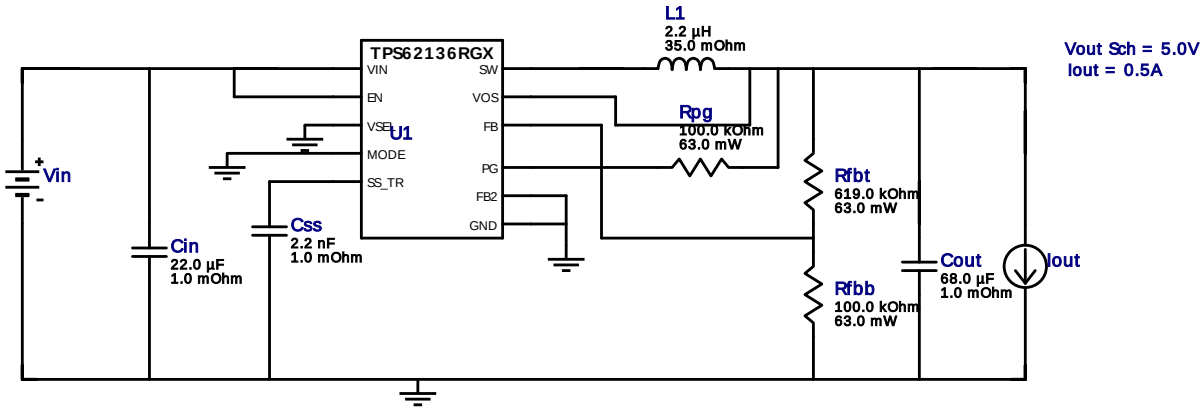
WEBENCH® Design Report

VinMin = 11.4V
VinMax = 12.6V
Vout = 5.0V
Vout Sch = 5.0V
Iout = 0.5A

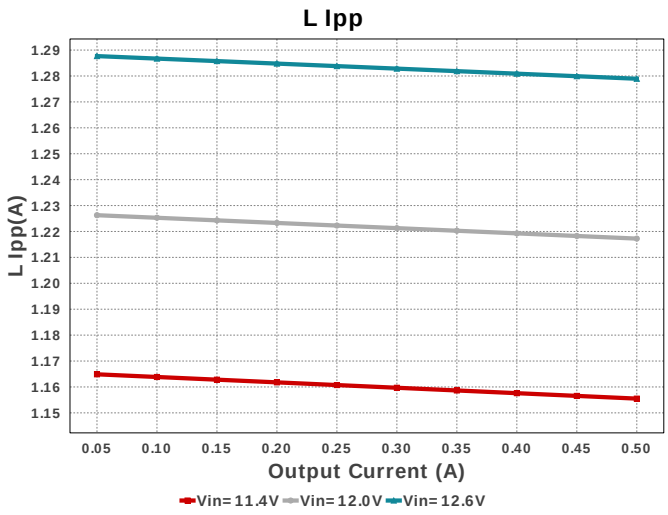
Device = TPS62136RGXR
Topology = Buck
Created = 2019-01-08 21:11:10.048
BOM Cost = NA
BOM Count = 8
Total Pd = 0.28W

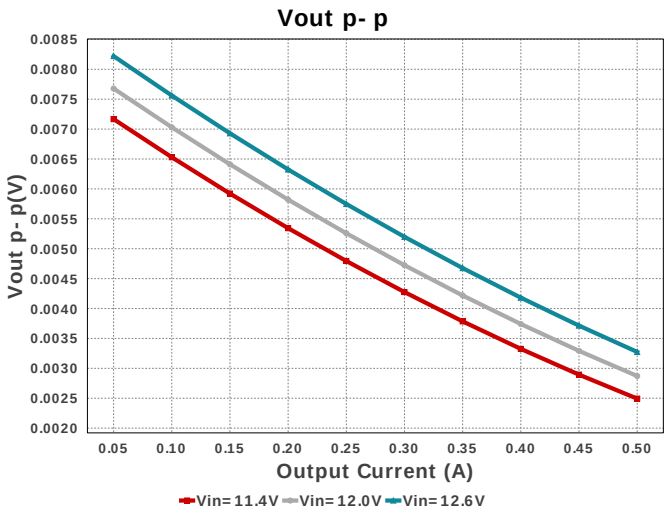
Design : 9202 TPS62136RGXR
TPS62136RGXR 11.4V-12.6V to 5.00V @ 0.5A

