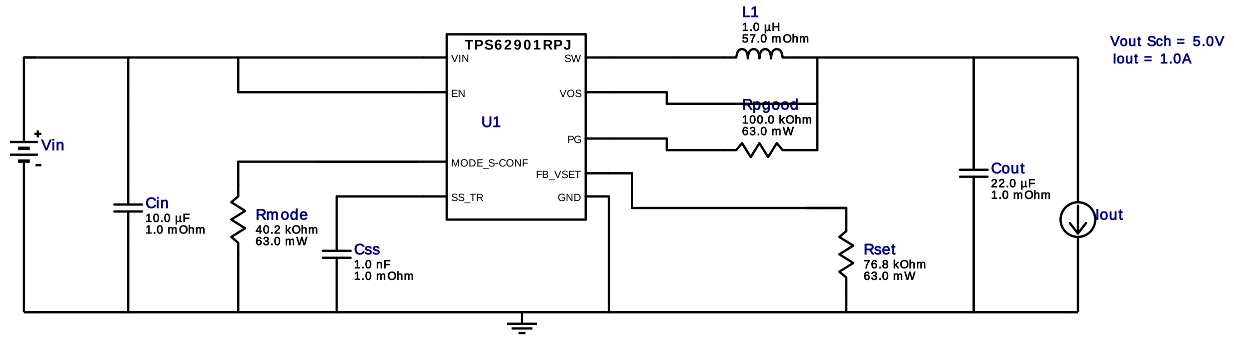
VinMin = 10.0V
VinMax = 16.0V
Vout = 5.0V
Vout Sch = 5.0V
Iout = 1.0A

Device = TPS62901RPJR
Topology = Buck
Created = 2023-12-06 01:01:43.767
BOM Cost = $0.78
BOM Count = 8
Total Pd = 0.66W

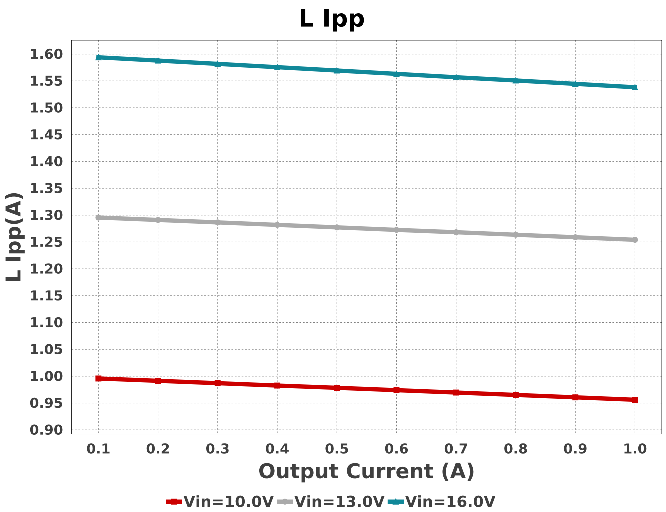
WEBENCH ® Design Report

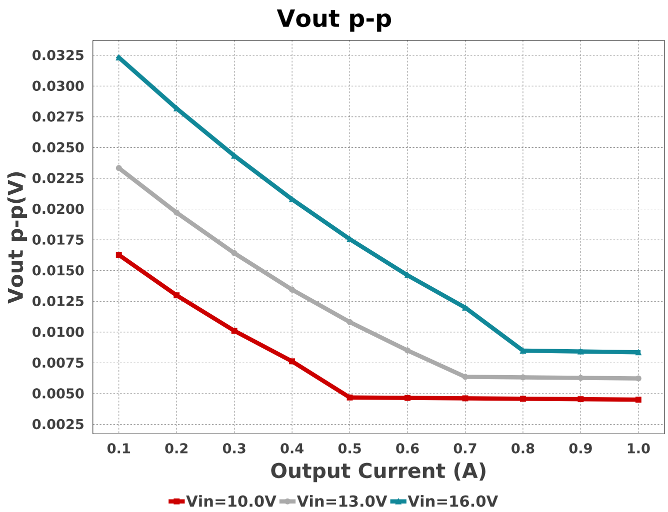
Design : 16 TPS62901RPJR
TPS62901RPJR 10V-16V to 5.00V @ 1A

