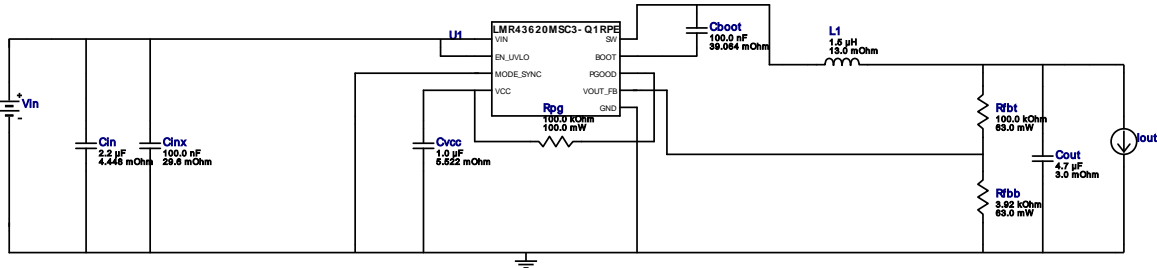


WEBENCH® Design Report

 Design : 510 LMR43620MSC3RPERQ1
 LMR43620MSC3RPERQ1 28V-29V to 26.50V @ 1.5A


Design Alerts

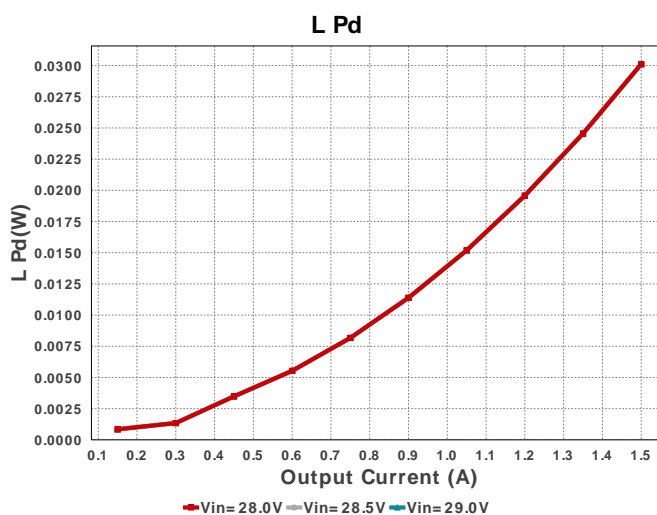
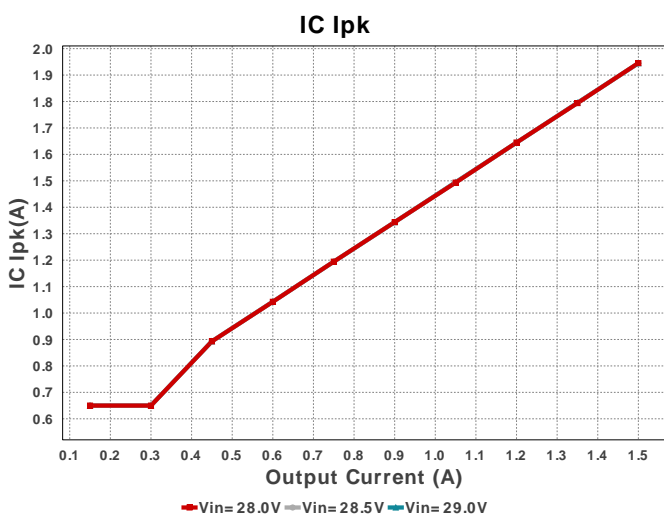
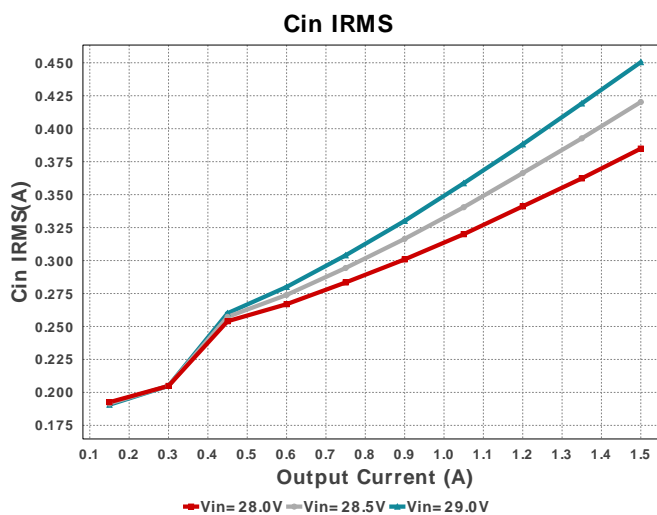
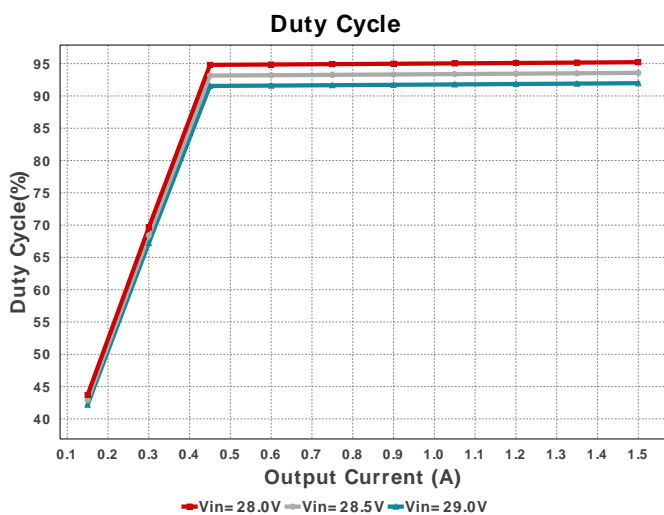
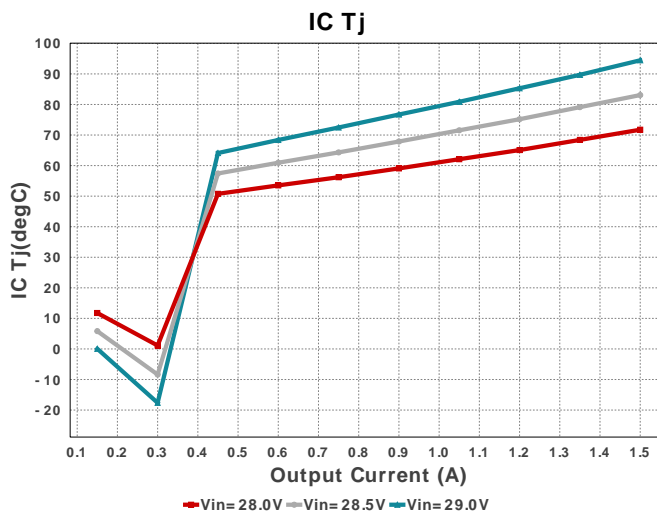
