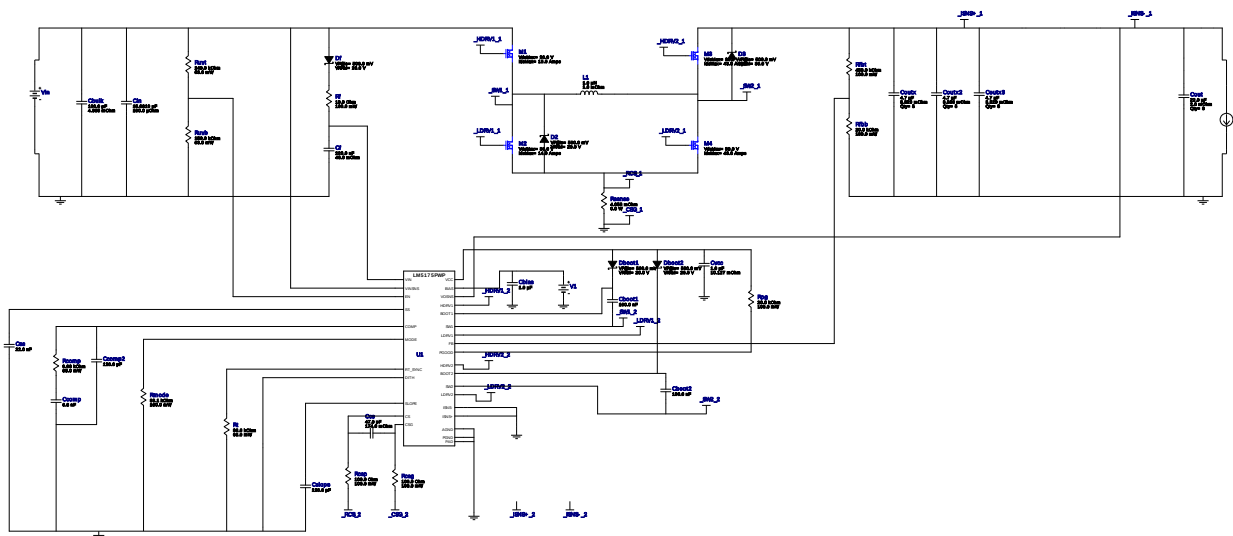


WEBENCH® Design Report

Design : 3893481/37 LM5175PWPR
LM5175PWPR 3.6V-4.2V to 19.00V @ 4.0A

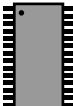


My Comments
39

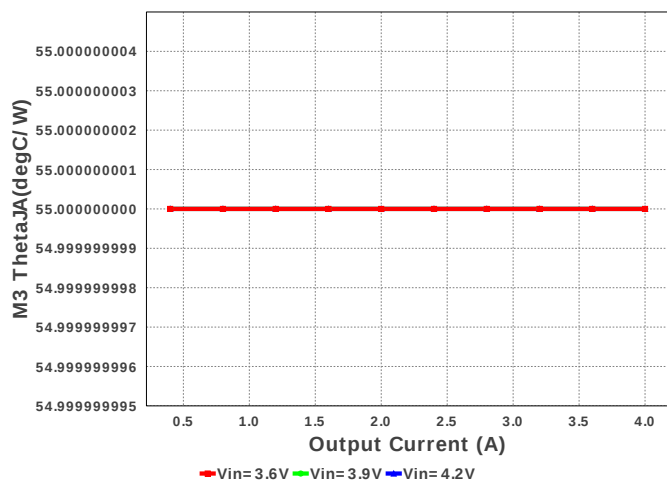
Electrical BOM

#	Name	Manufacturer	Part Number	Properties	Qty	Price	Footprint
1.	Cbias	Taiyo Yuden	GMK212B7105KG-T Series= X7R	Cap= 1.0 uF VDC= 35.0 V IRMS= 0.0 A	1	\$0.05	0805 7 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	MuRata	GRM31CR60J107ME39L Series= X5R	Cap= 100.0 uF ESR= 4.885 mOhm VDC= 6.3 V IRMS= 4.4118 A	1	\$0.14	1206_190 11 mm ²
5.	Ccomp	Yageo America	CC0805KRX7R9BB682 Series= X7R	Cap= 6.8 nF VDC= 50.0 V IRMS= 0.0 A	1	\$0.01	0805 7 mm ²
6.	Ccomp2	Samsung Electro-Mechanics	CL21C121JB61PNC Series= C0G/NP0	Cap= 120.0 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	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 ²
9.	Cin	CUSTOM	CUSTOM Series= ?	Cap= 15.8819 uF ESR= 100.0 uOhm VDC= 5.586 V IRMS= 2.0 A	1	NA	CUSTOM 0 mm ²

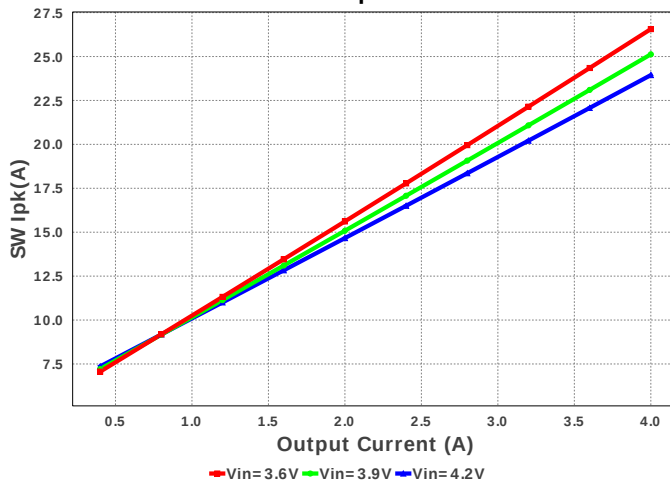
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10.	Cout	MuRata	GRM32ER61E226KE15L Series= X5R	Cap= 22.0 uF ESR= 2.0 mOhm VDC= 25.0 V IRMS= 3.67 A	3	\$0.16	 1210 15 mm ²
11.	Coutx	TDK	C3225X6S1H475K Series= X6S	Cap= 4.7 uF ESR= 3.329 mOhm VDC= 50.0 V IRMS= 0.0 A	5	\$0.19	 1210 15 mm ²
12.	Coutx2	TDK	C3225X6S1H475K Series= X6S	Cap= 4.7 uF ESR= 3.329 mOhm VDC= 50.0 V IRMS= 0.0 A	5	\$0.19	 1210 15 mm ²
13.	Coutx3	TDK	C3225X6S1H475K Series= X6S	Cap= 4.7 uF ESR= 3.329 mOhm VDC= 50.0 V IRMS= 0.0 A	5	\$0.19	 1210 15 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	Diodes Inc.	B220-13-F	VF@Io= 500.0 mV VRRM= 20.0 V	1	\$0.08	 SMB 44 mm ²
18.	D3	Diodes Inc.	B230A-13-F	VF@Io= 500.0 mV VRRM= 30.0 V	1	\$0.09	 SMA 37 mm ²
19.	Dboot1	Diodes Inc.	B220-13-F	VF@Io= 500.0 mV VRRM= 20.0 V	1	\$0.08	 SMB 44 mm ²
20.	Dboot2	Diodes Inc.	B220-13-F	VF@Io= 500.0 mV VRRM= 20.0 V	1	\$0.08	 SMB 44 mm ²
21.	Df	Diodes Inc.	B220-13-F	VF@Io= 500.0 mV VRRM= 20.0 V	1	\$0.08	 SMB 44 mm ²
22.	L1	Coilcraft	XAL1010-102MEB	L= 1.0 uH DCR= 1.0 mOhm	1	\$1.71	 XAL1010 160 mm ²
23.	M1	Texas Instruments	CSD17577Q3A	VdsMax= 30.0 V IdsMax= 19.0 Amps	1	\$0.28	 TRANS_NexFET_Q3A 18 mm ²
24.	M2	Texas Instruments	CSD17578Q3A	VdsMax= 30.0 V IdsMax= 14.0 Amps	1	\$0.25	 TRANS_NexFET_Q3A 18 mm ²
25.	M3	Texas Instruments	CSD17573Q5B	VdsMax= 30.0 V IdsMax= 43.0 Amps	1	\$0.75	 TRANS_NexFET_Q5B 58 mm ²
26.	M4	Texas Instruments	CSD17573Q5B	VdsMax= 30.0 V IdsMax= 43.0 Amps	1	\$0.75	 TRANS_NexFET_Q5B 58 mm ²