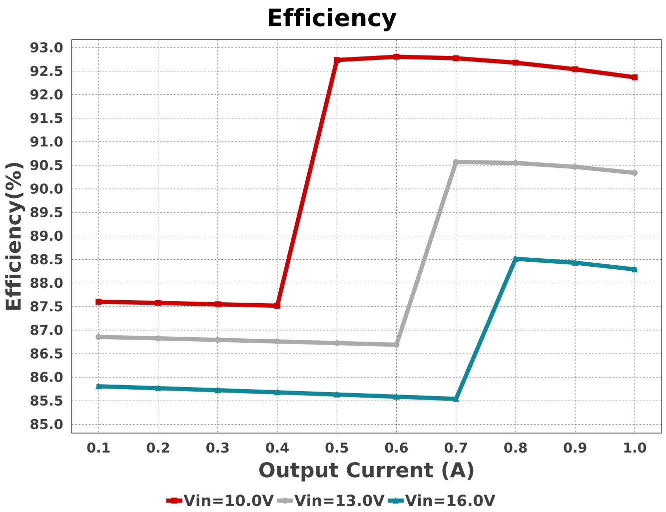


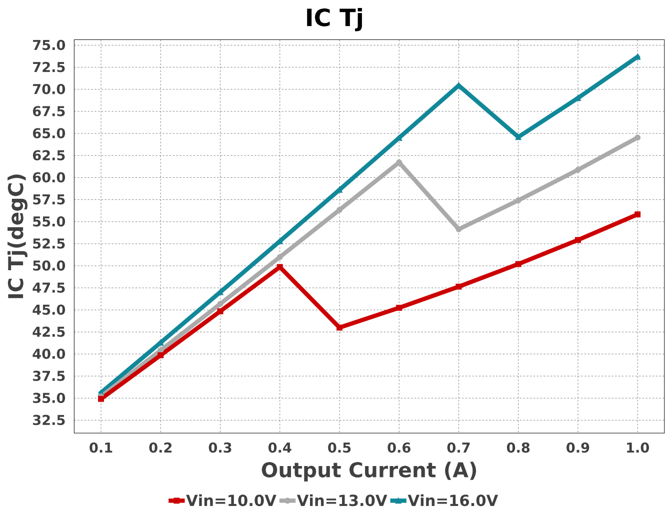
Electrical BOM

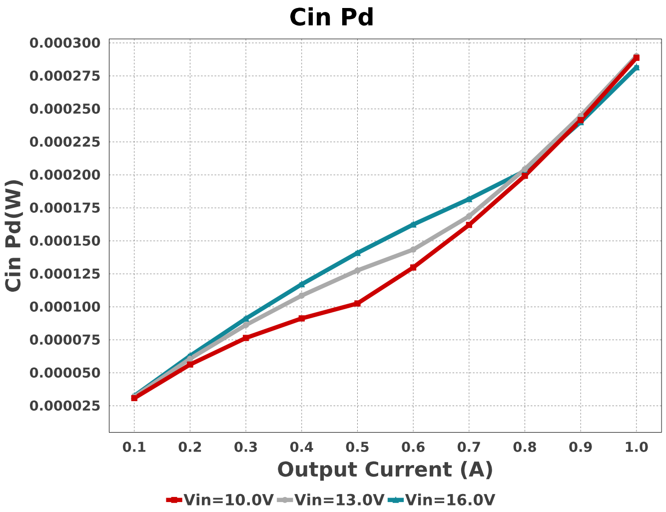
Name	Manufacturer	Part Number	Properties	Qty	Price	Footprint
Cin	MuRata	GRM219R61E106KA12 Series= X5R	Cap= 10.0 uF ESR= 1.0 mOhm VDC= 25.0 V IRMS= 0.0 A	1	$0.05	0805 7 mm²
Cout	MuRata	GRM21BD70J226ME44L Series= X7T	Cap= 22.0 uF ESR= 1.0 mOhm VDC= 6.3 V IRMS= 6.0 A	1	$0.10	0805 7 mm²
Css	MuRata	GRM155R61A102KA01D Series= X5R	Cap= 1.0 nF ESR= 1.0 mOhm VDC= 10.0 V IRMS= 0.0 A	1	$0.01	0402 3 mm²
L1	MuRata	DFE201610E-1R0M=P2	L= 1.0 µH 57.0 mOhm	1	$0.11	DFE201610E 8 mm²
Rmode	Vishay-Dale	CRCW040240K2FKED Series= CRCW..e3	Res= 40.2 kOhm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	0402 3 mm²
Rpgood	Vishay-Dale	CRCW0402100KFKED Series= CRCW..e3	Res= 100.0 kOhm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	0402 3 mm²
Rset	Vishay-Dale	CRCW040276K8FKED Series= CRCW..e3	Res= 76.8 kOhm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	0402 3 mm²
U1	Texas Instruments	TPS62901RPJR	Switcher	1	$0.48	RPJ0009A 8 mm²

