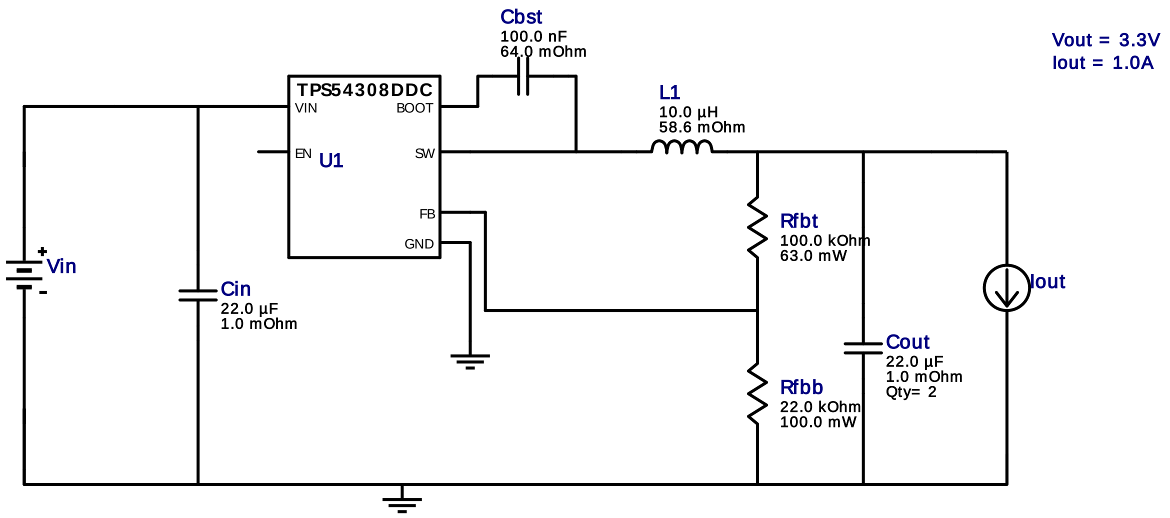
Mouser
1: 1,35 €
10: 1,15 €
100: 0,926 €

VinMin = 10.0V
VinMax = 28.0V
Vout = 3.3V
Iout = 1.0A

Device = TPS54308DDCR
Topology = Buck
Created = 2019-02-19 07:28:08.529
BOM Cost = $4.36
BOM Count = 8
Total Pd = 0.38W