#	Name	Manufacturer	Part Number	Properties	Qty	Price	Footprint
27.	Rcomp	Vishay-Dale	CRCW04029K09FKED Series= CRCW..e3	Res= 9.09 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
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	CRCW0603453KFKEA Series= CRCW..e3	Res= 453.0 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	CUSTOM	CUSTOM Series= ?	Res= 4.053 mOhm Power= 0.0 W Tolerance= 0.0%	1	NA	CUSTOM 0 mm ²
36.	Rt	Vishay-Dale	CRCW040286K6FKED Series= CRCW..e3	Res= 86.6 kOhm Power= 63.0 mW Tolerance= 1.0%	1	\$0.01	 0402 3 mm ²
37.	Ruvb	Vishay-Dale	CRCW0402150KFKEA Series= CRCW..e3	Res= 150.0 kOhm Power= 63.0 mW Tolerance= 1.0%	1	\$0.01	 0402 3 mm ²
38.	Rvvt	Vishay-Dale	CRCW0402249KFKEA 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

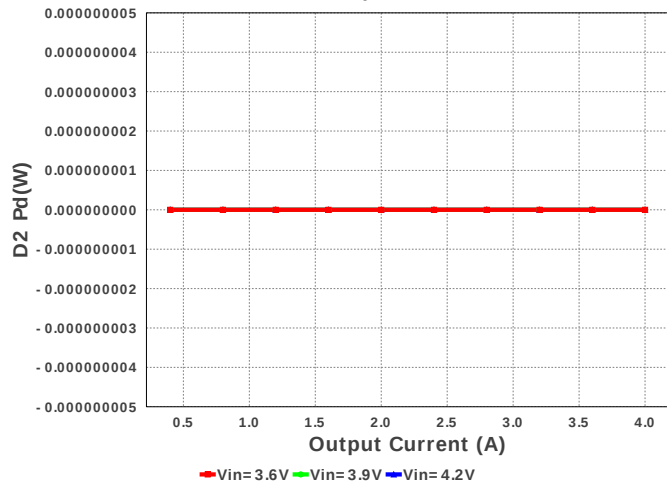
M3 ThetaJA



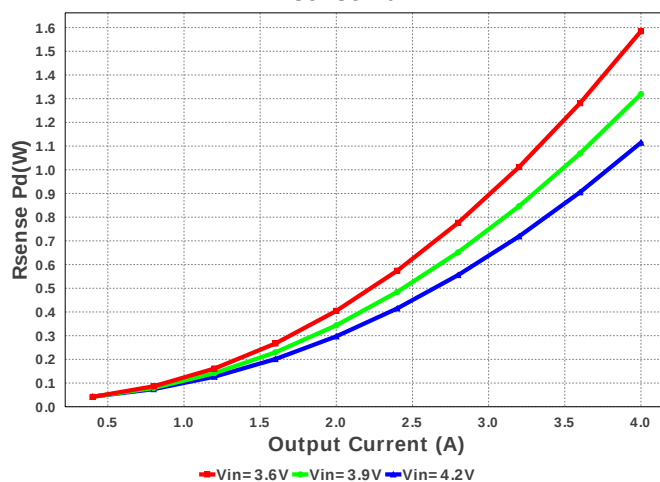
SW Ipk



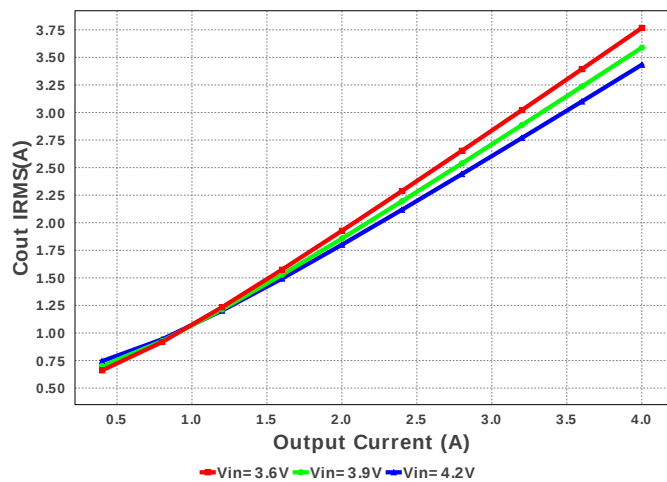
D2 Pd



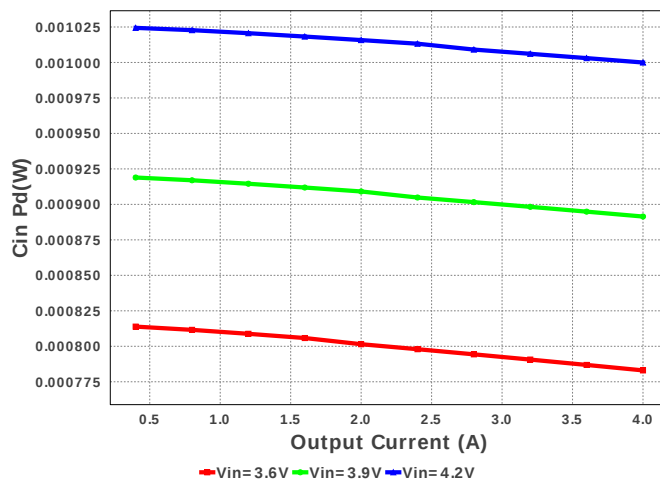
Rsense Pd

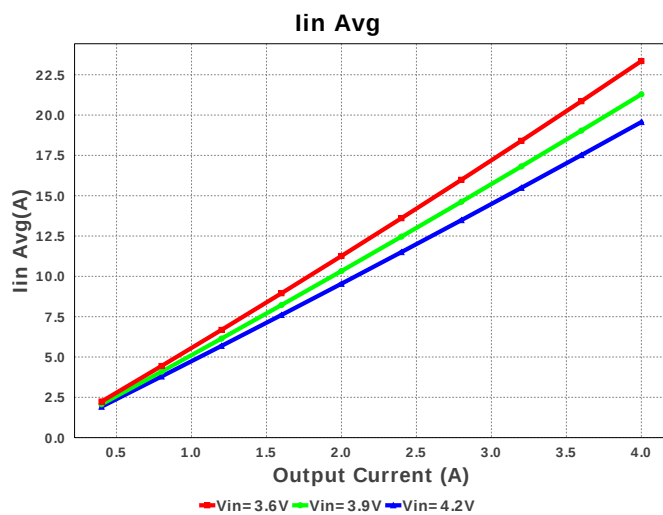
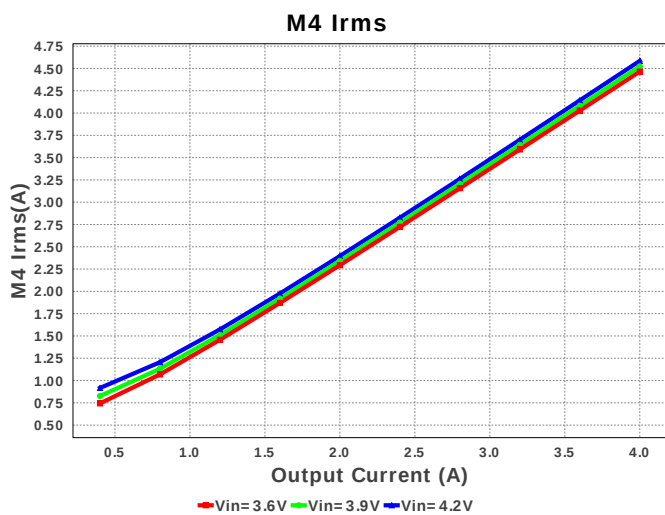
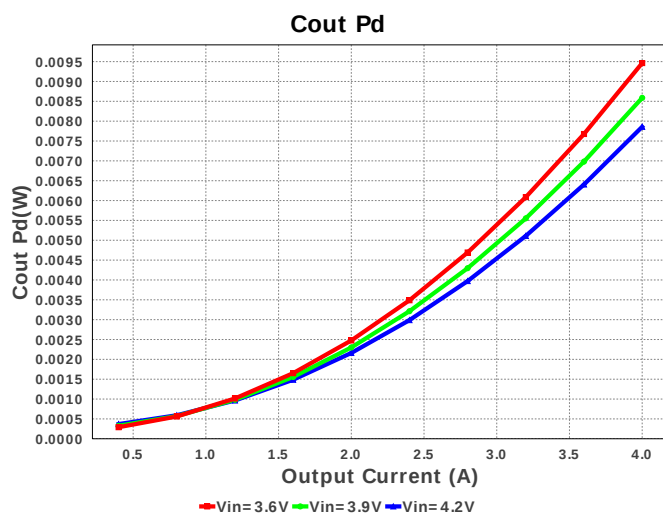
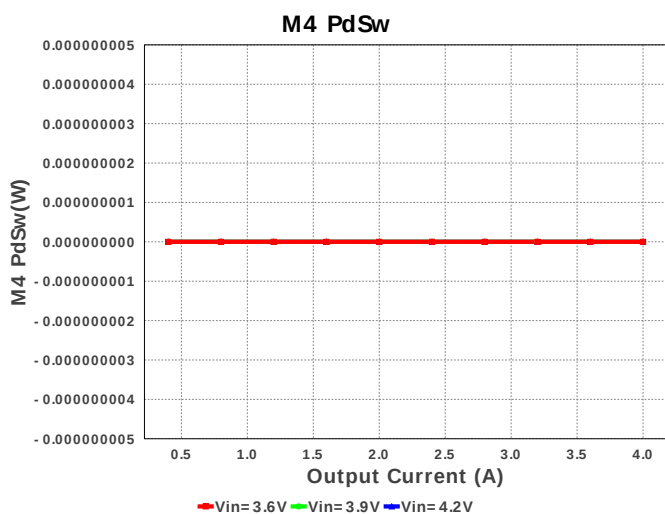
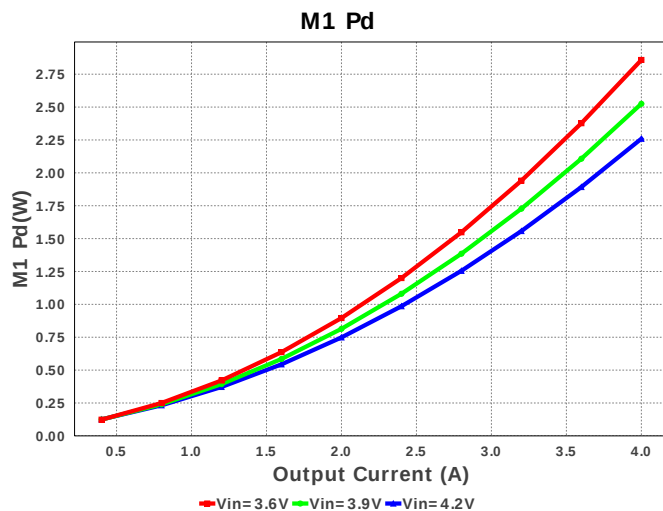
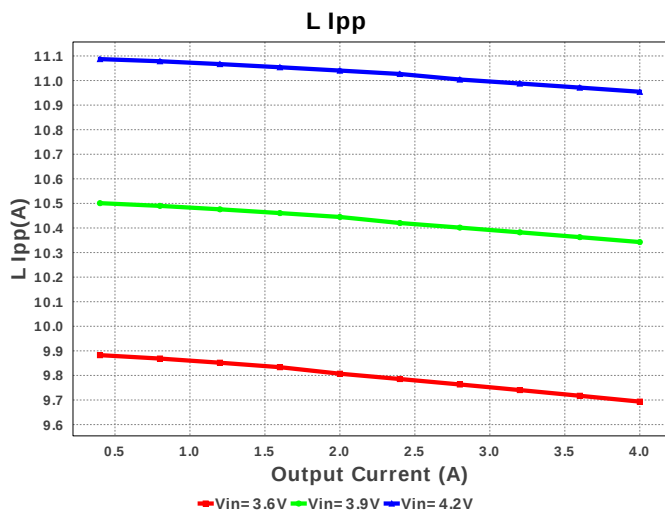


