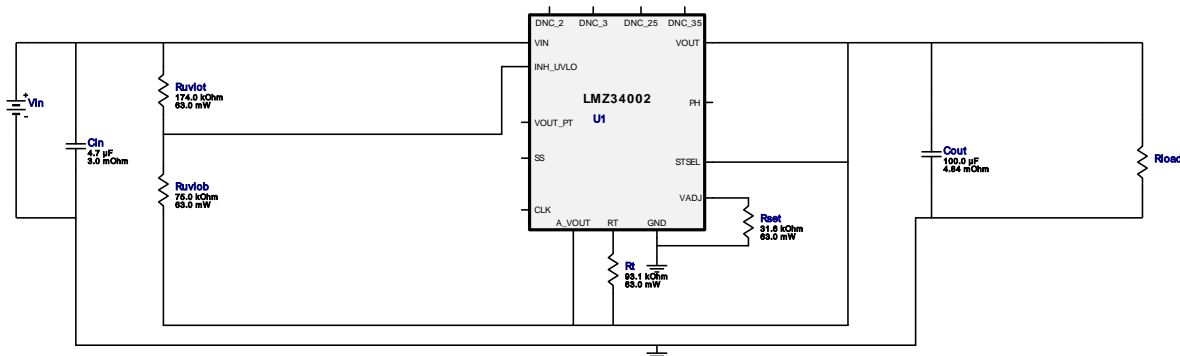


VinMin = 4.5V  
VinMax = 24.0V  
Vout = -3.3V  
Iout = 1.0A







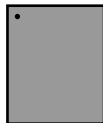
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Topology = Inverting\_Buck\_Boost  
Created = 8/9/16 5:58:27 PM  
BOM Cost = \$7.00  
BOM Count = 7  
Total Pd = 0.9W

