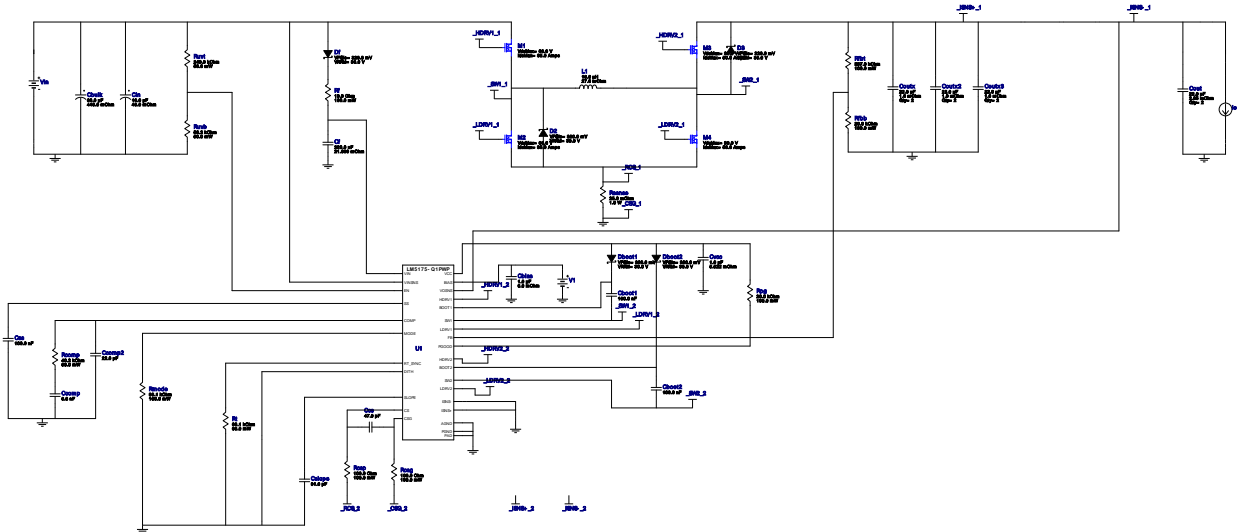

























WEBENCH[®] Design Report

 Design : LM5175QPWPRQ1
 LM5175QPWPRQ1 7.0V-20.0V to 15.00V @ 1.5A

My Comments
 No comments

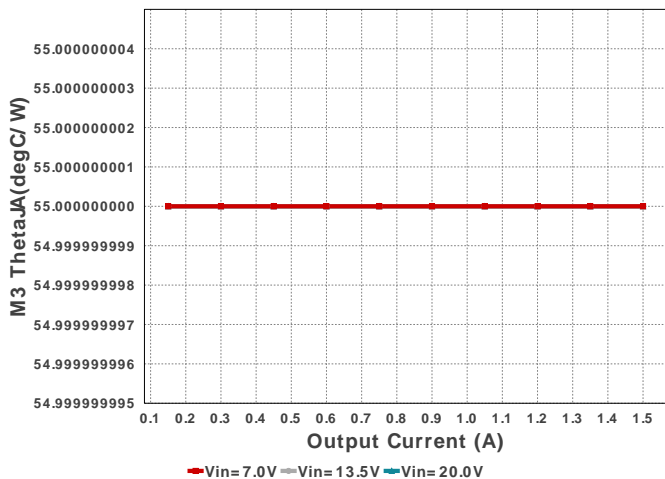
Electrical BOM

#	Name	Manufacturer	Part Number	Properties	Qty	Price	Footprint
1.	Cbias	MuRata	GRM219R71E105KA88D Series= X7R	Cap= 1.0 uF ESR= 6.0 mOhm VDC= 25.0 V IRMS= 3.87 A	1	\$0.05	 0805 7 mm ²
2.	Cboot1	TDK	C3216C0G1H104J160AA Series= C0G/NP0	Cap= 100.0 nF VDC= 50.0 V IRMS= 0.0 A	1	\$0.20	 1206 11 mm ²
3.	Cboot2	TDK	C3216C0G1H104J160AA Series= C0G/NP0	Cap= 100.0 nF VDC= 50.0 V IRMS= 0.0 A	1	\$0.20	 1206 11 mm ²
4.	Cbulk	Nichicon	UUD1E680MCL1GS Series= uD	Cap= 68.0 uF ESR= 440.0 mOhm VDC= 25.0 V IRMS= 230.0 mA	1	\$0.12	 SM_RADIAL_6.3AMM 80 mm ²
5.	Ccomp	Samsung Electro-Mechanics	CL21C682JBFNNNE Series= C0G/NP0	Cap= 6.8 nF VDC= 50.0 V IRMS= 0.0 A	1	\$0.05	 0805 7 mm ²
6.	Ccomp2	Samsung Electro-Mechanics	CL21C220JBANFNC Series= C0G/NP0	Cap= 22.0 pF VDC= 50.0 V IRMS= 0.0 A	1	\$0.01	 0805 7 mm ²
7.	Ccs	Samsung Electro-Mechanics	CL10C470JB8NNWC Series= C0G/NP0	Cap= 47.0 pF VDC= 50.0 V IRMS= 0.0 A	1	\$0.01	 0603 5 mm ²
8.	Cf	TDK	C1608X5R1H224K080AB Series= X5R	Cap= 220.0 nF ESR= 21.699 mOhm VDC= 50.0 V IRMS= 1.125 A	1	\$0.04	 0603 5 mm ²

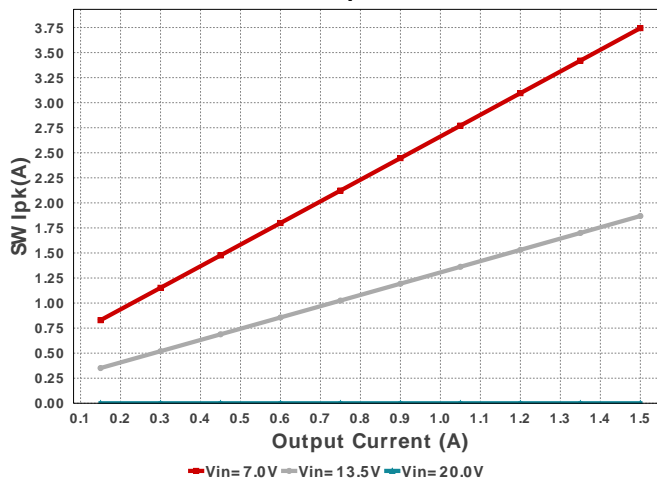
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9.	Cin	Panasonic	50SVPF10M Series= SVPF	Cap= 10.0 uF ESR= 40.0 mOhm VDC= 50.0 V IRMS= 2.5 A	1	\$0.40	 CAPSMT_62_F61 74 mm ²
10.	Cout	TDK	C2012X5R1V226M125AC Series= X5R	Cap= 22.0 uF ESR= 2.05 mOhm VDC= 35.0 V IRMS= 4.5559 A	2	\$0.38	 0805 7 mm ²
11.	Coutx	MuRata	KCM55WR71J226MH01K Series= X7R	Cap= 22.0 uF ESR= 1.0 mOhm VDC= 63.0 V IRMS= 0.0 A	2	\$2.31	 KCM55W 59 mm ²
12.	Coutx2	MuRata	KCM55WR71J226MH01K Series= X7R	Cap= 22.0 uF ESR= 1.0 mOhm VDC= 63.0 V IRMS= 0.0 A	2	\$2.31	 KCM55W 59 mm ²
13.	Coutx3	MuRata	KCM55WR71J226MH01K Series= X7R	Cap= 22.0 uF ESR= 1.0 mOhm VDC= 63.0 V IRMS= 0.0 A	2	\$2.31	 KCM55W 59 mm ²
14.	Cslope	Samsung Electro-Mechanics	CL10C910JB8NNNC Series= C0G/NP0	Cap= 91.0 pF VDC= 50.0 V IRMS= 0.0 A	1	\$0.01	 0603 5 mm ²
15.	Css	TDK	C3216C0G1H104J160AA Series= C0G/NP0	Cap= 100.0 nF VDC= 50.0 V IRMS= 0.0 A	1	\$0.20	 1206 11 mm ²
16.	Cvcc	TDK	CGA3E1X7R1V105K080AC Series= X7R	Cap= 1.0 uF ESR= 5.522 mOhm VDC= 35.0 V IRMS= 2.2162 A	1	\$0.06	 0603 5 mm ²
17.	D2	Toshiba	CMS06	VF@Io= 320.0 mV VRRM= 30.0 V	1	\$0.20	 M-FLAT 19 mm ²
18.	D3	Toshiba	CMS06	VF@Io= 320.0 mV VRRM= 30.0 V	1	\$0.20	 M-FLAT 19 mm ²
19.	Dboot1	Toshiba	CMS06	VF@Io= 320.0 mV VRRM= 30.0 V	1	\$0.20	 M-FLAT 19 mm ²
20.	Dboot2	Toshiba	CMS06	VF@Io= 320.0 mV VRRM= 30.0 V	1	\$0.20	 M-FLAT 19 mm ²
21.	Df	Toshiba	CMS06	VF@Io= 320.0 mV VRRM= 30.0 V	1	\$0.20	 M-FLAT 19 mm ²
22.	L1	Coilcraft	XAL6060-103MEB	L= 10.0 uH DCR= 27.0 mOhm	1	\$0.82	 XAL6060 72 mm ²
23.	M1	Texas Instruments	CSD18543Q3A	VdsMax= 60.0 V IdsMax= 35.0 Amps	1	\$0.27	 DNH0008A 18 mm ²
24.	M2	Texas Instruments	CSD18543Q3A	VdsMax= 60.0 V IdsMax= 35.0 Amps	1	\$0.27	 DNH0008A 18 mm ²
25.	M3	Texas Instruments	CSD17308Q3	VdsMax= 30.0 V IdsMax= 50.0 Amps	1	\$0.25	 DQG0008A 18 mm ²
26.	M4	Texas Instruments	CSD17308Q3	VdsMax= 30.0 V IdsMax= 50.0 Amps	1	\$0.25	 DQG0008A 18 mm ²
27.	Rcomp	Vishay-Dale	CRCW040240K2FKED Series= CRCW..e3	Res= 40.2 kOhm Power= 63.0 mW Tolerance= 1.0%	1	\$0.01	 0402 3 mm ²

