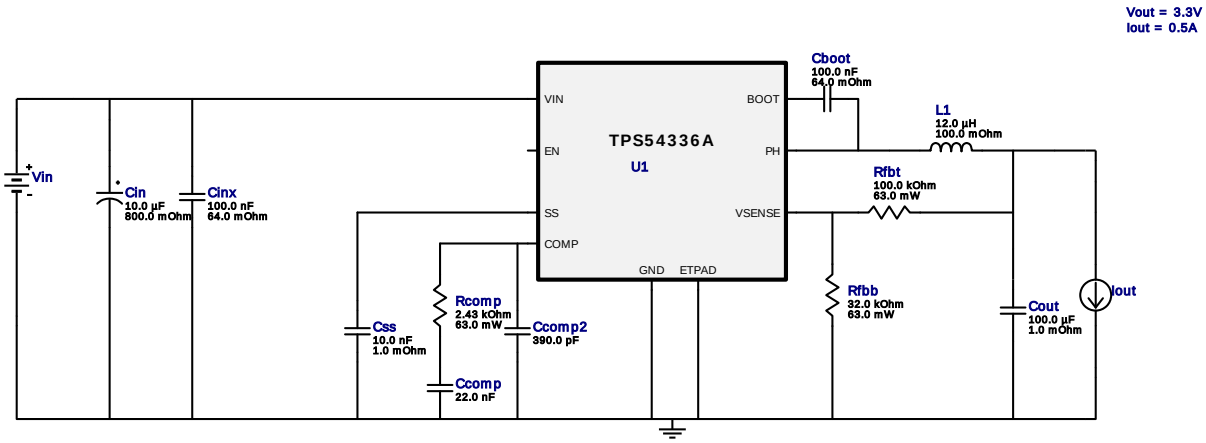
VinMin = 5.0V
VinMax = 20.0V
Vout = 3.3V
Iout = 0.5A

Device = TPS54336ADDAR
Topology = Buck
Created = 2024-04-09 03:34:54.894
BOM Cost = $1.40
BOM Count = 12
Total Pd = 0.22W

WEBENCH® Design Report

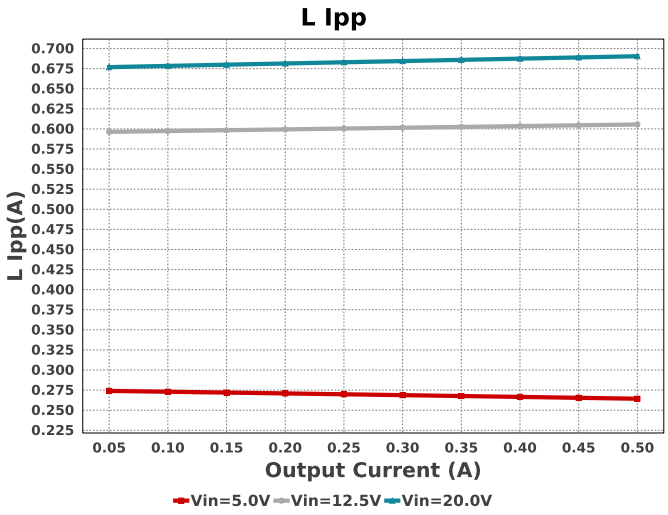
Design : 95 TPS54336ADDAR
TPS54336ADDAR 5V-20V to 3.30V @ 0.5A