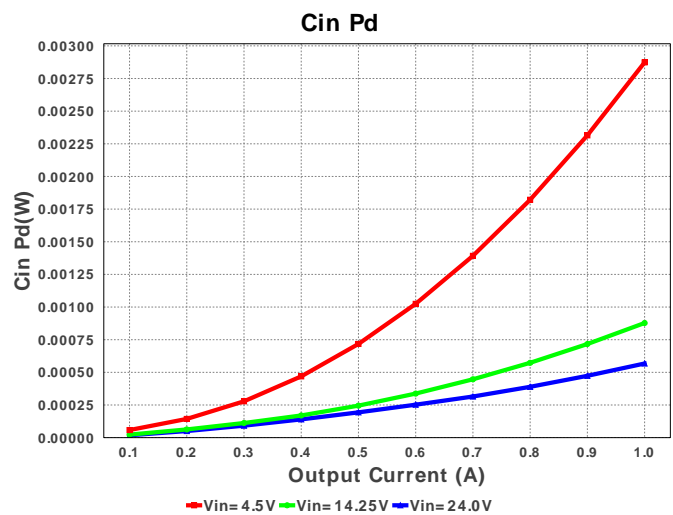
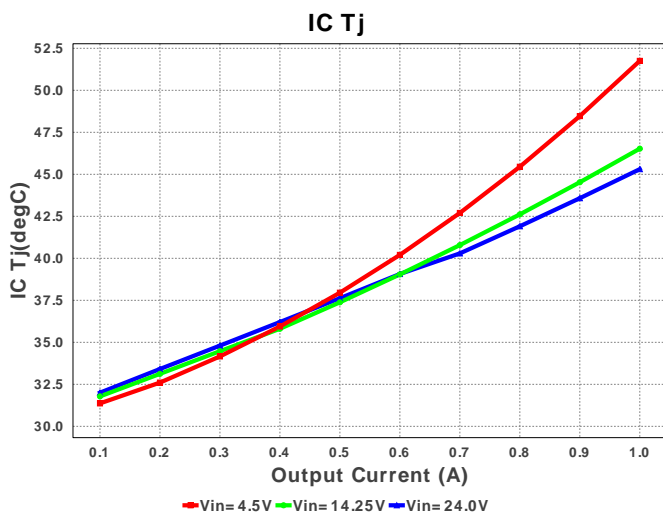
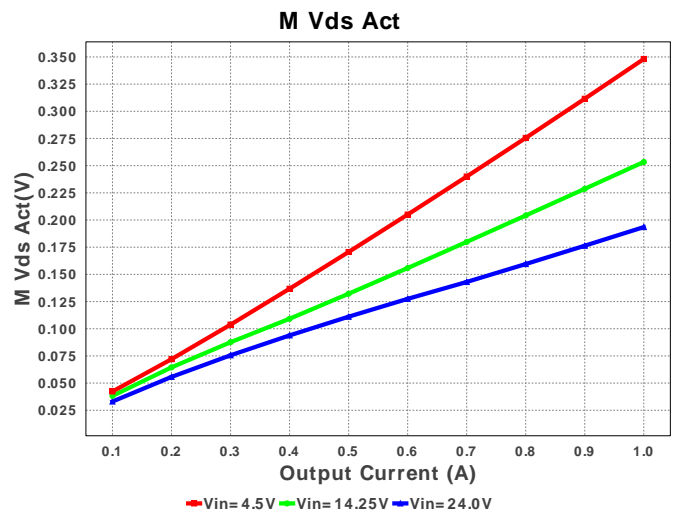