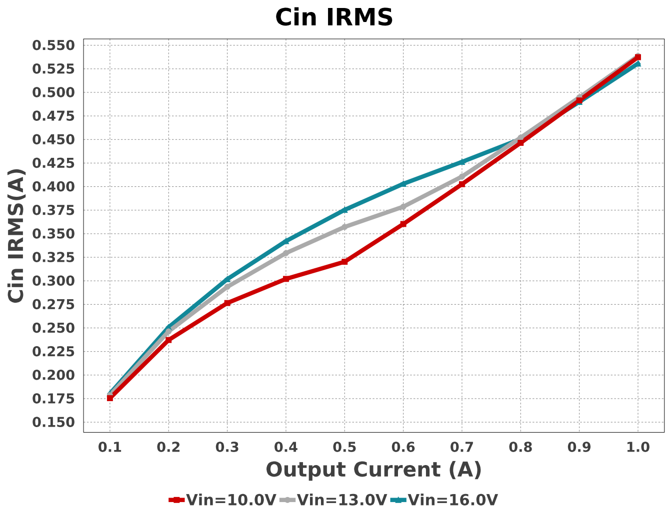

L Ipp
L Ipp(A)
Output Current (A)
Vin=10.0V
Vin=13.0V
Vin=16.0V

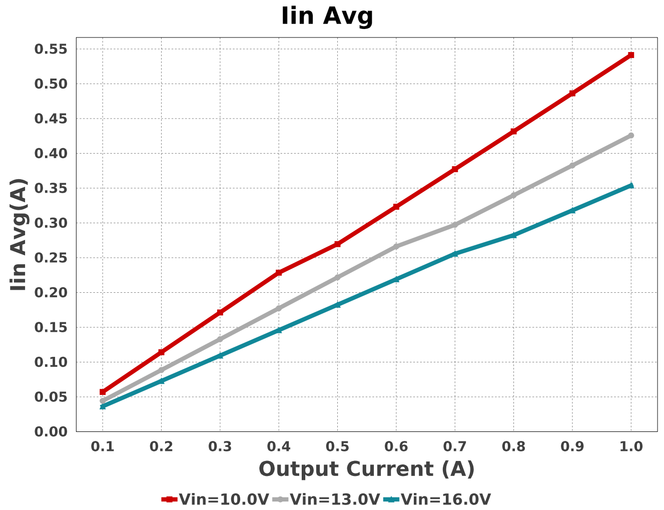

Vout p-p
Vout p-p(V)
Output Current (A)
Vin=10.0V
Vin=13.0V
Vin=16.0V

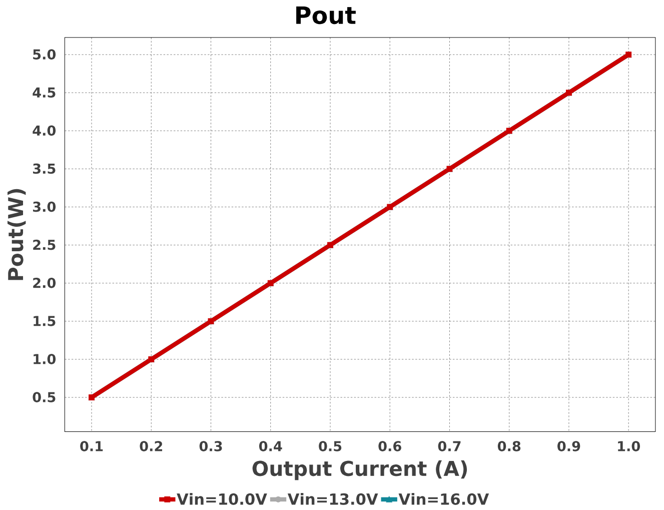

Efficiency
Efficiency(%)
Output Current (A)
Vin=10.0V
Vin=13.0V
Vin=16.0V

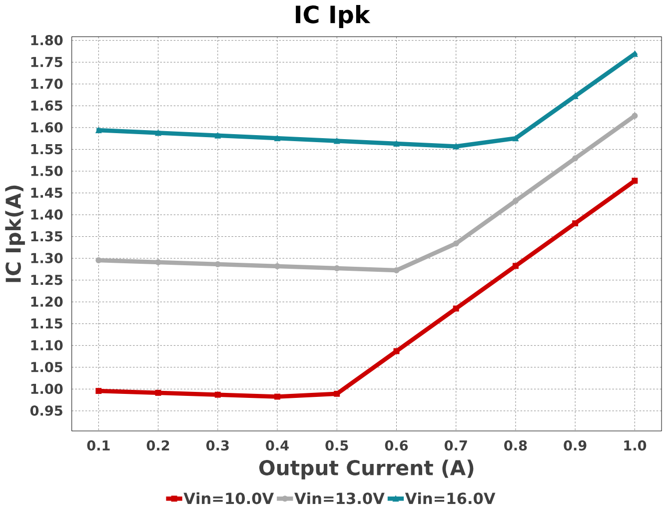

IC Tj
IC Tj(degC)
Output Current (A)
Vin=10.0V
Vin=13.0V
