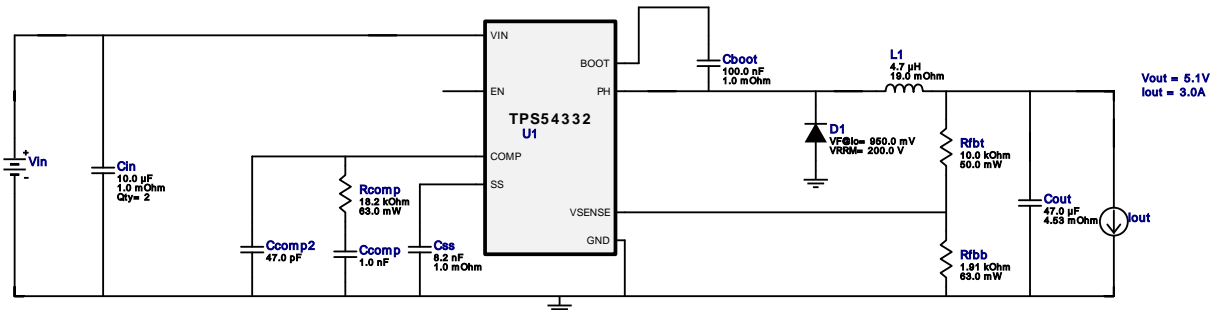


VinMin = 9.0V  
VinMax = 20.0V  
Vout = 5.1V  
Iout = 3.0A

Device = TPS54332DDAR  
Topology = Buck  
Created = 2021-11-10 05:05:48.759  
BOM Cost = \$2.24  
BOM Count = 13  
Total Pd = 3.06W


