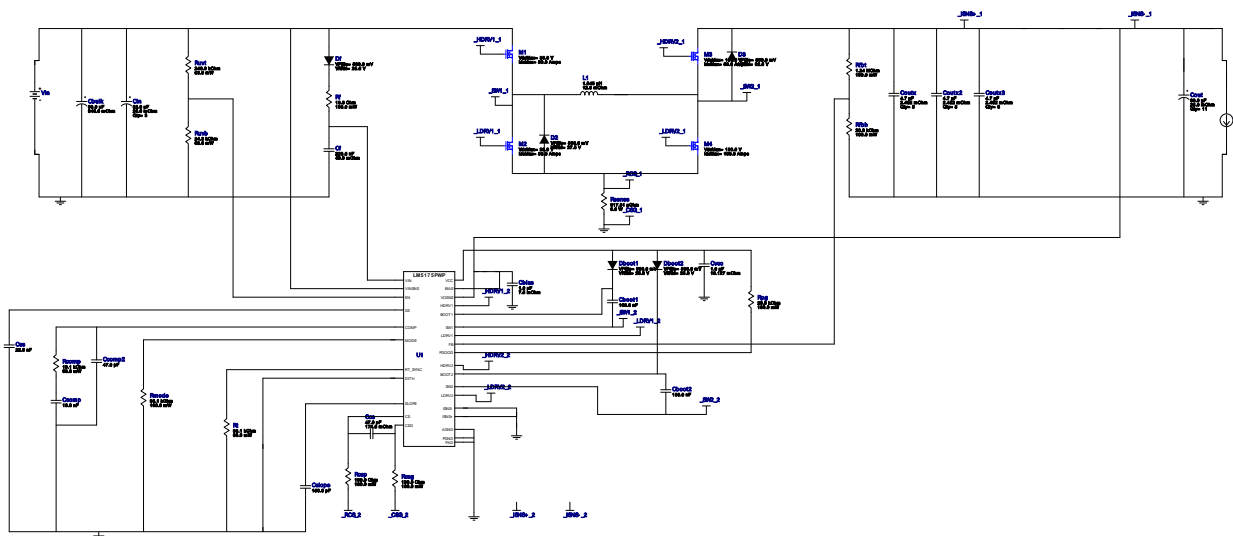





















## WEBENCH® Design Report

Design : 4688446/16 LM5175PWPR  
LM5175PWPR 14.0V-22.0V to 50.00V @ 20.0A



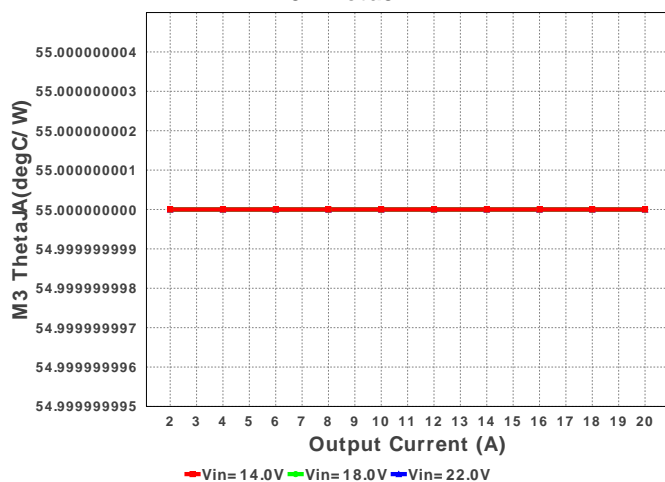
### Electrical BOM

#	Name	Manufacturer	Part Number	Properties	Qty	Price	Footprint
1.	Cbias	TDK	C3216X7R2A105M160AA Series= X7R	Cap= 1.0 uF ESR= 7.5 mOhm VDC= 100.0 V IRMS= 5.9235 A	1	\$0.11	 1206 11 mm <sup>2</sup>
2.	Cboot1	Kemet	C0603C104K3RACTU Series= X7R	Cap= 100.0 nF VDC= 25.0 V IRMS= 0.0 A	1	\$0.01	 0603 5 mm <sup>2</sup>
3.	Cboot2	Kemet	C0603C104K3RACTU Series= X7R	Cap= 100.0 nF VDC= 25.0 V IRMS= 0.0 A	1	\$0.01	 0603 5 mm <sup>2</sup>
4.	Cbulk	Nichicon	UUD1V680MCL1GS Series= uD	Cap= 68.0 uF ESR= 340.0 mOhm VDC= 35.0 V IRMS= 280.0 mA	1	\$0.11	 SM_RADIAL_6.3BMM 80 mm <sup>2</sup>
5.	Ccomp	MuRata	GRM216R71H103KA01D Series= X7R	Cap= 10.0 nF VDC= 50.0 V IRMS= 0.0 A	1	\$0.01	 0805 7 mm <sup>2</sup>
6.	Ccomp2	Kemet	C0805C470K5GACTU Series= C0G/NP0	Cap= 47.0 pF VDC= 50.0 V IRMS= 0.0 A	1	\$0.01	 0805 7 mm <sup>2</sup>
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 mm <sup>2</sup>
8.	Cf	Kemet	C0805C224K5RACTU Series= X7R	Cap= 220.0 nF ESR= 46.0 mOhm VDC= 50.0 V IRMS= 2.65 A	1	\$0.02	 0805 7 mm <sup>2</sup>
9.	Cin	Panasonic	35SVPF82M Series= ?	Cap= 82.0 uF ESR= 20.0 mOhm VDC= 35.0 V IRMS= 4.0 A	3	\$0.61	 CAPSMT_62_E12 106 mm <sup>2</sup>