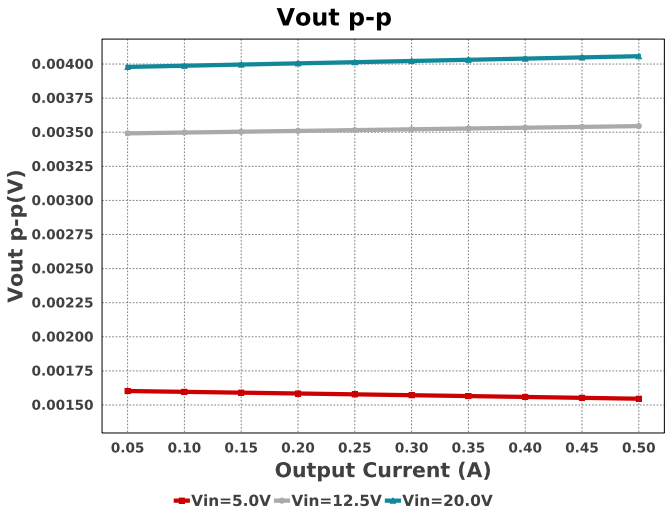


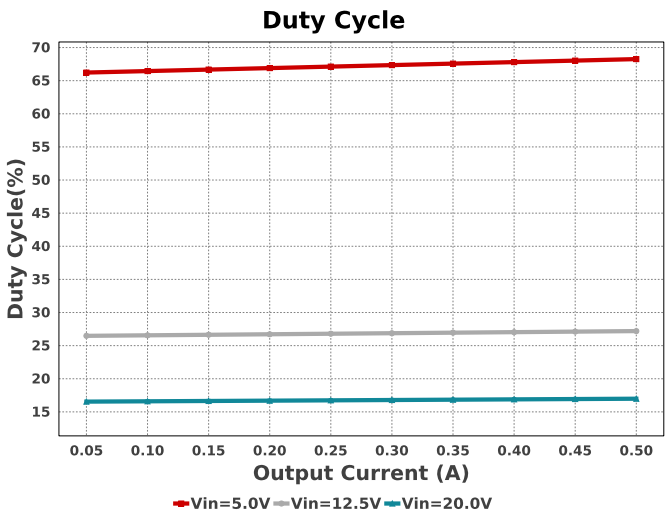
Electrical BOM

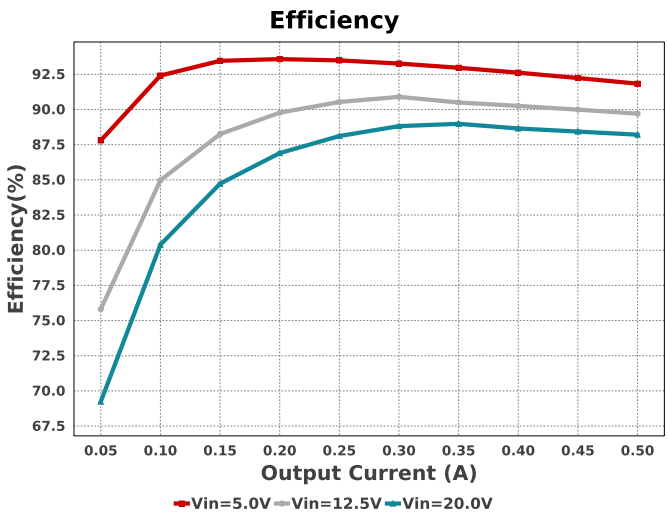
Name	Manufacturer	Part Number	Properties	Qty	Price	Footprint
Cboot	Kemet	C0805C104M5RACTU Series= X7R	Cap= 100.0 nF ESR= 64.0 mOhm VDC= 50.0 V IRMS= 1.64 A	1	$0.01	0805 7 mm²
Ccomp	TDK	CGA4J2C0G1H223J125AA Series= C0G/NP0	Cap= 22.0 nF VDC= 50.0 V IRMS= 0.0 A	1	$0.07	0805 7 mm²
Ccomp2	MuRata	GRM1555C1H391JA01J Series= C0G/NP0	Cap= 390.0 pF VDC= 50.0 V IRMS= 0.0 A	1	$0.01	0402 3 mm²
Cin	Vishay-Sprague	293D106X0035D2TE3 Series= 293D	Cap= 10.0 uF ESR= 800.0 mOhm VDC= 35.0 V IRMS= 430.0 mA	1	$0.26	7343-31 59 mm²
Cinx	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 mm²
Cout	MuRata	GRM32EC80J107ME20L Series= X6S	Cap= 100.0 uF ESR= 1.0 mOhm VDC= 6.3 V IRMS= 6.0 A	1	$0.17	1210_270 15 mm²
Css	MuRata	GRM033R71A103KA01D Series= X7R	Cap= 10.0 nF ESR= 1.0 mOhm VDC= 10.0 V IRMS= 0.0 A	1	$0.01	0201 2 mm²
L1	NIC Components	NPI54C120MTRF	L= 12.0 µH 100.0 mOhm	1	$0.09	IND_NPI54C 61 mm²
Rcomp	Vishay-Dale	CRCW04022K43FKED Series= CRCW..e3	Res= 2.43 kOhm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	0402 3 mm²
Rfbb	Vishay-Dale	TNPW040232K0BEED Series= ?	Res= 32.0 kOhm Power= 63.0 mW Tolerance= 0.1%	1	$0.11	0402 3 mm²

