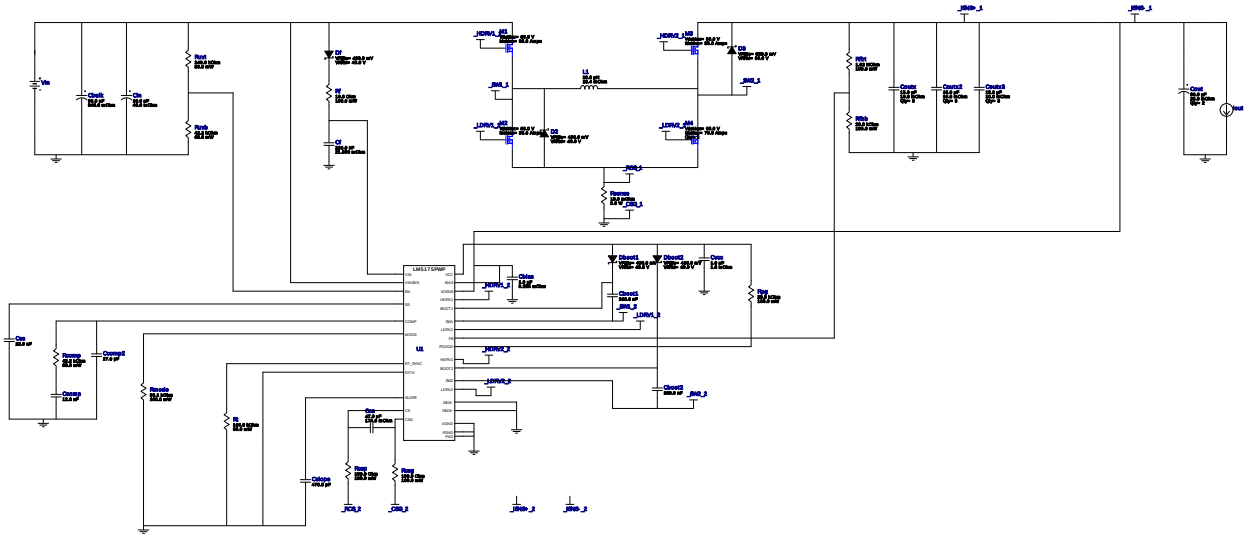
WEBENCH® Design Report

VinMin = 9.0V
VinMax = 30.0V
Vout = 42.0V
Iout = 2.0A

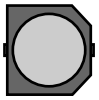
Device = LM5175PWPR
Topology = Buck_Boost
Created = 2018-12-24 18:33:05.228
BOM Cost = $38.69
BOM Count = 47
Total Pd = 9.1W

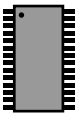
Design : LM5175PWPR
LM5175PWPR 9V-30V to 42.00V @ 2A

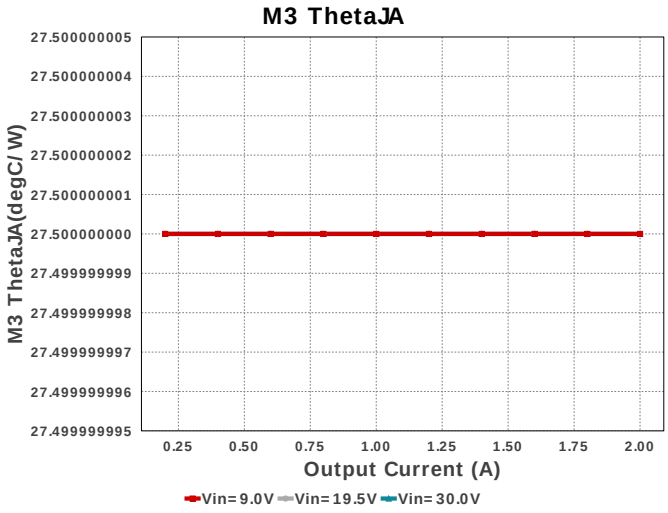


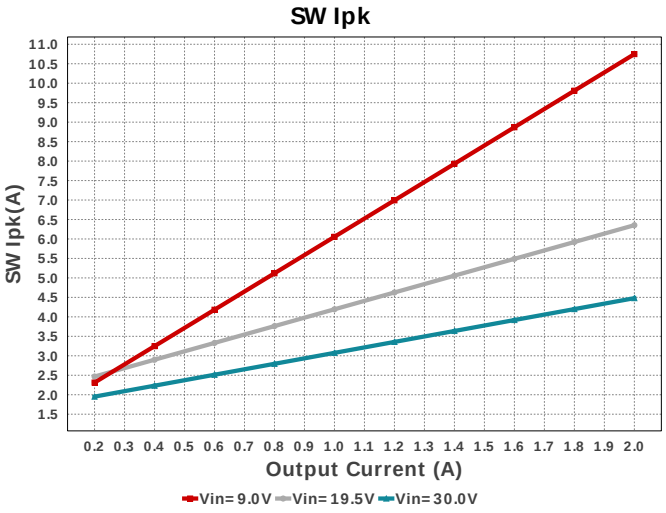
Electrical BOM

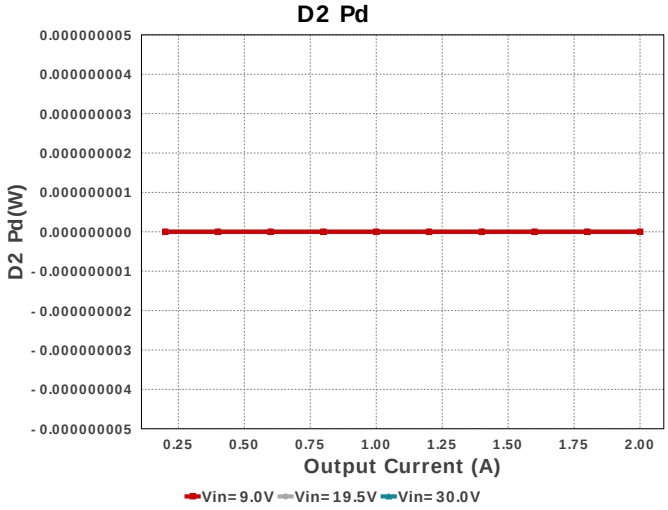
#	Name	Manufacturer	Part Number	Properties	Qty	Price	Footprint
1.	Cbias	TDK	C2012X7S2A105K125AB Series= X7S	Cap= 1.0 uF ESR= 8.255 mOhm VDC= 100.0 V IRMS= 2.27442 A	1	$0.14	0805 7 mm²
2.	Cboot1	AVX	08053C104JAZ2A Series= X7R	Cap= 100.0 nF VDC= 25.0 V IRMS= 0.0 A	1	$0.10	0805 7 mm²
3.	Cboot2	AVX	08053C104JAZ2A Series= X7R	Cap= 100.0 nF VDC= 25.0 V IRMS= 0.0 A	1	$0.10	0805 7 mm²
4.	Cbulk	Nichicon	UUD1V680MCL1GS Series= uD	Cap= 68.0 uF ESR= 340.0 mOhm VDC= 35.0 V IRMS= 280.0 mA	1	$0.13	SM_RADIAL_6.3BMM 80 mm²
5.	Ccomp	Kemet	C0603C123J3GACTU Series= C0G/NP0	Cap= 12.0 nF VDC= 25.0 V IRMS= 0.0 A	1	$0.12	0603 5 mm²
6.	Ccomp2	Samsung Electro-Mechanics	CL21C270JBANNNC Series= C0G/NP0	Cap= 27.0 pF VDC= 50.0 V IRMS= 0.0 A	1	$0.01	0805 7 mm²
7.	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
8.	Cf	TDK	CGA3E3X7R1H224K080AB Series= X7R	Cap= 220.0 nF ESR= 21.699 mOhm VDC= 50.0 V IRMS= 1.125 A	1	$0.04	0603 5 mm²
9.	Cin	Panasonic	50SVPF10M Series= SVPF	Cap= 10.0 uF ESR= 40.0 mOhm VDC= 50.0 V IRMS= 2.5 A	1	$0.42	CAPSMT_62_F61 74 mm²

