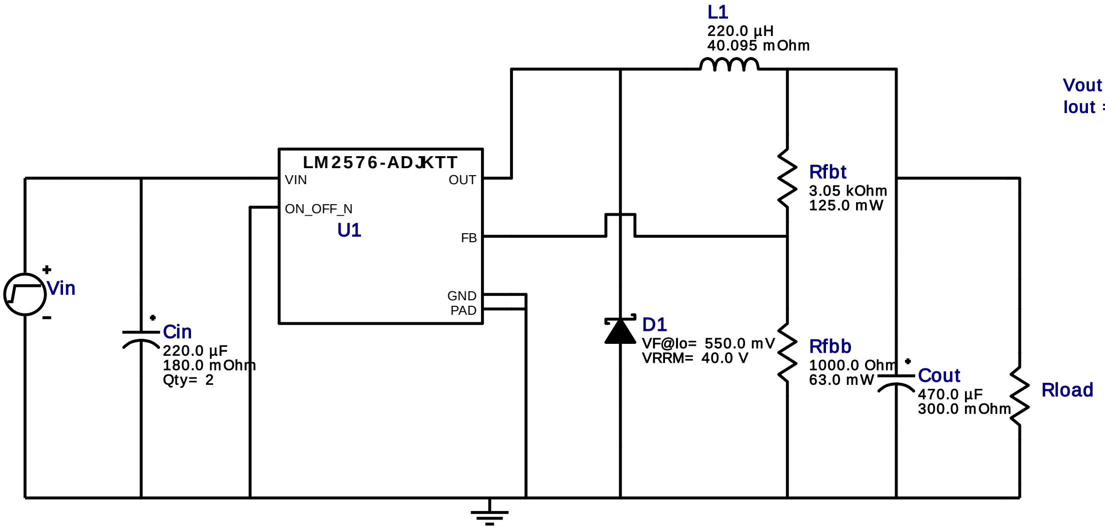
VinMin = 10.0V
VinMax = 28.0V
Vout = 5.0V
Iout = 1.3A

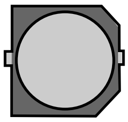
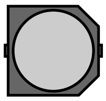
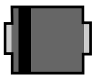
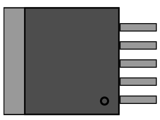
Device = LM2576SX-ADJ/NOPB
Topology = Buck
Created = 2024-03-31 23:34:42.960
BOM Cost = $9.29
BOM Count = 8
Total Pd = 0.87W