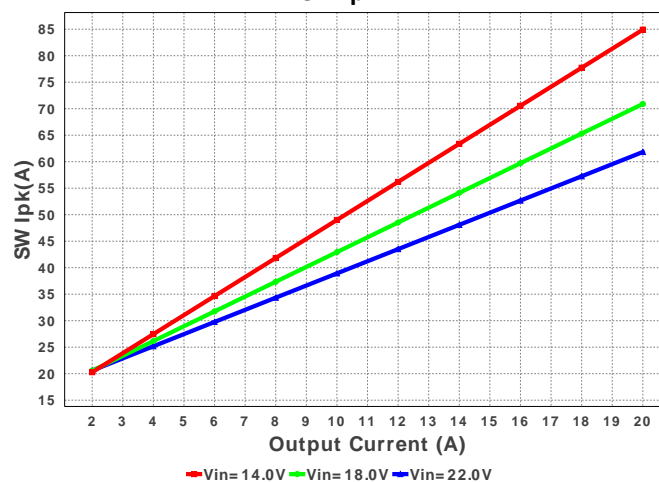
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10.	Cout	Panasonic	63SXV33M Series= ?	Cap= 33.0 uF ESR= 25.0 mOhm VDC= 63.0 V IRMS= 2.95 A	11	\$1.25	 CAPSMT_62_E12 106 mm²
11.	Coutx	TDK	C5750X5R2A475K Series= X5R	Cap= 4.7 uF ESR= 2.482 mOhm VDC= 100.0 V IRMS= 0.0 A	5	\$0.37	 2220 54 mm²
12.	Coutx2	TDK	C5750X5R2A475K Series= X5R	Cap= 4.7 uF ESR= 2.482 mOhm VDC= 100.0 V IRMS= 0.0 A	5	\$0.37	 2220 54 mm²
13.	Coutx3	TDK	C5750X5R2A475K Series= X5R	Cap= 4.7 uF ESR= 2.482 mOhm VDC= 100.0 V IRMS= 0.0 A	5	\$0.37	 2220 54 mm²
14.	Cslope	Kemet	C0603C151K3GACTU Series= C0G/NP0	Cap= 150.0 pF VDC= 25.0 V IRMS= 0.0 A	1	\$0.01	 0603 5 mm²
15.	Css	Kemet	C0603C223K3RACTU Series= X7R	Cap= 22.0 nF VDC= 25.0 V IRMS= 0.0 A	1	\$0.01	 0603 5 mm²
16.	Cvcc	MuRata	GRM188R61C105KA93D Series= X5R	Cap= 1.0 uF ESR= 10.127 mOhm VDC= 16.0 V IRMS= 994.63 mA	1	\$0.01	 0603 5 mm²
17.	D2	CUSTOM	CUSTOM	VF@Io= 500.0 mV VRRM= 27.5 V	1	NA	CUSTOM 0 mm²
18.	D3	CUSTOM	CUSTOM	VF@Io= 500.0 mV VRRM= 62.5 V	1	NA	CUSTOM 0 mm²
19.	Dboot1	CUSTOM	CUSTOM	VF@Io= 500.0 mV VRRM= 25.3 V	1	NA	CUSTOM 0 mm²
20.	Dboot2	CUSTOM	CUSTOM	VF@Io= 500.0 mV VRRM= 25.3 V	1	NA	CUSTOM 0 mm²
21.	Df	CUSTOM	CUSTOM	VF@Io= 500.0 mV VRRM= 28.6 V	1	NA	CUSTOM 0 mm²
22.	L1	CUSTOM	CUSTOM	L= 1.045 uH DCR= 12.5 mOhm	1	NA	CUSTOM 0 mm²
23.	M1	Texas Instruments	CSD17308Q3	VdsMax= 30.0 V IdsMax= 50.0 Amps	1	\$0.34	 TRANS_NexFET_Q3 18 mm²
24.	M2	Texas Instruments	CSD17304Q3	VdsMax= 30.0 V IdsMax= 56.0 Amps	1	\$0.36	 TRANS_NexFET_Q3 18 mm²
25.	M3	Texas Instruments	CSD19534Q5A	VdsMax= 100.0 V IdsMax= 50.0 Amps	1	\$0.68	 TRANS_NexFET_Q5A 55 mm²
26.	M4	Texas Instruments	CSD19533Q5A	VdsMax= 100.0 V IdsMax= 100.0 Amps	1	\$0.83	 TRANS_NexFET_Q5A 55 mm²
27.	Rcomp	Vishay-Dale	CRCW040219K1FKED Series= CRCW..e3	Res= 19.1 kOhm Power= 63.0 mW Tolerance= 1.0%	1	\$0.01	 0402 3 mm²
28.	Rcsg	Vishay-Dale	CRCW0603100RFKEA Series= CRCW..e3	Res= 100.0 Ohm Power= 100.0 mW Tolerance= 1.0%	1	\$0.01	 0603 5 mm²

