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.

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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, I^{2}C, 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 E^{2}PROM I^{2}C port. The 2-wire SMBus communication port supports both SMBus and I^{2}C 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 I^2C/EEPROM Interface (I^2C)

This interface allows a host computer to interact with a target E^{2}PROM or other I^{2}C interface device such as a battery monitor device through a two-wire I^{2}C interface. The interface contains a controlled power pin, the I^{2}C 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-kΩ 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-kΩ 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 µF, 25 V, X7R, 10%	603	TDK	C1608X7R1E104KT
0	C13	Open	603		
2	C16, C21	Capacitor, POSCAP 4.7 µF, 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 x 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 mΩ	SOT23	Vishay	Si2335DS
4	R1, R14, R16, R19	Resistor, chip, 10 kΩ, 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 MΩ, 1/16 W, 1%	603	Std	Std
1	R2	Resistor, chip, 15 kΩ, 1/16 W, 5%	603	Std	Std
7	R3–R5, R32–R34, R39	Resistor, chip, 100 kΩ, 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 kΩ, 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	TNPW06031133BT9RT1
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)
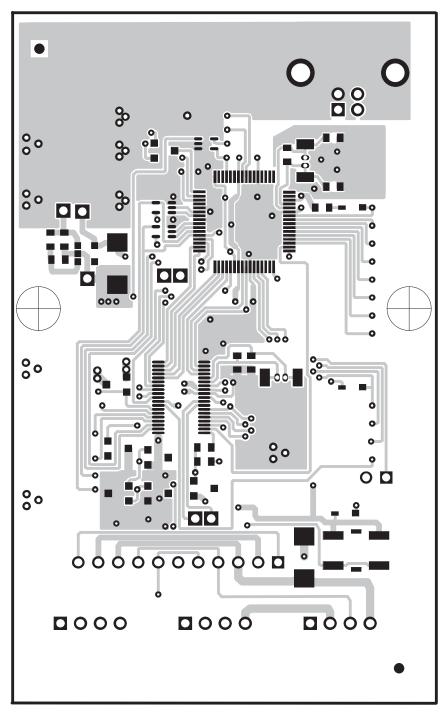
3.2 EV2300 Component Placement
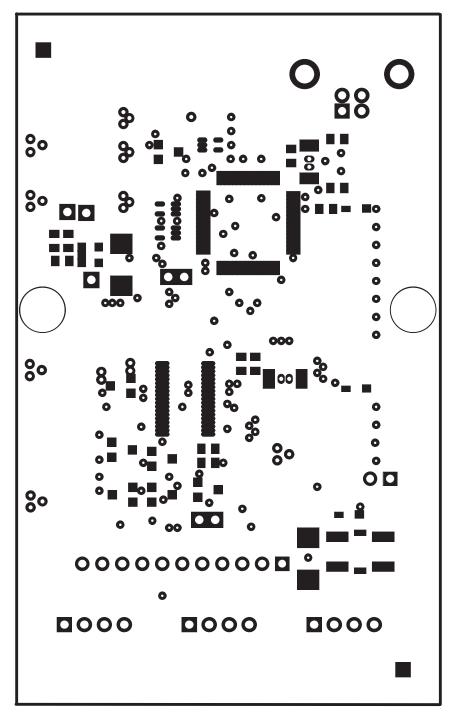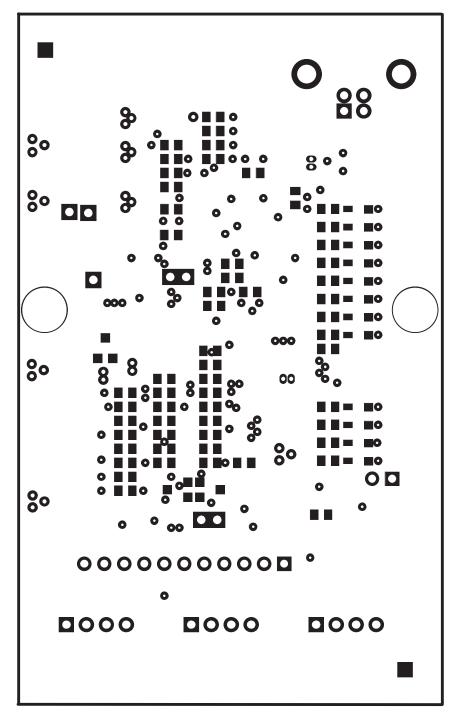

