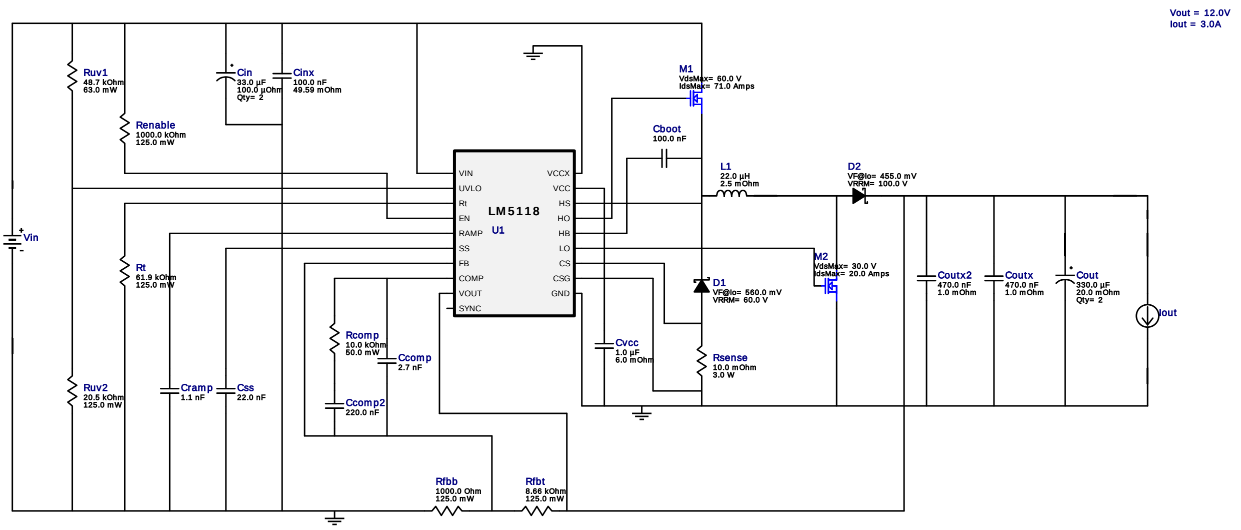
![Texas Instruments]

VinMin = 5.0V
VinMax = 45.0V
Vout = 12.0V
Iout = 3.0A

Device = LM5118MH/NOPB
Topology = Buck_Boost
Created = 2026-01-07 06:36:07.945
BOM Cost = NA
BOM Count = 27
Total Pd = 0.48W

WEBENCH ® Design Report

Design : 3 LM5118MH/NOPB
LM5118MH/NOPB 5V-45V to 12.00V @ 3A

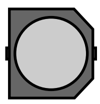
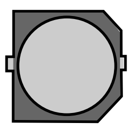


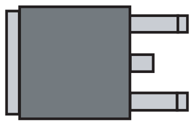
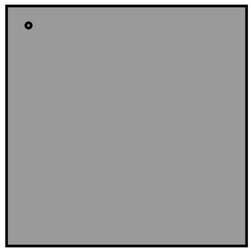
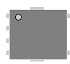
Design Alerts

Component Selection Information

Tool Tip for Keep selected FETs during Redesign Configuration Option: By Default if you hit REDESIGN button, Webench re-designs all the external components including Fets. But if we have checked this configuration option, currently selected fets in schematic will get locked and re-design happens for only other external components. This helps to update the desing by keeping Fets unchanged.

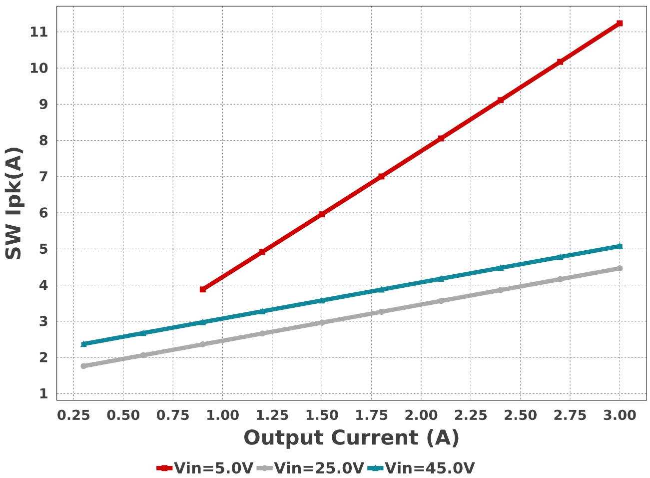
Electrical BOM

Name	Manufacturer	Part Number	Properties	Qty	Price	Footprint
Cboot	MuRata	GRM31C5C1H104JA01K Series= C0G/NP0	Cap= 100.0 nF VDC= 50.0 V IRMS= 0.0 A	1	\$0.14	 1206 11 mm^2
Ccomp	muRata	GRM2165C1H272JA01D Series= C0G/NP0	Cap= 2.7 nF VDC= 50.0 V IRMS= 0.0 A	1	NA	0603 0 mm^2
Ccomp2	muRata	GRM31C5C1H224JE02L Series= C0G/NP0	Cap= 220.0 nF VDC= 5.0 V IRMS= 0.0 A	1	NA	 1210 0 mm^2
Cin	knscha	118EC469 Series= SXV	Cap= 33.0 uF ESR= 100.0 uOhm VDC= 63.0 V IRMS= 2.95 A	2	NA	 CAPSMT_62_E12 0 mm^2
Cinx	samsung	CL21B104KCFNNNE Series= X7S	Cap= 100.0 nF ESR= 49.59 mOhm VDC= 100.0 V IRMS= 751.62 mA	1	NA	0603 0 mm^2
Cout	Panasonic	EEHZC1E331P Series= ZC	Cap= 330.0 uF ESR= 20.0 mOhm VDC= 25.0 V IRMS= 2.0 A	2	\$1.01	 SM_RADIAL_10BMM 160 mm^2

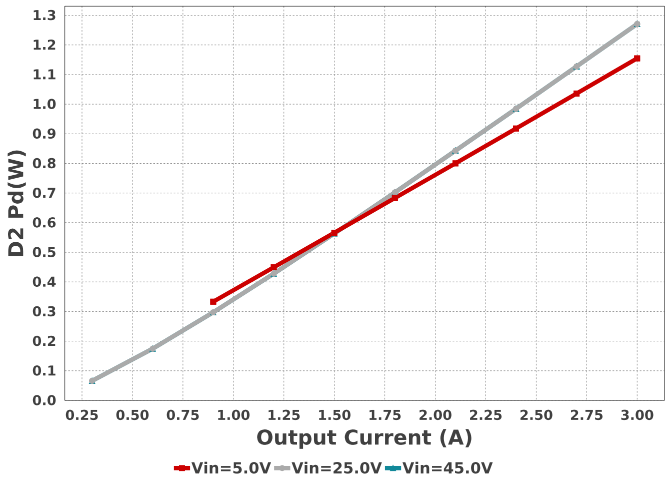
Name	Manufacturer	Part Number	Properties	Qty	Price	Footprint
Coutx	MuRata	GRM21BR71H474KA88L Series= X7R	Cap= 470.0 nF ESR= 1.0 mOhm VDC= 50.0 V IRMS= 0.0 A	1	$0.05	0805 7 mm^2
Coutx2	MuRata	GRM21BR71H474KA88L Series= X7R	Cap= 470.0 nF ESR= 1.0 mOhm VDC= 50.0 V IRMS= 0.0 A	1	$0.05	0805 7 mm^2
Cramp	murata	GRM2165C1H112JA01D Series= C0G/NP0	Cap= 1.1 nF VDC= 50.0 V IRMS= 0.0 A	1	NA	0402 0 mm^2
Css	MuRata	GCM21B5C1H223JA16L Series= C0G/NP0	Cap= 22.0 nF VDC= 50.0 V IRMS= 0.0 A	1	$0.12	0805 7 mm^2
Cvcc	MuRata	GRM219R71E105KA88D Series= X7R	Cap= 1.0 uF ESR= 6.0 mOhm VDC= 25.0 V IRMS= 3.87 A	1	$0.05	0805 7 mm^2
D1	Diodes Inc.	PDS760-13	VF@Io= 560.0 mV VRRM= 60.0 V	1	$0.36	 PowerDI5 50 mm^2
D2	STMicroelectronics	STPS20M100SG-TR	VF@Io= 455.0 mV VRRM= 100.0 V	1	$1.94	 DDPAK 210 mm^2
L1	XR	XRPQ2918J-220M	L= 22.0 µH 2.5 mOhm	1	NA	 WE-HCI_2212 0 mm^2
M1	ON Semiconductor	NTMFS5C670NLT1G	VdsMax= 60.0 V IdsMax= 71.0 Amps	1	$1.02	 SO-8FL 58 mm^2
M2	Texas Instruments	CSD17578Q3A	VdsMax= 30.0 V IdsMax= 20.0 Amps	1	$0.13	 DNH0008A 18 mm^2
Rcomp	yageo	RC0805FR-0710KL Series= ?	Res= 10.0 kOhm Power= 50.0 mW Tolerance= 1.0%	1	NA	0201 0 mm^2
Renable	Panasonic	ERJ-6ENF1004V Series= ERJ-6E	Res= 1000.0 kOhm Power= 125.0 mW Tolerance= 1.0%	1	$0.01	0805 7 mm^2
Rfbb	Panasonic	ERJ-6ENF1001V Series= ERJ-6E	Res= 1000.0 Ohm Power= 125.0 mW Tolerance= 1.0%	1	$0.01	0805 7 mm^2
Rfbt	Panasonic	ERJ-6ENF8661V Series= ERJ-6E	Res= 8.66 kOhm Power= 125.0 mW Tolerance= 1.0%	1	$0.01	0805 7 mm^2
Rsense	Bourns	CRA2512-FZ-R010ELF Series= CRA	Res= 10.0 mOhm Power= 3.0 W Tolerance= 1.0%	1	$0.13	 2512 43 mm^2
Rt	Vishay-Dale	CRCW080561K9FKEA Series= CRCW..e3	Res= 61.9 kOhm Power= 125.0 mW Tolerance= 1.0%	1	$0.01	0805 7 mm^2

