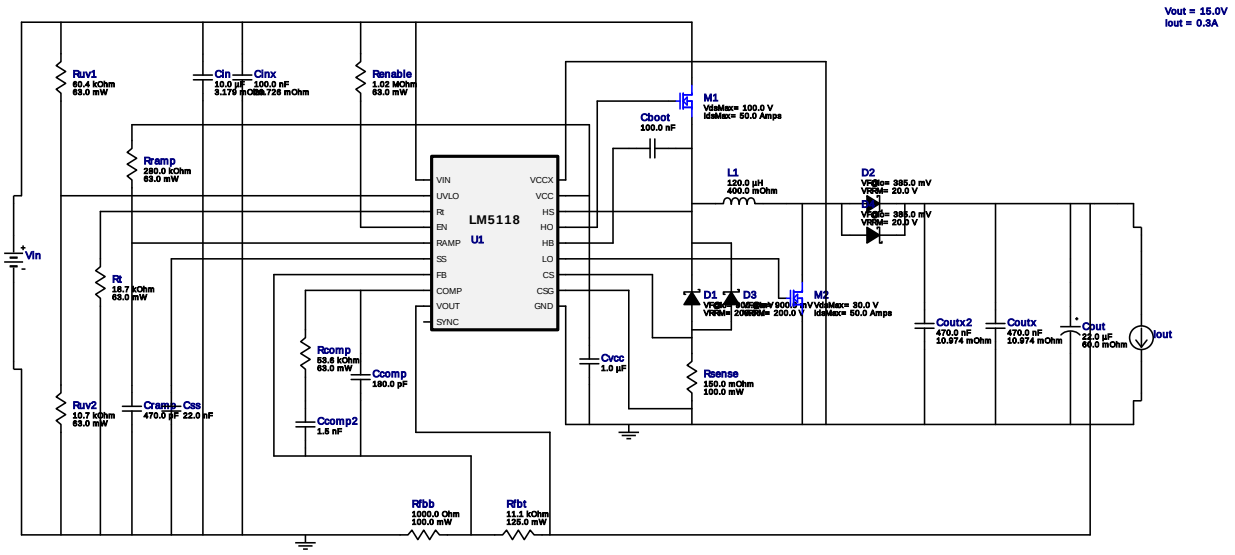
WEBENCH® Design Report

VinMin = 10.0V
VinMax = 55.0V
Vout = 15.0V
Iout = 0.3A

Device = LM5118MH/NOPB
Topology = Buck_Boost
Created = 2017-10-06 22:49:00.354
BOM Cost = $5.58
BOM Count = 28
Total Pd = 1.9W

Design : 872819/80 LM5118MH/NOPB
LM5118MH/NOPB 10.0V-55.0V to 15.00V @ 0.3A

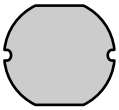


My Comments

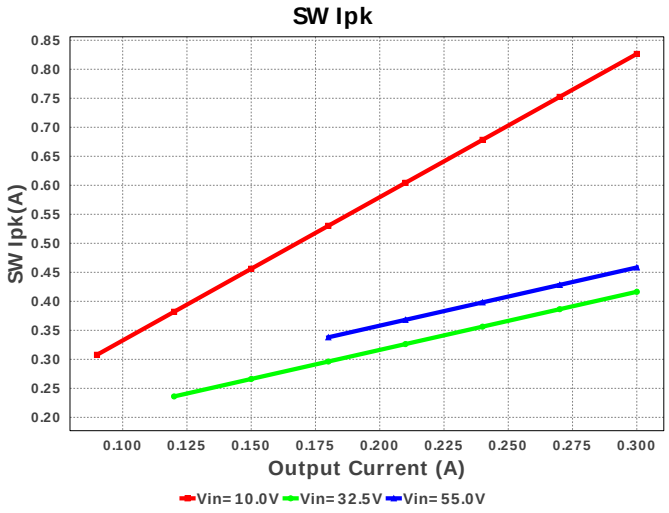
No comments

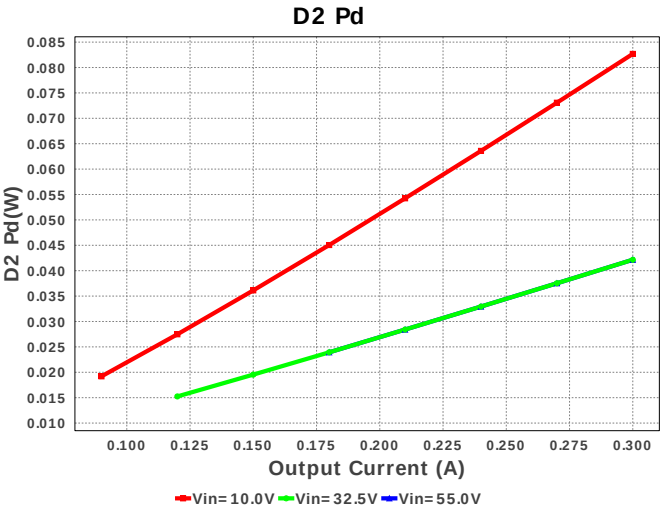
Electrical BOM

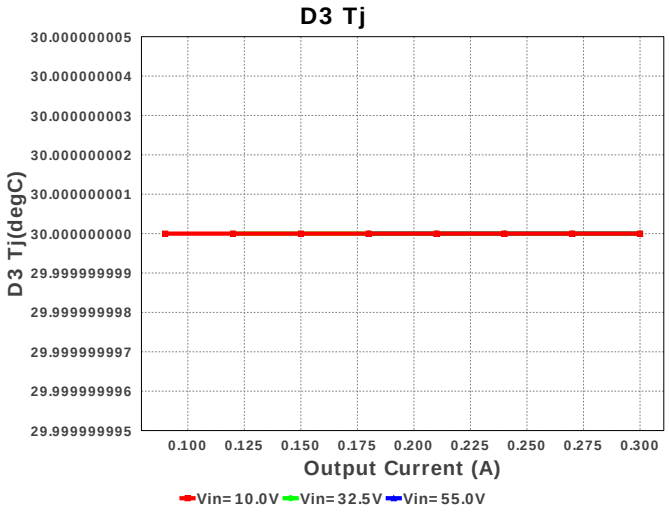
#	Name	Manufacturer	Part Number	Properties	Qty	Price	Footprint
1.	Cboot	Yageo America	CC0805KRX7R8BB104 Series= X7R	Cap= 100.0 nF VDC= 25.0 V IRMS= 0.0 A	1	$0.01	0805 7 mm²
2.	Ccomp	Samsung Electro-Mechanics	CL21C181JBANNNC Series= C0G/NP0	Cap= 180.0 pF VDC= 50.0 V IRMS= 0.0 A	1	$0.01	0805 7 mm²
3.	Ccomp2	Yageo America	CC0805KRX7R9BB152 Series= X7R	Cap= 1.5 nF VDC= 50.0 V IRMS= 0.0 A	1	$0.01	0805 7 mm²
4.	Cin	TDK	C5750X7S2A106K230KB Series= X7S	Cap= 10.0 uF ESR= 3.179 mOhm VDC= 100.0 V IRMS= 5.1199 A	1	$0.92	2220_250 54 mm²
5.	Cinx	TDK	C2012X5R2A104K125AA Series= X5R	Cap= 100.0 nF ESR= 20.726 mOhm VDC= 100.0 V IRMS= 1.456 A	1	$0.04	0805 7 mm²
6.	Cout	Chemi-Con	APXH200ARA220MF60G Series= PXH	Cap= 22.0 uF ESR= 60.0 mOhm VDC= 20.0 V IRMS= 1.65 A	1	$0.50	CAPSMT_62_F60 77 mm²
7.	Coutx	TDK	C1608X5R1H474K080AB Series= X5R	Cap= 470.0 nF ESR= 10.974 mOhm VDC= 50.0 V IRMS= 1.57483 A	1	$0.03	0603 5 mm²
8.	Coutx2	TDK	C1608X5R1H474K080AB Series= X5R	Cap= 470.0 nF ESR= 10.974 mOhm VDC= 50.0 V IRMS= 1.57483 A	1	$0.03	0603 5 mm²

