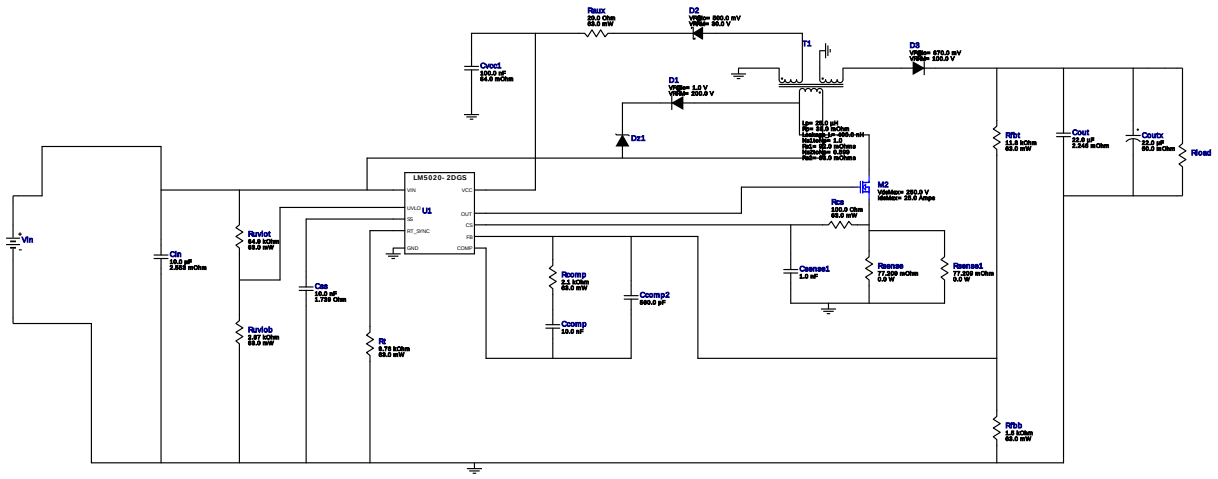
TEXAS INSTRUMENTS

WEBENCH® Design Report

VinMin = 32.0V
VinMax = 34.0V
Vout = 11.0V
Iout = 2.0A

Device = LM5020MM-2/NOPB
Topology = Flyback
Created = 7/13/16 1:29:11 AM
BOM Cost = $0.00
BOM Count = 25
Total Pd = 3.5W

