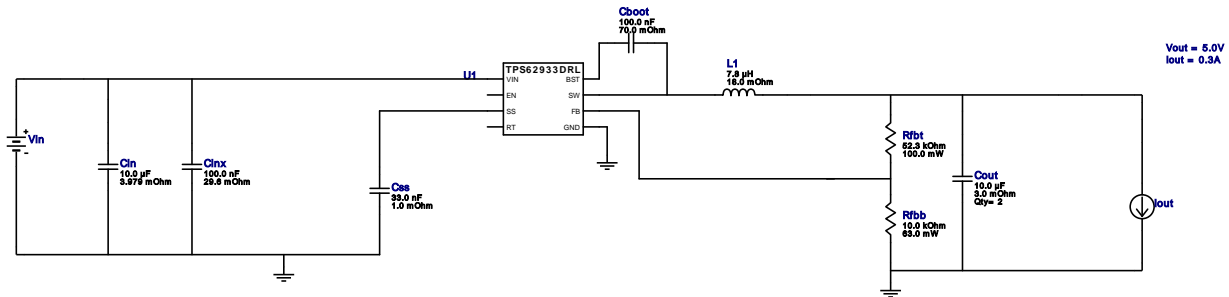


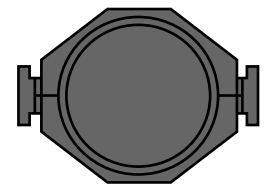
WEBENCH® Design Report

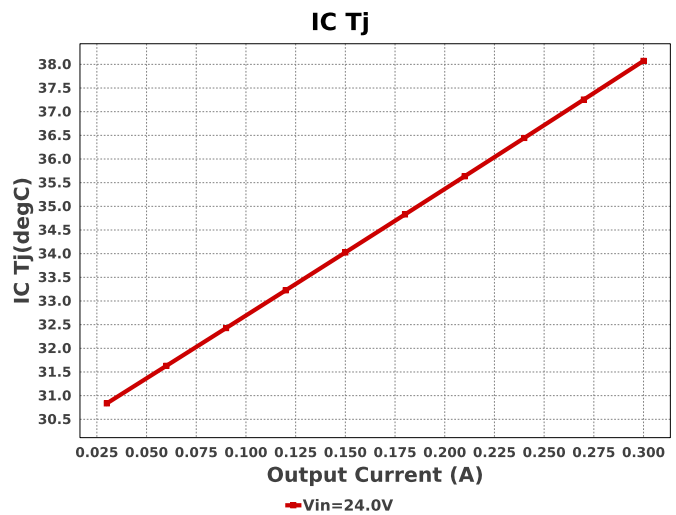
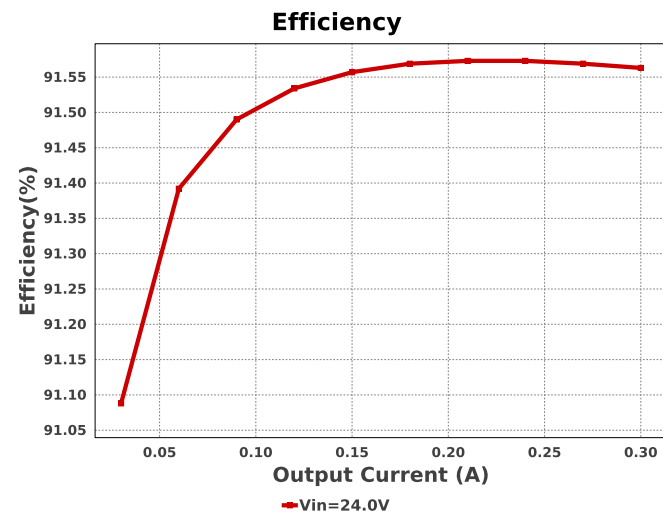
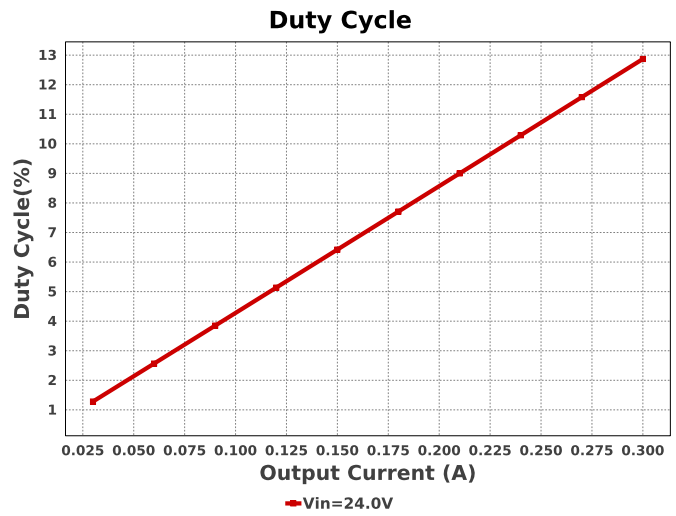
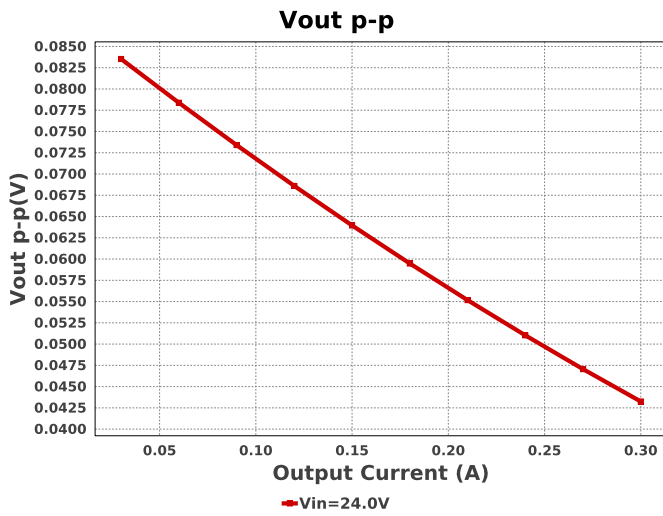
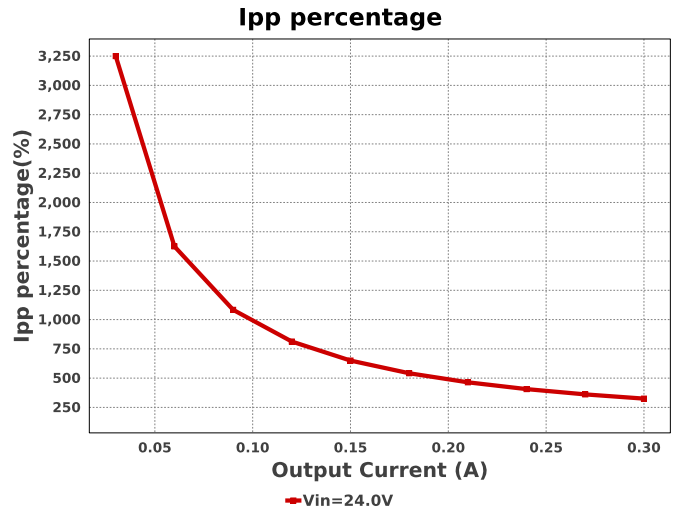
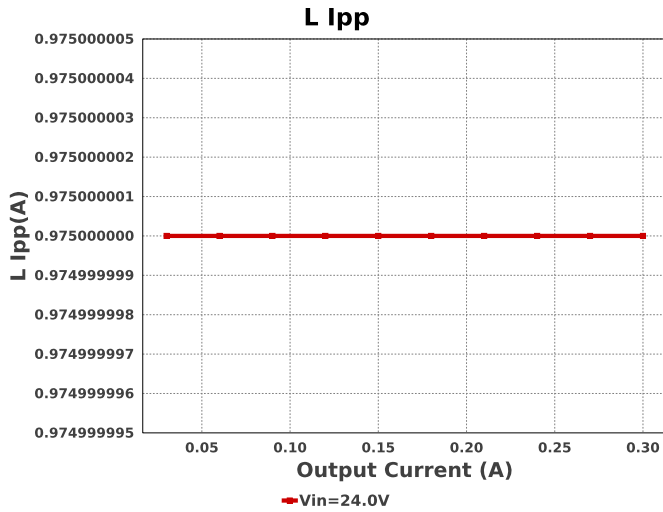
Design : 3 TPS62933DRLR
TPS62933DRLR 24V-24V to 5.00V @ 0.3A

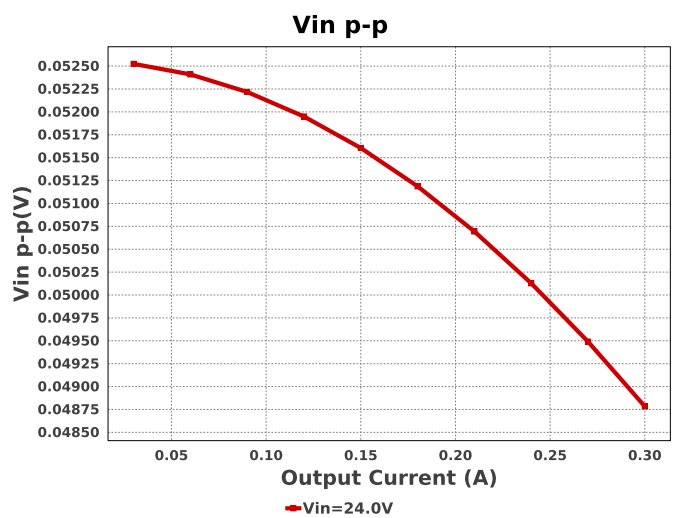
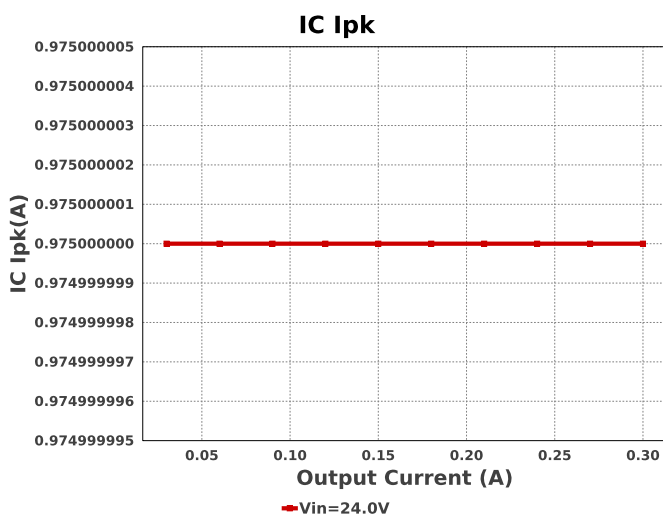
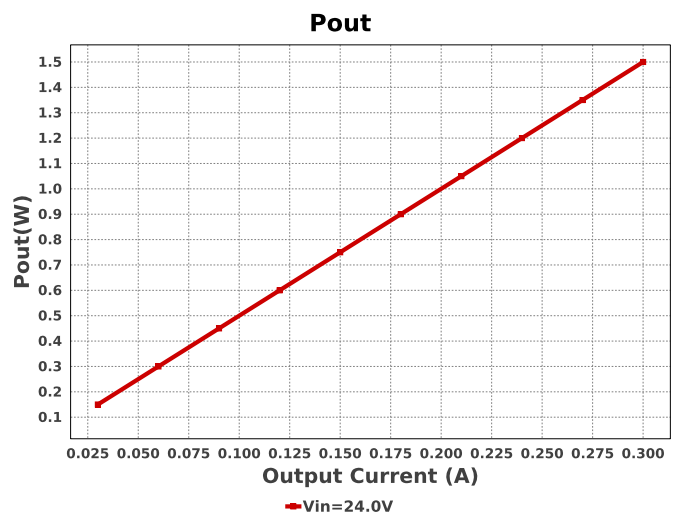
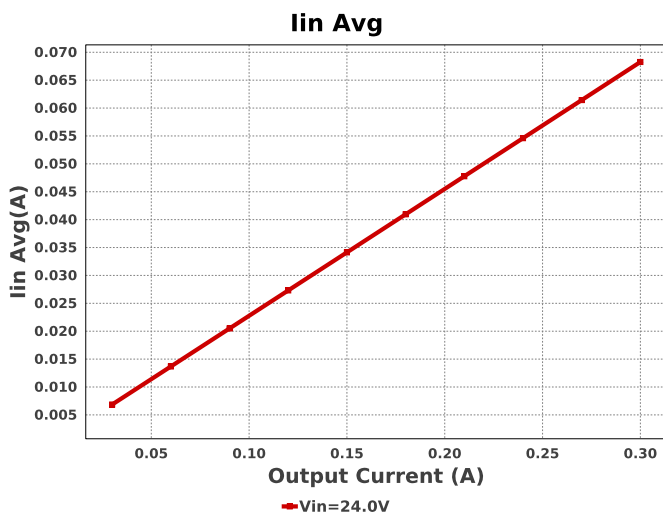
