

EV2300 EVM Interface Board

This user's guide describes the function and operation of the EV2300 evaluation module. This guide includes a complete description of the EV2300 EVM, as well as a bill of materials, and schematic.

Contents

1	Introduction	2
2	Interfaces	2
3	EV2300 Bill of Materials, Component Placement, Schematic	6

List of Figures

1	Board Layer 1	8
2	Solder Mask 1	9
3	Solder Mask 2.....	10
4	Board Layer 2.....	11
5	Component Placement 1	12
6	Component Placement 2	13
7	Internal Board Layer 1	14
8	Internal Board Layer 2	15

List of Tables

1	Ordering Information.....	2
---	---------------------------	---

1 Introduction

This EVM interface board enables an IBM-compatible or other type (with required driver for the particular platform) PC to communicate with Texas Instruments SMBus, HDQ, or DQ interface gas gauges via a Universal Serial Bus (USB) port. In addition to this board, PC software is required to interpret the gas gauge data to complete the evaluation system.

1.1 Features

- Fully powered from the USB port
- Capable of providing a 25-mA 3.3-V source
- Complete interface between USB and SMBus, I²C, and HDQ (8/16) interfaces using a simple API

1.2 Kit Contents

- EV2300 circuit module
- Standard USB cable

1.3 Ordering Information

Table 1. Ordering Information

EVM Part Number
EV2300

2 Interfaces

The EV2300 interfaces are described in the following table. The reference designators on the circuit board and the functions are also listed.

Reference Designator	Function	Function
HDQ and SMB	SMBus, HDQ, and DQ Interface ports	Terminal block for connecting to a target device
I ² C	E ² PROM I ² C Interface	Terminal for connecting to a target E ² PROM or I ² C interface battery monitor
USB	USB Interface	Interface to host computer

2.1 Overview

The EV2300 is enclosed and is provided as shown.



2.2 EV2300 Controller

The EV2300 controller is a bq8012 running at 4 MHz. The controller firmware is stored in flash memory and is executed by the core at power-up after the boot ROM code verifies the integrity words.

The controller communicates with target device(s) through either: a 2-wire SMBus communication port, a 1-wire HDQ port, or a 2-wire E²PROM I²C port. The 2-wire SMBus communication port supports both SMBus and I²C protocols.

2.3 USB Interface (USB)

The interface board connects to a USB port (version 1.1) on a host computer and is powered from the port. All communication over the USB is proprietary and does not fit any USB-defined device classes. Therefore communication with the device requires a loader and driver from Texas Instruments.

The loader enumerates the device (determines it is present on the USB), then loads the EV2300 controller firmware for the USB interface. Once the firmware load is complete, the loader sends a command to the USB interface IC to execute the new program and the loader driver exits. A new driver takes control and enumerates the EV2300 and makes the device present to programs running on the host.

The installer for the USB EVB installs:

1. A loader driver
2. A binary to load onto the USB interface IC
3. An EV2300 controller driver for direct access to the device
4. An EV2300 DLL for application access to the device

2.4 HDQ Interface (HDQ)

This interface allows a host computer to interact with a slave or target device through the two-wire SMBus or the one-wire HDQ interfaces. The ports are labeled with the corresponding signal names above each port connector. Connect the signal and a ground reference (GND), and optionally VOUT, to a target device.

The two-wire interface supports SMBus version 1.1 byte, word, block transactions with and without PEC. The SMBus limits the capacitance on each line (Data and Clock) to 100 pF. The EV2300 places 8 pF on each line, so a device may place up to 92 pF total. If the capacitive load approaches or exceeds 100 pF, SMBus communication may not be reliable.

Pin	Name	Description
1	GND	Ground return/reference for HDQ interface
2	VOUT	Controlled EEPROM power. Supplies 5 VDC to a target EEPROM IC
3	HDQ	HDQ one-wire interface. Pulled up to 3.3-V rail with a 10-kΩ resistor
4	VCC	Supplies 3.3 VDC to a target. Current load should be limited to 30 mA

2.5 I²C/EEPROM Interface (I²C)

This interface allows a host computer to interact with a target E²PROM or other I²C interface device such as a battery monitor device through a two-wire I²C interface. The interface contains a controlled power pin, the I²C clock and data lines, and a ground reference.

Pin	Name	Description
1	GND	Ground return. Connected to the SMD and HDQ GND
2	SCL	I ² C clock. This line must be pulled up by the target.
3	SDA	I ² C data. This line must be pulled up by the target.
4	VOUT	Controlled EEPROM power. Supplies 5 VDC to a target EEPROM IC

2.6 SMBus Interface (SMBus)

Pin	Name	Description
1	GND	Ground reference
2	SMBC	SMB clock pin. This pin is pulled to 3.3 VDC through a 10-k Ω resistor. Do not exceed 5.6 VDC on this pin.
3	SMBD	SMB data pin. This pin is pulled to 3.3 VDC through a 10-k Ω resistor. Do not exceed 5.6 VDC on this pin.
4	NC	Not connected on this board. This pin is floating.

3 EV2300 Bill of Materials, Component Placement, Schematic

This chapter includes the schematic, component placement on the circuit board, and a listing of the bill of materials for the EV2300 EVM.