Name	Manufacturer	Part Number	Properties	Qty	Price	Footprint
Ruv1	viking	ARG05BTC4872N Series= CRCW..e3	Res= 48.7 kOhm Power= 63.0 mW Tolerance= 1.0%	1	NA	0402 0 mm^2
Ruv2	Vishay-Dale	CRCW080520K5FKEA Series= CRCW..e3	Res= 20.5 kOhm Power= 125.0 mW Tolerance= 1.0%	1	$0.01	0805 7 mm^2
U1	Texas Instruments	LM5118MH/NOPB	Switcher	1	$3.18	MXA20A 71 mm^2

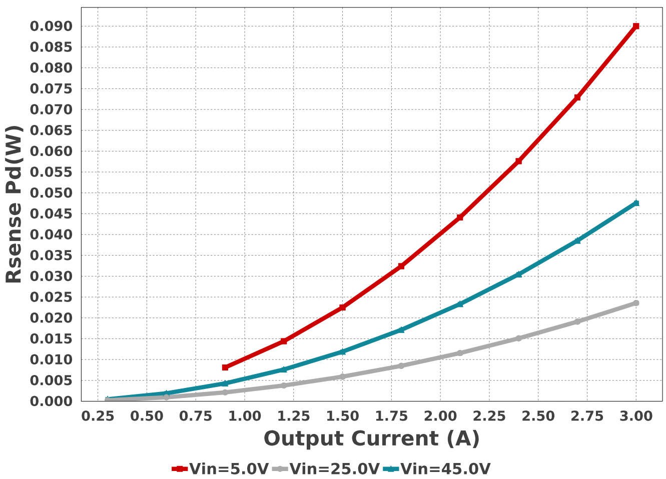
SW Ipk



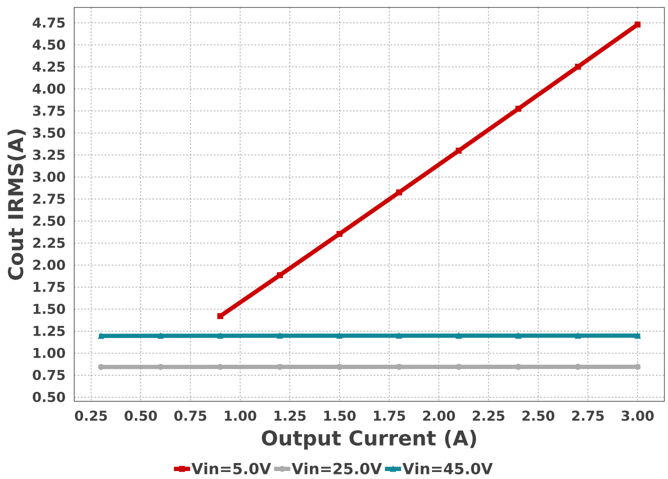
D2 Pd



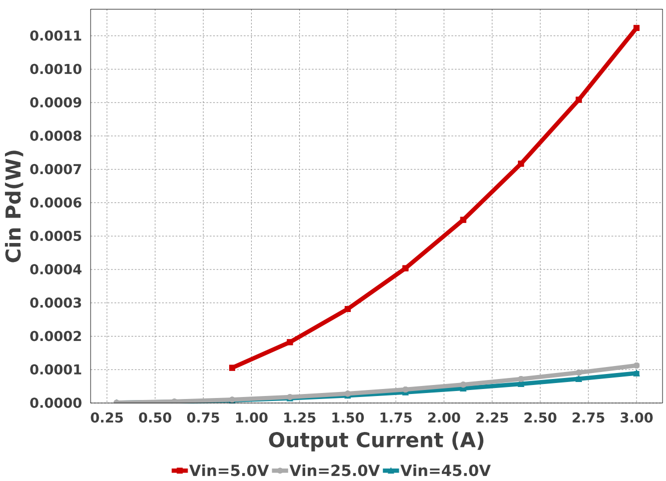
Rsense Pd



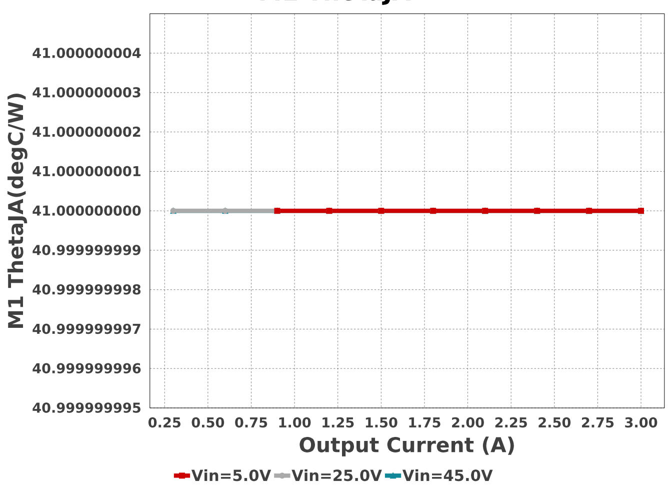
Cout IRMS

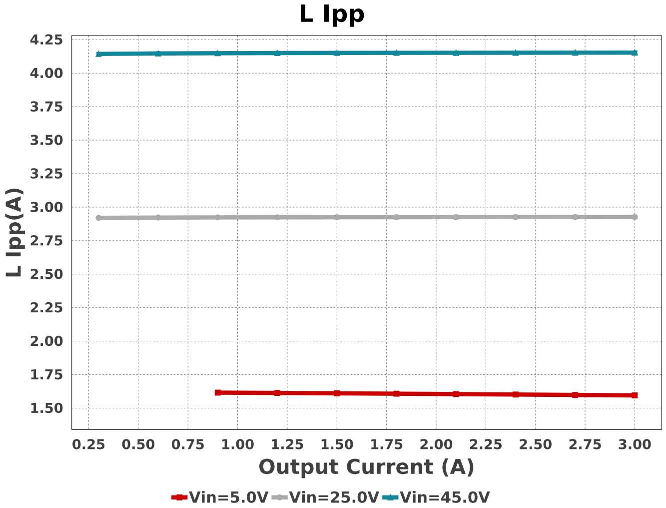


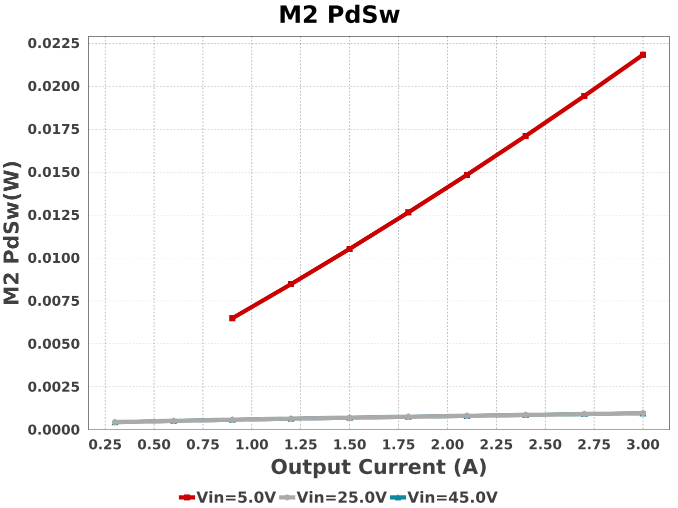
Cin Pd

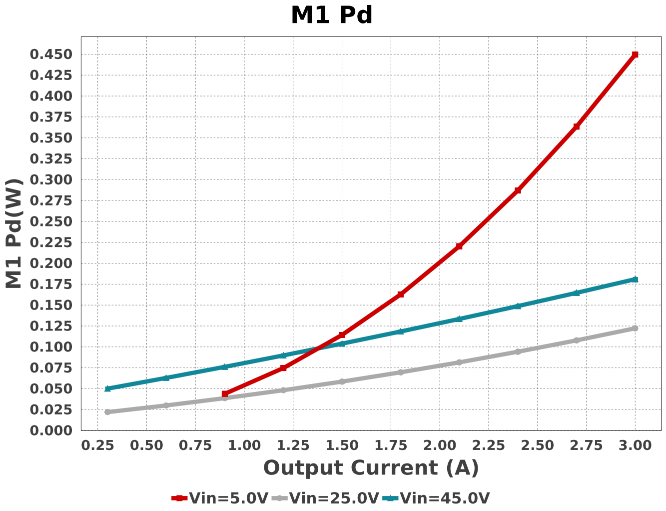


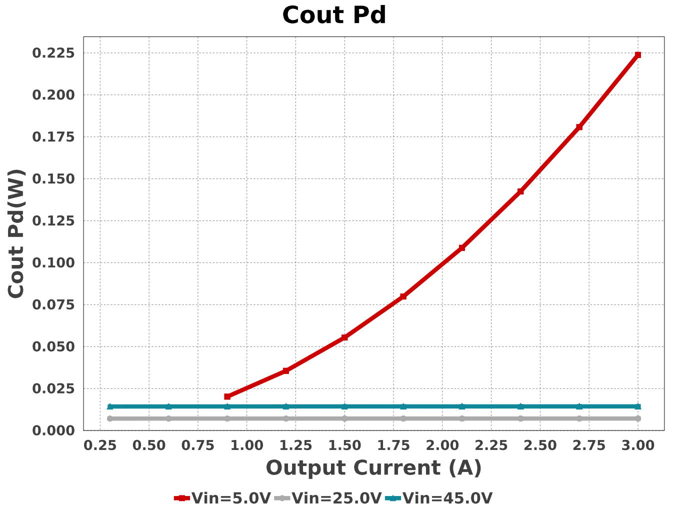
M1 ThetaJA

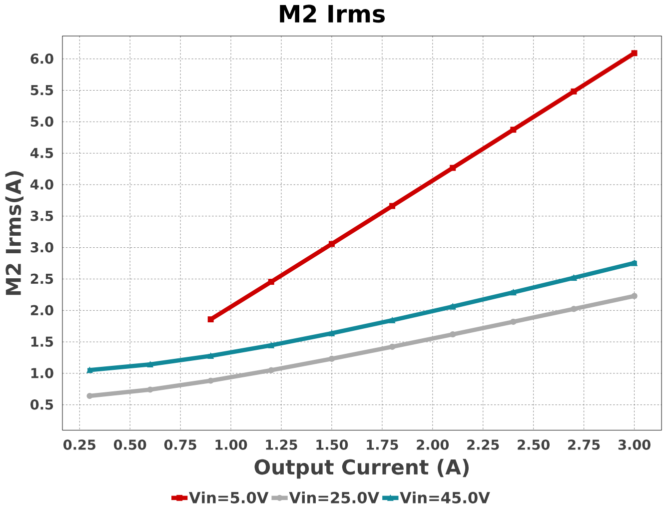


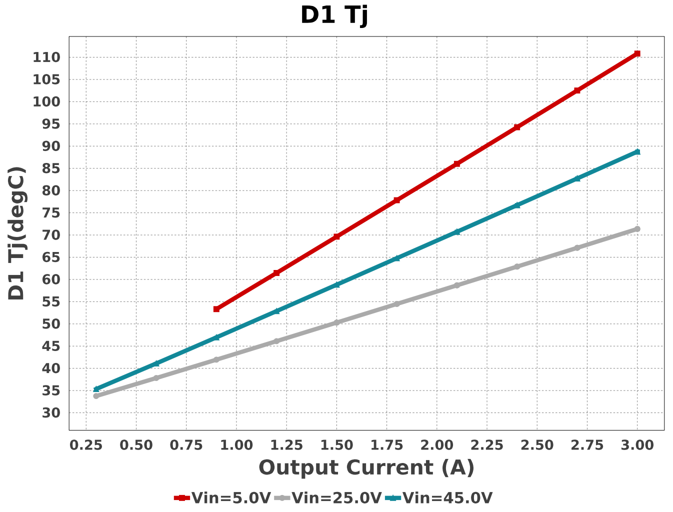

L Ipp
L Ipp(A)
4.25
4.00
3.75
3.50
3.25
3.00
2.75
