AN-2185 LMR14203/LMR14206 Demonstration Board

1 Introduction

The Texas Instruments LMR14203/06 is a PWM DC/DC buck (step-down) regulator. With a wide input range from 4.5V-42V, it is suitable for a variety of applications from automotive to power conditioning of unregulated sources. The LMR14203/LMR14006 demonstration board is designed to provide the design engineer with a fully functional power converter based on the buck topology to evaluate the LMR14203/06 series of buck regulators. The demonstration board comes populated with either the LMR14203XMK or LMR14206XMK, but can easily be modified to accommodate any of the LMR14203/06 regulator ICs.

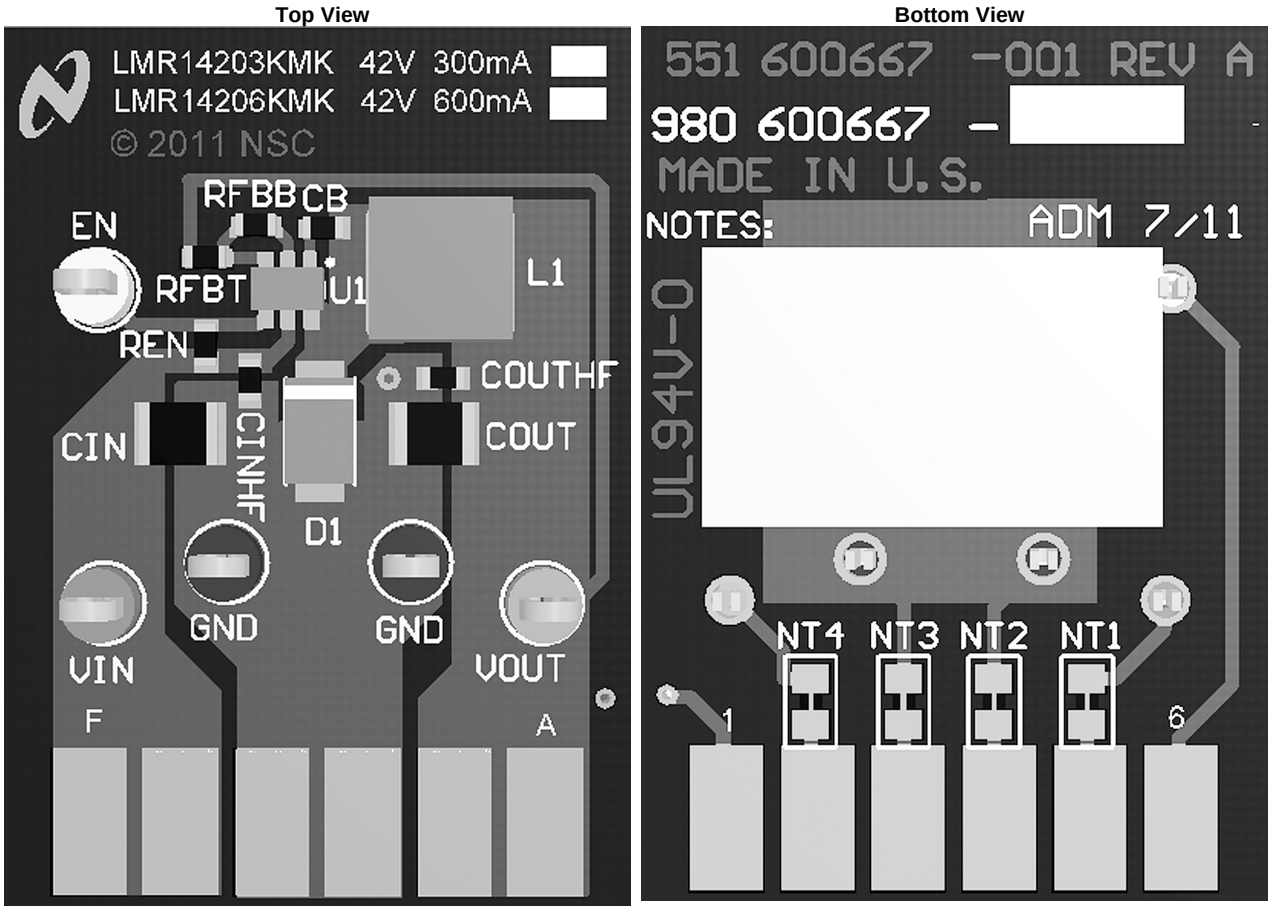


Figure 1. LMR14203/LMR14206 Demonstration Board

2 Features

- 4.5V to 42V Input Voltage Range
- 1.2V Output Voltage
- Up to 300/600 mA Output Current
- Switching Frequency of 1.25 MHz
- Internal Compensation

