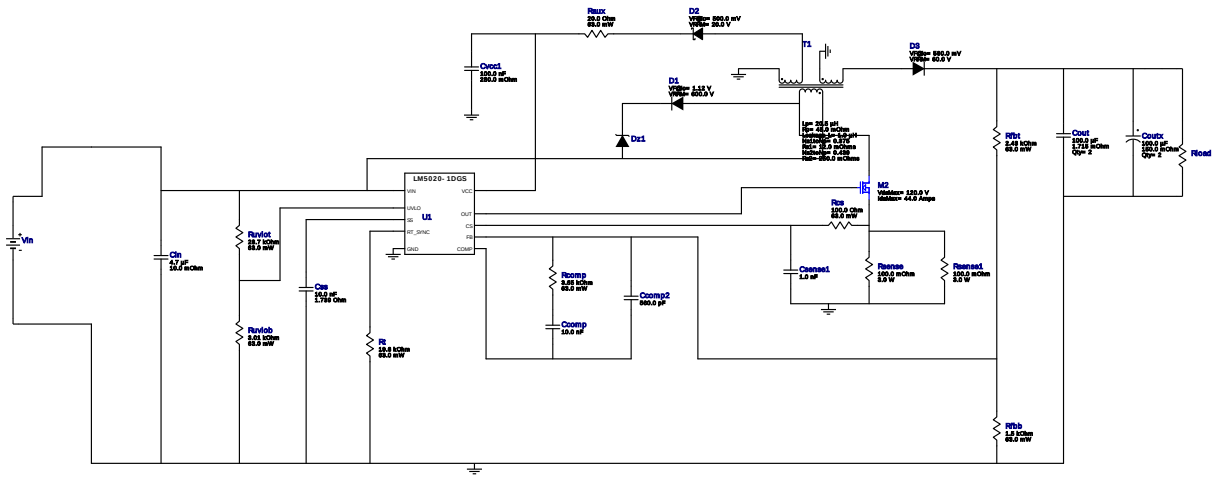
WEBENCH® Design Report

VinMin = 14.0V
VinMax = 22.0V
Vout = 3.3V
Iout = 4.0A

Device = LM5020MM-1/NOPB
Topology = Flyback
Created = 7/13/16 12:58:09 AM
BOM Cost = $0.00
BOM Count = 27
Total Pd = 4.24W

