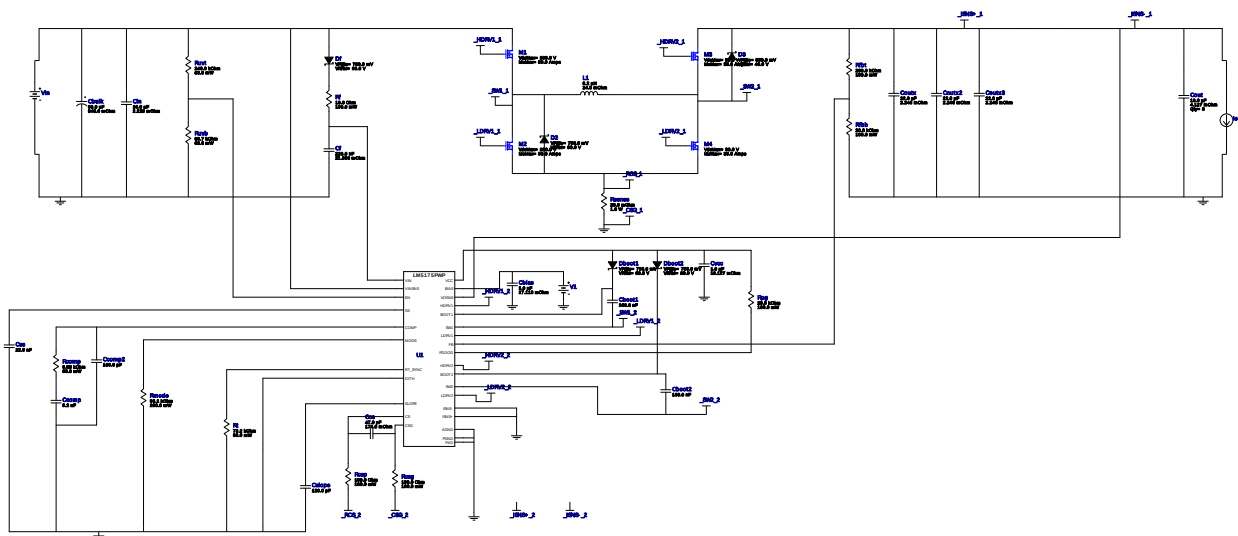


WEBENCH® Design Report

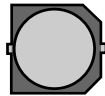
Design : 916945/899 LM5175PWPR
LM5175PWPR 5.0V-36.0V to 12.00V @ 2.0A



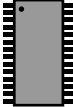
My Comments

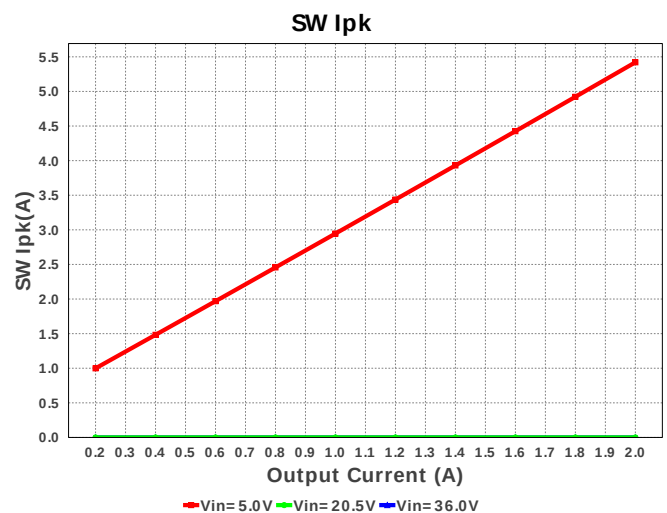
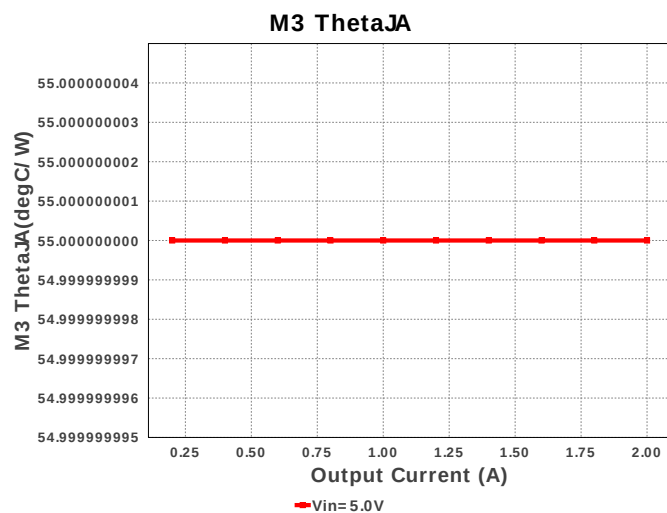
5-36Vin, 12V 2A output, LM5175 buck boost

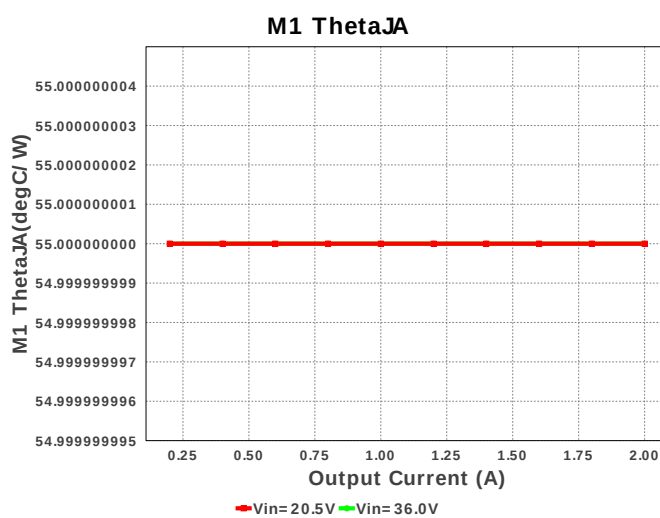
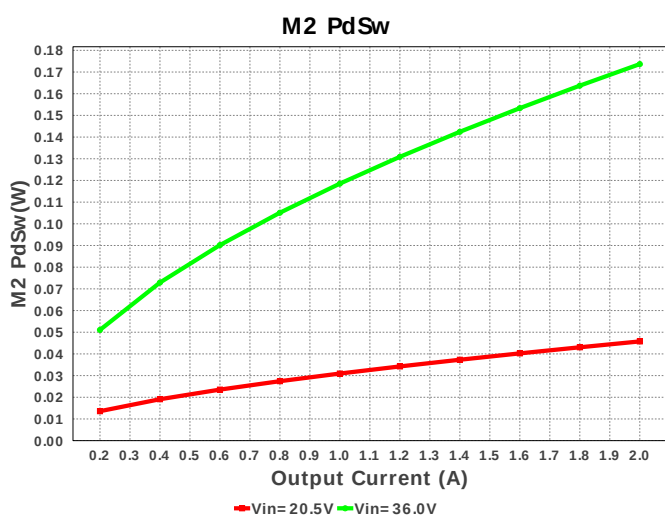
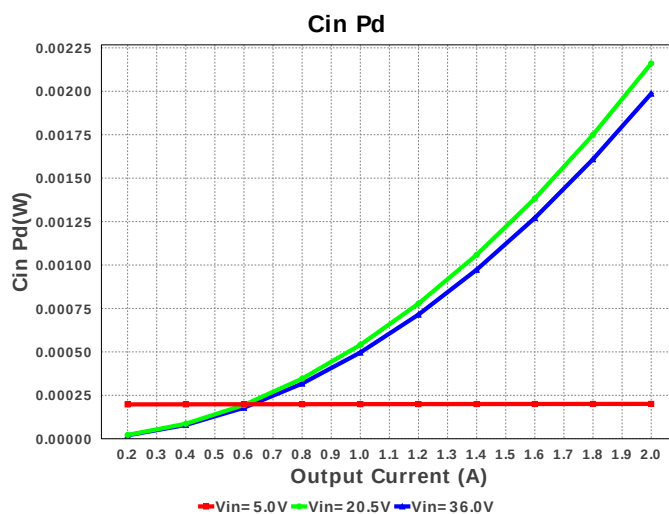
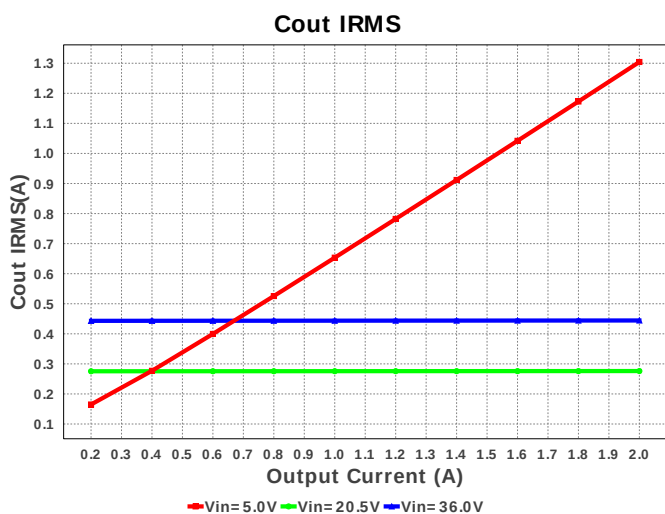
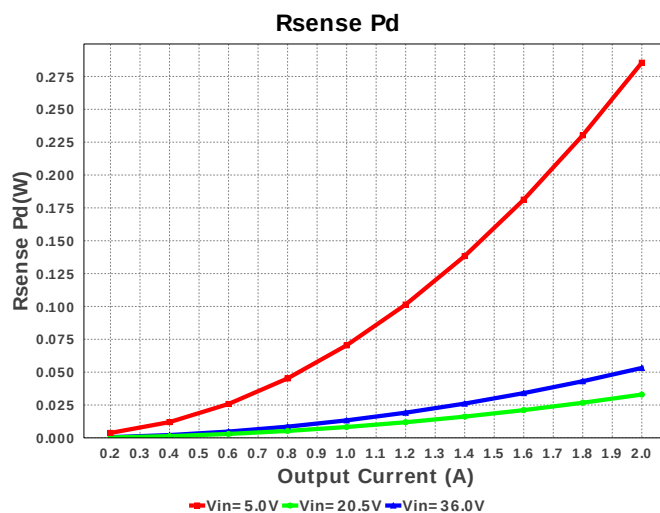
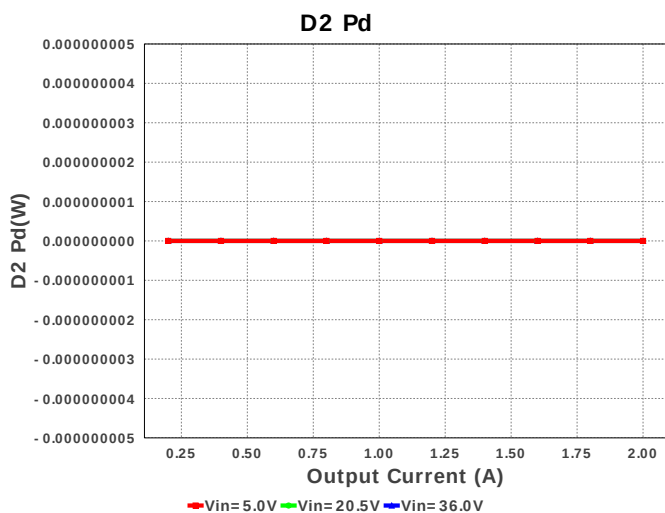
Electrical BOM