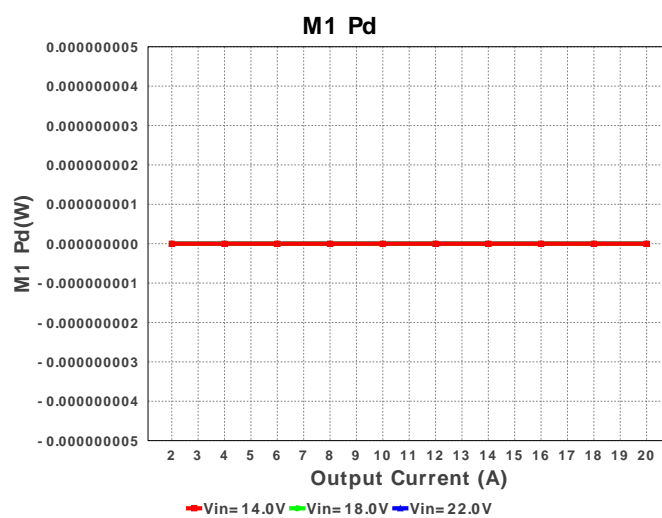
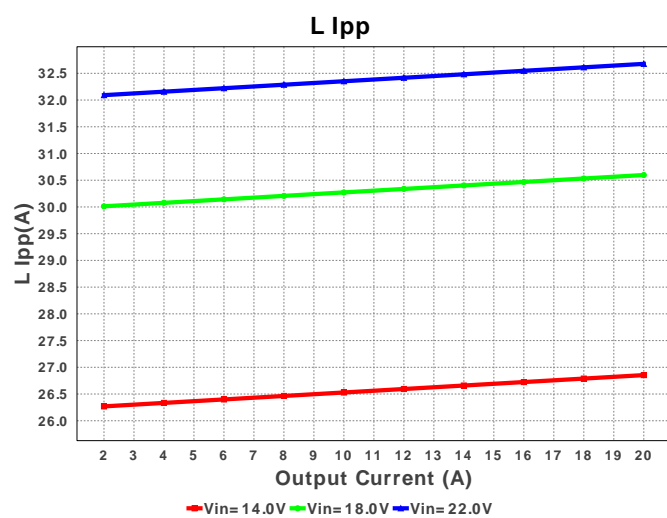
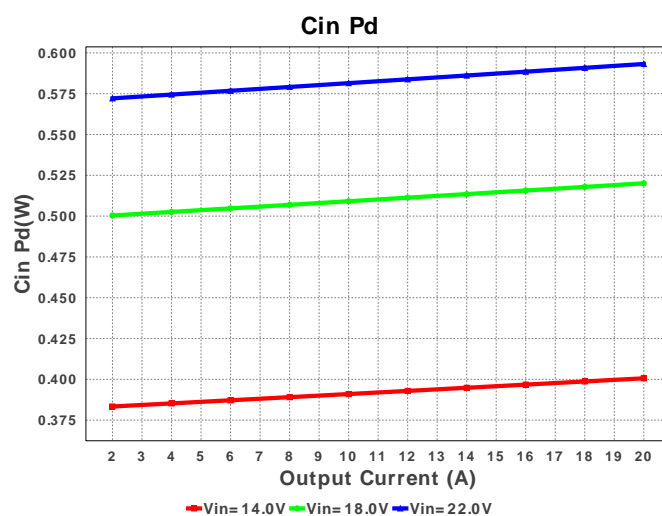
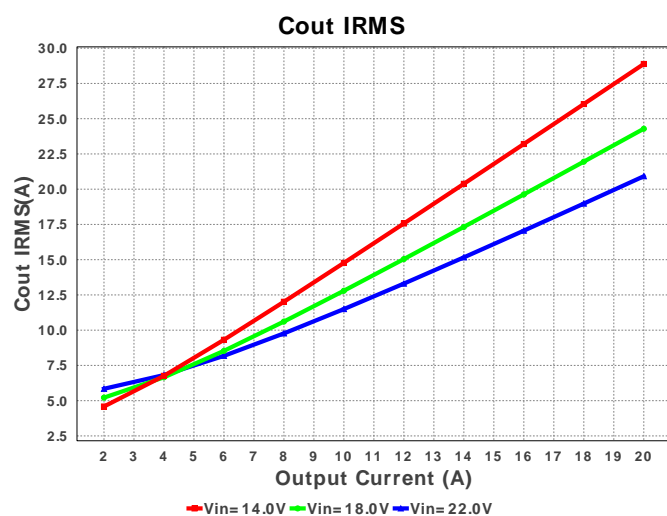
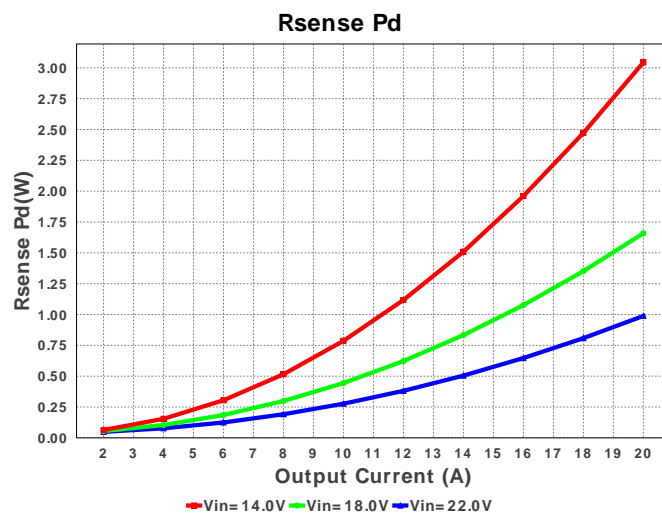
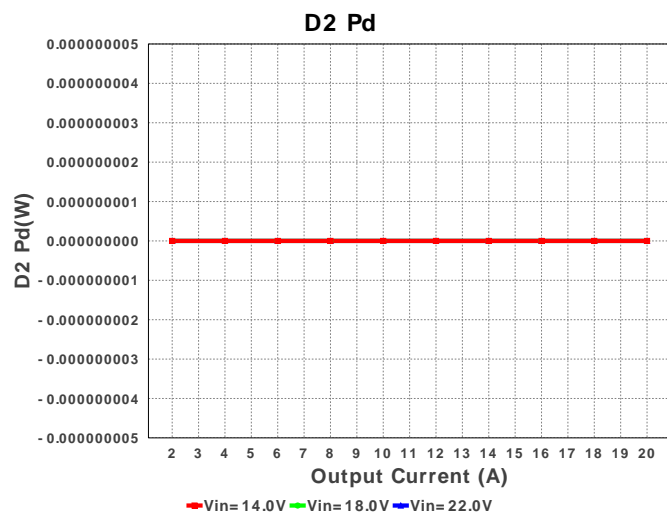
#	Name	Manufacturer	Part Number	Properties	Qty	Price	Footprint
29.	Rcsp	Vishay-Dale	CRCW0603100RFKEA Series= CRCW..e3	Res= 100.0 Ohm Power= 100.0 mW Tolerance= 1.0%	1	\$0.01	 0603 5 mm <sup>2</sup>
30.	Rf	Vishay-Dale	CRCW060310R0FKEA Series= CRCW..e3	Res= 10.0 Ohm Power= 100.0 mW Tolerance= 1.0%	1	\$0.01	 0603 5 mm <sup>2</sup>
31.	Rfbb	Vishay-Dale	CRCW060320K0FKEA Series= CRCW..e3	Res= 20.0 kOhm Power= 100.0 mW Tolerance= 1.0%	1	\$0.01	 0603 5 mm <sup>2</sup>
32.	Rfbt	Vishay-Dale	CRCW06031M24FKEA Series= CRCW..e3	Res= 1.24 MOhm Power= 100.0 mW Tolerance= 1.0%	1	\$0.01	 0603 5 mm <sup>2</sup>
33.	Rmode	Vishay-Dale	CRCW060393K1FKEA Series= CRCW..e3	Res= 93.1 kOhm Power= 100.0 mW Tolerance= 1.0%	1	\$0.01	 0603 5 mm <sup>2</sup>
34.	Rpg	Vishay-Dale	CRCW060320K0FKEA Series= CRCW..e3	Res= 20.0 kOhm Power= 100.0 mW Tolerance= 1.0%	1	\$0.01	 0603 5 mm <sup>2</sup>
35.	Rsense	CUSTOM	CUSTOM Series= ?	Res= 817.31 uOhm Power= 0.0 W Tolerance= 0.0%	1	NA	CUSTOM 0 mm <sup>2</sup>
36.	Rt	Vishay-Dale	CRCW040268K1FKED Series= CRCW..e3	Res= 68.1 kOhm Power= 63.0 mW Tolerance= 1.0%	1	\$0.01	 0402 3 mm <sup>2</sup>
37.	Ruvb	Vishay-Dale	CRCW040224K3FKED Series= CRCW..e3	Res= 24.3 kOhm Power= 63.0 mW Tolerance= 1.0%	1	\$0.01	 0402 3 mm <sup>2</sup>
38.	Rvvt	Vishay-Dale	CRCW0402249KFKED Series= CRCW..e3	Res= 249.0 kOhm Power= 63.0 mW Tolerance= 1.0%	1	\$0.01	 0402 3 mm <sup>2</sup>
39.	U1	Texas Instruments	LM5175PWPR	Switcher	1	\$3.10	 PWP0028F_N 98 mm <sup>2</sup>

