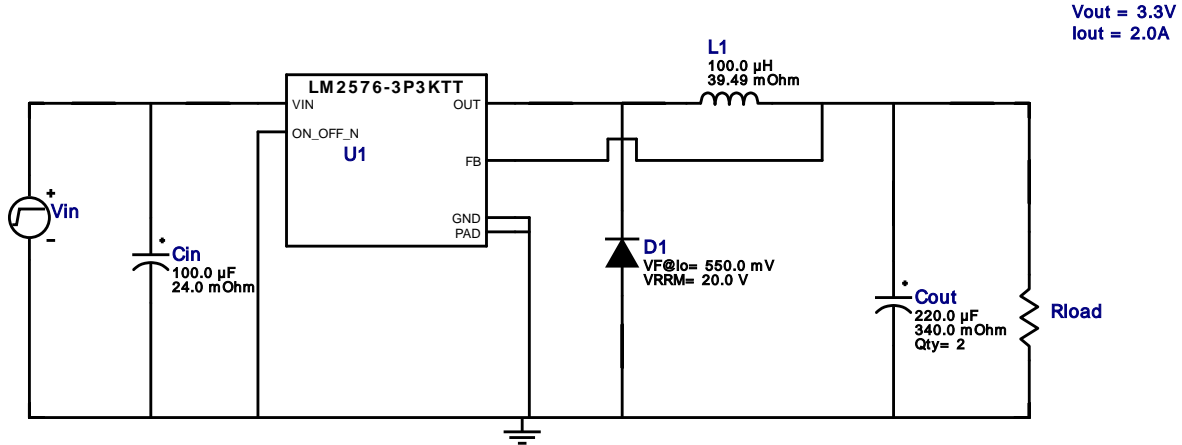


WEBENCH® Design Report




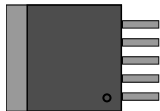
Design : 3 LM2576SX-3.3/NOPB
LM2576SX-3.3/NOPB Compact Buck Converter

