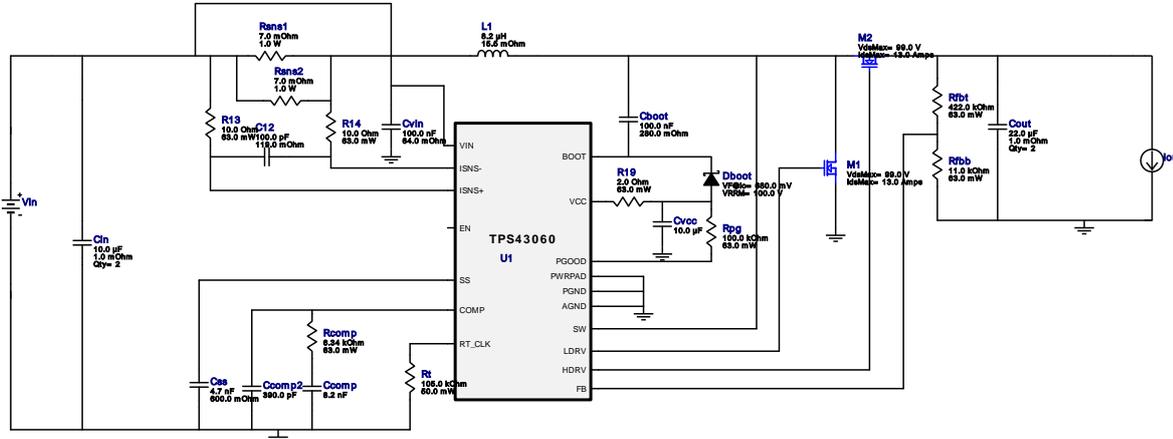


# WEBENCH® Design Report

Design : 15206 TPS43060RTER  
 TPS43060RTER 19V-28V to 48.00V @ 3A

Vout = 48.0V  
 Iout = 3.0A



1. The pulse skip mode in the device has not been modeled. Efficiency and operational parameters of the model in pulse skip mode is not valid.