3.1 Bill of Materials (BOM)

Qty	Ref Des ⁽¹⁾	Description ^{(2) (3) (4)}	Size	MFR	Part Number
10	C1-C7, C10-C12, C15, C20	Capacitor, ceramic, 0.1 μ F, 25 V, X7R, 10%	603	TDK	C1608X7R1E104KT
0	C13	Open	603		
2	C16, C21	Capacitor, POSCAP 4.7 μ F, 35 V, 20%	6032 ©)	AVX	TAJC475K035R
1	C18	Capacitor, ceramic, 2200 pF, 50 V, C0G, 10%	603	TDK	C1608C0G1H222KT
1	C19	Capacitor, ceramic, 150 pF, 50 V, C0G, 10%	603	TDK	C1608C0G1H151KT
2	C8, C9	Capacitor, ceramic, 22 pF, 50 V, C0G, 10%	603	TDK	C1608C0G1H220KT
0	D1-D7, D9, D13-D15, D17	Open	0.068 × 0.049		
2	D12, D19	Diode, LED, green, 20 mA, 0.9 mcd	0.068 × 0.049	Panasonic	LN1371G-(TR)
1	D20	Diode, LED, red, 20 mA, 0.9 mcd	0.068 × 0.049	Panasonic	LN1271R-(TR)
3	D21-D23	Diode, dual, 250 mA, 70 V	SOT23	Vishay-Liteon	BAW56GS08
5	D8, D10, D11, D16, D18	Diode, low capacitance, TVS	SOT23	General Semi	GL05T
1	J1	Connector, USB upstream (Type B)	0.47" × 0.67"	Molex	67068-1000
3	J13-J15	Header, friction lock assembly, 4-pin right angle	0.400 × 0.500	Molex	22-05-3041
1	J2	Header, 11 pin, 100 mil spacing, (36-pin strip)	121100	Sullins	PTC36SAAN
0	J3-J5, J8-J11	Open	0.038"		
1	J7	Header, 2 pin, 100 mil spacing, (36-pin strip)	0.100 × 2"	Sullins	PTC36SAAN
1	Q1	Transistor, NPN, high-performance, 500 mA	SOT23	Fairchild	MMBT2222A
1	Q2	MOSFET, P-ch, -12 V, 4 A, 51 m Ω	SOT23	Vishay	Si2335DS
4	R1, R14, R16, R19	Resistor, chip, 10 k Ω , 1/16 W, 5%	603	Std	Std
12	R13, R15, R21-R24, R26, R27, R45, R46, R49, R50	Resistor, chip, 100 Ω , 1/16 W, 5%	603	Std	Std
3	R18, R42, R43	Resistor, chip, 1 M Ω , 1/16 W, 1%	603	Std	Std
1	R2	Resistor, chip, 15 k Ω , 1/16 W, 5%	603	Std	Std
7	R3-R5, R32-R34, R39	Resistor, chip, 100 k Ω , 1/16 W, 5%	603	Std	Std
3	R30, R51, R52	Resistor, chip, 620 Ω , 1/16 W, 5%	603	Std	Std
2	R31, R41	Resistor, chip, 10 Ω , 1/16 W, 5%	603	Std	Std
1	R35	Resistor, chip, 61.9 k Ω , 1/16 W, 1%	603	Std	Std
1	R53	Resistor, chip, 0 Ω , 1/16 W, 5%	603	Std	Std

⁽¹⁾ Reference designators marked with an asterisk (*) cannot be substituted. All other components can be substituted with equivalent manufacturers components.

⁽²⁾ These assemblies are ESD sensitive, ESD precautions should be observed.

⁽³⁾ These assemblies must be clean and free from flux and all contaminants. Use of no clean flux is not acceptable.

⁽⁴⁾ These assemblies must comply with workmanship standards IPC-A-610 Class 2.

Qty	Ref Des ⁽¹⁾	Description ^{(2) (3) (4)}	Size	MFR	Part Number
1	R54	Resistor, chip, 113 kΩ, 1/16 W, 0.1%	603	Vishay	TNPW06031133BT9R T1
1	R6	Resistor, chip, 1.5 kΩ, 1/16 W, 5%	603	Std	Std
0	R7, R10-R12, R17, R20, R25, R28, R36-R38, R40	Open	603		
2	R8, R9	Resistor, chip, 33 Ω, 1/16 W, 5%	603	Std	Std
0	SW1	Open	5 mm × 5 mm		
2	U1, U2	IC, Single bus buffer gate with 3-state output, with negative enable	DCK	TI	SN74LVC1G125DCK
1	U3	IC, Single bus buffer gate with 3-state output, with positive enable	DCK	TI	SN74LVC1G126DCK
1	U4	IC, USB, general purpose, device controller	0.480 × 0.480"	TI	TUSB3210PM
1	U5	IC, ultra low-power LDO regulator, 3.3 V, 50 mA	SOT23-5	TI	TPS77033DBV
1	U6	IC, Advance gas gauge	DBT38	TI	bq8015DBT
1	Y1 or Y4	Crystal, high performance, 12.00 MHz, SMT	0.126 × 0.126	Citizen or Daishinku	CSA-309-12.000MABJ or DSX630G-12.00 MHz
0	Y2 or Y3	Crystal, 32.768 MHz, 7-12 pF capacitance	1,9 mm × 5 mm	Daishinku or ECS	DST520G-32.768kHz or ECS-0.327-8-14
1	N/A	Plastic enclosure, bone, Texas Instruments silkscreen		PacTec	84107-501-039
		Wire Cable Assembly ⁽⁵⁾			
1	Mate	Connector, female, 0.100 centers		22-01-30 47	Molex
4	N/A	Terminals, crimp, tin		08-50-011 4	Molex
	N/A	Wire, insulated 22 Awg, red, 18 inches (±3 inches) (VOUT)		Any	Any
	N/A	Wire, insulated 22 Awg, white, 18 inches (±3 inches) (SCL)		Any	Any
	N/A	Wire, insulated 22 Awg, black, 18 inches (±3 inches) (GND)		Any	Any
	N/A	Wire, insulated 22 Awg, brown, 18 inches (±3 inches) (SDA)		Any	Any
1	N/A	Heatshrink 1"		Any	Any

⁽⁵⁾ Make one EEPROM connector wire assembly for each assembly produced, from J15 mate, 4 - 22 AWG wires and crimp terminals. Wire colors for pin numbers are listed below. Strip and tin flying leads 0.25 inches from end of wire.