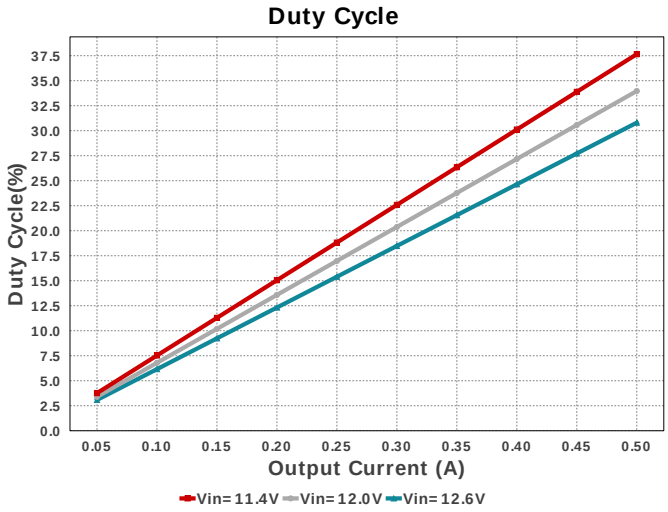


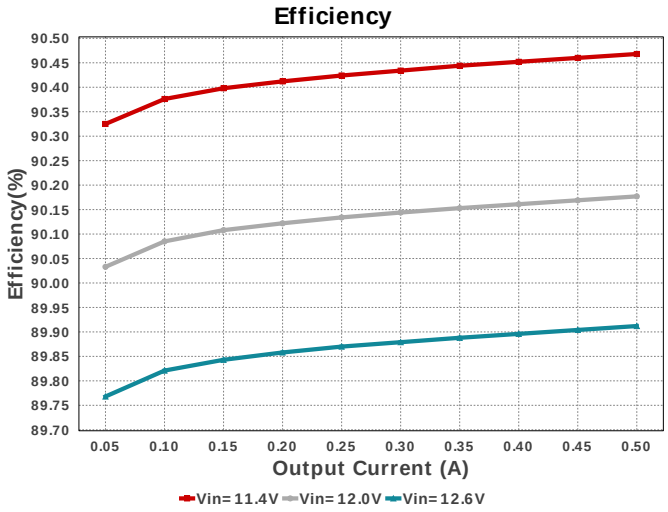
Electrical BOM

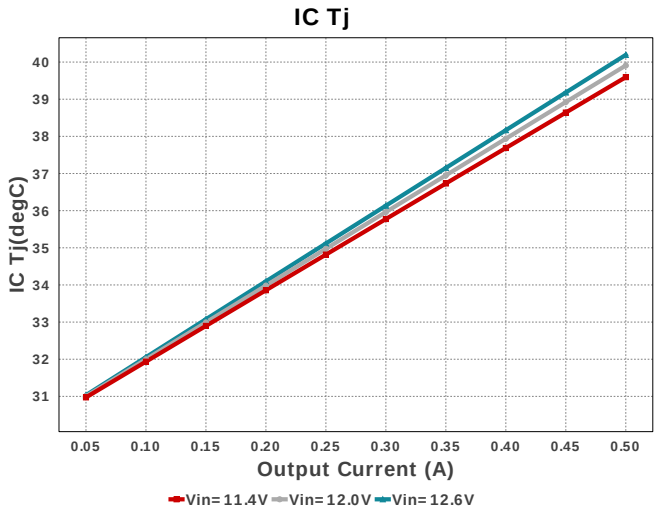
Name	Manufacturer	Part Number	Properties	Qty	Price	Footprint
Cin	CUSTOM	CUSTOM Series= X5R	Cap= 22.0 uF ESR= 1.0 mOhm VDC= 35.0 V IRMS= 3.8868 A	1	NA	0805 0 mm²
Cout	CUSTOM	CUSTOM Series= X5R	Cap= 68.0 uF ESR= 1.0 mOhm VDC= 10.0 V IRMS= 3.80451 A	1	NA	0805 0 mm²
Css	MuRata	GRM155R71C222KA01D Series= X7R	Cap= 2.2 nF ESR= 1.0 mOhm VDC= 16.0 V IRMS= 0.0 A	1	$0.01	0402 3 mm²
L1	CUSTOM	CUSTOM	L= 2.2 µH DCR= 35.0 mOhm	1	NA	XAL4020 0 mm²
Rfbb	Vishay-Dale	CRCW0402100KFKED Series= CRCW..e3	Res= 100.0 kOhm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	0402 3 mm²
Rfbt	Vishay-Dale	CRCW0402619KFKED Series= CRCW..e3	Res= 619.0 kOhm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	0402 3 mm²
Rpg	Vishay-Dale	CRCW0402100KFKED Series= CRCW..e3	Res= 100.0 kOhm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	0402 3 mm²
U1	Texas Instruments	TPS62136RGXR	Switcher	1	$0.83	RGX0011A 12 mm²