Design : 4738744/4 LM5020MM-1/NOPB
LM5020MM-1/NOPB 14.0V-22.0V to 3.30V @ 4.0A

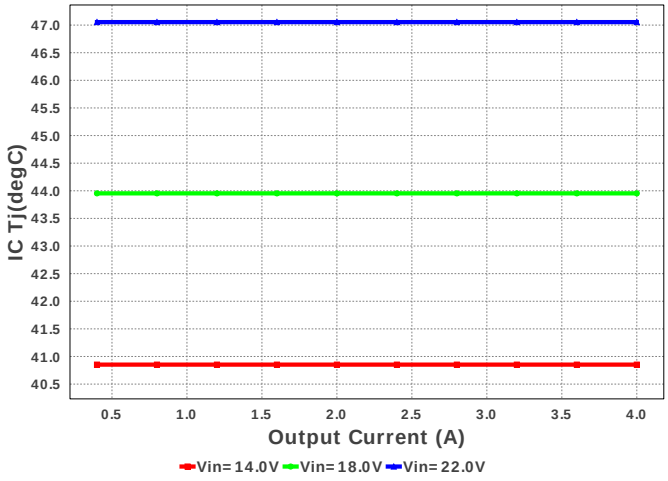


Electrical BOM

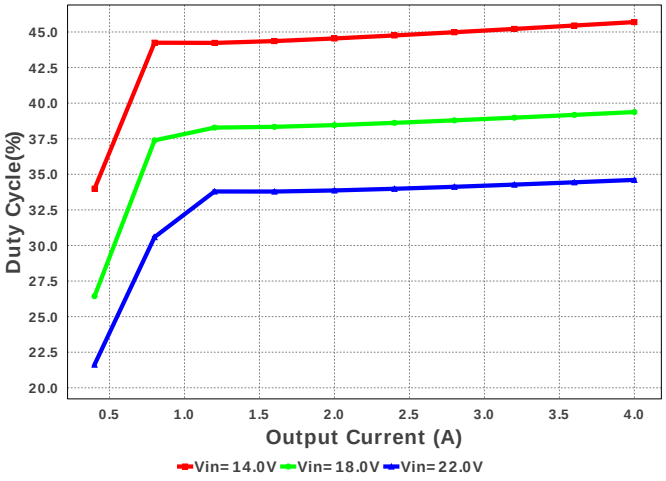
#	Name	Manufacturer	Part Number	Properties	Qty	Price	Footprint
1.	Ccomp	MuRata	GRM216R71H103KA01D Series= X7R	Cap= 10.0 nF VDC= 50.0 V IRMS= 0.0 A	1	$0.01	0805 7 mm²
2.	Ccomp2	Yageo America	CC0805KRX7R9BB561 Series= X7R	Cap= 560.0 pF VDC= 50.0 V IRMS= 0.0 A	1	$0.01	0805 7 mm²
3.	Cin	AVX	12063D475MAT2A Series= X5R	Cap= 4.7 uF ESR= 10.0 mOhm VDC= 25.0 V IRMS= 0.0 A	1	$0.11	1206 11 mm²
4.	Cout	TDK	C3216JB0J107M Series= JB	Cap= 100.0 uF ESR= 1.715 mOhm VDC= 6.3 V IRMS= 0.0 A	2	$0.39	1206 11 mm²
5.	Coutx	Panasonic	EEE-FC1V101P Series= FC	Cap= 100.0 uF ESR= 150.0 mOhm VDC= 35.0 V IRMS= 220.0 mA	2	$0.24	SM_RADIAL_G 172 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	CD214C-F3600	VF@Io= 1.12 V VRRM= 600.0 V	1	$0.18	SMC 83 mm²

#	Name	Manufacturer	Part Number	Properties	Qty	Price	Footprint
10.	D2	Diodes Inc.	B220-13-F	VF@Io= 500.0 mV VRRM= 20.0 V	1	$0.08	 SMB 44 mm^2
11.	D3	Diodes Inc.	PDS760-13	VF@Io= 560.0 mV VRRM= 60.0 V	1	$0.60	 PowerDI5 50 mm^2
12.	Dz1	Diodes Inc.	DFLZ24-7	Zener	1	$0.10	 PowerDI123 13 mm^2
13.	M2	Infineon Technologies	BSC190N12NS3 G	VdsMax= 120.0 V IdsMax= 44.0 Amps	1	$0.64	 PG-TDSON-8 55 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	CRCW04023K65FKED Series= CRCW..e3	Res= 3.65 kOhm 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	Bourns	CRA2512-FZ-R100ELF Series= ?	Res= 100.0 mOhm Power= 3.0 W Tolerance= 1.0%	1	$0.17	 2512 43 mm^2
20.	Rsense1	Bourns	CRA2512-FZ-R100ELF Series= ?	Res= 100.0 mOhm Power= 3.0 W Tolerance= 1.0%	1	$0.17	 2512 43 mm^2
21.	Rt	Vishay-Dale	CRCW040219K6FKED Series= CRCW..e3	Res= 19.6 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	Any	ATS-1410R-WNC	Lp= 20.5 µH Rp= 45.0 mOhm Leakage_L= 1.0 µH Ns1toNp= 0.375 Rs1= 12.0 mOhms Ns2toNp= 0.439 Rs2= 250.0 mOhms	1	NA	Atech_ATS-1410R-WNC 756 mm^2
25.	U1	Texas Instruments	LM5020MM-1/NOPB	Switcher	1	$0.80	mpds035b 35 mm^2