Red - pin #4 (signal VOUT)
Brown - pin #3 (signal SDA)
White - pin #2 (signal SCL)
Black - pin #1 (GND)

3.2 EV2300 Component Placement

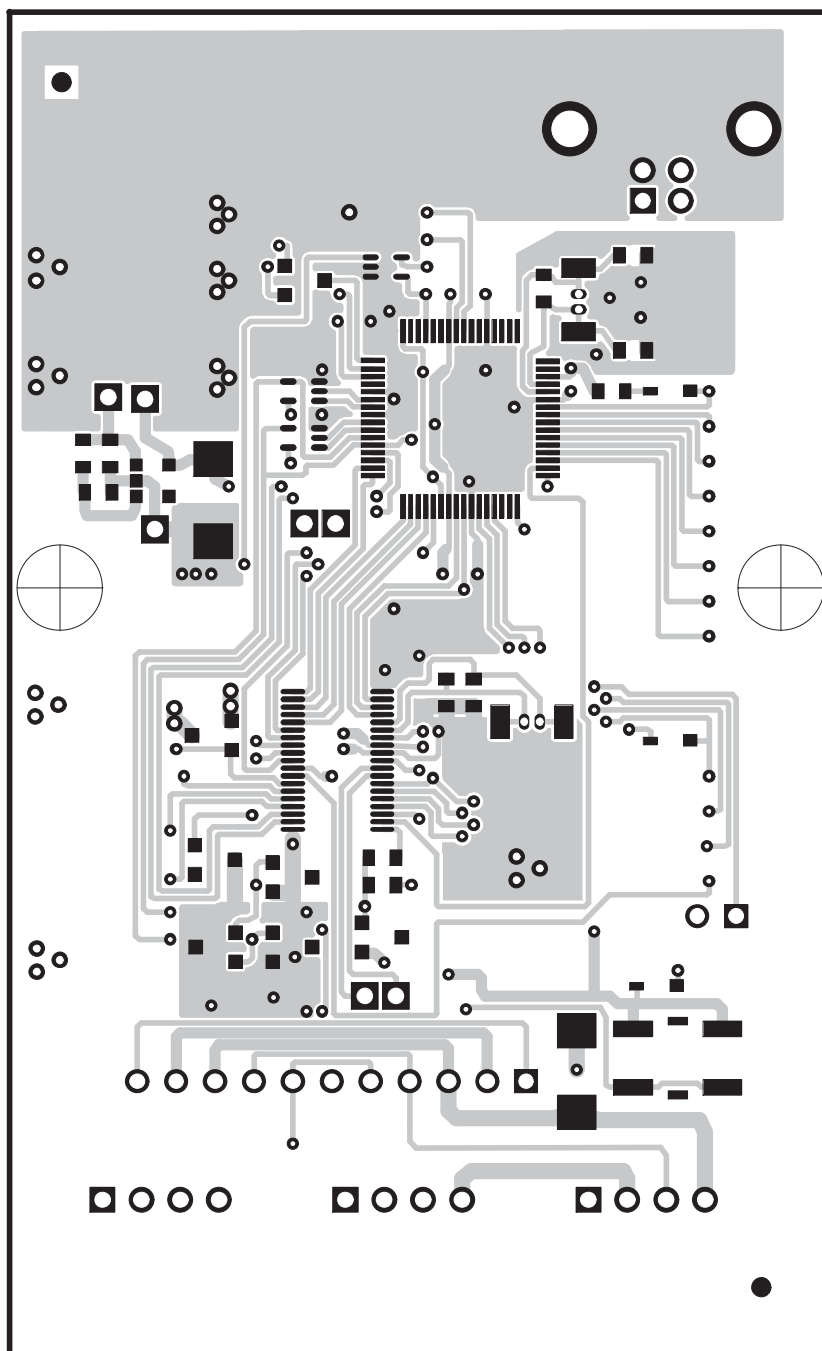


Figure 1. Board Layer 1

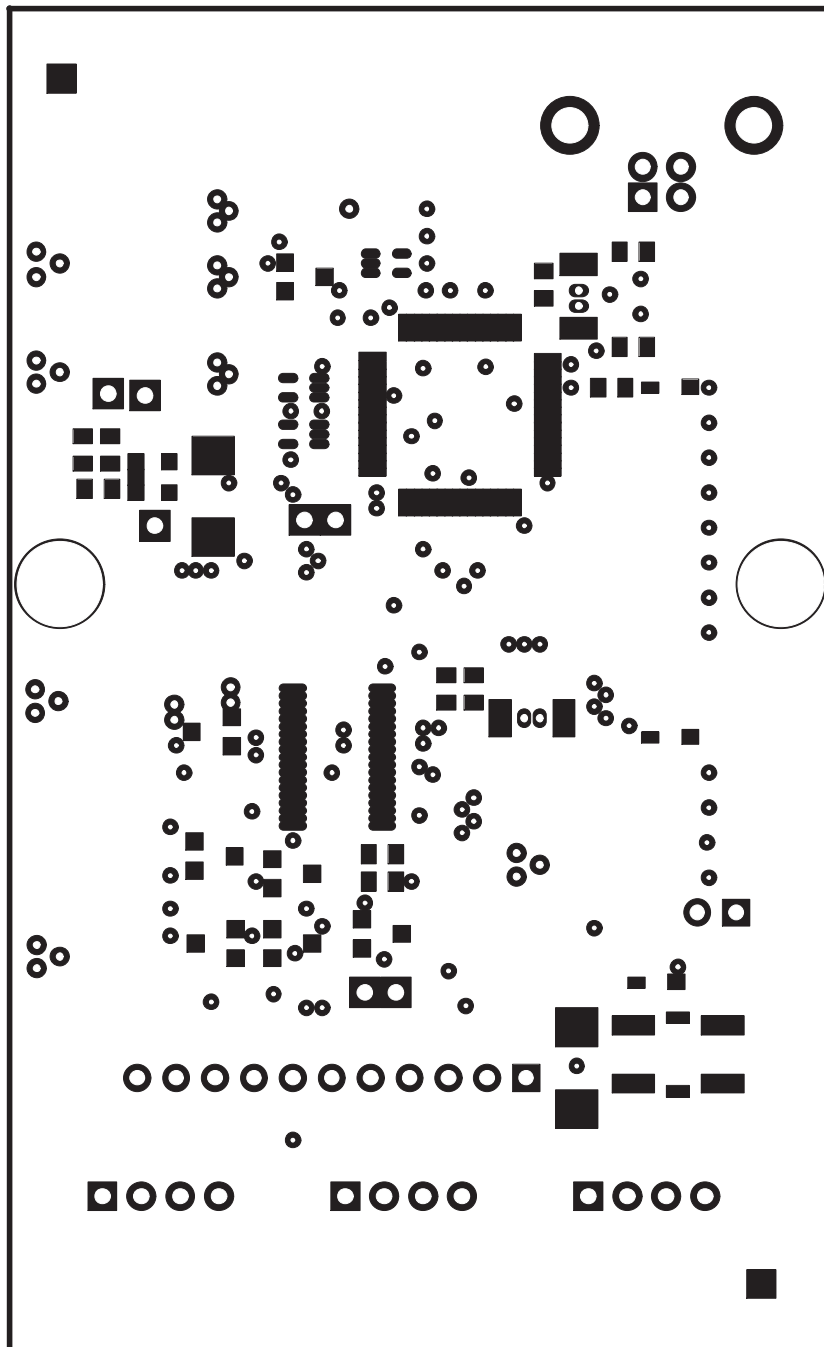


Figure 2. Solder Mask 1

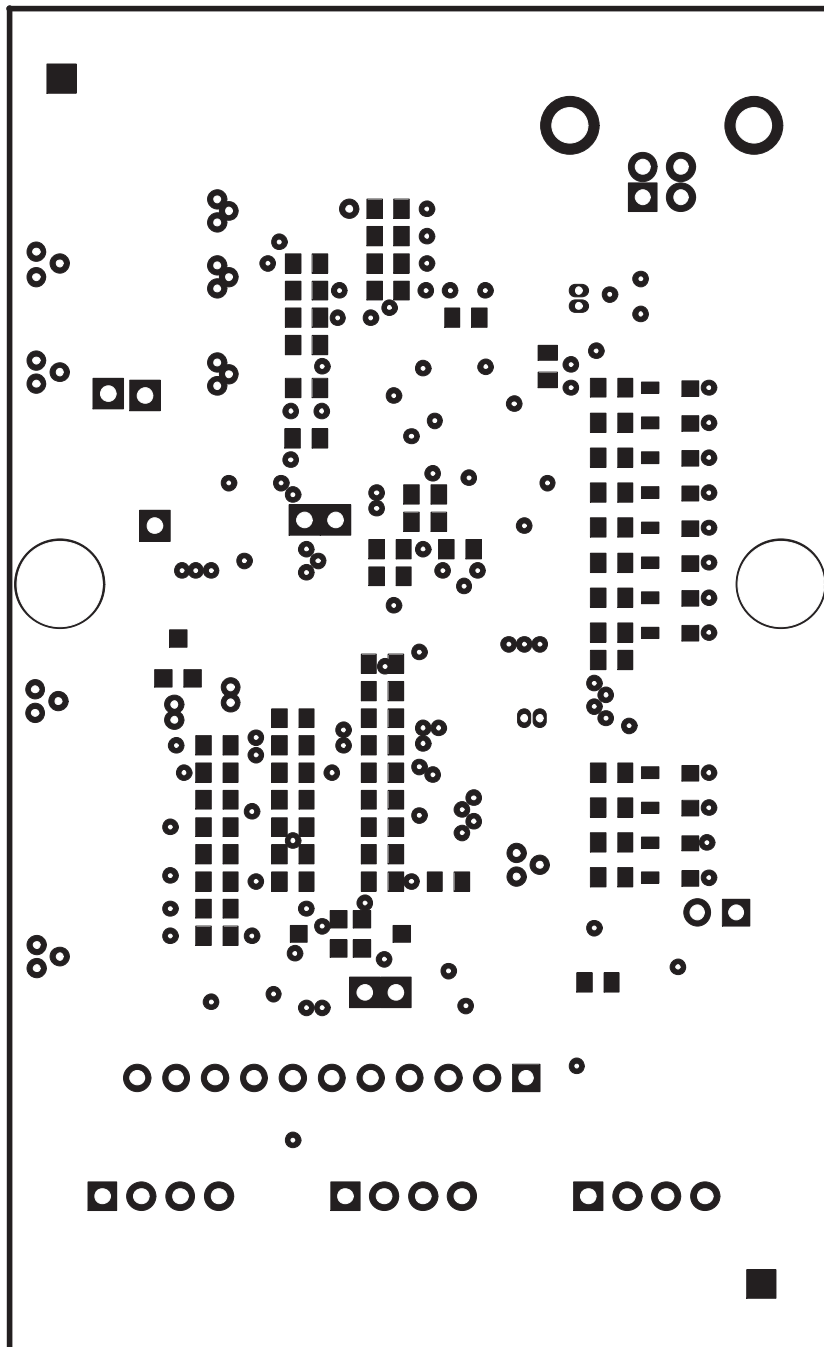


Figure 3. Solder Mask 2

