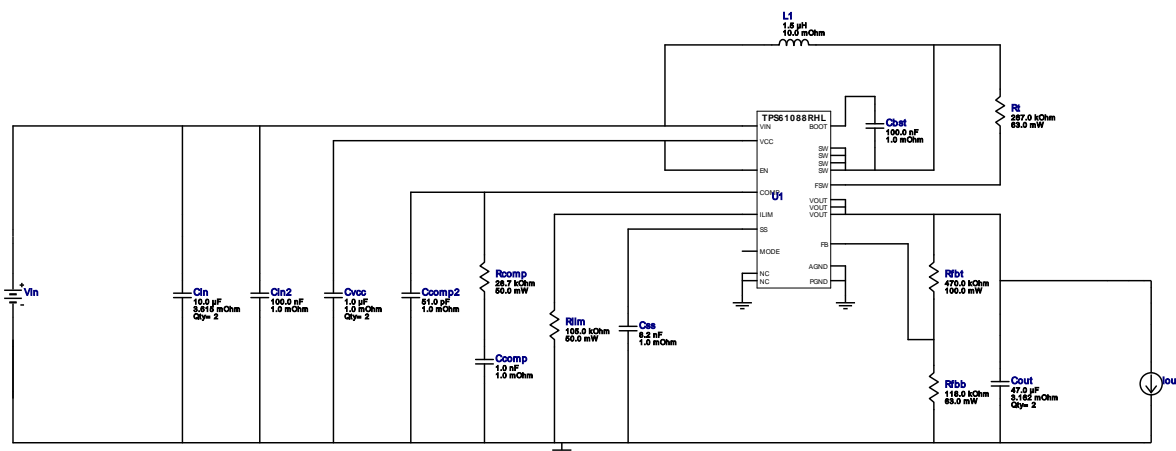


WEBENCH® Design Report

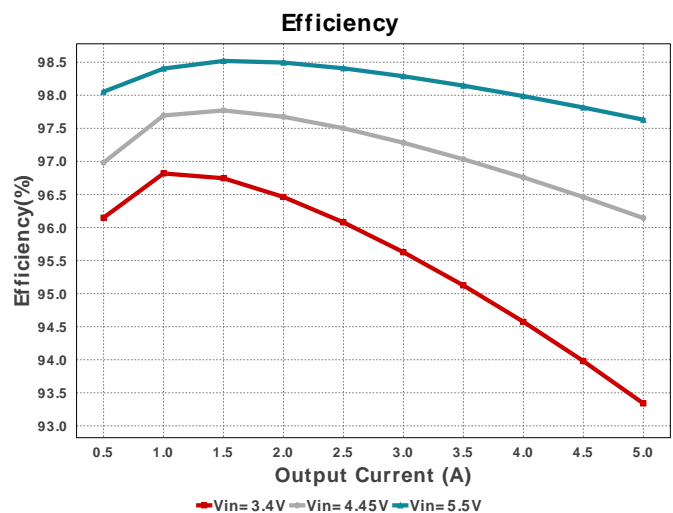
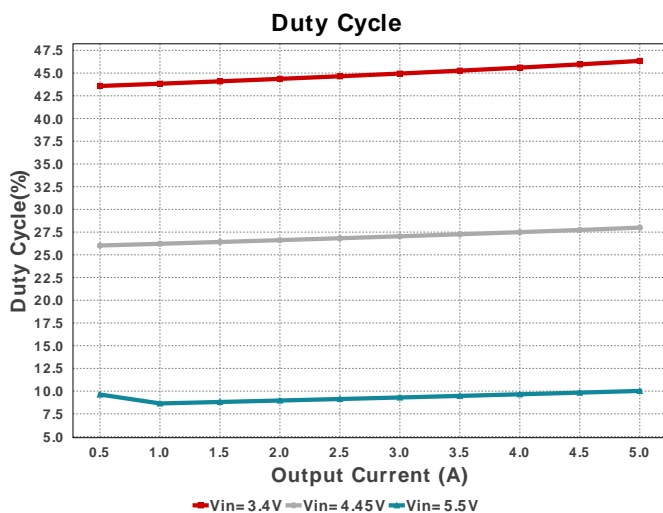