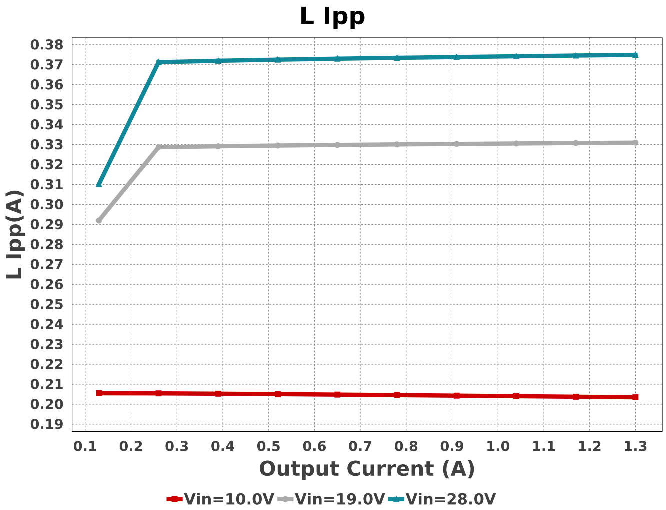
WEBENCH ® Design Report

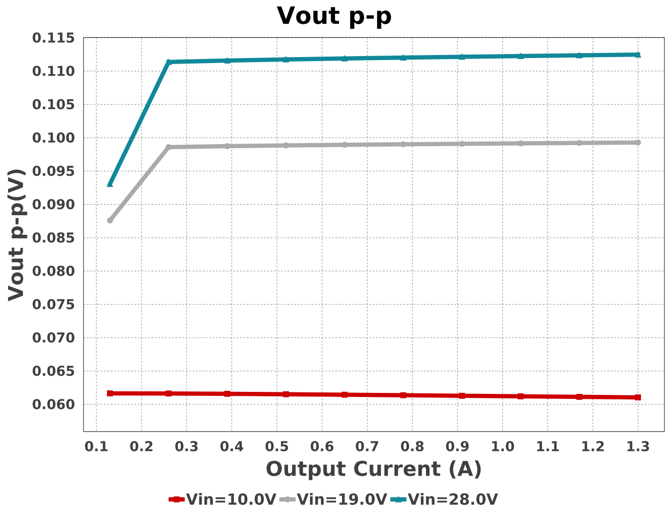
Design : 48 LM2576SX-ADJ/NOPB
LM2576SX-ADJ/NOPB 10V-28V to 5.00V @ 1.3A

