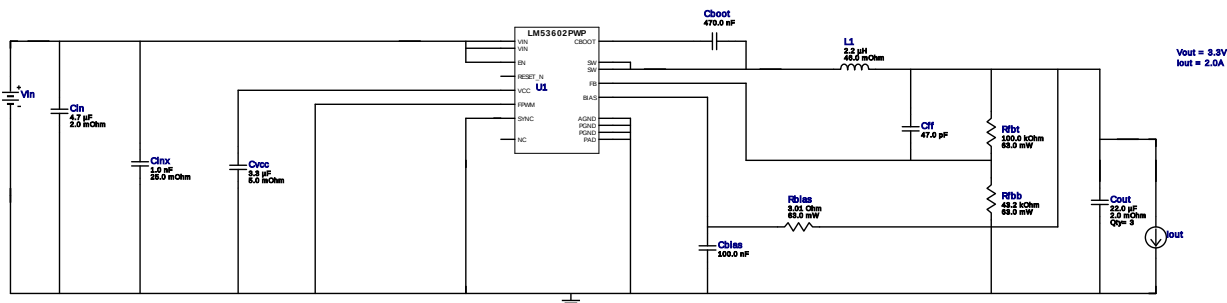


WEBENCH® Design Report

Design : 4352199/21 LM53602AQPWPRQ1
LM53602AQPWPRQ1 14.0V-22.0V to 3.30V @ 2.0A

VinMin = 14.0V
VinMax = 22.0V
Vout = 3.3V
Iout = 2.0A

Device = LM53602AQPWPRQ1
Topology = Buck
Created = 7/17/16 8:02:23 AM
BOM Cost = \$3.39
BOM Count = 14
Total Pd = 1.52W

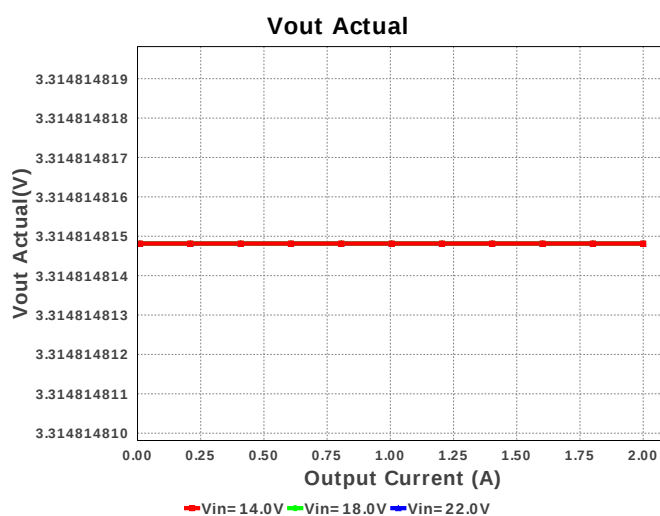
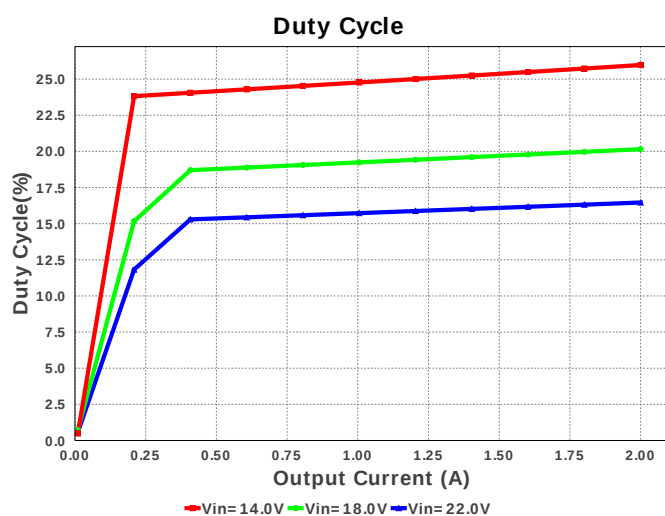
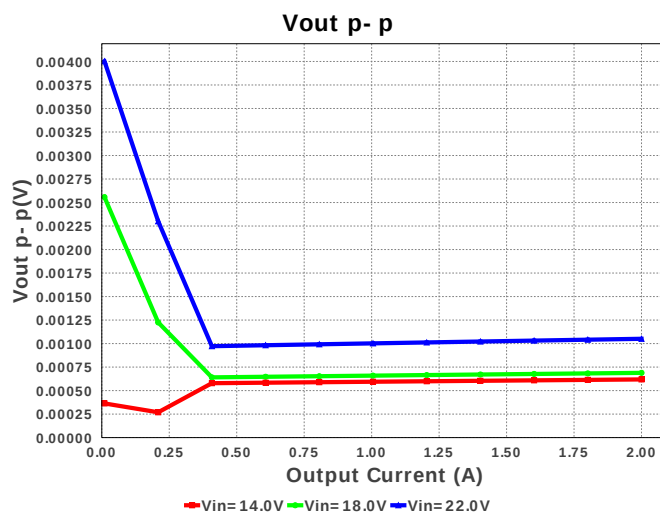
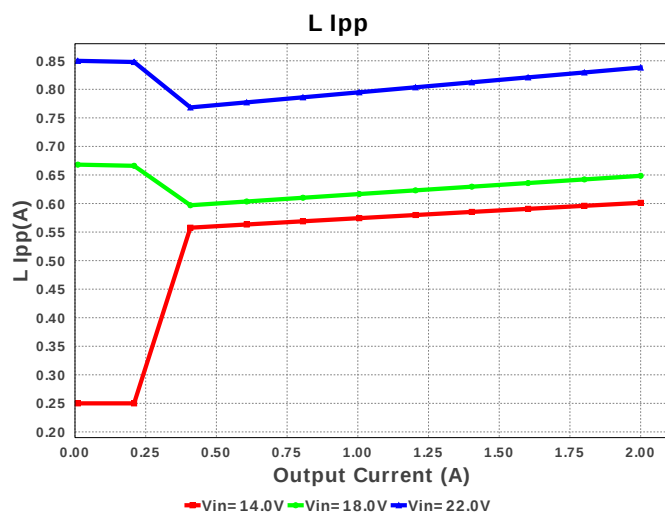