2.50
2.25
2.00
1.75
1.50
0.25 0.50 0.75 1.00 1.25 1.50 1.75 2.00 2.25 2.50 2.75 3.00
Output Current (A)
Vin=5.0V Vin=25.0V Vin=45.0V

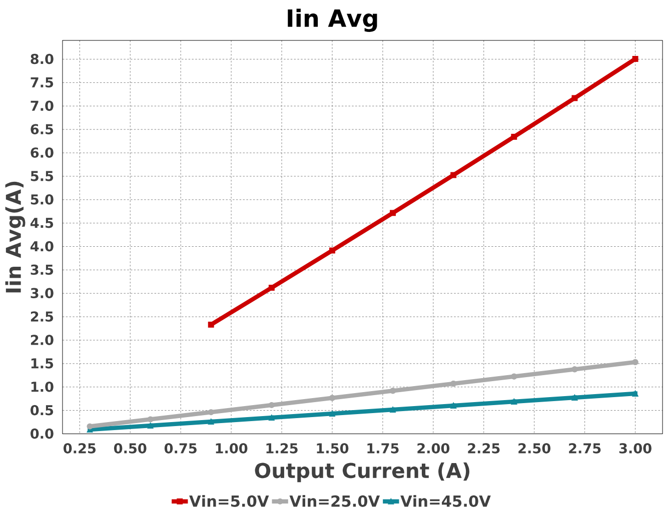

M2 PdSw
M2 PdSw(W)
0.0225
0.0200
0.0175
0.0150
0.0125
0.0100
0.0075
0.0050
0.0025
0.0000
0.25 0.50 0.75 1.00 1.25 1.50 1.75 2.00 2.25 2.50 2.75 3.00
Output Current (A)
Vin=5.0V Vin=25.0V Vin=45.0V

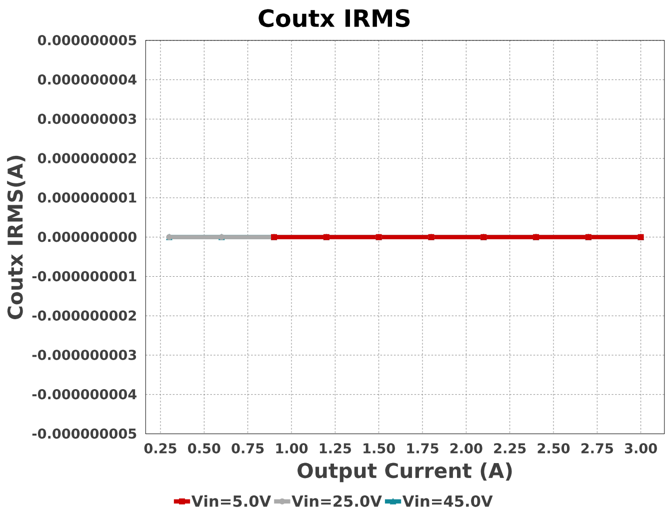

M1 Pd
M1 Pd(W)
0.450
0.425
0.400
0.375
0.350
0.325
0.300
0.275
0.250
0.225
0.200
0.175
0.150
0.125
0.100
0.075
0.050
0.025
0.000
0.25 0.50 0.75 1.00 1.25 1.50 1.75 2.00 2.25 2.50 2.75 3.00
Output Current (A)
Vin=5.0V Vin=25.0V Vin=45.0V

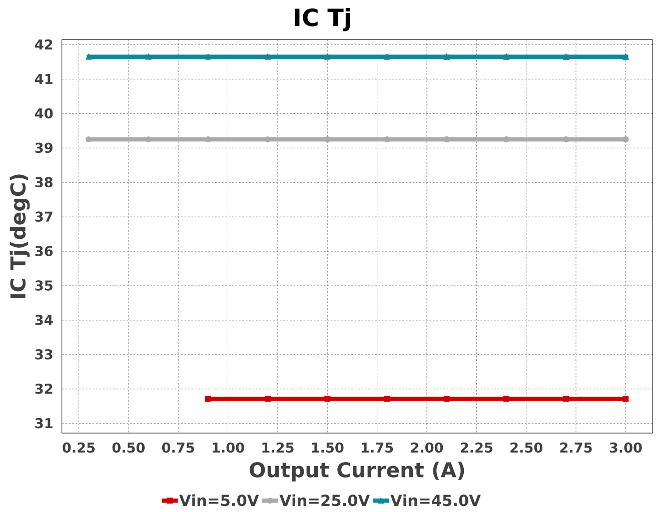

Cout Pd
Cout Pd(W)
0.225
0.200
0.175
0.150
0.125
0.100
0.075
0.050
0.025
0.000
0.25 0.50 0.75 1.00 1.25 1.50 1.75 2.00 2.25 2.50 2.75 3.00
Output Current (A)
Vin=5.0V Vin=25.0V Vin=45.0V