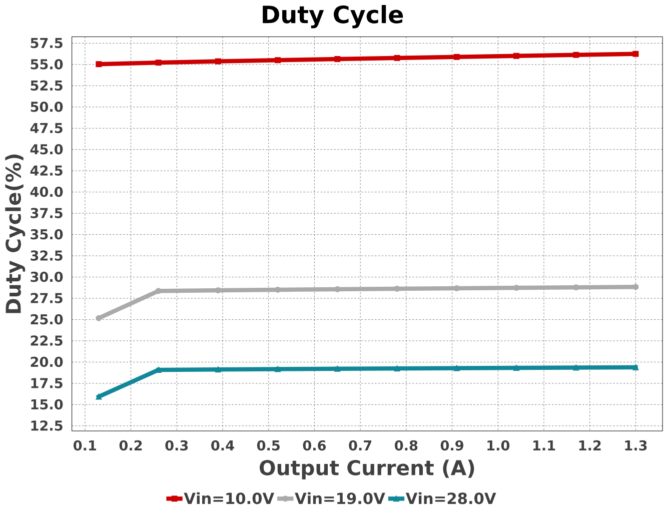


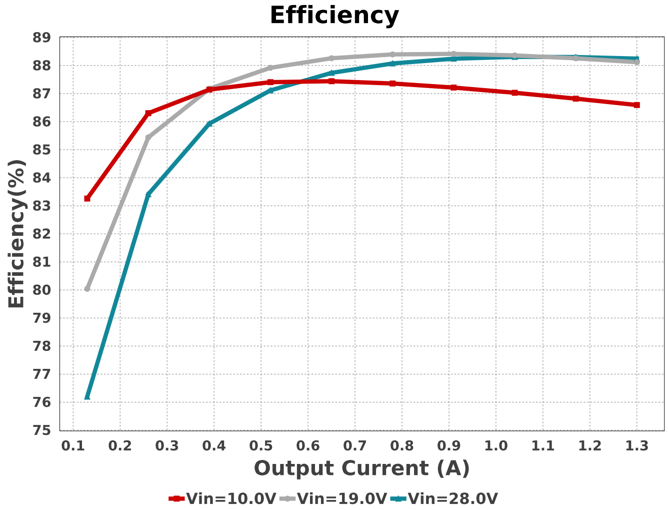
Electrical BOM

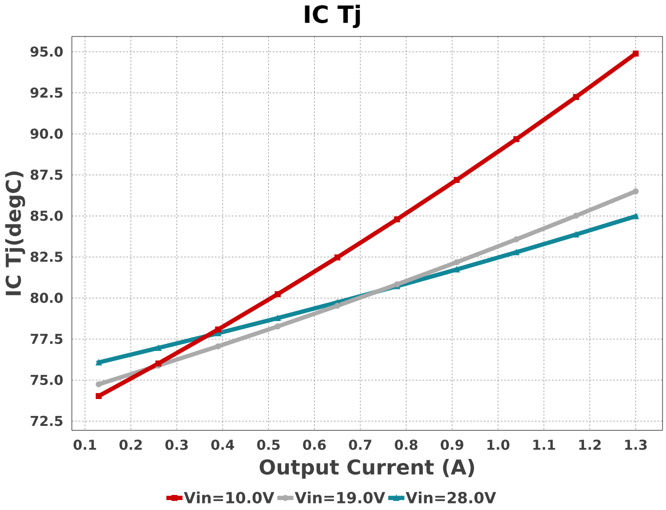
Name	Manufacturer	Part Number	Properties	Qty	Price	Footprint
Cin	Nichicon	UUD1H221MNL1GS Series= uD	Cap= 220.0 uF ESR= 180.0 mOhm VDC= 50.0 V IRMS= 670.0 mA	2	$0.30	 SM_RADIAL_10BMM 160 mm²
Cout	Chemi-Con	EMVY160ADA471MHA0G Series= MVY	Cap= 470.0 uF ESR= 300.0 mOhm VDC= 16.0 V IRMS= 450.0 mA	1	$0.25	 CAPSMT_62_HA0 106 mm²
D1	Diodes Inc.	B540C-13-F	VF@Io= 550.0 mV VRRM= 40.0 V	1	$0.19	 SMC 83 mm²
L1	Wurth Elektronik	74437529203221	L= 220.0 µH 40.095 mOhm	1	$6.72	WE-HCF Round_2920 0 mm²
Rfbb	Vishay-Dale	CRCW04021K00FKED Series= CRCW..e3	Res= 1000.0 Ohm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	0402 3 mm²
Rfbt	Yageo	RT0805BRD073K05L Series= ?	Res= 3.05 kOhm Power= 125.0 mW Tolerance= 0.1%	1	$0.05	0805 7 mm²
U1	Texas Instruments	LM2576SX-ADJ/NOPB	Switcher	1	$1.47	 KTT0005B 198 mm²