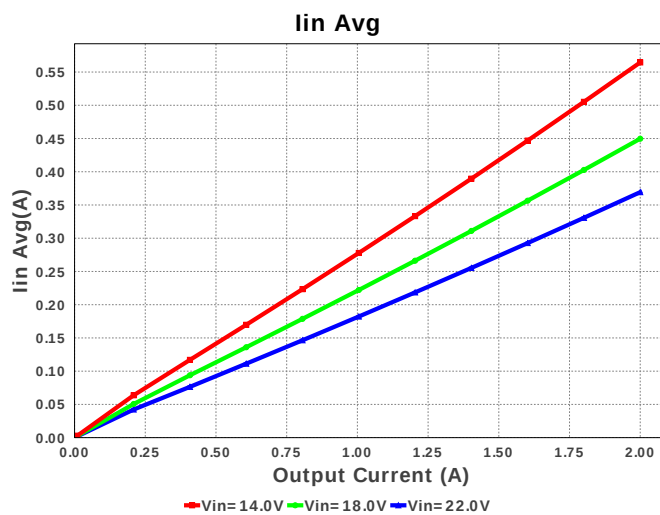
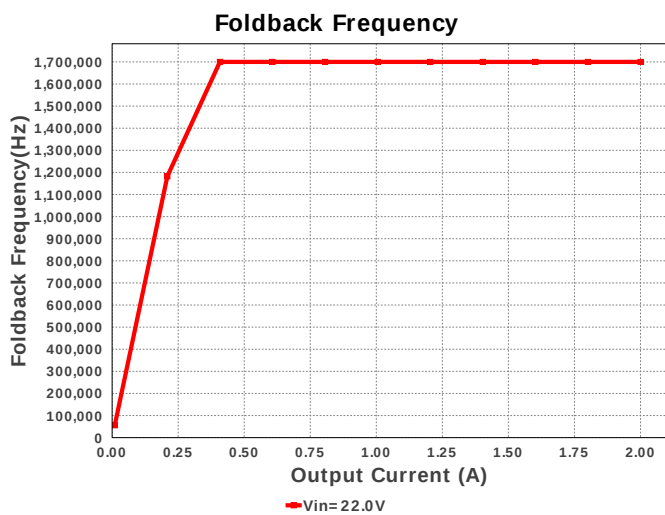
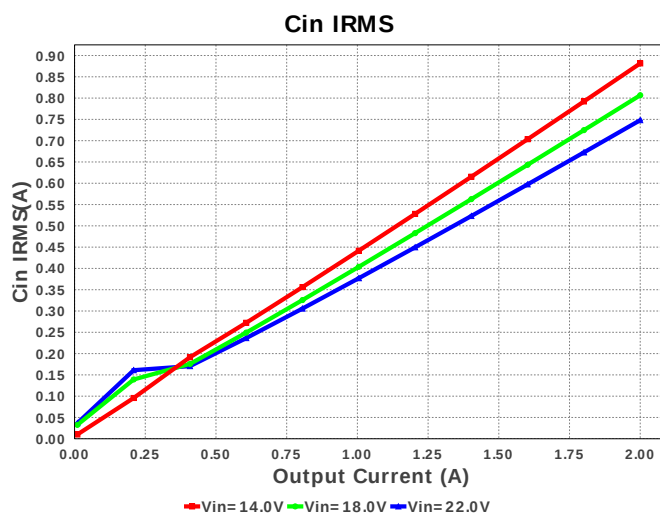
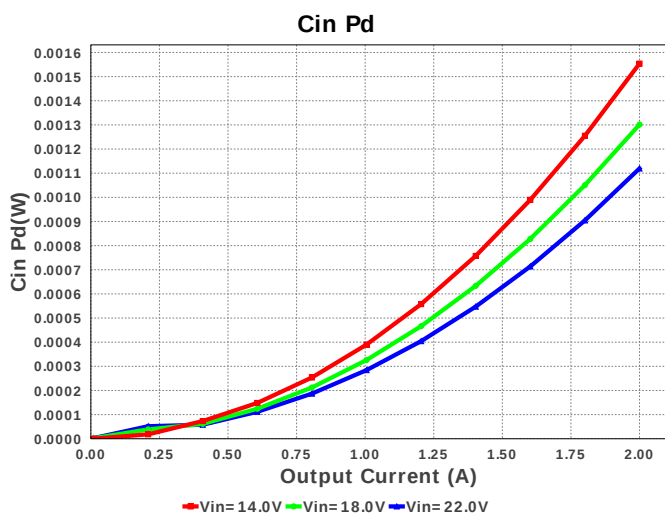
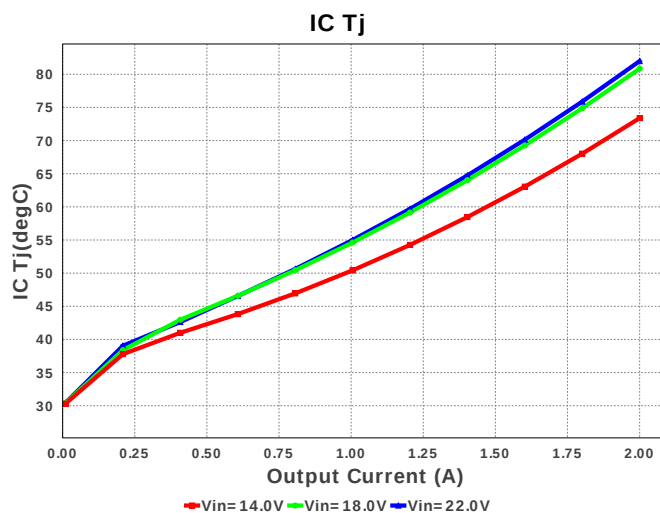
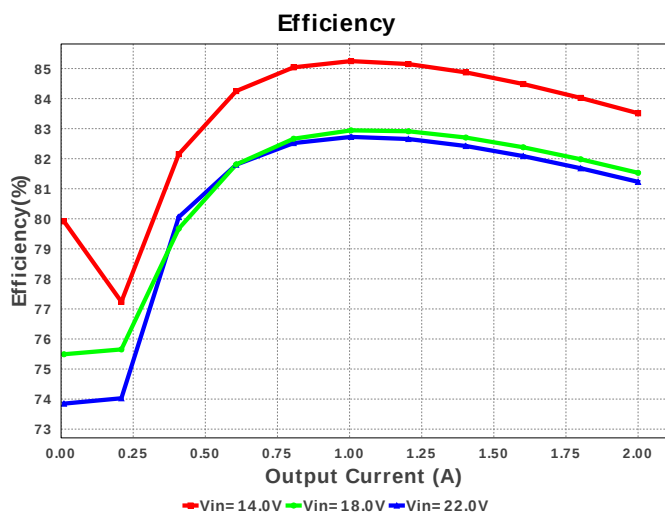
1. The input capacitor included in the BOM only contains a small filter capacitor that should be placed near the IC. Depending on where the power supply is laid out in the system additional bulk capacitance may need to be added to filter the line ripple.
2. If there is no VinTyp specified, WEBENCH will 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.

