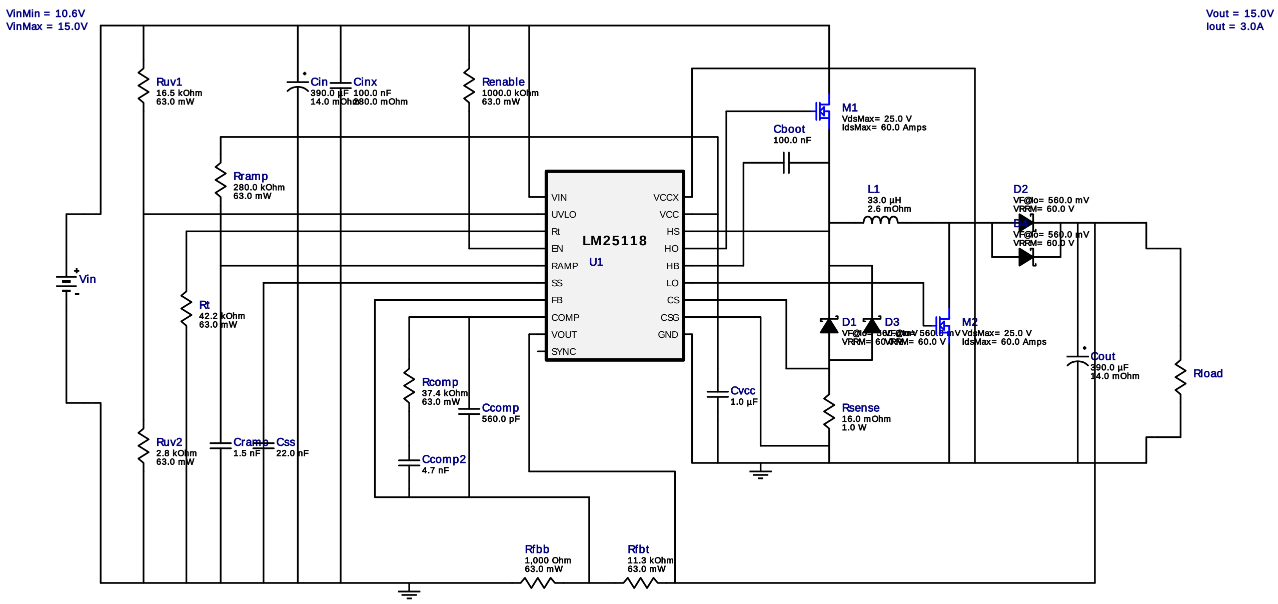
TEXAS INSTRUMENTS

WEBENCH ® Design Report

VinMin = 10.6V
VinMax = 15.0V
Vout = 15.0V
Iout = 3.0A

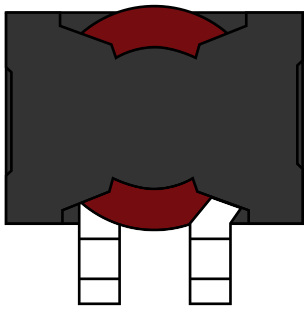
Device = LM25118MH/NOPB
Topology = Buck_Boost
Created = 7/23/14 6:07:24 PM
BOM Cost = $9.64
Footprint = 1,526.0mm2
BOM Count = 26
Total Pd = 3.15W

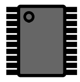
Design : 1175773/528 LM25118MH/NOPB
LM25118MH/NOPB 10.6V-15.0V to 15.0V @ 3.0A

