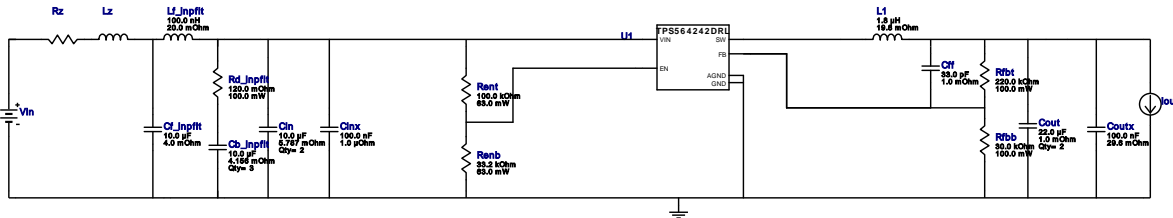


WEBENCH® Design Report

 Design : 9590 TPS564242DRLR
 TPS564242DRLR 6V-9V to 5.00V @ 1.5A


Design Alerts

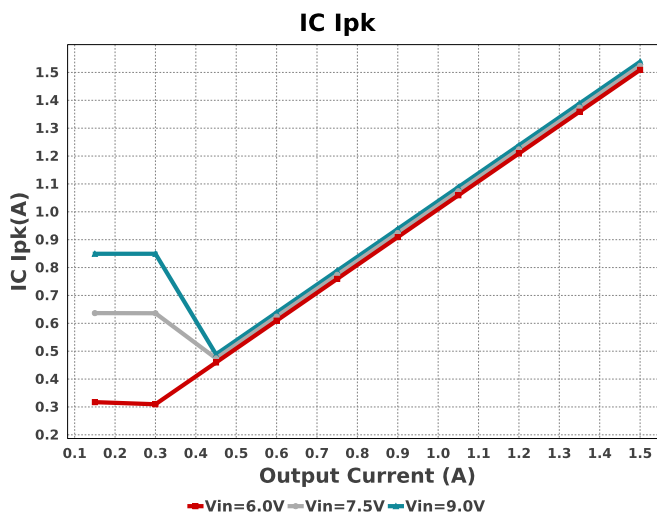
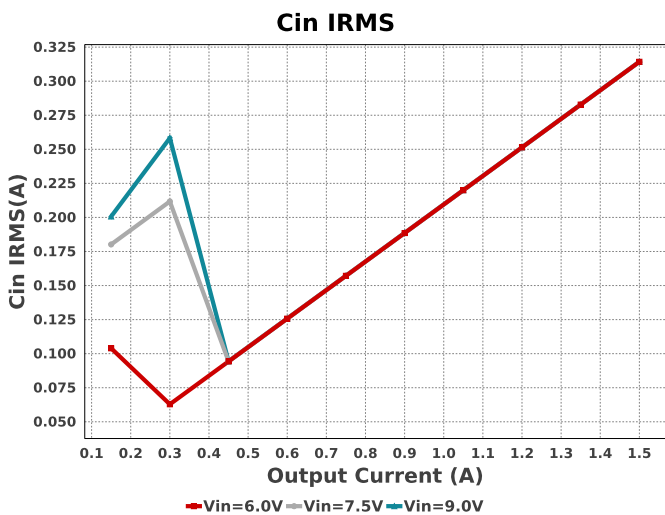
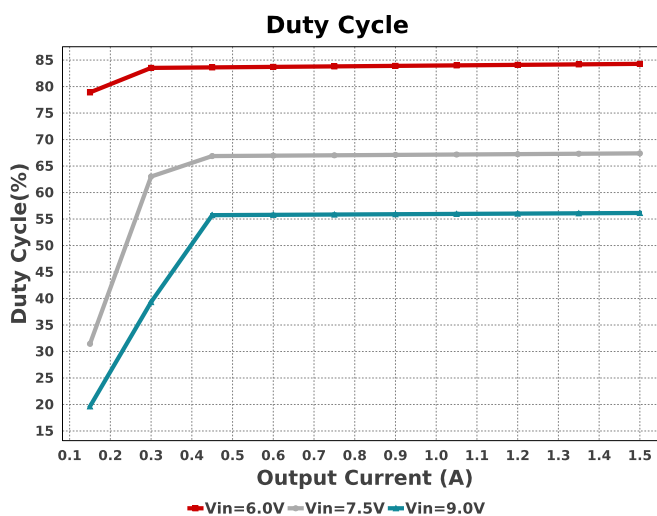
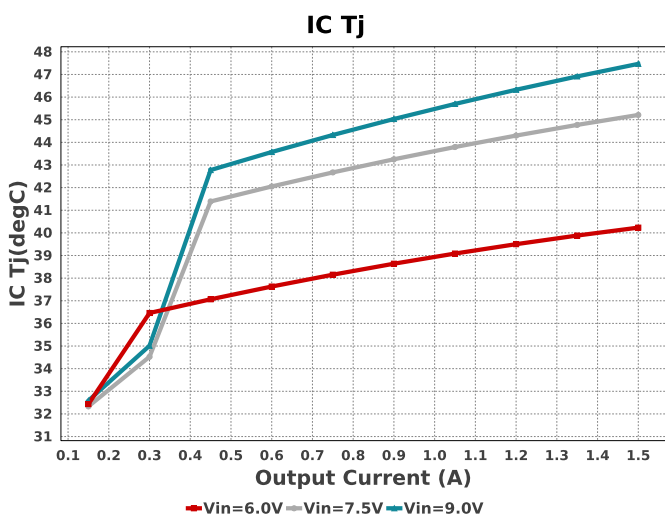
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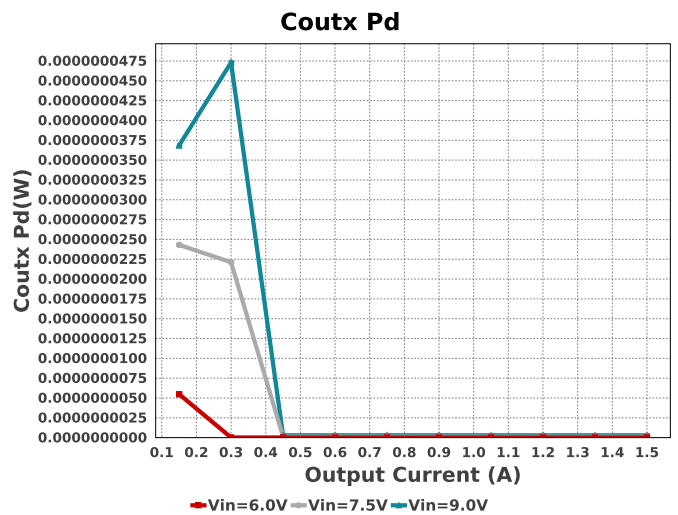
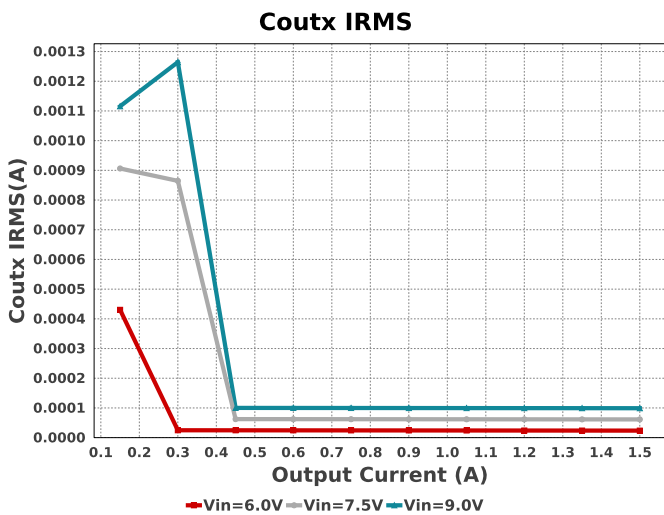
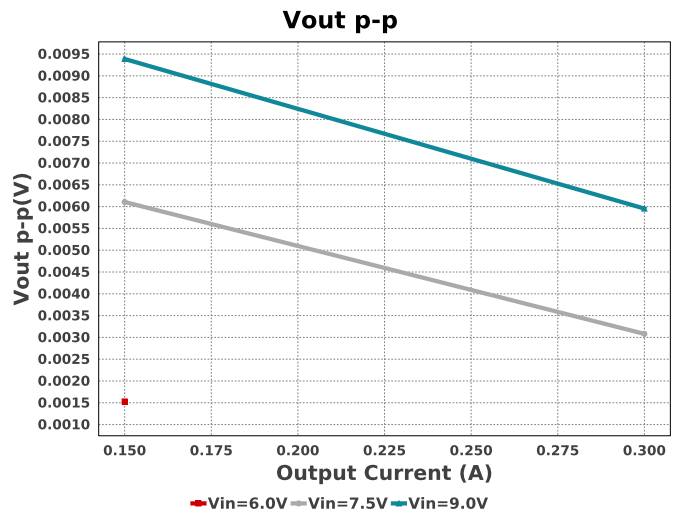
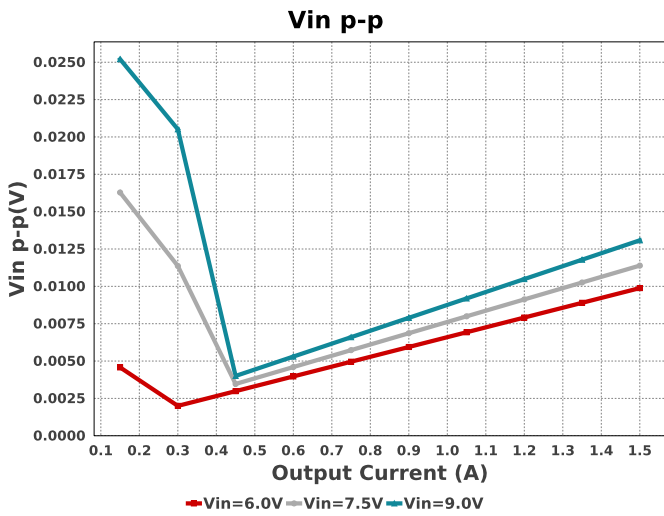
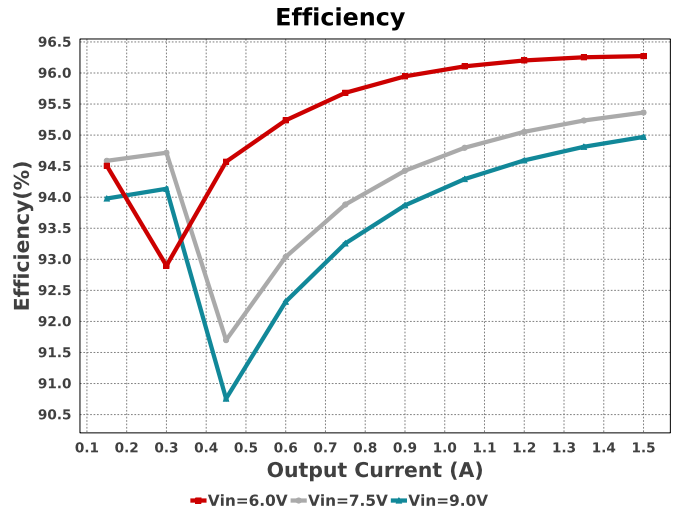
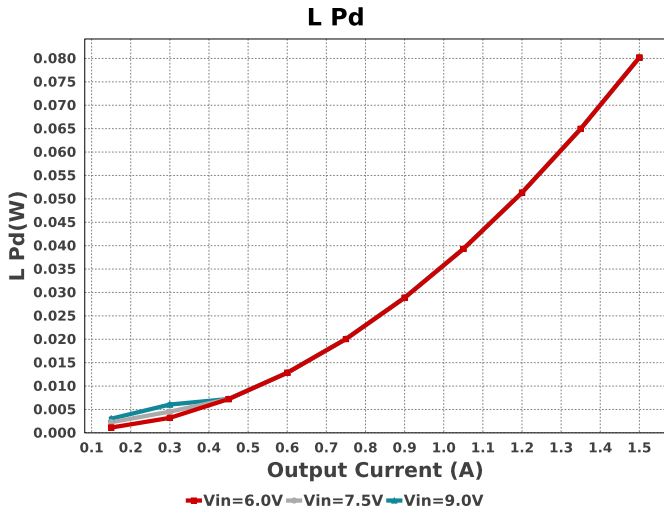
 The TPS564242 can support the large duty operation, please contact <https://e2e.ti.com/support/power-management/f/196> forum for application help.

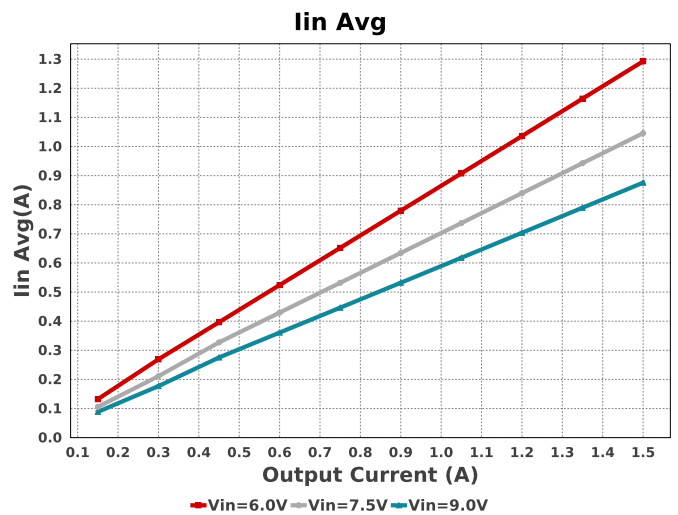
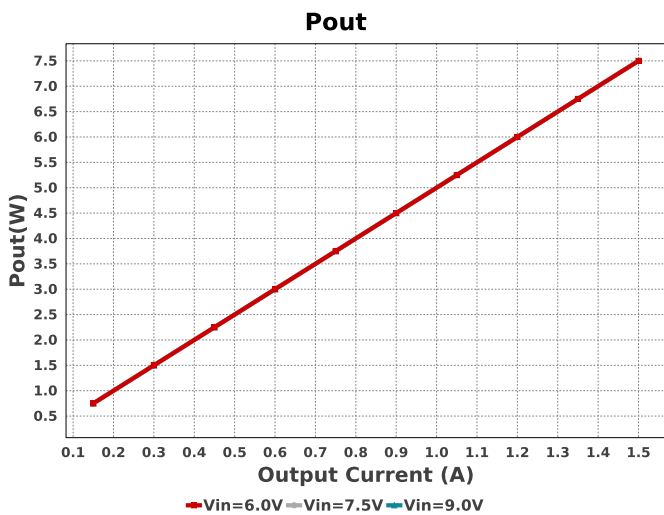
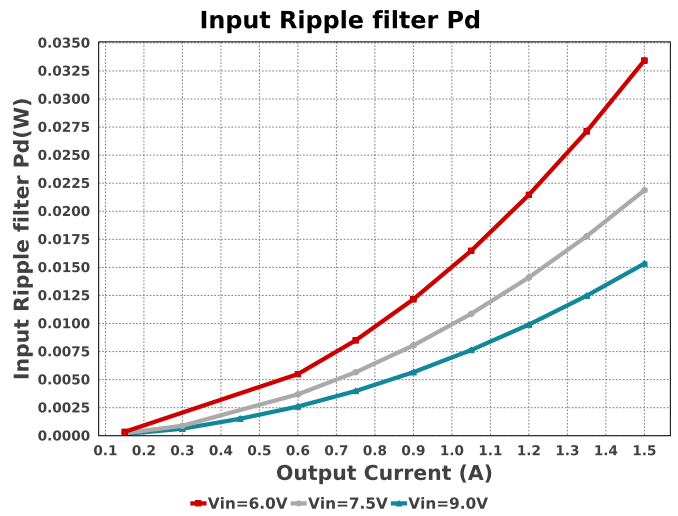