Vin=16.0V

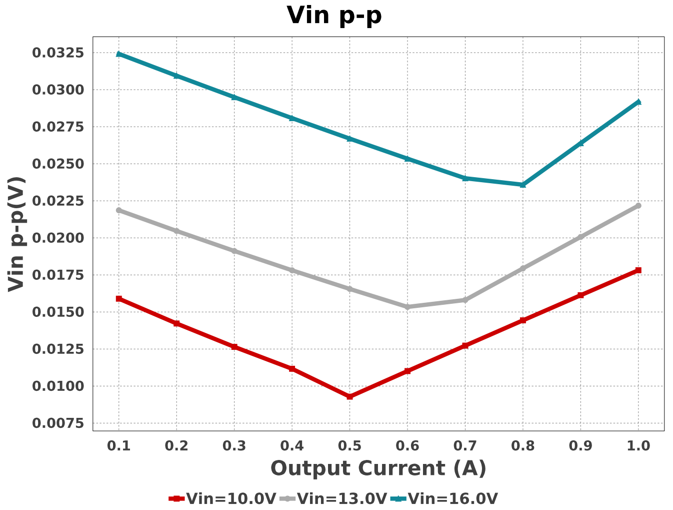

Cin Pd
Cin Pd(W)
Output Current (A)
Vin=10.0V
Vin=13.0V
Vin=16.0V

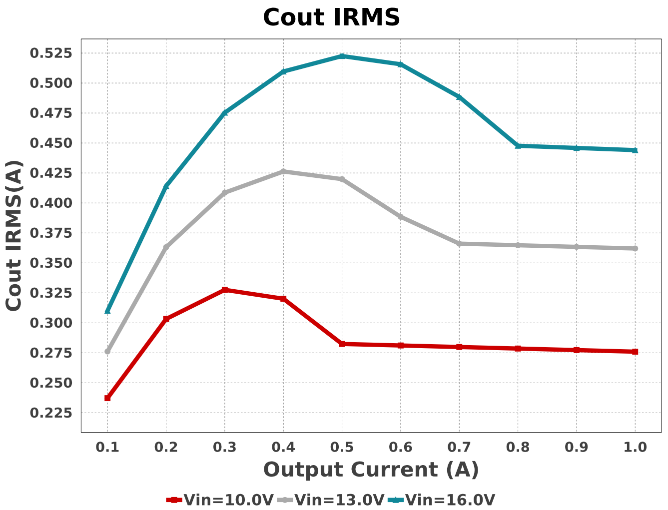

Cin IRMS
Cin IRMS(A)
Output Current (A)
Vin=10.0V
Vin=13.0V
Vin=16.0V

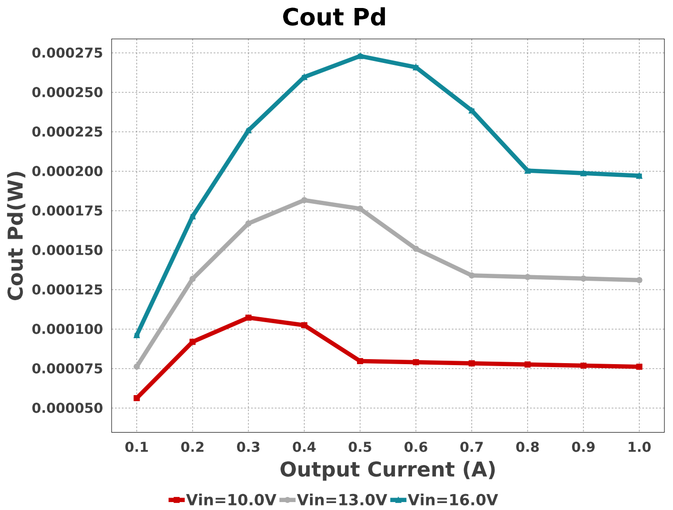

Iin Avg
Iin Avg(A)
0.55
0.50
0.45
0.40
0.35
0.30
0.25
0.20
0.15
0.10
0.05
0.00
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1.0
Output Current (A)
Vin=10.0V