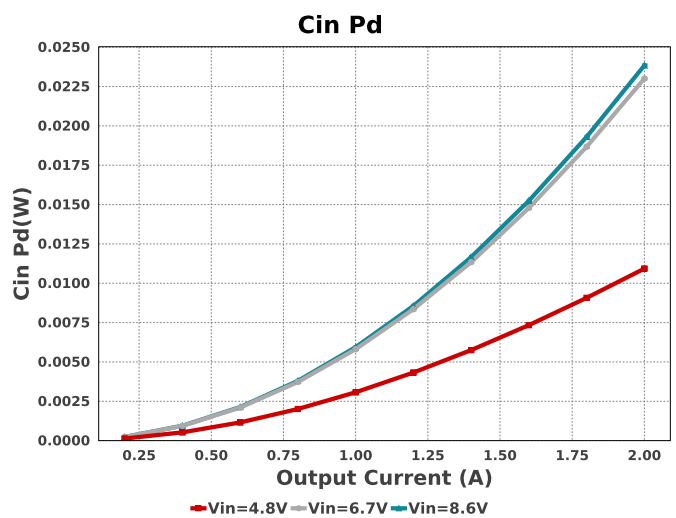
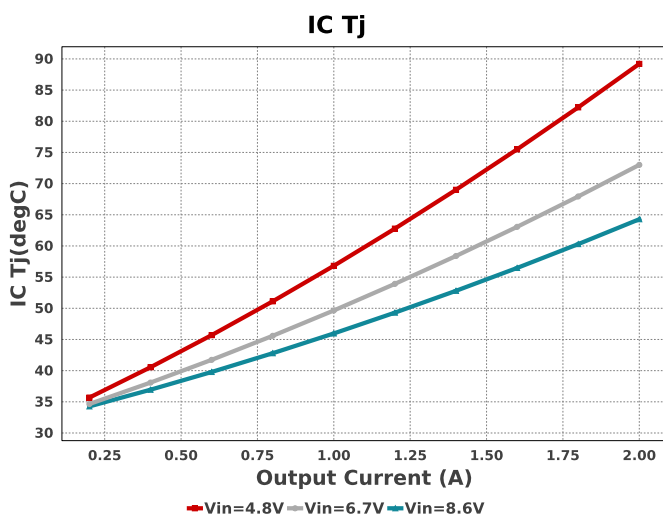
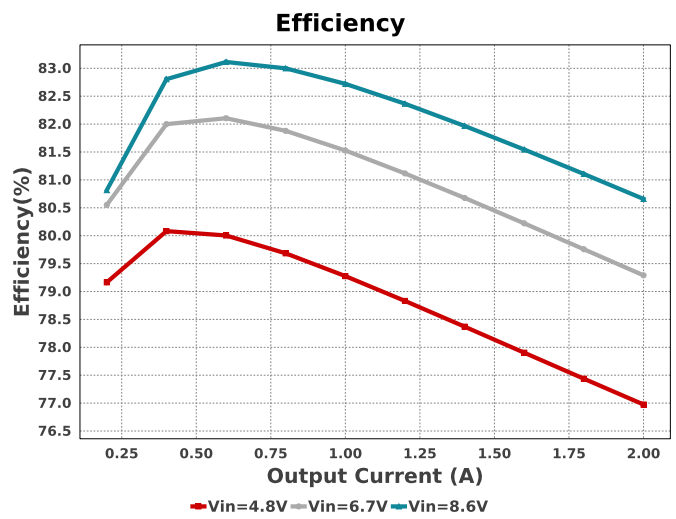
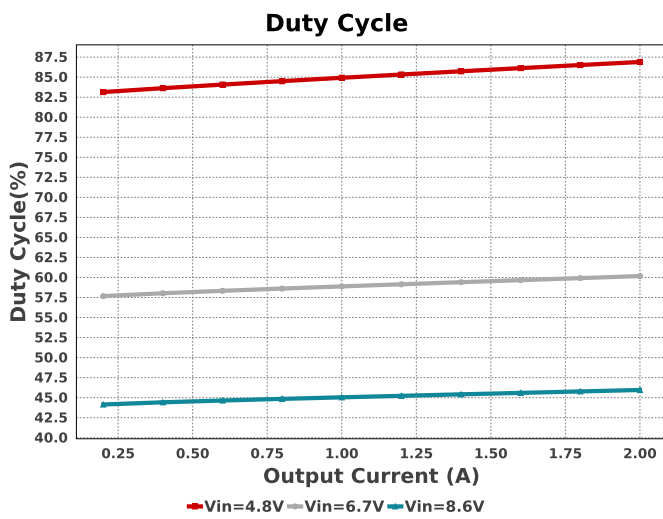
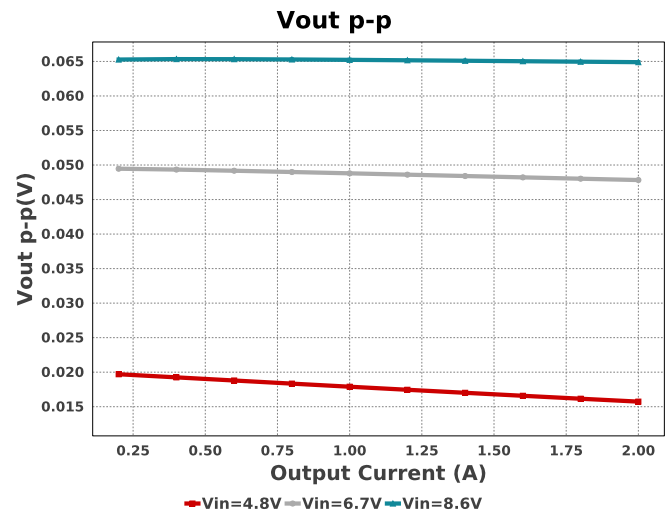
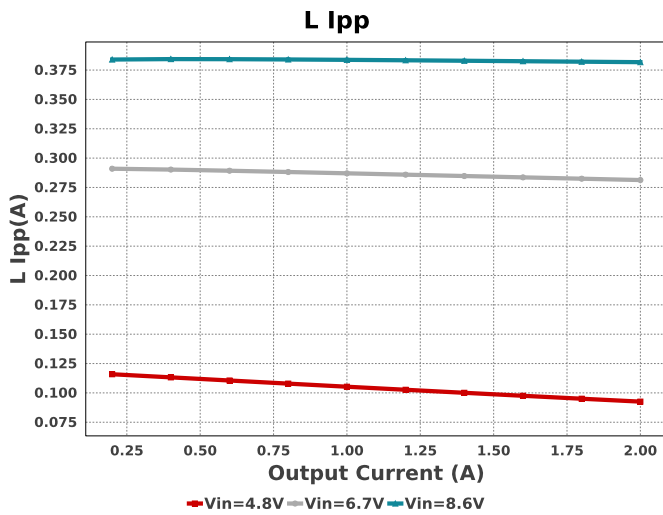
VinMin = 4.8V
VinMax = 8.6V
Vout = 3.3V
Iout = 2.0A

