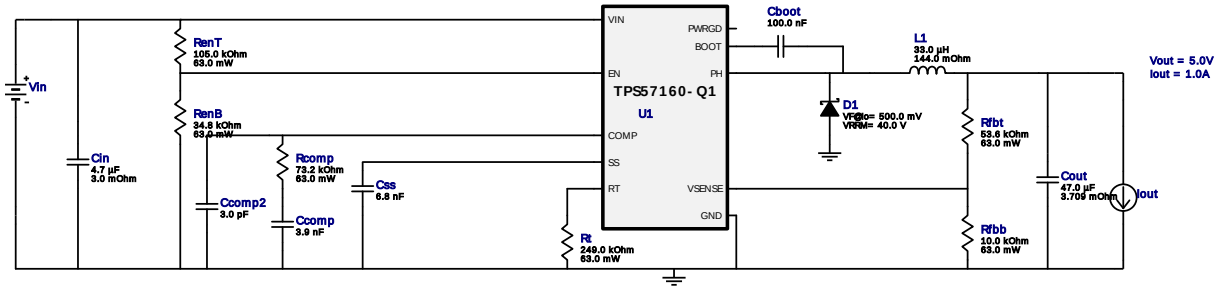
WEBENCH® Design Report

VinMin = 5.5V
VinMax = 24.0V
Vout = 5.0V
Iout = 1.0A

Device = TPS57160QDGQRQ1
Topology = Buck
Created = 8/9/16 7:28:17 PM
BOM Cost = $2.99
BOM Count = 15
Total Pd = 0.78W

Design : 1085452/8 TPS57160QDGQRQ1
TPS57160QDGQRQ1 5.5V-24.0V to 5.00V @ 1.0A

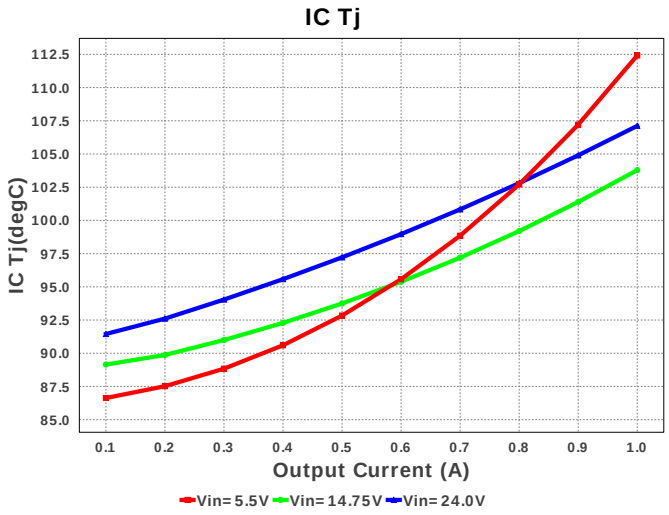


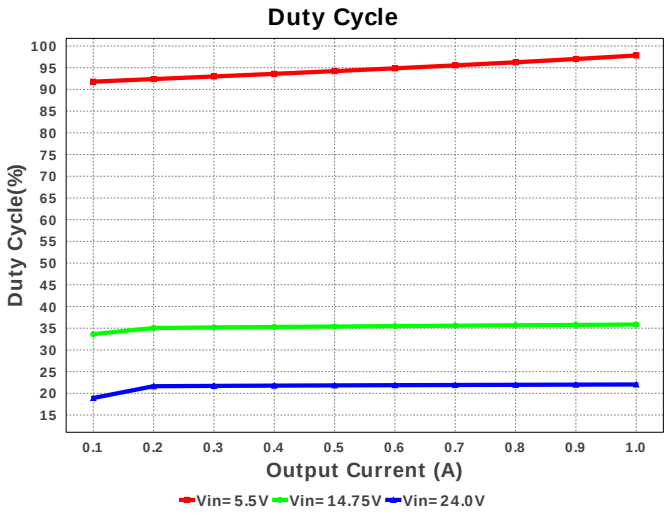
1. This regulator device is qualified for Automotive applications. All passives and other components selected in this design may not be qualified for Automotive applications. The user is required to verify that all components in the design meet the qualification and safety requirements for their specific application.View WEBENCH(R) Disclaimer.

