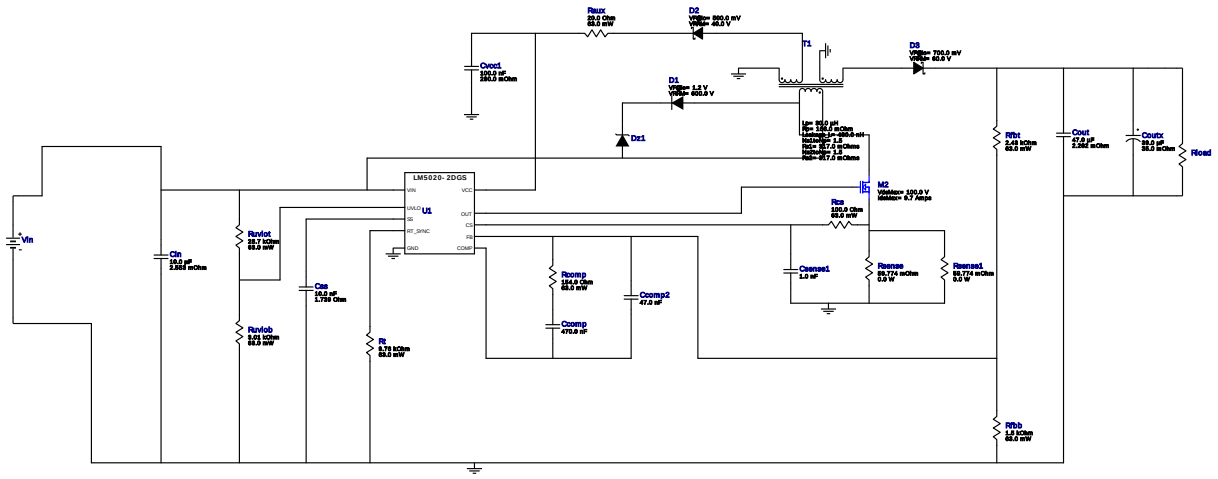
TEXAS INSTRUMENTS

WEBENCH® Design Report

VinMin = 14.0V
VinMax = 22.0V
Vout = 3.3V
Iout = 2.0A

Device = LM5020MM-2/NOPB
Topology = Flyback
Created = 7/13/16 1:01:10 AM
BOM Cost = $0.00
BOM Count = 25
Total Pd = 5.17W

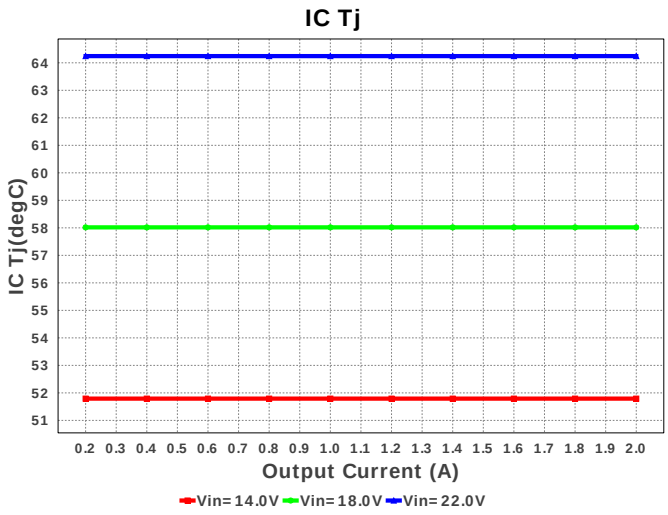
Design : 4738744/6 LM5020MM-2/NOPB
LM5020MM-2/NOPB 14.0V-22.0V to 3.30V @ 2.0A