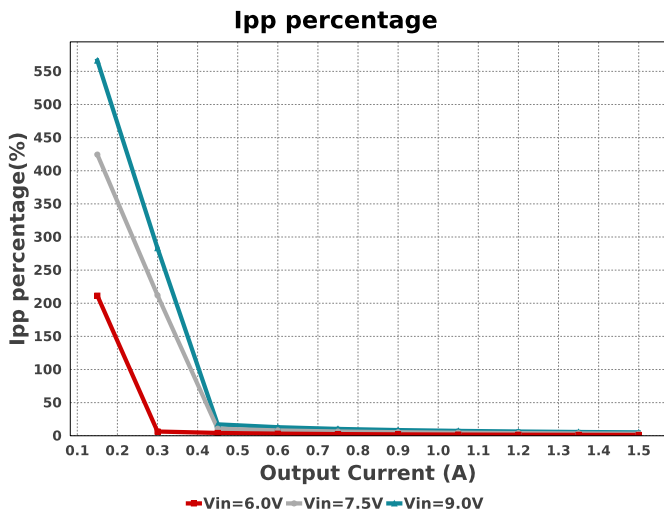
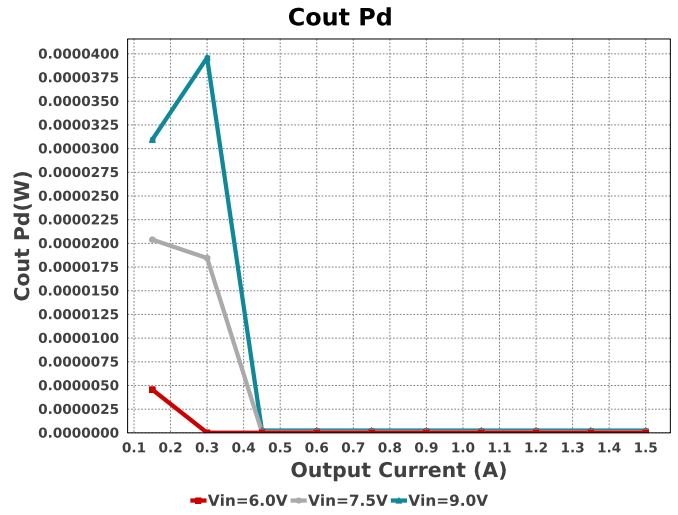
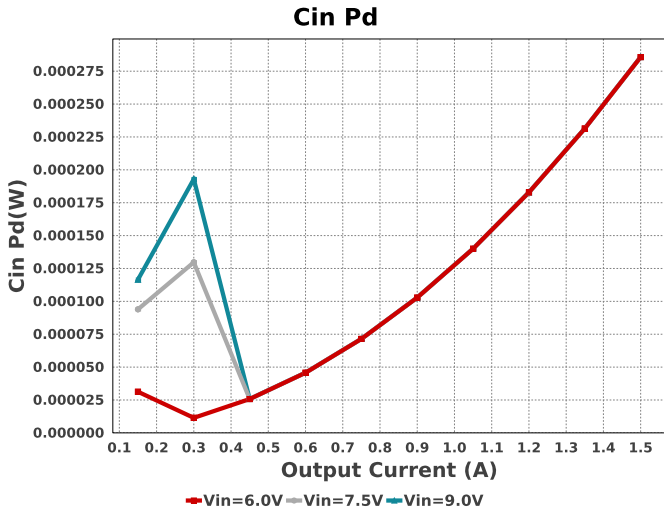
Electrical BOM

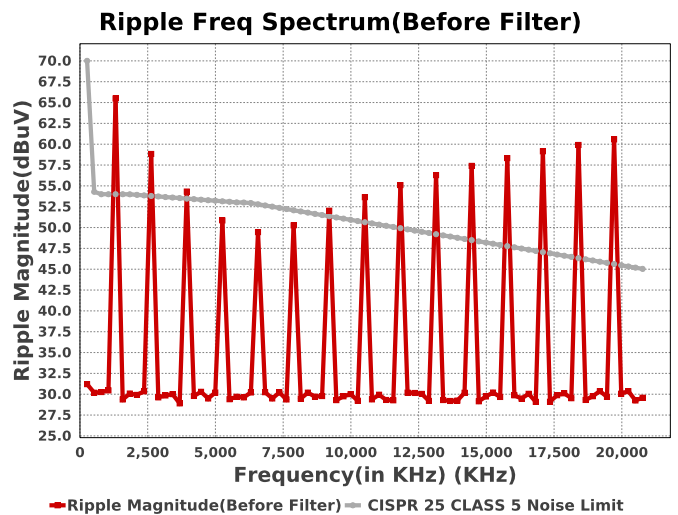
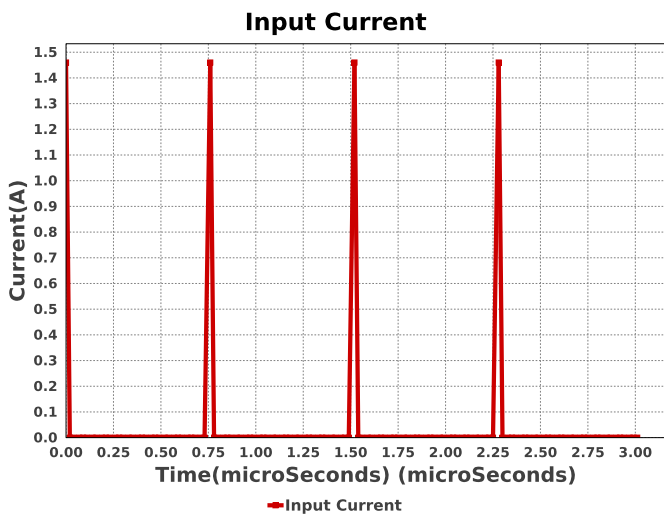
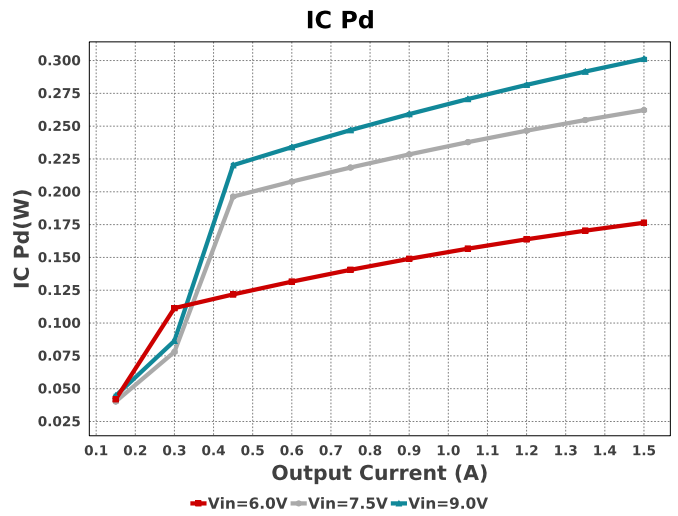
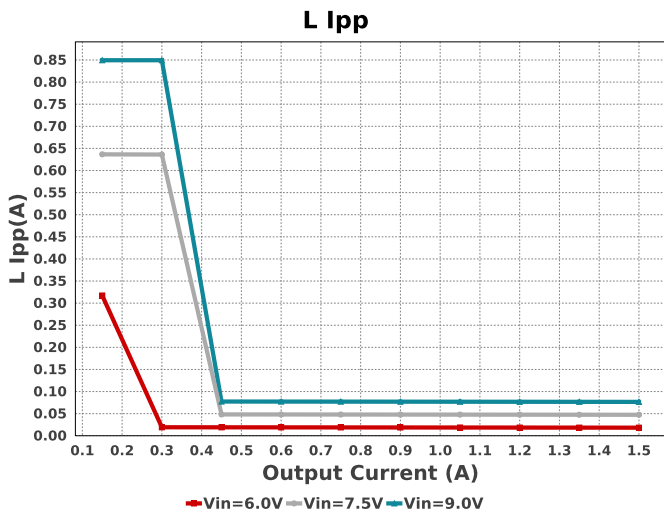
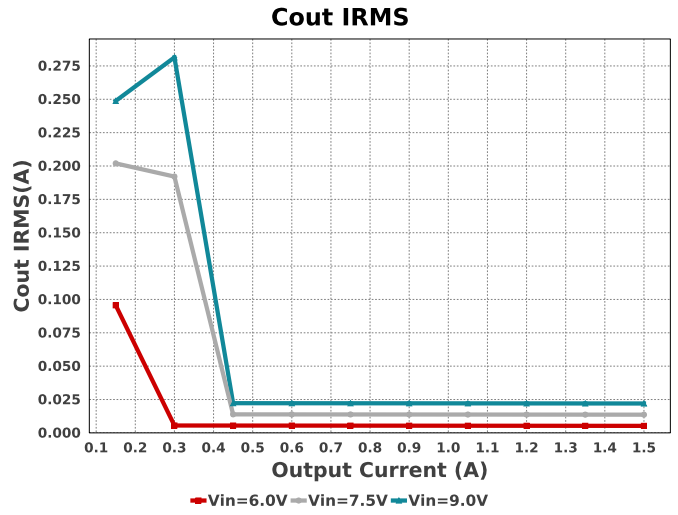
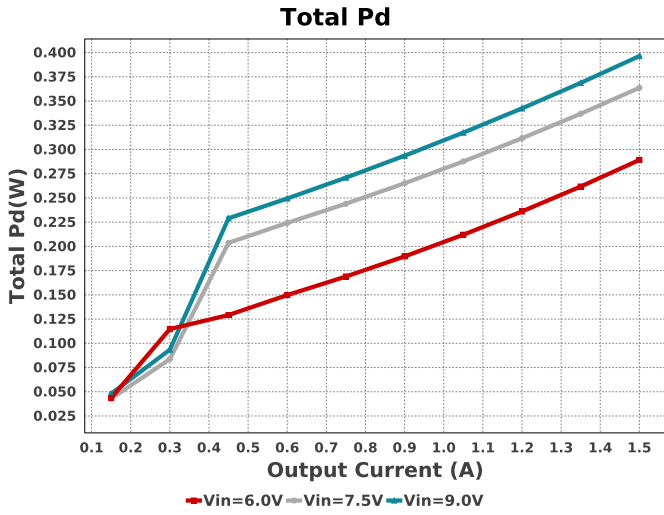
Name	Manufacturer	Part Number	Properties	Qty	Price	Footprint
Cb_inpfilt	MuRata	GRM31CR71C106KAC7L Series= X7R	Cap= 10.0 uF ESR= 4.156 mOhm VDC= 16.0 V IRMS= 2.59073 A	3	\$0.08	 1206_190 11 mm ²
Cf_inpfilt	MuRata	GRM31CR71E106KA12L Series= X7R	Cap= 10.0 uF ESR= 4.0 mOhm VDC= 25.0 V IRMS= 6.0 A	1	\$0.06	 1206_180 11 mm ²
Cff	MuRata	GRM1555C1E330JA01D Series= C0G/NP0	Cap= 33.0 pF ESR= 1.0 mOhm VDC= 25.0 V IRMS= 0.0 A	1	\$0.01	 0402 3 mm ²