3 Shutdown Operation

The demonstration board includes a pull-up resistor to enable the device once V_{IN} has exceeded 1.0V (typ). Using the EN post to disable the device by pulling this node to GND. A logic signal may be applied, to the post, to test startup and shutdown of the device.

4 Adjusting the Output Voltage

The output voltage can be changed from 1.2V to another voltage by adjusting the feedback resistors using the following equation:

$$V_{OUT} = V_{FB}(1 + (RFBT/RFBB)) \quad (1)$$

Where V_{FB} is 0.765V.

For more information on component selection and features, see:

- *LMR14203 SIMPLE SWITCHER 42Vin, 0.3A Step-Down Voltage Regulator in SOT-23* (SNVS732)
- *LMR14206 SIMPLE SWITCHER 42Vin, 0.6A Step-Down Voltage Regulator in SOT-23* (SNVS733)

5 LMR14203 Demonstration Board Schematic

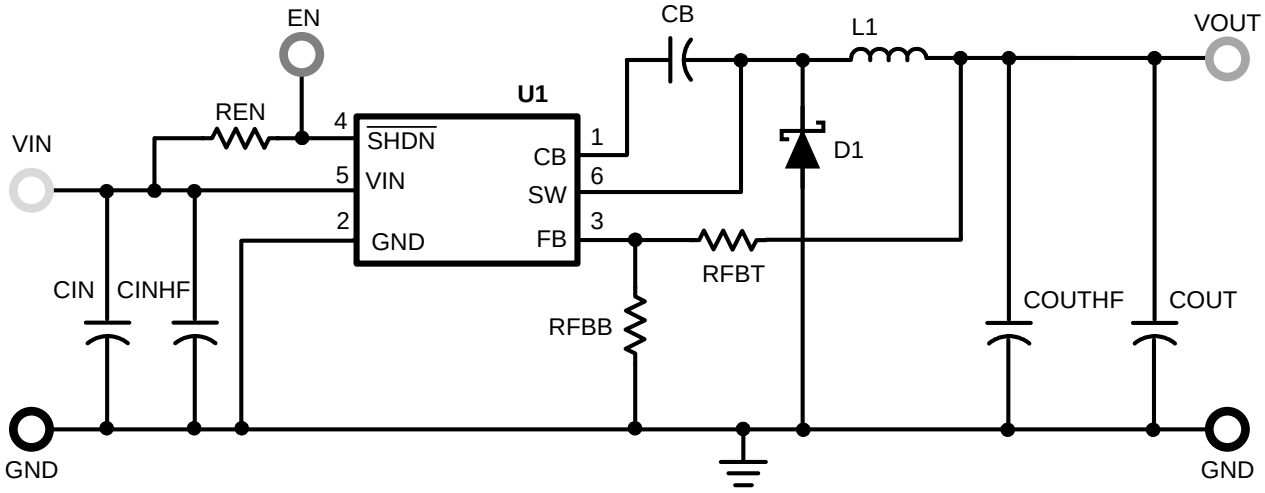


Figure 2. LMR14203 Demonstration Board Schematic

Table 1. Bill of Materials LMR14203

ID	Part Number	Type	Size	Parameters	Qty	Vendor
U1	LMR14203	Buck Regulator	SOT-6		1	Texas Instruments
L1	NR6045T150M	Inductor	NR6045	15 µH, 2.3A	1	Taiyo Yuden
D1	B260A-13-F	Diode	SMA	60V, 2 A	1	Diodes Inc
CIN	GRM32ER72A225KA35L	Capacitor	1210	2.2 µF, 100V	1	Murata
CINHF, COUTHF	C0603C223K3RACTU	Capacitor	0603	0.022 µF, 25V	2	Kemet
COUT	GRM32ER61A476KE20L	Capacitor	1210	47 µF, 10V	1	Murata
CB	C0603C224K4RACTU	Capacitor	0603	0.22 µF, 16V	1	Kemet
