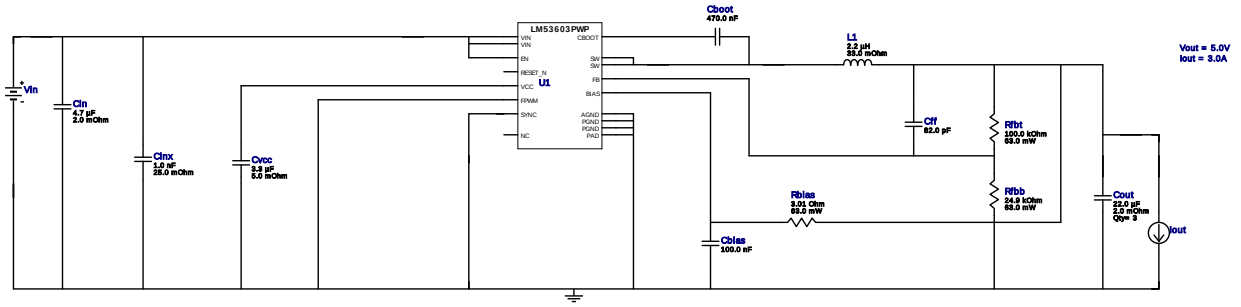
WEBENCH® Design Report

VinMin = 14.0V
VinMax = 36.0V
Vout = 5.0V
Iout = 3.0A

Device = LM53603AQPWPRQ1
Topology = Buck
Created = 9/8/16 10:23:22 PM
BOM Cost = $3.54
BOM Count = 14
Total Pd = 3.14W

Design : 1177446/100 LM53603AQPWPRQ1
LM53603AQPWPRQ1 14.0V-36.0V to 5.00V @ 3.0A



1. The input capacitor included in the BOM only contains a small filter capacitor that should be placed near the IC. Depending on where the power supply is laid out in the system additional bulk capacitance may need to be added to filter the line ripple.

2. If there is no VinTyp specified, WEBENCH will use the VinMax value. To change the VinTyp value, click on the "Change Design Inputs" button under the Optimization Tuning knob. In some applications, while the design requires the input voltage to be a wide range, for a majority of the time, it is operating at a much lower voltage than the maximum input voltage. Sizing the inductor based on the maximum input voltage may yield an inductance much larger than typically needed, causing a larger footprint for the overall design. At the same time, components such as the input capacitor must be rated based on the maximum input voltage. WEBENCH now supports the use of this additional input voltage specification.

3. 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.