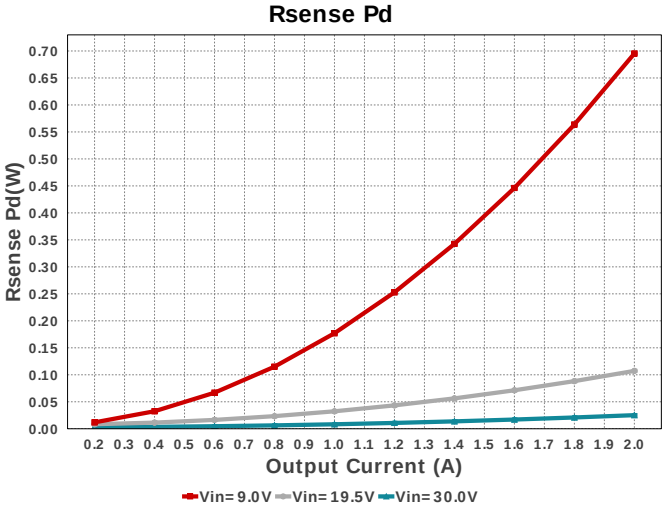
#	Name	Manufacturer	Part Number	Properties	Qty	Price	Footprint
10.	Cout	Panasonic	63SXV33M Series= SXV	Cap= 33.0 uF ESR= 25.0 mOhm VDC= 63.0 V IRMS= 2.95 A	2	$1.24	 CAPSMT_62_E12 106 mm²
11.	Coutx	MuRata	KCM55WR72A156MH01K Series= X7R	Cap= 15.0 uF ESR= 10.0 mOhm VDC= 100.0 V IRMS= 0.0 A	3	$3.11	 KCM55W 59 mm²
12.	Coutx2	MuRata	KCM55WR72A156MH01K Series= X7R	Cap= 15.0 uF ESR= 10.0 mOhm VDC= 100.0 V IRMS= 0.0 A	3	$3.11	 KCM55W 59 mm²
13.	Coutx3	MuRata	KCM55WR72A156MH01K Series= X7R	Cap= 15.0 uF ESR= 10.0 mOhm VDC= 100.0 V IRMS= 0.0 A	3	$3.11	 KCM55W 59 mm²
14.	Cslope	Samsung Electro-Mechanics	CL10C471JB8NFNC Series= C0G/NP0	Cap= 470.0 pF VDC= 50.0 V IRMS= 0.0 A	1	$0.01	 0603 5 mm²
15.	Css	TDK	CGA4J2C0G1H223J125AA Series= C0G/NP0	Cap= 22.0 nF VDC= 50.0 V IRMS= 0.0 A	1	$0.09	 0805 7 mm²
16.	Cvcc	Taiyo Yuden	EMK107B7105KA-T Series= X7R	Cap= 1.0 uF ESR= 1.0 mOhm VDC= 16.0 V IRMS= 0.0 A	1	$0.02	 0603 5 mm²
17.	D2	ON Semiconductor	MBRS2040LT3G	VF@Io= 430.0 mV VRRM= 40.0 V	1	$0.12	 SMB 44 mm²
18.	D3	ON Semiconductor	SS26T3G	VF@Io= 630.0 mV VRRM= 60.0 V	1	$0.10	 SMB 44 mm²
19.	Dboot1	ON Semiconductor	MBRS2040LT3G	VF@Io= 430.0 mV VRRM= 40.0 V	1	$0.12	 SMB 44 mm²
20.	Dboot2	ON Semiconductor	MBRS2040LT3G	VF@Io= 430.0 mV VRRM= 40.0 V	1	$0.12	 SMB 44 mm²
21.	Df	ON Semiconductor	MBRS2040LT3G	VF@Io= 430.0 mV VRRM= 40.0 V	1	$0.12	 SMB 44 mm²
22.	L1	Coilcraft	XAL1010-103MEB	L= 10.0 µH DCR= 13.4 mOhm	1	$1.71	 XAL1010 160 mm²
23.	M1	Texas Instruments	CSD18543Q3A	VdsMax= 60.0 V IdsMax= 35.0 Amps	1	$0.27	 DNH0008A 18 mm²
24.	M2	Texas Instruments	CSD18543Q3A	VdsMax= 60.0 V IdsMax= 35.0 Amps	1	$0.27	 DNH0008A 18 mm²
25.	M3	Texas Instruments	CSD18543Q3A	VdsMax= 60.0 V IdsMax= 35.0 Amps	1	$0.27	 DNH0008A 18 mm²
26.	M4	Texas Instruments	CSD18543Q3A	VdsMax= 60.0 V IdsMax= 70.0 Amps	2	$0.27	 DNH0008A 18 mm²
27.	Rcomp	Vishay-Dale	CRCW040242K2FKED Series= CRCW..e3	Res= 42200.0Ohm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	 0402 3 mm²

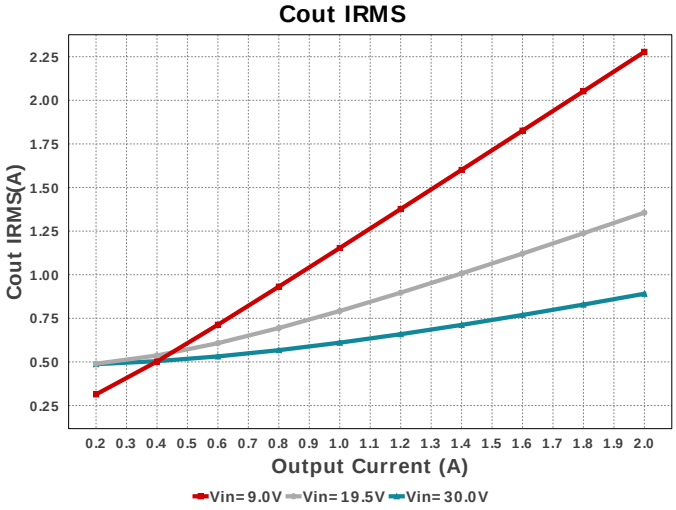
#	Name	Manufacturer	Part Number	Properties	Qty	Price	Footprint
28.	Rcsg	Vishay-Dale	CRCW0603100RFKEA Series= CRCW..e3	Res= 100.0Ohm Power= 100.0 mW Tolerance= 1.0%	1	$0.01	 0603 5 mm^2
29.	Rcsp	Vishay-Dale	CRCW0603100RFKEA Series= CRCW..e3	Res= 100.0Ohm Power= 100.0 mW Tolerance= 1.0%	1	$0.01	 0603 5 mm^2
30.	Rf	Yageo	RC0603FR-0710RL Series= ?	Res= 10.0Ohm Power= 100.0 mW Tolerance= 1.0%	1	$0.01	 0603 5 mm^2
31.	Rfbb	Yageo	RC0603FR-0720KL Series= ?	Res= 20000.0Ohm Power= 100.0 mW Tolerance= 1.0%	1	$0.01	 0603 5 mm^2
32.	Rfbt	Vishay-Dale	CRCW06031M02FKEA Series= CRCW..e3	Res= 1020000.0Ohm Power= 100.0 mW Tolerance= 1.0%	1	$0.01	 0603 5 mm^2
33.	Rmode	Yageo	RC0603FR-0793K1L Series= ?	Res= 93100.0Ohm Power= 100.0 mW Tolerance= 1.0%	1	$0.01	 0603 5 mm^2
34.	Rpg	Yageo	RC0603FR-0720KL Series= ?	Res= 20000.0Ohm Power= 100.0 mW Tolerance= 1.0%	1	$0.01	 0603 5 mm^2
35.	Rsense	Riedon	CSR2512C0R01F Series= ?	Res= 0.01Ohm Power= 3.0 W Tolerance= 1.0%	1	$0.18	 2512 43 mm^2
36.	Rt	Vishay-Dale	CRCW0402100KFKED Series= CRCW..e3	Res= 100000.0Ohm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	 0402 3 mm^2
37.	Ruvb	Vishay-Dale	CRCW040242K2FKED Series= CRCW..e3	Res= 42200.0Ohm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	 0402 3 mm^2
38.	Ruvt	Yageo	RC0201FR-07249KL Series= ?	Res= 249000.0Ohm Power= 50.0 mW Tolerance= 1.0%	1	$0.01	 0201 2 mm^2
39.	U1	Texas Instruments	LM5175PWPR	Switcher	1	$3.10	 PWP0028F_N 98 mm^2