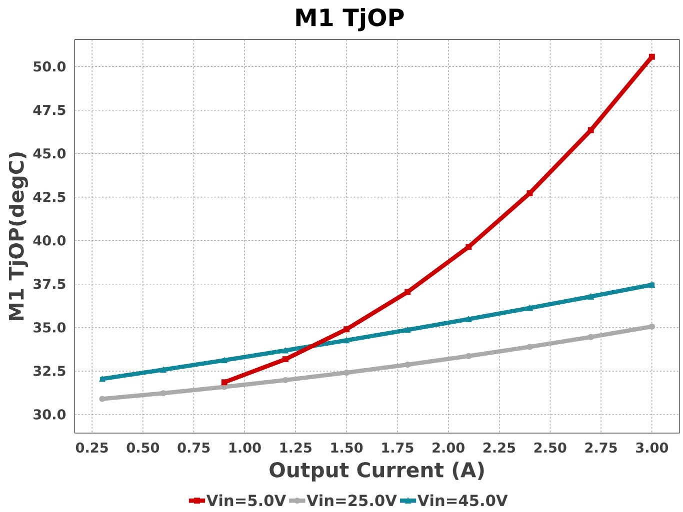

M2 Irms
M2 Irms(A)
6.0
5.5
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.25 0.50 0.75 1.00 1.25 1.50 1.75 2.00 2.25 2.50 2.75 3.00
Output Current (A)
Vin=5.0V Vin=25.0V Vin=45.0V

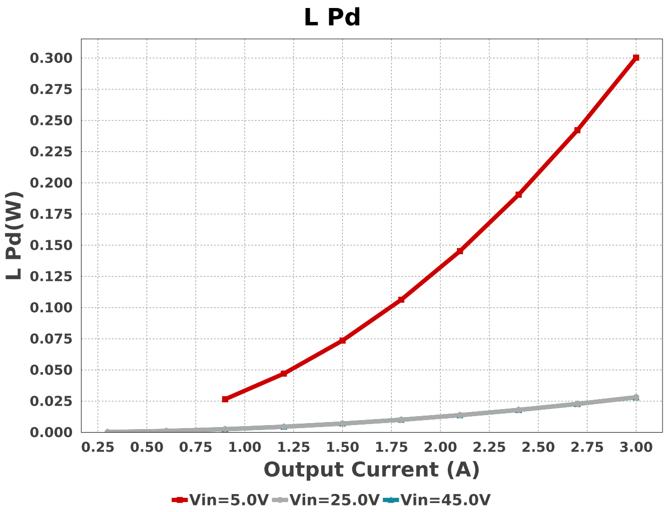

D1 Tj
D1 Tj(degC)
110
105
100
95
90
85
80
75
70
65
60
55
50
45
40
35
30
0.25 0.50 0.75 1.00 1.25 1.50 1.75 2.00 2.25 2.50 2.75 3.00
Output Current (A)
Vin=5.0V Vin=25.0V Vin=45.0V

