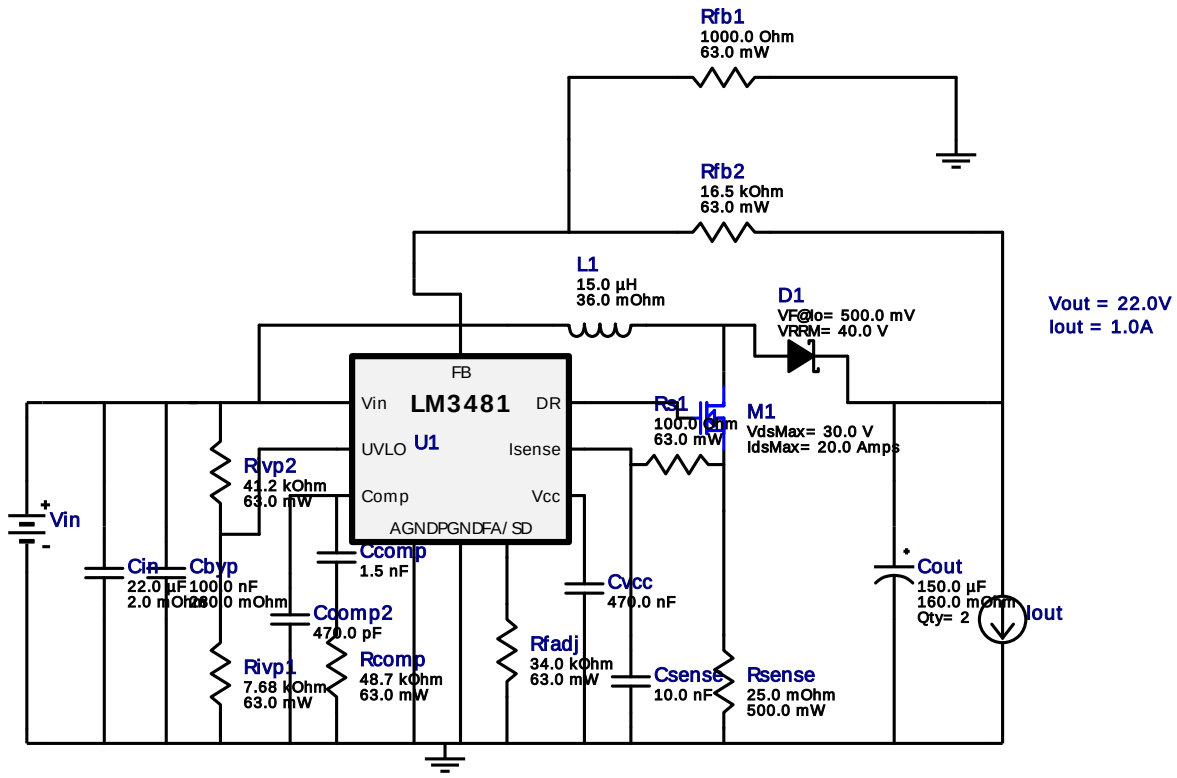
TEXAS INSTRUMENTS

WEBENCH® Design Report

VinMin = 10.0V
VinMax = 14.0V
Vout = 22.0V
Iout = 1.0A

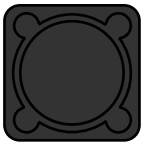
Device = LM3481MM/NOPB
Topology = Boost
Created = 7/15/16 8:15:13 PM
BOM Cost = $2.29
BOM Count = 20
Total Pd = 1.16W

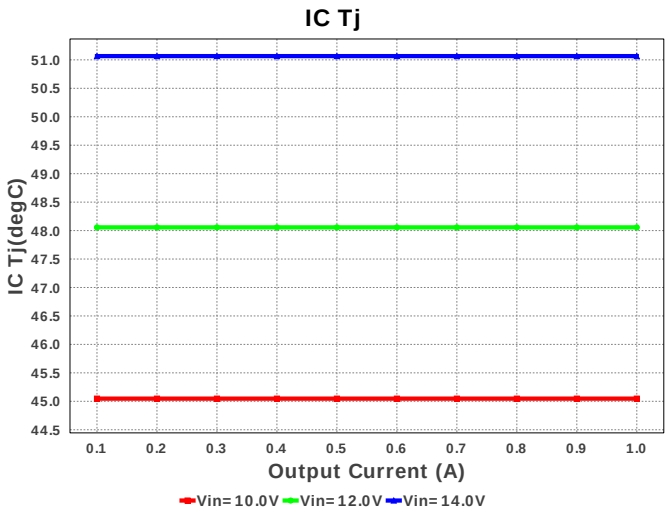
Design : 906020/2245 LM3481MM/NOPB
LM3481MM/NOPB 10.0V-14.0V to 22.00V @ 1.0A