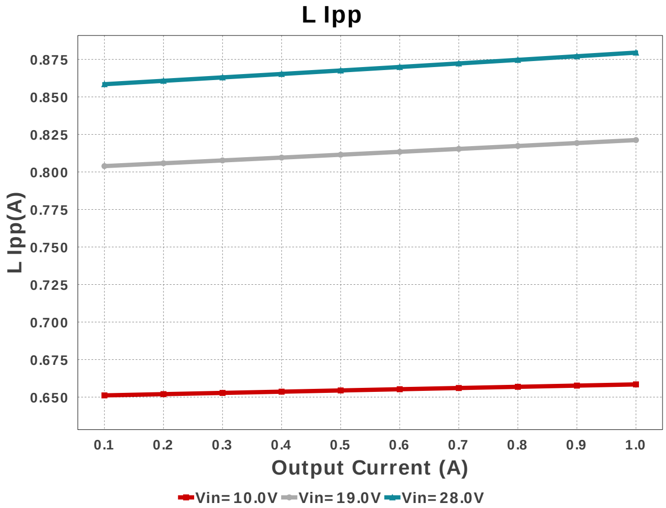
WEBENCH ® Design Report

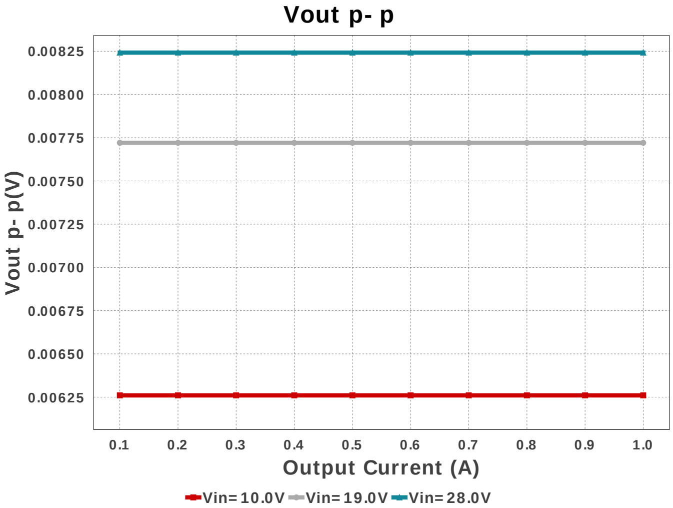
Design : 16 TPS54308DDCR
TPS54308DDCR 10V-28V to 3.30V @ 1A