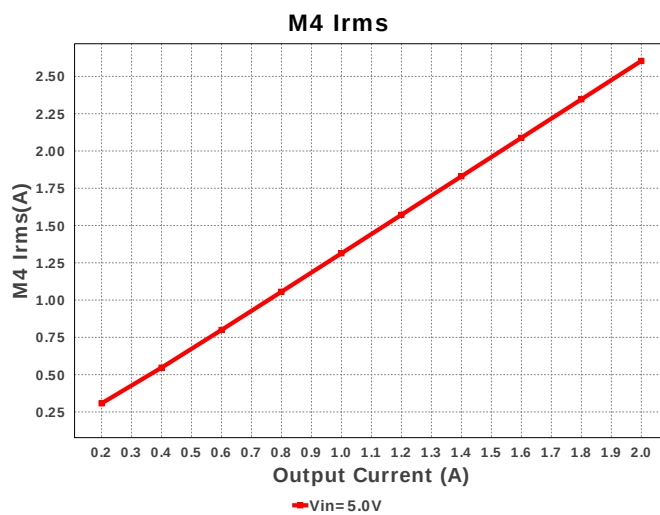
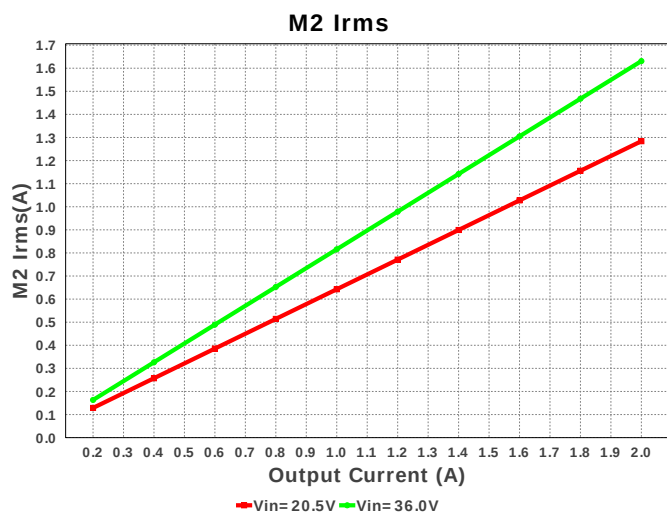
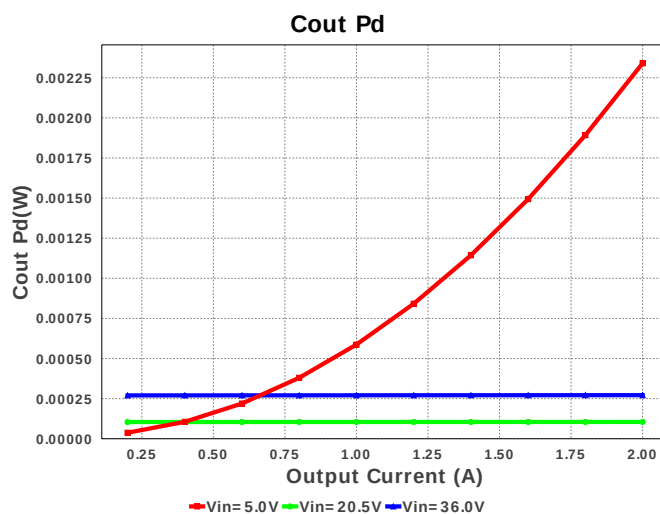
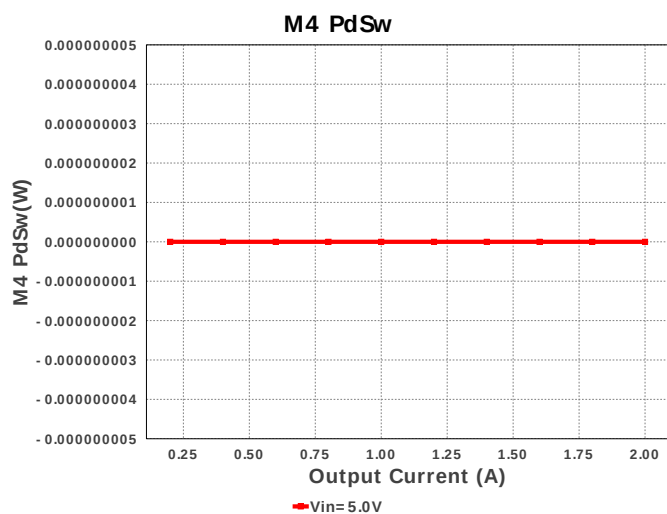
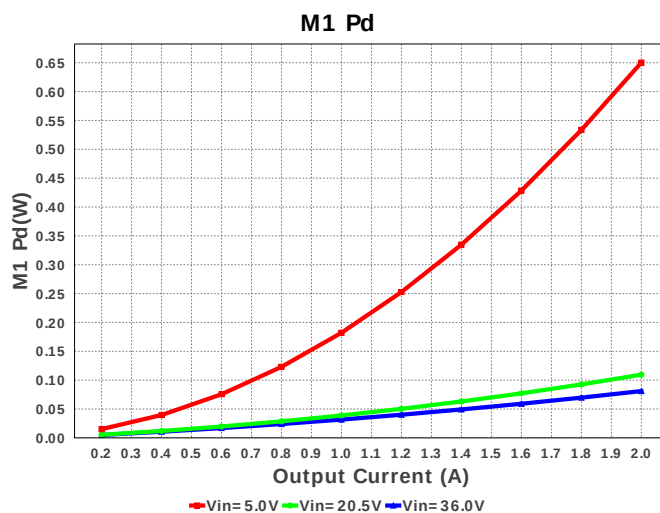
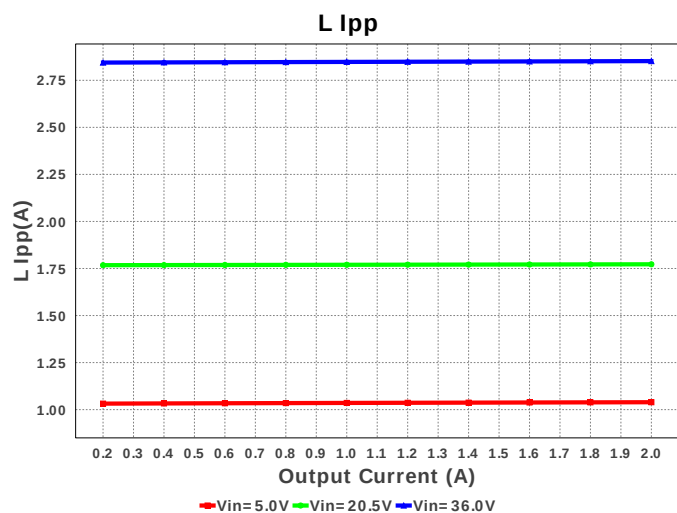
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1.	Cbias	MuRata	GRM188R61E105KA12D Series= X5R	Cap= 1.0 uF ESR= 17.113 mOhm VDC= 25.0 V IRMS= 979.39 mA	1	\$0.01	0603 5 mm ²
2.	Cboot1	Kemet	C0603C104K3RACTU Series= X7R	Cap= 100.0 nF VDC= 25.0 V IRMS= 0.0 A	1	\$0.01	0603 5 mm ²
3.	Cboot2	Kemet	C0603C104K3RACTU Series= X7R	Cap= 100.0 nF VDC= 25.0 V IRMS= 0.0 A	1	\$0.01	0603 5 mm ²
4.	Cbulk	Nichicon	UUD1H680MNL1GS Series= uD	Cap= 68.0 uF ESR= 340.0 mOhm VDC= 50.0 V IRMS= 300.0 mA	1	\$0.19	 SM_RADIAL_8MM 113 mm ²
5.	Ccomp	MuRata	GRM033R61A822KA01D Series= X5R	Cap= 8.2 nF VDC= 10.0 V IRMS= 0.0 A	1	\$0.01	0201 2 mm ²
6.	Ccomp2	Yageo America	CC0805JRNPO9BN101 Series= C0G/NP0	Cap= 100.0 pF VDC= 50.0 V IRMS= 0.0 A	1	\$0.01	0805 7 mm ²
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 ²
8.	Cf	TDK	C1608X5R1H224K080AB Series= X5R	Cap= 220.0 nF ESR= 21.699 mOhm VDC= 50.0 V IRMS= 1.125 A	1	\$0.03	0603 5 mm ²

