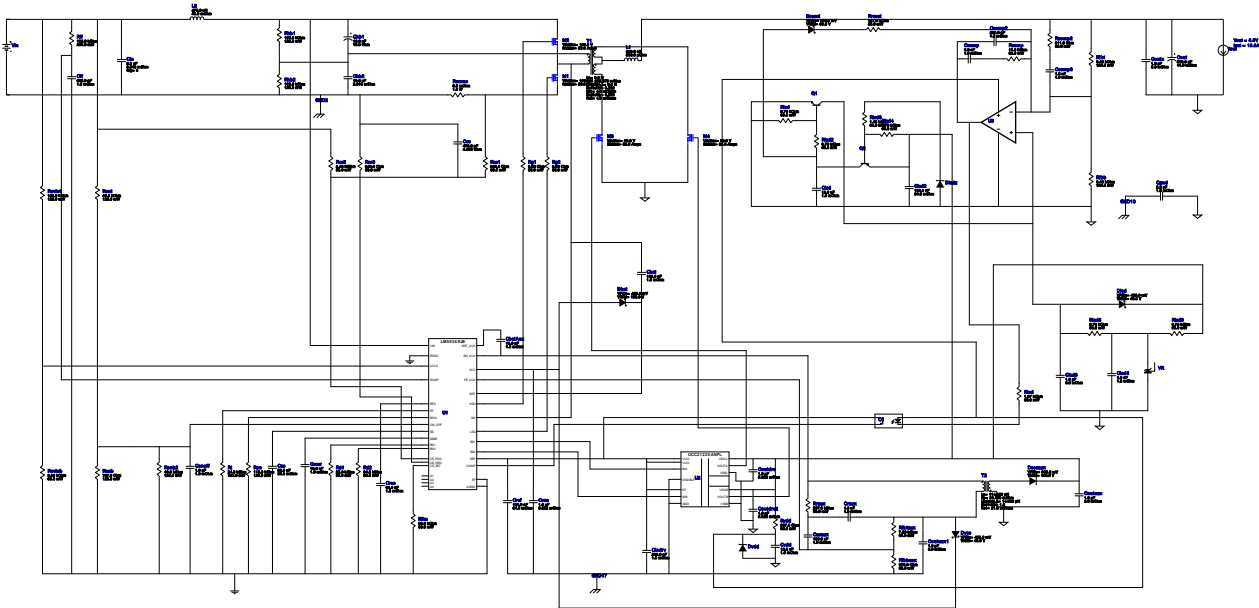


WEBENCH® Design Report

 Design : 1119133/291 LM5036RJBR
 Design 286fromandrew.frazer@stellascapes.com


















1. Auxiliary supply Vout On state and off state Voltages are set in the ratio of 1:1.4. Hence select aux Vout such that both on state (input) and off state voltages are within the given range 8.5V to 14V. Level shift detector Zener voltage can be adjusted according to application. Dlsdz clamp voltage needs to be between off-state Vaux2 and on-state Vaux2 in order to detect the level shift. If the user changes off-state and on-state voltage level, then the clamp voltage needs to be changed. The FETS may need to be reselected if the selected Fets are over rated for current. The compensation components can be designed by running the Simplis simulations by downloading the model from www.ti.com.










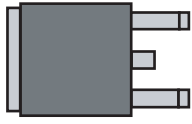





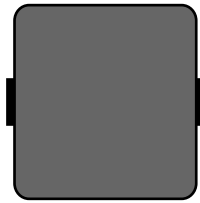
My Comments

No comments

Electrical BOM



#	Name	Manufacturer	Part Number	Properties	Qty	Price	Footprint
1.	Cacaux	MuRata	GRM31CR72E104KW03L Series= X7R	Cap= 100.0 nF ESR= 1.0 mOhm VDC= 250.0 V IRMS= 0.0 A	1	\$0.07	 1206 11 mm ²
2.	Cbst	MuRata	GRM31CR72E104KW03L Series= X7R	Cap= 100.0 nF ESR= 1.0 mOhm VDC= 250.0 V IRMS= 0.0 A	1	\$0.07	 1206 11 mm ²
3.	CbstAux	Taiyo Yuden	QMK212B7103KG-T Series= X7R	Cap= 10.0 nF ESR= 1.0 mOhm VDC= 250.0 V IRMS= 0.0 A	1	\$0.04	 0805 7 mm ²
4.	Ccomp	MuRata	GRM155R71E682KA01D Series= X7R	Cap= 6.8 nF ESR= 1.0 mOhm VDC= 25.0 V IRMS= 0.0 A	1	\$0.01	 0402 3 mm ²
5.	Ccomp2	MuRata	GRM033R71E221KA01D Series= X7R	Cap= 220.0 pF ESR= 1.0 mOhm VDC= 25.0 V IRMS= 0.0 A	1	\$0.01	 0201 2 mm ²
6.	Ccomp3	MuRata	GRM033R71E152KA01D Series= X7R	Cap= 1.5 nF ESR= 1.0 mOhm VDC= 25.0 V IRMS= 0.0 A	1	\$0.01	 0201 2 mm ²

