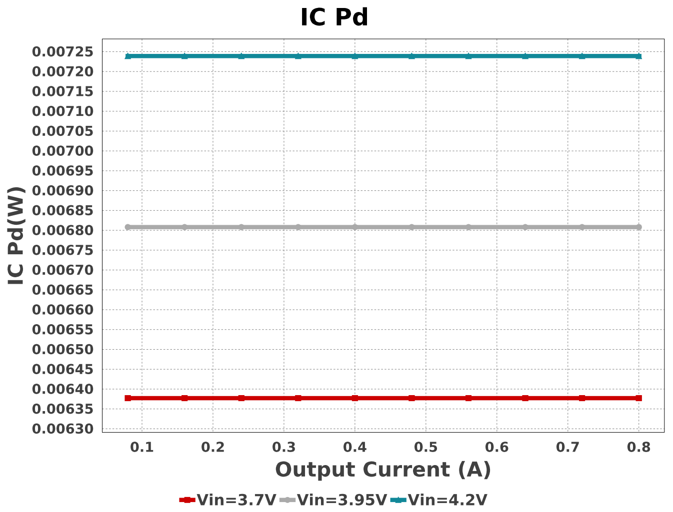

Pout
Pout(W)
4.00
3.75
3.50
3.25
3.00
2.75
2.50
2.25
2.00
1.75
1.50
1.25
1.00
0.75
0.50
0.25
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
Output Current (A)
Vin=3.7V Vin=3.95V Vin=4.2V

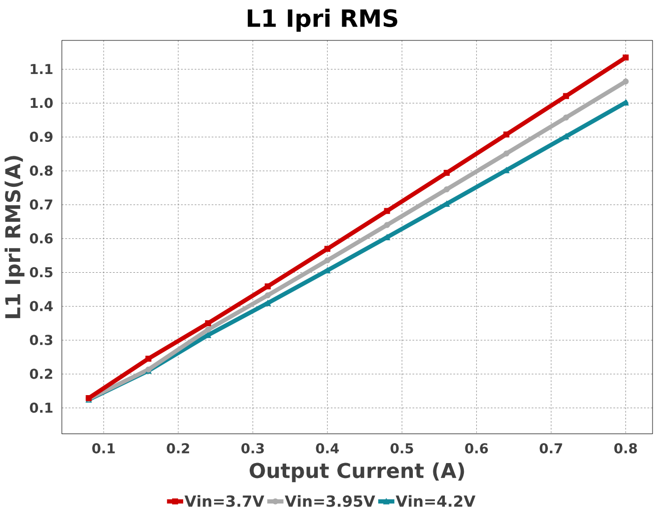

L1 Ipri pk
L1 Ipri pk(A)
1.3
1.2
1.1
1.0
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
Output Current (A)
Vin=3.7V Vin=3.95V Vin=4.2V

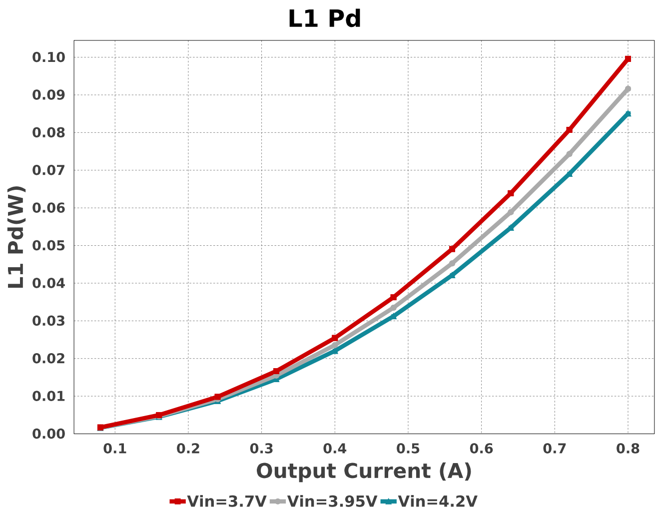

Iin Avg
Iin Avg(A)
1.2
1.1
1.0
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0.0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
Output Current (A)
Vin=3.7V Vin=3.95V Vin=4.2V


Total Pd
Total Pd(W)
0.425
0.400
0.375
0.350
0.325
0.300
0.275
0.250
0.225
0.200
0.175
0.150
0.125
0.100
0.075
0.050
0.025
0.000
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
Output Current (A)
Vin=3.7V Vin=3.95V Vin=4.2V


