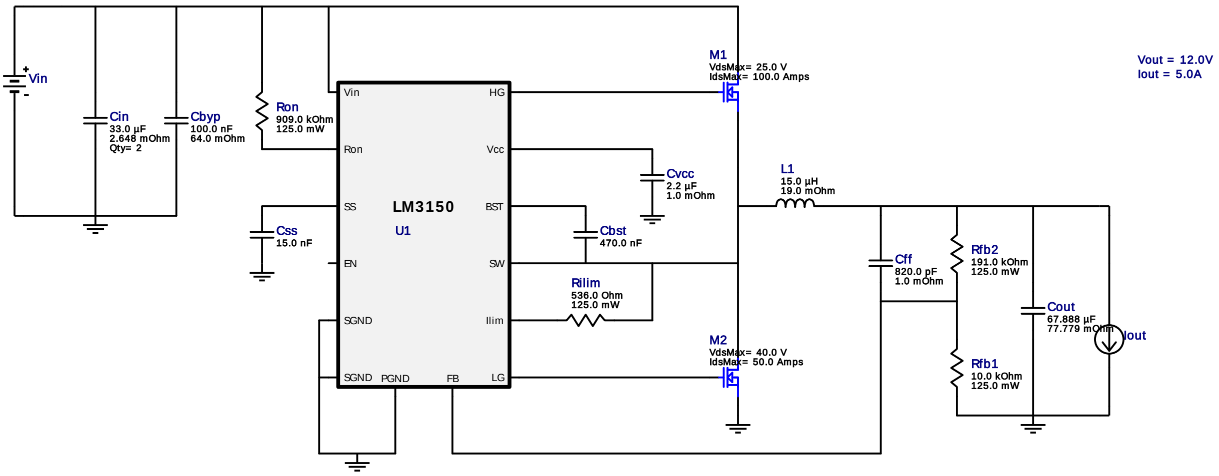
VinMin = 12.8V
VinMax = 16.8V
Vout = 12.0V
Iout = 5.0A

Device = LM3150MH/NOPB
Topology = Buck
Created = 2020-03-27 21:57:03.571
BOM Cost = NA
BOM Count = 16
Total Pd = 1.06W

WEBENCH ® Design Report

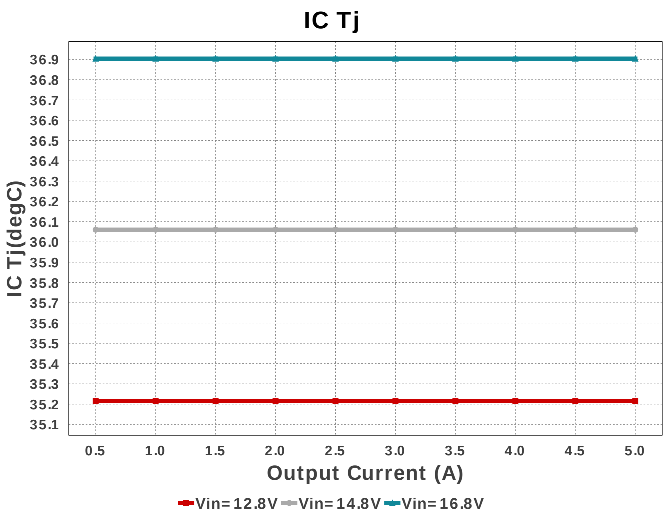
Design : 131 LM3150MH/NOPB
LM3150MH/NOPB 12.8V-16.8V to 12.00V @ 5A