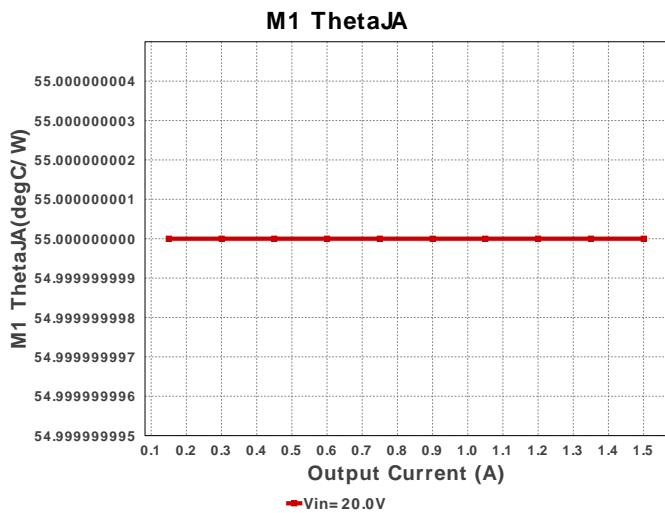
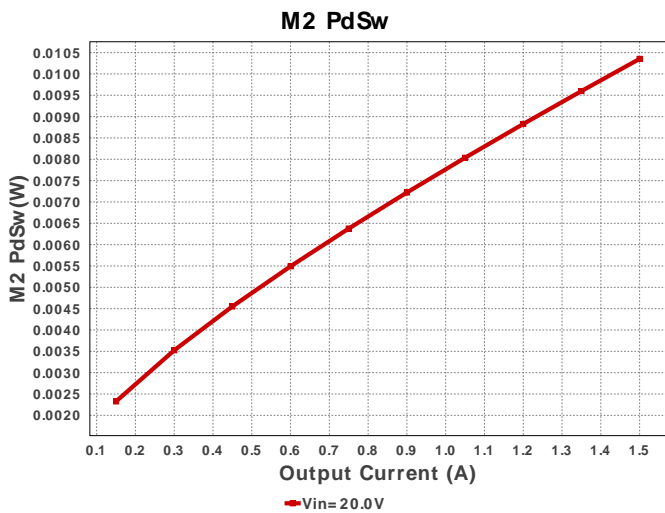
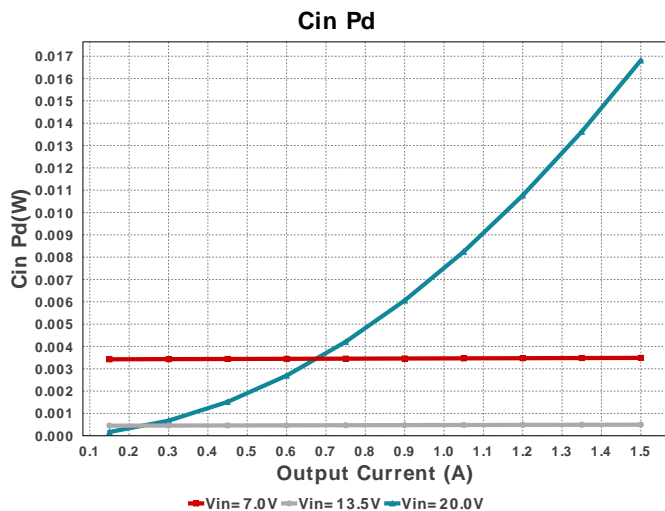
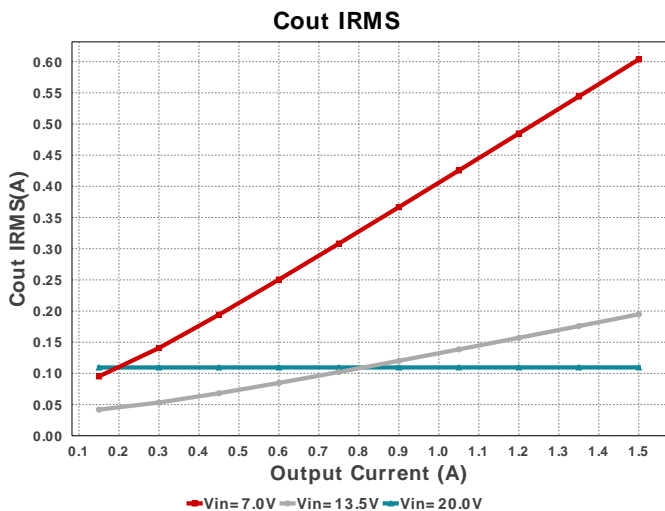
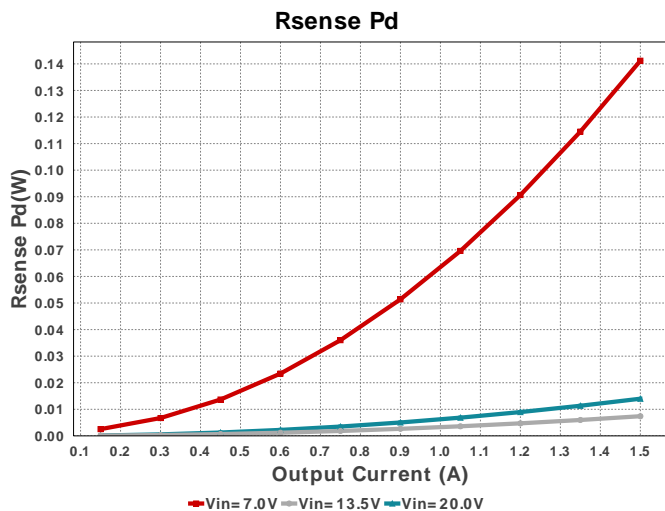
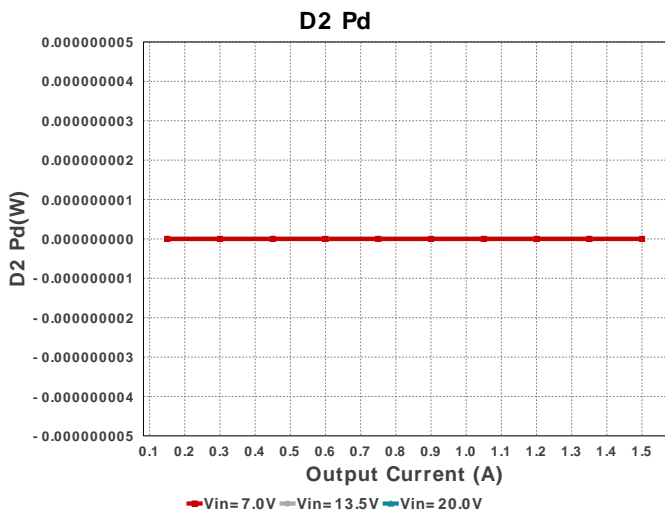
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28.	Rcsg	Yageo	RC0603FR-07100RL Series= ?	Res= 100.0 Ohm Power= 100.0 mW Tolerance= 1.0%	1	\$0.01	0603 5 mm ²
29.	Rcsp	Yageo	RC0603FR-07100RL Series= ?	Res= 100.0 Ohm Power= 100.0 mW Tolerance= 1.0%	1	\$0.01	0603 5 mm ²
30.	Rf	Yageo	RC0603FR-0710RL Series= ?	Res= 10.0 Ohm Power= 100.0 mW Tolerance= 1.0%	1	\$0.01	0603 5 mm ²
31.	Rfbb	Yageo	RT0603BRD0720KL Series= ?	Res= 20.0 kOhm Power= 100.0 mW Tolerance= 0.1%	1	\$0.04	0603 5 mm ²
32.	Rfbt	Yageo	RC0603FR-07357KL Series= ?	Res= 357.0 kOhm Power= 100.0 mW Tolerance= 1.0%	1	\$0.01	0603 5 mm ²
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 ²
34.	Rpg	Yageo	RT0603BRD0720KL Series= ?	Res= 20.0 kOhm Power= 100.0 mW Tolerance= 0.1%	1	\$0.04	0603 5 mm ²
35.	Rsense	Stackpole Electronics Inc	CSRN2010FK25L0 Series= ?	Res= 25.0 mOhm Power= 1.0 W Tolerance= 1.0%	1	\$0.16	2010 32 mm ²
36.	Rt	Yageo	RC0402FR-0768K1L Series= ?	Res= 68.1 kOhm Power= 63.0 mW Tolerance= 1.0%	1	\$0.01	0402 3 mm ²
37.	Ruvb	Yageo	RC0201FR-0756K2L Series= ?	Res= 56.2 kOhm Power= 50.0 mW Tolerance= 1.0%	1	\$0.01	0201 2 mm ²
38.	Ruvt	Yageo	RC0201FR-07249KL Series= ?	Res= 249.0 kOhm Power= 50.0 mW Tolerance= 1.0%	1	\$0.01	0201 2 mm ²
39.	U1	Texas Instruments	LM5175QPWPRQ1	Switcher	1	\$3.66	PWP0028C_N 98 mm ²

