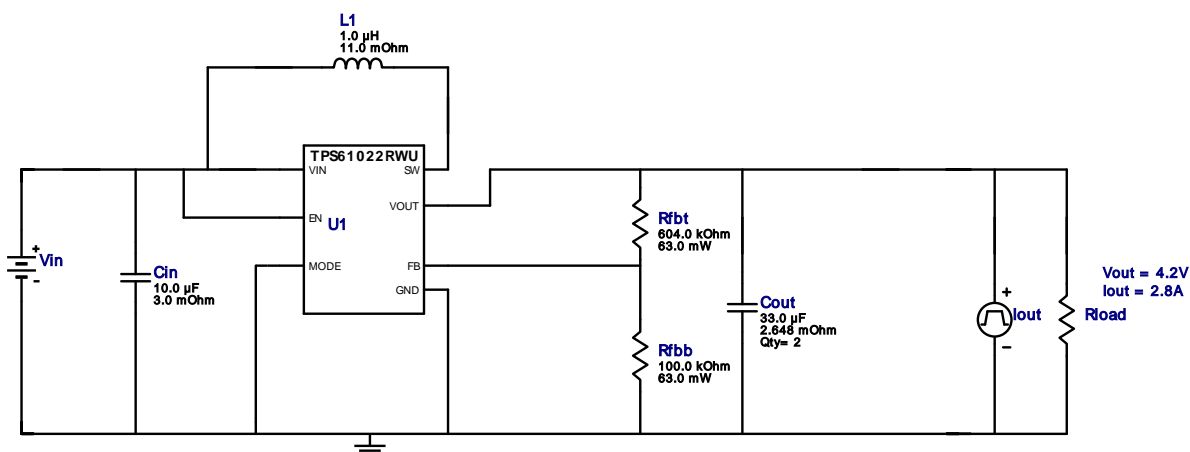


WEBENCH® Design Report

Design : 4 TPS61022RWUR
TPS61022RWUR 2.5V-4.2V to 4.2V @ 2.8A



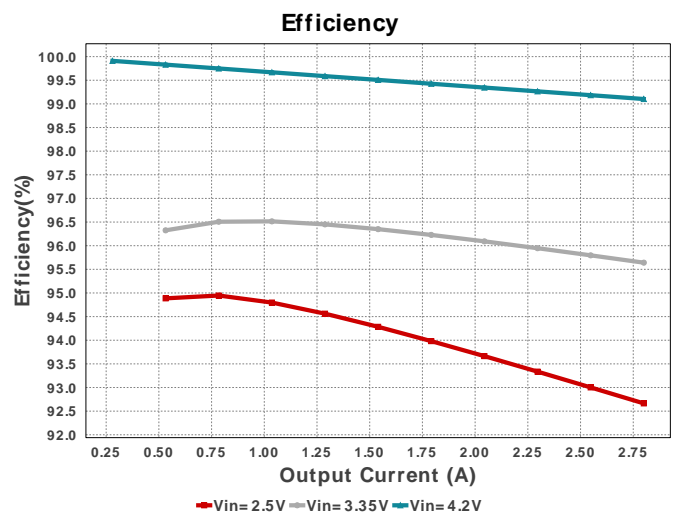
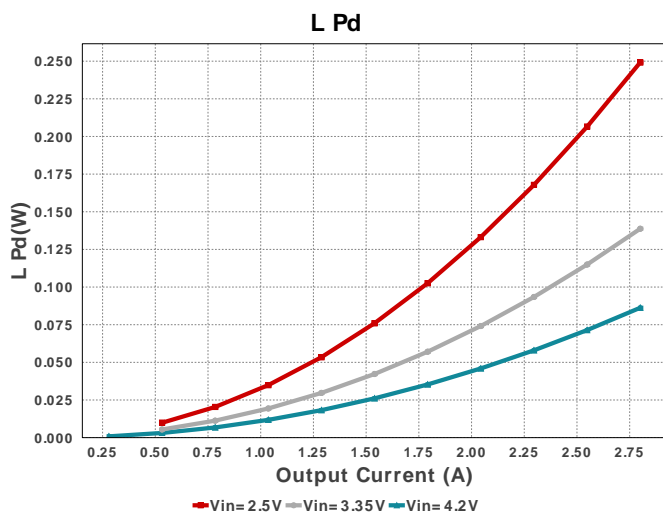