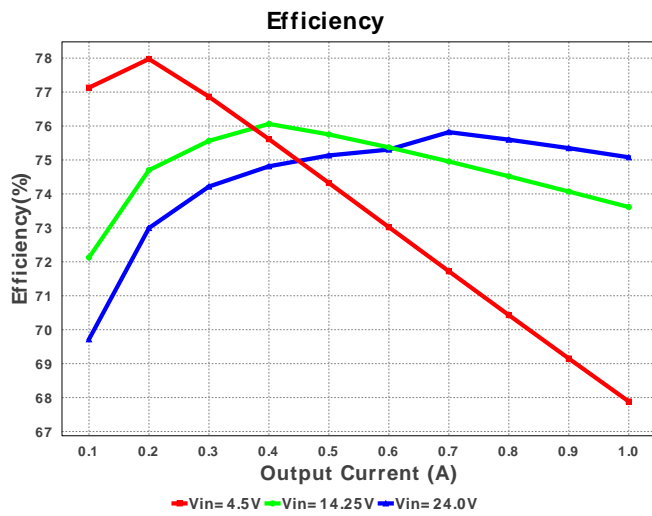
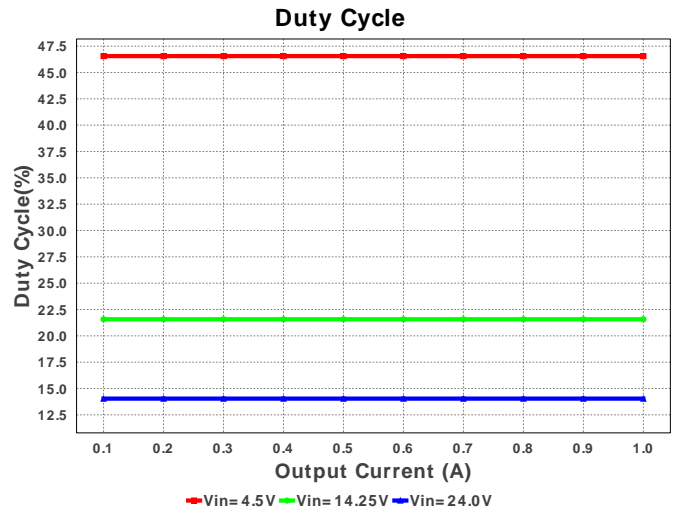
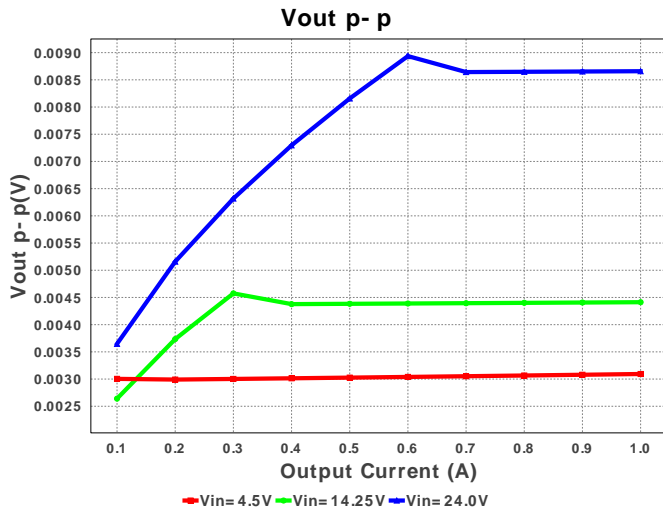
## WEBENCH® Design Report