Cout IRMS
Cout IRMS(A)
0.95
0.90
0.85
0.80
0.75
0.70
0.65
0.60
0.55
0.50
0.45
0.40
0.35
0.30
0.25
0.20
0.15
0.10
0.05
0.00
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
Output Current (A)
Vin=3.7V Vin=3.95V Vin=4.2V


IC Pd
IC Pd(W)
0.00725
0.00720
0.00715
0.00710
0.00705
0.00700
0.00695
0.00690
0.00685
0.00680
0.00675
0.00670
0.00665
0.00660
0.00655
0.00650
0.00645
0.00640
0.00635
0.00630
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
Output Current (A)
Vin=3.7V Vin=3.95V Vin=4.2V





Operating Values

#	Name	Value	Category	Description
1.	Cin IRMS	104.614 mA	Capacitor	Input capacitor RMS ripple current
2.	Cout IRMS	950.749 mA	Capacitor	Output capacitor RMS ripple current
3.	Cs IRMS	950.749 mA	Capacitor	Coupling capacitor RMS ripple current
4.	M1 Ipk	2.292 A	Current	M1 peak current.
5.	D1 Pd	182.5 mW	Diode	Output Diode Power Dissipation
6.	IC Pd	6.377 mW	IC	IC power dissipation
7.	IC Tj	100.391 degC	IC	IC junction temperature
8.	ICThetaJA	61.3 degC/W	IC	IC junction-to-ambient thermal resistance
9.	Iin Avg	1.194 A	IC	Average input current
10.	M1 Irms	1.485 A	Mosfet	M1 MOSFET Irms
11.	M1 Pd	50.42 mW	Mosfet	M1 MOSFET total power dissipation
12.	M1 TjOP	103.277 degC	Mosfet	M1 MOSFET junction temperature
13.	D1 Pd	182.5 mW	Power	Output Diode Power Dissipation
14.	IC Pd	6.377 mW	Power	IC power dissipation
15.	L1 Pd	99.57 mW	Power	Power Dissipation in the Inductor
16.	M1 Pd	50.42 mW	Power	M1 MOSFET total power dissipation
17.	Rsns Pd	74.497 mW	Power	Current Limit Sense Resistor Power Dissipation
18.	Total Pd	417.88 mW	Power	Total Power Dissipation
19.	Rsns Pd	74.497 mW	Resistor	Current Limit Sense Resistor Power Dissipation
20.	BOM Count	22	System Information	Total Design BOM count
21.	Duty Cycle	58.547 %	System Information	Duty cycle
22.	Efficiency	90.541 %	System Information	Steady state efficiency
23.	FootPrint	374.0 mm^2	System Information	Total Foot Print Area of BOM components
24.	Frequency	489.425 kHz	System Information	Switching frequency
25.	Iout	800.0 mA	System Information	Iout operating point
26.	Iout_DCM	157.006 mA	System Information	Approximate Current below which DCM mode of operation will begin
27.	M1 Ipp	724.786 mA	System Information	M1 ripple pk-pk.
28.	Mode	CCM	System Information	Conduction Mode
29.	Pout	4.0 W	System Information	Total output power
30.	Total BOM	NA	System Information	Total BOM Cost
31.	Vin	3.7 V	System Information	Vin operating point
32.	Vout	5.0 V	System Information	Operational Output Voltage
33.	Vout Actual	4.979 V	System Information	Vout Actual calculated based on selected voltage divider resistors
34.	Vout Tolerance	961.269 m%	System Information	Vout Tolerance based on IC Tolerance (no load) and voltage divider resistors if applicable
35.	Vout p-p	20.362 mV	System Information	Peak-to-peak output ripple voltage
36.	L1 Ipri Ipp	362.393 mA	Transformer	L1 primary side ripple pk-pk.

#	Name	Value	Category	Description
37.	L1 Ipri RMS	1.135 A	Transformer	L1 primary rms current.
38.	L1 Ipri pk	1.311 A	Transformer	L1 primary pk current.
39.	L1 Is RMS	806.811 mA	Transformer	L1 secondary rms current
40.	L1 Isec Ipp	362.393 mA	Transformer	L1 secondary side ripple pk-pk.
41.	L1 Isec pk	981.196 mA	Transformer	Peak current in L1 secondary
42.	L1 Pd	99.57 mW	Transformer	Power Dissipation in the Inductor

Design Inputs

Name	Value	Description
Iout	800.0 m	Maximum Output Current
VinMax	4.2	Maximum input voltage
VinMin	3.7	Minimum input voltage
Vout	5.0	Output Voltage
base_pn	LM34966-Q1	Base Product Number
source	DC	Input Source Type
Ta	100.0	Ambient temperature

WEBENCH® Assembly

Component Testing

Some published data on components in datasheets such as Capacitor ESR and Inductor DC resistance is based on conservative values that will guarantee that the components always exceed the specification. For design purposes it is usually better to work with typical values. Since this data is not always available it is a good practice to measure the Capacitance and ESR values of Cin and Cout, and the inductance and DC resistance of L1 before assembly of the board. Any large discrepancies in values should be electrically simulated in WEBENCH to check for instabilities and thermally simulated in WebTHERM to make sure critical temperatures are not exceeded.