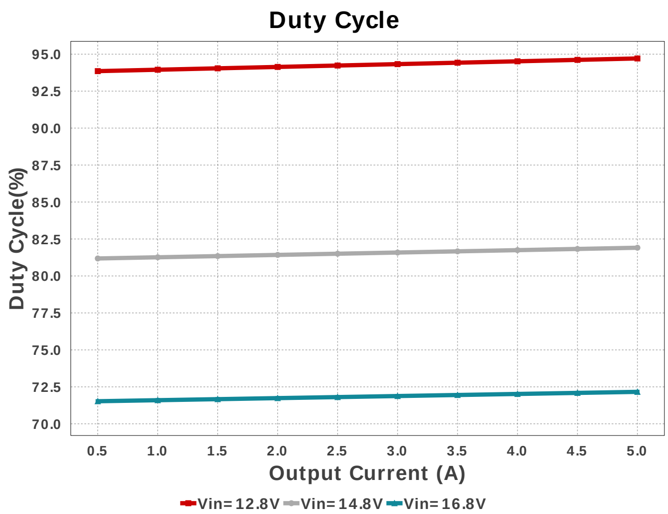


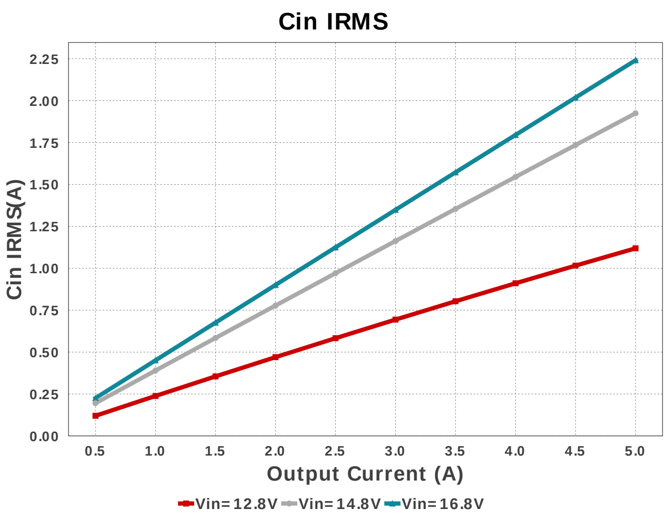
Electrical BOM

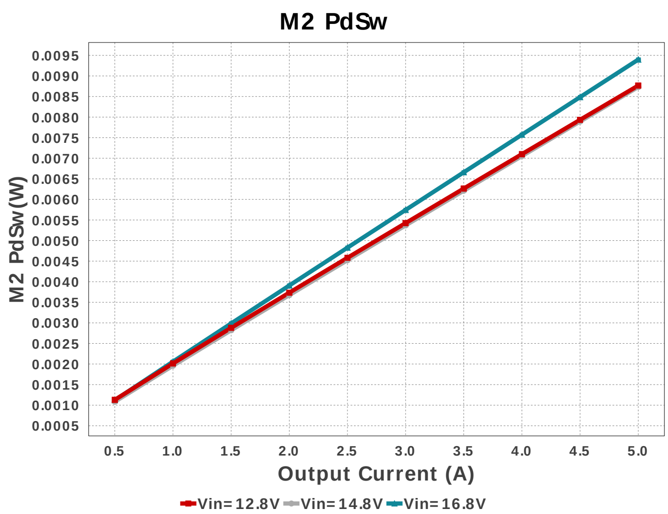
Name	Manufacturer	Part Number	Properties	Qty	Price	Footprint
Cbst	Panasonic	ECPU1C474MA5 Series= ECPU(A)	Cap= 470.0 nF VDC= 16.0 V IRMS= 0.0 A	1	$0.20	1206 11 mm²
Cbyp	Kemet	C0805C104M5RACTU Series= X7R	Cap= 100.0 nF ESR= 64.0 mOhm VDC= 50.0 V IRMS= 1.64 A	1	$0.01	0805 7 mm²
Cff	Yageo	CC0805KRX7R9BB821 Series= X7R	Cap= 820.0 pF ESR= 1.0 mOhm VDC= 50.0 V IRMS= 0.0 A	1	$0.02	0805 7 mm²
Cin	TDK	C3216X5R1E336M160AC Series= X5R	Cap= 33.0 uF ESR= 2.648 mOhm VDC= 25.0 V IRMS= 4.4586 A	2	$0.39	1206_180 11 mm²
Cout	CUSTOM	CUSTOM Series= ?	Cap= 67.888 uF ESR= 77.779 mOhm VDC= 15.0 V IRMS= 537.53 mA	1	NA	CUSTOM 0 mm²
Css	TDK	CGA4F2C0G1H153J085AA Series= C0G/NP0	Cap= 15.0 nF VDC= 50.0 V IRMS= 0.0 A	1	$0.07	0805 7 mm²
Cvcc	Taiyo Yuden	EMK212BJ225KG-T Series= X5R	Cap= 2.2 uF ESR= 1.0 mOhm VDC= 16.0 V IRMS= 0.0 A	1	$0.02	0805 7 mm²
L1	Coilcraft	MSS1210-153MEB	L= 15.0 µH 19.0 mOhm	1	$0.81	MSS1210 204 mm²

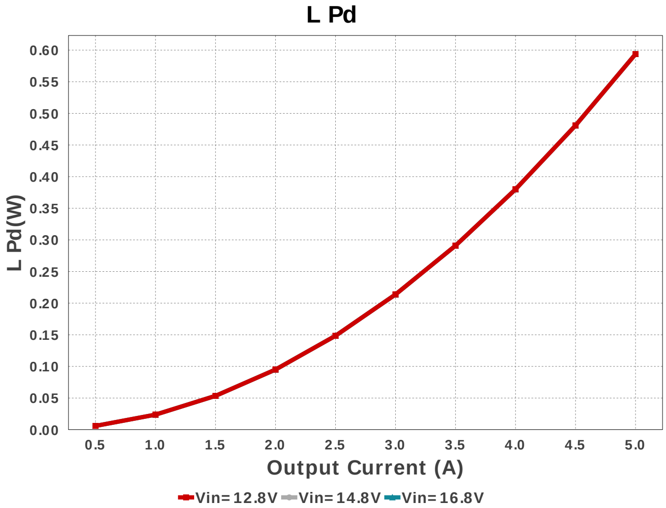
Name	Manufacturer	Part Number	Properties	Qty	Price	Footprint
M1	Texas Instruments	CSD16342Q5A	VdsMax= 25.0 V IdsMax= 100.0 Amps	1	$0.32	TRANS_NexFET_Q5A 55 mm²
M2	Texas Instruments	CSD18514Q5A	VdsMax= 40.0 V IdsMax= 50.0 Amps	1	$0.24	TRANS_NexFET_Q5A 55 mm²
Rfb1	Vishay-Dale	CRCW080510K0FKEA Series= CRCW..e3	Res= 10.0 kOhm Power= 125.0 mW Tolerance= 1.0%	1	$0.01	0805 7 mm²
Rfb2	Panasonic	ERJ-6ENF1913V Series= ERJ-6E	Res= 191.0 kOhm Power= 125.0 mW Tolerance= 1.0%	1	$0.01	0805 7 mm²
Rilim	Vishay-Dale	CRCW0805536RFKEA Series= CRCW..e3	Res= 536.0 Ohm Power= 125.0 mW Tolerance= 1.0%	1	$0.01	0805 7 mm²
Ron	Panasonic	ERJ-6ENF9093V Series= ERJ-6E	Res= 909.0 kOhm Power= 125.0 mW Tolerance= 1.0%	1	$0.01	0805 7 mm²
U1	Texas Instruments	LM3150MH/NOPB	Switcher	1	$1.43	MXA14A 59 mm²