Figure 1. Board Layer 1

Figure 2. Solder Mask 1
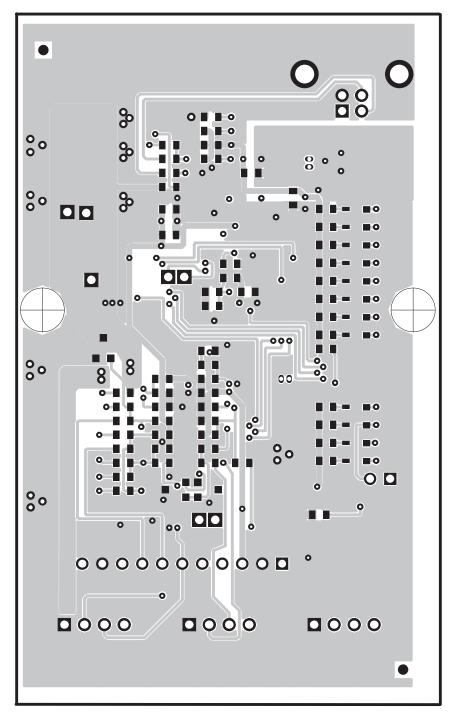
Figure 3. Solder Mask 2
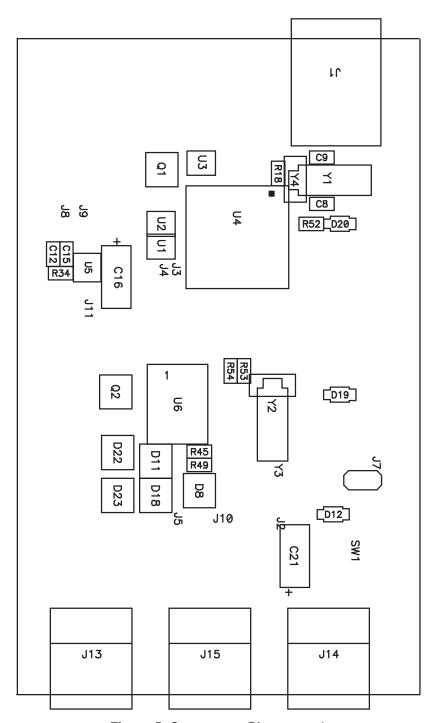
Figure 4. Board Layer 2
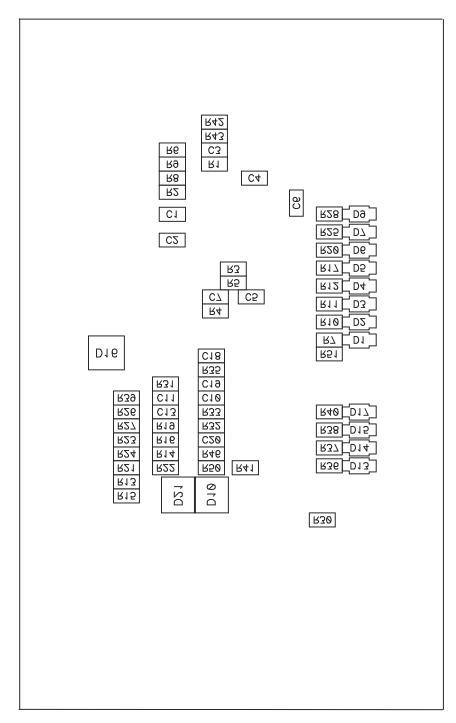
Figure 5. Component Placement 1
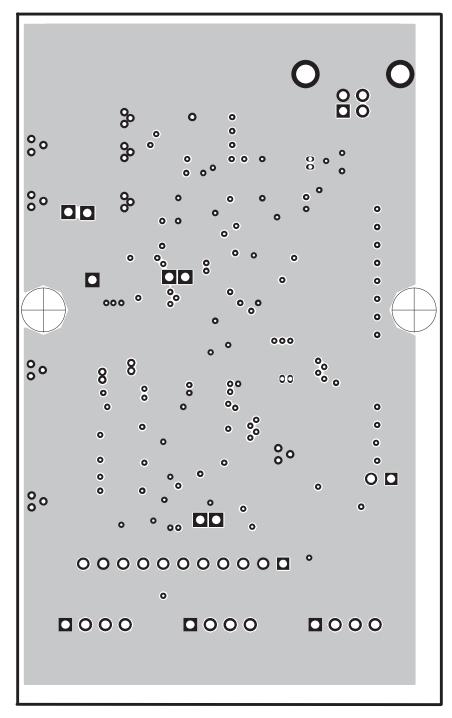