Cin	Taiyo Yuden	MSASE21GAB5106KTNA01 Series= X5R	Cap= 10.0 uF ESR= 5.787 mOhm VDC= 16.0 V IRMS= 2.755 A	2	\$0.03	 0805 7 mm ²
Cinx	CUSTOM	CUSTOM Series= ?	Cap= 100.0 nF ESR= 1.0 uOhm VDC= 18.0 V IRMS= 377.12 mA	1	NA	CUSTOM 0 mm ²
Cout	Taiyo Yuden	LMK212BJ226MG-T Series= X5R	Cap= 22.0 uF ESR= 1.0 mOhm VDC= 10.0 V IRMS= 1.6 A	2	\$0.09	 0805 7 mm ²
Coutx	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
L1	Bourns	SRN6045-1R8Y	L= 1.8 uH 19.8 mOhm	1	\$0.25	 SRN6045 64 mm ²
Lf_inpfilt	TDK	NLCV32T-R10M-PFR	L= 100.0 nH 20.0 mOhm	1	\$0.10	 NLCV32 13 mm ²
Rd_inpfilt	Panasonic	ERJ-3RSFR12V Series= ERJ-3R	Res= 120.0 mOhm Power= 100.0 mW Tolerance= 1.0%	1	\$0.03	 0603 5 mm ²

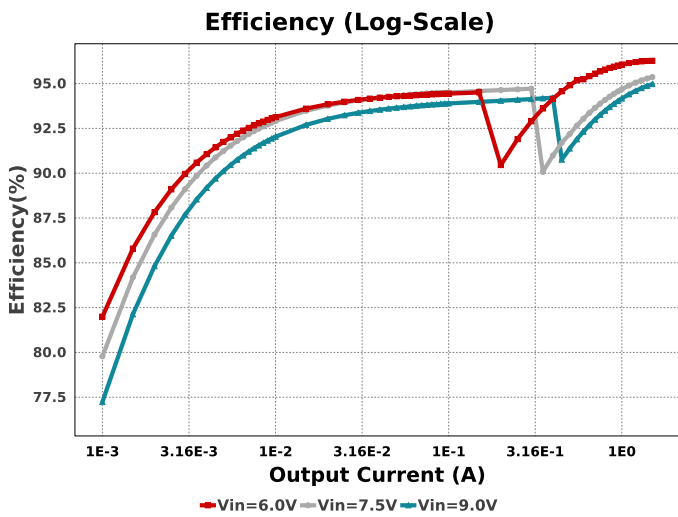
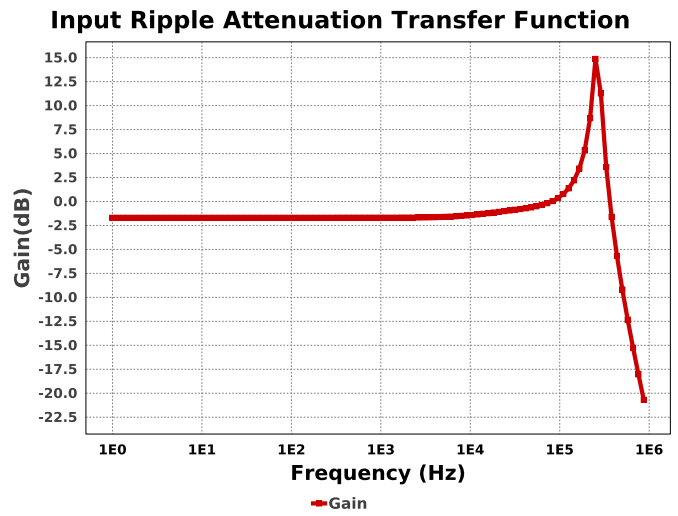
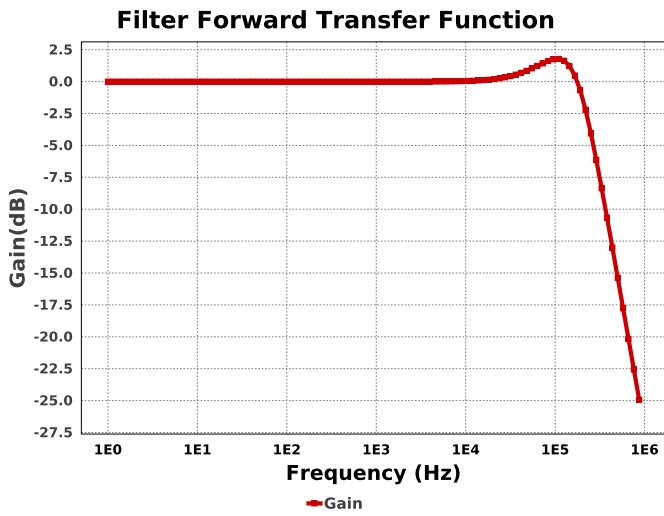
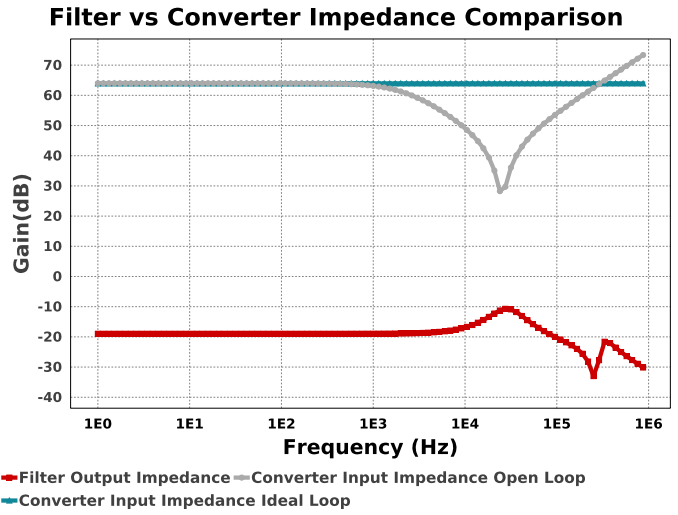
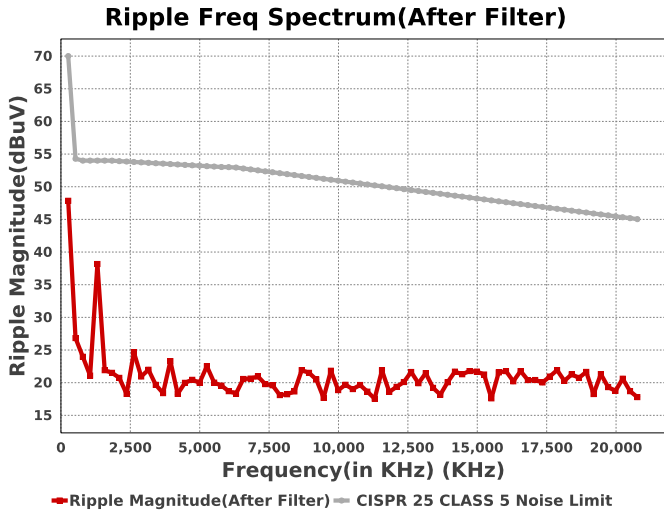
