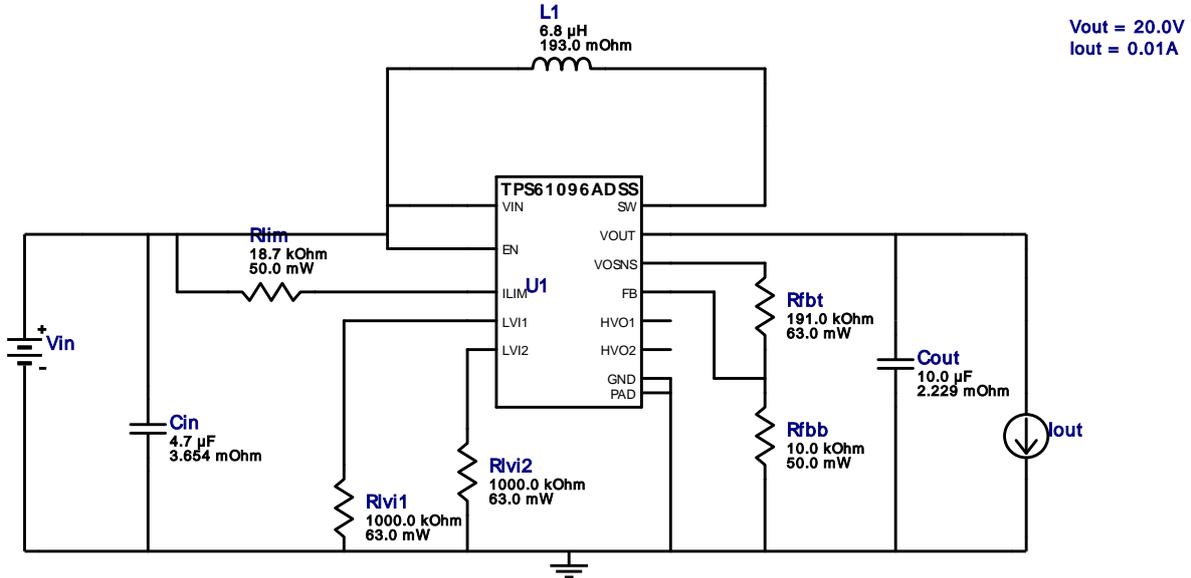
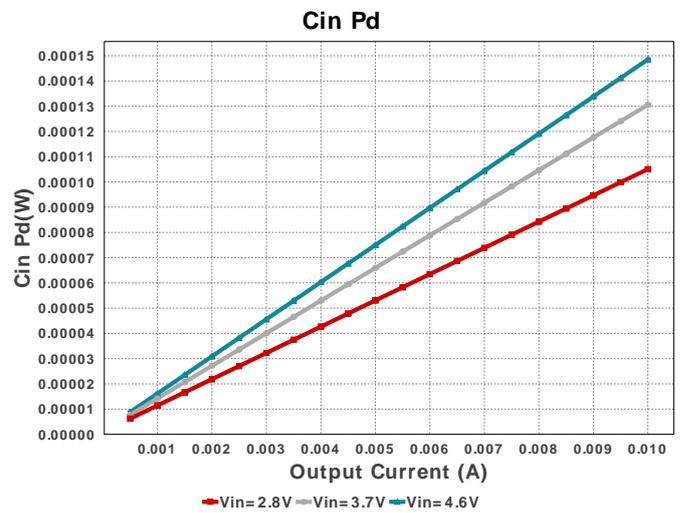
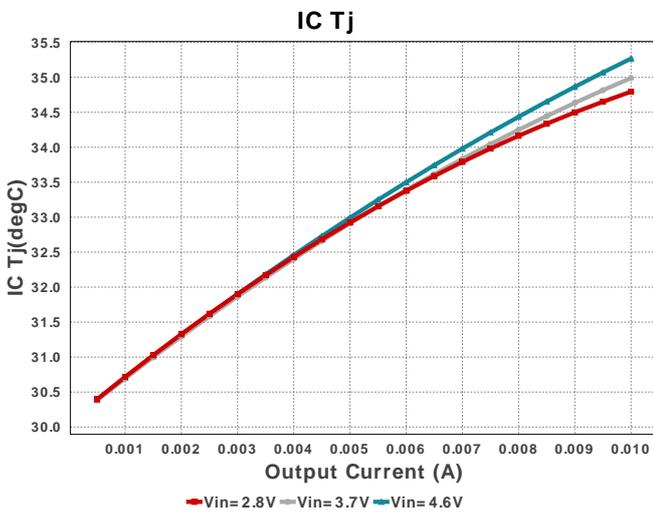
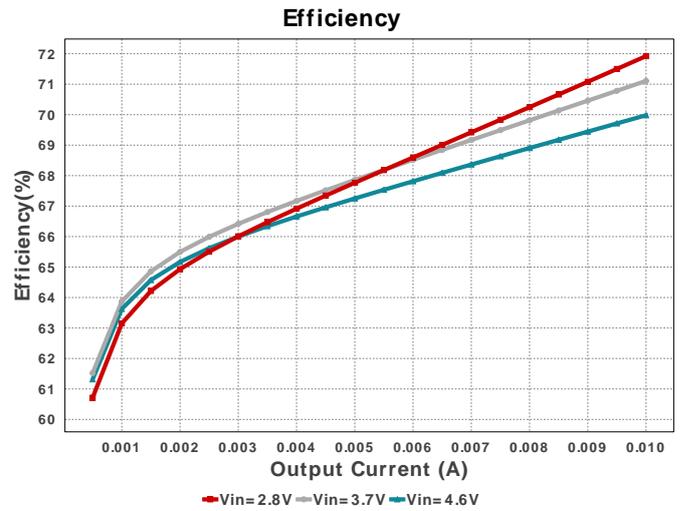
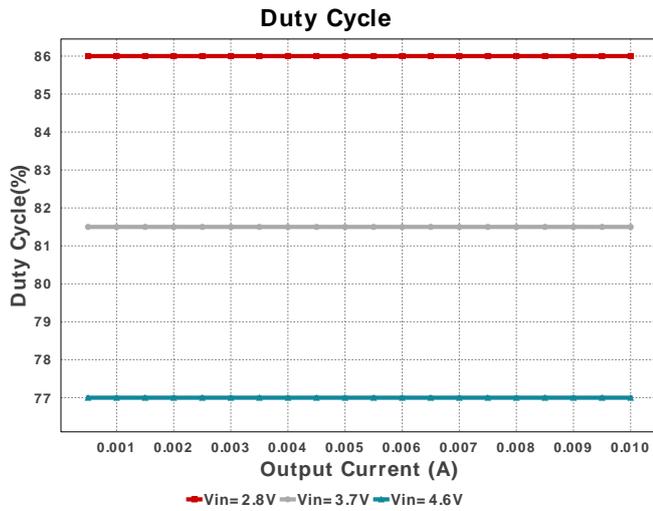
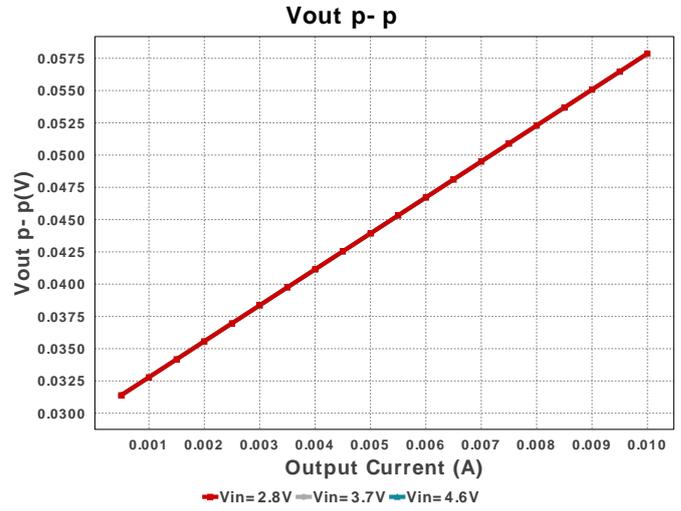
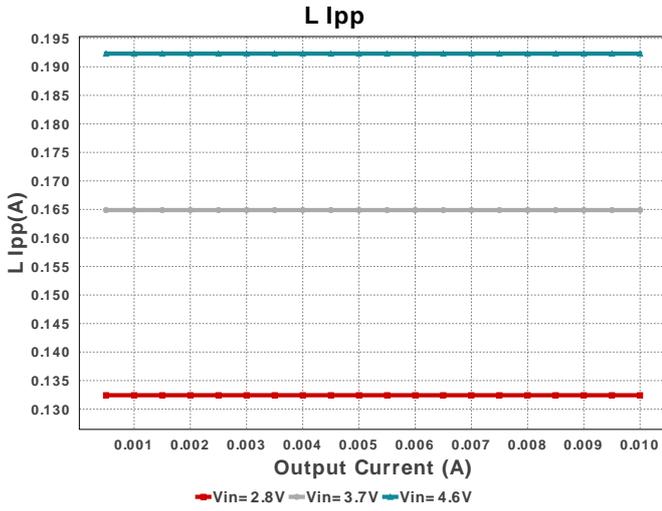
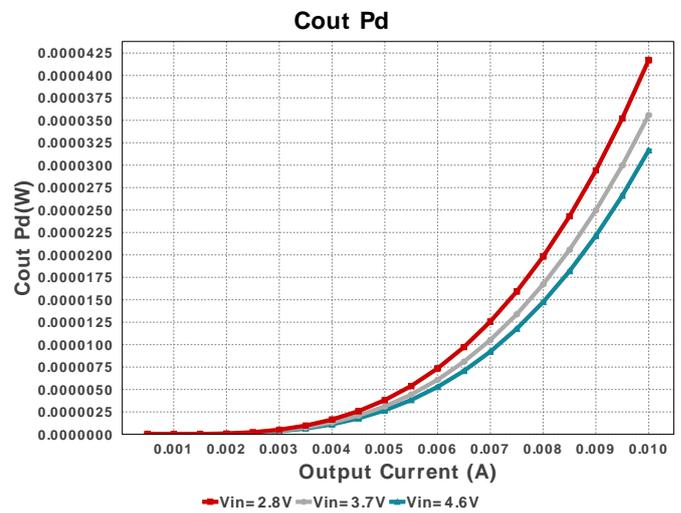
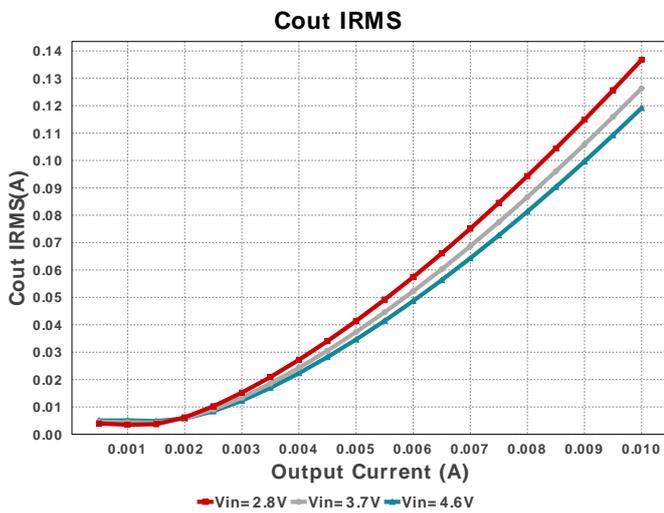
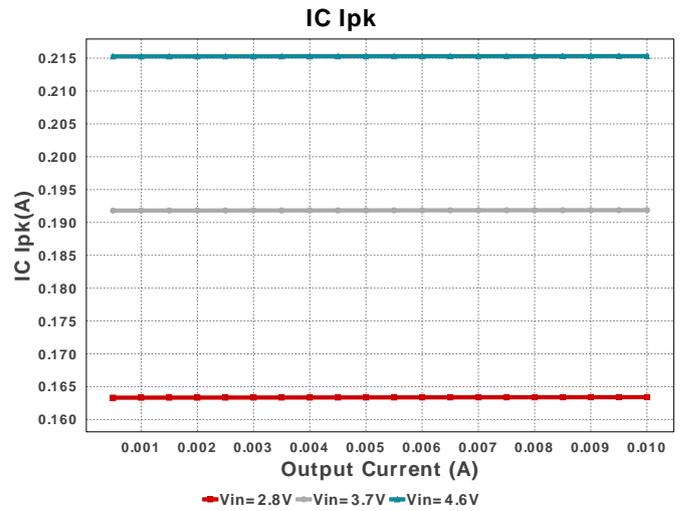
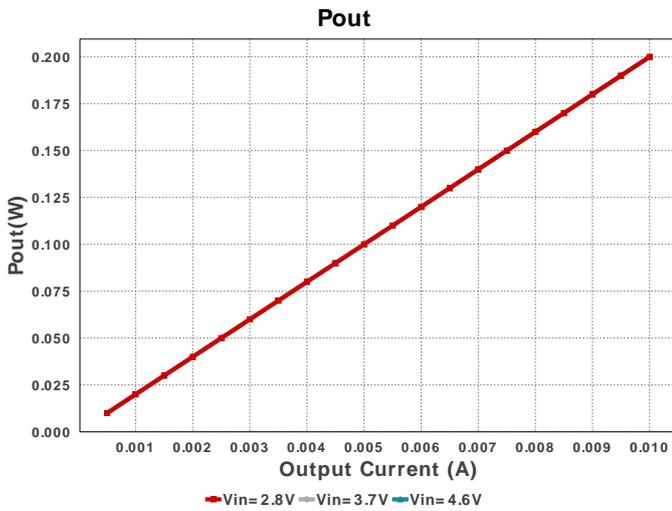
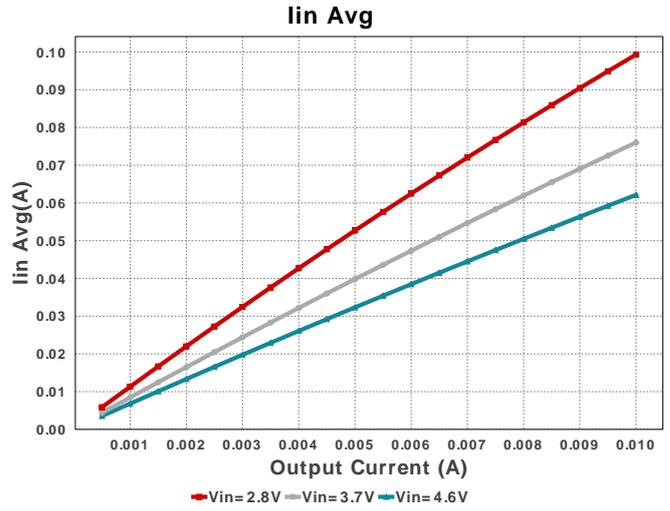
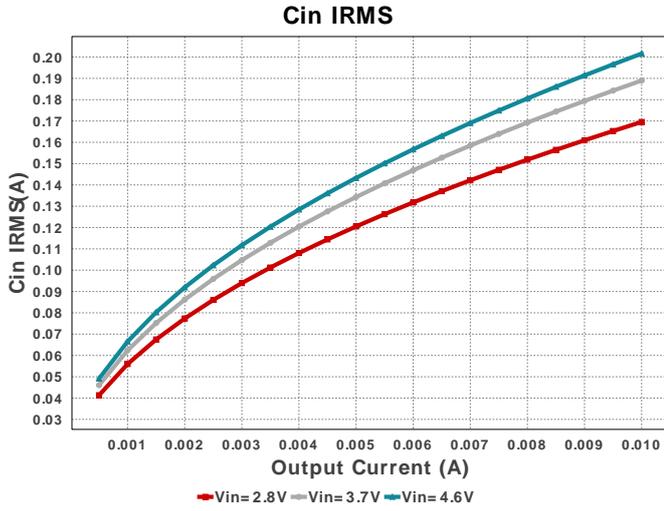


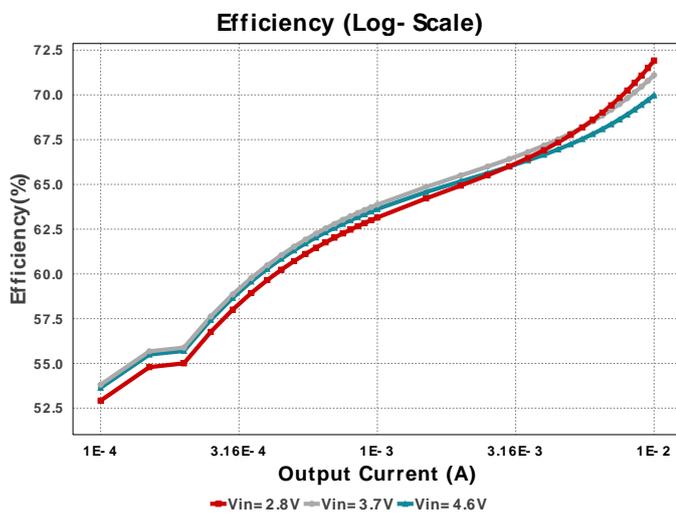
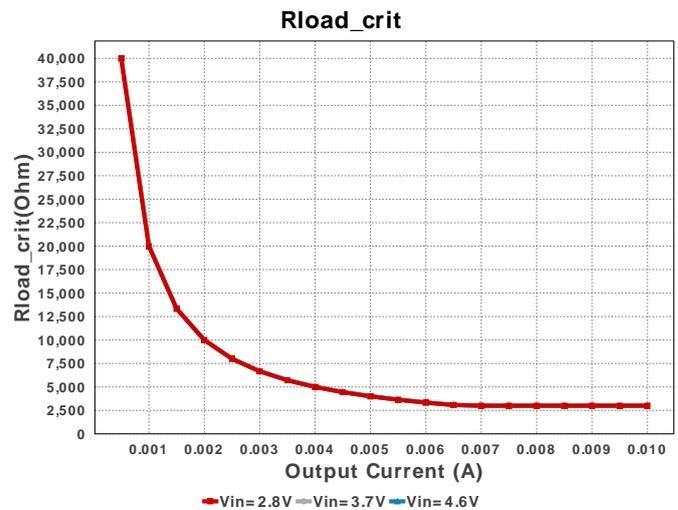
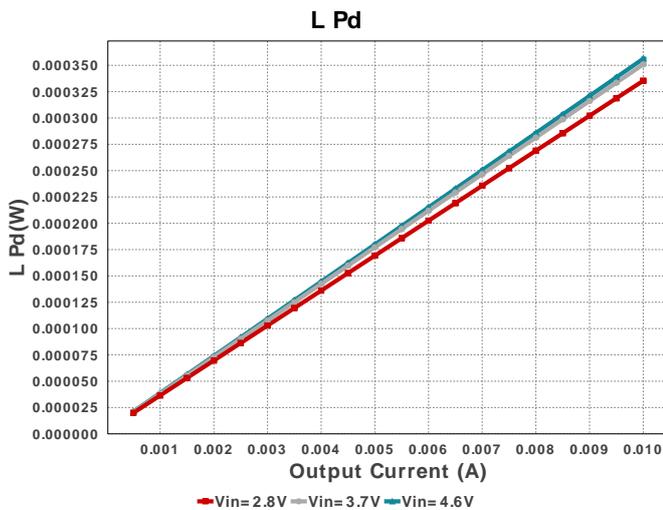