RFBT	CRCW06036K04FKEA	Resistor	0603	6.04 kΩ, 1%	1	Vishay
RFBB	CRCW060310K5FKEA	Resistor	0603	10.5 kΩ, 1%	1	Vishay
REN	CRCW06031M00JNEA	Resistor	0603	1.0 MΩ, 5%	1	Vishay
EN	5014	Test Point Loop		Yellow	1	Keystone
VIN	5010	Test Point Loop		Red	1	Keystone
VOUT	5013	Test Point Loop		Orange	1	Keystone
GND	5011	Test Point Loop		Black	2	Keystone

6 LMR14206 Demonstration Board Schematic

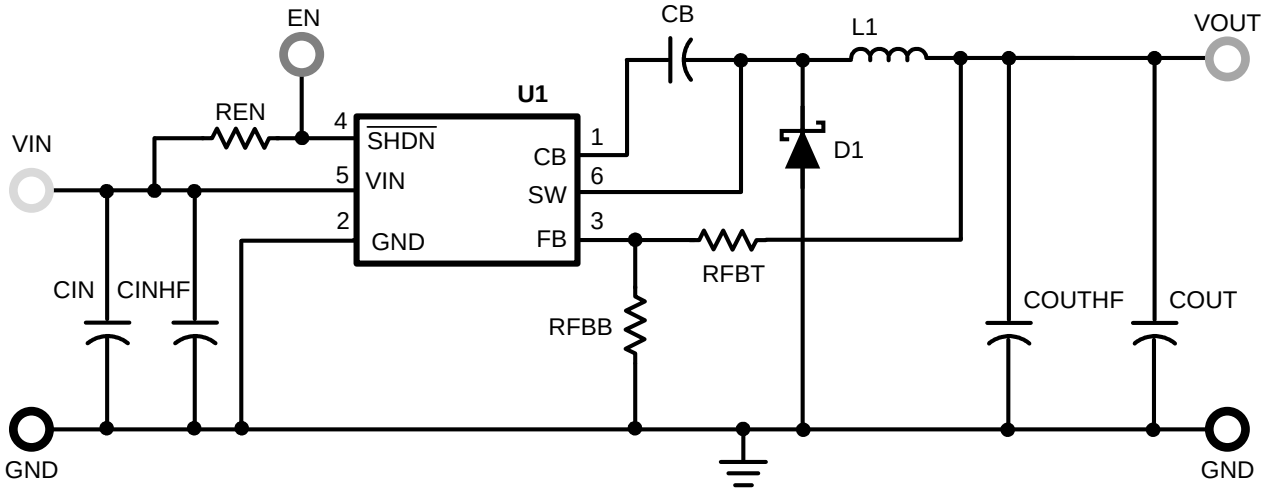


Figure 3. LMR14206 Demonstration Board Schematic

Table 2. Bill of Materials (BOM) LMR14206

ID	Part Number	Type	Size	Parameters	Qty	Vendor
U1	LMR14206	Buck Regulator	SOT-6		1	Texas Instruments
L1	NR6045T150M	Inductor	NR6045	15 µH, 2.3A	1	Taiyo Yuden
D1	B260A-13-F	Diode	SMA	60V, 2 A	1	Diodes Inc
CIN	GRM32ER72A225KA35L	Capacitor	1210	2.2 µF, 100V	1	Murata
CINHF, COUTHF	C0603C223K3RACTU	Capacitor	0603	0.022 µF, 25V	2	Kemet
COUT	GRM32ER61A476KE20L	Capacitor	1210	47 µF, 10V	1	Murata
CB	C0603C224K4RACTU	Capacitor	0603	0.22 µF, 16V	1	Kemet
RFBT	CRCW06036K04FKEA	Resistor	0603	6.04 kΩ, 1%	1	Vishay
RFBB	CRCW060310K5FKEA	Resistor	0603	10.5 kΩ, 1%	1	Vishay
REN	CRCW06031M00JNEA	Resistor	0603	1.0 MΩ, 5%	1	Vishay
EN	5014	Test Point Loop		Yellow	1	Keystone
VIN	5010	Test Point Loop		Red	1	Keystone
VOUT	5013	Test Point Loop		Orange	1	Keystone
GND	5011	Test Point Loop		Black	2	Keystone

7 Quick Setup Procedures

Step 1: Connect a power supply to VIN terminals.