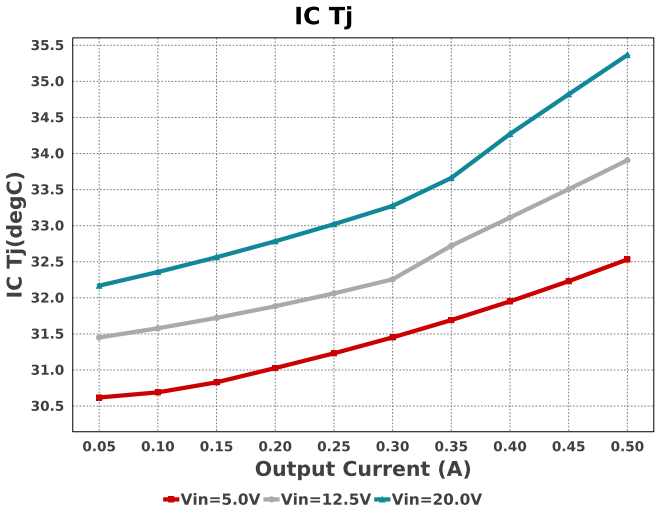
Name	Manufacturer	Part Number	Properties	Qty	Price	Footprint
Rfbt	Vishay-Dale	CRCW0402100KFKED Series= CRCW..e3	Res= 100.0 kOhm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	0402 3 mm^2
U1	Texas Instruments	TPS54336ADDAR	Switcher	1	$0.64	R-PDSO-G8 55 mm^2

