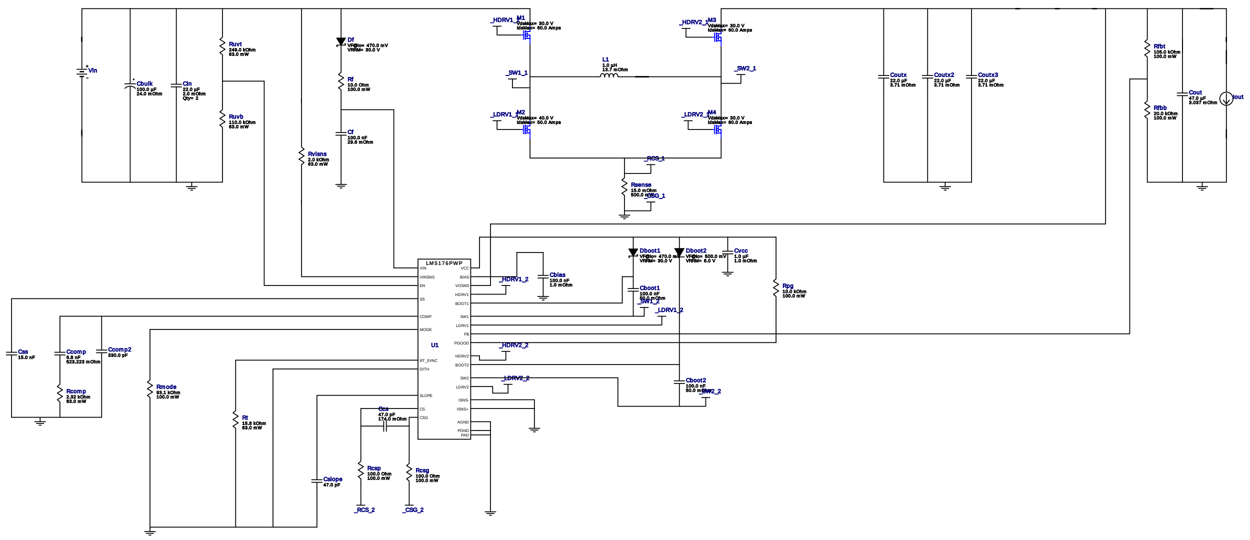
VinMin = 4.5V
VinMax = 16.0V
Vout = 5.0V
Iout = 4.5A

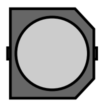
Device = LM5176PWPR
Topology = Buck_Boost
Created = 2022-11-05 18:25:52.024
BOM Cost = NA
BOM Count = 39
Total Pd = 1.49W

WEBENCH ® Design Report

Design : 63 LM5176PWPR
LM5176PWPR 4.5V-18V to 5.00V @ 4.5A

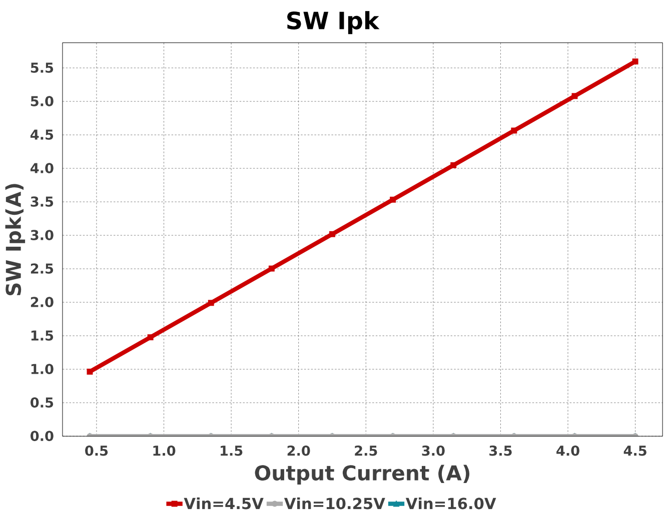


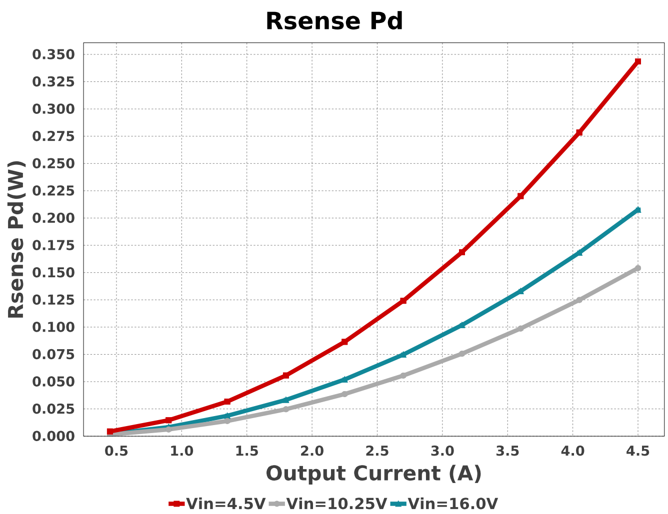
Electrical BOM

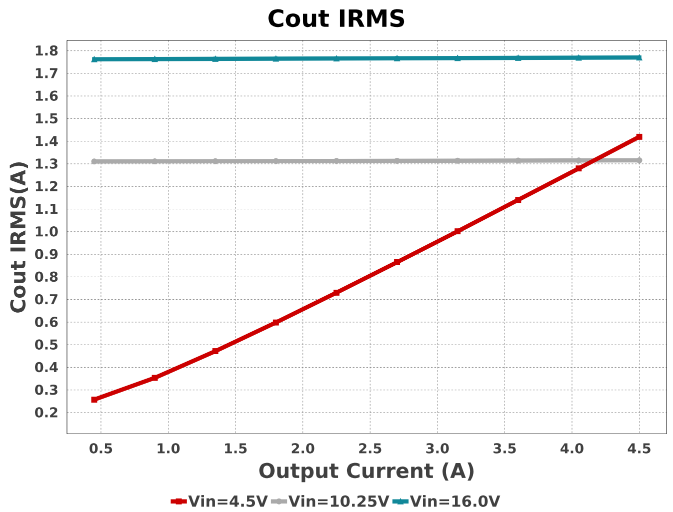
Name	Manufacturer	Part Number	Properties	Qty	Price	Footprint
Cbias	MuRata	GRM155R71A104KA01D Series= X7R	Cap= 100.0 nF ESR= 1.0 mOhm VDC= 10.0 V IRMS= 0.0 A	1	$0.01	0402 3 mm²
Cboot1	AVX	06033C104KAT2A Series= X7R	Cap= 100.0 nF ESR= 50.0 mOhm VDC= 25.0 V IRMS= 0.0 A	1	$0.01	0603 5 mm²
Cboot2	AVX	06033C104KAT2A Series= X7R	Cap= 100.0 nF ESR= 50.0 mOhm VDC= 25.0 V IRMS= 0.0 A	1	$0.01	0603 5 mm²
Cbulk	Panasonic	25SVPF100M Series= SVPF	Cap= 100.0 uF ESR= 24.0 mOhm VDC= 25.0 V IRMS= 3.2 A	1	$0.66	 CAPSMT_62_E7 106 mm²
Ccomp	TDK	CGA2B3X7S2A682K050BB Series= X7S	Cap= 6.8 nF ESR= 523.22 mOhm VDC= 100.0 V IRMS= 273.561 mA	1	$0.01	0402 3 mm²
Ccomp2	Samsung Electro-Mechanics	CL21C331JBANNNC Series= C0G/NP0	Cap= 330.0 pF VDC= 50.0 V IRMS= 0.0 A	1	$0.01	0805 7 mm²
Ccs	AVX	06035A470JAT2A Series= C0G/NP0	Cap= 47.0 pF ESR= 174.0 mOhm VDC= 50.0 V IRMS= 0.0 A	1	$0.01	0603 5 mm²
Cf	TDK	CGA3E2X7R1H104K080AA Series= X7R	Cap= 100.0 nF ESR= 29.6 mOhm VDC= 50.0 V IRMS= 971.99 mA	1	$0.01	0603 5 mm²