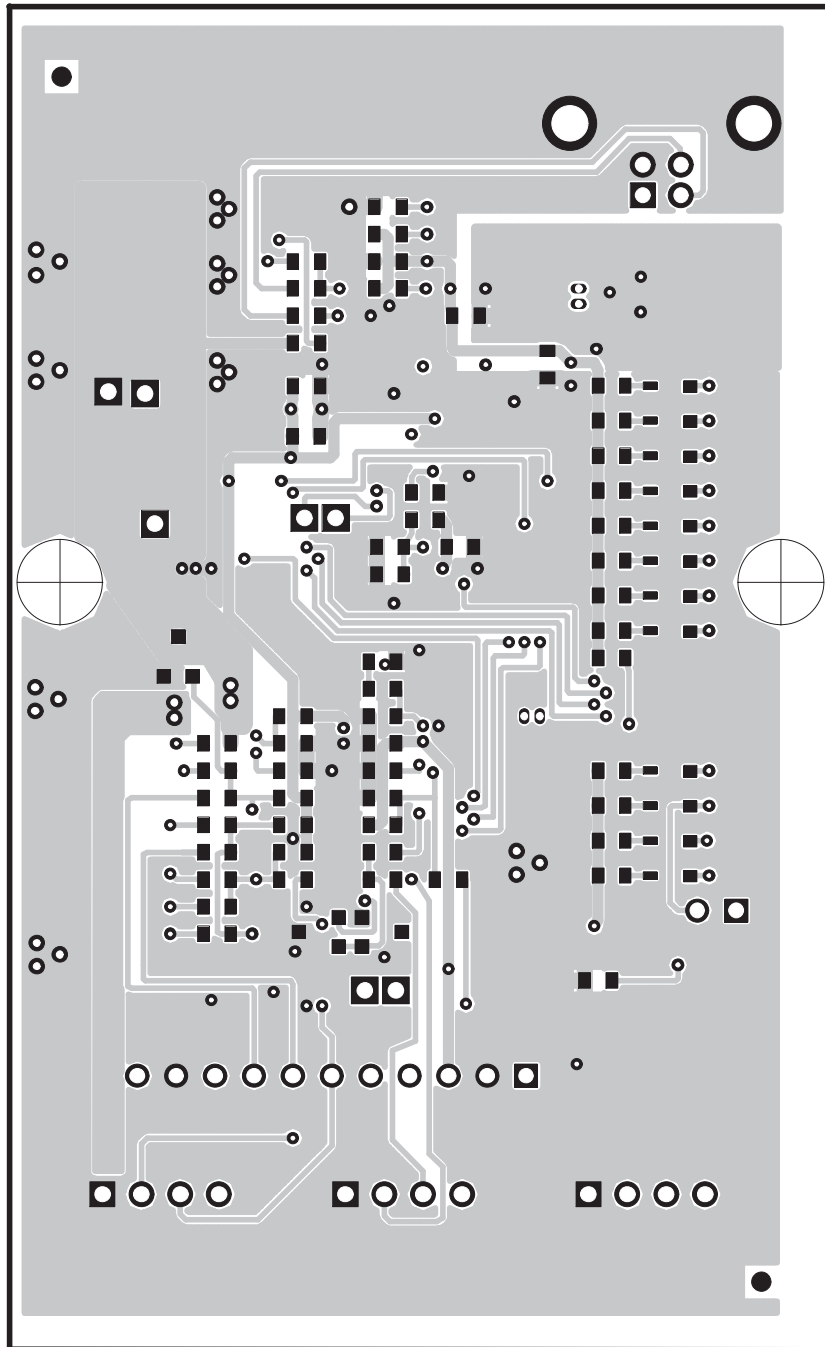


Figure 4. Board Layer 2

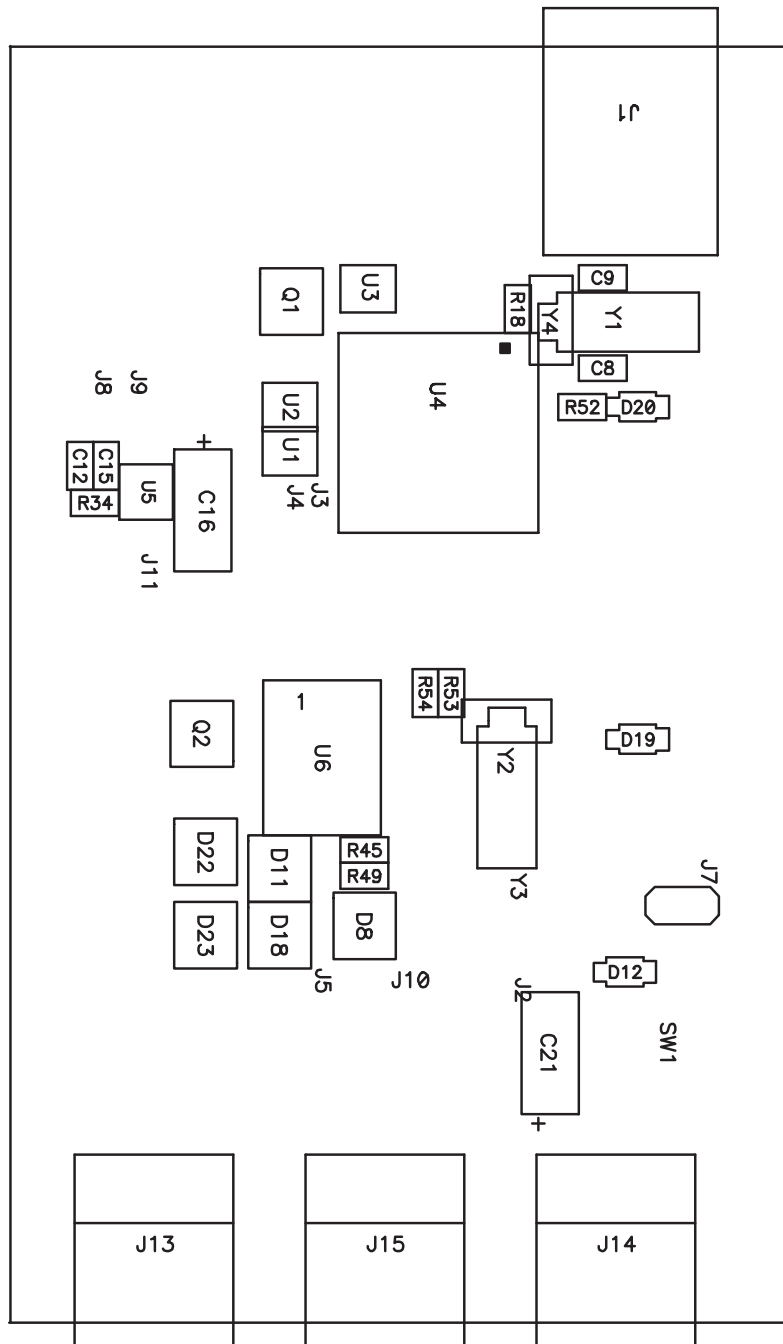


Figure 5. Component Placement 1

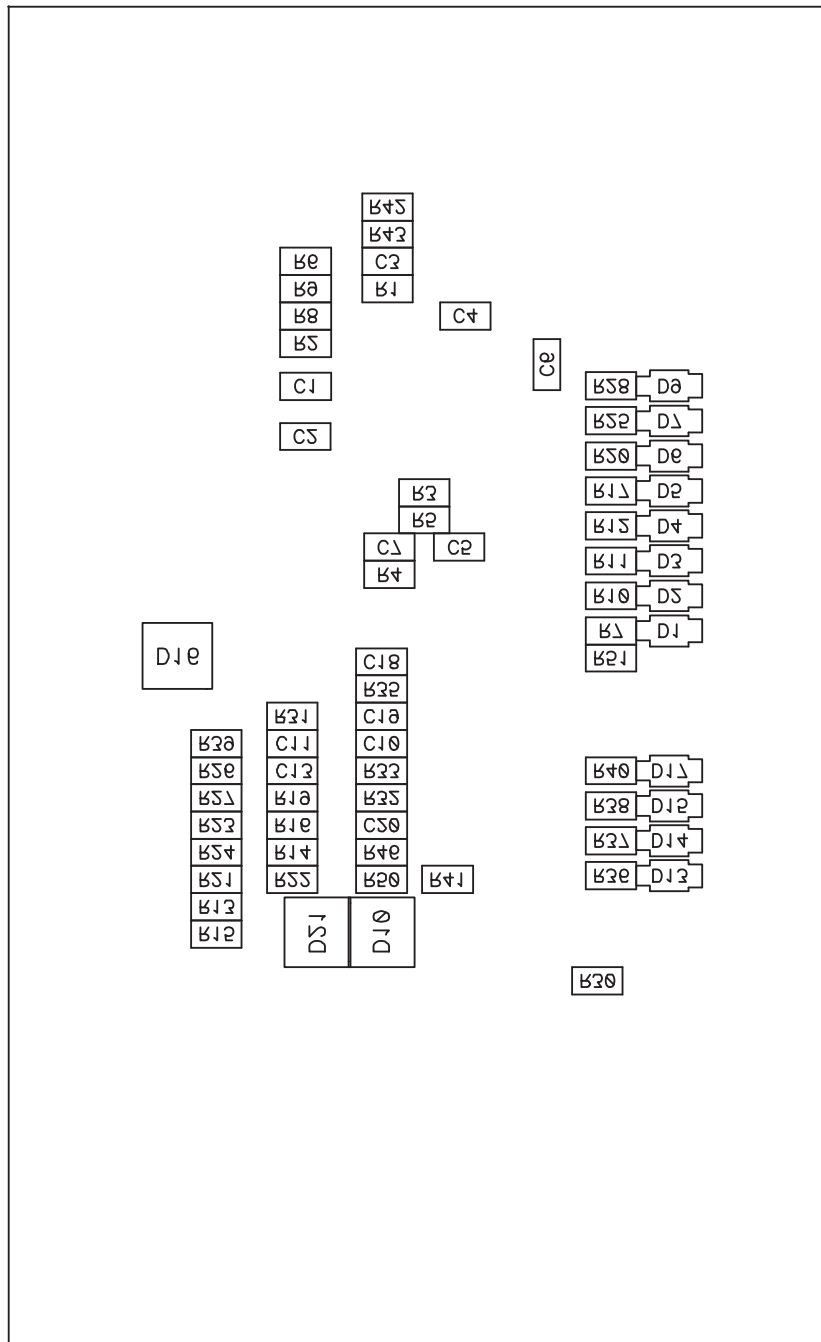


Figure 6. Component Placement 2

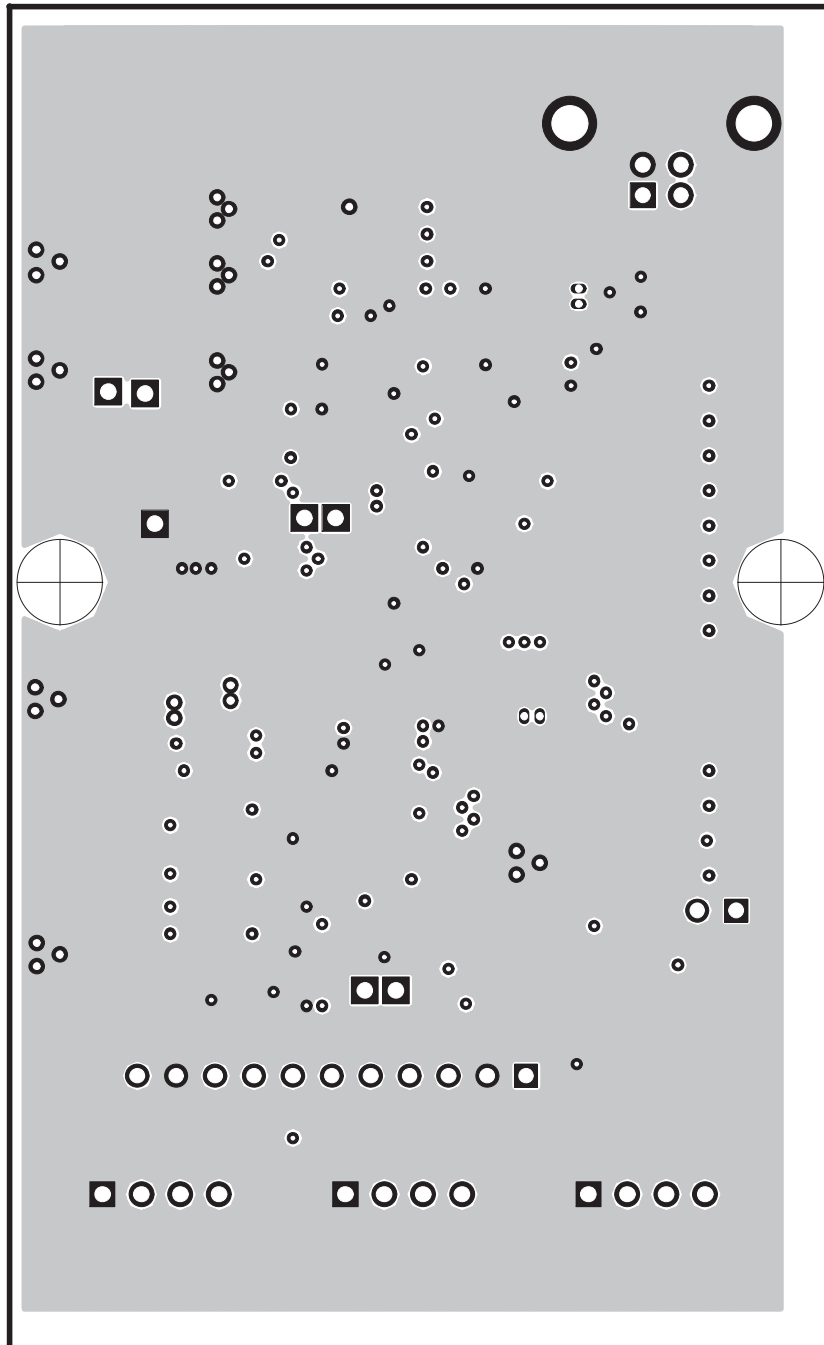


Figure 7. Internal Board Layer 1

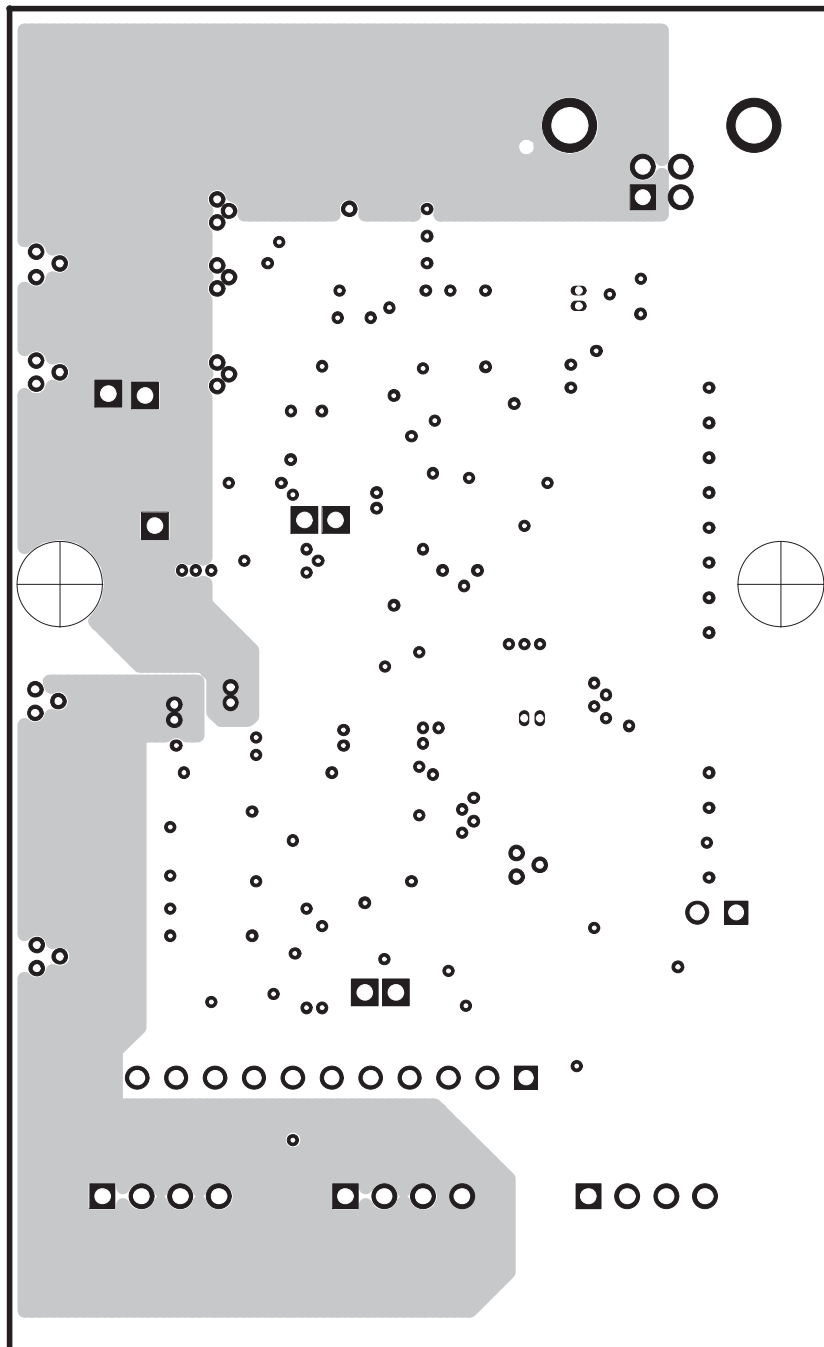
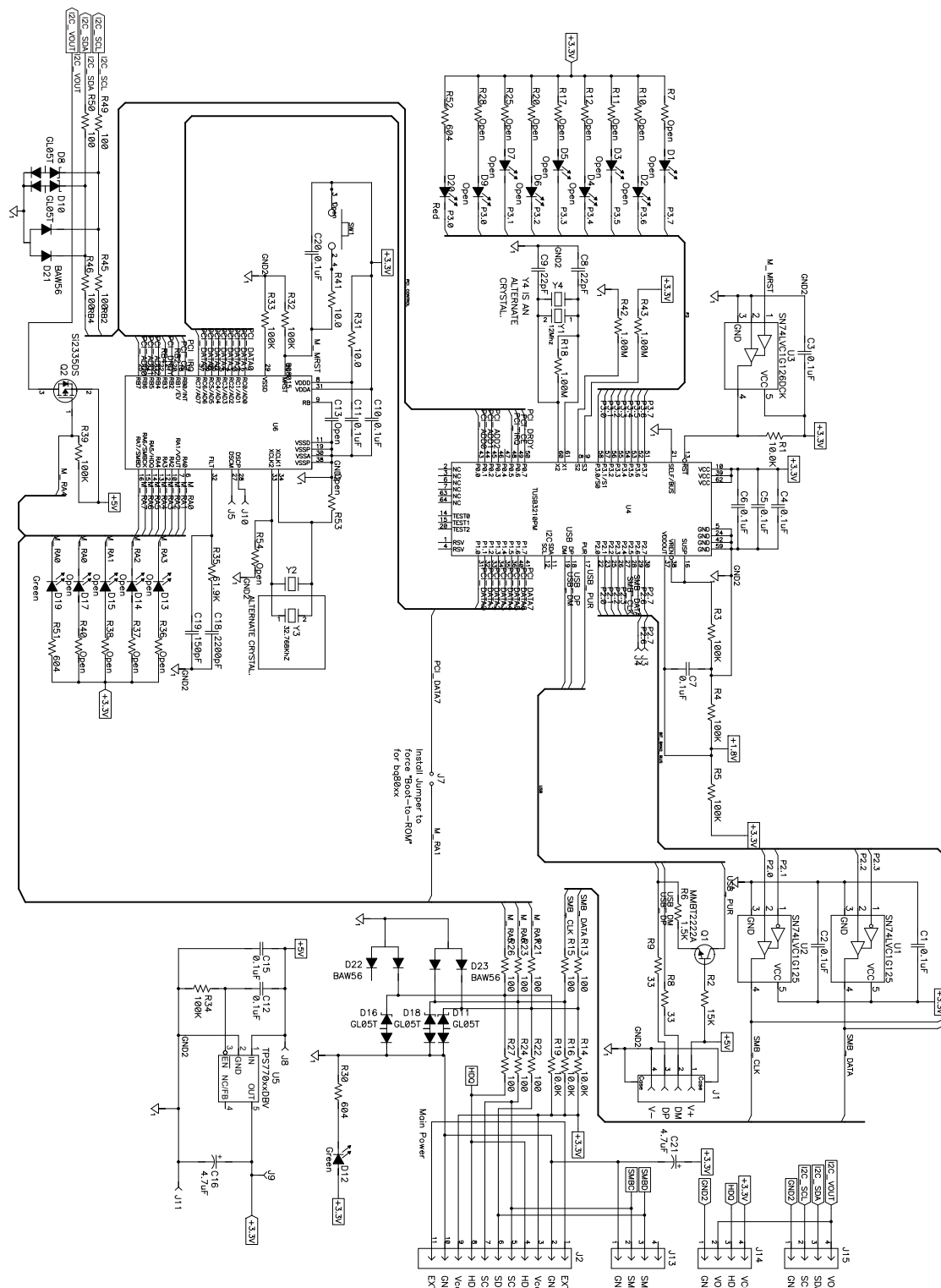