Vin=13.0V
Vin=16.0V

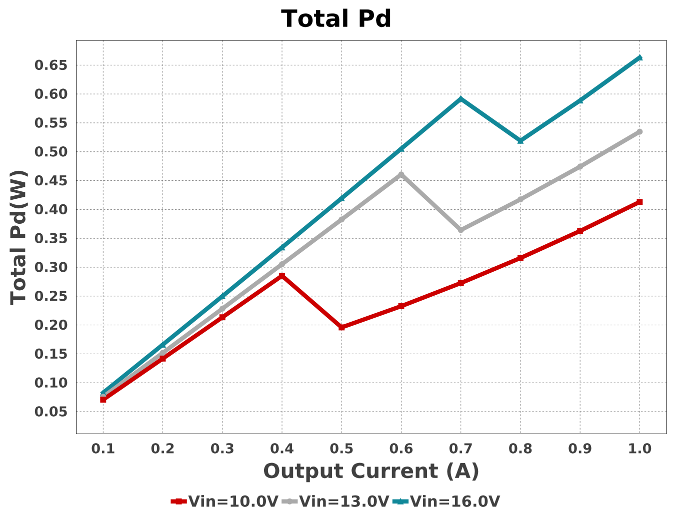

Pout
Pout(W)
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1.0
Output Current (A)
Vin=10.0V
Vin=13.0V
Vin=16.0V

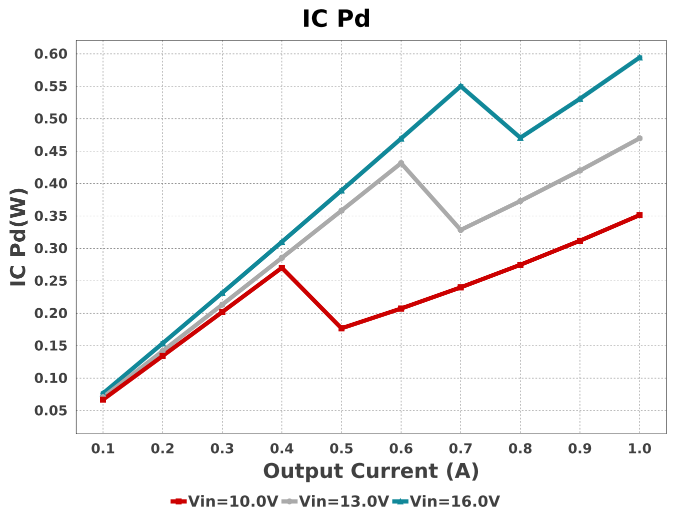

IC Ipk
IC Ipk(A)
1.80
1.75
1.70
1.65
1.60
1.55
1.50
1.45
1.40
1.35
1.30
1.25
1.20
1.15
1.10
1.05
1.00
0.95
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1.0
Output Current (A)
Vin=10.0V
Vin=13.0V
Vin=16.0V