## WEBENCH<sup>®</sup> Design Report

Design : 8 TPS54332DDAR  
TPS54332DDAR 9V-20V to 5.00V @ 3A

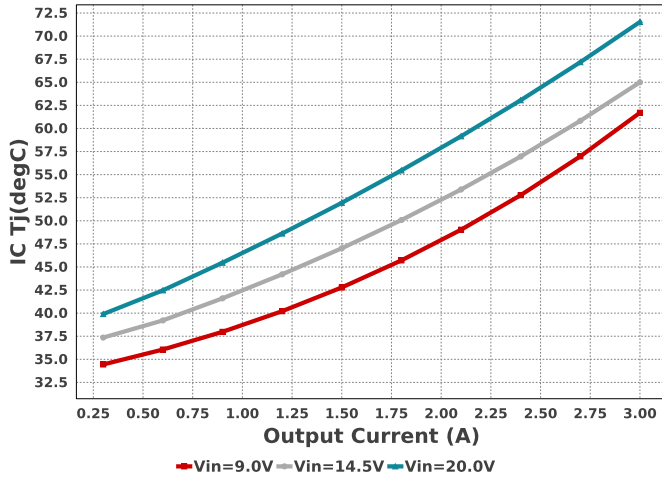


## Electrical BOM

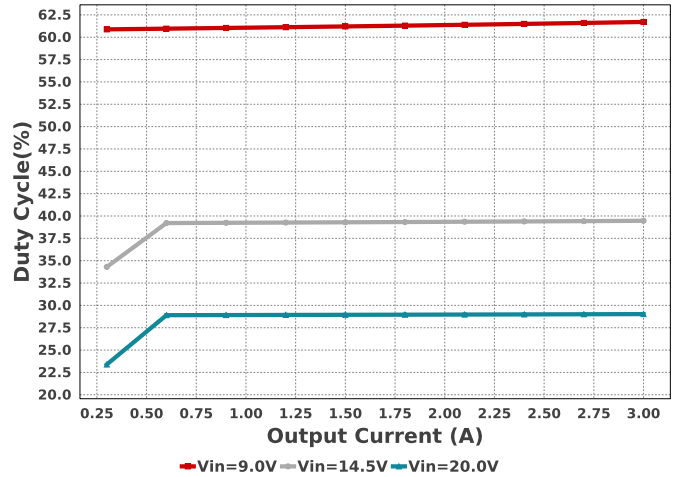
Name	Manufacturer	Part Number	Properties	Qty	Price	Footprint
Cboot	MuRata	GRM155R71A104KA01D Series= X7R	Cap= 100.0 nF ESR= 1.0 mOhm VDC= 10.0 V IRMS= 0.0 A	1	\$0.01	0402 3 mm <sup>2</sup>
Ccomp	MuRata	GRM1555C1H102JA01J Series= C0G/NP0	Cap= 1.0 nF VDC= 50.0 V IRMS= 0.0 A	1	\$0.01	0402 3 mm <sup>2</sup>
Ccomp2	Samsung Electro-Mechanics	CL21C470JBANNNC Series= C0G/NP0	Cap= 47.0 pF VDC= 50.0 V IRMS= 0.0 A	1	\$0.01	0805 7 mm <sup>2</sup>
Cin	TDK	C3225X7R1H106M250AC Series= X7R	Cap= 10.0 uF ESR= 1.0 mOhm VDC= 50.0 V IRMS= 5.0 A	2	\$0.28	1210 15 mm <sup>2</sup>
Cout	TDK	C4532X5R1A476M280KA Series= X5R	Cap= 47.0 uF ESR= 4.53 mOhm VDC= 10.0 V IRMS= 3.6038 A	1	\$0.47	1812_320 23 mm <sup>2</sup>
Css	MuRata	GRM033R71A822KA01D Series= X7R	Cap= 8.2 nF ESR= 1.0 mOhm VDC= 10.0 V IRMS= 0.0 A	1	\$0.01	0201 2 mm <sup>2</sup>
D1	SMC Diode Solutions	SBRD10200TR	VF@Io= 950.0 mV VRRM= 200.0 V	1	\$0.12	DPAK 102 mm <sup>2</sup>
L1	Bourns	SDR1005-4R7ML	L= 4.7 uH 19.0 mOhm	1	\$0.32	SDR1005 176 mm <sup>2</sup>
Rcomp	Vishay-Dale	CRCW040218K2FKED Series= CRCW...e3	Res= 18.2 kOhm Power= 63.0 mW Tolerance= 1.0%	1	\$0.01	0402 3 mm <sup>2</sup>
Rfbb	Vishay-Dale	CRCW04021K91FKED Series= CRCW...e3	Res= 1.91 kOhm Power= 63.0 mW Tolerance= 1.0%	1	\$0.01	0402 3 mm <sup>2</sup>

Name	Manufacturer	Part Number	Properties	Qty	Price	Footprint
Rfbt	Yageo	RC0201FR-0710KL Series= ?	Res= 10.0 kOhm Power= 50.0 mW Tolerance= 1.0%	1	\$0.01	0201 2 mm <sup>2</sup>
U1	Texas Instruments	TPS54332DDAR	Switcher	1	\$0.70	 DDA0008H 55 mm <sup>2</sup>