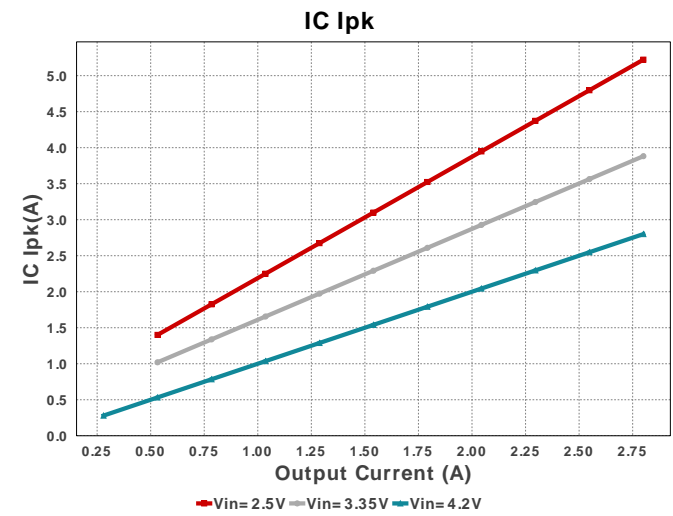
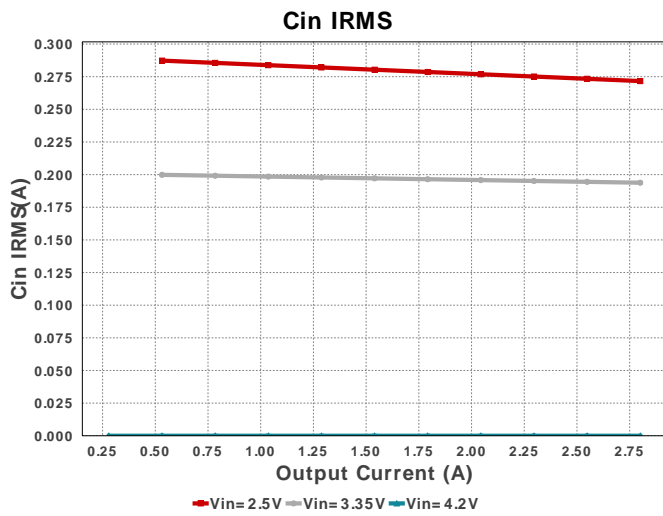
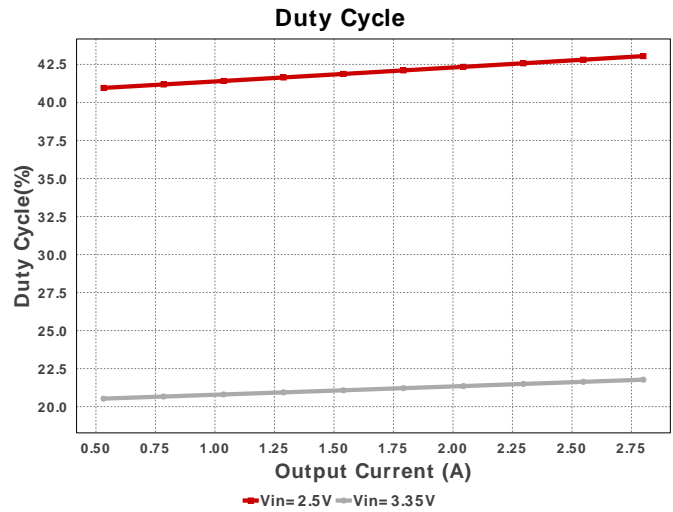
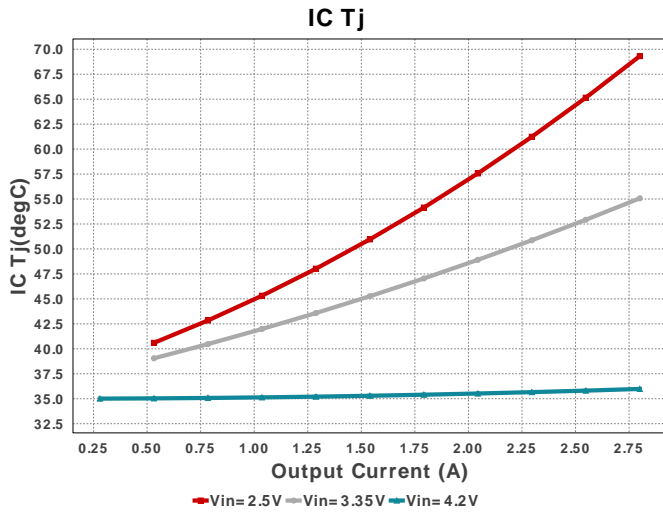
Design Alerts