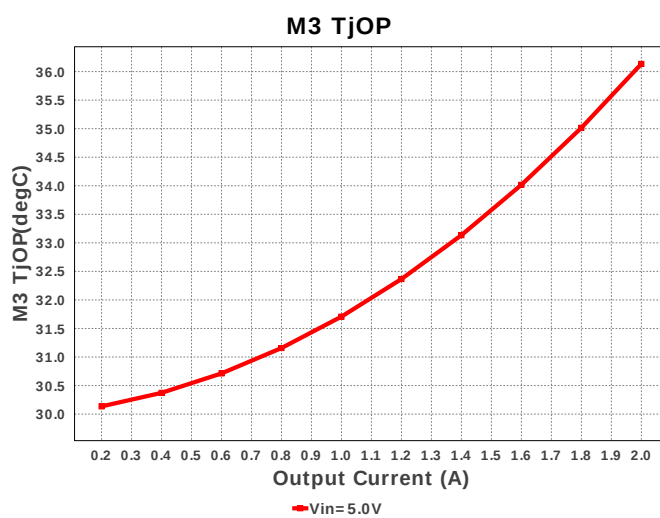
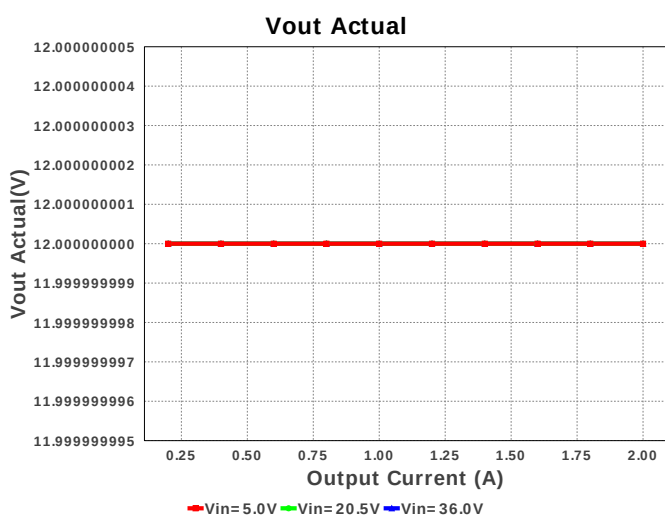
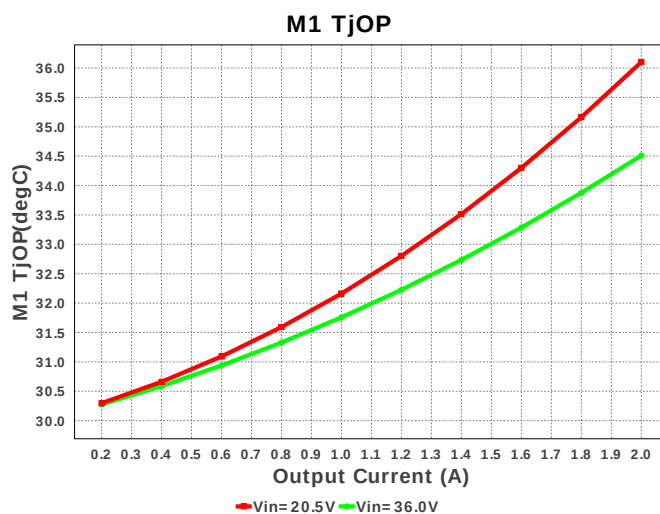
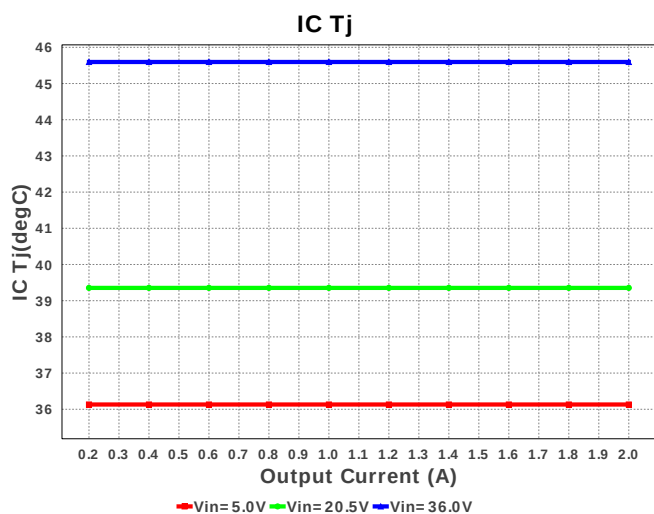
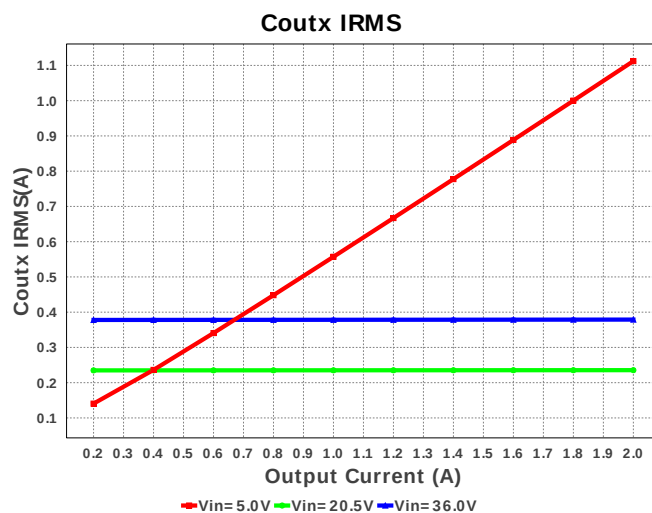
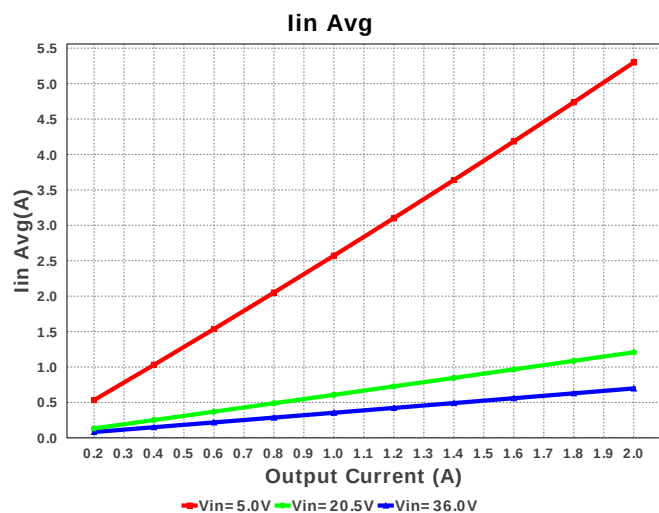
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9.	Cin	TDK	C3216X5R1H106K160AB Series= X5R	Cap= 10.0 uF ESR= 2.229 mOhm VDC= 50.0 V IRMS= 4.8593 A	1	\$0.26	 1206_180 11 mm ²
10.	Cout	MuRata	GRM21BR61C106KE15L Series= X5R	Cap= 10.0 uF ESR= 4.127 mOhm VDC= 16.0 V IRMS= 2.46634 A	3	\$0.03	 0805 7 mm ²
11.	Coutx	TDK	C3216JB1E226M Series= JB	Cap= 22.0 uF ESR= 2.246 mOhm VDC= 25.0 V IRMS= 0.0 A	1	\$0.55	 1206 11 mm ²
12.	Coutx2	TDK	C3216JB1E226M Series= JB	Cap= 22.0 uF ESR= 2.246 mOhm VDC= 25.0 V IRMS= 0.0 A	1	\$0.55	 1206 11 mm ²
13.	Coutx3	TDK	C3216JB1E226M Series= JB	Cap= 22.0 uF ESR= 2.246 mOhm VDC= 25.0 V IRMS= 0.0 A	1	\$0.55	 1206 11 mm ²
14.	Cslope	Yageo America	CC0603JRNPO9BN121 Series= C0G/NP0	Cap= 120.0 pF VDC= 50.0 V IRMS= 0.0 A	1	\$0.01	 0603 5 mm ²
15.	Css	Kemet	C0603C223K3RACTU Series= X7R	Cap= 22.0 nF VDC= 25.0 V IRMS= 0.0 A	1	\$0.01	 0603 5 mm ²
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 mm ²
17.	D2	Fairchild Semiconductor	SS26FL	VF@Io= 700.0 mV VRRM= 60.0 V	1	\$0.09	 SOD-123F 12 mm ²
18.	D3	Fairchild Semiconductor	SS24FL	VF@Io= 550.0 mV VRRM= 40.0 V	1	\$0.07	 SOD-123F 12 mm ²
19.	Dboot1	Fairchild Semiconductor	SS26FL	VF@Io= 700.0 mV VRRM= 60.0 V	1	\$0.09	 SOD-123F 12 mm ²
20.	Dboot2	Fairchild Semiconductor	SS26FL	VF@Io= 700.0 mV VRRM= 60.0 V	1	\$0.09	 SOD-123F 12 mm ²
21.	Df	Fairchild Semiconductor	SS26FL	VF@Io= 700.0 mV VRRM= 60.0 V	1	\$0.09	 SOD-123F 12 mm ²
22.	L1	Coilcraft	XAL6060-822MEB	L= 8.2 uH DCR= 24.0 mOhm	1	\$0.82	 XAL6060 72 mm ²
23.	M1	Texas Instruments	CSD19537Q3	VdsMax= 100.0 V IdsMax= 50.0 Amps	1	\$0.41	 DQG0008A 18 mm ²
24.	M2	Texas Instruments	CSD19537Q3	VdsMax= 100.0 V IdsMax= 50.0 Amps	1	\$0.41	 DQG0008A 18 mm ²
25.	M3	Texas Instruments	CSD17577Q3A	VdsMax= 30.0 V IdsMax= 35.0 Amps	1	\$0.21	 DNH0008A 18 mm ²
26.	M4	Texas Instruments	CSD17577Q3A	VdsMax= 30.0 V IdsMax= 35.0 Amps	1	\$0.21	 DNH0008A 18 mm ²
27.	Rcomp	Vishay-Dale	CRCW04029K53FKED Series= CRCW..e3	Res= 9.53 kOhm Power= 63.0 mW Tolerance= 1.0%	1	\$0.01	0402 3 mm ²
28.	Rcsg	Vishay-Dale	CRCW0603100RFKEA Series= CRCW..e3	Res= 100.0 Ohm Power= 100.0 mW Tolerance= 1.0%	1	\$0.01	0603 5 mm ²

