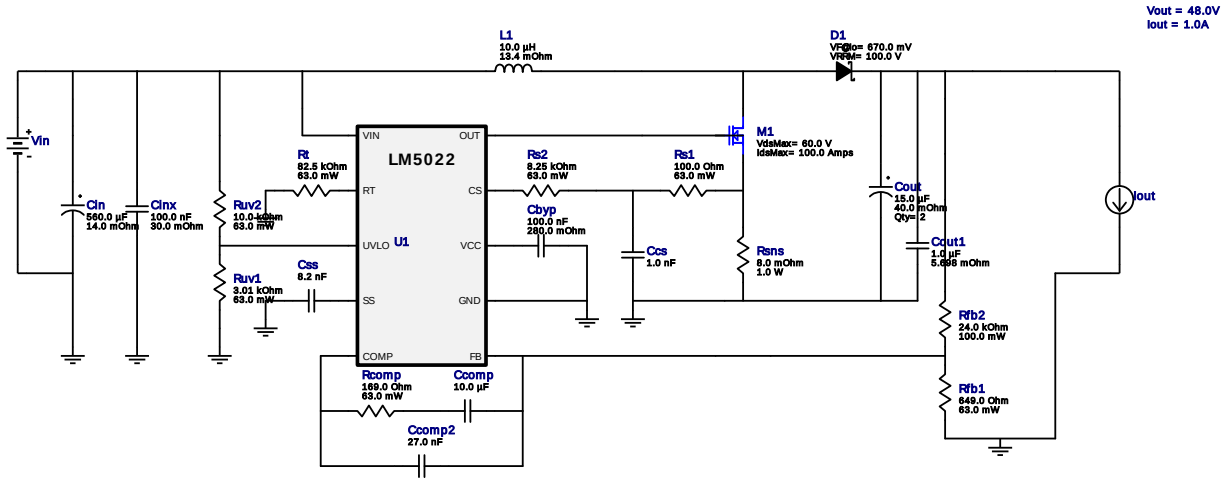
WEBENCH® Design Report

VinMin = 6.0V
VinMax = 10.0V
Vout = 48.0V
Iout = 1.0A

Device = LM5022MM/NOPB
Topology = Boost
Created = 7/24/16 7:27:52 AM
BOM Cost = $7.30
BOM Count = 23
Total Pd = 5.89W