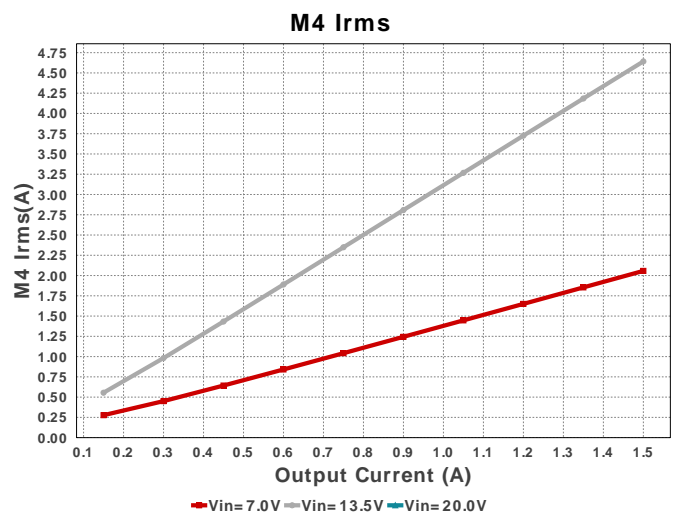
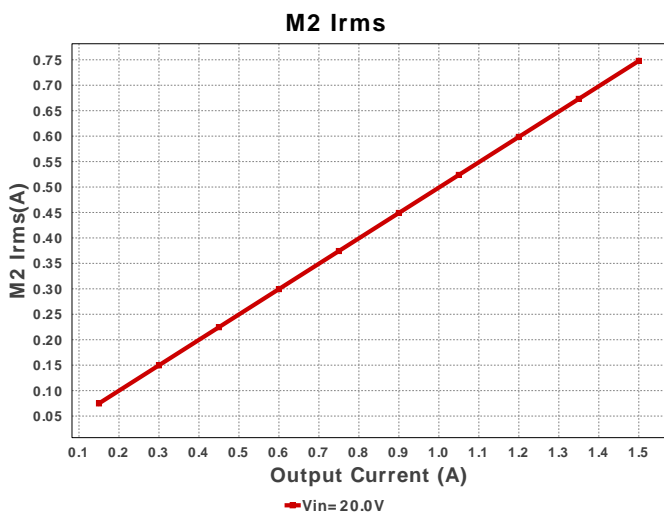
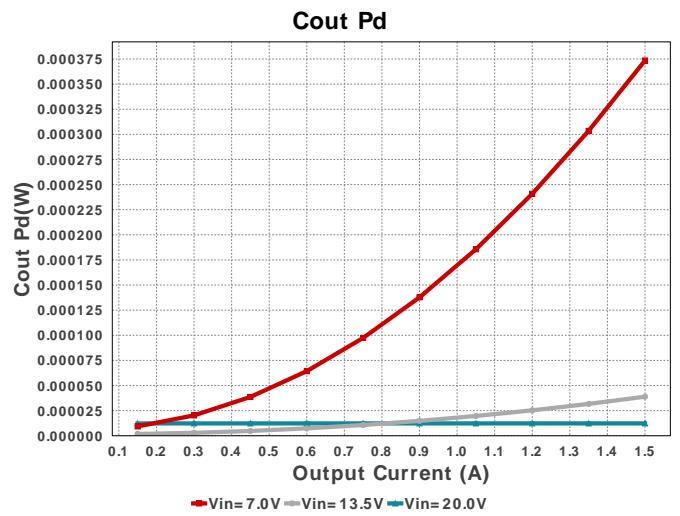
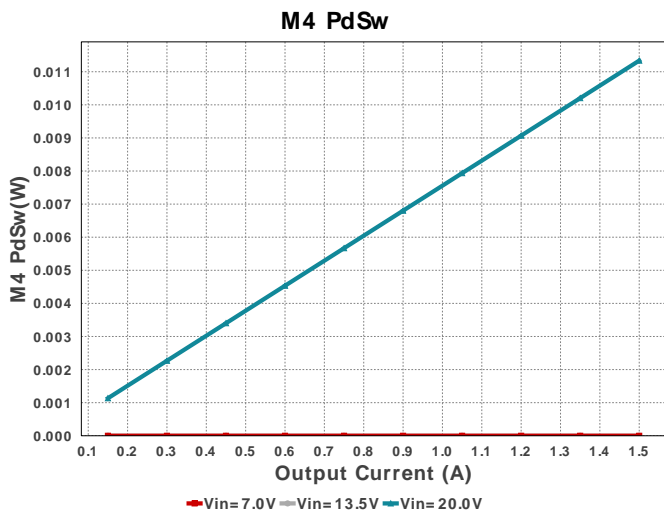
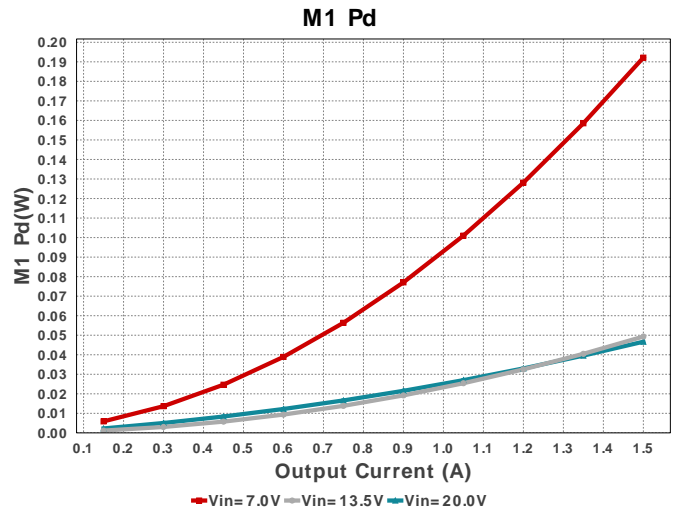
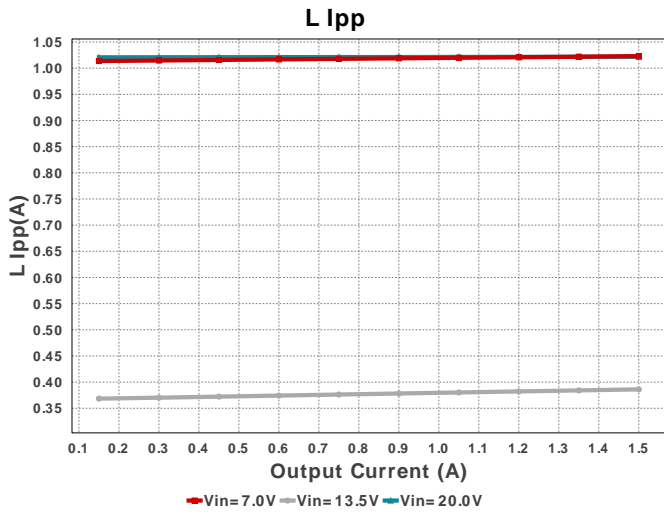
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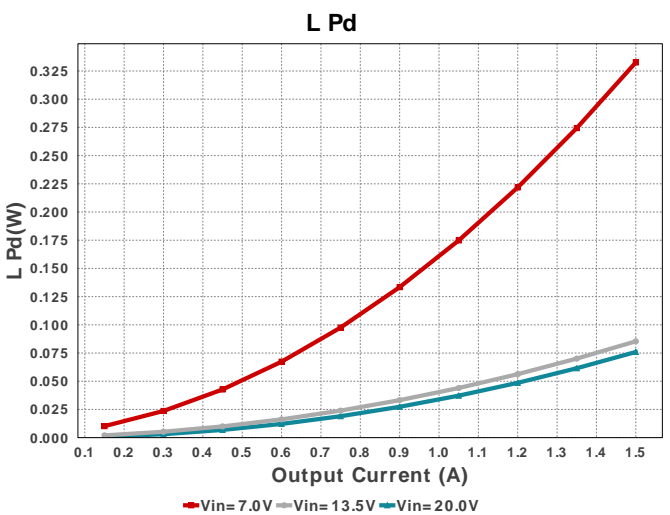
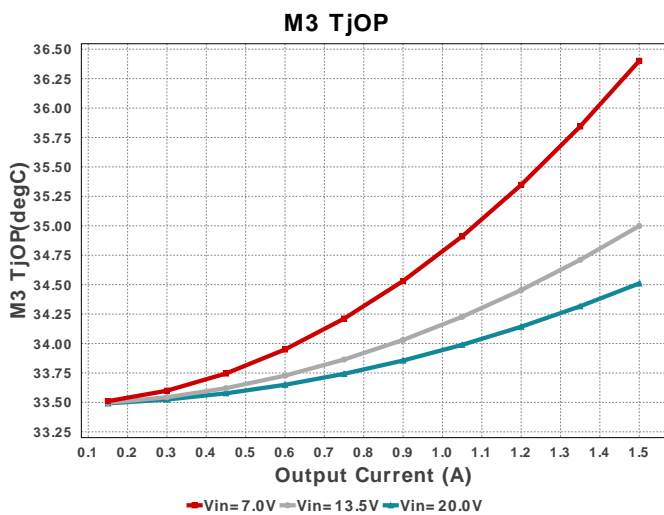
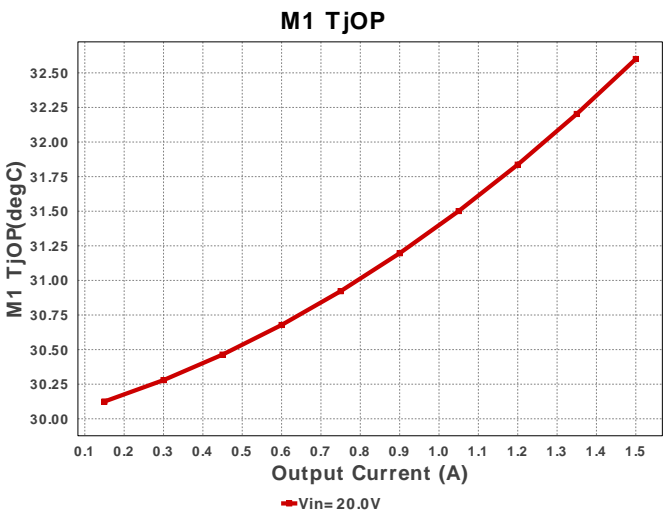
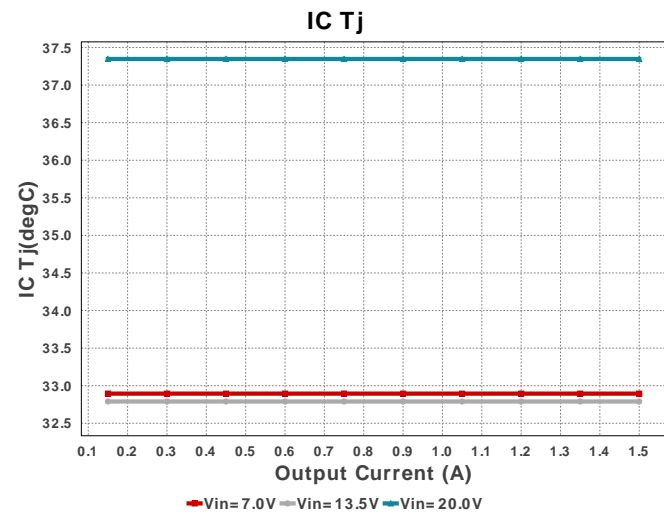
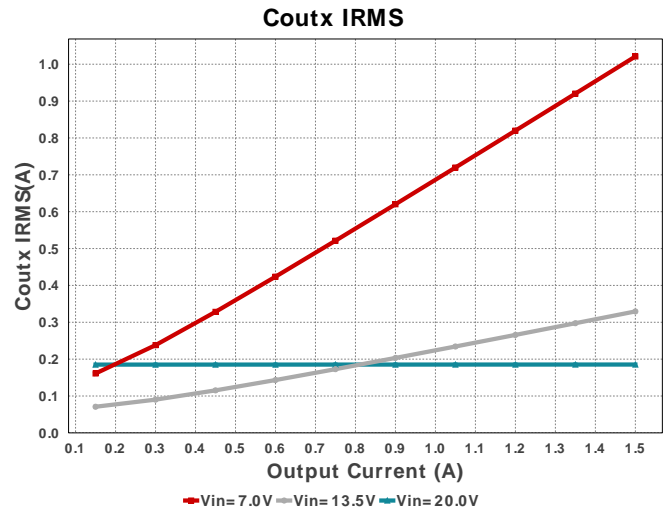
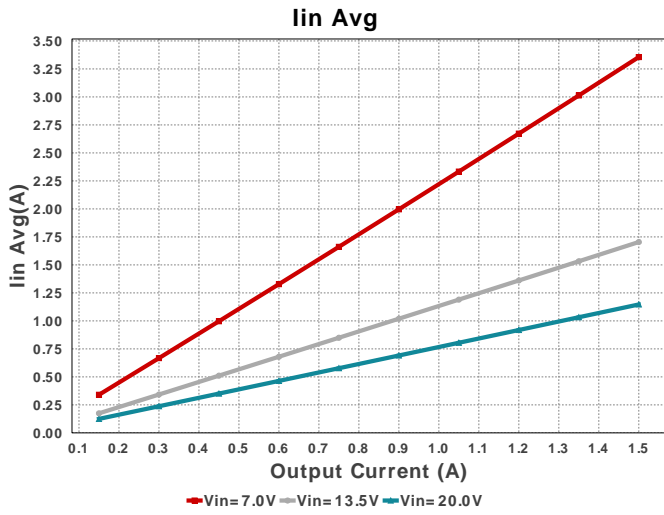