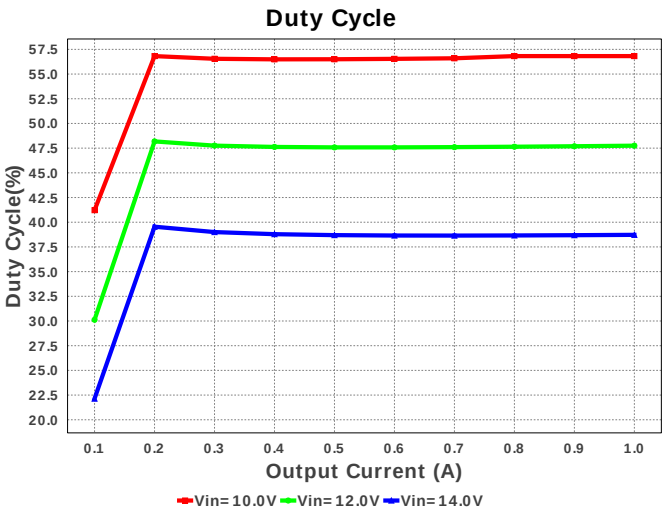


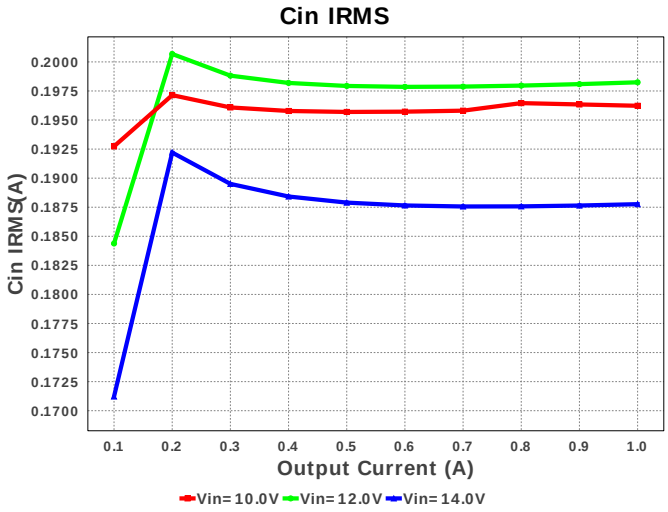
Electrical BOM

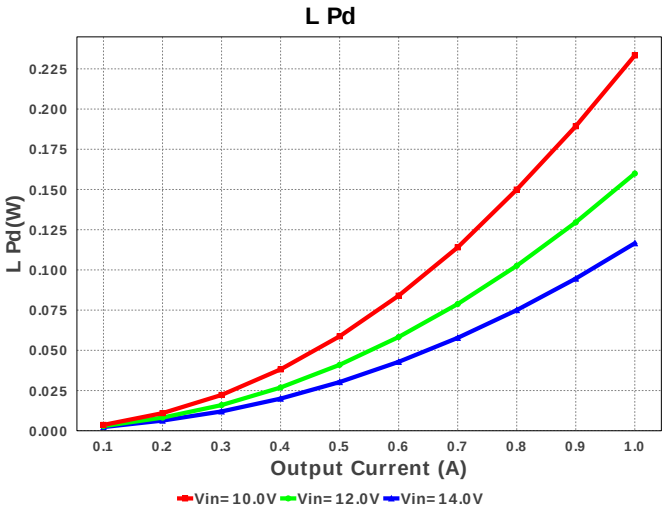
#	Name	Manufacturer	Part Number	Properties	Qty	Price	Footprint
1.	Cbyp	AVX	08053C104KAT2A Series= X7R	Cap= 100.0 nF ESR= 280.0 mOhm VDC= 25.0 V IRMS= 0.0 A	1	$0.01	0805 7 mm²
2.	Ccomp	Yageo America	CC0805KRX7R9BB152 Series= X7R	Cap= 1.5 nF VDC= 50.0 V IRMS= 0.0 A	1	$0.01	0805 7 mm²
3.	Ccomp2	Yageo America	CC0805KRX7R9BB471 Series= X7R	Cap= 470.0 pF VDC= 50.0 V IRMS= 0.0 A	1	$0.01	0805 7 mm²
4.	Cin	MuRata	GRM32ER61E226KE15L Series= X5R	Cap= 22.0 uF ESR= 2.0 mOhm VDC= 25.0 V IRMS= 3.67 A	1	$0.16	1210 15 mm²
5.	Cout	Panasonic	EEE-FK1V151P Series= FK	Cap= 150.0 uF ESR= 160.0 mOhm VDC= 35.0 V IRMS= 600.0 mA	2	$0.21	SM_RADIAL_F 124 mm²
6.	Csense	MuRata	GRM216R71H103KA01D Series= X7R	Cap= 10.0 nF VDC= 50.0 V IRMS= 0.0 A	1	$0.01	0805 7 mm²
7.	Cvcc	MuRata	GRM155C80J474KE19D Series= X6S	Cap= 470.0 nF VDC= 6.3 V IRMS= 0.0 A	1	$0.01	0402 3 mm²

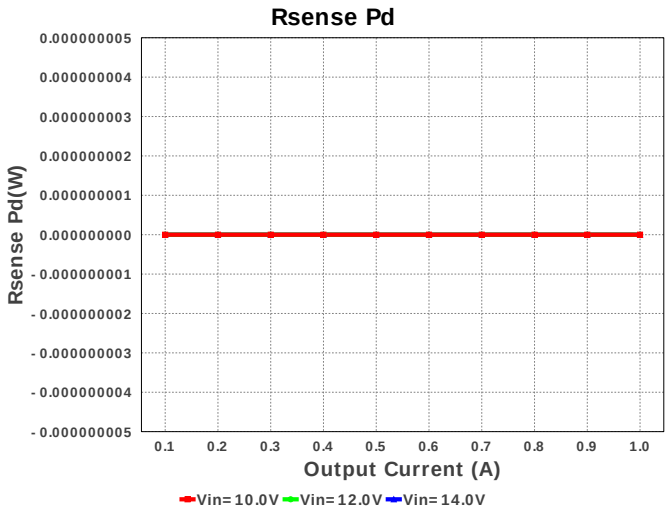
#	Name	Manufacturer	Part Number	Properties	Qty	Price	Footprint
8.	D1	Diodes Inc.	B240A-13-F	VF@Io= 500.0 mV VRRM= 40.0 V	1	$0.09	 SMA 37 mm^2
9.	L1	Bourns	SRR1208-150ML	L= 15.0 µH DCR= 36.0 mOhm	1	$0.37	 SRR1208 216 mm^2
10.	M1	Texas Instruments	CSD17579Q3A	VdsMax= 30.0 V IdsMax= 20.0 Amps	1	$0.23	 TRANS_NexFET_Q3A 18 mm^2
11.	Rcomp	Vishay-Dale	CRCW040248K7FKED Series= CRCW..e3	Res= 48.7 kOhm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	 0402 3 mm^2
12.	Rfadj	Vishay-Dale	CRCW040234K0FKED Series= CRCW..e3	Res= 34.0 kOhm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	 0402 3 mm^2
13.	Rfb1	Vishay-Dale	CRCW04021K00FKED Series= CRCW..e3	Res= 1000.0 Ohm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	 0402 3 mm^2
14.	Rfb2	Vishay-Dale	CRCW040216K5FKED Series= CRCW..e3	Res= 16.5 kOhm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	 0402 3 mm^2
15.	Rivp1	Vishay-Dale	CRCW04027K68FKED Series= CRCW..e3	Res= 7.68 kOhm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	 0402 3 mm^2
16.	Rivp2	Vishay-Dale	CRCW040241K2FKED Series= CRCW..e3	Res= 41.2 kOhm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	 0402 3 mm^2
17.	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
18.	Rsense	Stackpole Electronics Inc	CSR1206FK25L0 Series= ?	Res= 25.0 mOhm Power= 500.0 mW Tolerance= 1.0%	1	$0.10	 1206 11 mm^2
19.	U1	Texas Instruments	LM3481MM/NOPB	Switcher	1	$0.80	 MUB10A 24 mm^2