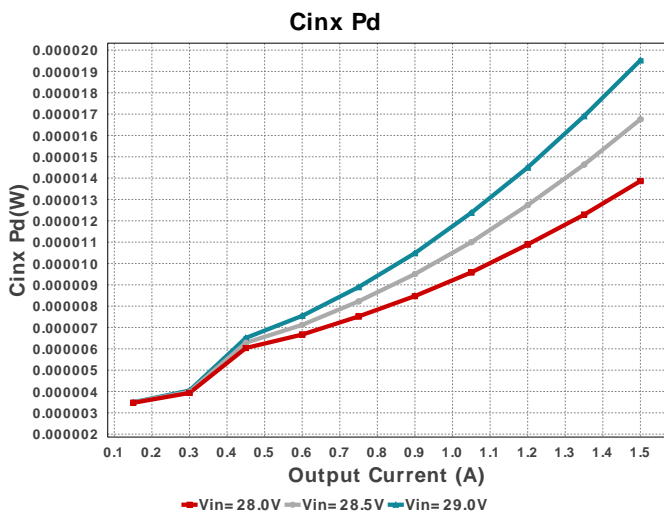
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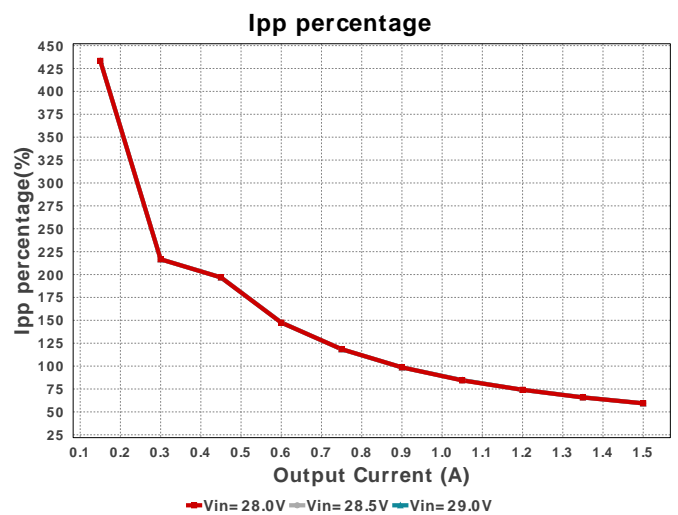
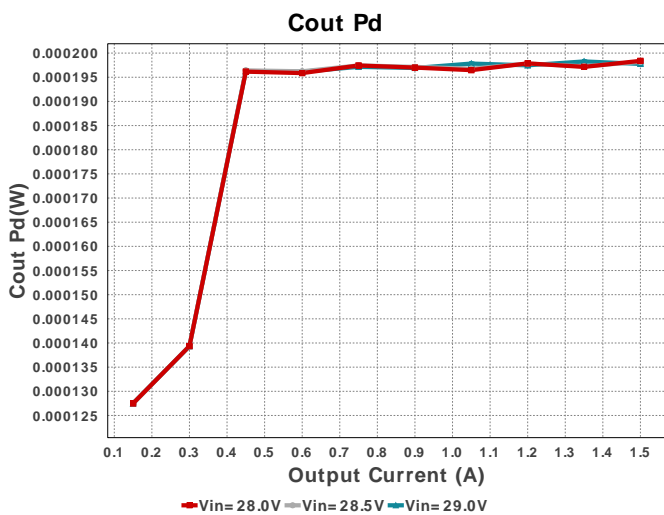
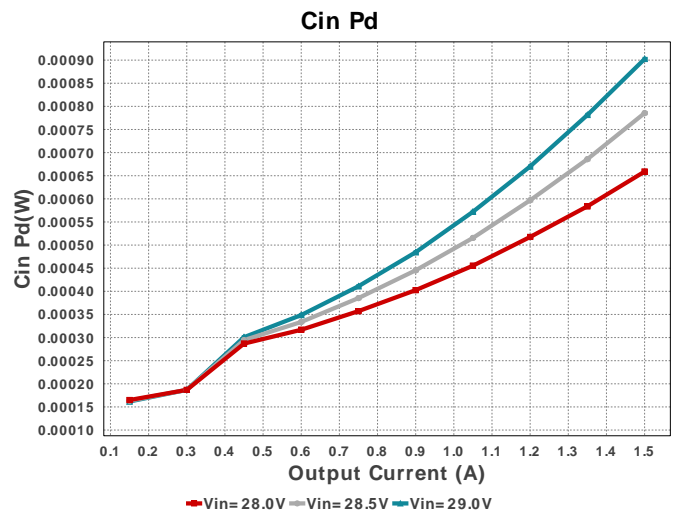
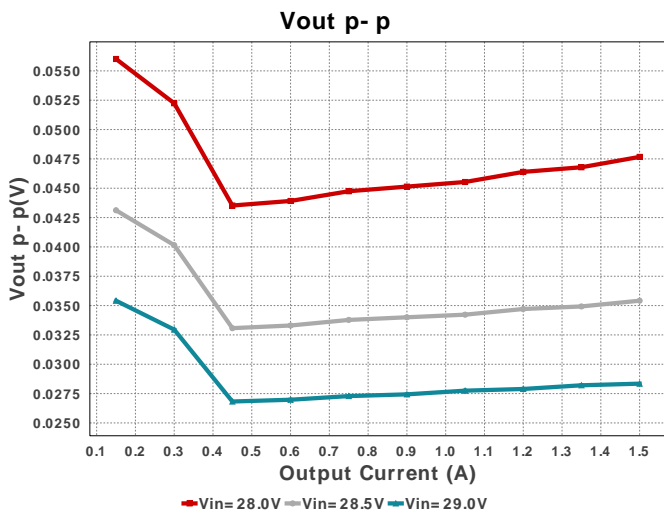
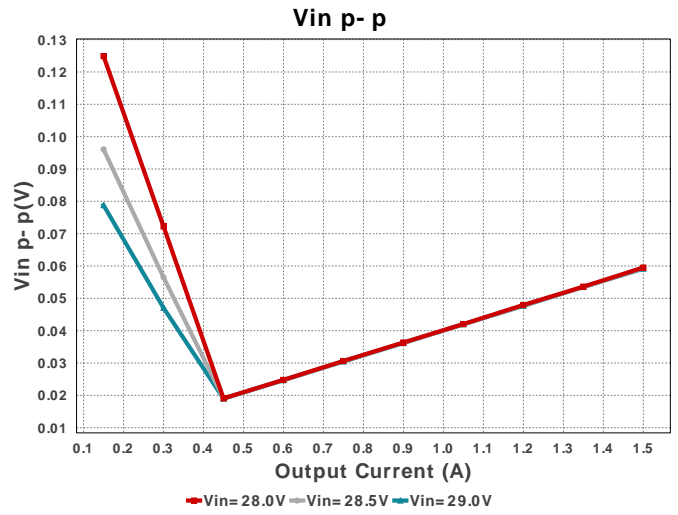
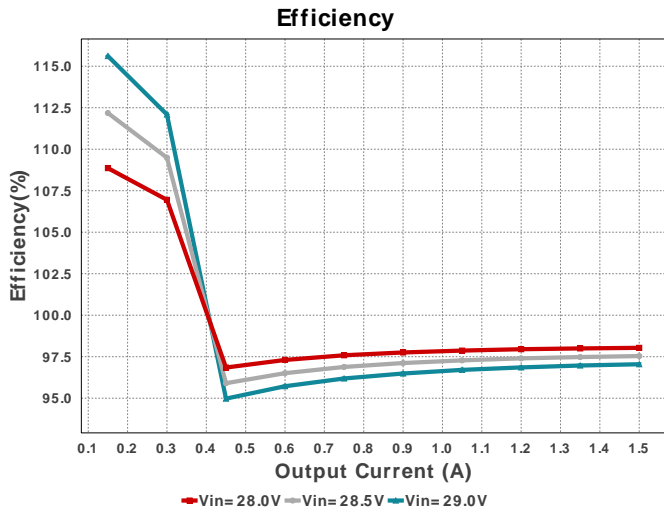
The LMR43620MSC3-Q1 is qualified for Automotive applications. All passives and other components selected in this design may not be qualified for Automotive applications. The user is required to verify that all components in the design meet the qualification and safety requirements for their specific application. This device is recommended for maximum Vin of 36V