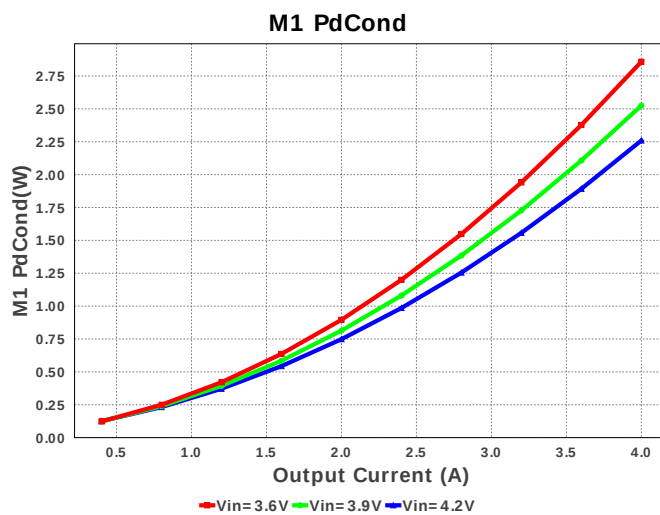
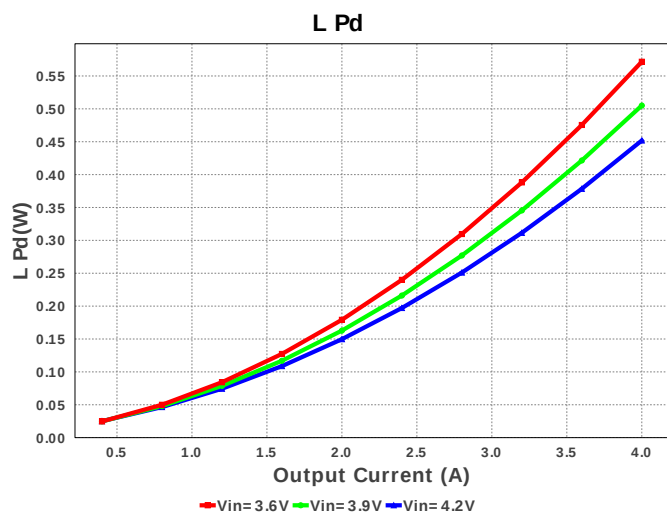
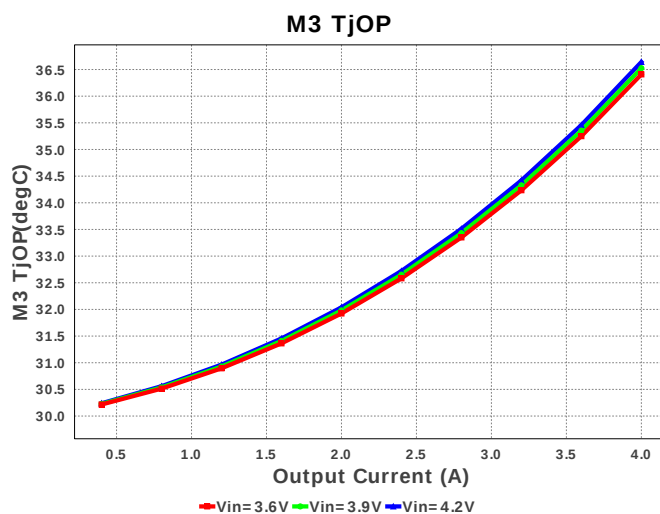
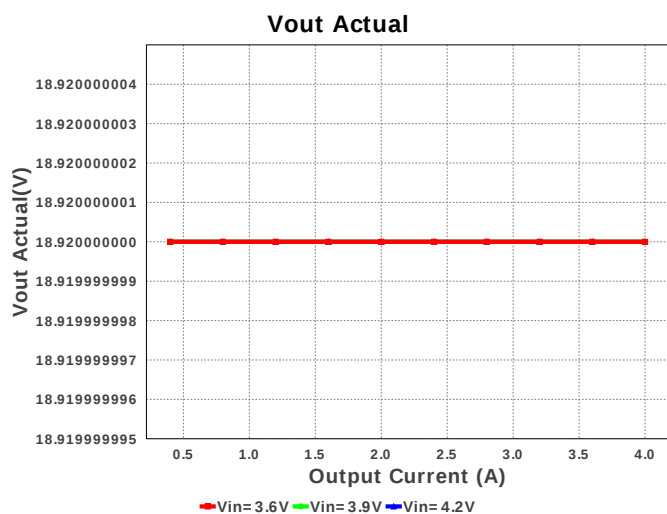
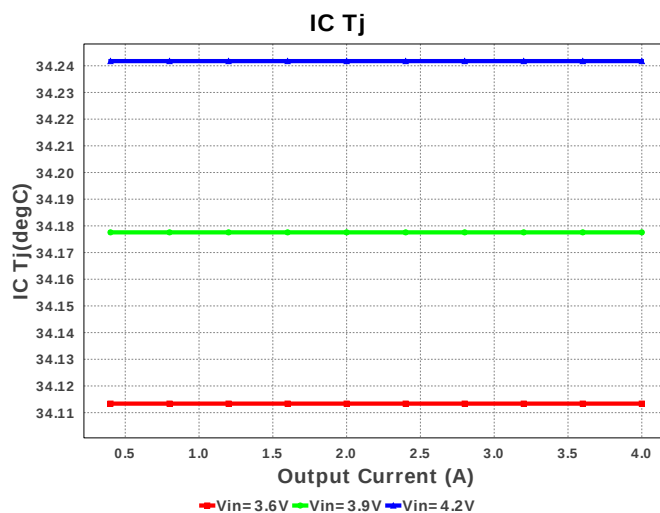
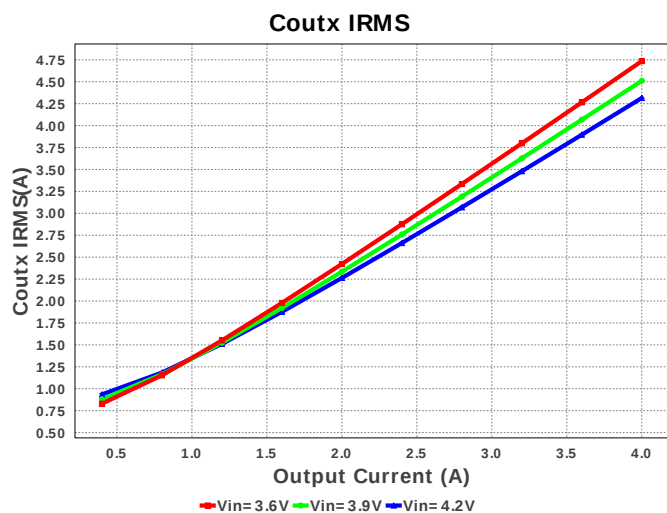