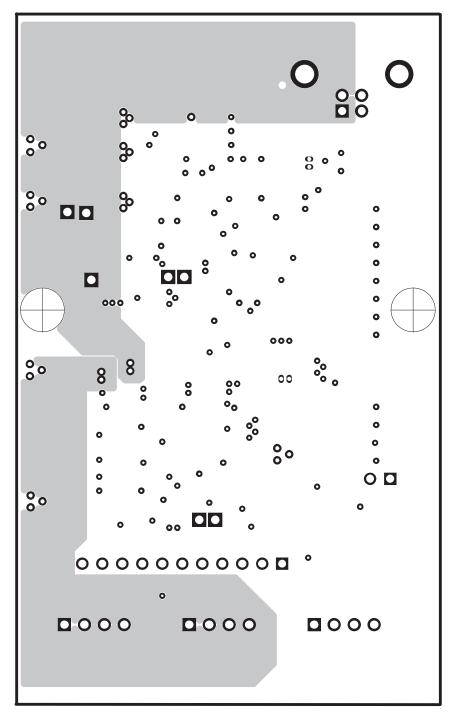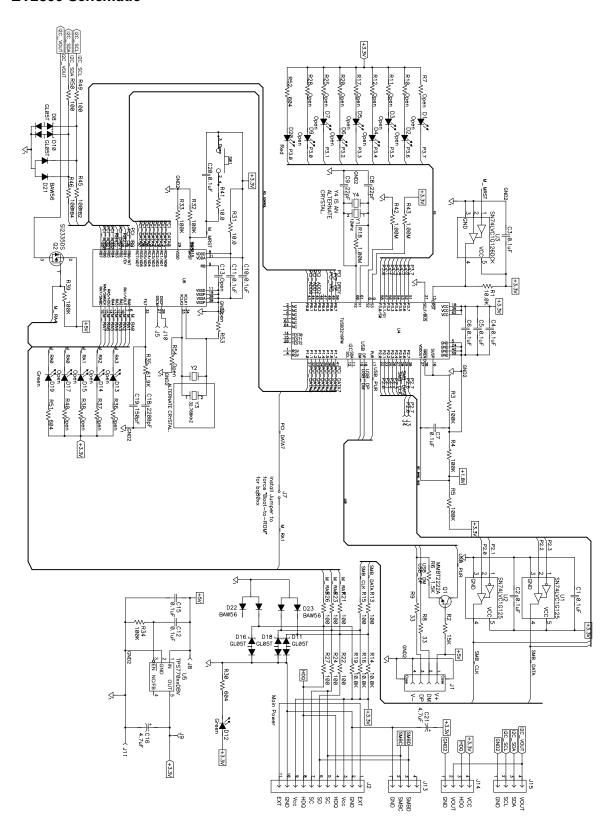Figure 6. Component Placement 2

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**

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**

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

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