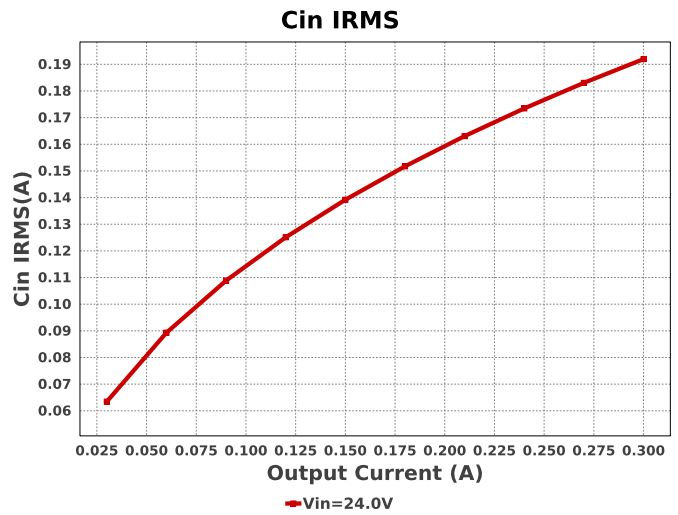
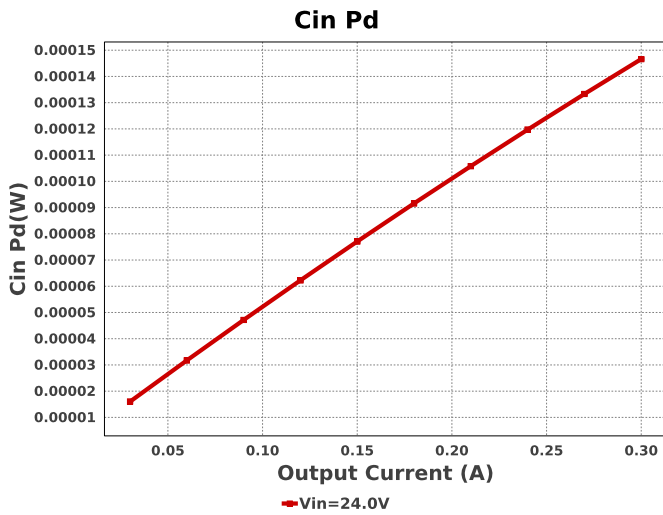


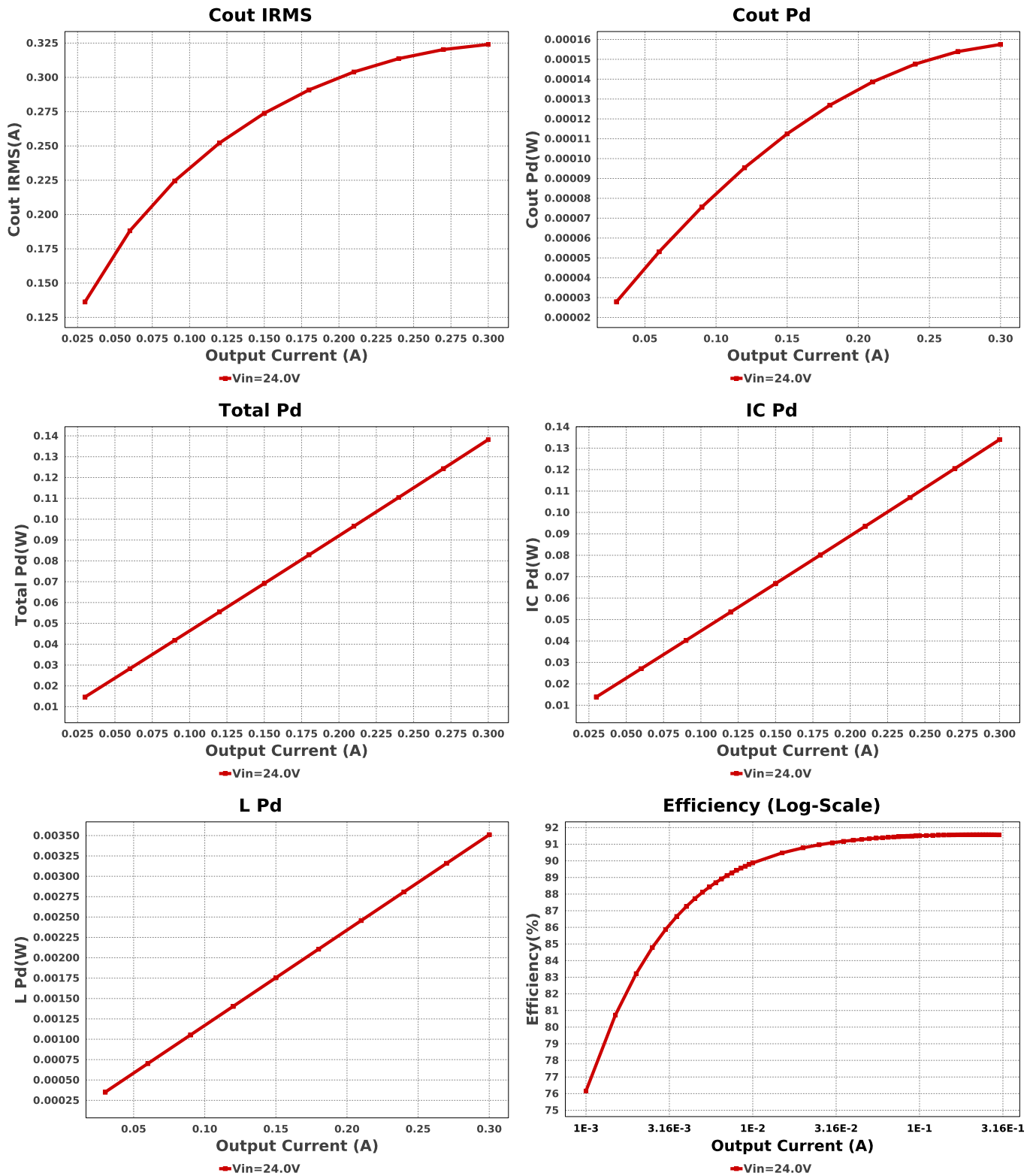
Electrical BOM

Name	Manufacturer	Part Number	Properties	Qty	Price	Footprint
Cboot	TDK	C0603X5R1A104K030BC Series= X5R	Cap= 100.0 nF ESR= 70.0 mOhm VDC= 10.0 V IRMS= 0.0 A	1	\$0.01	0201 2 mm ²
Cin	Taiyo Yuden	MSASU32MSB5106KPNA01 Series= X5R	Cap= 10.0 uF ESR= 3.979 mOhm VDC= 50.0 V IRMS= 3.4821 A	1	\$0.16	1210 15 mm ²
Cinx	TDK	CGA3E2X7R1H104K080AA Series= X7R	Cap= 100.0 nF ESR= 29.6 mOhm VDC= 50.0 V IRMS= 971.99 mA	1	\$0.01	0603 5 mm ²