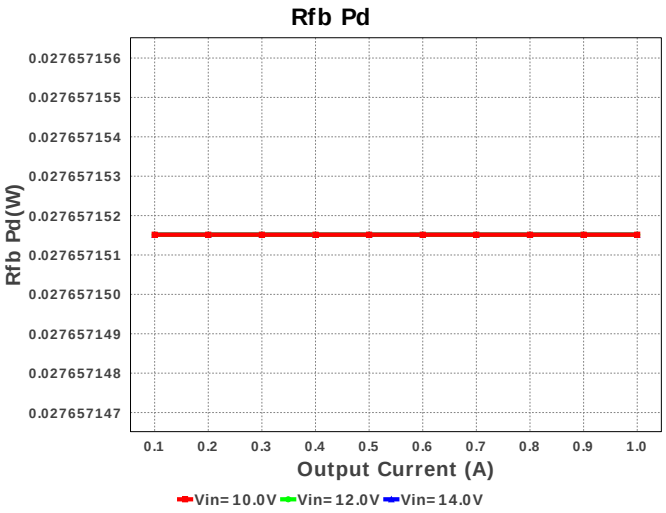




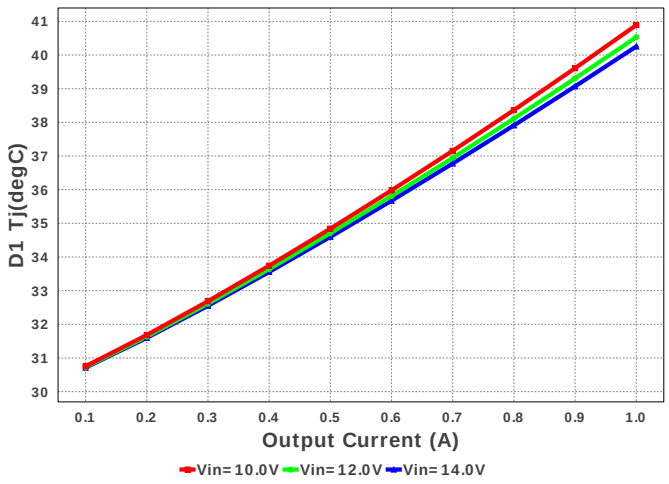




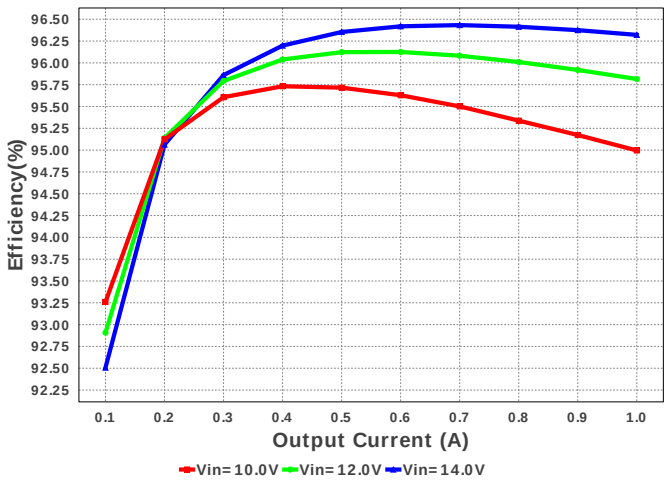




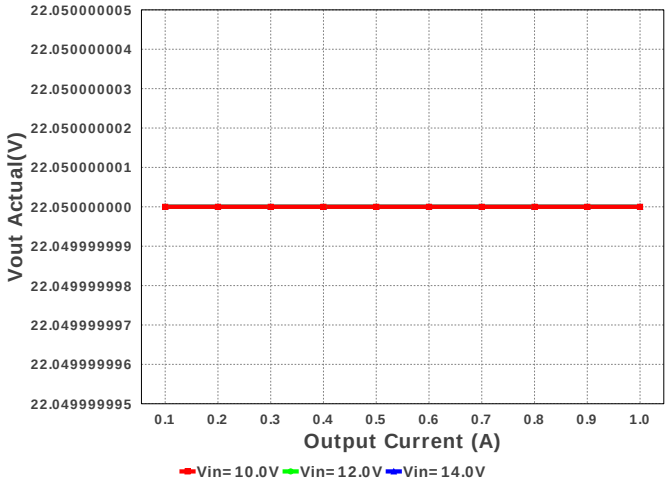
D1 Tj



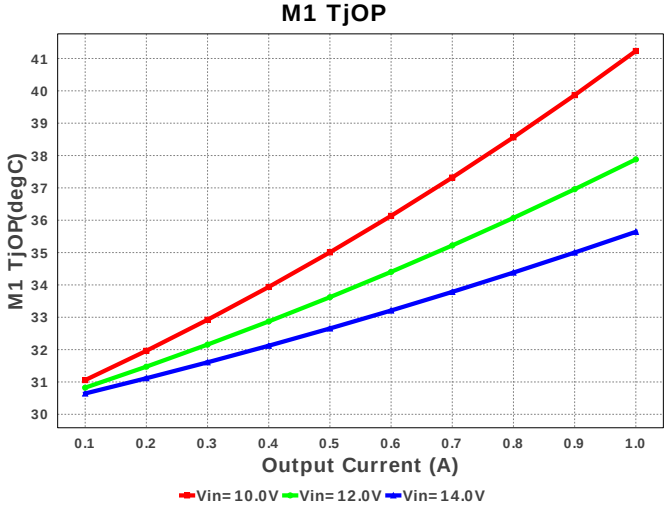
Efficiency



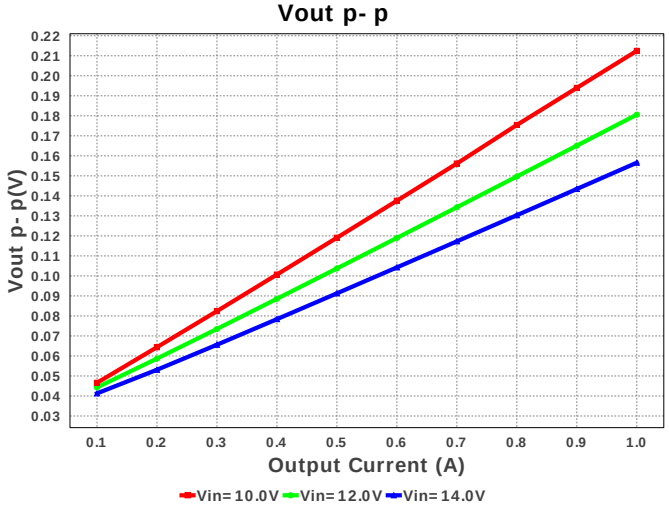
Vout Actual



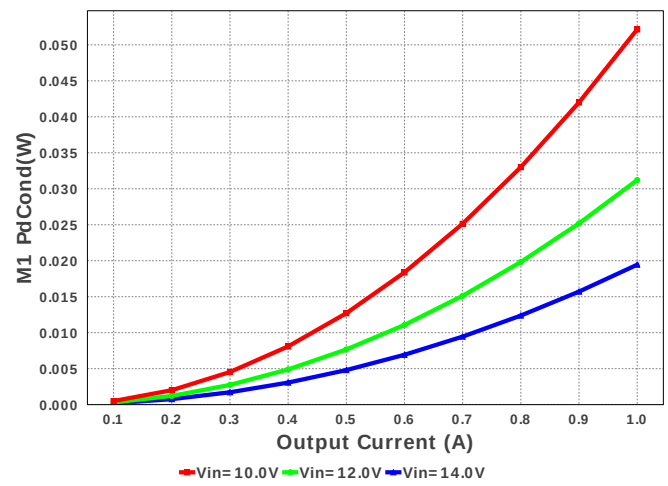
M1 TjOP

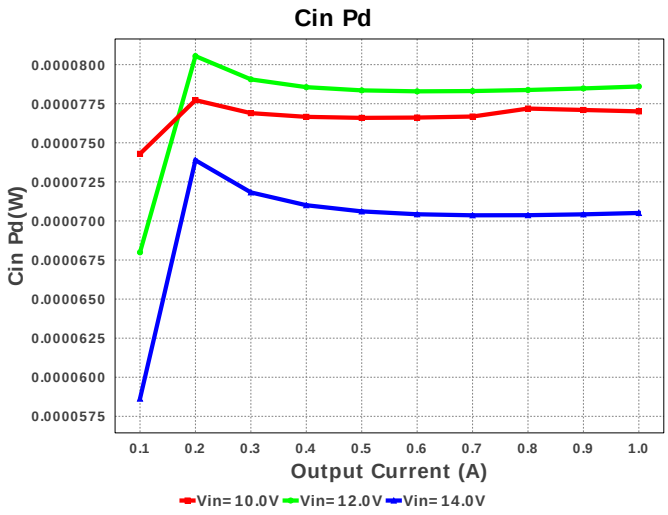


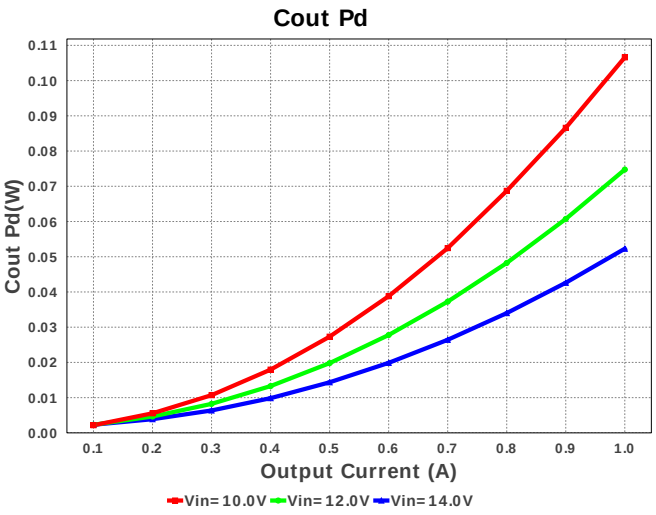
Vout p- p

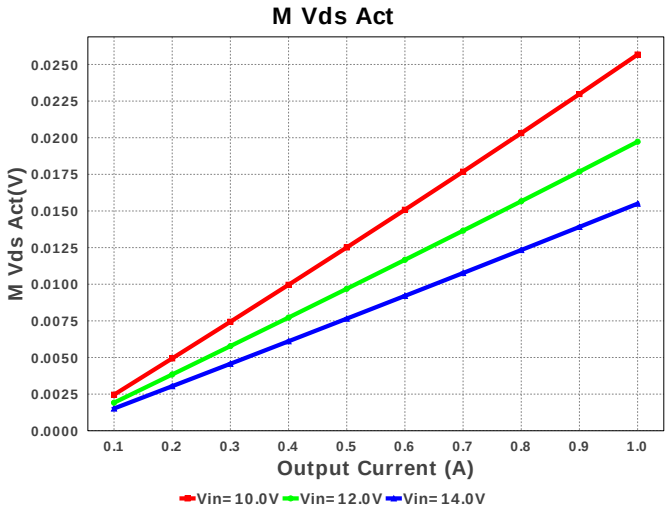


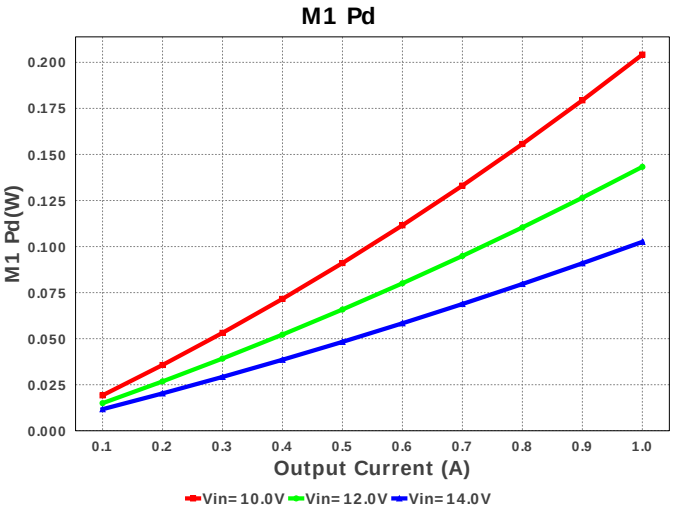
M1 PdCond

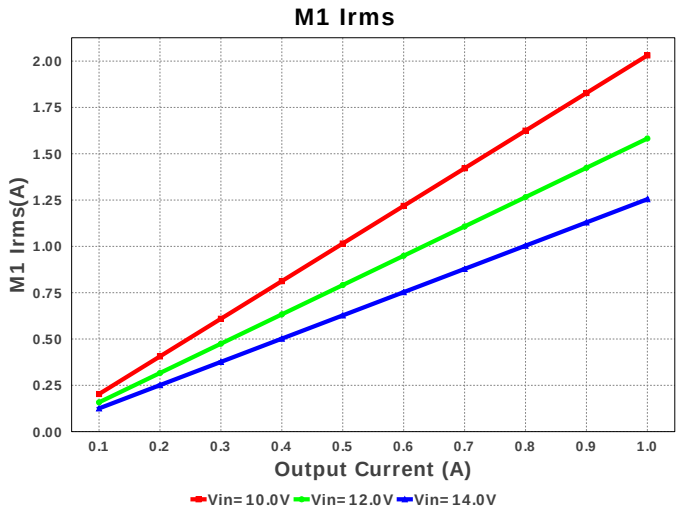


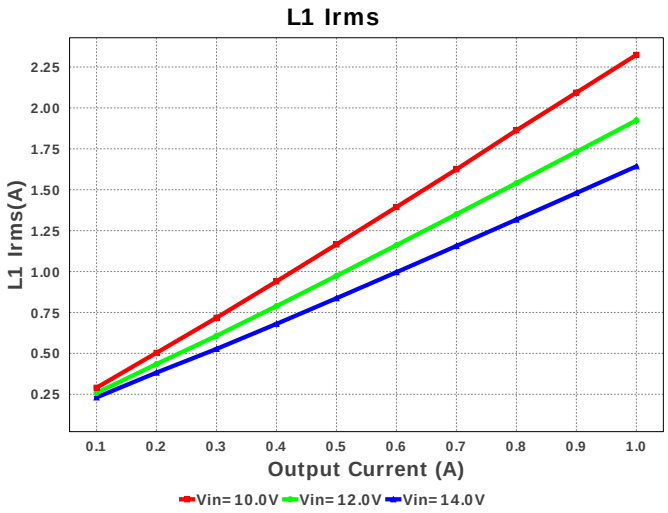


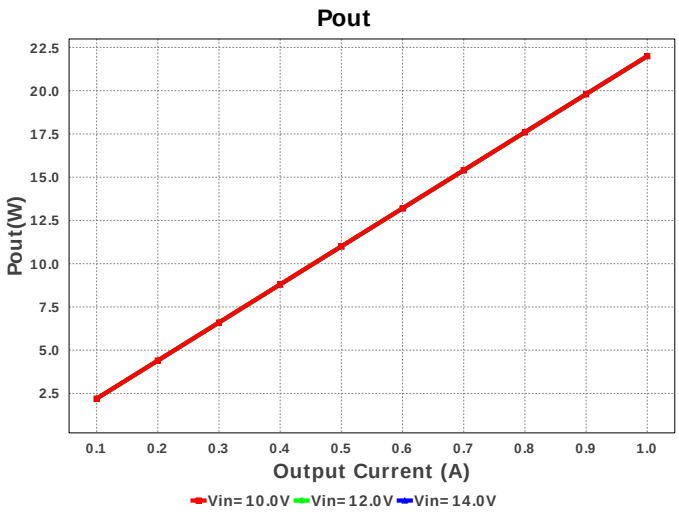