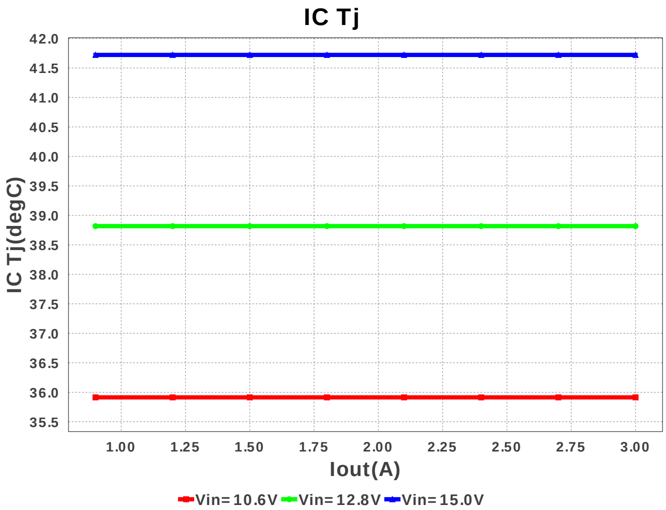


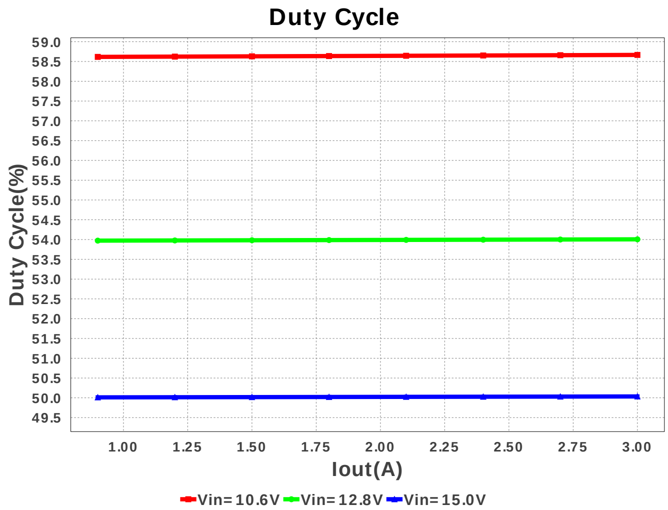
Electrical BOM

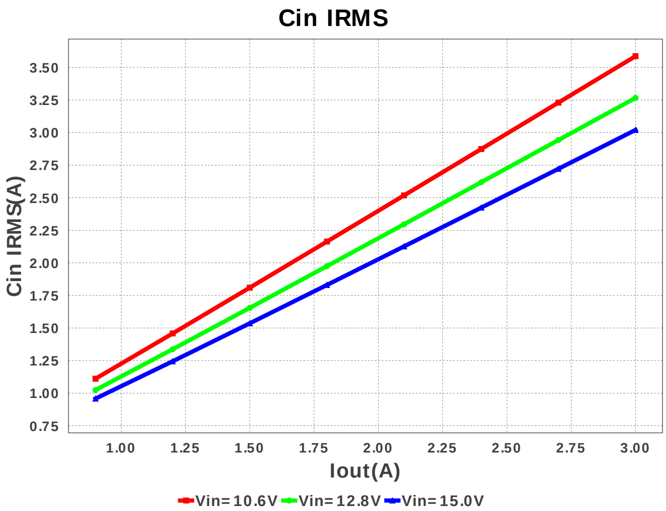
#	Name	Manufacturer	Part Number	Properties	Qty	Price	Footprint
1.	Cboot	Yageo America	CC0805KRX7R9BB104 Series= X7R	Cap= 100.0 nF VDC= 50.0 V IRMS= 0.0 A	1	$0.01	0805 7mm2
2.	Ccomp	Yageo America	CC0805KRX7R9BB561 Series= X7R	Cap= 560.0 pF VDC= 50.0 V IRMS= 0.0 A	1	$0.01	0805 7mm2
3.	Ccomp2	Yageo America	CC0805KRX7R9BB472 Series= X7R	Cap= 4.7 nF VDC= 50.0 V IRMS= 0.0 A	1	$0.01	0805 7mm2
4.	Cin	Panasonic	20SVPF390M Series= 1273	Cap= 390.0 µF ESR= 14.0 mOhm VDC= 20.0 V IRMS= 4.95 A	1	$0.63	CAPSMT_62_E12 106mm2
5.	Cinx	AVX	08053C104KAT2A Series= X7R	Cap= 100.0 nF ESR= 280.0 mOhm VDC= 25.0 V IRMS= 0.0 A	1	$0.01	0805 7mm2
6.	Cout	Panasonic	20SVPF390M Series= 1273	Cap= 390.0 µF ESR= 14.0 mOhm VDC= 20.0 V IRMS= 4.95 A	1	$0.63	CAPSMT_62_E12 106mm2
7.	Cramp	Yageo America	CC0805KRX7R9BB152 Series= X7R	Cap= 1.5 nF VDC= 50.0 V IRMS= 0.0 A	1	$0.01	0805 7mm2
8.	Css	Yageo America	CC0805KRX7R9BB223 Series= X7R	Cap= 22.0 nF VDC= 50.0 V IRMS= 0.0 A	1	$0.01	0805 7mm2
9.	Cvcc	MuRata	GRM155R61A105KE15D Series= X5R	Cap= 1.0 µF VDC= 10.0 V IRMS= 0.0 A	1	$0.01	0402 3mm2

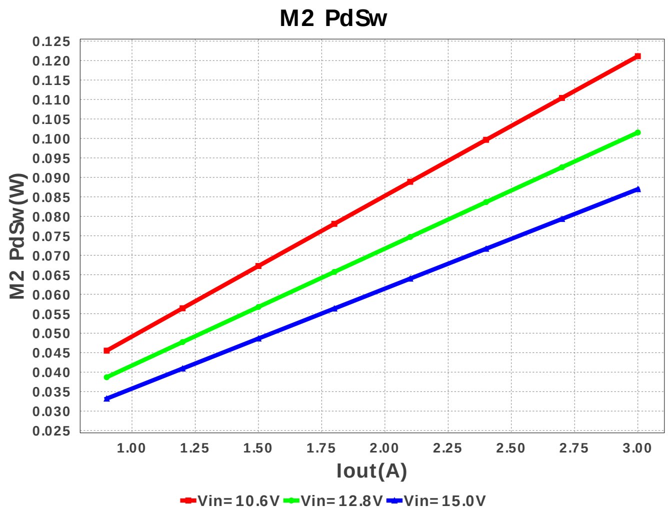
#	Name	Manufacturer	Part Number	Properties	Qty	Price	Footprint
10.	D1	Diodes Inc.	PDS760-13	VF@Io= 560.0 mV VRRM= 60.0 V	1	$0.60	 PowerDI5 50mm2
11.	D2	Diodes Inc.	PDS760-13	VF@Io= 560.0 mV VRRM= 60.0 V	1	$0.60	 PowerDI5 50mm2
12.	D3	Diodes Inc.	PDS760-13	VF@Io= 560.0 mV VRRM= 60.0 V	1	$0.60	 PowerDI5 50mm2
13.	D4	Diodes Inc.	PDS760-13	VF@Io= 560.0 mV VRRM= 60.0 V	1	$0.60	 PowerDI5 50mm2
