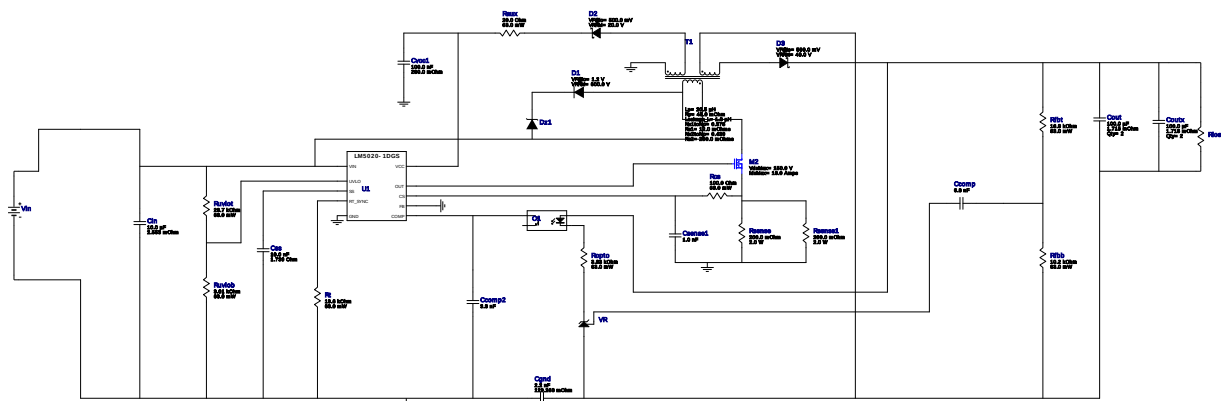


WEBENCH® Design Report

Design : 4731873/1 LM5020MM-1/NOPB
LM5020MM-1/NOPB 14.0V-24.0V to 3.30V @ 2.0A

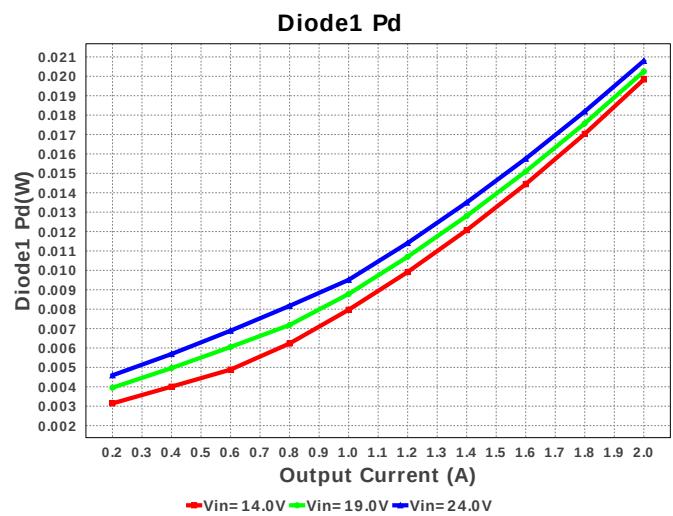
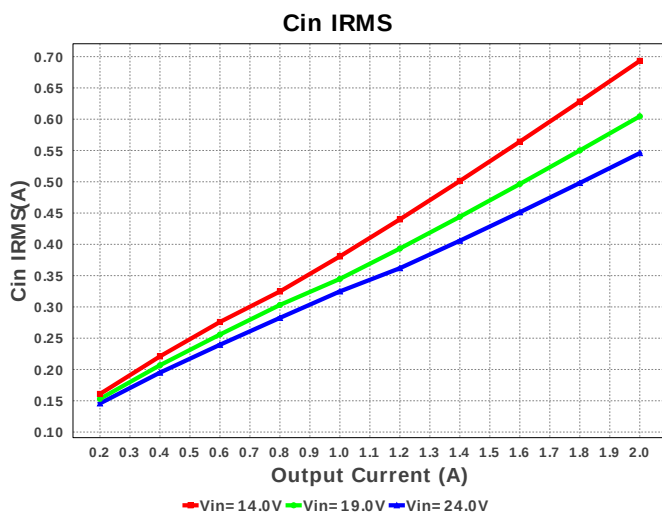
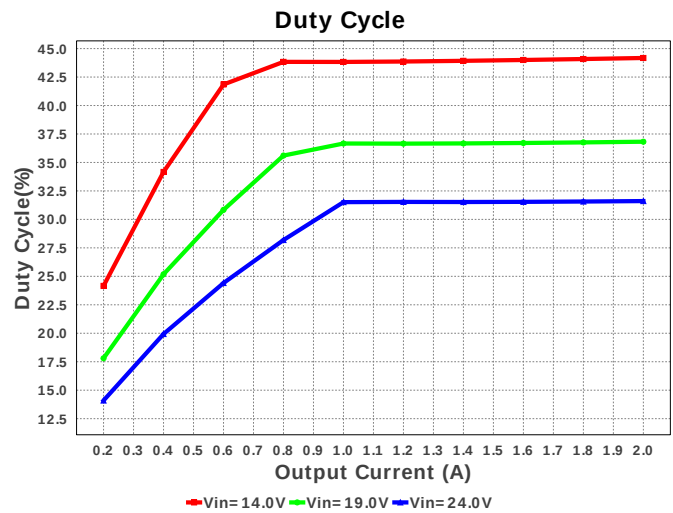
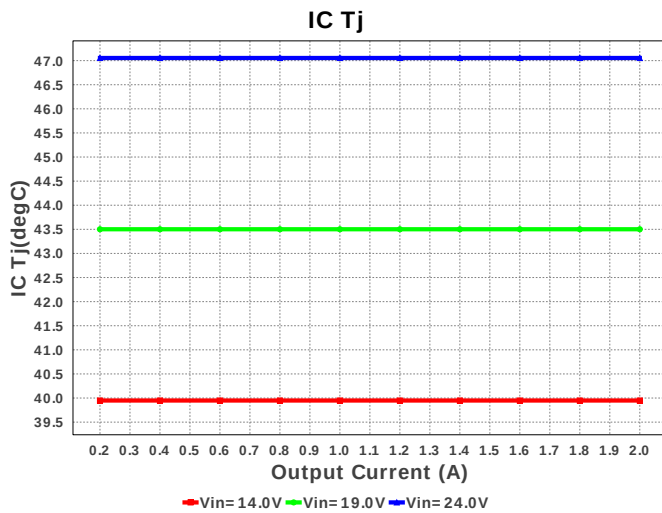


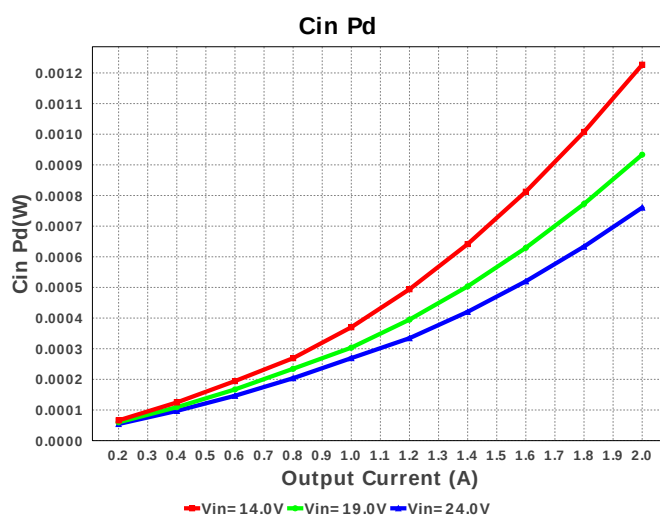
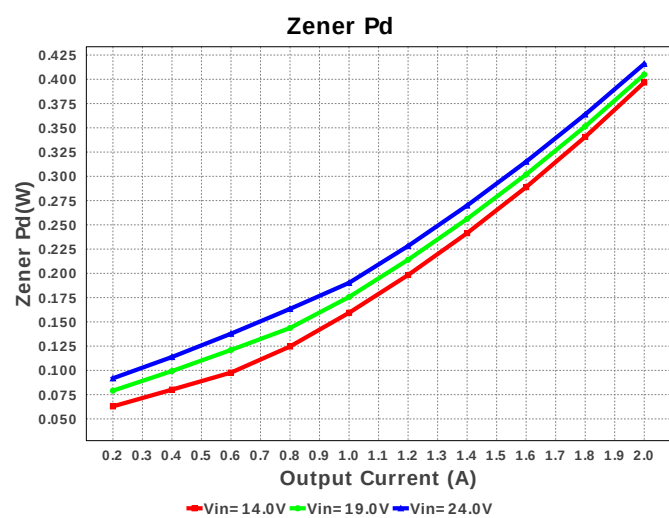
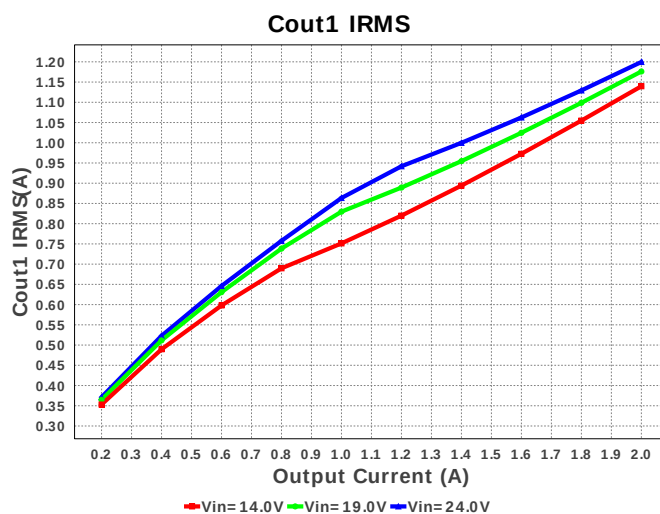
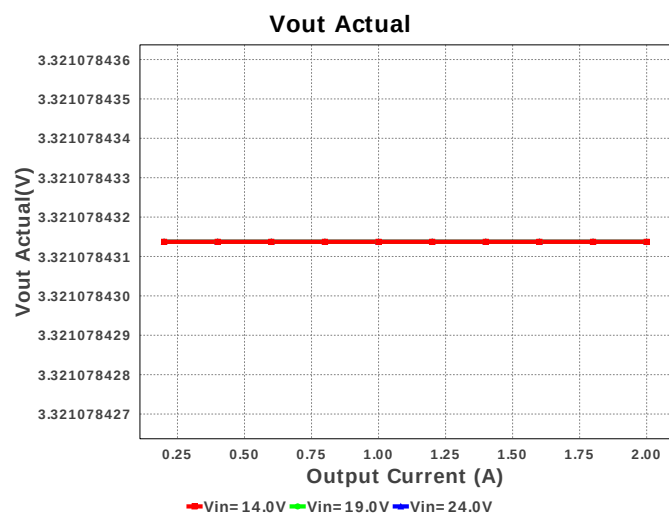
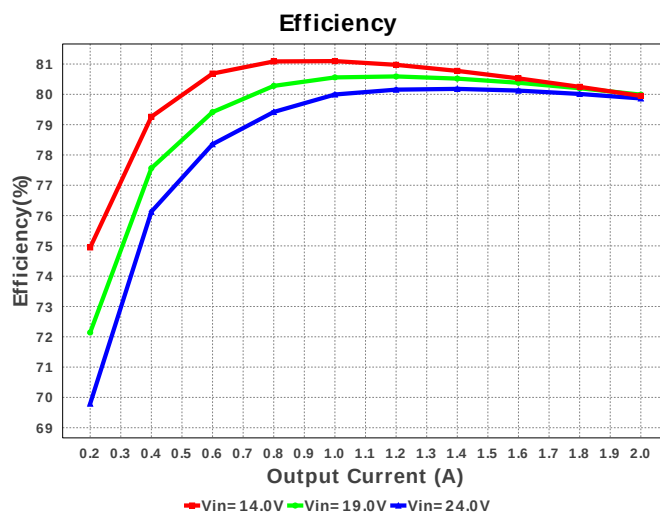
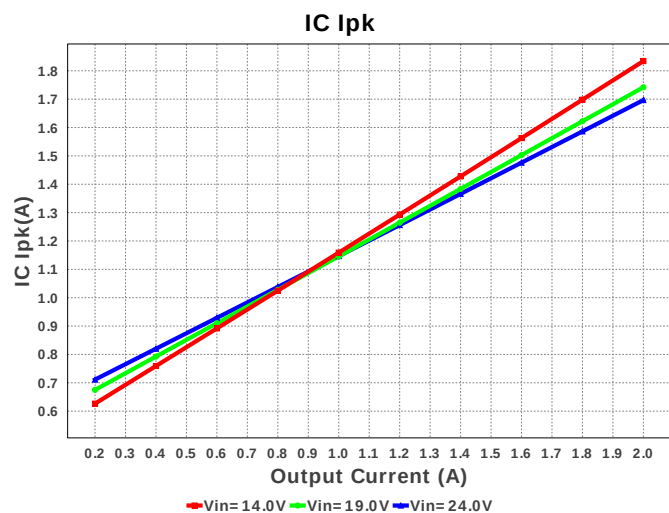
Electrical BOM

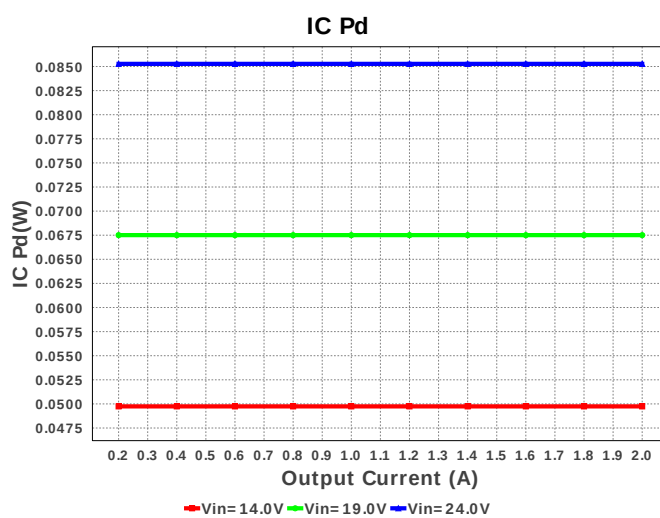
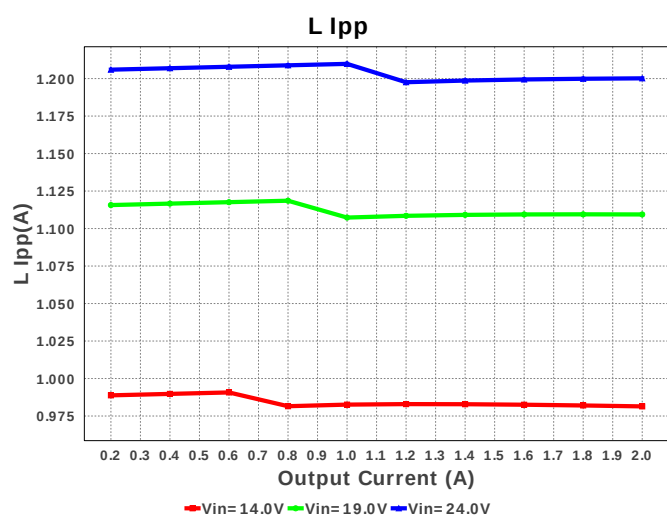
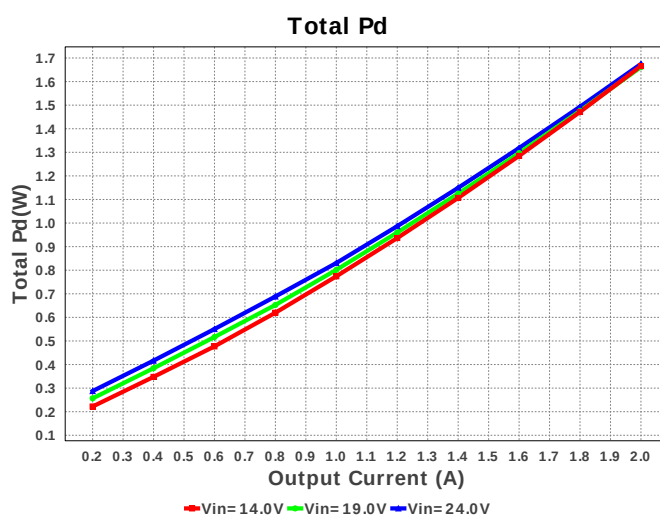
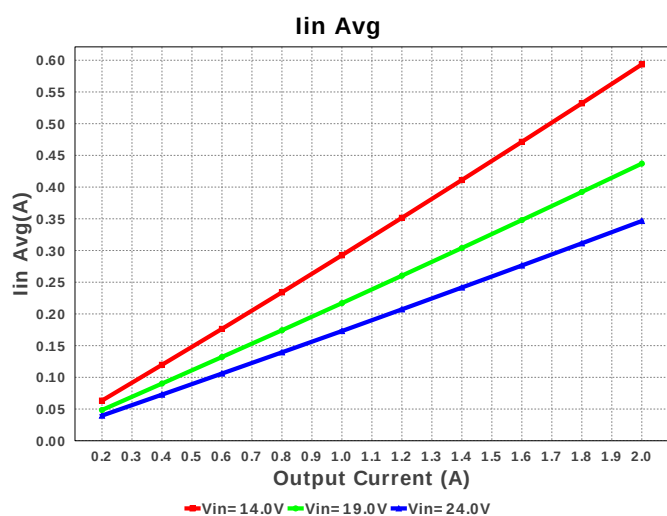
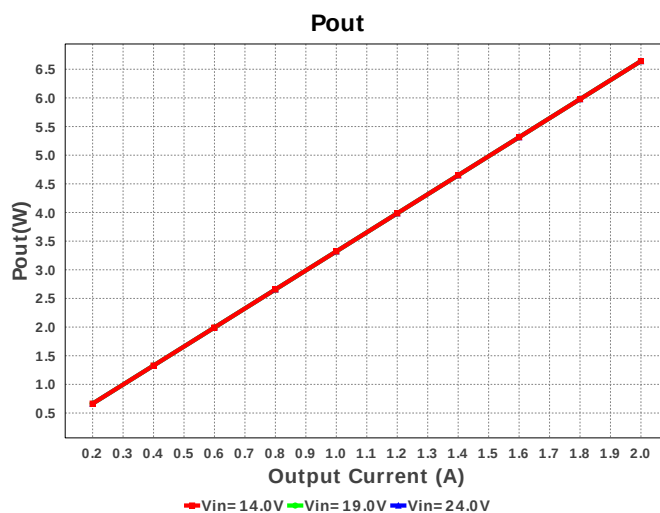
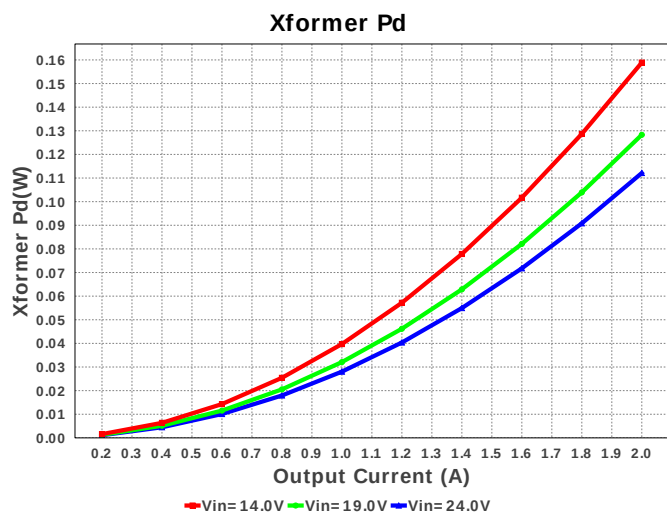
