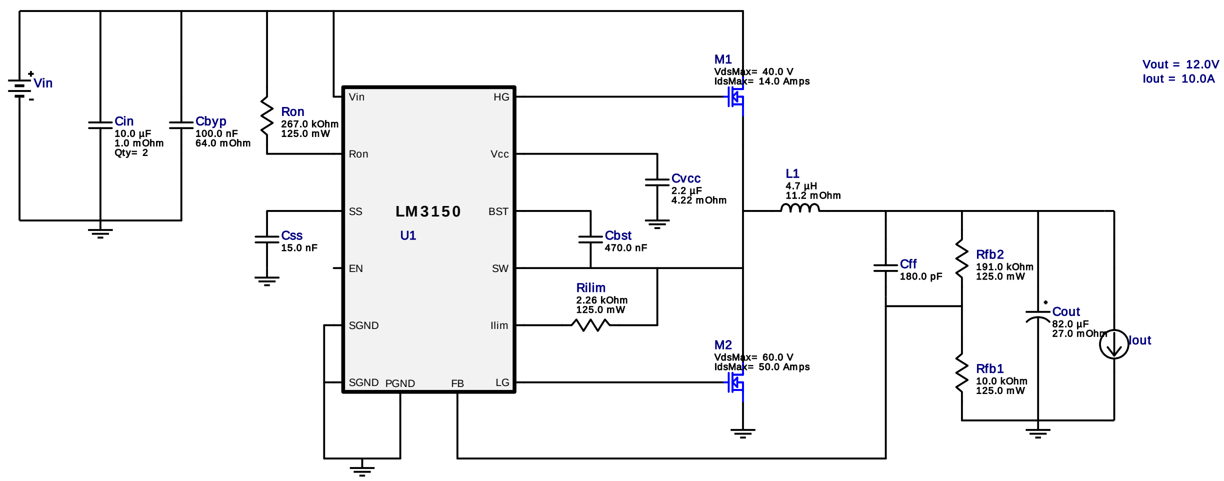
VinMin = 18.0V
VinMax = 30.0V
Vout = 12.0V
Iout = 10.0A

Device = LM3150MH/NOPB
Topology = Buck
Created = 2023-07-25 08:07:52.153
BOM Cost = $4.78
BOM Count = 16
Total Pd = 5.14W

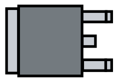
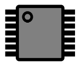
WEBENCH ® Design Report

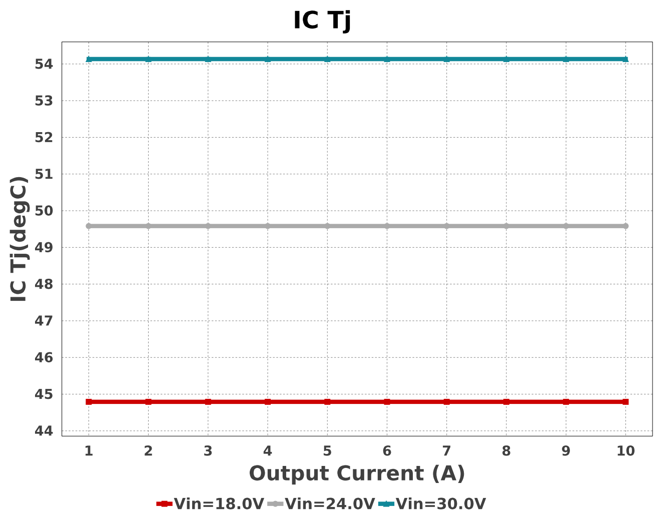
Design : 4 LM3150MH/NOPB
LM3150MH/NOPB 18V-30V to 12.00V @ 10A