Design : 4738744/21 LM5020MM-2/NOPB
LM5020MM-2/NOPB 32.0V-34.0V to 11.00V @ 2.0A

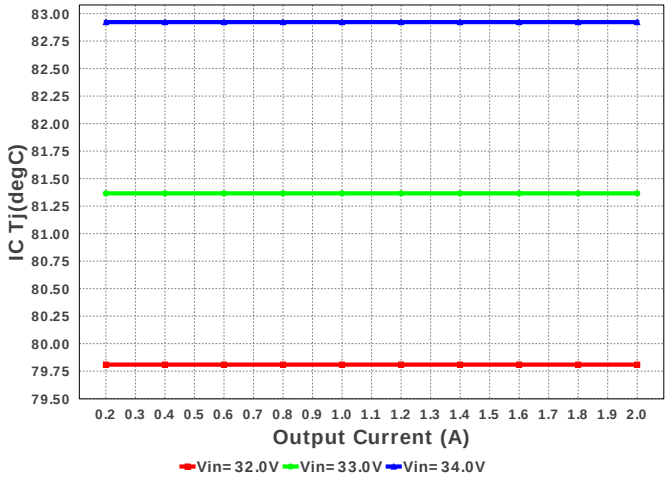


Electrical BOM

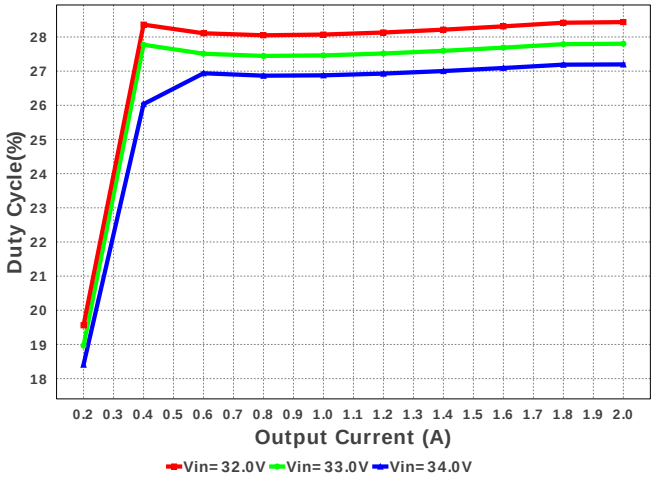
#	Name	Manufacturer	Part Number	Properties	Qty	Price	Footprint
1.	Ccomp	MuRata	GRM216R71H103KA01D Series= X7R	Cap= 10.0 nF VDC= 50.0 V IRMS= 0.0 A	1	$0.01	0805 7 mm²
2.	Ccomp2	Yageo America	CC0805KRX7R9BB561 Series= X7R	Cap= 560.0 pF VDC= 50.0 V IRMS= 0.0 A	1	$0.01	0805 7 mm²
3.	Cin	TDK	C3216X6S1V106K 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	C3216JB1E226M Series= JB	Cap= 22.0 uF ESR= 2.246 mOhm VDC= 25.0 V IRMS= 0.0 A	1	$0.55	1206 11 mm²
5.	Coutx	Chemi-Con	APXH200ARA220MF60G Series= PXH	Cap= 22.0 uF ESR= 60.0 mOhm VDC= 20.0 V IRMS= 1.65 A	1	$0.48	CAPSMT_62_F60 77 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	Kemet	C0805C104K5RACTU Series= X7R	Cap= 100.0 nF ESR= 64.0 mOhm VDC= 50.0 V IRMS= 1.64 A	1	$0.01	0805 7 mm²
9.	D1	Central Semiconductor	CMR1U-02M	VF@Io= 1.0 V VRRM= 200.0 V	1	$0.17	SMA 37 mm²

#	Name	Manufacturer	Part Number	Properties	Qty	Price	Footprint
10.	D2	Bourns	CD214A-B130LF	VF@Io= 500.0 mV VRRM= 30.0 V	1	$0.08	 SMA 37 mm^2
11.	D3	Fairchild Semiconductor	FSV8100V	VF@Io= 670.0 mV VRRM= 100.0 V	1	$0.21	 TO-277A 56 mm^2
12.	Dz1	NXP Semiconductor	BZX585-C22,115	Zener	1	$0.02	 SOD-523 5 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	CRCW04022K10FKED Series= CRCW..e3	Res= 2.1 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	CRCW040211K8FKED Series= CRCW..e3	Res= 11.8 kOhm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	 0402 3 mm^2
19.	Rsense	CUSTOM	CUSTOM Series= ?	Res= 77.209 mOhm Power= 0.0 W Tolerance= 0.0%	1	NA	CUSTOM 0 mm^2
20.	Rsense1	CUSTOM	CUSTOM Series= ?	Res= 77.209 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	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	CRCW040264K9FKED Series= CRCW..e3	Res= 64.9 kOhm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	 0402 3 mm^2
24.	T1	Wurth Elektronik	750315445	Lp= 25.0 µH Rp= 38.0 mOhm Leakage_L= 400.0 nH Ns1toNp= 1.0 Rs1= 92.0 mOhms Ns2toNp= 0.599 Rs2= 63.0 mOhms	1	NA	Wurth_750315445 0 mm^2
25.	U1	Texas Instruments	LM5020MM-2/NOPB	Switcher	1	$0.80	mpds035b 35 mm^2