Step 2: Connect a load to VOUT terminals.

Step 3 EN should be left floating for normal operation. Short this to ground to shutdown the part.

Step 4: Set V_{IN} = 24V, with 0A load applied, check V_{OUT} with a voltmeter. Nominal 1.2V

Step 5: Apply a 300mA load and check V_{OUT}. Nominal 1.2V

8 Measurements

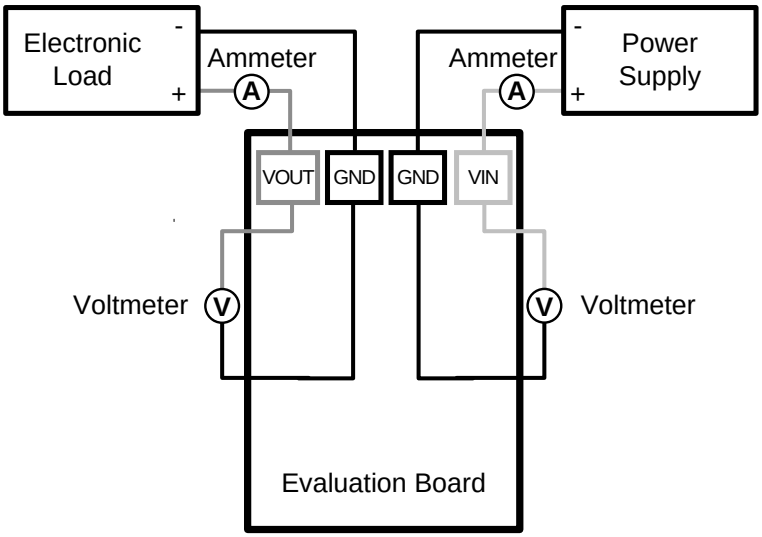


Figure 4. Efficiency Measurements

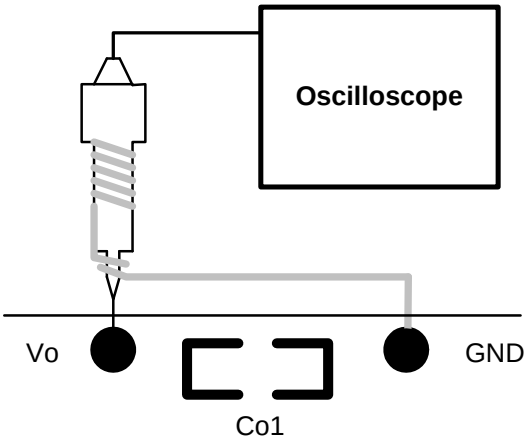


Figure 5. Voltage Ripple Measurements

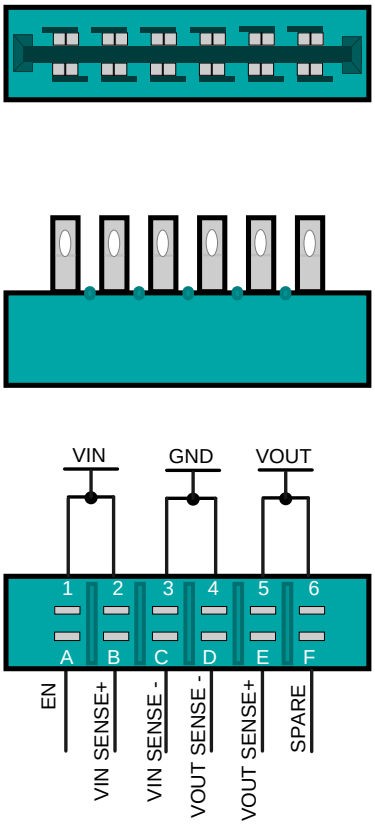
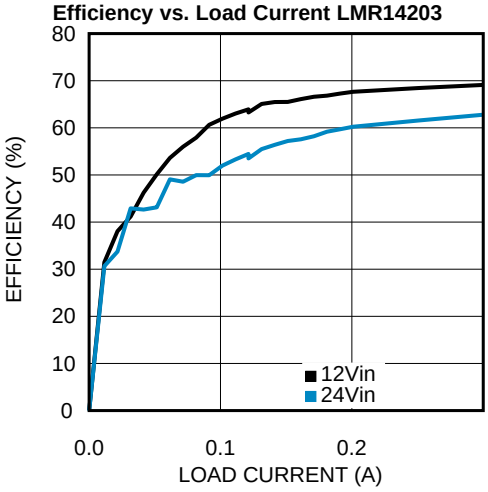