#	Name	Manufacturer	Part Number	Properties	Qty	Price	Footprint
1.	Ccomp	Yageo America	CC0805KRX7R9BB682 Series= X7R	Cap= 6.8 nF VDC= 50.0 V IRMS= 0.0 A	1	\$0.01	0805 7 mm ²
2.	Ccomp2	MuRata	GRM216R71E332KA01D Series= X7R	Cap= 3.3 nF VDC= 25.0 V IRMS= 0.0 A	1	\$0.01	0805 7 mm ²
3.	Cfb	MuRata	GRM155R71E103KA01D Series= X7R	Cap= 10.0 nF VDC= 25.0 V IRMS= 0.0 A	1	\$0.01	0402 3 mm ²
4.	Cgnd	TDK	C4532JB3D222K Series= JB	Cap= 2.2 nF ESR= 129.263 mOhm VDC= 2.0 kV IRMS= 0.0 A	1	\$0.16	1812 23 mm ²
5.	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 mm ²
6.	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 mm ²
7.	Coutx	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 mm ²
8.	Csense1	MuRata	GRM033R71C102KA01D Series= X7R	Cap= 1.0 nF VDC= 16.0 V IRMS= 0.0 A	1	\$0.01	0201 2 mm ²
9.	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 mm ²
10.	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 mm ²

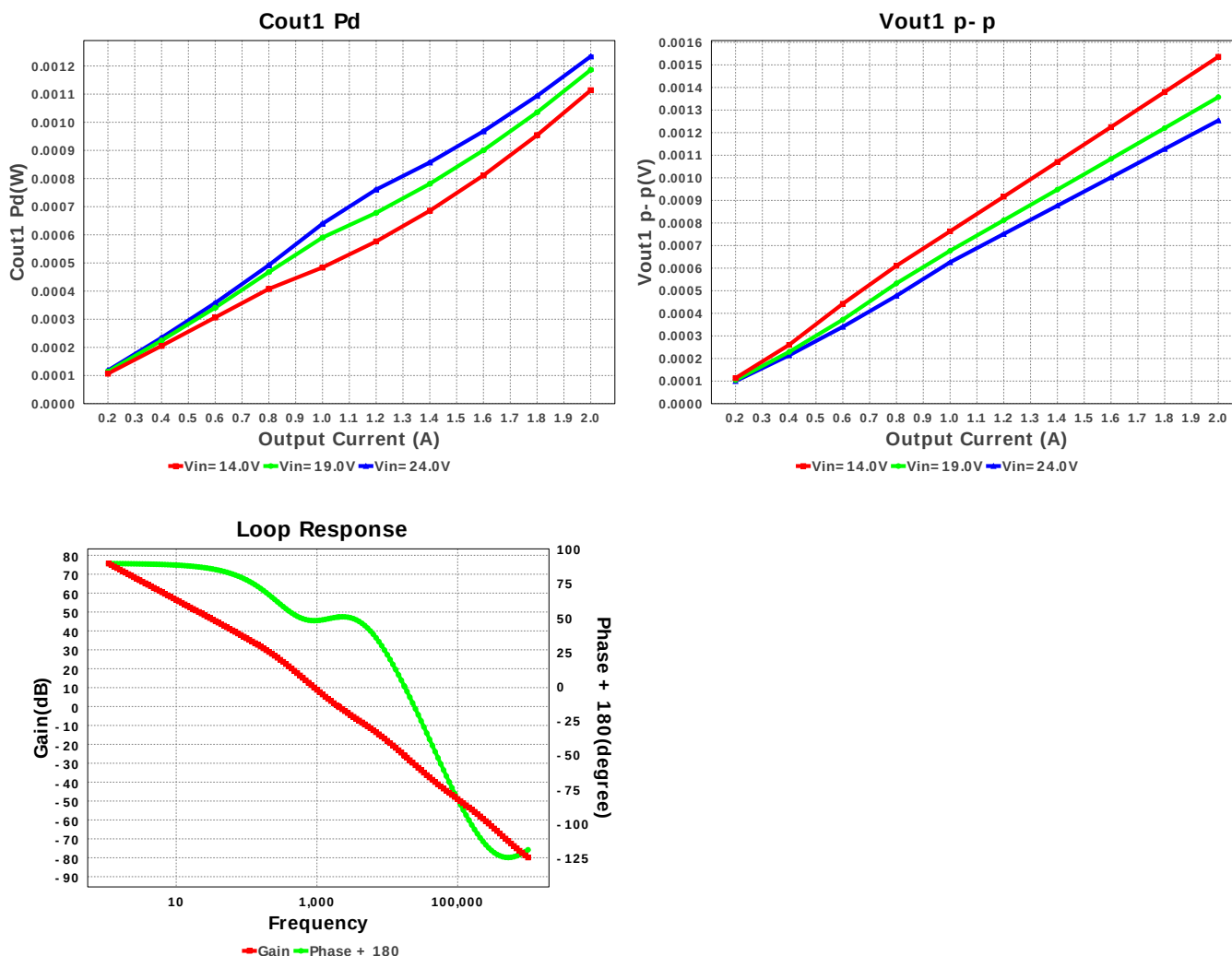
#	Name	Manufacturer	Part Number	Properties	Qty	Price	Footprint
11.	D1	Bourns	CD214B-F3600	VF@Io= 1.2 V VRRM= 600.0 V	1	\$0.14	 SMB 44 mm ²
12.	D2	Vishay-Semiconductor	SS12-E3/61T	VF@Io= 500.0 mV VRRM= 20.0 V	1	\$0.08	 SMA 37 mm ²
13.	D3	Diodes Inc.	B340A-13-F	VF@Io= 500.0 mV VRRM= 40.0 V	1	\$0.11	 SMA 37 mm ²
14.	Dz1	Diodes Inc.	DFLZ24-7	Zener	1	\$0.10	 PowerDI123 13 mm ²
15.	M2	Fairchild Semiconductor	FDMC86240	VdsMax= 150.0 V IdsMax= 16.0 Amps	1	\$0.93	 TRANS_Fairchild_MLP08S 18 mm ²
16.	O1	California Eastern Laboratories	PS2811-1	Optocoupler	1	\$0.38	 SSOP-4 111 mm ²
17.	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