Device = LM2576SX-3.3/NOPB
Topology = Buck
Created = 2022-09-10 17:46:59.322
BOM Cost = \$9.10
BOM Count = 6
Total Pd = 1.58W

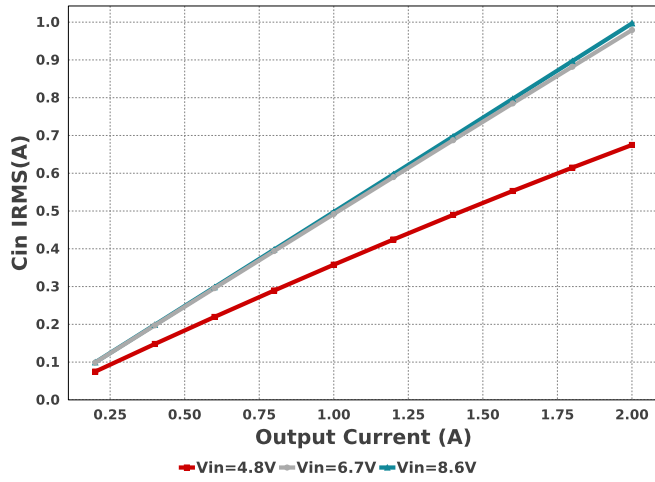


Electrical BOM

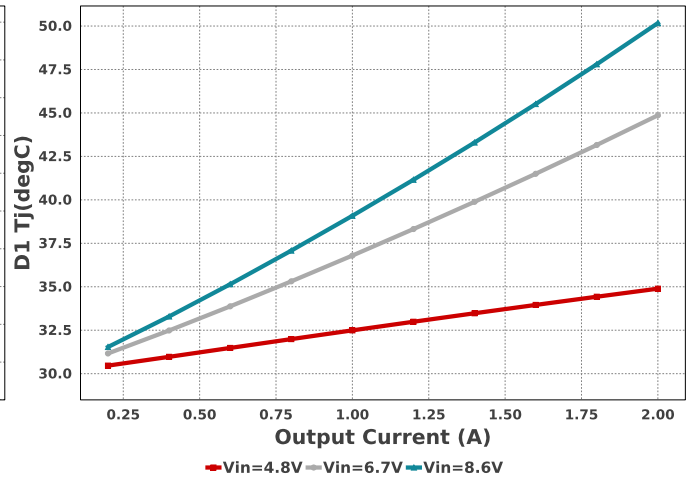
Name	Manufacturer	Part Number	Properties	Qty	Price	Footprint
Cin	Panasonic	16SVPC100M Series= SVPC	Cap= 100.0 uF ESR= 24.0 mOhm VDC= 16.0 V IRMS= 2.49 A	1	\$0.47	 SM_RADIAL_6.3AMM 80 mm²
Cout	Nichicon	UUD1C221MCL1GS Series= uD	Cap= 220.0 uF ESR= 340.0 mOhm VDC= 16.0 V IRMS= 280.0 mA	2	\$0.13	 SM_RADIAL_6.3BMM 80 mm²
D1	Diodes Inc.	B520C-13-F	VF@Io= 550.0 mV VRRM= 20.0 V	1	\$0.21	 SMC 83 mm²
L1	Würth Elektronik	74437429203101	L= 100.0 µH 39.49 mOhm	1	\$6.72	WE-HCF Litz_2920 0 mm²
U1	Texas Instruments	LM2576SX-3.3/NOPB	Switcher	1	\$1.44	 KTT0005B 198 mm²