Cout	Kemet	C0805C106K8PACTU Series= X5R	Cap= 10.0 uF ESR= 3.0 mOhm VDC= 10.0 V IRMS= 11.43 A	2	\$0.03	0805 7 mm ²
Css	MuRata	GRM155R71A333KA01D Series= X7R	Cap= 33.0 nF ESR= 1.0 mOhm VDC= 10.0 V IRMS= 0.0 A	1	\$0.01	0402 3 mm ²
L1	NIC Components	NPI52P7R8MTRF	L= 7.8 uH 18.0 mOhm	1	\$0.54	IND_NPI52P 445 mm ²
Rfbb	Vishay-Dale	CRCW040210K0FKED Series= CRCW..e3	Res= 10.0 kOhm Power= 63.0 mW Tolerance= 1.0%	1	\$0.01	0402 3 mm ²
Rfbs	Yageo	RC0603FR-0752K3L Series= ?	Res= 52.3 kOhm Power= 100.0 mW Tolerance= 1.0%	1	\$0.01	0603 5 mm ²
U1	Texas Instruments	TPS62933DRLR	Switcher	1	\$0.44	DRL0008A-MFG 9 mm ²









Operating Values

#	Name	Value	Category	Description
1.	Cin IRMS	191.953 mA	Capacitor	Input capacitor RMS ripple current
2.	Cin Pd	146.61 μ W	Capacitor	Input capacitor power dissipation
3.	Cout IRMS	324.037 mA	Capacitor	Output capacitor RMS ripple current
4.	Cout Pd	157.5 μ W	Capacitor	Output capacitor power dissipation
5.	IC Ipk	975.0 mA	IC	Peak switch current in IC
6.	IC Pd	134.0 mW	IC	IC power dissipation
7.	IC Tj	38.074 degC	IC	IC junction temperature
8.	IC Tolerance	16.0 mV	IC	IC Feedback Tolerance
9.	ICThetaJA Effective	60.25 degC/W	IC	Effective IC Junction-to-Ambient Thermal Resistance
10.	Iin Avg	68.259 mA	IC	Average input current