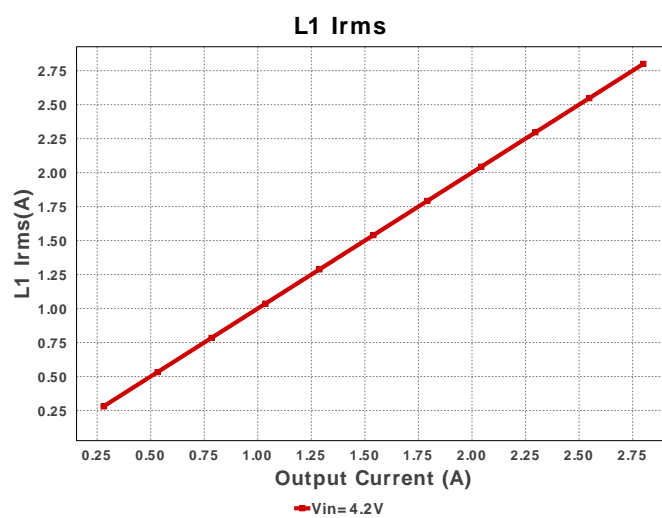
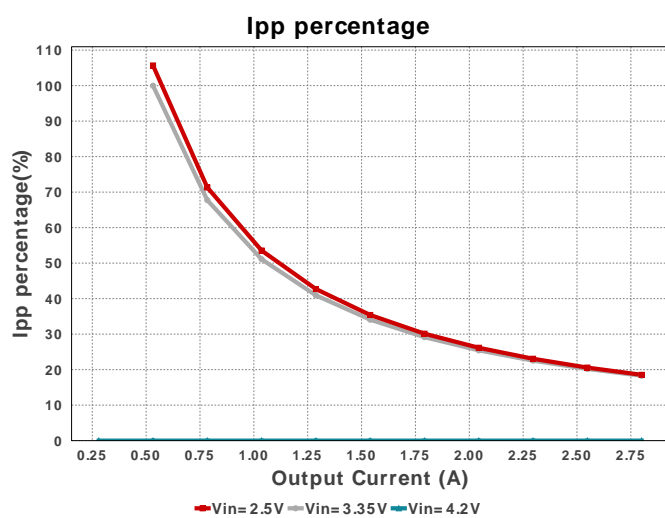
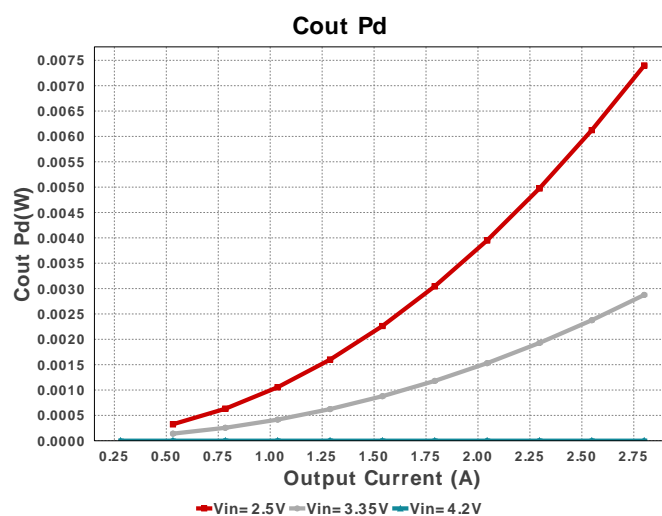