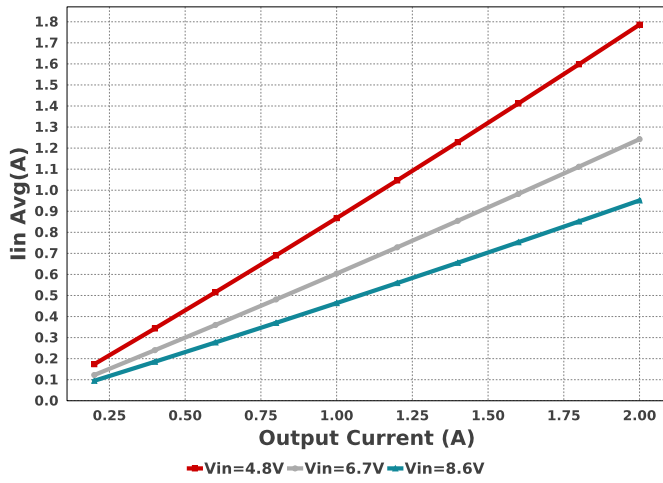
Cin IRMS



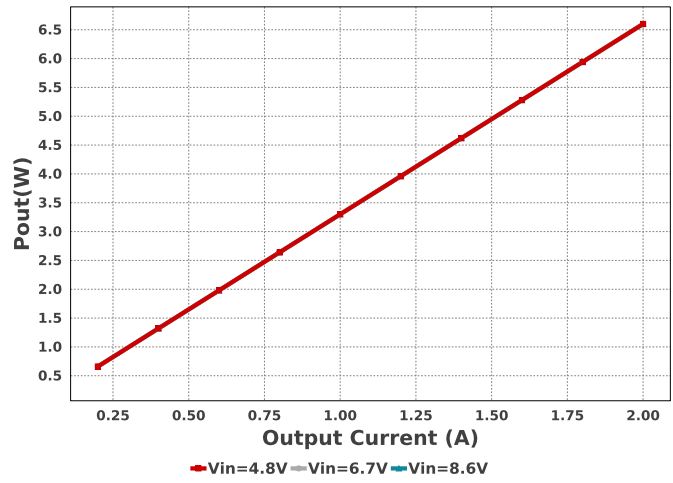
D1 Tj



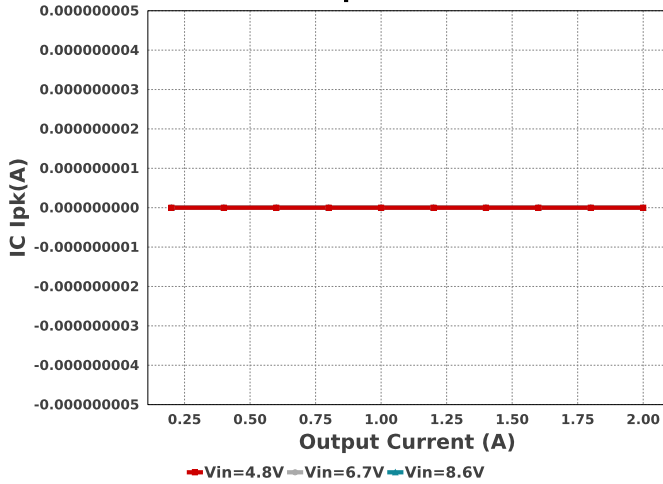
Iin Avg



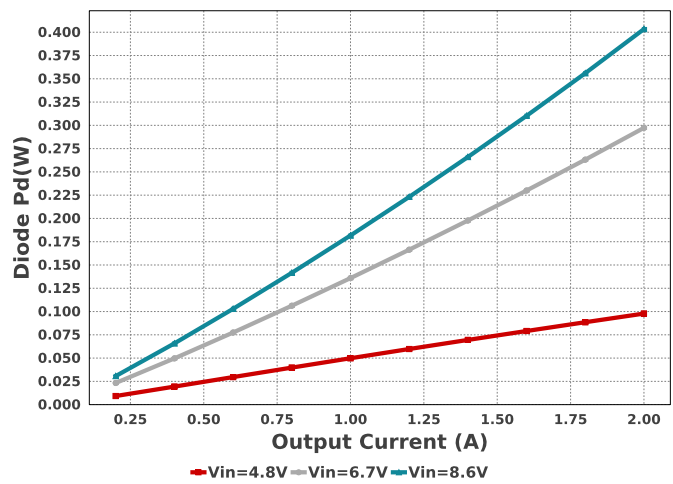
Pout

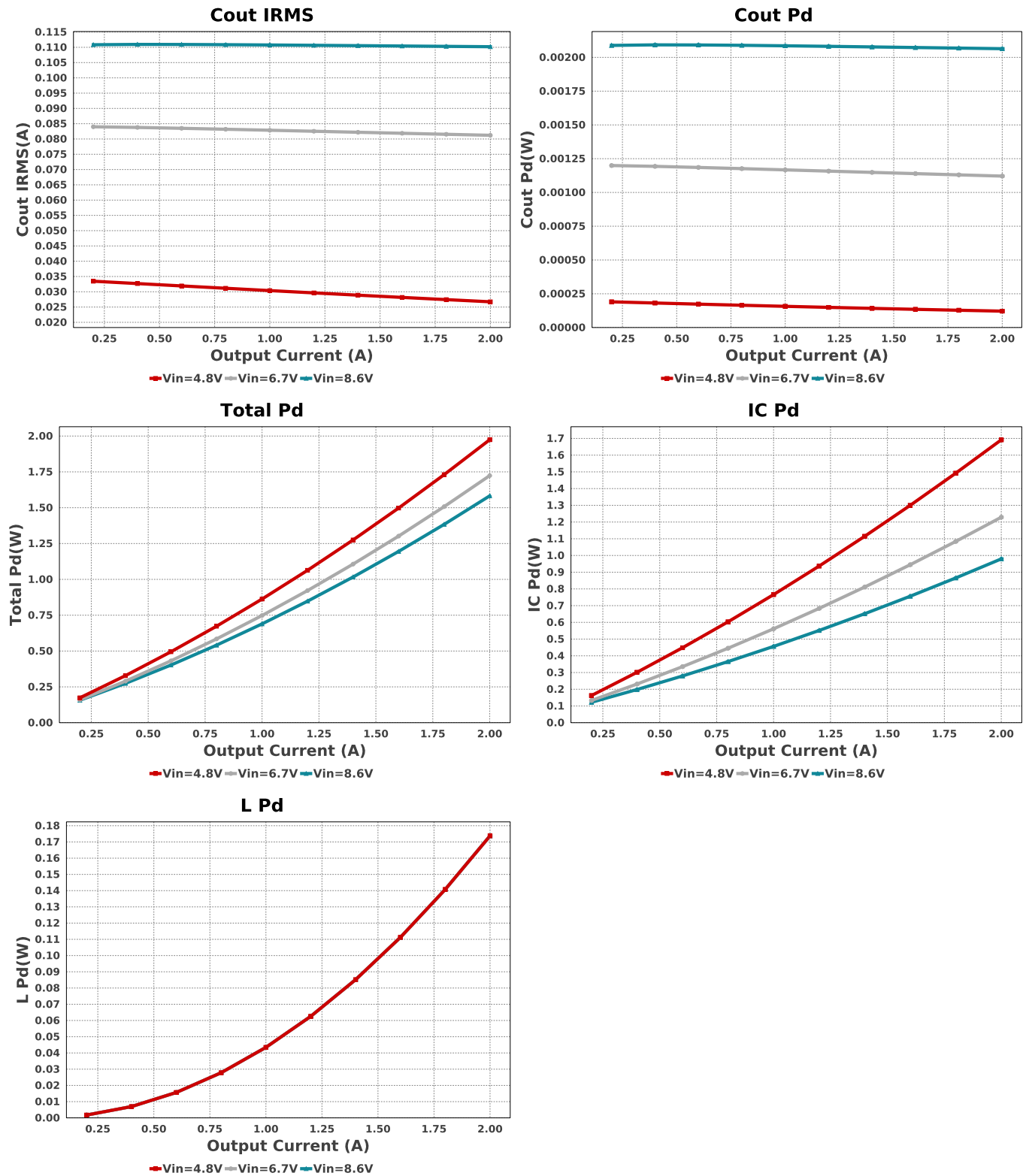


IC Ipk



Diode Pd





Operating Values

#	Name	Value	Category	Description
1.	BOM Count	6		Total Design BOM count
2.	Total BOM	\$9.104		Total BOM Cost
3.	Cin IRMS	996.731 mA	Capacitor	Input capacitor RMS ripple current
4.	Cin Pd	23.843 mW	Capacitor	Input capacitor power dissipation
5.	Cout IRMS	110.196 mA	Capacitor	Output capacitor RMS ripple current
6.	Cout Pd	2.064 mW	Capacitor	Output capacitor power dissipation
7.	D1 Tj	50.169 degC	Diode	D1 junction temperature
8.	Diode Pd	403.38 mW	Diode	Diode power dissipation
9.	IC Ip	0.0 A	IC	Peak switch current in IC
10.	IC Pd	979.54 mW	IC	IC power dissipation
11.	IC Tj	64.284 degC	IC	IC junction temperature

