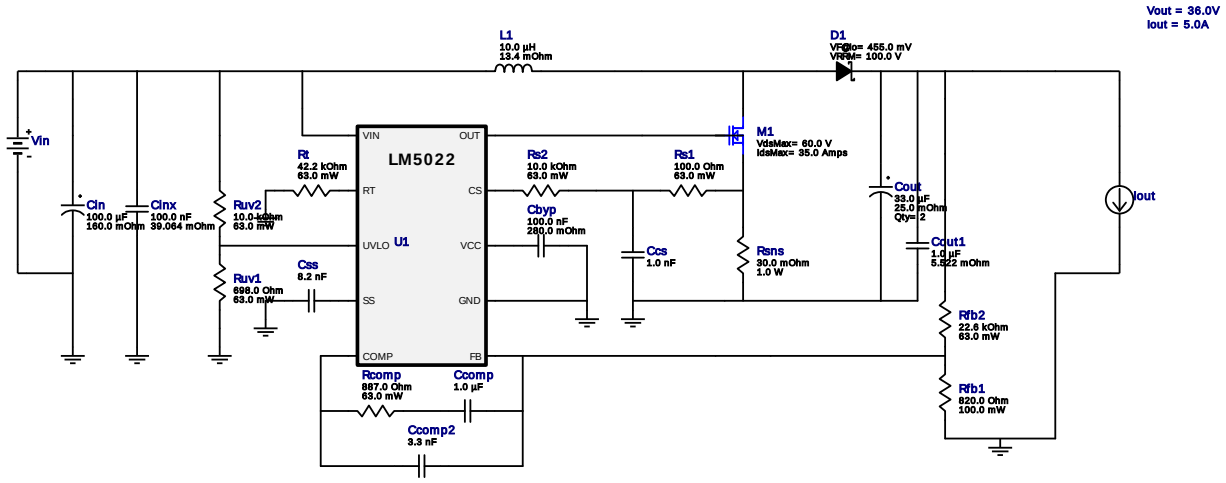
WEBENCH® Design Report

VinMin = 24.0V
VinMax = 24.0V
Vout = 36.0V
Iout = 5.0A

Device = LM5022MM/NOPB
Topology = Boost
Created = 5/9/17 11:35:14 PM
BOM Cost = $7.22
BOM Count = 23
Total Pd = 5.2W

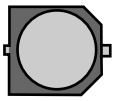
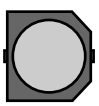
Design : 4812076/26 LM5022MM/NOPB
LM5022MM/NOPB 24.0V-24.0V to 36.00V @ 5.0A



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	EMK212B7105KG-T Series= X7R	Cap= 1.0 uF VDC= 16.0 V IRMS= 0.0 A	1	$0.02	0805 7 mm²
3.	Ccomp2	Yageo America	CC0805KRX7R9BB332 Series= X7R	Cap= 3.3 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	EEE-FK1V101P Series= FK	Cap= 100.0 uF ESR= 160.0 mOhm VDC= 35.0 V IRMS= 600.0 mA	1	$0.22	 SM_RADIAL_F 124 mm²
6.	Cinx	TDK	C1005X5R1H104K050BB Series= X5R	Cap= 100.0 nF ESR= 39.064 mOhm VDC= 50.0 V IRMS= 814.67 mA	1	$0.01	0402 3 mm²
7.	Cout	Panasonic	63SXV33M Series= SXV	Cap= 33.0 uF ESR= 25.0 mOhm VDC= 63.0 V IRMS= 2.95 A	2	$1.20	 CAPSMT_62_E12 106 mm²
8.	Cout1	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 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

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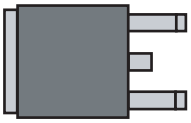
#	Name	Manufacturer	Part Number	Properties	Qty	Price	Footprint
10.	D1	STMicroelectronics	STPS20M100SG-TR	VF@Io= 455.0 mV VRRM= 100.0 V	1	$1.39	 DDPAK 210 mm^2
11.	L1	Coilcraft	XAL1010-103MEB	L= 10.0 µH DCR= 13.4 mOhm	1	$1.71	 XAL1010 160 mm^2
12.	M1	Texas Instruments	CSD18543Q3A	VdsMax= 60.0 V IdsMax= 35.0 Amps	1	$0.27	 DNH0008A 18 mm^2
13.	Rcomp	Vishay-Dale	CRCW0402887RFKED Series= CRCW..e3	Res= 887.0 Ohm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	 0402 3 mm^2
14.	Rfb1	Yageo America	RC0603FR-07820RL Series= ?	Res= 820.0 Ohm Power= 100.0 mW Tolerance= 1.0%	1	$0.01	 0603 5 mm^2
15.	Rfb2	Vishay-Dale	CRCW040222K6FKED Series= CRCW..e3	Res= 22.6 kOhm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	 0402 3 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	CRCW040210K0FKED Series= CRCW..e3	Res= 10.0 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	CRCW0402698RFKED Series= CRCW..e3	Res= 698.0 Ohm 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