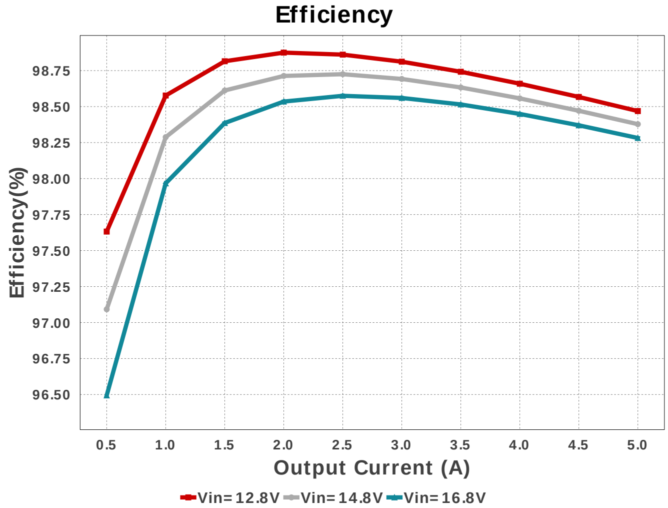


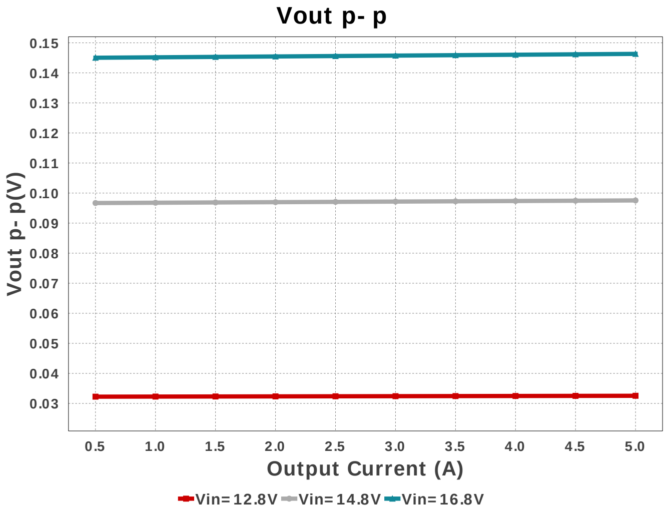


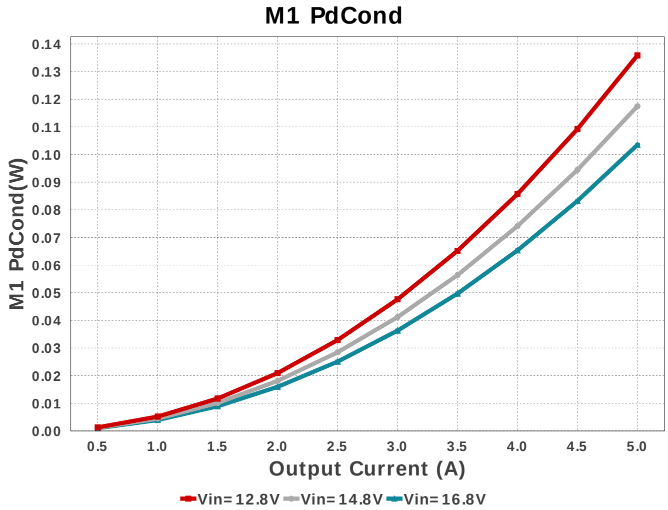


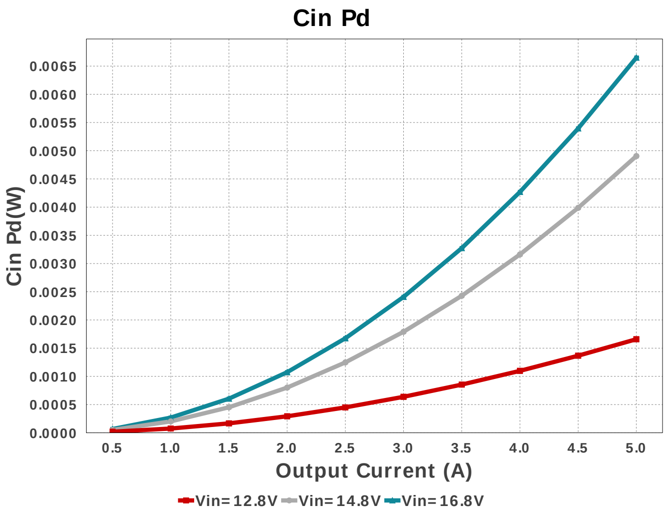


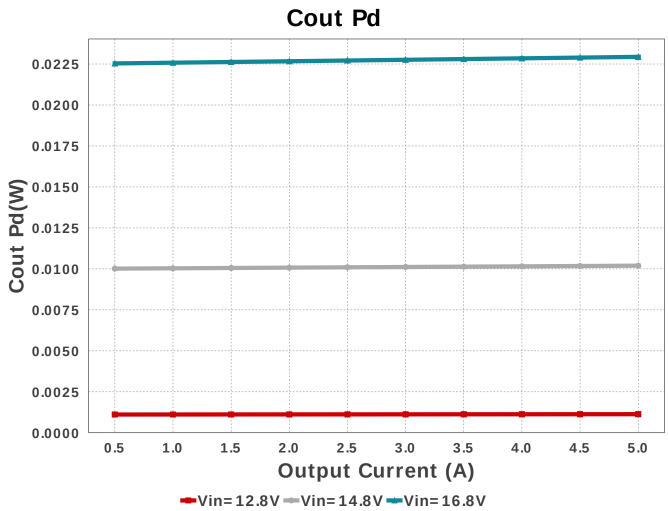

L Pd
L Pd(W)
Output Current (A)
Vin=12.8V Vin=14.8V Vin=16.8V

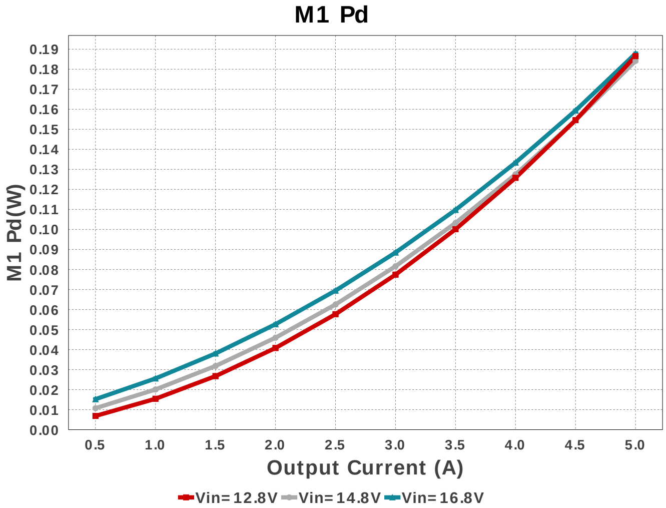

Efficiency
Efficiency(%)
Output Current (A)
Vin=12.8V Vin=14.8V Vin=16.8V

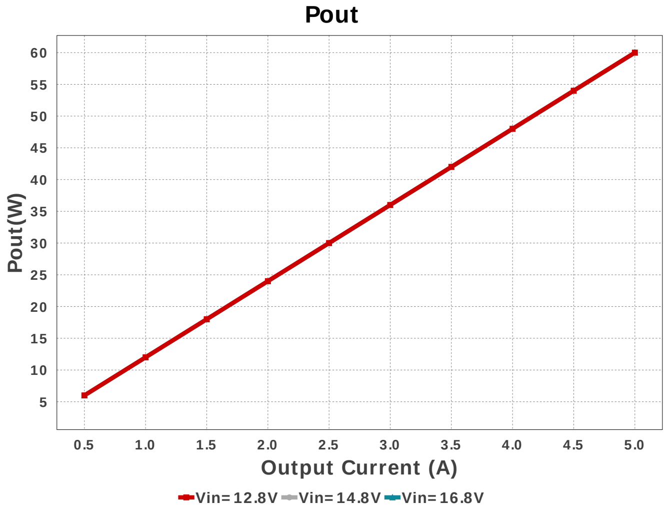

Vout p- p
Vout p- p(V)
Output Current (A)
Vin=12.8V Vin=14.8V Vin=16.8V

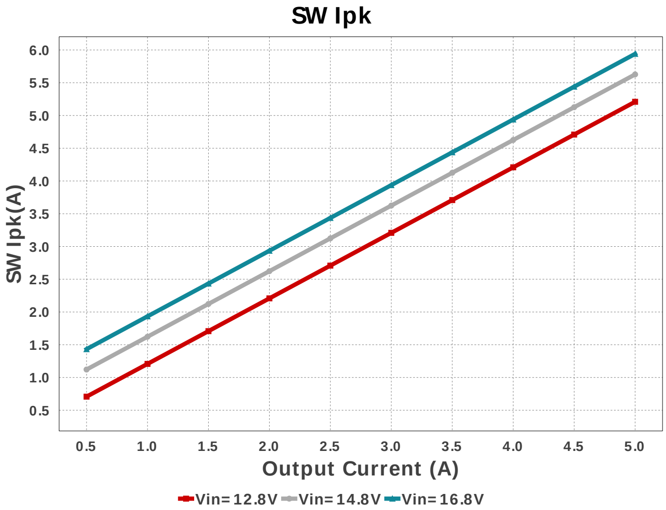

M1 PdCond
M1 PdCond(W)
Output Current (A)
Vin=12.8V Vin=14.8V Vin=16.8V

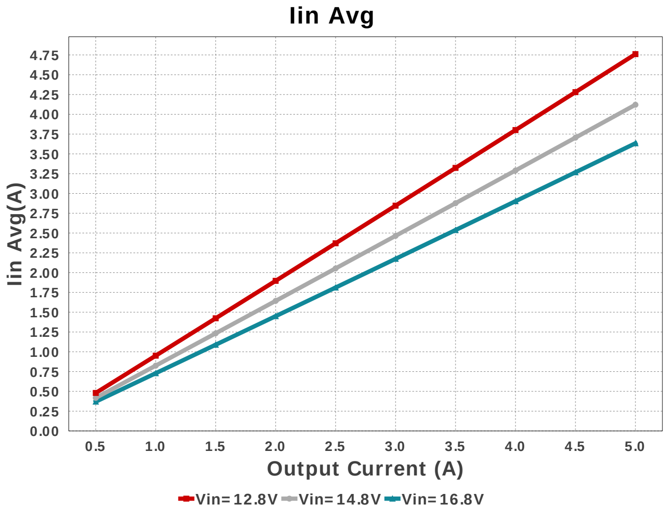

Cin Pd
Cin Pd(W)
Output Current (A)
Vin=12.8V Vin=14.8V Vin=16.8V

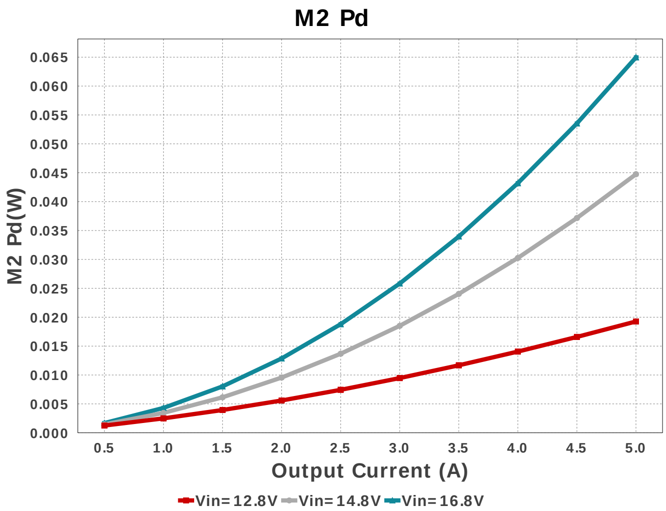

Cout Pd
Cout Pd(W)
Output Current (A)
Vin=12.8V Vin=14.8V Vin=16.8V

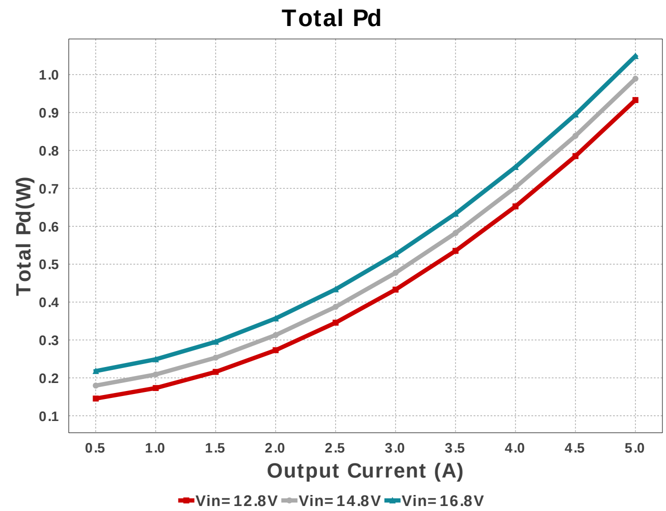

M1 Pd
M1 Pd(W)
Output Current (A)
Vin=12.8V Vin=14.8V Vin=16.8V