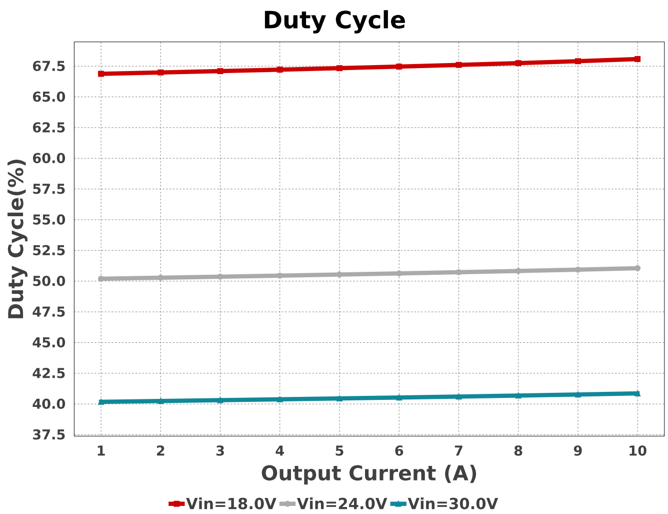


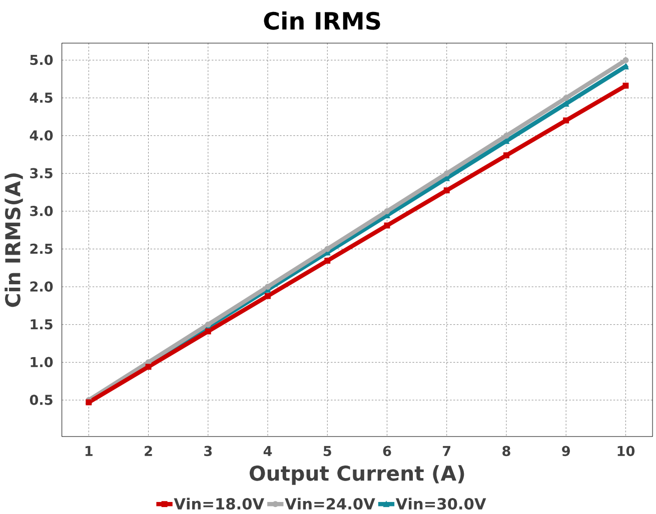
Electrical BOM

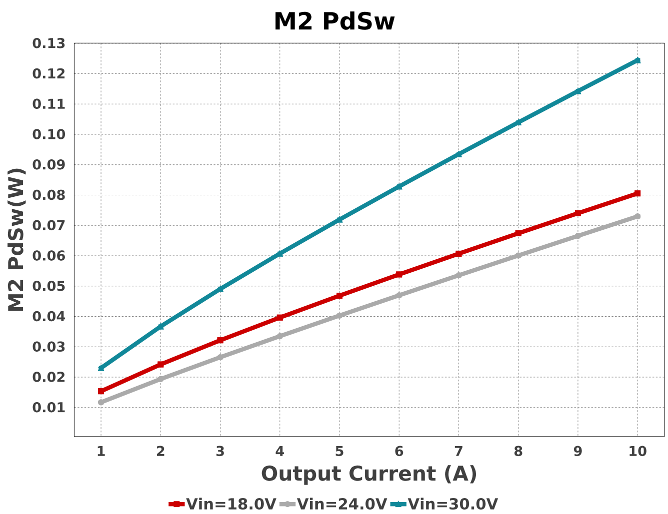
Name	Manufacturer	Part Number	Properties	Qty	Price	Footprint
Cbst	Panasonic	ECPU1C474MA5 Series= ECPU(A)	Cap= 470.0 nF VDC= 16.0 V IRMS= 0.0 A	1	$0.27	1206 11 mm^2
Cbyp	Kemet	C0805C104M5RACTU Series= X7R	Cap= 100.0 nF ESR= 64.0 mOhm VDC= 50.0 V IRMS= 1.64 A	1	$0.01	0805 7 mm^2
Cff	Kemet	C0805C181K5GACTU Series= C0G/NP0	Cap= 180.0 pF VDC= 50.0 V IRMS= 0.0 A	1	$0.01	0805 7 mm^2
Cin	TDK	C3216X5R1H106K160AB Series= X5R	Cap= 10.0 uF ESR= 1.0 mOhm VDC= 50.0 V IRMS= 4.9 A	2	$0.24	1206_180 11 mm^2
Cout	Panasonic	16SVPF82M Series= SVPF	Cap= 82.0 uF ESR= 27.0 mOhm VDC= 16.0 V IRMS= 3.0 A	1	$0.47	CAPSMT_62_E61 53 mm^2
Css	TDK	C2012C0G1H153J085AA Series= C0G/NP0	Cap= 15.0 nF VDC= 50.0 V IRMS= 0.0 A	1	$0.06	0805 7 mm^2
Cvcc	MuRata	GRM21BR71A225KA01L Series= X7R	Cap= 2.2 uF ESR= 4.22 mOhm VDC= 10.0 V IRMS= 2.08454 A	1	$0.03	0805 7 mm^2
L1	Bourns	SRP1270-4R7M	L= 4.7 µH 11.2 mOhm	1	$0.83	SRP1270 246 mm^2

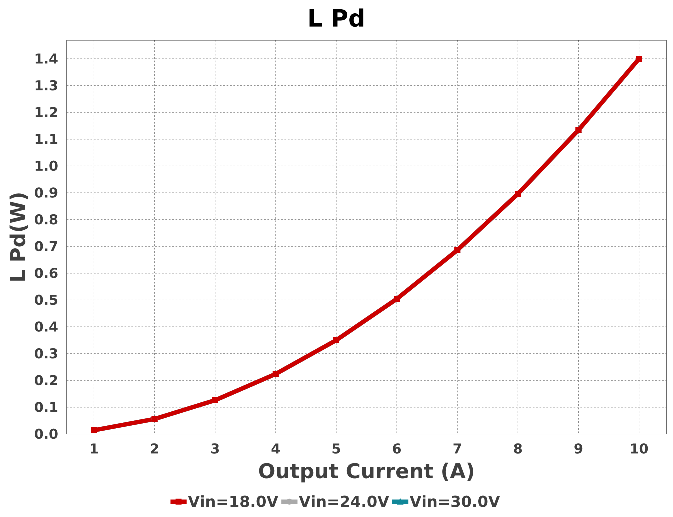
Name	Manufacturer	Part Number	Properties	Qty	Price	Footprint
M1	Fairchild Semiconductor	FDD8647L	VdsMax= 40.0 V IdsMax= 14.0 Amps	1	$0.70	 DPAK 102 mm^2
M2	Texas Instruments	CSD18534Q5A	VdsMax= 60.0 V IdsMax= 50.0 Amps	1	$0.31	 DQJ0008A 55 mm^2
Rfb1	Panasonic	ERJ-6ENF1002V Series= ERJ-6E	Res= 10.0 kOhm Power= 125.0 mW Tolerance= 1.0%	1	$0.01	0805 7 mm^2
Rfb2	Panasonic	ERJ-6ENF1913V Series= ERJ-6E	Res= 191.0 kOhm Power= 125.0 mW Tolerance= 1.0%	1	$0.01	0805 7 mm^2
Rilim	Vishay-Dale	CRCW08052K26FKEA Series= CRCW..e3	Res= 2.26 kOhm Power= 125.0 mW Tolerance= 1.0%	1	$0.01	0805 7 mm^2
Ron	Panasonic	ERJ-6ENF2673V Series= ERJ-6E	Res= 267.0 kOhm Power= 125.0 mW Tolerance= 1.0%	1	$0.01	0805 7 mm^2
U1	Texas Instruments	LM3150MH/NOPB	Switcher	1	$1.57	 MXA14A 59 mm^2