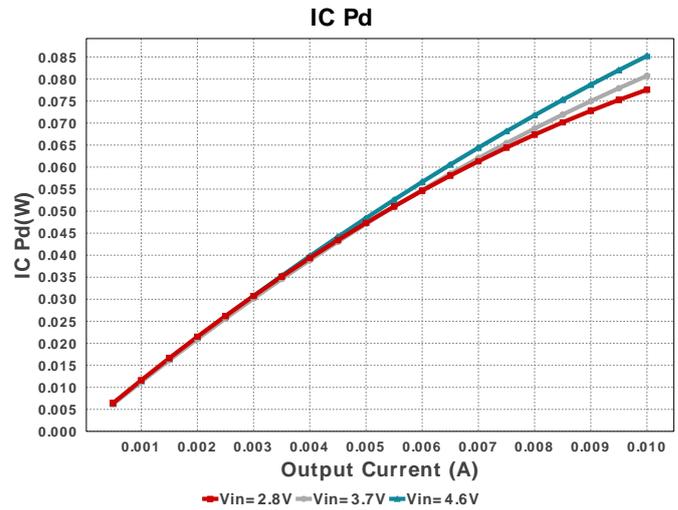
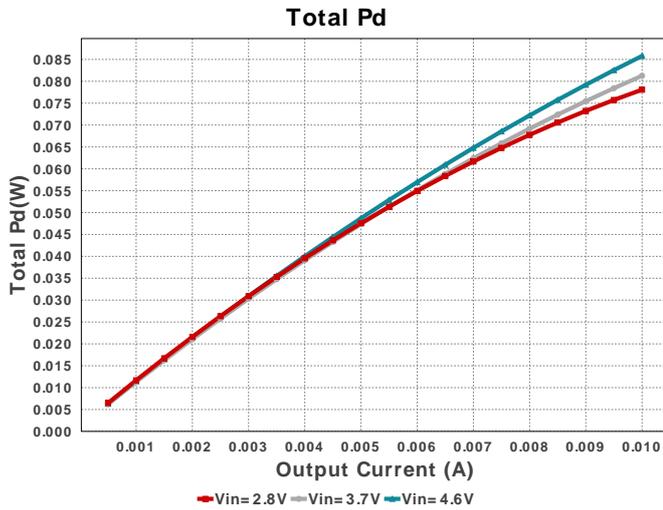
WEBENCH® Design Report

 Design : 317 TPS61096ADSSR
 TPS61096ADSSR 2.8V-4.6V to 20.00V @ 0.01A

Electrical BOM

Name	Manufacturer	Part Number	Properties	Qty	Price	Footprint
Cin	MuRata	GRM31CR71A475KA01L Series= X7R	Cap= 4.7 uF ESR= 3.654 mOhm VDC= 10.0 V IRMS= 3.0632 A	1	\$0.07	 1206_190 11 mm ²
Cout	TDK	CGA5L1X7R1V106K160AC Series= X7R	Cap= 10.0 uF ESR= 2.229 mOhm VDC= 35.0 V IRMS= 4.8593 A	1	\$0.24	 1206_190 11 mm ²
L1	Würth Elektronik	74438336068	L= 6.8 uH 193.0 mOhm	1	\$0.93	WE-MAPI_3020 16 mm ²
Rfbb	Yageo	RC0201FR-0710KL Series= ?	Res= 10.0 kOhm Power= 50.0 mW Tolerance= 1.0%	1	\$0.01	 0201 2 mm ²