## Design Alerts

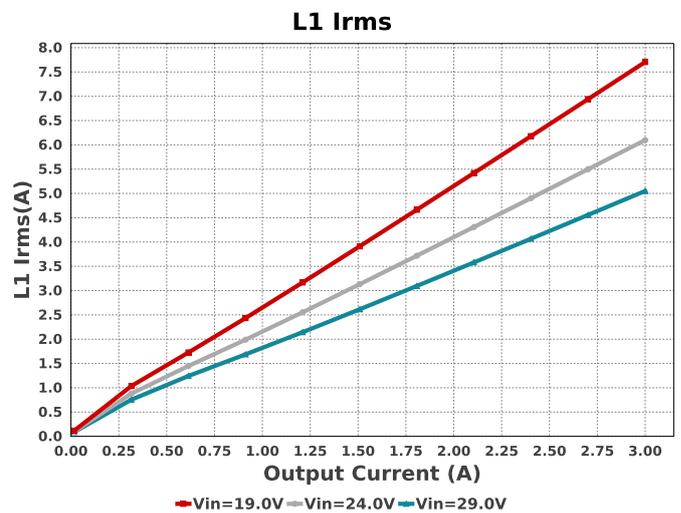
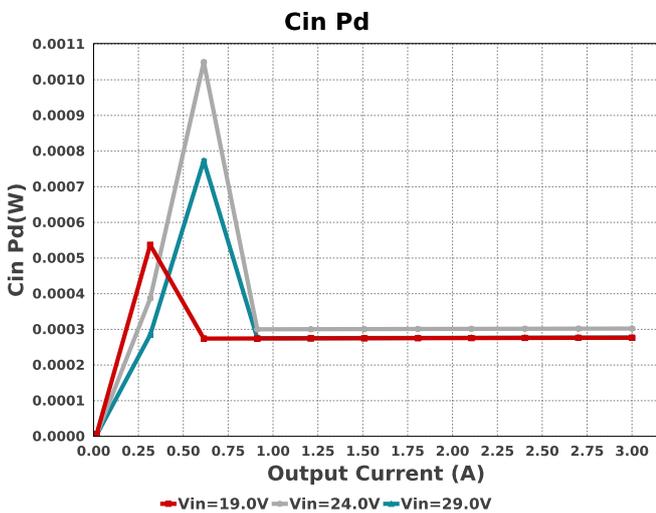
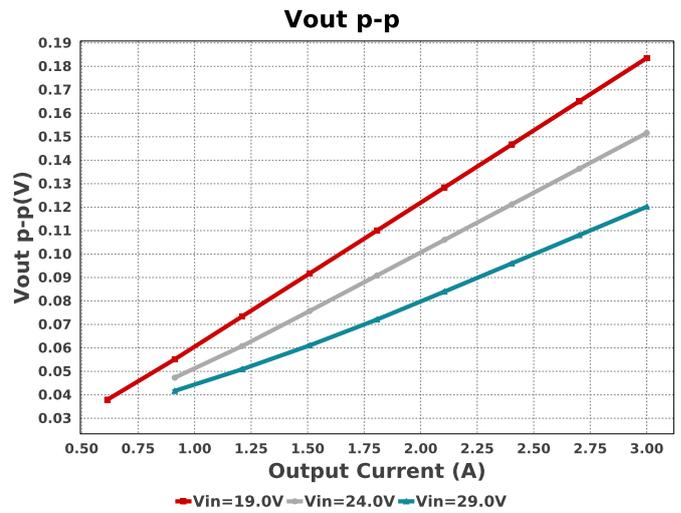
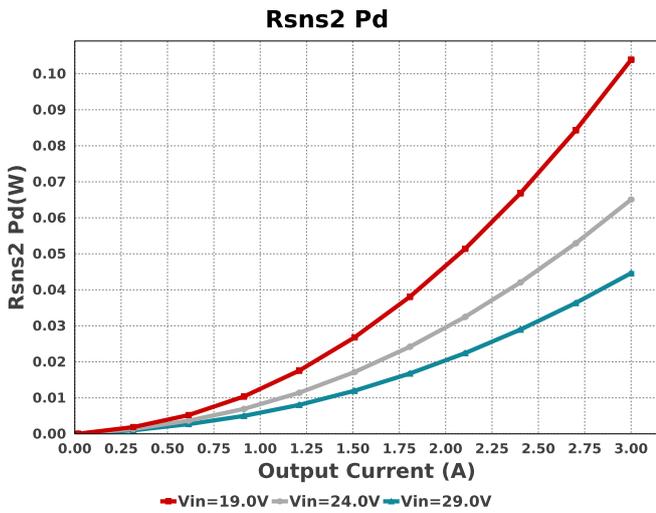
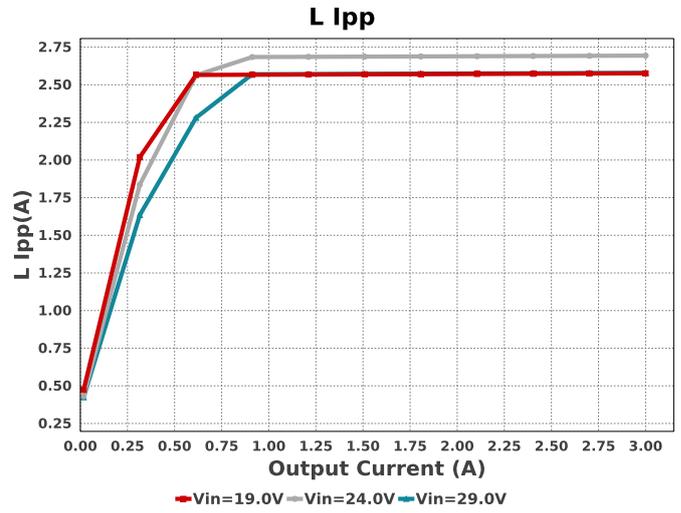
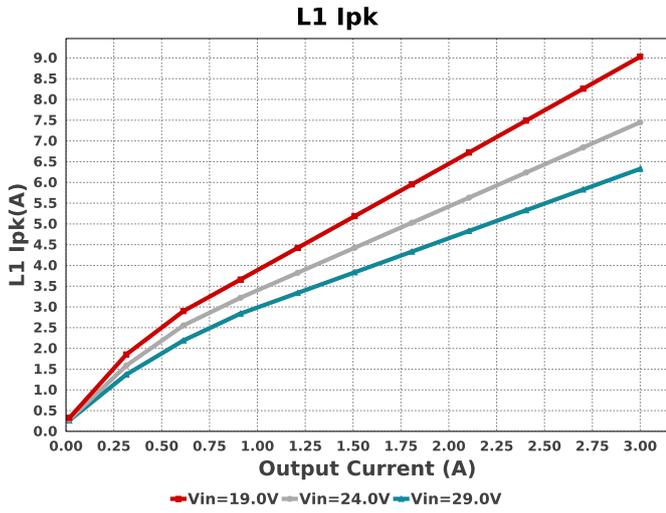
### TPS43060 Design