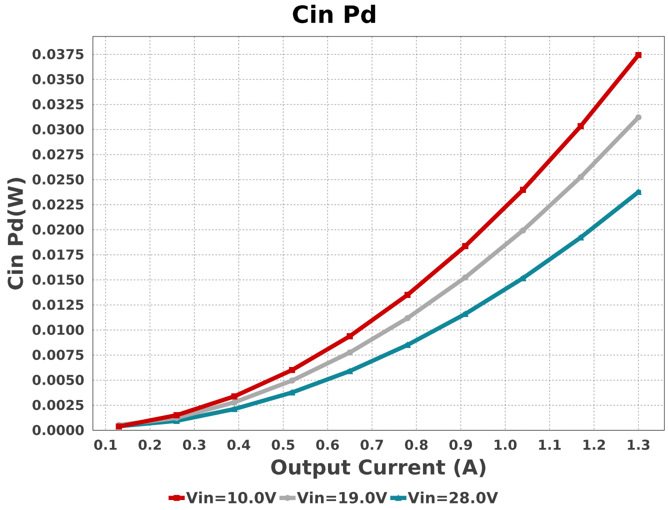

L Ipp
L Ipp(A)
Output Current (A)
Vin=10.0V
Vin=19.0V
Vin=28.0V


Vout p-p
Vout p-p(V)
Output Current (A)
Vin=10.0V
Vin=19.0V
Vin=28.0V

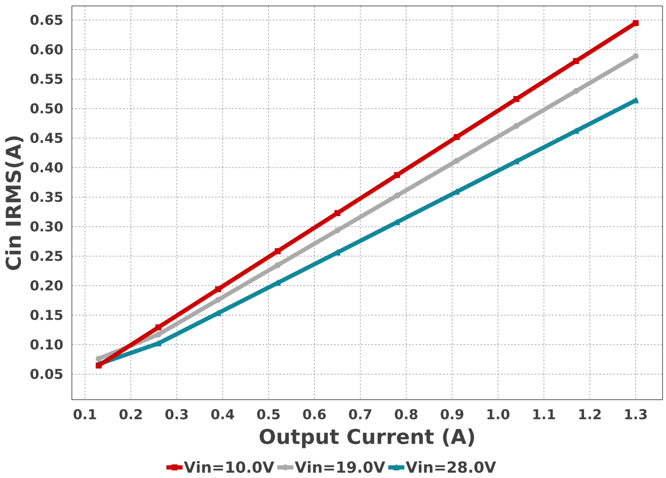

Duty Cycle
Duty Cycle(%)
Output Current (A)
Vin=10.0V
Vin=19.0V
Vin=28.0V


Efficiency
Efficiency(%)
Output Current (A)
Vin=10.0V
Vin=19.0V
Vin=28.0V

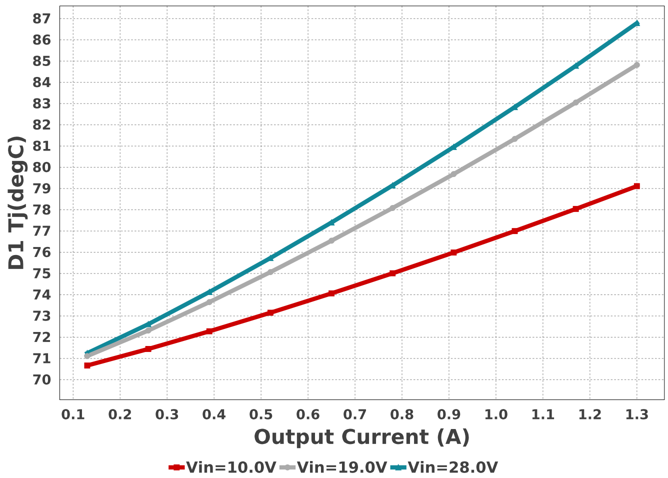

IC Tj
IC Tj(degC)
Output Current (A)
Vin=10.0V
Vin=19.0V
Vin=28.0V


Cin Pd
Cin Pd(W)
Output Current (A)
Vin=10.0V
Vin=19.0V
Vin=28.0V

