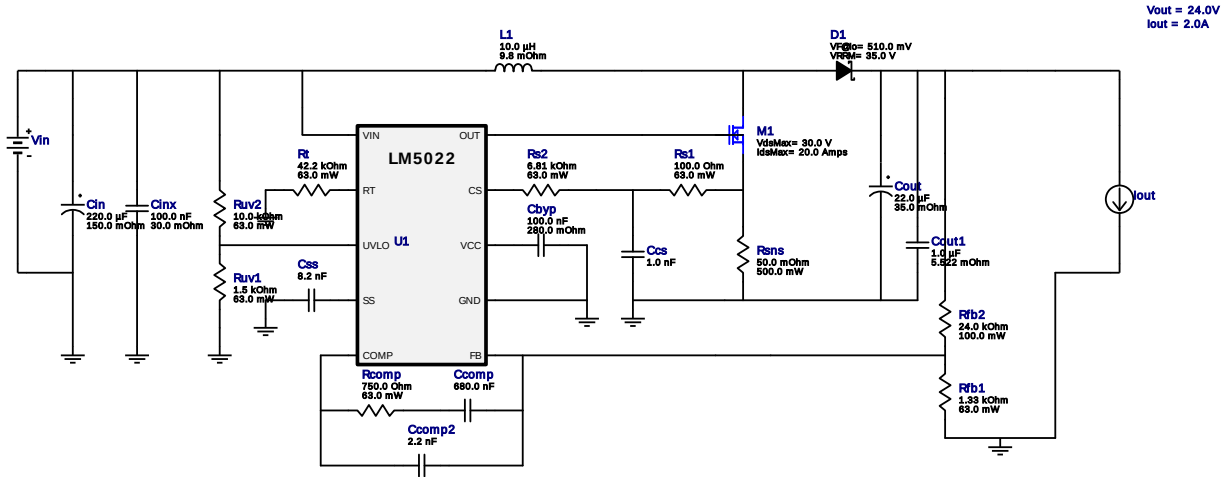
TEXAS INSTRUMENTS

WEBENCH® Design Report

VinMin = 12.0V
VinMax = 18.0V
Vout = 24.0V
Iout = 2.0A

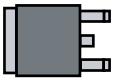
Device = LM5022MM/NOPB
Topology = Boost
Created = 7/14/16 5:16:33 PM
BOM Cost = $3.07
BOM Count = 22
Total Pd = 2.32W