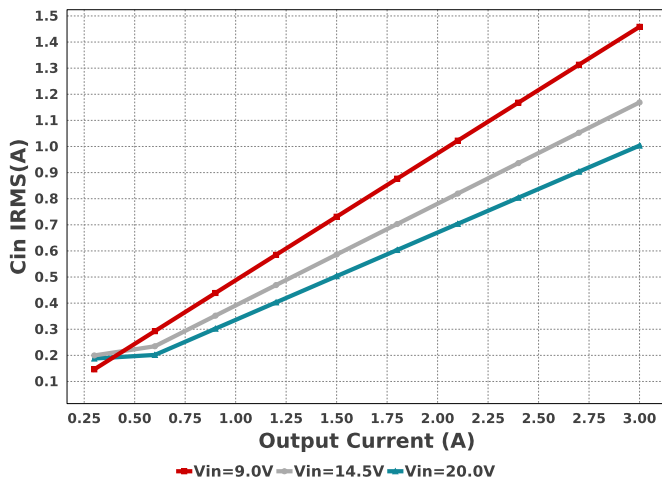
IC Tj



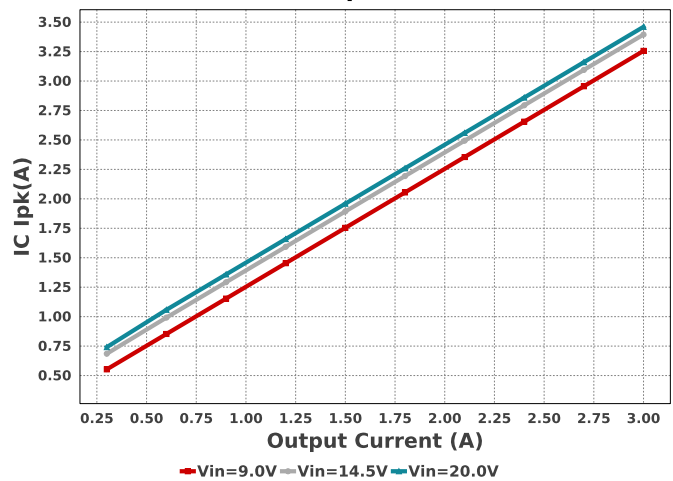
Duty Cycle



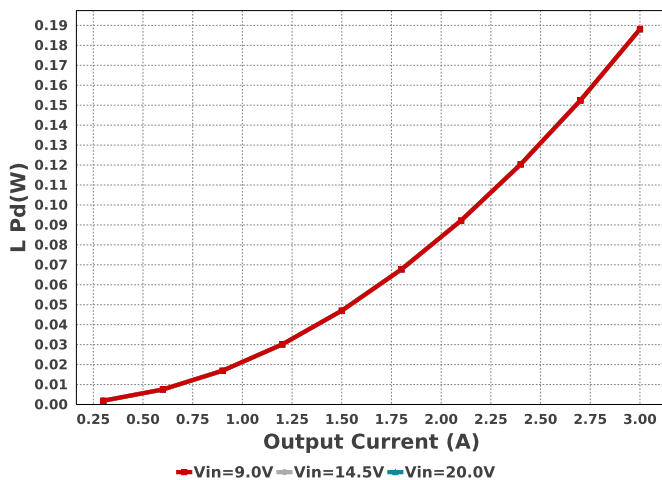