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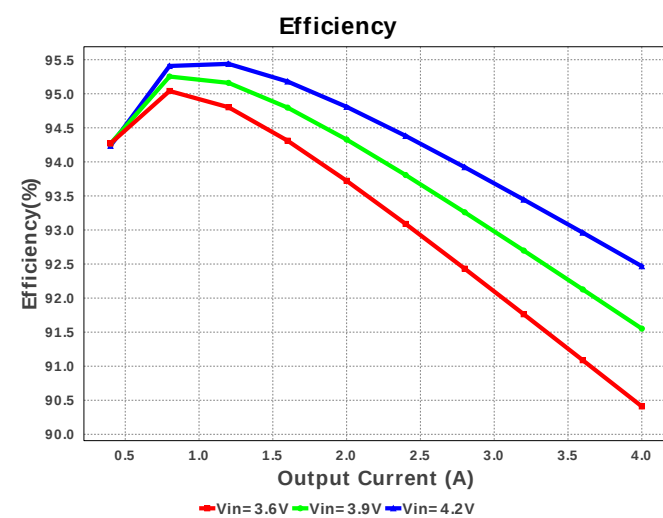
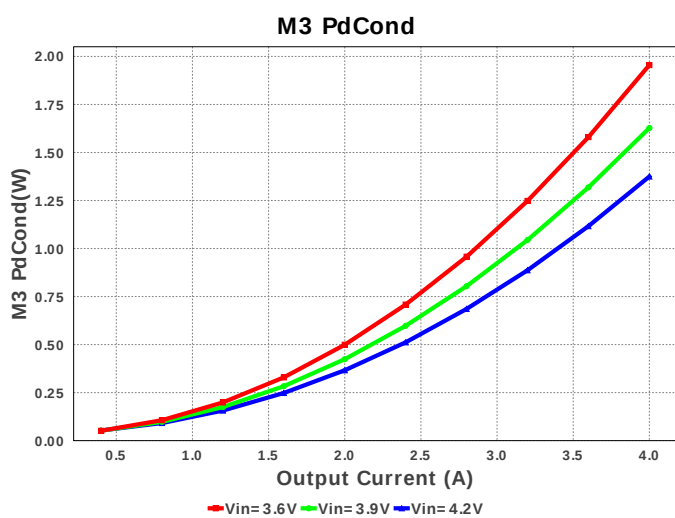
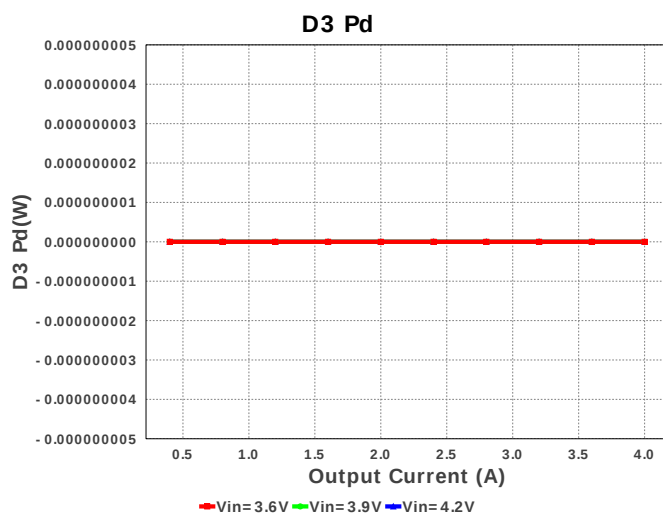
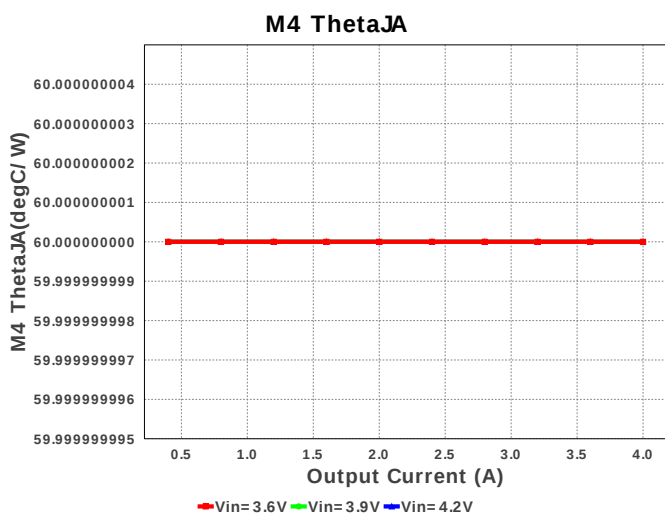
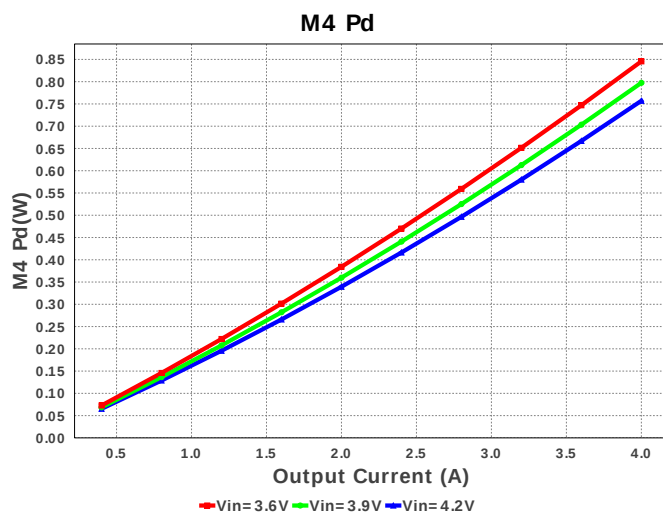
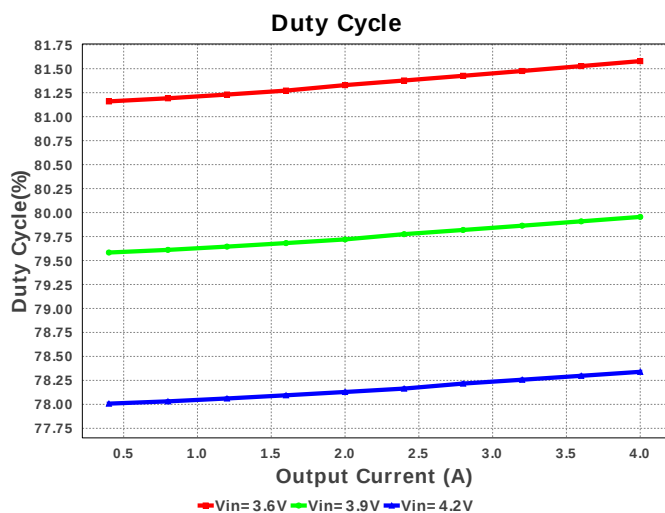