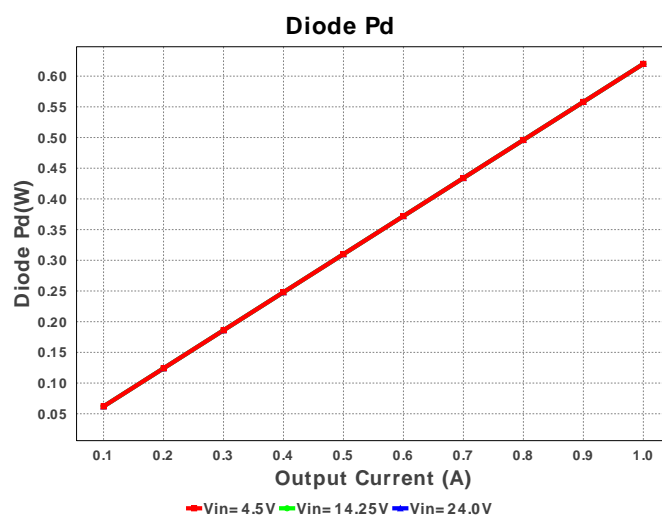
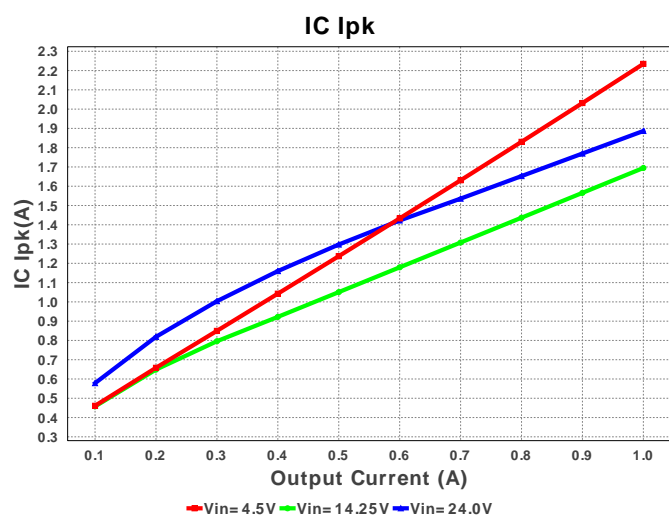
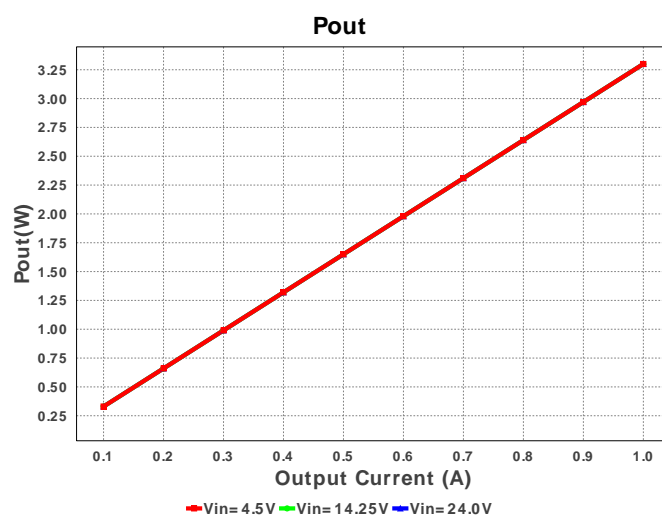
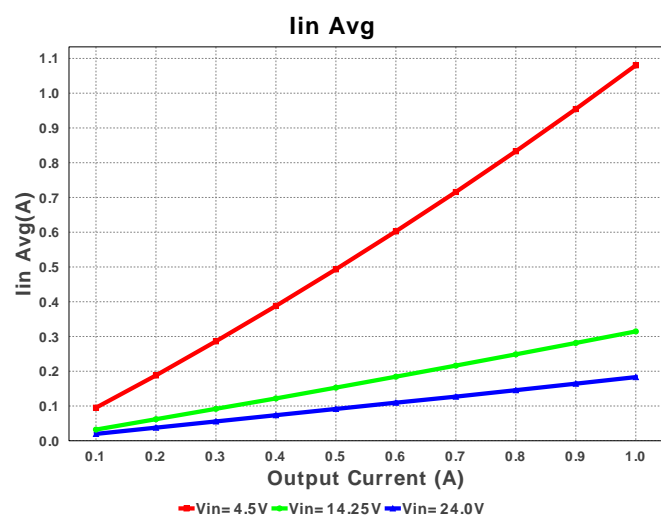