Cin IRMS



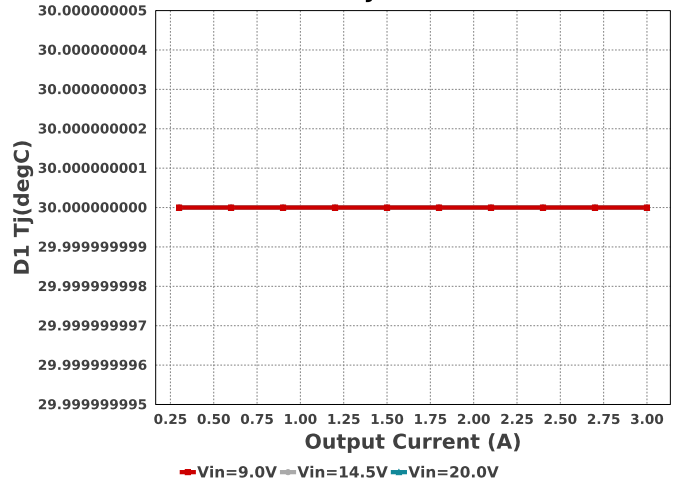
IC Ipk

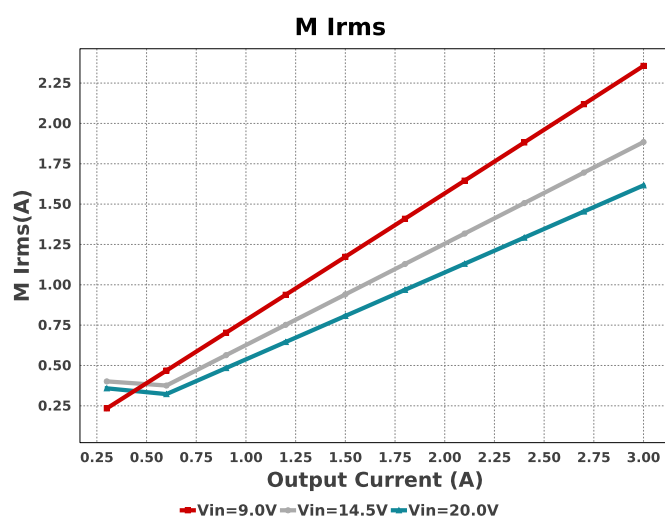
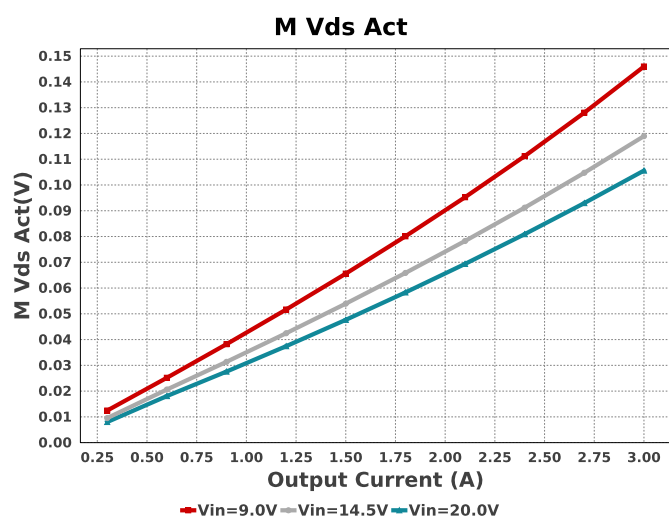