Name	Manufacturer	Part Number	Properties	Qty	Price	Footprint
Renb	Vishay-Dale	CRCW040233K2FKED Series= CRCW..e3	Res= 33.2 kOhm Power= 63.0 mW Tolerance= 1.0%	1	\$0.01	0402 3 mm ²
Rent	Vishay-Dale	CRCW0402100KFKED Series= CRCW..e3	Res= 100.0 kOhm Power= 63.0 mW Tolerance= 1.0%	1	\$0.01	0402 3 mm ²
Rfbb	Yageo	RC0603FR-0730KL Series= ?	Res= 30.0 kOhm Power= 100.0 mW Tolerance= 1.0%	1	\$0.01	0603 5 mm ²
Rfbt	Yageo	RC0603FR-07220KL Series= ?	Res= 220.0 kOhm Power= 100.0 mW Tolerance= 1.0%	1	\$0.01	0603 5 mm ²
U1	Texas Instruments	TPS564242DRLR	Switcher	1	\$0.17	DRL0006A 7 mm ²











Operating Values

#	Name	Value	Category	Description
1.	Cin IRMS	314.269 mA	Capacitor	Input capacitor RMS ripple current
2.	Cin Pd	285.78 μ W	Capacitor	Input capacitor power dissipation
3.	Cout IRMS	22.019 mA	Capacitor	Output capacitor RMS ripple current