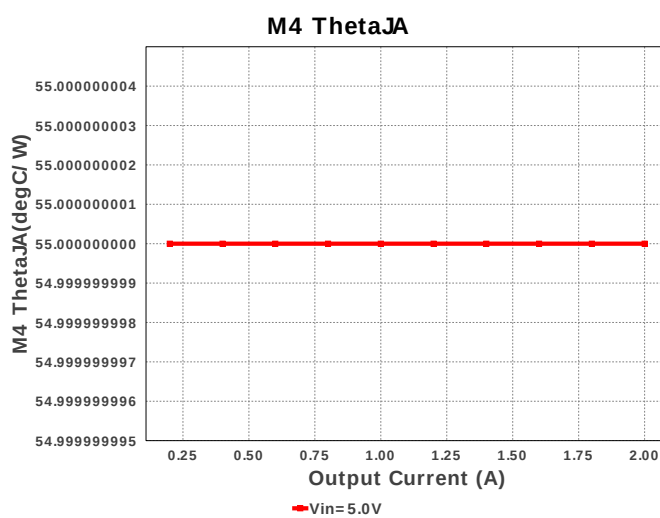
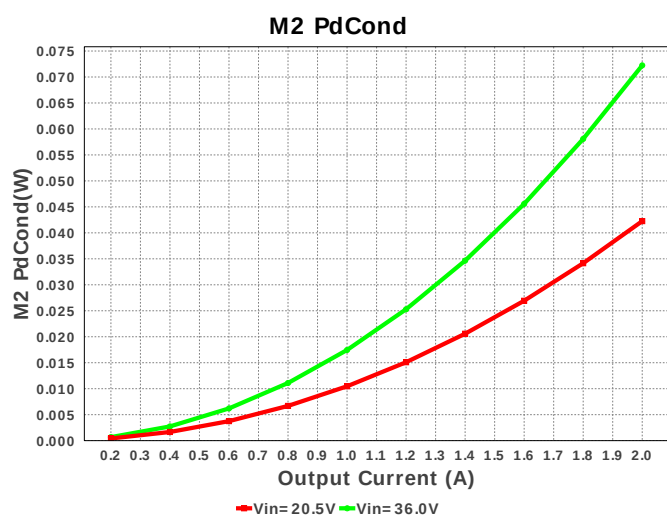
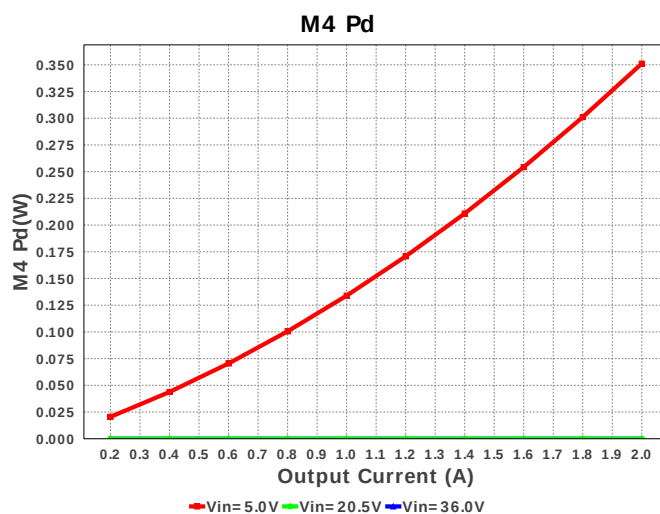
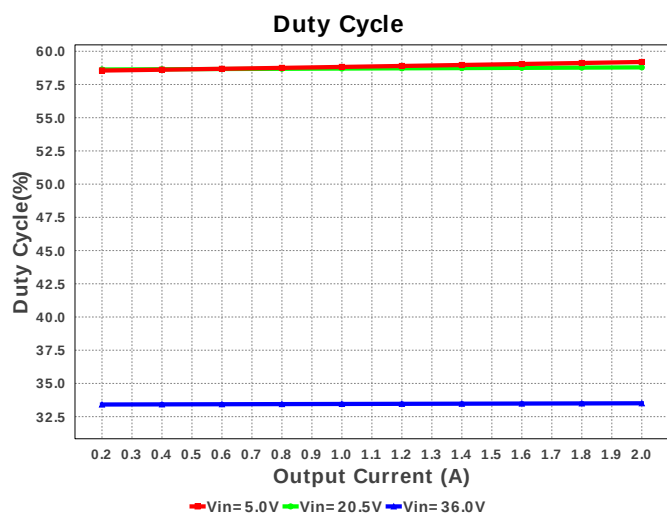
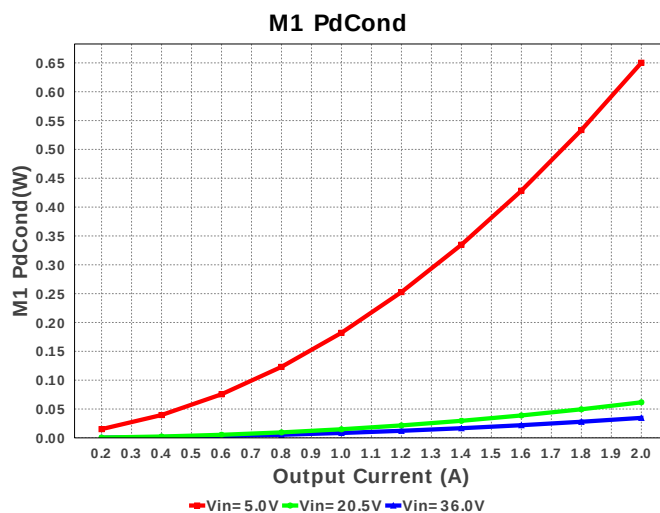
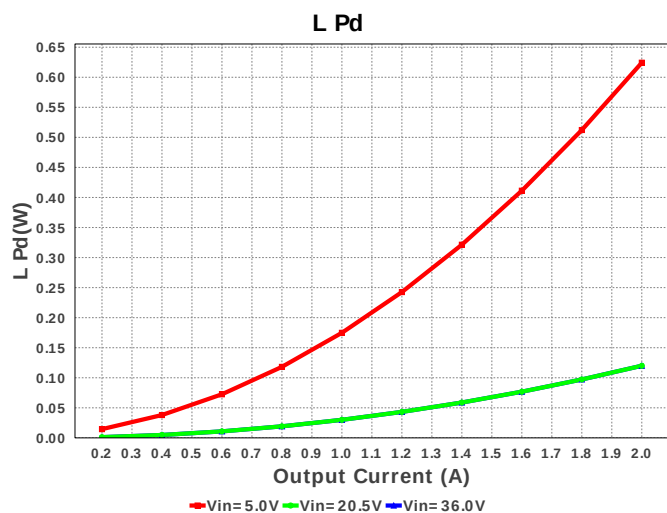
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29.	Rcsp	Vishay-Dale	CRCW0603100RFKEA Series= CRCW..e3	Res= 100.0 Ohm Power= 100.0 mW Tolerance= 1.0%	1	\$0.01	 0603 5 mm ²
30.	Rf	Vishay-Dale	CRCW060310R0FKEA Series= CRCW..e3	Res= 10.0 Ohm Power= 100.0 mW Tolerance= 1.0%	1	\$0.01	 0603 5 mm ²
31.	Rfbb	Vishay-Dale	CRCW060320K0FKEA Series= CRCW..e3	Res= 20.0 kOhm Power= 100.0 mW Tolerance= 1.0%	1	\$0.01	 0603 5 mm ²
32.	Rfbt	Vishay-Dale	CRCW0603280KFKEA Series= CRCW..e3	Res= 280.0 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	Vishay-Dale	CRCW060320K0FKEA Series= CRCW..e3	Res= 20.0 kOhm Power= 100.0 mW Tolerance= 1.0%	1	\$0.01	 0603 5 mm ²
35.	Rsense	Susumu Co Ltd	PRL1632-R020-F-T1 Series= PRL1632	Res= 20.0 mOhm Power= 1.0 W Tolerance= 1.0%	1	\$0.19	 0612 11 mm ²
36.	Rt	Vishay-Dale	CRCW040273K2FKED Series= CRCW..e3	Res= 73.2 kOhm Power= 63.0 mW Tolerance= 1.0%	1	\$0.01	 0402 3 mm ²
37.	Ruvb	Vishay-Dale	CRCW040288K7FKED Series= CRCW..e3	Res= 88.7 kOhm Power= 63.0 mW Tolerance= 1.0%	1	\$0.01	 0402 3 mm ²
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 ²
39.	U1	Texas Instruments	LM5175PWPR	Switcher	1	\$3.10	 PWP0028F_N 98 mm ²