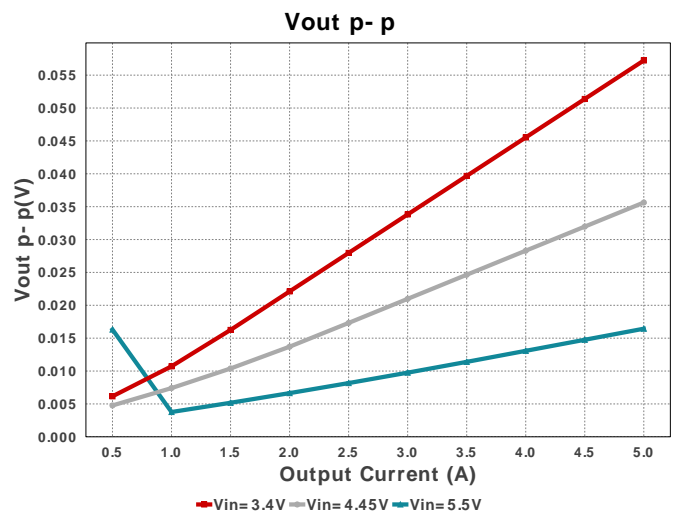
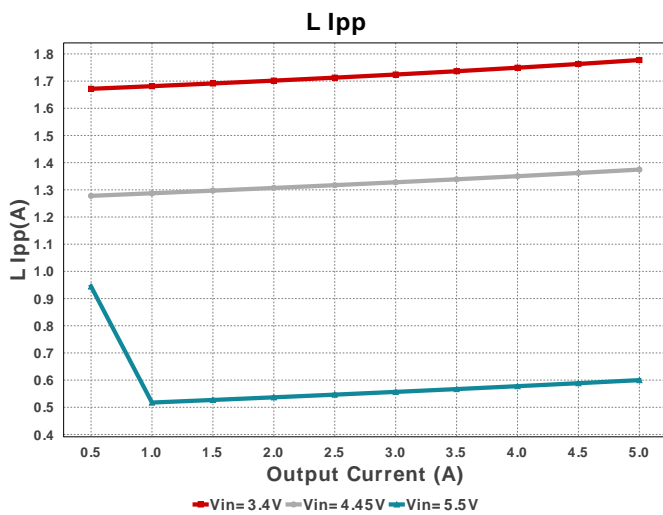
Design : 84 TPS61088RHLL
TPS61088RHLL 3.4V-5.5V to 6.00V @ 5A