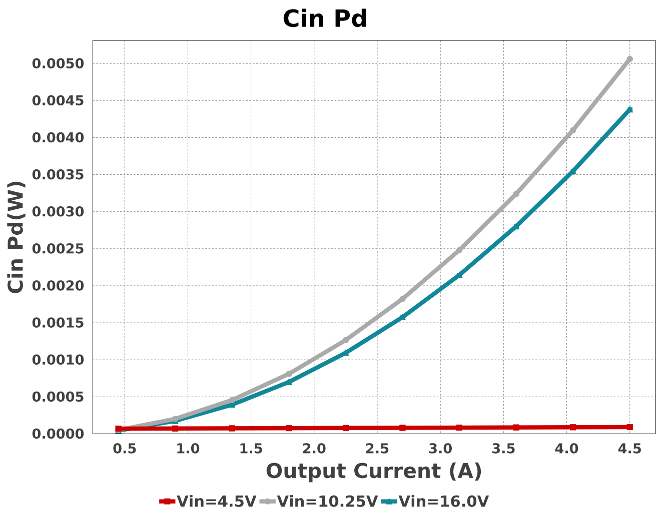
Name	Manufacturer	Part Number	Properties	Qty	Price	Footprint
Cin	MuRata	GRM32ER61E226KE15L Series= X5R	Cap= 22.0 uF ESR= 2.0 mOhm VDC= 25.0 V IRMS= 3.67 A	2	$0.23	1210 15 mm^2
Cout	MuRata	GRM32ER61C476KE15L Series= X5R	Cap= 47.0 uF ESR= 3.037 mOhm VDC= 16.0 V IRMS= 4.59346 A	1	$0.17	1210_280 15 mm^2
Coutx	TDK	C1608X5R1A226M080AC Series= X5R	Cap= 22.0 uF ESR= 3.71 mOhm VDC= 10.0 V IRMS= 2.69936 A	1	$0.08	0603 5 mm^2
Coutx2	TDK	C1608X5R1A226M080AC Series= X5R	Cap= 22.0 uF ESR= 3.71 mOhm VDC= 10.0 V IRMS= 2.69936 A	1	$0.08	0603 5 mm^2
Coutx3	TDK	C1608X5R1A226M080AC Series= X5R	Cap= 22.0 uF ESR= 3.71 mOhm VDC= 10.0 V IRMS= 2.69936 A	1	$0.08	0603 5 mm^2
Cslope	Samsung Electro-Mechanics	CL10C470JB8NNNC Series= C0G/NP0	Cap= 47.0 pF VDC= 50.0 V IRMS= 0.0 A	1	$0.01	0603 5 mm^2
Css	Kemet	C0603C153J3GACTU Series= C0G/NP0	Cap= 15.0 nF VDC= 25.0 V IRMS= 0.0 A	1	$0.09	0603 5 mm^2
Cvcc	Taiyo Yuden	EMK107B7105KA-T Series= X7R	Cap= 1.0 uF ESR= 1.0 mOhm VDC= 16.0 V IRMS= 0.0 A	1	$0.01	0603 5 mm^2
Dboot1	Torex USA Corporation	XBS053V15R-G	VF@Io= 470.0 mV VRRM= 30.0 V	1	$0.15	SOD-523 5 mm^2
Dboot2	CUSTOM	CUSTOM	VF@Io= 500.0 mV VRRM= 6.0 V	1	NA	CUSTOM 0 mm^2
Df	Torex USA Corporation	XBS053V15R-G	VF@Io= 470.0 mV VRRM= 30.0 V	1	$0.15	SOD-523 5 mm^2
L1	Vishay-Dale	IHLP2020CZER1R0M01	L= 1.0 µH 13.7 mOhm	1	$0.63	IHLP-2020CZ 54 mm^2
M1	Texas Instruments	CSD17577Q5A	VdsMax= 30.0 V IdsMax= 60.0 Amps	1	$0.21	TRANS_NexFET_Q5A 55 mm^2
M2	Texas Instruments	CSD18514Q5A	VdsMax= 40.0 V IdsMax= 50.0 Amps	1	$0.26	TRANS_NexFET_Q5A 55 mm^2
M3	Texas Instruments	CSD17577Q5A	VdsMax= 30.0 V IdsMax= 60.0 Amps	1	$0.21	TRANS_NexFET_Q5A 55 mm^2
M4	Texas Instruments	CSD17577Q5A	VdsMax= 30.0 V IdsMax= 60.0 Amps	1	$0.21	TRANS_NexFET_Q5A 55 mm^2
Rcomp	Vishay-Dale	CRCW04022K32FKED Series= CRCW..e3	Res= 2.32 kOhm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	0402 3 mm^2

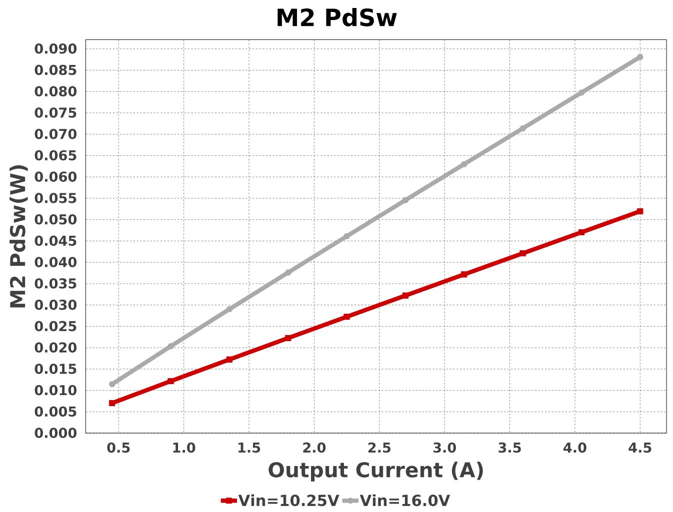
Name	Manufacturer	Part Number	Properties	Qty	Price	Footprint
Rcsg	Vishay-Dale	CRCW0603100RFKEA Series= CRCW..e3	Res= 100.0 Ohm Power= 100.0 mW Tolerance= 1.0%	1	$0.01	0603 5 mm^2
Rcsp	Vishay-Dale	CRCW0603100RFKEA Series= CRCW..e3	Res= 100.0 Ohm Power= 100.0 mW Tolerance= 1.0%	1	$0.01	0603 5 mm^2
Rf	Yageo	RC0603FR-0710RL Series= ?	Res= 10.0 Ohm Power= 100.0 mW Tolerance= 1.0%	1	$0.01	0603 5 mm^2
Rfbb	Yageo	RC0603FR-0720KL Series= ?	Res= 20.0 kOhm Power= 100.0 mW Tolerance= 1.0%	1	$0.01	0603 5 mm^2
Rfbt	Vishay-Dale	CRCW0603105KFKEA Series= CRCW..e3	Res= 105.0 kOhm Power= 100.0 mW Tolerance= 1.0%	1	$0.01	0603 5 mm^2
Rmode	Yageo	RC0603FR-0793K1L Series= ?	Res= 93.1 kOhm Power= 100.0 mW Tolerance= 1.0%	1	$0.01	0603 5 mm^2
Rpg	Yageo	RC0603FR-0710KL Series= ?	Res= 10.0 kOhm Power= 100.0 mW Tolerance= 1.0%	1	$0.01	0603 5 mm^2
Rsense	Stackpole Electronics Inc	CSR1206FK15L0 Series= ?	Res= 15.0 mOhm Power= 500.0 mW Tolerance= 1.0%	1	$0.11	1206 11 mm^2
Rt	Vishay-Dale	CRCW040215K8FKED Series= CRCW..e3	Res= 15.8 kOhm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	0402 3 mm^2
Ruvb	Vishay-Dale	CRCW0402110KFKED Series= CRCW..e3	Res= 110.0 kOhm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	0402 3 mm^2
Ruvt	Vishay-Dale	CRCW0402249KFKED Series= CRCW..e3	Res= 249.0 kOhm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	0402 3 mm^2
Rvisns	Vishay-Dale	CRCW04022K00FKED Series= CRCW..e3	Res= 2.0 kOhm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	0402 3 mm^2
U1	Texas Instruments	LM5176PWPR	Switcher	1	$2.90	PWP0028C_N 98 mm^2