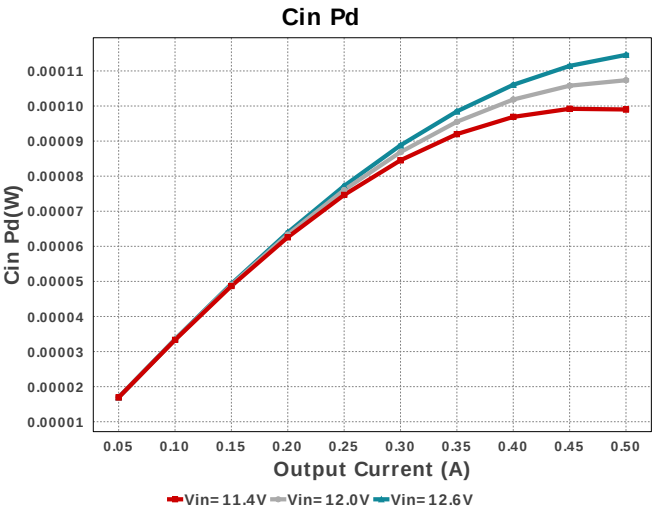


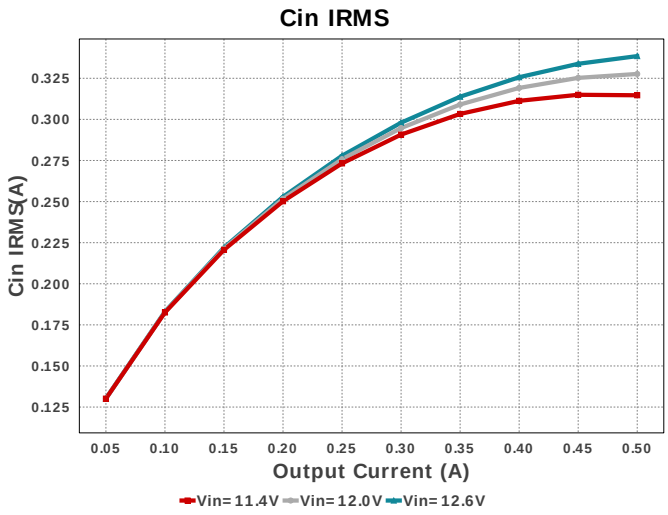


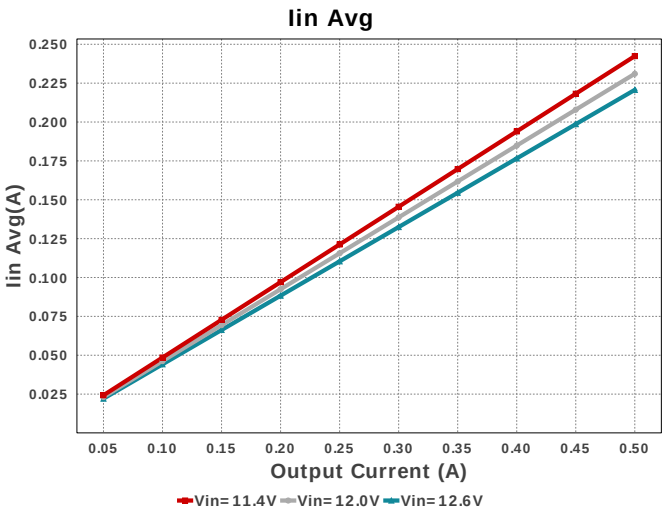


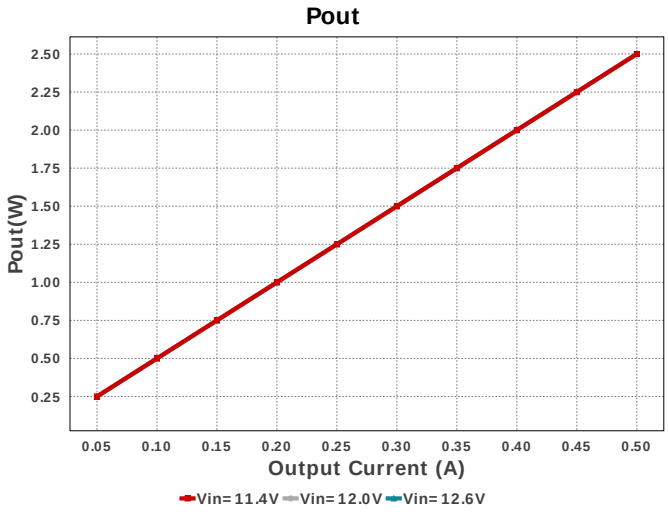


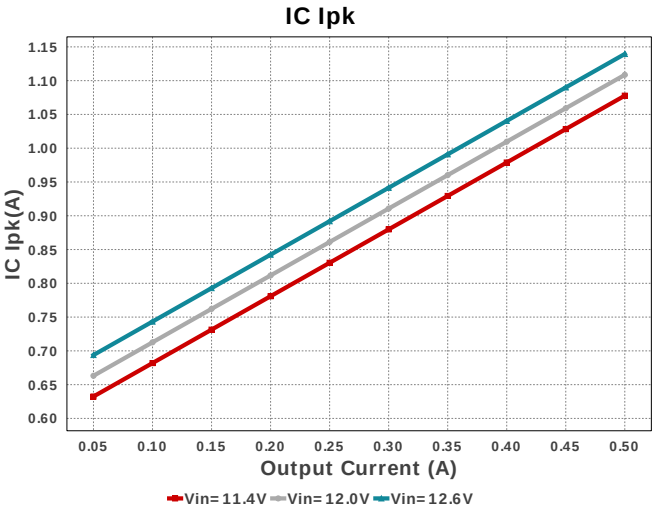


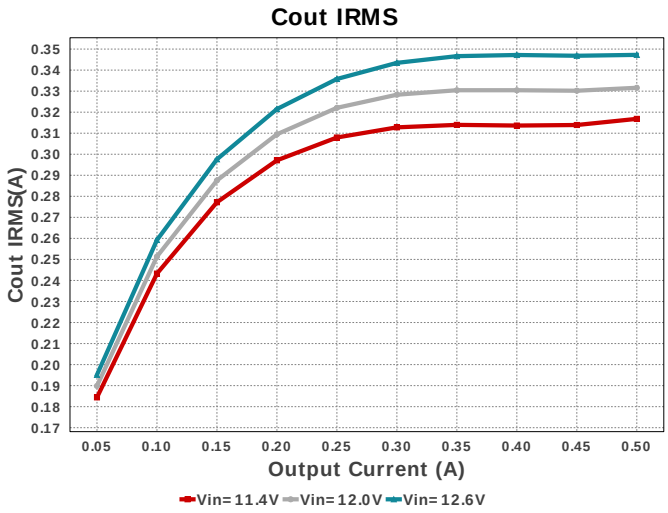


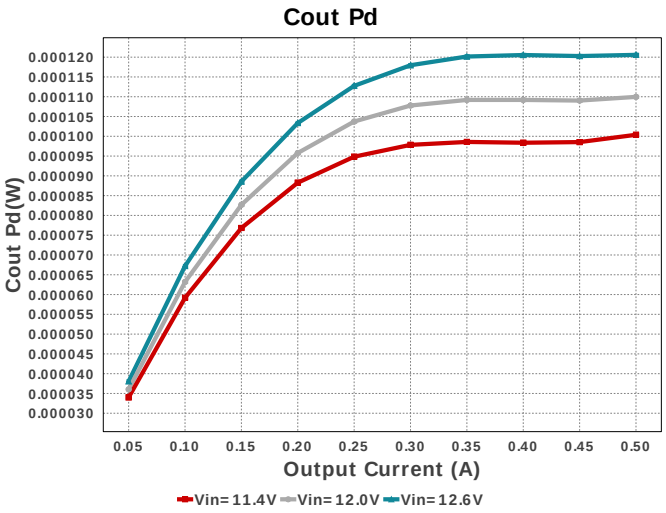


