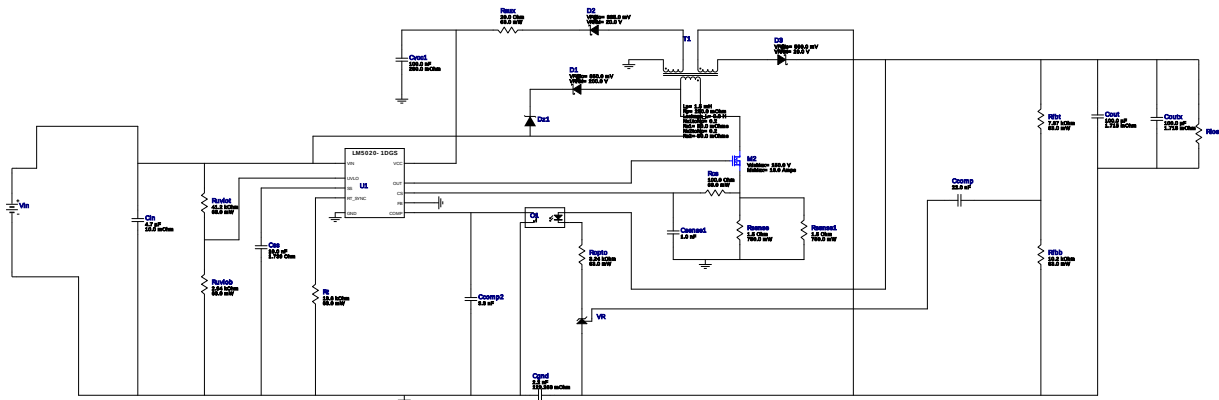


WEBENCH® Design Report

Design : 4764320/5 LM5020MM-1/NOPB
LM5020MM-1/NOPB 20.0V-25.0V to 4.40V @ 1.0A

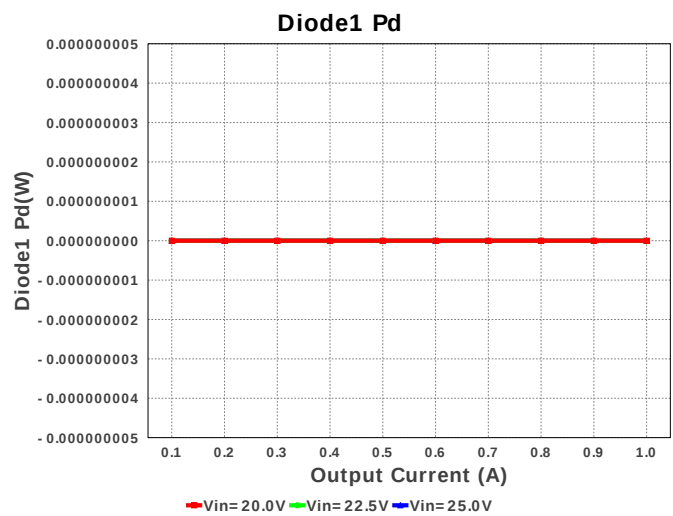
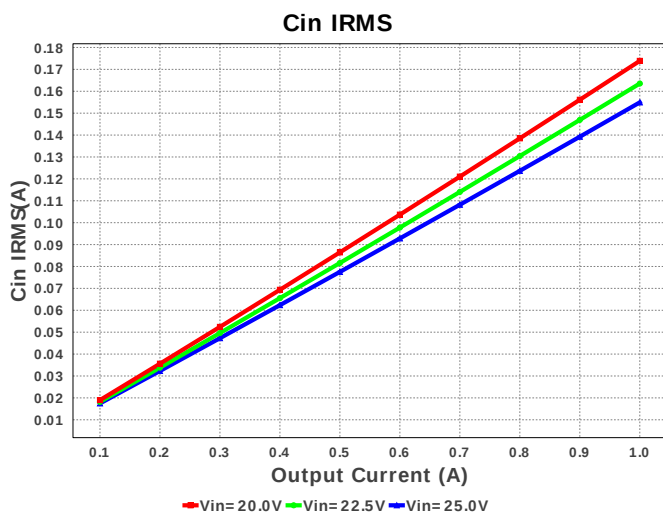
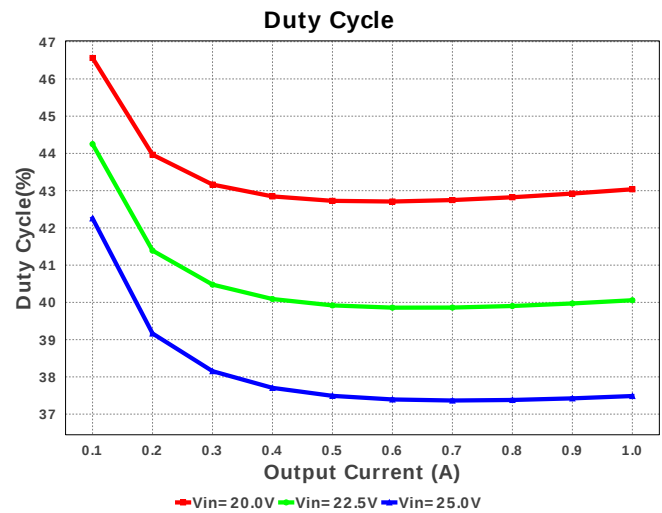
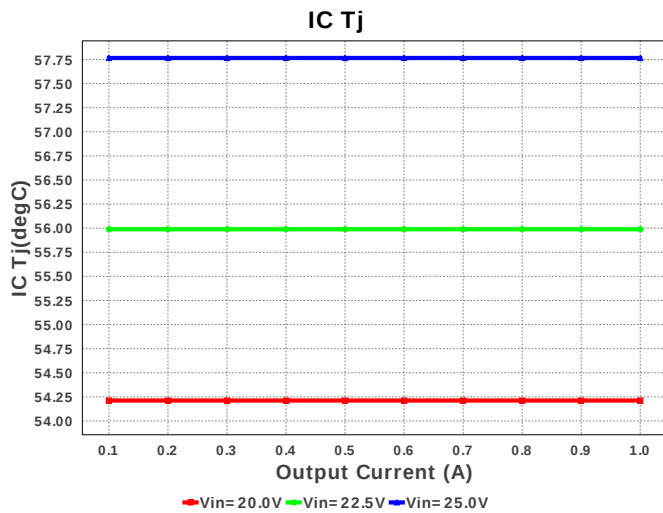


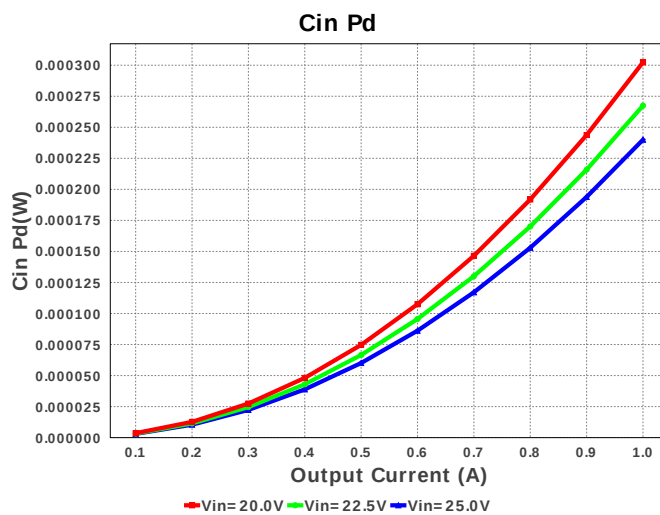
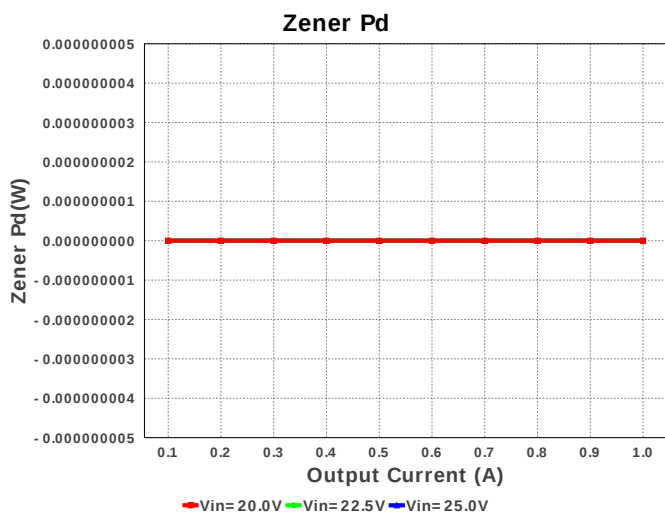
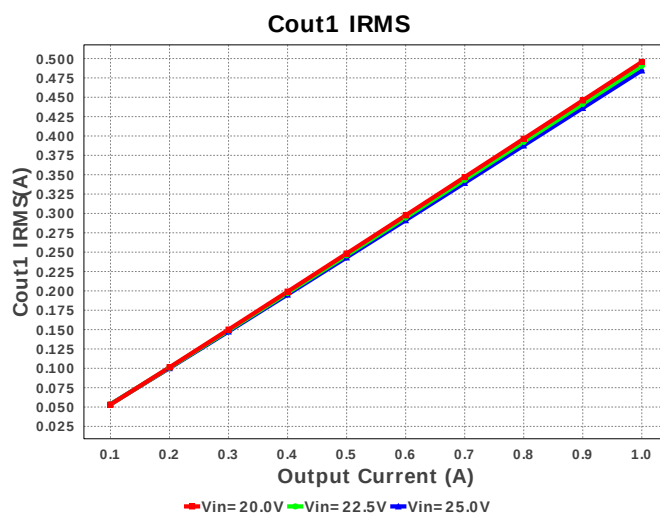
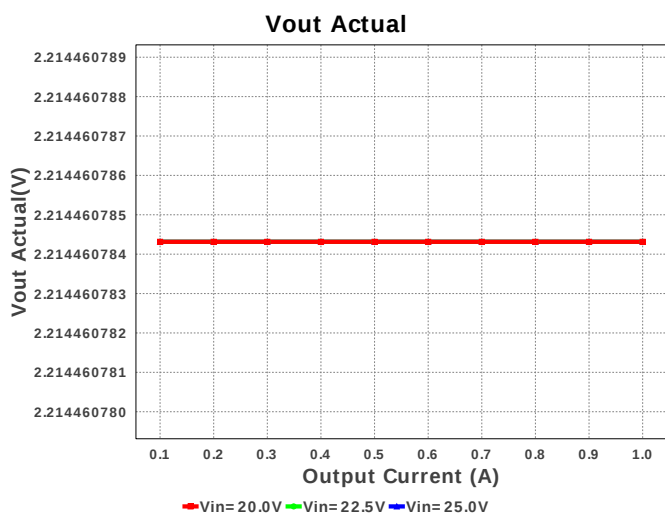
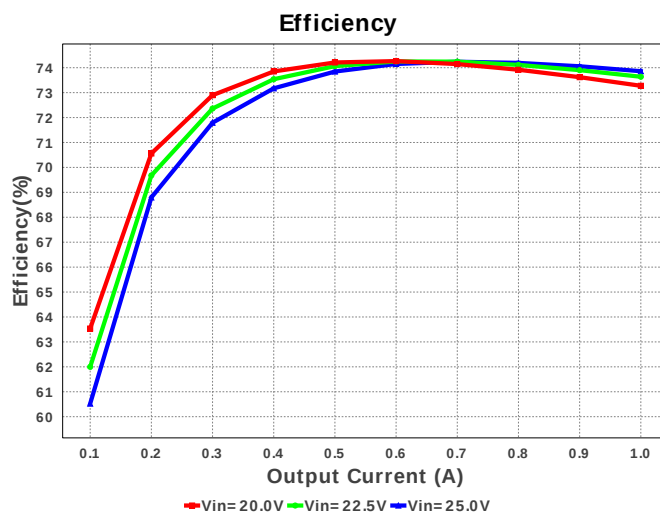
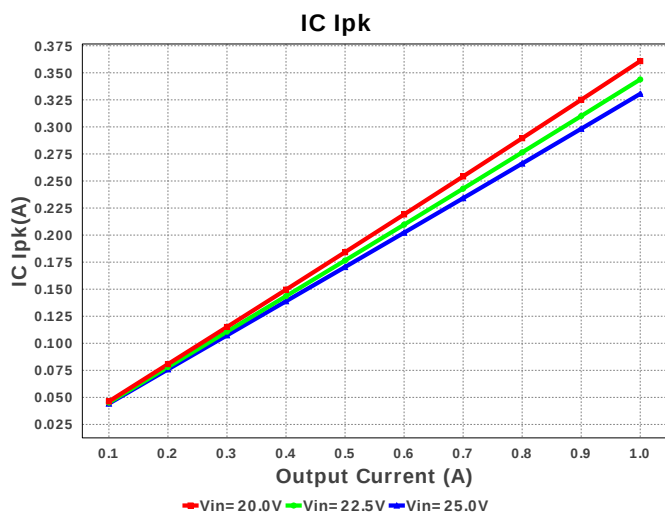
Electrical BOM

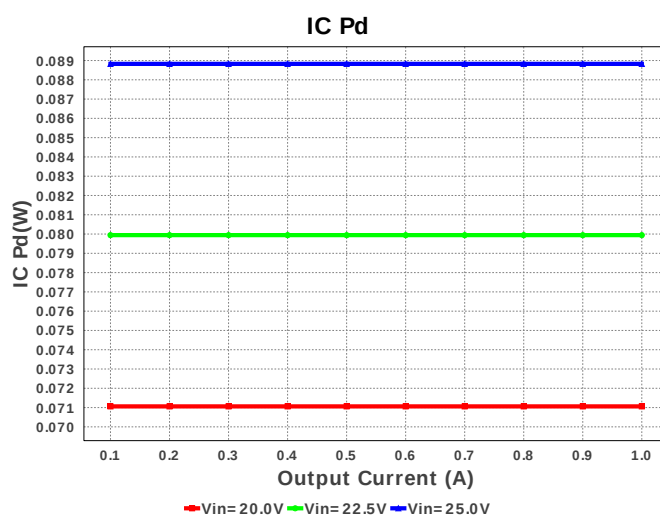
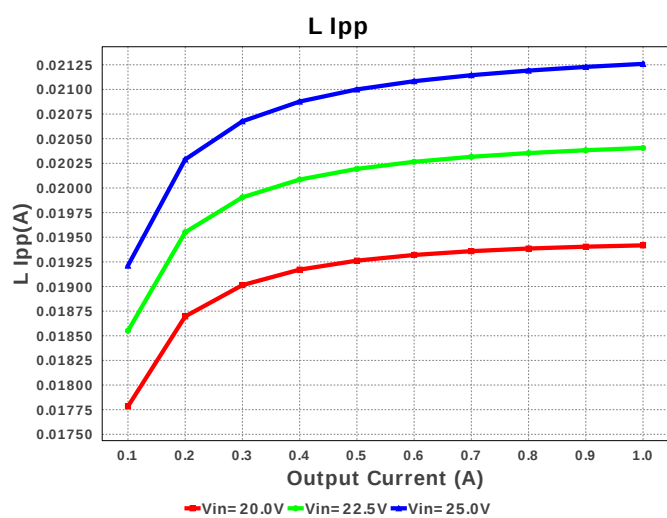
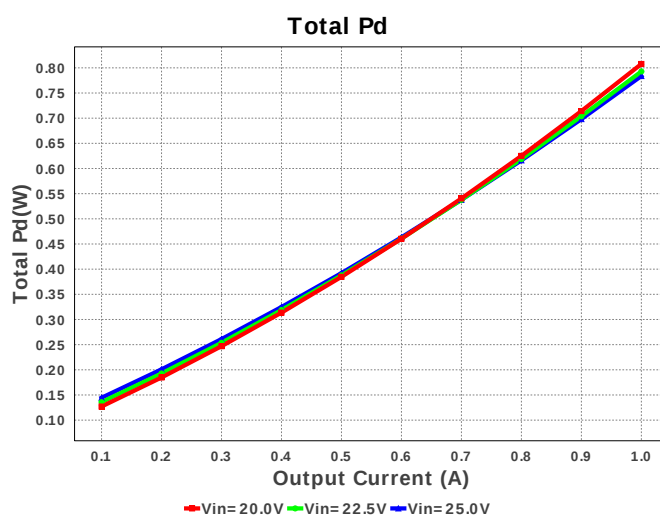