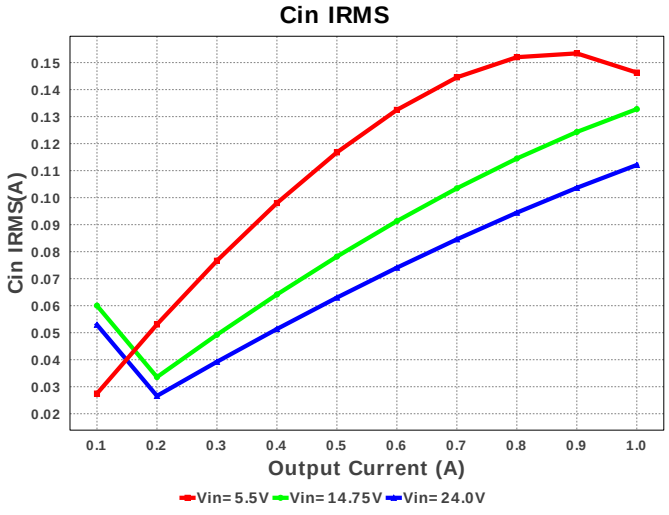
Electrical BOM

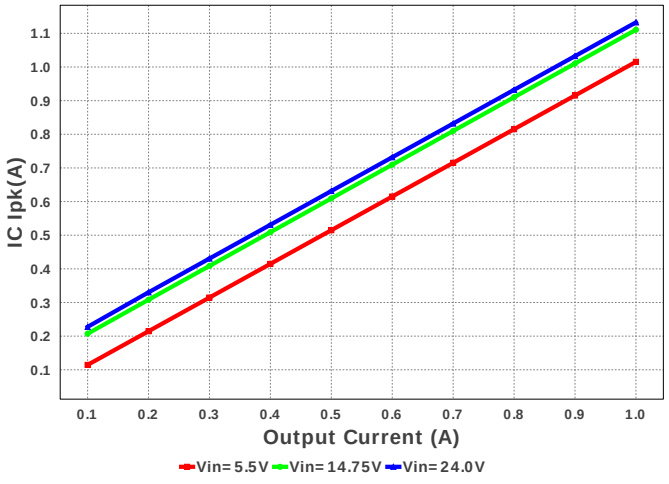
#	Name	Manufacturer	Part Number	Properties	Qty	Price	Footprint
1.	Cboot	MuRata	GRM155R61A104KA01D Series= X5R	Cap= 100.0 nF VDC= 10.0 V IRMS= 0.0 A	1	$0.01	0402 3 mm²
2.	Ccomp	Yageo America	CC0805KRX7R9BB392 Series= X7R	Cap= 3.9 nF VDC= 50.0 V IRMS= 0.0 A	1	$0.01	0805 7 mm²
3.	Ccomp2	MuRata	GRM1555C1H3R0CA01D Series= C0G/NP0	Cap= 3.0 pF VDC= 50.0 V IRMS= 0.0 A	1	$0.01	0402 3 mm²
4.	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 mm²
5.	Cout	MuRata	GRM31CR61A476KE15L Series= X5R	Cap= 47.0 uF ESR= 3.709 mOhm VDC= 10.0 V IRMS= 4.2862 A	1	$0.15	1206_190 11 mm²
6.	Css	Yageo America	CC0805KRX7R9BB682 Series= X7R	Cap= 6.8 nF VDC= 50.0 V IRMS= 0.0 A	1	$0.01	0805 7 mm²
7.	D1	Diodes Inc.	B240A-13-F	VF@Io= 500.0 mV VRRM= 40.0 V	1	$0.09	SMA 37 mm²
8.	L1	Vishay-Dale	IHLP3232DZER330M11	L= 33.0 µH DCR= 144.0 mOhm	1	$0.75	IHLP-3232DZ 112 mm²
9.	Rcomp	Vishay-Dale	CRCW040273K2FKED Series= CRCW..e3	Res= 73.2 kOhm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	0402 3 mm²
10.	RenB	Vishay-Dale	CRCW040234K8FKED Series= CRCW..e3	Res= 34.8 kOhm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	0402 3 mm²
11.	RenT	Vishay-Dale	CRCW0402105KFKED Series= CRCW..e3	Res= 105.0 kOhm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	0402 3 mm²