14.	L1	Coilcraft	SER2918H-333KL	L= 33.0 µH DCR= 2.6 mOhm	1	$2.40	 SER2918 895mm2
15.	M1	Texas Instruments	CSD16327Q3	VdsMax= 25.0 V IdsMax= 60.0 Amps	1	$0.44	 TRANS_NexFET_Q3 19mm2
16.	M2	Texas Instruments	CSD16327Q3	VdsMax= 25.0 V IdsMax= 60.0 Amps	1	$0.44	 TRANS_NexFET_Q3 19mm2
17.	Rcomp	Vishay-Dale	CRCW040237K4FKED Series= CRCW..e3	Res= 37.4 kOhm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	0402 3mm2
18.	Renable	Vishay-Dale	CRCW04021M00FKED Series= CRCW..e3	Res= 1000.0 kOhm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	0402 3mm2
19.	Rfbb	Vishay-Dale	CRCW04021K00FKED Series= CRCW..e3	Res= 1,000 Ohm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	0402 3mm2
20.	Rfbt	Vishay-Dale	CRCW040211K3FKED Series= CRCW..e3	Res= 11.3 kOhm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	0402 3mm2
21.	Rramp	Vishay-Dale	CRCW0402280KFKED Series= CRCW..e3	Res= 280.0 kOhm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	0402 3mm2
22.	Rsense	Panasonic	ERJ-M1WSF16MU Series= 1119	Res= 16.0 mOhm Power= 1.0 W Tolerance= 1.0%	1	$0.15	 2512 43mm2
23.	Rt	Vishay-Dale	CRCW040242K2FKED Series= CRCW..e3	Res= 42.2 kOhm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	0402 3mm2
24.	Ruv1	Vishay-Dale	CRCW040216K5FKED Series= CRCW..e3	Res= 16.5 kOhm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	0402 3mm2
25.	Ruv2	Vishay-Dale	CRCW04022K80FKED Series= CRCW..e3	Res= 2.8 kOhm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	0402 3mm2

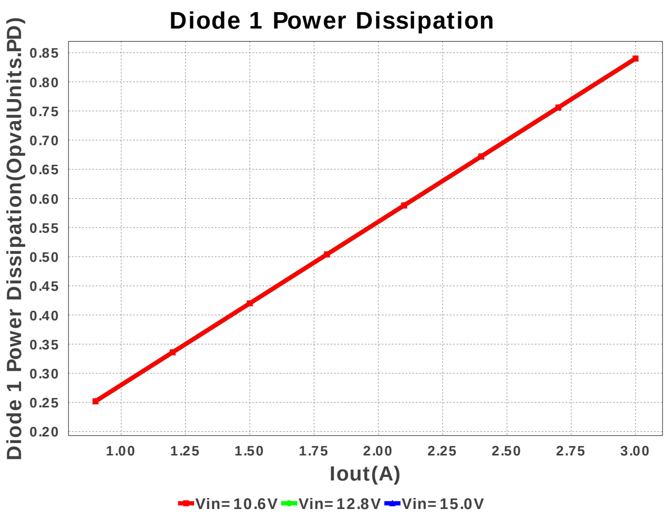
#	Name	Manufacturer	Part Number	Properties	Qty	Price	Footprint
26.	U1	Texas Instruments	LM25118MH/NOPB	Switcher	1	$2.40	 MXA20A 71mm2