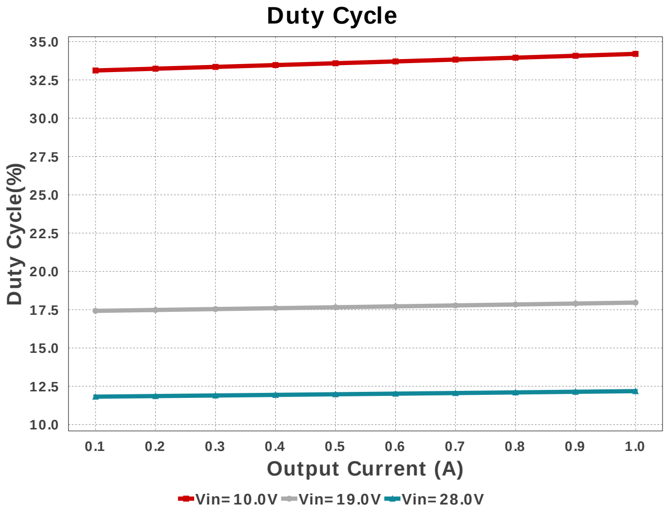


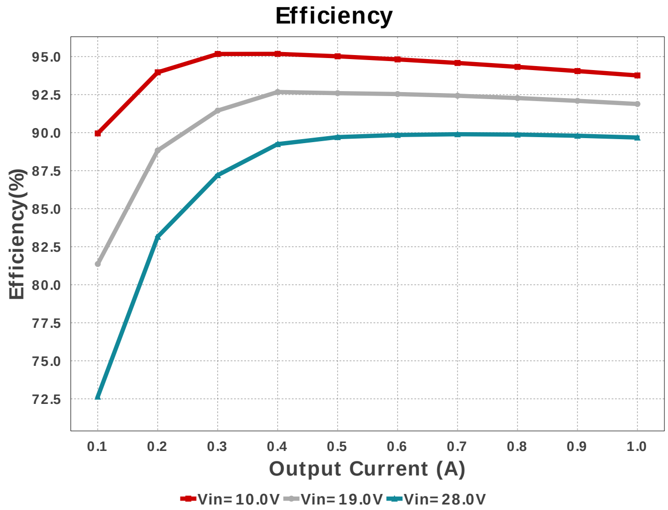
Electrical BOM

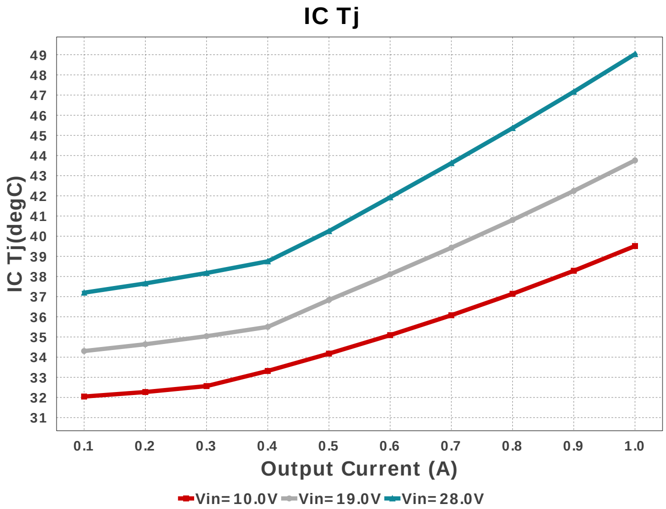
Name	Manufacturer	Part Number	Properties	Qty	Price	Footprint
Cbst	Kemet	C0805C104M5RACTU Series= X7R	Cap= 100.0 nF ESR= 64.0 mOhm VDC= 50.0 V IRMS= 1.64 A	1	$0.02	0805 7 mm²
Cin	MuRata	KCM55WR71J226MH01K Series= X7R	Cap= 22.0 uF ESR= 1.0 mOhm VDC= 63.0 V IRMS= 0.0 A	1	$2.90	KCM55W 59 mm²
Cout	AVX	12103D226MAT2A Series= X5R	Cap= 22.0 uF ESR= 1.0 mOhm VDC= 25.0 V IRMS= 0.0 A	2	$0.31	1210 15 mm²
L1	Bourns	SRN6045-100M	L= 10.0 µH DCR= 58.6 mOhm	1	$0.20	SRN6045 64 mm²
Rfbb	Yageo	RC0603FR-0722KL Series= ?	Res= 22.0 kOhm Power= 100.0 mW Tolerance= 1.0%	1	$0.01	0603 5 mm²
Rfbt	Vishay-Dale	CRCW0402100KFKED Series= CRCW..e3	Res= 100.0 kOhm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	0402 3 mm²
U1	Texas Instruments	TPS54308DDCR	Switcher	1	$0.60	DDC0006A_N 10 mm²

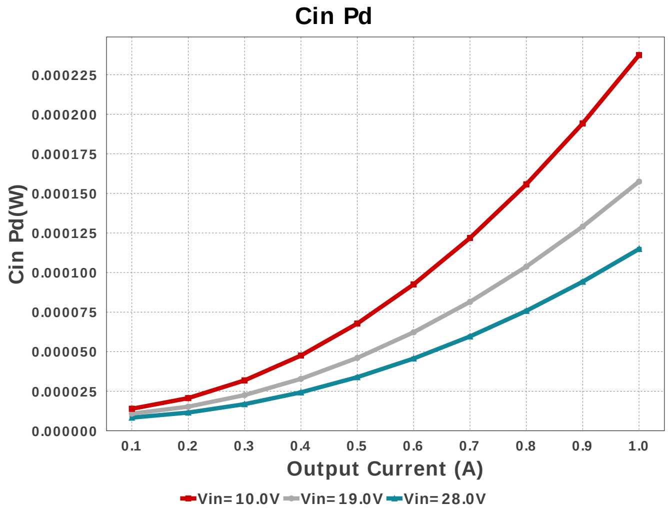

L Ipp
L Ipp(A)
0.875
0.850
0.825
0.800
0.775
0.750
0.725
0.700
0.675
0.650
0.1 0.2 0.3 0.4 0.5 0.6 0.7 0.8 0.9 1.0
Output Current (A)
Vin=10.0V Vin=19.0V Vin=28.0V