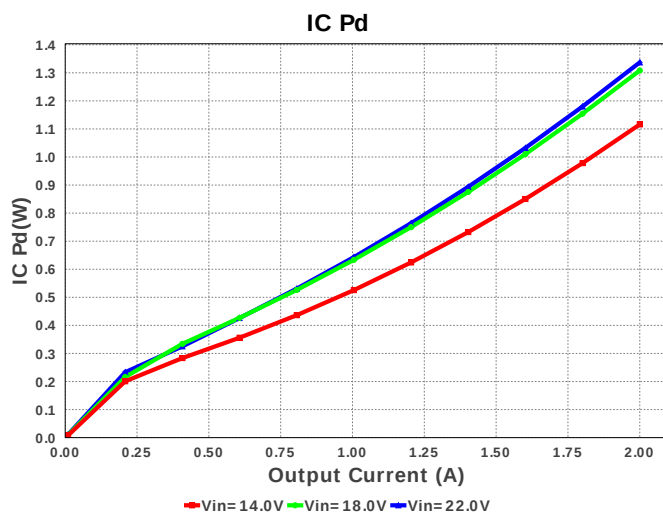
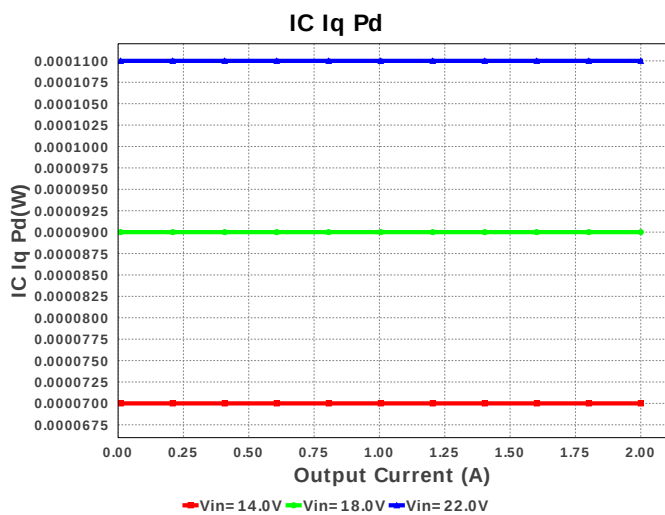
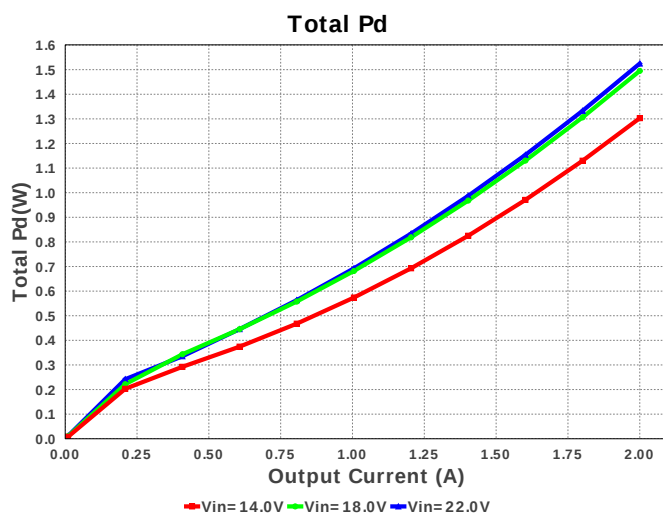