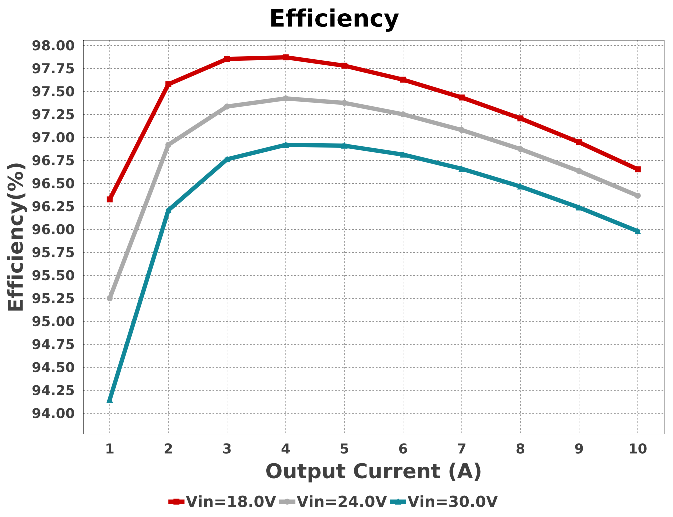


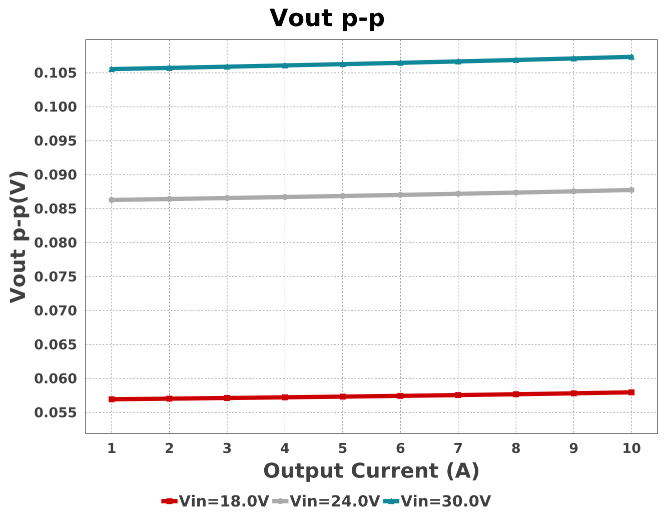


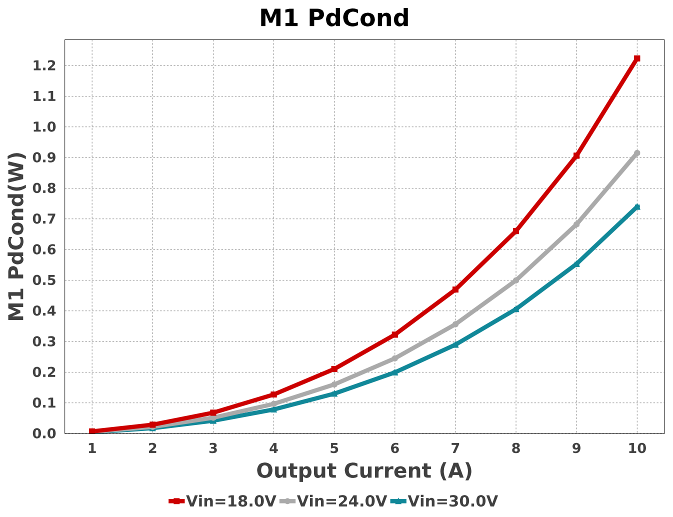


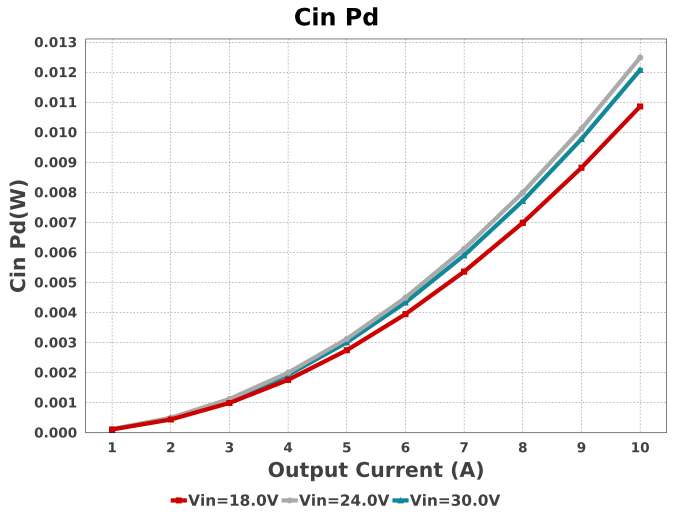


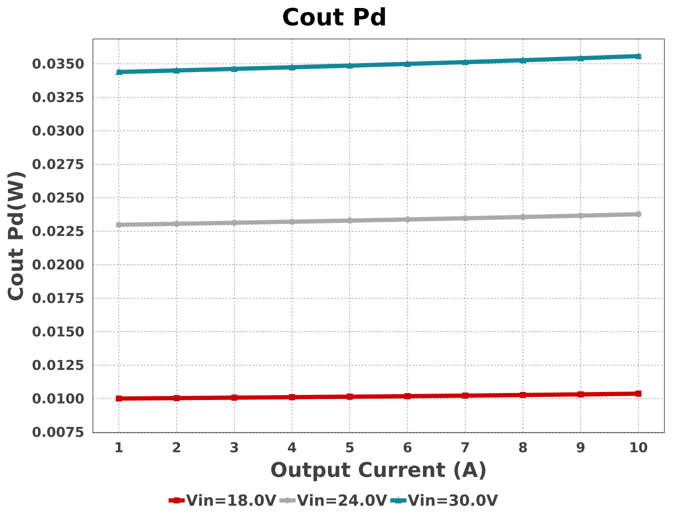

L Pd
L Pd(W)
Output Current (A)
Vin=18.0V Vin=24.0V Vin=30.0V

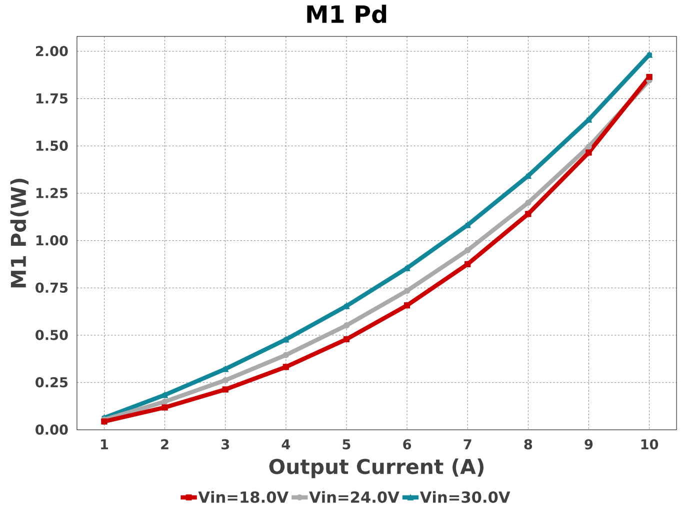

Efficiency
Efficiency(%)
Output Current (A)
Vin=18.0V Vin=24.0V Vin=30.0V

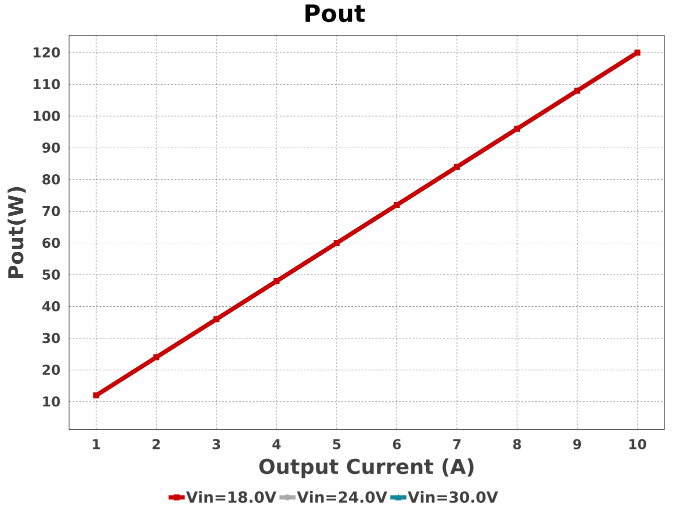

Vout p-p
Vout p-p(V)
Output Current (A)
Vin=18.0V Vin=24.0V Vin=30.0V

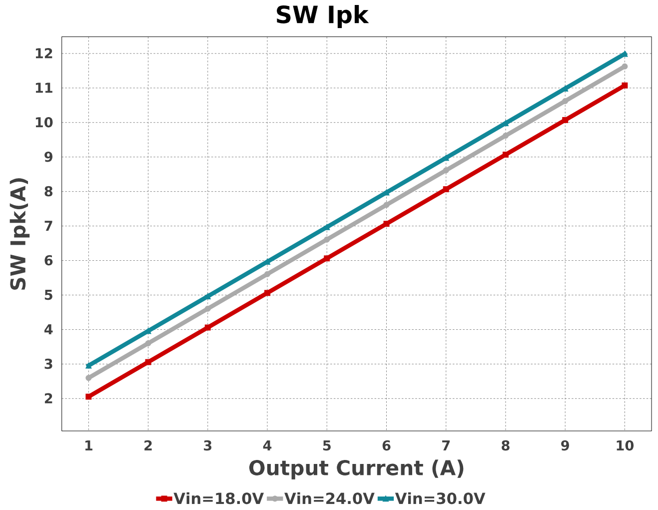

M1 PdCond
M1 PdCond(W)
Output Current (A)
Vin=18.0V Vin=24.0V Vin=30.0V

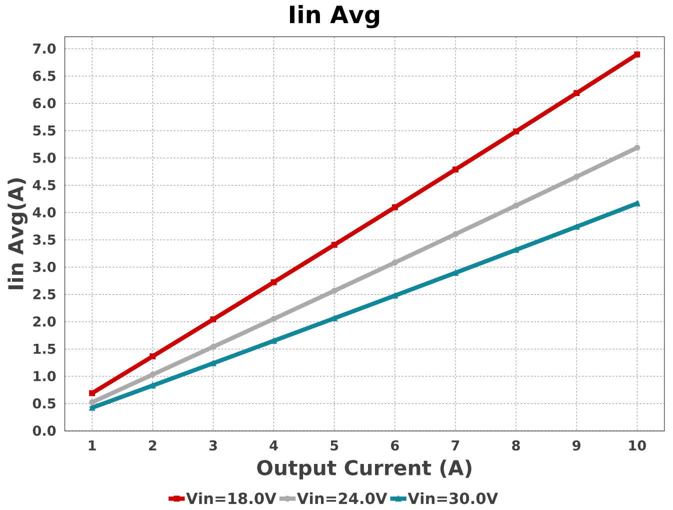

Cin Pd
Cin Pd(W)
Output Current (A)
Vin=18.0V Vin=24.0V Vin=30.0V

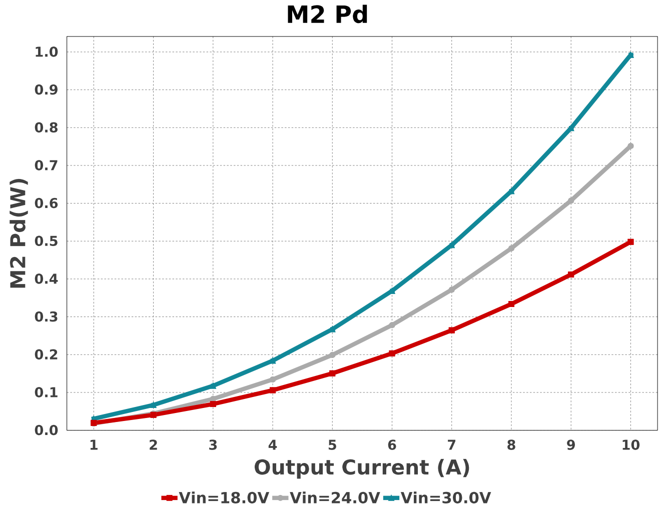

Cout Pd
Cout Pd(W)
Output Current (A)
Vin=18.0V Vin=24.0V Vin=30.0V

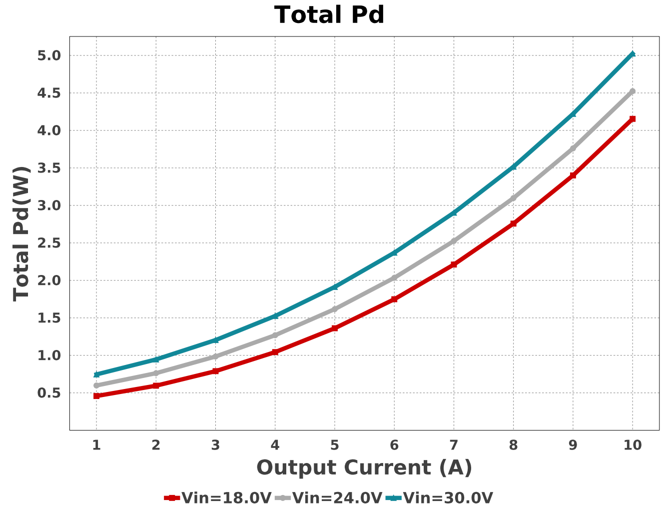

M1 Pd
M1 Pd(W)
Output Current (A)