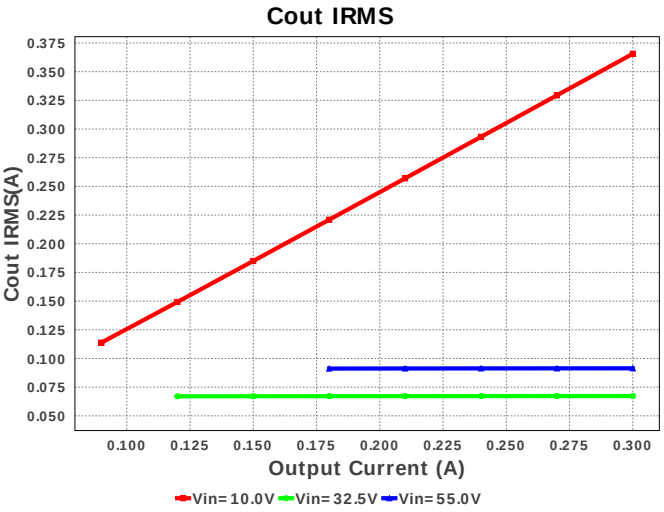
#	Name	Manufacturer	Part Number	Properties	Qty	Price	Footprint
9.	Cramp	Yageo America	CC0805KRX7R9BB471 Series= X7R	Cap= 470.0 pF VDC= 50.0 V IRMS= 0.0 A	1	$0.01	 0805 7 mm²
10.	Css	Yageo America	CC0805KRX7R9BB223 Series= X7R	Cap= 22.0 nF VDC= 50.0 V IRMS= 0.0 A	1	$0.01	 0805 7 mm²
11.	Cvcc	Taiyo Yuden	EMK212B7105KG-T Series= X7R	Cap= 1.0 uF VDC= 16.0 V IRMS= 0.0 A	1	$0.02	 0805 7 mm²
12.	D1	SMC Diode Solutions	SK220ATR	VF@Io= 900.0 mV VRRM= 200.0 V	1	$0.04	 SMA 37 mm²
13.	D2	ON Semiconductor	MBR0520LT1G	VF@Io= 385.0 mV VRRM= 20.0 V	1	$0.06	 SOD-123 13 mm²
14.	D3	SMC Diode Solutions	SK220ATR	VF@Io= 900.0 mV VRRM= 200.0 V	1	$0.04	 SMA 37 mm²
15.	D4	ON Semiconductor	MBR0520LT1G	VF@Io= 385.0 mV VRRM= 20.0 V	1	$0.06	 SOD-123 13 mm²
16.	L1	NIC Components	NPI105C121MTRF	L= 120.0 µH DCR= 400.0 mOhm	1	$0.14	 IND_NPI105C 141 mm²
17.	M1	Texas Instruments	CSD19537Q3	VdsMax= 100.0 V IdsMax= 50.0 Amps	1	$0.41	 DQG0008A 18 mm²
18.	M2	Texas Instruments	CSD17308Q3	VdsMax= 30.0 V IdsMax= 50.0 Amps	1	$0.25	 DQG0008A 18 mm²
19.	Rcomp	Vishay-Dale	CRCW040253K6FKED Series= CRCW..e3	Res= 53.6 kOhm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	 0402 3 mm²
20.	Renable	Vishay-Dale	CRCW04021M02FKED Series= CRCW..e3	Res= 1.02 MOhm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	 0402 3 mm²
21.	Rfbb	Susumu Co Ltd	RR1220P-102-D Series= RR12	Res= 1000.0 Ohm Power= 100.0 mW Tolerance= 0.5%	1	$0.01	 0805 7 mm²
22.	Rfbt	Yageo America	RT0805BRD0711K1L Series= ?	Res= 11.1 kOhm Power= 125.0 mW Tolerance= 0.1%	1	$0.04	 0805 7 mm²
23.	Rramp	Vishay-Dale	CRCW0402280KFKED Series= CRCW..e3	Res= 280.0 kOhm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	 0402 3 mm²
24.	Rsense	Panasonic	ERJ-3RSFR15V Series= ERJ-3R	Res= 150.0 mOhm Power= 100.0 mW Tolerance= 1.0%	1	$0.03	 0603 5 mm²
25.	Rt	Vishay-Dale	CRCW040218K7FKED Series= CRCW..e3	Res= 18.7 kOhm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	 0402 3 mm²
26.	Ruv1	Vishay-Dale	CRCW040260K4FKED Series= CRCW..e3	Res= 60.4 kOhm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	 0402 3 mm²
27.	Ruv2	Vishay-Dale	CRCW040210K7FKED Series= CRCW..e3	Res= 10.7 kOhm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	 0402 3 mm²

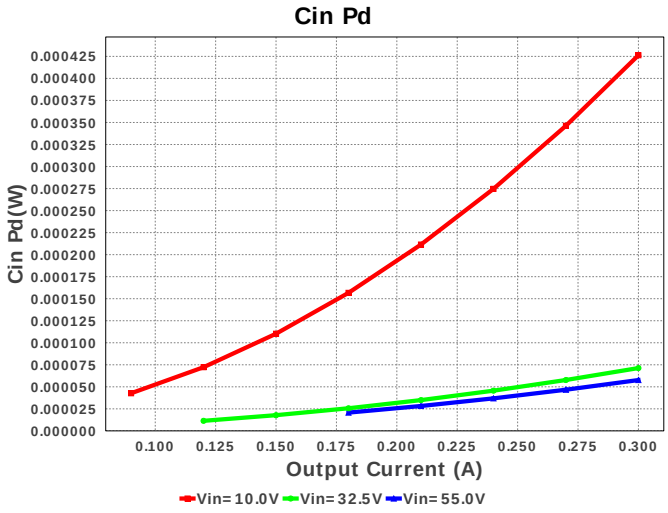
#	Name	Manufacturer	Part Number	Properties	Qty	Price	Footprint
28.	U1	Texas Instruments	LM5118MH/NOPB	Switcher	1	$2.86	 MXA20A 71 mm²