Design : 1194016/2196 LM5022MM/NOPB
LM5022MM/NOPB 6.0V-10.0V to 48.00V @ 1.0A



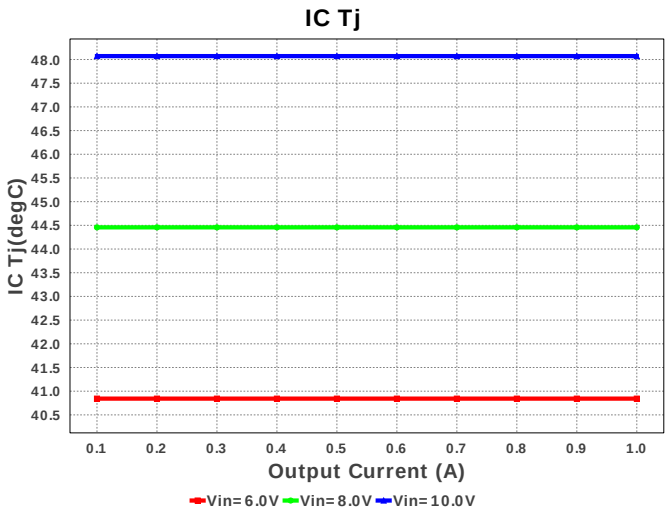
My Comments

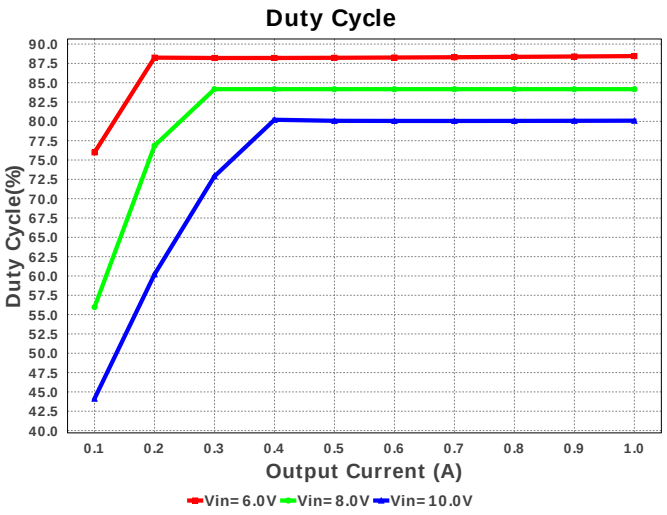
No comments

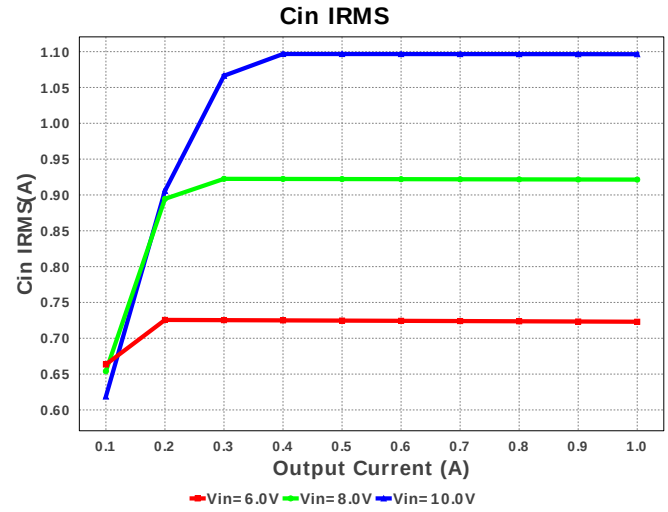
Electrical BOM

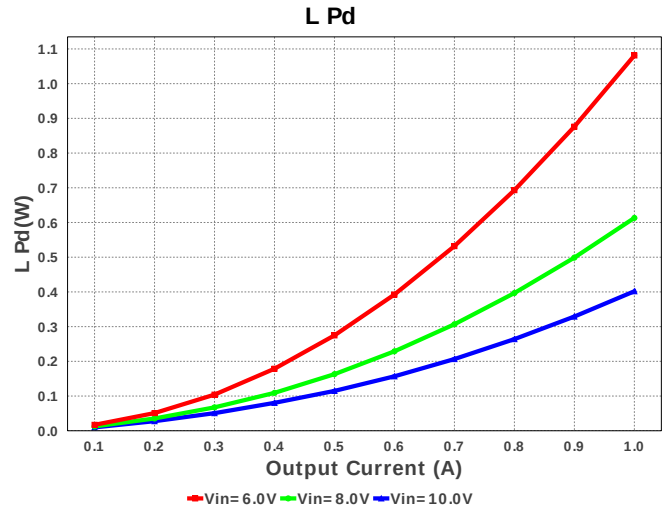
#	Name	Manufacturer	Part Number	Properties	Qty	Price	Footprint
1.	Cbyp	AVX	08053C104KAT2A Series= X7R	Cap= 100.0 nF ESR= 280.0 mOhm VDC= 25.0 V IRMS= 0.0 A	1	$0.01	0805 7 mm²
2.	Ccomp	Taiyo Yuden	LMK212BJ106KG-T Series= X5R	Cap= 10.0 uF VDC= 10.0 V IRMS= 0.0 A	1	$0.03	0805 7 mm²
3.	Ccomp2	Yageo America	CC0805KRX7R9BB273 Series= X7R	Cap= 27.0 nF VDC= 50.0 V IRMS= 0.0 A	1	$0.01	0805 7 mm²
4.	Ccs	Samsung Electro-Mechanics	CL21C102JBCNFNC Series= C0G/NP0	Cap= 1.0 nF VDC= 50.0 V IRMS= 0.0 A	1	$0.01	0805 7 mm²
5.	Cin	Panasonic	16SVPF560M Series= ?	Cap= 560.0 uF ESR= 14.0 mOhm VDC= 16.0 V IRMS= 4.95 A	1	$0.61	CAPSMT_62_E12 106 mm²
6.	Cinx	MuRata	GRM188R71C104KA01D Series= X7R	Cap= 100.0 nF ESR= 30.0 mOhm VDC= 16.0 V IRMS= 1.7 A	1	$0.01	0603 5 mm²
7.	Cout	Panasonic	100SXV15M Series= ?	Cap= 15.0 uF ESR= 40.0 mOhm VDC= 100.0 V IRMS= 2.35 A	2	$1.25	CAPSMT_62_E12 106 mm²
8.	Cout1	TDK	C3216X5R2A105K Series= X5R	Cap= 1.0 uF ESR= 5.698 mOhm VDC= 100.0 V IRMS= 0.0 A	1	$0.07	1206 11 mm²

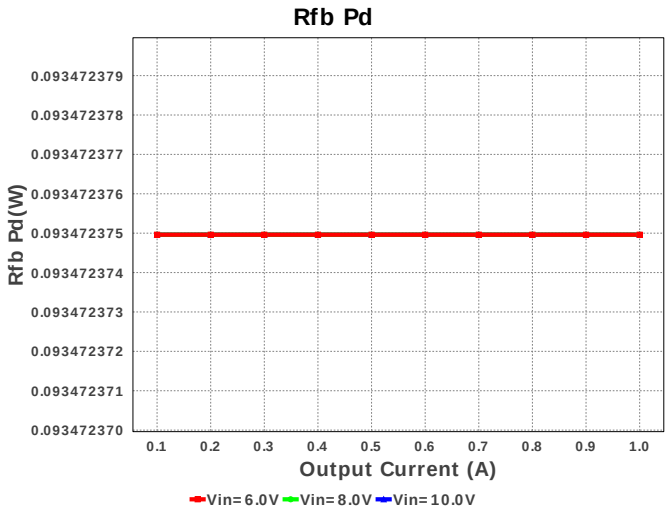
#	Name	Manufacturer	Part Number	Properties	Qty	Price	Footprint
9.	Css	MuRata	GRM155R71E822KA01D Series= X7R	Cap= 8.2 nF VDC= 25.0 V IRMS= 0.0 A	1	$0.01	 0402 3 mm²