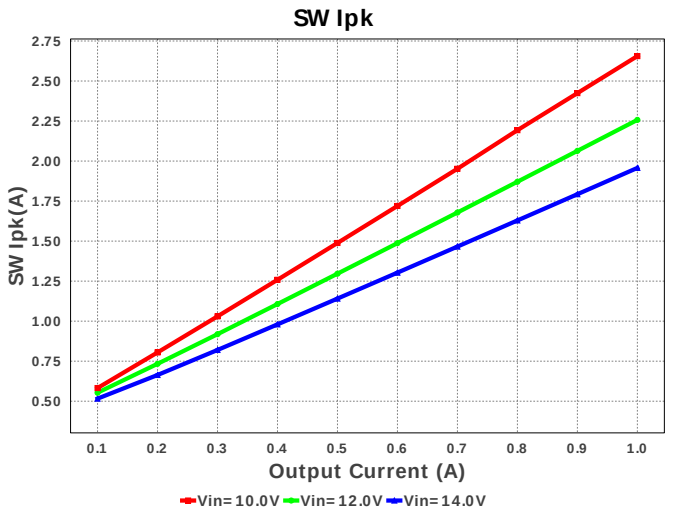


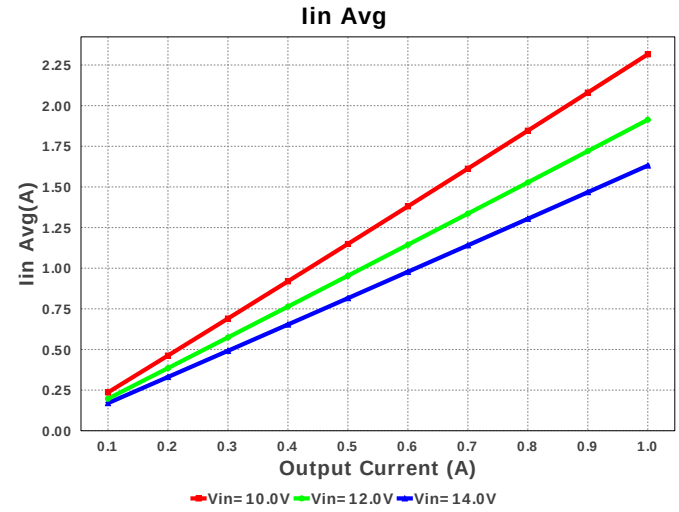


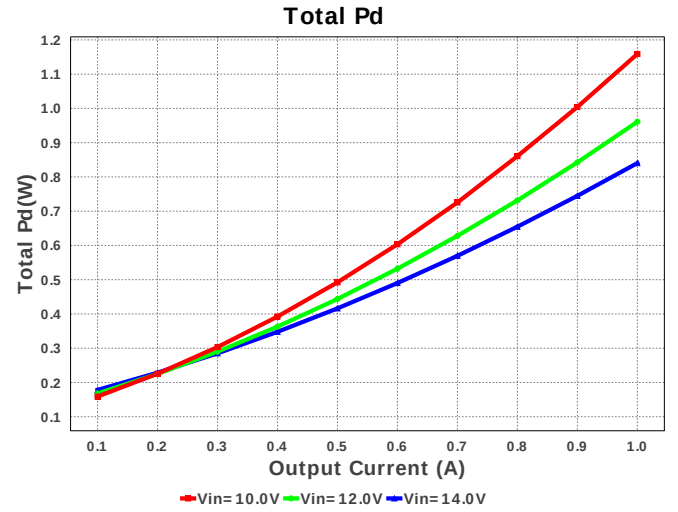


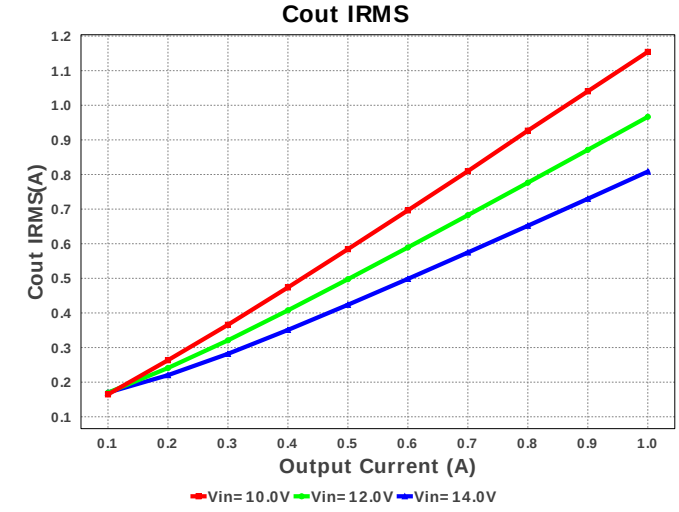


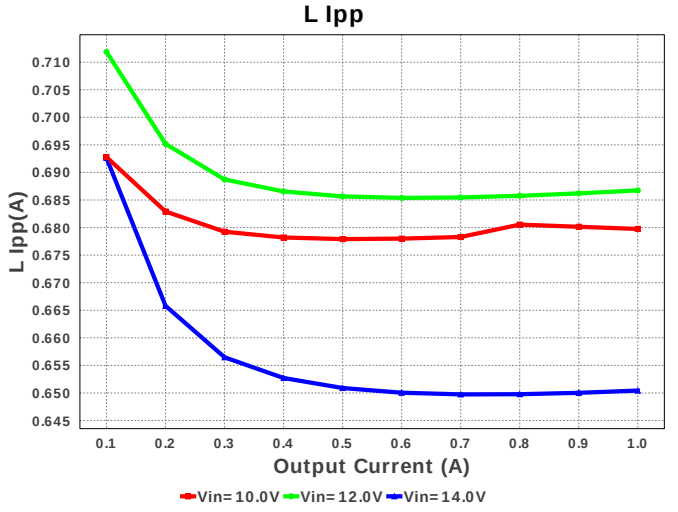


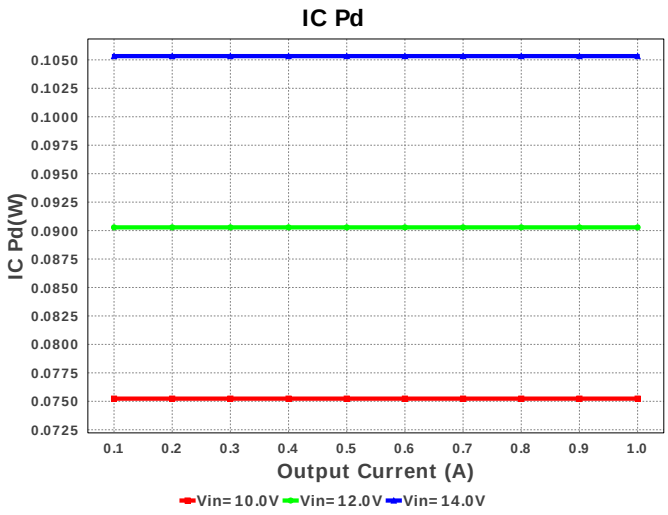


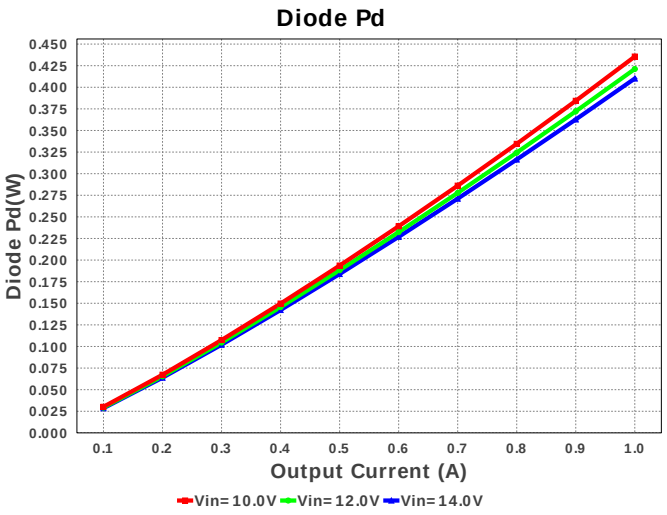


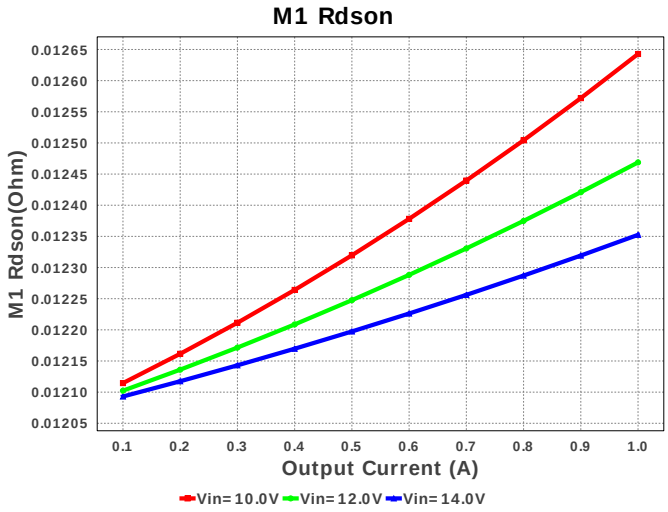


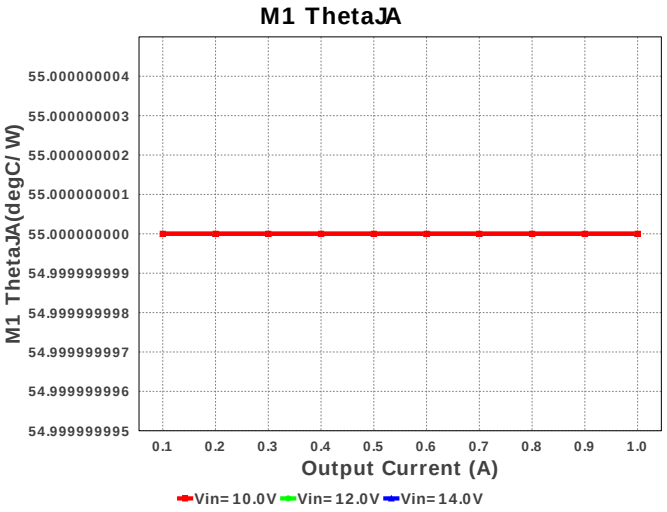


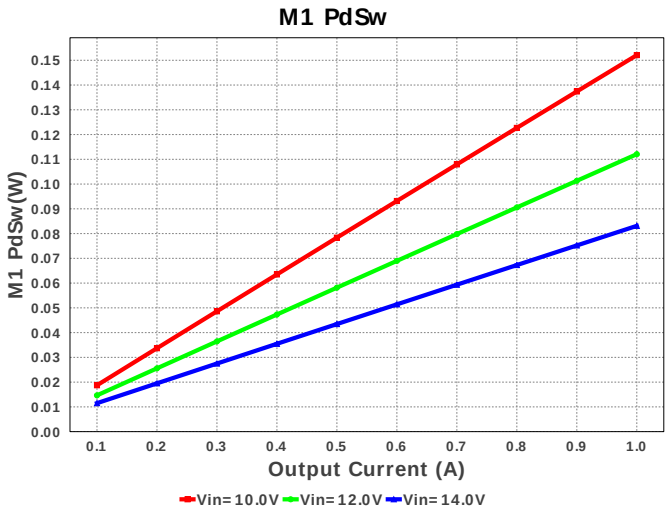


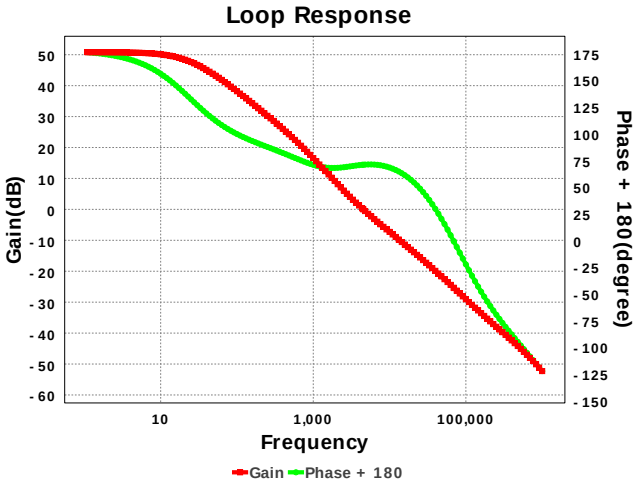












Operating Values

#	Name	Value	Category	Description
1.	Cin IRMS	196.226 mA	Current	Input capacitor RMS ripple current
2.	Cout IRMS	1.154 A	Current	Output capacitor RMS ripple current