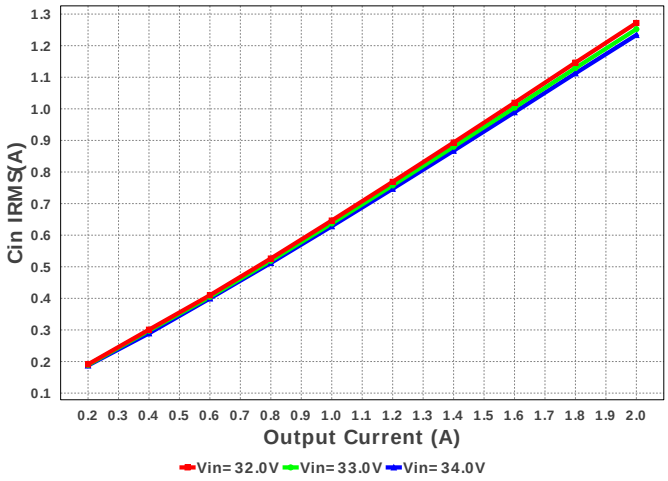
IC Tj



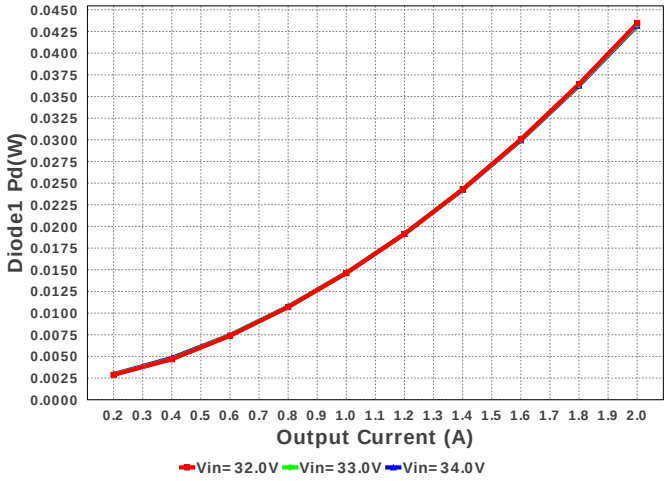
Duty Cycle



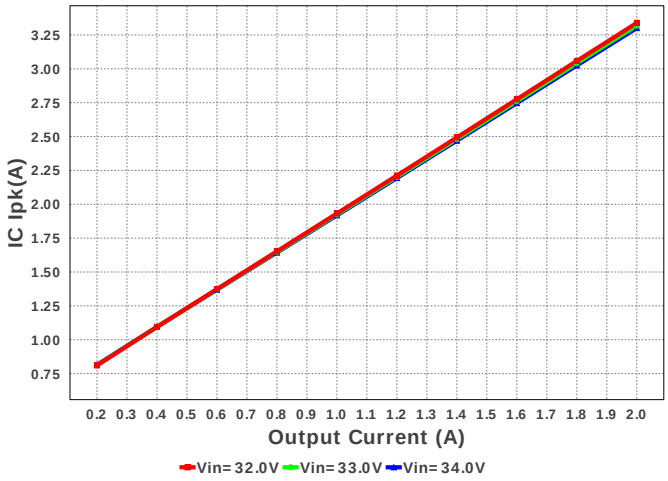
Cin IRMS



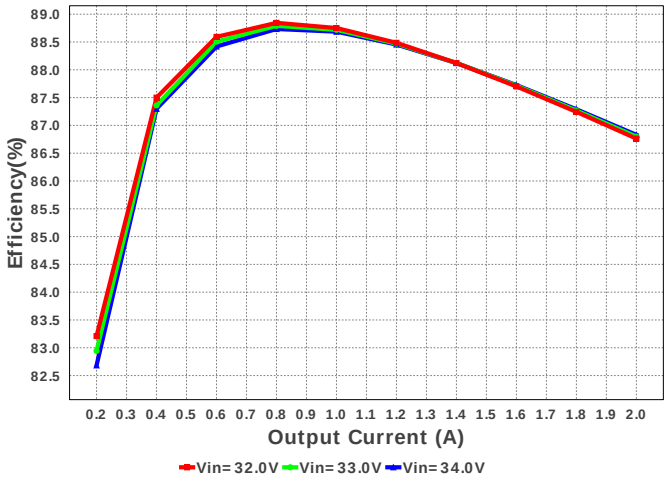
Diode1 Pd

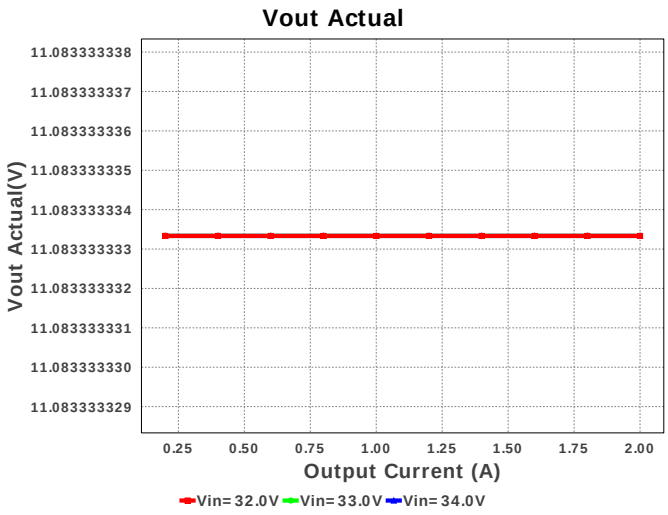


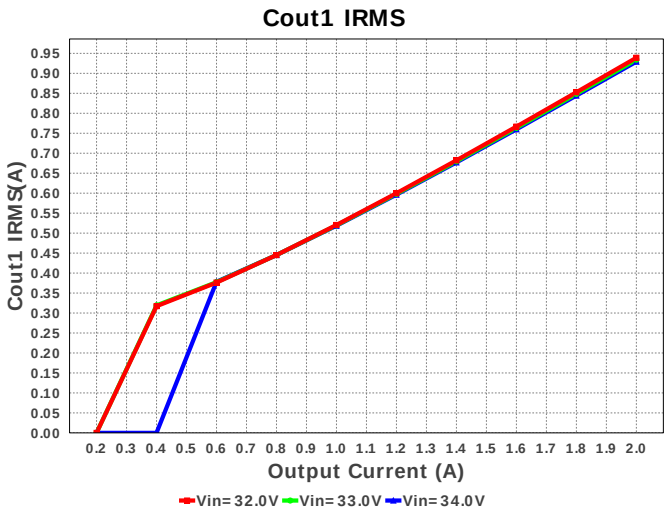
IC Ipk

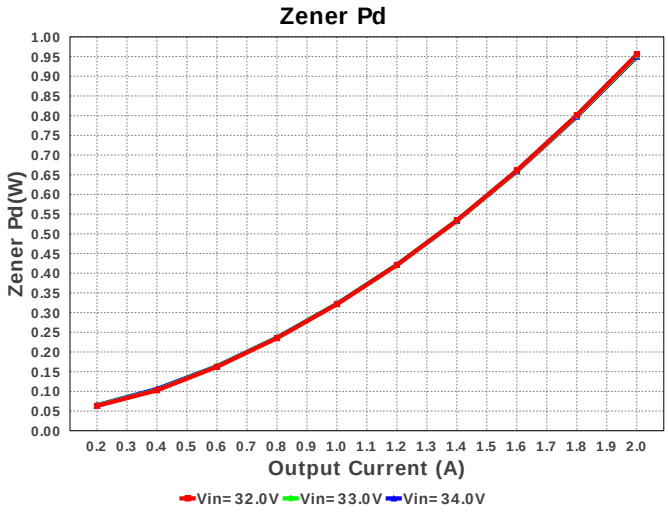


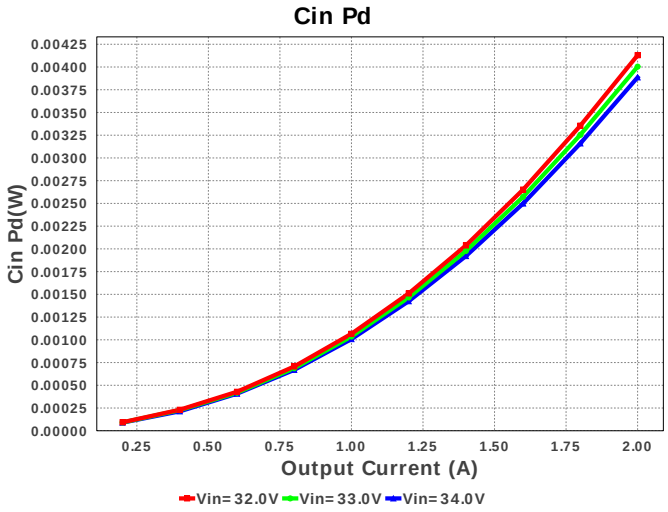
Efficiency

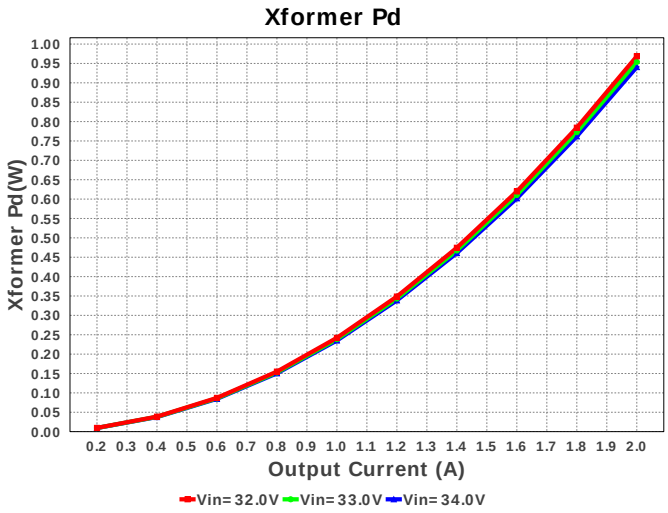


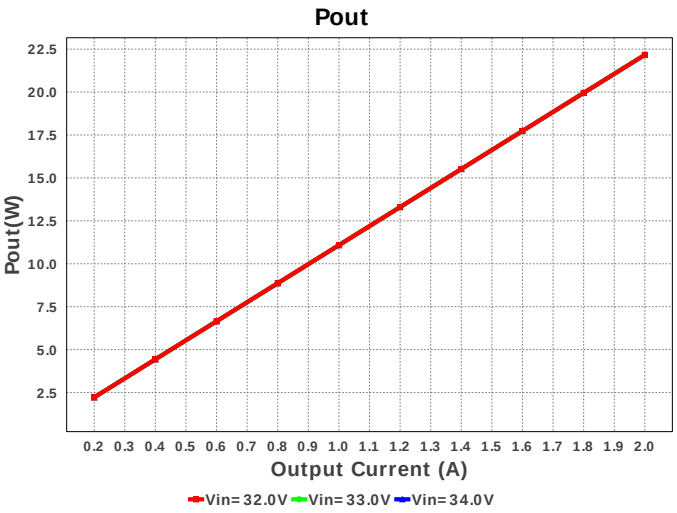


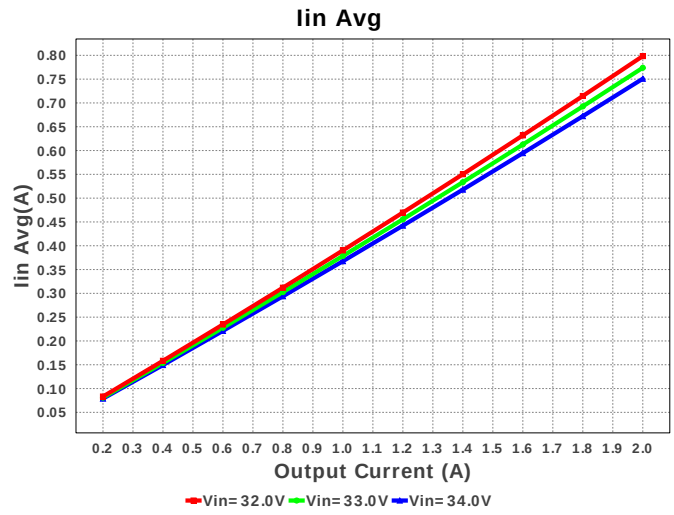


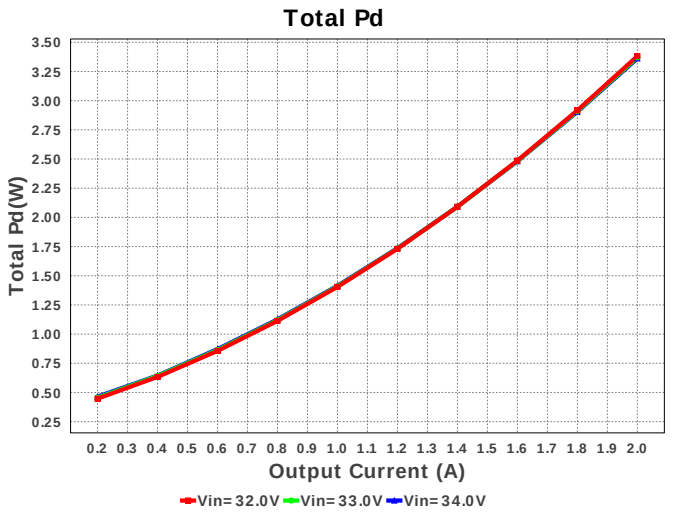