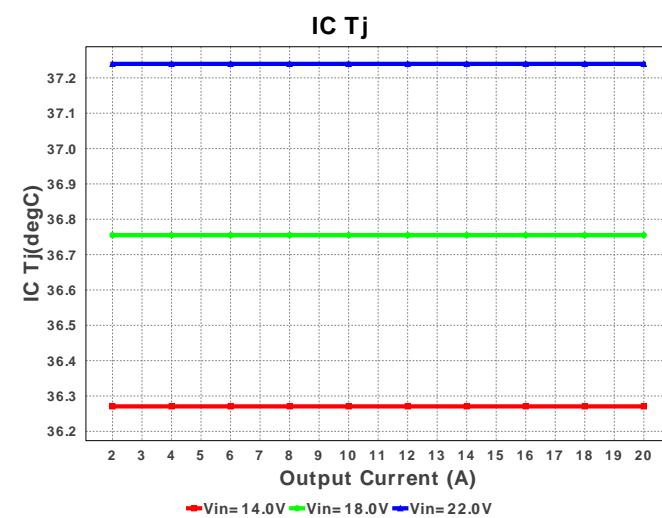
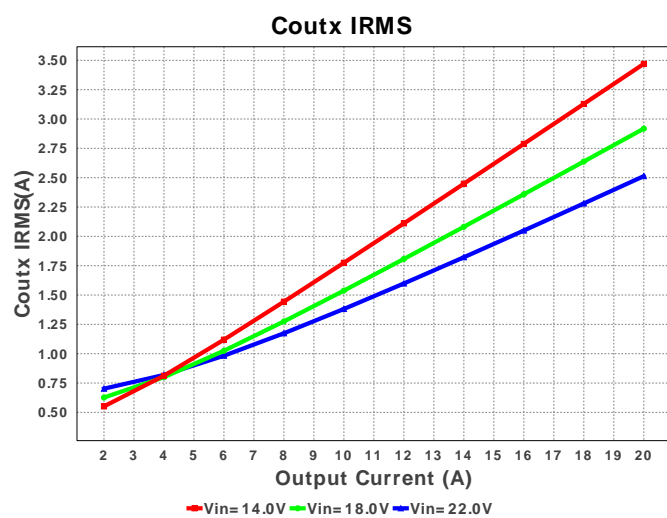
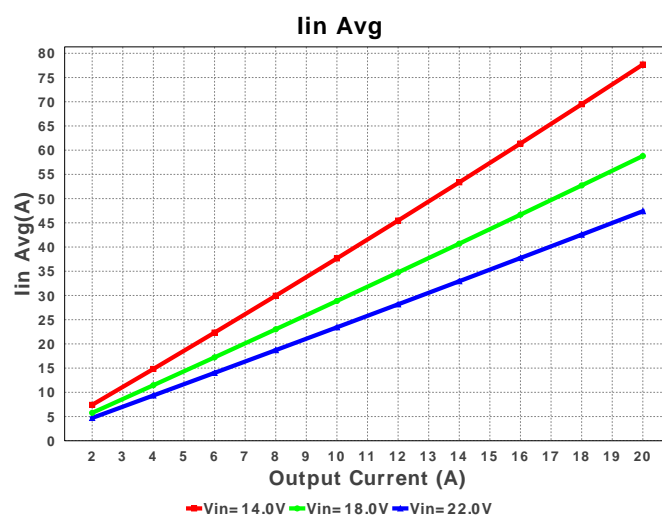
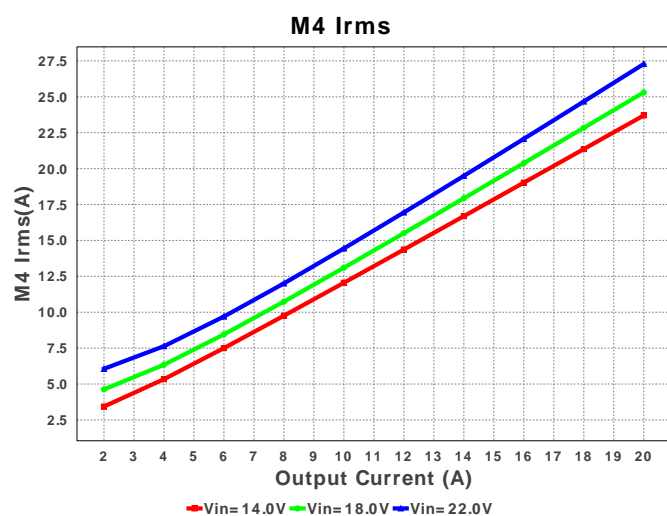
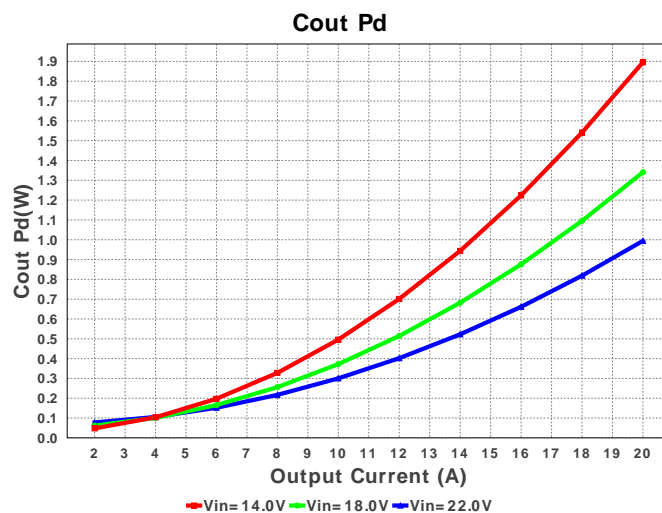
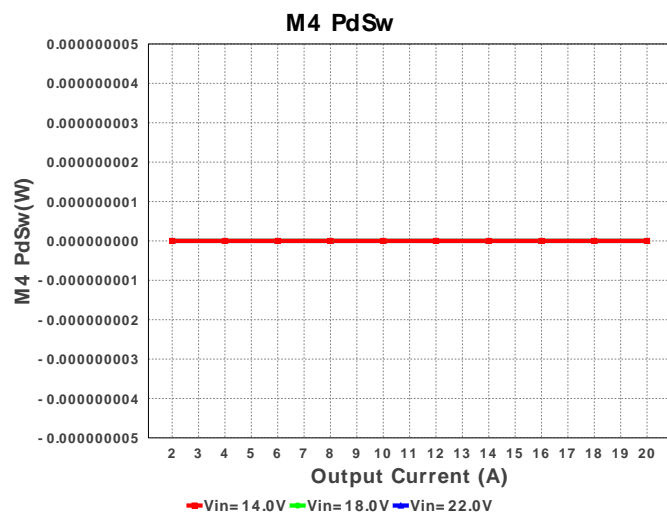
M3 ThetaJA