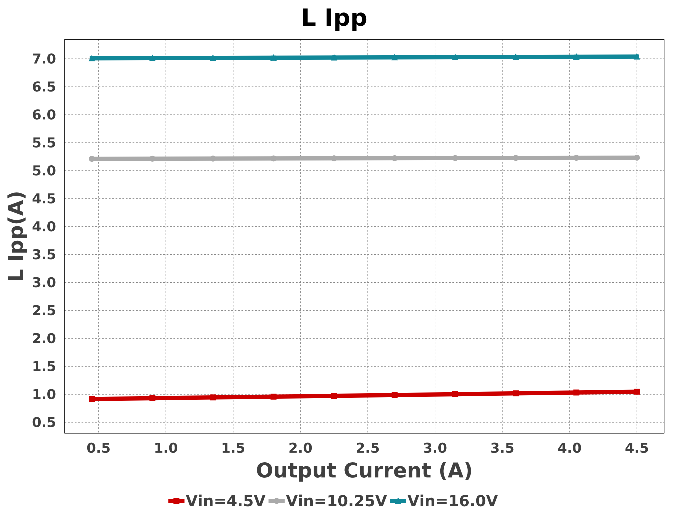


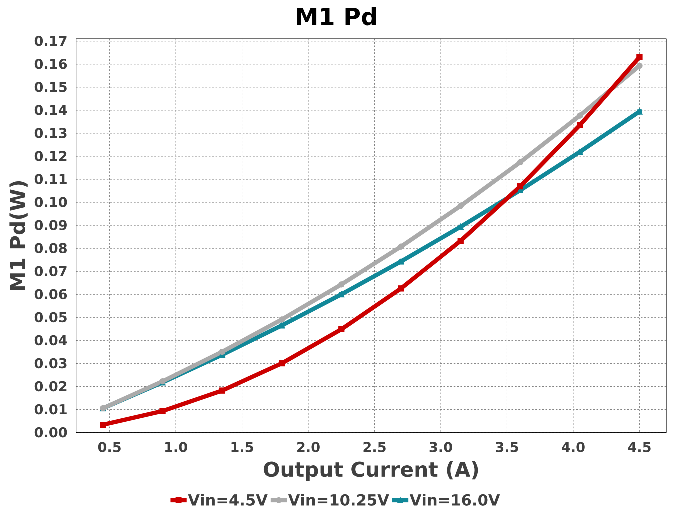


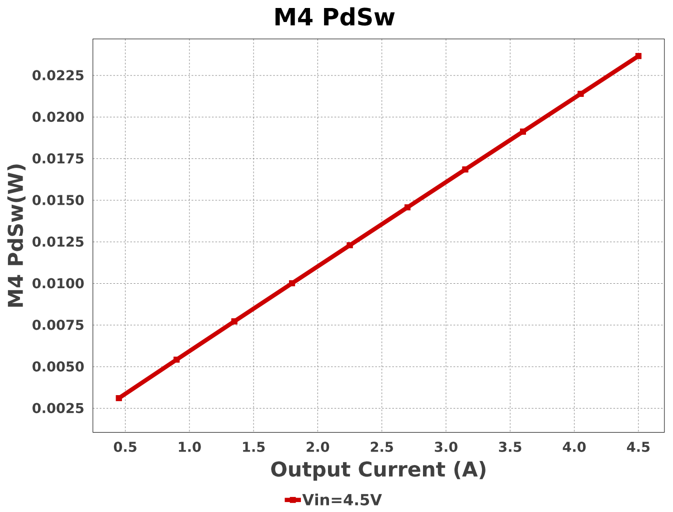

Cout IRMS
Cout IRMS(A)
Output Current (A)
Vin=4.5V Vin=10.25V Vin=16.0V

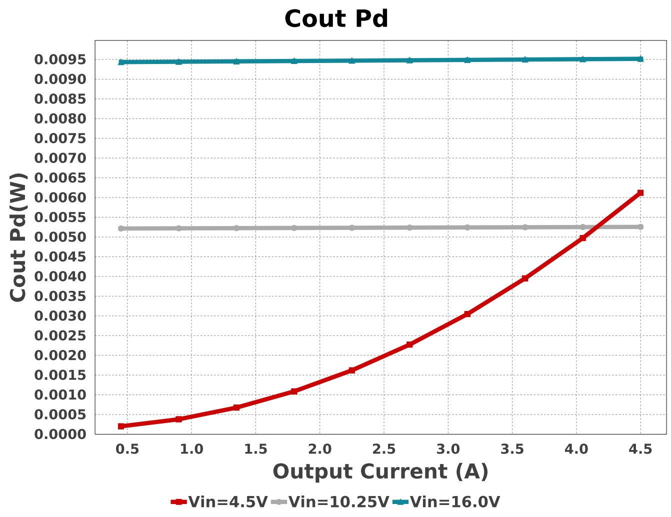

Cin Pd
Cin Pd(W)
Output Current (A)
Vin=4.5V Vin=10.25V Vin=16.0V

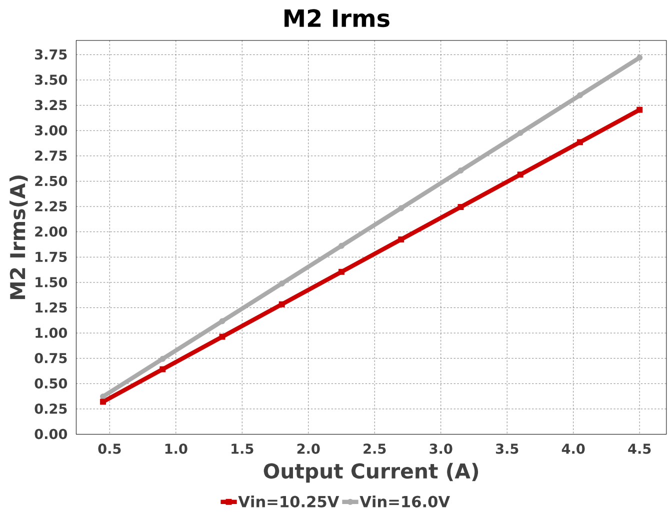

M2 PdSw
M2 PdSw(W)
Output Current (A)
Vin=10.25V Vin=16.0V

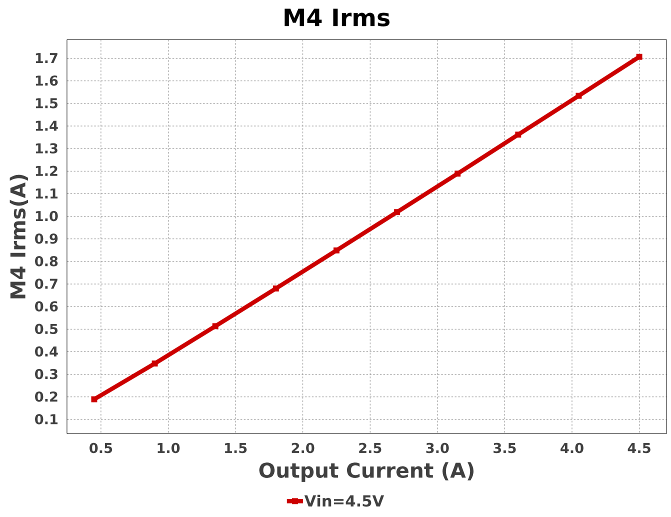

L Ipp
L Ipp(A)
Output Current (A)
Vin=4.5V Vin=10.25V Vin=16.0V

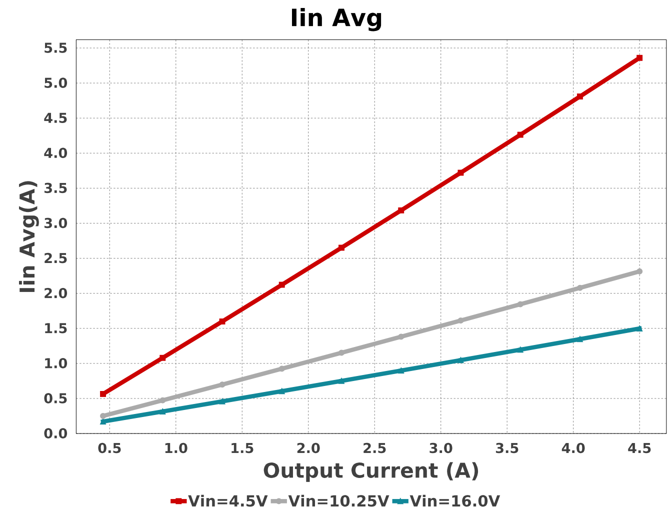

M1 Pd
M1 Pd(W)
Output Current (A)
Vin=4.5V Vin=10.25V Vin=16.0V

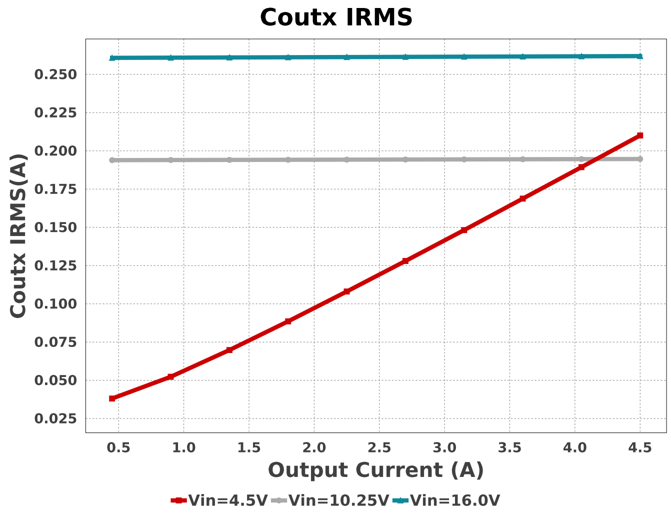

M4 PdSw
M4 PdSw(W)
Output Current (A)
Vin=4.5V

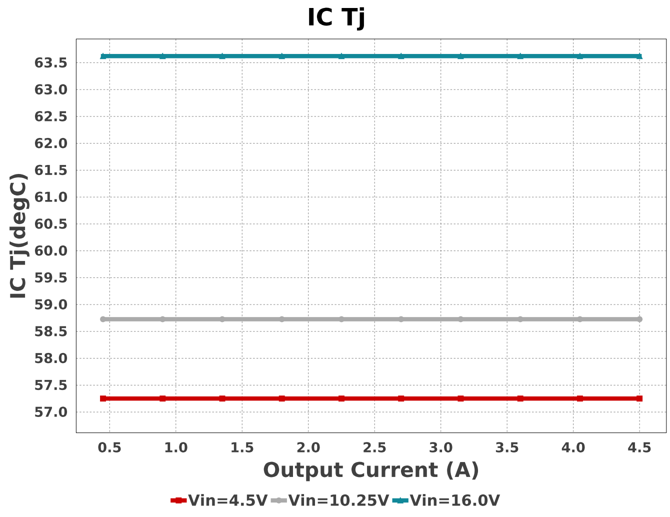

Cout Pd
Cout Pd(W)
Output Current (A)