4.	Cout Pd	242.43 nW	Capacitor	Output capacitor power dissipation
5.	Coutx IRMS	99.075 μ A	Capacitor	Output capacitor_x RMS ripple current
6.	Coutx Pd	290.55 pW	Capacitor	Output capacitor_x power loss
7.	Input Ripple Noise After 38.22 dBuV input filter		EMI Noise	Input Ripple Noise after filter at switching frequency
8.	Input Ripple Noise before input filter	65.5 dBuV	EMI Noise	Input Ripple Noise before filter at switching frequency
9.	Input Ripple filter Pd	15.339 mW	EMI Noise	Input Ripple Filter Power Dissipation

#	Name	Value	Category	Description
10.	Noise limits defined by CISPR Standards	54.0 dBuV	EMI Noise	Noise limits for CLASS 5 of CISPR 25 standard
11.	IC Ipk	1.538 A	IC	Peak switch current in IC
12.	IC Pd	301.18 mW	IC	IC power dissipation
13.	IC Tj	47.468 degC	IC	IC junction temperature
14.	IC Tolerance	11.0 mV	IC	IC Feedback Tolerance
15.	ICThetaJA Effective	58.0 degC/W	IC	IC junction-to-ambient thermal resistance with TI EVM
16.	Iin Avg	875.75 mA	IC	Average input current
17.	Ipp percentage	5.108 %	Inductor	Inductor ripple current percentage (with respect to average inductor current)
18.	L Ipp	76.621 mA	Inductor	Peak-to-peak inductor ripple current
19.	L Pd	80.207 mW	Inductor	Inductor power dissipation
20.	Cin Pd	285.78 µW	Power	Input capacitor power dissipation
21.	Cout Pd	242.43 nW	Power	Output capacitor power dissipation
22.	Coutx Pd	290.55 pW	Power	Output capacitor_x power loss
23.	IC Pd	301.18 mW	Power	IC power dissipation
24.	Input Ripple filter Pd	15.339 mW	Power	Input Ripple Filter Power Dissipation
25.	L Pd	80.207 mW	Power	Inductor power dissipation
26.	Total Pd	396.373 mW	Power	Total Power Dissipation
27.	BOM Count	19	System	Total Design BOM count
28.	Duty Cycle	56.142 %	System Information	Duty cycle