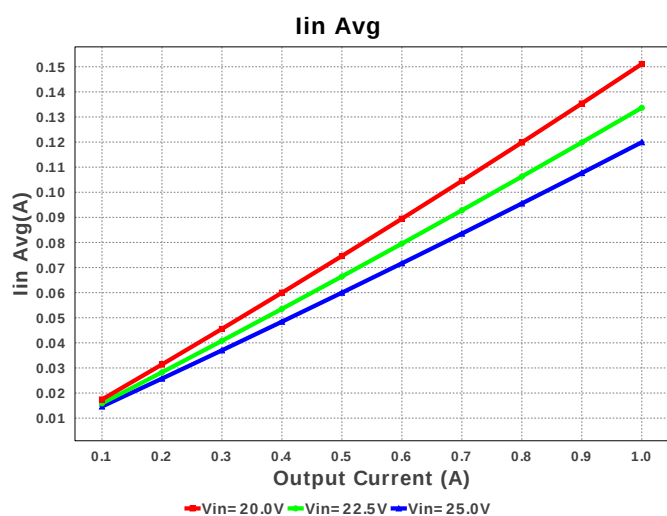
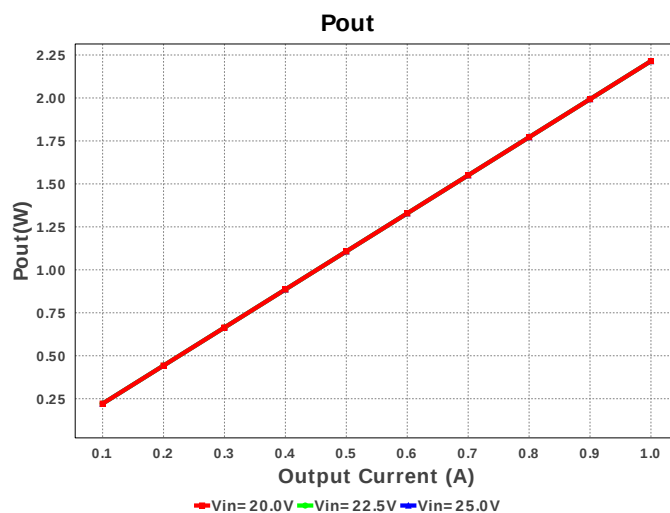
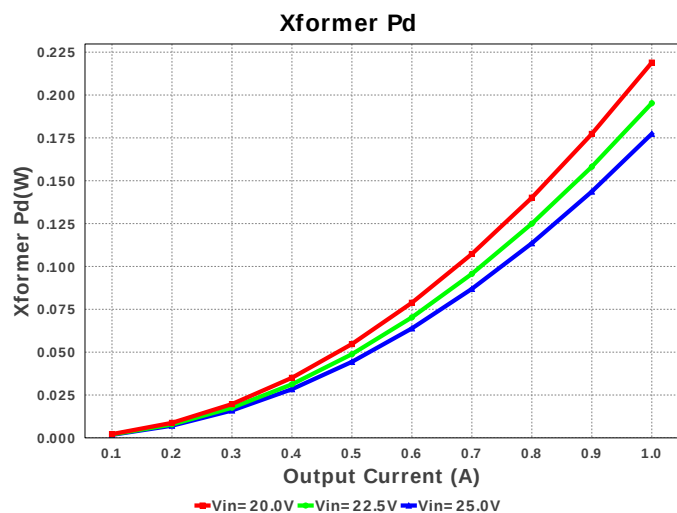
#	Name	Manufacturer	Part Number	Properties	Qty	Price	Footprint
1.	Ccomp	Yageo America	CC0805KRX7R9BB223 Series= X7R	Cap= 22.0 nF VDC= 50.0 V IRMS= 0.0 A	1	\$0.01	0805 7 mm ²
2.	Ccomp2	MuRata	GRM216R71E332KA01D Series= X7R	Cap= 3.3 nF VDC= 25.0 V IRMS= 0.0 A	1	\$0.01	0805 7 mm ²
3.	Cfb	MuRata	GRM155R71E103KA01D 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	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 mm ²
6.	Cout	TDK	C3216JB0J107M Series= JB	Cap= 100.0 uF ESR= 1.715 mOhm VDC= 6.3 V IRMS= 0.0 A	1	\$0.39	1206 11 mm ²