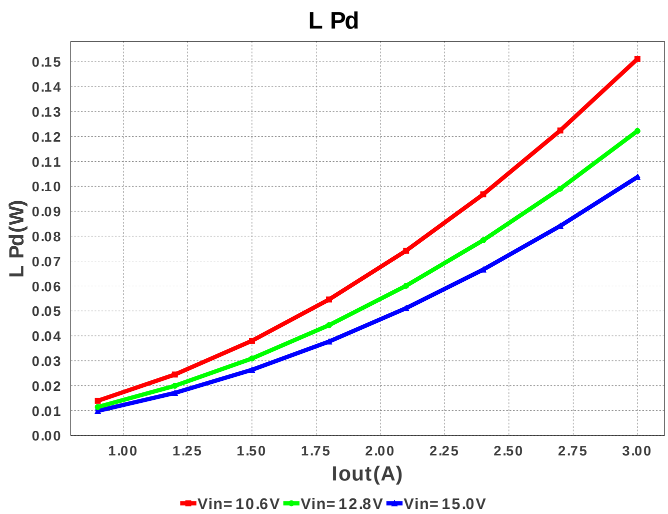


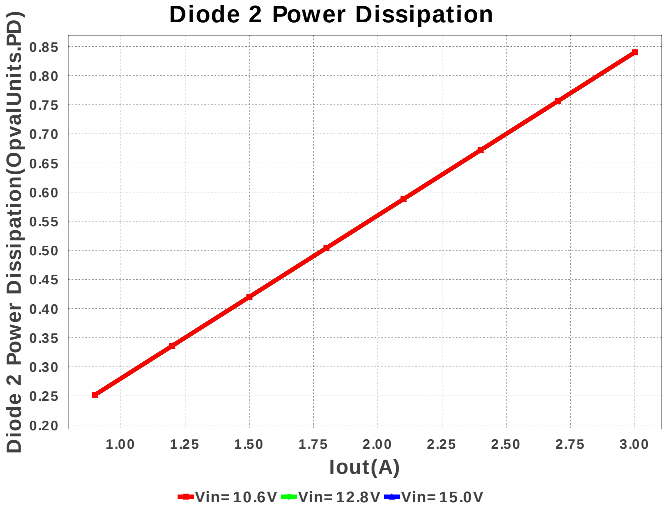


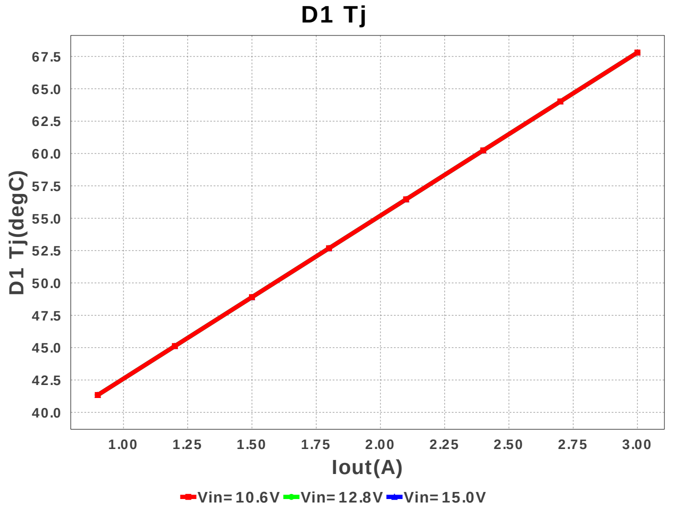


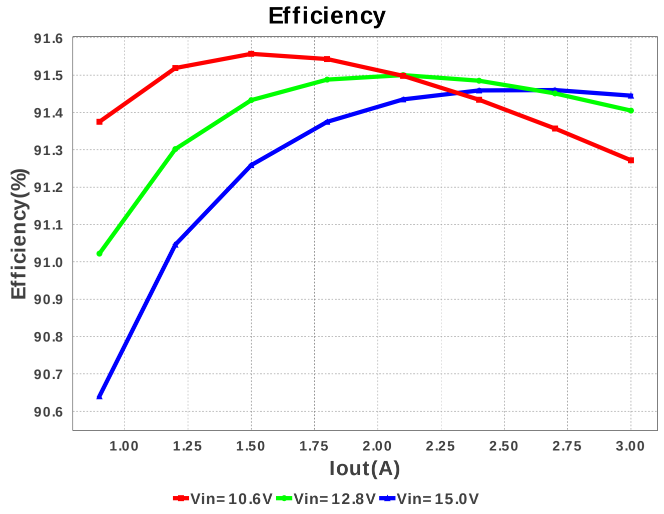


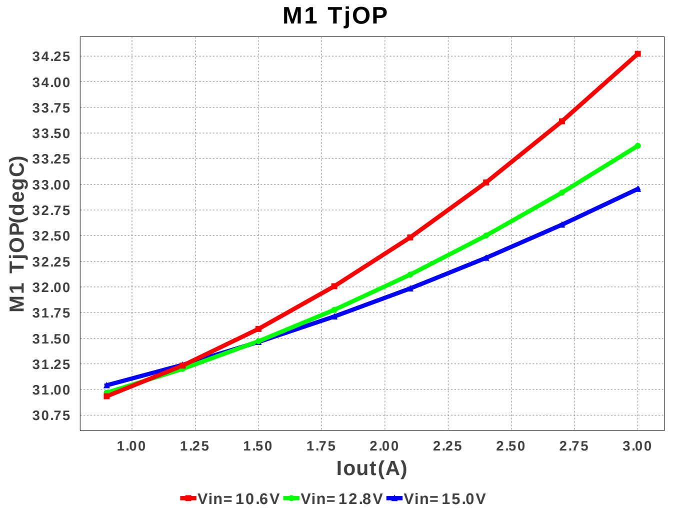


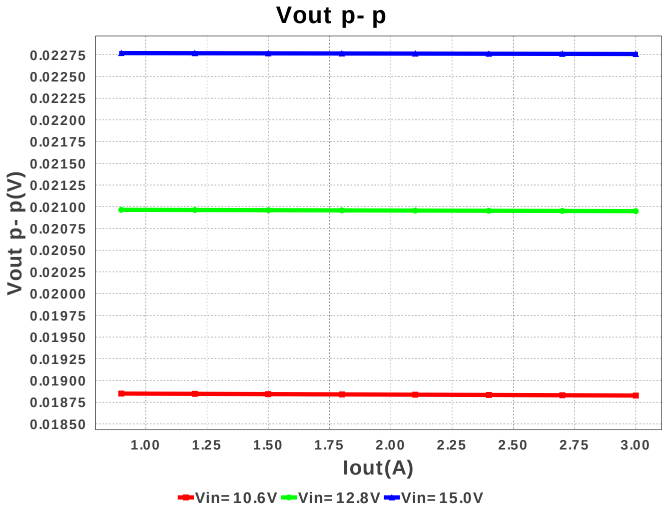


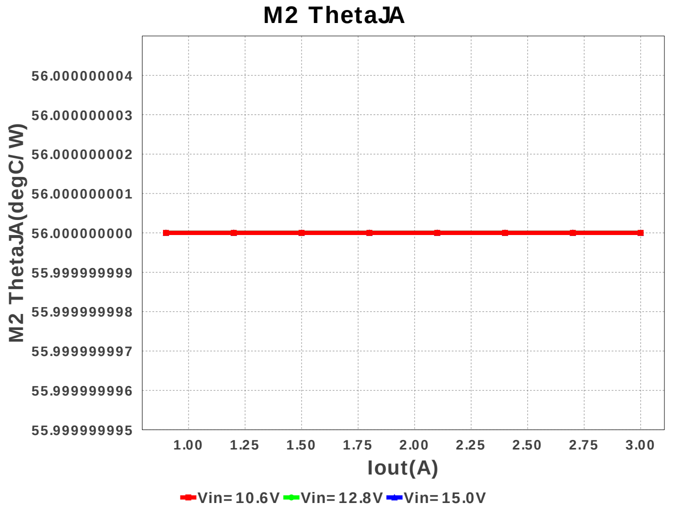

Diode 2 Power Dissipation
Diode 2 Power Dissipation(OpvalUnits.PD)
Iout(A)
Vin=10.6V Vin=12.8V Vin=15.0V