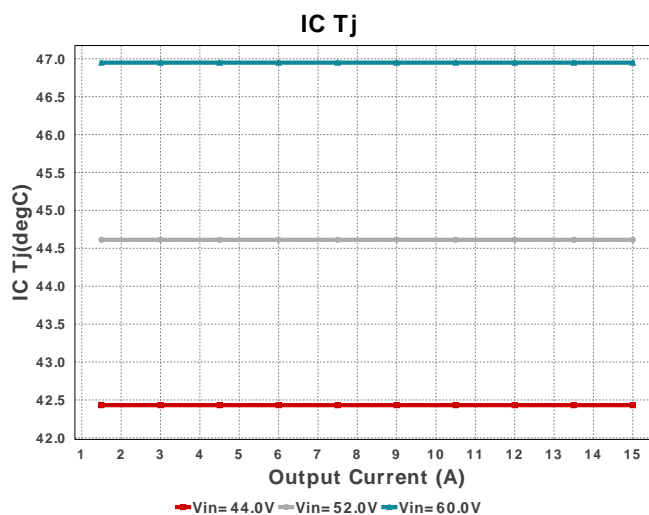
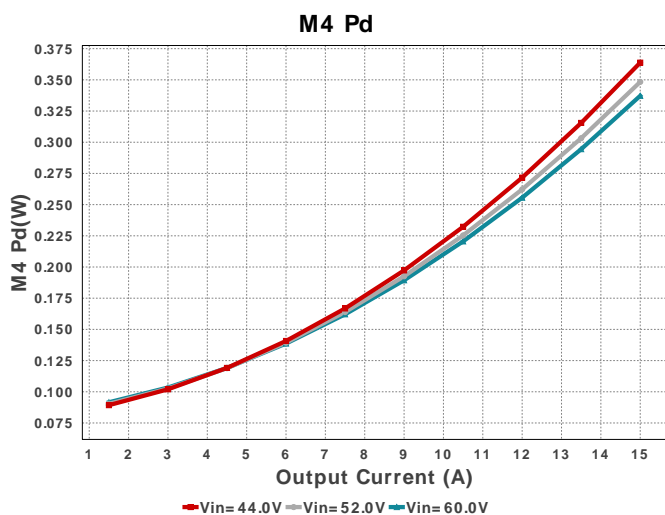
#	Name	Manufacturer	Part Number	Properties	Qty	Price	Footprint
7.	Ccs	TDK	CGA2B2X7R1H471K050BA Series= X7R	Cap= 470.0 pF ESR= 4.9649 Ohm VDC= 50.0 V IRMS= 228.41 mA	1	\$0.01	 0402 3 mm ²
8.	Cff	MuRata	GRM155R72A681KA01D Series= X7R	Cap= 680.0 pF ESR= 1.0 mOhm VDC= 100.0 V IRMS= 0.0 A	1	\$0.01	 0402 3 mm ²
9.	Cgnd	Johanson Technology	202S41W222KV4E Series= X7R	Cap= 2.2 nF ESR= 1.0 mOhm VDC= 2.0 kV IRMS= 0.0 A	1	\$0.09	 1210_280 15 mm ²
10.	Chb1	Chemi-Con	EMVE630ADA100MF55G Series= MVE	Cap= 10.0 uF ESR= 15.9 Ohm VDC= 63.0 V IRMS= 32.0 mA	1	\$0.09	 CAPSMT_62_F55 77 mm ²
11.	Chb2	TDK	C2012X5R1V106K085AC Series= X5R	Cap= 10.0 uF ESR= 2.818 mOhm VDC= 35.0 V IRMS= 3.8868 A	1	\$0.17	 0805 7 mm ²
12.	Cin	TDK	C3216X7S2A335M160AB Series= X7S	Cap= 3.3 uF ESR= 3.048 mOhm VDC= 100.0 V IRMS= 4.157 A	3	\$0.43	 1206_190 11 mm ²
13.	Cindv	Taiyo Yuden	UMK212B7224KG-T Series= X7R	Cap= 220.0 nF ESR= 1.0 mOhm VDC= 50.0 V IRMS= 0.0 A	1	\$0.02	 0805 7 mm ²
14.	Clsd	MuRata	GRM155R71E123KA61D Series= X7R	Cap= 12.0 nF ESR= 1.0 mOhm VDC= 25.0 V IRMS= 0.0 A	1	\$0.01	 0402 3 mm ²
15.	Clsd2	Kemet	C0805C104K3RACTU Series= X7R	Cap= 100.0 nF ESR= 64.0 mOhm VDC= 25.0 V IRMS= 1.64 A	1	\$0.01	 0805 7 mm ²
16.	Clsd3	MuRata	GRM219R71E105KA88D Series= X7R	Cap= 1.0 uF ESR= 6.0 mOhm VDC= 25.0 V IRMS= 3.87 A	1	\$0.02	 0805 7 mm ²
17.	Clsd4	MuRata	GRM033R71E102KA01D Series= X7R	Cap= 1.0 nF ESR= 1.0 mOhm VDC= 25.0 V IRMS= 0.0 A	1	\$0.01	 0201_033 2 mm ²
18.	Conoff	MuRata	GRM033R71E102KA01D Series= X7R	Cap= 1.0 nF ESR= 1.0 mOhm VDC= 25.0 V IRMS= 0.0 A	1	\$0.01	 0201_033 2 mm ²
19.	Cout	Panasonic	16SVPF560M Series= SVPF	Cap= 560.0 uF ESR= 14.0 mOhm VDC= 16.0 V IRMS= 4.95 A	1	\$0.64	 CAPSMT_62_E12 106 mm ²
20.	Coutaux	MuRata	GRM219R71E105KA88D Series= X7R	Cap= 1.0 uF ESR= 6.0 mOhm VDC= 25.0 V IRMS= 3.87 A	1	\$0.02	 0805 7 mm ²
21.	Coutaux1	MuRata	GRM219R71E105KA88D Series= X7R	Cap= 1.0 uF ESR= 6.0 mOhm VDC= 25.0 V IRMS= 3.87 A	1	\$0.02	 0805 7 mm ²
22.	Coutdrv	TDK	C1608X5R1H105K080AB Series= X5R	Cap= 1.0 uF ESR= 5.522 mOhm VDC= 50.0 V IRMS= 2.2162 A	1	\$0.03	 0603 5 mm ²

