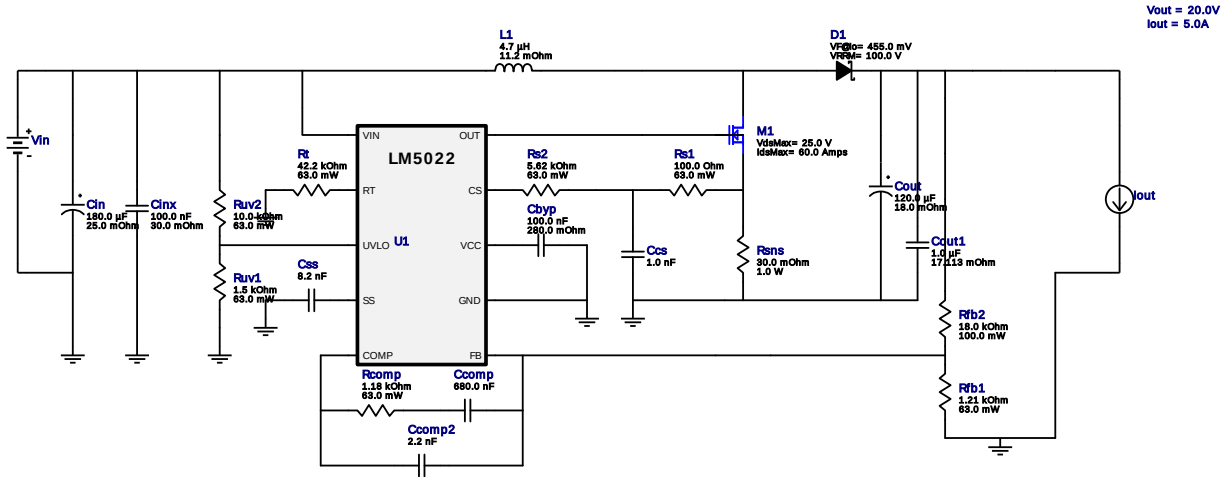
TEXAS INSTRUMENTS

WEBENCH® Design Report

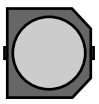
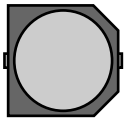
VinMin = 12.0V
VinMax = 14.0V
Vout = 20.0V
Iout = 5.0A

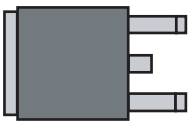
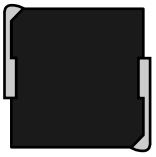
Device = LM5022MM/NOPB
Topology = Boost
Created = 7/12/16 5:53:38 PM
BOM Cost = $4.78
BOM Count = 22
Total Pd = 5.29W

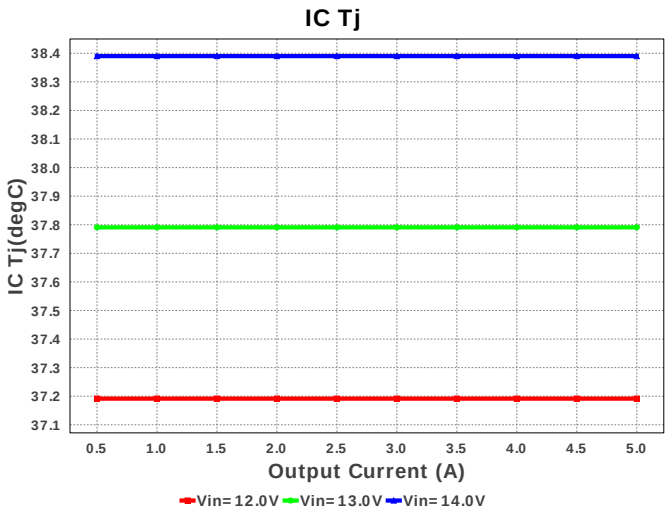
Design : 906020/2227 LM5022MM/NOPB
LM5022MM/NOPB 12.0V-14.0V to 20.00V @ 5.0A