7.	Coutx	TDK	C3216X5R1A107M Series= X5R	Cap= 100.0 uF ESR= 1.715 mOhm VDC= 10.0 V IRMS= 0.0 A	1	\$0.67	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

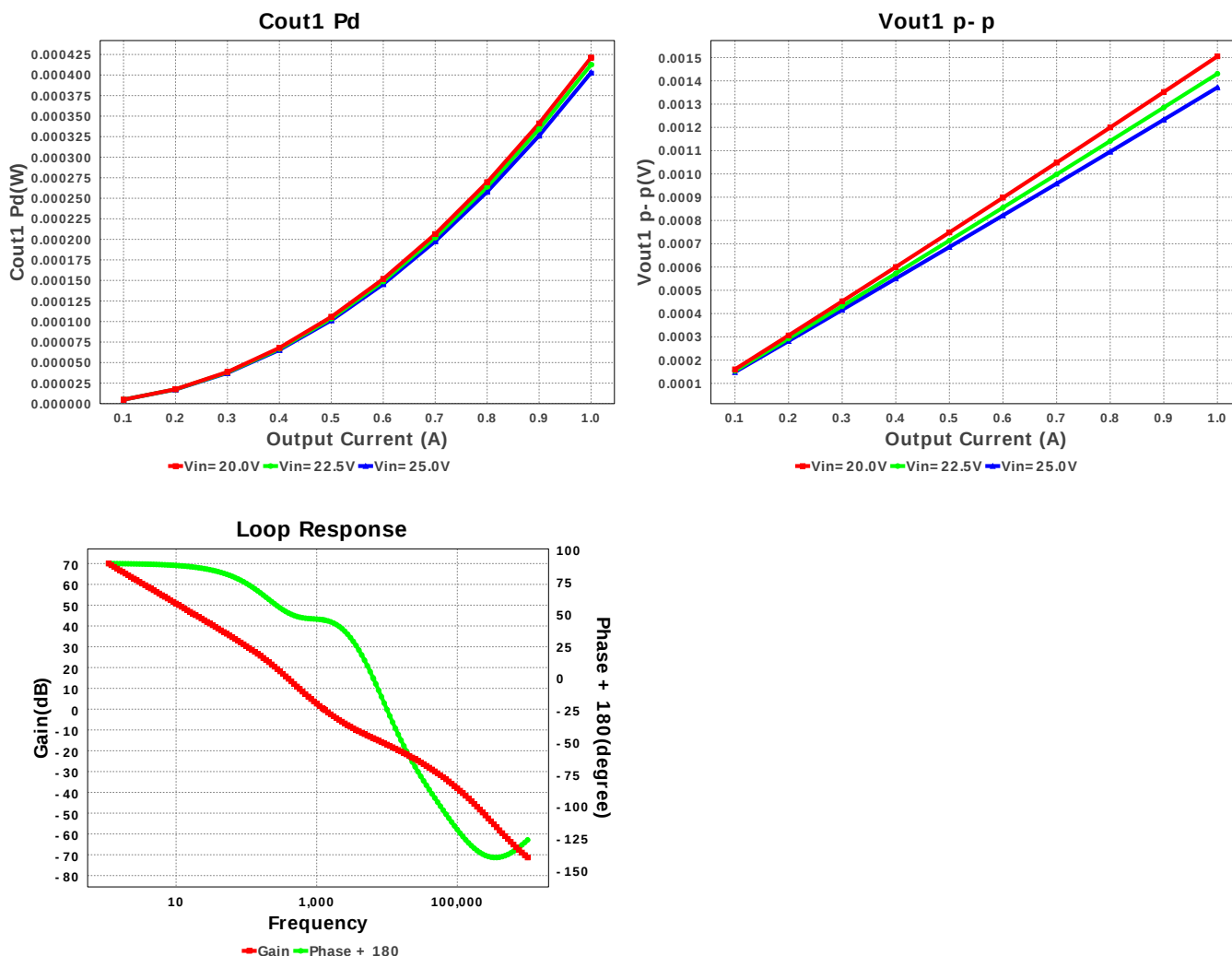
#	Name	Manufacturer	Part Number	Properties	Qty	Price	Footprint
11.	D1	Diodes Inc.	DFLS1200-7	VF@Io= 850.0 mV VRRM= 200.0 V	1	\$0.21	 PowerDI123 13 mm ²
12.	D2	ON Semiconductor	MBR0520LT1G	VF@Io= 385.0 mV VRRM= 20.0 V	1	\$0.06	 SOD-123 13 mm ²
13.	D3	Diodes Inc.	B220-13-F	VF@Io= 500.0 mV VRRM= 20.0 V	1	\$0.08	 SMB 44 mm ²
14.	Dz1	Diodes Inc.	MMSZ5254B-7-F	Zener	1	\$0.04	 SOD-123 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	CRCW04027K87FKED Series= CRCW..e3	Res= 7.87 kOhm Power= 63.0 mW Tolerance= 1.0%	1	\$0.01	 0402 3 mm ²