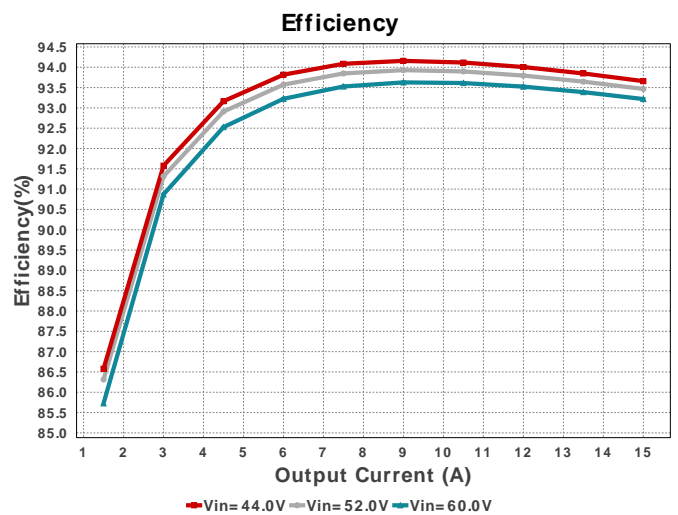
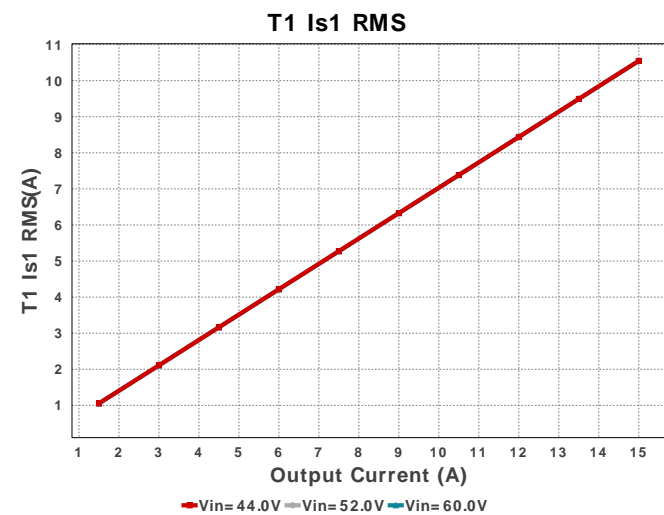
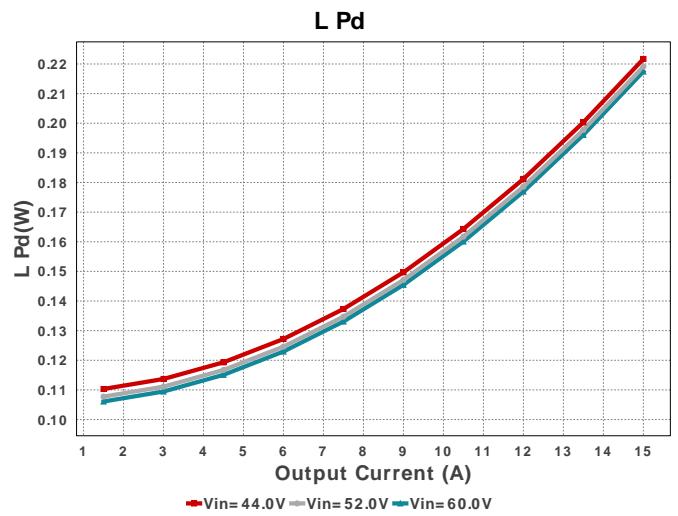
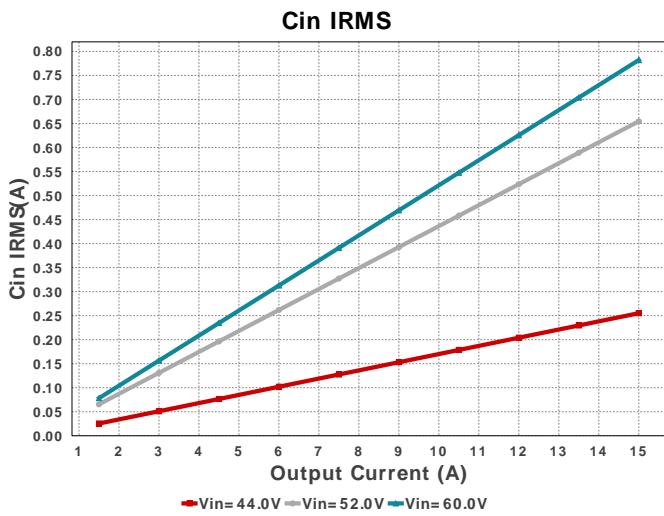
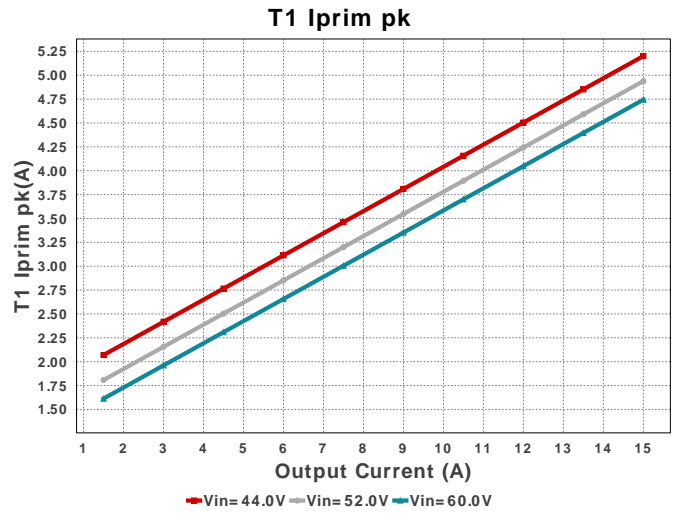
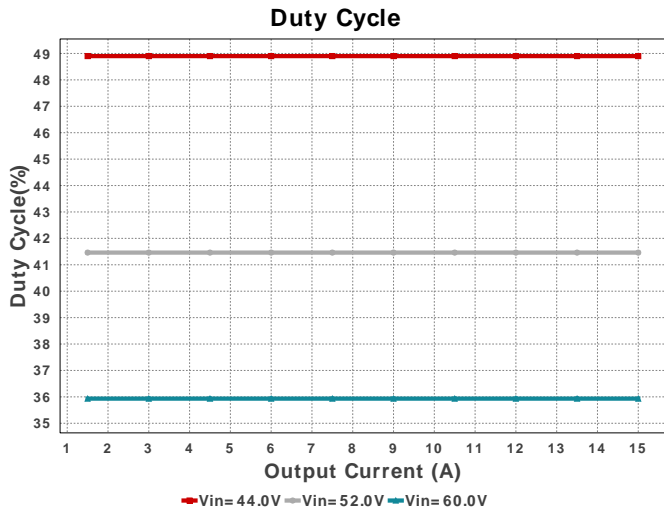
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23.	Coutdrv2	TDK	C1608X5R1H105K080AB Series= X5R	Cap= 1.0 uF ESR= 5.522 mOhm VDC= 50.0 V IRMS= 2.2162 A	1	\$0.03	 0603 5 mm ²
24.	Coutx	Kemet	C0805C185K8PACTU Series= X5R	Cap= 1.8 uF ESR= 5.0 mOhm VDC= 10.0 V IRMS= 7.73 A	1	\$0.09	 0805 7 mm ²
25.	Craux	Taiyo Yuden	QMK212B7102KD-T Series= X7R	Cap= 1.0 nF ESR= 1.0 mOhm VDC= 250.0 V IRMS= 0.0 A	1	\$0.04	 0805 7 mm ²
26.	Cref	Kemet	C0805C104K3RACTU Series= X7R	Cap= 100.0 nF ESR= 64.0 mOhm VDC= 25.0 V IRMS= 1.64 A	1	\$0.01	 0805 7 mm ²
27.	Cres	MuRata	GRM155R61C683KA88D Series= X5R	Cap= 68.0 nF ESR= 1.0 mOhm VDC= 16.0 V IRMS= 0.0 A	1	\$0.01	 0402 3 mm ²
28.	Css	AVX	08055C563KAT2A Series= X7R	Cap= 56.0 nF ESR= 32.0 mOhm VDC= 50.0 V IRMS= 0.0 A	1	\$0.02	 0805 7 mm ²
29.	Csssr	MuRata	GRM155R71E183KA61D Series= X7R	Cap= 18.0 nF ESR= 1.0 mOhm VDC= 25.0 V IRMS= 0.0 A	1	\$0.01	 0402 3 mm ²
30.	Cvcc	TDK	C1608X5R1H105K080AB Series= X5R	Cap= 1.0 uF ESR= 5.522 mOhm VDC= 50.0 V IRMS= 2.2162 A	1	\$0.03	 0603 5 mm ²
31.	Cvdd	MuRata	GRM155R71E123KA61D Series= X7R	Cap= 12.0 nF ESR= 1.0 mOhm VDC= 25.0 V IRMS= 0.0 A	1	\$0.01	 0402 3 mm ²
32.	Dbst	STMicroelectronics	STPS20M100SG-TR	VF@Io= 455.0 mV VRRM= 100.0 V	1	\$1.39	 DDPAK 210 mm ²
33.	Dlsd	Bourns	CD1005-B0140R	VF@Io= 450.0 mV VRRM= 45.0 V	1	\$0.08	 Diode_1005 7 mm ²
34.	Dlsdz	Diodes Inc.	DFLZ9V1-7	Zener	1	\$0.15	 PowerDI123 13 mm ²
35.	Dreset	Toshiba	CMS06	VF@Io= 320.0 mV VRRM= 30.0 V	1	\$0.20	 M-FLAT 19 mm ²
36.	Dsecaux	CUSTOM	CUSTOM	VF@Io= 500.0 mV VRRM= 100.0 V	1	NA	CUSTOM 0 mm ²
37.	Dvcc	Bourns	CD1005-B0140R	VF@Io= 450.0 mV VRRM= 45.0 V	1	\$0.08	 Diode_1005 7 mm ²
38.	Dvdd	Diodes Inc.	MMSZ5230B-7-F	Zener	1	\$0.04	 SOD-123 13 mm ²
39.	L1	Würth Elektronik	7443556082	L= 820.0 nH DCR= 500.0 µOhm	1	\$4.43	 WE-HCB-18X8.9 410 mm ²