#	Name	Value	Category	Description
11.	Ipp percentage	325.0 %	Inductor	Inductor ripple current percentage (with respect to average inductor current)
12.	L Ipp	975.0 mA	Inductor	Peak-to-peak inductor ripple current
13.	L Pd	3.51 mW	Inductor	Inductor power dissipation
14.	Cin Pd	146.61 μ W	Power	Input capacitor power dissipation
15.	Cout Pd	157.5 μ W	Power	Output capacitor power dissipation
16.	IC Pd	134.0 mW	Power	IC power dissipation
17.	L Pd	3.51 mW	Power	Inductor power dissipation
18.	Total Pd	138.216 mW	Power	Total Power Dissipation
19.	BOM Count	10	System	Total Design BOM count
20.	Duty Cycle	12.87 %	System	Duty cycle
21.	Efficiency	91.563 %	System	Steady state efficiency
22.	FootPrint	499.0 mm ²	System	Total Foot Print Area of BOM components
23.	Frequency	321.017 kHz	System	Switching frequency
24.	Inductor ripple current requirement used for Inductor selection	40.0 %	System	Custom Inductor ripple current (% of average inductor current) requirement used for Inductor selection
25.	Iout	300.0 mA	System	Iout operating point
26.	Iout transient step used for Cout calculations	150.0 mA	System	Custom Transient current step requirement that was used for Cout selection (A).