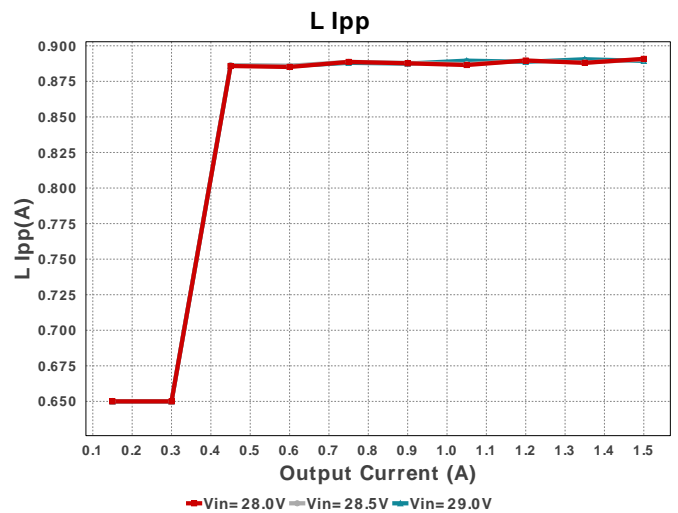
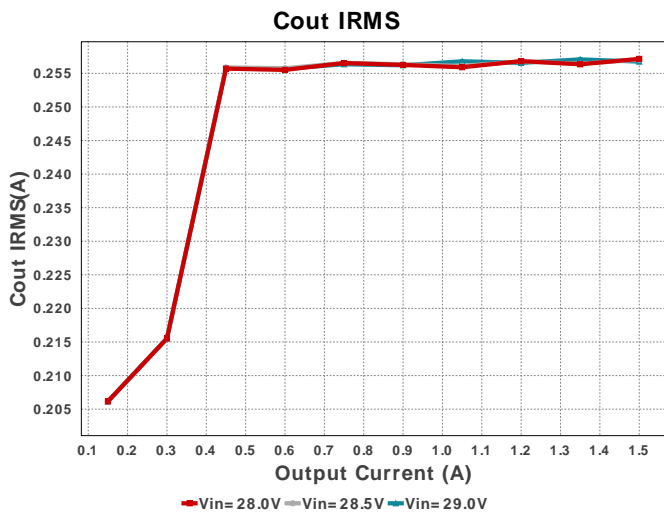
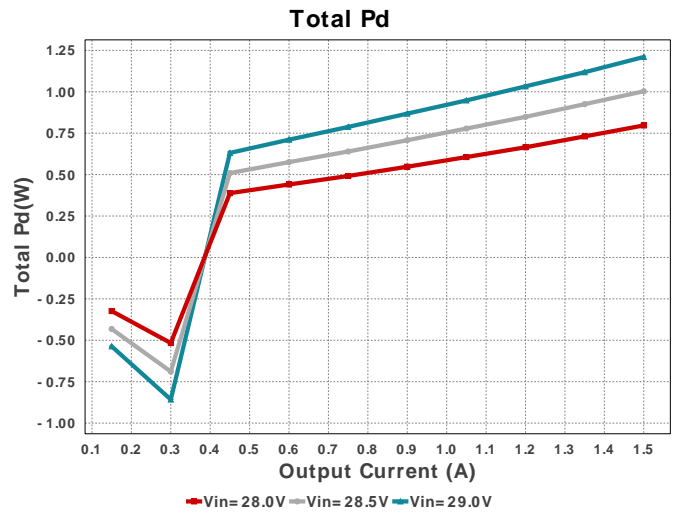