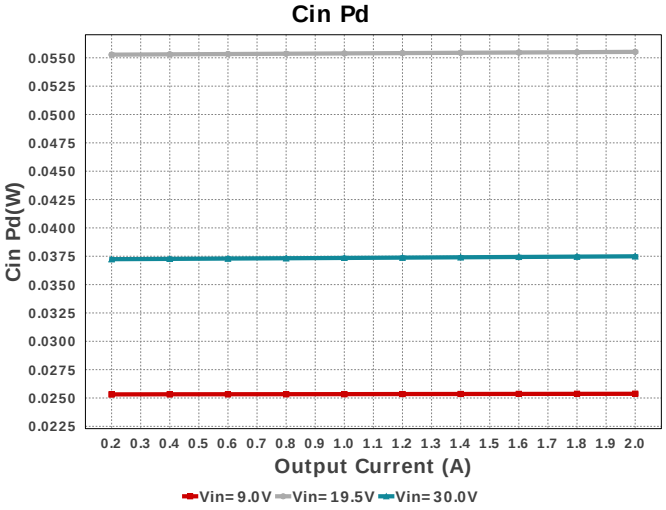


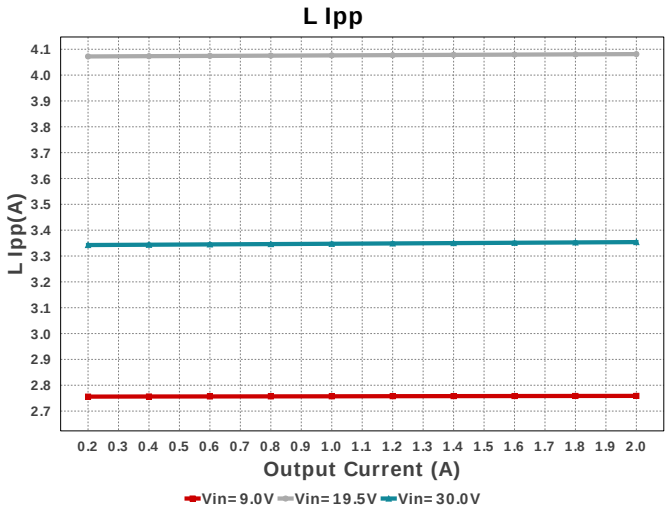


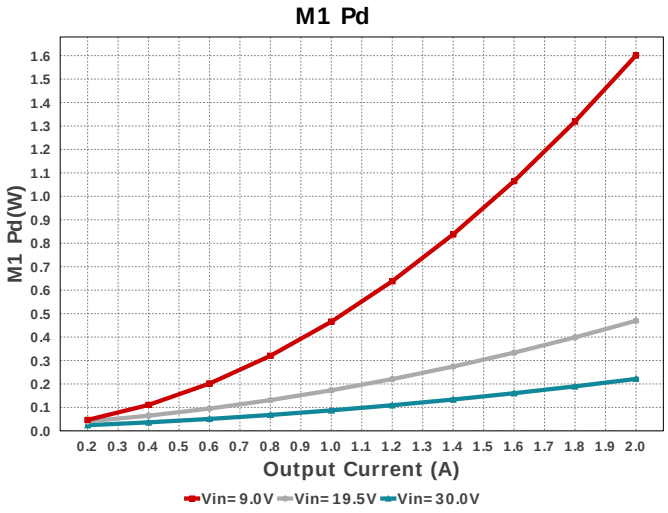


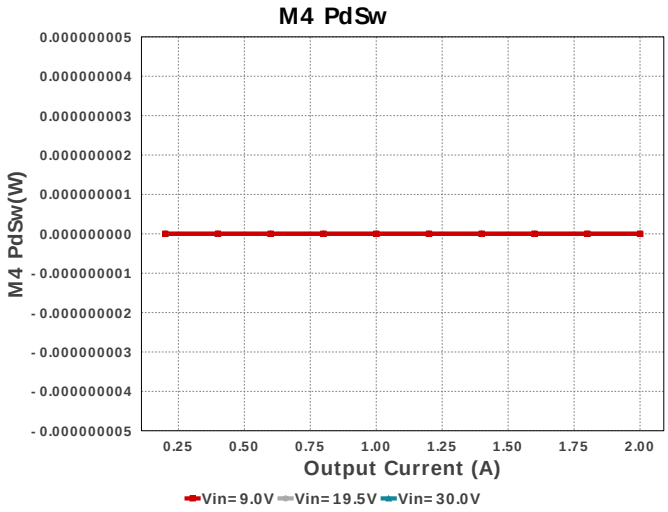


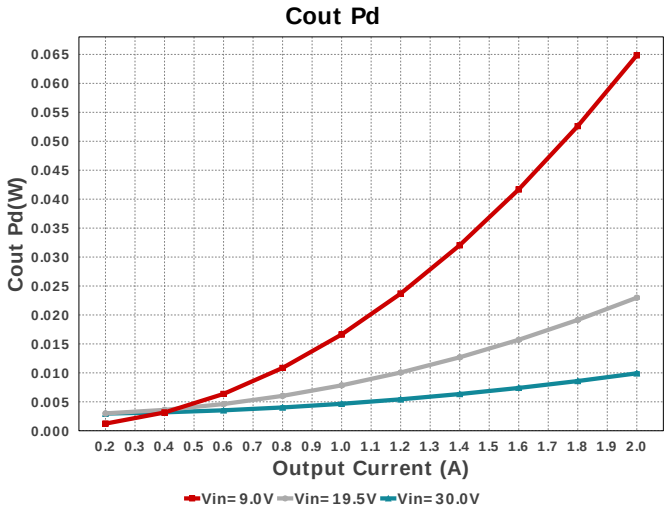


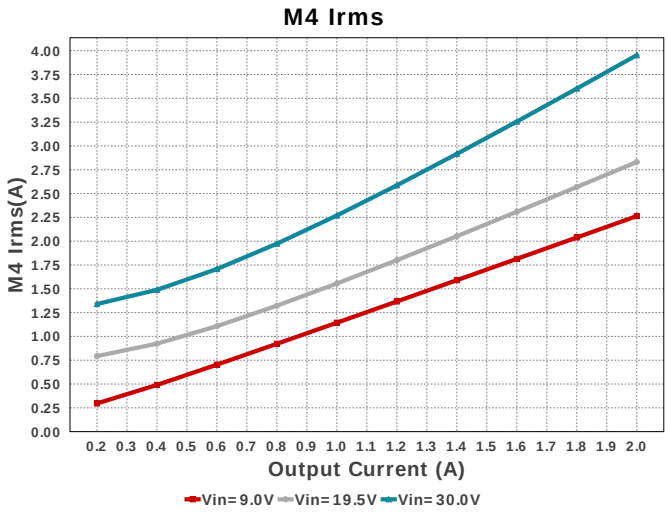


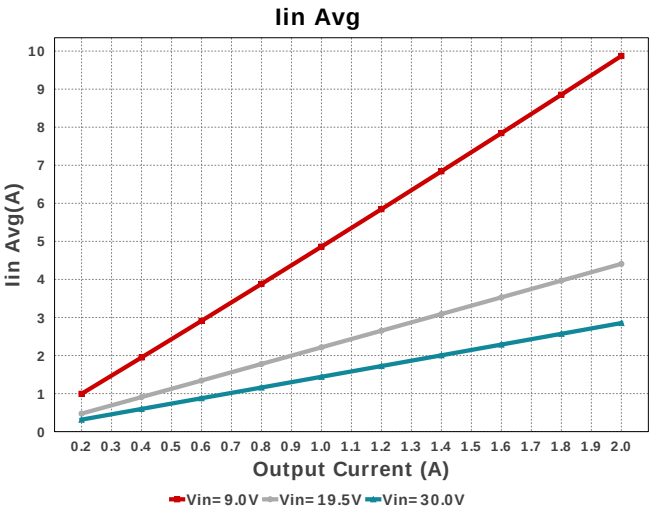




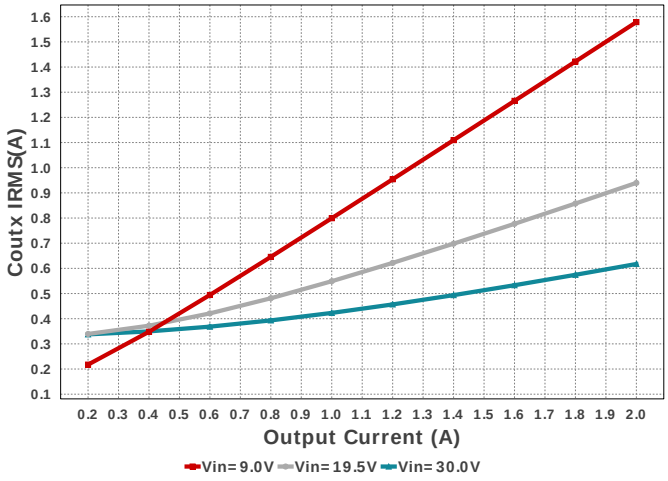




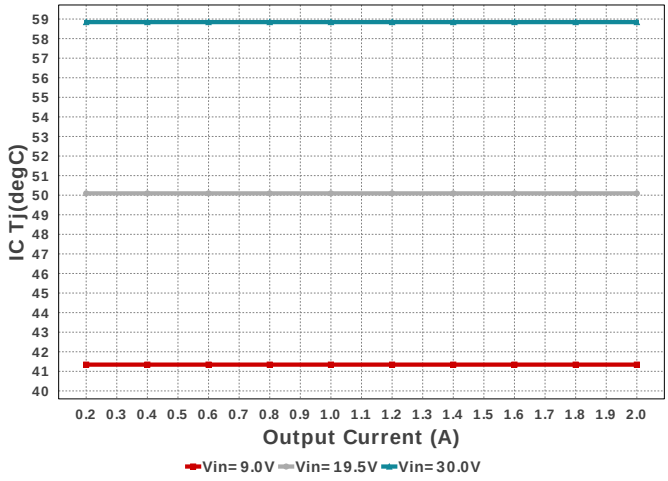




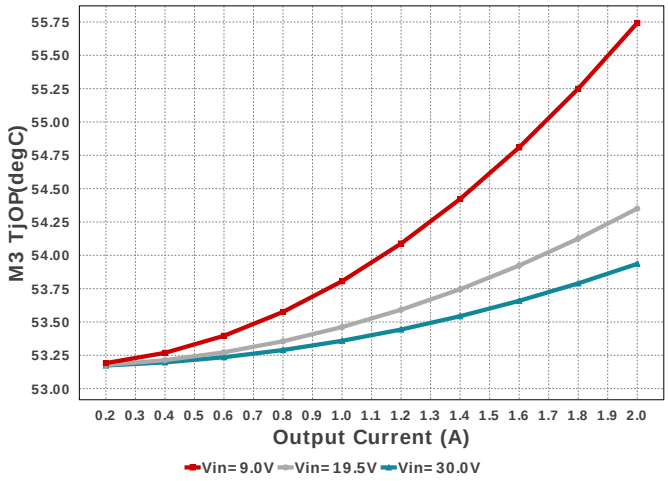
Coutx IRMS



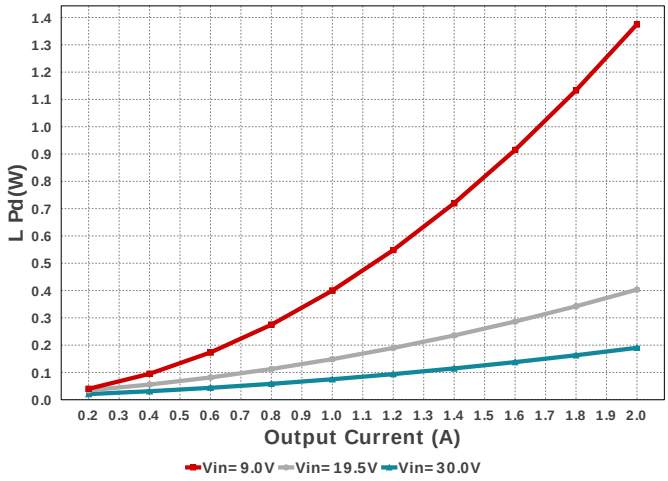
IC Tj



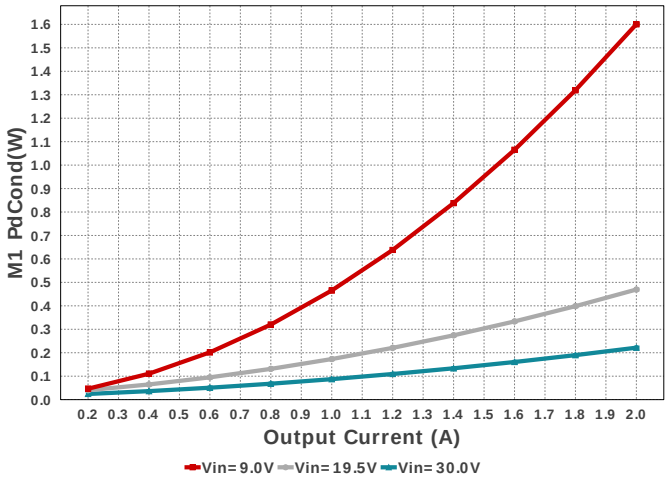
M3 TjOP



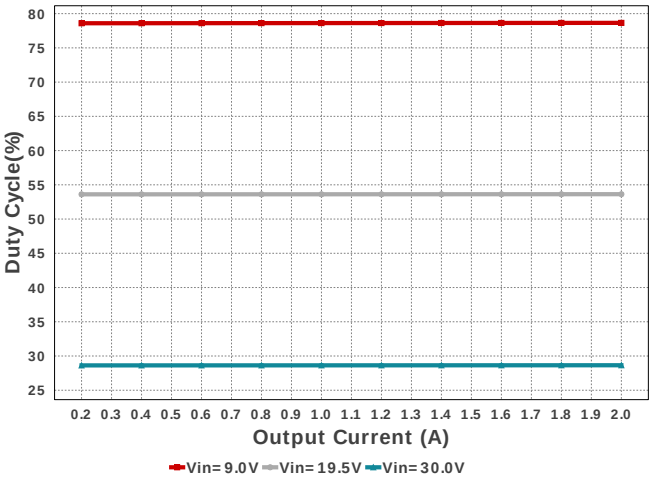
L Pd

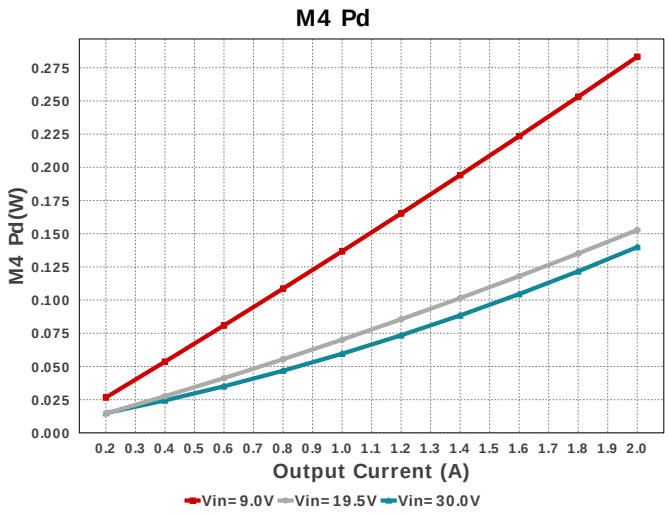


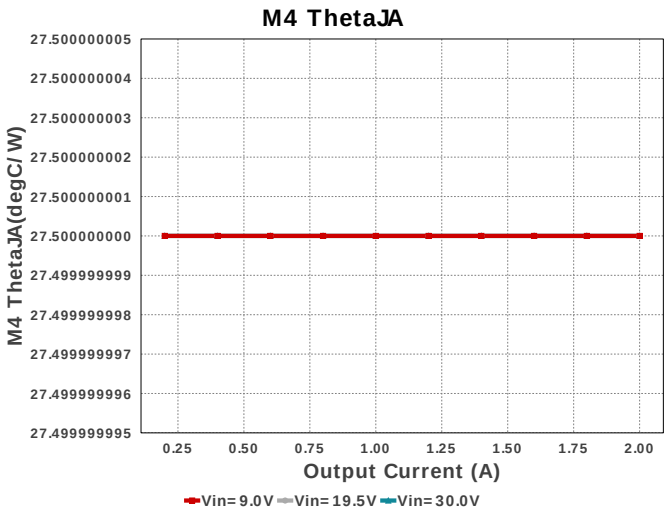
M1 PdCond

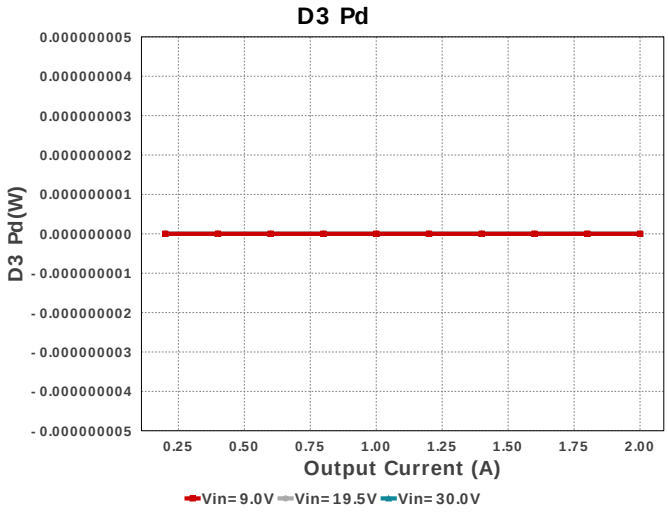


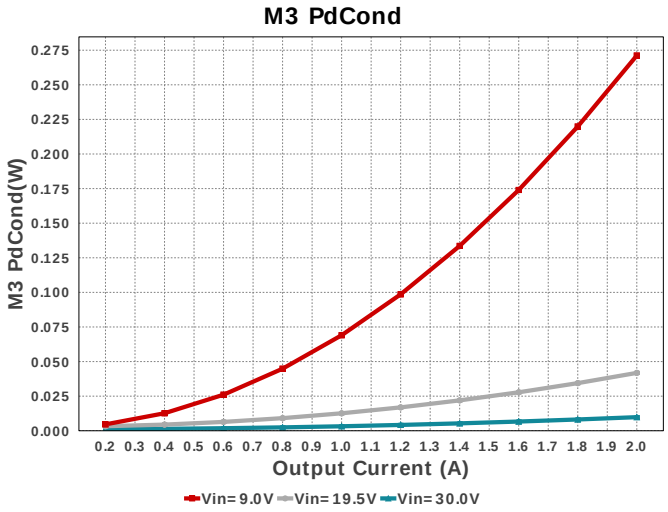
Duty Cycle

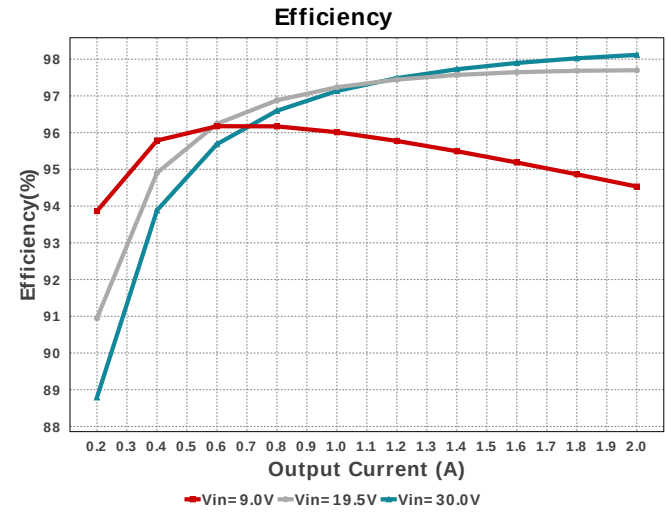


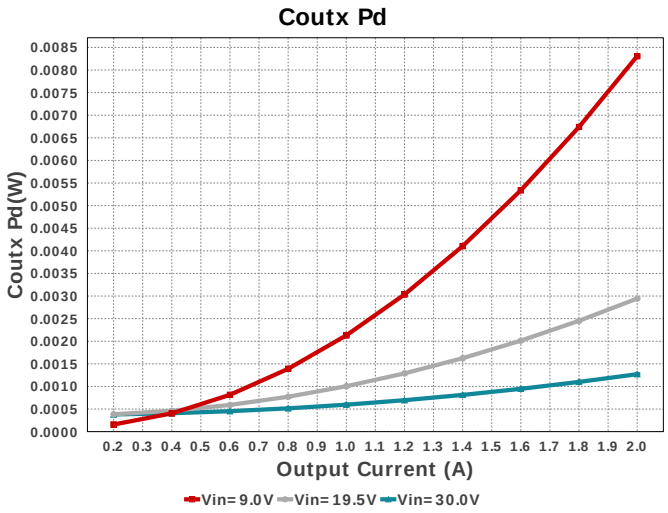


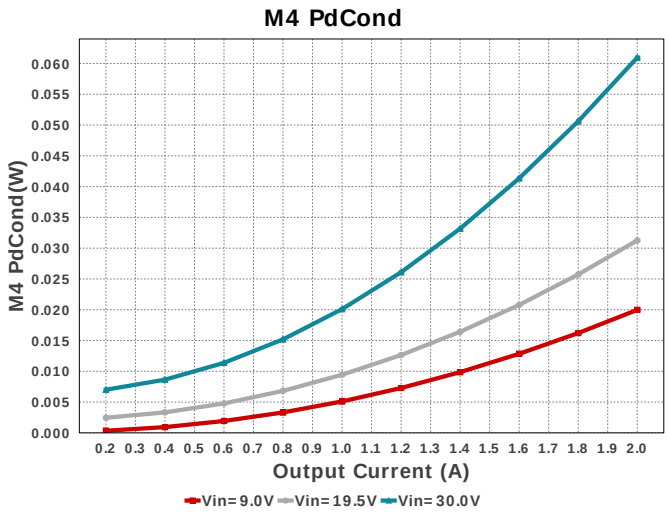


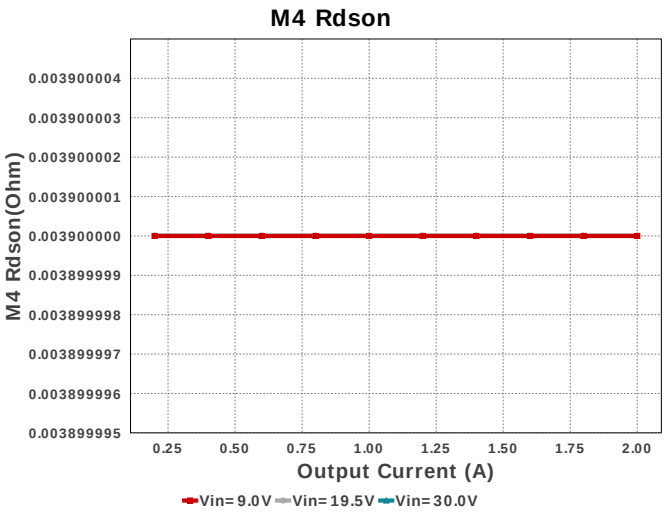


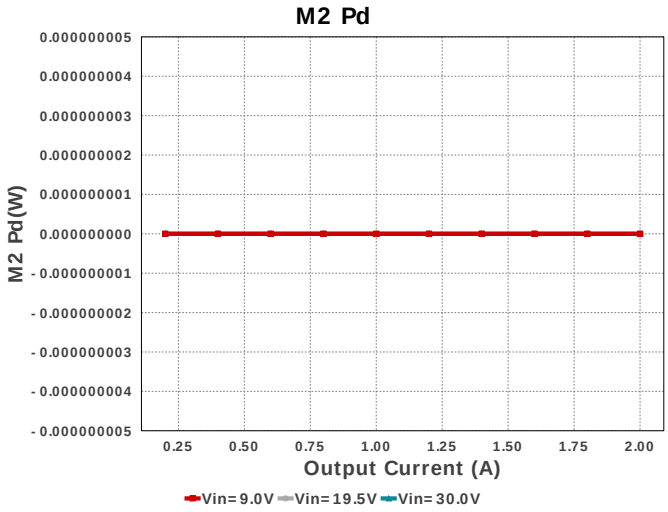


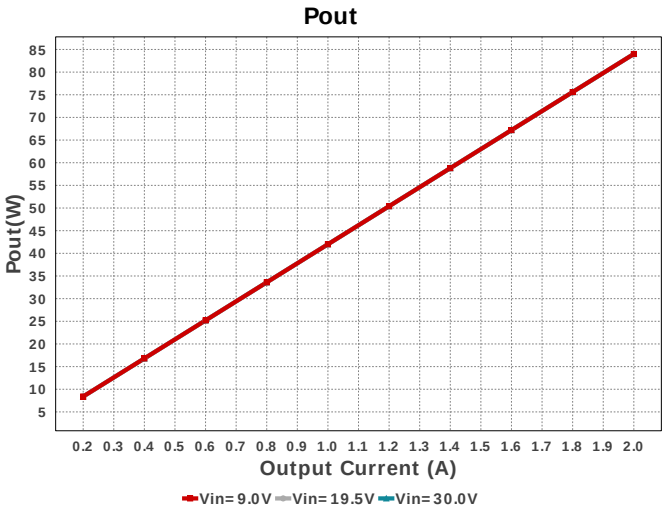