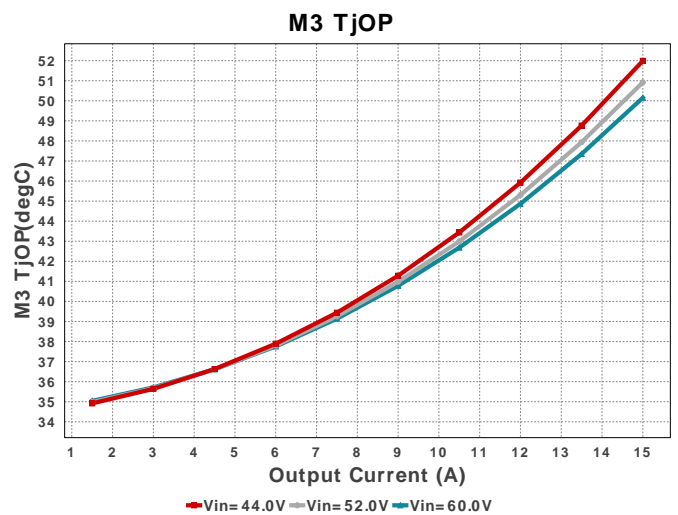
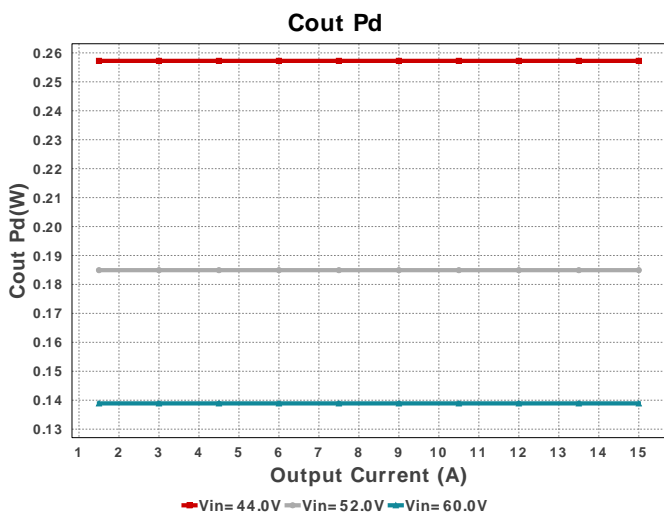
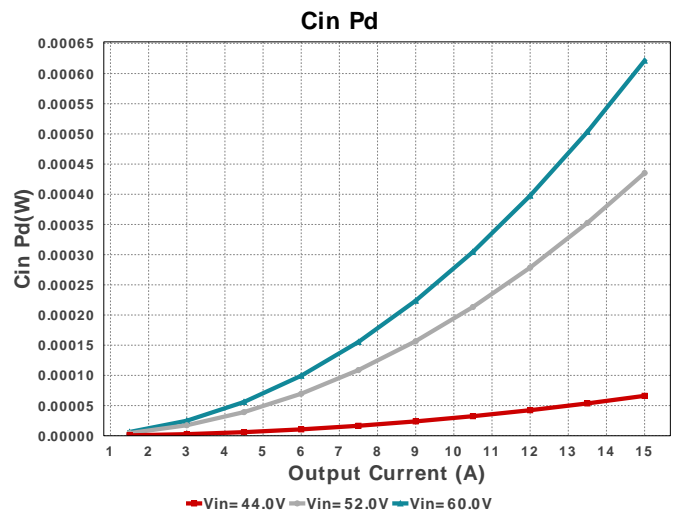
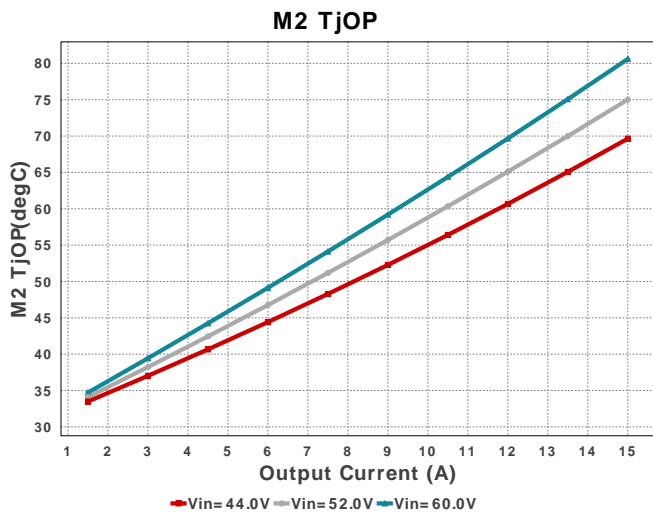
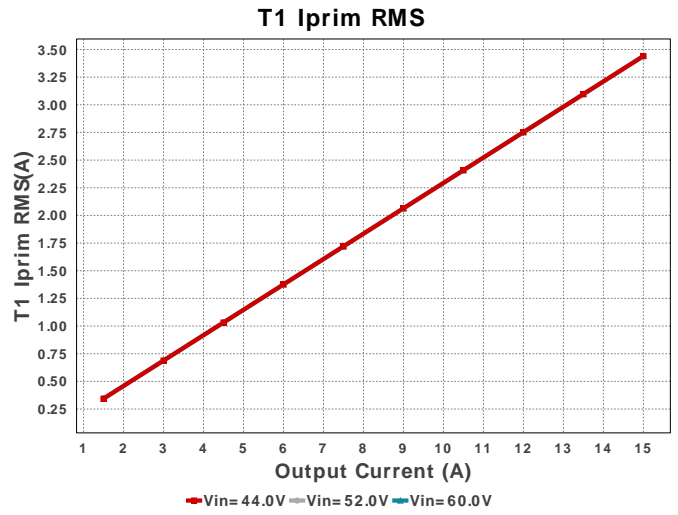
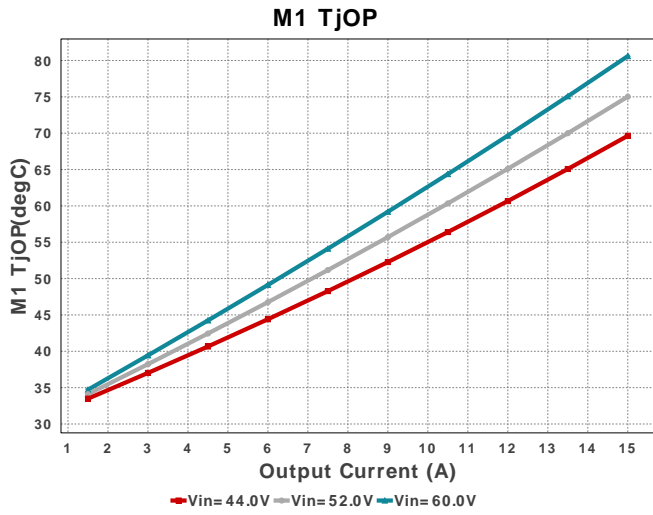
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40.	L2	MuRata	LQM2HPNR47MG0L	L= 470.0 nH DCR= 40.0 mOhm	1	\$0.12	 1008 10 mm ²
41.	M1	Texas Instruments	CSD19537Q3	VdsMax= 100.0 V IdsMax= 50.0 Amps	1	\$0.41	 DQG0008A 18 mm ²
42.	M2	Texas Instruments	CSD19537Q3	VdsMax= 100.0 V IdsMax= 50.0 Amps	1	\$0.41	 DQG0008A 18 mm ²
43.	M3	Texas Instruments	CSD17575Q3	VdsMax= 30.0 V IdsMax= 60.0 Amps	1	\$0.35	 DQG0008A 18 mm ²
44.	M4	Texas Instruments	CSD17575Q3	VdsMax= 30.0 V IdsMax= 60.0 Amps	1	\$0.35	 DQG0008A 18 mm ²
45.	O1	CUSTOM	Custom	Optocoupler	1	NA	CUSTOM 0 mm ²
46.	Q1	Central Semiconductor	CMPT3904 LEAD FREE	Bipolar Transistor	1	NA	 SOT-23 14 mm ²
47.	Q2	Central Semiconductor	CMPT3906 LEAD FREE	Bipolar Transistor	1	NA	 SOT-23 14 mm ²
48.	Rcomp	Vishay-Dale	CRCW040211K8FKED Series= CRCW..e3	Res= 11.8 kOhm Power= 63.0 mW Tolerance= 1.0%	1	\$0.01	 0402 3 mm ²
49.	Rcomp2	Vishay-Dale	CRCW0402511R1FKED Series= CRCW..e3	Res= 511.0 Ohm Power= 63.0 mW Tolerance= 1.0%	1	\$0.01	 0402 3 mm ²
50.	Rcs1	Vishay-Dale	CRCW0402348R1FKED Series= CRCW..e3	Res= 348.0 Ohm Power= 63.0 mW Tolerance= 1.0%	1	\$0.01	 0402 3 mm ²
51.	Rcs2	Vishay-Dale	CRCW04022M43FKED Series= CRCW..e3	Res= 2.43 MOhm Power= 63.0 mW Tolerance= 1.0%	1	\$0.01	 0402 3 mm ²
52.	Rcs3	Vishay-Dale	CRCW0402348R1FKED Series= CRCW..e3	Res= 348.0 Ohm Power= 63.0 mW Tolerance= 1.0%	1	\$0.01	 0402 3 mm ²
53.	Rd1	Vishay-Dale	CRCW040222K6FKED Series= CRCW..e3	Res= 22.6 kOhm Power= 63.0 mW Tolerance= 1.0%	1	\$0.01	 0402 3 mm ²
54.	Rd2	Vishay-Dale	CRCW040234K8FKED Series= CRCW..e3	Res= 34.8 kOhm Power= 63.0 mW Tolerance= 1.0%	1	\$0.01	 0402 3 mm ²
55.	Rfbb	Yageo America	RT0805BRD076K49L Series= ?	Res= 6.49 kOhm Power= 125.0 mW Tolerance= 0.1%	1	\$0.04	 0805 7 mm ²
56.	Rfbbaux	Vishay-Dale	CRCW0402976R1FKED Series= CRCW..e3	Res= 976.0 Ohm Power= 63.0 mW Tolerance= 1.0%	1	\$0.01	 0402 3 mm ²
57.	Rfbt	Yageo America	RT0805BRD076K49L Series= ?	Res= 6.49 kOhm Power= 125.0 mW Tolerance= 0.1%	1	\$0.04	 0805 7 mm ²
58.	Rfbtaux	Vishay-Dale	CRCW04027K68FKED Series= CRCW..e3	Res= 7.68 kOhm Power= 63.0 mW Tolerance= 1.0%	1	\$0.01	 0402 3 mm ²
59.	Rff	Panasonic	ERJ-8ENF1053V Series= ERJ-8E	Res= 105.0 kOhm Power= 250.0 mW Tolerance= 1.0%	1	\$0.01	 1206 11 mm ²
60.	Rg1	Vishay-Dale	CRCW04023R32FKED Series= CRCW..e3	Res= 3.32 Ohm Power= 63.0 mW Tolerance= 1.0%	1	\$0.01	 0402 3 mm ²