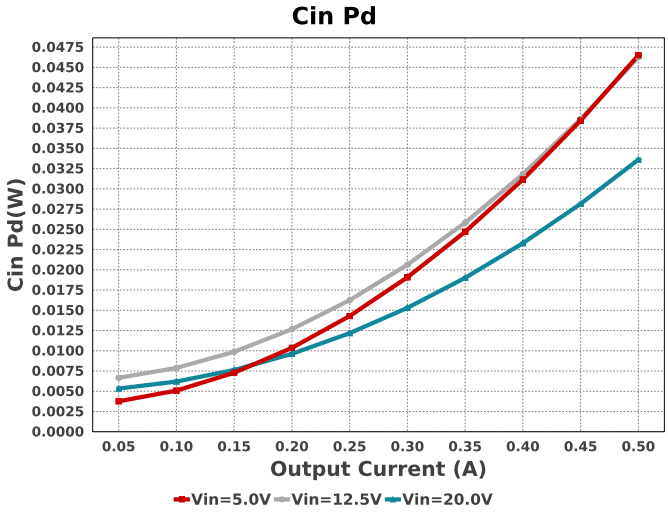


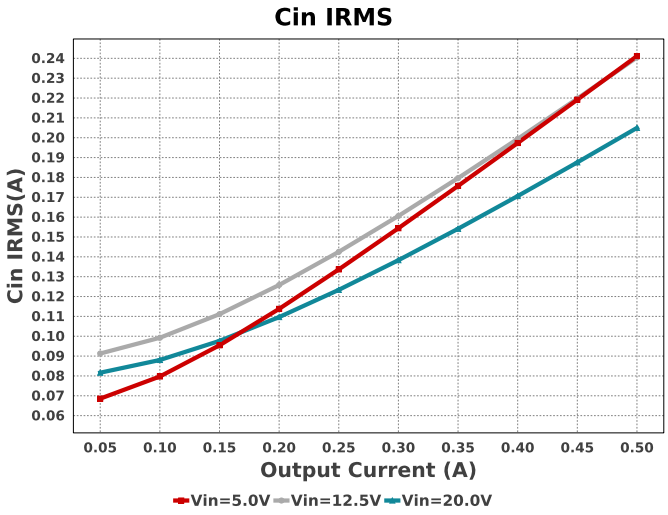


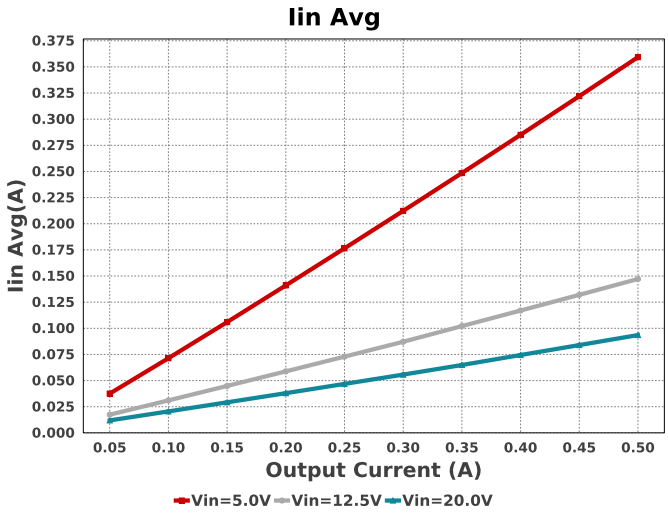


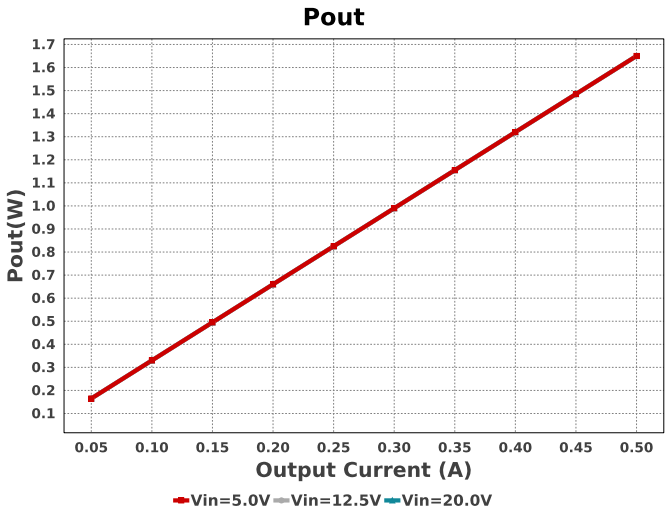


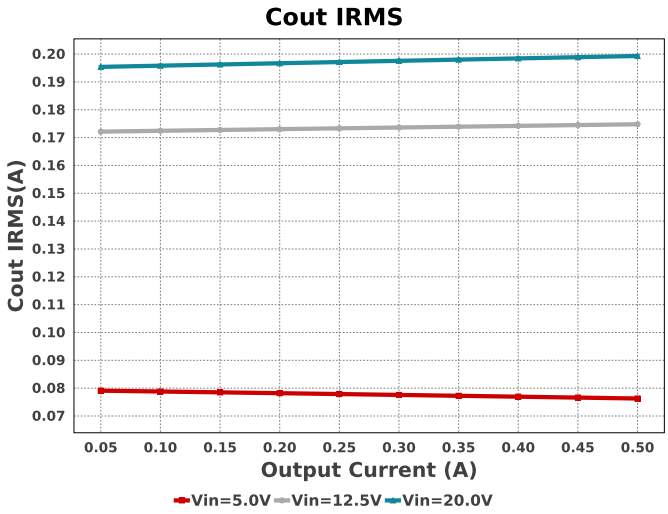


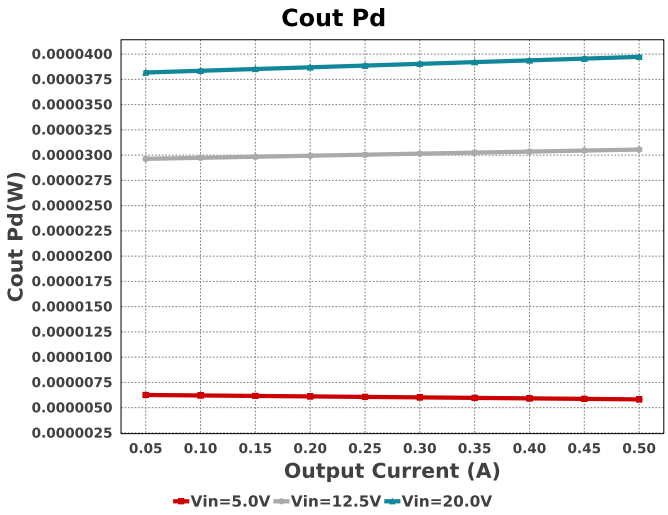


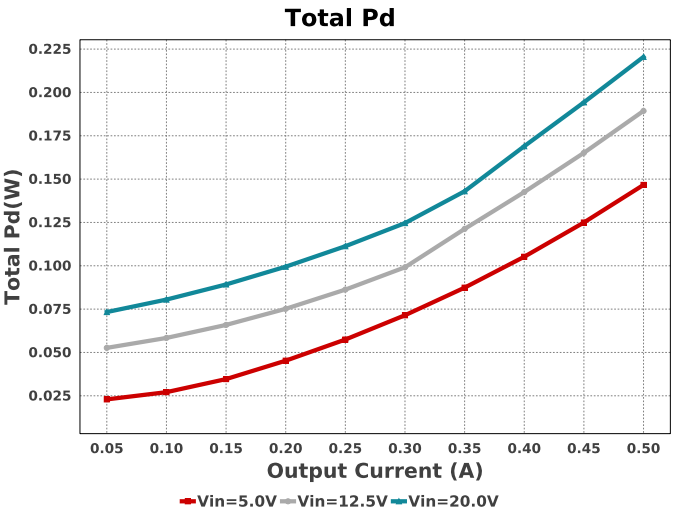


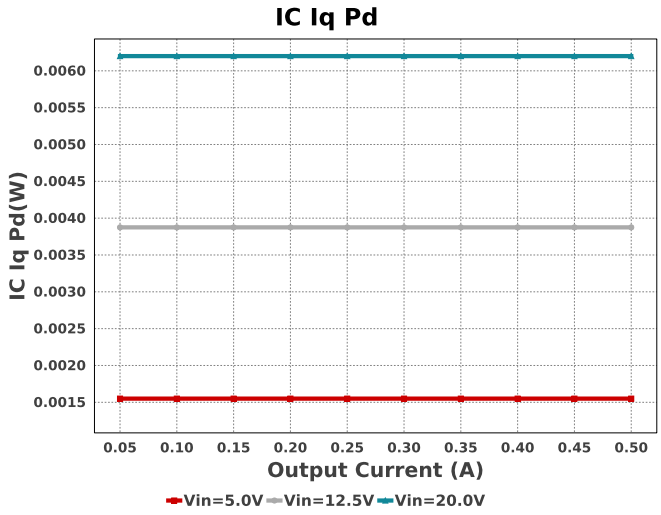


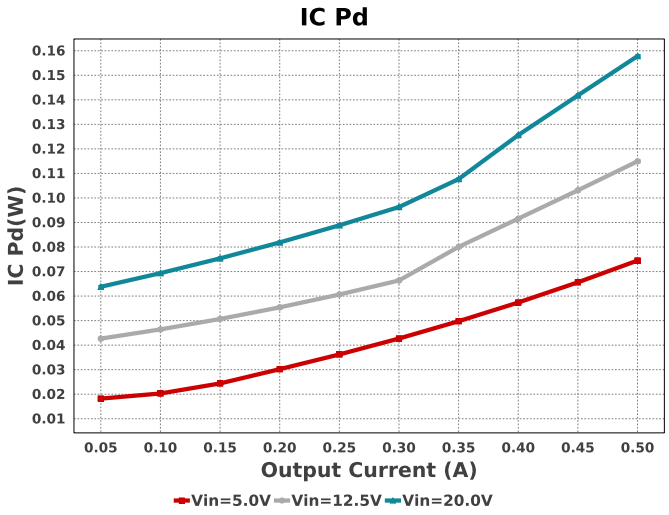


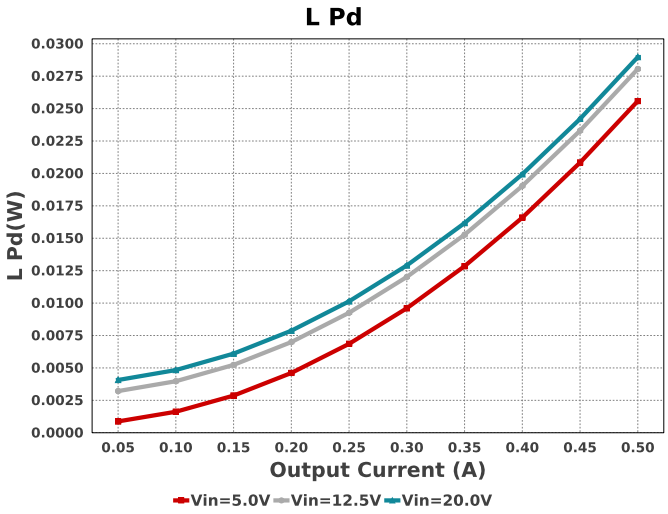


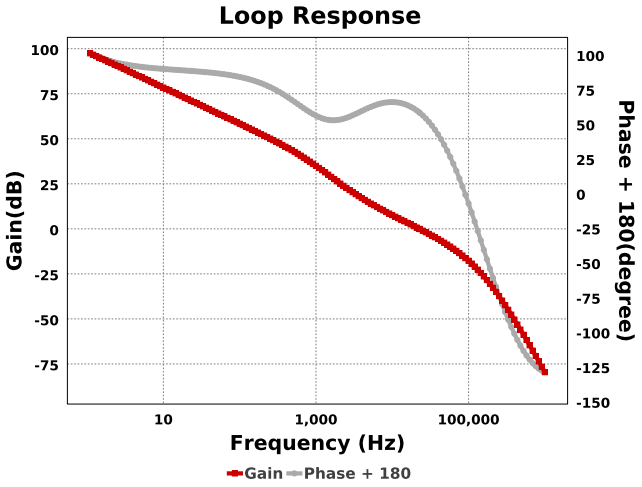












Operating Values

#	Name	Value	Category	Description
1.	Cin IRMS	204.944 mA	Capacitor	Input capacitor RMS ripple current
2.	Cin Pd	33.602 mW	Capacitor	Input capacitor power dissipation