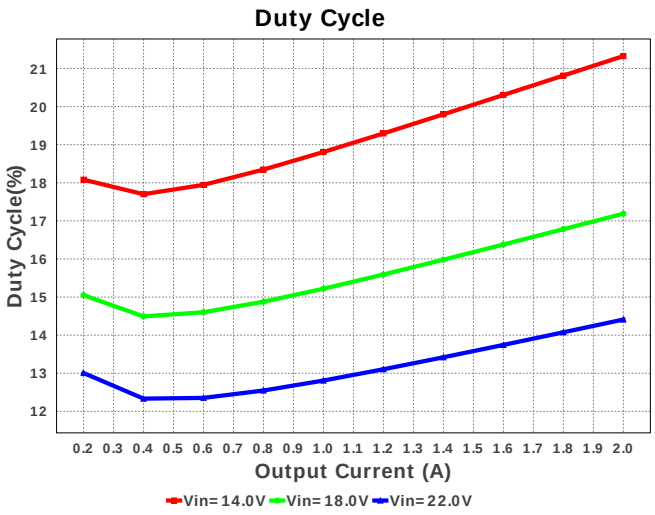


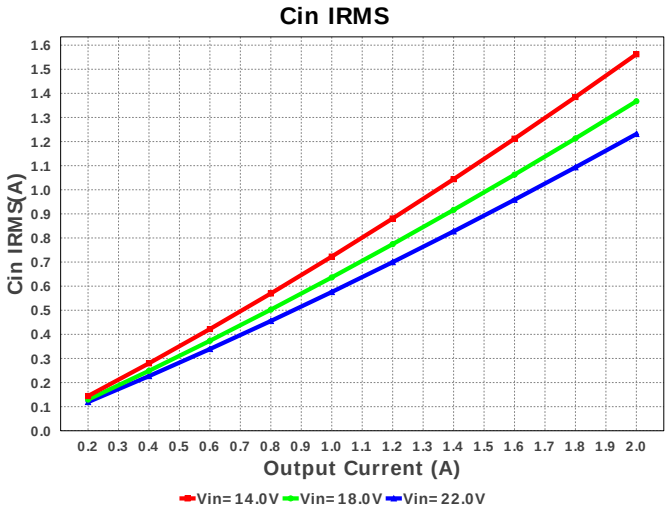
Electrical BOM

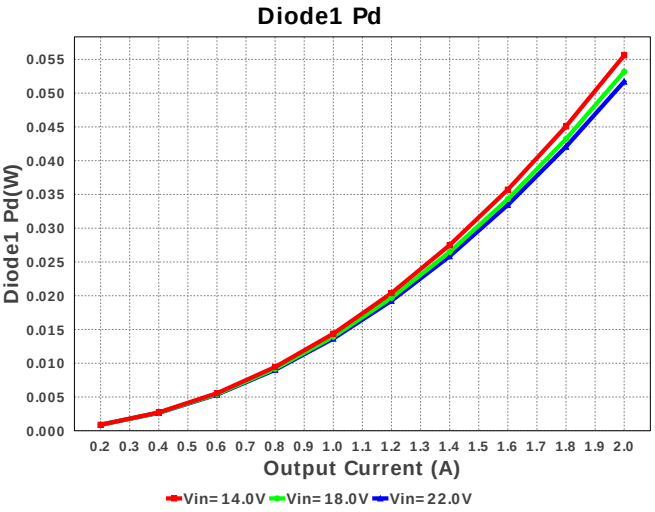
#	Name	Manufacturer	Part Number	Properties	Qty	Price	Footprint
1.	Ccomp	MuRata	GRM155C80J474KE19D Series= X6S	Cap= 470.0 nF VDC= 6.3 V IRMS= 0.0 A	1	$0.01	0402 3 mm²
2.	Ccomp2	Taiyo Yuden	TMK212B7473KD-T Series= X7R	Cap= 47.0 nF VDC= 25.0 V IRMS= 0.0 A	1	$0.01	0805 7 mm²
3.	Cin	TDK	C3216X6S1E106K Series= X6S	Cap= 10.0 uF ESR= 2.553 mOhm VDC= 25.0 V IRMS= 0.0 A	1	$0.12	1206 11 mm²
4.	Cout	TDK	C3225X6S0J476M Series= X6S	Cap= 47.0 uF ESR= 2.282 mOhm VDC= 6.3 V IRMS= 0.0 A	1	$0.15	1210 15 mm²
5.	Coutx	Panasonic	16SVPC39M Series= SVPC	Cap= 39.0 uF ESR= 35.0 mOhm VDC= 16.0 V IRMS= 1.82 A	1	$0.49	SM_RADIAL_5MM 58 mm²
6.	Csense1	MuRata	GRM033R71C102KA01D Series= X7R	Cap= 1.0 nF VDC= 16.0 V IRMS= 0.0 A	1	$0.01	0201 2 mm²
7.	Css	Kemet	C0805C103K5RACTU Series= X7R	Cap= 10.0 nF ESR= 1.739 Ohm VDC= 50.0 V IRMS= 411.0 mA	1	$0.01	0805 7 mm²
8.	Cvcc1	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
9.	D1	Bourns	CD214B-F3600	VF@Io= 1.2 V VRRM= 600.0 V	1	$0.14	SMB 44 mm²