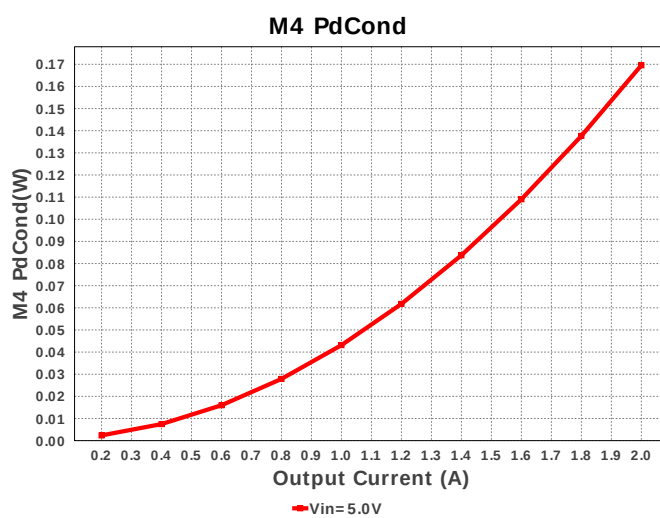
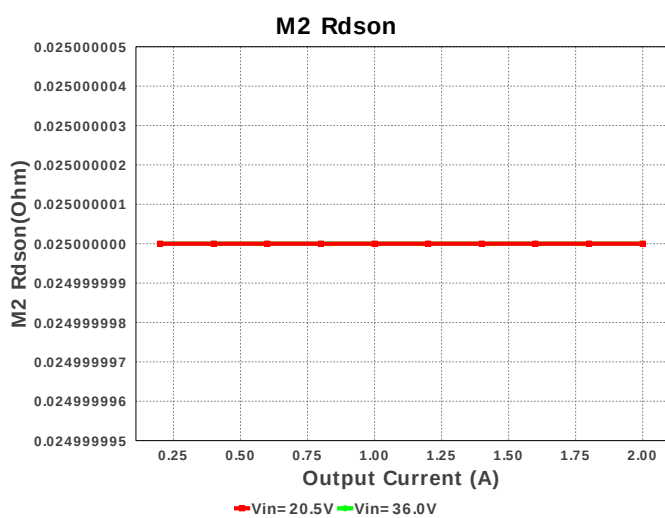
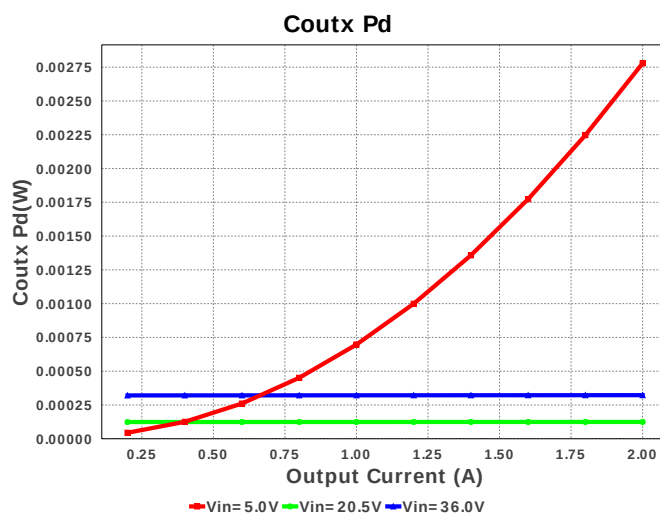
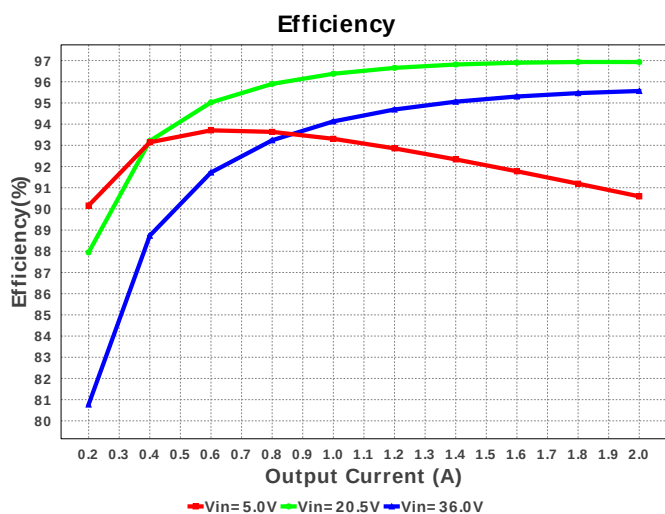
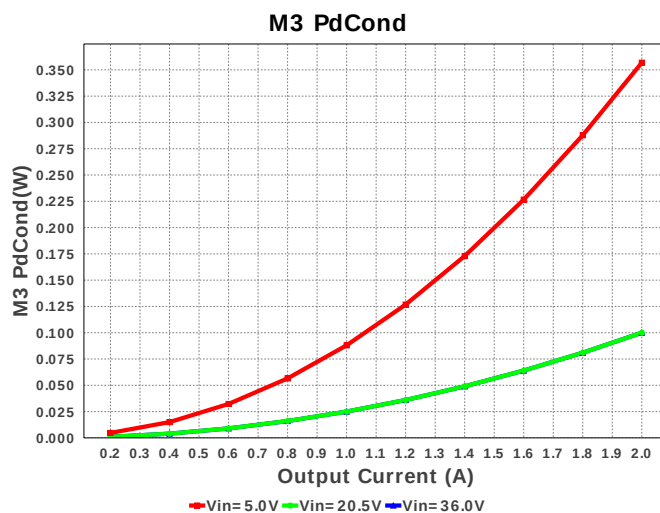
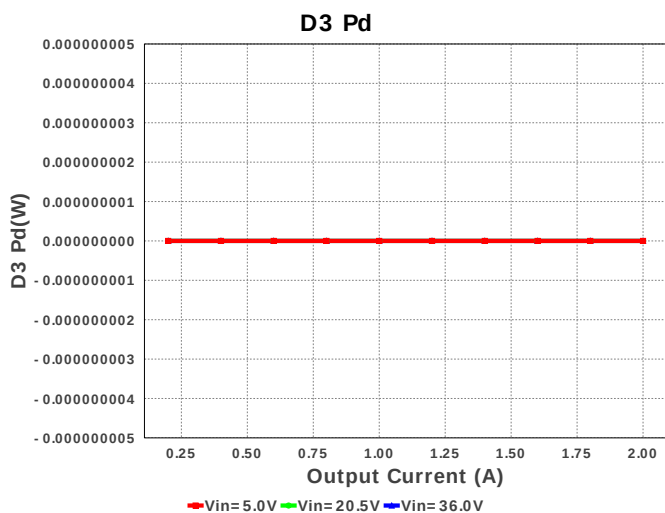