3.	Cout IRMS	199.316 mA	Capacitor	Output capacitor RMS ripple current
4.	Cout Pd	39.727 µW	Capacitor	Output capacitor power dissipation
5.	IC Iq Pd	6.2 mW	IC	IC Iq Pd
6.	IC Pd	157.82 mW	IC	IC power dissipation
7.	IC Tj	35.366 degC	IC	IC junction temperature
8.	IC Tolerance	12.0 mV	IC	IC Feedback Tolerance
9.	ICThetaJA Effective	34.0 degC/W	IC	Effective IC Junction-to-Ambient Thermal Resistance
10.	Iin Avg	93.526 mA	IC	Average input current
11.	L Ipp	690.45 mA	Inductor	Peak-to-peak inductor ripple current
12.	L Pd	28.973 mW	Inductor	Inductor power dissipation
13.	Cin Pd	33.602 mW	Power	Input capacitor power dissipation
14.	Cout Pd	39.727 µW	Power	Output capacitor power dissipation
15.	IC Pd	157.82 mW	Power	IC power dissipation
16.	L Pd	28.973 mW	Power	Inductor power dissipation
17.	Total Pd	220.516 mW	Power	Total Power Dissipation
18.	BOM Count	12	System Information	Total Design BOM count
19.	Cross Freq	22.585 kHz	System Information	Bode plot crossover frequency
20.	Duty Cycle	16.987 %	System Information	Duty cycle
21.	Efficiency	88.211 %	System Information	Steady state efficiency
22.	FootPrint	224.0 mm^2	System Information	Total Foot Print Area of BOM components
23.	Frequency	340.0 kHz	System Information	Switching frequency
24.	Gain Marg	-16.235 dB	System Information	Bode Plot Gain Margin