#	Name	Manufacturer	Part Number	Properties	Qty	Price	Footprint
12.	Rfbb	Vishay-Dale	CRCW040210K0FKED Series= CRCW..e3	Res= 10.0 kOhm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	0402 3 mm^2
13.	Rfbt	Vishay-Dale	CRCW040253K6FKED Series= CRCW..e3	Res= 53.6 kOhm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	0402 3 mm^2
14.	Rt	Vishay-Dale	CRCW0402249KFKED Series= CRCW..e3	Res= 249.0 kOhm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	0402 3 mm^2
15.	U1	Texas Instruments	TPS57160QDGQRQ1	Switcher	1	$1.83	S-PDSO-G10 24 mm^2

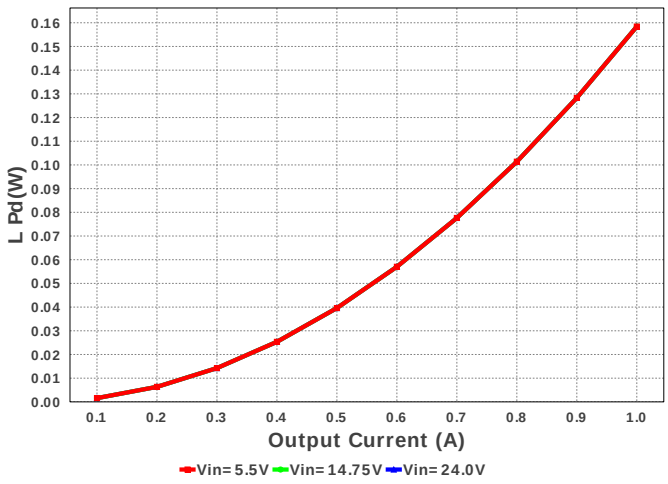




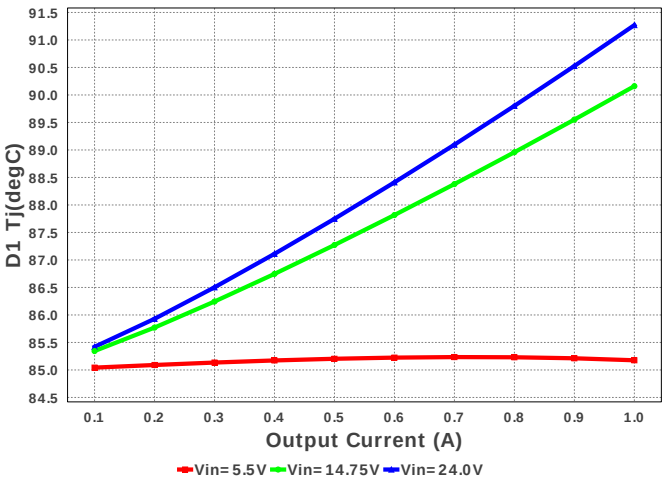




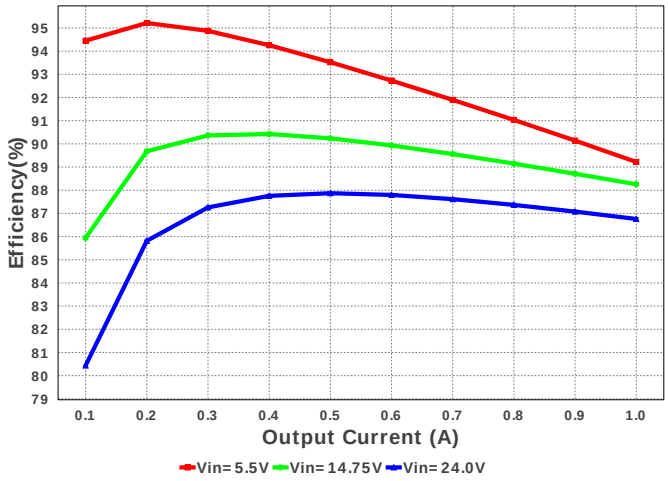
L Pd



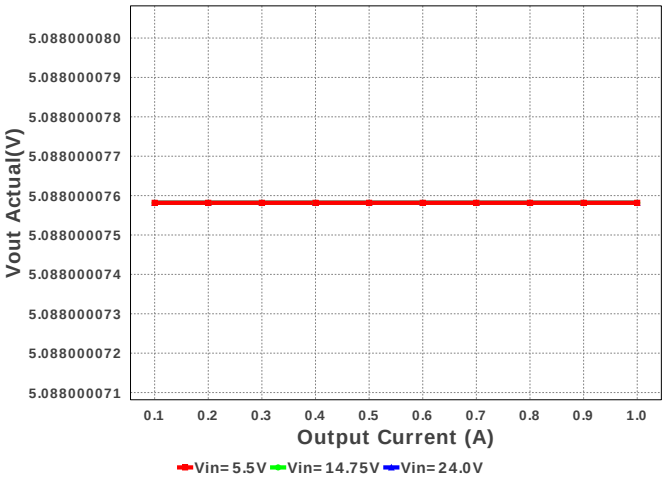
D1 Tj



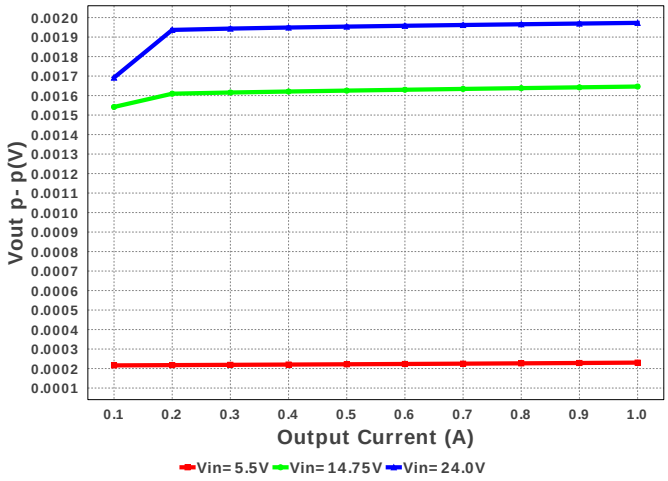