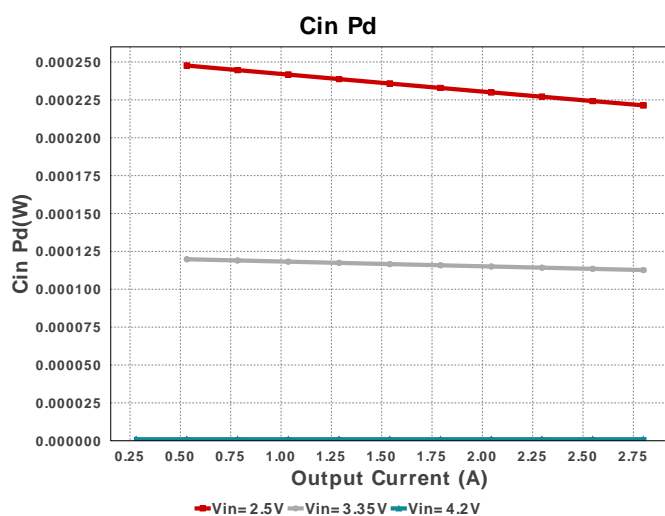
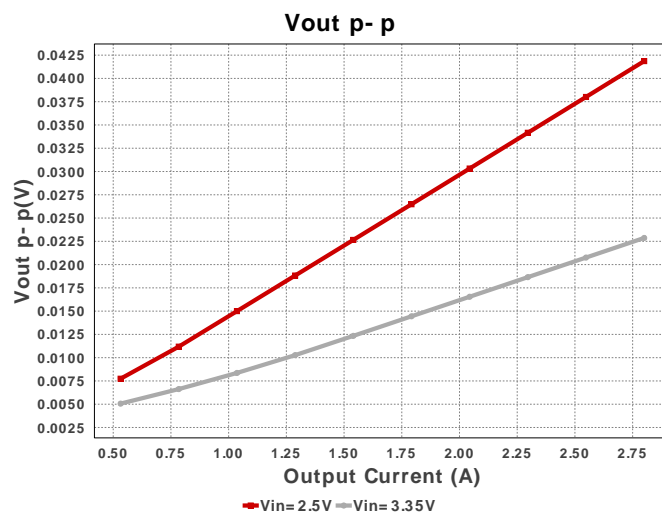
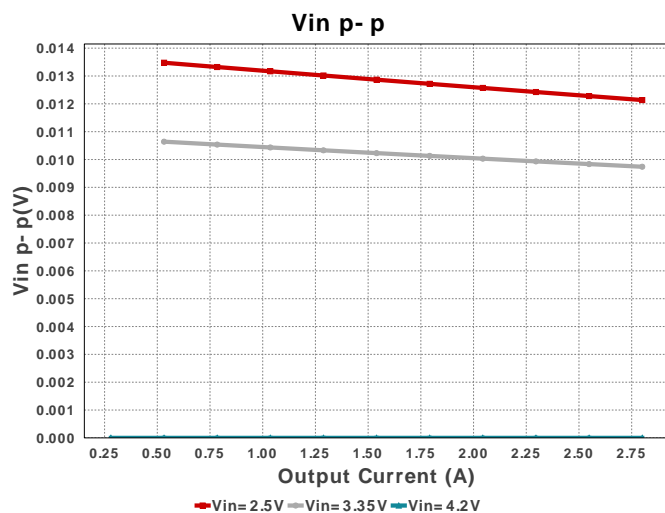
Component Selection Information