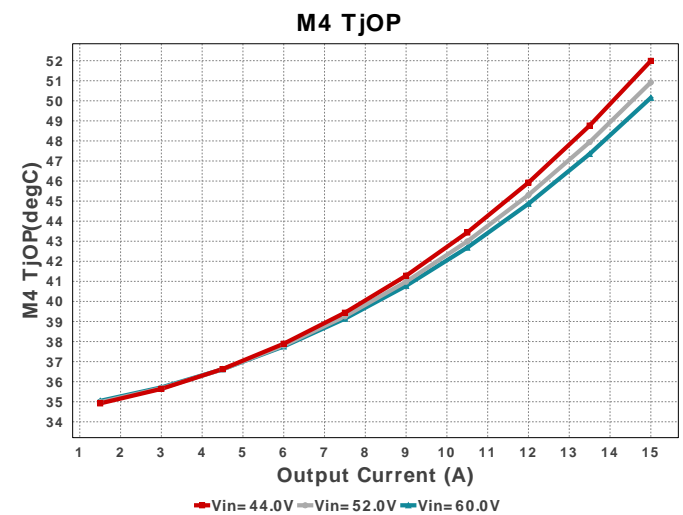
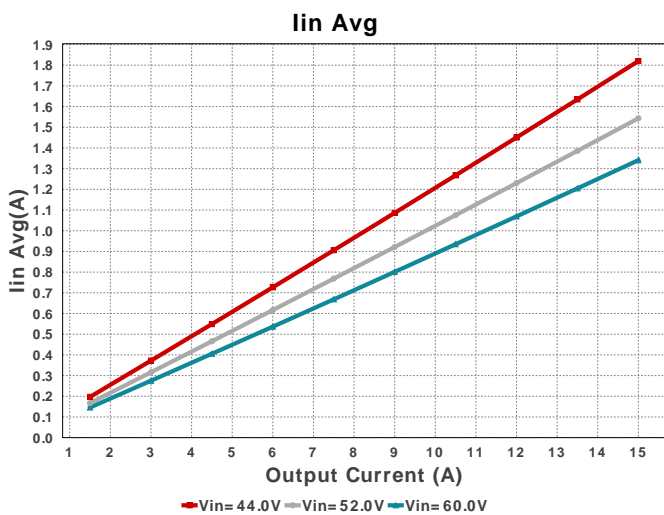
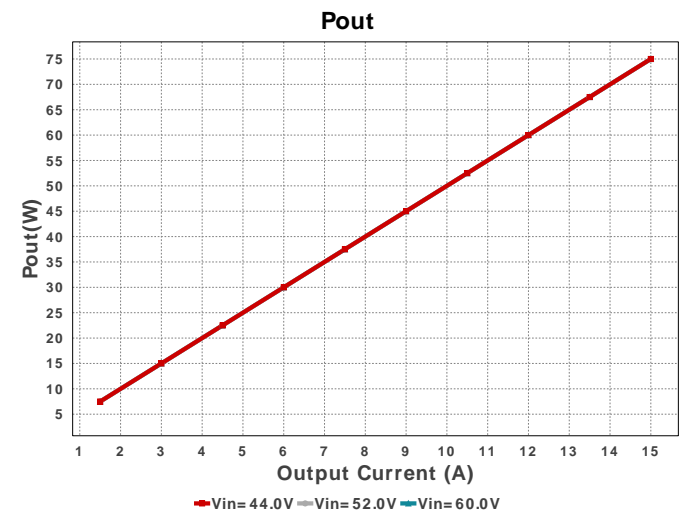
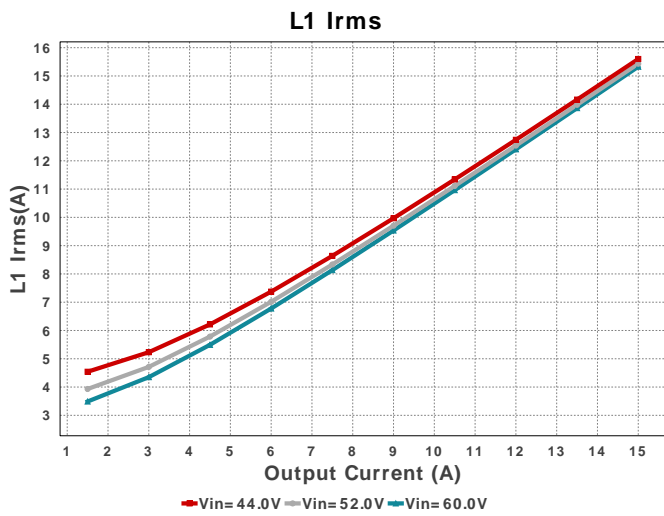
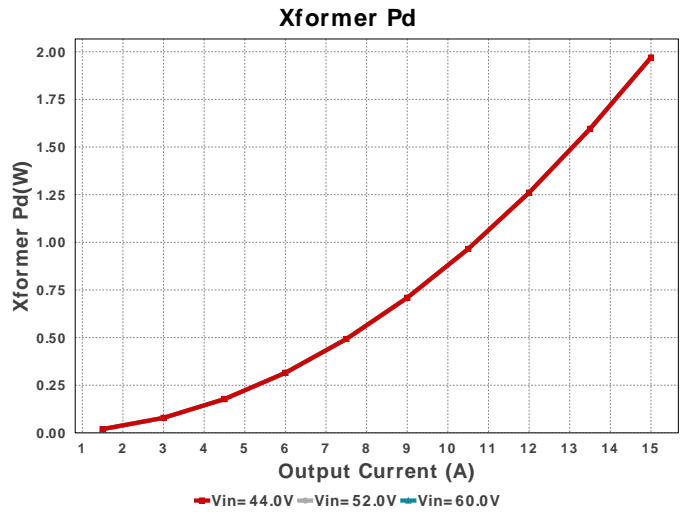
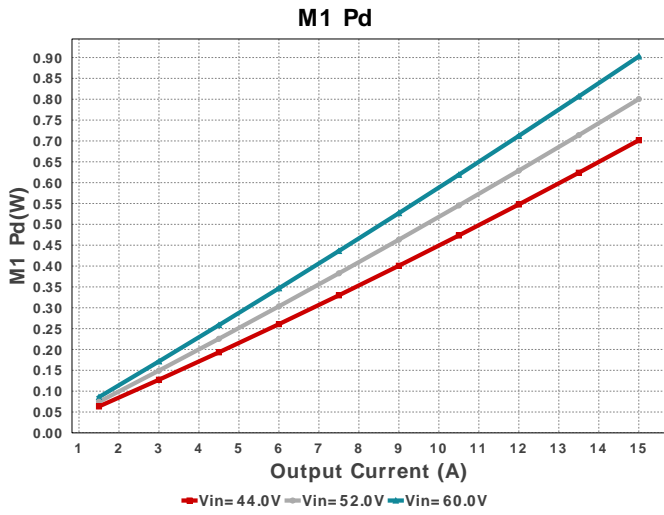
#	Name	Manufacturer	Part Number	Properties	Qty	Price	Footprint
61.	Rg2	Vishay-Dale	CRCW04023R32FKED Series= CRCW..e3	Res= 3.32 Ohm Power= 63.0 mW Tolerance= 1.0%	1	\$0.01	0402 3 mm ²
62.	Rhb1	Panasonic	ERJ-6ENF1003V Series= ERJ-6E	Res= 100.0 kOhm Power= 125.0 mW Tolerance= 1.0%	1	\$0.01	0805 7 mm ²
63.	Rhb2	Panasonic	ERJ-6ENF1003V Series= ERJ-6E	Res= 100.0 kOhm Power= 125.0 mW Tolerance= 1.0%	1	\$0.01	0805 7 mm ²
64.	Rled	Vishay-Dale	CRCW04021K37FKED Series= CRCW..e3	Res= 1.37 kOhm Power= 63.0 mW Tolerance= 1.0%	1	\$0.01	0402 3 mm ²
65.	Rlim	Vishay-Dale	CRCW040259K0FKED Series= CRCW..e3	Res= 59.0 kOhm Power= 63.0 mW Tolerance= 1.0%	1	\$0.01	0402 3 mm ²
66.	Rlsd	Vishay-Dale	CRCW04029K76FKED Series= CRCW..e3	Res= 9.76 kOhm Power= 63.0 mW Tolerance= 1.0%	1	\$0.01	0402 3 mm ²
67.	Rlsd2	Vishay-Dale	CRCW04029K76FKED Series= CRCW..e3	Res= 9.76 kOhm Power= 63.0 mW Tolerance= 1.0%	1	\$0.01	0402 3 mm ²
68.	Rlsd3	Vishay-Dale	CRCW04021K15FKED Series= CRCW..e3	Res= 1.15 kOhm Power= 63.0 mW Tolerance= 1.0%	1	\$0.01	0402 3 mm ²
69.	Rlsd4	Vishay-Dale	CRCW04029K76FKED Series= CRCW..e3	Res= 9.76 kOhm Power= 63.0 mW Tolerance= 1.0%	1	\$0.01	0402 3 mm ²