#	Name	Value	Category	Description
25.	Iout	500.0 mA	System Information	Iout operating point
26.	Low Freq Gain	97.437 dB	System Information	Gain at 1Hz
27.	Mode	CCM	System Information	Conduction Mode
28.	Phase Marg	59.525 deg	System Information	Bode Plot Phase Margin
29.	Pout	1.65 W	System Information	Total output power
30.	Total BOM	$1.4	System Information	Total BOM Cost
31.	Vin	20.0 V	System Information	Vin operating point
32.	Vout	3.3 V	System Information	Operational Output Voltage
33.	Vout Actual	3.3 V	System Information	Vout Actual calculated based on selected voltage divider resistors
34.	Vout Tolerance	2.347 %	System Information	Vout Tolerance based on IC Tolerance (no load) and voltage divider resistors if applicable
35.	Vout p-p	4.057 mV	System Information	Peak-to-peak output ripple voltage

Design Inputs

Name	Value	Description
Iout	500.0 m	Maximum Output Current
VinMax	20.0	Maximum input voltage
VinMin	5.0	Minimum input voltage
Vout	3.3	Output Voltage
base_pn	TPS54336A	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 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

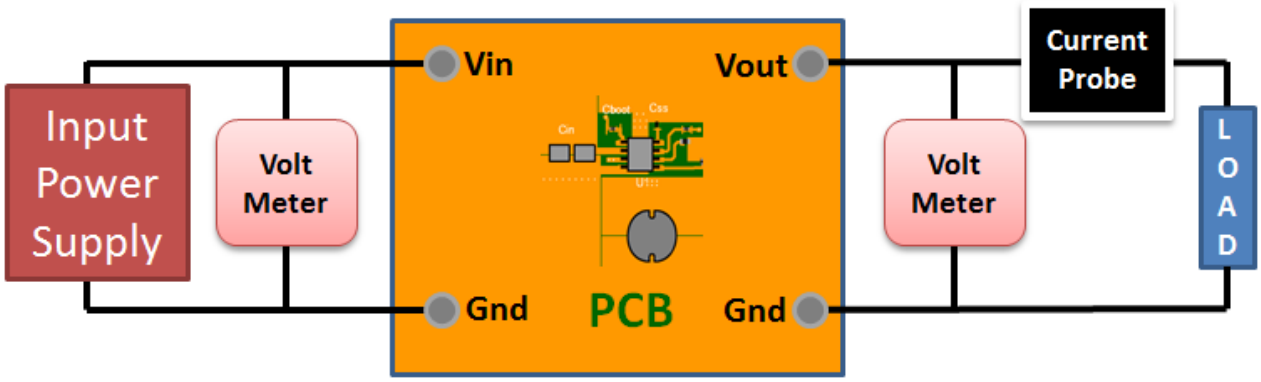
If board assembly is done in house it is best to tack down one terminal of a component on the board then solder the other terminal. For surface mount parts with large tabs, such as the DPAK, the tab on the back of the package should be pre-tinned with solder, then tacked into place by one of the pins. 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 5.0V 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 : 7E00AF9B0638DEC2[v1]
2. **TPS54336A** Product Folder : http://www.ti.com/product/TPS54336A : contains the data sheet and other resources.