Efficiency



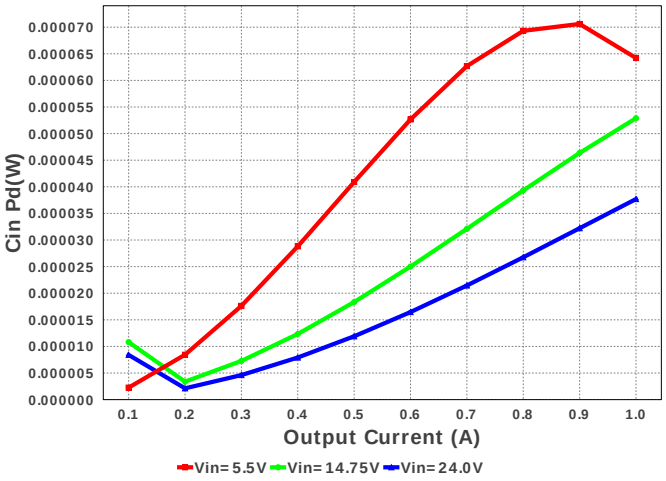
Vout Actual

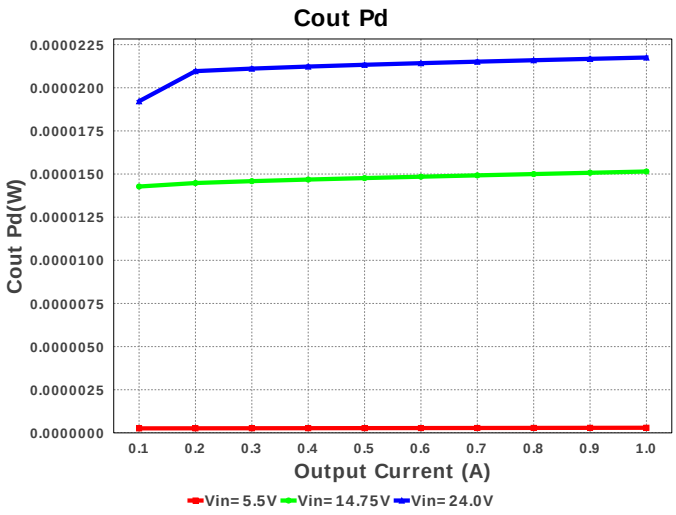


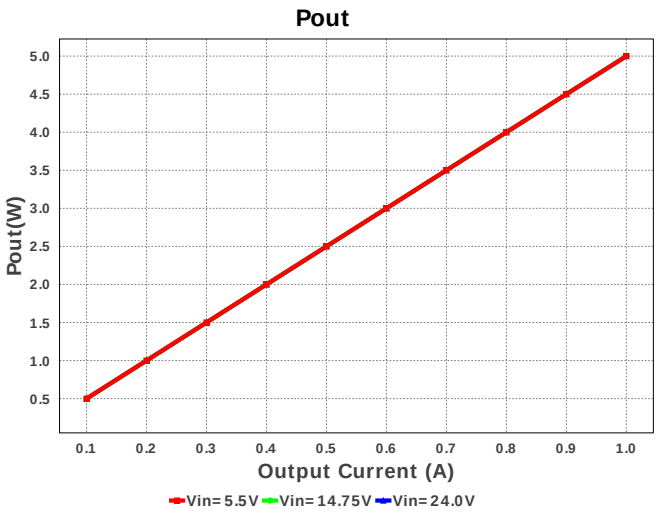
Vout p- p

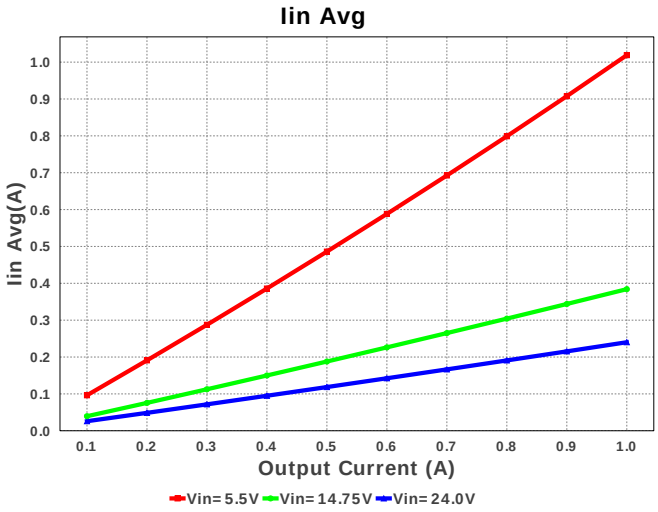


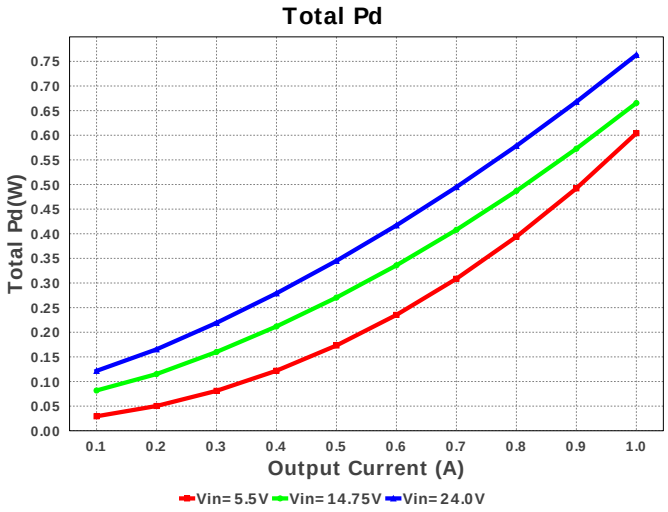
Cin Pd

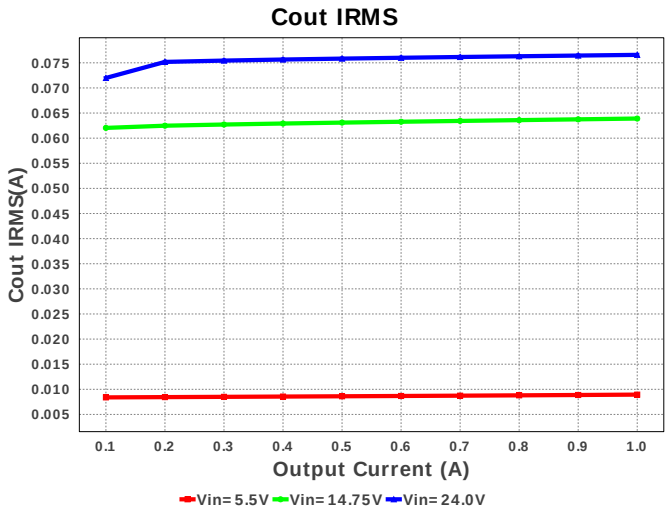


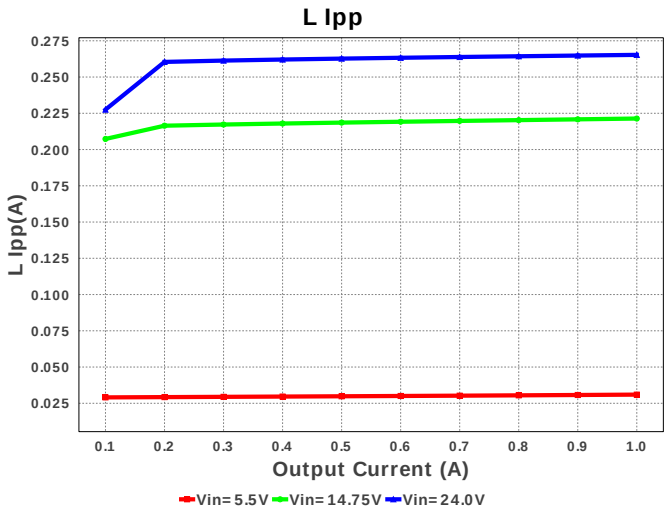


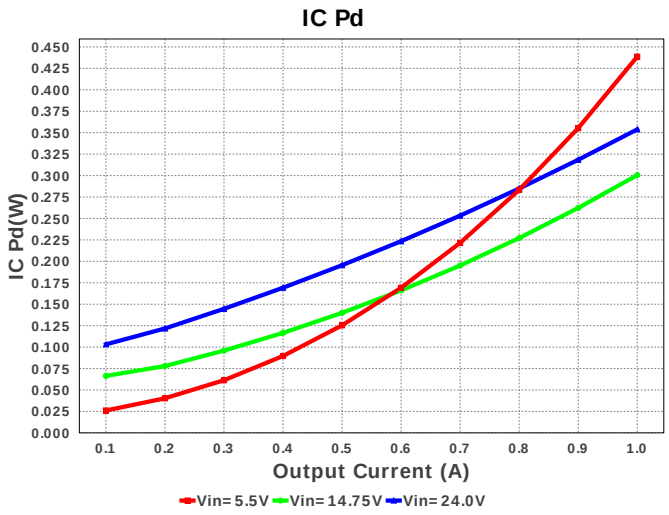


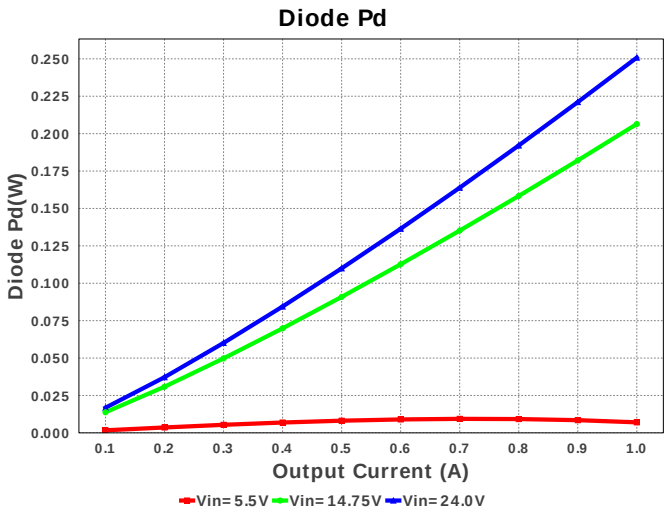


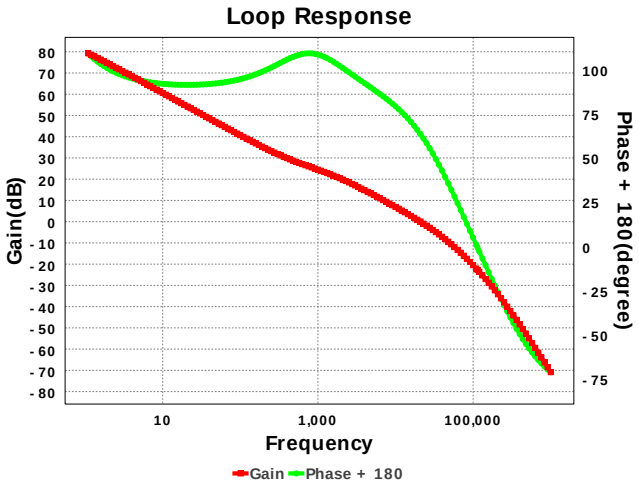












Operating Values

#	Name	Value	Category	Description
1.	Cin IRMS	112.024 mA	Current	Input capacitor RMS ripple current
2.	Cout IRMS	76.789 mA	Current	Output capacitor RMS ripple current
3.	IC Ipk	1.0 A	Current	Peak switch current in IC