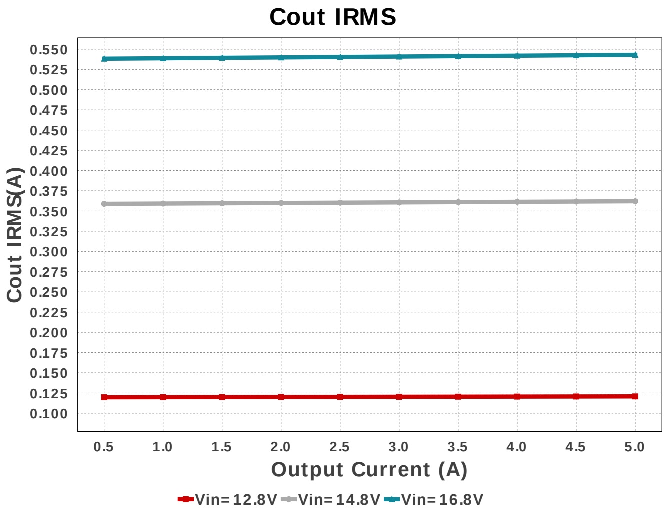

Pout
Pout(W)
Output Current (A)
Vin=12.8V Vin=14.8V Vin=16.8V

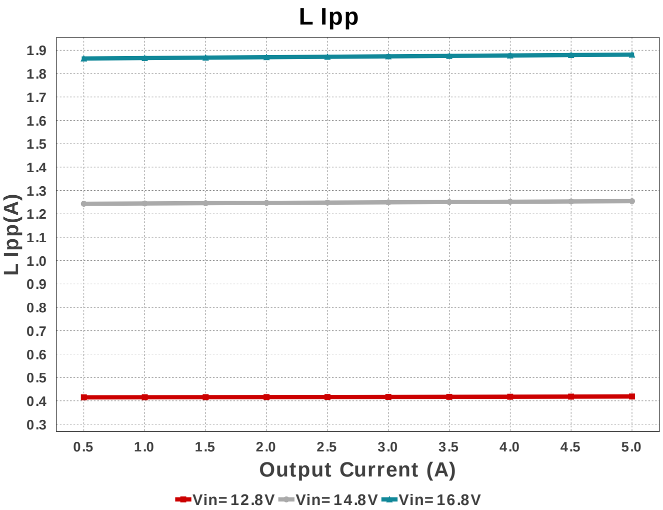

SW Ipk
SW Ipk(A)
Output Current (A)
Vin=12.8V Vin=14.8V Vin=16.8V

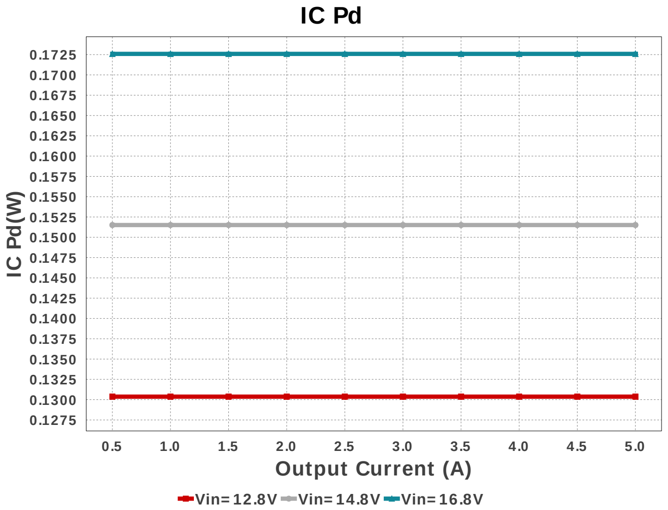

Iin Avg
Iin Avg(A)
Output Current (A)
Vin=12.8V Vin=14.8V Vin=16.8V

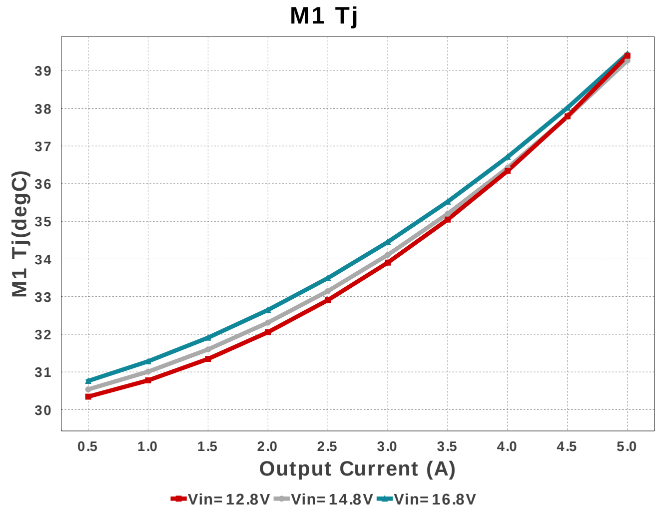

M2 Pd
M2 Pd(W)
Output Current (A)
Vin=12.8V Vin=14.8V Vin=16.8V

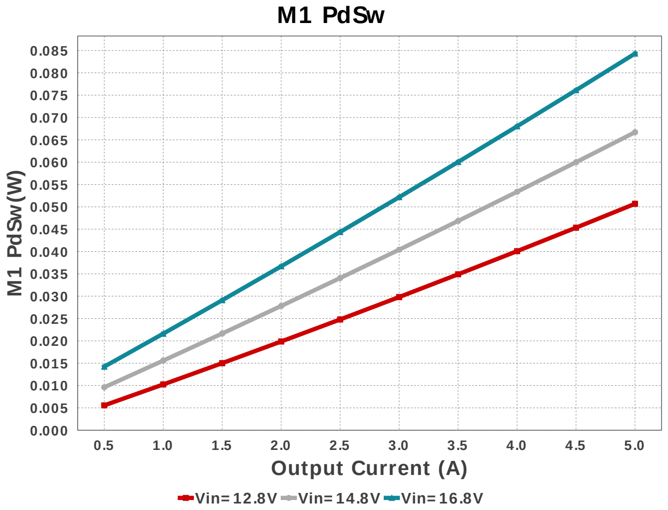

Total Pd
Total Pd(W)
Output Current (A)
Vin=12.8V Vin=14.8V Vin=16.8V

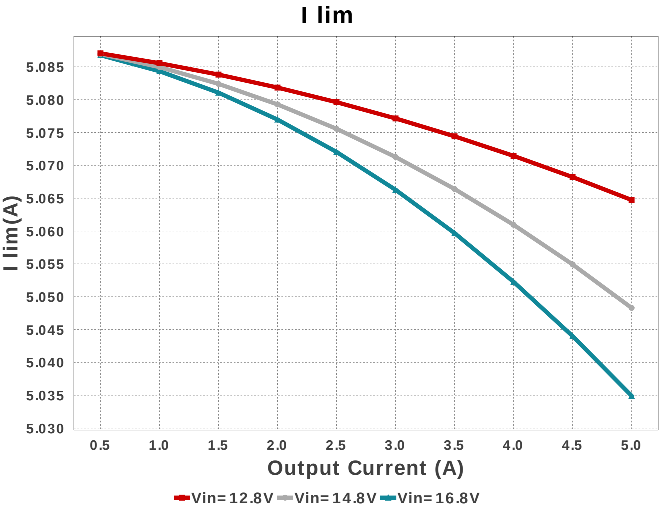

Cout IRMS
Cout IRMS(A)
Output Current (A)
Vin=12.8V Vin=14.8V Vin=16.8V

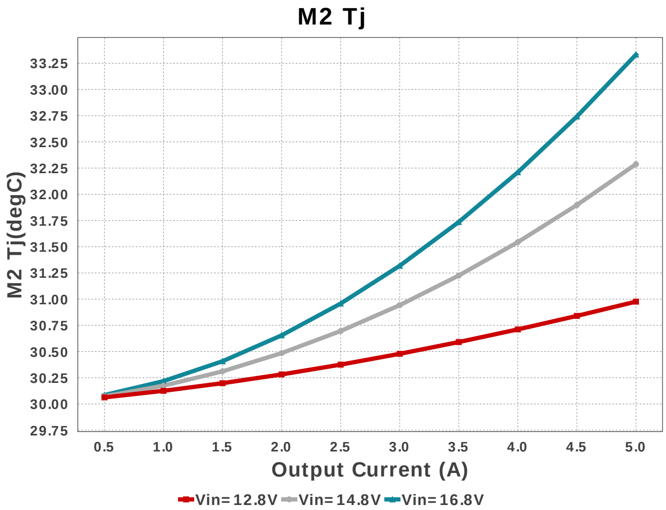

L Ipp
L Ipp(A)
Output Current (A)
Vin=12.8V Vin=14.8V Vin=16.8V

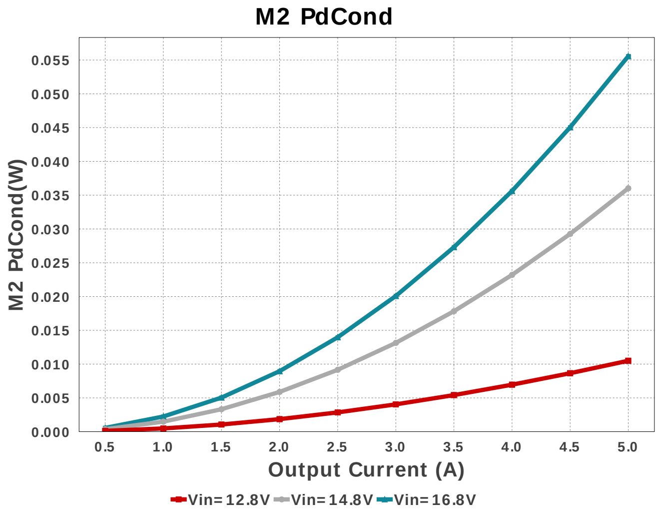

IC Pd
IC Pd(W)
Output Current (A)
Vin=12.8V Vin=14.8V Vin=16.8V


M1 Tj
M1 Tj(degC)
Output Current (A)