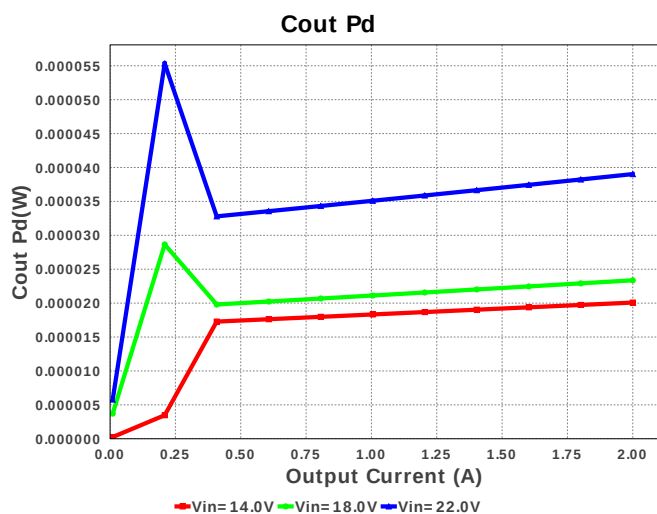
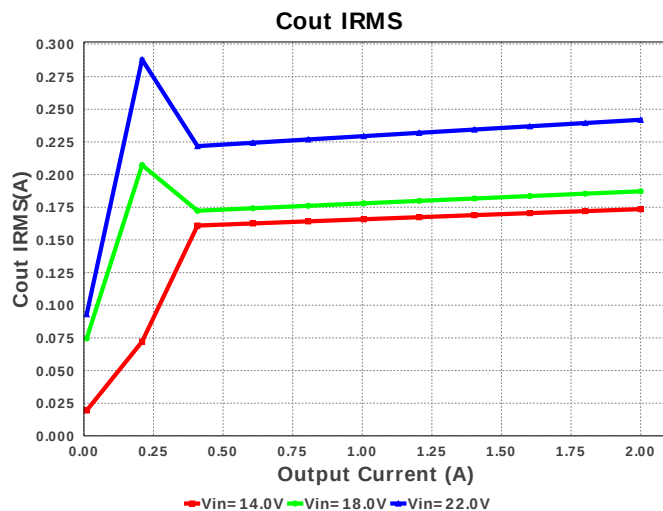
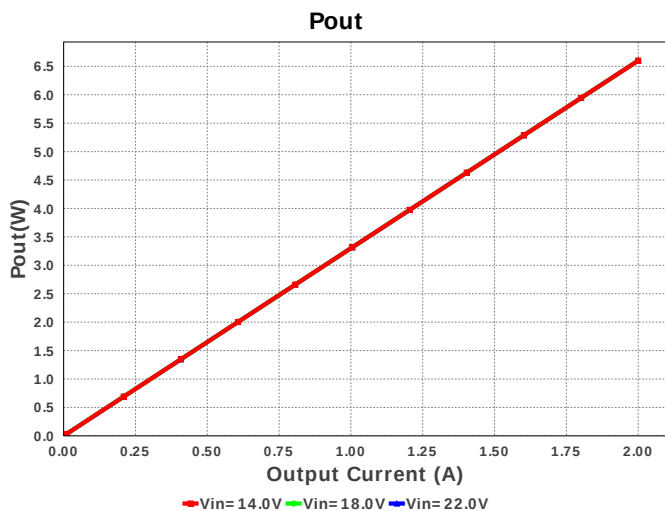
Electrical BOM