27.	Mode	PFM	System	Conduction Mode
28.	Overshoot Value	1.637 mV	System	Theoretical Vout Overshoot Value
29.	Pout	1.5 W	System	Total output power
30.	Total BOM	\$1.26	System	Total BOM Cost
31.	Undershoot Value	34.94 mV	System	Theoretical Vout Undershoot Value
32.	Vin	24.0 V	System	Vin operating point
33.	Vin p-p	48.783 mV	System	Peak-to-peak input voltage
34.	Vout	5.0 V	System	Operational Output Voltage
35.	Vout Actual	4.984 V	System	Vout Actual calculated based on selected voltage divider resistors
36.	Vout Ripple requirement used for Cout calculations	1.0 %	System	Custom maximum output ripple requirement that was used for Cout selection(% of Vout).
37.	Vout Tolerance	3.73 %	System	Vout Tolerance based on IC Tolerance (no load) and voltage divider resistors if applicable
38.	Vout p-p	43.248 mV	System	Peak-to-peak output ripple voltage
39.	Vout transient requirement used for Cout calculations	3.0 %	System	Custom Transient voltage change requirement that was used for Cout selection (% of Vout).

Design Inputs

Name	Value	Description
Iout	300.0 m	Maximum Output Current
VinMax	24.0	Maximum input voltage
VinMin	24.0	Minimum input voltage
Vout	5.0	Output Voltage
base_pn	TPS62933	Base Product Number
source	DC	Input Source Type
Ta	30.0	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 C_{in} and C_{out} , 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

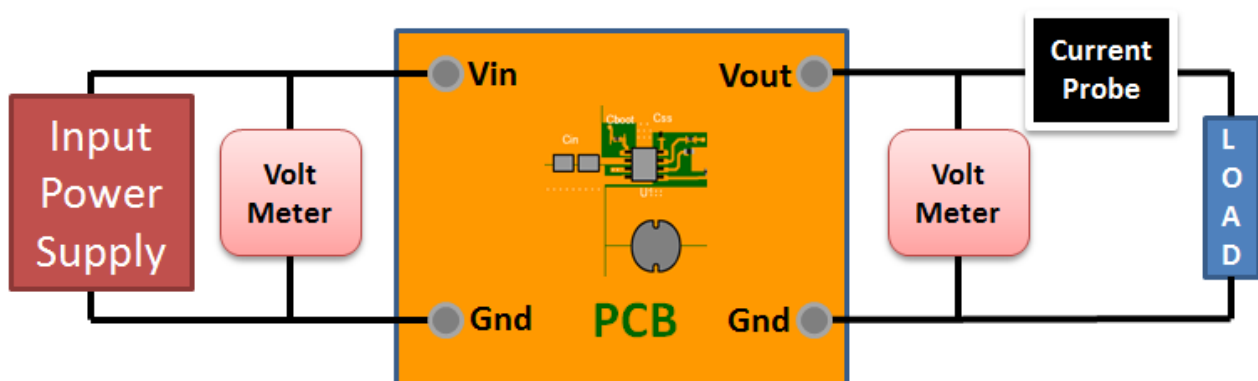
If board assembly is done in house it is best to tack down one terminal of a component on the board then solder the other terminal. For surface mount parts with large tabs, such as the DPAK, the tab on the back of the package should be pre-tinned with solder, then tacked into place by one of the pins. To solder the tab down 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 24.0V and set the input supply's current limit to zero. With the input supply off connect up the input supply to V_{in} and GND. Connect a digital volt meter and a load if needed to set the minimum load of the design from V_{out} 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 V_{in} and GND, a load is connected between V_{out} and GND and a current meter is connected in series between V_{out} 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 : D9C36EA418C0A5CE9A27A54D0E582552[v1]
2. **TPS62933** Product Folder : <http://www.ti.com/product/TPS62933> : contains the data sheet and other resources.

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