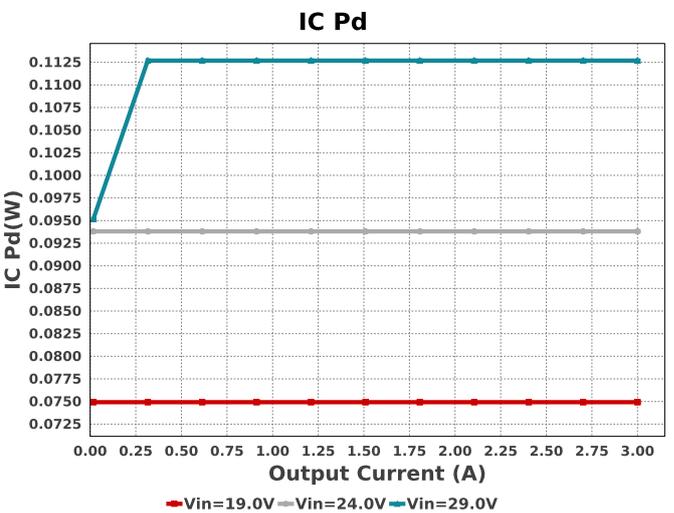
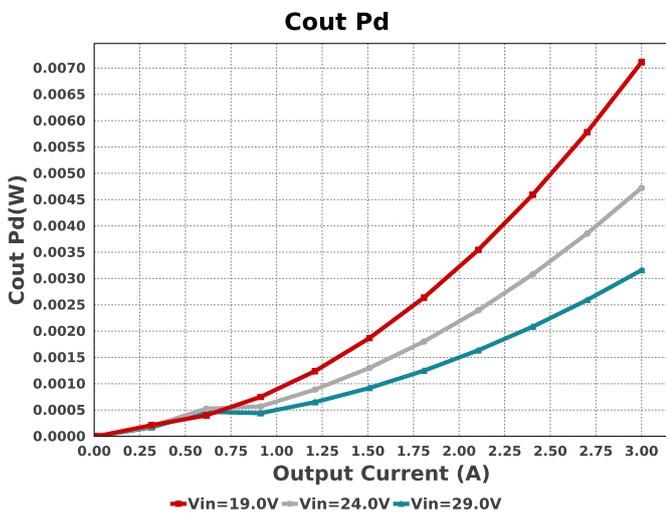
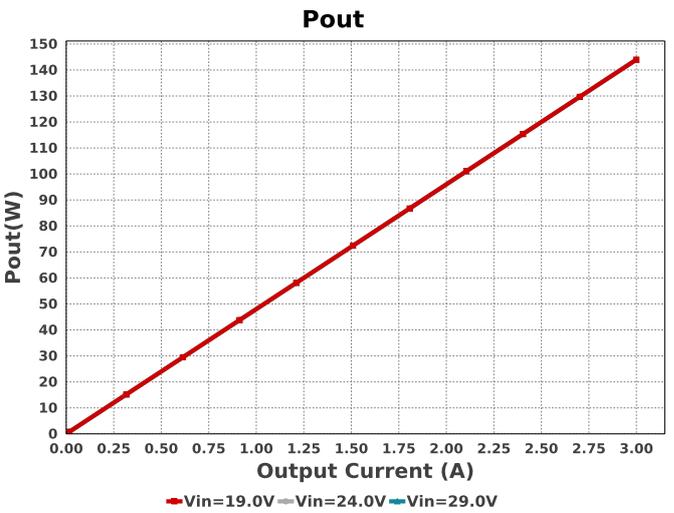
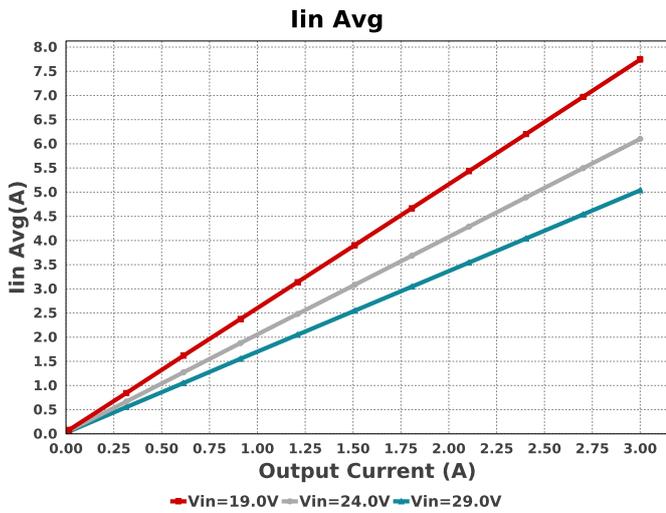
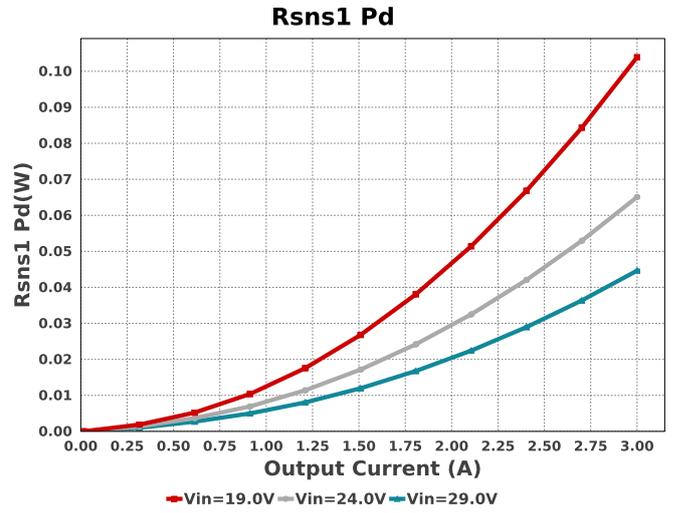
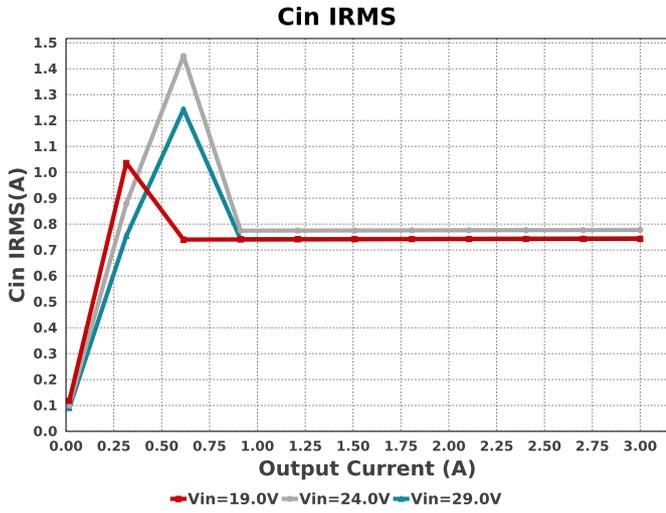
With the current design condition, suitable FET components M1 and M2 could not be found in the current database. Hence, this design is created using ideal FETs. Please note that the resulting FET parameters are ideal, so the efficiency and loss values (related to FET) have been disabled. Also, schematic/PCB export and thermal simulations will not work with ideal FET.