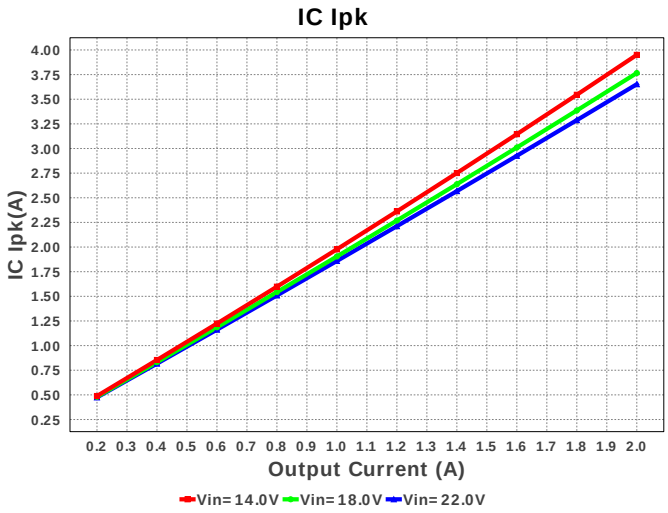
#	Name	Manufacturer	Part Number	Properties	Qty	Price	Footprint
10.	D2	Vishay-Semiconductor	SS14-E3/61T	VF@Io= 500.0 mV VRRM= 40.0 V	1	$0.08	 SMA 37 mm^2
11.	D3	Diodes Inc.	B560C-13-F	VF@Io= 700.0 mV VRRM= 60.0 V	1	$0.17	 SMC 83 mm^2
12.	Dz1	NXP Semiconductor	BZX585-C22,115	Zener	1	$0.02	 SOD-523 5 mm^2
13.	M2	Texas Instruments	CSD19537Q3	VdsMax= 100.0 V IdsMax= 9.7 Amps	1	$0.75	 TRANS_NexFET_Q3 18 mm^2
14.	Raux	Vishay-Dale	CRCW040220R0FKED Series= CRCW..e3	Res= 20.0 Ohm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	 0402 3 mm^2
15.	Rcomp	Vishay-Dale	CRCW0402154RFKED Series= CRCW..e3	Res= 154.0 Ohm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	 0402 3 mm^2
16.	Rcs	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.	Rfbb	Vishay-Dale	CRCW04021K50FKED Series= CRCW..e3	Res= 1.5 kOhm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	 0402 3 mm^2
18.	Rfbt	Vishay-Dale	CRCW04022K43FKED Series= CRCW..e3	Res= 2.43 kOhm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	 0402 3 mm^2
19.	Rsense	CUSTOM	CUSTOM Series= ?	Res= 59.774 mOhm Power= 0.0 W Tolerance= 0.0%	1	NA	CUSTOM 0 mm^2
20.	Rsense1	CUSTOM	CUSTOM Series= ?	Res= 59.774 mOhm Power= 0.0 W Tolerance= 0.0%	1	NA	CUSTOM 0 mm^2
21.	Rt	Vishay-Dale	CRCW04029K76FKED Series= CRCW..e3	Res= 9.76 kOhm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	 0402 3 mm^2
22.	Ruvlob	Vishay-Dale	CRCW04023K01FKED Series= CRCW..e3	Res= 3.01 kOhm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	 0402 3 mm^2
23.	Ruvlot	Vishay-Dale	CRCW040228K7FKED Series= CRCW..e3	Res= 28.7 kOhm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	 0402 3 mm^2
24.	T1	Wurth Elektronik	750315249	Lp= 30.0 µH Rp= 166.0 mOhm Leakage_L= 480.0 nH Ns1toNp= 1.5 Rs1= 317.0 mOhms Ns2toNp= 1.5 Rs2= 317.0 mOhms	1	NA	Wurth_750315249 0 mm^2
25.	U1	Texas Instruments	LM5020MM-2/NOPB	Switcher	1	$0.80	mpds035b 35 mm^2