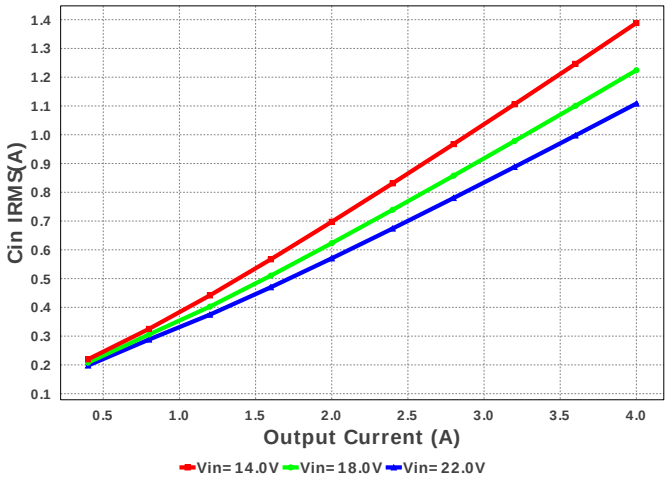
IC Tj



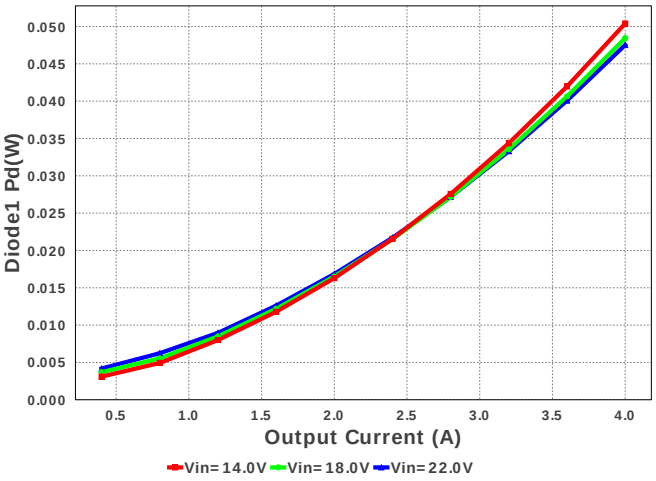
Duty Cycle



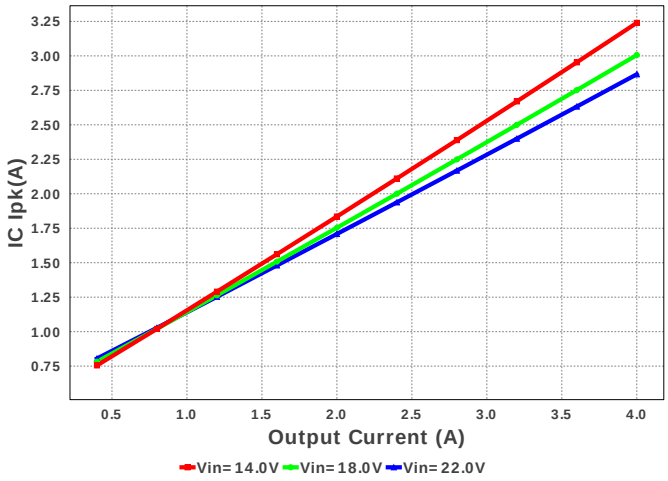
Cin IRMS



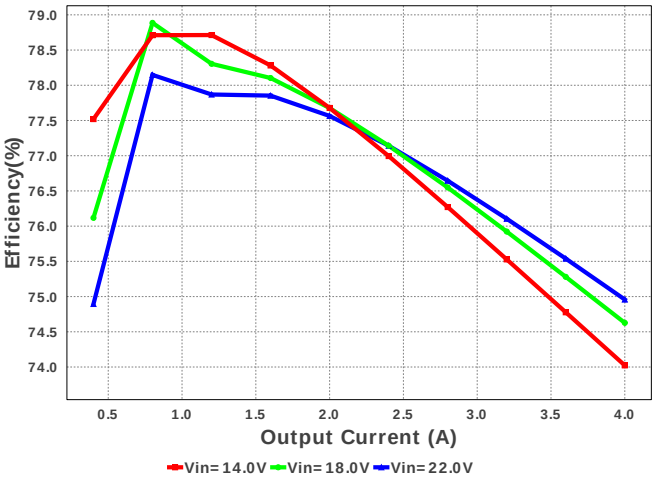
Diode1 Pd

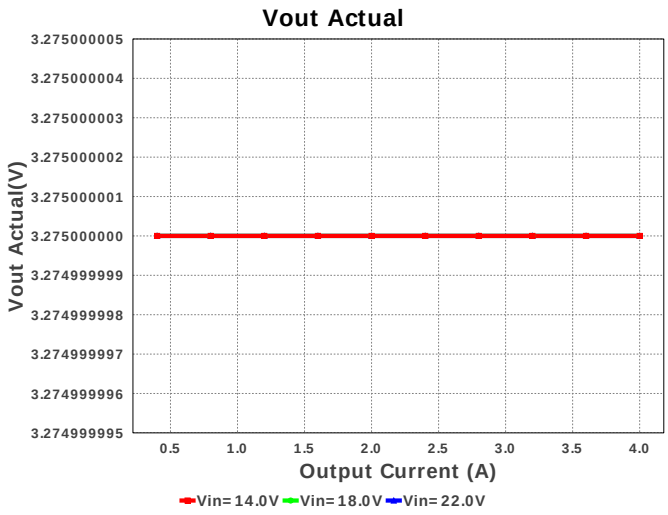


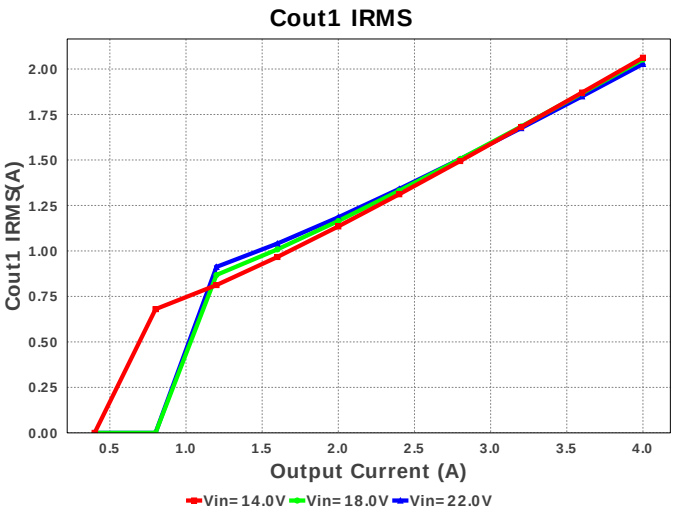
IC Ipk

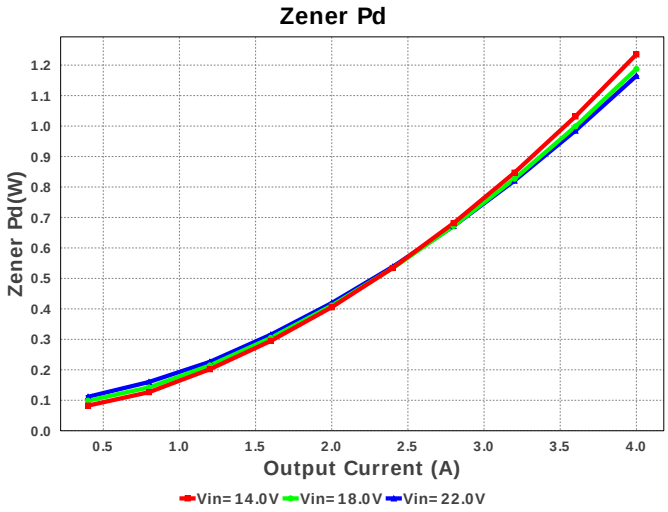


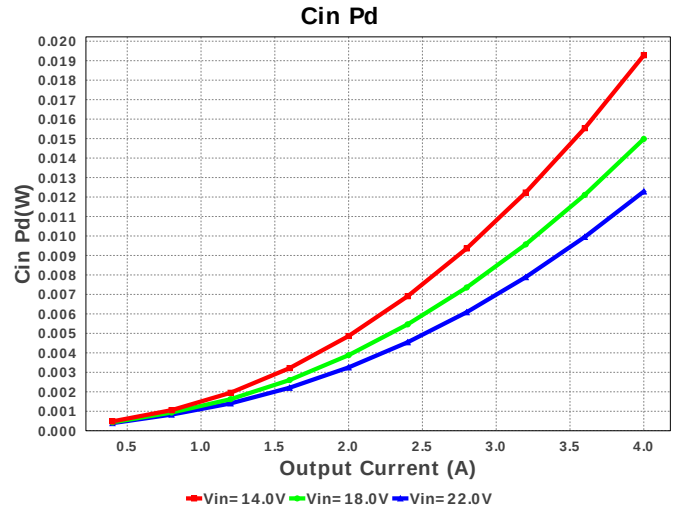
Efficiency

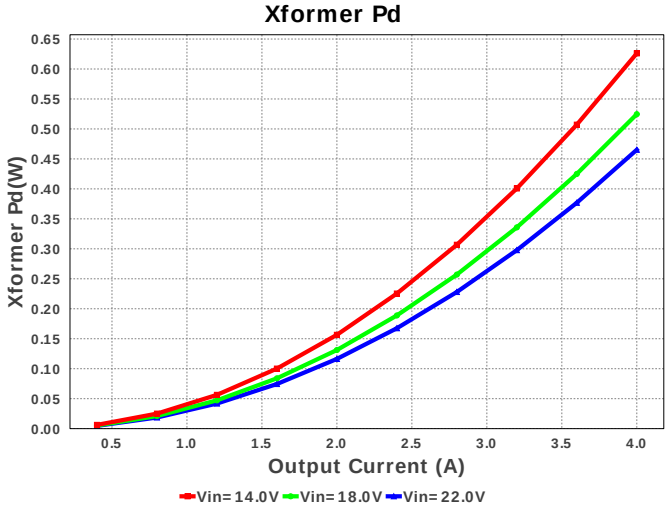


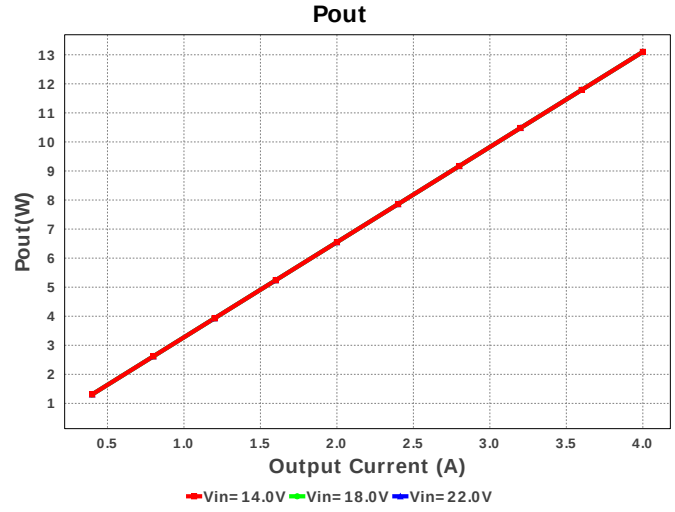


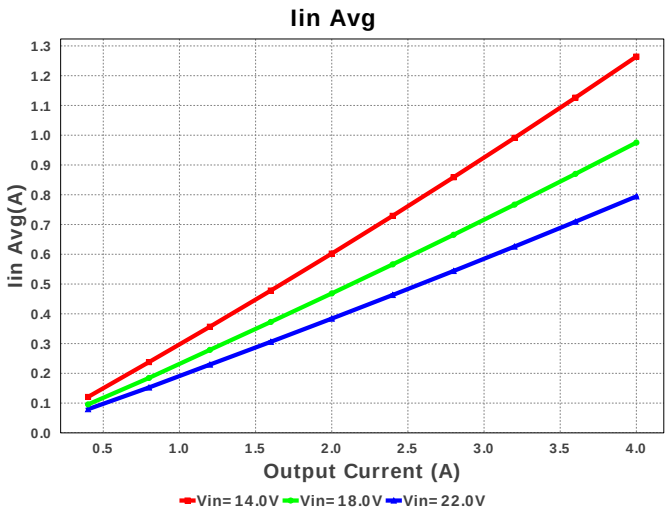


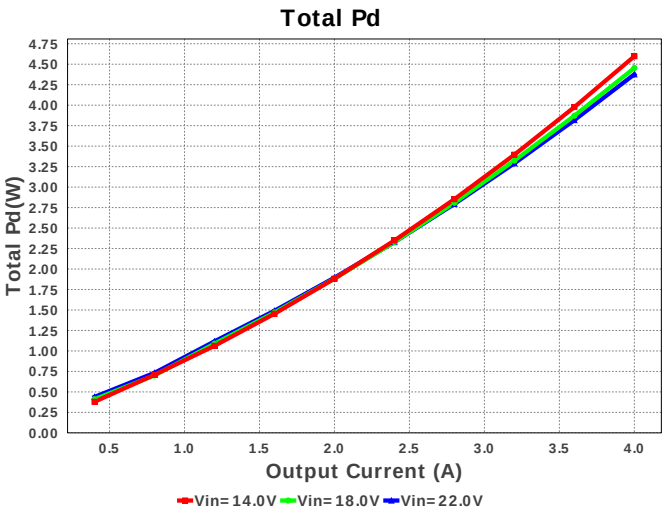