Vin=12.8V Vin=14.8V Vin=16.8V


M1 PdSw
M1 PdSw(W)
Output Current (A)
Vin=12.8V Vin=14.8V Vin=16.8V


I lim
I lim(A)
Output Current (A)
Vin=12.8V Vin=14.8V Vin=16.8V





Operating Values

#	Name	Value	Category	Description
1.	Cin IRMS	2.241 A	Capacitor	Input capacitor RMS ripple current
2.	Cin Pd	6.649 mW	Capacitor	Input capacitor power dissipation
3.	Cout IRMS	543.049 mA	Capacitor	Output capacitor RMS ripple current
4.	Cout Pd	22.937 mW	Capacitor	Output capacitor power dissipation
5.	I lim	4.997 A	Current	Current limit threshold
6.	IC Pd	172.59 mW	IC	IC power dissipation
7.	IC Tj	41.219 degC	IC	IC junction temperature
8.	IC Tolerance	12.0 mV	IC	IC Feedback Tolerance
9.	Iin Avg	3.634 A	IC	Average input current
10.	L Ipp	1.881 A	Inductor	Peak-to-peak inductor ripple current
11.	L Pd	593.75 mW	Inductor	Inductor power dissipation
12.	M1 Pd	187.26 mW	Mosfet	M1 MOSFET total power dissipation
13.	M1 PdCond	102.95 mW	Mosfet	M1 MOSFET conduction losses
