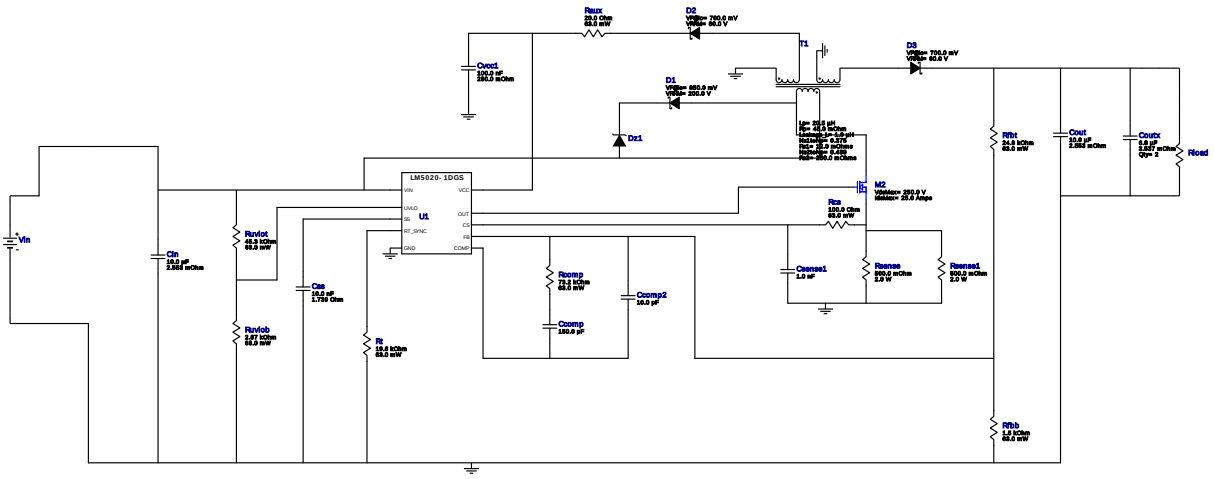
WEBENCH® Design Report

VinMin = 22.0V
VinMax = 34.0V
Vout = 22.0V
Iout = 1.0A

Device = LM5020MM-1/NOPB
Topology = Flyback
Created = 7/13/16 1:38:54 AM
BOM Cost = $0.00
BOM Count = 26
Total Pd = 1.28W