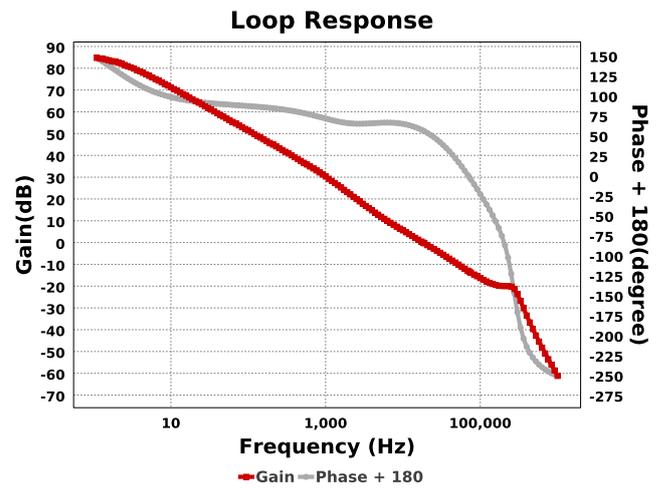
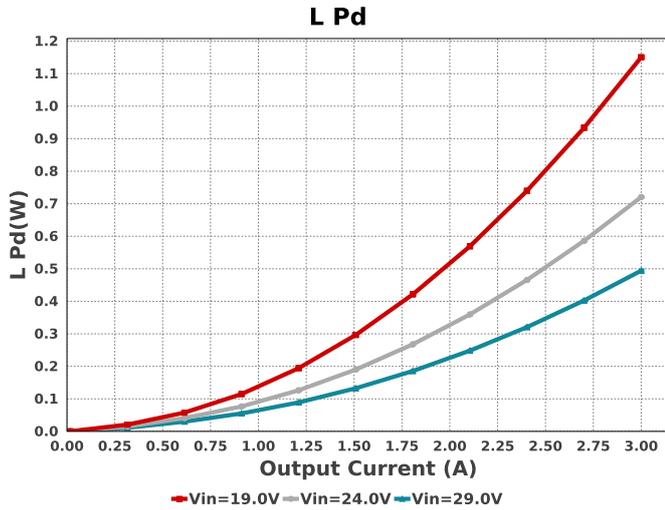
## Electrical BOM