Vin=18.0V Vin=24.0V Vin=30.0V

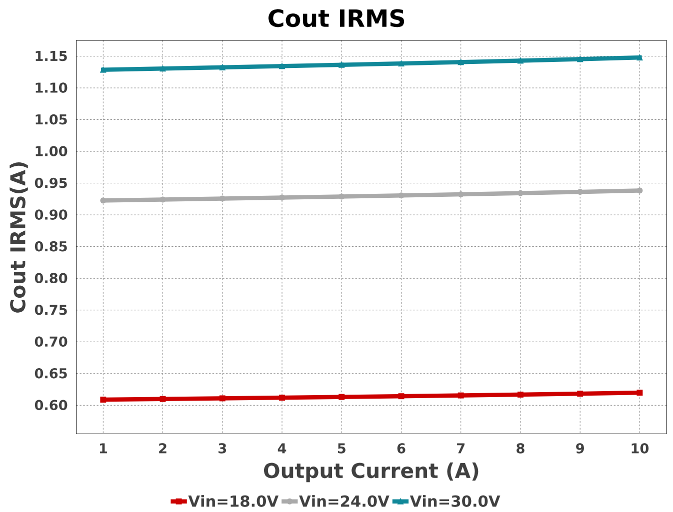

Pout
Pout(W)
Output Current (A)
Vin=18.0V Vin=24.0V Vin=30.0V

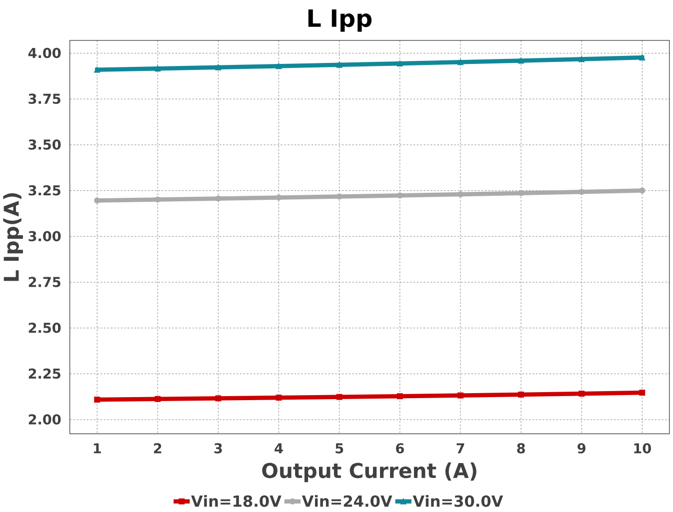

SW Ipk
SW Ipk(A)
Output Current (A)
Vin=18.0V Vin=24.0V Vin=30.0V

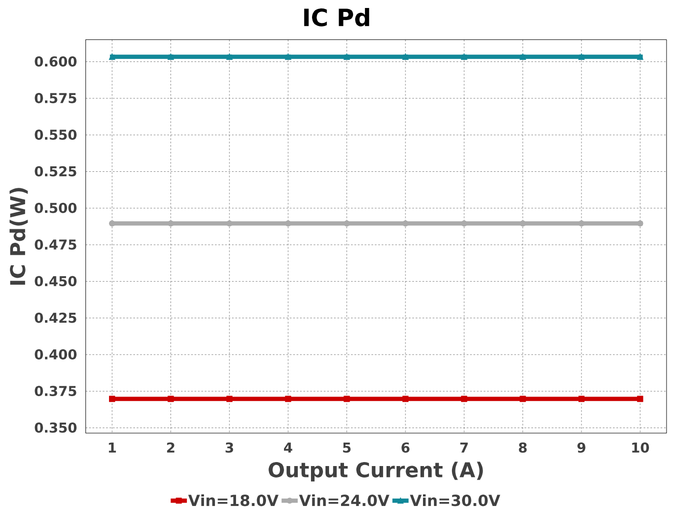

Iin Avg
Iin Avg(A)
Output Current (A)
Vin=18.0V Vin=24.0V Vin=30.0V

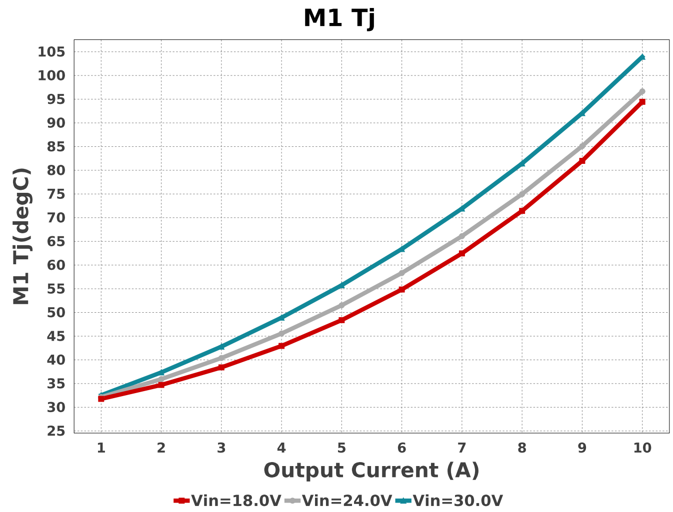

M2 Pd
M2 Pd(W)
Output Current (A)
Vin=18.0V Vin=24.0V Vin=30.0V

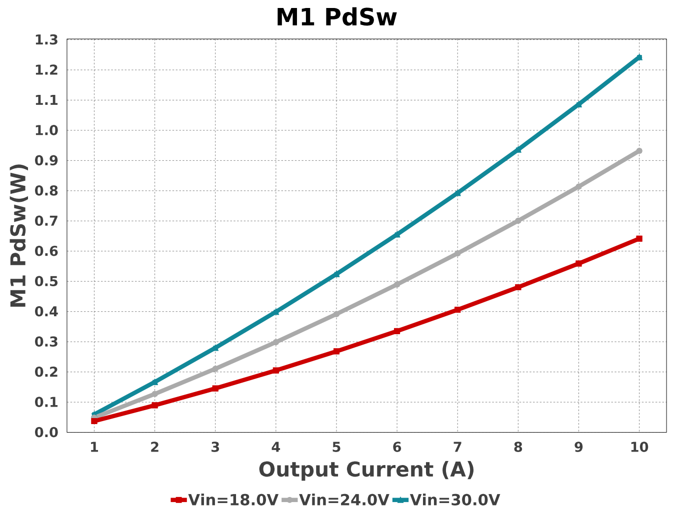

Total Pd
Total Pd(W)
Output Current (A)
Vin=18.0V Vin=24.0V Vin=30.0V

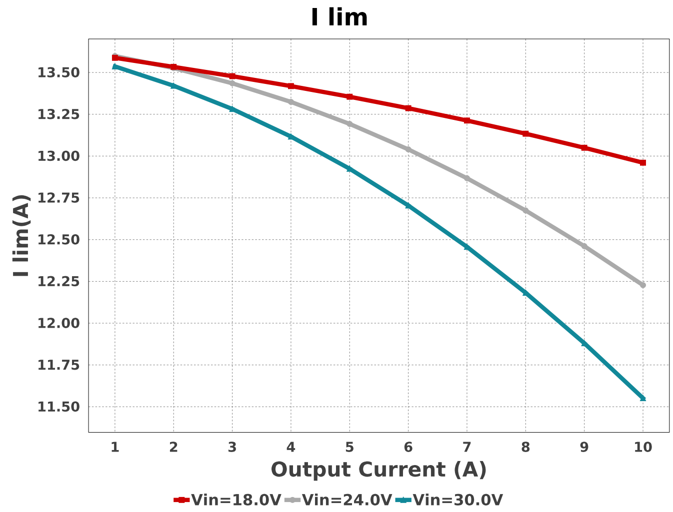

Cout IRMS
Cout IRMS(A)
Output Current (A)
Vin=18.0V Vin=24.0V Vin=30.0V

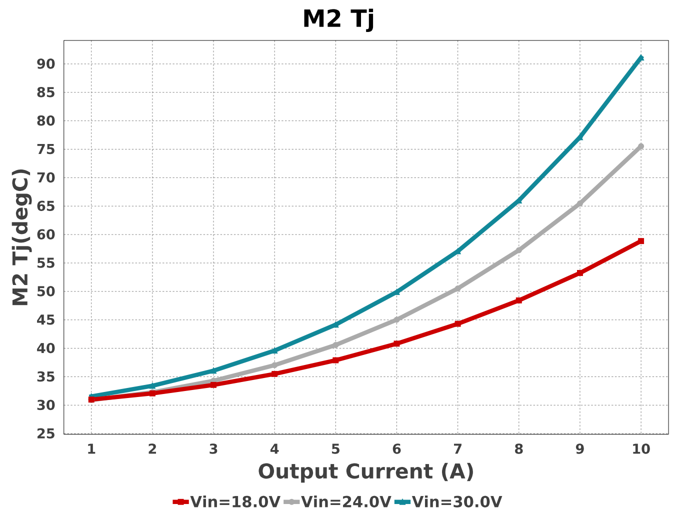

L Ipp
L Ipp(A)
Output Current (A)
Vin=18.0V Vin=24.0V Vin=30.0V

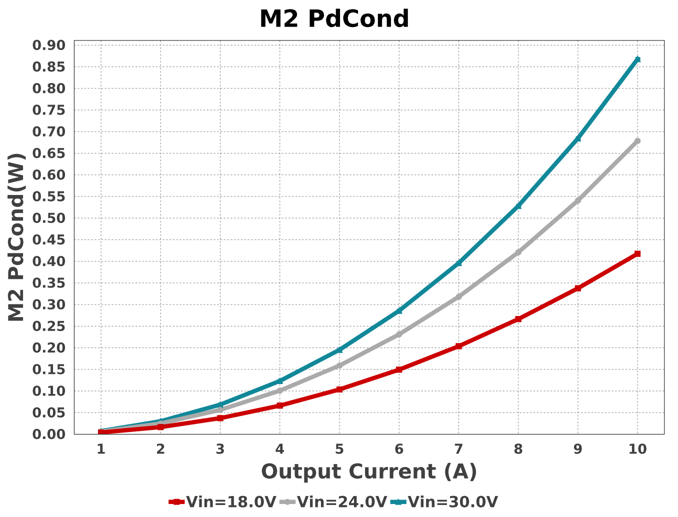

IC Pd
IC Pd(W)
Output Current (A)
Vin=18.0V Vin=24.0V Vin=30.0V


M1 Tj
M1 Tj(degC)
Output Current (A)