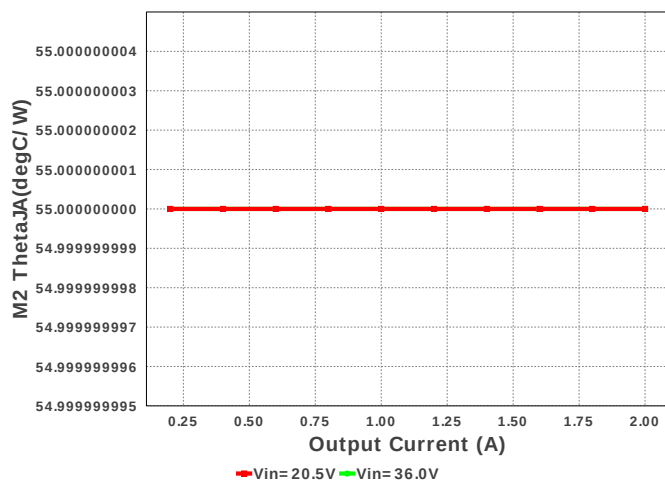




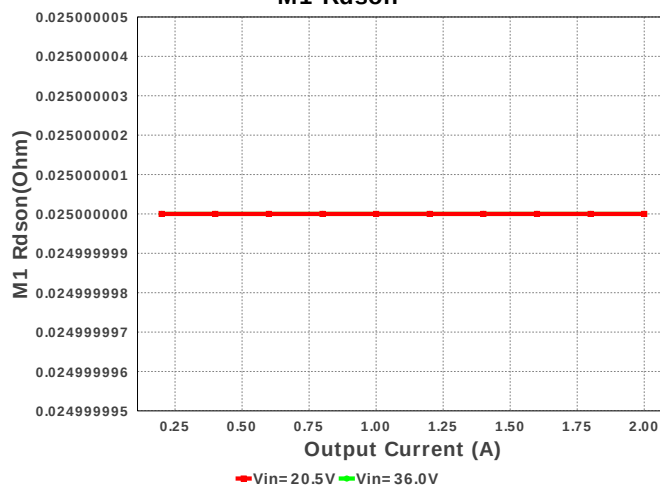




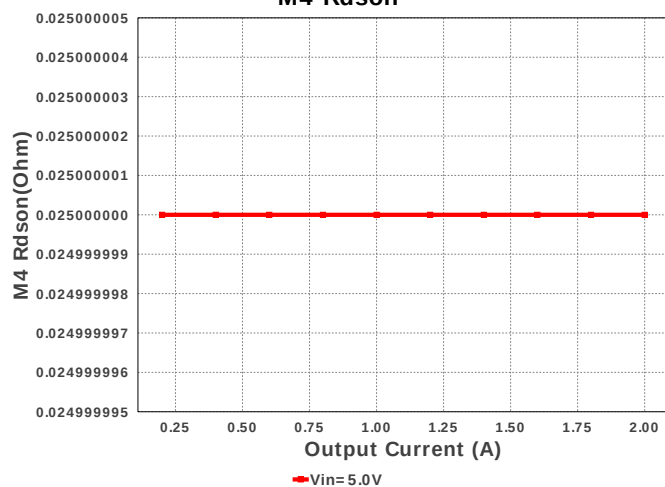
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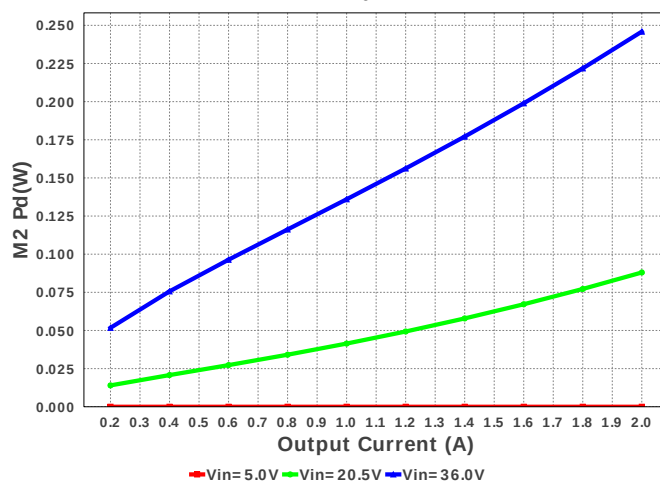
M1 Rdson