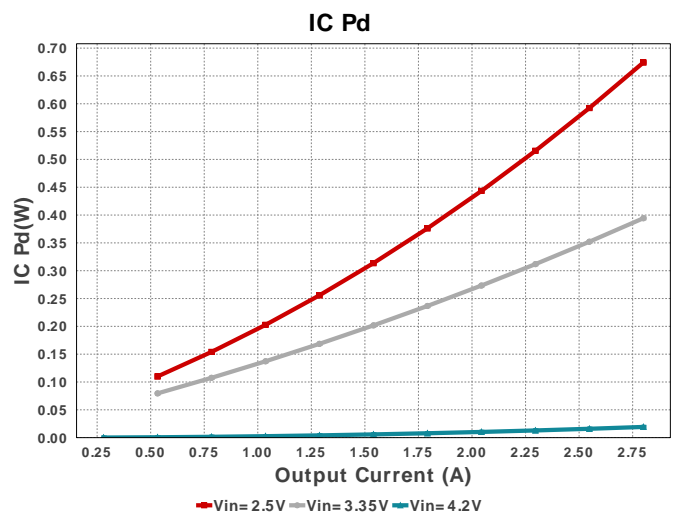
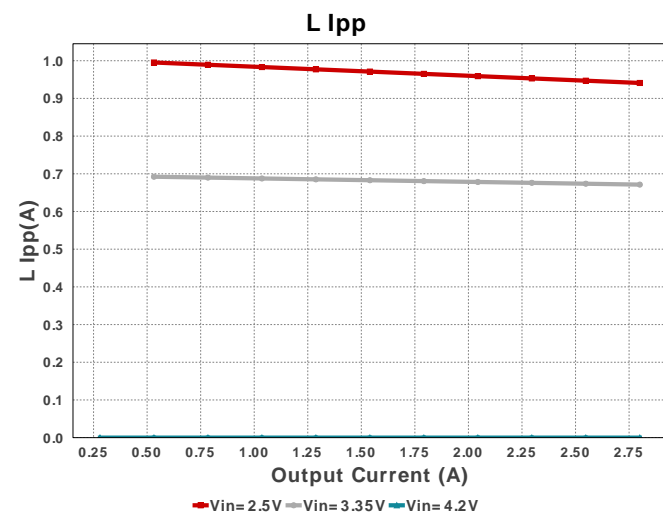
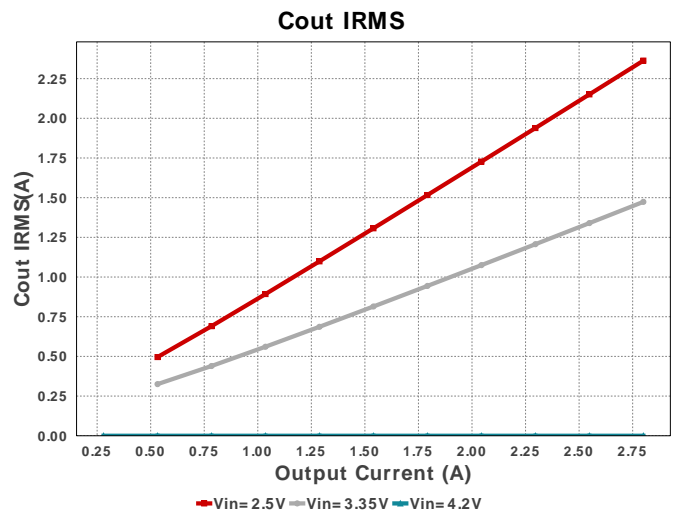
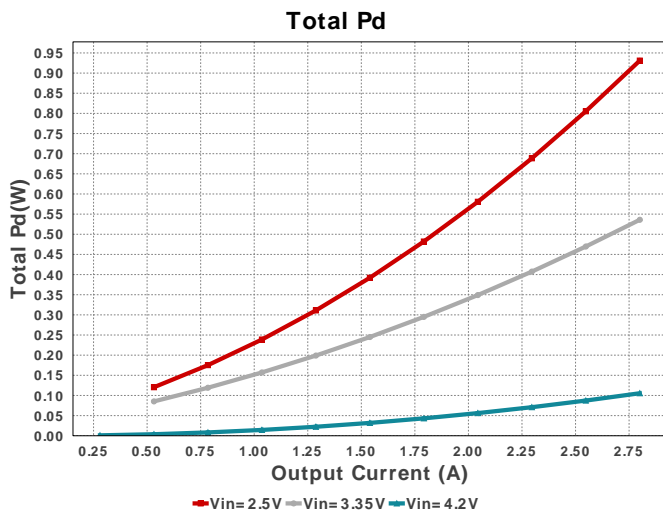
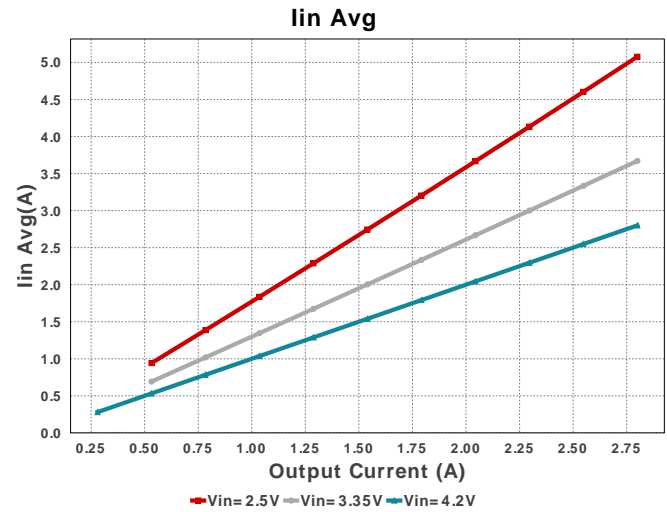
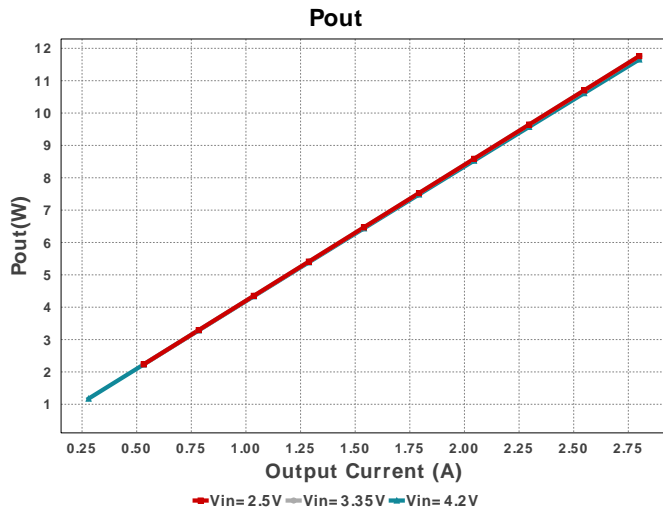
1. The TPS61022 Device will operate in Pass-Through mode when Vin is greater than Vout. In Pass-Through mode, Vout is not regulated to the set Vout, instead Vout is Vin with the drop across the FET's on-resistance and the DCR of the inductor. 2. This is a Boost Converter with 0.5V ultra-low input voltage. 3. The efficiency validation is done only for FPWM mode. Charts may be inaccurate for AutoMode at light loads and hence they are disabled for light loads.