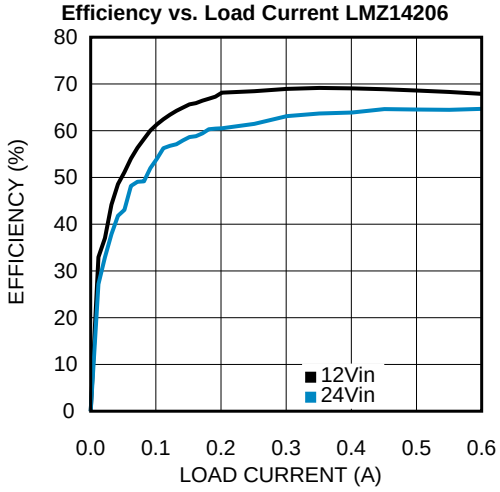
Figure 6. Edge Connector Schematic

9 Typical Performance Characteristics

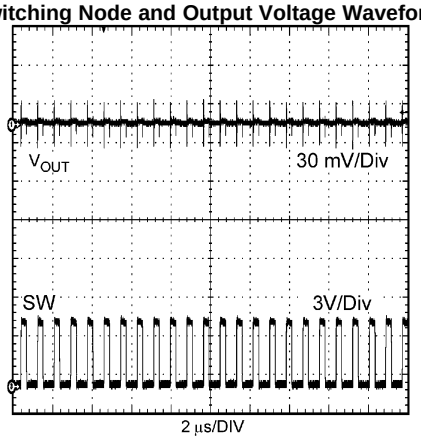
Efficiency vs. Load Current LMR14203



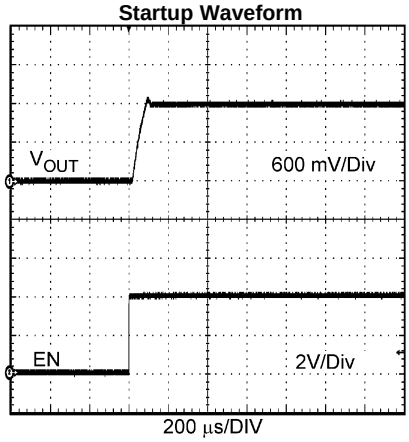
Efficiency vs. Load Current LMZ14206



Switching Node and Output Voltage Waveforms



Startup Waveform



10 Layout

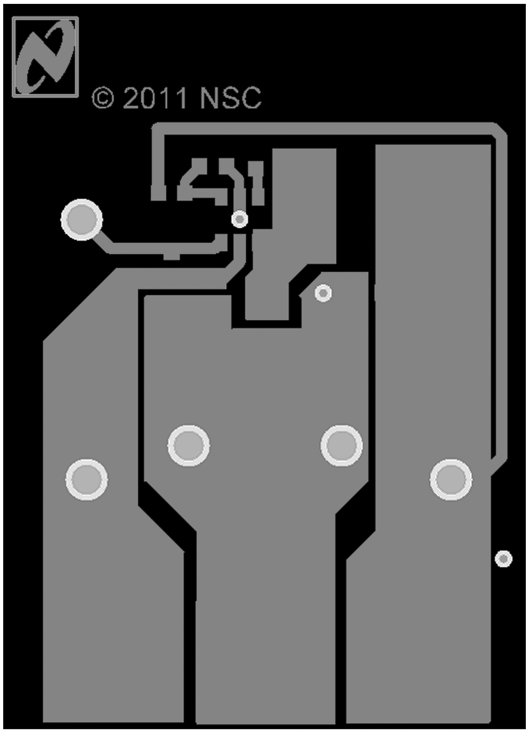


Figure 7. Top Layer

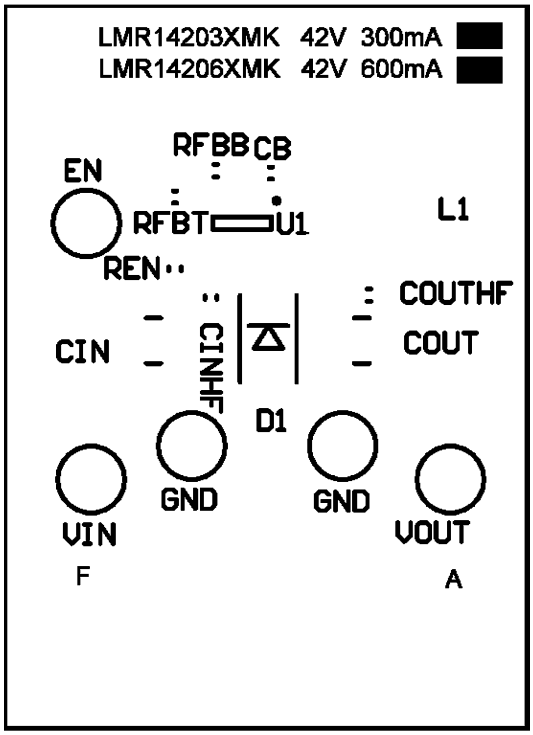


Figure 8. Top Overlay

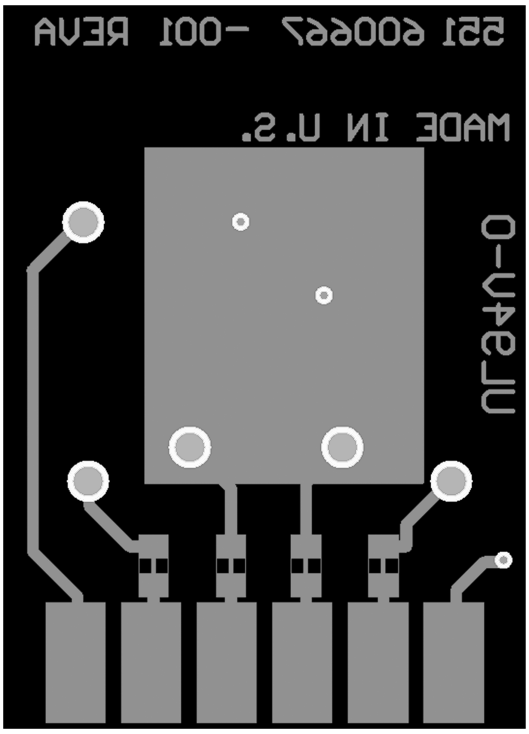


Figure 9. Bottom Layer

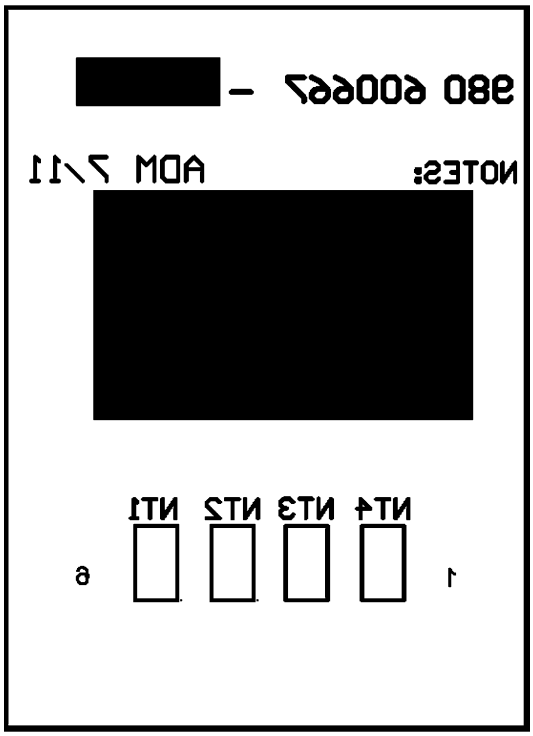


Figure 10. Bottom Overlay

IMPORTANT NOTICE

Texas Instruments Incorporated and its subsidiaries (TI) reserve the right to make corrections, enhancements, improvements and other changes to its semiconductor products and services per JESD46, latest issue, and to discontinue any product or service per JESD48, latest issue. Buyers should obtain the latest relevant information before placing orders and should verify that such information is current and complete. All semiconductor products (also referred to herein as “components”) are sold subject to TI’s terms and conditions of sale supplied at the time of order acknowledgment.