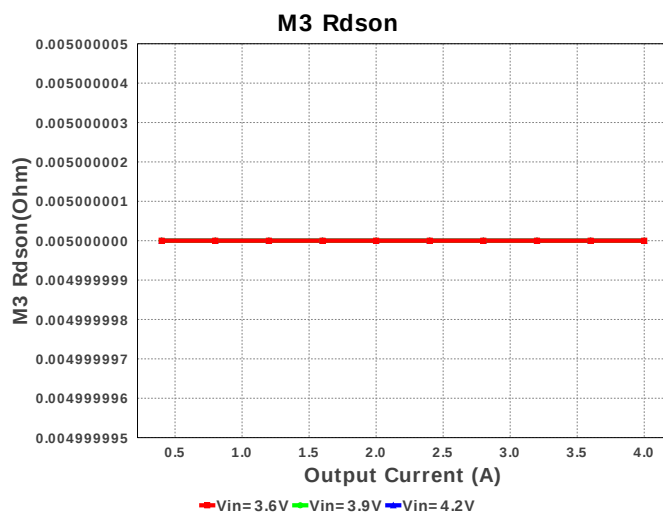
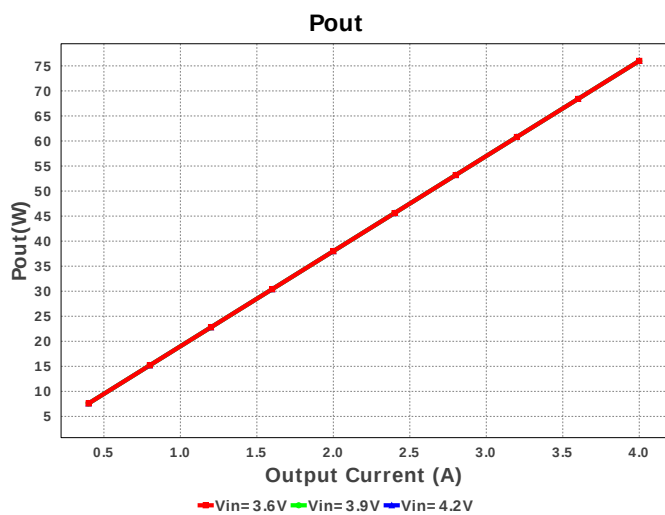
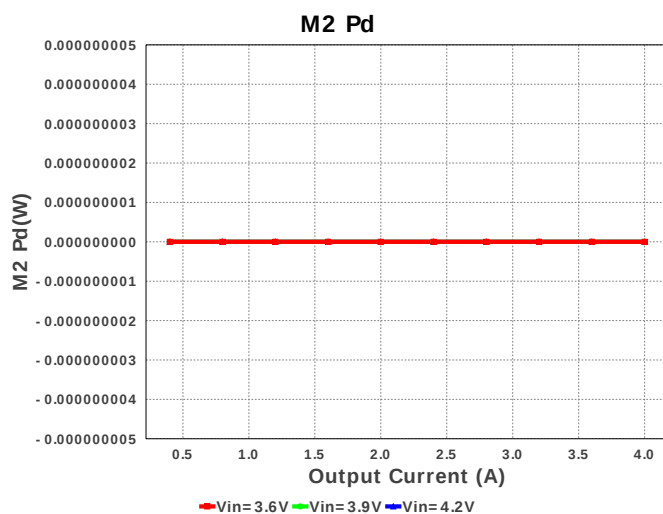
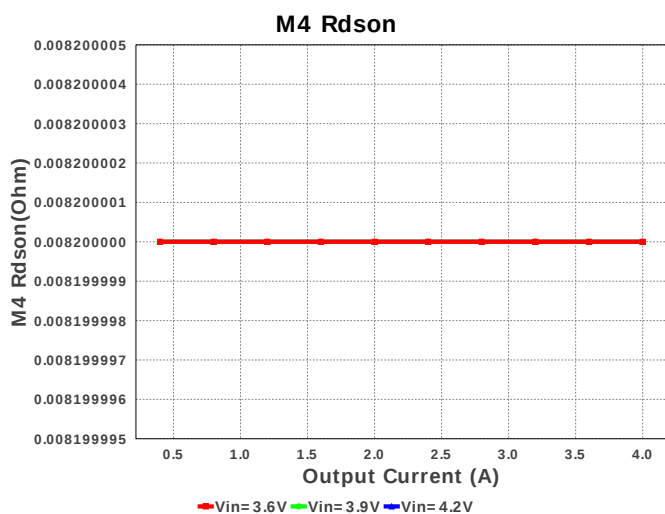
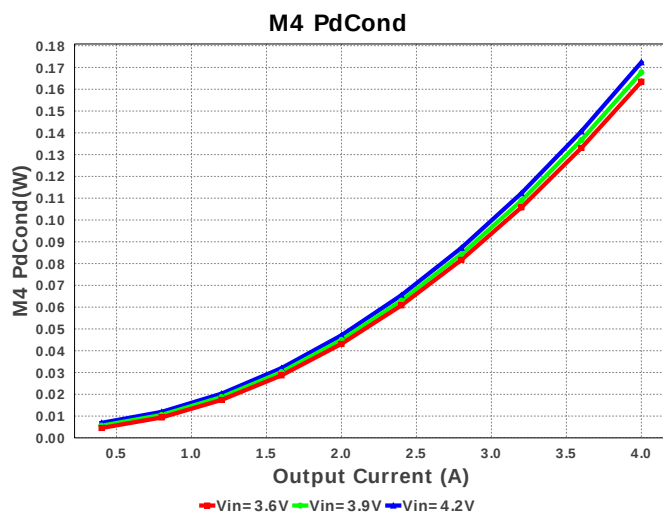
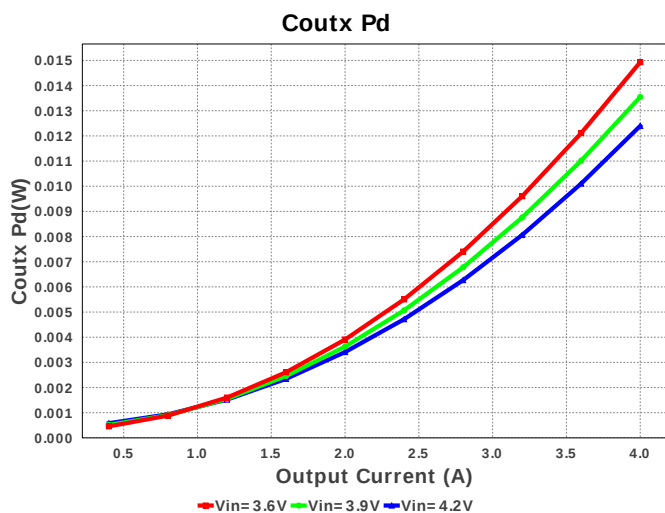
Cin Pd