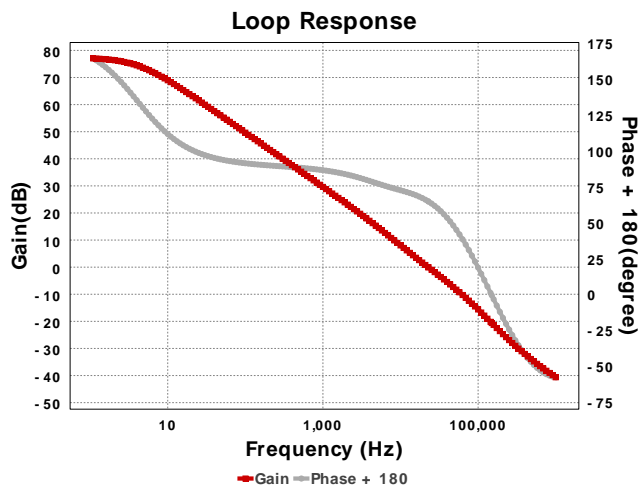
Electrical BOM

Name	Manufacturer	Part Number	Properties	Qty	Price	Footprint
Cin	Kemet	C0805C106K8PACTU Series= X5R	Cap= 10.0 uF ESR= 3.0 mOhm VDC= 10.0 V IRMS= 11.43 A	1	\$0.03	0805 7 mm ²
Cout	TDK	C3216X5R1E336M160AC Series= X5R	Cap= 33.0 uF ESR= 2.648 mOhm VDC= 25.0 V IRMS= 4.4586 A	2	\$0.39	1206_180 11 mm ²
L1	TDK	VLP8040T-1R0N	L= 1.0 uH 11.0 mOhm	1	\$0.22	VLP8040 113 mm ²
Rfbb	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	Vishay-Dale	CRCW0402604KFKED Series= CRCW..e3	Res= 604.0 kOhm Power= 63.0 mW Tolerance= 1.0%	1	\$0.01	0402 3 mm ²
U1	Texas Instruments	TPS61022RWUR	Switcher	1	\$0.57	RWU0007A 9 mm ²









Operating Values

#	Name	Value	Category	Description
1.	Cin IRMS	271.635 mA	Capacitor	Input capacitor RMS ripple current
2.	Cin Pd	221.36 μ W	Capacitor	Input capacitor power dissipation
3.	Cout IRMS	2.363 A	Capacitor	Output capacitor RMS ripple current
4.	Cout Pd	7.396 mW	Capacitor	Output capacitor power dissipation
5.	IC Ipk	5.222 A	IC	Peak switch current in IC
6.	IC Pd	674.18 mW	IC	IC power dissipation
7.	IC Tj	69.316 degC	IC	IC junction temperature
8.	IC Tolerance	15.0 mV	IC	IC Feedback Tolerance
9.	ICThetaJA	50.9 degC/W	IC	IC junction-to-ambient thermal resistance
10.	Iin Avg	5.076 A	IC	Average input current
11.	Ipp percentage	18.536 %	Inductor	Inductor ripple current percentage (with respect to average inductor current)
12.	L Ipp	940.973 mA	Inductor	Peak-to-peak inductor ripple current
13.	L Pd	249.16 mW	Inductor	Inductor power dissipation
14.	Cin Pd	221.36 μ W	Power	Input capacitor power dissipation
15.	Cout Pd	7.396 mW	Power	Output capacitor power dissipation
16.	IC Pd	674.18 mW	Power	IC power dissipation
17.	L Pd	249.16 mW	Power	Inductor power dissipation
18.	Total Pd	931.012 mW	Power	Total Power Dissipation
19.	BOM Count	7	System	Total Design BOM count
20.	Cross Freq	14.036 kHz	System	Bode plot crossover frequency
21.	Duty Cycle	43.047 %	System	Duty cycle
22.	Efficiency	92.664 %	System	Steady state efficiency
23.	FootPrint	157.0 mm ²	System	Total Foot Print Area of BOM components
24.	Frequency	1.068 MHz	System	Switching frequency
25.	Gain Marg	-15.427 dB	System	Bode Plot Gain Margin
26.	Iout	2.8 A	System	Iout operating point
27.	Low Freq Gain	72.233 dB	System	Gain at 1Hz
28.	Mode	CCM	System	Conduction Mode
29.	Phase Marg	63.96 deg	System	Bode Plot Phase Margin
30.	Pout	11.76 W	System	Total output power
31.	Total BOM	\$1.62	System	Total BOM Cost
32.	Vin	2.5 V	System	Vin operating point
33.	Vin p-p	12.136 mV	System	Peak-to-peak input voltage
34.	Vout	4.2 V	System	Operational Output Voltage