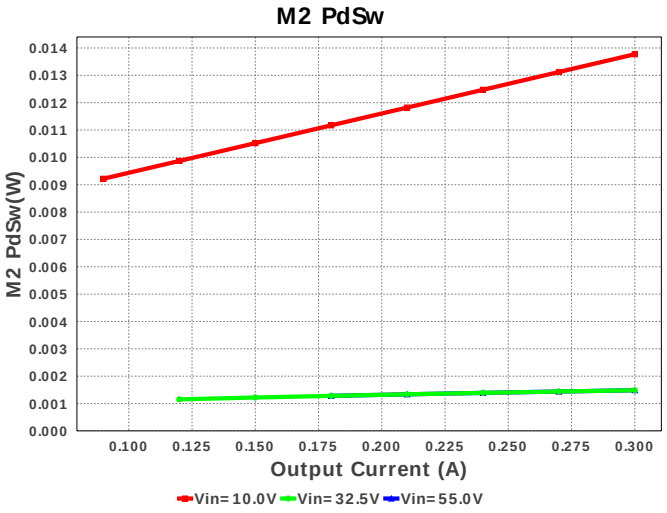


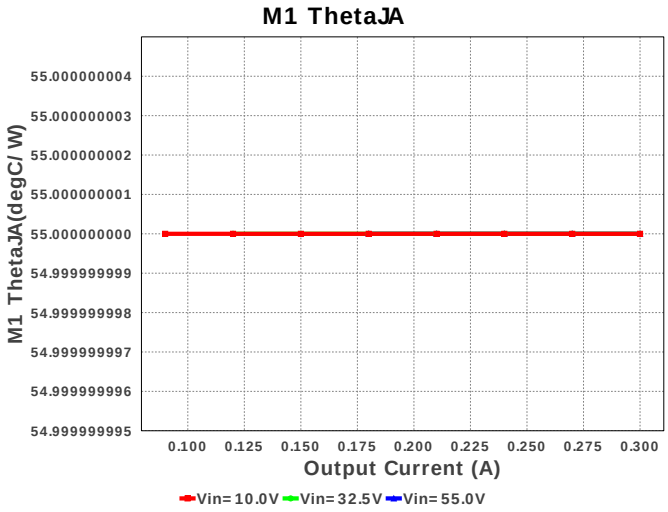


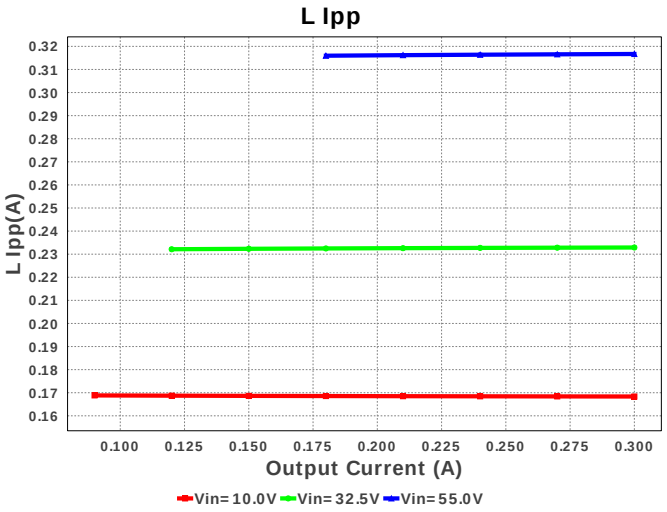


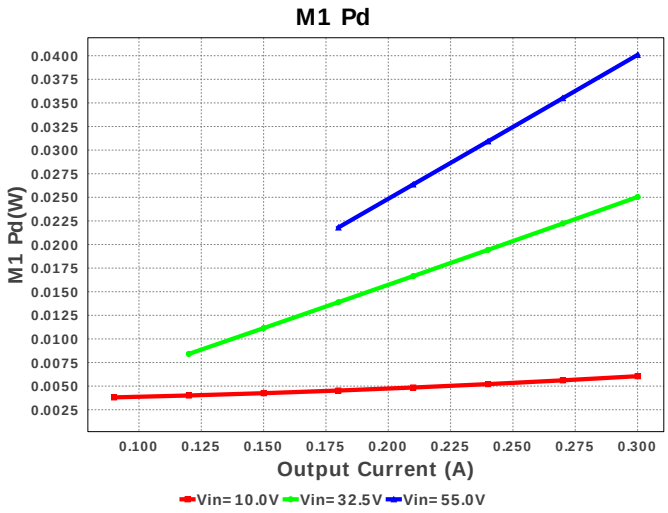


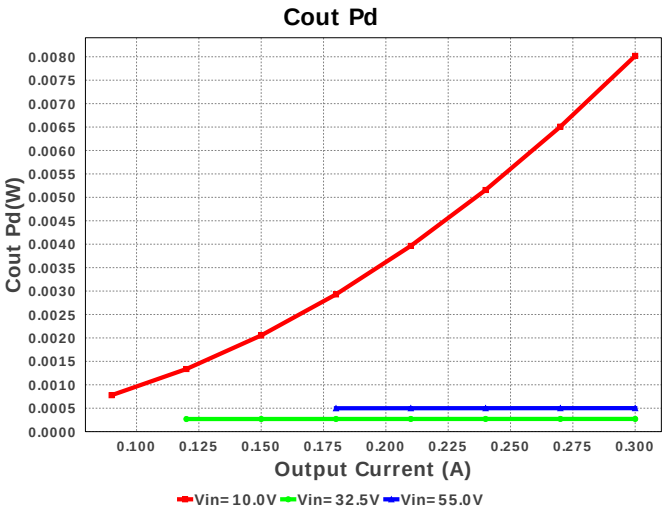


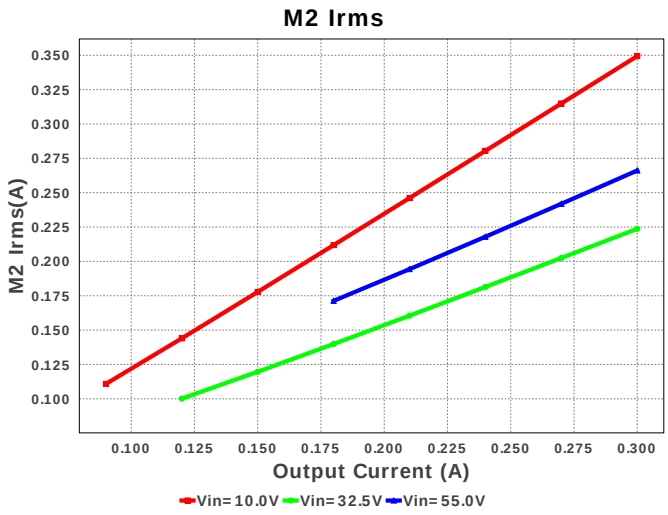


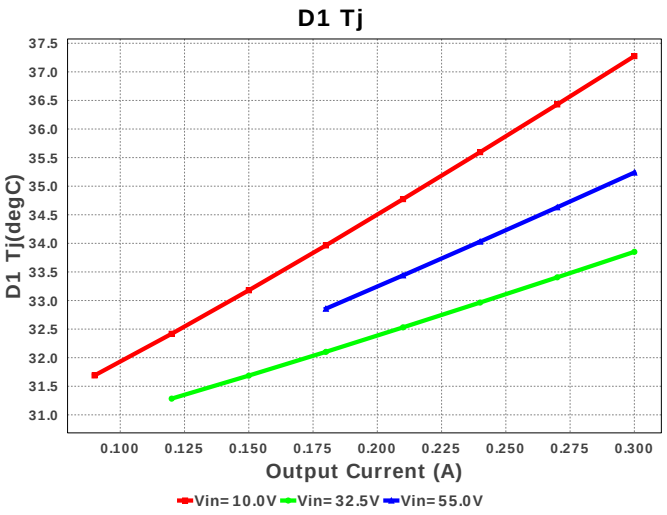


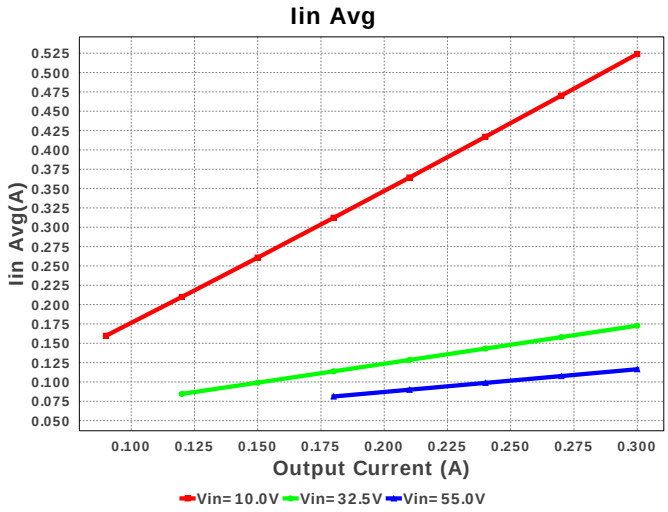


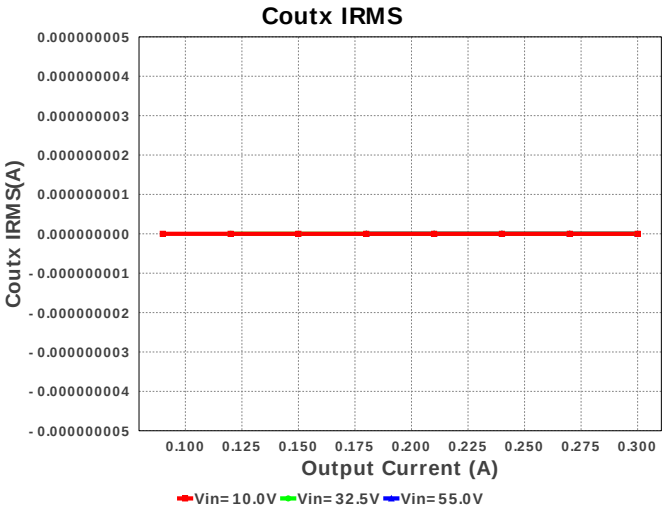


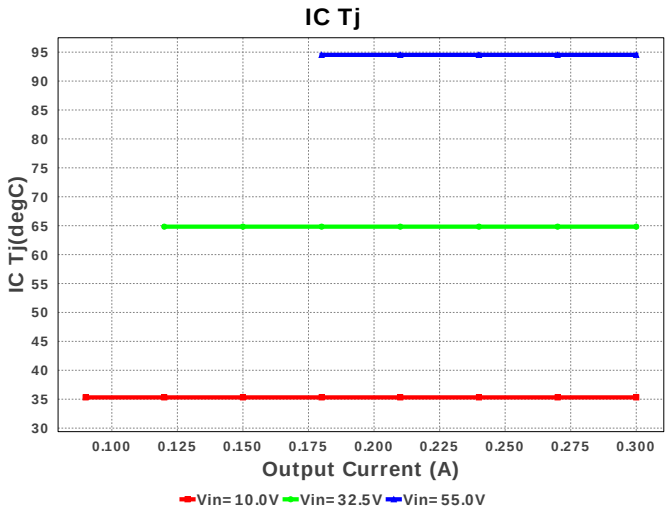


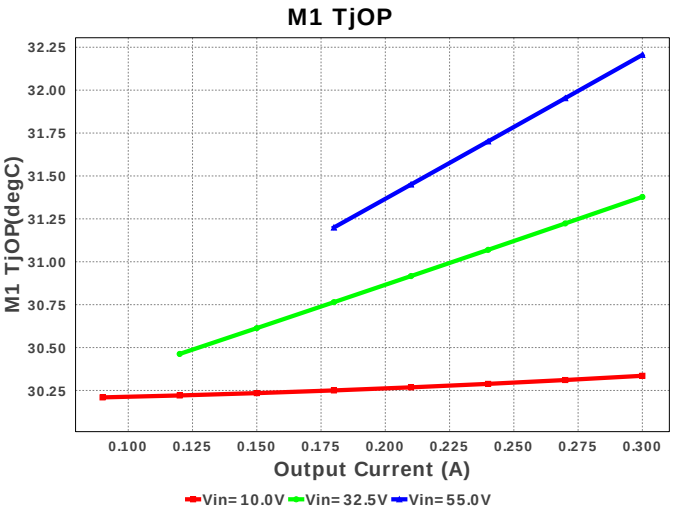


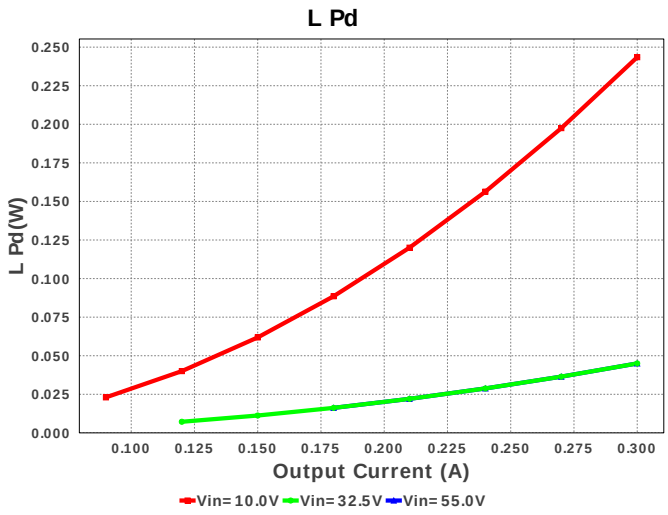


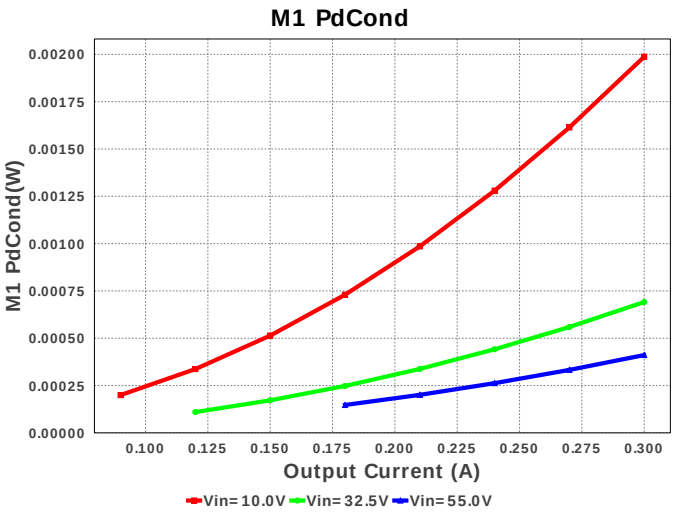


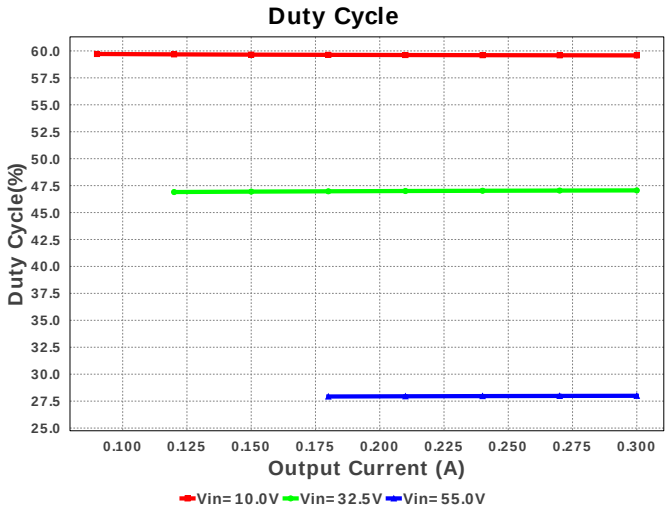


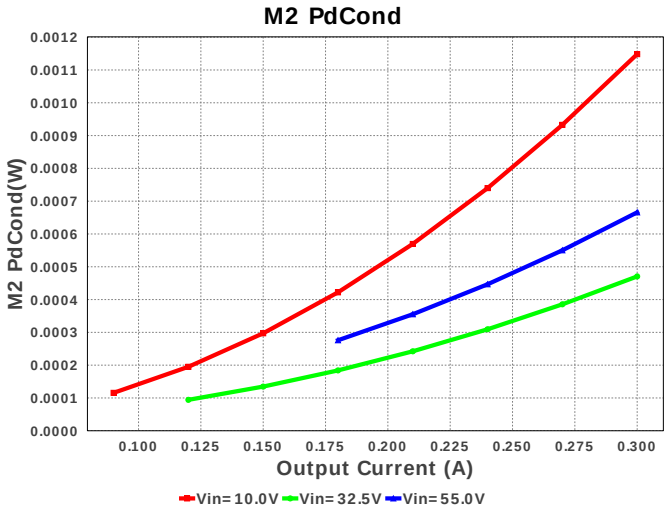


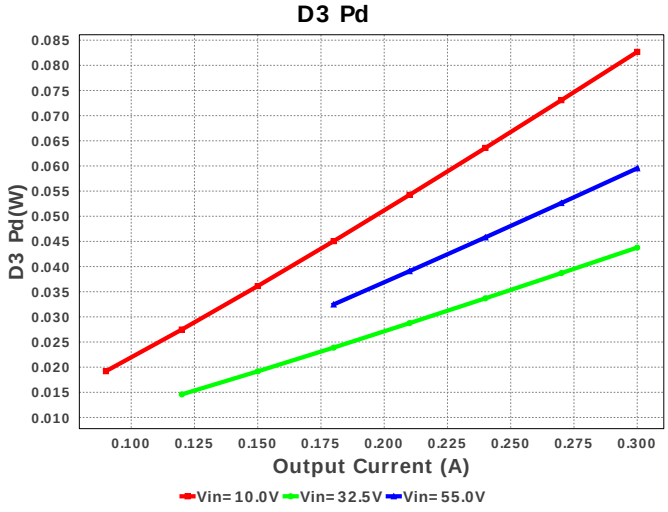


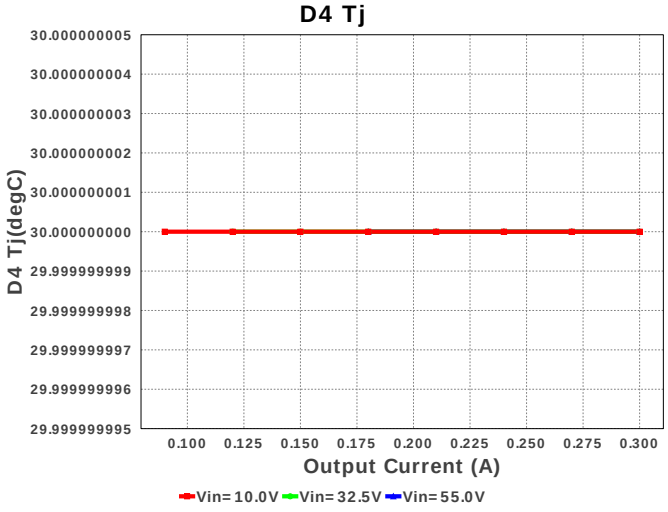


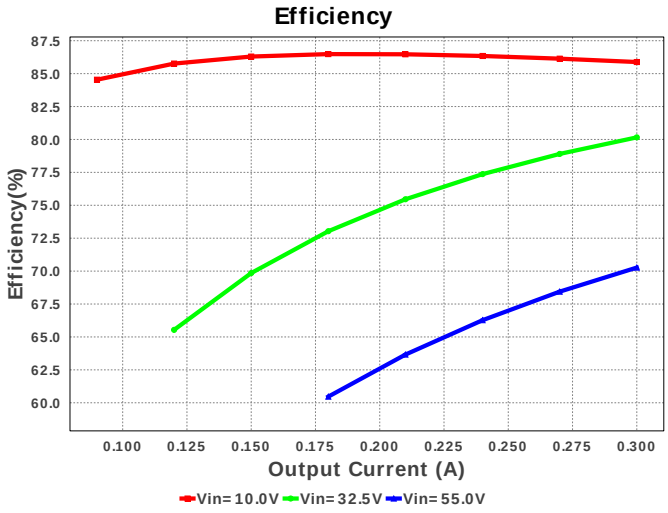


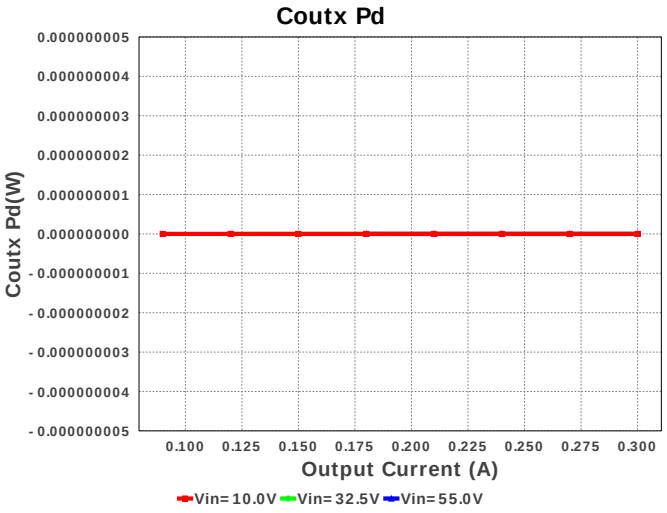


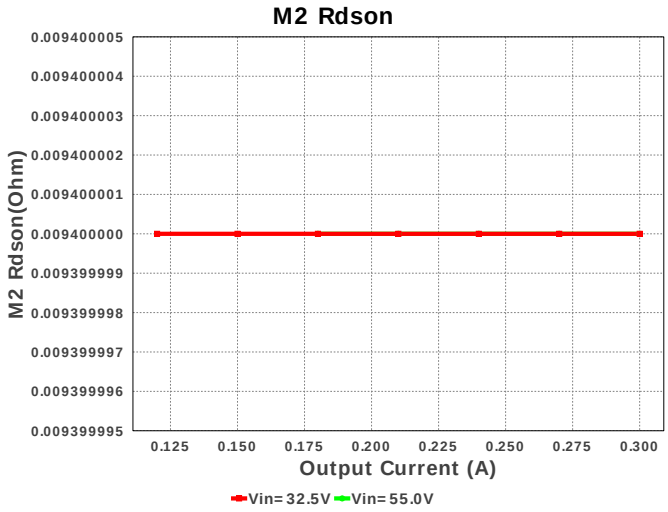


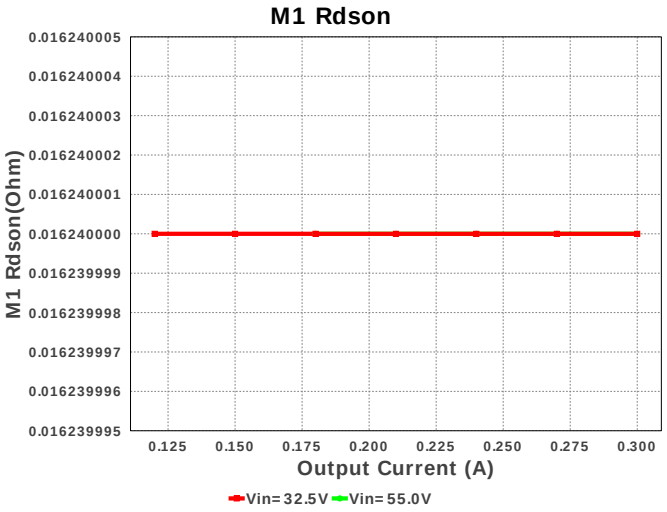