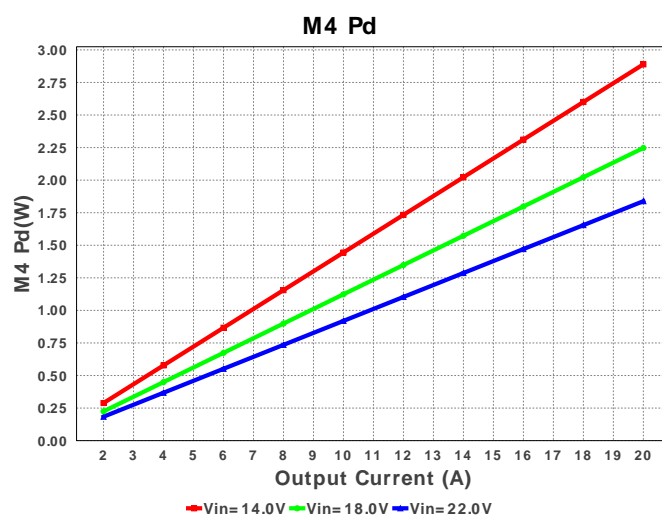
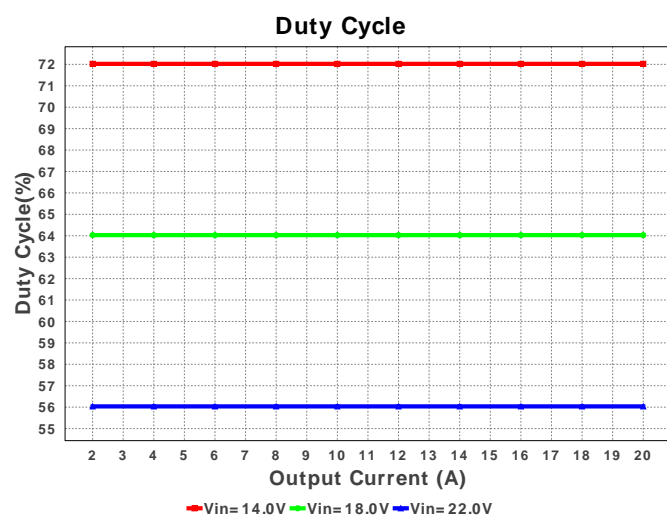
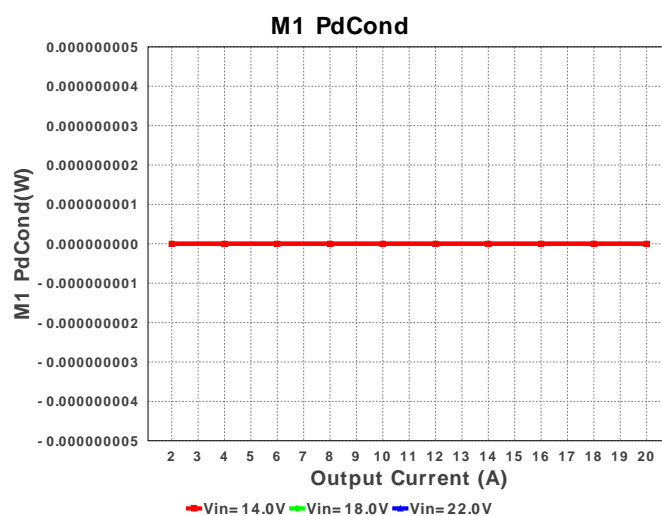
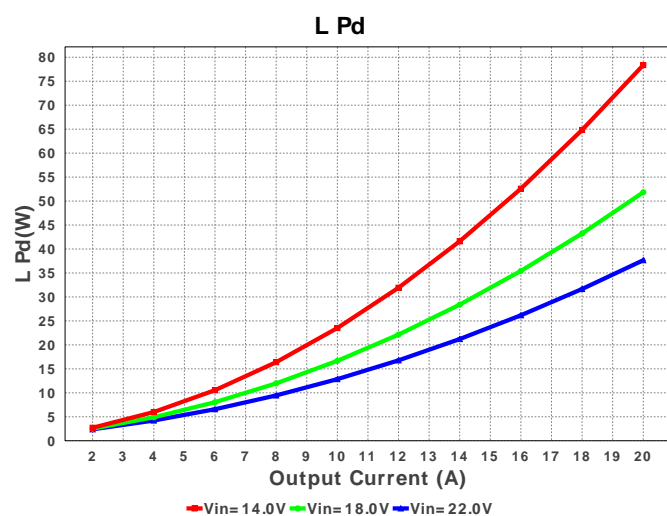
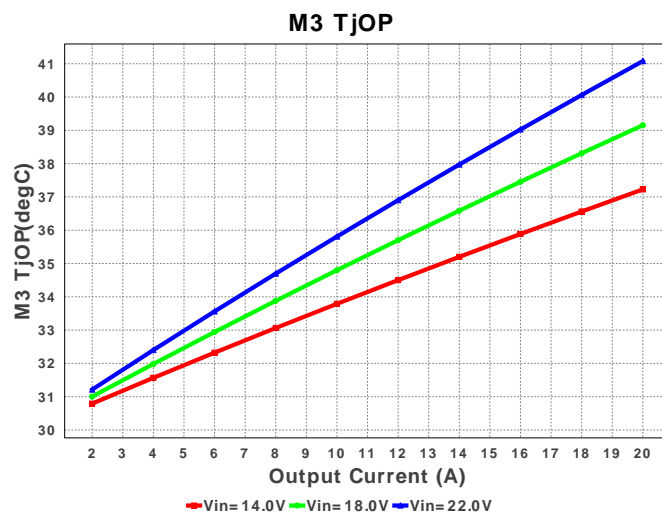
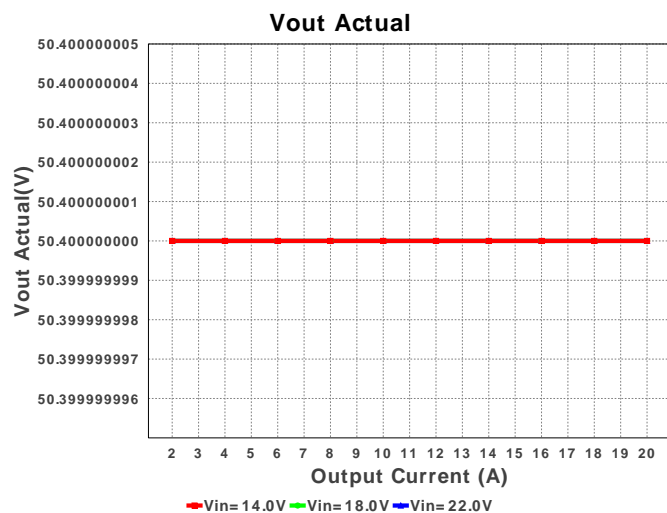