70.	Rlsd5	Vishay-Dale	CRCW04029K76FKED Series= CRCW..e3	Res= 9.76 kOhm Power= 63.0 mW Tolerance= 1.0%	1	\$0.01	0402 3 mm ²
71.	Rlsd6	Vishay-Dale	CRCW04029K76FKED Series= CRCW..e3	Res= 9.76 kOhm Power= 63.0 mW Tolerance= 1.0%	1	\$0.01	0402 3 mm ²
72.	Ron	Yageo America	RT0805BRD07113KL Series= ?	Res= 113.0 kOhm Power= 125.0 mW Tolerance= 0.1%	1	\$0.04	0805 7 mm ²
73.	Ronb	Vishay-Dale	CRCW0805787RFKEA Series= CRCW..e3	Res= 787.0 Ohm Power= 125.0 mW Tolerance= 1.0%	1	\$0.01	0805 7 mm ²
74.	Ronb2	Panasonic	ERJ-6ENF4992V Series= ERJ-6E	Res= 49.9 kOhm Power= 125.0 mW Tolerance= 1.0%	1	\$0.01	0805 7 mm ²
75.	Ront	Panasonic	ERJ-6ENF4022V Series= ERJ-6E	Res= 40.2 kOhm Power= 125.0 mW Tolerance= 1.0%	1	\$0.01	0805 7 mm ²
76.	Rraux	Vishay-Dale	CRCW0402237KFKED Series= CRCW..e3	Res= 237.0 kOhm Power= 63.0 mW Tolerance= 1.0%	1	\$0.01	0402 3 mm ²
77.	Rreset	Vishay-Dale	CRCW0402147KFKED Series= CRCW..e3	Res= 147.0 kOhm Power= 63.0 mW Tolerance= 1.0%	1	\$0.01	0402 3 mm ²
78.	Rsense	Rohm	PMR25HZPFU5L00 Series= PMR25	Res= 5.0 mOhm Power= 1.0 W Tolerance= 1.0%	1	\$0.19	1210 15 mm ²
79.	Rt	Panasonic	ERJ-6ENF2492V Series= ERJ-6E	Res= 24.9 kOhm Power= 125.0 mW Tolerance= 1.0%	1	\$0.01	0805 7 mm ²
80.	Ruvlob	Vishay-Dale	CRCW04023K09FKED Series= CRCW..e3	Res= 3.09 kOhm Power= 63.0 mW Tolerance= 1.0%	1	\$0.01	0402 3 mm ²
81.	Ruvlot	Panasonic	ERJ-6ENF1003V Series= ERJ-6E	Res= 100.0 kOhm Power= 125.0 mW Tolerance= 1.0%	1	\$0.01	0805 7 mm ²