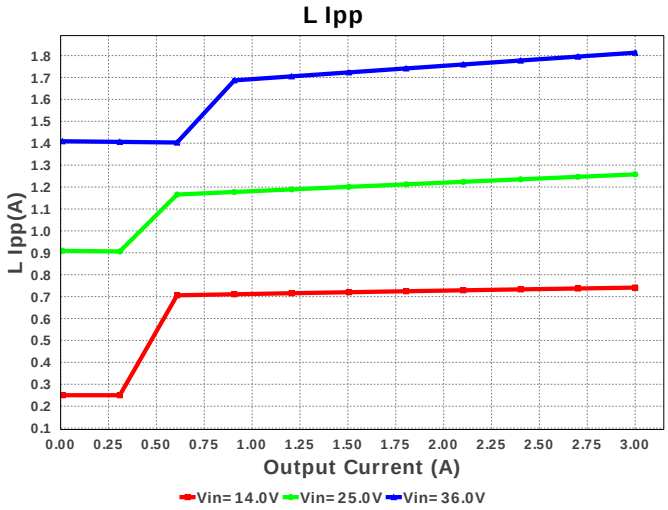
My Comments

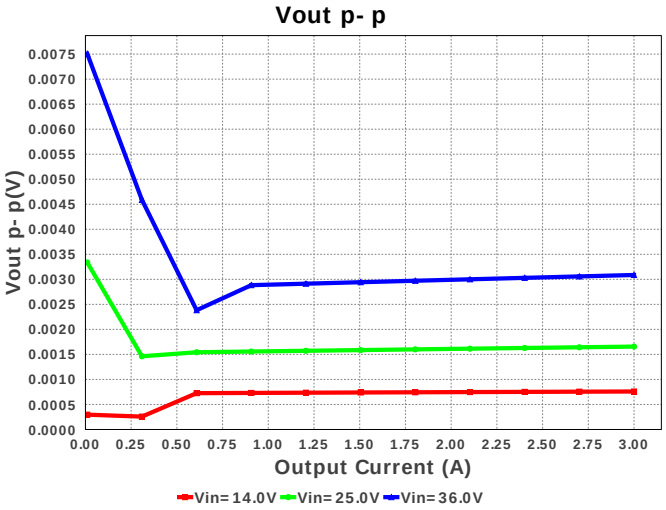
No comments

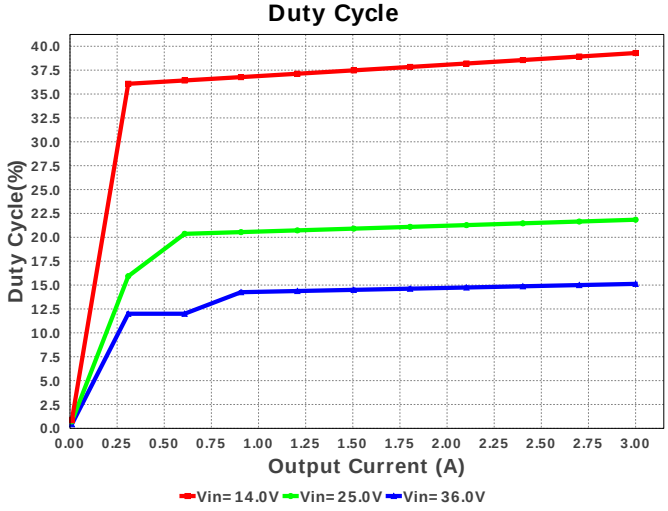
Electrical BOM

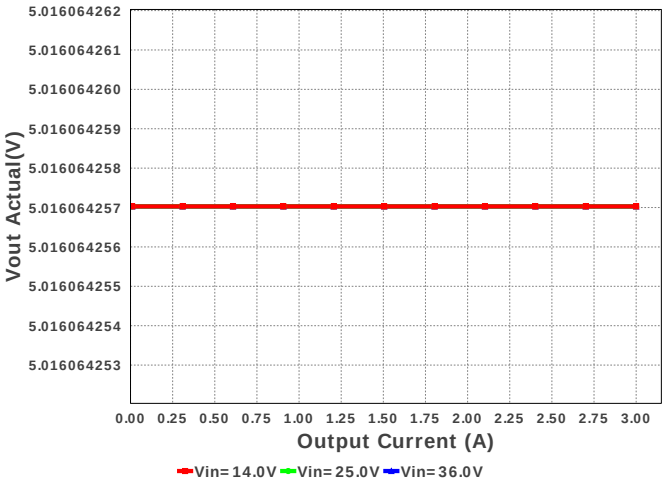
#	Name	Manufacturer	Part Number	Properties	Qty	Price	Footprint
1.	Cbias	MuRata	GRM155R61A104KA01D Series= X5R	Cap= 100.0 nF VDC= 10.0 V IRMS= 0.0 A	1	$0.01	0402 3 mm²
2.	Cboot	MuRata	GRM21BR72A474KA73L Series= X7R	Cap= 470.0 nF VDC= 100.0 V IRMS= 0.0 A	1	$0.13	0805 7 mm²
3.	Cff	Yageo America	CC0805JRNPO9BN820 Series= C0G/NP0	Cap= 82.0 pF VDC= 50.0 V IRMS= 0.0 A	1	$0.01	0805 7 mm²
4.	Cin	MuRata	GRM32ER71H475KA88L Series= X7R	Cap= 4.7 uF ESR= 2.0 mOhm VDC= 50.0 V IRMS= 5.35 A	1	$0.19	1210 15 mm²
5.	Cinx	Kemet	C0805C102J5GACTU Series= C0G/NP0	Cap= 1.0 nF ESR= 25.0 mOhm VDC= 50.0 V IRMS= 1.71 A	1	$0.01	0805 7 mm²
6.	Cout	MuRata	GRM32ER61C226ME20L Series= X5R	Cap= 22.0 uF ESR= 2.0 mOhm VDC= 16.0 V IRMS= 3.68 A	3	$0.12	1210 15 mm²
7.	Cvcc	Kemet	C0805C335K8PACTU Series= X5R	Cap= 3.3 uF ESR= 5.0 mOhm VDC= 10.0 V IRMS= 8.13 A	1	$0.05	0805 7 mm²