Figure 8. Internal Board Layer 2

3.3 EV2300 Schematic



Revision History

Changes from A Revision (February 2005) to B Revision Page

- Changed label 3
 - Changed HDQ Interface pin names 4
-

NOTE: Page numbers for previous revisions may differ from page numbers in the current version.

Changes from B Revision (December 2011) to C Revision Page

- Added Schematic 16
-

NOTE: Page numbers for previous revisions may differ from page numbers in the current version.

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

Audio	www.ti.com/audio
Amplifiers	amplifier.ti.com
Data Converters	dataconverter.ti.com
DLP® Products	www.dlp.com
DSP	dsp.ti.com
Clocks and Timers	www.ti.com/clocks
Interface	interface.ti.com
Logic	logic.ti.com
Power Mgmt	power.ti.com
Microcontrollers	microcontroller.ti.com
RFID	www.ti-rfid.com
OMAP Applications Processors	www.ti.com/omap
Wireless Connectivity	www.ti.com/wirelessconnectivity

Applications

Automotive and Transportation	www.ti.com/automotive
Communications and Telecom	www.ti.com/communications
Computers and Peripherals	www.ti.com/computers
Consumer Electronics	www.ti.com/consumer-apps
Energy and Lighting	www.ti.com/energy
Industrial	www.ti.com/industrial
Medical	www.ti.com/medical
Security	www.ti.com/security
Space, Avionics and Defense	www.ti.com/space-avionics-defense
Video and Imaging	www.ti.com/video

TI E2E Community

e2e.ti.com