Rfbt	Vishay-Dale	CRCW0402191KFKED Series= CRCW..e3	Res= 191.0 kOhm Power= 63.0 mW Tolerance= 1.0%	1	\$0.01	 0402 3 mm ²
Rlim	Yageo	RC0201FR-0718K7L Series= ?	Res= 18.7 kOhm Power= 50.0 mW Tolerance= 1.0%	1	\$0.01	 0201 2 mm ²
Rlvi1	Vishay-Dale	CRCW04021M00FKED Series= CRCW..e3	Res= 1000.0 kOhm Power= 63.0 mW Tolerance= 1.0%	1	\$0.01	 0402 3 mm ²
Rlvi2	Vishay-Dale	CRCW04021M00FKED Series= CRCW..e3	Res= 1000.0 kOhm Power= 63.0 mW Tolerance= 1.0%	1	\$0.01	 0402 3 mm ²
U1	Texas Instruments	TPS61096ADSSR	Switcher	1	\$0.46	 DSS0012A 12 mm ²







Operating Values

#	Name	Value	Category	Description
1.	Cin IRMS	169.545 mA	Capacitor	Input capacitor RMS ripple current
2.	Cin Pd	105.04 μ W	Capacitor	Input capacitor power dissipation
3.	Cout IRMS	136.776 mA	Capacitor	Output capacitor RMS ripple current
4.	Cout Pd	41.699 μ W	Capacitor	Output capacitor power dissipation
5.	IC Ipk	163.401 mA	IC	Peak switch current in IC
6.	IC Pd	77.579 mW	IC	IC power dissipation
7.	IC Tj	34.794 degC	IC	IC junction temperature
8.	ICThetaJA	61.8 degC/W	IC	IC junction-to-ambient thermal resistance
9.	Iin Avg	99.314 mA	IC	Average input current
10.	L Ipp	132.43 mA	Inductor	Peak-to-peak inductor ripple current
11.	L Pd	335.36 μ W	Inductor	Inductor power dissipation

#	Name	Value	Category	Description
12.	Cin Pd	105.04 μ W	Power	Input capacitor power dissipation