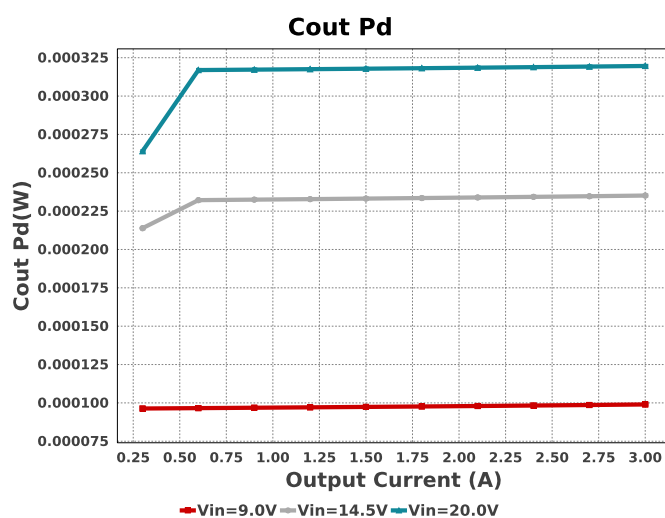
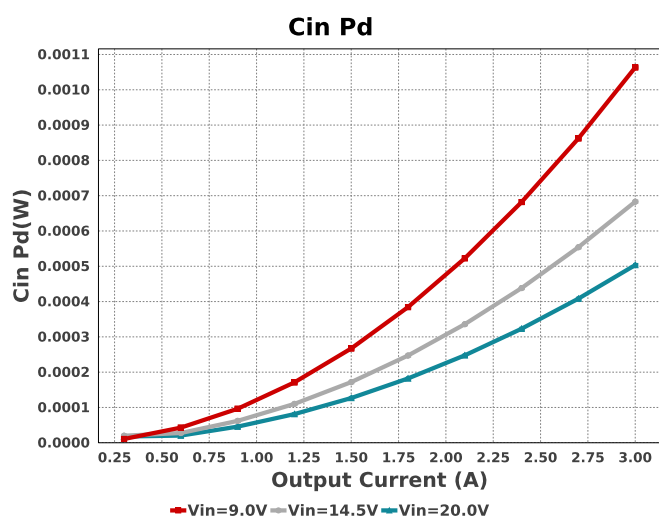
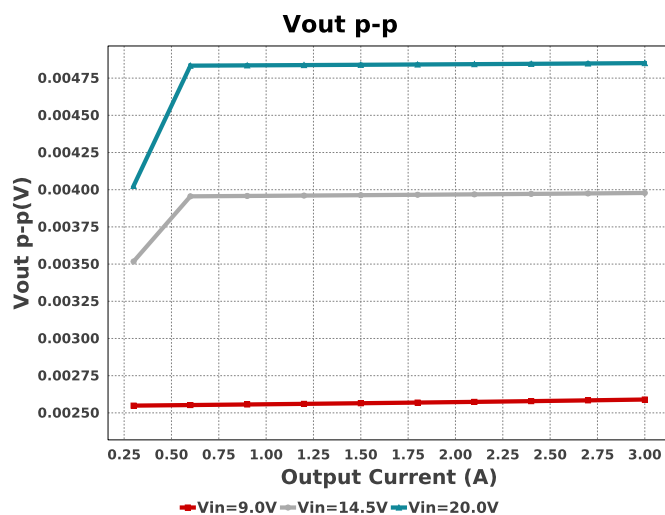
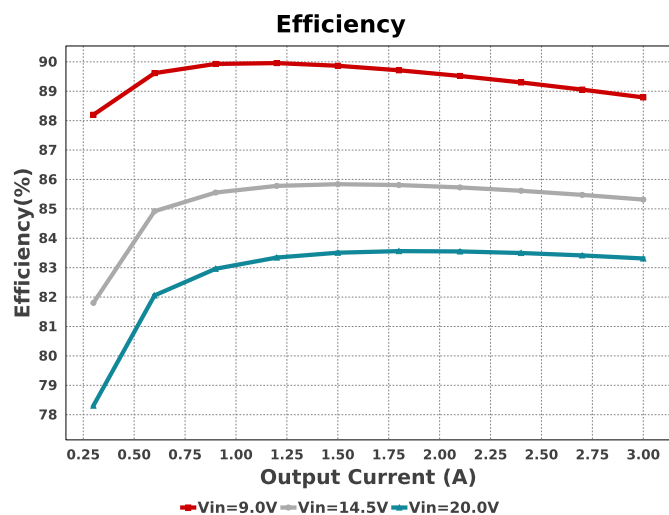