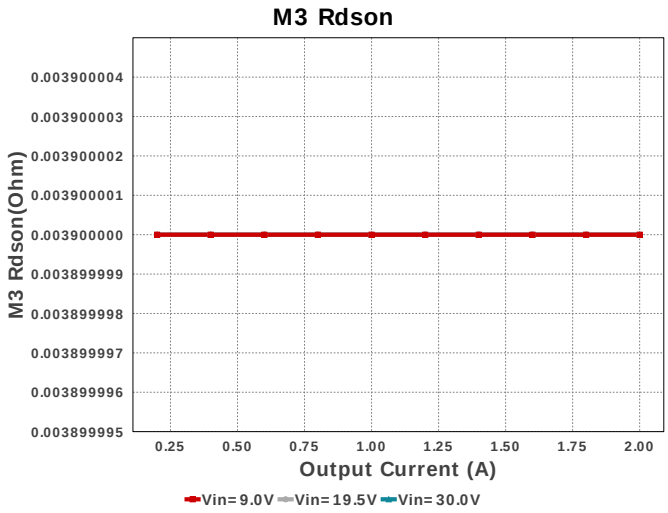


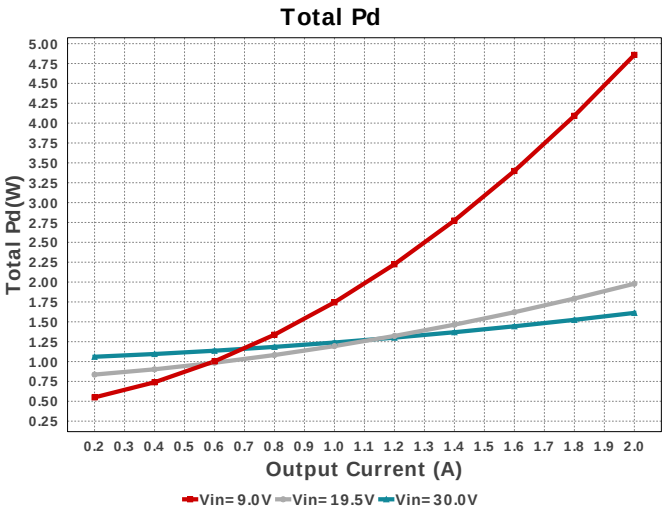


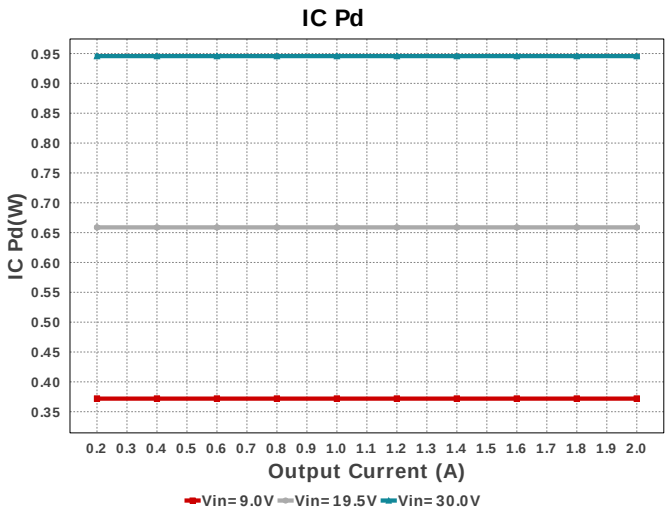


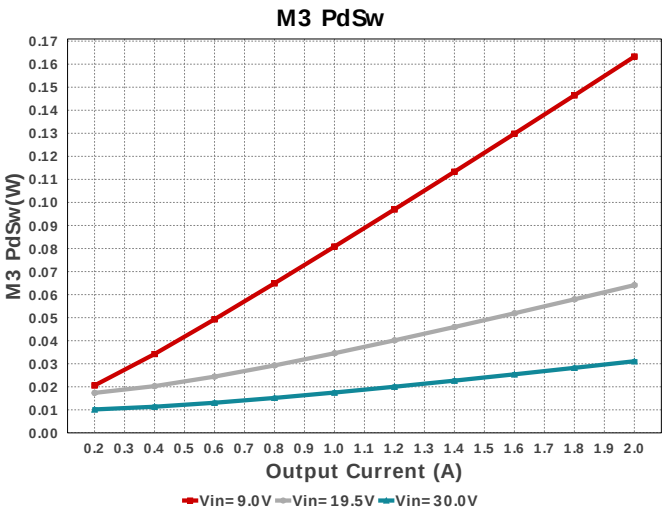


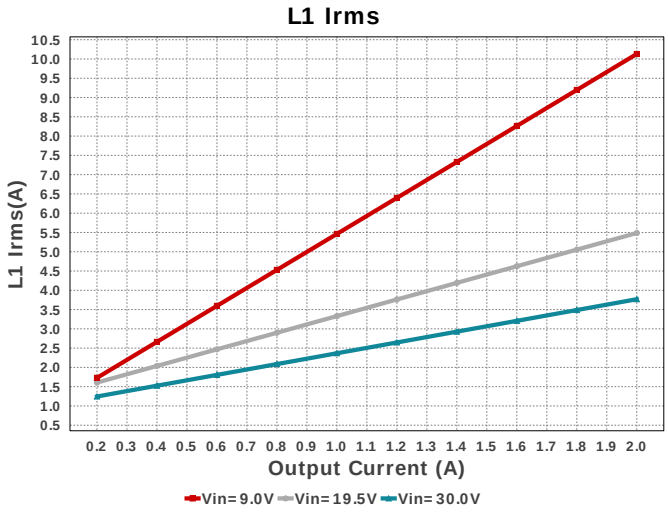


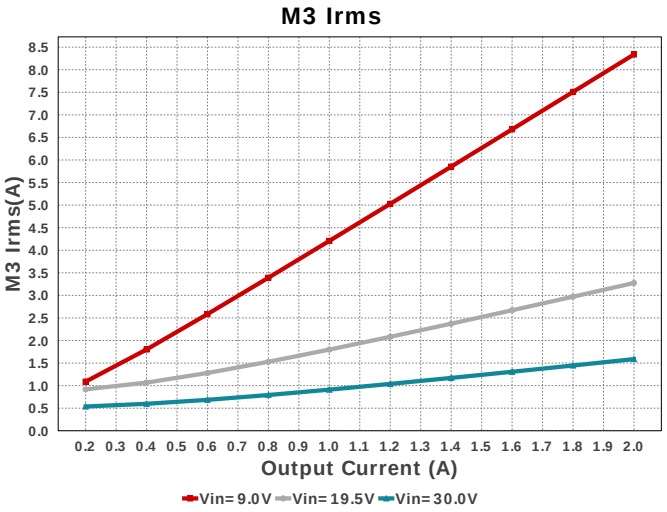


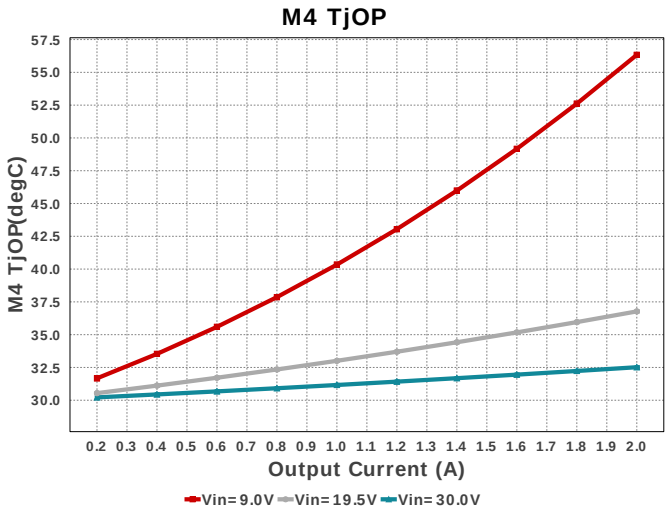


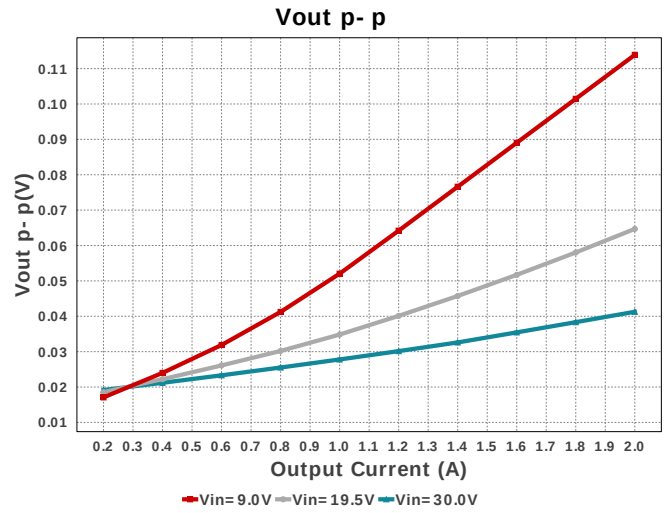


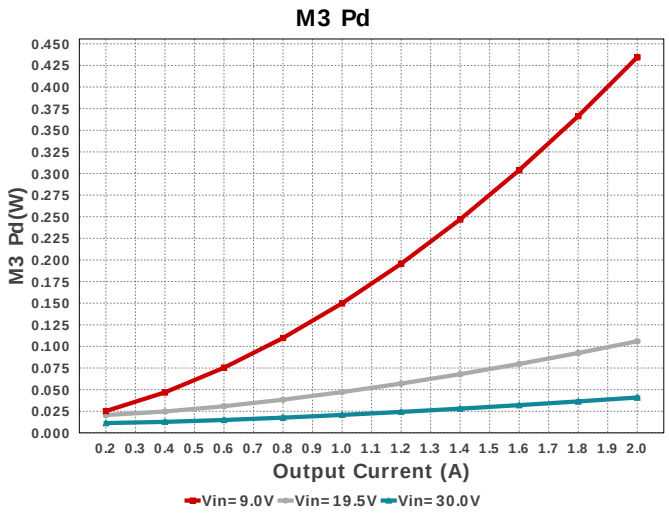


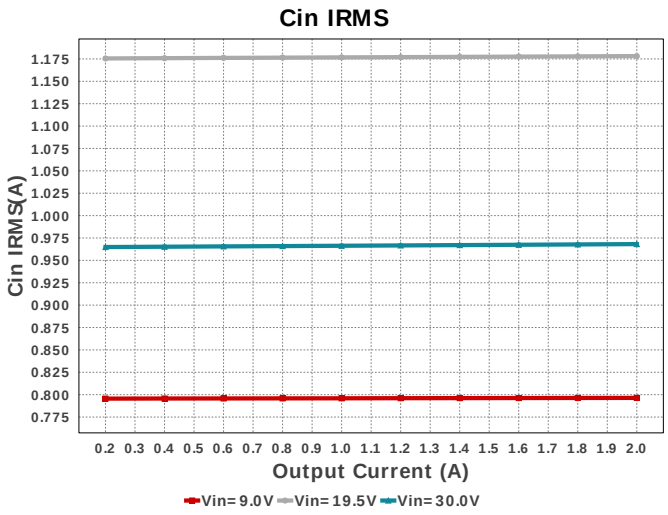


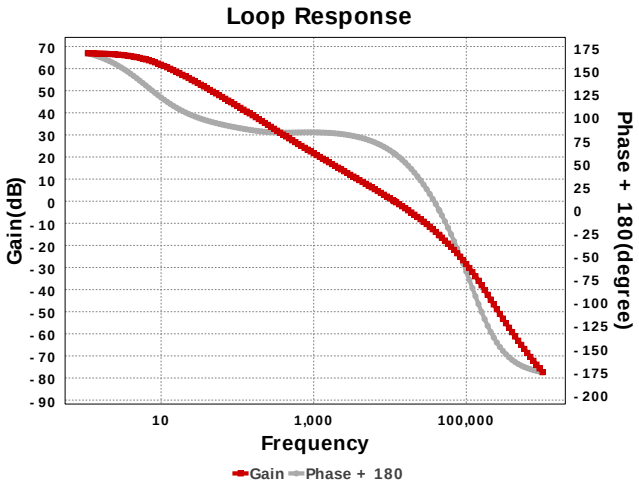












Operating Values

#	Name	Value	Category	Description
1.	Cin IRMS	2.65 A	Capacitor	Input capacitor RMS ripple current
2.	Cin Pd	280.93 mW	Capacitor	Input capacitor power dissipation
3.	Cout IRMS	1.52 A	Capacitor	Output capacitor RMS ripple current
4.	Cout Pd	28.861 mW	Capacitor	Output capacitor power dissipation
5.	Coutx IRMS	1.053 A	Capacitor	Output capacitor_x RMS ripple current
6.	Coutx Pd	3.697 mW	Capacitor	Output capacitor_x power loss
7.	D2 Pd	0.0 W	Diode	Diode power dissipation
8.	D3 Pd	0.0 W	Diode	Diode power dissipation
9.	IC Pd	638.31 mW	IC	IC power dissipation