10.	D1	Fairchild Semiconductor	FSV12100V	VF@Io= 670.0 mV VRRM= 100.0 V	1	$0.26	 TO-277A 56 mm²
11.	L1	Coilcraft	XAL1010-103MEB	L= 10.0 µH DCR= 13.4 mOhm	1	$1.71	 XAL1010 160 mm²
12.	M1	Texas Instruments	CSD18531Q5A	VdsMax= 60.0 V IdsMax= 100.0 Amps	1	$0.90	 TRANS_NexFET_Q5A 55 mm²
13.	Rcomp	Vishay-Dale	CRCW0402169RFKED Series= CRCW..e3	Res= 169.0 Ohm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	 0402 3 mm²
14.	Rfb1	Vishay-Dale	CRCW0402649RFKED Series= CRCW..e3	Res= 649.0 Ohm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	 0402 3 mm²
15.	Rfb2	Yageo America	RC0603FR-0724KL Series= ?	Res= 24.0 kOhm Power= 100.0 mW Tolerance= 1.0%	1	$0.01	 0603 5 mm²
16.	Rs1	Vishay-Dale	CRCW0402100RFKED Series= CRCW..e3	Res= 100.0 Ohm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	 0402 3 mm²
17.	Rs2	Vishay-Dale	CRCW04028K25FKED Series= CRCW..e3	Res= 8.25 kOhm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	 0402 3 mm²
18.	Rsns	Susumu Co Ltd	PRL1632-R008-F-T1 Series= PRL1632	Res= 8.0 mOhm Power= 1.0 W Tolerance= 1.0%	1	$0.19	 0612 11 mm²
19.	Rt	Vishay-Dale	CRCW040282K5FKED Series= CRCW..e3	Res= 82.5 kOhm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	 0402 3 mm²
20.	Ruv1	Vishay-Dale	CRCW04023K01FKED Series= CRCW..e3	Res= 3.01 kOhm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	 0402 3 mm²
21.	Ruv2	Vishay-Dale	CRCW040210K0FKED Series= CRCW..e3	Res= 10.0 kOhm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	 0402 3 mm²
22.	U1	Texas Instruments	LM5022MM/NOPB	Switcher	1	$0.90	 MUB10A 24 mm²