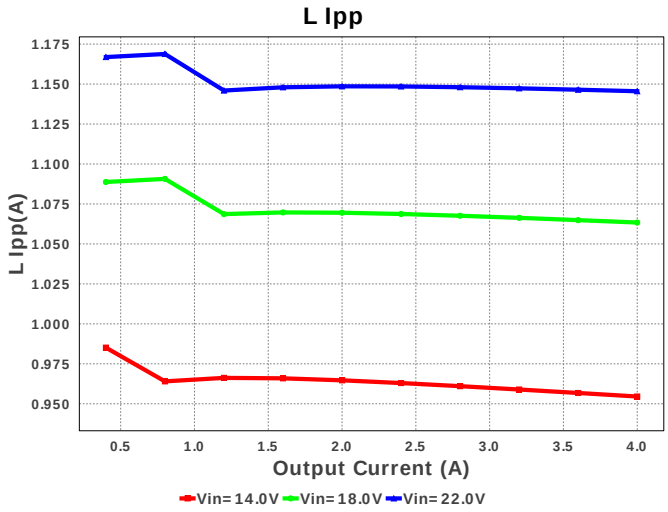


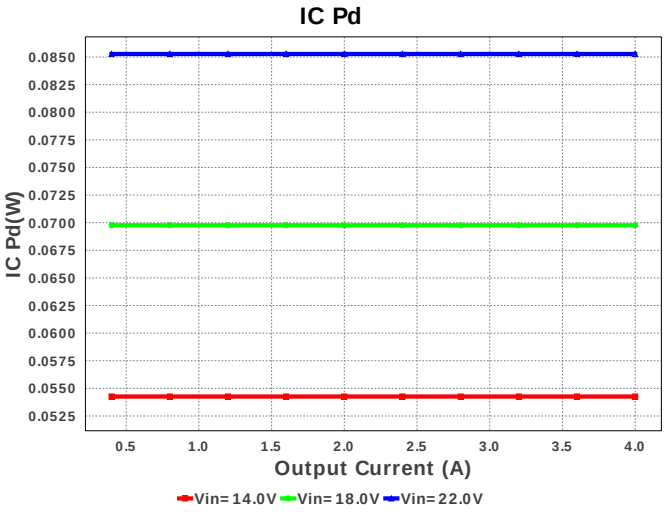


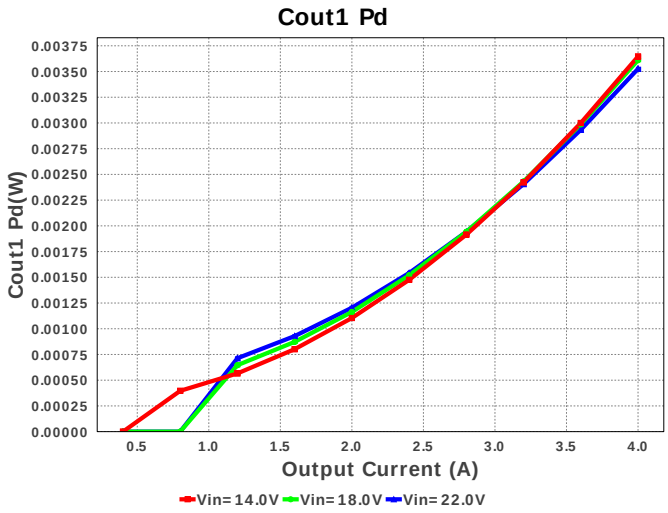


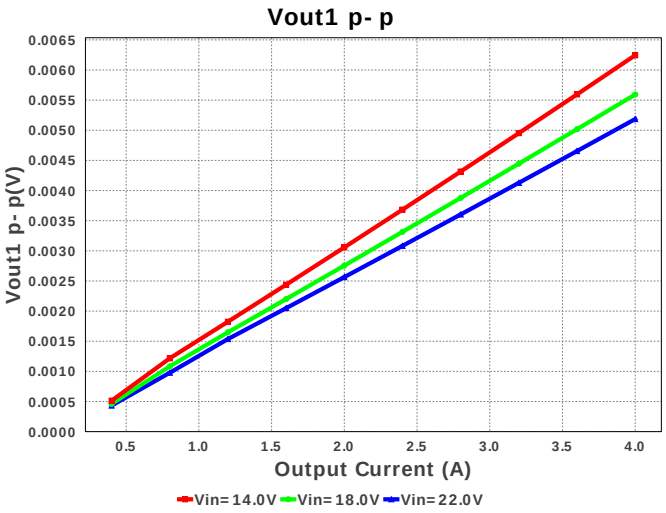


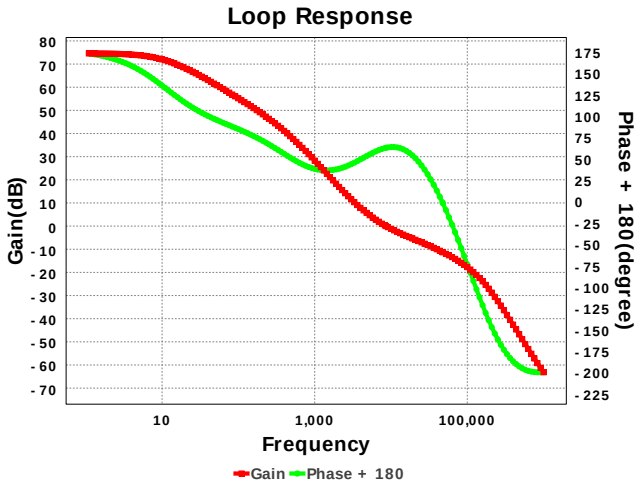












Operating Values

#	Name	Value	Category	Description
1.	Cin IRMS	1.375 A	Current	Input capacitor RMS ripple current
2.	Cout1 IRMS	2.283 A	Current	Output capacitor1 RMS ripple current
3.	IC Ipk	3.215 A	Current	Peak switch current
4.	Iin Avg	1.238 A	Current	Average input current
5.	L Ipp	957.1 mA	Current	Peak-to-peak inductor ripple current