Design : 4738744/29 LM5020MM-1/NOPB
LM5020MM-1/NOPB 22.0V-34.0V to 22.00V @ 1.0A

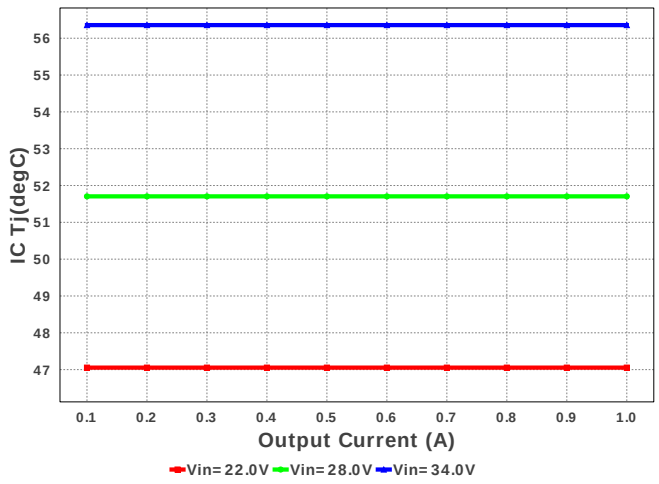


Electrical BOM

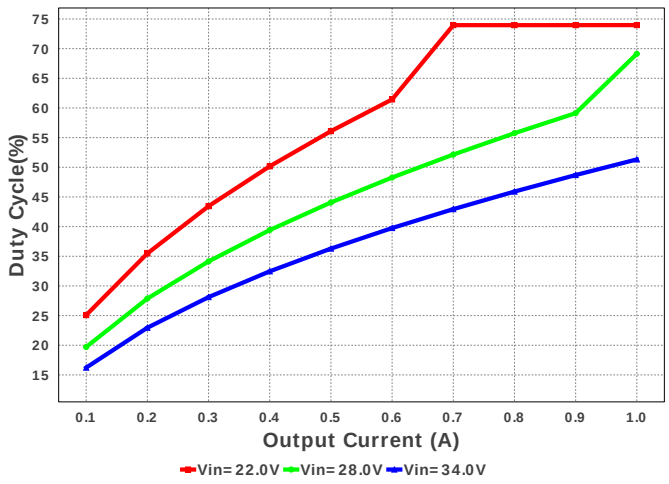
#	Name	Manufacturer	Part Number	Properties	Qty	Price	Footprint
1.	Ccomp	TDK	C2012C0G1H151J Series= C0G/NP0	Cap= 150.0 pF VDC= 50.0 V IRMS= 0.0 A	1	$0.01	0805 7 mm²
2.	Ccomp2	Kemet	C0805C100K5GACTU Series= C0G/NP0	Cap= 10.0 pF VDC= 50.0 V IRMS= 0.0 A	1	$0.01	0805 7 mm²
3.	Cin	TDK	C3216X6S1V106K Series= X6S	Cap= 10.0 uF ESR= 2.553 mOhm VDC= 35.0 V IRMS= 0.0 A	1	$0.14	1206 11 mm²
4.	Cout	TDK	C3216X6S1V106K Series= X6S	Cap= 10.0 uF ESR= 2.553 mOhm VDC= 35.0 V IRMS= 0.0 A	1	$0.14	1206 11 mm²
5.	Coutx	TDK	C3216JB1V685K Series= JB	Cap= 6.8 uF ESR= 3.537 mOhm VDC= 35.0 V IRMS= 0.0 A	2	NA	1206 11 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	Diodes Inc.	DFLS1200-7	VF@Io= 850.0 mV VRRM= 200.0 V	1	$0.21	PowerDI123 13 mm²
10.	D2	Diodes Inc.	B160-13-F	VF@Io= 700.0 mV VRRM= 60.0 V	1	$0.06	SMA 37 mm²

#	Name	Manufacturer	Part Number	Properties	Qty	Price	Footprint
11.	D3	Diodes Inc.	B260A-13-F	VF@Io= 700.0 mV VRRM= 60.0 V	1	$0.09	 SMA 37 mm^2
12.	Dz1	CUSTOM	CUSTOM	Zener	1	NA	CUSTOM 0 mm^2
13.	M2	Infineon Technologies	BSC600N25NS3 G	VdsMax= 250.0 V IdsMax= 25.0 Amps	1	$1.41	 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	CRCW040273K2FKED Series= CRCW..e3	Res= 73.2 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	CRCW040224K9FKED Series= CRCW..e3	Res= 24.9 kOhm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	 0402 3 mm^2
19.	Rsense	Stackpole Electronics Inc	CSRN2512FKR500 Series= ?	Res= 500.0 mOhm Power= 2.0 W Tolerance= 1.0%	1	$0.09	 2512 43 mm^2
20.	Rsense1	Stackpole Electronics Inc	CSRN2512FKR500 Series= ?	Res= 500.0 mOhm Power= 2.0 W Tolerance= 1.0%	1	$0.09	 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	CRCW04022K87FKED Series= CRCW..e3	Res= 2.87 kOhm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	 0402 3 mm^2
23.	Ruvlot	Vishay-Dale	CRCW040245K3FKED Series= CRCW..e3	Res= 45.3 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