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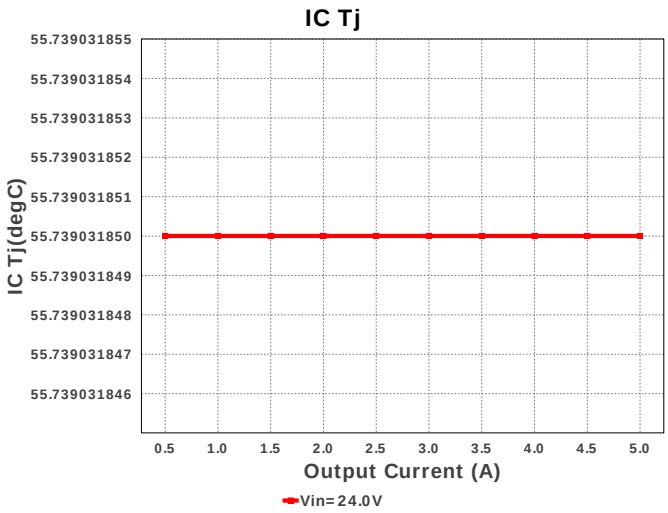

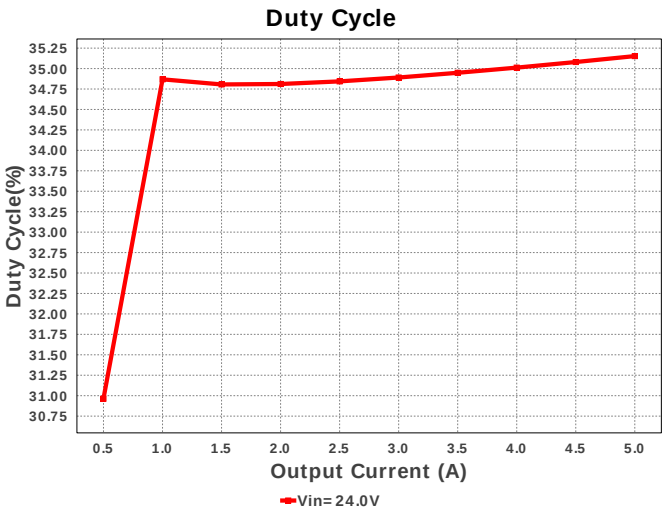

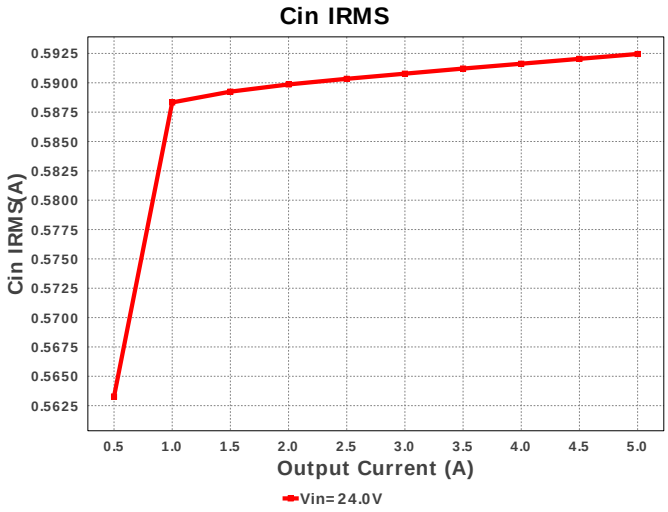

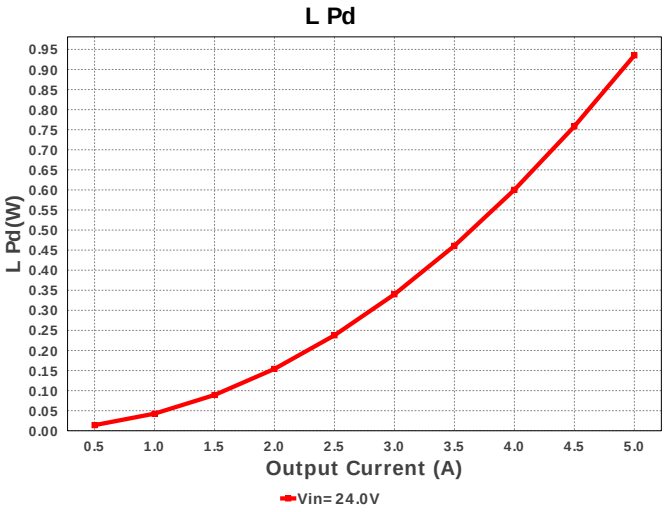

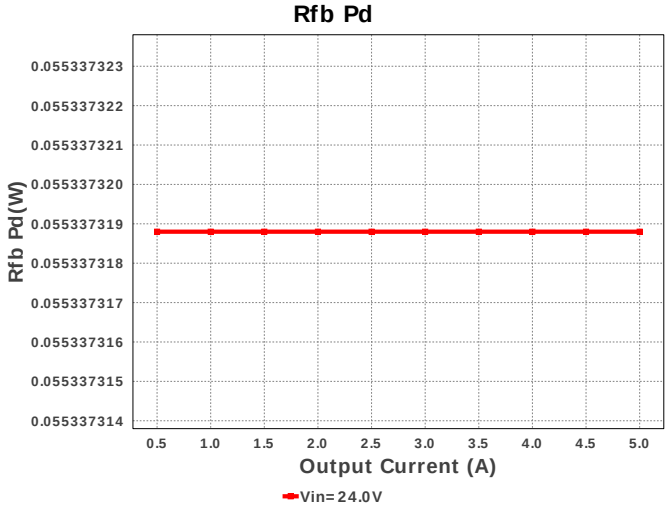