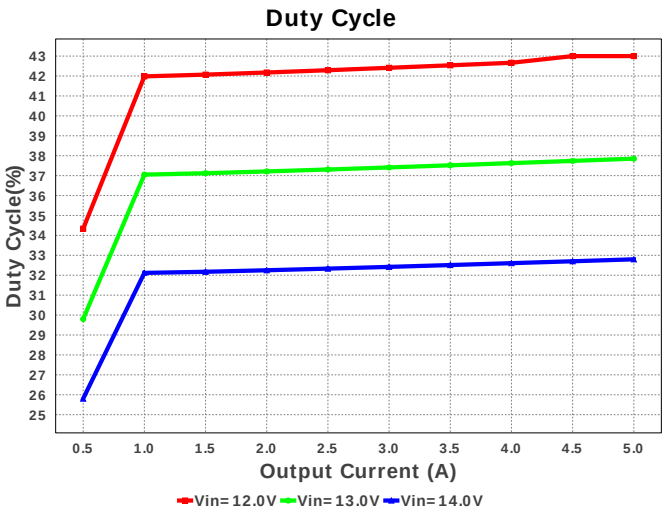


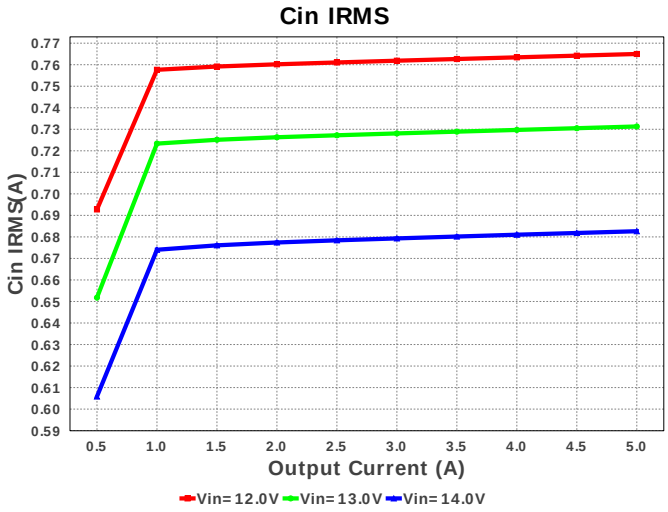
Electrical BOM

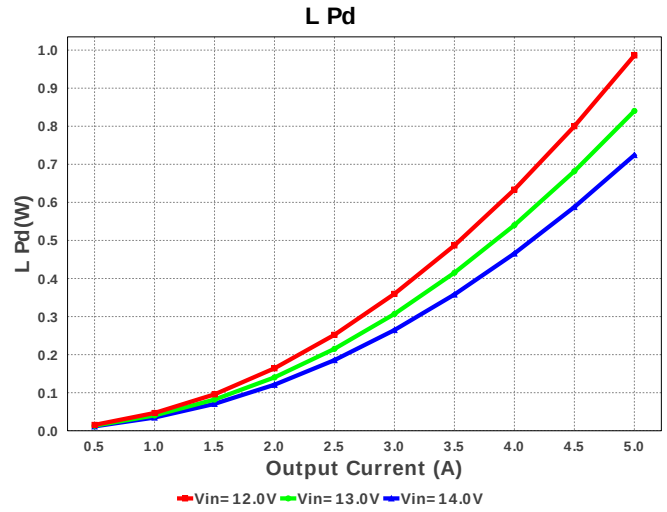
#	Name	Manufacturer	Part Number	Properties	Qty	Price	Footprint
1.	Cbyp	AVX	08053C104KAT2A Series= X7R	Cap= 100.0 nF ESR= 280.0 mOhm VDC= 25.0 V IRMS= 0.0 A	1	$0.01	0805 7 mm²
2.	Ccomp	MuRata	GRM155R60J684KE19D Series= X5R	Cap= 680.0 nF VDC= 6.3 V IRMS= 0.0 A	1	$0.02	0402 3 mm²
3.	Ccomp2	Yageo America	CC0805KRX7R9BB222 Series= X7R	Cap= 2.2 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	20SVPF180M Series= ?	Cap= 180.0 uF ESR= 25.0 mOhm VDC= 20.0 V IRMS= 3.2 A	1	$0.50	 CAPSMT_62_E7 106 mm²
6.	Cinx	MuRata	GRM188R71E104KA01D Series= X7R	Cap= 100.0 nF ESR= 30.0 mOhm VDC= 25.0 V IRMS= 1.51 A	1	$0.01	0603 5 mm²
7.	Cout	Panasonic	35SVPF120M Series= ?	Cap= 120.0 uF ESR= 18.0 mOhm VDC= 35.0 V IRMS= 4.4 A	1	$0.70	 CAPSMT_62_F12 151 mm²
8.	Cout1	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 mm²
9.	Css	MuRata	GRM155R71E822KA01D Series= X7R	Cap= 8.2 nF VDC= 25.0 V IRMS= 0.0 A	1	$0.01	0402 3 mm²

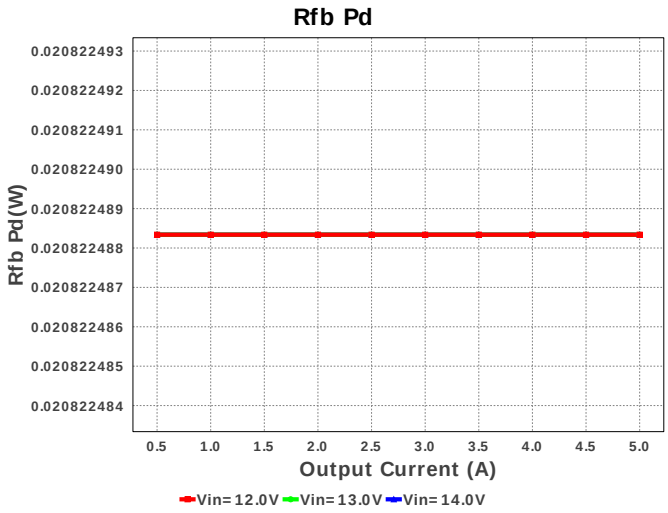
#	Name	Manufacturer	Part Number	Properties	Qty	Price	Footprint
10.	D1	STMicroelectronics	STPS20M100SG-TR	VF@Io= 455.0 mV VRRM= 100.0 V	1	$1.33	 DDPAK 210 mm^2
11.	L1	Bourns	SRP1270-4R7M	L= 4.7 µH DCR= 11.2 mOhm	1	$0.60	 SRP1270 246 mm^2
12.	M1	Texas Instruments	CSD16327Q3	VdsMax= 25.0 V IdsMax= 60.0 Amps	1	$0.44	 TRANS_NexFET_Q3 18 mm^2
13.	Rcomp	Vishay-Dale	CRCW04021K18FKED Series= CRCW..e3	Res= 1.18 kOhm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	 0402 3 mm^2
14.	Rfb1	Vishay-Dale	CRCW04021K21FKED Series= CRCW..e3	Res= 1.21 kOhm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	 0402 3 mm^2
15.	Rfb2	Yageo America	RC0603FR-0718KL Series= ?	Res= 18.0 kOhm Power= 100.0 mW Tolerance= 1.0%	1	$0.01	 0603 5 mm^2
16.	Rs1	Vishay-Dale	CRCW0402100RFKED Series= CRCW..e3	Res= 100.0 Ohm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	 0402 3 mm^2
17.	Rs2	Vishay-Dale	CRCW04025K62FKED Series= CRCW..e3	Res= 5.62 kOhm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	 0402 3 mm^2
18.	Rsns	Stackpole Electronics Inc	CSRN2010FK30L0 Series= ?	Res= 30.0 mOhm Power= 1.0 W Tolerance= 1.0%	1	$0.15	 2010 32 mm^2
19.	Rt	Vishay-Dale	CRCW040242K2FKED Series= CRCW..e3	Res= 42.2 kOhm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	 0402 3 mm^2
20.	Ruv1	Vishay-Dale	CRCW04021K50FKED Series= CRCW..e3	Res= 1.5 kOhm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	 0402 3 mm^2
21.	Ruv2	Vishay-Dale	CRCW040210K0FKED Series= CRCW..e3	Res= 10.0 kOhm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	 0402 3 mm^2
22.	U1	Texas Instruments	LM5022MM/NOPB	Switcher	1	$0.90	 MUB10A 24 mm^2