SW Ipk

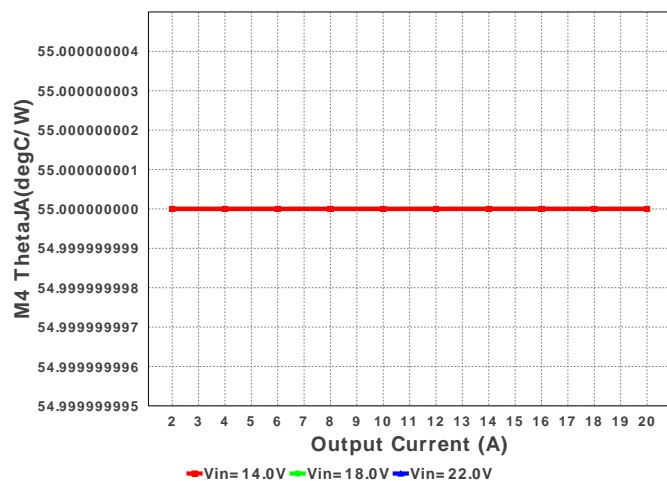




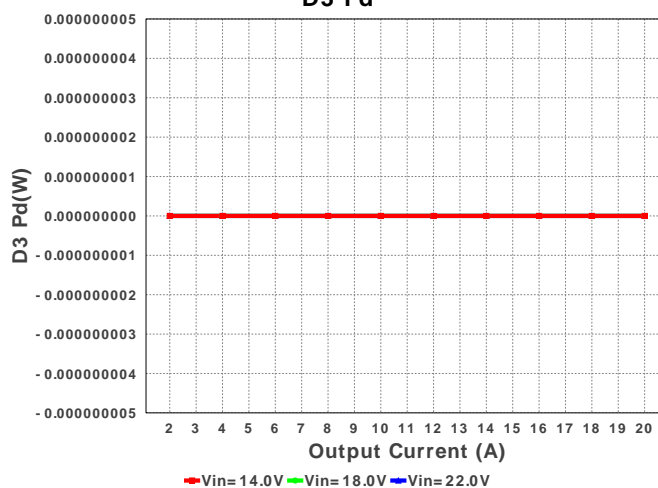




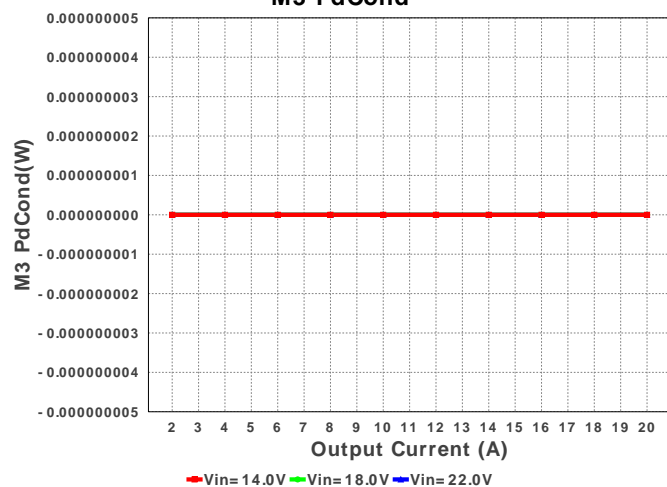
M4 ThetaJA



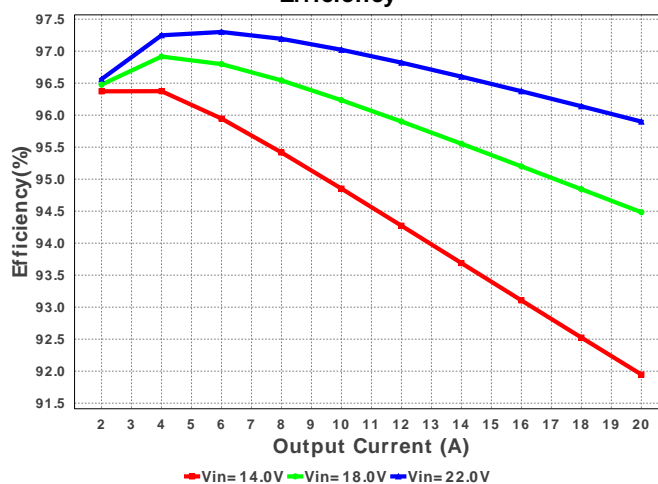
D3 Pd



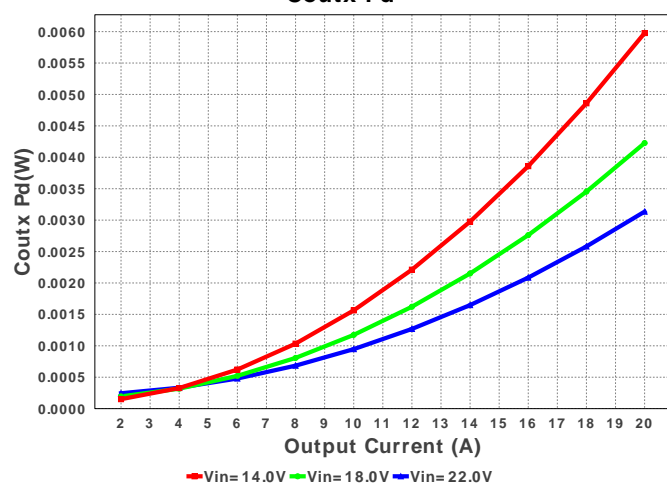
M3 PdCond



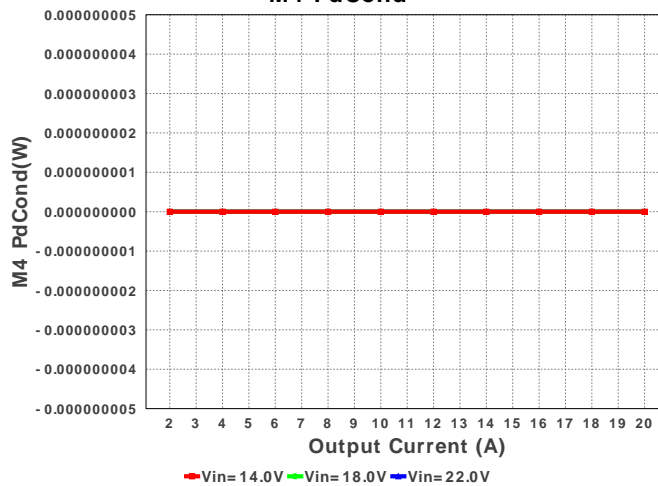
Efficiency



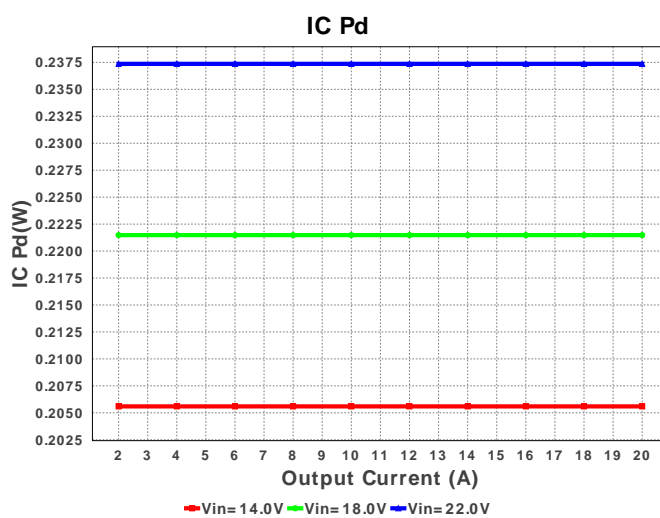
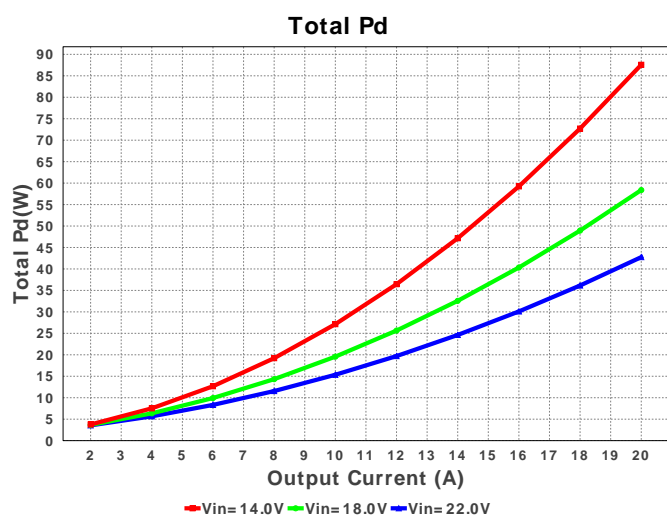
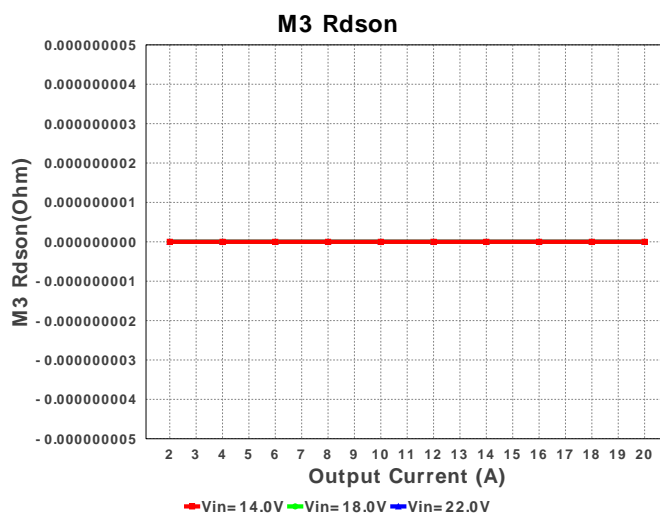
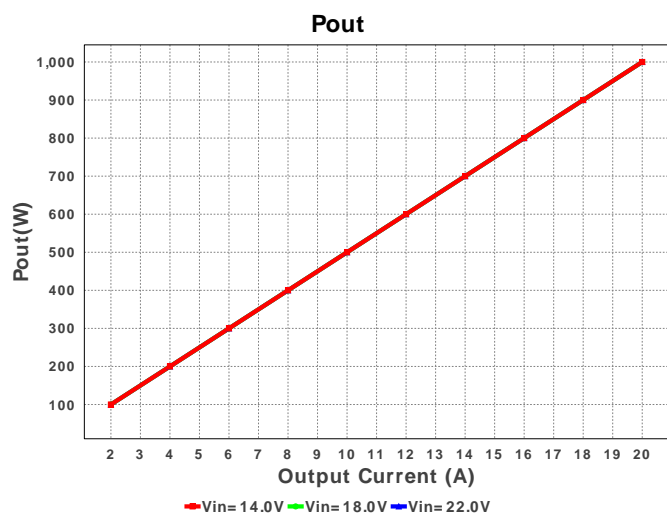
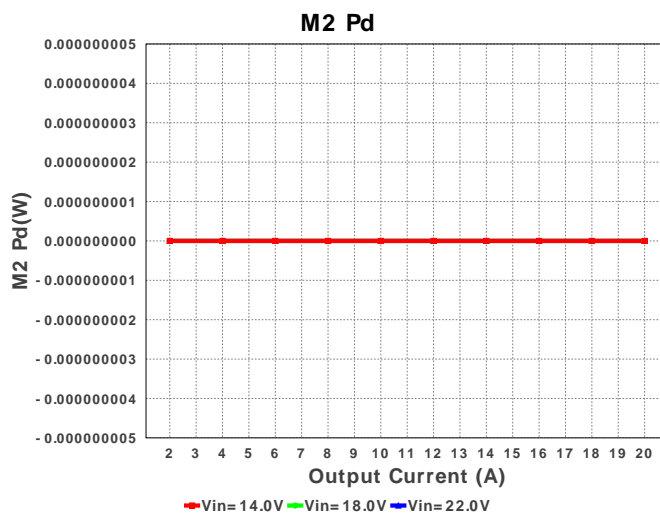
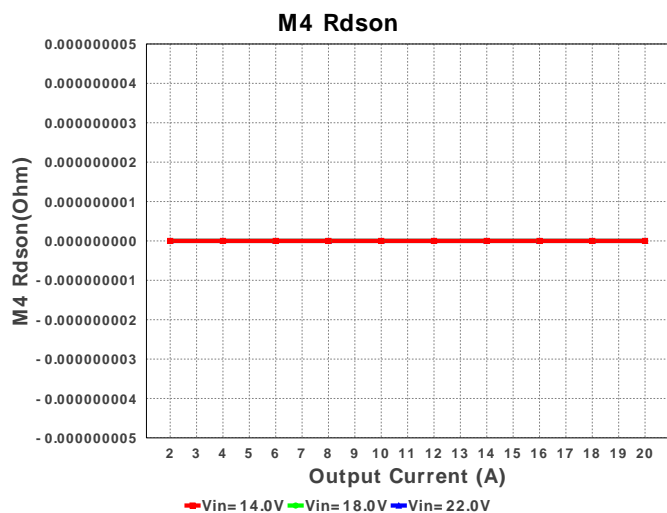
Coutx Pd