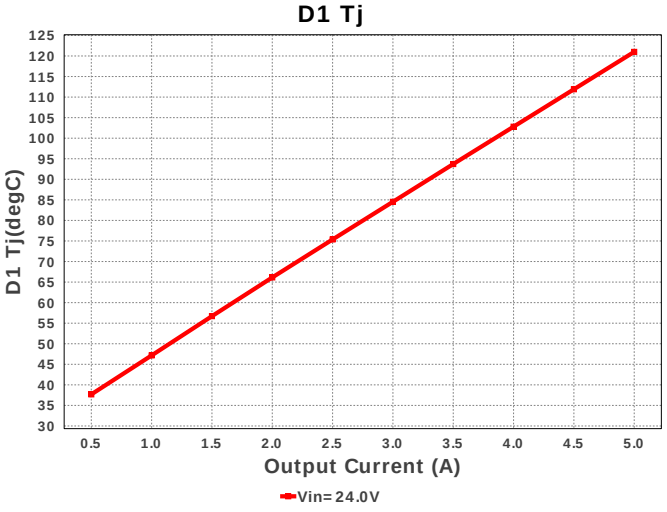

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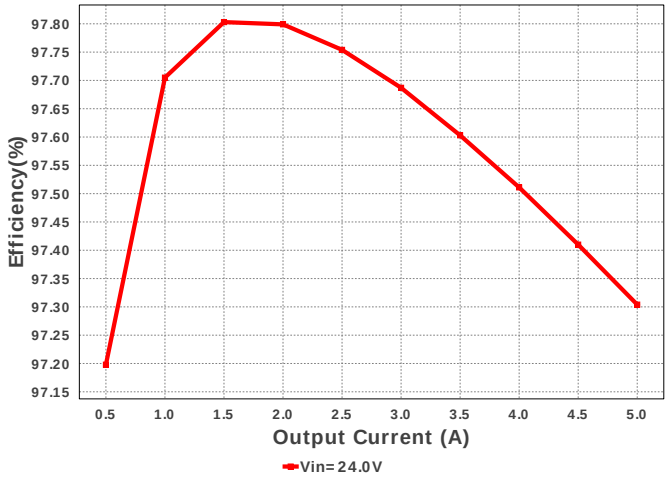
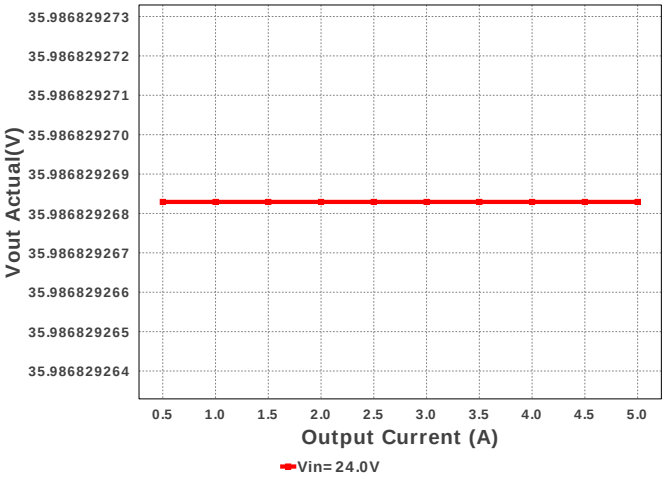
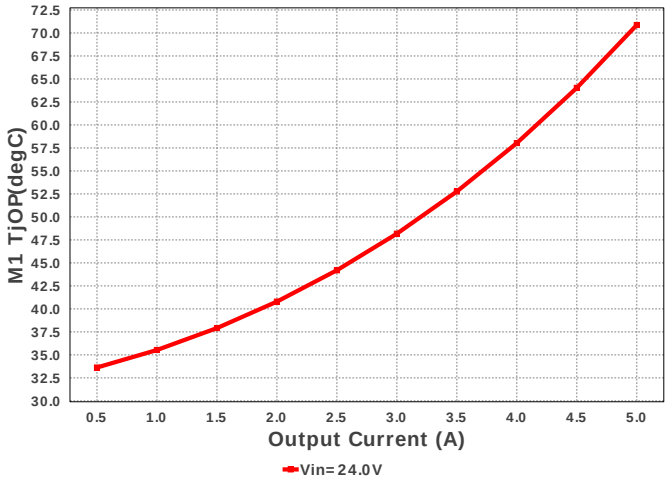
Efficiency