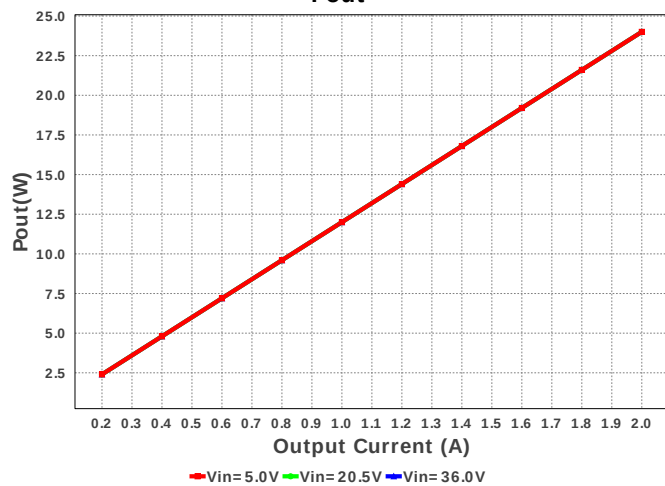
M4 Rdson



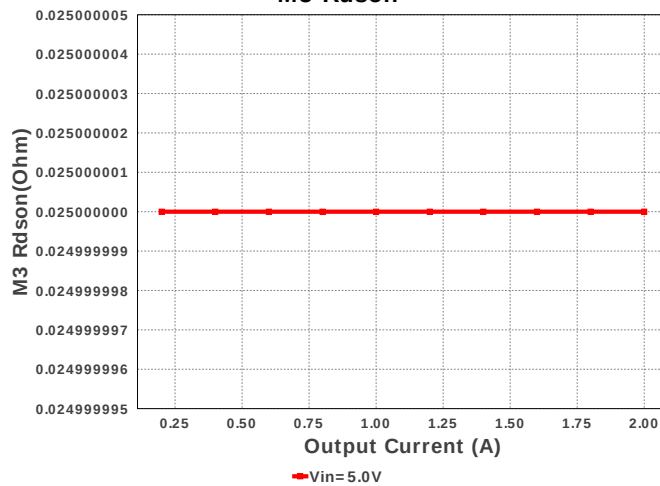
M2 Pd

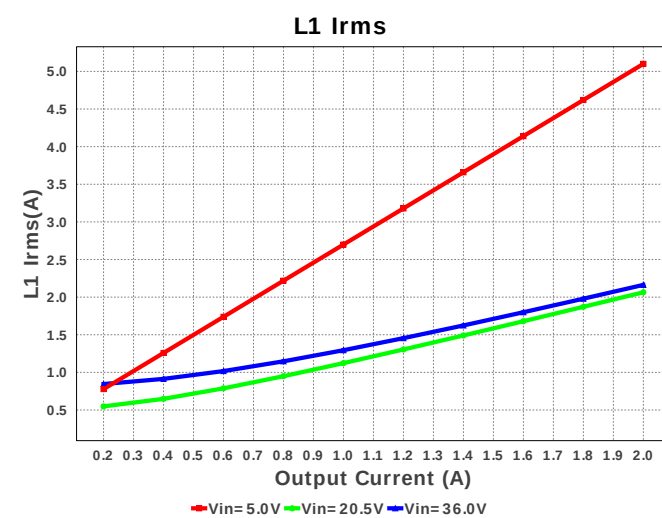
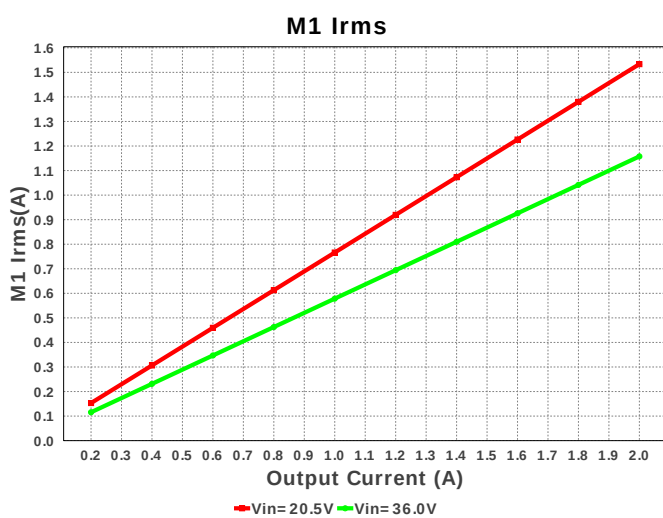
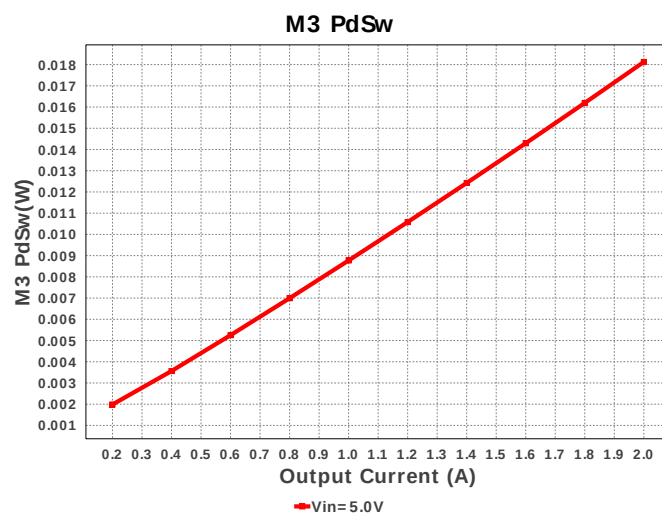
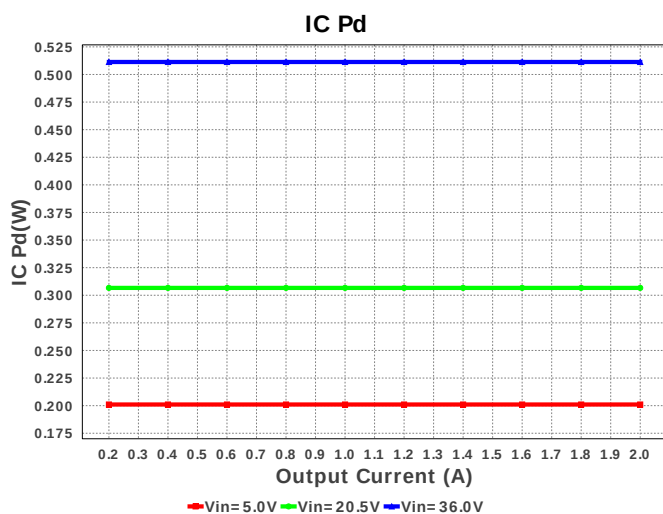
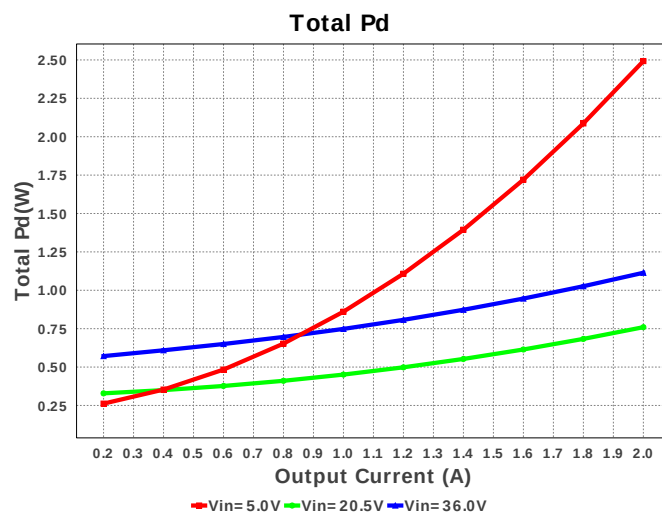
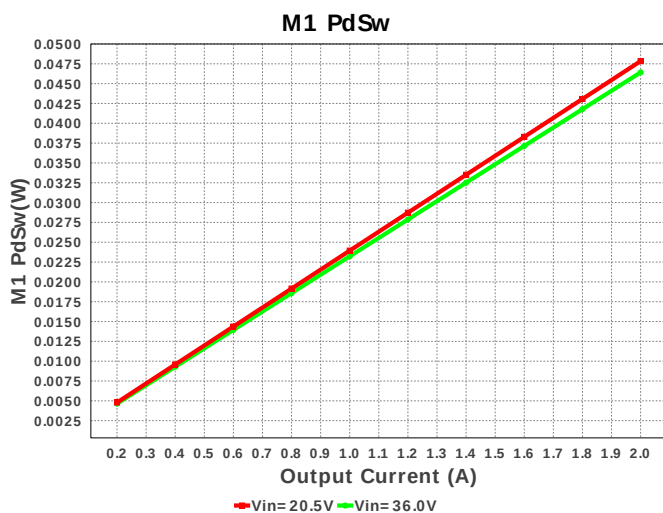