10.	IC Tj	49.468 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	10.344 A	IC	Average input current
14.	L Ipp	9.18 A	Inductor	Peak-to-peak inductor ripple current
15.	L Pd	1.924 W	Inductor	Inductor power dissipation
16.	L1 Irms	11.983 A	Inductor	Inductor ripple current
17.	M1 Pd	2.24 W	Mosfet	M1 MOSFET total power dissipation
18.	M1 PdCond	2.24 W	Mosfet	M1 MOSFET conduction losses
19.	M2 Pd	0.0 W	Mosfet	M2 MOSFET total power dissipation
20.	M3 Irms	11.618 A	Mosfet	MOSFET RMS ripple current
21.	M3 Pd	2.333 W	Mosfet	MOSFET power dissipation
22.	M3 PdCond	2.106 W	Mosfet	M1 MOSFET conduction losses
23.	M3 PdSw	227.51 mW	Mosfet	M1 MOSFET switching losses
24.	M3 ThetaJA	55.0 degC/W	Mosfet	MOSFET junction-to-ambient thermal resistance
25.	M3 TjOP	75.447 degC	Mosfet	MOSFET junction temperature
26.	M4 Irms	3.095 A	Mosfet	MOSFET RMS ripple current
27.	M4 Pd	300.6 mW	Mosfet	MOSFET power dissipation
28.	M4 PdCond	37.351 mW	Mosfet	M2 MOSFET conduction losses
29.	M4 PdSw	0.0 W	Mosfet	M2 MOSFET switching losses
30.	M4 ThetaJA	27.5 degC/W	Mosfet	MOSFET junction-to-ambient thermal resistance