Vin=4.5V Vin=10.25V Vin=16.0V

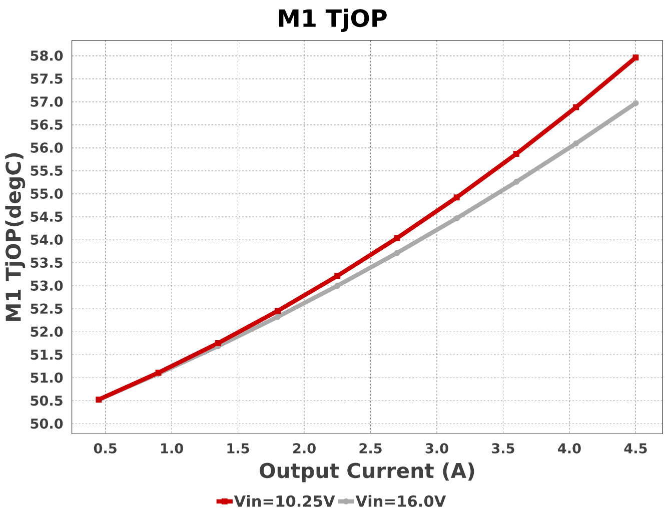

M2 Irms
M2 Irms(A)
Output Current (A)
Vin=10.25V Vin=16.0V

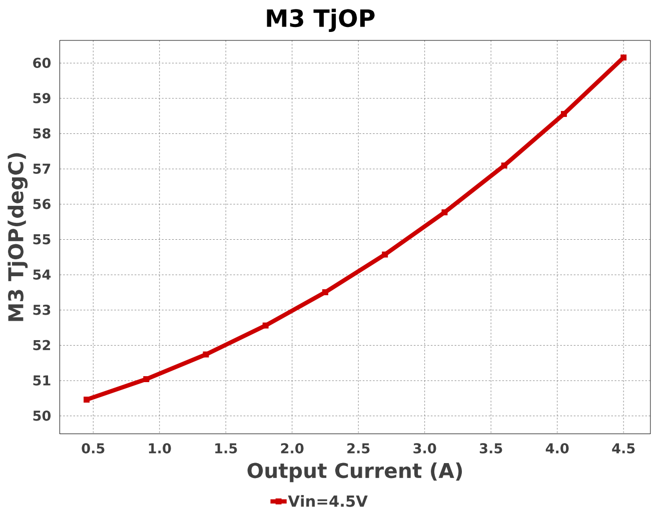

M4 Irms
M4 Irms(A)
Output Current (A)
Vin=4.5V

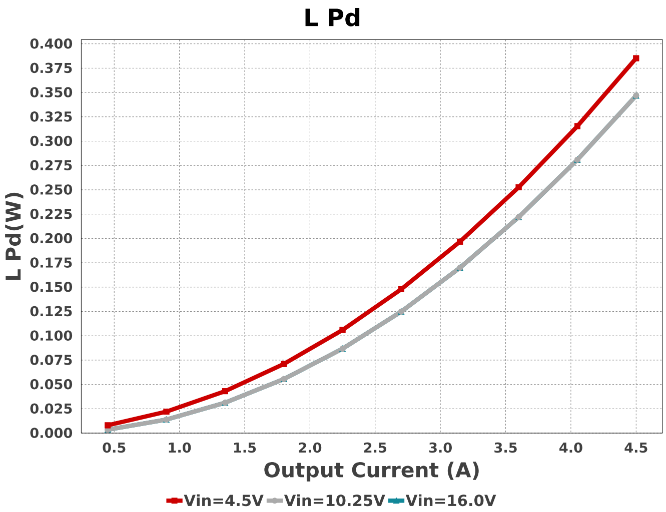

Iin Avg
Iin Avg(A)
Output Current (A)
Vin=4.5V Vin=10.25V Vin=16.0V

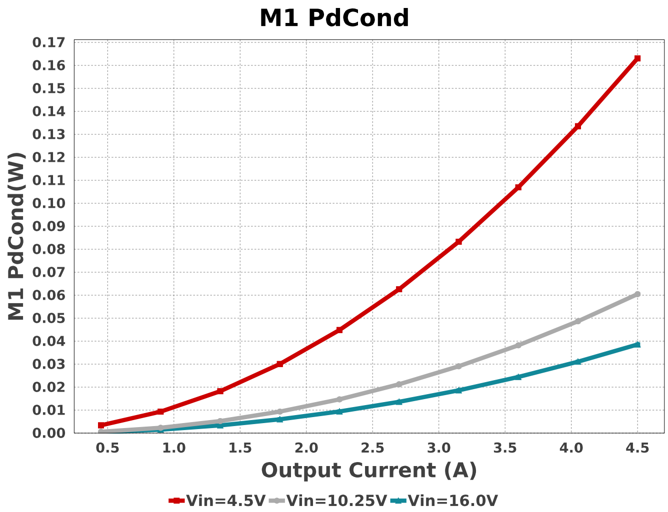

Coutx IRMS
Coutx IRMS(A)
Output Current (A)
Vin=4.5V Vin=10.25V Vin=16.0V

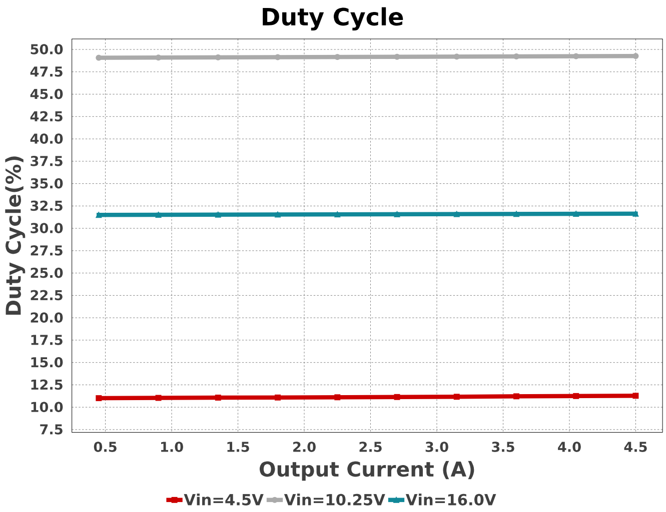

IC Tj
IC Tj(degC)
Output Current (A)
Vin=4.5V Vin=10.25V Vin=16.0V

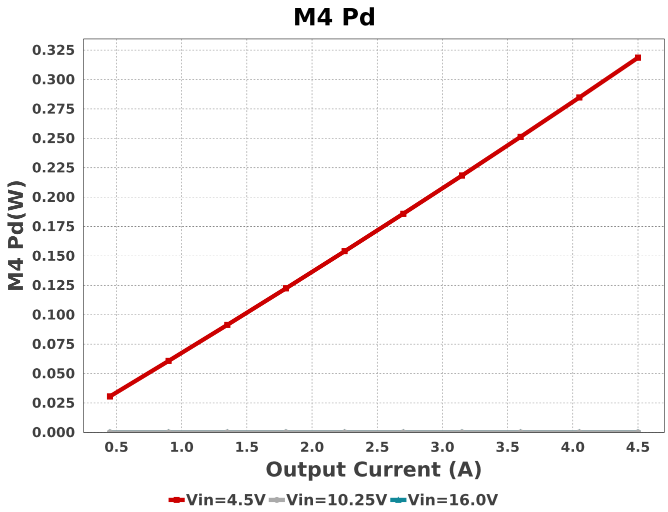

M1 TjOP
M1 TjOP(degC)
58.0
57.5
57.0
56.5
56.0
55.5
55.0
54.5
54.0
53.5
53.0
52.5
52.0
51.5
51.0
50.5
50.0
0.5
1.0
1.5
2.0
2.5
3.0
3.5
4.0
4.5
Output Current (A)
Vin=10.25V
Vin=16.0V