21.	Ropto	Vishay-Dale	CRCW04023K24FKED Series= CRCW..e3	Res= 3.24 kOhm Power= 63.0 mW Tolerance= 1.0%	1	\$0.01	 0402 3 mm ²
22.	Rsense	Stackpole Electronics Inc	RMCF2010FT1R50 Series= ?	Res= 1.5 Ohm Power= 750.0 mW Tolerance= 1.0%	1	\$0.03	 2010 32 mm ²
23.	Rsense1	Stackpole Electronics Inc	RMCF2010FT1R50 Series= ?	Res= 1.5 Ohm Power= 750.0 mW Tolerance= 1.0%	1	\$0.03	 2010 32 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	CRCW04022K94FKED Series= CRCW..e3	Res= 2.94 kOhm Power= 63.0 mW Tolerance= 1.0%	1	\$0.01	 0402 3 mm ²
26.	Ruvlot	Vishay-Dale	CRCW040241K2FKED Series= CRCW..e3	Res= 41.2 kOhm Power= 63.0 mW Tolerance= 1.0%	1	\$0.01	 0402 3 mm ²
27.	T1	GCI Technologies	G044050	Lp= 1.5 mH Rp= 250.0 mOhm Leakage_L= 0.0 H Ns1toNp= 0.2 Rs1= 50.0 mOhms Ns2toNp= 0.2 Rs2= 50.0 mOhms	1	NA	GCI_G044050 0 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	TL431AIDBZR	Voltage References	1	\$0.08	 DBZ0003A 14 mm ²









Operating Values

#	Name	Value	Category	Description
1.	Cin IRMS	227.261 mA	Current	Input capacitor RMS ripple current
2.	Cout1 IRMS	523.257 mA	Current	Output capacitor1 RMS ripple current
3.	IC IpK	470.486 mA	Current	Peak switch current
4.	Iin Avg	258.09 mA	Current	Average input current
5.	L Ipp	24.783 mA	Current	Peak-to-peak inductor ripple current
6.	BOM Count	29	General	Total Design BOM count