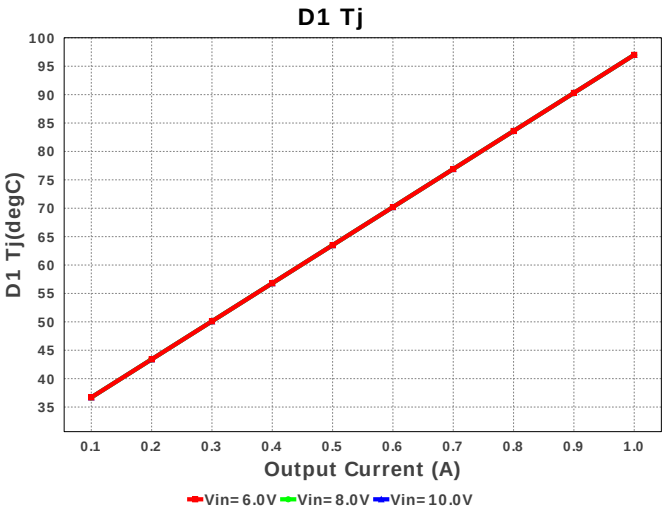




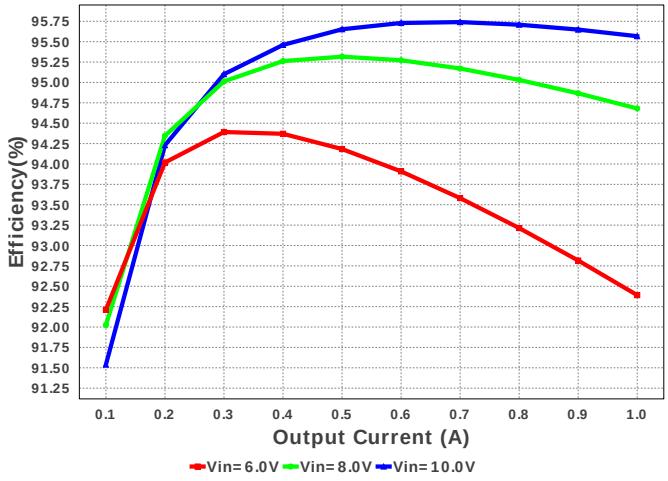




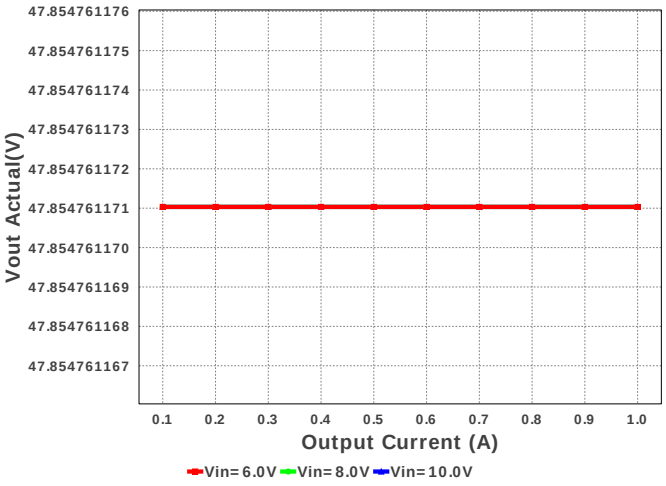




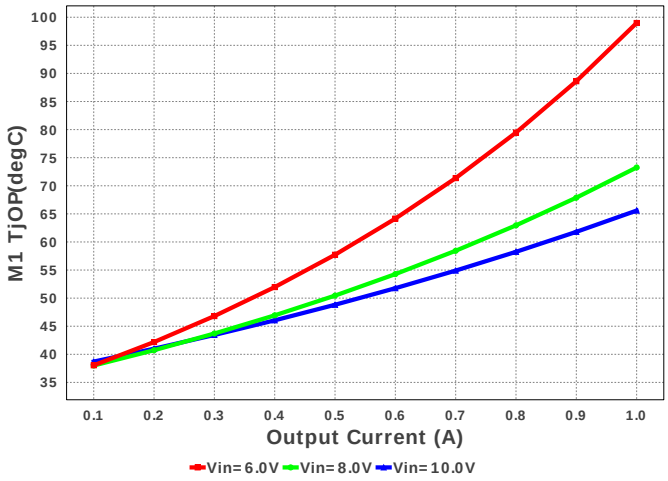
Efficiency



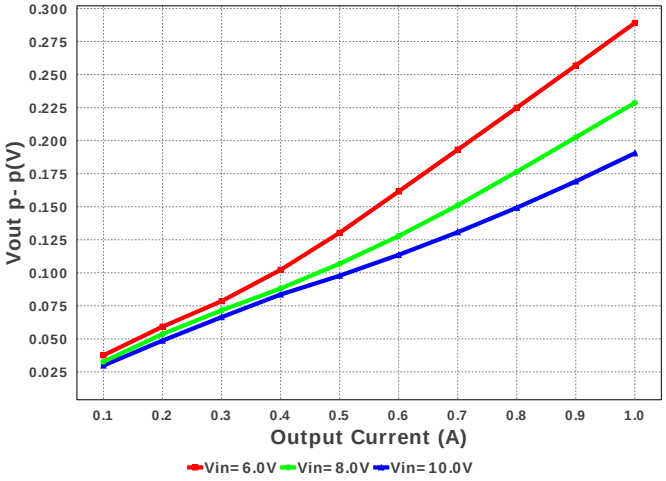
Vout Actual



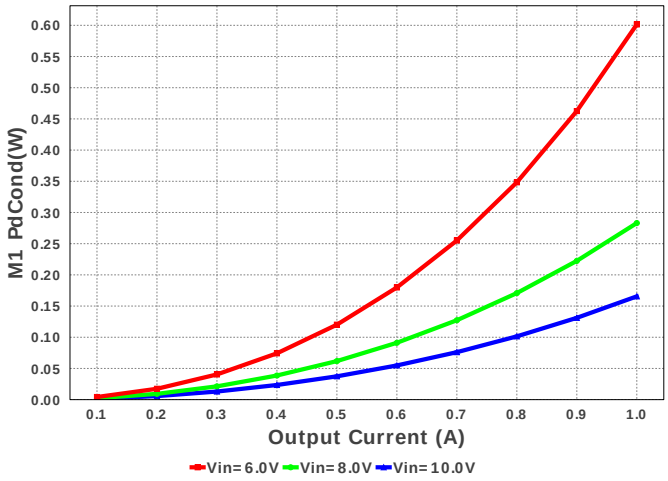
M1 TjOP



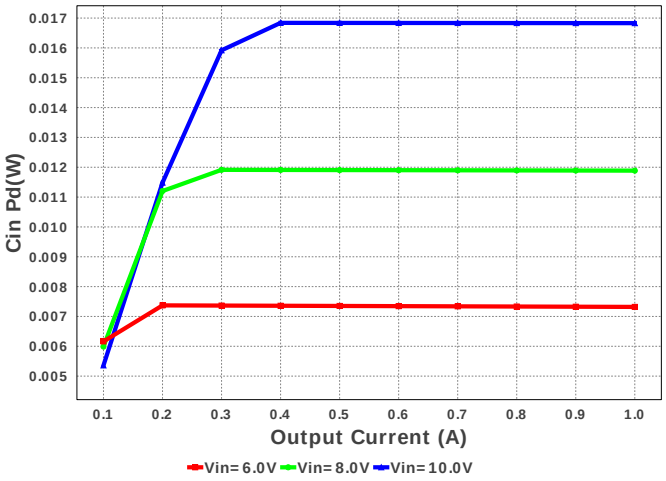
Vout p- p

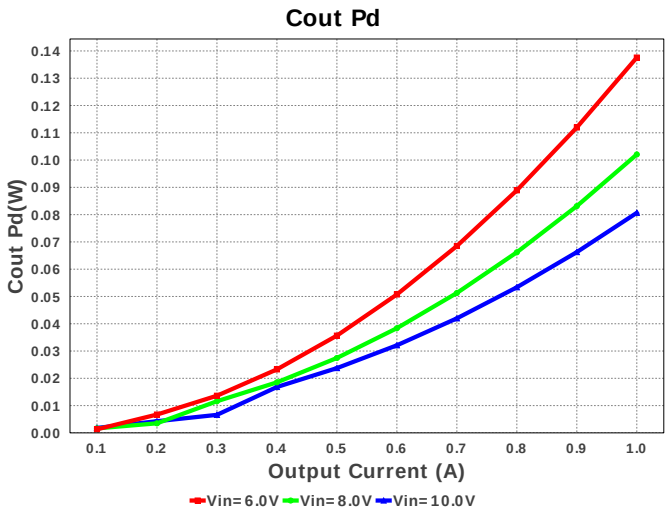


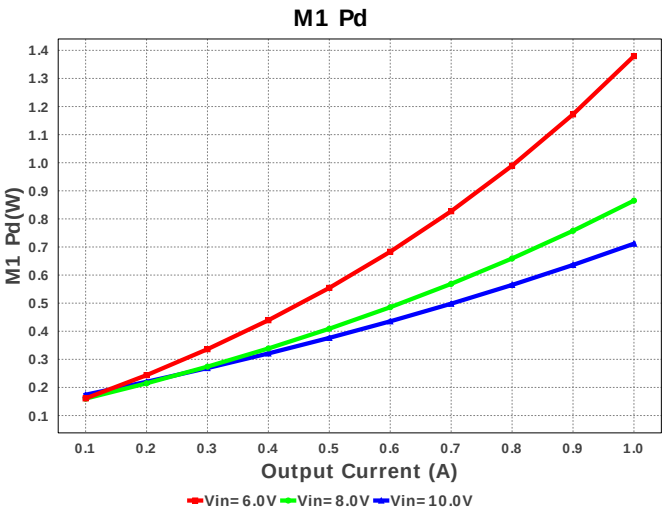
M1 PdCond

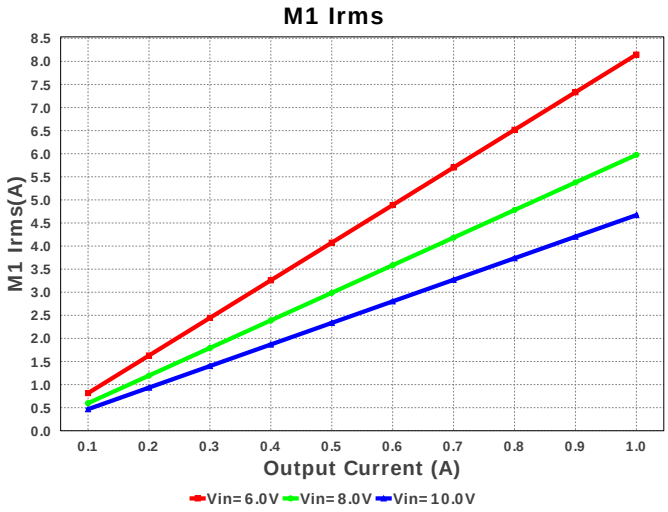


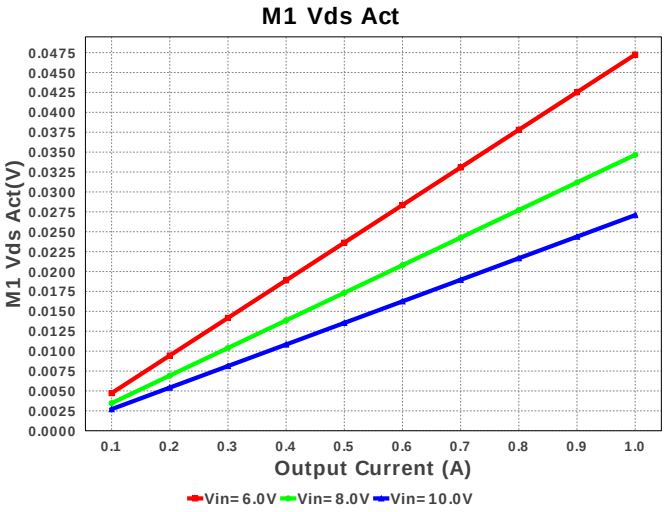
Cin Pd

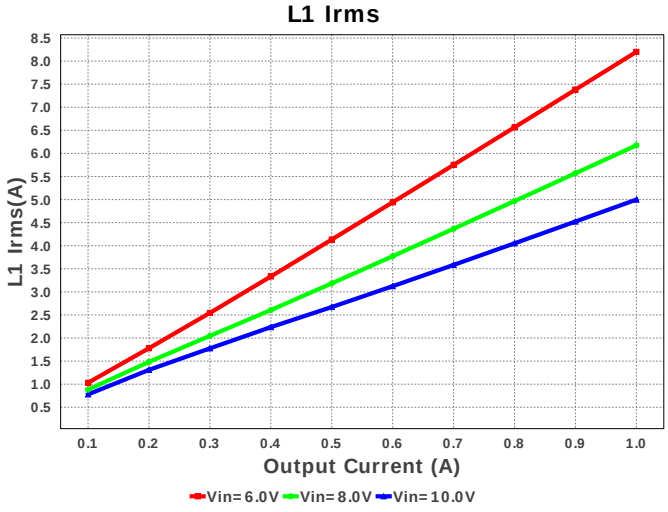


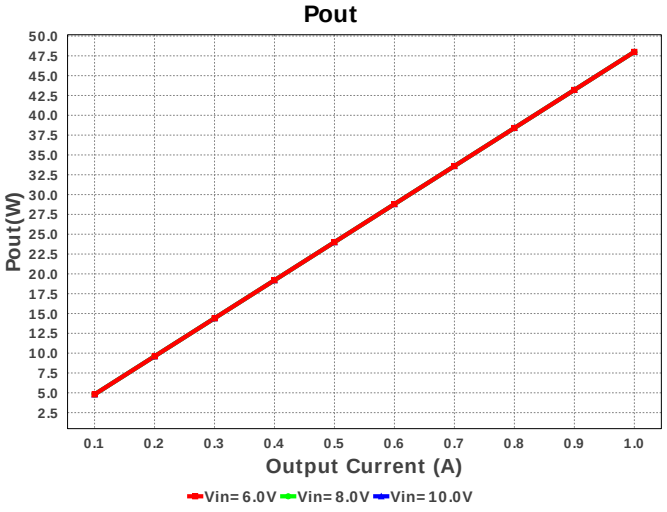


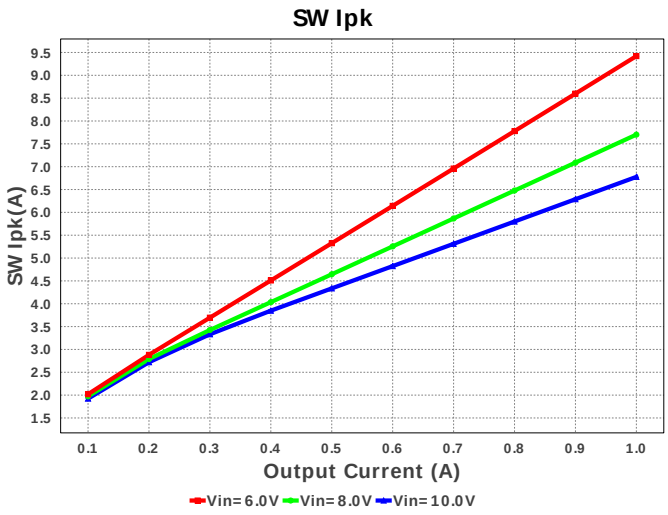


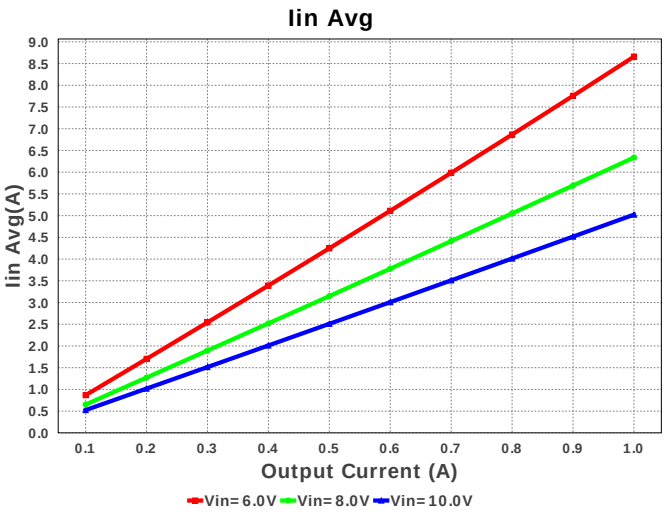


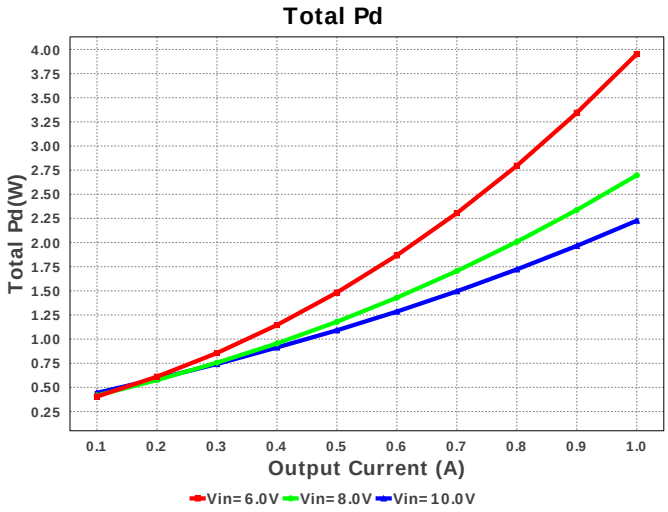


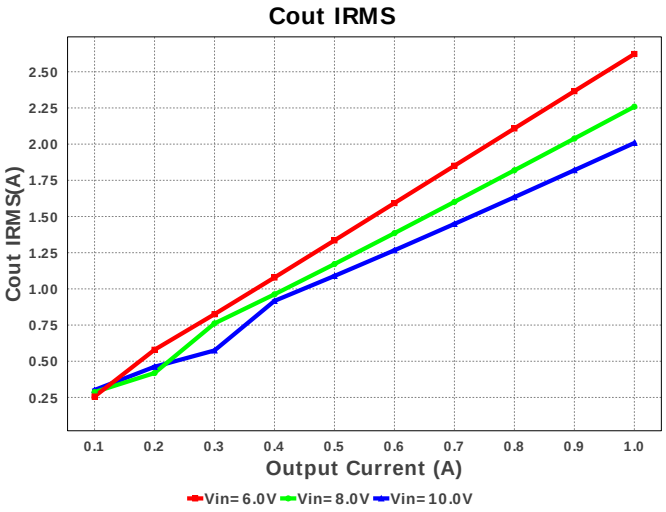