31.	M4 TjOP	54.073 degC	Mosfet	MOSFET junction temperature
32.	M4 TjOP	54.073 degC	Mosfet	M4 MOSFET junction temperature

#	Name	Value	Category	Description
33.	Cin Pd	280.93 mW	Power	Input capacitor power dissipation
34.	Cout Pd	28.861 mW	Power	Output capacitor power dissipation
35.	Coutx Pd	3.697 mW	Power	Output capacitor_x power loss
36.	D2 Pd	0.0 W	Power	Diode power dissipation
37.	D3 Pd	0.0 W	Power	Diode power dissipation
38.	IC Pd	638.31 mW	Power	IC power dissipation
39.	L Pd	1.924 W	Power	Inductor power dissipation
40.	M1 Pd	2.24 W	Power	M1 MOSFET total power dissipation
41.	M1 PdCond	2.24 W	Power	M1 MOSFET conduction losses
42.	M2 Pd	0.0 W	Power	M2 MOSFET total power dissipation
43.	M3 Pd	2.333 W	Power	MOSFET power dissipation
44.	M3 PdCond	2.106 W	Power	M1 MOSFET conduction losses
45.	M3 PdSw	227.51 mW	Power	M1 MOSFET switching losses
46.	M3 Rdson	15.6 mOhm	Power	Drain-Source On-resistance
47.	M4 Pd	300.6 mW	Power	MOSFET power dissipation
48.	M4 PdCond	37.351 mW	Power	M2 MOSFET conduction losses