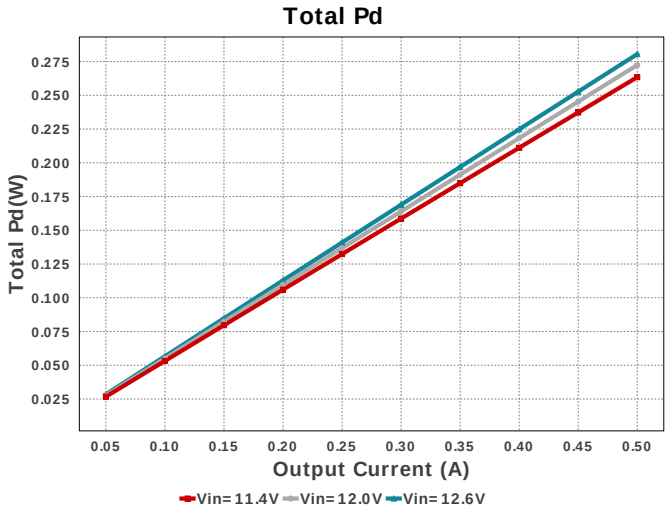


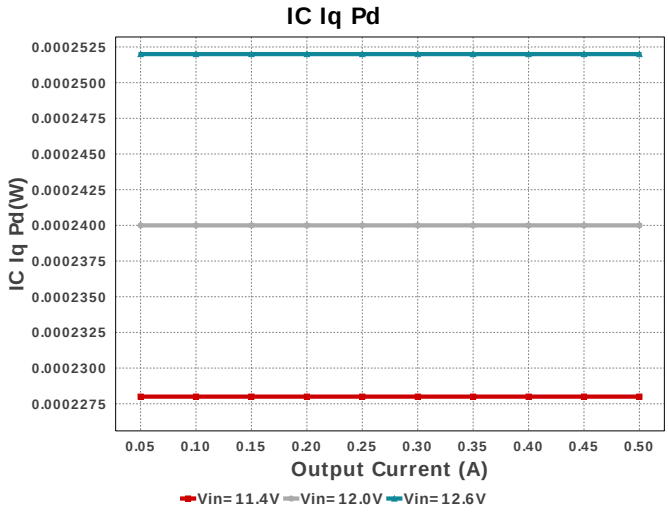


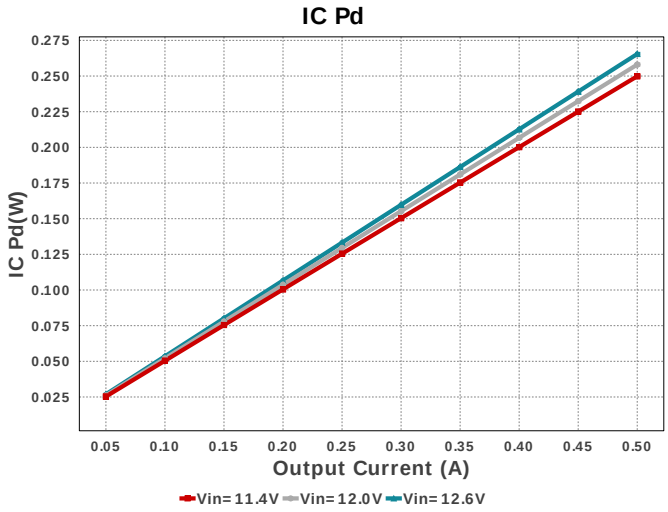


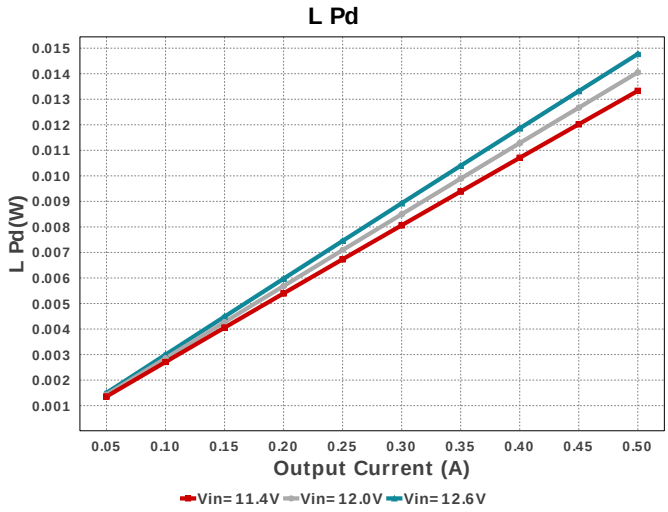


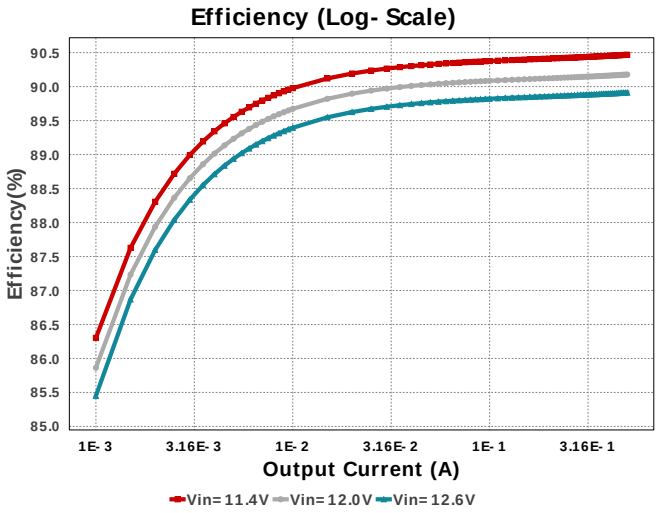












Operating Values

#	Name	Value	Category	Description
1.	BOM Count	8		Total Design BOM count
2.	Total BOM	NA		Total BOM Cost
3.	Cin IRMS	338.498 mA	Capacitor	Input capacitor RMS ripple current
4.	Cin Pd	114.58 µW	Capacitor	Input capacitor power dissipation
5.	Cout IRMS	347.247 mA	Capacitor	Output capacitor RMS ripple current
6.	Cout Pd	120.58 µW	Capacitor	Output capacitor power dissipation
7.	IC Ipk	1.139 A	IC	Peak switch current in IC
8.	IC Iq Pd	252.0 µW	IC	IC Iq Pd
9.	IC Pd	265.46 mW	IC	IC power dissipation
10.	IC Tj	40.194 degC	IC	IC junction temperature
11.	ICThetaJA	38.4 degC/W	IC	IC junction-to-ambient thermal resistance