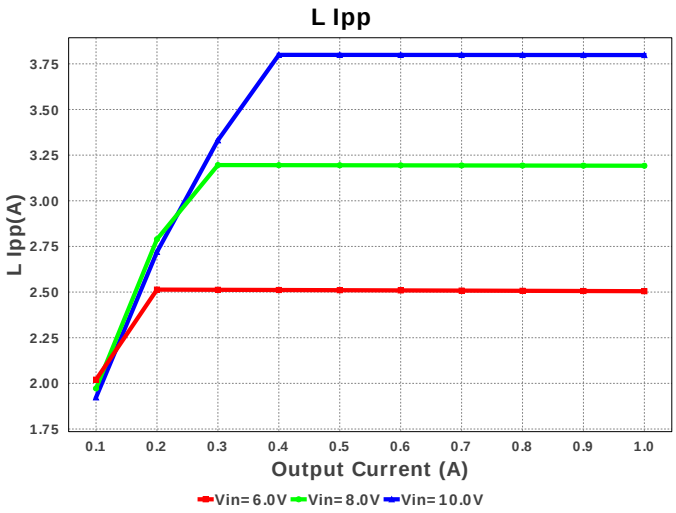


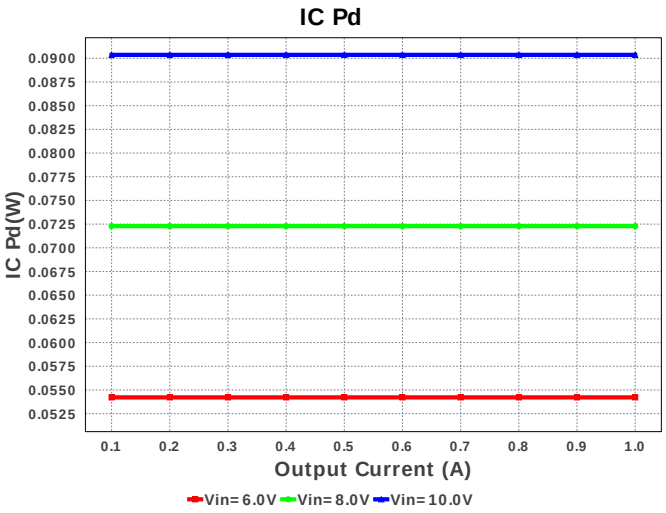


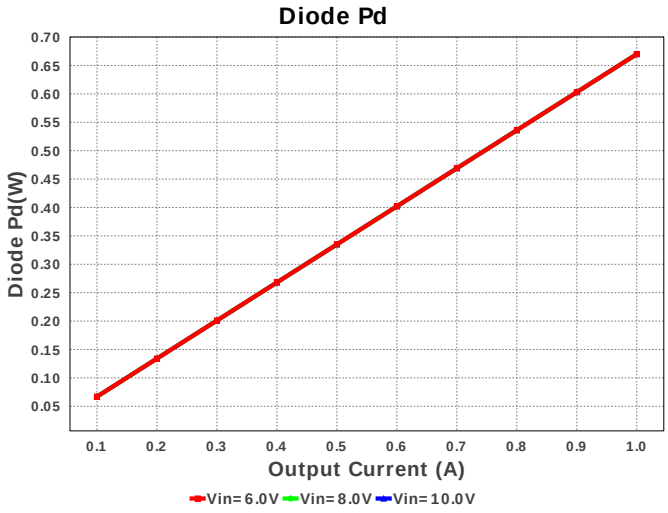


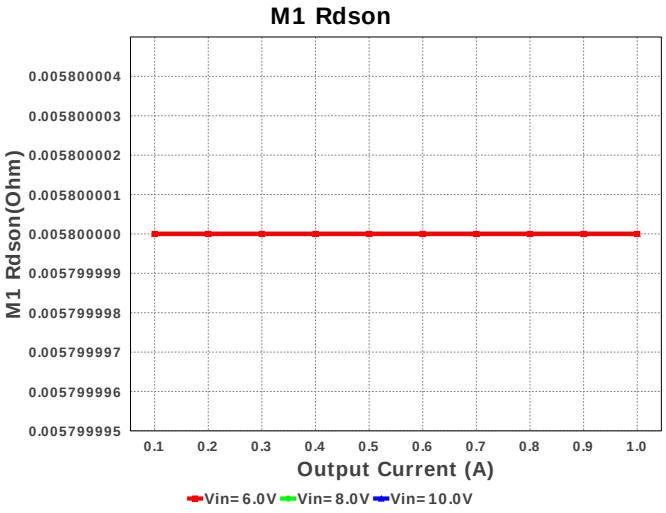


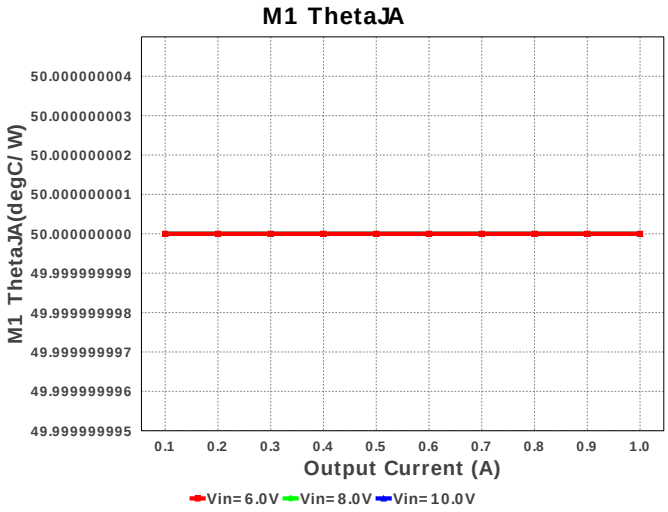


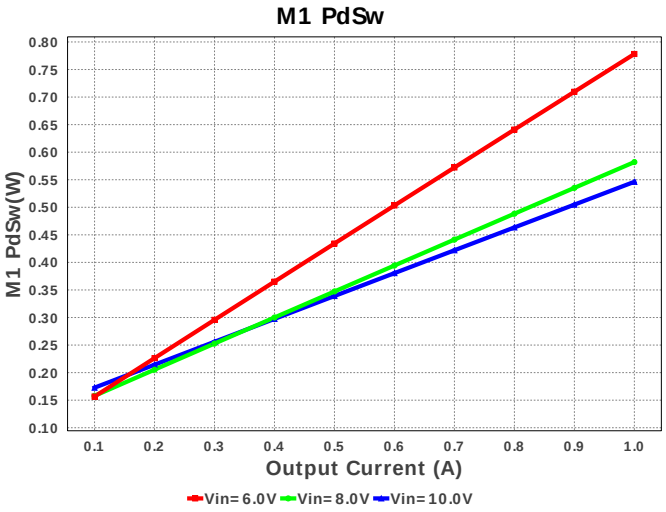


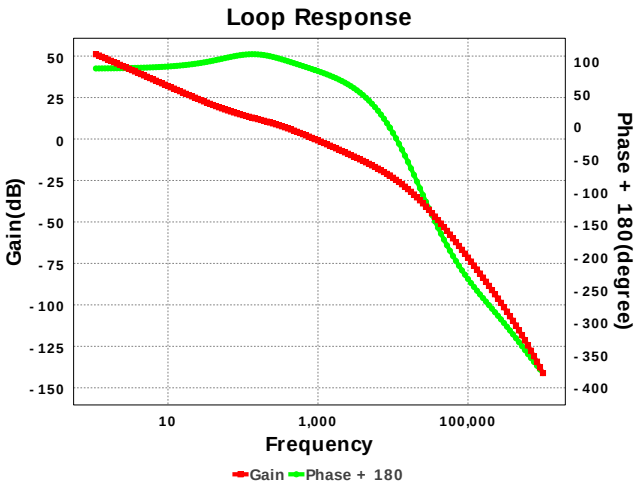












Operating Values

#	Name	Value	Category	Description
1.	Cin IRMS	730.76 mA	Current	Input capacitor RMS ripple current
2.	Cout IRMS	2.582 A	Current	Output capacitor RMS ripple current
3.	Iin Avg	8.981 A	Current	Average input current
4.	L Ipp	2.531 A	Current	Peak-to-peak inductor ripple current
5.	L1 Irms	8.201 A	Current	Inductor ripple current
6.	M1 Irms	8.147 A	Current	M1 MOSFET Irms
7.	SW Ipk	9.434 A	Current	Peak switch current
8.	BOM Count	23	General	Total Design BOM count