M4 PdCond

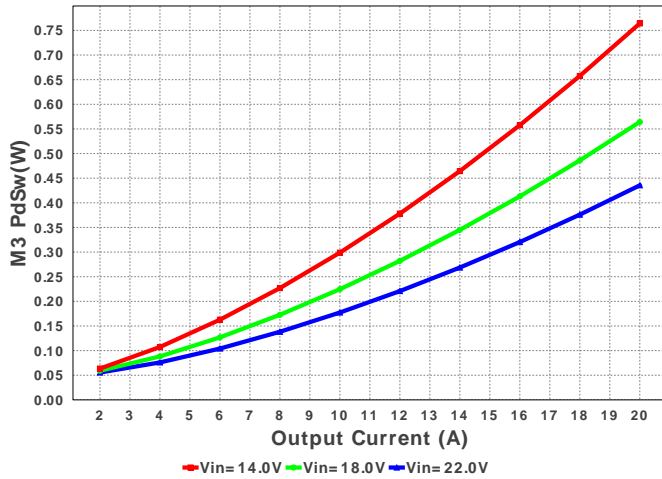




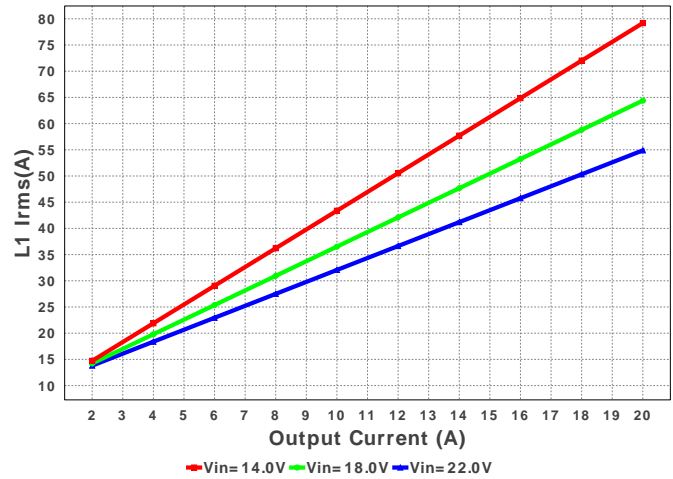




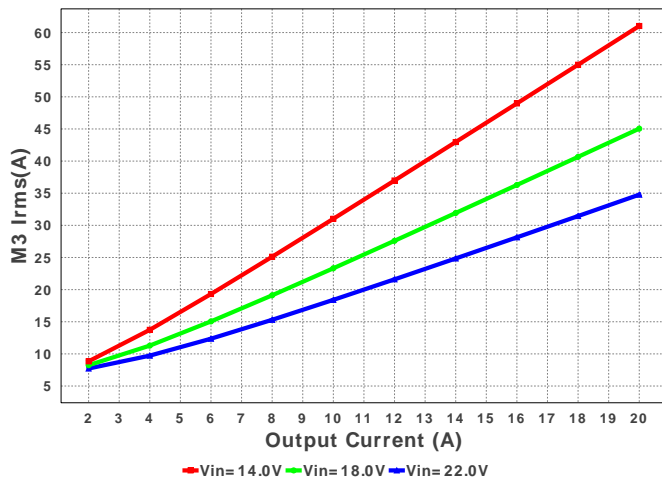
M3 PdSw



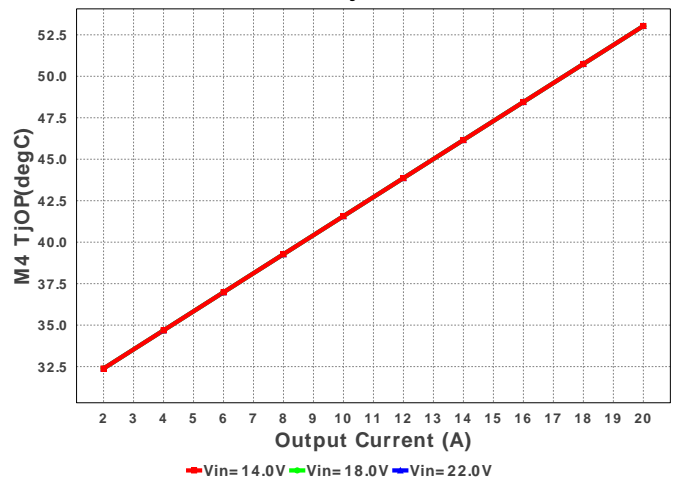
L1 Irms



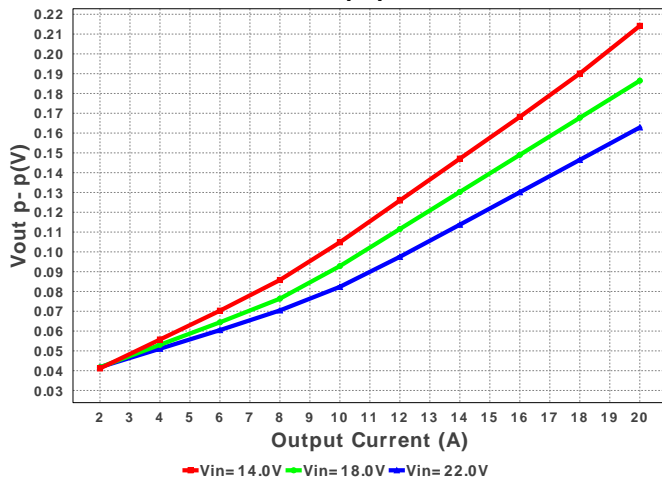
M3 Irms



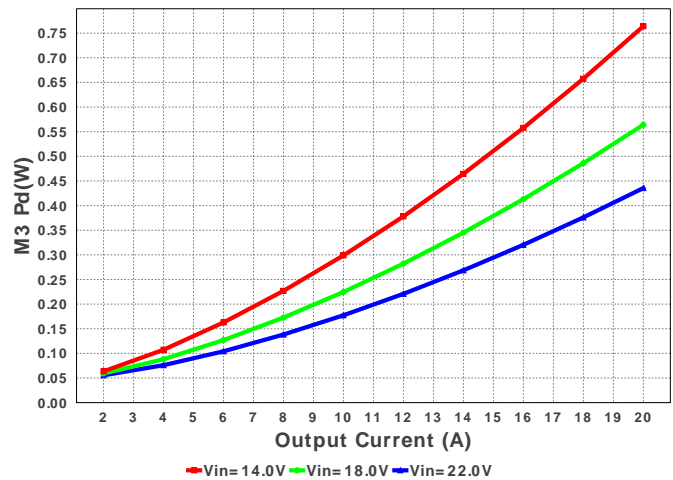
M4 TjOP

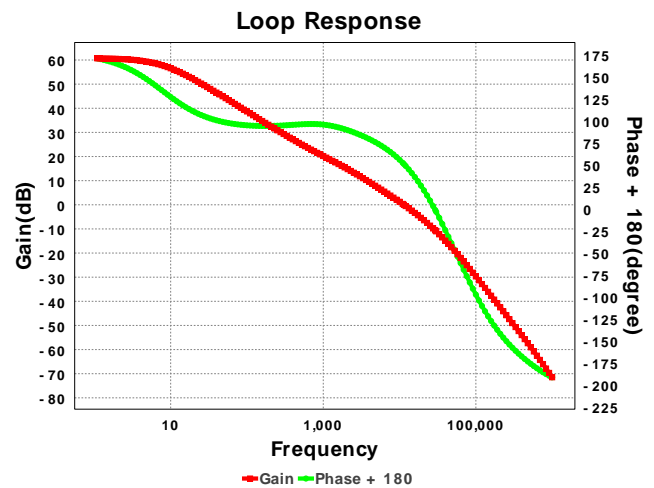
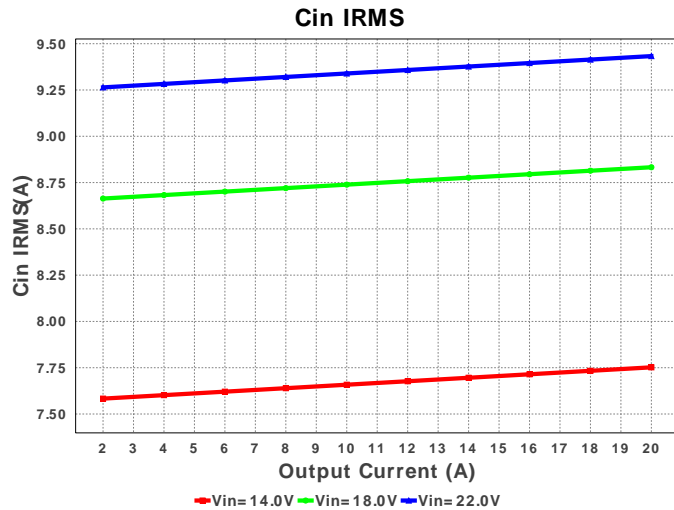


Vout p-p



M3 Pd





## Operating Values

#	Name	Value	Category	Description
1.	Cin IRMS	12.075 A	Current	Input capacitor RMS ripple current
2.	Cout IRMS	21.387 A	Current	Output capacitor RMS ripple current
3.	Coutx IRMS	2.57 A	Current	Output capacitor_x RMS ripple current
4.	Iin Avg	78.308 A	Current	Average input current
5.	L Ipp	41.827 A	Current	Peak-to-peak inductor ripple current
6.	L1 Irms	83.503 A	Current	Inductor ripple current
7.	M3 Irms	62.768 A	Current	MOSFET RMS ripple current
8.	M4 Irms	24.383 A	Current	MOSFET RMS ripple current
9.	SW Ipk	66.405 A	Current	Peak switch current
10.	BOM Count	63	General	Total Design BOM count
11.	FootPrint	3.743 k mm <sup>2</sup>	General	Total Foot Print Area of BOM components
12.	Frequency	367.688 kHz	General	Switching frequency
13.	IC Tolerance	0.0 V	General	IC Feedback Tolerance
14.	Pout	1,000.0 W	General	Total output power
15.	Total BOM	\$0.0	General	Total BOM Cost
16.	Low Freq Gain	60.651 dB	Op_Point	Gain at 10Hz
17.	M3 TjOP	41.079 degC	Op_Point	MOSFET junction temperature
18.	M4 TjOP	53.032 degC	Op_Point	MOSFET junction temperature
19.	Vout Actual	50.4 V	Op_Point	Vout Actual calculated based on selected voltage divider resistors
20.	Vout OP	50.0 V	Op_Point	Operational Output Voltage
21.	Cross Freq	11.399 kHz	Op_point	Bode plot crossover frequency
22.	Duty Cycle	56.036 %	Op_point	Duty cycle
23.	Efficiency	91.215 %	Op_point	Steady state efficiency
24.	Gain Marg	-10.641 dB	Op_point	Bode Plot Gain Margin
25.	IC Tj	37.24 degC	Op_point	IC junction temperature
26.	ICThetaJA	30.5 degC/W	Op_point	IC junction-to-ambient thermal resistance
27.	IOUT_OP	20.0 A	Op_point	Iout operating point