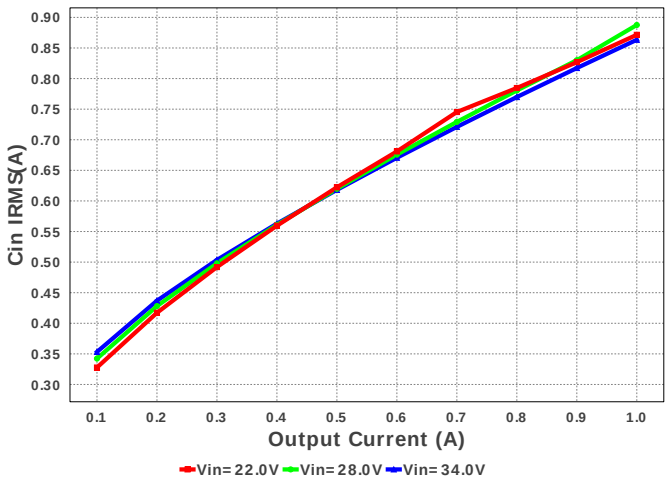
IC Tj



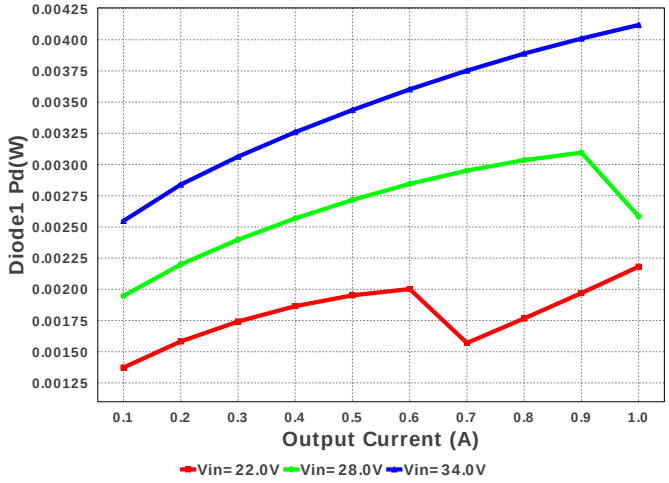
Duty Cycle



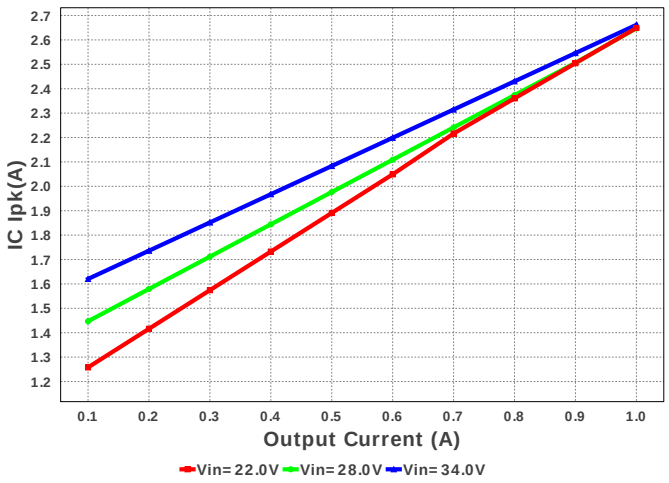
Cin IRMS



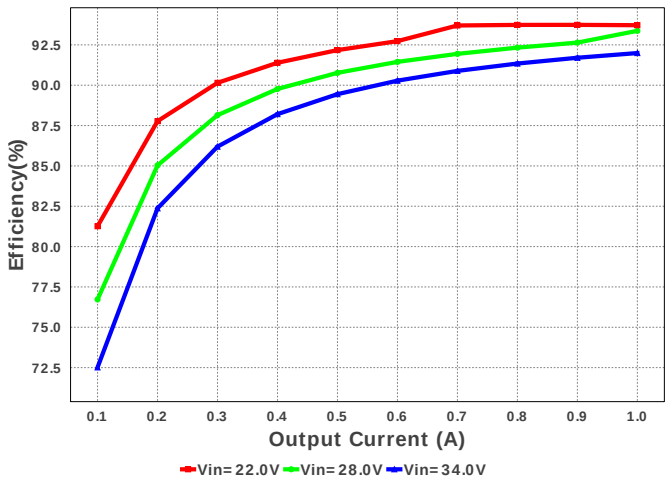
Diode1 Pd

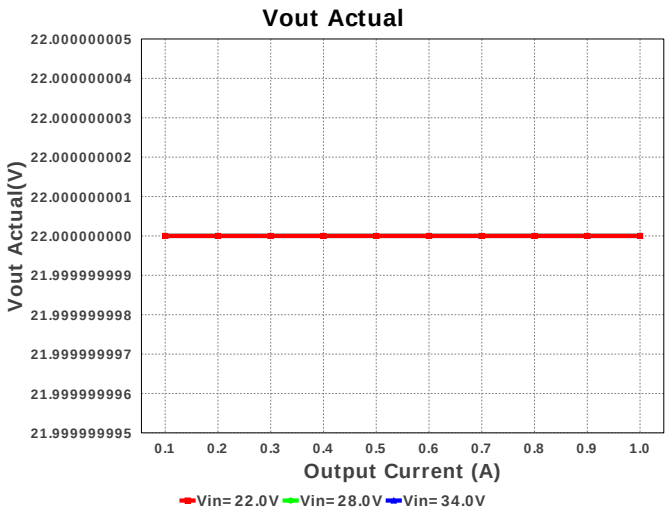


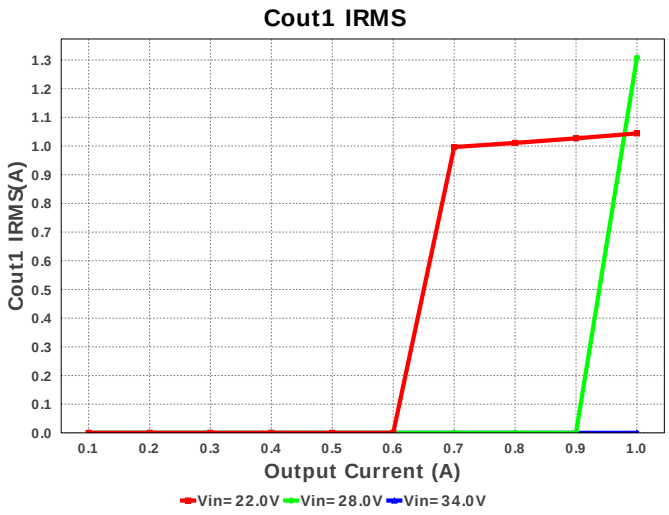
IC Ipk

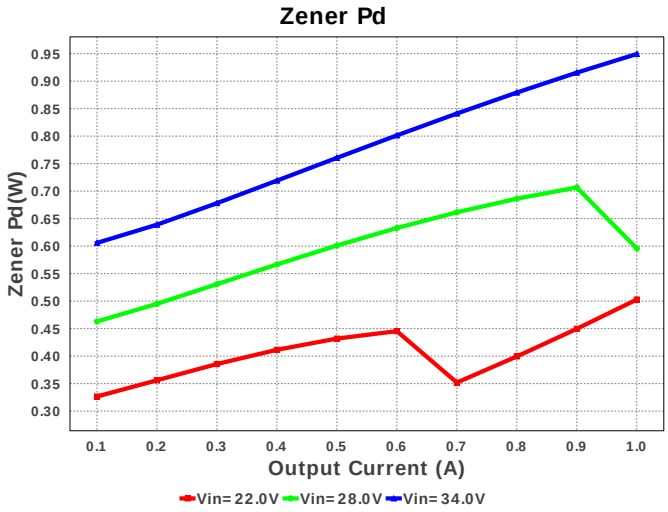


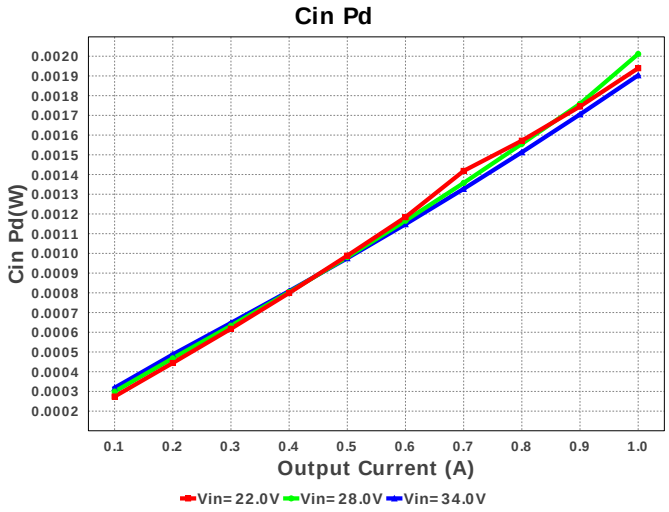
Efficiency

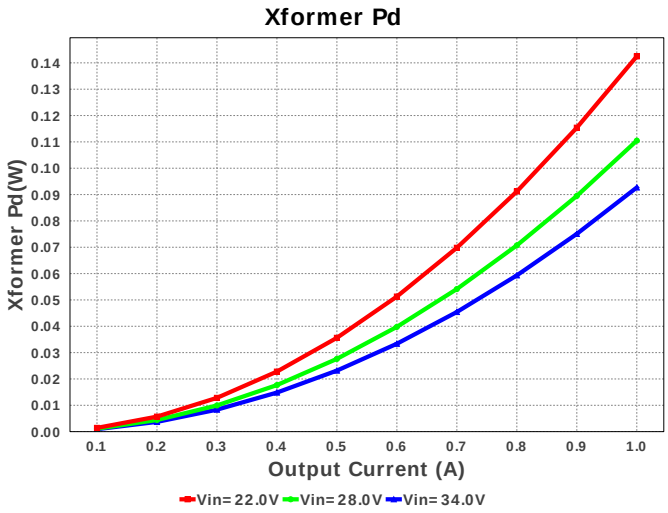


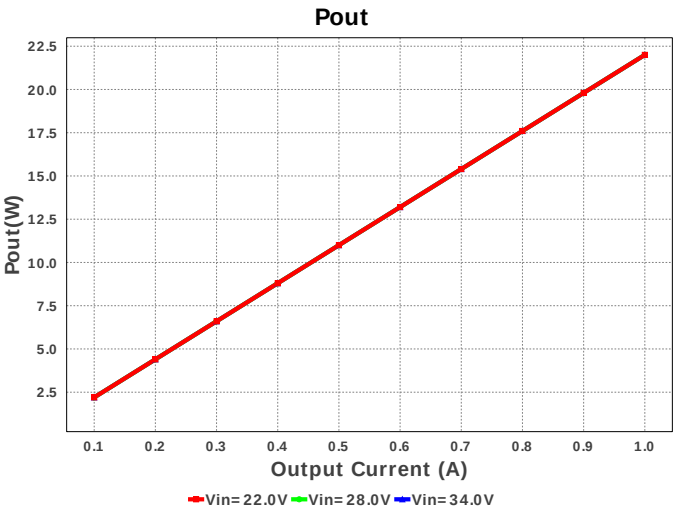


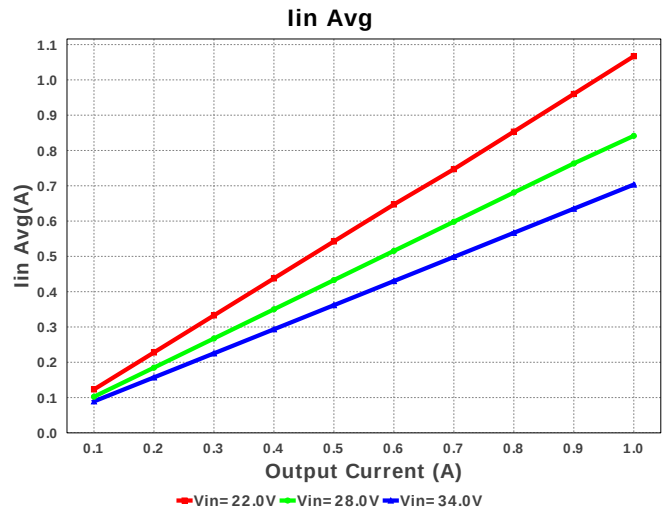


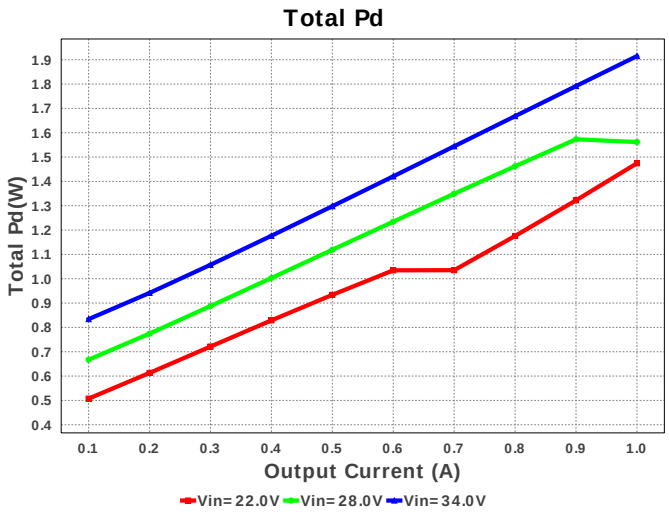


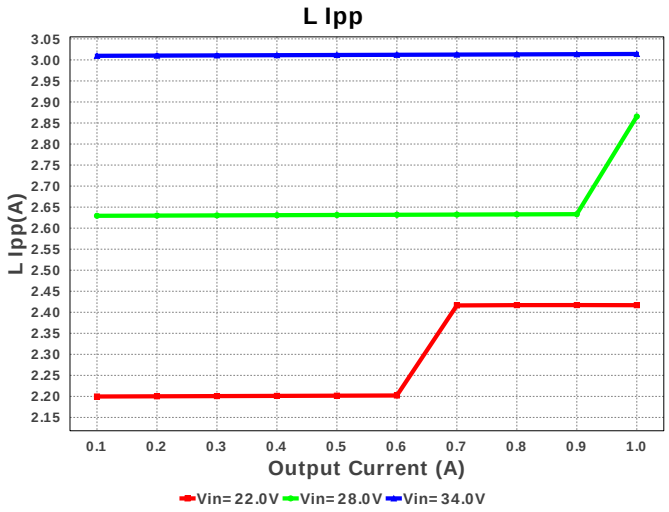