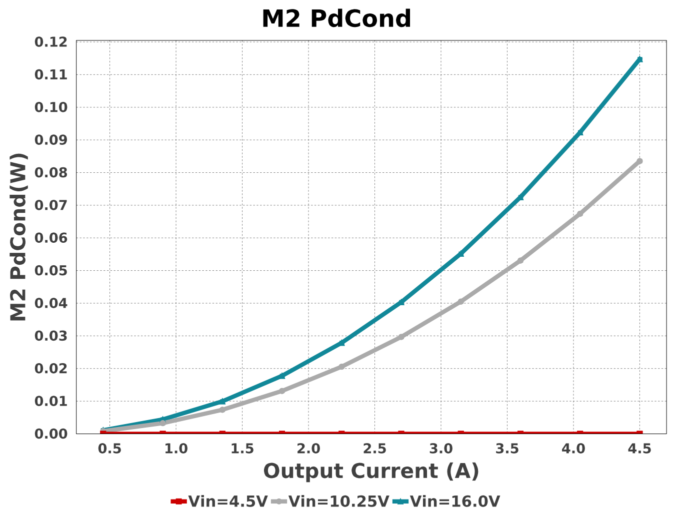

M3 TjOP
M3 TjOP(degC)
60
59
58
57
56
55
54
53
52
51
50
0.5
1.0
1.5
2.0
2.5
3.0
3.5
4.0
4.5
Output Current (A)
Vin=4.5V

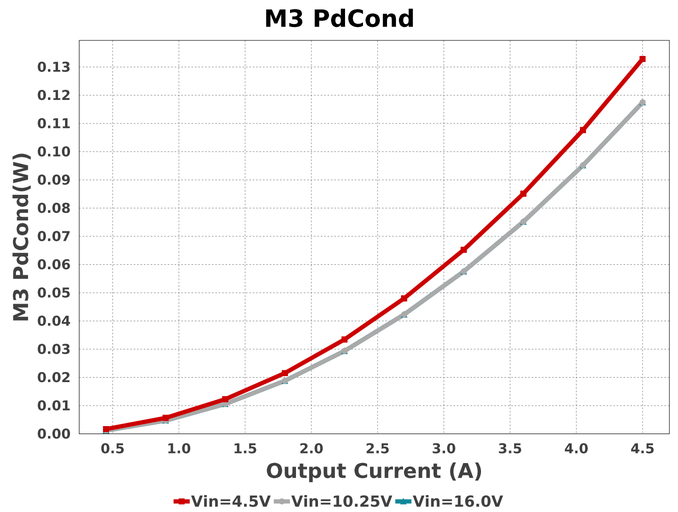

L Pd
L Pd(W)
0.400
0.375
0.350
0.325
0.300
0.275
0.250
0.225
0.200
0.175
0.150
0.125
0.100
0.075
0.050
0.025
0.000
0.5
1.0
1.5
2.0
2.5
3.0
3.5
4.0
4.5
Output Current (A)
Vin=4.5V
Vin=10.25V
Vin=16.0V

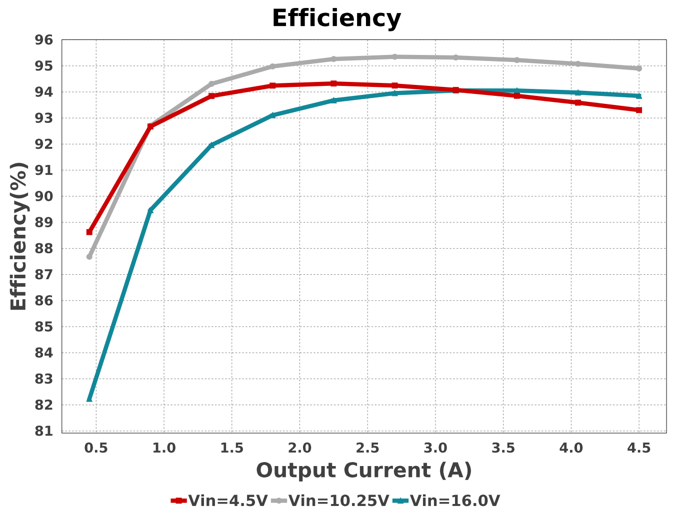

M1 PdCond
M1 PdCond(W)
0.17
0.16
0.15
0.14
0.13
0.12
0.11
0.10
0.09
0.08
0.07
0.06
0.05
0.04
0.03
0.02
0.01
0.00
0.5
1.0
1.5
2.0
2.5
3.0
3.5
4.0
4.5
Output Current (A)
Vin=4.5V
Vin=10.25V
Vin=16.0V

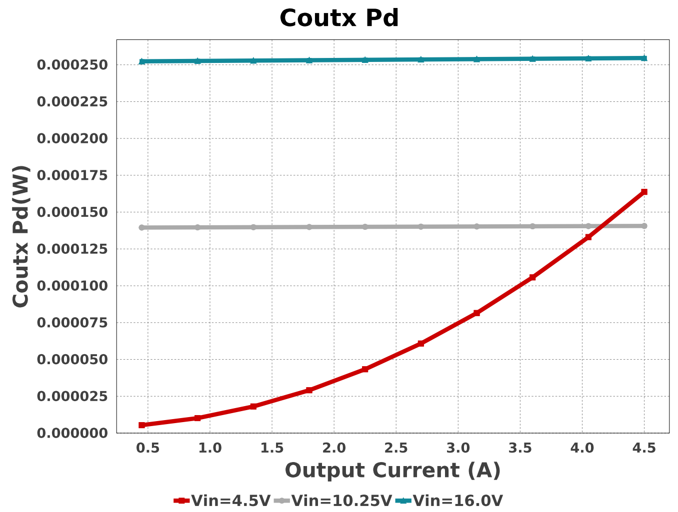

Duty Cycle
Duty Cycle(%)
50.0
47.5
45.0
42.5
40.0
37.5
35.0
32.5
30.0
27.5
25.0
22.5
20.0
17.5
15.0
12.5
10.0
7.5
0.5
1.0
1.5
2.0
2.5
3.0
3.5
4.0
4.5
Output Current (A)
Vin=4.5V
Vin=10.25V
Vin=16.0V

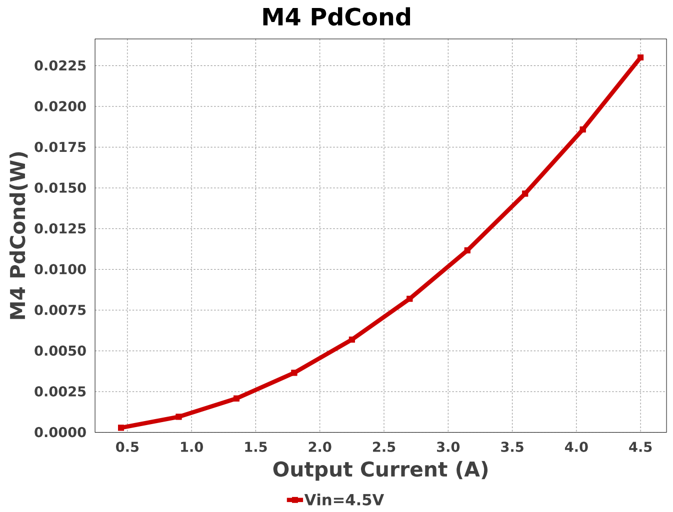

M4 Pd
M4 Pd(W)
0.325
0.300
0.275
0.250
0.225
0.200
0.175
0.150
0.125
0.100
0.075
0.050
0.025
0.000
0.5
1.0
1.5
2.0
2.5
3.0
3.5
4.0
4.5
Output Current (A)
Vin=4.5V
Vin=10.25V
Vin=16.0V

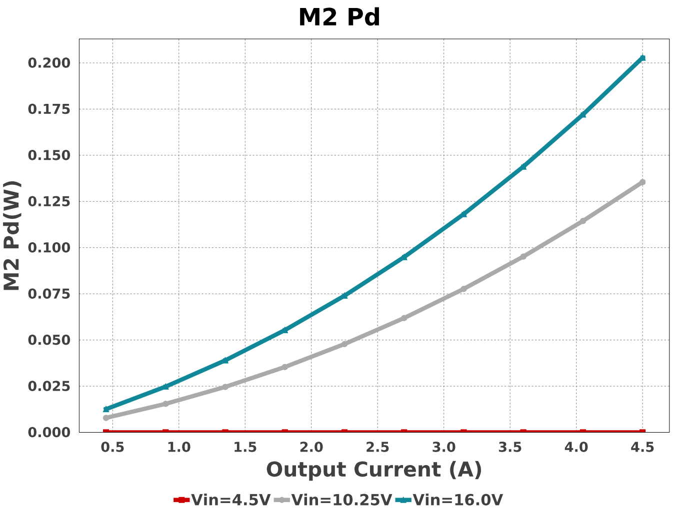

M2 PdCond
M2 PdCond(W)
0.00
0.01
0.02
0.03
0.04
0.05
0.06
0.07
0.08
0.09
0.10
0.11
0.12
0.5
1.0
1.5
2.0
2.5
3.0
3.5
4.0
4.5
Output Current (A)
Vin=4.5V
Vin=10.25V
Vin=16.0V