Vin=18.0V Vin=24.0V Vin=30.0V


M1 PdSw
M1 PdSw(W)
Output Current (A)
Vin=18.0V Vin=24.0V Vin=30.0V


I lim
I lim(A)
Output Current (A)
Vin=18.0V Vin=24.0V Vin=30.0V





Operating Values

#	Name	Value	Category	Description
1.	Cin IRMS	4.916 A	Capacitor	Input capacitor RMS ripple current
2.	Cin Pd	12.084 mW	Capacitor	Input capacitor power dissipation
3.	Cout IRMS	1.148 A	Capacitor	Output capacitor RMS ripple current
4.	Cout Pd	35.598 mW	Capacitor	Output capacitor power dissipation
5.	I lim	10.024 A	Current	Current limit threshold
6.	IC Pd	603.37 mW	IC	IC power dissipation
7.	IC Tj	69.219 degC	IC	IC junction temperature
8.	IC Tolerance	12.0 mV	IC	IC Feedback Tolerance
9.	Iin Avg	4.172 A	IC	Average input current
10.	L Ipp	3.978 A	Inductor	Peak-to-peak inductor ripple current
11.	L Pd	1.4 W	Inductor	Inductor power dissipation
12.	M1 Pd	1.877 W	Mosfet	M1 MOSFET total power dissipation
13.	M1 PdCond	634.71 mW	Mosfet	M1 MOSFET conduction losses