Name	Manufacturer	Part Number	Properties	Qty	Price	Footprint
C12	AVX	06035A101JAT2A Series= C0G/NP0	Cap= 100.0 pF ESR= 119.0 mOhm VDC= 50.0 V IRMS= 0.0 A	1	\$0.01	0603 5 mm <sup>2</sup>
Cboot	AVX	08053C104KAT2A Series= X7R	Cap= 100.0 nF ESR= 280.0 mOhm VDC= 25.0 V IRMS= 0.0 A	1	\$0.01	0805 7 mm <sup>2</sup>
Ccomp	TDK	C2012C0G1H822K060AA Series= C0G/NP0	Cap= 8.2 nF VDC= 50.0 V IRMS= 0.0 A	1	\$0.05	0805 7 mm <sup>2</sup>
Ccomp2	MuRata	GRM1555C1H391JA01J Series= C0G/NP0	Cap= 390.0 pF VDC= 50.0 V IRMS= 0.0 A	1	\$0.01	0402 3 mm <sup>2</sup>
Cin	MuRata	GRM32ER71H106MA12 Series= X7R	Cap= 10.0 uF ESR= 1.0 mOhm VDC= 50.0 V IRMS= 0.0 A	2	\$0.25	1210_270 15 mm <sup>2</sup>
Cout	TDK	CKG57NX7S2A226M500JH Series= X7S	Cap= 22.0 uF ESR= 1.0 mOhm VDC= 100.0 V IRMS= 0.0 A	2	\$2.17	CKG57N 56 mm <sup>2</sup>
Css	MuRata	GRM188R71E472KA01D Series= X7R	Cap= 4.7 nF ESR= 600.0 mOhm VDC= 25.0 V IRMS= 0.0 A	1	\$0.01	0603 5 mm <sup>2</sup>