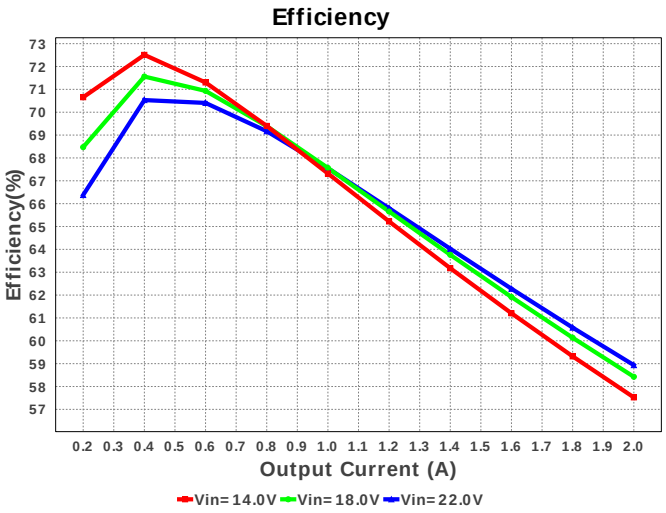


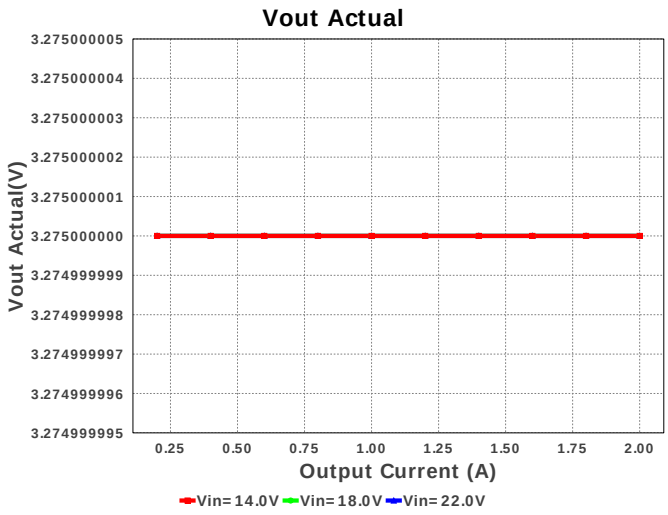


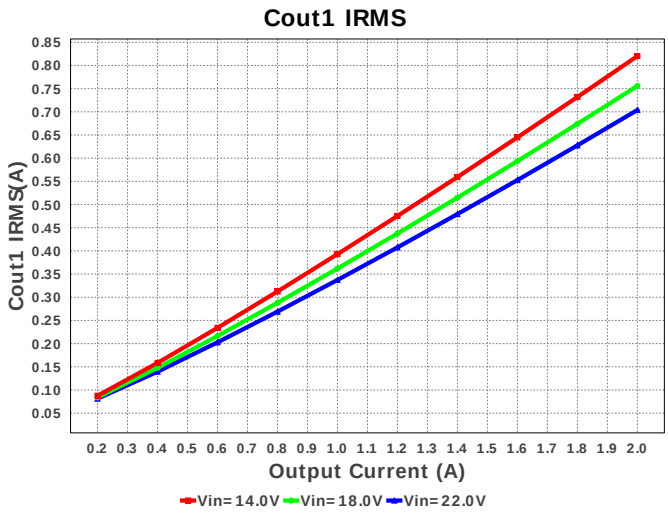


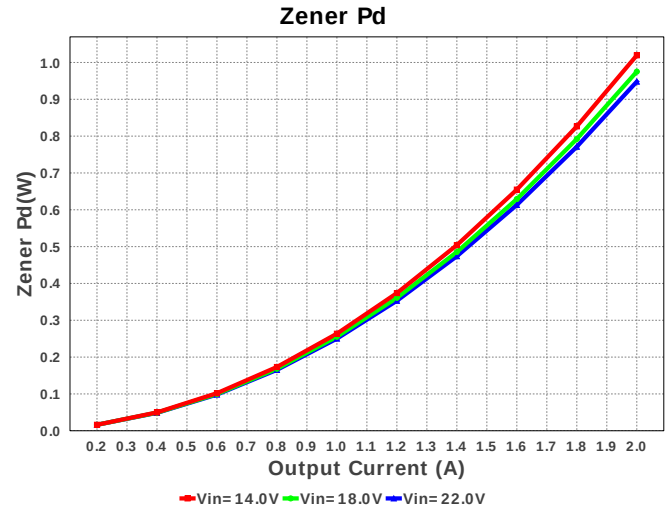


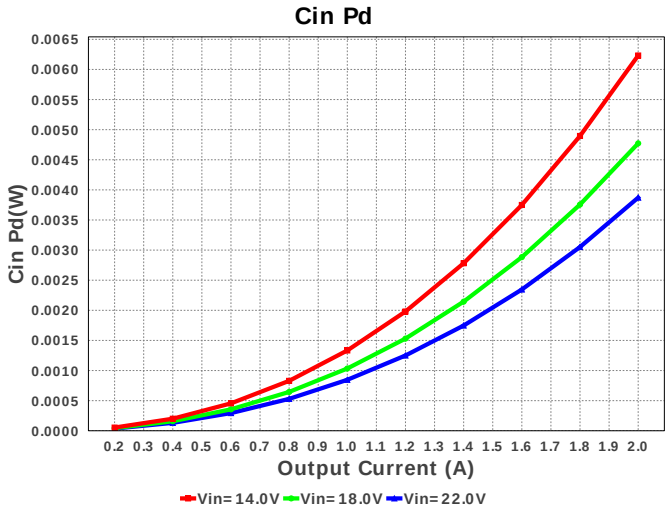


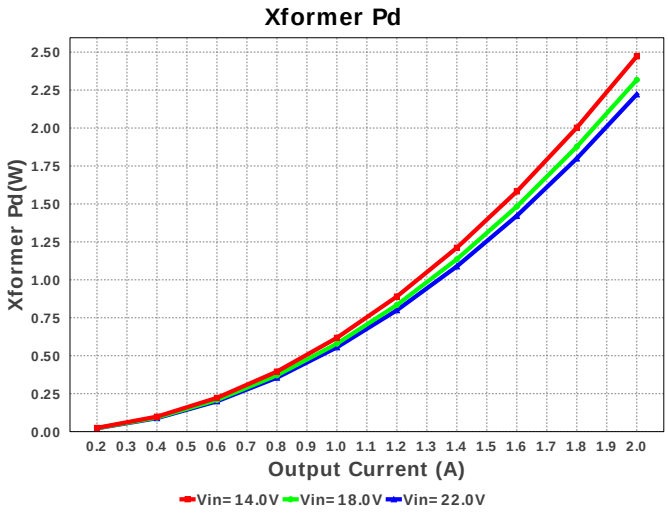


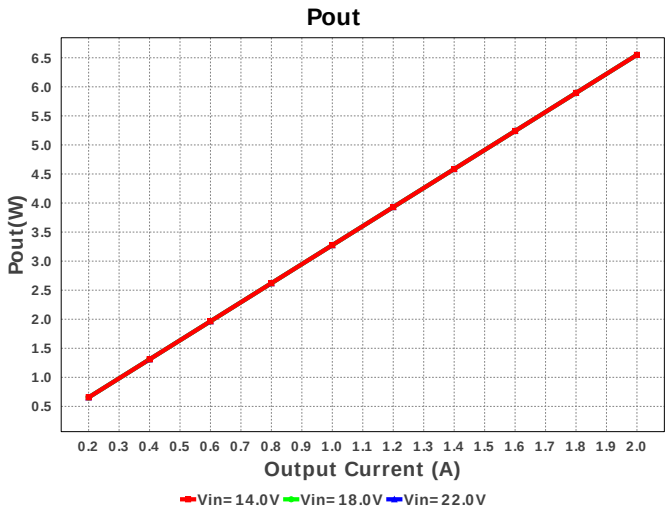


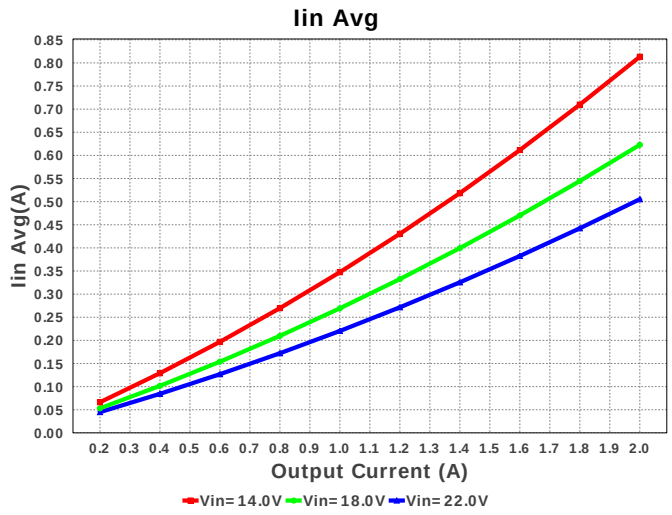


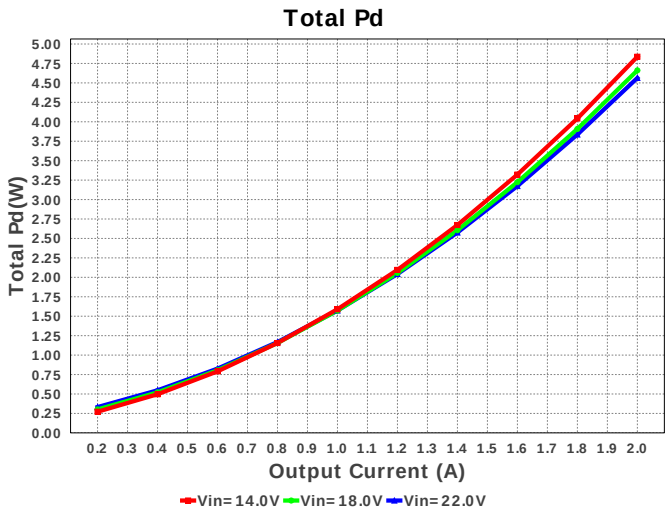


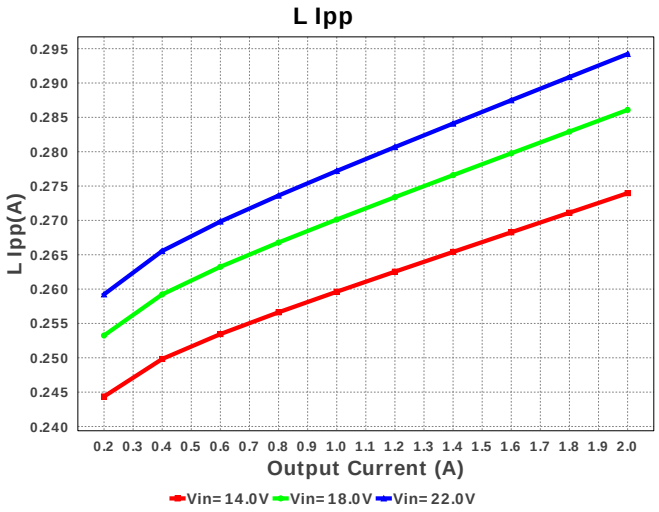


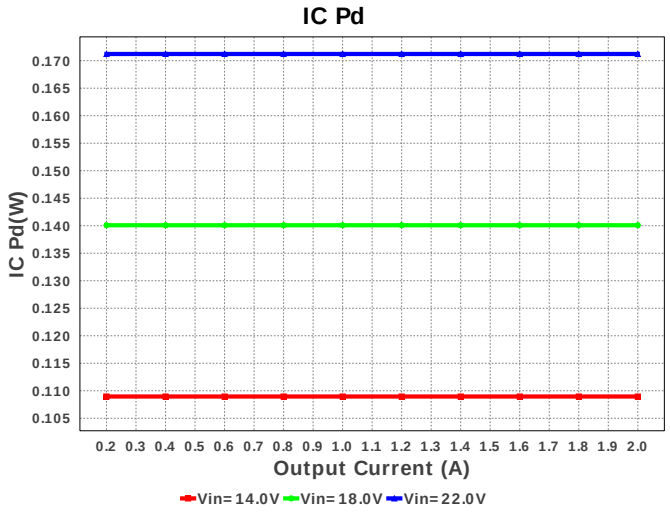


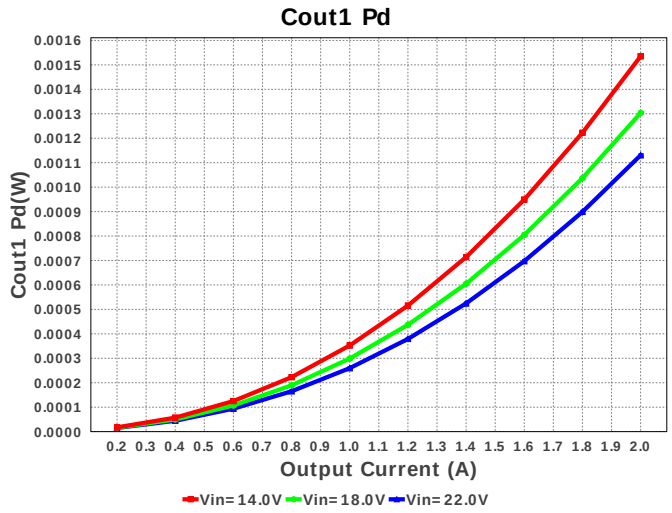


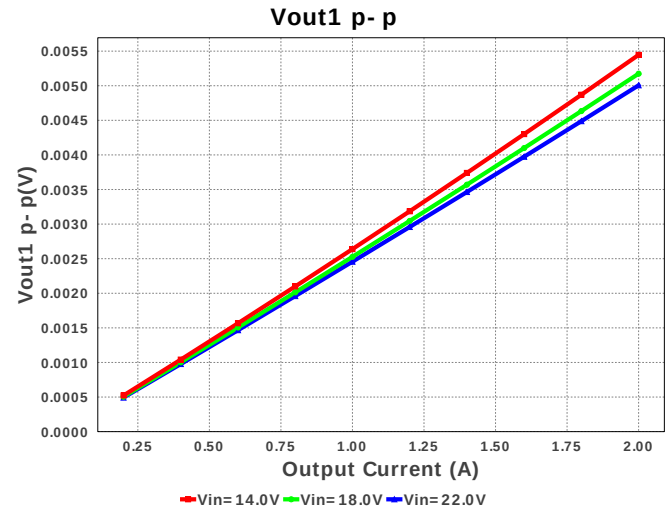


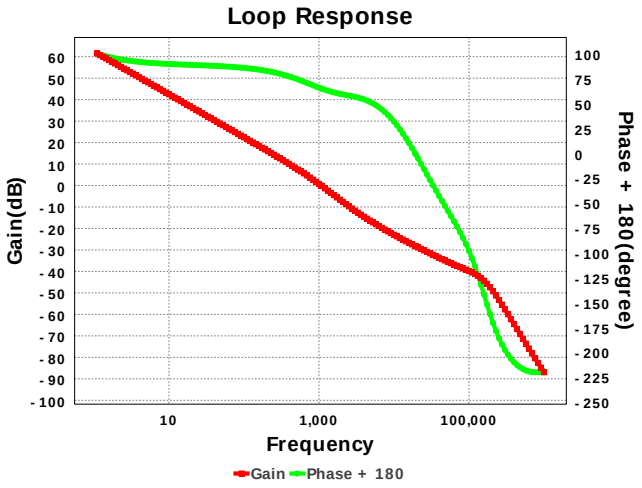












Operating Values