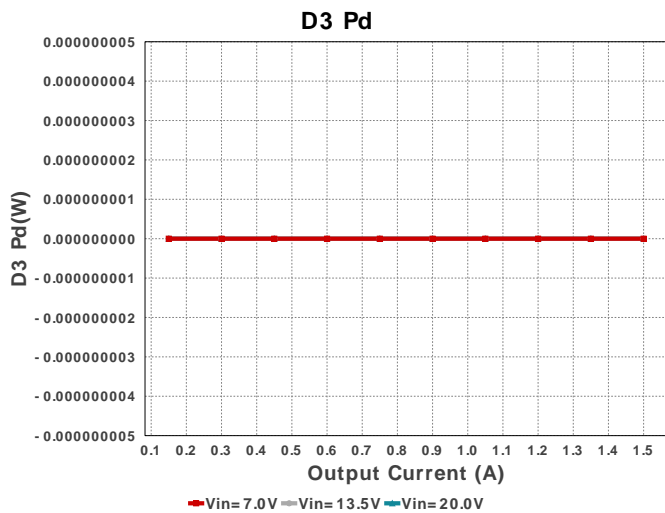
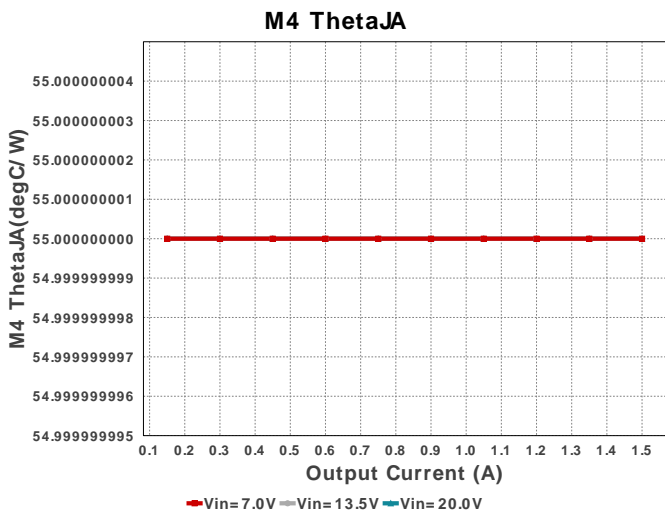
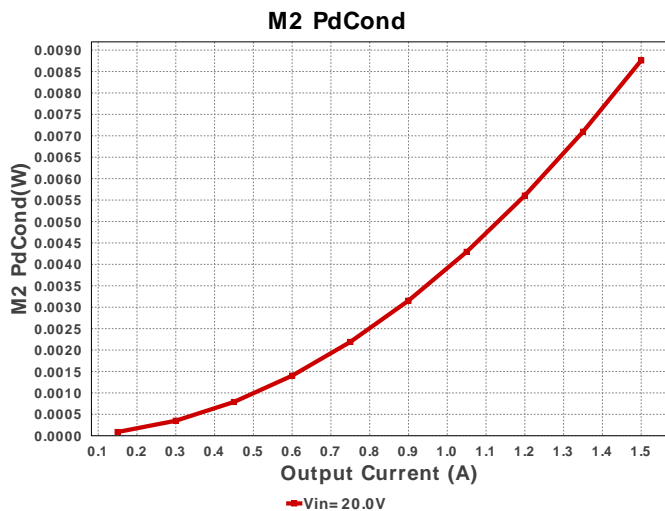
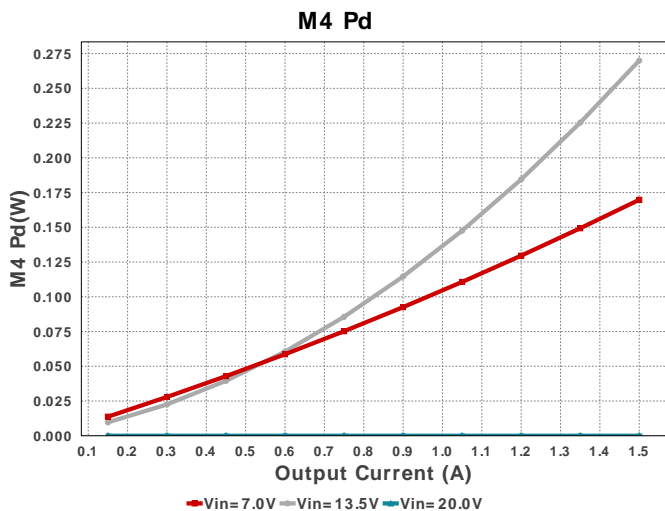
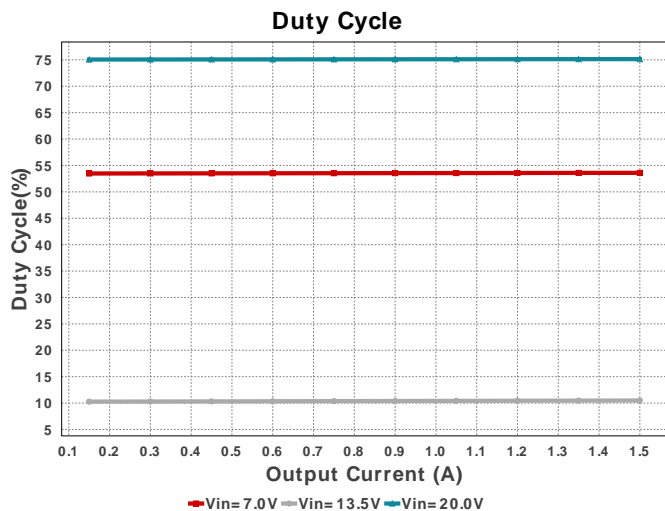
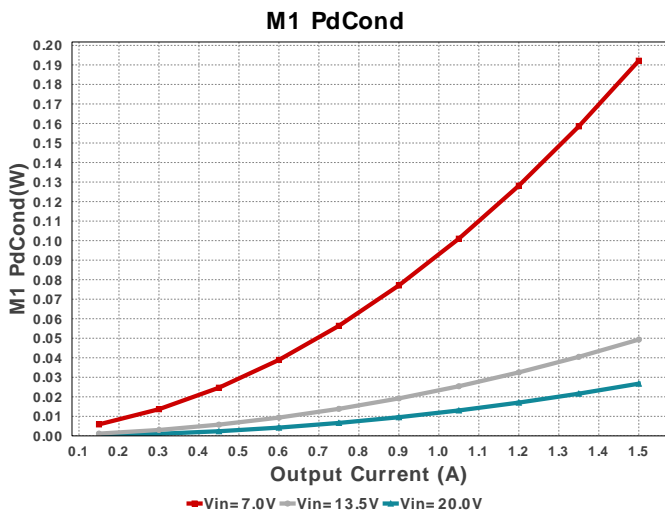
SW Ipk