49.	M4 PdSw	0.0 W	Power	M2 MOSFET switching losses
50.	M4 Rdson	3.9 mOhm	Power	Drain-Source On-resistance
51.	Rsense Pd	1.35 W	Power	LED Current Rsns Power Dissipation
52.	Total Pd	9.099 W	Power	Total Power Dissipation
53.	Rsense Pd	1.35 W	Resistor	LED Current Rsns Power Dissipation
54.	BOM Count	47	System Information	Total Design BOM count
55.	Cross Freq	11.424 kHz	System Information	Bode plot crossover frequency
56.	Duty Cycle	28.776 %	System Information	Duty cycle
57.	Efficiency	90.226 %	System Information	Steady state efficiency
58.	FootPrint	1.614 k mm^2	System Information	Total Foot Print Area of BOM components
59.	Frequency	256.41 kHz	System Information	Switching frequency
60.	Gain Marg	-15.448 dB	System Information	Bode Plot Gain Margin
61.	Iout	2.0 A	System Information	Iout operating point
62.	Low Freq Gain	66.913 dB	System Information	Gain at 1Hz
63.	Mode	CCM	System Information	Conduction Mode
64.	Operating Topology	Boost	System Information	The current operating topology of the device
65.	Phase Marg	62.071 deg	System Information	Bode Plot Phase Margin
66.	Pout	84.0 W	System Information	Total output power
67.	SW Ipk	7.398 A	System Information	Peak switch current
68.	Total BOM	$38.69	System Information	Total BOM Cost
69.	Vin	9.0 V	System Information	Vin operating point
70.	Vout	42.0 V	System Information	Operational Output Voltage
71.	Vout Actual	41.6 V	System Information	Vout Actual calculated based on selected voltage divider resistors
72.	Vout Tolerance	1.981 %	System Information	Vout Tolerance based on IC Tolerance (no load) and voltage divider resistors if applicable
73.	Vout p-p	67.842 mV	System Information	Peak-to-peak output ripple voltage

Design Inputs

#	Name	Value	Description
1.	Iout	2.0	Maximum Output Current
2.	VinMax	30.0	Maximum input voltage
3.	VinMin	9.0	Minimum input voltage
4.	Vout	42.0	Output Voltage
5.	base_pn	LM5175	Base Product Number
6.	source	DC	Input Source Type
7.	Ta	30.0	Ambient temperature

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. **LM5175** Product Folder : http://www.ti.com/product/LM5175 : contains the data sheet and other resources.