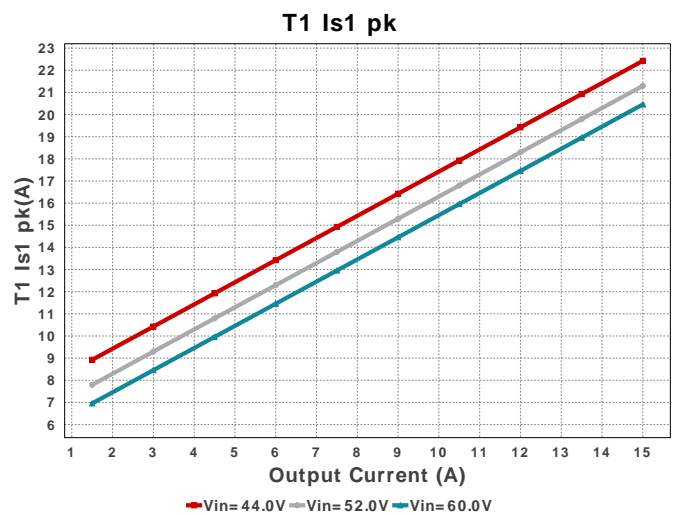
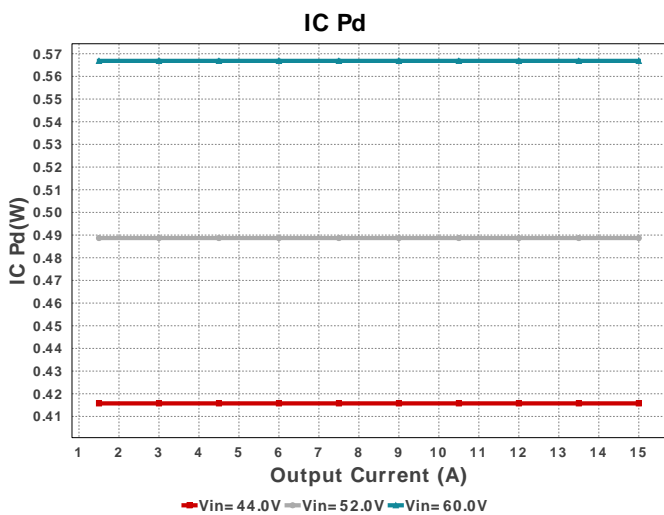
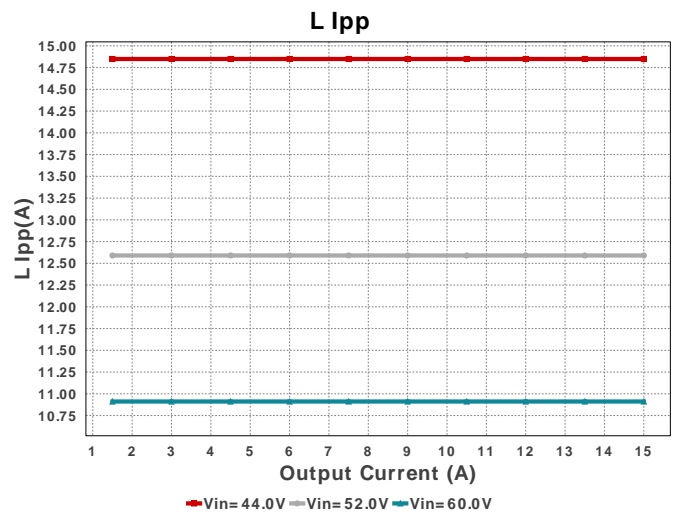
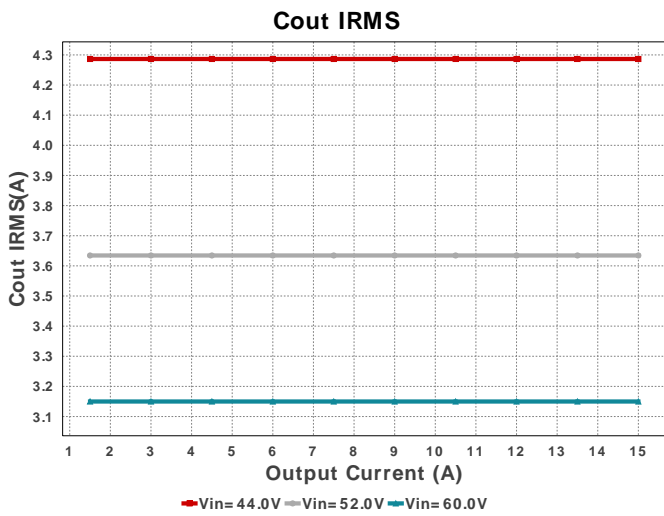
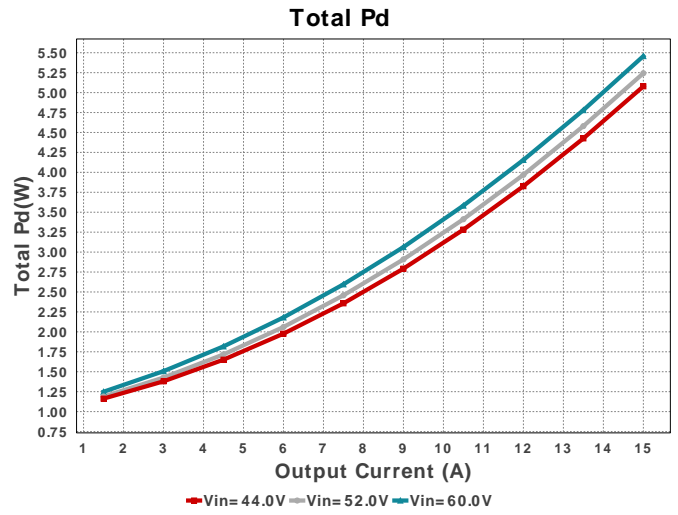
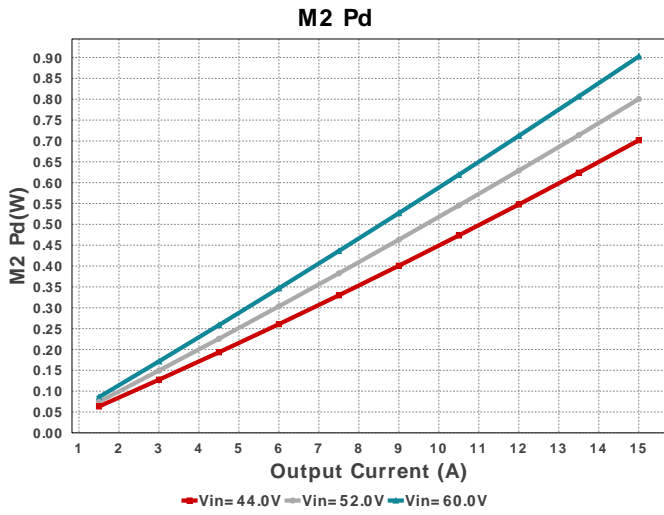
#	Name	Manufacturer	Part Number	Properties	Qty	Price	Footprint
82.	Rvdd	Vishay-Dale	CRCW0402237RFKED Series= CRCW..e3	Res= 237.0 Ohm Power= 63.0 mW Tolerance= 1.0%	1	\$0.01	0402 3 mm ²
83.	T1	CUSTOM	CUSTOM	Lp= 0.0 H Rp= 209.375 mOhm Leakage_L= 0.0 H Ns1toNp= 0.232 Rs1= 4.0 mOhms Ns2toNp= 0.232 Rs2= 4.0 mOhms	1	NA	CUSTOM 0 mm ²
84.	T2	CUSTOM	CUSTOM	Lp= 114.859 µH Rp= 20.158 mOhm Leakage_L= 14.932 µH Ns1toNp= 1.0 Rs1= 21.0 mOhms	1	NA	CUSTOM 0 mm ²
85.	U1	Texas Instruments	LM5036RJBR	Switcher	1	\$2.10	0 mm ²
86.	U2	Texas Instruments	UCC21225ANPL	Switcher	1	NA	 D0014A 85 mm ²
87.	U3	Texas Instruments	LM8261M5	Switcher	1	NA	0 mm ²
88.	VR	Texas Instruments	TL432BCDBVR	Voltage References	1	\$0.20	 R-PDSO-G3 16 mm ²