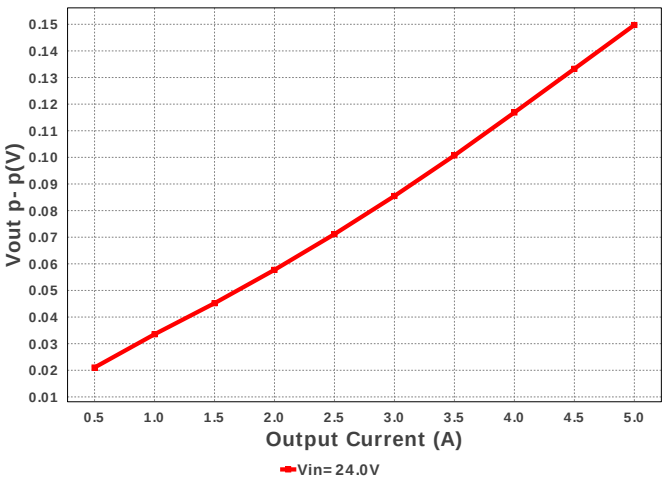
Vout Actual



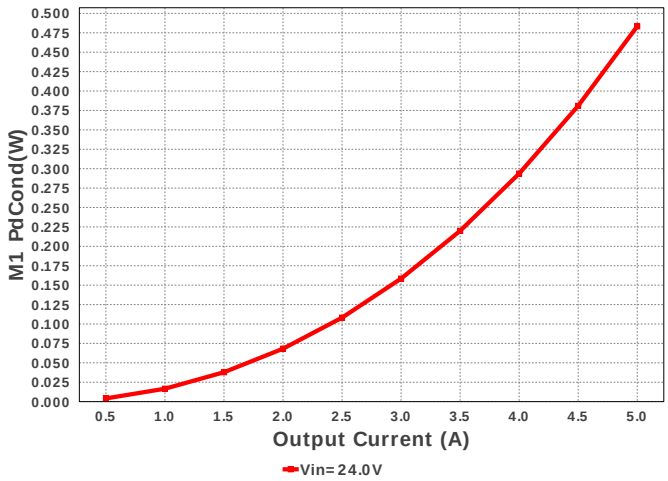
M1 TjOP



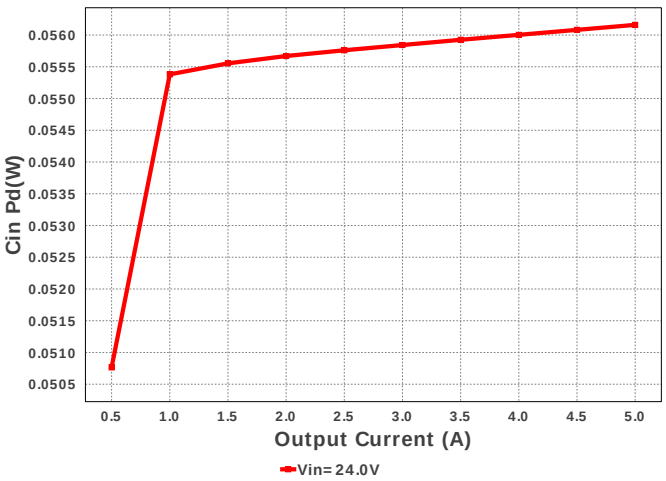
Vout p- p



M1 PdCond



Cin Pd



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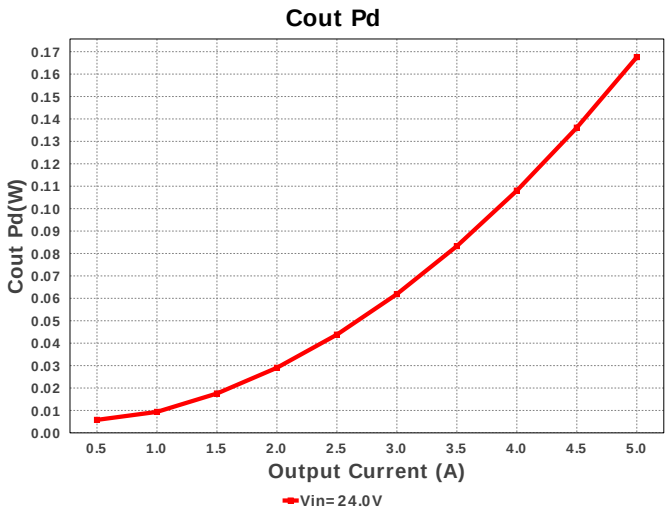