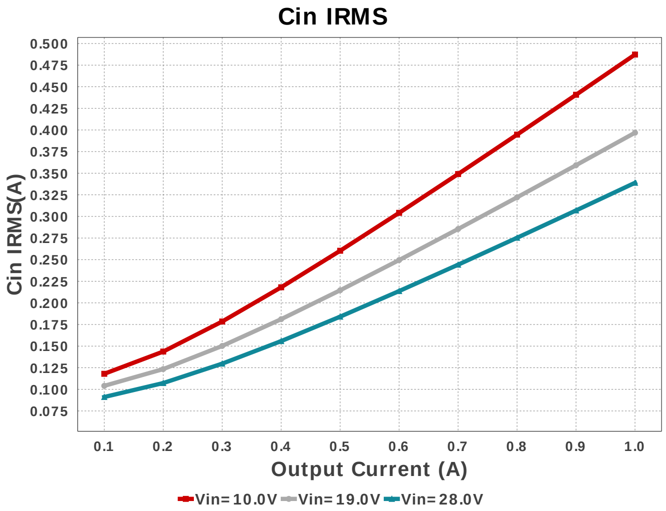

Vout p- p
Vout p- p(V)
0.00825
0.00800
0.00775
0.00750
0.00725
0.00700
0.00675
0.00650
0.00625
0.1 0.2 0.3 0.4 0.5 0.6 0.7 0.8 0.9 1.0
Output Current (A)
Vin=10.0V Vin=19.0V Vin=28.0V

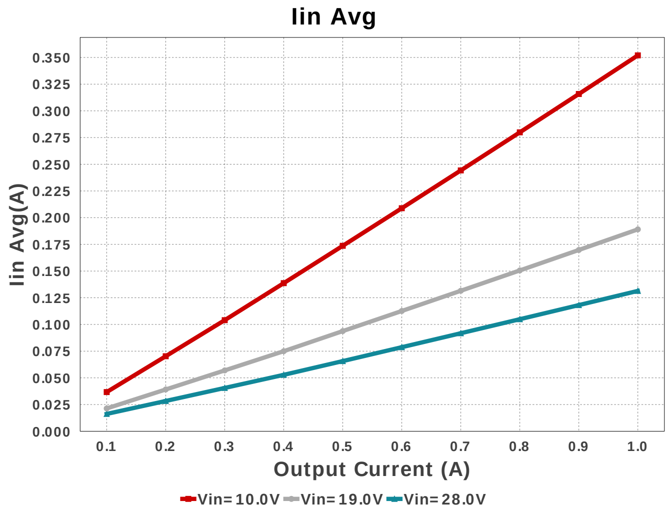

Duty Cycle
Duty Cycle(%)
35.0
32.5
30.0
27.5
25.0
22.5
20.0
17.5
15.0
12.5
10.0
0.1 0.2 0.3 0.4 0.5 0.6 0.7 0.8 0.9 1.0
Output Current (A)
Vin=10.0V Vin=19.0V Vin=28.0V

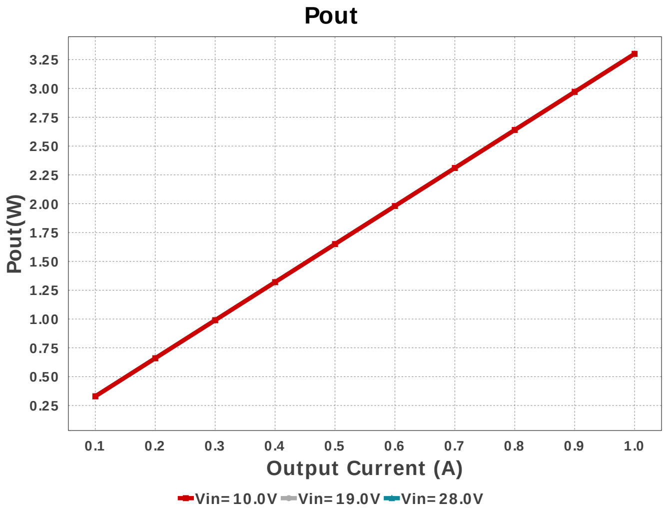

Efficiency
Efficiency(%)
95.0
92.5
90.0
87.5
85.0
82.5
80.0
77.5
75.0
72.5
0.1 0.2 0.3 0.4 0.5 0.6 0.7 0.8 0.9 1.0
Output Current (A)
Vin=10.0V Vin=19.0V Vin=28.0V