Name	Manufacturer	Part Number	Properties	Qty	Price	Footprint
Cvcc	Taiyo Yuden	EMK107BBJ106MA-T Series= X5R	Cap= 10.0 uF VDC= 16.0 V IRMS= 0.0 A	1	\$0.07	 0603 5 mm <sup>2</sup>
Cvin	Kemet	C0805C104M5RACTU Series= X7R	Cap= 100.0 nF ESR= 64.0 mOhm VDC= 50.0 V IRMS= 1.64 A	1	\$0.01	 0805 7 mm <sup>2</sup>
Dboot	International Rectifier	10MQ100NTRPBF	VF@Io= 680.0 mV VRRM= 100.0 V	1	\$0.10	 SMA 37 mm <sup>2</sup>
L1	Bourns	SRP1270-8R2M	L= 8.2 uH 15.5 mOhm	1	\$0.83	 SRP1270 246 mm <sup>2</sup>
M1	NA	IdealFET	VdsMax= 99.0 V IdsMax= 13.0 Amps	1	NA	KCS0003B 80 mm <sup>2</sup>
M2	NA	IdealFET	VdsMax= 99.0 V IdsMax= 13.0 Amps	1	NA	KCS0003B 80 mm <sup>2</sup>
R13	Vishay-Dale	CRCW040210R0FKED Series= CRCW..e3	Res= 10.0 Ohm Power= 63.0 mW Tolerance= 1.0%	1	\$0.01	 0402 3 mm <sup>2</sup>
R14	Vishay-Dale	CRCW040210R0FKED Series= CRCW..e3	Res= 10.0 Ohm Power= 63.0 mW Tolerance= 1.0%	1	\$0.01	 0402 3 mm <sup>2</sup>
R19	Vishay-Dale	CRCW04022R00FKED Series= CRCW..e3	Res= 2.0 Ohm Power= 63.0 mW Tolerance= 1.0%	1	\$0.01	 0402 3 mm <sup>2</sup>
Rcomp	Vishay-Dale	CRCW04026K34FKED Series= CRCW..e3	Res= 6.34 kOhm Power= 63.0 mW Tolerance= 1.0%	1	\$0.01	 0402 3 mm <sup>2</sup>
Rfbb	Vishay-Dale	CRCW040211K0FKED Series= CRCW..e3	Res= 11.0 kOhm Power= 63.0 mW Tolerance= 1.0%	1	\$0.01	 0402 3 mm <sup>2</sup>
Rfbt	Vishay-Dale	CRCW0402422KFKED Series= CRCW..e3	Res= 422.0 kOhm Power= 63.0 mW Tolerance= 1.0%	1	\$0.01	 0402 3 mm <sup>2</sup>
Rpg	Vishay-Dale	CRCW0402100KFKED Series= CRCW..e3	Res= 100.0 kOhm Power= 63.0 mW Tolerance= 1.0%	1	\$0.01	 0402 3 mm <sup>2</sup>
Rsns1	Susumu Co Ltd	PRL1632-R007-F-T1 Series= PRL1632	Res= 7.0 mOhm Power= 1.0 W Tolerance= 1.0%	1	\$0.20	 0612 11 mm <sup>2</sup>
Rsns2	Susumu Co Ltd	PRL1632-R007-F-T1 Series= PRL1632	Res= 7.0 mOhm Power= 1.0 W Tolerance= 1.0%	1	\$0.20	 0612 11 mm <sup>2</sup>
Rt	Yageo	RC0201FR-07105KL Series= ?	Res= 105.0 kOhm Power= 50.0 mW Tolerance= 1.0%	1	\$0.01	 0201 2 mm <sup>2</sup>
U1	Texas Instruments	TPS43060RTER	Switcher	1	\$0.94	 S-PVQFN-N16 17 mm <sup>2</sup>