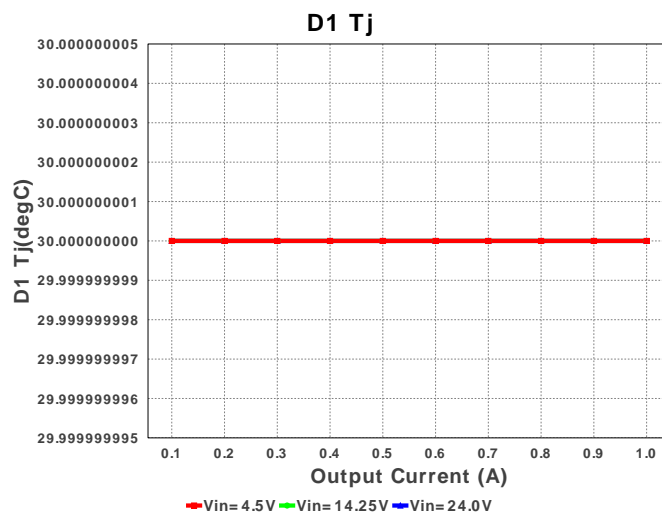
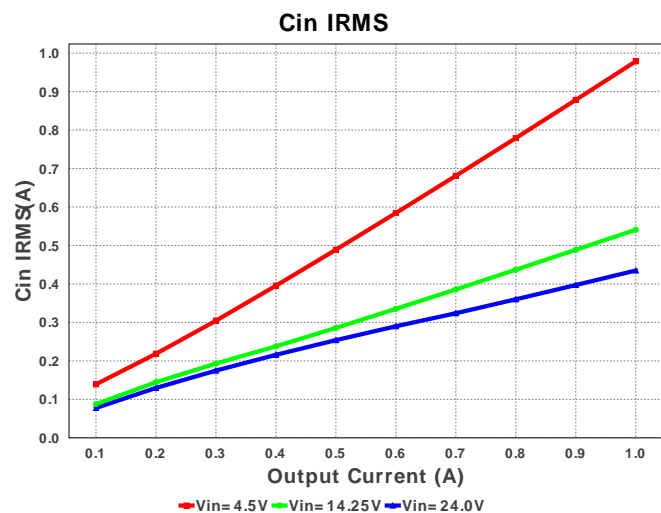
Design : 4181735/4 LMZ34002RKGR  
LMZ34002RKGR 4.5V-24.0V to -3.30V @ 1.0A