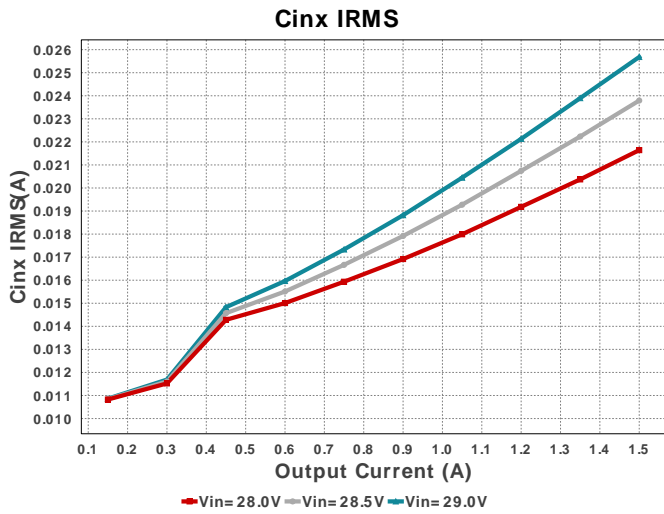
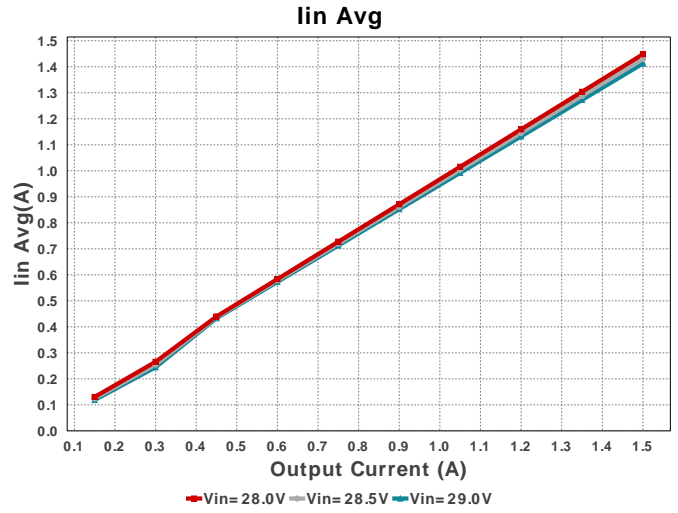
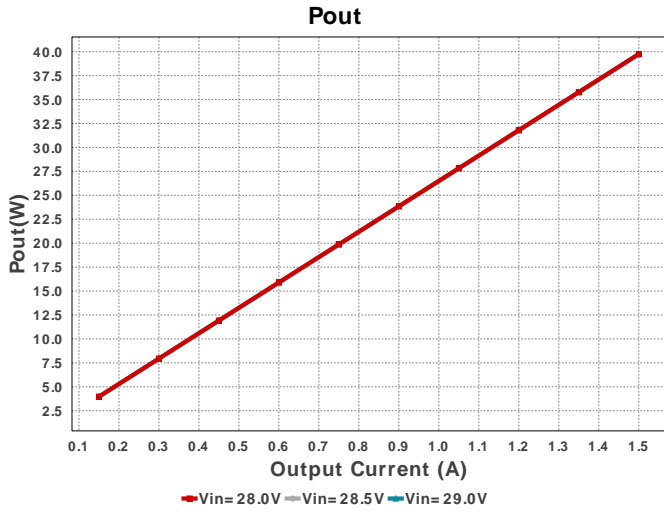
Electrical BOM