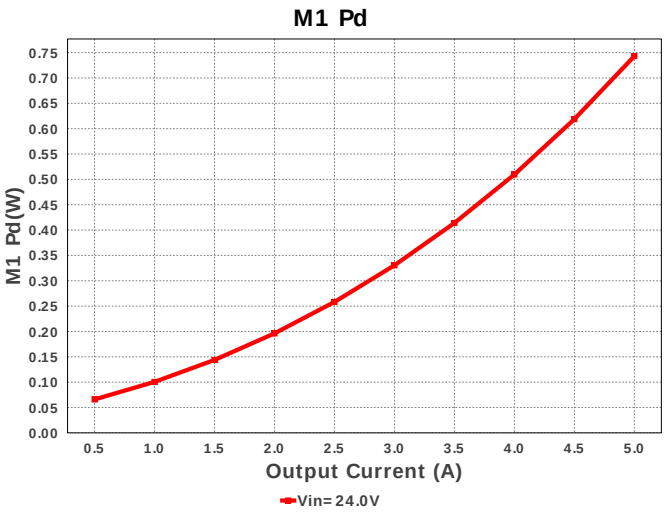

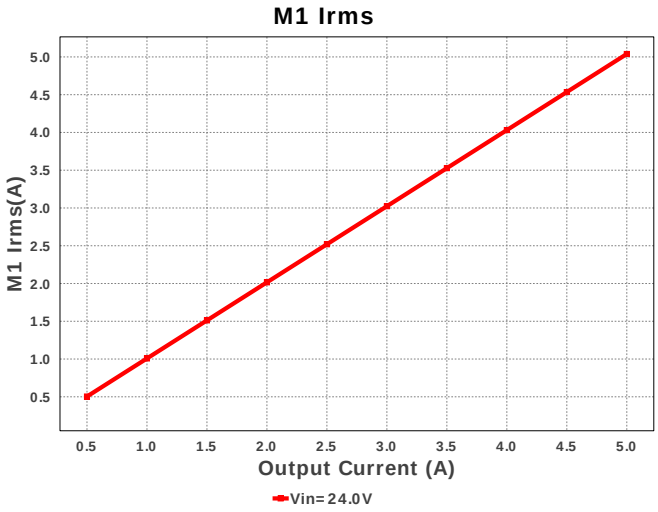

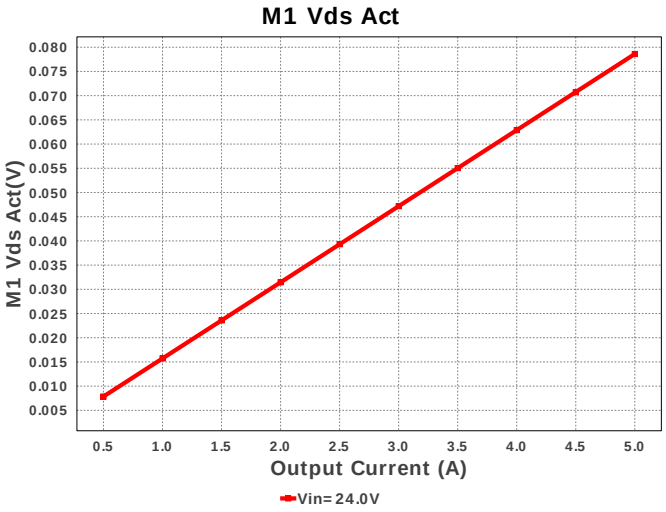

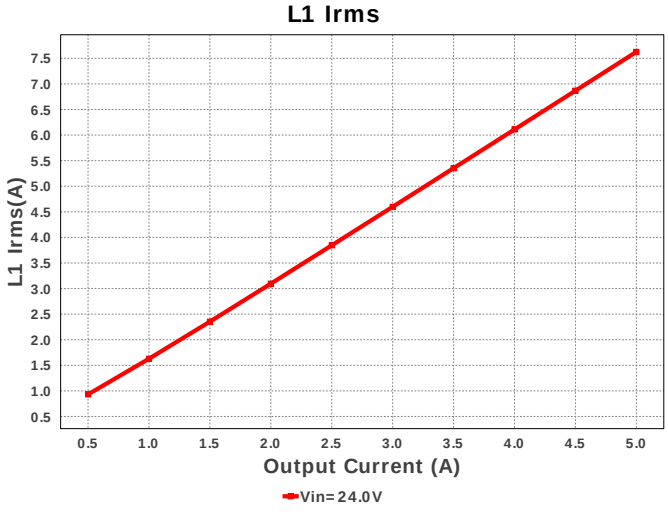

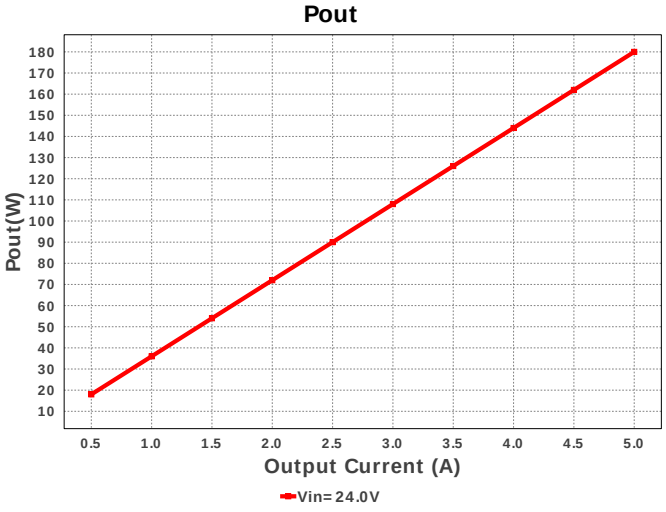

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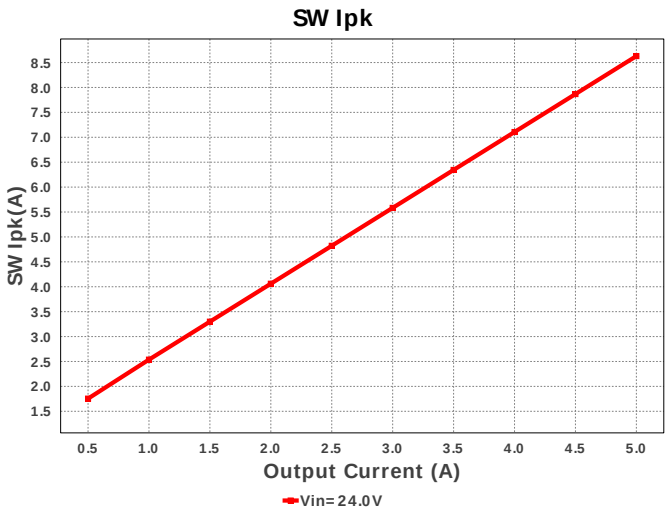