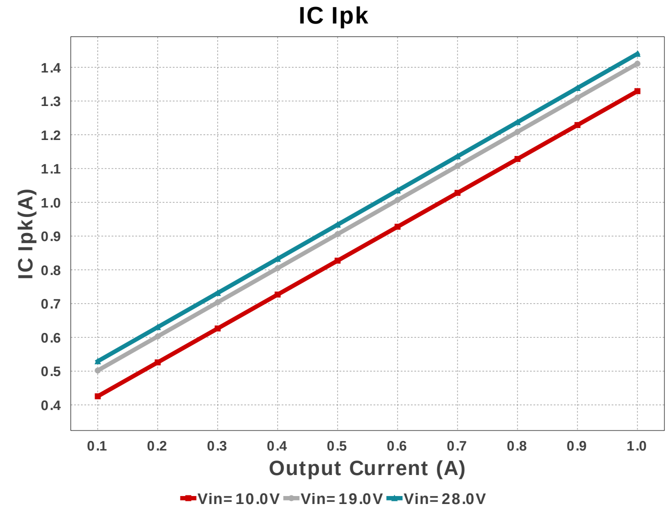

IC Tj
IC Tj(degC)
49 48 47 46 45 44 43 42 41 40 39 38 37 36 35 34 33 32 31
0.1 0.2 0.3 0.4 0.5 0.6 0.7 0.8 0.9 1.0
Output Current (A)
Vin=10.0V Vin=19.0V Vin=28.0V

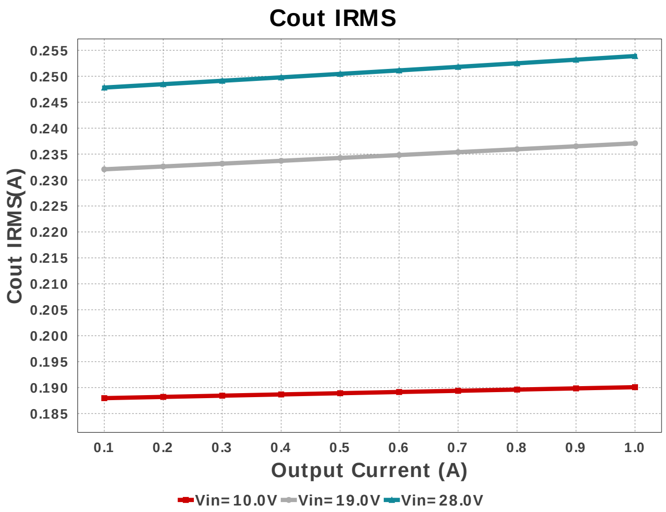

Cin Pd
Cin Pd(W)
0.000225
0.000200
0.000175
0.000150
0.000125
0.000100
0.000075
0.000050
0.000025
0.000000
0.1 0.2 0.3 0.4 0.5 0.6 0.7 0.8 0.9 1.0
Output Current (A)
Vin=10.0V Vin=19.0V Vin=28.0V