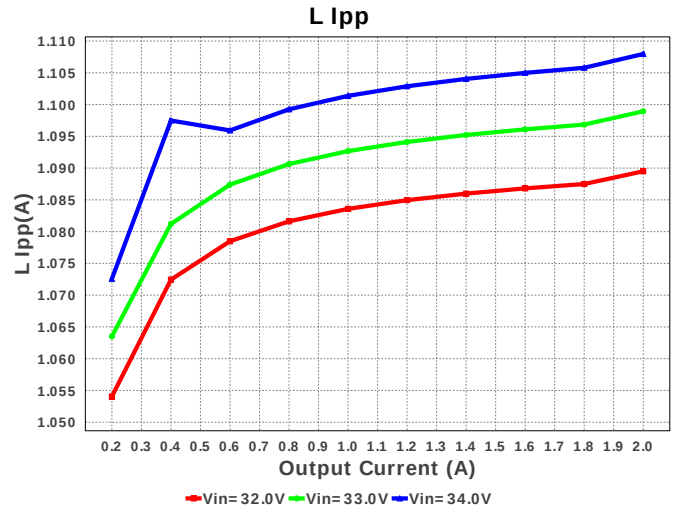


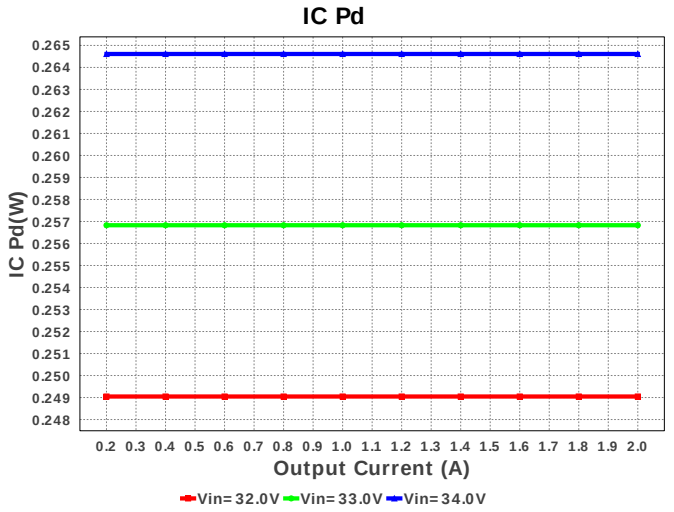


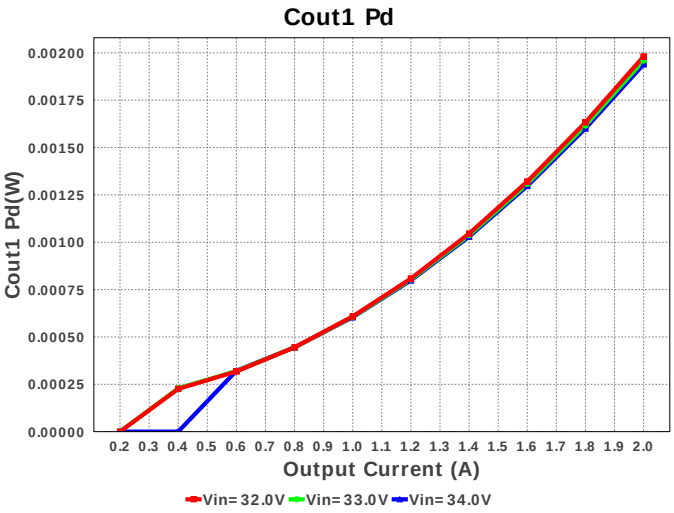


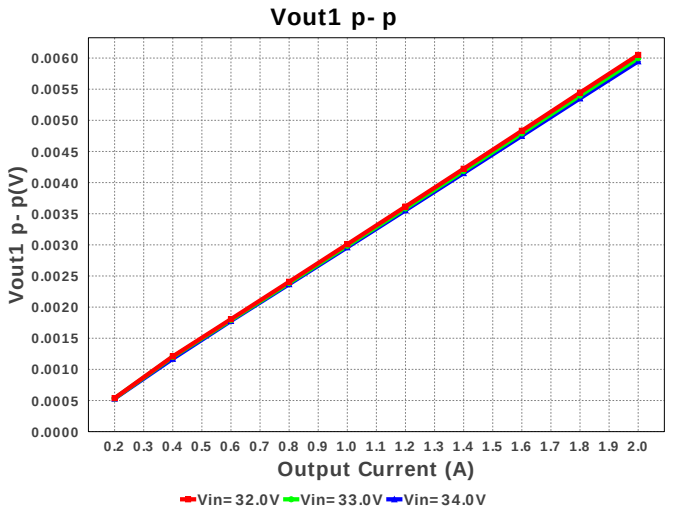


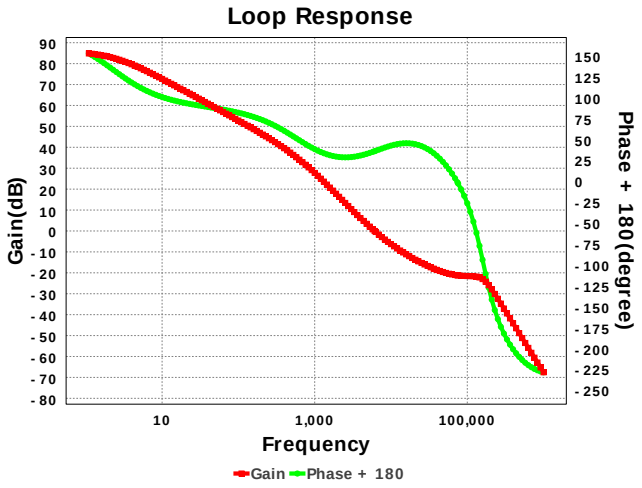












Operating Values

#	Name	Value	Category	Description
1.	Cin IRMS	1.275 A	Current	Input capacitor RMS ripple current
2.	Cout1 IRMS	1.269 A	Current	Output capacitor1 RMS ripple current
3.	IC Ipk	3.341 A	Current	Peak switch current
4.	Iin Avg	802.21 mA	Current	Average input current