18.	Rcs	Vishay-Dale	CRCW0402100R0FKED Series= CRCW..e3	Res= 100.0 Ohm Power= 63.0 mW Tolerance= 1.0%	1	\$0.01	 0402 3 mm ²
19.	Rfbb	Vishay-Dale	CRCW040210K2FKED Series= CRCW..e3	Res= 10.2 kOhm Power= 63.0 mW Tolerance= 1.0%	1	\$0.01	 0402 3 mm ²
20.	Rfbt	Vishay-Dale	CRCW040216K9FKED Series= CRCW..e3	Res= 16.9 kOhm Power= 63.0 mW Tolerance= 1.0%	1	\$0.01	 0402 3 mm ²
21.	Ropto	Vishay-Dale	CRCW04023K83FKED Series= CRCW..e3	Res= 3.83 kOhm Power= 63.0 mW Tolerance= 1.0%	1	\$0.01	 0402 3 mm ²
22.	Rsense	Stackpole Electronics Inc	CSRN2512FKR200 Series= ?	Res= 200.0 mOhm Power= 2.0 W Tolerance= 1.0%	1	\$0.13	 2512 43 mm ²
23.	Rsense1	Stackpole Electronics Inc	CSRN2512FKR200 Series= ?	Res= 200.0 mOhm Power= 2.0 W Tolerance= 1.0%	1	\$0.13	 2512 43 mm ²
24.	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