3.	Iin Avg	2.316 A	Current	Average input current
4.	L Ipp	679.75 mA	Current	Peak-to-peak inductor ripple current
5.	L1 Irms	2.324 A	Current	Inductor ripple current
6.	M1 Irms	2.031 A	Current	M1 MOSFET Irms
7.	SW Ipk	2.656 A	Current	Peak switch current
8.	BOM Count	20	General	Total Design BOM count
9.	FootPrint	619.0 mm^2	General	Total Foot Print Area of BOM components
10.	Frequency	554.021 kHz	General	Switching frequency
11.	IC Tolerance	19.0 mV	General	IC Feedback Tolerance

#	Name	Value	Category	Description
12.	M Vds Act	25.669 mV	General	M Vds
13.	M1 Rdson	12.64 mOhm	General	Drain-Source On-resistance
14.	M1 ThetaJA	55.0 degC/W	General	MOSFET junction-to-ambient thermal resistance
15.	Pout	22.0 W	General	Total output power
16.	Total BOM	$2.29	General	Total BOM Cost
17.	D1 Tj	40.889 degC	Op_Point	D1 junction temperature
18.	Low Freq Gain	47.769 dB	Op_Point	Gain at 10Hz
19.	Vout Actual	22.05 V	Op_Point	Vout Actual calculated based on selected voltage divider resistors
20.	Vout OP	22.0 V	Op_Point	Operational Output Voltage
21.	Cross Freq	3.349 kHz	Op_point	Bode plot crossover frequency
22.	Duty Cycle	56.818 %	Op_point	Duty cycle
23.	Efficiency	95.002 %	Op_point	Steady state efficiency
24.	Gain Marg	-22.652 dB	Op_point	Bode Plot Gain Margin
25.	IC Tj	44.996 degC	Op_point	IC junction temperature
26.	ICThetaJA	200.0 degC/W	Op_point	IC junction-to-ambient thermal resistance