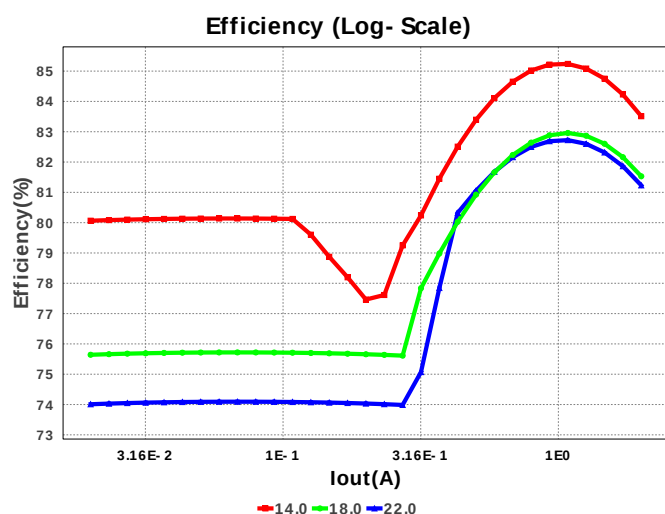
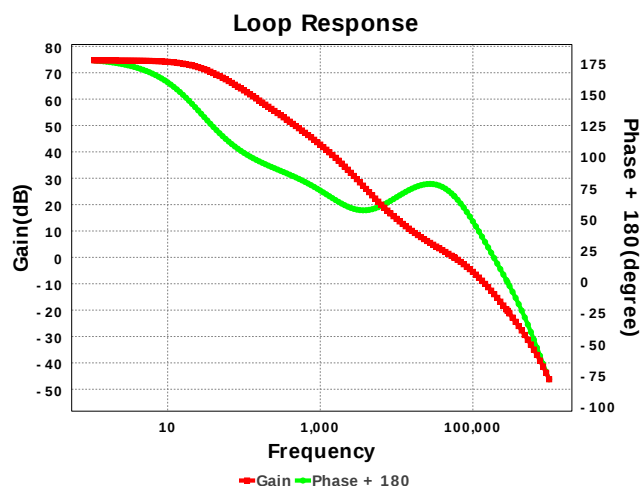
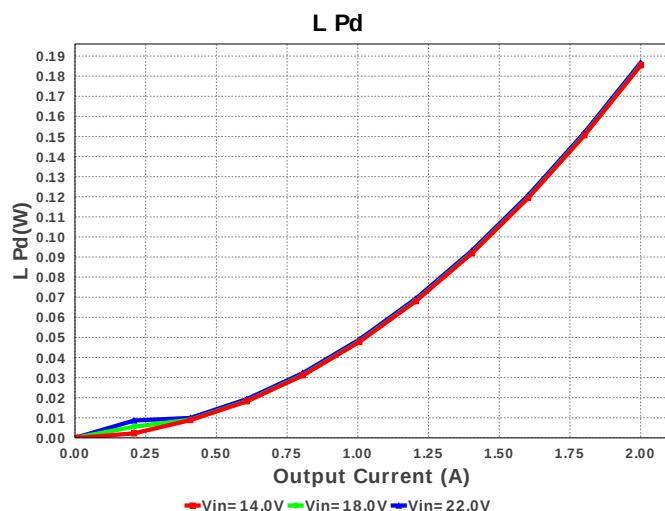
#	Name	Manufacturer	Part Number	Properties	Qty	Price	Footprint
1.	Cbias	MuRata	GRM155R60J104KA01D Series= X5R	Cap= 100.0 nF VDC= 6.3 V IRMS= 0.0 A	1	\$0.01	0402 3 mm ²
2.	Cboot	Taiyo Yuden	GMK212BJ474KG-T Series= X5R	Cap= 470.0 nF VDC= 35.0 V IRMS= 0.0 A	1	\$0.03	0805 7 mm ²
3.	Cff	Samsung Electro-Mechanics	CL02C470JO2ANNC Series= C0G/NP0	Cap= 47.0 pF VDC= 16.0 V IRMS= 0.0 A	1	\$0.01	01005 2 mm ²
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 mm ²
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 mm ²
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 mm ²
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 mm ²
8.	L1	Vishay-Dale	IHLP1212BZER2R2M11	L= 2.2 uH DCR= 46.0 mOhm	1	\$0.56	IHLP-1212BZ 19 mm ²