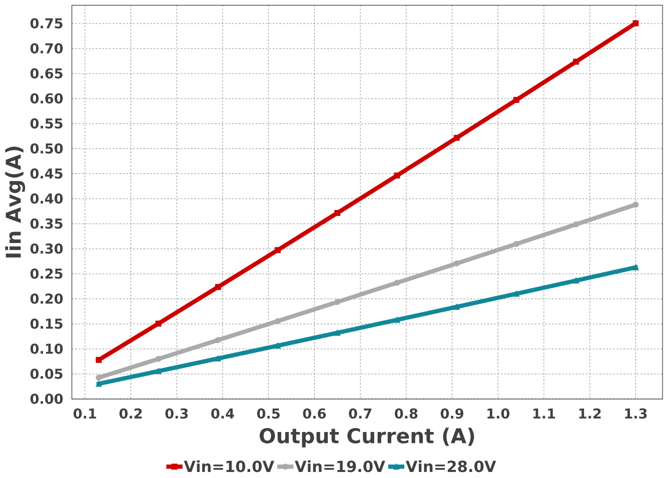
Cin IRMS



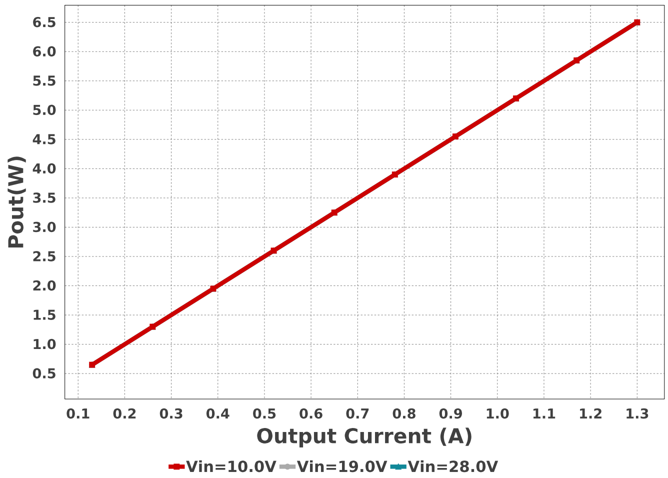
D1 Tj



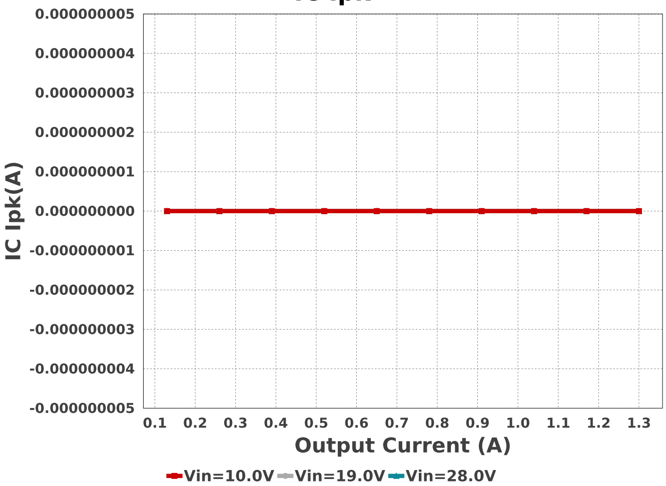
Iin Avg



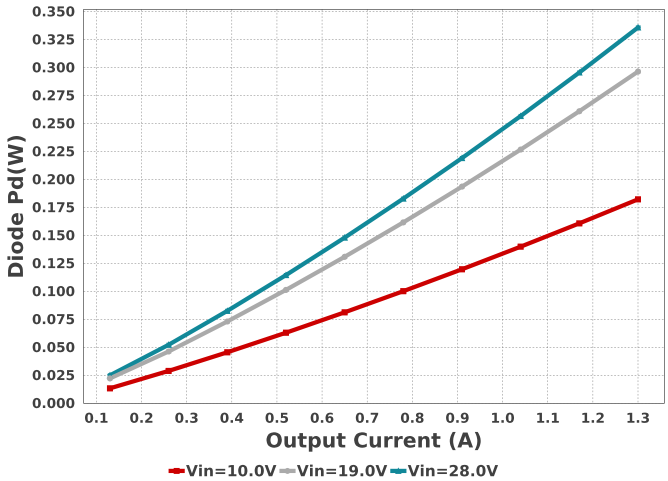
Pout

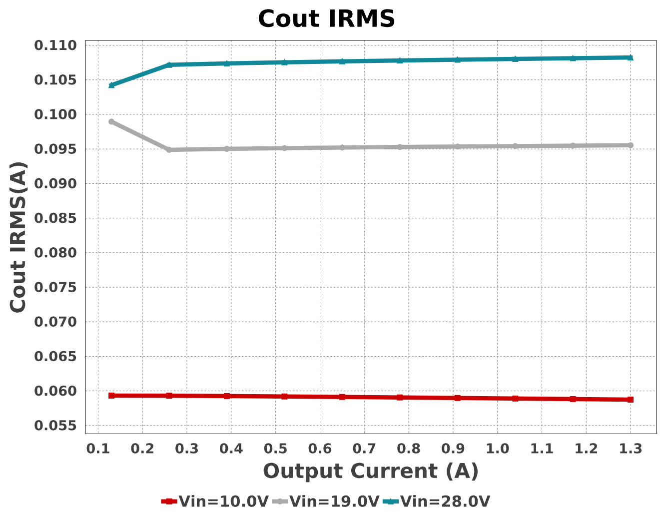


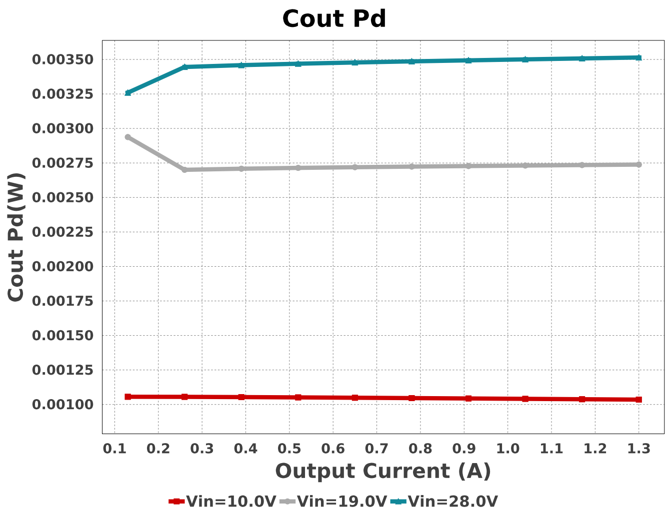
IC Ipk

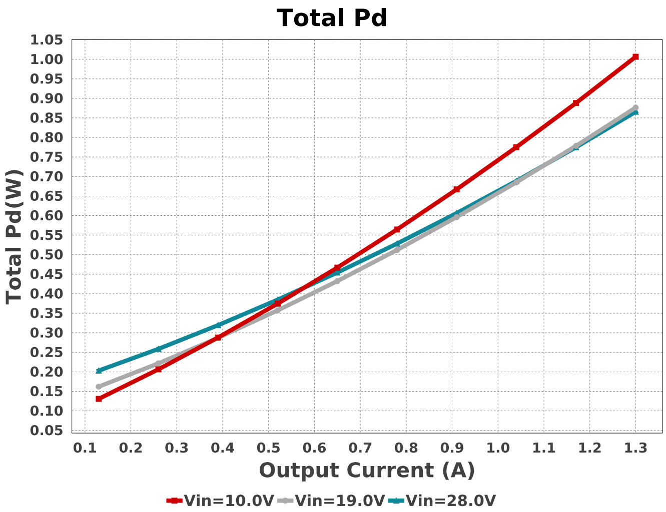


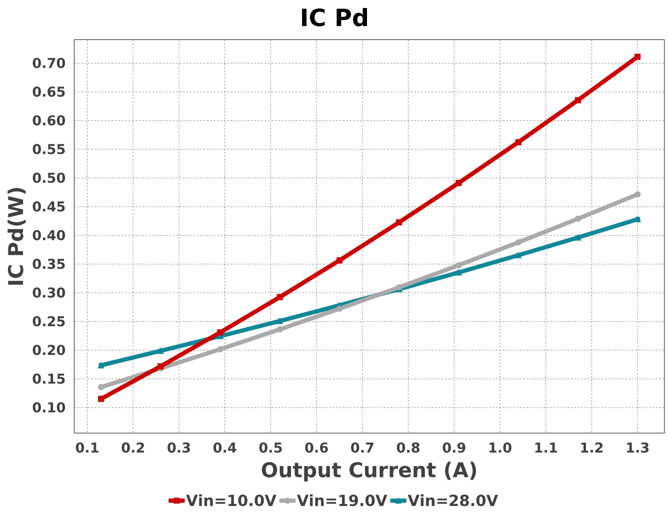
Diode Pd

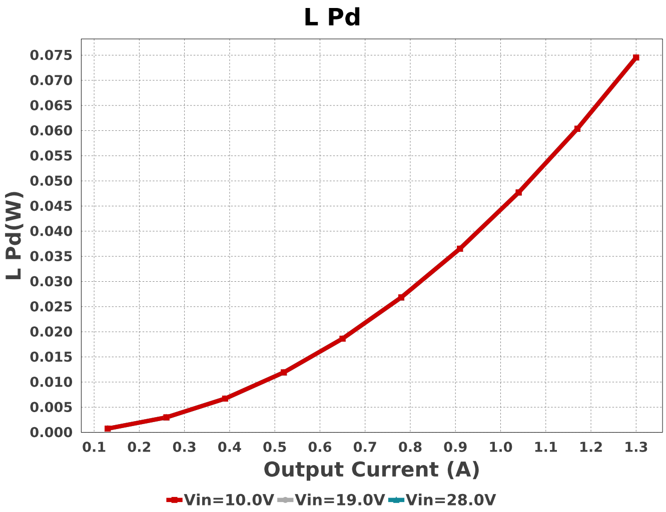












Operating Values

#	Name	Value	Category	Description
1.	Cin IRMS	513.91 mA	Capacitor	Input capacitor RMS ripple current
2.	Cin Pd	23.769 mW	Capacitor	Input capacitor power dissipation
3.	Cout IRMS	108.229 mA	Capacitor	Output capacitor RMS ripple current
4.	Cout Pd	3.514 mW	Capacitor	Output capacitor power dissipation
5.	D1 Tj	86.79 degC	Diode	D1 junction temperature
6.	Diode Pd	335.81 mW	Diode	Diode power dissipation
7.	IC Ipk	0.0 A	IC	Peak switch current in IC
8.	IC Pd	428.08 mW	IC	IC power dissipation
9.	IC Tj	84.983 degC	IC	IC junction temperature
10.	IC Tolerance	13.0 mV	IC	IC Feedback Tolerance
11.	ICThetaJA	35.0 degC/W	IC	IC junction-to-ambient thermal resistance