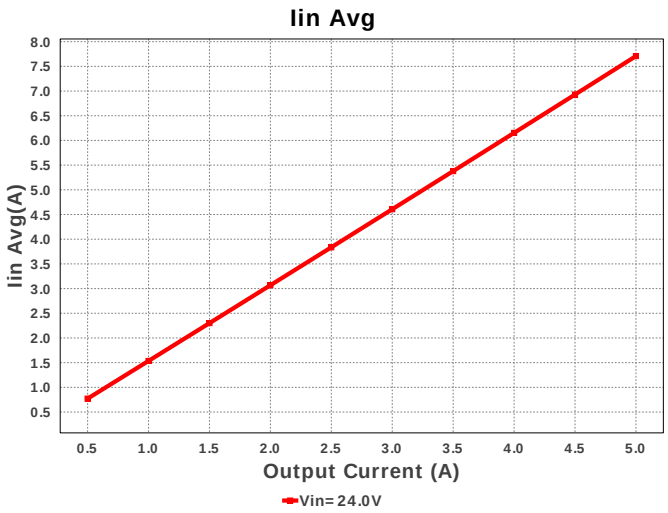

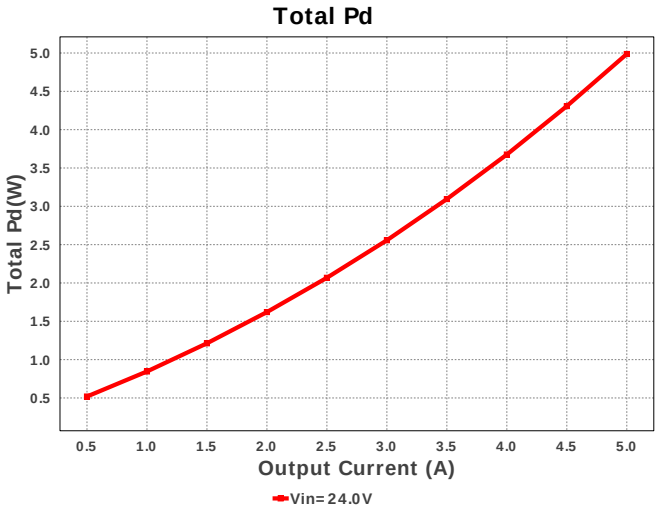

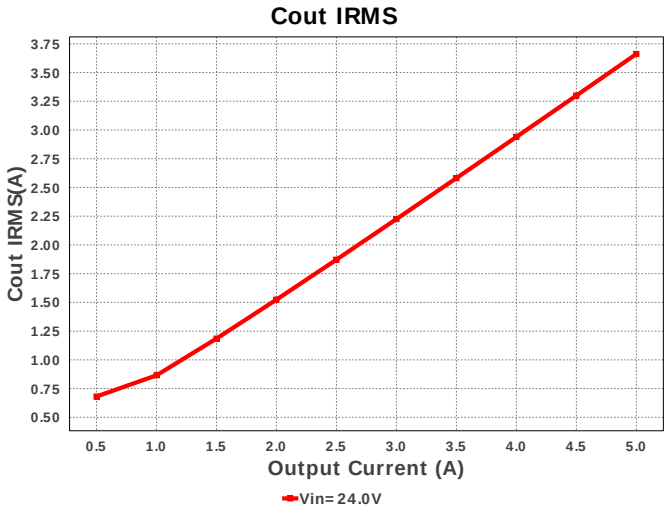

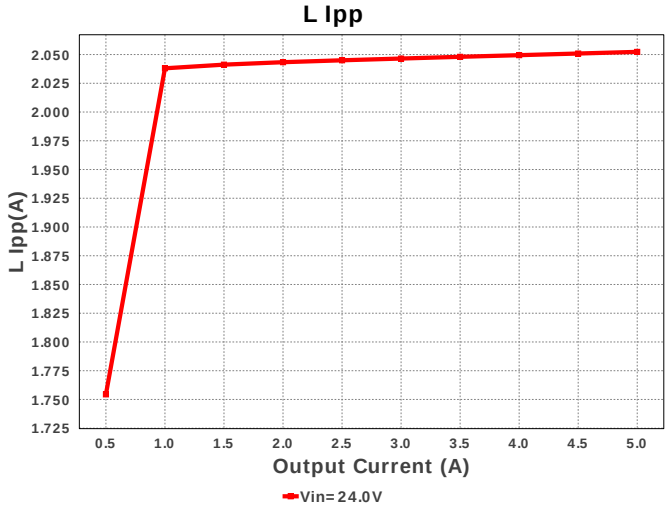

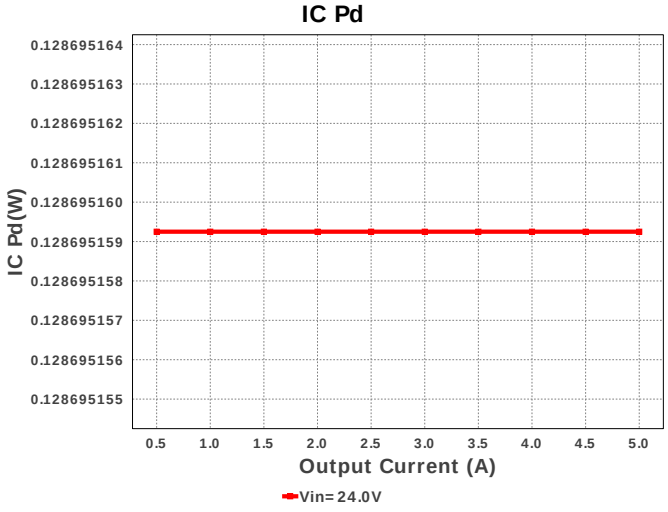

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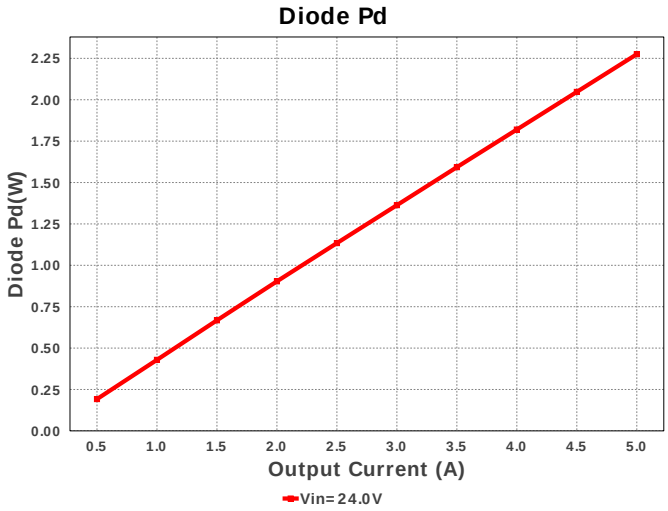