14.	M1 PdSw	84.306 mW	Mosfet	M1 MOSFET switching losses
15.	M1 Tj	39.446 degC	Mosfet	M1 MOSFET junction temperature
16.	M2 Pd	72.33 mW	Mosfet	M2 MOSFET total power dissipation
17.	M2 PdCond	55.985 mW	Mosfet	M2 MOSFET conduction losses
18.	M2 PdSw	16.345 mW	Mosfet	M2 MOSFET switching losses
19.	M2 Tj	33.685 degC	Mosfet	M2 MOSFET junction temperature
20.	Cin Pd	6.649 mW	Power	Input capacitor power dissipation
21.	Cout Pd	22.937 mW	Power	Output capacitor power dissipation
22.	IC Pd	172.59 mW	Power	IC power dissipation
23.	L Pd	593.75 mW	Power	Inductor power dissipation
24.	M1 Pd	187.26 mW	Power	M1 MOSFET total power dissipation
25.	M1 PdCond	102.95 mW	Power	M1 MOSFET conduction losses
26.	M1 PdSw	84.306 mW	Power	M1 MOSFET switching losses
27.	M2 Pd	72.33 mW	Power	M2 MOSFET total power dissipation
28.	M2 PdCond	55.985 mW	Power	M2 MOSFET conduction losses
29.	M2 PdSw	16.345 mW	Power	M2 MOSFET switching losses