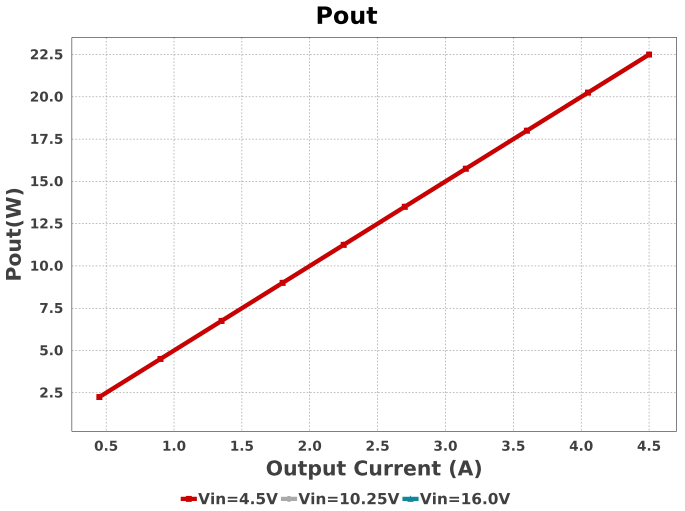

M3 PdCond
M3 PdCond(W)
0.00
0.01
0.02
0.03
0.04
0.05
0.06
0.07
0.08
0.09
0.10
0.11
0.12
0.13
0.5
1.0
1.5
2.0
2.5
3.0
3.5
4.0
4.5
Output Current (A)
Vin=4.5V
Vin=10.25V
Vin=16.0V

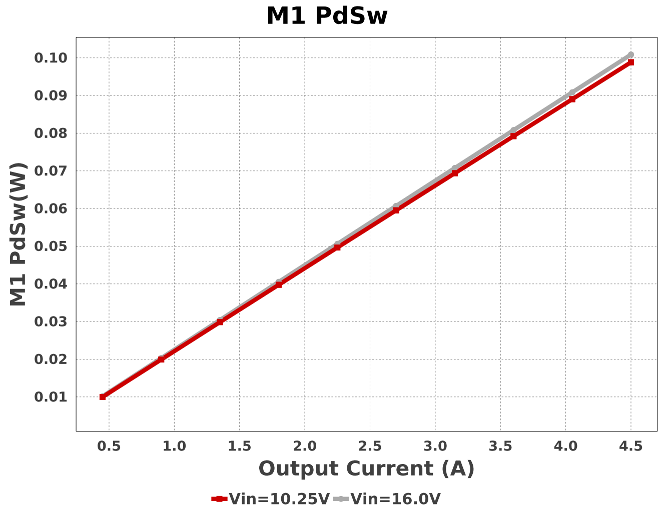

Efficiency
Efficiency(%)
81
82
83
84
85
86
87
88
89
90
91
92
93
94
95
96
0.5
1.0
1.5
2.0
2.5
3.0
3.5
4.0
4.5
Output Current (A)
Vin=4.5V
Vin=10.25V
Vin=16.0V

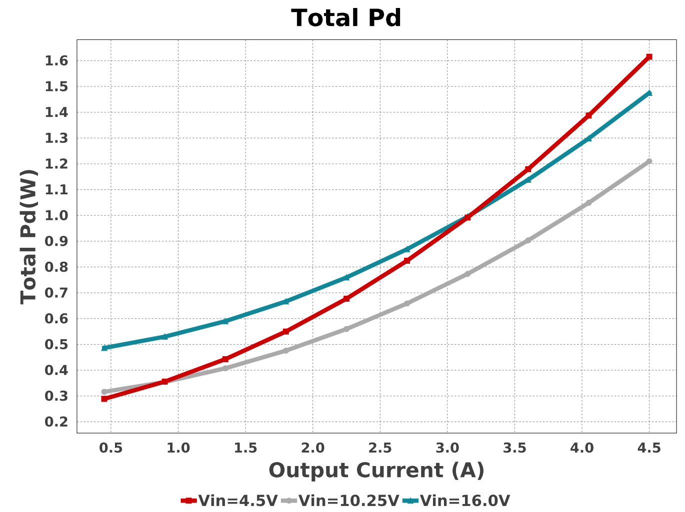

Coutx Pd
Coutx Pd(W)
0.000000
0.000025
0.000050
0.000075
0.000100
0.000125
0.000150
0.000175
0.000200
0.000225
0.000250
0.5
1.0
1.5
2.0
2.5
3.0
3.5
4.0
4.5
Output Current (A)
Vin=4.5V
Vin=10.25V
Vin=16.0V

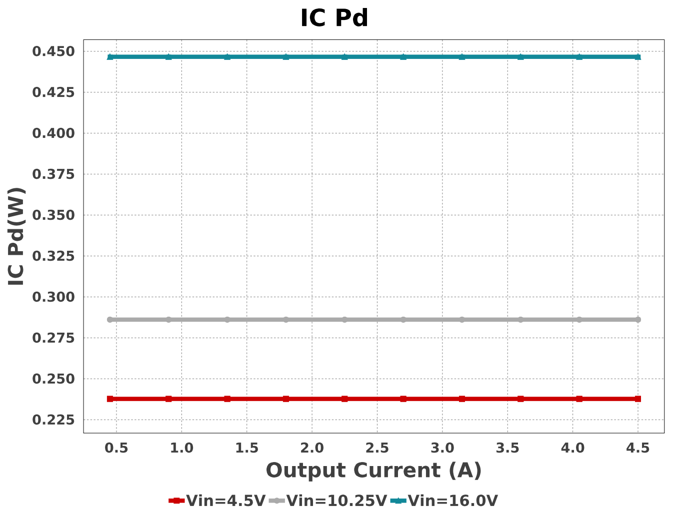

M4 PdCond
M4 PdCond(W)
0.0000
0.0025
0.0050
0.0075
0.0100
0.0125
0.0150
0.0175
0.0200
0.0225
0.5
1.0
1.5
2.0
2.5
3.0
3.5
4.0
4.5
Output Current (A)
Vin=4.5V

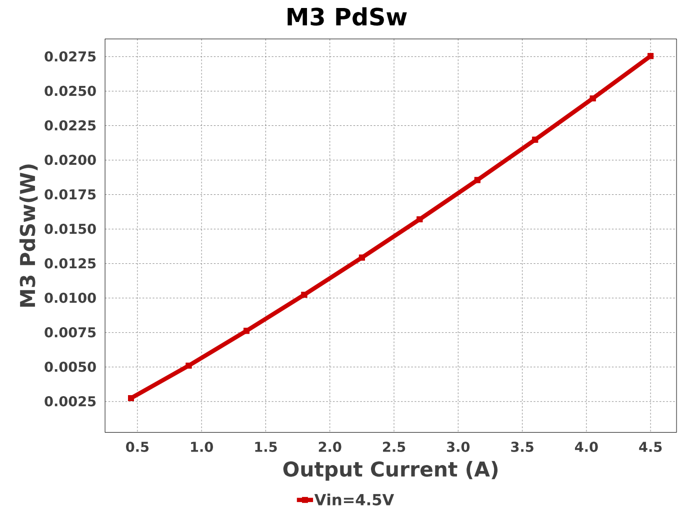

M2 Pd
M2 Pd(W)
0.000
0.025
0.050
0.075
0.100
0.125
0.150
0.175
0.200
0.5
1.0
1.5
2.0
2.5
3.0
3.5
4.0
4.5
Output Current (A)
Vin=4.5V
Vin=10.25V
Vin=16.0V