4.	Iin Avg	240.73 mA	Current	Average input current
5.	L Ipp	266.0 mA	Current	Peak-to-peak inductor ripple current
6.	BOM Count	15	General	Total Design BOM count
7.	FootPrint	232.0 mm^2	General	Total Foot Print Area of BOM components
8.	Frequency	478.381 kHz	General	Switching frequency
9.	Mode	CCM	General	Conduction Mode
10.	Pout	5.0 W	General	Total output power
11.	Total BOM	$2.99	General	Total BOM Cost
12.	D1 Tj	91.623 degC	Op_Point	D1 junction temperature
13.	Low Freq Gain	79.195 dB	Op_Point	Gain at 10Hz
14.	Vout Actual	5.088 V	Op_Point	Vout Actual calculated based on selected voltage divider resistors
15.	Vout OP	5.0 V	Op_Point	Operational Output Voltage
16.	Cross Freq	20.84 kHz	Op_point	Bode plot crossover frequency
17.	Duty Cycle	22.102 %	Op_point	Duty cycle
18.	Efficiency	86.543 %	Op_point	Steady state efficiency
19.	Gain Marg	-22.764 dB	Op_point	Bode Plot Gain Margin
20.	IC Tj	107.129 degC	Op_point	IC junction temperature
21.	ICThetaJA	62.5 degC/W	Op_point	IC junction-to-ambient thermal resistance
22.	IOUT_OP	1.0 A	Op_point	Iout operating point
23.	Phase Marg	64.021 deg	Op_point	Bode Plot Phase Margin
24.	VIN_OP	24.0 V	Op_point	Vin operating point
25.	Vout p-p	1.978 mV	Op_point	Peak-to-peak output ripple voltage
26.	Cin Pd	37.648 µW	Power	Input capacitor power dissipation
27.	Cout Pd	21.87 µW	Power	Output capacitor power dissipation
28.	Diode Pd	264.913 mW	Power	Diode power dissipation
29.	IC Pd	354.071 mW	Power	IC power dissipation
30.	L Pd	158.4 mW	Power	Inductor power dissipation
31.	Total Pd	777.481 mW	Power	Total Power Dissipation

#	Name	Value	Category	Description
32.	Vout Tolerance	2.72 %		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	5.5	Minimum input voltage
4.	Vout	5.0	Output Voltage
5.	base_pn	TPS57160-Q1	Base Product Number
6.	source	DC	Input Source Type
7.	Ta	85.0	Ambient temperature

Design Assistance

1. The TPS57160-Q1 is qualified for Automotive applications. All passives and other components selected in this design may not be qualified for Automotive applications. The user is required to verify that all components in the design meet the qualification and safety requirements for their specific application

2. **TPS57160-Q1** Product Folder : http://www.ti.com/product/TPS57160%2DQ1 : contains the data sheet and other resources.