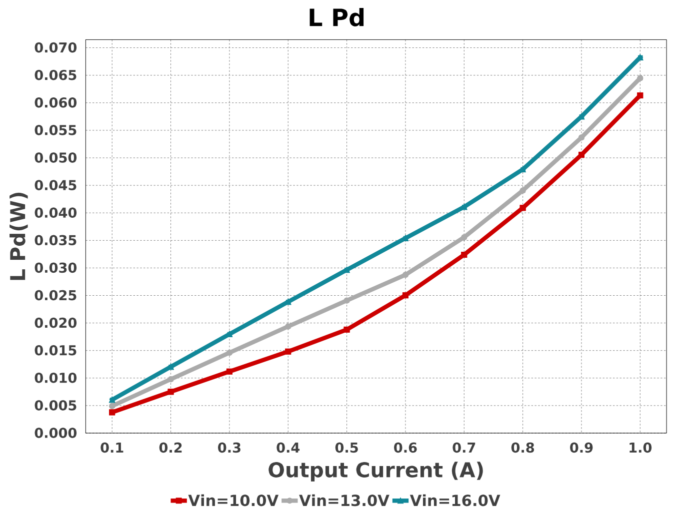

Vin p-p
Vin p-p(V)
0.0325
0.0300
0.0275
0.0250
0.0225
0.0200
0.0175
0.0150
0.0125
0.0100
0.0075
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1.0
Output Current (A)
Vin=10.0V
Vin=13.0V
Vin=16.0V

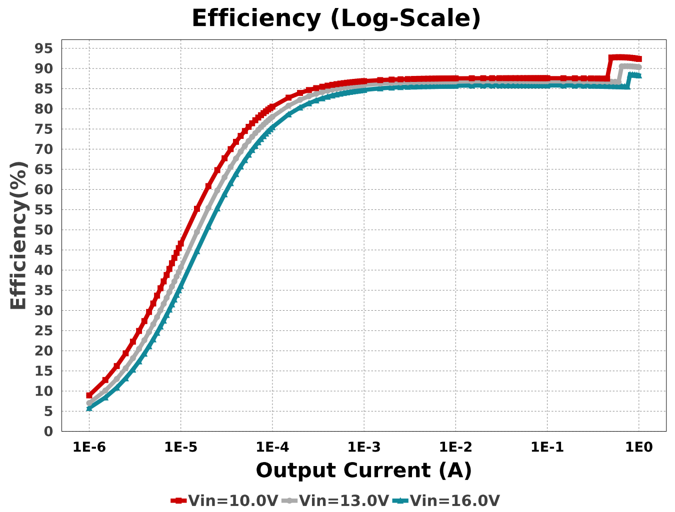

Cout IRMS
Cout IRMS(A)
0.525
0.500
0.475
0.450
0.425
0.400
0.375
0.350
0.325
0.300
0.275
0.250
0.225
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1.0
Output Current (A)
Vin=10.0V
Vin=13.0V
Vin=16.0V


Cout Pd
Cout Pd(W)
0.000275
0.000250
0.000225
0.000200
0.000175
0.000150
0.000125
0.000100
0.000075
0.000050
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1.0
Output Current (A)
Vin=10.0V
Vin=13.0V
Vin=16.0V