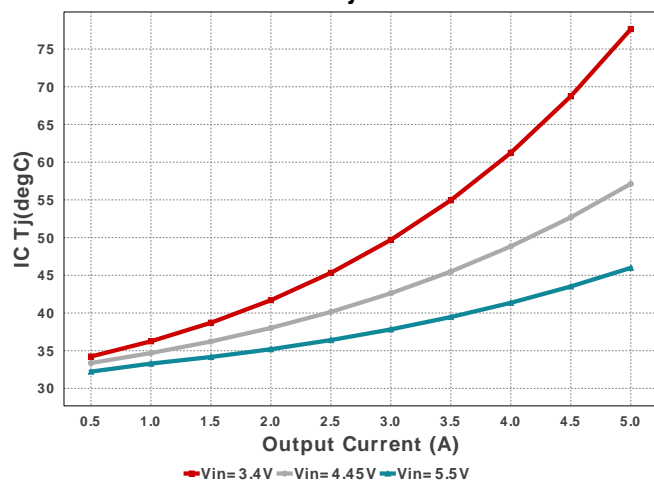
Electrical BOM

Name	Manufacturer	Part Number	Properties	Qty	Price	Footprint
Cbst	MuRata	GRM155R71C104KA88D Series= X7R	Cap= 100.0 nF ESR= 1.0 mOhm VDC= 16.0 V IRMS= 0.0 A	1	\$0.01	0402 3 mm ²
Ccomp	MuRata	GRM033R71C102KA01D Series= X7R	Cap= 1.0 nF ESR= 1.0 mOhm VDC= 16.0 V IRMS= 0.0 A	1	\$0.01	0201 2 mm ²
Ccomp2	MuRata	GRM1555C1E510JA01D Series= C0G/NP0	Cap= 51.0 pF ESR= 1.0 mOhm VDC= 25.0 V IRMS= 0.0 A	1	\$0.01	0402 3 mm ²
Cin	MuRata	GRM31CR61C106KA88L Series= X5R	Cap= 10.0 uF ESR= 3.615 mOhm VDC= 16.0 V IRMS= 3.8281 A	2	\$0.08	1206_190 11 mm ²
Cin2	MuRata	GRM155R71C104KA88D Series= X7R	Cap= 100.0 nF ESR= 1.0 mOhm VDC= 16.0 V IRMS= 0.0 A	1	\$0.01	0402 3 mm ²
Cout	TDK	C5750X5R1C476M230KA Series= X5R	Cap= 47.0 uF ESR= 3.162 mOhm VDC= 16.0 V IRMS= 5.1344 A	2	\$0.72	2220_250 54 mm ²
Css	MuRata	GRM155R71C822KA01D Series= X7R	Cap= 8.2 nF ESR= 1.0 mOhm VDC= 16.0 V IRMS= 0.0 A	1	\$0.01	0402 3 mm ²
Cvcc	Taiyo Yuden	EMK107B7105KA-T Series= X7R	Cap= 1.0 uF ESR= 1.0 mOhm VDC= 16.0 V IRMS= 0.0 A	2	\$0.02	0603 5 mm ²
L1	Bourns	SRP6540-1R5M	L= 1.5 uH 10.0 mOhm	1	\$0.59	SRP6540 83 mm ²

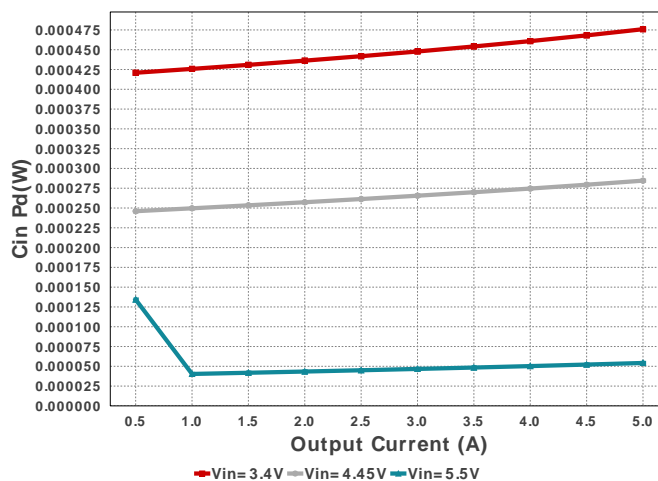
Name	Manufacturer	Part Number	Properties	Qty	Price	Footprint
Rcomp	Yageo	RC0201FR-0728K7L Series= ?	Res= 28.7 kOhm Power= 50.0 mW Tolerance= 1.0%	1	\$0.01	0201 2 mm ²
Rfbb	Vishay-Dale	CRCW0402118KFKED Series= CRCW..e3	Res= 118.0 kOhm Power= 63.0 mW Tolerance= 1.0%	1	\$0.01	0402 3 mm ²
Rfbt	Yageo	RC0603FR-07470KL Series= ?	Res= 470.0 kOhm Power= 100.0 mW Tolerance= 1.0%	1	\$0.01	0603 5 mm ²
Rlim	Yageo	RC0201FR-07105KL Series= ?	Res= 105.0 kOhm Power= 50.0 mW Tolerance= 1.0%	1	\$0.01	0201 2 mm ²
Rt	Vishay-Dale	CRCW0402267KFKED Series= CRCW..e3	Res= 267.0 kOhm Power= 63.0 mW Tolerance= 1.0%	1	\$0.01	0402 3 mm ²
U1	Texas Instruments	TPS61088RHLR	Switcher	1	\$1.60	RHL0020A 25 mm ²