7.	FootPrint	442.0 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.	Mode	CCM	General	Conduction Mode
11.	Pout	4.42 W	General	Total output power
12.	Total BOM	\$0.0	General	Total BOM Cost
13.	Low Freq Gain	70.001 dB	Op_point	Gain at 10Hz
14.	Vout Actual	4.42 V	Op_point	Vout Actual calculated based on selected voltage divider resistors
15.	Cross Freq	1.452 kHz	Op_point	Bode plot crossover frequency
16.	Duty Cycle	56.341 %	Op_point	Duty cycle
17.	Efficiency	85.629 %	Op_point	Steady state efficiency
18.	Gain Marg	-12.419 dB	Op_point	Bode Plot Gain Margin
19.	IC Tj	62.104 degC	Op_point	IC junction temperature
20.	ICThetaJA	200.0 degC/W	Op_point	IC junction-to-ambient thermal resistance
21.	IOUT_OP	1.0 A	Op_point	Iout operating point
22.	Phase Marg	47.057 deg	Op_point	Bode Plot Phase Margin
23.	VIN_OP	20.0 V	Op_point	Vin operating point
24.	Vout1 OP	4.42 V	Op_point	Operational Voltage 1
25.	Vout1 p-p	1.964 mV	Op_point	Peak-to-peak output1 ripple voltage
26.	Cin Pd	516.477 μW	Power	Input capacitor power dissipation
27.	Cout1 Pd	469.564 μW	Power	Output capacitor1 power dissipation
28.	Cout1 Pd	469.564 μW	Power	Output capacitor1 power dissipation
29.	Diode1 Pd	0.0 W	Power	Diode1 power dissipation
30.	IC Pd	110.52 mW	Power	IC power dissipation
31.	Total Pd	741.802 mW	Power	Total Power Dissipation

#	Name	Value	Category	Description
32.	Xformer Pd	245.015 mW	Power	Transformer power dissipation
33.	Zener Pd	0.0 W	Power	Zener power dissipation
34.	Vout Tolerance	1.891 %		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.	Iout1	1.0	Output Current #1
3.	Iout2	2.0	Output Current #2
4.	Iout3	4.0	Output Current #3
5.	VinMax	25.0	Maximum input voltage
6.	VinMin	20.0	Minimum input voltage
7.	Vout	4.4	Output Voltage
8.	Vout1	4.4	Output Voltage #1
9.	Vout2	1.0	Output Voltage #2
10.	Vout3	3.0	Output Voltage #3
11.	base_pn	LM5020-1	Base Product Number
12.	source	DC	Input Source Type
13.	Ta	40.0	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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