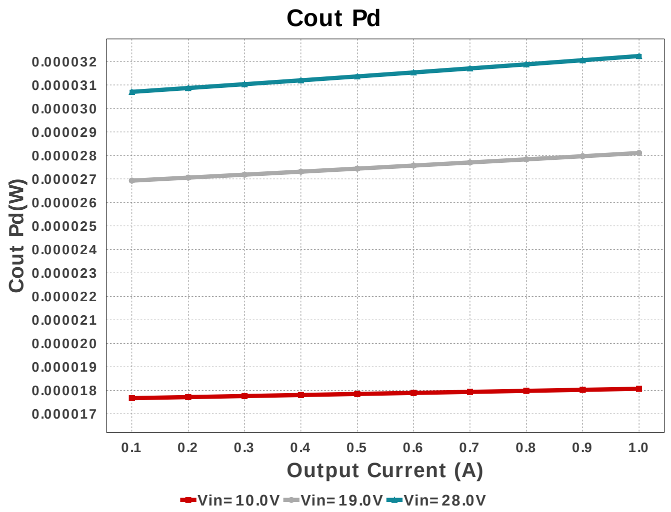

Cin IRMS
Cin IRMS(A)
0.500 0.475 0.450 0.425 0.400 0.375 0.350 0.325 0.300 0.275 0.250 0.225 0.200 0.175 0.150 0.125 0.100 0.075
0.1 0.2 0.3 0.4 0.5 0.6 0.7 0.8 0.9 1.0
Output Current (A)
Vin=10.0V Vin=19.0V Vin=28.0V


Iin Avg
Iin Avg(A)
0.350 0.325 0.300 0.275 0.250 0.225 0.200 0.175 0.150 0.125 0.100 0.075 0.050 0.025 0.000
0.1 0.2 0.3 0.4 0.5 0.6 0.7 0.8 0.9 1.0
Output Current (A)
Vin=10.0V Vin=19.0V Vin=28.0V

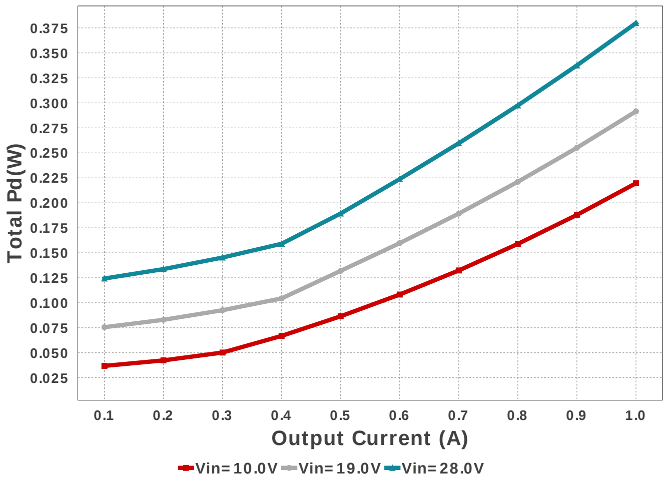

Pout
Pout(W)
3.25 3.00 2.75 2.50 2.25 2.00 1.75 1.50 1.25 1.00 0.75 0.50 0.25
0.1 0.2 0.3 0.4 0.5 0.6 0.7 0.8 0.9 1.0
Output Current (A)
Vin=10.0V Vin=19.0V Vin=28.0V


IC Ipk
IC Ipk(A)
1.4 1.3 1.2 1.1 1.0 0.9 0.8 0.7 0.6 0.5 0.4
0.1 0.2 0.3 0.4 0.5 0.6 0.7 0.8 0.9 1.0
Output Current (A)
Vin=10.0V Vin=19.0V Vin=28.0V

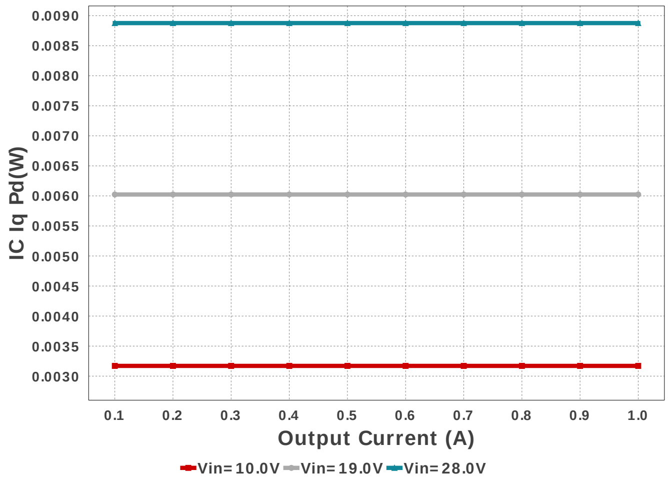

Cout IRMS
Cout IRMS(A)
0.255 0.250 0.245 0.240 0.235 0.230 0.225 0.220 0.215 0.210 0.205 0.200 0.195 0.190 0.185
0.1 0.2 0.3 0.4 0.5 0.6 0.7 0.8 0.9 1.0
Output Current (A)
Vin=10.0V Vin=19.0V Vin=28.0V