29.	Efficiency	94.971 %	System Information	Steady state efficiency
30.	FootPrint	217.0 mm ²	System Information	Total Foot Print Area of BOM components
31.	Frequency	1.314 MHz	System Information	Switching frequency
32.	Iout	1.5 A	System Information	Iout operating point
33.	Mode	CCM	System Information	Conduction Mode
34.	Pout	7.5 W	System Information	Total output power
35.	Total BOM	NA	System Information	Total BOM Cost
36.	Vin	9.0 V	System Information	Vin operating point
37.	Vin p-p	13.08 mV	System Information	Peak-to-peak input voltage
38.	Vout	5.0 V	System Information	Operational Output Voltage
39.	Vout Actual	5.0 V	System Information	Vout Actual calculated based on selected voltage divider resistors
40.	Vout Tolerance	3.644 %	System Information	Vout Tolerance based on IC Tolerance (no load) and voltage divider resistors if applicable

Design Inputs

Name	Value	Description
Iout	1.5	Maximum Output Current
VinMax	9.0	Maximum input voltage
VinMin	6.0	Minimum input voltage
Vout	5.0	Output Voltage
base_pn	TPS564242	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

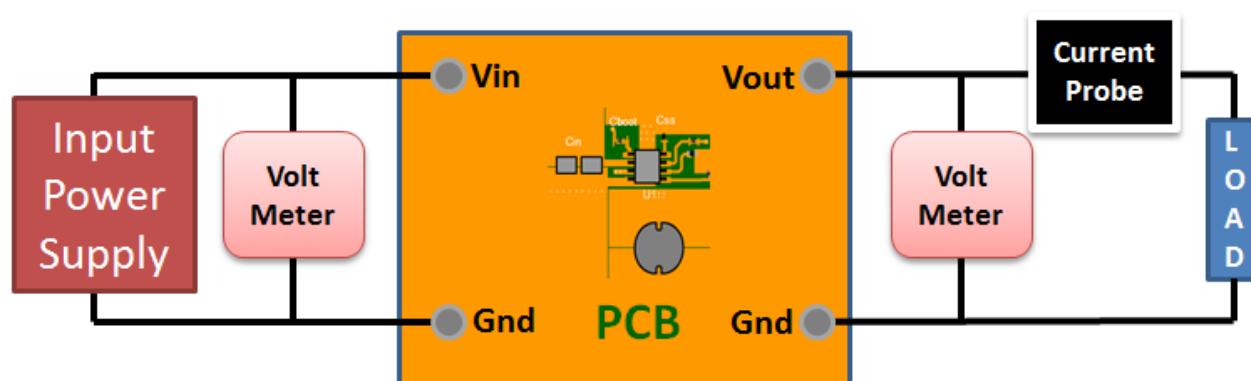
If board assembly is done in house it is best to tack down one terminal of a component on the board then solder the other terminal. For surface mount parts with large tabs, such as the DPAK, the tab on the back of the package should be pre-tinned with solder, then tacked into place by one of the pins. 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 6.0V 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 : AE3011FD2EE8F4EB[v1]
2. **TPS564242** Product Folder : <http://www.ti.com/product/TPS564242> : contains the data sheet and other resources.

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