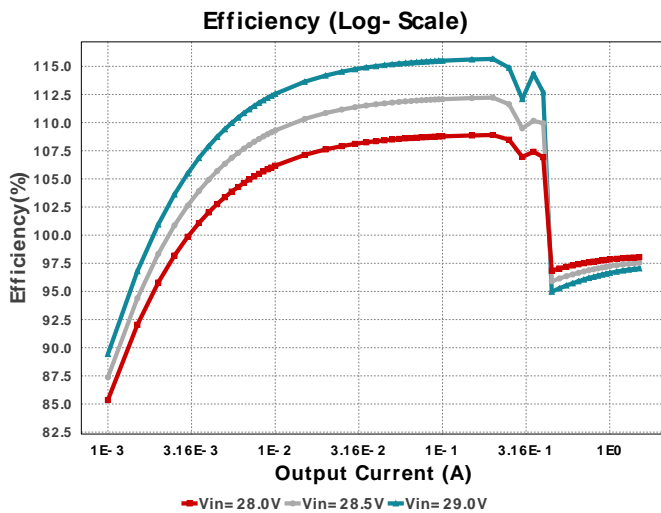
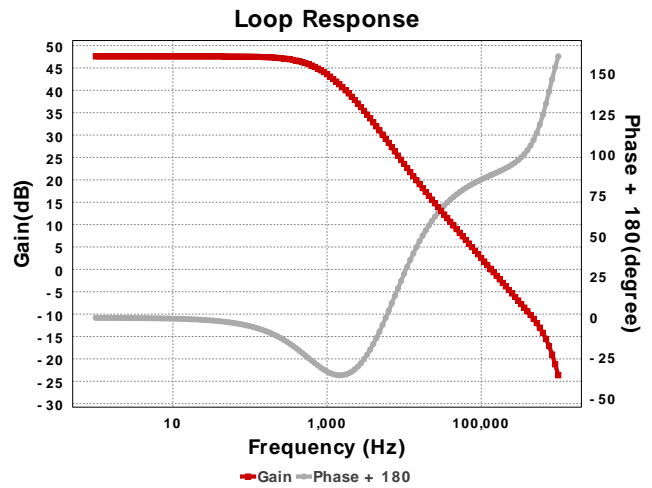
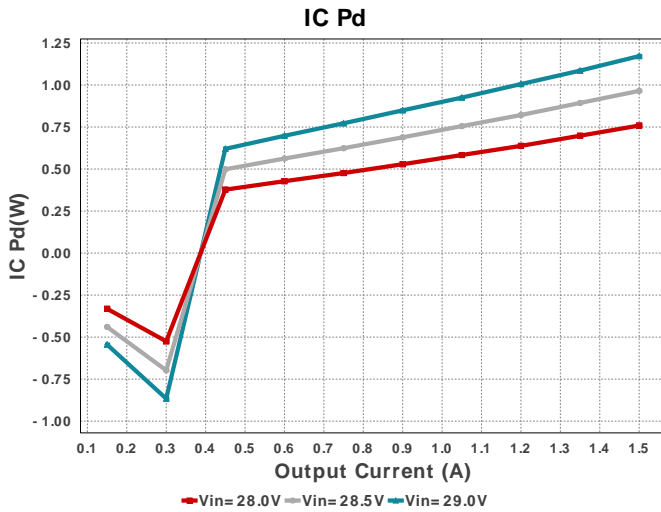
Name	Manufacturer	Part Number	Properties	Qty	Price	Footprint
Cboot	TDK	CGA2B3X7R1H104K050BB Series= X7R	Cap= 100.0 nF ESR= 39.064 mOhm VDC= 50.0 V IRMS= 814.67 mA	1	\$0.02	0402 3 mm ²
Cin	MuRata	GRM31CR71H225KA88L Series= X7R	Cap= 2.2 uF ESR= 4.448 mOhm VDC= 50.0 V IRMS= 2.2252 A	1	\$0.10	1206_190 11 mm ²
Cinx	TDK	CGA3E2X7R1H104K080AA Series= X7R	Cap= 100.0 nF ESR= 29.6 mOhm VDC= 50.0 V IRMS= 971.99 mA	1	\$0.01	0603 5 mm ²
Cout	MuRata	GRM31CR71H475KA12L Series= X7R	Cap= 4.7 uF ESR= 3.0 mOhm VDC= 50.0 V IRMS= 4.98 A	1	\$0.22	1206 11 mm ²
Cvcc	TDK	CGA3E1X7R1V105K080AC Series= X7R	Cap= 1.0 uF ESR= 5.522 mOhm VDC= 35.0 V IRMS= 2.2162 A	1	\$0.05	0603 5 mm ²
L1	TDK	VLP8040T-1R5N	L= 1.5 uH 13.0 mOhm	1	\$0.22	VLP8040 113 mm ²
Rfbb	Vishay-Dale	CRCW04023K92FKED Series= CRCW..e3	Res= 3.92 kOhm Power= 63.0 mW Tolerance= 1.0%	1	\$0.01	0402 3 mm ²
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
Rpg	Vishay-Dale	CRCW0603100KFKEA Series= CRCW..e3	Res= 100.0 kOhm Power= 100.0 mW Tolerance= 1.0%	1	\$0.01	0603 5 mm ²