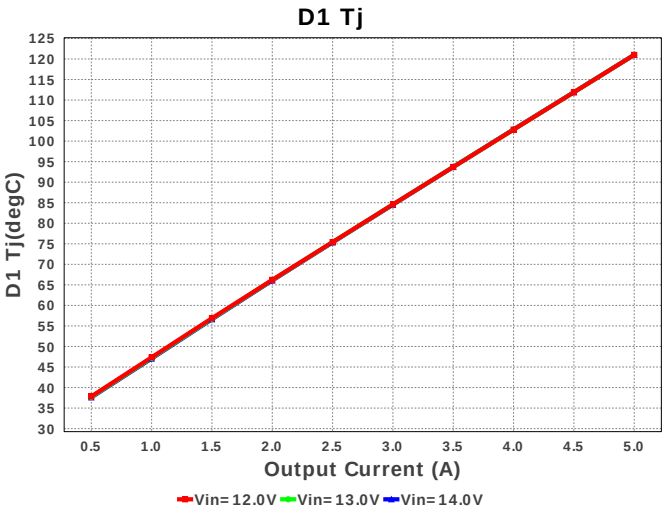


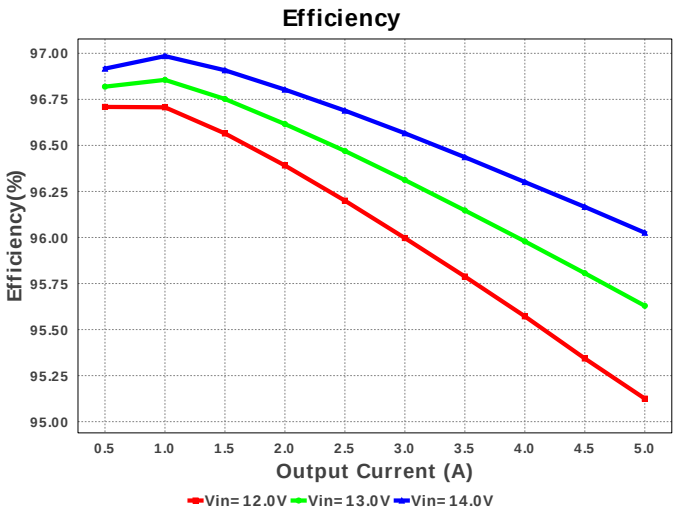


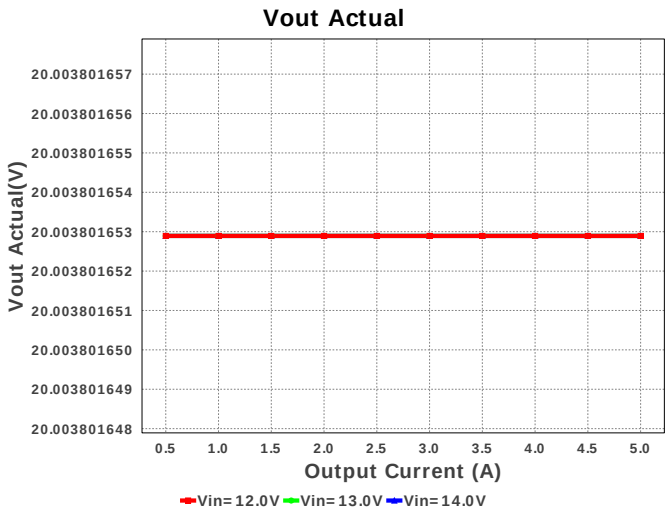


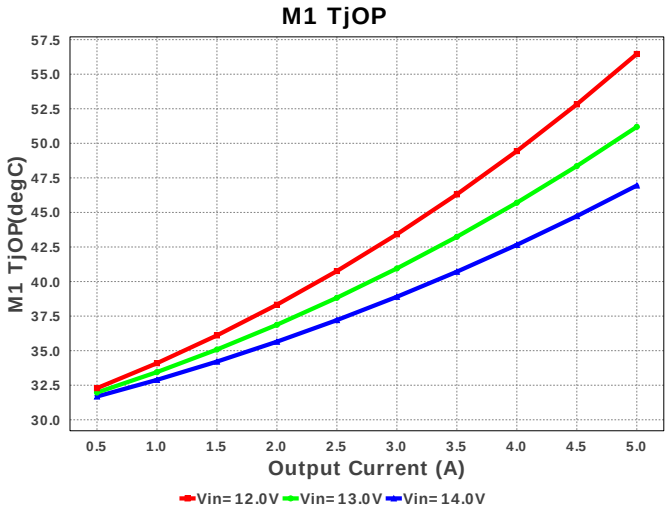


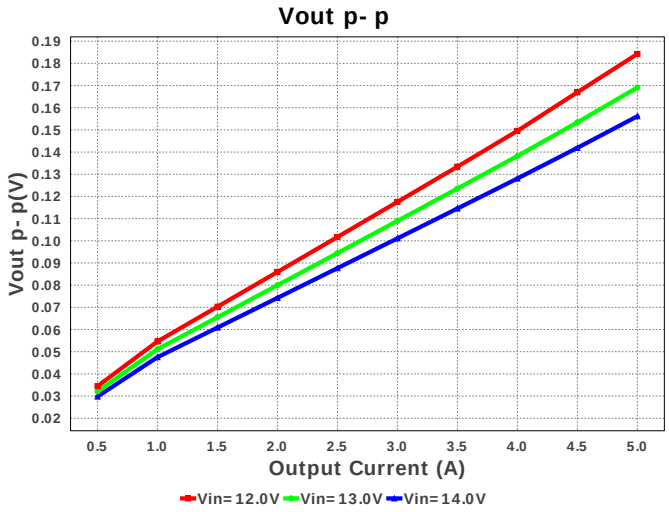


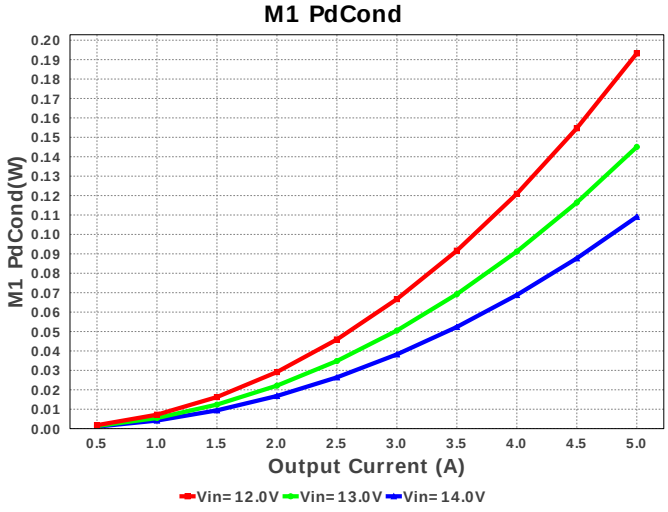


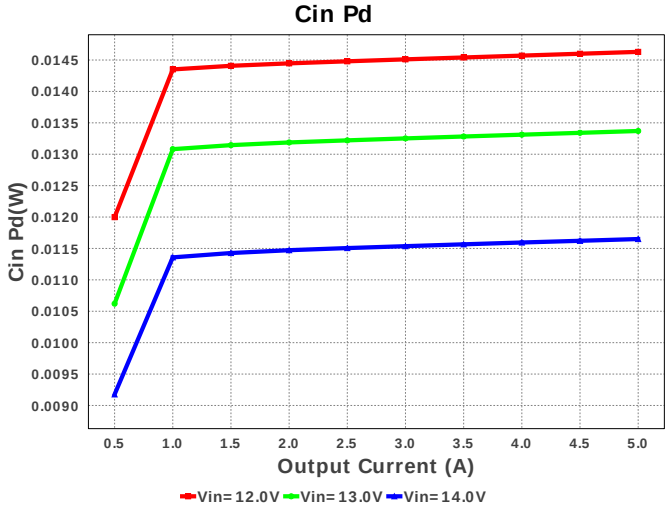


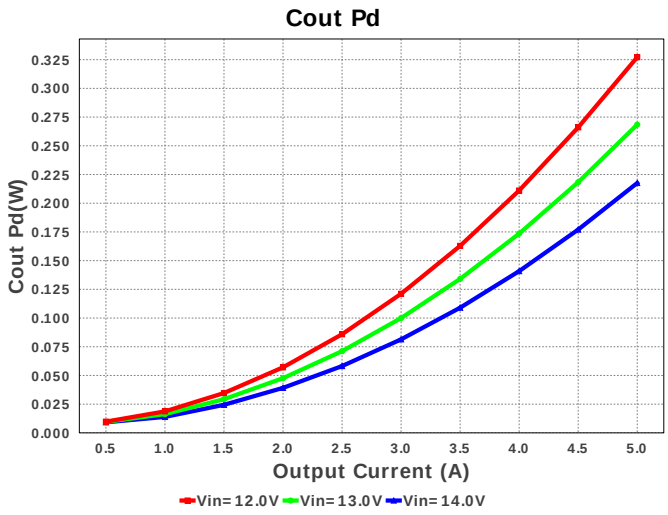


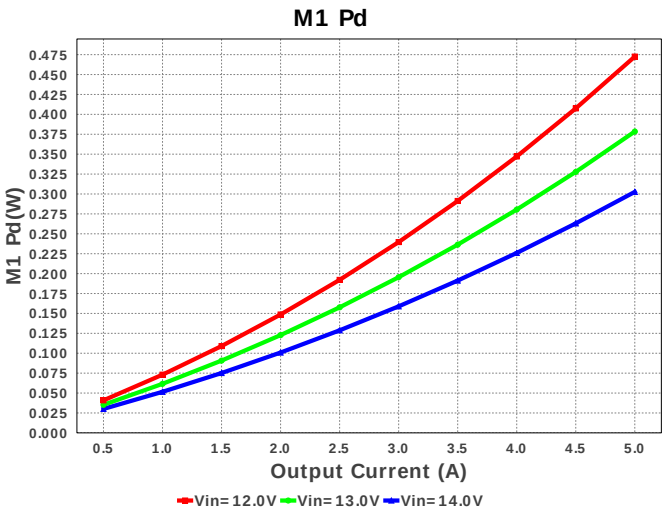


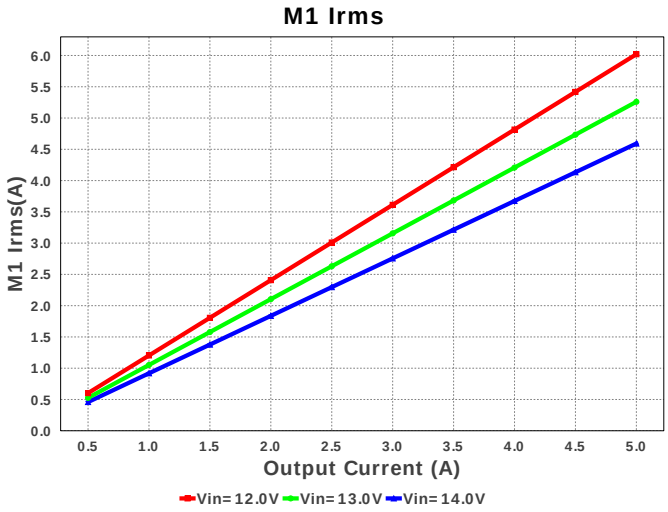


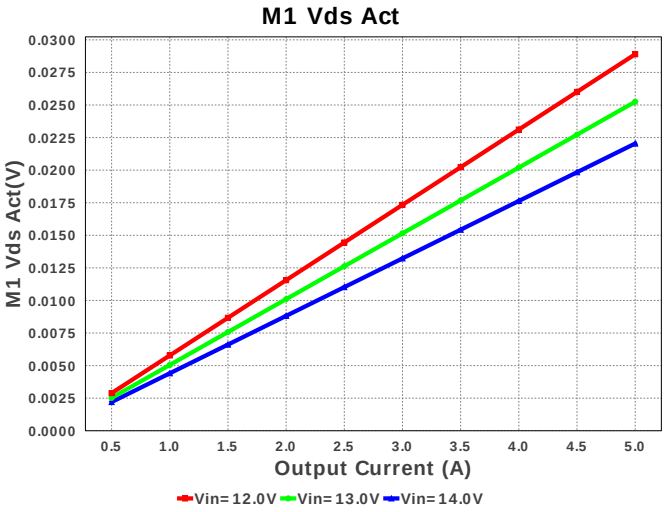


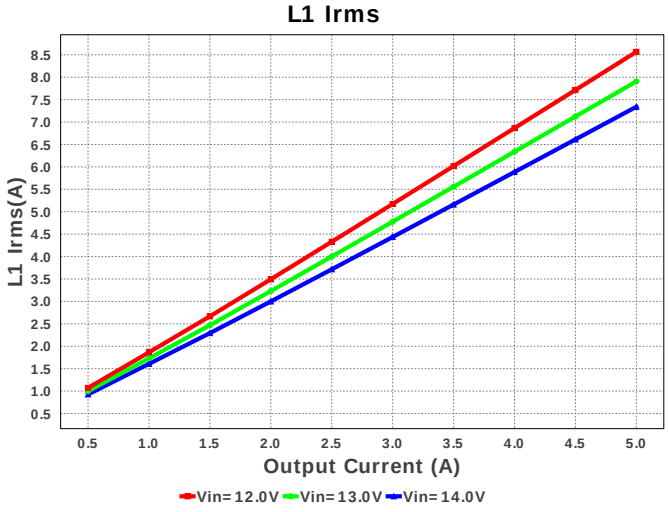


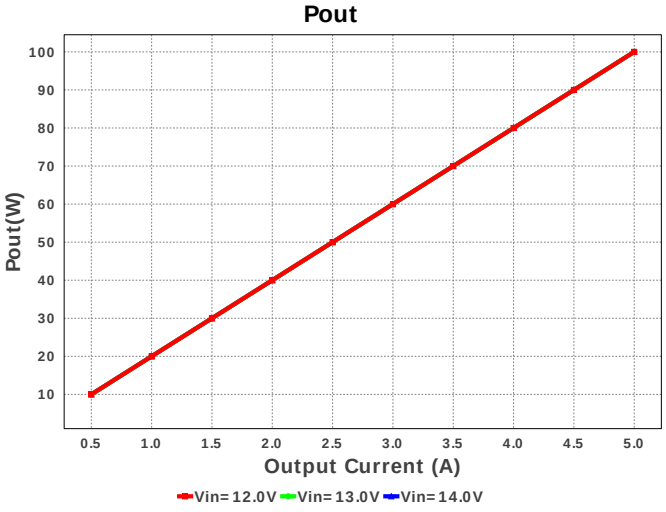


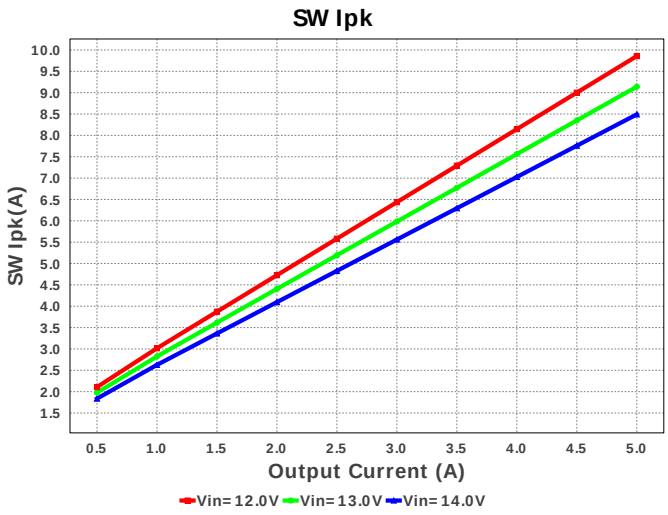


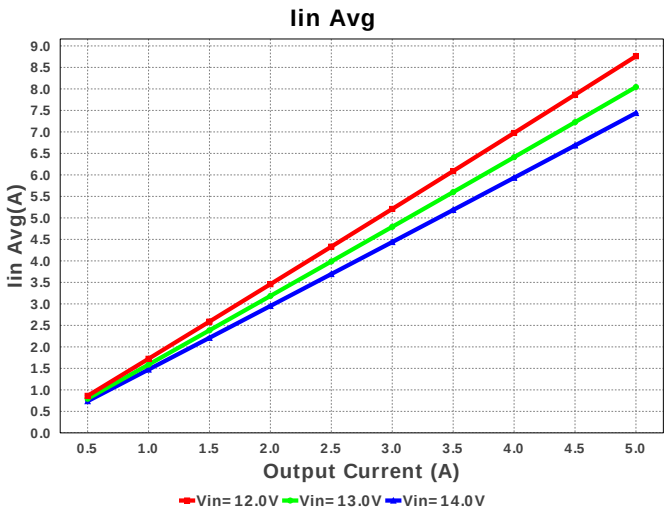