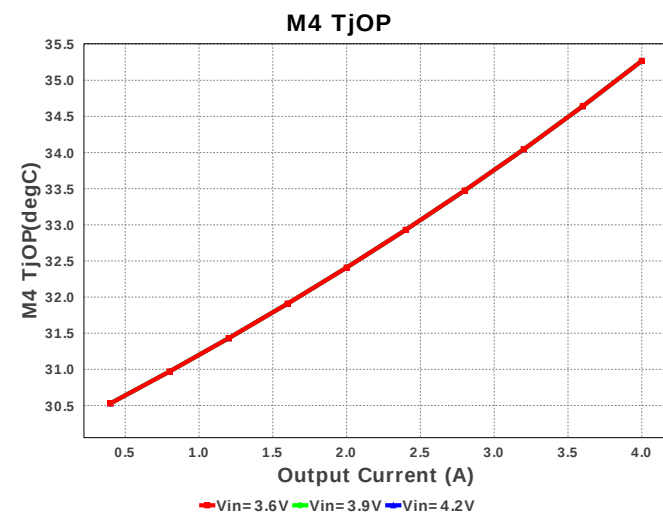
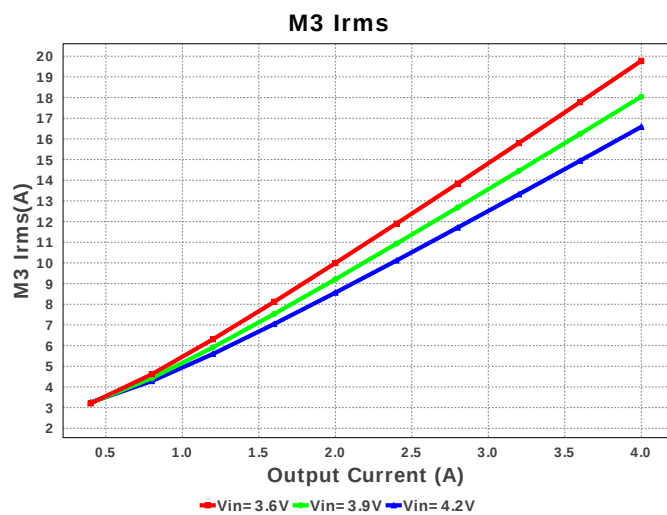
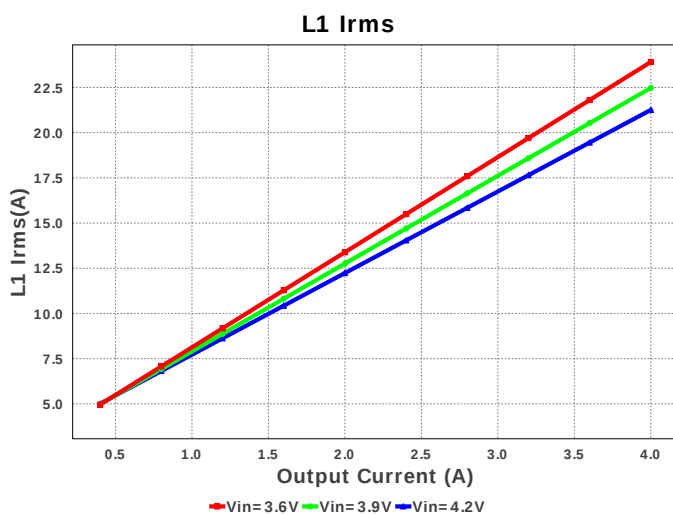
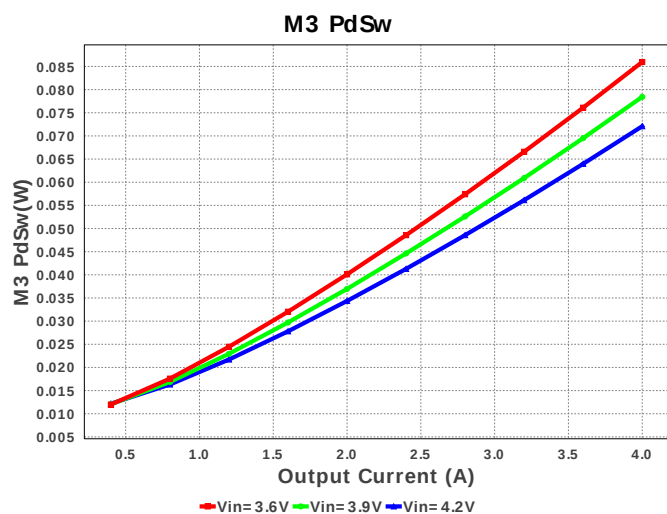
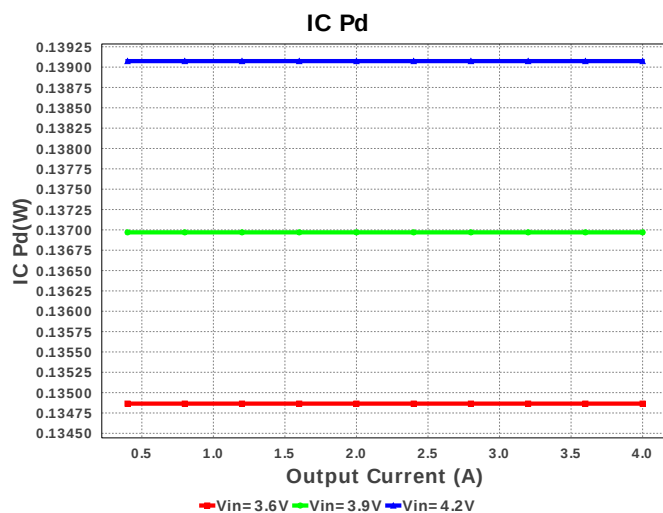
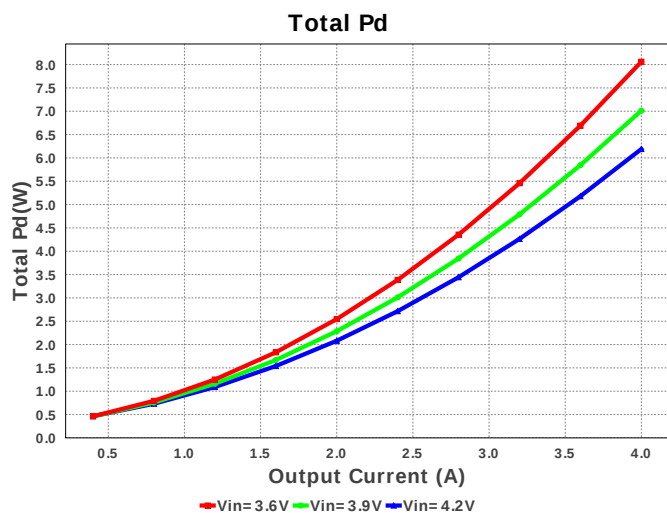