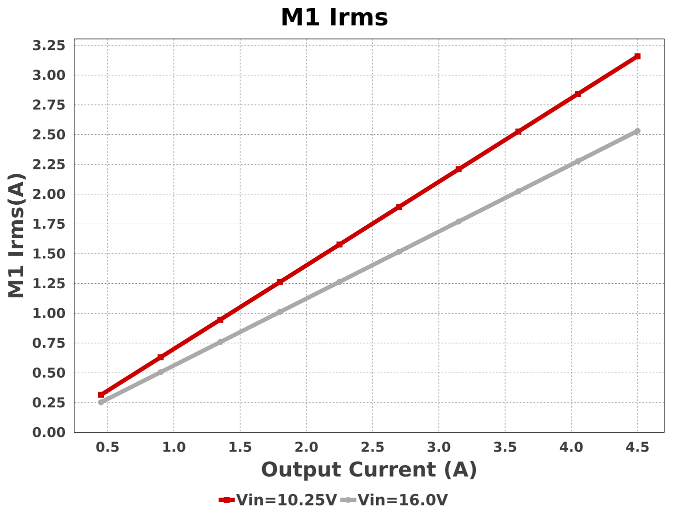

Pout
Pout(W)
Output Current (A)
Vin=4.5V Vin=10.25V Vin=16.0V

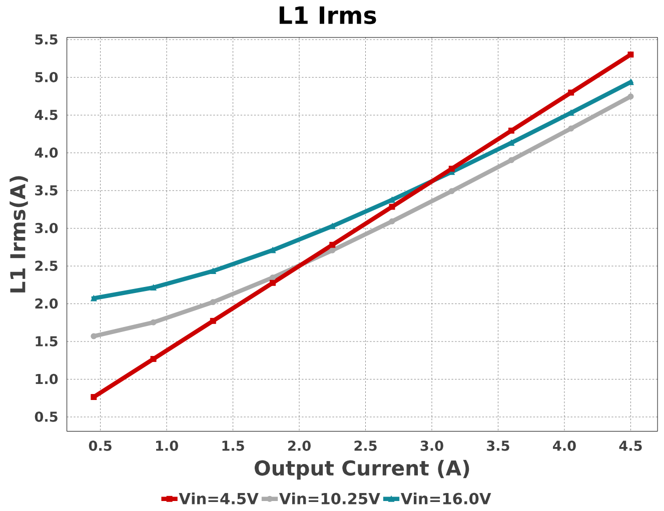

M1 PdSw
M1 PdSw(W)
Output Current (A)
Vin=10.25V Vin=16.0V

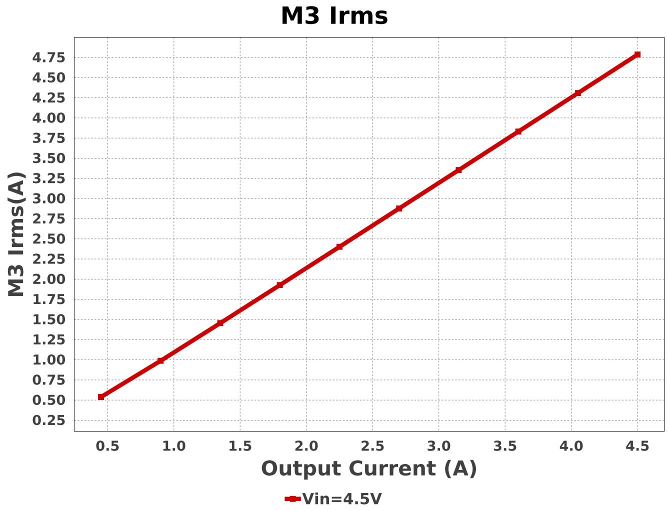

Total Pd
Total Pd(W)
Output Current (A)
Vin=4.5V Vin=10.25V Vin=16.0V

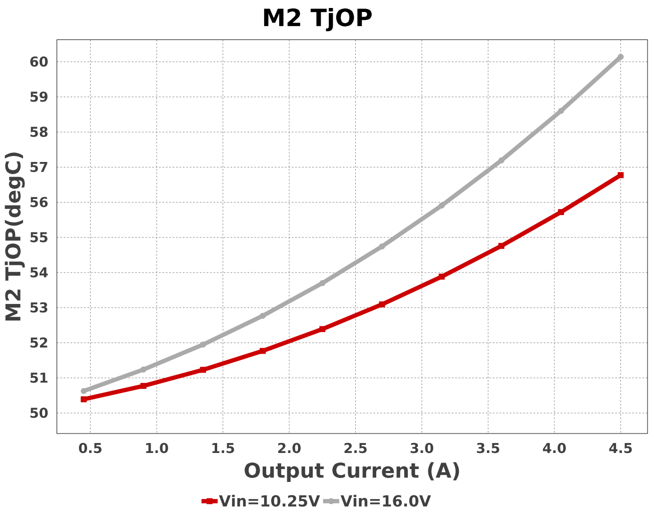

IC Pd
IC Pd(W)
Output Current (A)
Vin=4.5V Vin=10.25V Vin=16.0V

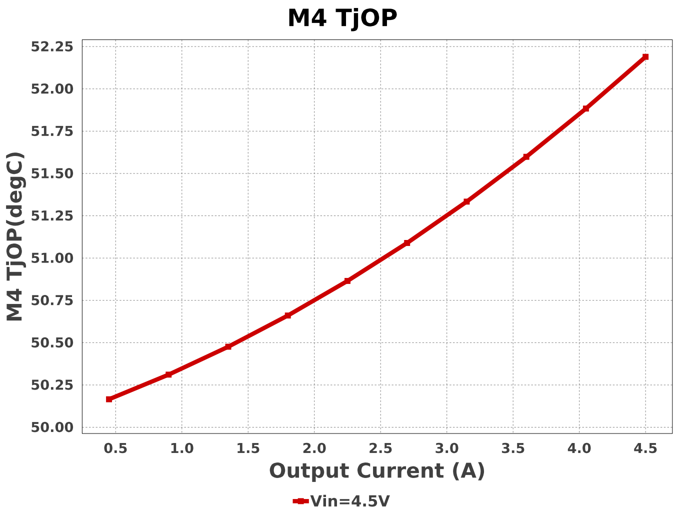

M3 PdSw
M3 PdSw(W)
Output Current (A)
Vin=4.5V

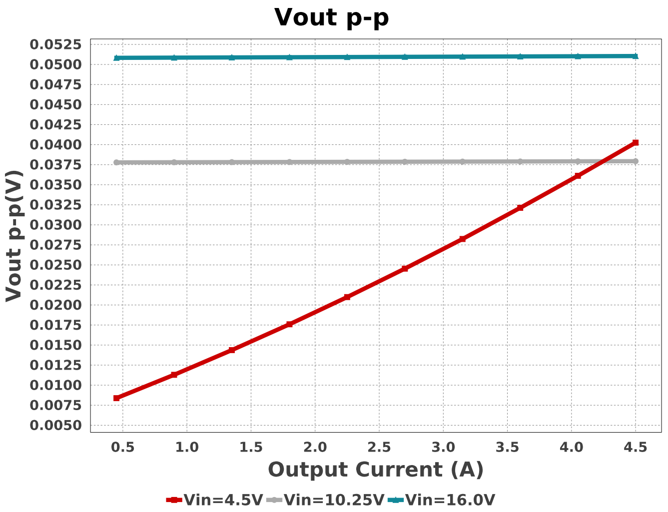

M1 Irms
M1 Irms(A)
Output Current (A)
Vin=10.25V Vin=16.0V

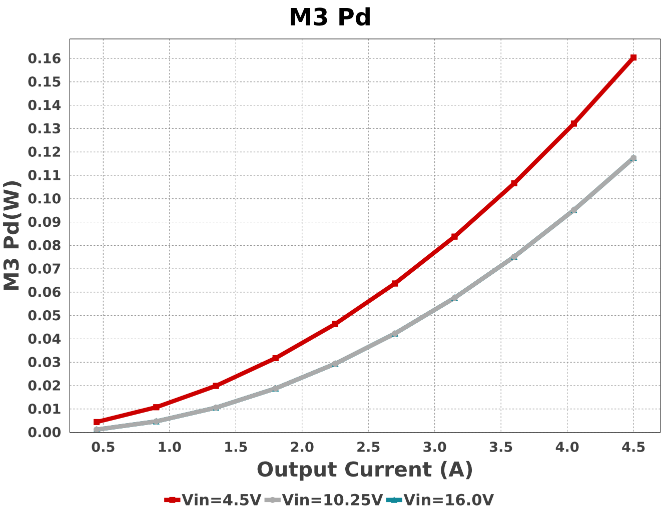

L1 Irms
L1 Irms(A)
Output Current (A)
Vin=4.5V
Vin=10.25V
Vin=16.0V

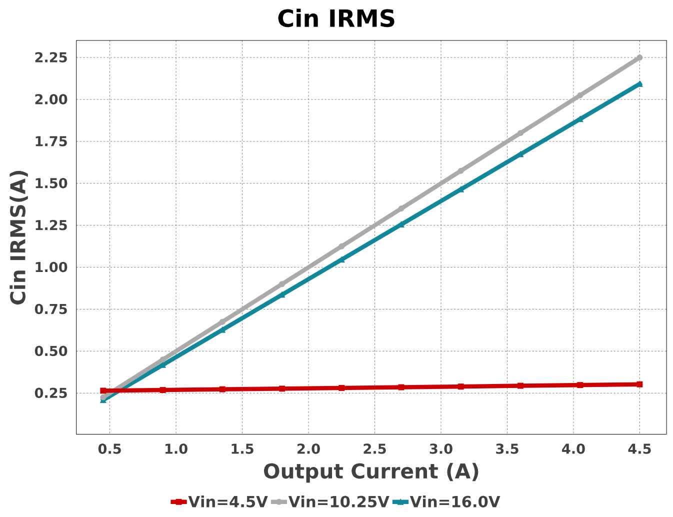

M3 Irms
M3 Irms(A)
Output Current (A)
Vin=4.5V

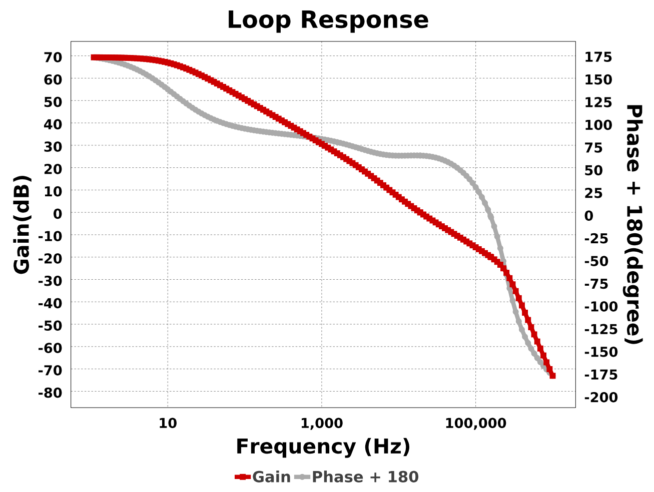

M2 TjOP
M2 TjOP(degC)
Output Current (A)
Vin=10.25V
Vin=16.0V


M4 TjOP
M4 TjOP(degC)
Output Current (A)
Vin=4.5V


Vout p-p
Vout p-p(V)
Output Current (A)
Vin=4.5V
Vin=10.25V
Vin=16.0V


M3 Pd
M3 Pd(W)
Output Current (A)
Vin=4.5V
Vin=10.25V
Vin=16.0V





Operating Values

#	Name	Value	Category	Description
1.	BOM Count	39		Total Design BOM count
2.	Total BOM	NA		Total BOM Cost
3.	Cin IRMS	2.093 A	Capacitor	Input capacitor RMS ripple current
4.	Cin Pd	4.38 mW	Capacitor	Input capacitor power dissipation
5.	Cout IRMS	1.77 A	Capacitor	Output capacitor RMS ripple current
6.	Cout Pd	9.516 mW	Capacitor	Output capacitor power dissipation
7.	Coutx IRMS	261.957 mA	Capacitor	Output capacitor_x RMS ripple current
8.	Coutx Pd	254.59 µW	Capacitor	Output capacitor_x power loss
9.	IC Pd	446.66 mW	IC	IC power dissipation
10.	IC Tj	63.623 degC	IC	IC junction temperature
11.	IC Tolerance	0.0 V	IC	IC Feedback Tolerance
12.	ICThetaJA	30.5 degC/W	IC	IC junction-to-ambient thermal resistance
13.	Iin Avg	1.499 A	IC	Average input current
14.	L Ipp	7.039 A	Inductor	Peak-to-peak inductor ripple current
15.	L Pd	346.78 mW	Inductor	Inductor power dissipation
16.	L1 Irms	4.938 A	Inductor	Inductor ripple current
17.	M1 Irms	2.531 A	Mosfet	MOSFET RMS ripple current
18.	M1 Pd	199.74 mW	Mosfet	MOSFET power dissipation
19.	M1 PdCond	39.464 mW	Mosfet	M1 MOSFET conduction losses
20.	M1 PdSw	160.27 mW	Mosfet	M1 MOSFET switching losses
21.	M1 Rdson	5.8 mOhm	Mosfet	Drain-Source On-resistance
22.	M1 ThetaJA	50.0 degC/W	Mosfet	MOSFET junction-to-ambient thermal resistance
23.	M1 TjOP	59.987 degC	Mosfet	MOSFET junction temperature
24.	M2 Irms	3.721 A	Mosfet	MOSFET RMS ripple current
25.	M2 Pd	157.7 mW	Mosfet	MOSFET power dissipation
26.	M2 PdCond	112.09 mW	Mosfet	M2 MOSFET conduction losses
27.	M2 PdSw	45.614 mW	Mosfet	M2 MOSFET switching losses
28.	M2 Rdson	7.9 mOhm	Mosfet	Drain-Source On-resistance
29.	M2 ThetaJA	50.0 degC/W	Mosfet	MOSFET junction-to-ambient thermal resistance
30.	M2 TjOP	57.885 degC	Mosfet	MOSFET junction temperature
31.	M3 Pd	117.45 mW	Mosfet	M3 MOSFET total power dissipation
32.	M3 PdCond	117.45 mW	Mosfet	M3 MOSFET conduction losses
33.	M4 Pd	100.0 pW	Mosfet	M4 MOSFET total power dissipation
34.	Cin Pd	4.38 mW	Power	Input capacitor power dissipation
35.	Cout Pd	9.516 mW	Power	Output capacitor power dissipation
36.	Coutx Pd	254.59 µW	Power	Output capacitor_x power loss
37.	IC Pd	446.66 mW	Power	IC power dissipation