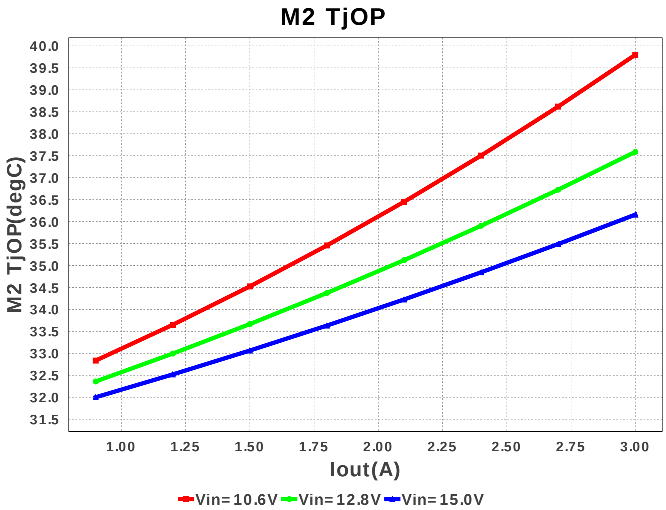

D1 Tj
D1 Tj(degC)
Iout(A)
Vin=10.6V Vin=12.8V Vin=15.0V

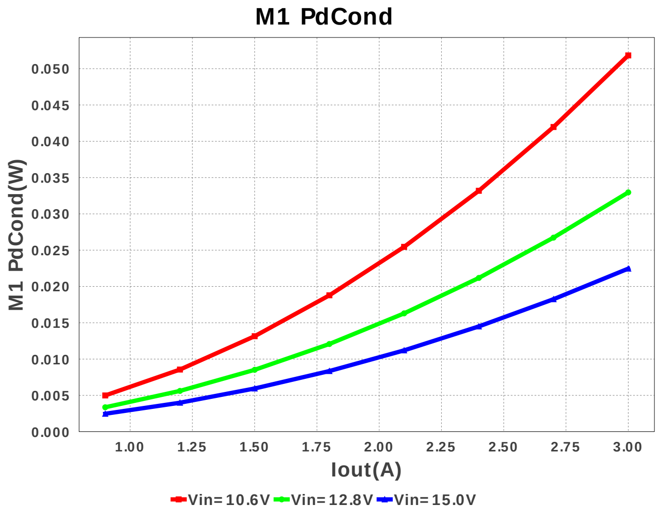

Efficiency
Efficiency(%)
Iout(A)
Vin=10.6V Vin=12.8V Vin=15.0V

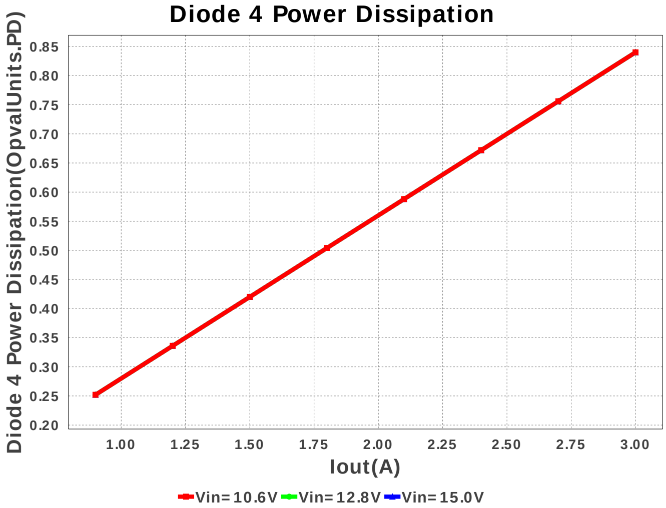

M1 TjOP
M1 TjOP(degC)
Iout(A)
Vin=10.6V Vin=12.8V Vin=15.0V

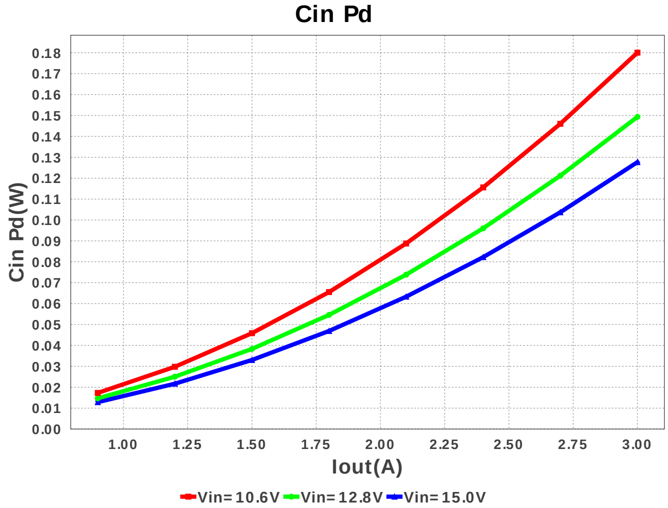

Vout p- p
Vout p- p(V)
Iout(A)
Vin=10.6V Vin=12.8V Vin=15.0V

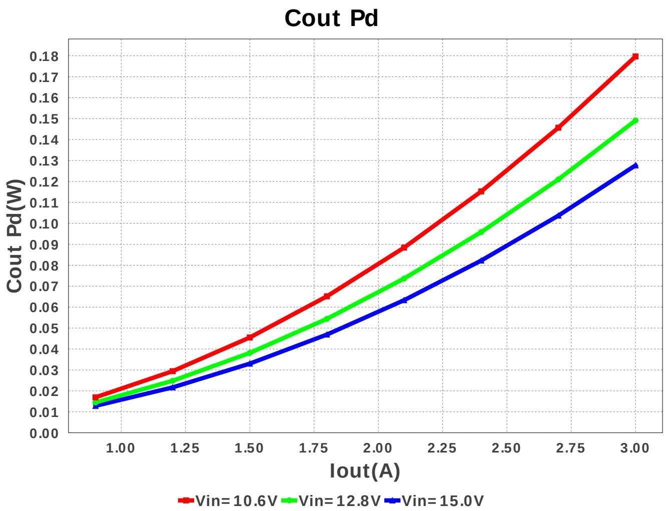

M2 ThetaJA
M2 ThetaJA(degC/ W)
Iout(A)
Vin=10.6V Vin=12.8V Vin=15.0V

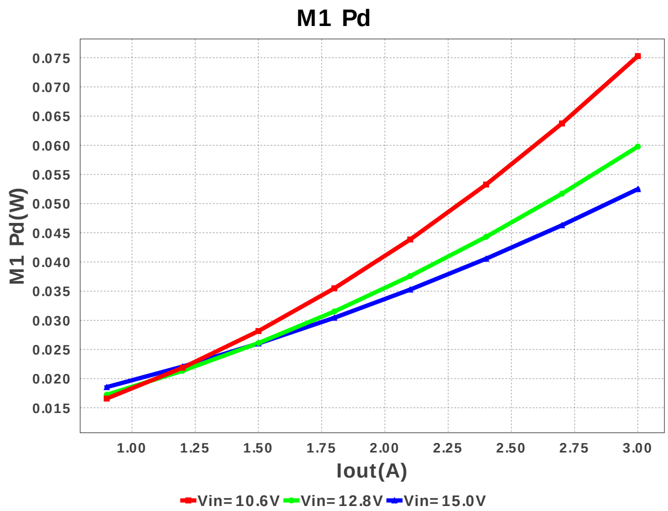

M2 TjOP
M2 TjOP(degC)
Iout(A)
Vin=10.6V Vin=12.8V Vin=15.0V

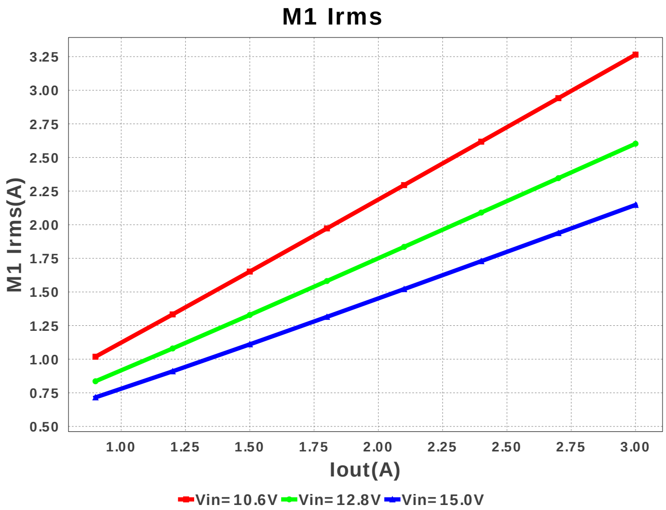

M1 PdCond
M1 PdCond(W)
Iout(A)
Vin=10.6V Vin=12.8V Vin=15.0V

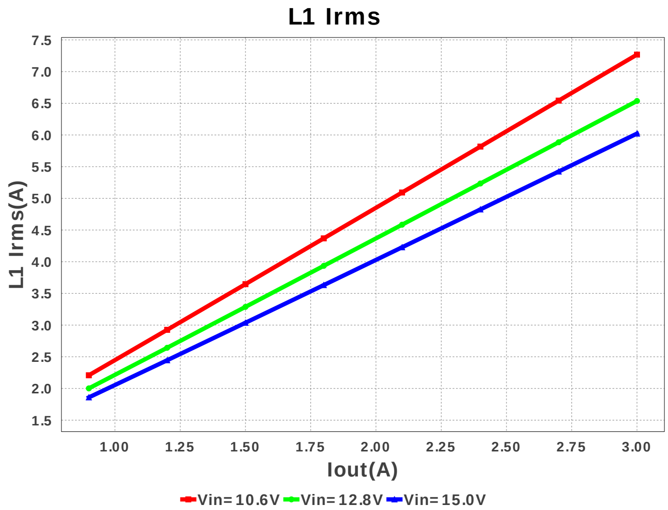

Diode 4 Power Dissipation
Diode 4 Power Dissipation(OpvalUnits.PD)
Iout(A)
Vin=10.6V Vin=12.8V Vin=15.0V