30.	Total Pd	1.056 W	Power	Total Power Dissipation
31.	BOM Count	16	System Information	Total Design BOM count
32.	Duty Cycle	72.162 %	System Information	Duty cycle
33.	Efficiency	98.271 %	System Information	Steady state efficiency
34.	FootPrint	500.0 mm^2	System Information	Total Foot Print Area of BOM components
35.	Frequency	122.752 kHz	System Information	Switching frequency
36.	Iout	5.0 A	System Information	Iout operating point
37.	Mode	CCM	System Information	Conduction Mode
38.	Pout	60.0 W	System Information	Total output power
39.	SW Ipk	5.941 A	System Information	Peak switch current
40.	Total BOM	NA	System Information	Total BOM Cost
41.	Vin	16.8 V	System Information	Vin operating point

#	Name	Value	Category	Description
42.	Vout Actual	12.06 V	System Information	Vout Actual calculated based on selected voltage divider resistors
43.	Vout Tolerance	3.958 %	System Information	Vout Tolerance based on IC Tolerance (no load) and voltage divider resistors if applicable
44.	Vout p-p	146.316 mV	System Information	Peak-to-peak output ripple voltage

Design Inputs

Name	Value	Description
Iout	5.0	Maximum Output Current
VinMax	16.8	Maximum input voltage
VinMin	12.8	Minimum input voltage
Vout	12.0	Output Voltage
base_pn	LM3150	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

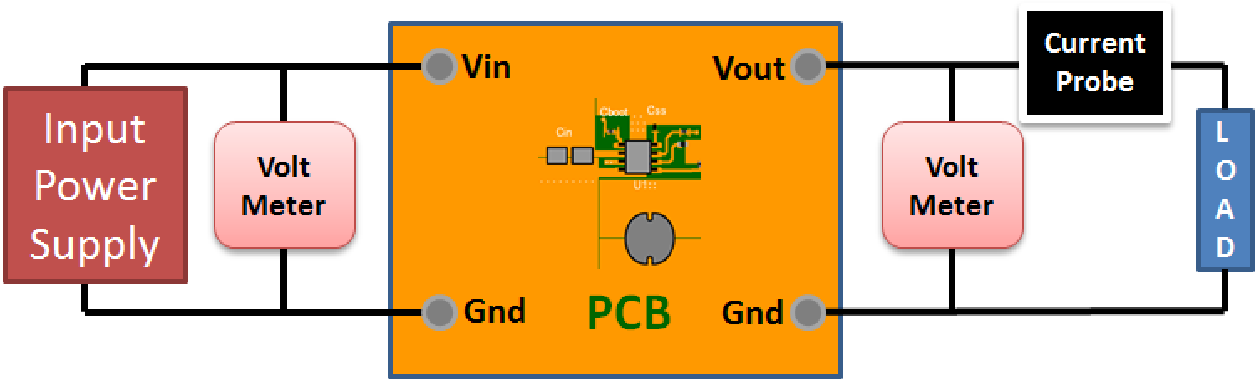
If board assembly is done in house it is best to tack down one terminal of a component on the board then solder the other terminal. For surface mount parts with large tabs, such as the DPAK, the tab on the back of the package should be pre-tinned with solder, then tacked into place by one of the pins. 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 12.8V 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 : E86007F5CFD5661C[v1]

2. **LM3150** Product Folder : http://www.ti.com/product/LM3150 : contains the data sheet and other resources.