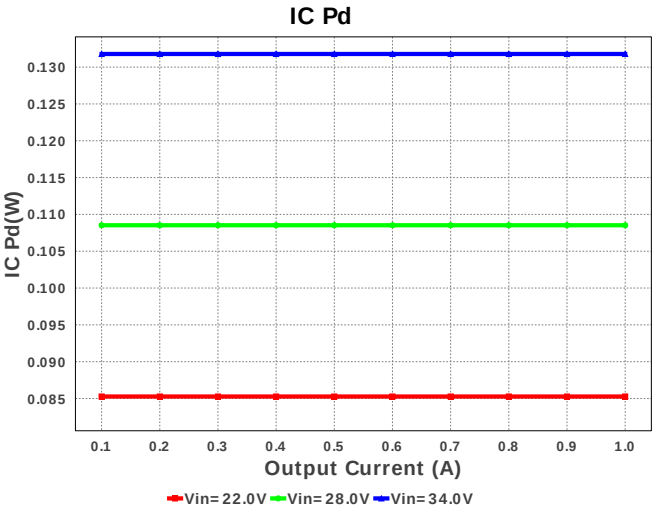


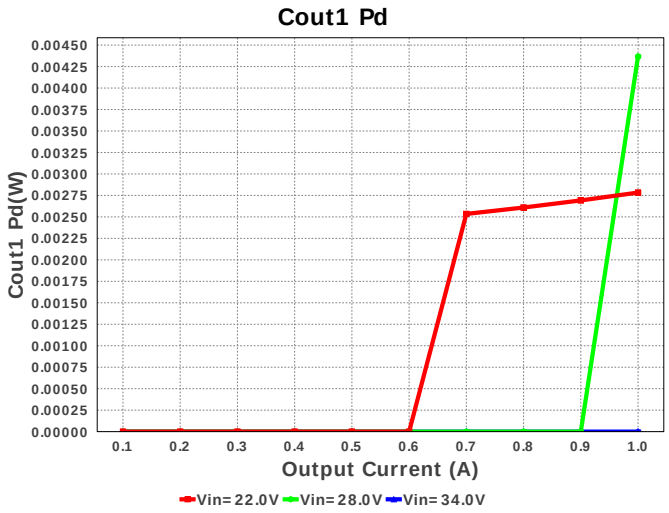


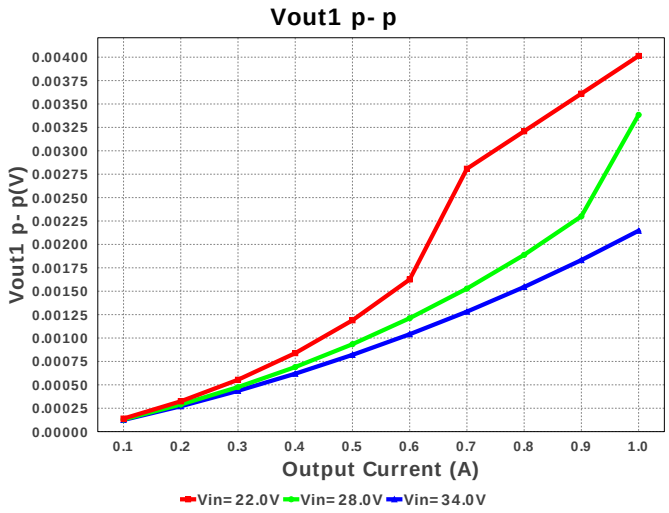


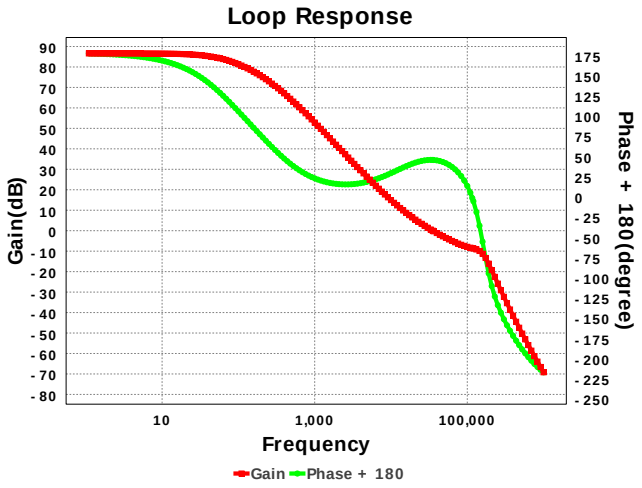












Operating Values

#	Name	Value	Category	Description
1.	Cin IRMS	869.075 mA	Current	Input capacitor RMS ripple current
2.	Cout1 IRMS	1.13 A	Current	Output capacitor1 RMS ripple current
3.	IC Ipk	2.64 A	Current	Peak switch current
4.	Iin Avg	1.058 A	Current	Average input current
5.	L Ipp	2.416 A	Current	Peak-to-peak inductor ripple current
6.	BOM Count	26	General	Total Design BOM count