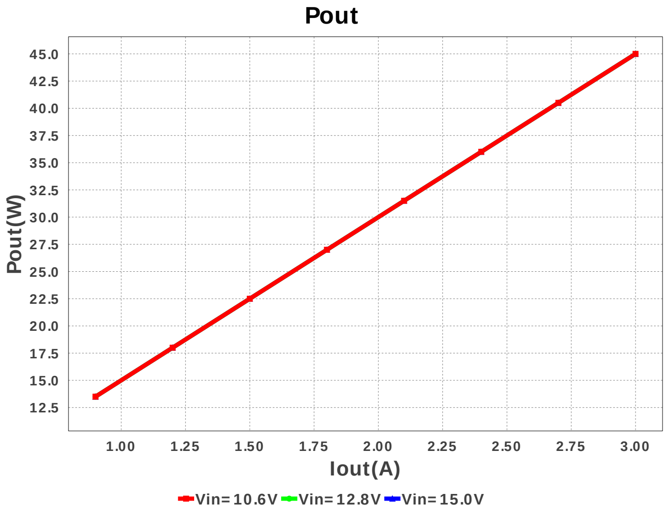

Cin Pd
Cin Pd(W)
Iout(A)
Vin=10.6V Vin=12.8V Vin=15.0V

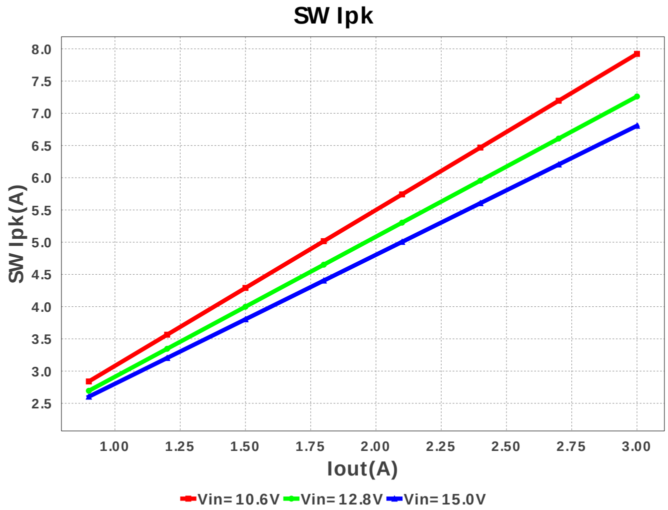

Cout Pd
Cout Pd(W)
Iout(A)
Vin=10.6V Vin=12.8V Vin=15.0V

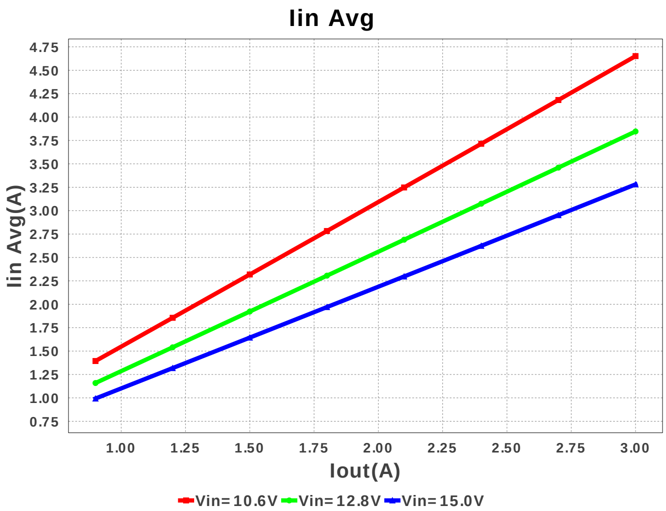

M1 Pd
M1 Pd(W)
Iout(A)
Vin=10.6V Vin=12.8V Vin=15.0V

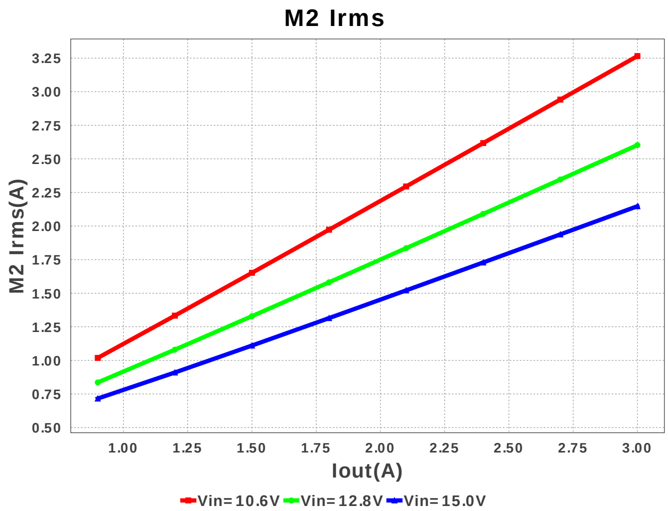

M1 Irms
M1 Irms(A)
Iout(A)
Vin=10.6V Vin=12.8V Vin=15.0V

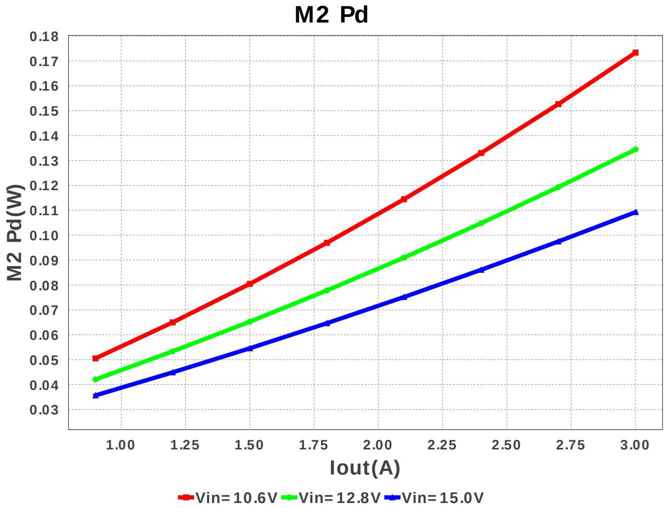

L1 Irms
L1 Irms(A)
Iout(A)
Vin=10.6V Vin=12.8V Vin=15.0V

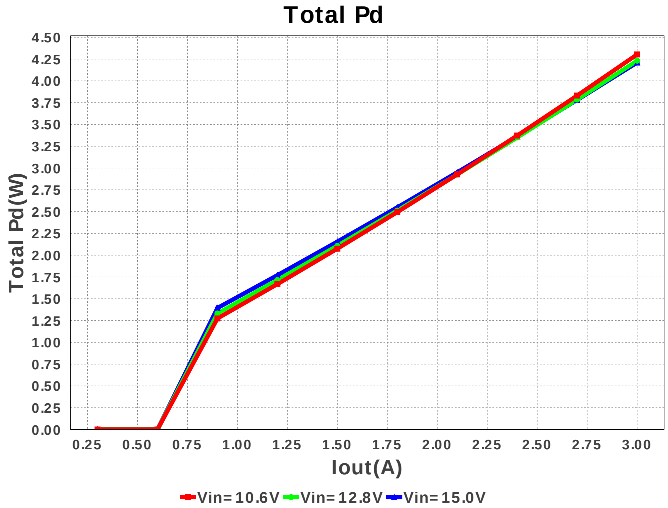

Pout
Pout(W)
Iout(A)
Vin=10.6V Vin=12.8V Vin=15.0V

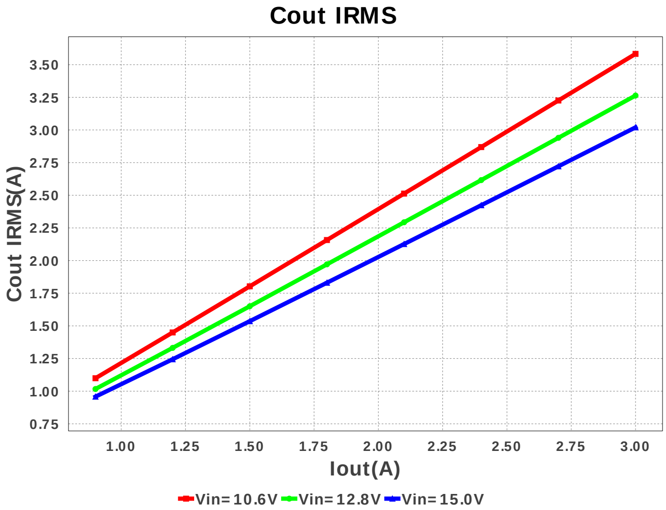

SW Ipk
SW Ipk(A)
Iout(A)
Vin=10.6V Vin=12.8V Vin=15.0V

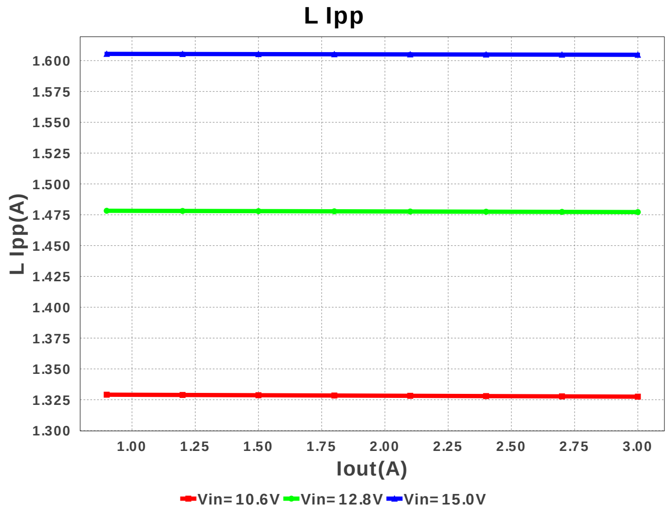

Iin Avg
Iin Avg(A)
Iout(A)
Vin=10.6V Vin=12.8V Vin=15.0V

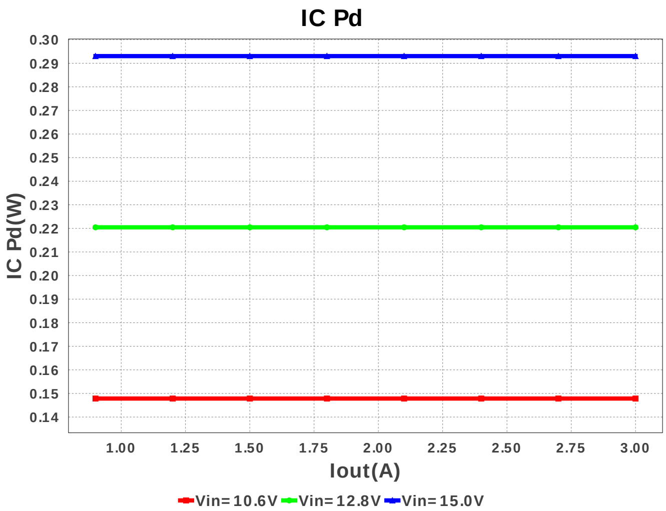

M2 Irms
M2 Irms(A)
Iout(A)
Vin=10.6V Vin=12.8V Vin=15.0V

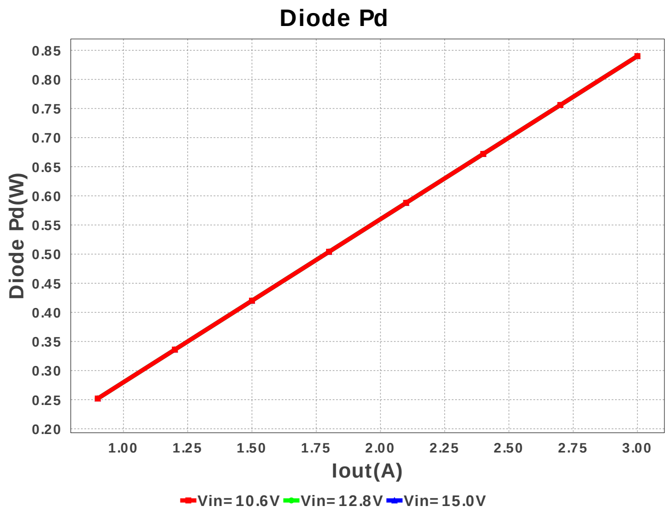

M2 Pd
M2 Pd(W)
Iout(A)
Vin=10.6V
Vin=12.8V
Vin=15.0V

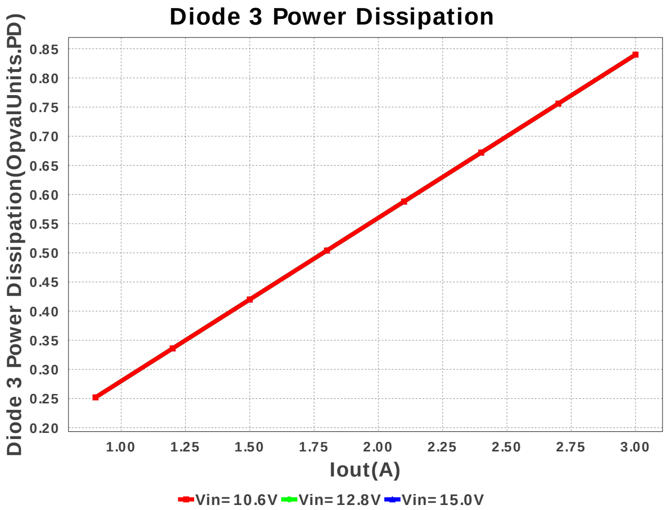

Total Pd
Total Pd(W)
Iout(A)
Vin=10.6V
Vin=12.8V
Vin=15.0V

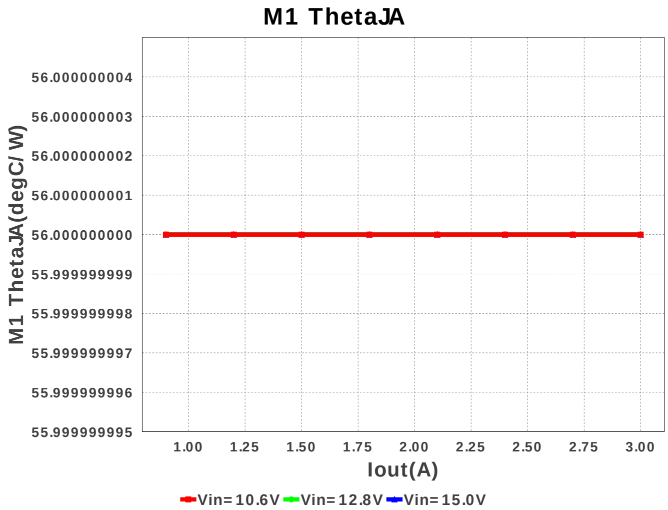

Cout IRMS
Cout IRMS(A)
Iout(A)
Vin=10.6V
Vin=12.8V
Vin=15.0V

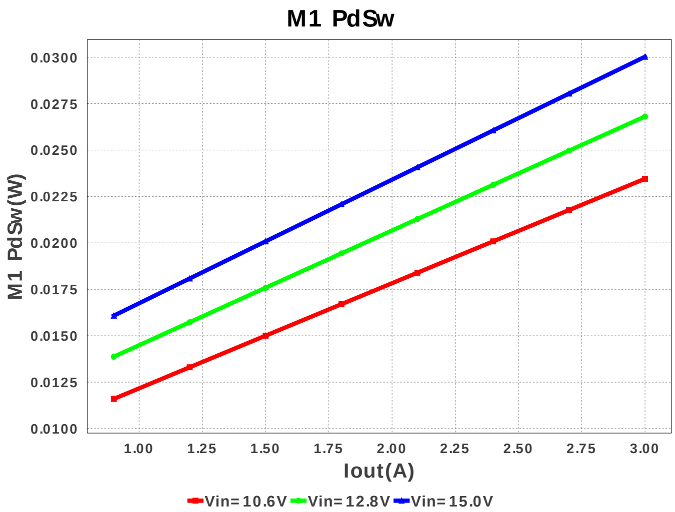

L Ipp
L Ipp(A)
Iout(A)
Vin=10.6V
Vin=12.8V
Vin=15.0V

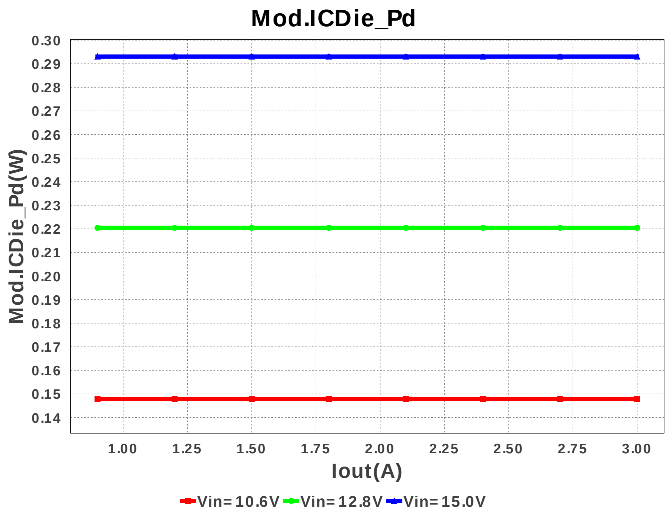

IC Pd
IC Pd(W)
Iout(A)
Vin=10.6V
Vin=12.8V
Vin=15.0V

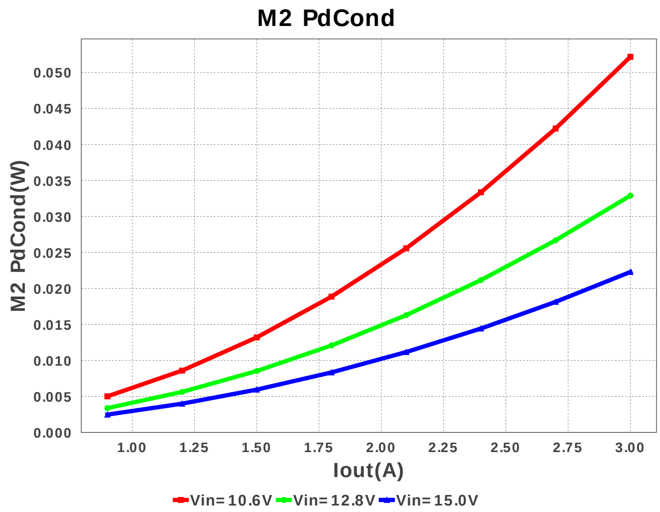

Diode Pd
Diode Pd(W)
Iout(A)
Vin=10.6V
Vin=12.8V
Vin=15.0V

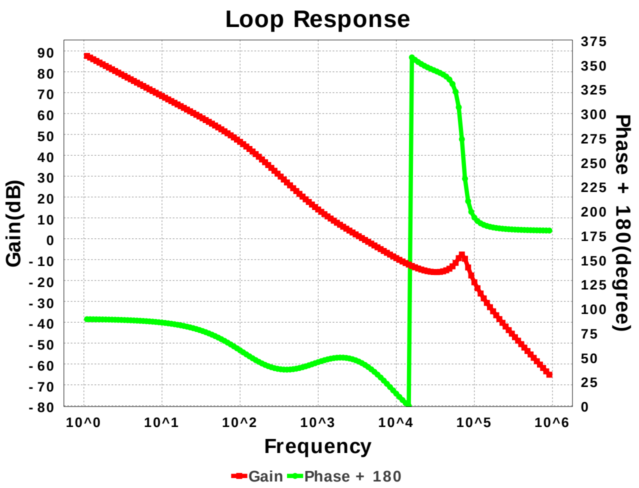












Operating Values

#	Name	Value	Category	Description
1.	Cin IRMS	3.586 A	Current	Input capacitor RMS ripple current