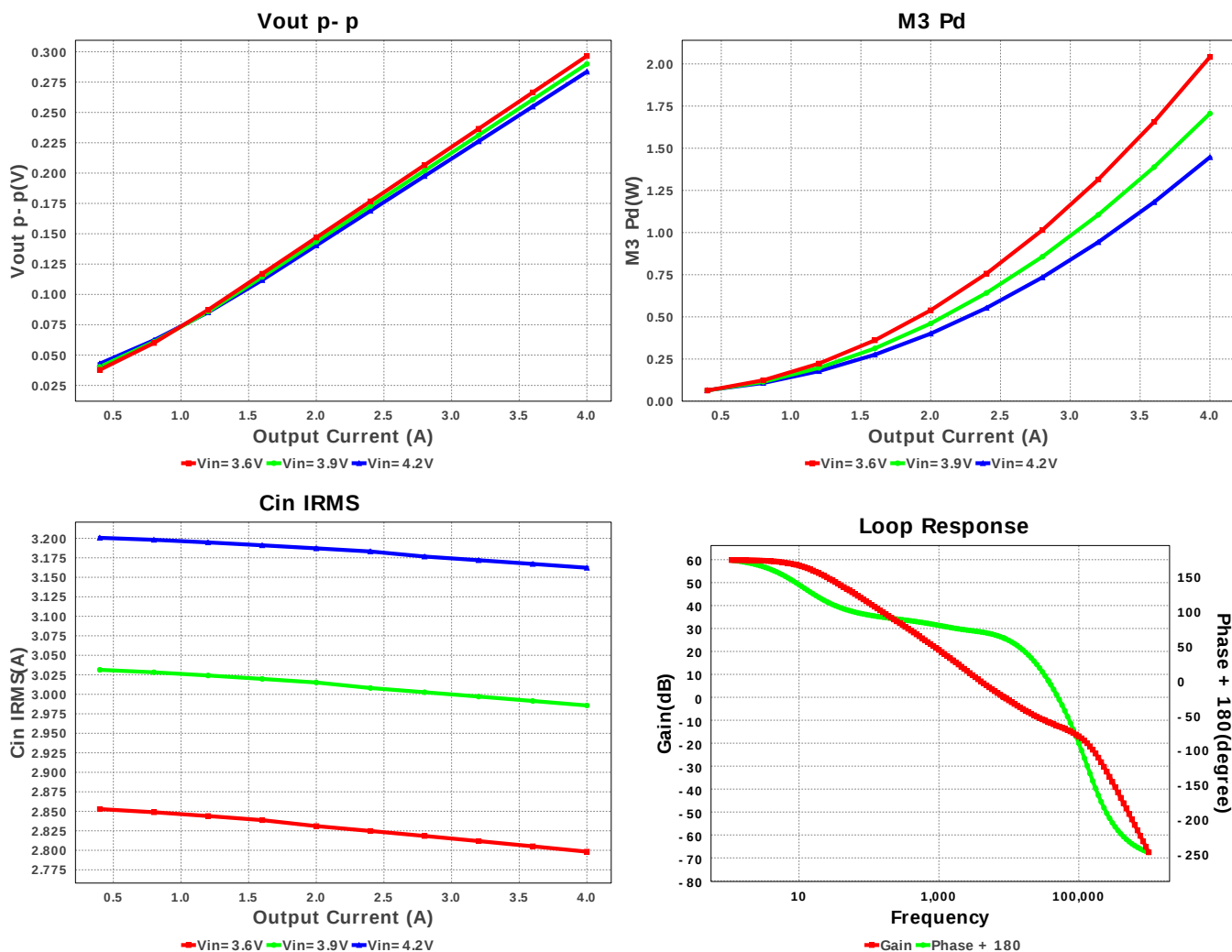












Operating Values

#	Name	Value	Category	Description
1.	Cin IRMS	3.278 A	Current	Input capacitor RMS ripple current
2.	Cout IRMS	3.445 A	Current	Output capacitor RMS ripple current
3.	Coutx IRMS	4.33 A	Current	Output capacitor_x RMS ripple current
4.	Iin Avg	23.405 A	Current	Average input current
5.	L Ipp	11.354 A	Current	Peak-to-peak inductor ripple current
6.	L1 Irms	24.389 A	Current	Inductor ripple current
7.	M3 Irms	19.923 A	Current	MOSFET RMS ripple current
8.	M4 Irms	4.497 A	Current	MOSFET RMS ripple current
9.	SW Ipk	24.212 A	Current	Peak switch current
10.	BOM Count	53	General	Total Design BOM count
11.	FootPrint	1.038 k mm ²	General	Total Foot Print Area of BOM components
12.	Frequency	293.755 kHz	General	Switching frequency
13.	IC Tolerance	0.0 V	General	IC Feedback Tolerance
14.	Pout	76.0 W	General	Total output power
15.	Total BOM	\$0.0	General	Total BOM Cost
16.	Low Freq Gain	59.799 dB	Op_Point	Gain at 10Hz
17.	M3 TjOP	36.644 degC	Op_Point	MOSFET junction temperature
18.	M4 TjOP	36.009 degC	Op_Point	MOSFET junction temperature
19.	Vout Actual	18.92 V	Op_Point	Vout Actual calculated based on selected voltage divider resistors
20.	Vout OP	19.0 V	Op_Point	Operational Output Voltage
21.	Cross Freq	8.537 kHz	Op_point	Bode plot crossover frequency
22.	Duty Cycle	78.42 %	Op_point	Duty cycle
23.	Efficiency	90.2 %	Op_point	Steady state efficiency
24.	Gain Marg	-10.844 dB	Op_point	Bode Plot Gain Margin
25.	IC Tj	34.242 degC	Op_point	IC junction temperature
26.	ICThetaJA	30.5 degC/W	Op_point	IC junction-to-ambient thermal resistance
27.	IOUT_OP	4.0 A	Op_point	Iout operating point
28.	Phase Marg	62.242 deg	Op_point	Bode Plot Phase Margin
29.	VIN_OP	3.6 V	Op_point	Vin operating point
30.	Vout p-p	283.794 mV	Op_point	Peak-to-peak output ripple voltage
31.	Cin Pd	1.074 mW	Power	Input capacitor power dissipation

#	Name	Value	Category	Description
32.	Cout Pd	7.914 mW	Power	Output capacitor power dissipation
33.	Coutx Pd	12.484 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	139.074 mW	Power	IC power dissipation
37.	L Pd	594.81 mW	Power	Inductor power dissipation
38.	M1 Pd	2.974 W	Power	M1 MOSFET total power dissipation
39.	M1 PdCond	2.974 W	Power	M1 MOSFET conduction losses
40.	M2 Pd	0.0 W	Power	M2 MOSFET total power dissipation
41.	M3 Pd	2.071 W	Power	MOSFET power dissipation
42.	M3 PdCond	1.985 W	Power	M1 MOSFET conduction losses
43.	M3 PdSw	86.609 mW	Power	M1 MOSFET switching losses
44.	M3 Rdson	5.0 mOhm	Power	Drain-Source On-resistance
45.	M4 Pd	848.008 mW	Power	MOSFET power dissipation
46.	M4 PdCond	165.844 mW	Power	M2 MOSFET conduction losses
47.	M4 PdSw	0.0 W	Power	M2 MOSFET switching losses
48.	M4 Rdson	8.2 mOhm	Power	Drain-Source On-resistance
49.	Rsense Pd	1.609 W	Power	Rsense Power Dissipation
50.	Total Pd	8.257 W	Power	Total Power Dissipation
51.	M3 ThetaJA	55.0 degC/W		MOSFET junction-to-ambient thermal resistance
52.	M4 ThetaJA	60.0 degC/W		MOSFET junction-to-ambient thermal resistance
53.	Vout Tolerance	1.935 %		Vout Tolerance based on IC Tolerance (no load) and voltage divider resistors if applicable

Design Inputs

#	Name	Value	Description
1.	Iout	4.0	Maximum Output Current
2.	VinMax	4.2	Maximum input voltage
3.	VinMin	3.6	Minimum input voltage
4.	Vout	19.0	Output Voltage
5.	base_pn	LM5175	Texas Instruments Base Part 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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