#	Name	Manufacturer	Part Number	Properties	Qty	Price	Footprint
8.	L1	Bourns	SRP4020-2R2M	L= 2.2 µH DCR= 33.0 mOhm	1	$0.49	 SRP4020 29 mm^2
9.	Rbias	Vishay-Dale	CRCW04023R01FKED Series= CRCW..e3	Res= 3.01 Ohm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	 0402 3 mm^2
10.	Rfbb	Vishay-Dale	CRCW040224K9FKED Series= CRCW..e3	Res= 24.9 kOhm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	 0402 3 mm^2
11.	Rfbt	Vishay-Dale	CRCW0402100KFKED Series= CRCW..e3	Res= 100.0 kOhm Power= 63.0 mW Tolerance= 1.0%	1	$0.01	 0402 3 mm^2
12.	U1	Texas Instruments	LM53603AQPWPRQ1	Switcher	1	$2.26	 PWP0016H_N 59 mm^2

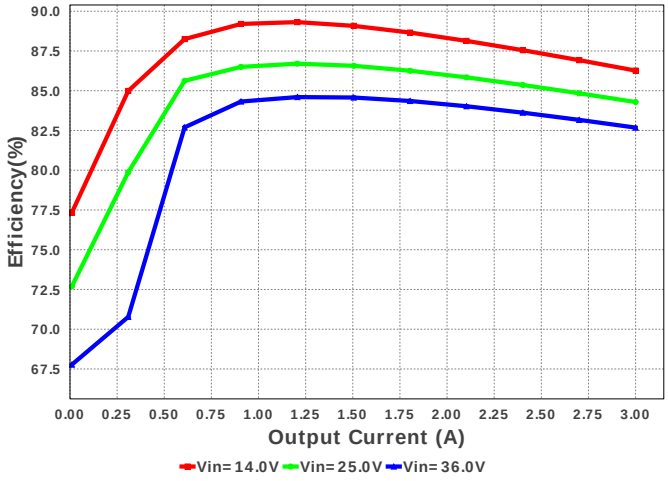




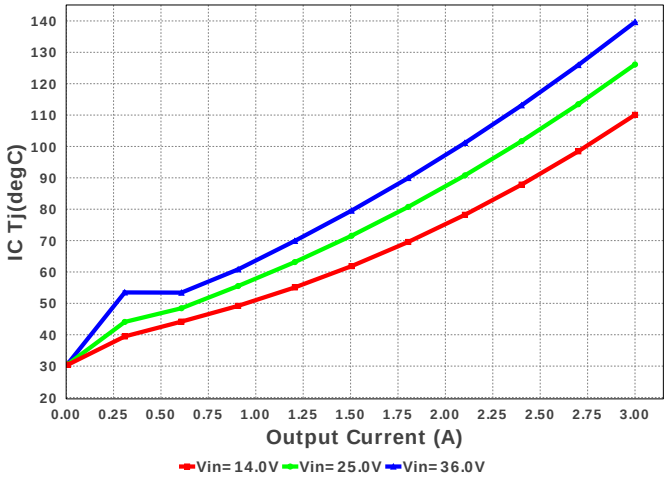




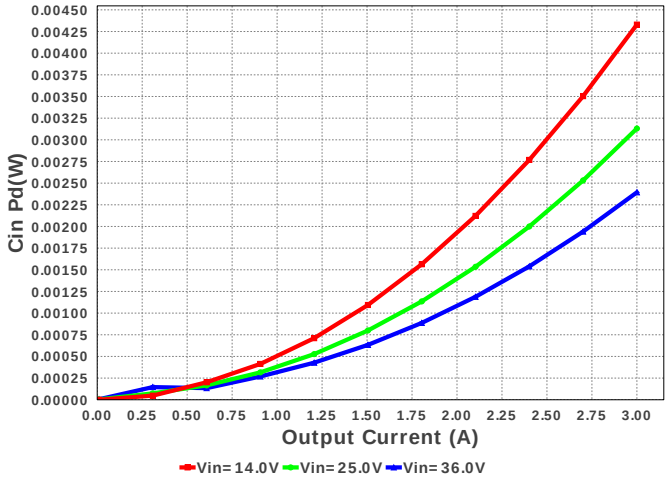
Efficiency