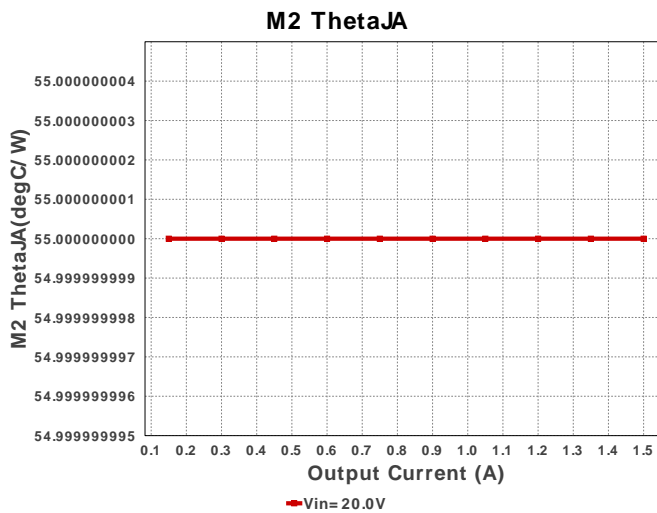
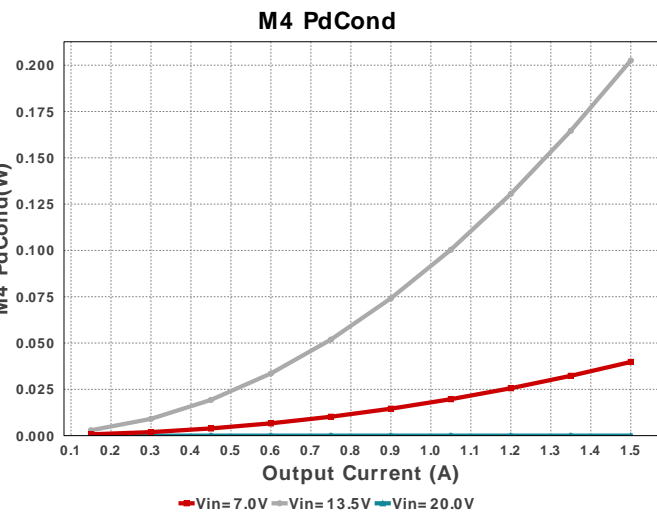
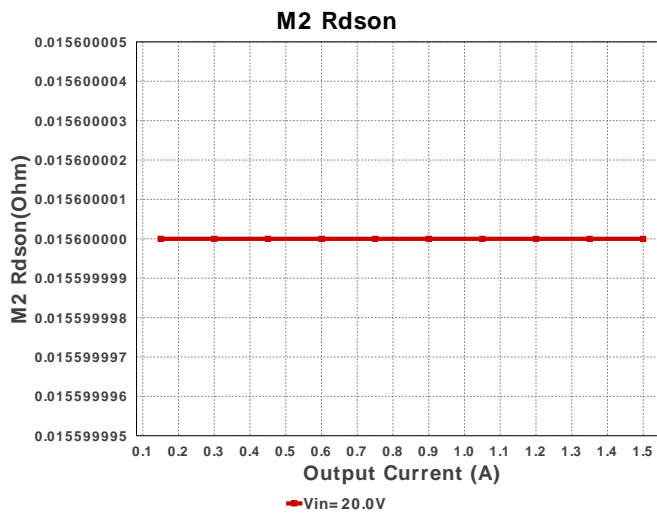
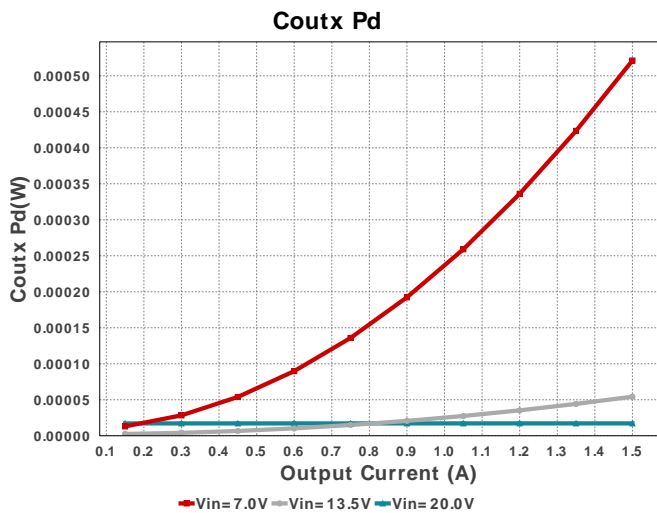
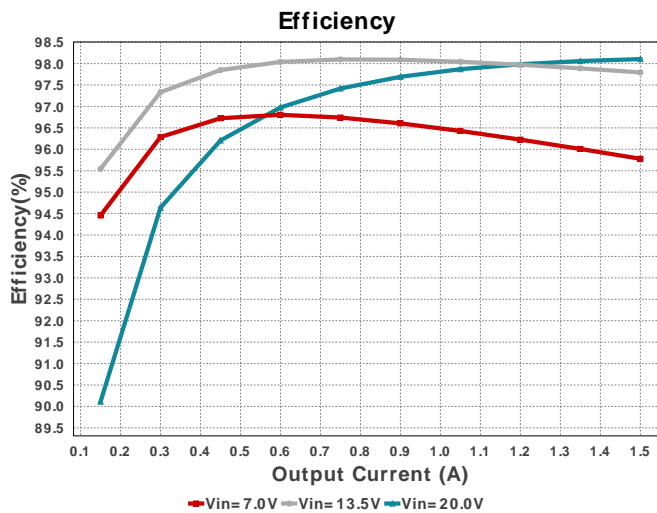
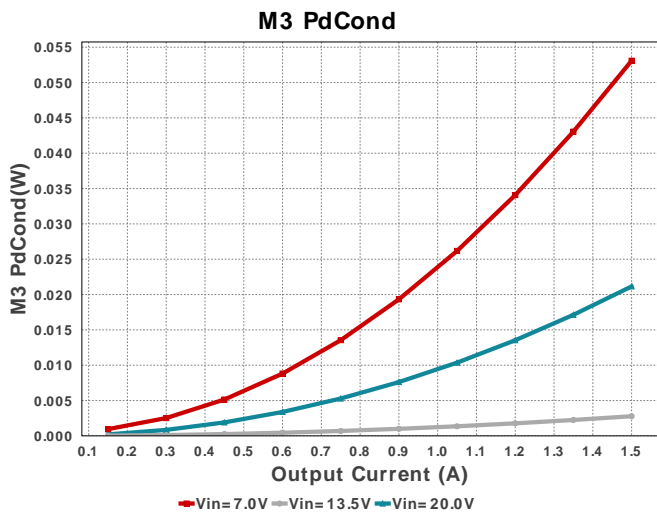