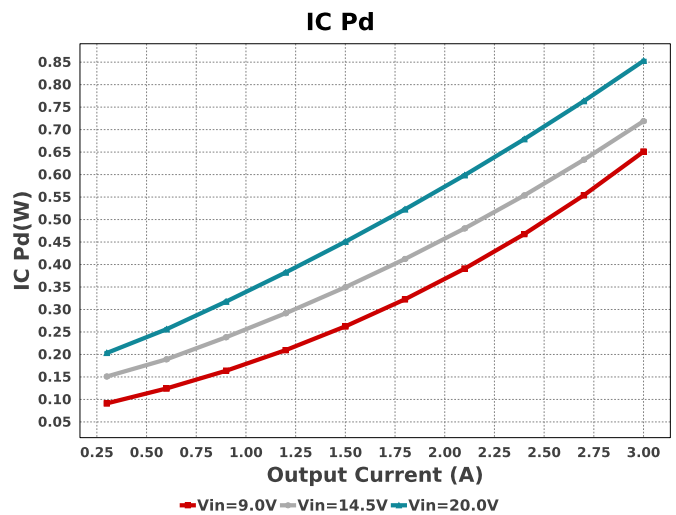
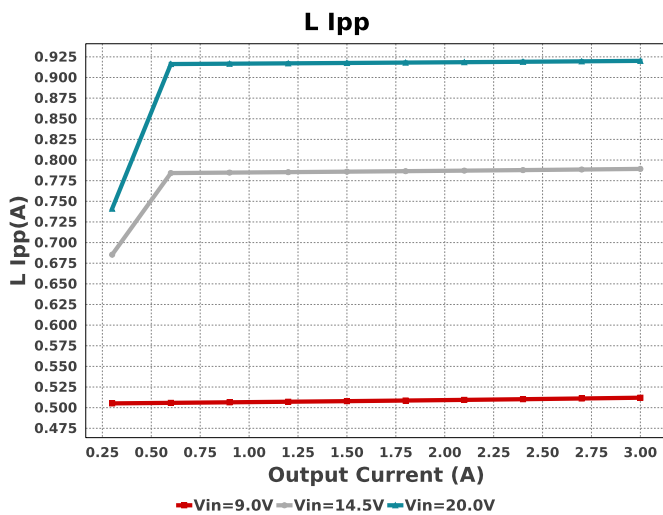
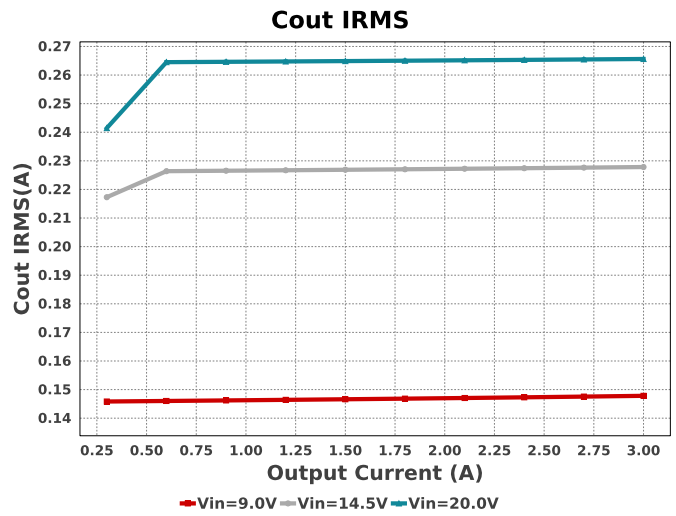
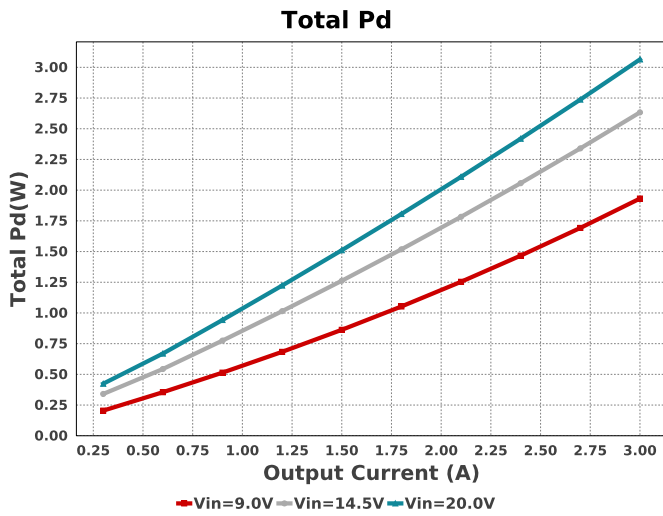
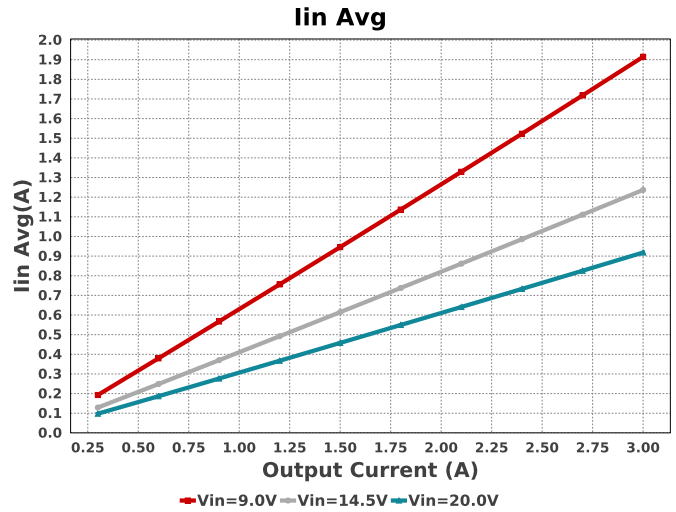
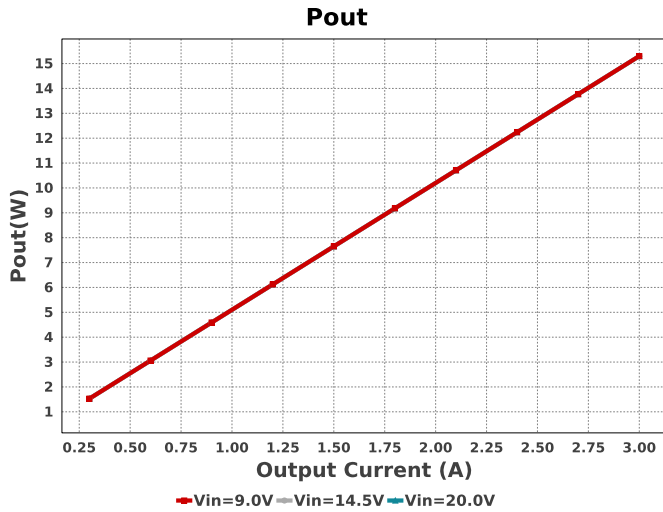
L Pd