27.	IOUT_OP	1.0 A	Op_point	Iout operating point
28.	M1 TjOP	41.171 degC	Op_point	M1 MOSFET junction temperature
29.	Phase Marg	69.116 deg	Op_point	Bode Plot Phase Margin
30.	VIN_OP	10.0 V	Op_point	Vin operating point
31.	Vout p-p	212.453 mV	Op_point	Peak-to-peak output ripple voltage
32.	Cin Pd	77.01 µW	Power	Input capacitor power dissipation
33.	Cout Pd	106.593 mW	Power	Output capacitor power dissipation
34.	Diode Pd	435.56 mW	Power	Diode power dissipation
35.	IC Pd	74.98 mW	Power	IC power dissipation
36.	L Pd	233.34 mW	Power	Inductor power dissipation
37.	M1 Pd	203.102 mW	Power	M1 MOSFET total power dissipation
38.	M1 PdCond	52.131 mW	Power	M1 MOSFET conduction losses
39.	M1 PdSw	150.971 mW	Power	M1 MOSFET switching losses
40.	Rfb Pd	27.657 mW	Power	Rfb Power Dissipation
41.	Rsense Pd	126.174 mW	Power	Rsense Power Dissipation
42.	Total Pd	1.157 W	Power	Total Power Dissipation
43.	Vout Tolerance	3.441 %		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	14.0	Maximum input voltage
3.	VinMin	10.0	Minimum input voltage
4.	Vout	22.0	Output Voltage
5.	base_pn	LM3481	Texas Instruments Base Part Number
6.	source	DC	Input Source Type
7.	ta	30.0	Ambient temperature

Design Assistance

1. LM3481 Product Folder : http://www.ti.com/product/LM3481 : contains the data sheet and other resources.