5.	L Ipp	1.086 A	Current	Peak-to-peak inductor ripple current
6.	BOM Count	25	General	Total Design BOM count
7.	FootPrint	393.0 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	22.167 W	General	Total output power
11.	Total BOM	$0.0	General	Total BOM Cost
12.	Low Freq Gain	84.703 dB	Op_Point	Gain at 10Hz
13.	Vout Actual	11.083 V	Op_Point	Vout Actual calculated based on selected voltage divider resistors
14.	Cross Freq	6.031 kHz	Op_point	Bode plot crossover frequency
15.	Duty Cycle	28.533 %	Op_point	Duty cycle
16.	Efficiency	86.351 %	Op_point	Steady state efficiency
17.	Gain Marg	-20.9 dB	Op_point	Bode Plot Gain Margin
18.	IC Tj	79.926 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	36.593 deg	Op_point	Bode Plot Phase Margin
22.	VIN_OP	32.0 V	Op_point	Vin operating point
23.	Vout1 OP	11.083 V	Op_point	Operational Voltage 1
24.	Vout1 p-p	6.059 mV	Op_point	Peak-to-peak output1 ripple voltage
25.	Cin Pd	4.149 mW	Power	Input capacitor power dissipation
26.	Cout1 Pd	3.615 mW	Power	Output capacitor1 power dissipation
27.	Cout1 Pd	3.615 mW	Power	Output capacitor1 power dissipation
28.	Diode1 Pd	43.519 mW	Power	Diode1 power dissipation
29.	IC Pd	249.632 mW	Power	IC power dissipation
30.	Total Pd	3.504 W	Power	Total Power Dissipation
31.	Xformer Pd	1.043 W	Power	Transformer power dissipation
32.	Zener Pd	957.42 mW	Power	Zener power dissipation
33.	Vout Tolerance	3.828 %		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	34.0	Maximum input voltage
6.	VinMin	32.0	Minimum input voltage
7.	Vout	11.0	Output Voltage
8.	Vout1	11.0	Output Voltage #1
9.	Vout2	5.0	Output Voltage #2
10.	Vout3	4.0	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.