9.	FootPrint	695.0 mm^2	General	Total Foot Print Area of BOM components
10.	Frequency	206.894 kHz	General	Switching frequency
11.	IC Tolerance	25.0 mV	General	IC Feedback Tolerance

#	Name	Value	Category	Description
12.	M1 Rdson	5.8 mOhm	General	Drain-Source On-resistance
13.	M1 ThetaJA	50.0 degC/W	General	MOSFET junction-to-ambient thermal resistance
14.	Pout	48.0 W	General	Total output power
15.	Total BOM	$7.3	General	Total BOM Cost
16.	D1 Tj	284.339 degC	Op_Point	D1 junction temperature
17.	Low Freq Gain	46.095 dB	Op_Point	Gain at 10Hz
18.	Vout Actual	47.855 V	Op_Point	Vout Actual calculated based on selected voltage divider resistors
19.	Vout OP	48.0 V	Op_Point	Operational Output Voltage
20.	Cross Freq	480.998 Hz	Op_point	Bode plot crossover frequency
21.	Duty Cycle	88.852 %	Op_point	Duty cycle
22.	Efficiency	89.076 %	Op_point	Steady state efficiency
23.	Gain Marg	-22.123 dB	Op_point	Bode Plot Gain Margin
24.	IC Tj	41.086 degC	Op_point	IC junction temperature
25.	ICThetaJA	200.0 degC/W	Op_point	IC junction-to-ambient thermal resistance
26.	IOUT_OP	1.0 A	Op_point	Iout operating point
27.	M1 TjOP	100.0 degC	Op_point	M1 MOSFET junction temperature
28.	Phase Marg	96.844 deg	Op_point	Bode Plot Phase Margin
29.	VIN_OP	6.0 V	Op_point	Vin operating point
30.	Vout p-p	297.245 mV	Op_point	Peak-to-peak output ripple voltage
31.	Cin Pd	7.476 mW	Power	Input capacitor power dissipation
32.	Cout Pd	133.361 mW	Power	Output capacitor power dissipation
33.	Diode Pd	2.543 W	Power	Diode power dissipation
34.	IC Pd	55.432 mW	Power	IC power dissipation
35.	L Pd	1.081 W	Power	Inductor power dissipation
36.	M1 Pd	1.4 W	Power	M1 MOSFET total power dissipation
37.	M1 PdCond	604.375 mW	Power	M1 MOSFET conduction losses
38.	M1 PdSw	795.632 mW	Power	M1 MOSFET switching losses
39.	Rfb Pd	93.472 mW	Power	Rfb Power Dissipation
40.	Total Pd	5.887 W	Power	Total Power Dissipation
41.	M1 Vds Act	47.252 mV		M Vds
42.	Vout Tolerance	3.99 %		Vout Tolerance based on IC Tolerance (no load) and voltage divider resistors if applicable

Design Inputs

#	Name	Value	Description
1.	Iout	1.0	Maximum Output Current
2.	VinMax	10.0	Maximum input voltage
3.	VinMin	6.0	Minimum input voltage
4.	Vout	48.0	Output Voltage
5.	base_pn	LM5022	Base Product Number
6.	source	DC	Input Source Type
7.	Ta	30.0	Ambient temperature

Design Assistance

1. **LM5022** Product Folder : http://www.ti.com/product/LM5022 : contains the data sheet and other resources.