Design : 906020/2237 LM5022MM/NOPB
LM5022MM/NOPB 12.0V-18.0V to 24.00V @ 2.0A

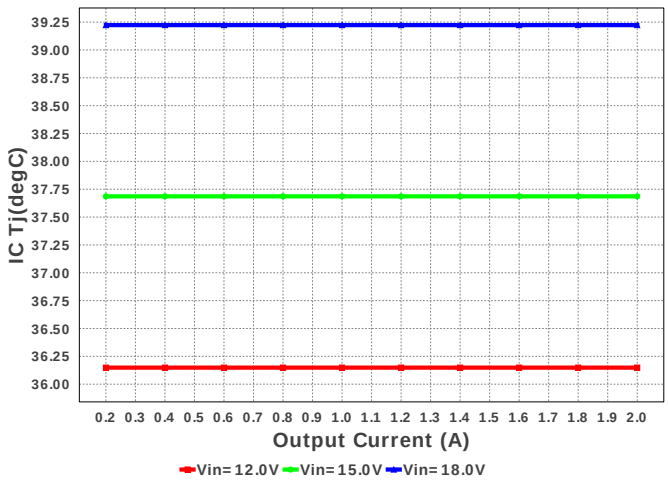


Electrical BOM

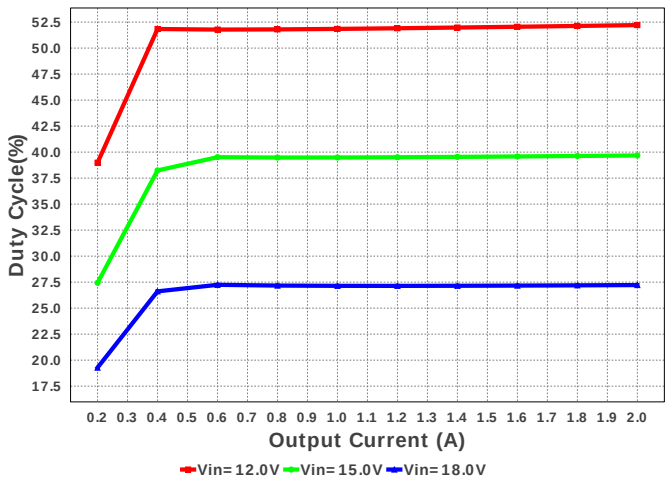
#	Name	Manufacturer	Part Number	Properties	Qty	Price	Footprint
1.	Cbyp	AVX	08053C104KAT2A Series= X7R	Cap= 100.0 nF ESR= 280.0 mOhm VDC= 25.0 V IRMS= 0.0 A	1	$0.01	0805 7 mm²
2.	Ccomp	MuRata	GRM155R60J684KE19D Series= X5R	Cap= 680.0 nF VDC= 6.3 V IRMS= 0.0 A	1	$0.02	0402 3 mm²
3.	Ccomp2	Yageo America	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	EEE-FC1V221P Series= FC	Cap= 220.0 uF ESR= 150.0 mOhm VDC= 35.0 V IRMS= 670.0 mA	1	$0.24	SM_RADIAL_G 172 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	35SVPF22M Series= ?	Cap= 22.0 uF ESR= 35.0 mOhm VDC= 35.0 V IRMS= 2.6 A	1	$0.43	CAPSMT_62_F61 74 mm²
8.	Cout1	TDK	C1608X7R1V105K080AC Series= X7R	Cap= 1.0 uF ESR= 5.522 mOhm VDC= 35.0 V IRMS= 2.2162 A	1	$0.05	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	ON Semiconductor	MBRD835LT4G	VF@Io= 510.0 mV VRRM= 35.0 V	1	$0.25	 DPAK 102 mm^2
11.	L1	Coilcraft	SER1360-103KLB	L= 10.0 µH DCR= 9.8 mOhm	1	$0.72	 SER1360 225 mm^2
12.	M1	Texas Instruments	CSD17579Q3A	VdsMax= 30.0 V IdsMax= 20.0 Amps	1	$0.23	 TRANS_NexFET_Q3A 18 mm^2
13.	Rcomp	Vishay-Dale	CRCW0402750RFKED Series= CRCW..e3	Res= 750.0 Ohm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	 0402 3 mm^2
14.	Rfb1	Vishay-Dale	CRCW04021K33FKED Series= CRCW..e3	Res= 1.33 kOhm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	 0402 3 mm^2
15.	Rfb2	Yageo America	RC0603FR-0724KL Series= ?	Res= 24.0 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	CRCW04026K81FKED Series= CRCW..e3	Res= 6.81 kOhm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	 0402 3 mm^2
18.	Rsns	Stackpole Electronics Inc	CSR1206FK50L0 Series= ?	Res= 50.0 mOhm Power= 500.0 mW Tolerance= 1.0%	1	$0.10	 1206 11 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