Cout Pd
Cout Pd(W)
0.000032 0.000031 0.000030 0.000029 0.000028 0.000027 0.000026 0.000025 0.000024 0.000023 0.000022 0.000021 0.000020 0.000019 0.000018 0.000017
0.1 0.2 0.3 0.4 0.5 0.6 0.7 0.8 0.9 1.0
Output Current (A)
Vin=10.0V Vin=19.0V Vin=28.0V

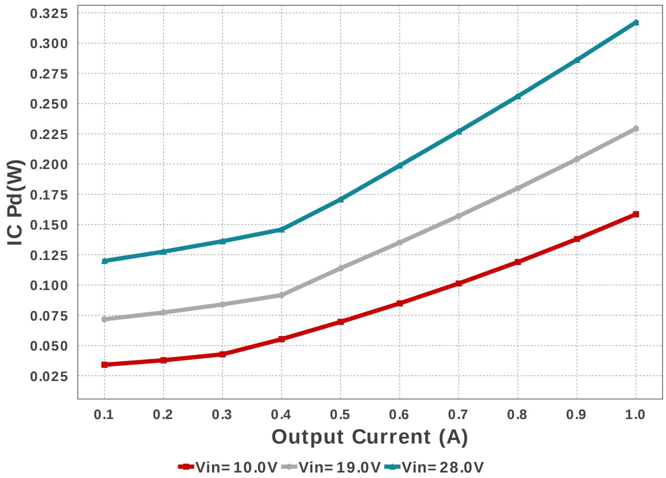
Total Pd



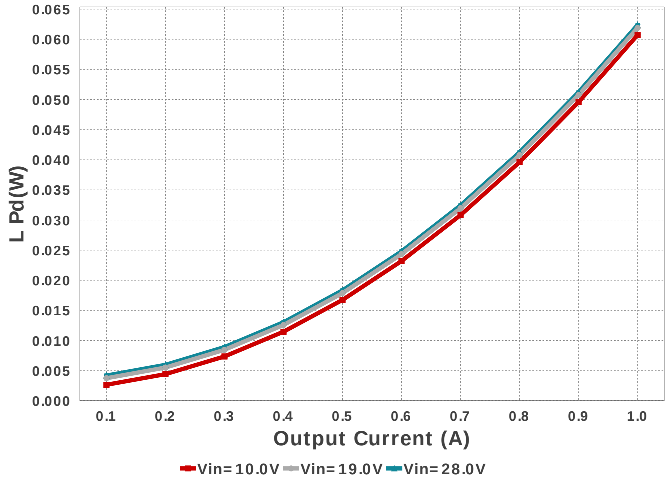
IC Iq Pd



IC Pd



L Pd



Operating Values

#	Name	Value	Category	Description
1.	Cin IRMS	338.911 mA	Capacitor	Input capacitor RMS ripple current
2.	Cin Pd	114.86 µW	Capacitor	Input capacitor power dissipation
3.	Cout IRMS	253.893 mA	Capacitor	Output capacitor RMS ripple current
4.	Cout Pd	32.231 µW	Capacitor	Output capacitor power dissipation
5.	IC Ipk	1.44 A	IC	Peak switch current in IC
6.	IC Iq Pd	8.877 mW	IC	IC Iq Pd
7.	IC Pd	317.2 mW	IC	IC power dissipation
8.	IC Tj	49.032 degC	IC	IC junction temperature
9.	ICThetaJA Effective	60.0 degC/W	IC	Effective IC Junction-to-Ambient Thermal Resistance
10.	Iin Avg	131.42 mA	IC	Average input current
11.	L Ipp	879.51 mA	Inductor	Peak-to-peak inductor ripple current
12.	L Pd	62.377 mW	Inductor	Inductor power dissipation
13.	Cin Pd	114.86 µW	Power	Input capacitor power dissipation
14.	Cout Pd	32.231 µW	Power	Output capacitor power dissipation
15.	IC Pd	317.2 mW	Power	IC power dissipation
16.	L Pd	62.377 mW	Power	Inductor power dissipation
17.	Total Pd	379.825 mW	Power	Total Power Dissipation
18.	BOM Count	8	System Information	Total Design BOM count
19.	Duty Cycle	12.185 %	System Information	Duty cycle
20.	Efficiency	89.678 %	System Information	Steady state efficiency