#	Name	Value	Category	Description
35.	Vout Actual	4.224 V	System Information	Vout Actual calculated based on selected voltage divider resistors
36.	Vout Tolerance	4.277 %	System Information	Vout Tolerance based on IC Tolerance (no load) and voltage divider resistors if applicable
37.	Vout p-p	41.861 mV	System Information	Peak-to-peak output ripple voltage

Design Inputs

Name	Value	Description
Iout	2.8	Maximum Output Current
VinMax	4.2	Maximum input voltage
VinMin	2.5	Minimum input voltage
Vout	4.2	Output Voltage
base_pn	TPS61022	Base Product Number
source	DC	Input Source Type
Ta	35.0	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 2.5V 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.

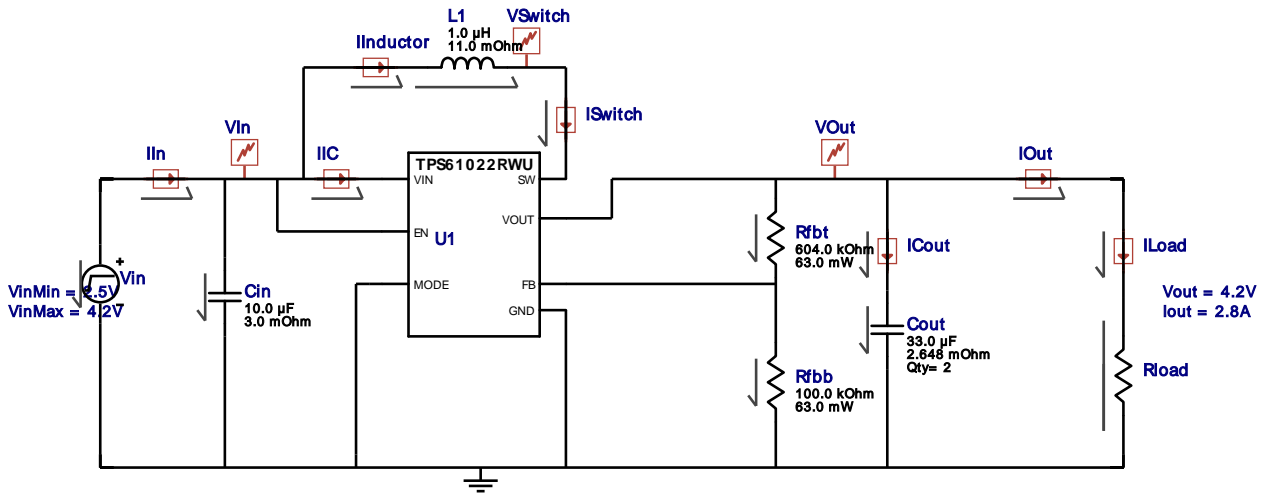


WEBENCH® Electrical Simulation Report

Design Id = 4

sim_id = 4

Simulation Type = Startup



Simulation Parameters

#	Name	Parameter Name	Description	Values
1.	Rload	R	Load Resistance	1.5000000000000002 ohm

Design Assistance

1. Feature Highlights: 1. Device will operate in Pass-Through mode when Vin is greater than Vout. In Pass-Through mode, Vout is not regulated to the set Vout, instead Vout is Vin with the drop across the FET's on-resistance and the DCR of the inductor. 2. Device will operate in PassThrough Mode When Vin is greater than Vout

2. Master key : 09E862586525B1D3[v1]

3. **TPS61022** Product Folder : <http://www.ti.com/product/TPS61022> : contains the data sheet and other resources.

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