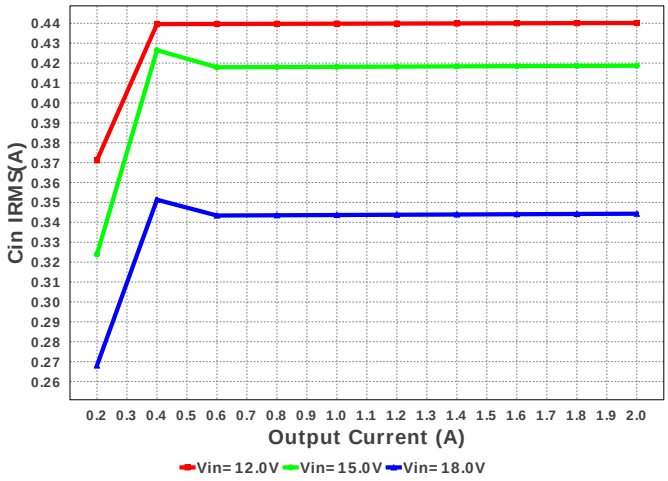
IC Tj



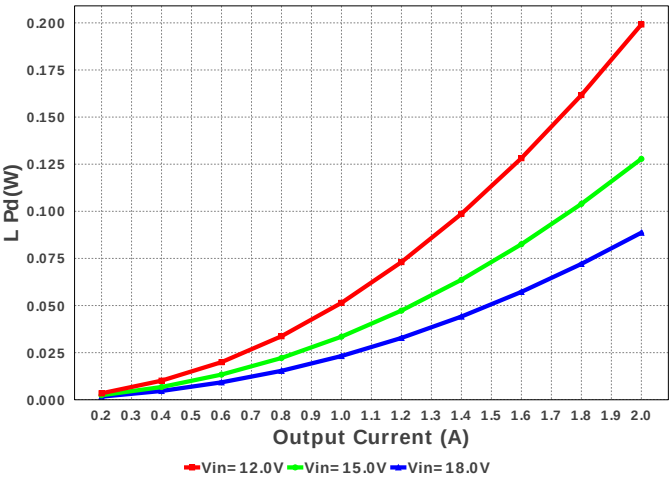
Duty Cycle



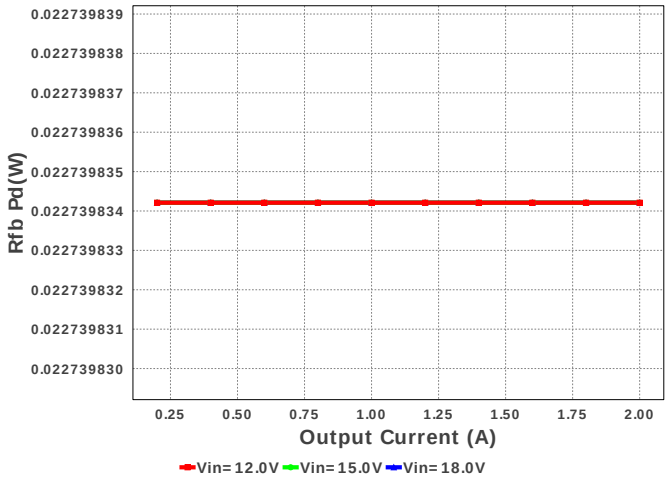
Cin IRMS



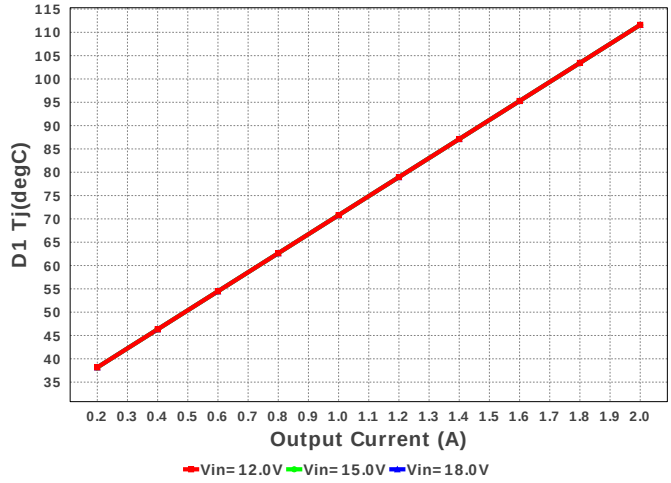
L Pd



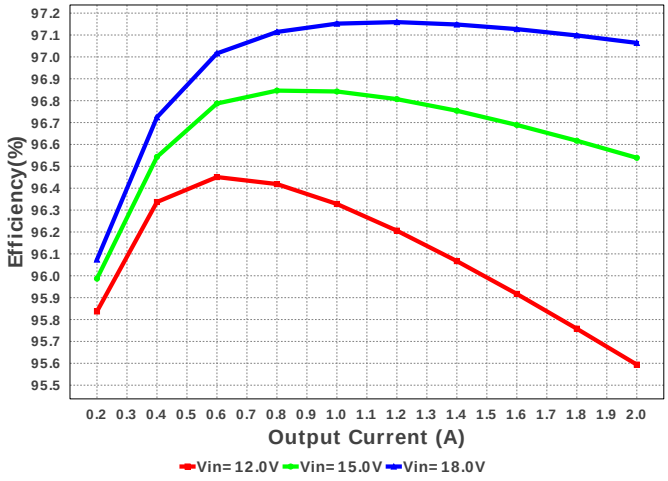
Rfb Pd



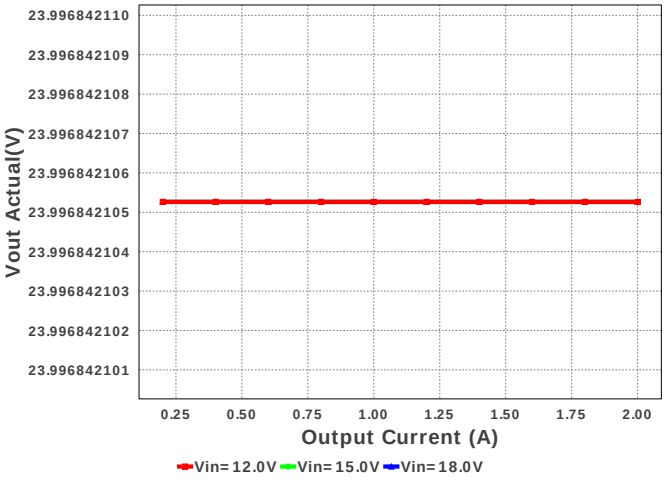
D1 Tj



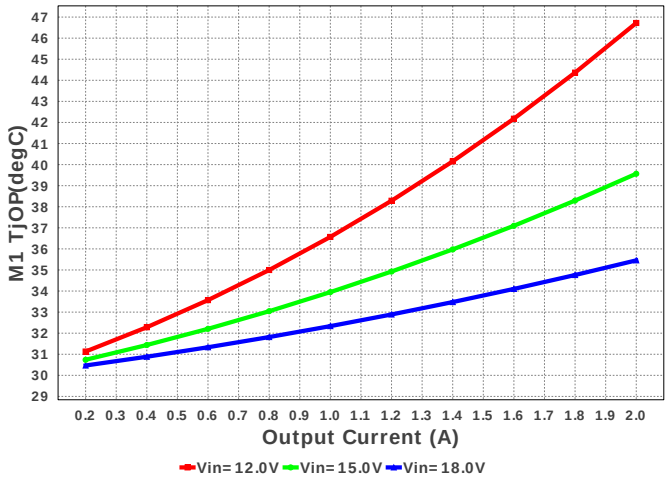
Efficiency



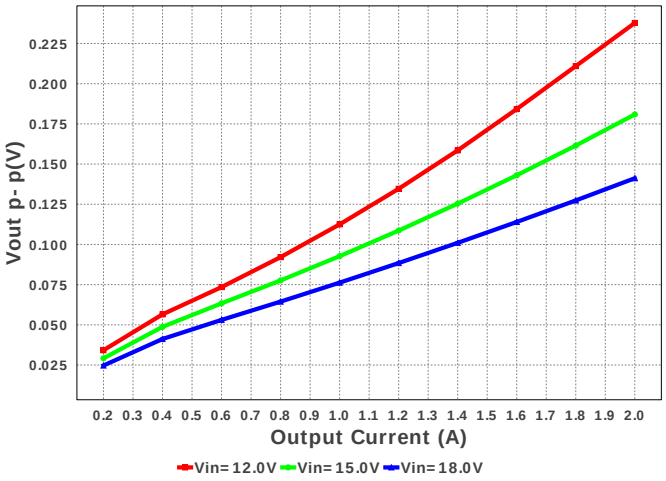
Vout Actual



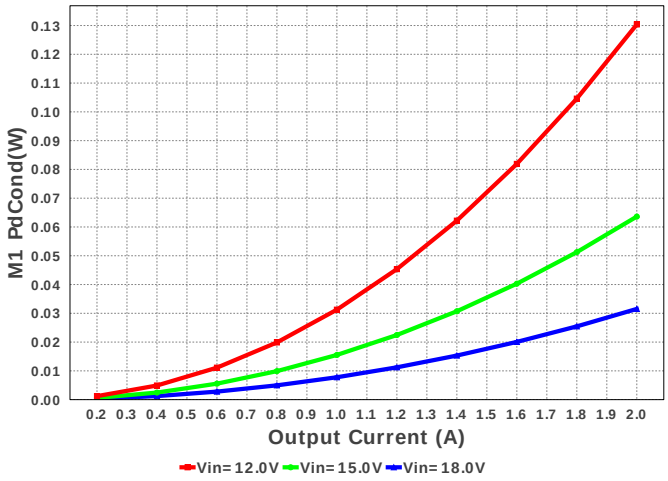
M1 TjOP



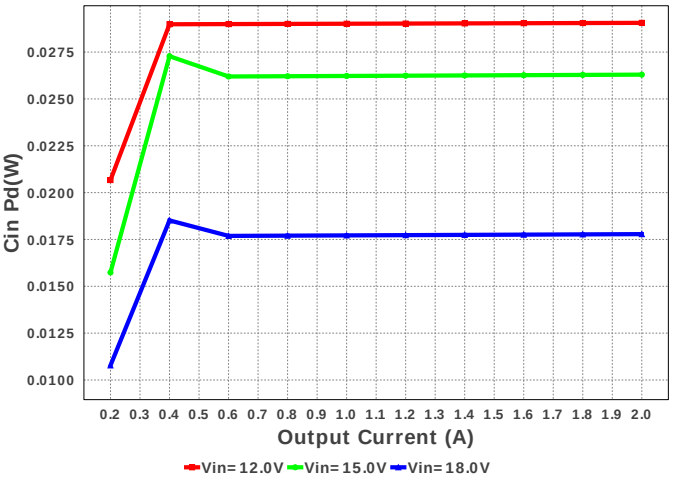
Vout p- p

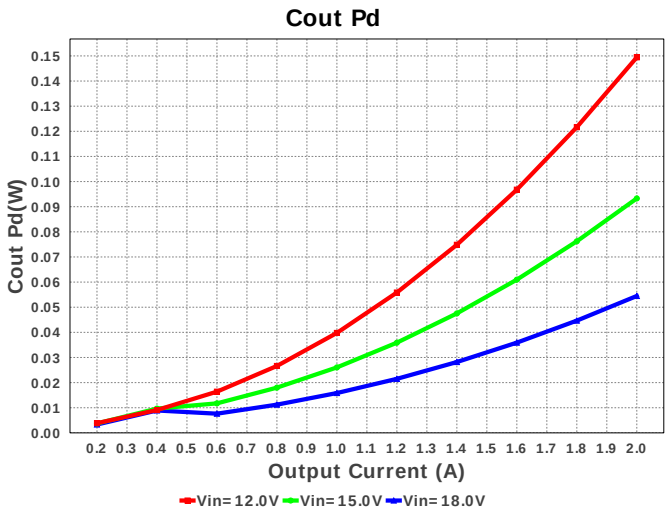


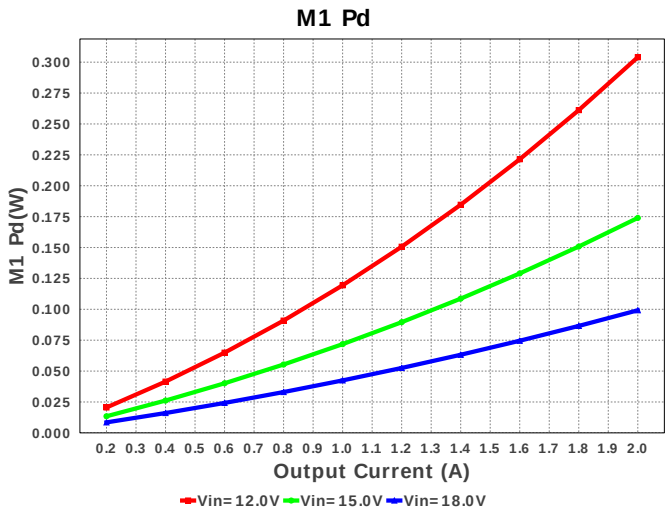
M1 PdCond

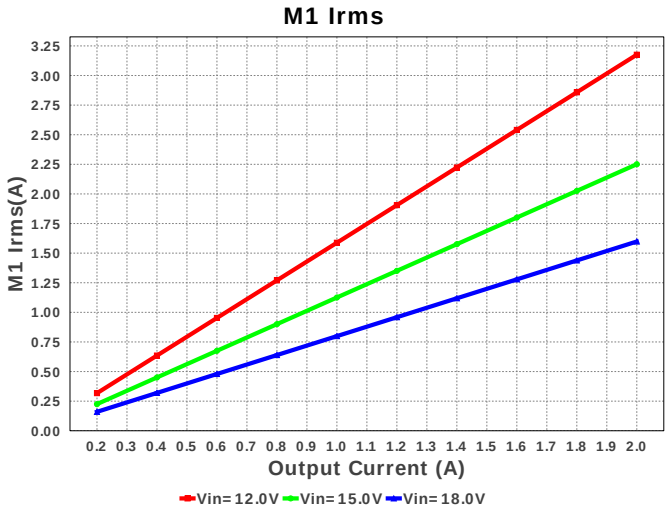