Name	Manufacturer	Part Number	Properties	Qty	Price	Footprint
U1	Texas Instruments	LMR43620MSC3RPERQ1	Switcher	1	\$1.21	RPE0009A 9 mm ²









Operating Values

#	Name	Value	Category	Description
1.	Cin IRMS	450.436 mA	Capacitor	Input capacitor RMS ripple current
2.	Cin Pd	902.47 μ W	Capacitor	Input capacitor power dissipation
3.	Cinx IRMS	25.682 mA	Capacitor	Bulk capacitor RMS ripple current
4.	Cinx Pd	19.523 μ W	Capacitor	Bulk capacitor power dissipation
5.	Cout IRMS	256.746 mA	Capacitor	Output capacitor RMS ripple current
6.	Cout Pd	197.76 μ W	Capacitor	Output capacitor power dissipation
7.	IC Ipk	1.945 A	IC	Peak switch current in IC
8.	IC Pd	1.172 W	IC	IC power dissipation
9.	IC Tj	94.458 degC	IC	IC junction temperature
10.	IC Tolerance	12.5 mV	IC	IC Feedback Tolerance
11.	ICThetaJA Effective	55.0 degC/W	IC	Effective IC Junction-to-Ambient Thermal Resistance
12.	Iin Avg	1.412 A	IC	Average input current
13.	Ipp percentage	59.293 %	Inductor	Inductor ripple current percentage (with respect to average inductor current)
14.	L Ipp	889.39 mA	Inductor	Peak-to-peak inductor ripple current
15.	L Pd	30.107 mW	Inductor	Inductor power dissipation
16.	Cin Pd	902.47 μ W	Power	Input capacitor power dissipation
17.	Cinx Pd	19.523 μ W	Power	Bulk capacitor power dissipation
18.	Cout Pd	197.76 μ W	Power	Output capacitor power dissipation
19.	IC Pd	1.172 W	Power	IC power dissipation
20.	L Pd	30.107 mW	Power	Inductor power dissipation
21.	Total Pd	1.21 W	Power	Total Power Dissipation
22.	BOM Count	10	System	Total Design BOM count
23.	Cross Freq	134.353 kHz	System	Bode plot crossover frequency
24.	Duty Cycle	91.976 %	System	Duty cycle
25.	Efficiency	97.046 %	System	Steady state efficiency
26.	FootPrint	167.0 mm ²	System	Total Foot Print Area of BOM components