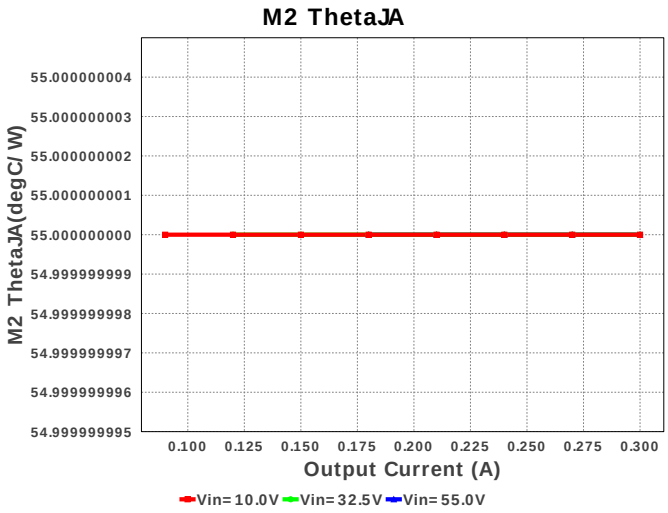


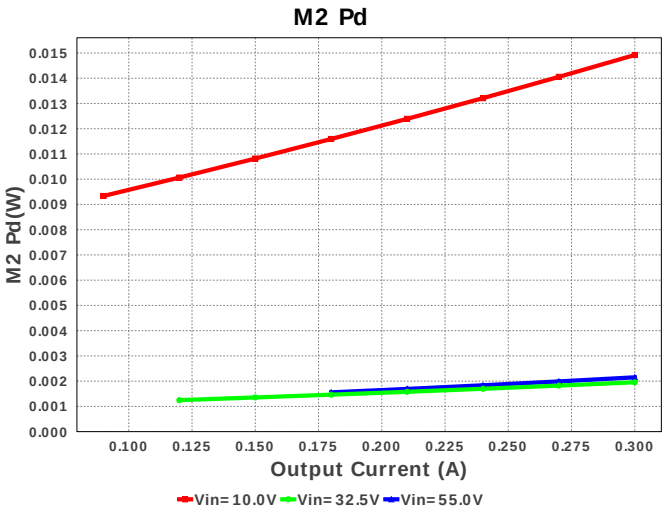


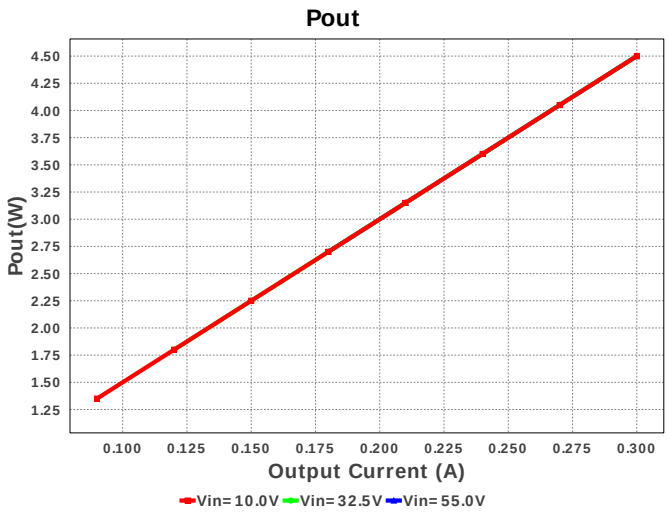


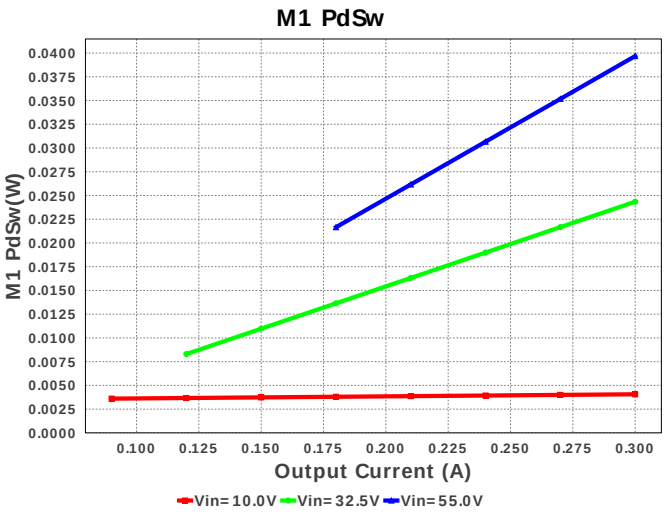


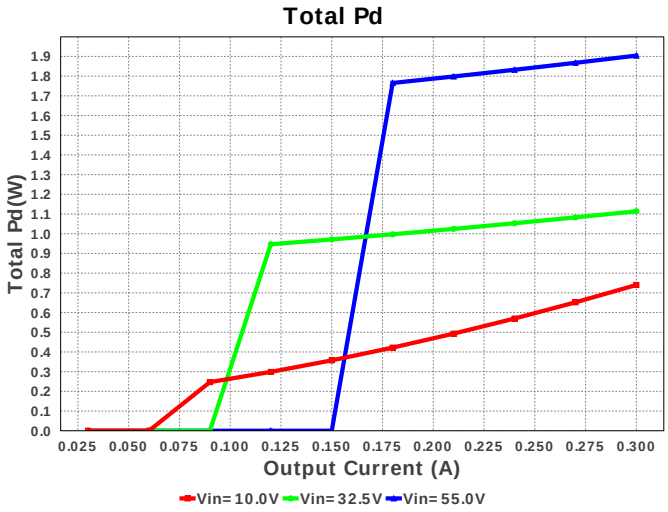


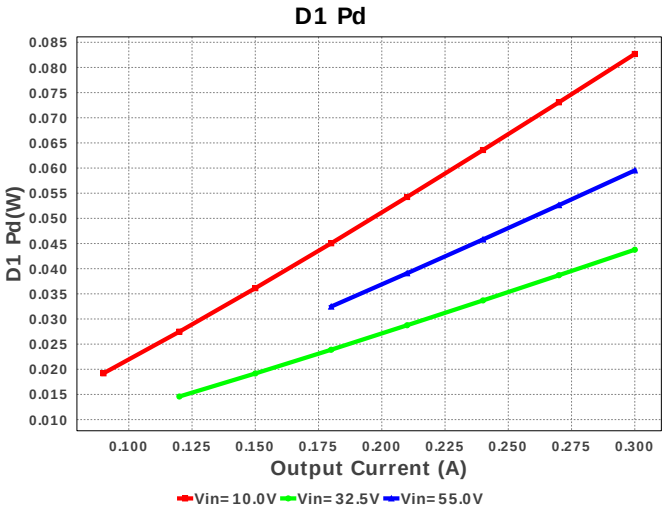


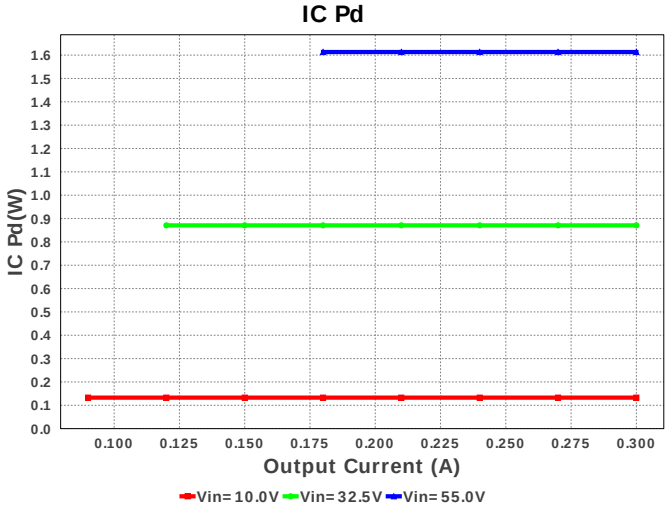


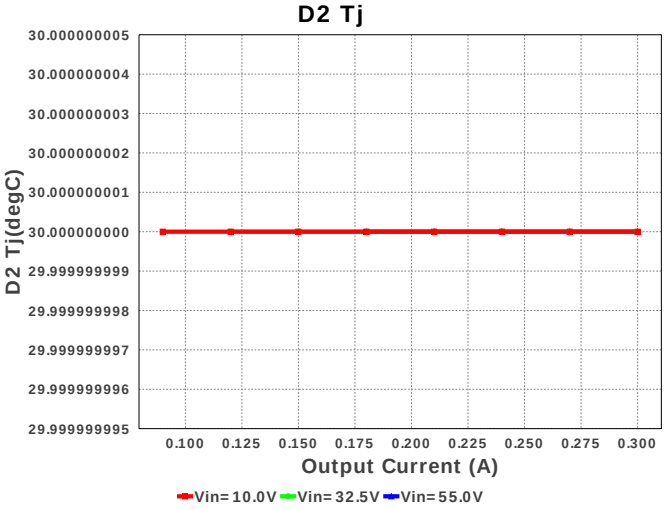


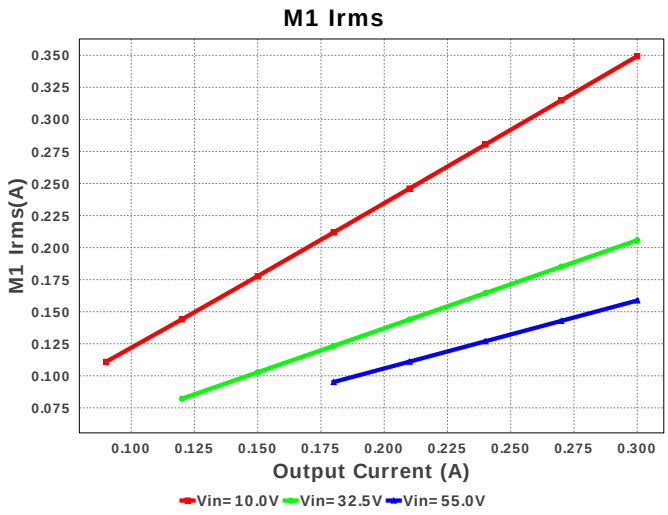


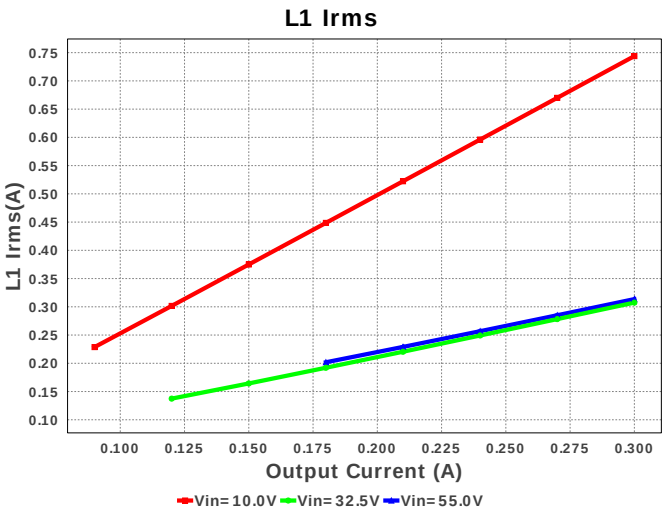


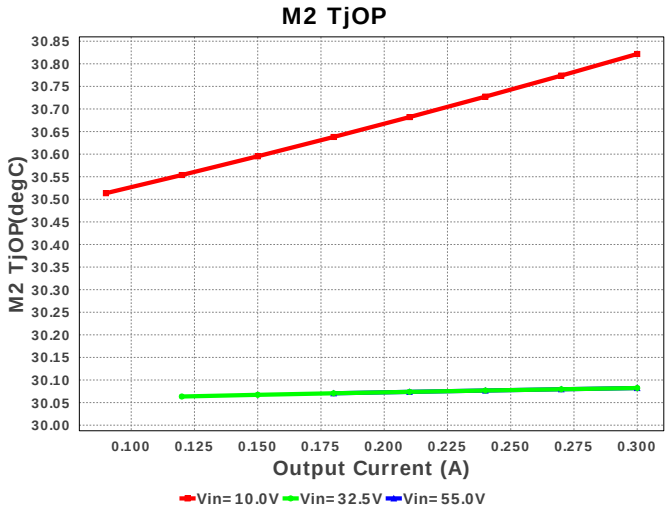


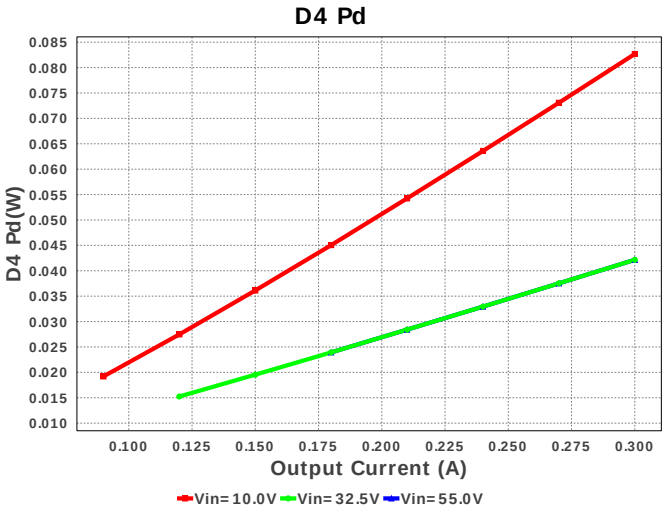


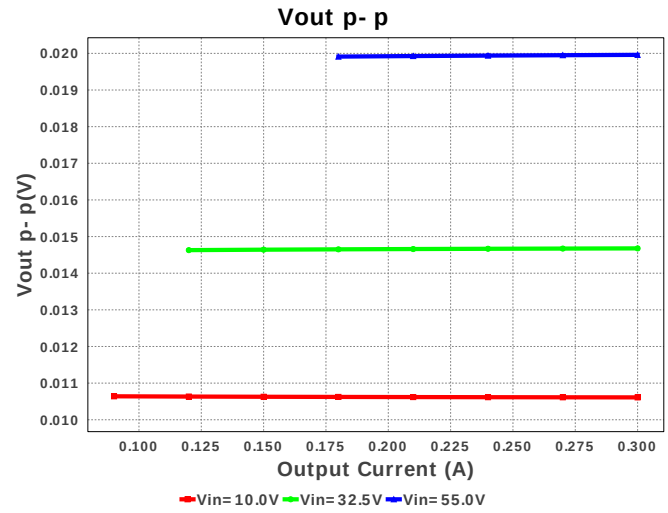


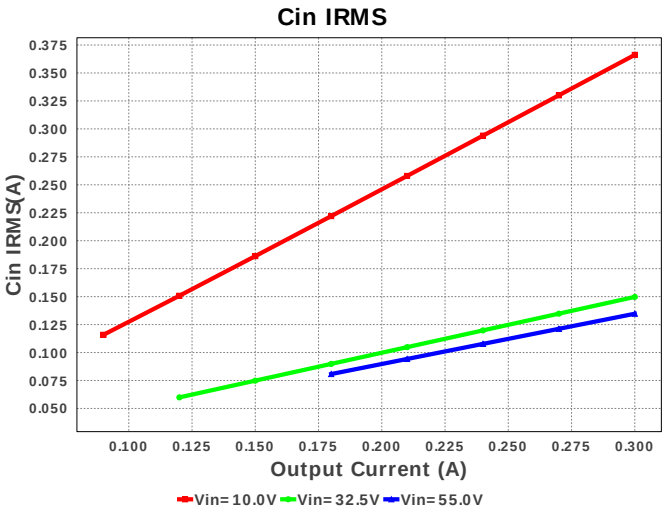


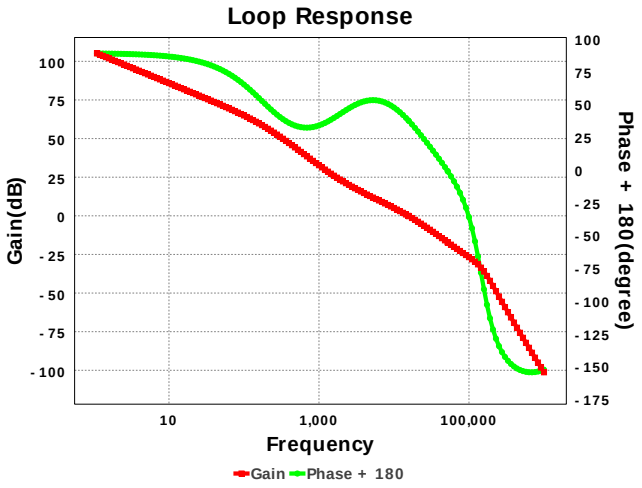












Operating Values

#	Name	Value	Category	Description
1.	Cin IRMS	134.693 mA	Current	Input capacitor RMS ripple current
2.	Cout IRMS	91.424 mA	Current	Output capacitor RMS ripple current