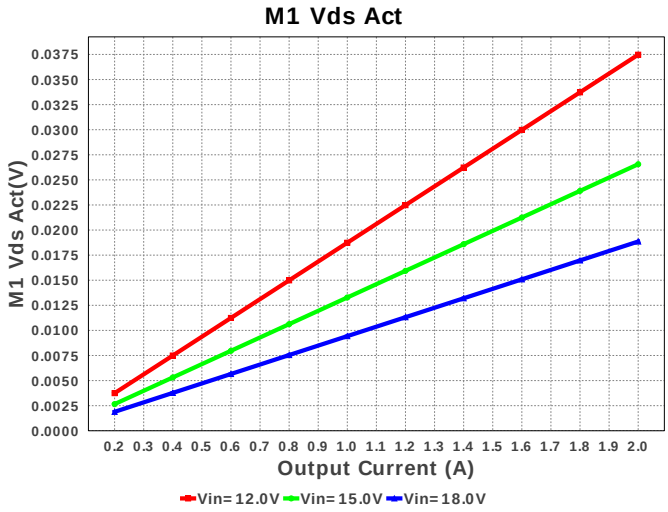
Cin Pd

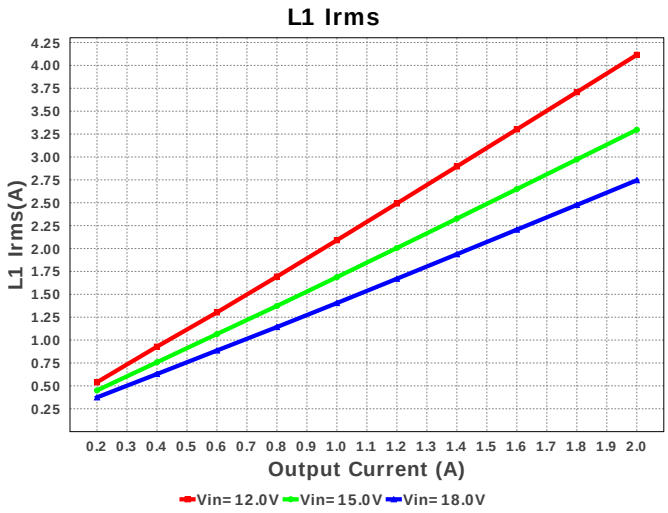


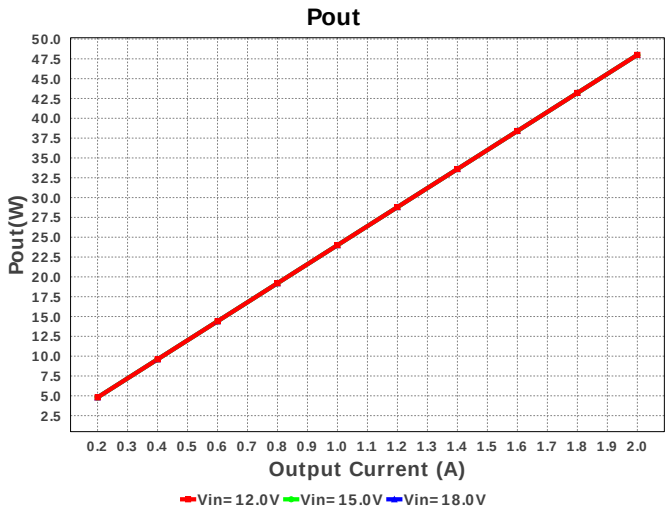


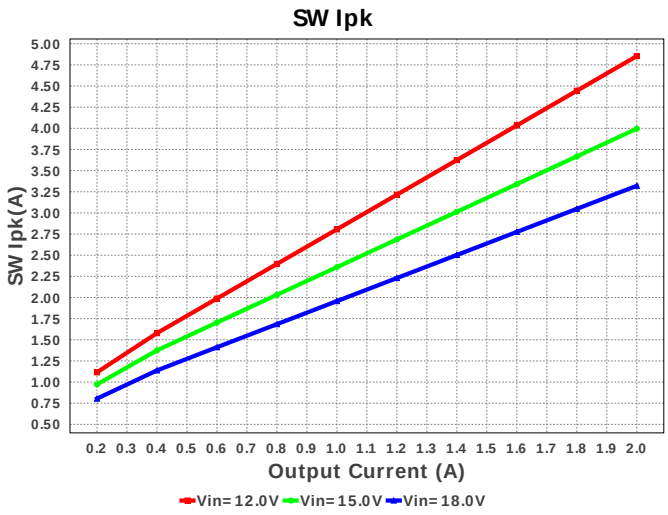


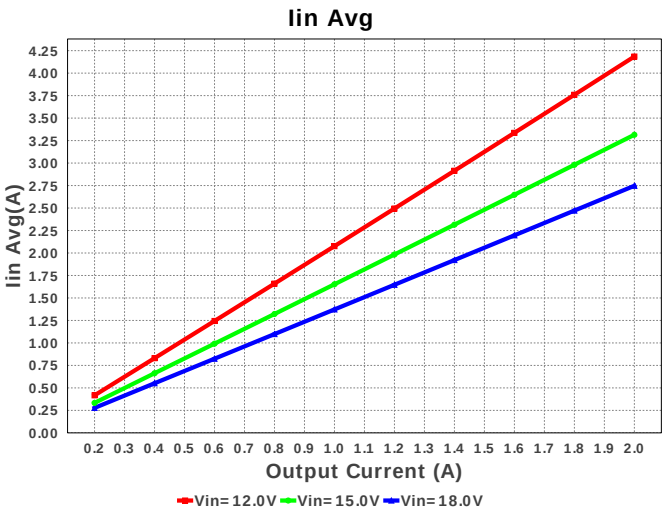


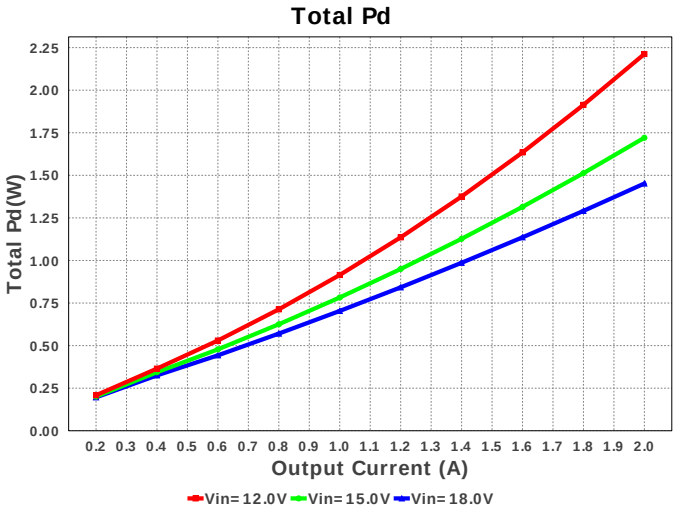


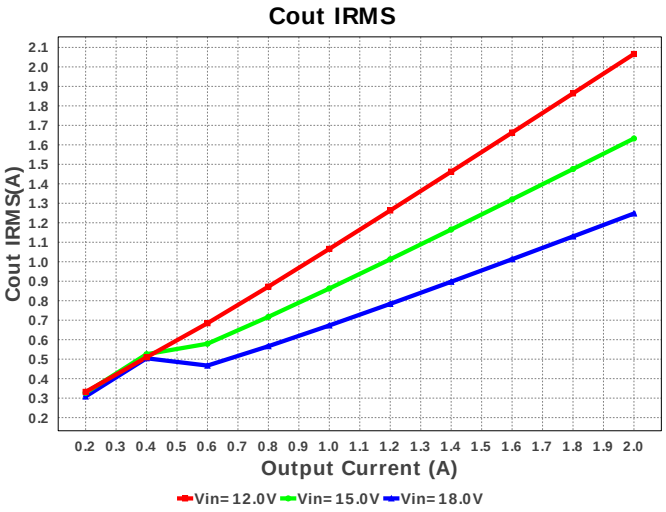


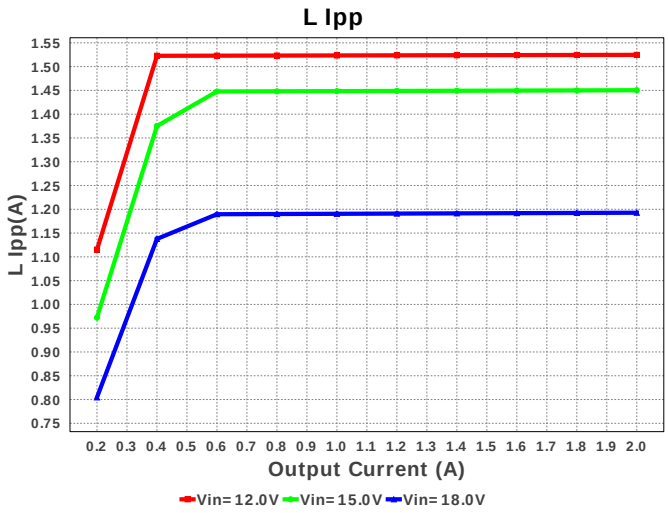


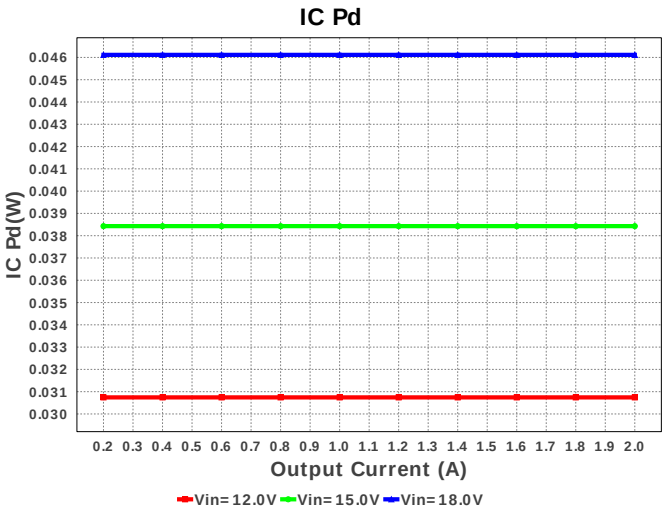


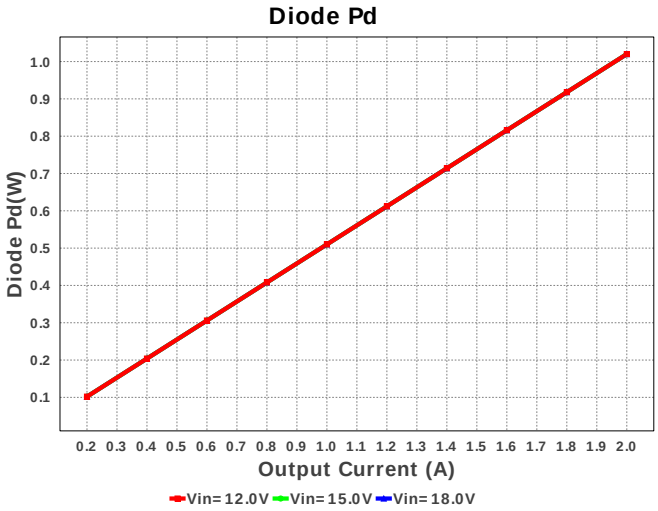


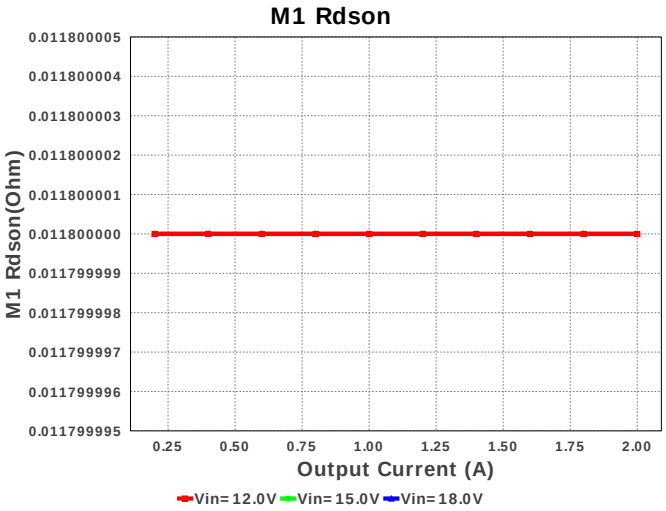


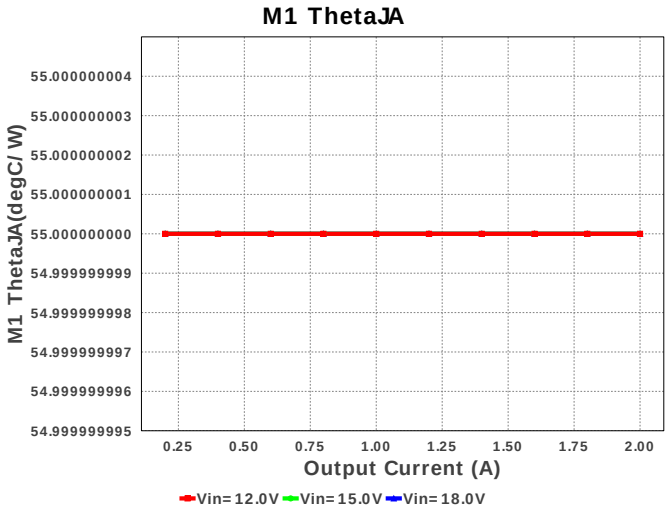


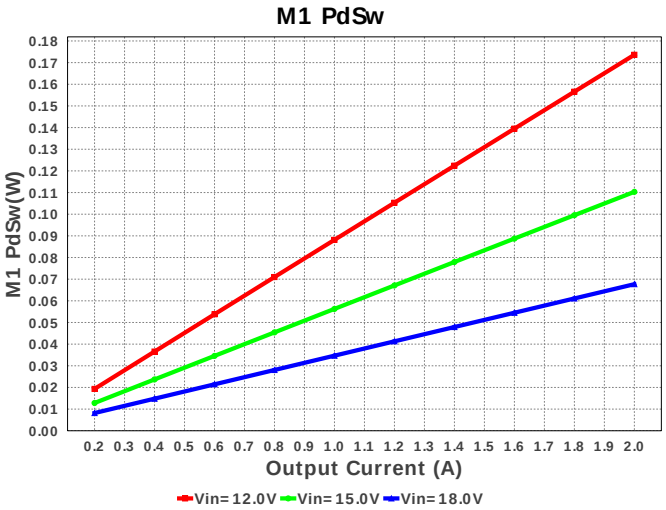


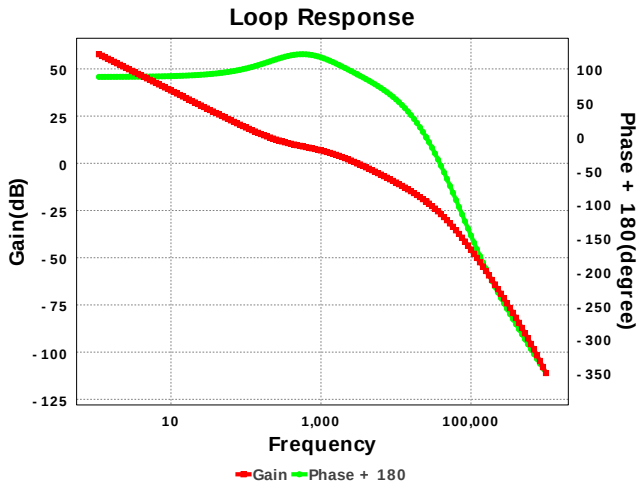