Soldering Component to Board

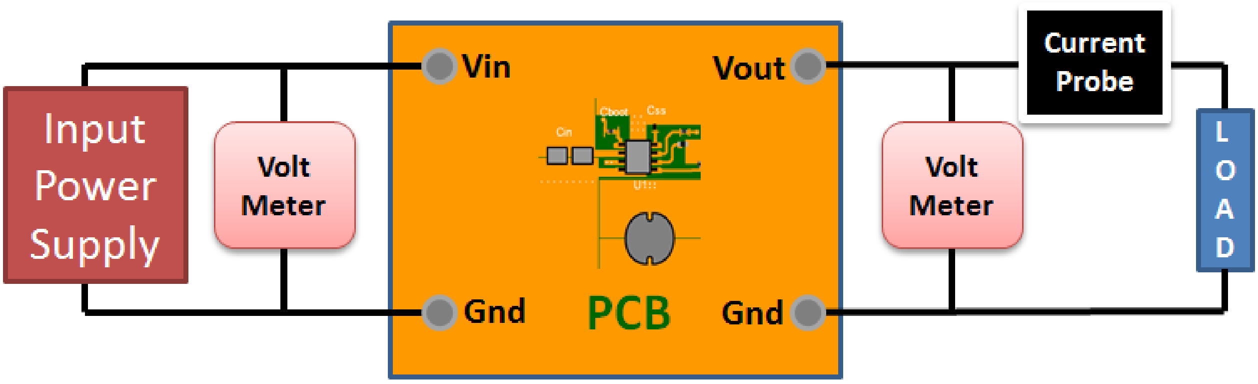
If board assembly is done in house it is best to tack down one terminal of a component on the board then solder the other terminal. For surface mount parts with large tabs, such as the DPAK, the tab on the back of the package should be pre-tinned with solder, then tacked into place by one of the pins. To solder the tab town to the board place the iron down on the board while resting against the tab, heating both surfaces simultaneously. Apply light pressure to the top of the plastic case until the solder flows around the part and the part is flush with the PCB. If the solder is not flowing around the board you may need a higher wattage iron (generally 25W to 30W is enough).

Initial Startup of Circuit

It is best to initially power up the board by setting the input supply voltage to the lowest operating input voltage 3.7V and set the input supply's current limit to zero. With the input supply off connect up the input supply to Vin and GND. Connect a digital volt meter and a load if needed to set the minimum Iout of the design from Vout and GND. Turn on the input supply and slowly turn up the current limit on the input supply. If the voltage starts to rise on the input supply continue increasing the input supply current limit while watching the output voltage. If the current increases on the input supply, but the voltage remains near zero, then there may be a short or a component misplaced on the board. Power down the board and visually inspect for solder bridges and recheck the diode and capacitor polarities. Once the power supply circuit is operational then more extensive testing may include full load testing, transient load and line tests to compare with simulation results.

Load Testing

The setup is the same as the initial startup, except that an additional digital voltmeter is connected between Vin and GND, a load is connected between Vout and GND and a current meter is connected in series between Vout and the load. The load must be able to handle at least rated output power + 50% (7.5 watts for this design). Ideally the load is supplied in the form of a variable load test unit. It can also be done in the form of suitably large power resistors. When using an oscilloscope to measure waveforms on the prototype board, the ground leads of the oscilloscope probes should be as short as possible and the area of the loop formed by the ground lead should be kept to a minimum. This will help reduce ground lead inductance and eliminate EMI noise that is not actually present in the circuit.



Design Assistance

1. The LM34966-Q1 is qualified for Automotive applications. All passives and other components selected in this design may not be qualified for Automotive applications. The user is required to verify that all components in the design meet the qualification and safety requirements for their specific application

2. Master key : 8203A6C6CAD8EBA8BF27793E47B632A6[v1]

3. **LM34966-Q1** Product Folder : http://www.ti.com/product/LM34966%2DQ1 : contains the data sheet and other resources.

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