14.	M1 PdSw	1.242 W	Mosfet	M1 MOSFET switching losses
15.	M1 Tj	103.96 degC	Mosfet	M1 MOSFET junction temperature
16.	M2 Pd	1.217 W	Mosfet	M2 MOSFET total power dissipation
17.	M2 PdCond	999.77 mW	Mosfet	M2 MOSFET conduction losses
18.	M2 PdSw	216.87 mW	Mosfet	M2 MOSFET switching losses
19.	M2 Tj	97.483 degC	Mosfet	M2 MOSFET junction temperature
20.	Cin Pd	12.084 mW	Power	Input capacitor power dissipation
21.	Cout Pd	35.598 mW	Power	Output capacitor power dissipation
22.	IC Pd	603.37 mW	Power	IC power dissipation
23.	L Pd	1.4 W	Power	Inductor power dissipation
24.	M1 Pd	1.877 W	Power	M1 MOSFET total power dissipation
25.	M1 PdCond	634.71 mW	Power	M1 MOSFET conduction losses
26.	M1 PdSw	1.242 W	Power	M1 MOSFET switching losses
27.	M2 Pd	1.217 W	Power	M2 MOSFET total power dissipation
28.	M2 PdCond	999.77 mW	Power	M2 MOSFET conduction losses
29.	M2 PdSw	216.87 mW	Power	M2 MOSFET switching losses