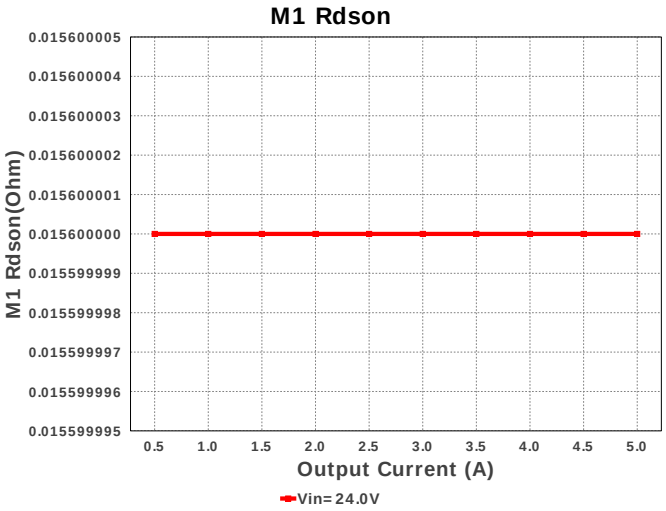

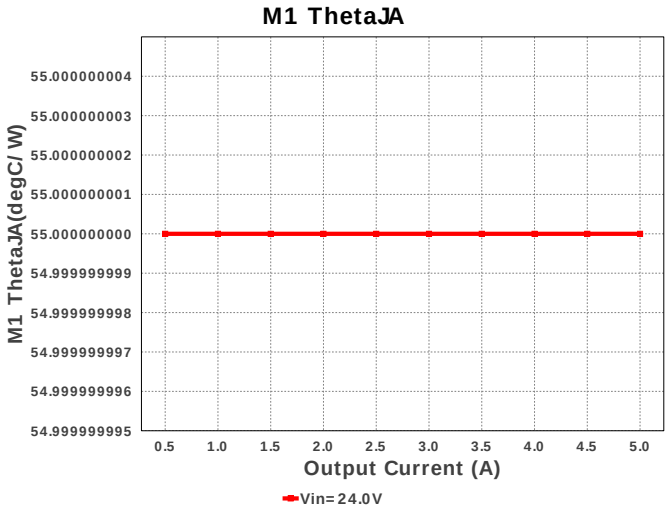

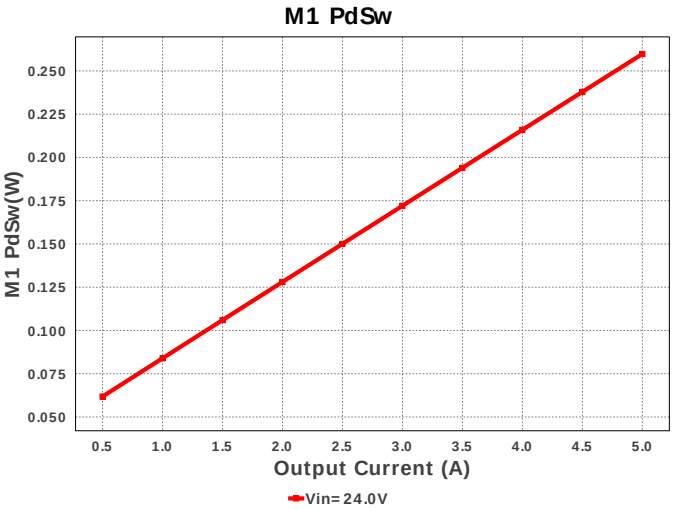

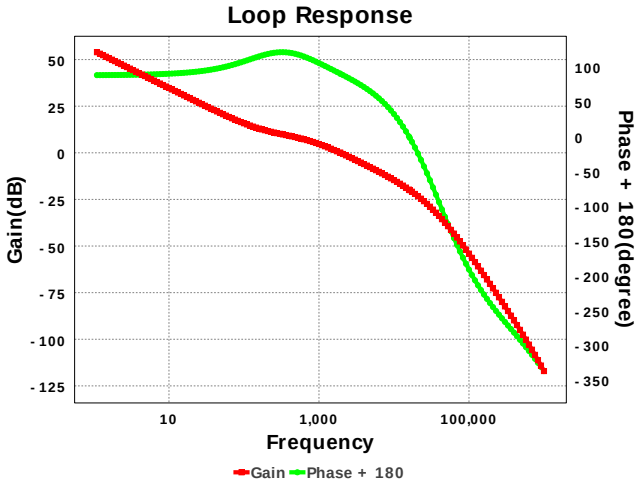

Operating Values

#	Name	Value	Category	Description
1.	Cin IRMS	595.935 mA	Current	Input capacitor RMS ripple current
2.	Cout IRMS	3.663 A	Current	Output capacitor RMS ripple current
3.	Iin Avg	7.717 A	Current	Average input current
4.	L Ipp	2.064 A	Current	Peak-to-peak inductor ripple current
5.	L1 Irms	7.627 A	Current	Inductor ripple current
6.	M1 Irms	5.028 A	Current	M1 MOSFET Irms
7.	SW Ipk	8.635 A	Current	Peak switch current
8.	BOM Count	23	General	Total Design BOM count
9.	FootPrint	842.0 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

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#	Name	Value	Category	Description
12.	M1 Rdson	15.6 mOhm	General	Drain-Source On-resistance
13.	M1 ThetaJA	55.0 degC/W	General	MOSFET junction-to-ambient thermal resistance
14.	Mode	CCM	General	Conduction Mode
15.	Pout	180.0 W	General	Total output power
16.	Total BOM	$7.22	General	Total BOM Cost
17.	D1 Tj	121.0 degC	Op_Point	D1 junction temperature
18.	Low Freq Gain	53.938 dB	Op_Point	Gain at 10Hz
19.	Vout Actual	35.987 V	Op_Point	Vout Actual calculated based on selected voltage divider resistors
20.	Vout OP	36.0 V	Op_Point	Operational Output Voltage
21.	Cross Freq	1.926 kHz	Op_point	Bode plot crossover frequency