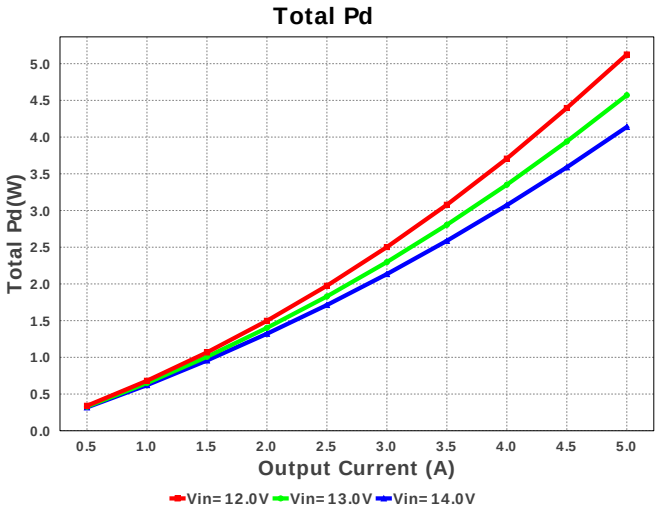


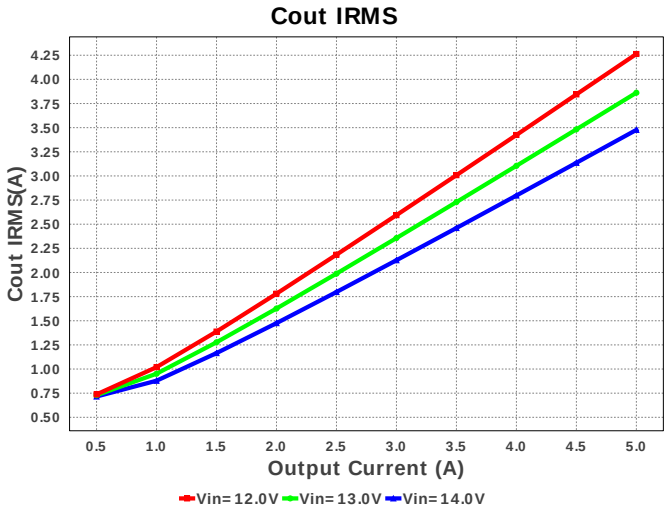


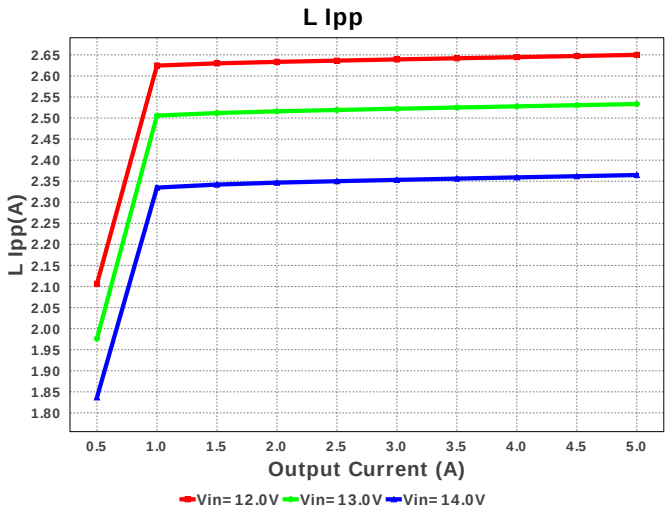


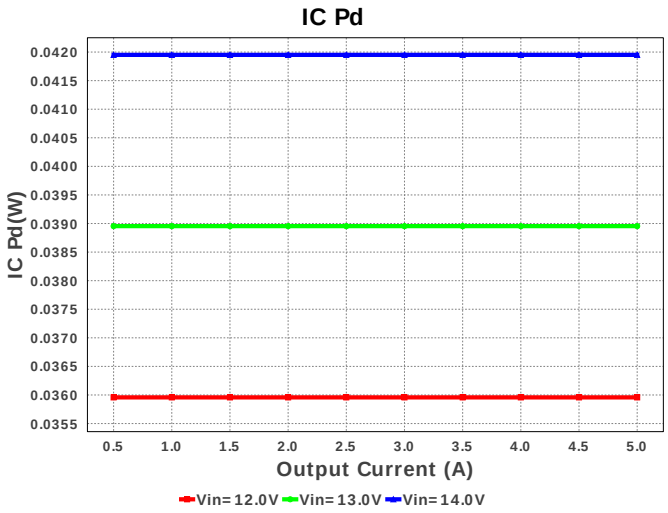


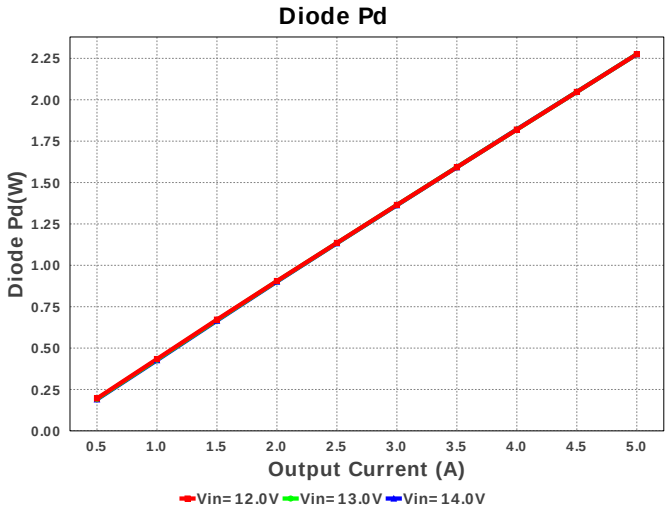


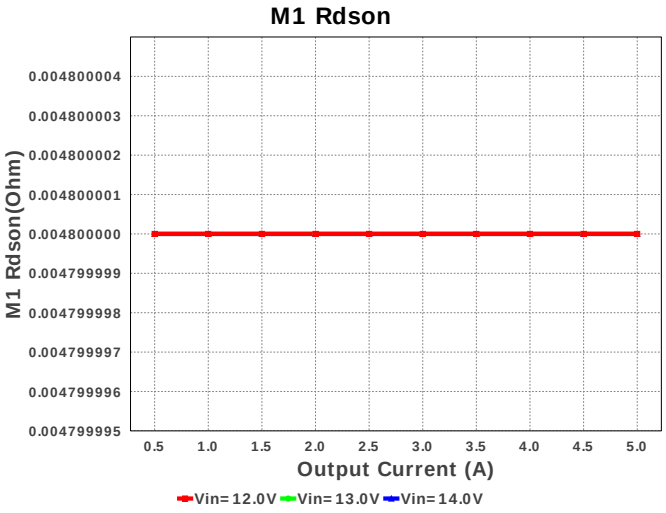


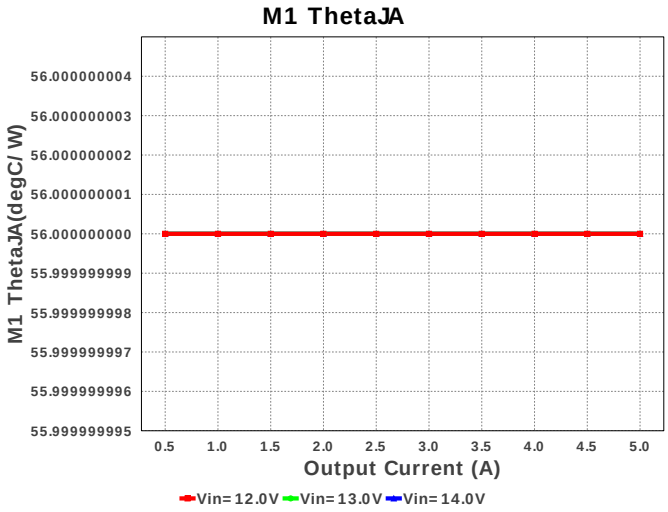


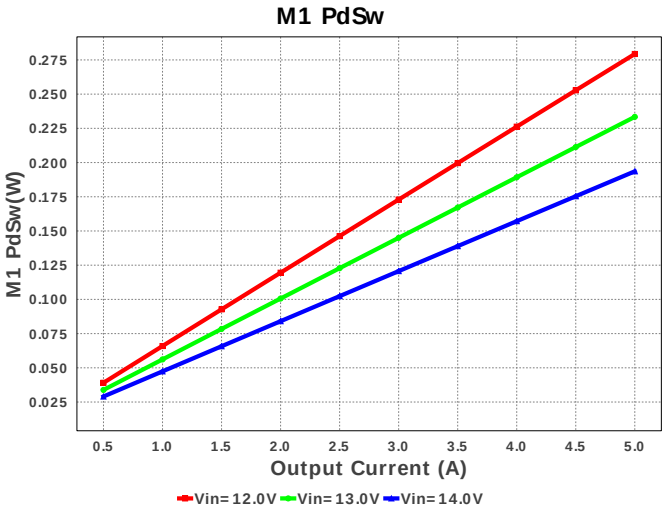


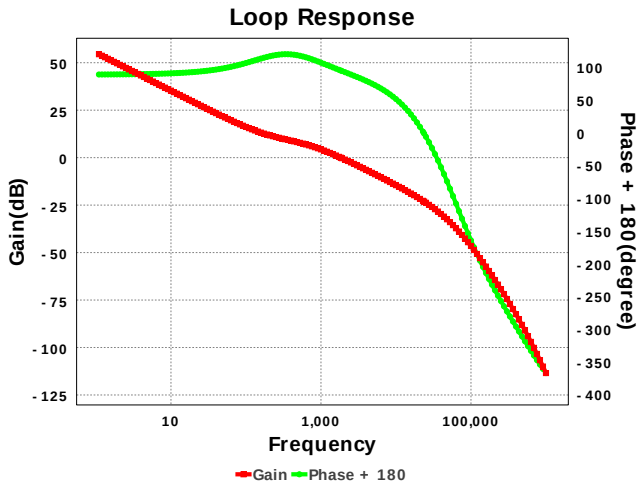












Operating Values

#	Name	Value	Category	Description
1.	Cin IRMS	769.475 mA	Current	Input capacitor RMS ripple current
2.	Cout IRMS	4.263 A	Current	Output capacitor RMS ripple current
3.	Iin Avg	8.774 A	Current	Average input current