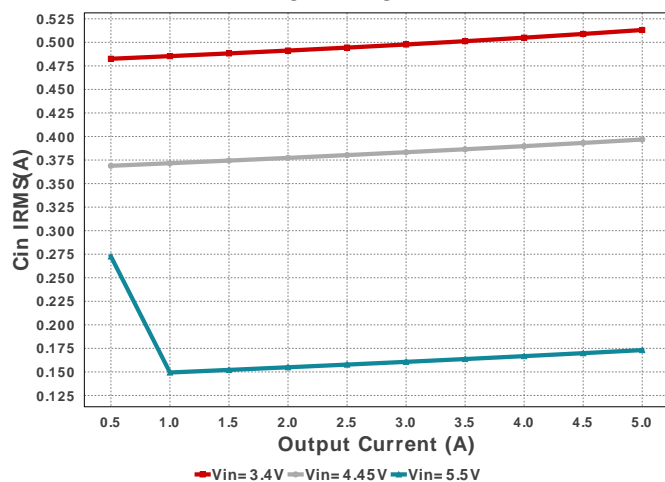
IC Tj



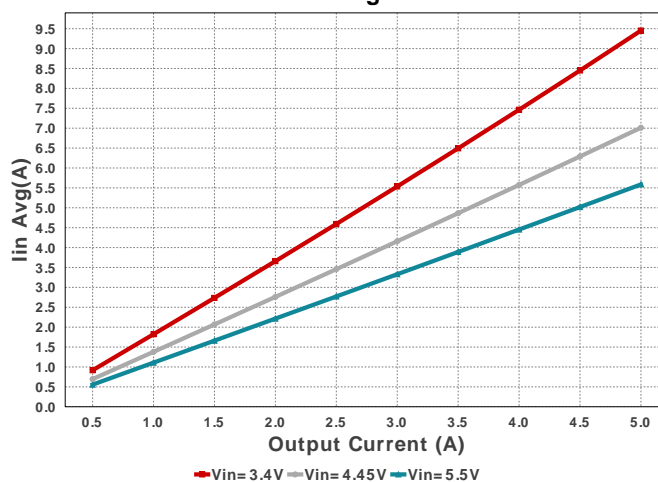
Cin Pd



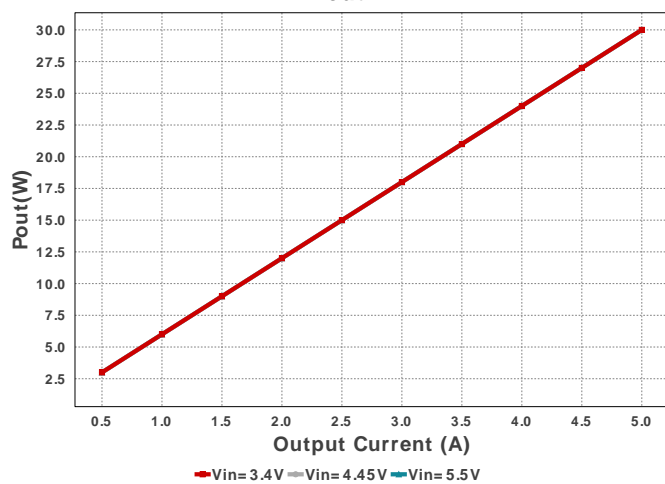
Cin IRMS



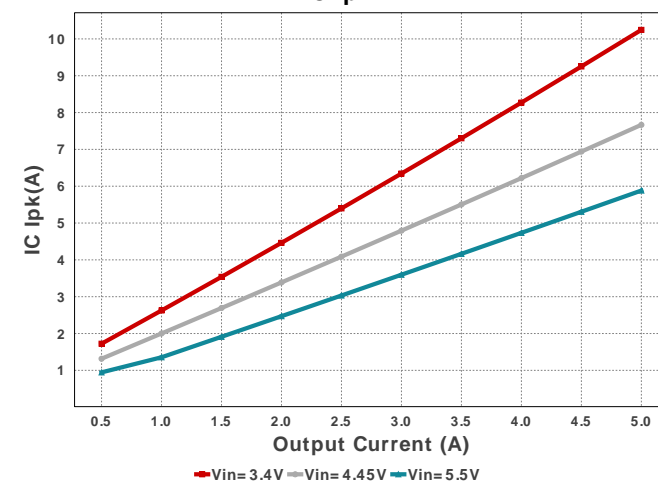
Iin Avg



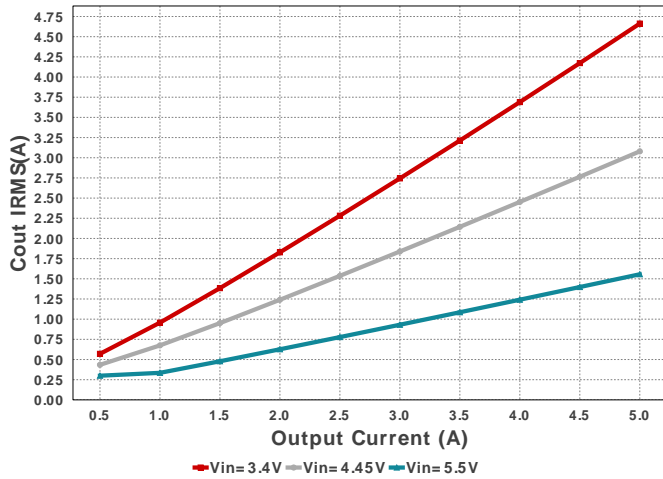
Pout



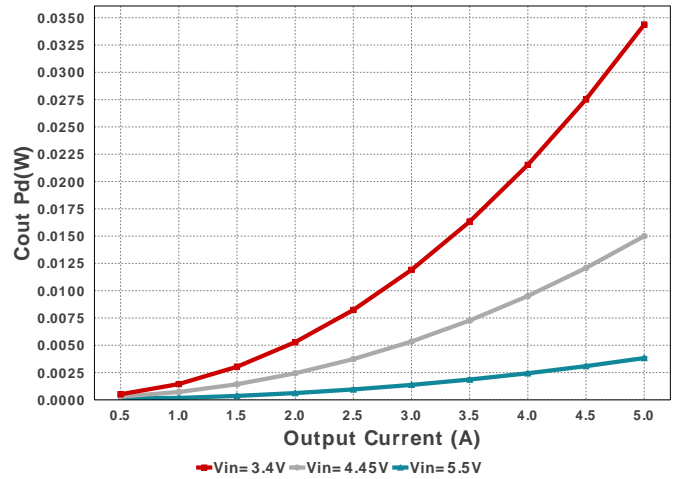
IC Ipk



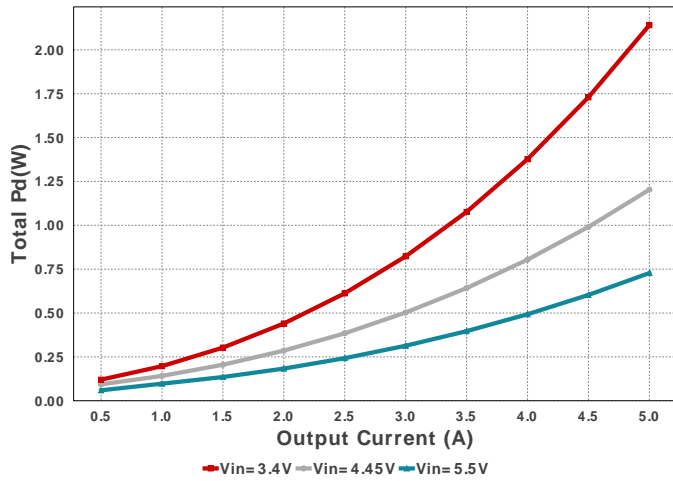
Cout IRMS



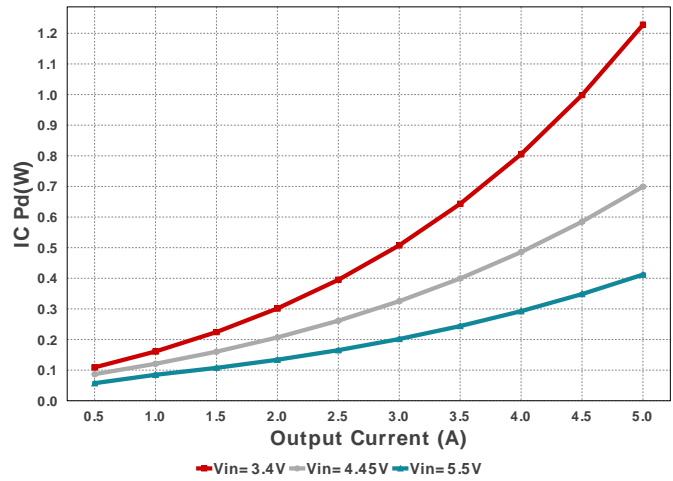
Cout Pd



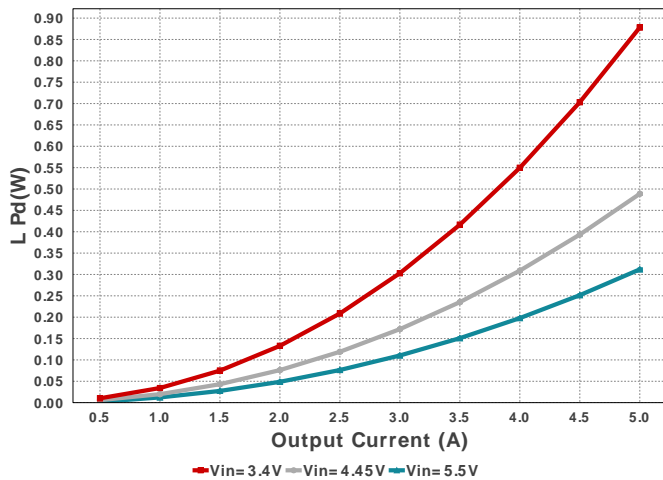
Total Pd



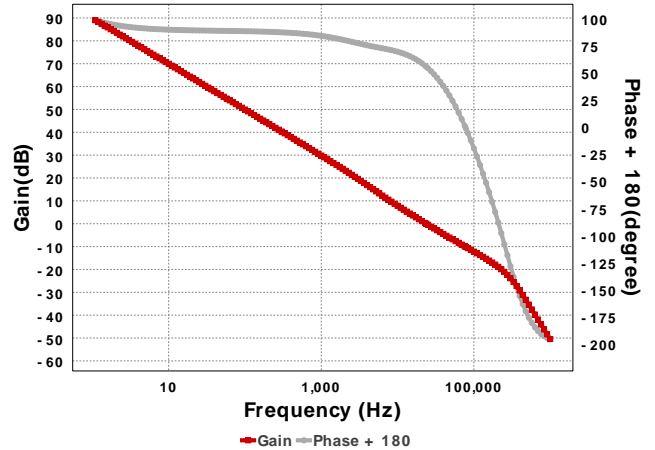
IC Pd

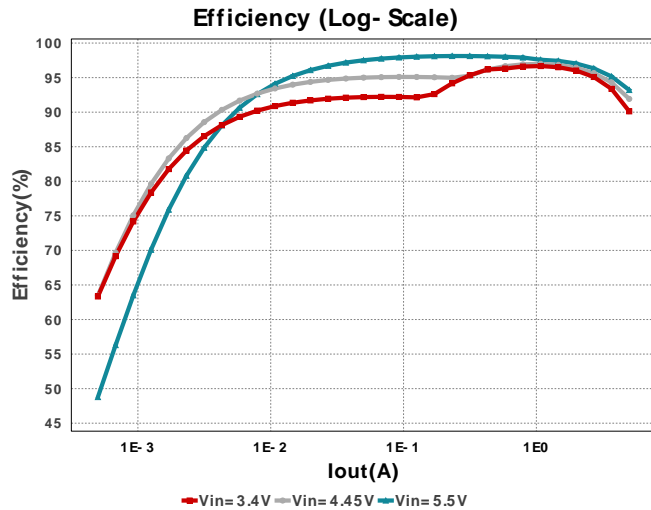


L Pd



Loop Response





Operating Values

#	Name	Value	Category	Description
1.	Cin IRMS	513.124 mA	Capacitor	Input capacitor RMS ripple current
2.	Cin Pd	475.91 μ W	Capacitor	Input capacitor power dissipation