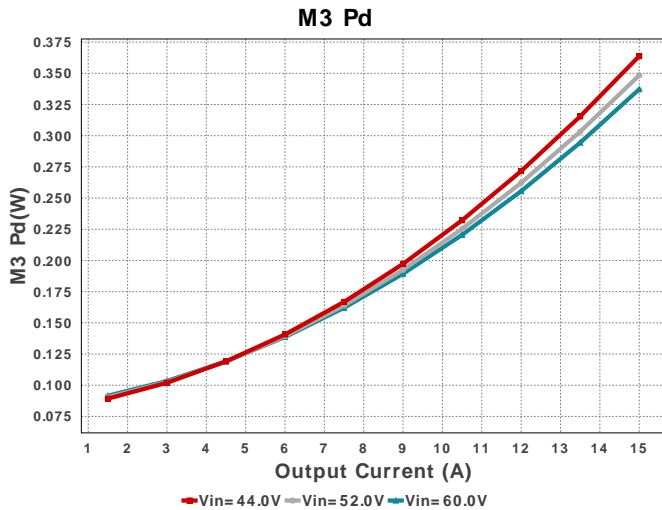












Operating Values

#	Name	Value	Category	Description
1.	Cin IRMS	782.09 mA	Current	Input capacitor RMS ripple current
2.	Cout IRMS	3.15 A	Current	Output capacitor RMS ripple current
3.	Iin Avg	1.344 A	Current	Average input current
4.	L Ipp	10.911 A	Current	Peak-to-peak inductor ripple current
5.	L1 Irms	15.327 A	Current	Inductor ripple current
6.	BOM Count	90	General	Total Design BOM count
7.	FootPrint	1.476 k mm ²	General	Total Foot Print Area of BOM components
8.	Frequency	200.803 kHz	General	Switching frequency
9.	Mode	CCM	General	Conduction Mode
10.	Pout	75.0 W	General	Total output power
11.	Total BOM	\$0.0	General	Total BOM Cost
12.	M1 Pd	902.548 mW	Mosfet	M1 MOSFET total power dissipation
13.	M1 TjOP	80.604 degC	Mosfet	M1 MOSFET junction temperature
14.	M2 Pd	902.548 mW	Mosfet	M2 MOSFET total power dissipation
15.	M2 TjOP	80.604 degC	Mosfet	M2 MOSFET junction temperature
16.	M3 Pd	337.206 mW	Mosfet	M3 MOSFET total power dissipation
17.	M3 TjOp	50.151 degC	Mosfet	M3 MOSFET junction temperature
18.	M4 Pd	337.206 mW	Mosfet	
19.	M4 TjOp	50.151 degC	Mosfet	
20.	Duty Cycle	35.933 %	Op Point	Duty cycle
21.	Efficiency	93.016 %	Op Point	Steady state efficiency
22.	IC Tj	46.949 degC	Op Point	IC junction temperature
23.	ICThetaJA	50.0 degC/W	Op Point	IC junction-to-ambient thermal resistance
24.	IOUT_OP	15.0 A	Op Point	Iout operating point
25.	VIN_OP	60.0 V	Op Point	Vin operating point
26.	Vout Actual	2.5 V	Op Point	Vout Actual calculated based on selected voltage divider resistors
27.	Vout OP	5.0 V	Op Point	Operational Output Voltage
28.	Vout Tolerance	1.802 %	Op Point	Vout Tolerance based on IC Tolerance (no load) and voltage divider resistors if applicable
29.	Cin Pd	621.452 μW	Power	Input capacitor power dissipation
30.	Cout Pd	138.903 mW	Power	Output capacitor power dissipation
31.	IC Pd	566.847 mW	Power	IC power dissipation
32.	L Pd	217.461 mW	Power	Inductor power dissipation
33.	Total Pd	5.631 W	Power	Total Power Dissipation
34.	T1 Iprim RMS	3.44 A	Transformer	Transformer Primary RMS Current
35.	T1 Iprim pk	4.744 A	Transformer	Transformer Primary Peak Current
36.	T1 Is1 RMS	10.548 A	Transformer	Transformer Secondary1 RMS Current
37.	T1 Is1 pk	20.456 A	Transformer	Transformer Secondary1 Peak Current
38.	Xformer Pd	1.97 W	Transformer	Transformer power dissipation

Design Inputs

#	Name	Value	Description
1.	Iout	15.0	Maximum Output Current
2.	VinMax	60.0	Maximum input voltage
3.	VinMin	44.0	Minimum input voltage
4.	Vout	5.0	Output Voltage
5.	base_pn	LM5036	Base Product Number
6.	source	DC	Input Source Type
7.	Ta	30.0	Ambient temperature

Design Assistance

1. Feature Highlights: Output current upto 13A, Input Voltage Range up to 100V, Integrated Flybuck regulator switches, Highly suited for telecommunication applications

2. **LM5036** Product Folder : <http://www.ti.com/product/LM5036> : contains the data sheet and other resources.

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