6.	BOM Count	27	General	Total Design BOM count
7.	FootPrint	1.553 k 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	13.1 W	General	Total output power
11.	Total BOM	$0.0	General	Total BOM Cost
12.	Low Freq Gain	73.061 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	7.348 kHz	Op_point	Bode plot crossover frequency
15.	Duty Cycle	45.187 %	Op_point	Duty cycle
16.	Efficiency	75.569 %	Op_point	Steady state efficiency
17.	Gain Marg	-8.742 dB	Op_point	Bode Plot Gain Margin
18.	IC Tj	40.923 degC	Op_point	IC junction temperature
19.	ICThetaJA	200.0 degC/W	Op_point	IC junction-to-ambient thermal resistance
20.	IOUT_OP	4.0 A	Op_point	Iout operating point
21.	Phase Marg	55.863 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	6.187 mV	Op_point	Peak-to-peak output1 ripple voltage
25.	Cin Pd	18.894 mW	Power	Input capacitor power dissipation
26.	Cout1 Pd	4.471 mW	Power	Output capacitor1 power dissipation
27.	Cout1 Pd	4.471 mW	Power	Output capacitor1 power dissipation
28.	Diode1 Pd	50.438 mW	Power	Diode1 power dissipation
29.	IC Pd	54.614 mW	Power	IC power dissipation
30.	Total Pd	4.235 W	Power	Total Power Dissipation
31.	Xformer Pd	765.724 mW	Power	Transformer power dissipation
32.	Zener Pd	1.236 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	4.0	Maximum Output Current
2.	Iout1	4.0	Output Current #1
3.	Iout2	2.0	Output Current #2
4.	Iout3	1.0	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	3.0	Output Voltage #2
10.	Vout3	4.0	Output Voltage #3
11.	base_pn	LM5020-1	Base Product Number
12.	source	DC	Input Source Type
13.	Ta	30.0	Ambient temperature

Design Assistance

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