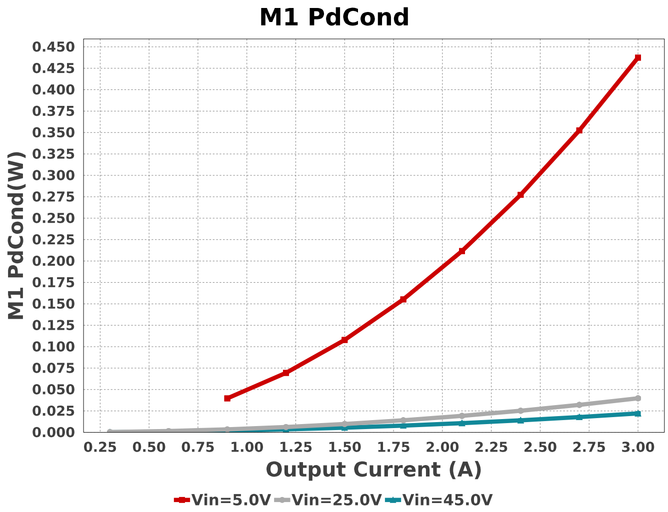

Iin Avg
Iin Avg(A)
Output Current (A)
Vin=5.0V
Vin=25.0V
Vin=45.0V

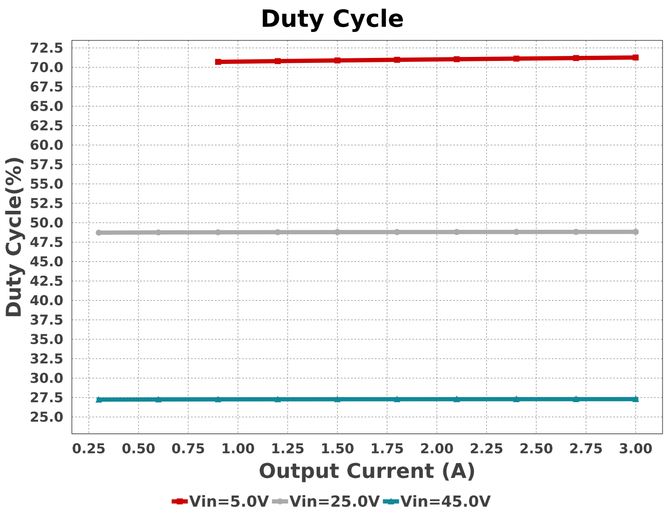

Coutx IRMS
Coutx IRMS(A)
Output Current (A)
Vin=5.0V
Vin=25.0V
Vin=45.0V

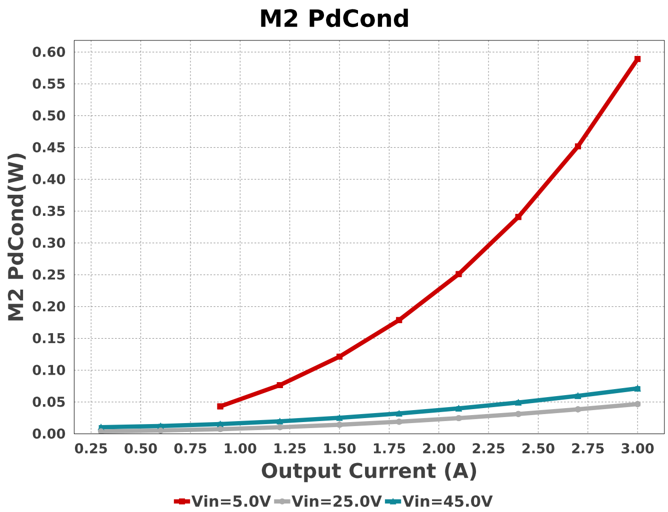

IC Tj
IC Tj(degC)
Output Current (A)
Vin=5.0V
Vin=25.0V
Vin=45.0V

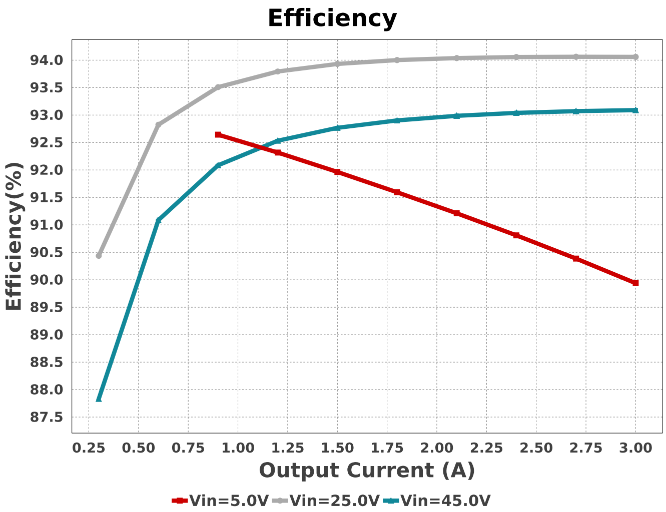

M1 TjOP
M1 TjOP(degC)
Output Current (A)
Vin=5.0V
Vin=25.0V
Vin=45.0V

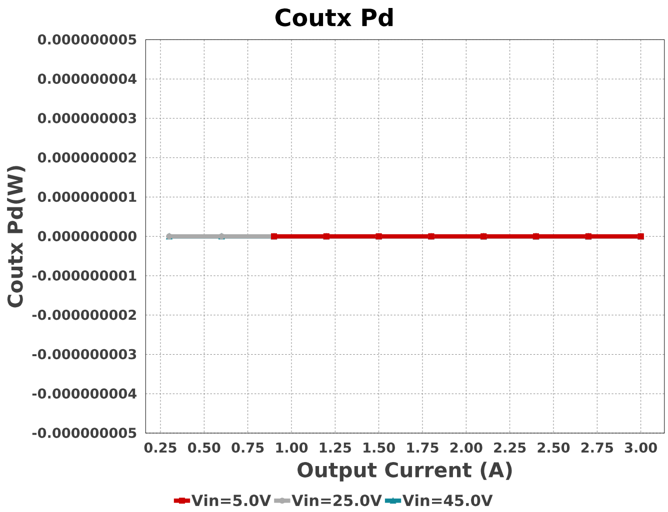

L Pd
L Pd(W)
Output Current (A)
Vin=5.0V
Vin=25.0V
Vin=45.0V

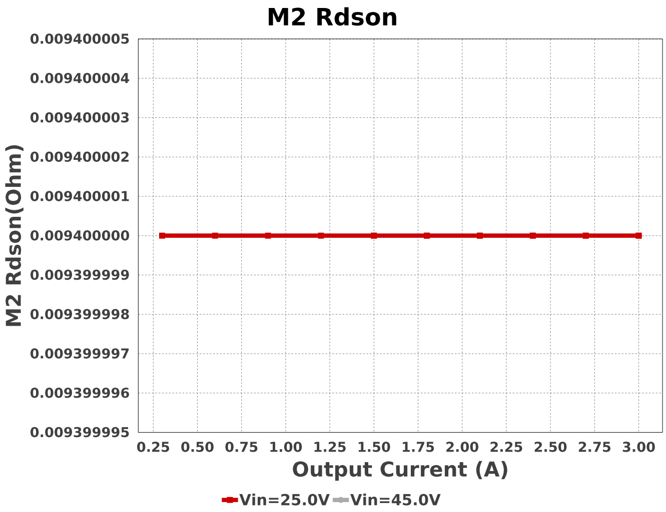

M1 PdCond
M1 PdCond(W)
Output Current (A)
Vin=5.0V
Vin=25.0V
Vin=45.0V

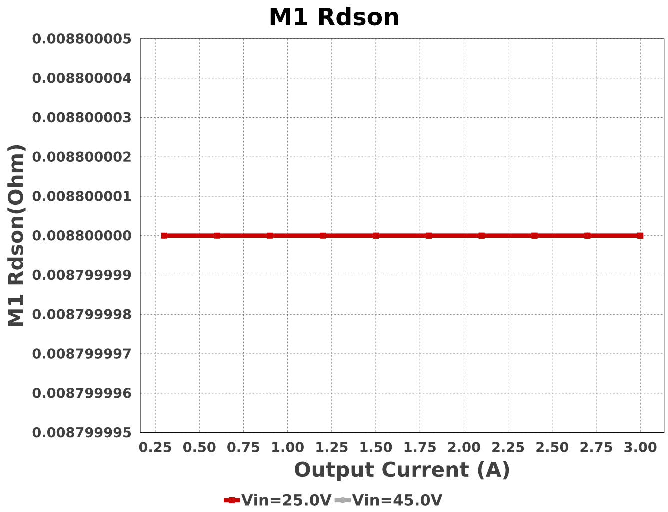

Duty Cycle
Duty Cycle(%)
Output Current (A)
Vin=5.0V Vin=25.0V Vin=45.0V


M2 PdCond
M2 PdCond(W)
Output Current (A)
Vin=5.0V Vin=25.0V Vin=45.0V

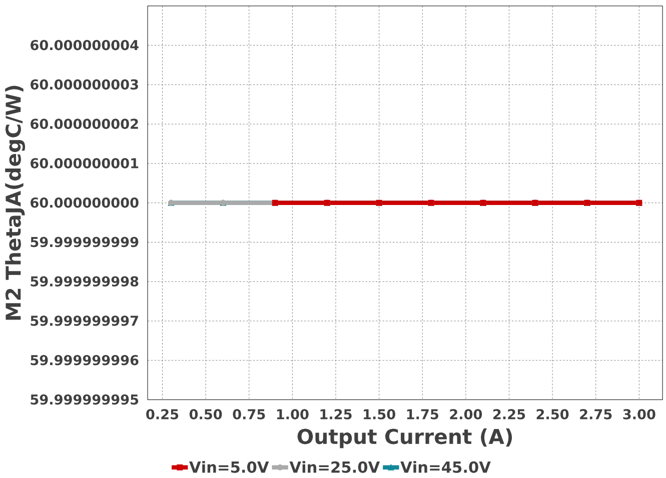

Efficiency
Efficiency(%)
Output Current (A)
Vin=5.0V Vin=25.0V Vin=45.0V


Coutx Pd
Coutx Pd(W)
Output Current (A)
Vin=5.0V Vin=25.0V Vin=45.0V

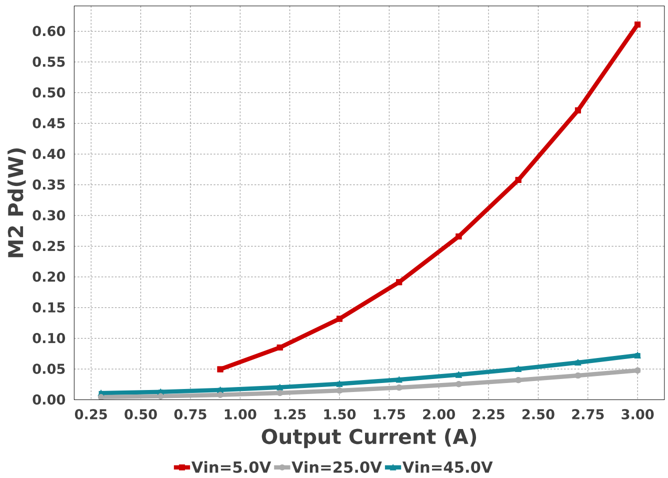

M2 Rdson
M2 Rdson(Ohm)
Output Current (A)
Vin=25.0V Vin=45.0V


M1 Rdson
M1 Rdson(Ohm)
Output Current (A)
Vin=25.0V Vin=45.0V

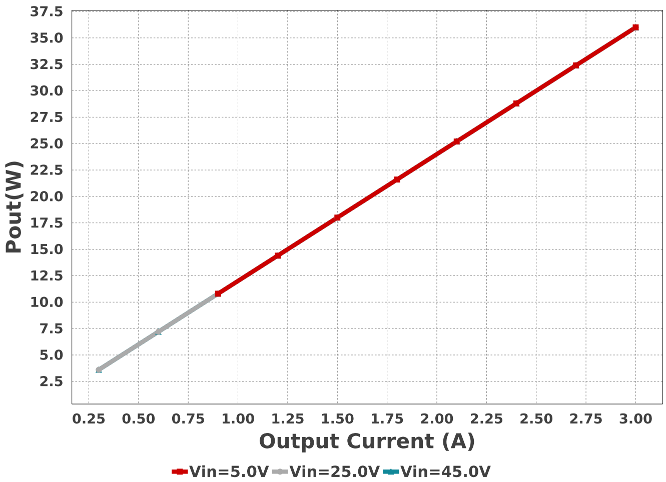
M2 ThetaJA



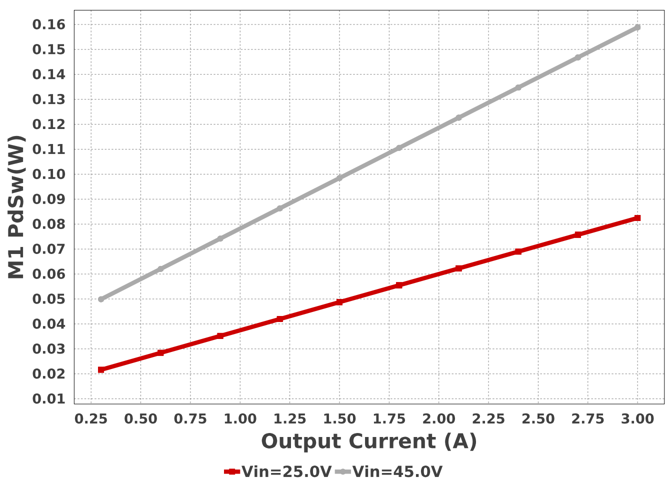
M2 Pd



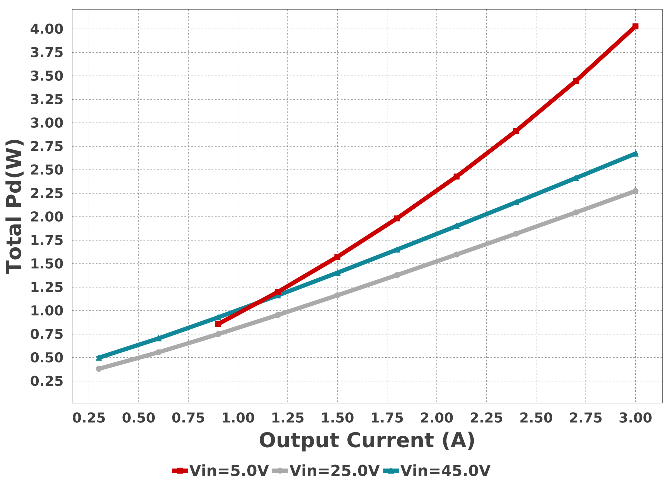
Pout



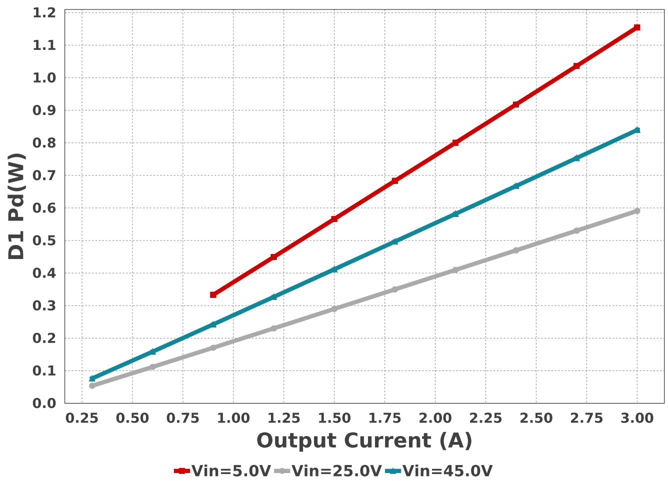
M1 PdSw



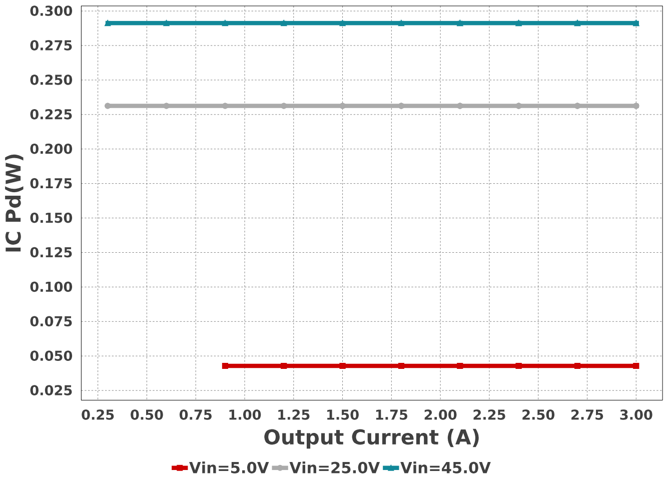
Total Pd



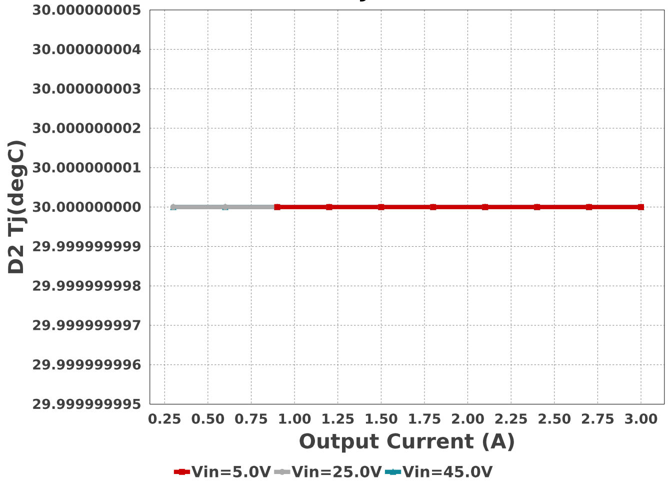
D1 Pd



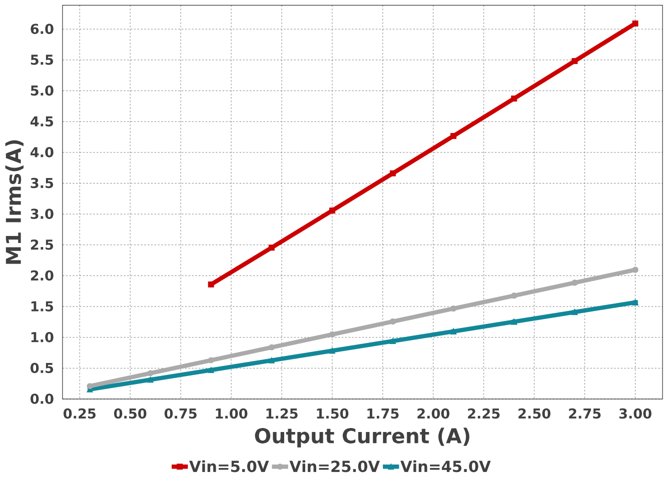
IC Pd



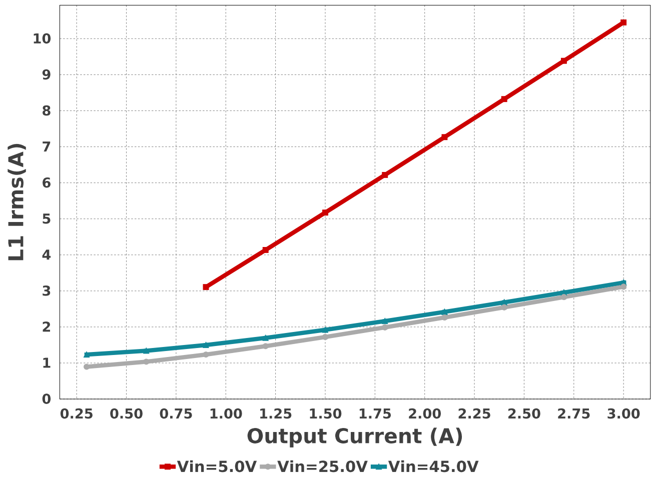
D2 Tj



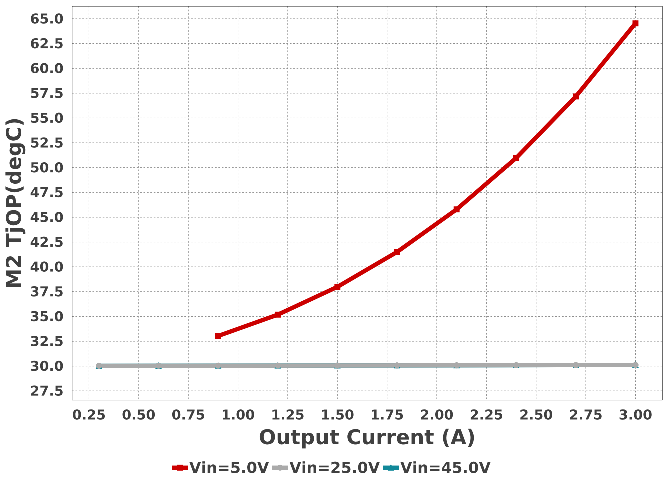
M1 Irms



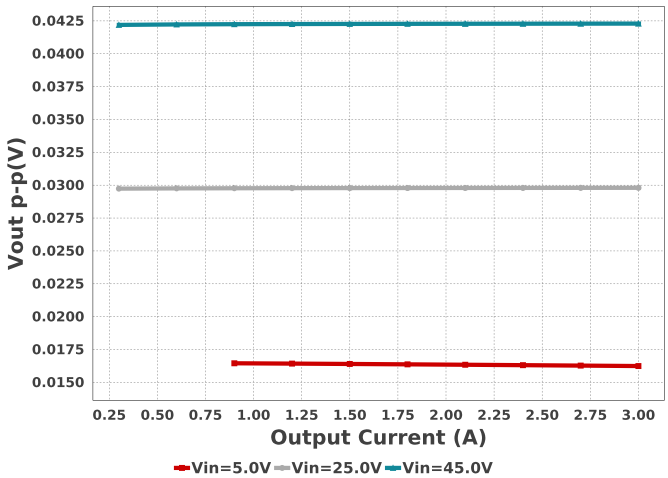
L1 Irms

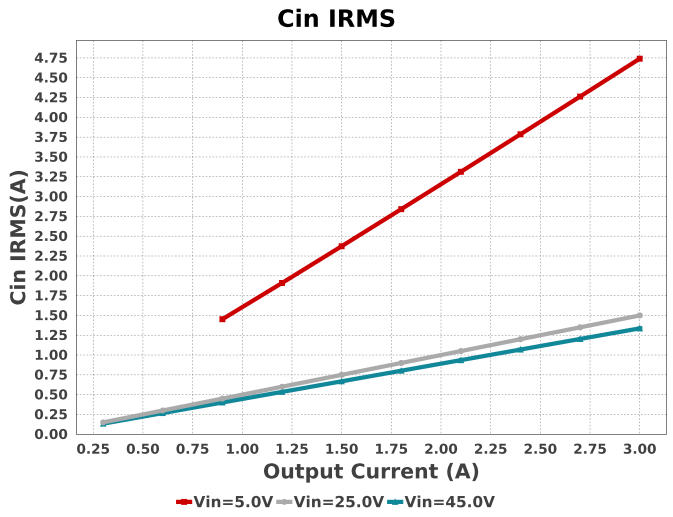


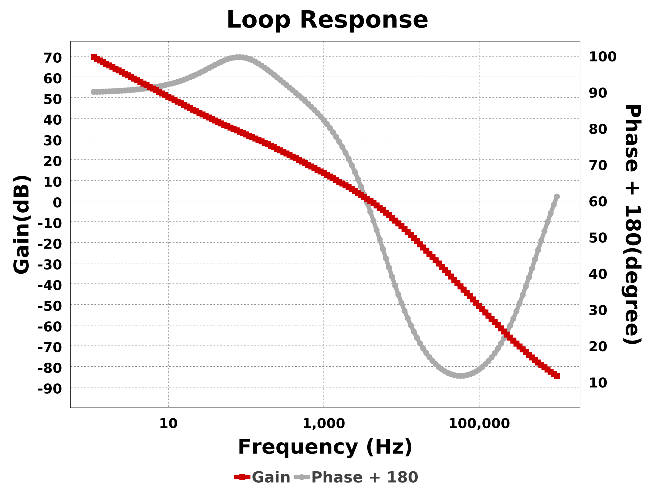
M2 TjOP



Vout p-p







Operating Values

#	Name	Value	Category	Description
1.	BOM Count	27		Total Design BOM count
2.	Total BOM	NA		Total BOM Cost
3.	Cin IRMS	4.741 A	Capacitor	Input capacitor RMS ripple current
4.	Cin Pd	1.124 mW	Capacitor	Input capacitor power dissipation
5.	Cout IRMS	4.732 A	Capacitor	Output capacitor RMS ripple current