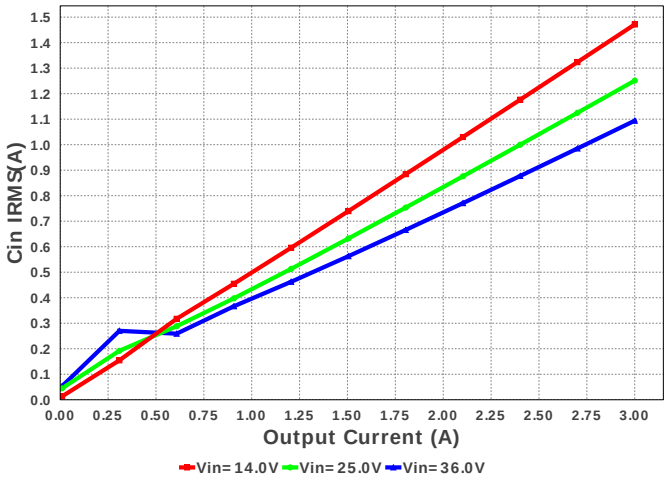
IC Tj



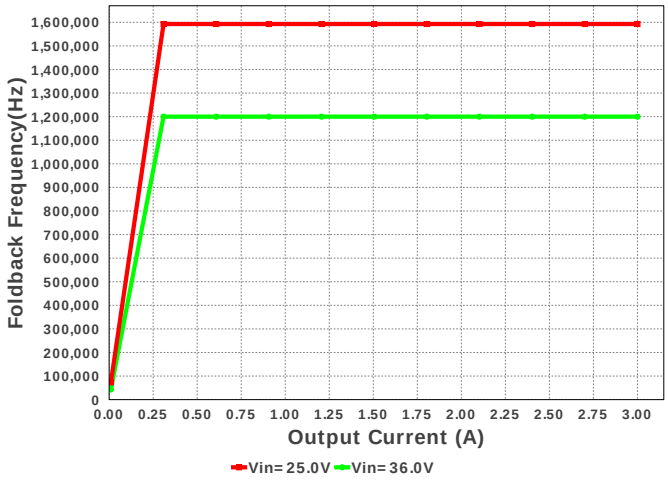
Cin Pd



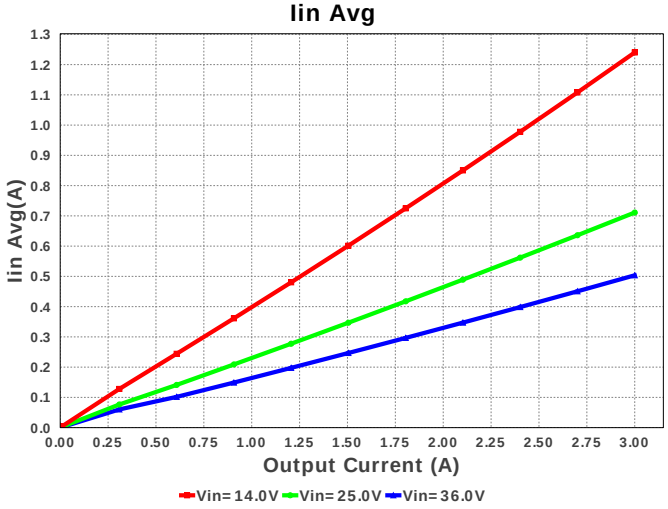
Cin IRMS

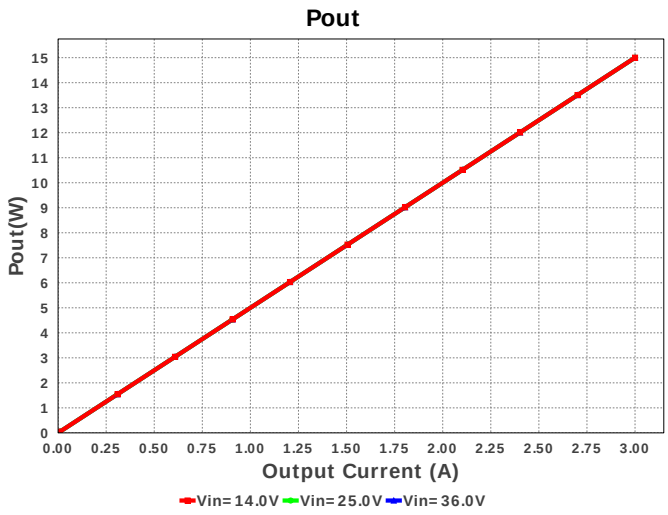


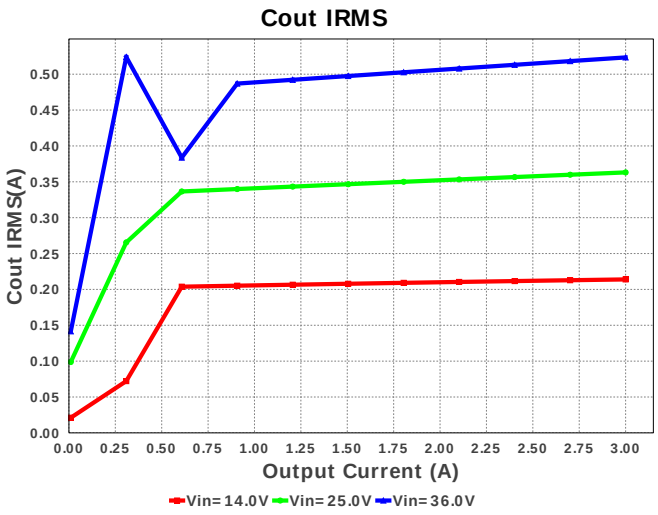
Foldback Frequency

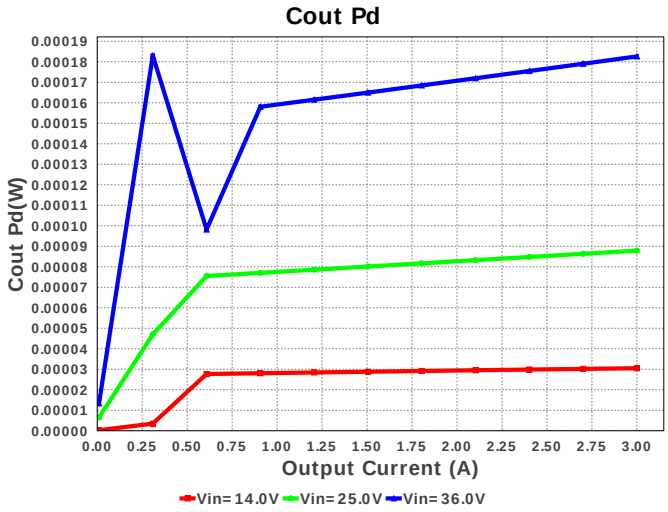


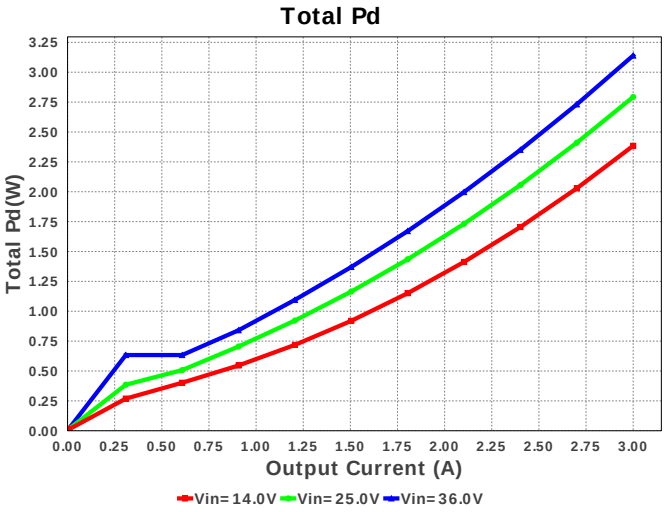
Iin Avg

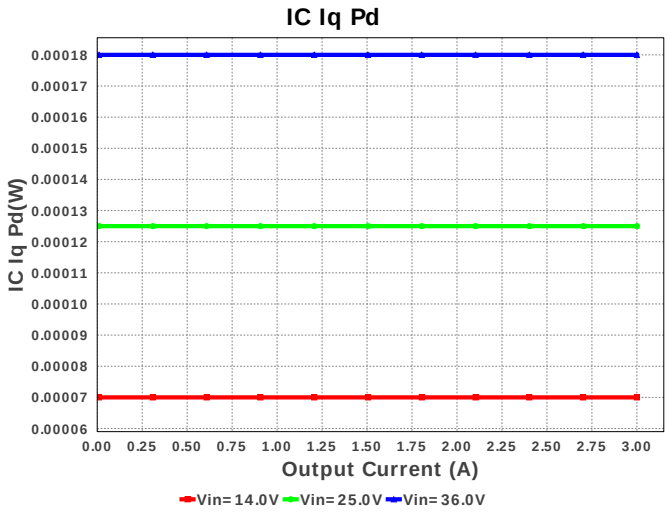


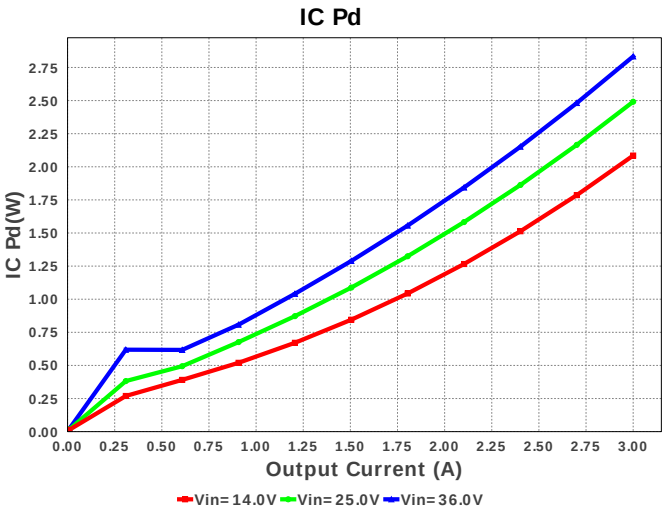


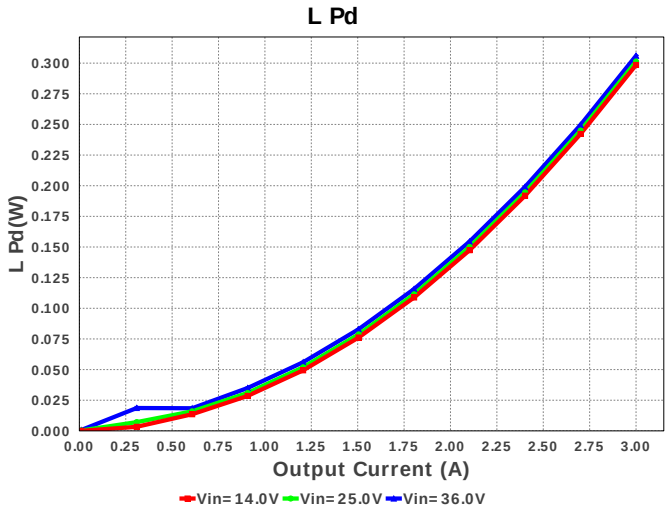


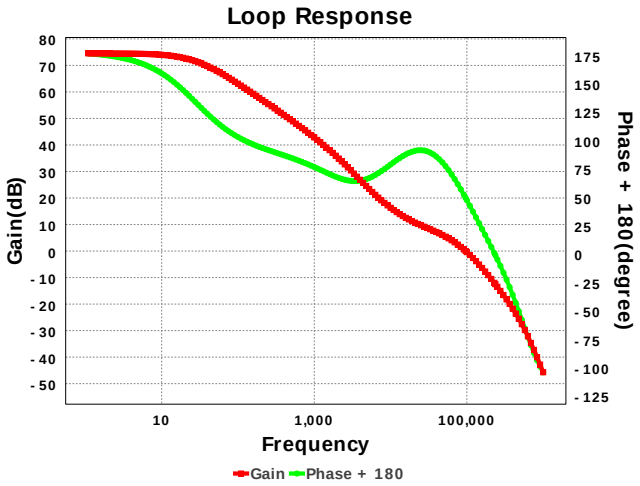


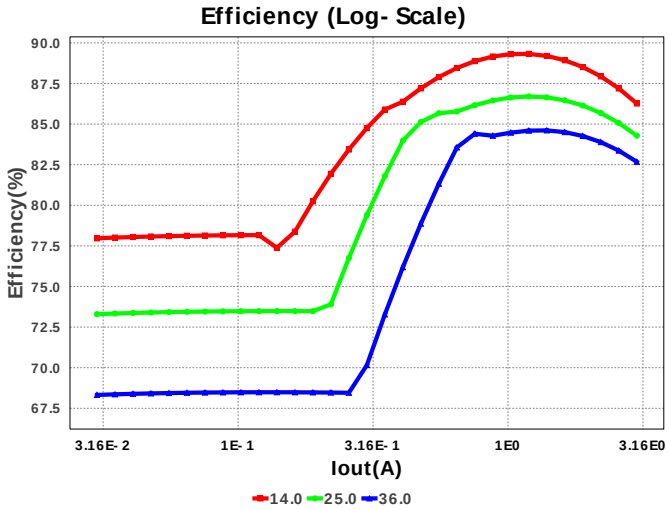












Operating Values

#	Name	Value	Category	Description
1.	Cin IRMS	1.094 A	Current	Input capacitor RMS ripple current
2.	Cout IRMS	523.375 mA	Current	Output capacitor RMS ripple current