Operating Values

#	Name	Value	Category	Description
1.	Cin IRMS	442.732 mA	Current	Input capacitor RMS ripple current
2.	Cout IRMS	2.066 A	Current	Output capacitor RMS ripple current
3.	Iin Avg	4.194 A	Current	Average input current
4.	L Ipp	1.534 A	Current	Peak-to-peak inductor ripple current
5.	L1 Irms	4.115 A	Current	Inductor ripple current
6.	M1 Irms	3.176 A	Current	M1 MOSFET Irms
7.	SW Ipk	4.858 A	Current	Peak switch current
8.	BOM Count	22	General	Total Design BOM count
9.	FootPrint	687.0 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	11.8 mOhm	General	Drain-Source On-resistance
13.	M1 ThetaJA	55.0 degC/W	General	MOSFET junction-to-ambient thermal resistance
14.	Pout	48.0 W	General	Total output power
15.	Total BOM	$3.07	General	Total BOM Cost
16.	D1 Tj	111.6 degC	Op_Point	D1 junction temperature
17.	Low Freq Gain	54.071 dB	Op_Point	Gain at 10Hz
18.	Vout Actual	23.997 V	Op_Point	Vout Actual calculated based on selected voltage divider resistors
19.	Vout OP	24.0 V	Op_Point	Operational Output Voltage
20.	Cross Freq	1.807 kHz	Op_point	Bode plot crossover frequency
21.	Duty Cycle	52.5 %	Op_point	Duty cycle
22.	Efficiency	95.382 %	Op_point	Steady state efficiency
23.	Gain Marg	-21.506 dB	Op_point	Bode Plot Gain Margin
24.	IC Tj	39.166 degC	Op_point	IC junction temperature