#	Name	Value	Category	Description
12.	Iin Avg	263.06 mA	IC	Average input current
13.	L Ipp	374.92 mA	Inductor	Peak-to-peak inductor ripple current
14.	L Pd	74.537 mW	Inductor	Inductor power dissipation
15.	Cin Pd	23.769 mW	Power	Input capacitor power dissipation
16.	Cout Pd	3.514 mW	Power	Output capacitor power dissipation
17.	Diode Pd	335.81 mW	Power	Diode power dissipation
18.	IC Pd	428.08 mW	Power	IC power dissipation
19.	L Pd	74.537 mW	Power	Inductor power dissipation
20.	Total Pd	865.688 mW	Power	Total Power Dissipation
21.	BOM Count	8	System Information	Total Design BOM count
22.	Duty Cycle	19.385 %	System Information	Duty cycle
23.	Efficiency	88.247 %	System Information	Steady state efficiency
24.	FootPrint	1.117 k mm^2	System Information	Total Foot Print Area of BOM components
25.	Frequency	52.0 kHz	System Information	Switching frequency
26.	Iout	1.3 A	System Information	Iout operating point
27.	Mode	CCM	System Information	Conduction Mode
28.	Pout	6.5 W	System Information	Total output power
29.	Total BOM	$9.29	System Information	Total BOM Cost
30.	Vin	28.0 V	System Information	Vin operating point
31.	Vout	5.0 V	System Information	Operational Output Voltage
32.	Vout Actual	4.982 V	System Information	Vout Actual calculated based on selected voltage divider resistors
33.	Vout Tolerance	1.902 %	System Information	Vout Tolerance based on IC Tolerance (no load) and voltage divider resistors if applicable
34.	Vout p-p	112.475 mV	System Information	Peak-to-peak output ripple voltage

Design Inputs

Name	Value	Description
Iout	1.3	Maximum Output Current
VinMax	28.0	Maximum input voltage
VinMin	10.0	Minimum input voltage
Vout	5.0	Output Voltage
base_pn	LM2576	Base Product Number
source	DC	Input Source Type
Ta	70.0	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

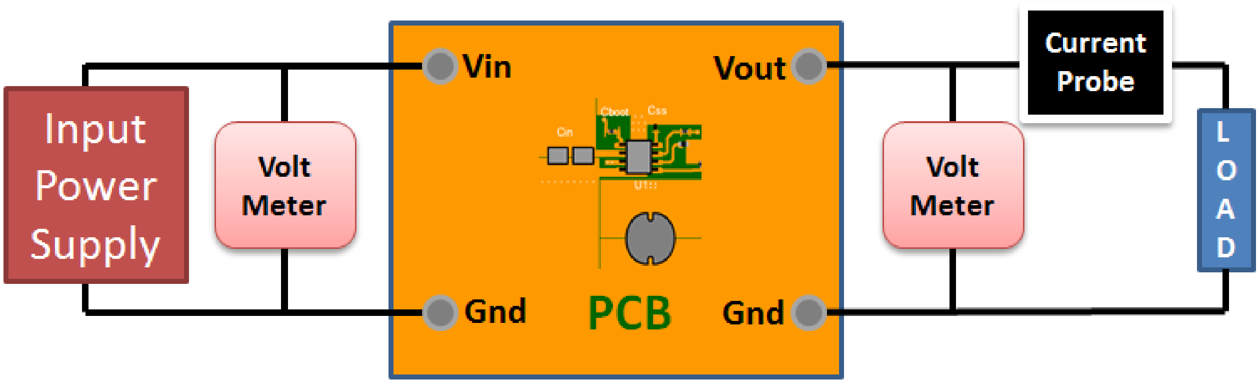
If board assembly is done in house it is best to tack down one terminal of a component on the board then solder the other terminal. For surface mount parts with large tabs, such as the DPAK, the tab on the back of the package should be pre-tinned with solder, then tacked into place by one of the pins. 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 : B1C77E59D715AC9F[v1]

2. **LM2576** Product Folder : http://www.ti.com/product/LM2576 : contains the data sheet and other resources.

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