3.	Coutx IRMS	1.575 A	Current	Output capacitor_x RMS ripple current
4.	Iin Avg	116.44 mA	Current	Average input current
5.	L Ipp	316.7 mA	Current	Peak-to-peak inductor ripple current
6.	L1 Irms	313.621 mA	Current	Inductor ripple current
7.	M1 Irms	158.733 mA	Current	MOSFET RMS ripple current
8.	M2 Irms	266.124 mA	Current	MOSFET RMS ripple current
9.	SW Ipk	458.351 mA	Current	Peak switch current
10.	BOM Count	28	General	Total Design BOM count
11.	FootPrint	575.0 mm^2	General	Total Foot Print Area of BOM components
12.	Frequency	294.659 kHz	General	Switching frequency
13.	IC Tolerance	18.0 mV	General	IC Feedback Tolerance
14.	M1 Rdson	16.24 mOhm	General	Drain-Source On-resistance
15.	M1 ThetaJA	55.0 degC/W	General	MOSFET junction-to-ambient thermal resistance
16.	M2 Rdson	9.4 mOhm	General	Drain-Source On-resistance
17.	M2 ThetaJA	55.0 degC/W	General	MOSFET junction-to-ambient thermal resistance
18.	Mode	CCM	General	Conduction Mode
19.	Pout	4.5 W	General	Total output power
20.	Total BOM	$5.58	General	Total BOM Cost
21.	D1 Tj	35.239 degC	Op_Point	D1 junction temperature
22.	D2 Tj	38.684 degC	Op_Point	D2 junction temperature
23.	D3 Tj	35.239 degC	Op_Point	D3 junction temperature
24.	D4 Tj	38.684 degC	Op_Point	D4 junction temperature
25.	Low Freq Gain	104.493 dB	Op_Point	Gain at 1Hz
26.	Vout Actual	14.883 V	Op_Point	Vout Actual calculated based on selected voltage divider resistors
27.	Vout OP	15.0 V	Op_Point	Operational Output Voltage
28.	Cross Freq	15.488 kHz	Op_point	Bode plot crossover frequency
29.	Duty Cycle	27.996 %	Op_point	Duty cycle
30.	Efficiency	70.268 %	Op_point	Steady state efficiency
31.	Gain Marg	-15.548 dB	Op_point	Bode Plot Gain Margin
32.	IC Tj	94.531 degC	Op_point	IC junction temperature
33.	ICThetaJA	40.0 degC/W	Op_point	IC junction-to-ambient thermal resistance