21.	FootPrint	177.0 mm^2	System Information	Total Foot Print Area of BOM components
22.	Frequency	340.0 kHz	System Information	Switching frequency
23.	Iout	1.0 A	System Information	Iout operating point
24.	Mode	CCM	System Information	PWM/PFM Mode

#	Name	Value	Category	Description
25.	Pout	3.3 W	System Information	Total output power
26.	Total BOM	$4.36	System Information	Total BOM Cost
27.	Vin	28.0 V	System Information	Vin operating point
28.	Vout Actual	3.305 V	System Information	Vout Actual calculated based on selected voltage divider resistors
29.	Vout Tolerance	1.656 %	System Information	Vout Tolerance based on IC Tolerance (no load) and voltage divider resistors if applicable
30.	Vout p-p	8.242 mV	System Information	Peak-to-peak output ripple voltage

Design Inputs

Name	Value	Description
Iout	1.0	Maximum Output Current
VinMax	28.0	Maximum input voltage
VinMin	10.0	Minimum input voltage
Vout	3.3	Output Voltage
base_pn	TPS54308	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

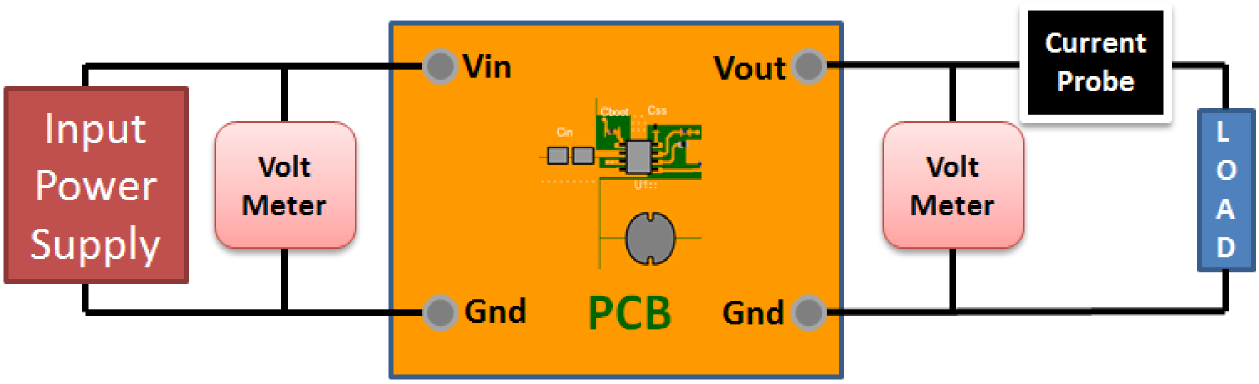
If board assembly is done in house it is best to tack down one terminal of a component on the board then solder the other terminal. For surface mount parts with large tabs, such as the DPAK, the tab on the back of the package should be pre-tinned with solder, then tacked into place by one of the pins. 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 10.0V 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 : 50B51B27C1279CB1[v1]

2. **TPS54308** Product Folder : http://www.ti.com/product/TPS54308 : contains the data sheet and other resources.

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