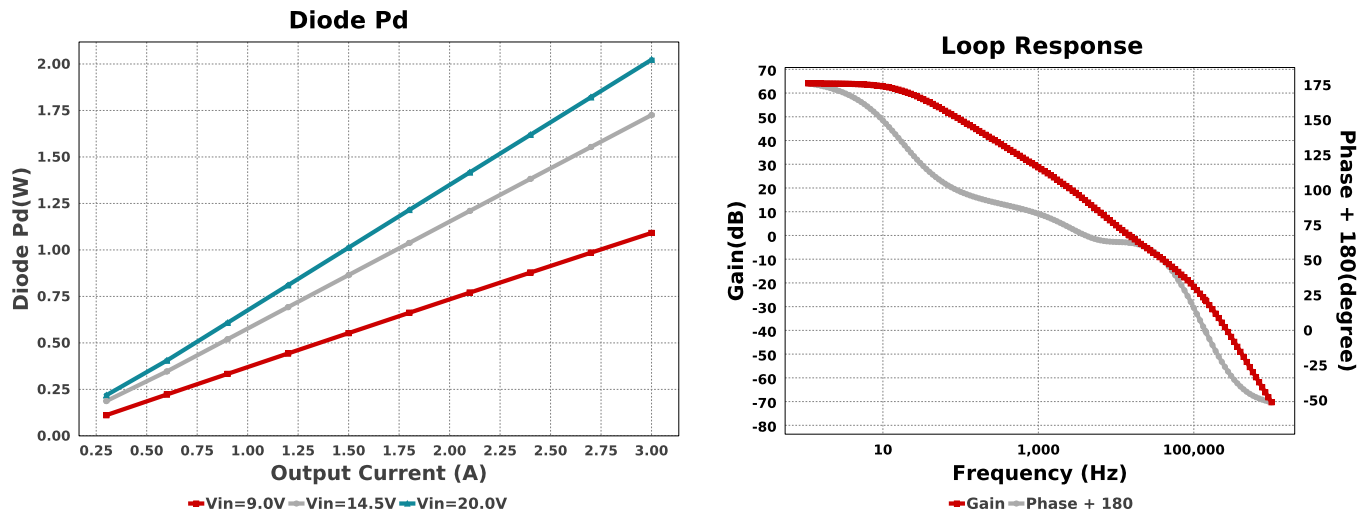


D1 Tj









## Operating Values

#	Name	Value	Category	Description
1.	BOM Count	13		Total Design BOM count
2.	Total BOM	\$2.239		Total BOM Cost
3.	Cin IRMS	1.003 A	Capacitor	Input capacitor RMS ripple current
4.	Cin Pd	503.42 $\mu$ W	Capacitor	Input capacitor power dissipation
5.	Cout IRMS	265.622 mA	Capacitor	Output capacitor RMS ripple current
6.	Cout Pd	319.61 $\mu$ W	Capacitor	Output capacitor power dissipation
7.	D1 Tj	30.0 degC	Diode	D1 junction temperature
8.	Diode Pd	2.023 W	Diode	Diode power dissipation
9.	IC Ipk	3.46 A	IC	Peak switch current in IC
10.	IC Pd	852.85 mW	IC	IC power dissipation
11.	IC Tj	71.534 degC	IC	IC junction temperature
12.	ICThetaJA	48.7 degC/W	IC	IC junction-to-ambient thermal resistance
13.	Iin Avg	918.23 mA	IC	Average input current
14.	L Ipp	920.14 mA	Inductor	Peak-to-peak inductor ripple current
15.	L Pd	188.1 mW	Inductor	Inductor power dissipation
16.	M Irms	1.616 A	Mosfet	MOSFET RMS ripple current
17.	M Vds Act	105.584 mV	Mosfet	Voltage drop across the MosFET
18.	Cin Pd	503.42 $\mu$ W	Power	Input capacitor power dissipation
19.	Cout Pd	319.61 $\mu$ W	Power	Output capacitor power dissipation
20.	Diode Pd	2.023 W	Power	Diode power dissipation
21.	IC Pd	852.85 mW	Power	IC power dissipation
22.	L Pd	188.1 mW	Power	Inductor power dissipation
23.	Total Pd	3.065 W	Power	Total Power Dissipation
24.	Cross Freq	14.811 kHz	System	Bode plot crossover frequency
25.	Duty Cycle	29.025 %	Information	Duty cycle
26.	Efficiency	83.313 %	Information	Steady state efficiency
27.	FootPrint	409.0 mm <sup>2</sup>	Information	Total Foot Print Area of BOM components
28.	Frequency	1000.0 kHz	Information	Switching frequency
29.	Gain Marg	-27.135 dB	Information	Bode Plot Gain Margin
30.	Iout	3.0 A	Information	Iout operating point
31.	Low Freq Gain	64.053 dB	Information	Gain at 1Hz
32.	Mode	CCM	Information	Conduction Mode
33.	Phase Marg	62.745 deg	Information	Bode Plot Phase Margin
34.	Pout	15.3 W	Information	Total output power
35.	Vin	20.0 V	Information	Vin operating point
36.	Vout	5.1 V	Information	Operational Output Voltage
37.	Vout Actual	4.988 V	Information	Vout Actual calculated based on selected voltage divider resistors