34.	IOUT_OP	300.0 mA	Op_point	Iout operating point
35.	M1 TjOP	32.206 degC	Op_point	MOSFET junction temperature
36.	M2 TjOP	30.498 degC	Op_point	MOSFET junction temperature
37.	Operating Topology	Buck	Op_point	The current operating topology of the device
38.	Phase Marg	37.289 deg	Op_point	Bode Plot Phase Margin
39.	VIN_OP	55.0 V	Op_point	Vin operating point
40.	Vout p-p	19.959 mV	Op_point	Peak-to-peak output ripple voltage
41.	Cin Pd	57.674 µW	Power	Input capacitor power dissipation
42.	Cout Pd	501.498 µW	Power	Output capacitor power dissipation
43.	Coutx Pd	0.0 W	Power	Output capacitor_x power loss
44.	D1 Pd	59.531 mW	Power	Diode power dissipation
45.	D2 Pd	42.155 mW	Power	Diode2 power dissipation
46.	D3 Pd	59.531 mW	Power	Diode3 power dissipation
47.	D4 Pd	42.155 mW	Power	Diode4 power dissipation
48.	IC Pd	1.613 W	Power	IC power dissipation
49.	L Pd	45.0 mW	Power	Inductor power dissipation
50.	M1 Pd	40.104 mW	Power	MOSFET power dissipation
51.	M1 PdCond	425.858 µW	Power	M1 MOSFET conduction losses
52.	M1 PdSw	39.678 mW	Power	M1 MOSFET switching losses

#	Name	Value	Category	Description
53.	M2 Pd	5.761 mW	Power	MOSFET power dissipation
54.	M2 PdCond	666.815 µW	Power	M2 MOSFET conduction losses
55.	M2 PdSw	5.094 mW	Power	M2 MOSFET switching losses
56.	Total Pd	1.904 W	Power	Total Power Dissipation
57.	Vout Tolerance	2.025 %		Vout Tolerance based on IC Tolerance (no load) and voltage divider resistors if applicable

Design Inputs

#	Name	Value	Description
1.	Iout	300.0 m	Maximum Output Current
2.	VinMax	55.0	Maximum input voltage
3.	VinMin	10.0	Minimum input voltage
4.	Vout	15.0	Output Voltage
5.	base_pn	LM5118	Base Product Number
6.	source	DC	Input Source Type
7.	Ta	30.0	Ambient temperature

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