38.	L Pd	346.78 mW	Power	Inductor power dissipation
39.	M1 Pd	199.74 mW	Power	MOSFET power dissipation
40.	M1 PdCond	39.464 mW	Power	M1 MOSFET conduction losses
41.	M1 PdSw	160.27 mW	Power	M1 MOSFET switching losses
42.	M2 Pd	157.7 mW	Power	MOSFET power dissipation
43.	M2 PdCond	112.09 mW	Power	M2 MOSFET conduction losses
44.	M2 PdSw	45.614 mW	Power	M2 MOSFET switching losses
45.	M3 Pd	117.45 mW	Power	M3 MOSFET total power dissipation
46.	M3 PdCond	117.45 mW	Power	M3 MOSFET conduction losses
47.	M4 Pd	100.0 pW	Power	M4 MOSFET total power dissipation
48.	Rsense Pd	207.65 mW	Power	LED Current Rsns Power Dissipation
49.	Total Pd	1.49 W	Power	Total Power Dissipation
50.	Rsense Pd	207.65 mW	Resistor	LED Current Rsns Power Dissipation
51.	Cross Freq	18.989 kHz	System Information	Bode plot crossover frequency

#	Name	Value	Category	Description
52.	Duty Cycle	31.637 %	System Information	Duty cycle
53.	Efficiency	93.789 %	System Information	Steady state efficiency
54.	FootPrint	657.0 mm^2	System Information	Total Foot Print Area of BOM components
55.	Frequency	494.364 kHz	System Information	Switching frequency
56.	Gain Marg	-19.846 dB	System Information	Bode Plot Gain Margin
57.	Iout	4.5 A	System Information	Iout operating point
58.	Low Freq Gain	69.317 dB	System Information	Gain at 1Hz
59.	Mode	CCM	System Information	Conduction Mode
60.	Operating Topology	Buck	System Information	The current operating topology of the device
61.	Phase Marg	66.458 deg	System Information	Bode Plot Phase Margin
62.	Pout	22.5 W	System Information	Total output power
63.	SW Ipk	0.0 A	System Information	Peak switch current
64.	Vin	16.0 V	System Information	Vin operating point
65.	Vout	5.0 V	System Information	Operational Output Voltage
66.	Vout Actual	5.0 V	System Information	Vout Actual calculated based on selected voltage divider resistors
67.	Vout Tolerance	1.697 %	System Information	Vout Tolerance based on IC Tolerance (no load) and voltage divider resistors if applicable
68.	Vout p-p	51.053 mV	System Information	Peak-to-peak output ripple voltage

Design Inputs

Name	Value	Description
Iout	4.5	Maximum Output Current
SoftStart	2.0 ms	Soft Start Time (ms)
VinMax	16.0	Maximum input voltage
VinMin	4.5	Minimum input voltage
Vout	5.0	Output Voltage
base_pn	LM5176	Base Product Number
source	DC	Input Source Type
Ta	50.0	Ambient temperature
UserFsw	500.0 k	Customer Selected Frequency

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

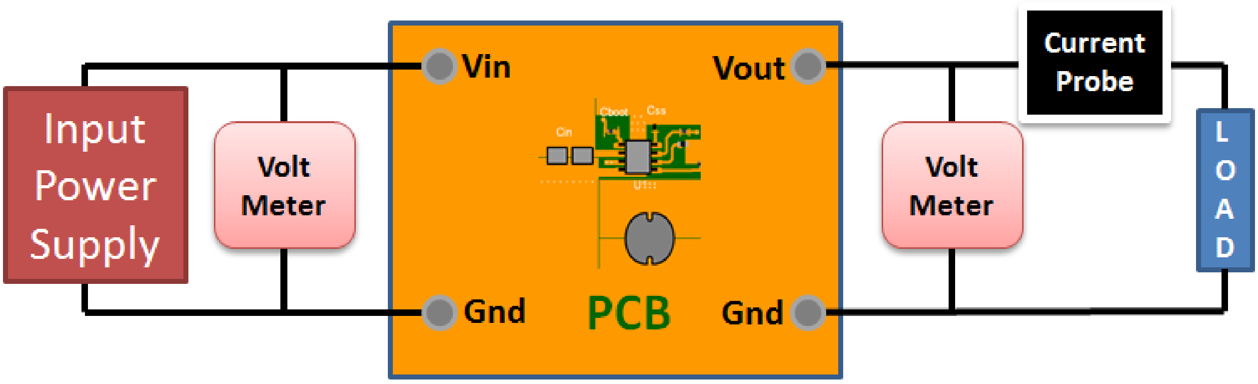
If board assembly is done in house it is best to tack down one terminal of a component on the board then solder the other terminal. For surface mount parts with large tabs, such as the DPAK, the tab on the back of the package should be pre-tinned with solder, then tacked into place by one of the pins. 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 4.5V 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. Tip: Snubbers and/or gate resistors may be required to limit the SW1,2 node switching spikes below the IC and FET abs max ratings.

2. Tip: Slope Capacitor: smaller slope capacitors provide better transition region behavior.

3. Master key : F9884934EAC7C183[v1]

4. **LM5176** Product Folder : http://www.ti.com/product/LM5176 : contains the data sheet and other resources.

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