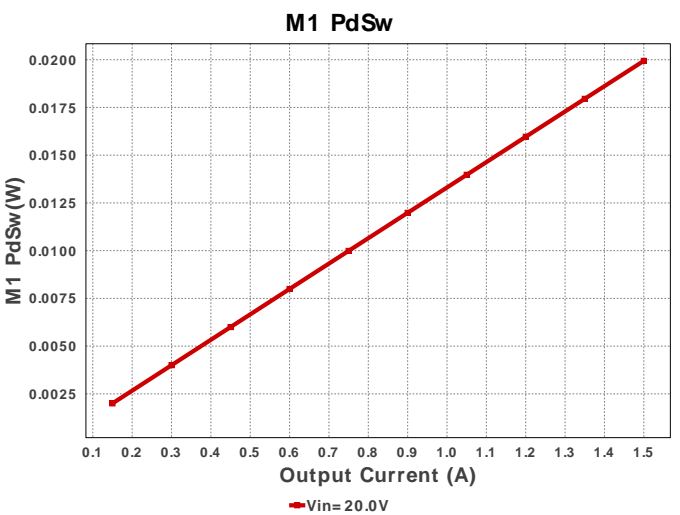
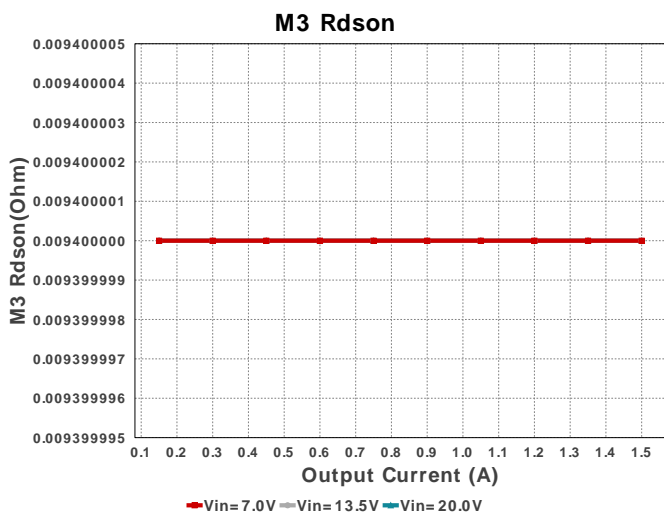
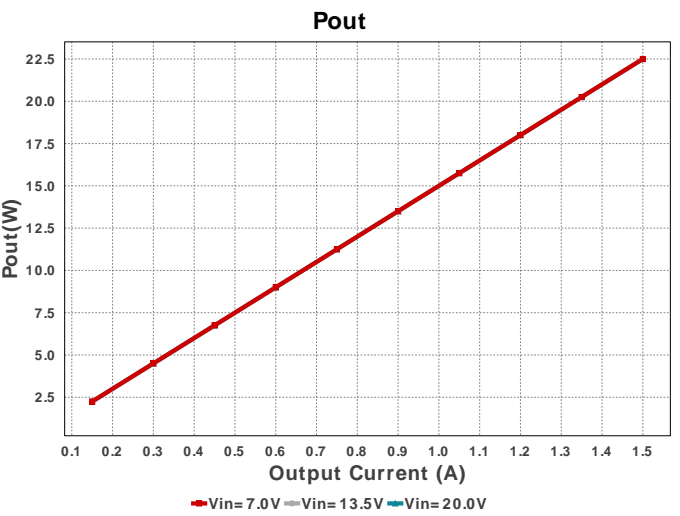
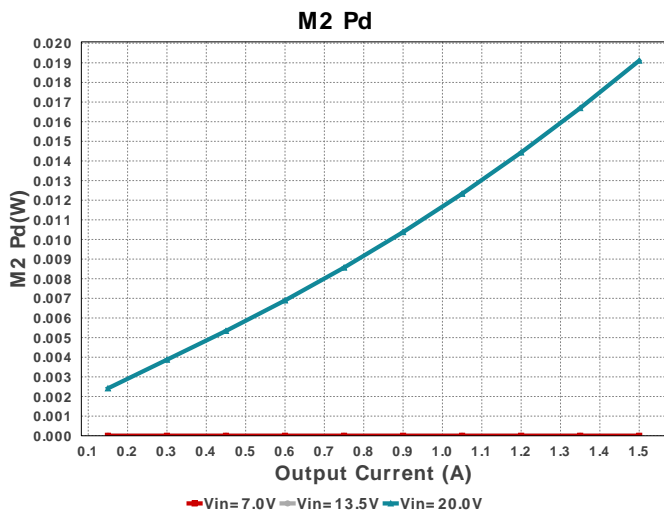
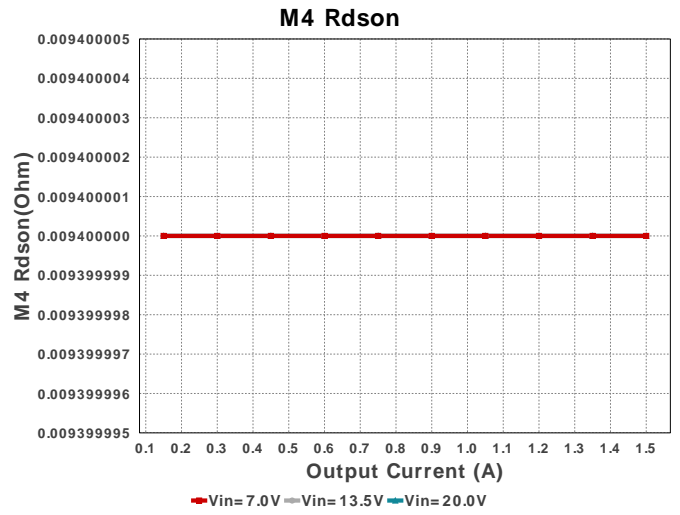
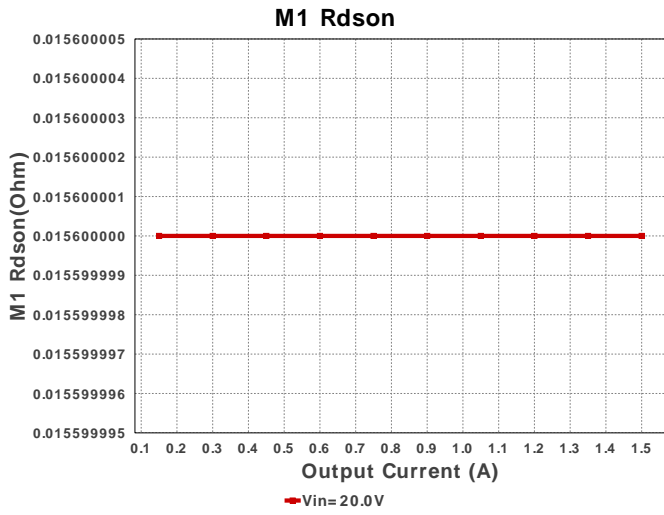