## Operating Values

#	Name	Value	Category	Description
1.	Cin IRMS	743.656 mA	Capacitor	Input capacitor RMS ripple current
2.	Cin Pd	276.51 $\mu$ W	Capacitor	Input capacitor power dissipation
3.	Cout Pd	7.112 mW	Capacitor	Output capacitor power dissipation
4.	IC Pd	11.4 mW	IC	IC power dissipation
5.	Iin Avg	7.707 A	IC	Average input current
6.	L Ipp	2.576 A	Inductor	Peak-to-peak inductor ripple current
7.	L Pd	1.15 W	Inductor	Inductor power dissipation
8.	L1 Ipk	8.995 A	Inductor	Inductor peak current
9.	L1 Irms	7.705 A	Inductor	Inductor ripple current
10.	Cin Pd	276.51 $\mu$ W	Power	Input capacitor power dissipation
11.	Cout Pd	7.112 mW	Power	Output capacitor power dissipation
12.	IC Pd	11.4 mW	Power	IC power dissipation
13.	L Pd	1.15 W	Power	Inductor power dissipation
14.	Rsns1 Pd	103.9 mW	Power	Rsns1 Power Dissipation
15.	Rsns2 Pd	103.9 mW	Power	Rsns2 Power Dissipation
16.	Rsns1 Pd	103.9 mW	Resistor	Rsns1 Power Dissipation
17.	Rsns2 Pd	103.9 mW	Resistor	Rsns2 Power Dissipation
18.	BOM Count	26	System	Total Design BOM count
19.	Cross Freq	12.496 kHz	System	Bode plot crossover frequency
20.	FootPrint	684.0 mm <sup>2</sup>	System	Total Foot Print Area of BOM components
21.	Frequency	547.619 kHz	System	Switching frequency
22.	Gain Marg	-11.452 dB	System	Bode Plot Gain Margin
23.	Iout	3.0 A	System	Iout operating point
24.	Low Freq Gain	83.008 dB	System	Gain at 1Hz
25.	Mode	CCM	System	Conduction Mode
26.	Phase Marg	56.152 deg	System	Bode Plot Phase Margin
27.	Pout	144.0 W	System	Total output power
28.	Total BOM	NA	System	Total BOM Cost
29.	Vin	19.0 V	System	Vin operating point
30.	Vout	48.0 V	System	Operational Output Voltage
31.	Vout Actual	48.024 V	System	Vout Actual calculated based on selected voltage divider resistors
32.	Vout Tolerance	4.058 %	System	Vout Tolerance based on IC Tolerance (no load) and voltage divider resistors if applicable
33.	Vout p-p	183.526 mV	System	Peak-to-peak output ripple voltage

## Design Inputs

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Name	Value	Description
Iout	3.0	Maximum Output Current
VinMax	29.0	Maximum input voltage
VinMin	19.0	Minimum input voltage
Vout	48.0	Output Voltage
base_pn	TPS43060	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

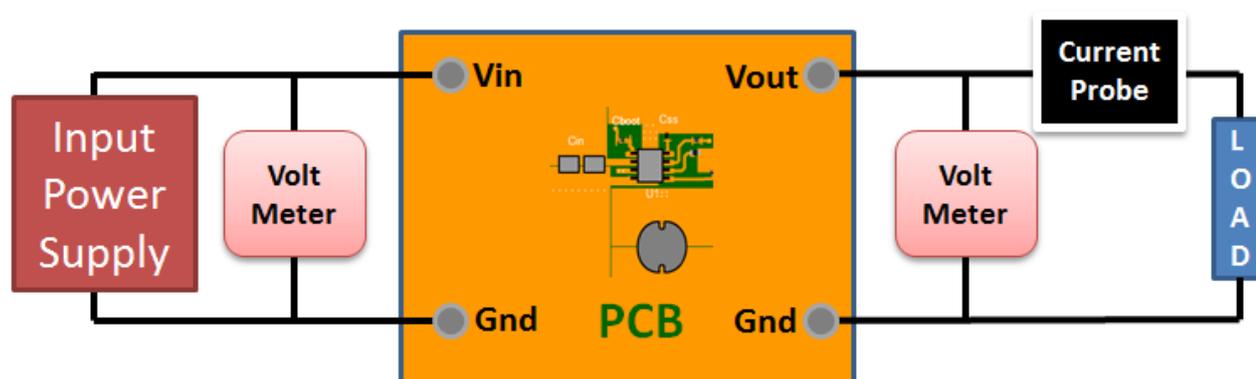
If board assembly is done in house it is best to tack down one terminal of a component on the board then solder the other terminal. For surface mount parts with large tabs, such as the DPAK, the tab on the back of the package should be pre-tinned with solder, then tacked into place by one of the pins. 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 19.0V 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. Feature Highlights: Low Quiescent Current Boost Controller, Wide  $V_{in}$  Range 4.5V to 38V  $V_{in}$ , 58V  $V_{out}$ , 7.5V Gate Drive optimized for standard MOSFET Thresholds Thermal Shutdown
2. Master key : 9323268074580801[v1]
3. **TPS43060** Product Folder : <http://www.ti.com/product/TPS43060> : contains the data sheet and other resources.

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