30.	Total Pd	5.145 W	Power	Total Power Dissipation
31.	BOM Count	16	System Information	Total Design BOM count
32.	Duty Cycle	40.873 %	System Information	Duty cycle
33.	Efficiency	95.889 %	System Information	Steady state efficiency
34.	FootPrint	602.0 mm^2	System Information	Total Foot Print Area of BOM components
35.	Frequency	393.547 kHz	System Information	Switching frequency
36.	Iout	10.0 A	System Information	Iout operating point
37.	Mode	CCM	System Information	Conduction Mode
38.	Pout	120.0 W	System Information	Total output power
39.	SW Ipk	11.989 A	System Information	Peak switch current
40.	Total BOM	$4.78	System Information	Total BOM Cost
41.	Vin	30.0 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	107.395 mV	System Information	Peak-to-peak output ripple voltage

Design Inputs

Name	Value	Description
Iout	10.0	Maximum Output Current
VinMax	30.0	Maximum input voltage
VinMin	18.0	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

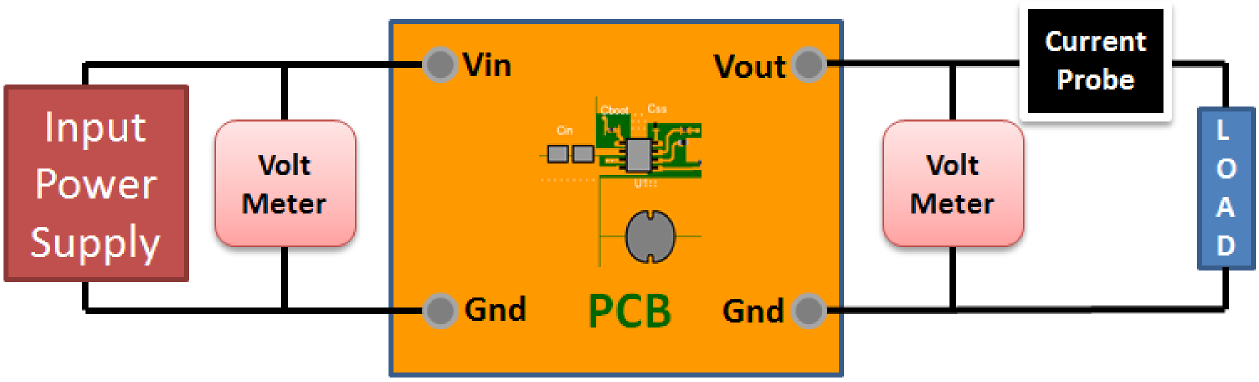
If board assembly is done in house it is best to tack down one terminal of a component on the board then solder the other terminal. For surface mount parts with large tabs, such as the DPAK, the tab on the back of the package should be pre-tinned with solder, then tacked into place by one of the pins. 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 18.0V 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 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 ouptput 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. In all cases, Vout should be well controlled within the targeted voltage range of $$[VOUTMIN] Volts to $$[VOUTMAX] Volts. 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 : F8E382142EB7C18A8CEE969F9B1CA523[v1]

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

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