3.	Iin Avg	503.53 mA	Current	Average input current
4.	L Ipp	1.813 A	Current	Peak-to-peak inductor ripple current
5.	BOM Count	14	General	Total Design BOM count
6.	FootPrint	186.0 mm^2	General	Total Foot Print Area of BOM components
7.	Frequency	1.2 MHz	General	Switching frequency
8.	Mode	CCM	General	Conduction Mode
9.	Pout	15.0 W	General	Total output power
10.	Total BOM	$3.54	General	Total BOM Cost
11.	Low Freq Gain	74.515 dB	Op_Point	Gain at 10Hz
12.	Vout Actual	5.016 V	Op_Point	Vout Actual calculated based on selected voltage divider resistors
13.	Vout OP	5.0 V	Op_Point	Operational Output Voltage
14.	Cross Freq	96.38 kHz	Op_point	Bode plot crossover frequency
15.	Duty Cycle	15.127 %	Op_point	Duty cycle
16.	Efficiency	82.68 %	Op_point	Steady state efficiency
17.	Gain Marg	-12.504 dB	Op_point	Bode Plot Gain Margin
18.	IC Tj	139.631 degC	Op_point	IC junction temperature
19.	ICThetaJA	38.9 degC/W	Op_point	IC junction-to-ambient thermal resistance
20.	IOUT_OP	3.0 A	Op_point	Iout operating point
21.	Phase Marg	50.467 deg	Op_point	Bode Plot Phase Margin
22.	VIN_OP	36.0 V	Op_point	Vin operating point
23.	Vout p-p	3.087 mV	Op_point	Peak-to-peak output ripple voltage
24.	Cin Pd	2.394 mW	Power	Input capacitor power dissipation
25.	Cout Pd	182.614 µW	Power	Output capacitor power dissipation
26.	IC Iq Pd	180.0 µW	Power	IC Iq Pd
27.	IC Pd	2.833 W	Power	IC power dissipation
28.	L Pd	306.039 mW	Power	Inductor power dissipation
29.	Total Pd	3.14 W	Power	Total Power Dissipation
30.	Foldback Frequency	1.2 MHz		Frequency reduced at high Vin
31.	Foldback Mode	Foldback Mode On		Foldback Mode

#	Name	Value	Category	Description
32.	Vout Tolerance	2.634 %		Vout Tolerance based on IC Tolerance (no load) and voltage divider resistors if applicable

Design Inputs

#	Name	Value	Description
1.	Iout	3.0	Maximum Output Current
2.	VinMax	36.0	Maximum input voltage
3.	VinMin	14.0	Minimum input voltage
4.	Vout	5.0	Output Voltage
5.	base_pn	LM53603A-Q1	Texas Instruments Base Part Number
6.	source	DC	Input Source Type
7.	ta	30.0	Ambient temperature

Design Assistance

1. The LM53603A-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. LM53603A-Q1 Product Folder : http://www.ti.com/product/LM53603%2DQ1 : contains the data sheet and other resources.