28.	Phase Marg	52.235 deg	Op_point	Bode Plot Phase Margin
29.	VIN_OP	14.0 V	Op_point	Vin operating point
30.	Vout p-p	162.607 mV	Op_point	Peak-to-peak output ripple voltage
31.	Cin Pd	971.962 mW	Power	Input capacitor power dissipation
32.	Cout Pd	1.04 W	Power	Output capacitor power dissipation
33.	Coutx Pd	3.278 mW	Power	Output capacitor_x power loss
34.	D2 Pd	0.0 W	Power	Diode power dissipation
35.	D3 Pd	0.0 W	Power	Diode power dissipation
36.	IC Pd	237.363 mW	Power	IC power dissipation
37.	L Pd	87.16 W	Power	Inductor power dissipation
38.	M1 Pd	0.0 W	Power	M1 MOSFET total power dissipation
39.	M1 PdCond	0.0 W	Power	M1 MOSFET conduction losses
40.	M2 Pd	0.0 W	Power	M2 MOSFET total power dissipation
41.	M3 Pd	786.007 mW	Power	MOSFET power dissipation
42.	M3 PdCond	0.0 W	Power	M1 MOSFET conduction losses
43.	M3 PdSw	786.007 mW	Power	M1 MOSFET switching losses
44.	M3 Rdson	0.0 Ohm	Power	Drain-Source On-resistance
45.	M4 Pd	2.889 W	Power	MOSFET power dissipation
46.	M4 PdCond	0.0 W	Power	M2 MOSFET conduction losses
47.	M4 PdSw	0.0 W	Power	M2 MOSFET switching losses
48.	M4 Rdson	0.0 Ohm	Power	Drain-Source On-resistance
49.	Rsense Pd	3.22 W	Power	LED Current Rns Power Dissipation
50.	Total Pd	96.311 W	Power	Total Power Dissipation
51.	M3 ThetaJA	55.0 degC/W		MOSFET junction-to-ambient thermal resistance
52.	M4 ThetaJA	55.0 degC/W		MOSFET junction-to-ambient thermal resistance

#	Name	Value	Category	Description
53.	Vout Tolerance	1.988 %		Vout Tolerance based on IC Tolerance (no load) and voltage divider resistors if applicable

## Design Inputs

#	Name	Value	Description
1.	Iout	20.0	Maximum Output Current
2.	VinMax	22.0	Maximum input voltage
3.	VinMin	14.0	Minimum input voltage
4.	Vout	50.0	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.

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**You should completely validate and test your design implementation to confirm the system functionality for your application prior to production.**

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