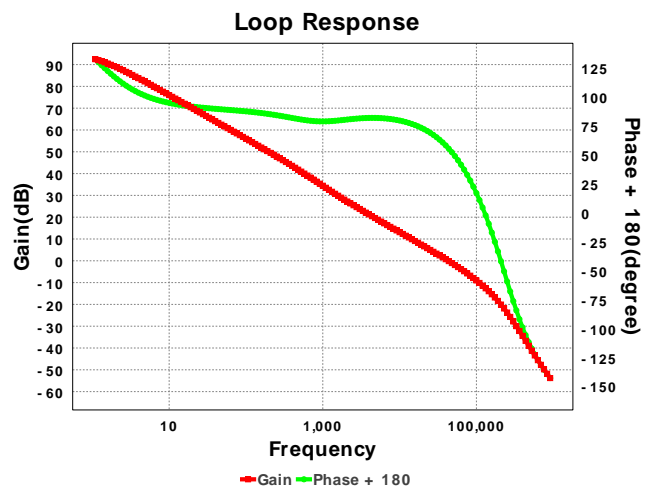
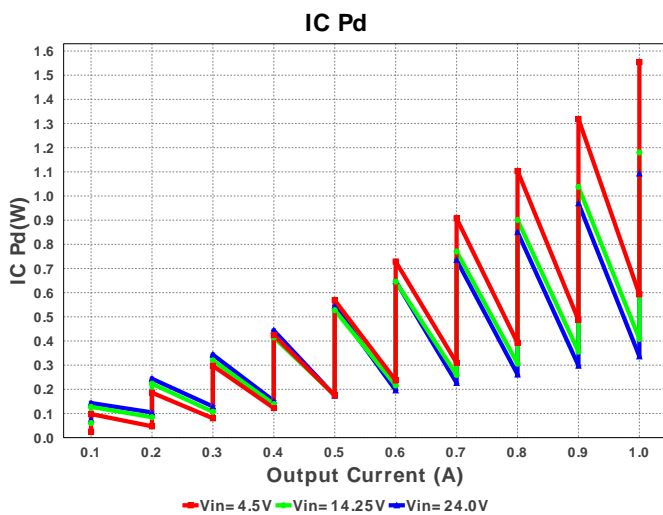
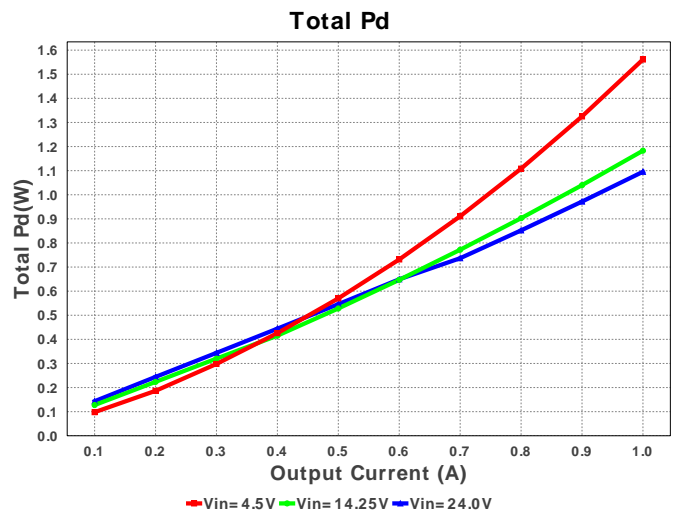
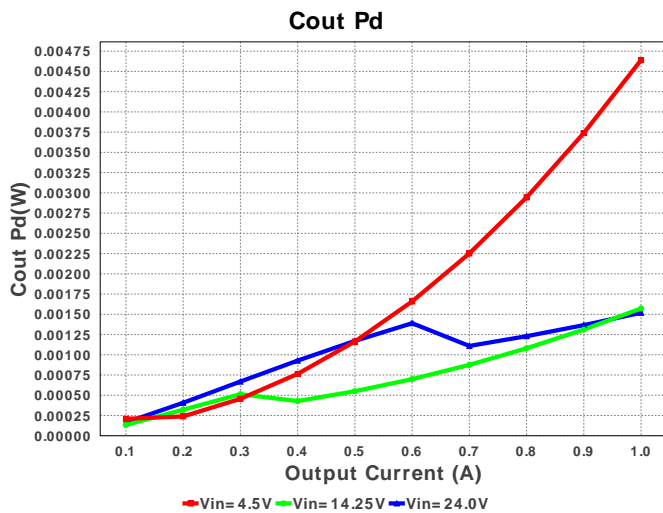
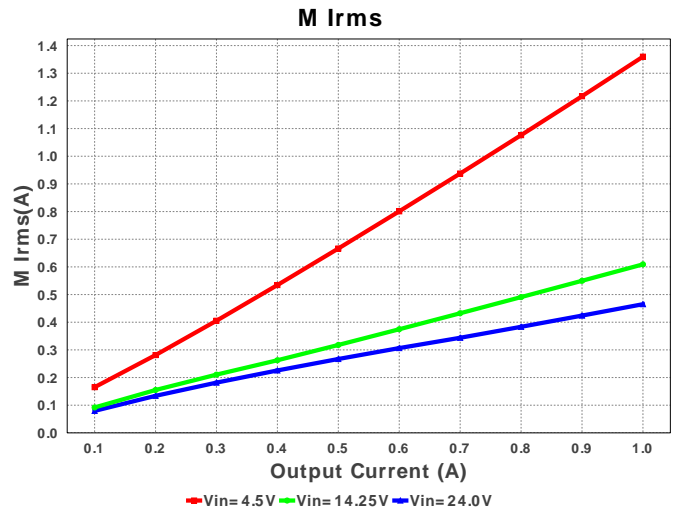
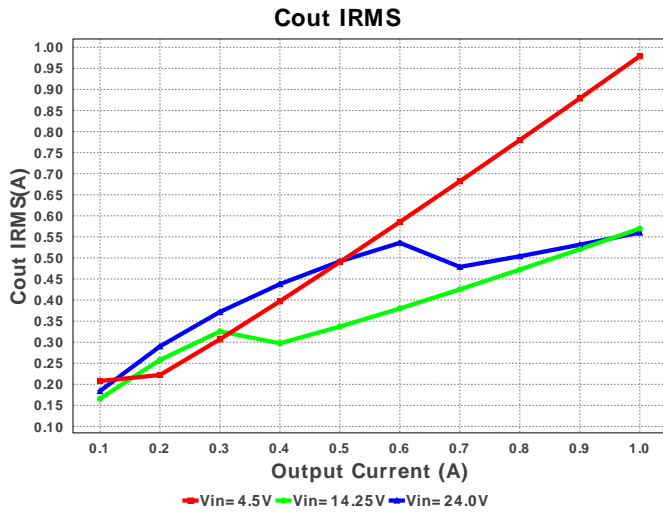