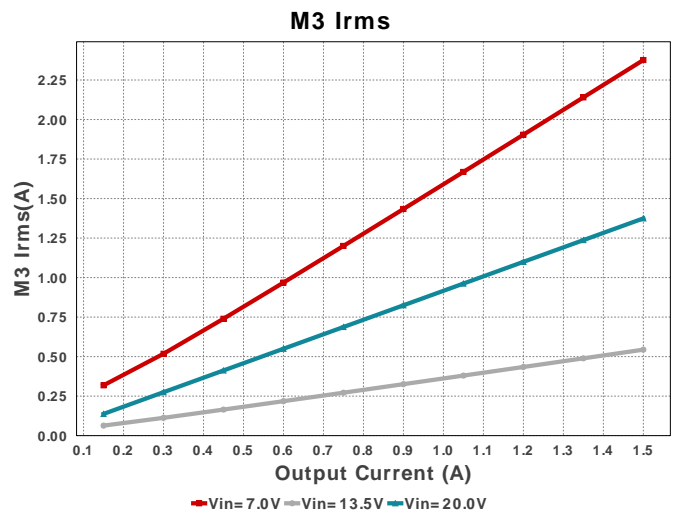
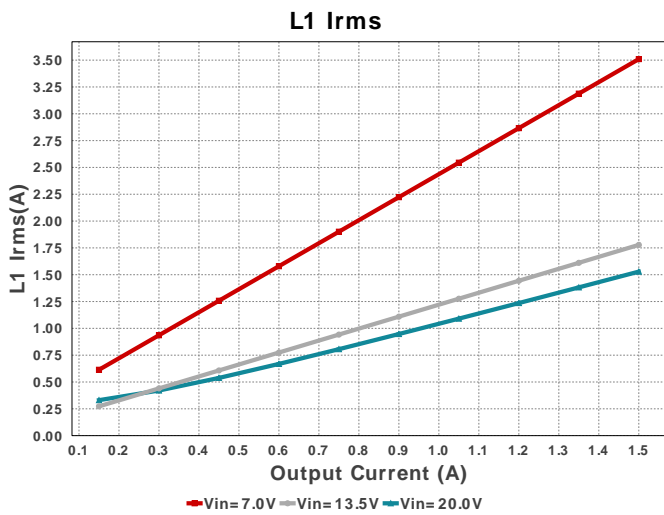
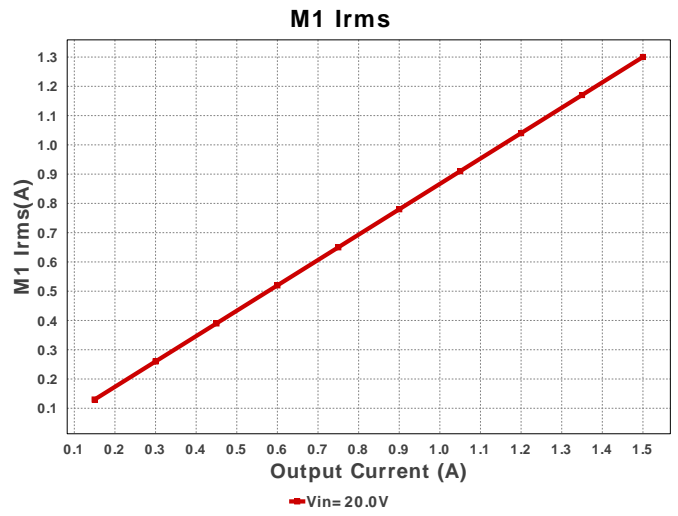
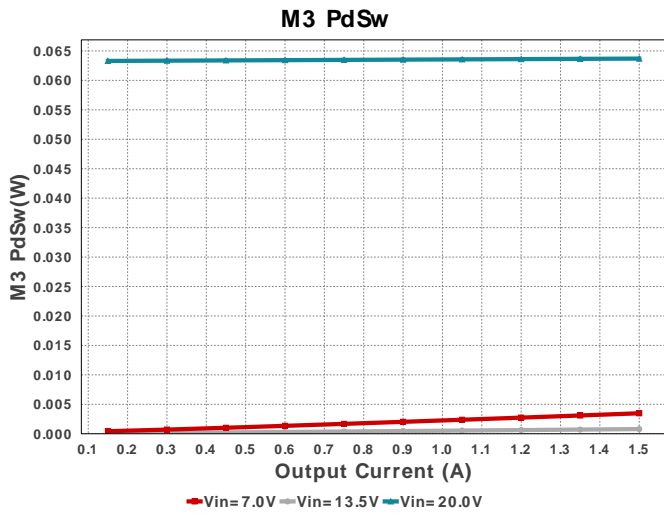
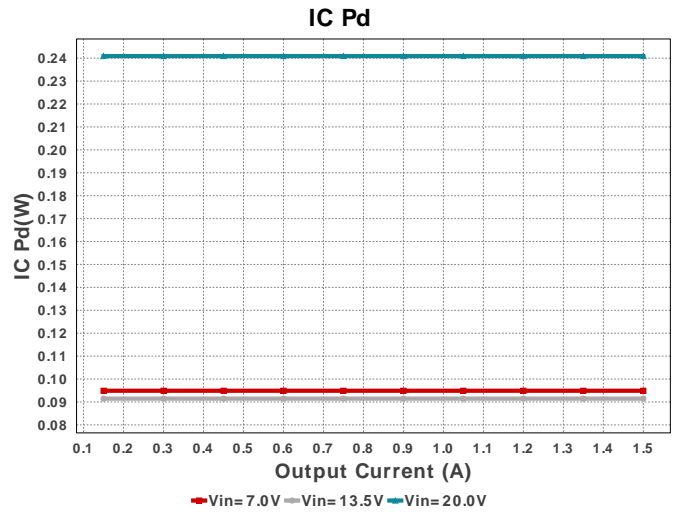
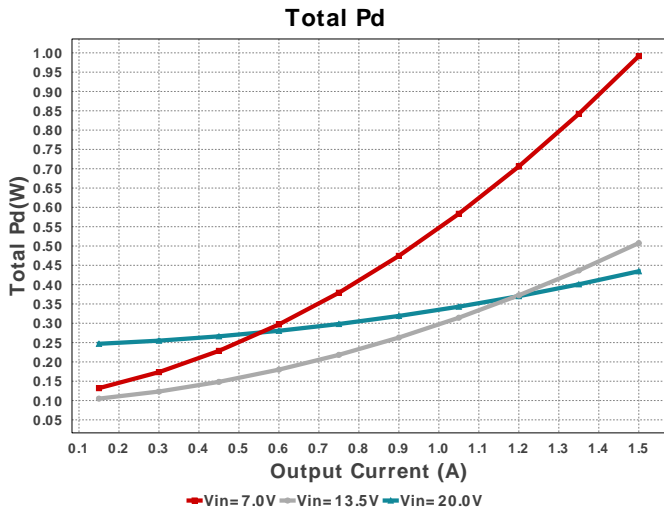


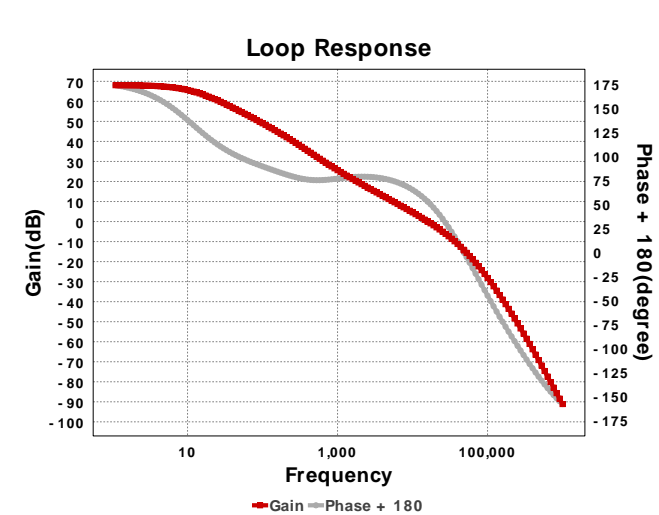
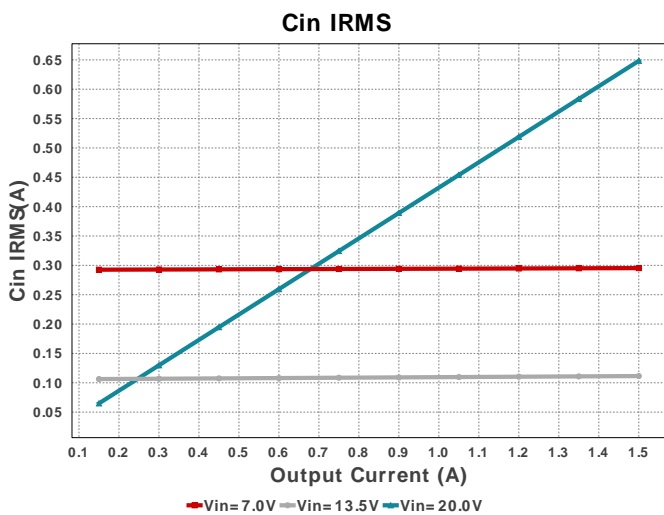
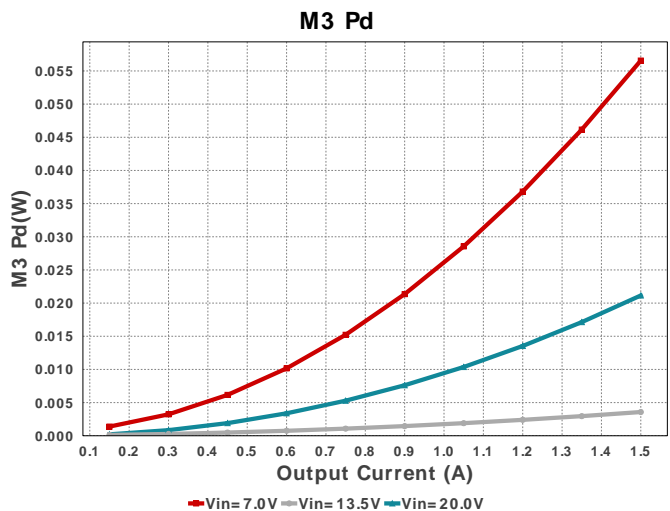
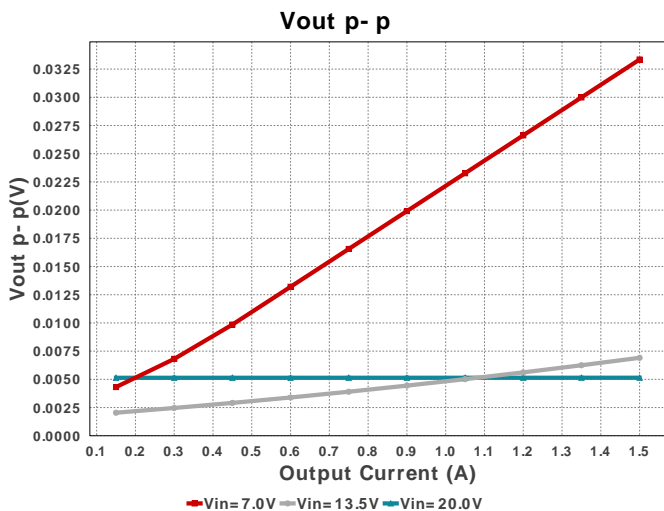
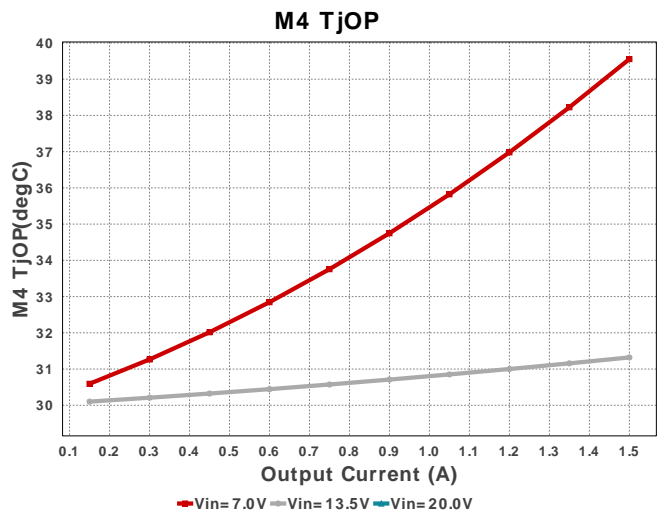
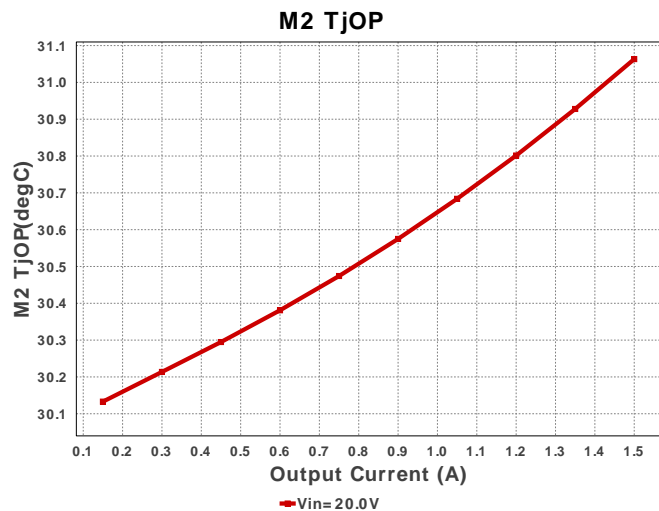