2.	Cout IRMS	3.583 A	Current	Output capacitor RMS ripple current
3.	Iin Avg	3.297 A	Current	Average input current
4.	L Ipp	1.326 A	Current	Peak-to-peak inductor ripple current
5.	L1 Irms	7.268 A	Current	Inductor ripple current
6.	M1 Irms	3.265 A	Current	MOSFET RMS ripple current
7.	M2 Irms	3.265 A	Current	MOSFET RMS ripple current
8.	SW Ipk	7.921 A	Current	Peak switch current
9.	BOM Count	26	General	Total Design BOM count
10.	FootPrint	1.526 kmm2	General	Total Foot Print Area of BOM components
11.	Frequency	141.667 kHz	General	Switching frequency

#	Name	Value	Category	Description
12.	IC Tolerance	18.0 mV	General	IC Feedback Tolerance
13.	M1 ThetaJA	56.0 degC/W	General	MOSFET junction-to-ambient thermal resistance
14.	M2 ThetaJA	56.0 degC/W	General	MOSFET junction-to-ambient thermal resistance
15.	Pout	45.0 W	General	Total output power
16.	Total BOM	$9.64	General	Total BOM Cost
17.	D1 Tj	67.8 degC	Op_Point	D1 junction temperature
18.	Vout OP	15.0 V	Op_Point	Operational Output Voltage
19.	Cross Freq	3.36 kHz	Op_point	Bode plot crossover frequency
20.	Duty Cycle	58.668 %	Op_point	Duty cycle
21.	Efficiency	90.996 %	Op_point	Steady state efficiency
22.	IC Tj	41.722 degC	Op_point	IC junction temperature
23.	ICThetaJA	40.0 degC/W	Op_point	IC junction-to-ambient thermal resistance
24.	IOUT_OP	3.0 A	Op_point	Iout operating point
25.	M1 TjOP	34.273 degC	Op_point	MOSFET junction temperature
26.	M2 TjOP	39.804 degC	Op_point	MOSFET junction temperature
27.	Phase Marg	35.198 deg	Op_point	Bode Plot Phase Margin
28.	VIN_OP	10.6 V	Op_point	Vin operating point
29.	Vout p-p	18.807 mV	Op_point	Peak-to-peak output ripple voltage