#	Name	Manufacturer	Part Number	Properties	Qty	Price	Footprint
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	CRCW040243K2FKED Series= CRCW..e3	Res= 43.2 kOhm Power= 63.0 mW Tolerance= 1.0%	1	\$0.01	 0402 3 mm ²
11.	Rfbb	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	LM53602AQPWPRQ1	Switcher	1	\$2.14	 PWP0016H_N 59 mm ²









Operating Values

#	Name	Value	Category	Description
1.	Cin IRMS	748.153 mA	Current	Input capacitor RMS ripple current
2.	Cout IRMS	241.945 mA	Current	Output capacitor RMS ripple current
3.	Iin Avg	369.29 mA	Current	Average input current
4.	L Ipp	838.12 mA	Current	Peak-to-peak inductor ripple current
5.	BOM Count	14	General	Total Design BOM count
6.	FootPrint	171.0 mm ²	General	Total Foot Print Area of BOM components
7.	Frequency	1.7 MHz	General	Switching frequency
8.	Pout	6.6 W	General	Total output power
9.	Total BOM	\$3.39	General	Total BOM Cost
10.	Low Freq Gain	74.662 dB	Op_Point	Gain at 10Hz
11.	Vout Actual	3.315 V	Op_Point	Vout Actual calculated based on selected voltage divider resistors
12.	Vout OP	3.3 V	Op_Point	Operational Output Voltage
13.	Cross Freq	56.689 kHz	Op_point	Bode plot crossover frequency
14.	Duty Cycle	16.463 %	Op_point	Duty cycle
15.	Efficiency	81.23 %	Op_point	Steady state efficiency
16.	Gain Marg	-20.274 dB	Op_point	Bode Plot Gain Margin
17.	IC Tj	81.99 degC	Op_point	IC junction temperature
18.	ICThetaJA	38.9 degC/W	Op_point	IC junction-to-ambient thermal resistance
19.	IOUT_OP	2.0 A	Op_point	Iout operating point
20.	Phase Marg	69.162 deg	Op_point	Bode Plot Phase Margin
21.	VIN_OP	22.0 V	Op_point	Vin operating point
22.	Vout p-p	1.051 mV	Op_point	Peak-to-peak output ripple voltage
23.	Cin Pd	1.119 mW	Power	Input capacitor power dissipation
24.	Cout Pd	39.025 μW	Power	Output capacitor power dissipation
25.	IC Iq Pd	110.0 μW	Power	IC Iq Pd
26.	IC Pd	1.337 W	Power	IC power dissipation
27.	L Pd	186.693 mW	Power	Inductor power dissipation
28.	Total Pd	1.525 W	Power	Total Power Dissipation
29.	Foldback Frequency	1.7 MHz		Frequency reduced at high Vin
30.	Vout Tolerance	2.425 %		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.	VinMax	22.0	Maximum input voltage
3.	VinMin	14.0	Minimum input voltage
4.	Vout	3.3	Output Voltage
5.	base_pn	LM53602A-Q1	Base Product Number
6.	source	DC	Input Source Type
7.	Ta	30.0	Ambient temperature

Design Assistance

1. The LM53602A-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. **LM53602A-Q1** Product Folder : <http://www.ti.com/product/LM53602%2DQ1> : contains the data sheet and other resources.

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You should completely validate and test your design implementation to confirm the system functionality for your application prior to production.

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