22.	Duty Cycle	35.225 %	Op_point	Duty cycle
23.	Efficiency	97.194 %	Op_point	Steady state efficiency
24.	Gain Marg	-20.225 dB	Op_point	Bode Plot Gain Margin
25.	IC Tj	68.376 degC	Op_point	IC junction temperature
26.	ICThetaJA	200.0 degC/W	Op_point	IC junction-to-ambient thermal resistance
27.	IOUT_OP	5.0 A	Op_point	Iout operating point
28.	M1 TjOP	78.703 degC	Op_point	M1 MOSFET junction temperature
29.	Phase Marg	92.424 deg	Op_point	Bode Plot Phase Margin
30.	VIN_OP	24.0 V	Op_point	Vin operating point
31.	Vout p-p	150.3 mV	Op_point	Peak-to-peak output ripple voltage
32.	Cin Pd	56.822 mW	Power	Input capacitor power dissipation
33.	Cout Pd	167.757 mW	Power	Output capacitor power dissipation
34.	Diode Pd	2.275 W	Power	Diode power dissipation
35.	IC Pd	191.88 mW	Power	IC power dissipation
36.	L Pd	935.298 mW	Power	Inductor power dissipation
37.	M1 Pd	885.503 mW	Power	M1 MOSFET total power dissipation
38.	M1 PdCond	496.121 mW	Power	M1 MOSFET conduction losses
39.	M1 PdSw	389.382 mW	Power	M1 MOSFET switching losses
40.	Rfb Pd	55.337 mW	Power	Rfb Power Dissipation
41.	Total Pd	5.197 W	Power	Total Power Dissipation
42.	M1 Vds Act	78.443 mV		M Vds
43.	Vout Tolerance	3.972 %		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	24.0	Maximum input voltage
3.	VinMin	24.0	Minimum input voltage
4.	Vout	36.0	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.

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