30.	Cin Pd	180.049 mW	Power	Input capacitor power dissipation
31.	Cout Pd	179.694 mW	Power	Output capacitor power dissipation
32.	Diode Pd	840.0 mW	Power	Diode power dissipation
33.	IC Pd	293.052 mW	Power	IC power dissipation
34.	L Pd	151.089 mW	Power	Inductor power dissipation
35.	M1 Pd	77.531 mW	Power	MOSFET power dissipation
36.	M1 PdCond	54.056 mW	Power	M1 MOSFET conduction losses
37.	M1 PdSw	23.475 mW	Power	M1 MOSFET switching losses
38.	M2 Pd	175.429 mW	Power	MOSFET power dissipation
39.	M2 PdCond	54.194 mW	Power	M2 MOSFET conduction losses
40.	M2 PdSw	121.235 mW	Power	M2 MOSFET switching losses
41.	Total Pd	3.147 W	Power	Total Power Dissipation
42.	Diode 1 Power Dissipation	840.0 mOpvalUnits.PD	Unknown	Power dissipation in the diode
43.	Diode 2 Power Dissipation	840.0 mOpvalUnits.PD	Unknown	Power dissipation in the diode
44.	Diode 3 Power Dissipation	840.0 mOpvalUnits.PD	Unknown	Power dissipation in the diode
45.	Diode 4 Power Dissipation	840.0 mOpvalUnits.PD	Unknown	Power dissipation in the diode

Design Inputs

#	Name	Value	Description
1.	Iout	3.0 A	Maximum Output Current
2.	Iout1	3.0 Amps	Output Current #1
3.	VinMax	15.0 V	Maximum input voltage
4.	VinMin	10.6 V	Minimum input voltage
5.	Vout	15.0 V	Output Voltage
6.	Vout1	15.0 Volt	Output Voltage #1
7.	base_pn	LM25118	Base Product Number
8.	source	DC	Input Source Type
9.	Ta	30.0 degC	Ambient temperature
10.	UserFsw	141.667 kHz	Customer Selected Frequency

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. **LM25118** Product Folder : http://www.ti.com/product/lm25118 : contains the data sheet and other resources.