#	Name	Value	Category	Description
1.	Cin IRMS	1.585 A	Current	Input capacitor RMS ripple current
2.	Cout1 IRMS	1.207 A	Current	Output capacitor1 RMS ripple current
3.	IC Ipk	3.973 A	Current	Peak switch current
4.	Iin Avg	836.81 mA	Current	Average input current
5.	L Ipp	271.92 mA	Current	Peak-to-peak inductor ripple current
6.	BOM Count	25	General	Total Design BOM count
7.	FootPrint	372.0 mm^2	General	Total Foot Print Area of BOM components
8.	Frequency	325.0 kHz	General	Switching frequency
9.	IC Tolerance	25.0 mV	General	IC Feedback Tolerance
10.	Pout	6.55 W	General	Total output power
11.	Total BOM	$0.0	General	Total BOM Cost
12.	Low Freq Gain	60.713 dB	Op_Point	Gain at 10Hz
13.	Vout Actual	3.275 V	Op_Point	Vout Actual calculated based on selected voltage divider resistors
14.	Cross Freq	998.203 Hz	Op_point	Bode plot crossover frequency
15.	Duty Cycle	21.806 %	Op_point	Duty cycle
16.	Efficiency	55.91 %	Op_point	Steady state efficiency
17.	Gain Marg	-24.13 dB	Op_point	Bode Plot Gain Margin
18.	IC Tj	51.843 degC	Op_point	IC junction temperature
19.	ICThetaJA	200.0 degC/W	Op_point	IC junction-to-ambient thermal resistance
20.	IOUT_OP	2.0 A	Op_point	Iout operating point
21.	Phase Marg	64.868 deg	Op_point	Bode Plot Phase Margin