### Electrical BOM

#	Name	Manufacturer	Part Number	Properties	Qty	Price	Footprint
1.	Cin	MuRata	GRM31CR71H475KA12L Series= X7R	Cap= 4.7 uF ESR= 3.0 mOhm VDC= 50.0 V IRMS= 4.98 A	1	\$0.07	 1206 11 mm <sup>2</sup>
2.	Cout	MuRata	GRM31CD80G107ME39L Series= X6T	Cap= 100.0 uF ESR= 4.84 mOhm VDC= 4.0 V IRMS= 4.3381 A	1	\$0.14	 1206_190 11 mm <sup>2</sup>
3.	Rset	Vishay-Dale	CRCW040231K6FKED Series= CRCW...e3	Res= 31.6 kOhm Power= 63.0 mW Tolerance= 1.0%	1	\$0.01	 0402 3 mm <sup>2</sup>
4.	Rt	Vishay-Dale	CRCW040293K1FKED Series= CRCW...e3	Res= 93.1 kOhm Power= 63.0 mW Tolerance= 1.0%	1	\$0.01	 0402 3 mm <sup>2</sup>
5.	Ruvlob	Vishay-Dale	CRCW040275K0FKED Series= CRCW...e3	Res= 75.0 kOhm Power= 63.0 mW Tolerance= 1.0%	1	\$0.01	 0402 3 mm <sup>2</sup>
6.	Ruvlot	Vishay-Dale	CRCW0402174KFKED Series= CRCW...e3	Res= 174.0 kOhm Power= 63.0 mW Tolerance= 1.0%	1	\$0.01	 0402 3 mm <sup>2</sup>
7.	U1	Texas Instruments	LMZ34002RKGR	Switcher	1	\$6.75	 RKG0041A 143 mm <sup>2</sup>







## Operating Values

#	Name	Value	Category	Description
1.	Cin IRMS	434.998 mA	Current	Input capacitor RMS ripple current
2.	Cout IRMS	560.208 mA	Current	Output capacitor RMS ripple current
3.	IC IpK	1.887 A	Current	Peak switch current in IC
4.	Iin Avg	174.8 mA	Current	Average input current
5.	M1 Irms	465.12 mA	Current	Q lavg
6.	BOM Count	7	General	Total Design BOM count
7.	FootPrint	177.0 mm <sup>2</sup>	General	Total Foot Print Area of BOM components
8.	Frequency	500.0 kHz	General	Switching frequency
9.	IC Tolerance	16.0 mV	General	IC Feedback Tolerance
10.	M Vds Act	193.49 mV	General	Voltage drop across the MosFET
11.	Mode	CCM	General	Conduction Mode

#	Name	Value	Category	Description
12.	Pout	3.3 W	General	Total output power
13.	Total BOM	\$7.0	General	Total BOM Cost
14.	D1 Tj	30.0 degC	Op_Point	D1 junction temperature
15.	Vout OP	-3.3 V	Op_Point	Operational Output Voltage
16.	Cross Freq	42.995 kHz	Op_point	Bode plot crossover frequency
17.	Duty Cycle	14.04 %	Op_point	Duty cycle
18.	Efficiency	78.663 %	Op_point	Steady state efficiency
19.	IC Tj	42.503 degC	Op_point	IC junction temperature
20.	ICThetaJA	14.0 degC/W	Op_point	IC junction-to-ambient thermal resistance
21.	IOUT_OP	1.0 A	Op_point	Iout operating point
22.	Phase Marg	56.673 deg	Op_point	Bode Plot Phase Margin
23.	VIN_OP	24.0 V	Op_point	Vin operating point
24.	Vout p-p	8.658 mV	Op_point	Peak-to-peak output ripple voltage
25.	Cin Pd	567.671 $\mu$ W	Power	Input capacitor power dissipation
26.	Cout Pd	1.519 mW	Power	Output capacitor power dissipation
27.	Diode Pd	620.0 mW	Power	Diode power dissipation
28.	IC Pd	136.204 mW	Power	IC power dissipation
29.	IC Pd	893.047 mW	Power	IC power dissipation
30.	Total Pd	895.13 mW	Power	Total Power Dissipation
31.	Vout Tolerance	484.85 m%		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.	VinMax	24.0	Maximum input voltage
3.	VinMin	4.5	Minimum input voltage
4.	Vout	-3.3	Output Voltage
5.	base_pn	LMZ34002	Base Product Number
6.	source	DC	Input Source Type
7.	Ta	30.0	Ambient temperature

## Design Assistance

1. **LMZ34002** Product Folder : <http://www.ti.com/product/LMZ34002> : contains the data sheet and other resources.

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