6.	Cout Pd	223.9 mW	Capacitor	Output capacitor power dissipation
7.	Coutx IRMS	0.0 A	Capacitor	Output capacitor_x RMS ripple current
8.	Coutx Pd	0.0 W	Capacitor	Output capacitor_x power loss
9.	D1 Pd	1.155 W	Diode	Diode power dissipation
10.	D1 Tj	110.821 degC	Diode	D1 junction temperature
11.	D2 Pd	1.155 W	Diode	Diode2 power dissipation
12.	IC Pd	294.65 mW	IC	IC power dissipation
13.	IC Tj	41.786 degC	IC	IC junction temperature
14.	IC Tolerance	18.0 mV	IC	IC Feedback Tolerance
15.	ICThetaJA	40.0 degC/W	IC	IC junction-to-ambient thermal resistance
16.	Iin Avg	895.17 mA	IC	Average input current
17.	L Ipp	1.595 A	Inductor	Peak-to-peak inductor ripple current
18.	L Pd	300.49 mW	Inductor	Inductor power dissipation
19.	L1 Irms	10.453 A	Inductor	Inductor ripple current
20.	M1 Irms	6.092 A	Mosfet	MOSFET RMS ripple current
21.	M1 Pd	457.62 mW	Mosfet	MOSFET power dissipation
22.	M1 PdCond	448.36 mW	Mosfet	M1 MOSFET conduction losses
23.	M1 ThetaJA	41.0 degC/W	Mosfet	MOSFET junction-to-ambient thermal resistance
24.	M1 TjOP	50.441 degC	Mosfet	MOSFET junction temperature
25.	M2 Irms	6.092 A	Mosfet	MOSFET RMS ripple current
26.	M2 Pd	605.68 mW	Mosfet	MOSFET power dissipation
27.	M2 PdCond	589.14 mW	Mosfet	M2 MOSFET conduction losses
28.	M2 PdSw	16.541 mW	Mosfet	M2 MOSFET switching losses
29.	M2 ThetaJA	60.0 degC/W	Mosfet	MOSFET junction-to-ambient thermal resistance
30.	M2 TjOP	64.166 degC	Mosfet	MOSFET junction temperature
31.	Cin Pd	1.124 mW	Power	Input capacitor power dissipation
32.	Cout Pd	223.9 mW	Power	Output capacitor power dissipation
33.	Coutx Pd	0.0 W	Power	Output capacitor_x power loss
34.	D1 Pd	1.155 W	Power	Diode power dissipation
35.	D2 Pd	1.155 W	Power	Diode2 power dissipation
36.	IC Pd	294.65 mW	Power	IC power dissipation
37.	L Pd	300.49 mW	Power	Inductor power dissipation
38.	M1 Pd	457.62 mW	Power	MOSFET power dissipation
39.	M1 PdCond	448.36 mW	Power	M1 MOSFET conduction losses
40.	M2 Pd	605.68 mW	Power	MOSFET power dissipation
41.	M2 PdCond	589.14 mW	Power	M2 MOSFET conduction losses
42.	M2 PdSw	16.541 mW	Power	M2 MOSFET switching losses
43.	Rsense Pd	90.0 mW	Power	LED Current Rsns Power Dissipation
44.	Total Pd	475.828 mW	Power	Total Power Dissipation