4.	L Ipp	2.666 A	Current	Peak-to-peak inductor ripple current
5.	L1 Irms	8.566 A	Current	Inductor ripple current
6.	M1 Irms	6.02 A	Current	M1 MOSFET Irms
7.	SW Ipk	9.864 A	Current	Peak switch current
8.	BOM Count	22	General	Total Design BOM count
9.	FootPrint	848.0 mm^2	General	Total Foot Print Area of BOM components
10.	Frequency	400.0 kHz	General	Switching frequency
11.	IC Tolerance	25.0 mV	General	IC Feedback Tolerance

#	Name	Value	Category	Description
12.	M1 Rdson	4.8 mOhm	General	Drain-Source On-resistance
13.	M1 ThetaJA	56.0 degC/W	General	MOSFET junction-to-ambient thermal resistance
14.	Pout	100.0 W	General	Total output power
15.	Total BOM	$4.78	General	Total BOM Cost
16.	D1 Tj	121.0 degC	Op_Point	D1 junction temperature
17.	Low Freq Gain	53.049 dB	Op_Point	Gain at 10Hz
18.	Vout Actual	20.004 V	Op_Point	Vout Actual calculated based on selected voltage divider resistors
19.	Vout OP	20.0 V	Op_Point	Operational Output Voltage
20.	Cross Freq	1.523 kHz	Op_point	Bode plot crossover frequency
21.	Duty Cycle	43.0 %	Op_point	Duty cycle
22.	Efficiency	94.98 %	Op_point	Steady state efficiency
23.	Gain Marg	-24.377 dB	Op_point	Bode Plot Gain Margin
24.	IC Tj	40.721 degC	Op_point	IC junction temperature
25.	ICThetaJA	200.0 degC/W	Op_point	IC junction-to-ambient thermal resistance