3.	Cout IRMS	4.662 A	Capacitor	Output capacitor RMS ripple current
4.	Cout Pd	34.366 mW	Capacitor	Output capacitor power dissipation
5.	IC Ipk	10.245 A	IC	Peak switch current in IC
6.	IC Pd	1.228 W	IC	IC power dissipation
7.	IC Tj	77.643 degC	IC	IC junction temperature
8.	ICThetaJA	38.8 degC/W	IC	IC junction-to-ambient thermal resistance
9.	Iin Avg	9.453 A	IC	Average input current
10.	L Ipp	1.778 A	Inductor	Peak-to-peak inductor ripple current
11.	L Pd	878.11 mW	Inductor	Inductor power dissipation
12.	Cin Pd	475.91 μ W	Power	Input capacitor power dissipation
13.	Cout Pd	34.366 mW	Power	Output capacitor power dissipation
14.	IC Pd	1.228 W	Power	IC power dissipation
15.	L Pd	878.11 mW	Power	Inductor power dissipation
16.	Total Pd	2.141 W	Power	Total Power Dissipation
17.	BOM Count	18	System	Total Design BOM count
18.	Cross Freq	23.577 kHz	System	Bode plot crossover frequency
19.	Duty Cycle	46.339 %	System	Duty cycle
20.	Efficiency	93.339 %	System	Steady state efficiency
21.	FootPrint	275.0 mm ²	System	Total Foot Print Area of BOM components
22.	Frequency	590.909 kHz	System	Switching frequency
23.	Gain Marg	-9.978 dB	System	Bode Plot Gain Margin
24.	Iout	5.0 A	System	Iout operating point
25.	Low Freq Gain	87.956 dB	System	Gain at 1Hz
26.	Mode	BOOST CCM	System	PWM/PFM Mode
27.	Phase Marg	57.558 deg	System	Bode Plot Phase Margin
28.	Pout	30.0 W	System	Total output power
29.	Total BOM	\$3.93	System	Total BOM Cost
30.	Vin	3.4 V	System	Vin operating point
31.	Vout Actual	6.0 V	System	Vout Actual calculated based on selected voltage divider resistors
32.	Vout Tolerance	4.273 %	System	Vout Tolerance based on IC Tolerance (no load) and voltage divider resistors if applicable
33.	Vout p-p	57.231 mV	System	Peak-to-peak output ripple voltage

Design Inputs

Name	Value	Description
Iout	5.0	Maximum Output Current
VinMax	5.5	Maximum input voltage
VinMin	3.4	Minimum input voltage
Vout	6.0	Output Voltage
base_pn	TPS61088	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 3.4V 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 : 9697144EE3E54A83[v1]
2. **TPS61088** Product Folder : <http://www.ti.com/product/TPS61088> : contains the data sheet and other resources.

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