#	Name	Value	Category	Description
27.	Frequency	1.604 MHz	System Information	Switching frequency
28.	Gain Marg	47.565 dB	System Information	Bode Plot Gain Margin
29.	Iout	1.5 A	System Information	Iout operating point
30.	Low Freq Gain	47.565 dB	System Information	Gain at 1Hz
31.	Mode	CCM	System Information	Conduction Mode
32.	Phase Marg	87.817 deg	System Information	Bode Plot Phase Margin
33.	Pout	39.75 W	System Information	Total output power
34.	Total BOM	\$1.86	System Information	Total BOM Cost
35.	Vin	29.0 V	System Information	Vin operating point
36.	Vin p-p	59.179 mV	System Information	Peak-to-peak input voltage
37.	Vout	26.5 V	System Information	Operational Output Voltage
38.	Vout Actual	26.51 V	System Information	Vout Actual calculated based on selected voltage divider resistors
39.	Vout Tolerance	3.218 %	System Information	Vout Tolerance based on IC Tolerance (no load) and voltage divider resistors if applicable
40.	Vout p-p	28.345 mV	System Information	Peak-to-peak output ripple voltage

Design Inputs

Name	Value	Description
Iout	1.5	Maximum Output Current
VinMax	29.0	Maximum input voltage
VinMin	28.0	Minimum input voltage
Vout	26.5	Output Voltage
base_pn	LMR43620MSC3-Q1	Base Product Number
source	DC	Input Source Type
Ta	30.0	Ambient temperature

WEBENCH® Assembly

Component Testing

Some published data on components in datasheets such as Capacitor ESR and Inductor DC resistance is based on conservative values that will guarantee that the components always exceed the specification. For design purposes it is usually better to work with typical values. Since this data is not always available it is a good practice to measure the Capacitance and ESR values of C_{in} and C_{out} , and the inductance and DC resistance of L1 before assembly of the board. Any large discrepancies in values should be electrically simulated in WEBENCH to check for instabilities and thermally simulated in WebTHERM to make sure critical temperatures are not exceeded.

Soldering Component to Board

If board assembly is done in house it is best to tack down one terminal of a component on the board then solder the other terminal. For surface mount parts with large tabs, such as the DPAK, the tab on the back of the package should be pre-tinned with solder, then tacked into place by one of the pins. To solder the tab down to the board place the iron down on the board while resting against the tab, heating both surfaces simultaneously. Apply light pressure to the top of the plastic case until the solder flows around the part and the part is flush with the PCB. If the solder is not flowing around the board you may need a higher wattage iron (generally 25W to 30W is enough).

Initial Startup of Circuit

It is best to initially power up the board by setting the input supply voltage to the lowest operating input voltage 28.0V and set the input supply's current limit to zero. With the input supply off connect up the input supply to V_{in} and GND. Connect a digital volt meter and a load if needed to set the minimum load of the design from V_{out} and GND. Turn on the input supply and slowly turn up the current limit on the input supply. If the voltage starts to rise on the input supply continue increasing the input supply current limit while watching the output voltage. If the current increases on the input supply, but the voltage remains near zero, then there may be a short or a component misplaced on the board. Power down the board and visually inspect for solder bridges and recheck the diode and capacitor polarities. Once the power supply circuit is operational then more extensive testing may include full load testing, transient load and line tests to compare with simulation results.

Load Testing

The setup is the same as the initial startup, except that an additional digital voltmeter is connected between V_{in} and GND, a load is connected between V_{out} and GND and a current meter is connected in series between V_{out} and the load. The load must be able to handle at least rated output power + 50% (7.5 watts for this design). Ideally the load is supplied in the form of a variable load test unit. It can also be done in the form of suitably large power resistors. When using an oscilloscope to measure waveforms on the prototype board, the ground leads of the oscilloscope probes should be as short as possible and the area of the loop formed by the ground lead should be kept to a minimum. This will help reduce ground lead inductance and eliminate EMI noise that is not actually present in the circuit.



Design Assistance

1. The LMR43620MSC3-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 This device is recommended for maximum V_{in} of 36V
2. Master key : 40EE3F1E021441DB[v1]
3. **LMR43620MSC3-Q1** Product Folder : <http://www.ti.com/product/LMR43620%2DQ1> : contains the data sheet and other resources.

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