45.	Rsense Pd	90.0 mW	Resistor	LED Current Rsns Power Dissipation
46.	Cross Freq	2.052 kHz	System Information	Bode plot crossover frequency
47.	D2 Tj	30.0 degC	System Information	D2 junction temperature
48.	Duty Cycle	71.273 %	System Information	Duty cycle

#	Name	Value	Category	Description
49.	Efficiency	89.369 %	System Information	Steady state efficiency
50.	FootPrint	1.685 k mm^2	System Information	Total Foot Print Area of BOM components
51.	Frequency	98.583 kHz	System Information	Switching frequency
52.	Gain Marg	-33.369 dB	System Information	Bode Plot Gain Margin
53.	Iout	3.0 A	System Information	Iout operating point
54.	Low Freq Gain	65.85 dB	System Information	Gain at 1Hz
55.	Mode	CCM	System Information	Conduction Mode
56.	Operating Topology	Buck-Boost	System Information	The current operating topology of the device
57.	Phase Marg	69.878 deg	System Information	Bode Plot Phase Margin
58.	Pout	36.0 W	System Information	Total output power
59.	SW Ipk	11.24 A	System Information	Peak switch current
60.	Vin	5.0 V	System Information	Vin operating point
61.	Vout	12.0 V	System Information	Operational Output Voltage
62.	Vout Actual	11.882 V	System Information	Vout Actual calculated based on selected voltage divider resistors
63.	Vout Tolerance	3.301 %	System Information	Vout Tolerance based on IC Tolerance (no load) and voltage divider resistors if applicable
64.	Vout p-p	16.237 mV	System Information	Peak-to-peak output ripple voltage

Design Inputs

Name	Value	Description
Iout	3.0	Maximum Output Current
VinMax	45.0	Maximum input voltage
VinMin	5.0	Minimum input voltage
Vout	12.0	Output Voltage
base_pn	LM5118	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

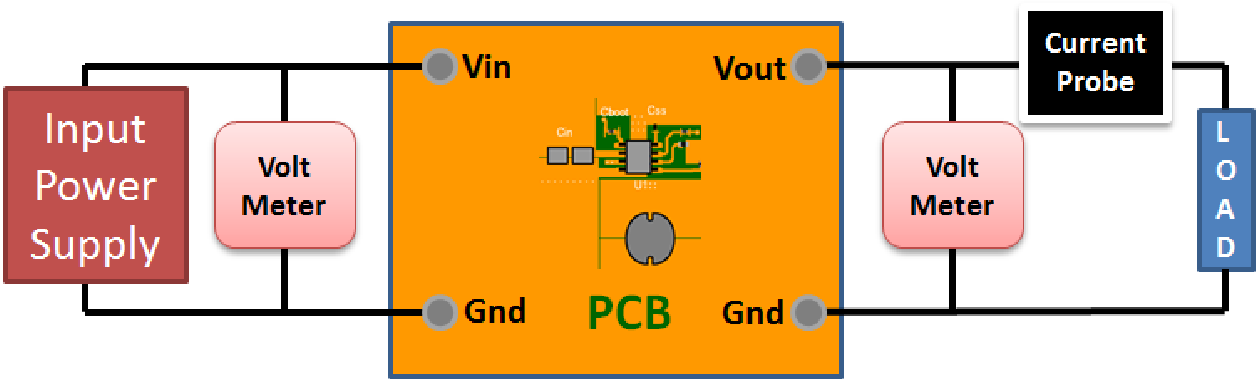
If board assembly is done in house it is best to tack down one terminal of a component on the board then solder the other terminal. For surface mount parts with large tabs, such as the DPAK, the tab on the back of the package should be pre-tinned with solder, then tacked into place by one of the pins. 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 5.0V 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.