#	Name	Value	Category	Description
38.	Vout Tolerance	5.256 %	System Information	Vout Tolerance based on IC Tolerance (no load) and voltage divider resistors if applicable
39.	Vout p-p	4.851 mV	System Information	Peak-to-peak output ripple voltage

## Design Inputs

Name	Value	Description
Iout	3.0	Maximum Output Current
VinMax	20.0	Maximum input voltage
VinMin	9.0	Minimum input voltage
Vout	5.1	Output Voltage
base_pn	TPS54332	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 9.0V 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.

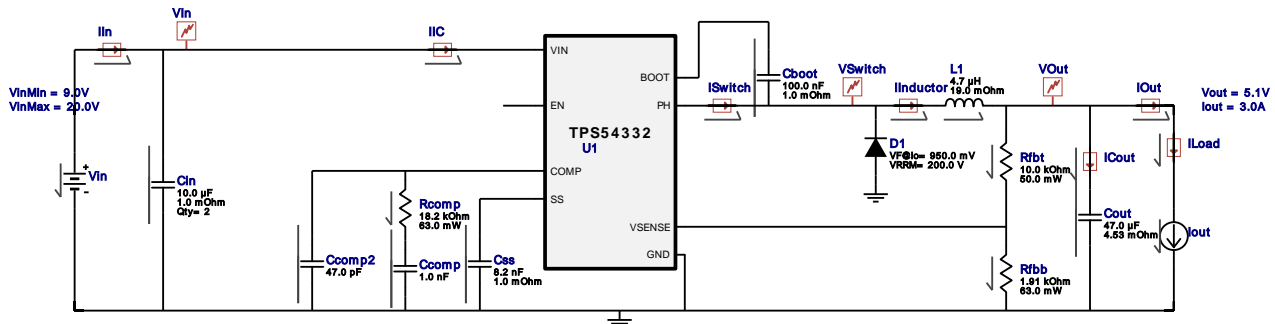


# WEBENCH® Electrical Simulation Report

Design Id = 8

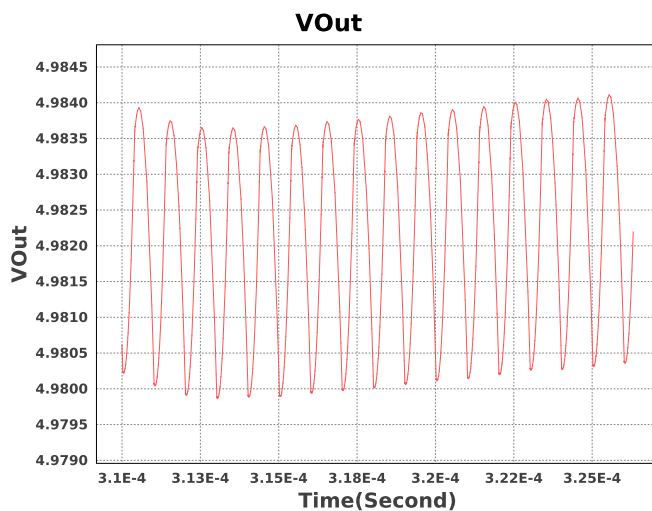
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Simulation Type = Steady State



## Simulation Parameters

#	Name	Parameter Name	Description	Values
1.	Cboot	IC	Initial Voltage	14.5 V
2.	L1	IC	Initial Current	3.0 A
3.	Iout	I	Load Current	3.0 A



## Design Assistance

1. Master key : 83550B91A7E12685[v1]

2. **TPS54332** Product Folder : <http://www.ti.com/product/TPS54332> : contains the data sheet and other resources.



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