7.	FootPrint	1.122 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	22.0 W	General	Total output power
11.	Total BOM	$0.0	General	Total BOM Cost
12.	Low Freq Gain	81.23 dB	Op_Point	Gain at 10Hz
13.	Vout Actual	22.0 V	Op_Point	Vout Actual calculated based on selected voltage divider resistors
14.	Cross Freq	21.222 kHz	Op_point	Bode plot crossover frequency
15.	Duty Cycle	73.805 %	Op_point	Duty cycle
16.	Efficiency	94.496 %	Op_point	Steady state efficiency
17.	Gain Marg	-10.476 dB	Op_point	Bode Plot Gain Margin
18.	IC Tj	47.164 degC	Op_point	IC junction temperature
19.	ICThetaJA	200.0 degC/W	Op_point	IC junction-to-ambient thermal resistance
20.	IOUT_OP	1.0 A	Op_point	Iout operating point
21.	Phase Marg	35.612 deg	Op_point	Bode Plot Phase Margin
22.	VIN_OP	22.0 V	Op_point	Vin operating point
23.	Vout1 OP	22.0 V	Op_point	Operational Voltage 1
24.	Vout1 p-p	3.988 mV	Op_point	Peak-to-peak output1 ripple voltage
25.	Cin Pd	1.928 mW	Power	Input capacitor power dissipation
26.	Cout1 Pd	3.261 mW	Power	Output capacitor1 power dissipation
27.	Cout1 Pd	3.261 mW	Power	Output capacitor1 power dissipation
28.	Diode1 Pd	2.194 mW	Power	Diode1 power dissipation
29.	IC Pd	85.822 mW	Power	IC power dissipation
30.	Total Pd	1.281 W	Power	Total Power Dissipation
31.	Xformer Pd	146.967 mW	Power	Transformer power dissipation
32.	Zener Pd	505.75 mW	Power	Zener power dissipation
33.	Vout Tolerance	3.944 %		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	1.0	Output Current #2
4.	Iout3	1.0	Output Current #3
5.	VinMax	34.0	Maximum input voltage
6.	VinMin	22.0	Minimum input voltage
7.	Vout	22.0	Output Voltage
8.	Vout1	22.0	Output Voltage #1
9.	Vout2	22.0	Output Voltage #2
10.	Vout3	43.0	Output Voltage #3
11.	base_pn	LM5020-1	Texas Instruments Base Part 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.