25.	ICThetaJA	200.0 degC/W	Op_point	IC junction-to-ambient thermal resistance
26.	IOUT_OP	2.0 A	Op_point	Iout operating point
27.	M1 TjOP	51.55 degC	Op_point	M1 MOSFET junction temperature
28.	Phase Marg	106.464 deg	Op_point	Bode Plot Phase Margin
29.	VIN_OP	12.0 V	Op_point	Vin operating point
30.	Vout p-p	239.847 mV	Op_point	Peak-to-peak output ripple voltage
31.	Cin Pd	29.402 mW	Power	Input capacitor power dissipation
32.	Cout Pd	149.373 mW	Power	Output capacitor power dissipation
33.	Diode Pd	1.02 W	Power	Diode power dissipation
34.	IC Pd	45.828 mW	Power	IC power dissipation
35.	L Pd	199.175 mW	Power	Inductor power dissipation
36.	M1 Pd	391.812 mW	Power	M1 MOSFET total power dissipation
37.	M1 PdCond	132.9 mW	Power	M1 MOSFET conduction losses
38.	M1 PdSw	258.912 mW	Power	M1 MOSFET switching losses
39.	Rfb Pd	22.74 mW	Power	Rfb Power Dissipation
40.	Total Pd	2.324 W	Power	Total Power Dissipation
41.	M1 Vds Act	37.472 mV		M Vds
42.	Vout Tolerance	3.936 %		Vout Tolerance based on IC Tolerance (no load) and voltage divider resistors if applicable

Design Inputs

#	Name	Value	Description
1.	Iout	2.0	Maximum Output Current
2.	VinMax	18.0	Maximum input voltage
3.	VinMin	12.0	Minimum input voltage
4.	Vout	24.0	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.