13.	Cout Pd	41.699 μ W	Power	Output capacitor power dissipation
14.	IC Pd	77.579 mW	Power	IC power dissipation
15.	L Pd	335.36 μ W	Power	Inductor power dissipation
16.	Total Pd	78.079 mW	Power	Total Power Dissipation
17.	BOM Count	9	System	Total Design BOM count
18.	Duty Cycle	86.0 %	System	Duty cycle
19.	Efficiency	71.922 %	System	Steady state efficiency
20.	FootPrint	63.0 mm ²	System	Total Foot Print Area of BOM components
21.	Frequency	399.377 kHz	System	Switching frequency
22.	Iout	10.0 mA	System	Iout operating point
23.	Mode	PFM	System	Conduction Mode
24.	Pout	200.0 mW	System	Total output power
25.	Rload_crit	3.0 kOhm	System	Minimum Rload required during Start up
26.	Total BOM	\$1.75	System	Total BOM Cost
27.	Vin	2.8 V	System	Vin operating point
28.	Vout	20.0 V	System	Operational Output Voltage
29.	Vout Actual	20.1 V	System	Vout Actual calculated based on selected voltage divider resistors
30.	Vout Tolerance	3.958 %	System	Vout Tolerance based on IC Tolerance (no load) and voltage divider resistors if applicable
31.	Vout p-p	57.862 mV	System	Peak-to-peak output ripple voltage

Design Inputs

Name	Value	Description
Iout	10.0 m	Maximum Output Current
VinMax	4.6	Maximum input voltage
VinMin	2.8	Minimum input voltage
Vout	20.0	Output Voltage
base_pn	TPS61096A	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