#	Name	Value	Category	Description
12.	IC Tolerance	13.0 mV	IC	IC Feedback Tolerance
13.	ICThetaJA	35.0 degC/W	IC	IC junction-to-ambient thermal resistance
14.	Iin Avg	951.46 mA	IC	Average input current
15.	L Ipp	381.731 mA	Inductor	Peak-to-peak inductor ripple current
16.	L Pd	173.76 mW	Inductor	Inductor power dissipation
17.	Cin Pd	23.843 mW	Power	Input capacitor power dissipation
18.	Cout Pd	2.064 mW	Power	Output capacitor power dissipation
19.	Diode Pd	403.38 mW	Power	Diode power dissipation
20.	IC Pd	979.54 mW	Power	IC power dissipation
21.	L Pd	173.76 mW	Power	Inductor power dissipation
22.	Total Pd	1.583 W	Power	Total Power Dissipation
23.	Duty Cycle	45.96 %	System	Duty cycle
24.	Efficiency	80.659 %	System	Steady state efficiency
25.	FootPrint	521.0 mm ²	System	Total Foot Print Area of BOM components
26.	Frequency	52.0 kHz	System	Switching frequency
27.	Iout	2.0 A	System	Iout operating point
28.	Mode	CCM	System	Conduction Mode
29.	Pout	6.6 W	System	Total output power
30.	Vin	8.6 V	System	Vin operating point
31.	Vout	3.3 V	System	Operational Output Voltage
32.	Vout Tolerance	393.939 m%	System	Vout Tolerance based on IC Tolerance (no load) and voltage divider resistors if applicable
33.	Vout p-p	64.894 mV	System	Peak-to-peak output ripple voltage

Design Inputs

Name	Value	Description
Iout	2.0	Maximum Output Current
VinMax	8.6	Maximum input voltage
VinMin	4.8	Minimum input voltage
Vout	3.3	Output Voltage
base_pn	LM2576	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 4.8V 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 : F74A8A8BF9BD65A9C54D6D115824F2F9[v1]
2. **LM2576** Product Folder : <http://www.ti.com/product/LM2576> : contains the data sheet and other resources.

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