TI warrants performance of its components to the specifications applicable at the time of sale, in accordance with the warranty in TI’s terms and conditions of sale of semiconductor products. Testing and other quality control techniques are used to the extent TI deems necessary to support this warranty. Except where mandated by applicable law, testing of all parameters of each component is not necessarily performed.

TI assumes no liability for applications assistance or the design of Buyers’ products. Buyers are responsible for their products and applications using TI components. To minimize the risks associated with Buyers’ products and applications, Buyers should provide adequate design and operating safeguards.

TI does not warrant or represent that any license, either express or implied, is granted under any patent right, copyright, mask work right, or other intellectual property right relating to any combination, machine, or process in which TI components or services are used. Information published by TI regarding third-party products or services does not constitute a license to use such products or services or a warranty or endorsement thereof. Use of such information may require a license from a third party under the patents or other intellectual property of the third party, or a license from TI under the patents or other intellectual property of TI.

Reproduction of significant portions of TI information in TI data books or data sheets is permissible only if reproduction is without alteration and is accompanied by all associated warranties, conditions, limitations, and notices. TI is not responsible or liable for such altered documentation. Information of third parties may be subject to additional restrictions.

Resale of TI components or services with statements different from or beyond the parameters stated by TI for that component or service voids all express and any implied warranties for the associated TI component or service and is an unfair and deceptive business practice. TI is not responsible or liable for any such statements.

Buyer acknowledges and agrees that it is solely responsible for compliance with all legal, regulatory and safety-related requirements concerning its products, and any use of TI components in its applications, notwithstanding any applications-related information or support that may be provided by TI. Buyer represents and agrees that it has all the necessary expertise to create and implement safeguards which anticipate dangerous consequences of failures, monitor failures and their consequences, lessen the likelihood of failures that might cause harm and take appropriate remedial actions. Buyer will fully indemnify TI and its representatives against any damages arising out of the use of any TI components in safety-critical applications.

In some cases, TI components may be promoted specifically to facilitate safety-related applications. With such components, TI’s goal is to help enable customers to design and create their own end-product solutions that meet applicable functional safety standards and requirements. Nonetheless, such components are subject to these terms.

No TI components are authorized for use in FDA Class III (or similar life-critical medical equipment) unless authorized officers of the parties have executed a special agreement specifically governing such use.

Only those TI components which TI has specifically designated as military grade or “enhanced plastic” are designed and intended for use in military/aerospace applications or environments. Buyer acknowledges and agrees that any military or aerospace use of TI components which have ***not*** been so designated is solely at the Buyer's risk, and that Buyer is solely responsible for compliance with all legal and regulatory requirements in connection with such use.

TI has specifically designated certain components as meeting ISO/TS16949 requirements, mainly for automotive use. In any case of use of non-designated products, TI will not be responsible for any failure to meet ISO/TS16949.

Products		**Applications**	
Audio	www.ti.com/audio	Automotive and Transportation	www.ti.com/automotive
Amplifiers	amplifier.ti.com	Communications and Telecom	www.ti.com/communications
Data Converters	dataconverter.ti.com	Computers and Peripherals	www.ti.com/computers
DLP® Products	www.dlp.com	Consumer Electronics	www.ti.com/consumer-apps
DSP	dsp.ti.com	Energy and Lighting	www.ti.com/energy
Clocks and Timers	www.ti.com/clocks	Industrial	www.ti.com/industrial
Interface	interface.ti.com	Medical	www.ti.com/medical
Logic	logic.ti.com	Security	www.ti.com/security
Power Mgmt	power.ti.com	Space, Avionics and Defense	www.ti.com/space-avionics-defense
Microcontrollers	microcontroller.ti.com	Video and Imaging	www.ti.com/video
RFID	www.ti-rfid.com		
OMAP Applications Processors	www.ti.com/omap	**TI E2E Community**	e2e.ti.com
Wireless Connectivity	www.ti.com/wirelessconnectivity		

Mailing Address: Texas Instruments, Post Office Box 655303, Dallas, Texas 75265