25.	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
26.	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
27.	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
28.	U1	Texas Instruments	LM5020MM-1/NOPB	Switcher	1	\$0.80	mpds035b 35 mm ²

#	Name	Manufacturer	Part Number	Properties	Qty	Price	Footprint
29.	VR	Texas Instruments	LMV431CM5/NOPB	Voltage References	1	\$0.16	 R-PDSO-G3 16 mm ²









Operating Values

#	Name	Value	Category	Description
1.	Cin IRMS	686.252 mA	Current	Input capacitor RMS ripple current
2.	Cout1 IRMS	1.24 A	Current	Output capacitor1 RMS ripple current
3.	IC IpK	1.82 A	Current	Peak switch current
4.	Iin Avg	581.5 mA	Current	Average input current
5.	L Ipp	977.79 mA	Current	Peak-to-peak inductor ripple current
6.	BOM Count	31	General	Total Design BOM count
7.	FootPrint	1.289 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	6.589 W	General	Total output power
11.	Total BOM	\$0.0	General	Total BOM Cost
12.	Low Freq Gain	75.629 dB	Op_Point	Gain at 10Hz
13.	Vout Actual	3.295 V	Op_Point	Vout Actual calculated based on selected voltage divider resistors
14.	Cross Freq	2.277 kHz	Op_point	Bode plot crossover frequency
15.	Duty Cycle	43.674 %	Op_point	Duty cycle
16.	Efficiency	80.936 %	Op_point	Steady state efficiency
17.	Gain Marg	-23.936 dB	Op_point	Bode Plot Gain Margin
18.	IC Tj	45.473 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	52.245 deg	Op_point	Bode Plot Phase Margin
22.	VIN_OP	14.0 V	Op_point	Vin operating point
23.	Vout1 OP	3.295 V	Op_point	Operational Voltage 1
24.	Vout1 p-p	1.522 mV	Op_point	Peak-to-peak output1 ripple voltage
25.	Cin Pd	1.202 mW	Power	Input capacitor power dissipation
26.	Cout1 Pd	1.318 mW	Power	Output capacitor1 power dissipation
27.	Cout1 Pd	1.318 mW	Power	Output capacitor1 power dissipation
28.	Diode1 Pd	19.766 mW	Power	Diode1 power dissipation
29.	IC Pd	77.364 mW	Power	IC power dissipation
30.	Total Pd	1.552 W	Power	Total Power Dissipation
31.	Xformer Pd	194.101 mW	Power	Transformer power dissipation

#	Name	Value	Category	Description
32.	Zener Pd	395.327 mW	Power	Zener power dissipation
33.	Vout Tolerance	3.301 %		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	2.0	Output Current #2
4.	Iout3	3.0	Output Current #3
5.	VinMax	24.0	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	9.0	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.

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