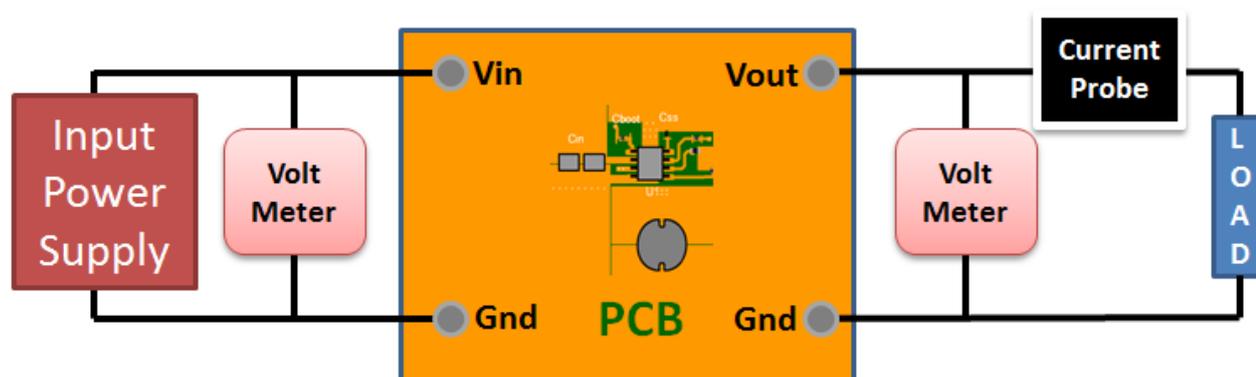
If board assembly is done in house it is best to tack down one terminal of a component on the board then solder the other terminal. For surface mount parts with large tabs, such as the DPAK, the tab on the back of the package should be pre-tinned with solder, then tacked into place by one of the pins. 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 2.8V 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 : D9CED8BEE5623EB1[v1]
2. **TPS61096A** Product Folder : <http://www.ti.com/product/TPS61096A> : contains the data sheet and other resources.

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