Operating Values

#	Name	Value	Category	Description
1.	Cin IRMS	648.294 mA	Current	Input capacitor RMS ripple current
2.	Cout IRMS	109.598 mA	Current	Output capacitor RMS ripple current
3.	Coutx IRMS	185.371 mA	Current	Output capacitor_x RMS ripple current
4.	Iin Avg	1.147 A	Current	Average input current
5.	L Ipp	1.022 A	Current	Peak-to-peak inductor ripple current
6.	L1 Irms	1.529 A	Current	Inductor ripple current
7.	M1 Irms	1.3 A	Current	MOSFET RMS ripple current
8.	M2 Irms	747.882 mA	Current	MOSFET RMS ripple current
9.	M3 Irms	1.374 A	Current	MOSFET RMS ripple current
10.	M4 Irms	NaN A	Current	MOSFET RMS ripple current
11.	SW Ipk	0.0 A	Current	Peak switch current

#	Name	Value	Category	Description
12.	BOM Count	4	General	Total Design BOM count
13.	FootPrint	1.009 k mm ²	General	Total Foot Print Area of BOM components
14.	Frequency	367.688 kHz	General	Switching frequency
15.	IC Tolerance	0.0 V	General	IC Feedback Tolerance
16.	M1 Rdson	15.6 mOhm	General	Drain-Source On-resistance
17.	M1 ThetaJA	55.0 degC/W	General	MOSFET junction-to-ambient thermal resistance
18.	M2 Rdson	15.6 mOhm	General	Drain-Source On-resistance
19.	M2 ThetaJA	55.0 degC/W	General	MOSFET junction-to-ambient thermal resistance
20.	M3 ThetaJA	55.0 degC/W	General	MOSFET junction-to-ambient thermal resistance
21.	M4 ThetaJA	55.0 degC/W	General	MOSFET junction-to-ambient thermal resistance
22.	Mode	CCM	General	Conduction Mode
23.	Pout	22.5 W	General	Total output power
24.	Total BOM	\$22.82	General	Total BOM Cost
25.	Cross Freq	15.92 kHz	Op Point	Bode plot crossover frequency
26.	Duty Cycle	75.141 %	Op Point	Duty cycle
27.	Efficiency	98.105 %	Op Point	Steady state efficiency
28.	Gain Marg	-14.436 dB	Op Point	Bode Plot Gain Margin
29.	IC Tj	37.348 degC	Op Point	IC junction temperature
30.	ICThetaJA	30.5 degC/W	Op Point	IC junction-to-ambient thermal resistance
31.	IOUT_OP	1.5 A	Op Point	Iout operating point
32.	Low Freq Gain	68.073 dB	Op Point	Gain at 1Hz
33.	M1 TjOP	32.6 degC	Op Point	MOSFET junction temperature
34.	M2 TjOP	31.063 degC	Op Point	MOSFET junction temperature
35.	M3 TjOP	34.51 degC	Op Point	MOSFET junction temperature
36.	M4 TjOP	NaN degC	Op Point	
37.	Operating Topology	Buck	Op Point	The current operating topology of the device
38.	Phase Marg	53.502 deg	Op Point	Bode Plot Phase Margin
39.	VIN_OP	20.0 V	Op Point	Vin operating point
40.	Vout Actual	15.08 V	Op Point	Vout Actual calculated based on selected voltage divider resistors
41.	Vout OP	15.0 V	Op Point	Operational Output Voltage
42.	Vout Tolerance	1.043 %	Op Point	Vout Tolerance based on IC Tolerance (no load) and voltage divider resistors if applicable
43.	Vout p-p	5.143 mV	Op Point	Peak-to-peak output ripple voltage
44.	Cin Pd	16.811 mW	Power	Input capacitor power dissipation
45.	Cout Pd	12.312 μW	Power	Output capacitor power dissipation
46.	Coutx Pd	17.181 μW	Power	Output capacitor_x power loss
47.	D2 Pd	0.0 W	Power	Diode power dissipation
48.	D3 Pd	0.0 W	Power	Diode power dissipation
49.	IC Pd	240.904 mW	Power	IC power dissipation
50.	L Pd	75.937 mW	Power	Inductor power dissipation
51.	M1 Pd	46.681 mW	Power	MOSFET power dissipation
52.	M1 PdCond	26.741 mW	Power	M1 MOSFET conduction losses
53.	M1 PdSw	19.94 mW	Power	M1 MOSFET switching losses
54.	M2 Pd	19.112 mW	Power	MOSFET power dissipation
55.	M2 PdCond	8.759 mW	Power	M2 MOSFET conduction losses
56.	M2 PdSw	10.353 mW	Power	M2 MOSFET switching losses
57.	M3 Pd	21.15 mW	Power	M3 MOSFET total power dissipation
58.	M3 PdCond	21.15 mW	Power	M3 MOSFET conduction losses
59.	M3 PdSw	63.697 mW	Power	M3 MOSFET switching losses
60.	M3 Rdson	9.4 mOhm	Power	Drain-Source On-resistance
61.	M4 Pd	0.0 W	Power	M4 MOSFET total power dissipation
62.	M4 Pd	0.0 W	Power	M4 MOSFET total power dissipation
63.	M4 PdCond	0.0 W	Power	M4 MOSFET conduction losses
64.	M4 PdSw	11.336 mW	Power	M4 MOSFET switching losses
65.	M4 Rdson	9.4 mOhm	Power	Drain-Source On-resistance
66.	Rsense Pd	13.983 mW	Power	Rsense Power Dissipation
67.	Total Pd	434.599 mW	Power	Total Power Dissipation

Design Inputs

#	Name	Value	Description
1.	Iout	1.5	Maximum Output Current
2.	SoftStart	16.0 ms	Soft Start Time
3.	VinMax	20.0	Maximum input voltage
4.	VinMin	7.0	Minimum input voltage
5.	Vout	15.0	Output Voltage
6.	acFrequency	0.0	AC Frequency
7.	base_pn	LM5175-Q1	Texas Instruments Base Part Number
8.	source	DC	Input Source Type
9.	ta	30.0	Ambient temperature
10.	userfsw	368.2 k	Customer Selected Frequency

Design Assistance

1. The LM5175-Q1 is qualified for Automotive applications. All passives and other components selected in this design may not be qualified for Automotive applications. The user is required to verify that all components in the design meet the qualification and safety requirements for their specific application.
2. 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.
3. Tip: Slope Capacitor: smaller slope capacitors provide better transition region behavior.
4. LM5175-Q1 Product Folder : <http://www.ti.com/product/LM5175%2DQ1> : contains the data sheet and other resources.

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