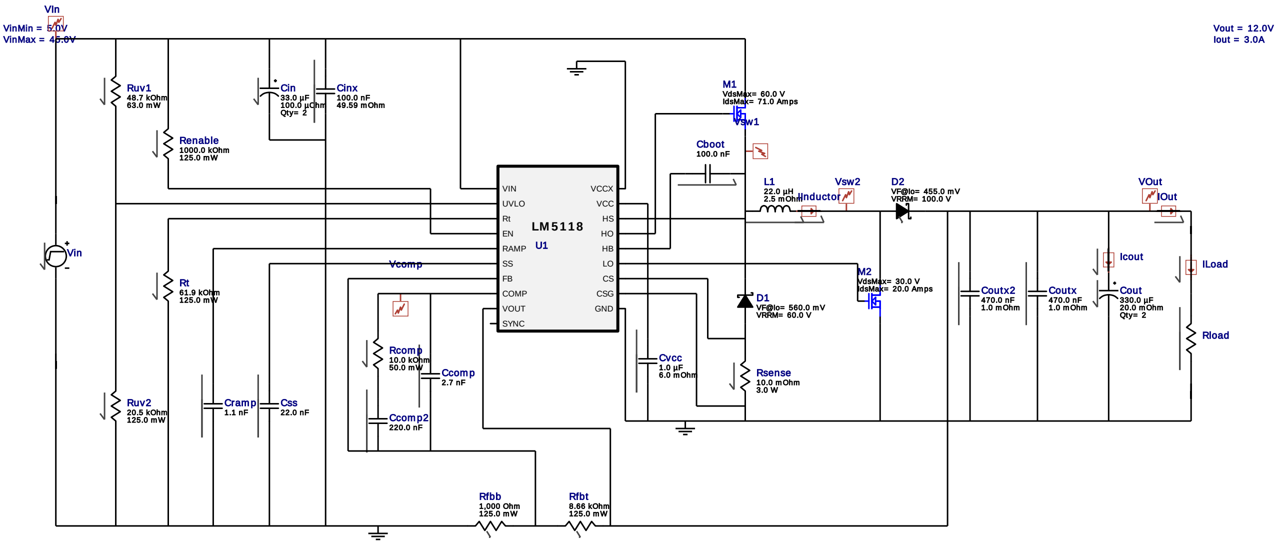


WEBENCH® Electrical Simulation Report

Design Id = 3

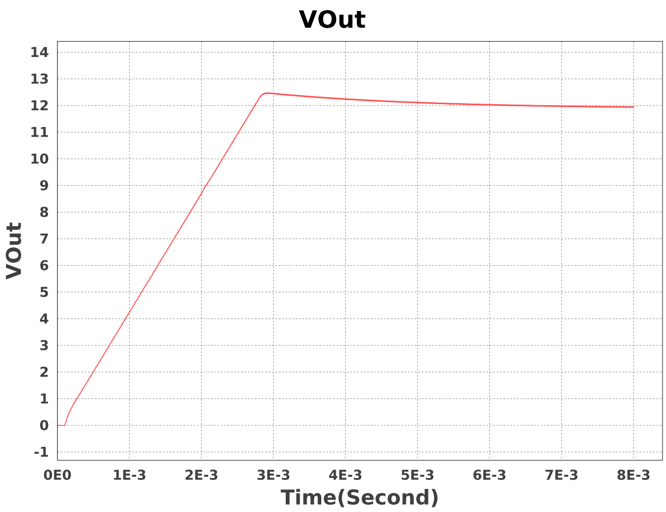
sim_id = 1

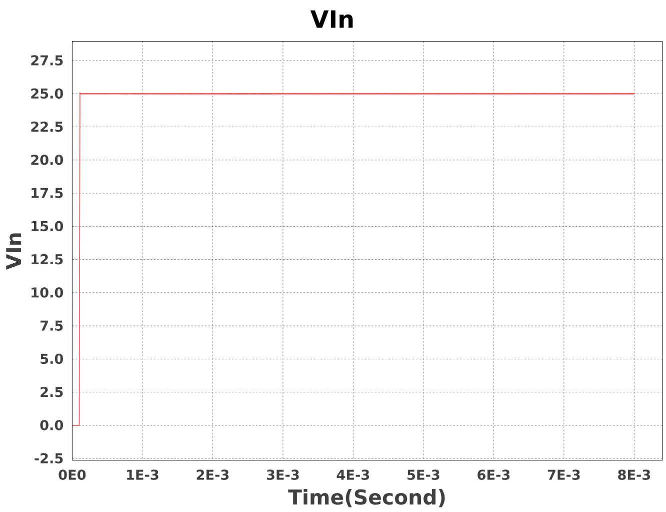
Simulation Type = Startup



Simulation Parameters

#	Name	Parameter Name	Description	Values
1.	Rload	R	Load Resistance	4.0 Ohm

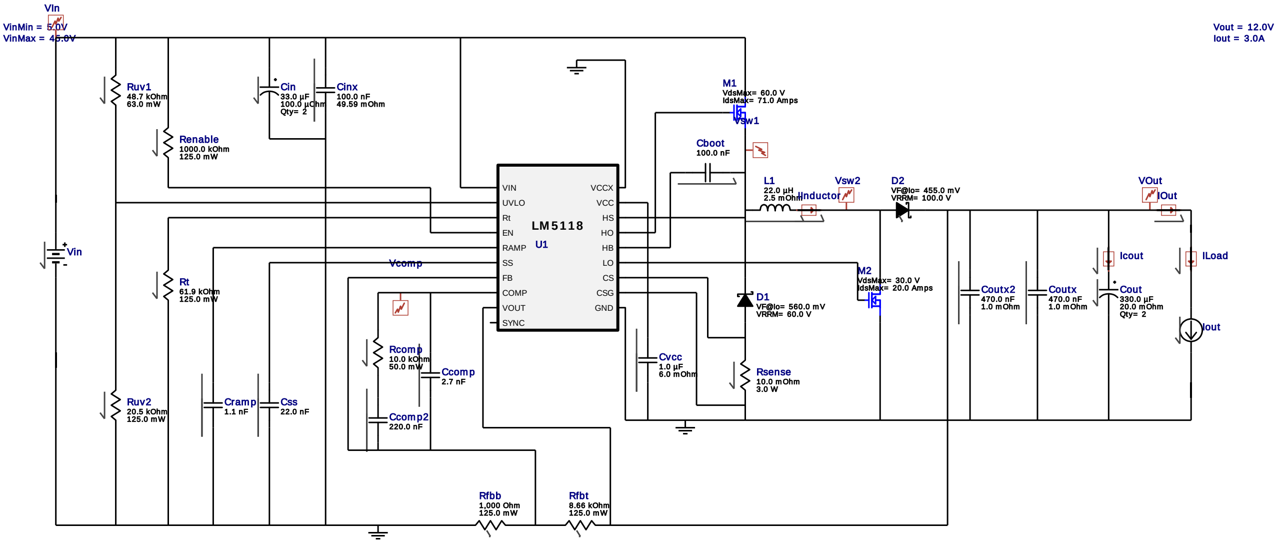




Design Id = 3

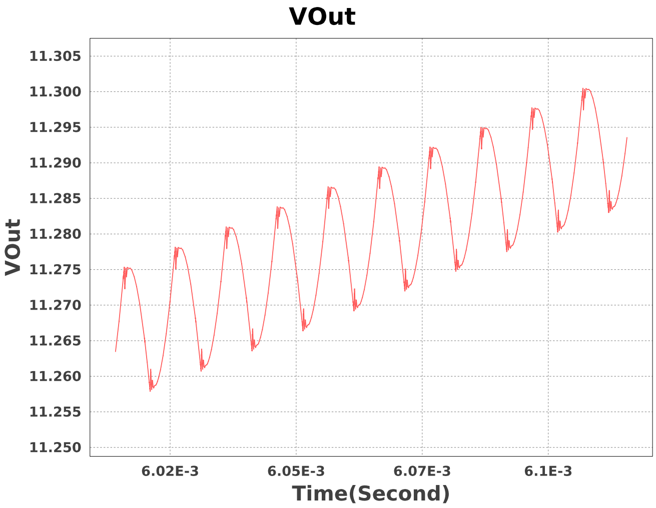
sim_id = 2

Simulation Type = Steady State



Simulation Parameters

#	Name	Parameter Name	Description	Values
1.	Cboot	IC	no description	25.0
2.	Iout	I	Load Current	3.0 A



Design Assistance

1. The LM5118 is a wide range buck-boost controller which is operable in an ultra wide input range of 3 to 75V. A buck-boost regulator can maintain regulation for input voltages either higher or lower than the output voltage. The challenge is that buck-boost power converters are not as efficient as buck regulators. The LM5118 has been designed as a dual mode controller whereby the power converter acts as a buck regulator while the input voltage is above the output. As the input voltage approaches the output voltage, a gradual transition to the buck-boost mode occurs. This gradual transition between modes eliminates disturbances at the output during transitions.

2. Master key : 5C966F0DD4384EC55C6065EF26115814[v1]

3. **LM5118** Product Folder : http://www.ti.com/product/lm5118 : contains the data sheet and other resources.

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