Pout

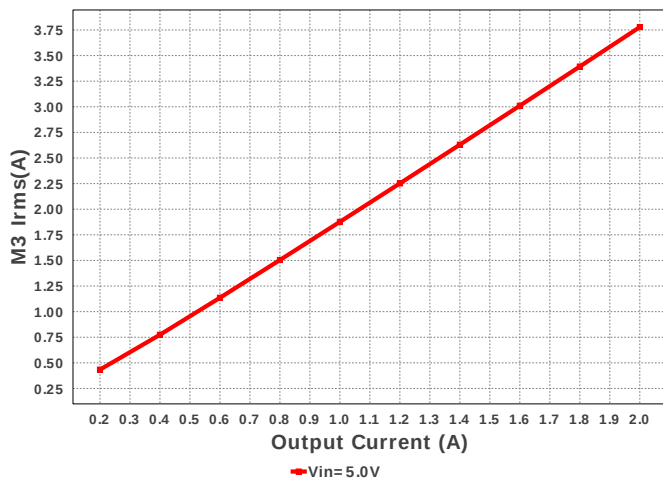


M3 Rdson

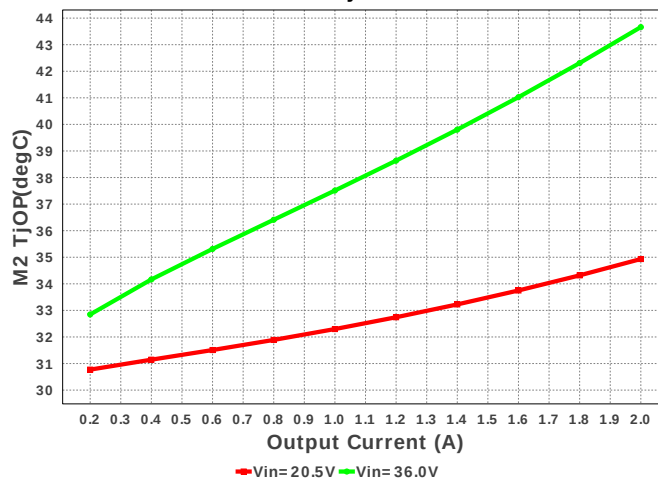




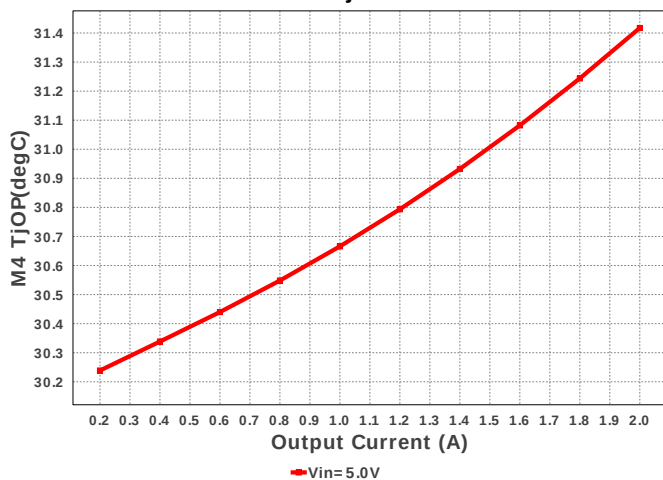
M3 Irms



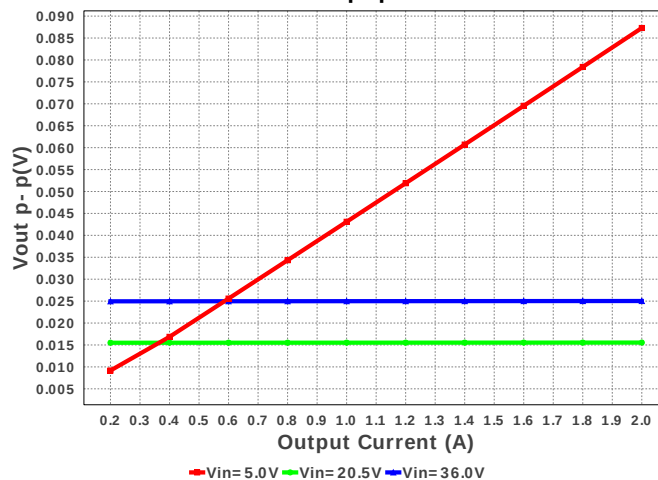
M2 TjOP



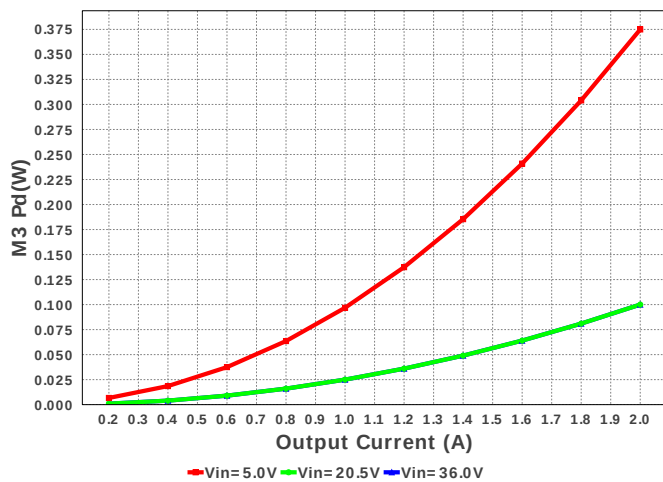
M4 TjOP



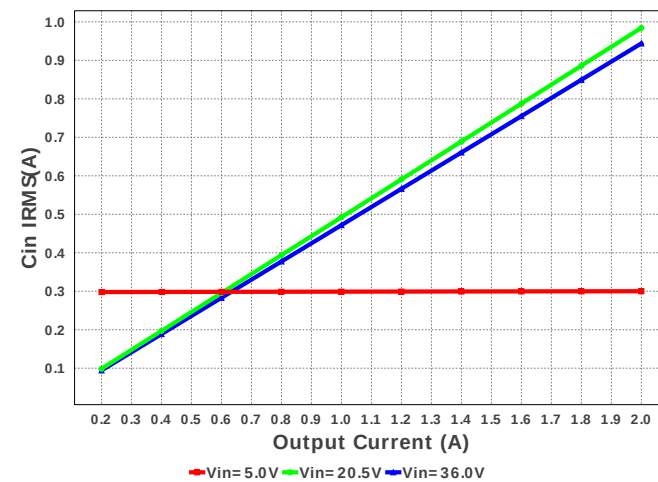
Vout p- p

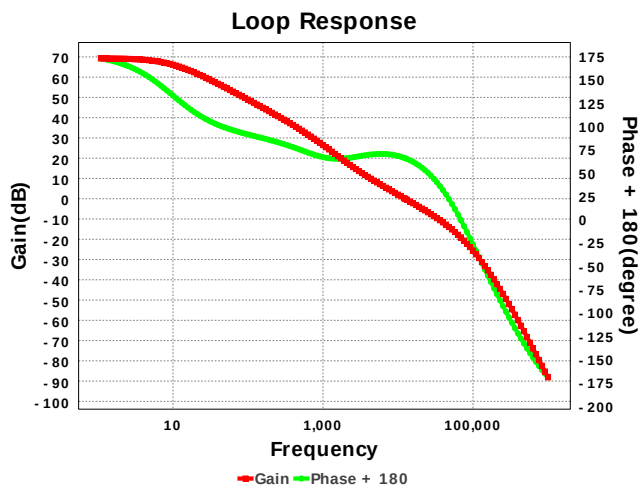


M3 Pd



Cin IRMS





Operating Values

#	Name	Value	Category	Description
1.	Cin IRMS	944.019 mA	Current	Input capacitor RMS ripple current
2.	Cout IRMS	254.65 mA	Current	Output capacitor RMS ripple current
3.	Coutx IRMS	217.164 mA	Current	Output capacitor_x RMS ripple current
4.	Iin Avg	696.31 mA	Current	Average input current
5.	L Ipp	1.634 A	Current	Peak-to-peak inductor ripple current
6.	L1 Irms	2.055 A	Current	Inductor ripple current
7.	M1 Irms	1.158 A	Current	MOSFET RMS ripple current
8.	M2 Irms	1.631 A	Current	MOSFET RMS ripple current
9.	SW Ipk	0.0 A	Current	Peak switch current
10.	BOM Count	41	General	Total Design BOM count
11.	FootPrint	581.0 mm ²	General	Total Foot Print Area of BOM components
12.	Frequency	343.832 kHz	General	Switching frequency
13.	IC Tolerance	0.0 V	General	IC Feedback Tolerance
14.	M1 Rdson	25.0 mOhm	General	Drain-Source On-resistance
15.	M1 ThetaJA	55.0 degC/W	General	MOSFET junction-to-ambient thermal resistance
16.	M2 Rdson	25.0 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	24.0 W	General	Total output power
20.	Total BOM	\$8.21	General	Total BOM Cost
21.	Low Freq Gain	69.233 dB	Op_Point	Gain at 10Hz
22.	Vout Actual	12.0 V	Op_Point	Vout Actual calculated based on selected voltage divider resistors
23.	Vout OP	12.0 V	Op_Point	Operational Output Voltage
24.	Cross Freq	12.483 kHz	Op_point	Bode plot crossover frequency
25.	Duty Cycle	33.505 %	Op_point	Duty cycle
26.	Efficiency	95.743 %	Op_point	Steady state efficiency
27.	Gain Marg	-19.155 dB	Op_point	Bode Plot Gain Margin
28.	IC Tj	45.595 degC	Op_point	IC junction temperature
29.	ICThetaJA	30.5 degC/W	Op_point	IC junction-to-ambient thermal resistance
30.	IOUT_OP	2.0 A	Op_point	Iout operating point
31.	M1 TjOP	36.135 degC	Op_point	MOSFET junction temperature
32.	M2 TjOP	39.431 degC	Op_point	MOSFET junction temperature
33.	Operating Topology	Buck	Op_point	The current operating topology of the device
34.	Phase Marg	66.381 deg	Op_point	Bode Plot Phase Margin
35.	VIN_OP	36.0 V	Op_point	Vin operating point
36.	Vout p-p	14.341 mV	Op_point	Peak-to-peak output ripple voltage
37.	Cin Pd	1.986 mW	Power	Input capacitor power dissipation
38.	Cout Pd	89.207 μW	Power	Output capacitor power dissipation
39.	Coutx Pd	105.922 μW	Power	Output capacitor_x power loss
40.	D2 Pd	0.0 W	Power	Diode power dissipation
41.	D3 Pd	0.0 W	Power	Diode power dissipation
42.	IC Pd	511.313 mW	Power	IC power dissipation
43.	L Pd	120.0 mW	Power	Inductor power dissipation
44.	M1 Pd	111.344 mW	Power	MOSFET power dissipation
45.	M1 PdCond	35.774 mW	Power	M1 MOSFET conduction losses
46.	M1 PdSw	75.57 mW	Power	M1 MOSFET switching losses
47.	M2 Pd	168.976 mW	Power	MOSFET power dissipation
48.	M2 PdCond	70.373 mW	Power	M2 MOSFET conduction losses
49.	M2 PdSw	98.604 mW	Power	M2 MOSFET switching losses
50.	M3 Pd	100.0 mW	Power	M3 MOSFET total power dissipation
51.	M3 PdCond	100.0 mW	Power	M3 MOSFET conduction losses
52.	M4 Pd	0.0 W	Power	M4 MOSFET total power dissipation

#	Name	Value	Category	Description
53.	Rsense Pd	53.196 mW	Power	LED Current Rsns Power Dissipation
54.	Total Pd	1.067 W	Power	Total Power Dissipation
55.	Vout Tolerance	1.886 %		Vout Tolerance based on IC Tolerance (no load) and voltage divider resistors if applicable

Design Inputs

#	Name	Value	Description
1.	Iout	2.0	Maximum Output Current
2.	VinMax	36.0	Maximum input voltage
3.	VinMin	5.0	Minimum input voltage
4.	Vout	12.0	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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