Operating Values

#	Name	Value	Category	Description
1.	Cin IRMS	530.588 mA	Capacitor	Input capacitor RMS ripple current
2.	Cin Pd	281.52 µW	Capacitor	Input capacitor power dissipation
3.	Cout IRMS	444.04 mA	Capacitor	Output capacitor RMS ripple current
4.	Cout Pd	197.17 µW	Capacitor	Output capacitor power dissipation
5.	IC Ipk	1.769 A	IC	Peak switch current in IC
6.	IC Pd	594.41 mW	IC	IC power dissipation
7.	IC Tj	73.689 degC	IC	IC junction temperature
8.	ICThetaJA	73.5 degC/W	IC	IC junction-to-ambient thermal resistance
9.	Iin Avg	353.95 mA	IC	Average input current
10.	L Ipp	1.538 A	Inductor	Peak-to-peak inductor ripple current
11.	L Pd	68.239 mW	Inductor	Inductor power dissipation
12.	Cin Pd	281.52 µW	Power	Input capacitor power dissipation
13.	Cout Pd	197.17 µW	Power	Output capacitor power dissipation
14.	IC Pd	594.41 mW	Power	IC power dissipation
15.	L Pd	68.239 mW	Power	Inductor power dissipation
16.	Total Pd	663.161 mW	Power	Total Power Dissipation
17.	BOM Count	8	System Information	Total Design BOM count
18.	Duty Cycle	32.149 %	System Information	Duty cycle
19.	Efficiency	88.29 %	System Information	Steady state efficiency
20.	FootPrint	41.0 mm^2	System Information	Total Foot Print Area of BOM components
21.	Frequency	2.21 MHz	System Information	Switching frequency
22.	Iout	1.0 A	System Information	Iout operating point
23.	Mode	CCM	System Information	Conduction Mode
24.	Pout	5.0 W	System Information	Total output power

#	Name	Value	Category	Description
25.	Total BOM	$0.78	System Information	Total BOM Cost
26.	Vin	16.0 V	System Information	Vin operating point
27.	Vin p-p	29.184 mV	System Information	Peak-to-peak input voltage
28.	Vout	5.0 V	System Information	Operational Output Voltage
29.	Vout Tolerance	900.0 m%	System Information	Vout Tolerance (full load)
30.	Vout p-p	8.358 mV	System Information	Peak-to-peak output ripple voltage

Design Inputs

	Name	Value	Description
	Iout	1.0	Maximum Output Current
	VinMax	16.0	Maximum input voltage
	VinMin	10.0	Minimum input voltage
	Vout	5.0	Output Voltage
	base_pn	TPS62901	Base Product Number
	source	DC	Input Source Type
	Ta	30.0	Ambient temperature
1.	Vout Sch	5.0	Output voltage selected

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

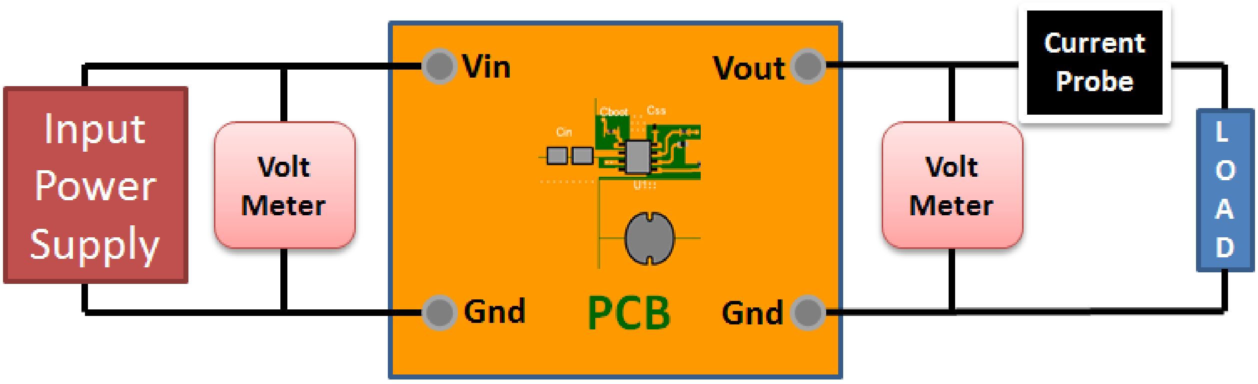
If board assembly is done in house it is best to tack down one terminal of a component on the board then solder the other terminal. For surface mount parts with large tabs, such as the DPAK, the tab on the back of the package should be pre-tinned with solder, then tacked into place by one of the pins. 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 10.0V 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. Master key : DDBD7590F6C2AE06[v1]

2. **TPS62901** Product Folder : http://www.ti.com/product/TPS62901 : contains the data sheet and other resources.

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