22.	VIN_OP	14.0 V	Op_point	Vin operating point
23.	Vout1 OP	3.275 V	Op_point	Operational Voltage 1
24.	Vout1 p-p	5.48 mV	Op_point	Peak-to-peak output1 ripple voltage
25.	Cin Pd	6.411 mW	Power	Input capacitor power dissipation
26.	Cout1 Pd	3.324 mW	Power	Output capacitor1 power dissipation
27.	Cout1 Pd	3.324 mW	Power	Output capacitor1 power dissipation
28.	Diode1 Pd	56.024 mW	Power	Diode1 power dissipation
29.	IC Pd	109.214 mW	Power	IC power dissipation
30.	Total Pd	5.165 W	Power	Total Power Dissipation
31.	Xformer Pd	3.166 W	Power	Transformer power dissipation
32.	Zener Pd	1.027 W	Power	Zener power dissipation
33.	Vout Tolerance	3.274 %		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.	Iout1	2.0	Output Current #1
3.	Iout2	3.0	Output Current #2
4.	Iout3	2.0	Output Current #3
5.	VinMax	22.0	Maximum input voltage
6.	VinMin	14.0	Minimum input voltage
7.	Vout	3.3	Output Voltage
8.	Vout1	3.3	Output Voltage #1
9.	Vout2	5.0	Output Voltage #2
10.	Vout3	5.0	Output Voltage #3
11.	base_pn	LM5020-2	Texas Instruments Base Part Number
12.	source	DC	Input Source Type
13.	ta	30.0	Ambient temperature

Design Assistance

1. LM5020-2 Product Folder : http://www.ti.com/product/LM5020-2 : contains the data sheet and other resources.