26.	IOUT_OP	5.0 A	Op_point	Iout operating point
27.	M1 TjOP	64.42 degC	Op_point	M1 MOSFET junction temperature
28.	Phase Marg	100.258 deg	Op_point	Bode Plot Phase Margin
29.	VIN_OP	12.0 V	Op_point	Vin operating point
30.	Vout p-p	184.408 mV	Op_point	Peak-to-peak output ripple voltage
31.	Cin Pd	14.802 mW	Power	Input capacitor power dissipation
32.	Cout Pd	327.188 mW	Power	Output capacitor power dissipation
33.	Diode Pd	2.275 W	Power	Diode power dissipation
34.	IC Pd	53.604 mW	Power	IC power dissipation
35.	L Pd	986.19 mW	Power	Inductor power dissipation
36.	M1 Pd	614.639 mW	Power	M1 MOSFET total power dissipation
37.	M1 PdCond	198.076 mW	Power	M1 MOSFET conduction losses
38.	M1 PdSw	416.563 mW	Power	M1 MOSFET switching losses
39.	Rfb Pd	20.822 mW	Power	Rfb Power Dissipation
40.	Total Pd	5.285 W	Power	Total Power Dissipation
41.	M1 Vds Act	28.895 mV		M Vds
42.	Vout Tolerance	3.915 %		Vout Tolerance based on IC Tolerance (no load) and voltage divider resistors if applicable

Design Inputs

#	Name	Value	Description
1.	Iout	5.0	Maximum Output Current
2.	VinMax	14.0	Maximum input voltage
3.	VinMin	12.0	Minimum input voltage
4.	Vout	20.0	Output Voltage
5.	base_pn	LM5022	Texas Instruments Base Part 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.