#	Name	Value	Category	Description
12.	Iin Avg	220.68 mA	IC	Average input current
13.	L Ipp	1.279 A	Inductor	Peak-to-peak inductor ripple current
14.	L Pd	14.773 mW	Inductor	Inductor power dissipation
15.	Cin Pd	114.58 µW	Power	Input capacitor power dissipation
16.	Cout Pd	120.58 µW	Power	Output capacitor power dissipation
17.	IC Pd	265.46 mW	Power	IC power dissipation
18.	L Pd	14.773 mW	Power	Inductor power dissipation
19.	Total Pd	280.504 mW	Power	Total Power Dissipation
20.	Duty Cycle	30.804 %	System Information	Duty cycle
21.	Efficiency	89.912 %	System Information	Steady state efficiency
22.	FootPrint	66.0 mm^2	System Information	Total Foot Print Area of BOM components
23.	Frequency	825.79 kHz	System Information	Switching frequency
24.	Iout	500.0 mA	System Information	Iout operating point
25.	Mode	PFM	System Information	Conduction Mode
26.	Pout	2.5 W	System Information	Total output power
27.	Vin	12.6 V	System Information	Vin operating point
28.	Vout	5.0 V	System Information	Operational Output Voltage
29.	Vout Actual	5.033 V	System Information	Vout Actual calculated based on selected voltage divider resistors
30.	Vout Sch	5.0 V	System Information	Output voltage selected
31.	Vout Tolerance	2.757 %	System Information	Vout Tolerance based on IC Tolerance (no load) and voltage divider resistors if applicable
32.	Vout p-p	3.274 mV	System Information	Peak-to-peak output ripple voltage

Design Inputs

	Name	Value	Description
	Iout	500.0 m	Maximum Output Current
	VinMax	12.6	Maximum input voltage
	VinMin	11.4	Minimum input voltage
	Vout	5.0	Output Voltage
	base_pn	TPS62136	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

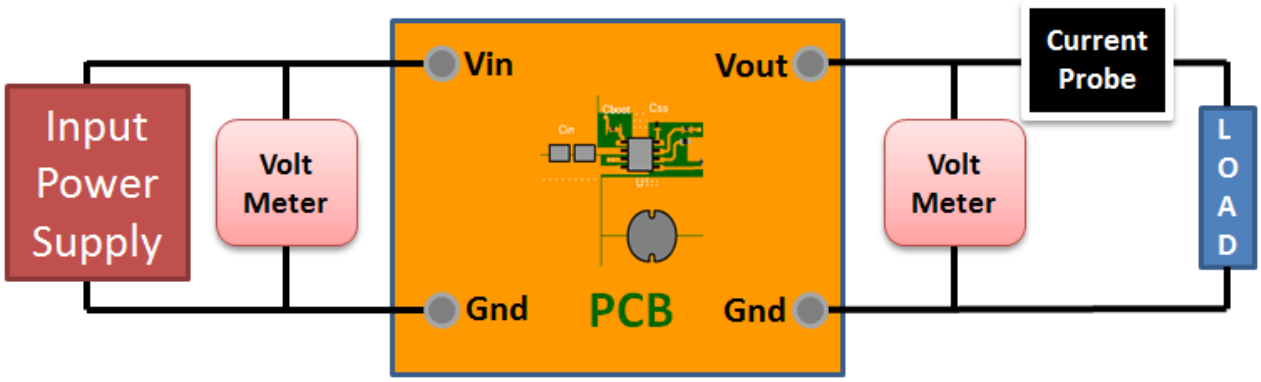
If board assembly is done in house it is best to tack down one terminal of a component on the board then solder the other terminal. For surface mount parts with large tabs, such as the DPAK, the tab on the back of the package should be pre-tinned with solder, then tacked into place by one of the pins. 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 11.4V 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 : F22F667B12AA23E8[v1]
2. **TPS62136** Product Folder : http://www.ti.com/product/tps62136 : contains the data sheet and other resources.