Thumbus2300

This users guide describes the function and operation of the Thumbus2300™ evaluation module. A complete description, as well as schematic diagram and bill of materials are included.

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1 Introduction

The Thumbus interface board enables an IBM-compatible or other type (with required driver for the particular platform) PC to communicate with Texas Instruments SMBus interface fuel 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 10-mA 5.0-V source
- Complete interface between USB and SMBus interfaces using a simple API
- Equivalent to the USB to SMBus function found in the EV2300 module

1.2 Kit Contents

- Thumbus circuit module
- USB OTG cable (mini-A to mini-B cable, polarity does not matter in this design) for connecting the Thumbus to a target device

Thumbus2300 is a trademark of Texas Instruments.

1.3 Ordering Information

Table 1. Ordering Information

EVM Part Number
THUMBUS2300

2 Interfaces

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

Reference Designator	Function	Function
SMB	SMBus Interface ports	Terminal block (USB mini-AB connector) for connecting to a target device
USB	USB Interface port	Interface to host computer

2.1 Overview

The Thumbus is enclosed and is provided as shown.

2.2 Thumbus Controller

The Thumbus controller is a bq8015 running at 12 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 a 2-wire SMBus communication port. The 2-wire SMBus communication port supports SMBus 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 Thumbus 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 Thumbus 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 Thumbus controller driver for direct access to the device
4. An Thumbus DLL for application access to the device

2.4 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.
5	I2C_VOUT	The naming of this pin is proprietary and is not part of I2C port definition. It provides 5V output when enabled from the host software. It is used by bqEASY to support auto cycle. Do not exceed 5.6 VDC on this pin.

3 Thumbus 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 Thumbus EVM.

3.1 Bill of Materials (BOM)

Qty	Ref Des [1]	Value	Description [2] [3] [4]	Size	Part Number	MFR
11	C1, C4, C5, C6, C7, C8, C9, C12, C13, C14, C15	0.1uF	Capacitor, Ceramic, 25-V, X7R, 10%	0603	C1608X7R1E104KT	TDK
1	C10	2200pF	Capacitor, Ceramic, 50-V, C0G, 10%	0603	C1608C0G1H222KT	TDK
1	C11	150pF	Capacitor, Ceramic, 50-V, C0G, 10%	0603	C1608C0G1H151KT	TDK
1	C16	0.47uF	Capacitor, Ceramic, 16V, X7R, 10%	0603	C1608X7R1C474K	TDK
2	C2, C3	22pF	Capacitor, Ceramic, 50-V, C0G, 10%	0603	C1608C0G1H220KT	TDK
2	D1, D2	GL05T-GS08	Diode, TVS diode, Low Capacitance	SOT23	GL05T-GS08	General Semi
1	D3	Green	Diode, LED, Green, 20-mA, 0.9-mcd	0.068 x 0.049	LN1371G	Panasonic
1	J1	USB A	Connector, USB A, Plug, 4pin	0.500 X 0.740 inch	48037-1000	
1	J5	USB mini-AB	Connector, USB, Mini AB, 5-pins	0.354 X 0.307 Inches	56579-0519	
1	Q1	Si2335DS	MOSFET,P-ch, -12 V, 4 A, 51 milliohm	SOT23	Si2335DS	Vishay
1	Q2	MMBT2222A	TRANSISTOR, NPN, HIGH-PERFORMANCE, 500mA	SOT23	MMBT2222A	Fairchild
6	R1, R2, R8, R11, R12, R13	100K	Resistor, Chip, 1/16-W, 5%	0603	Std	Std
1	R10	61.9K	Resistor, Chip, 1/16-W, 1%	0603	Std	Std
1	R14	1.5K	Resistor, Chip, 1/16-W, 5%	0603	Std	Std
2	R15, R17	33	Resistor, Chip, 1/16-W, 5%	0603	Std	Std
1	R16	15K	Resistor, Chip, 1/16-W, 5%	0603	Std	Std
2	R20, R21	100	Resistor, Chip, 1/16-W, 5%	0603	Std	Std
1	R22	604	Resistor, Chip, 1/16-W, 5%	0603	Std	Std
3	R3, R4, R6	1.00M	Resistor, Chip, 1/16-W, 1%	0603	Std	Std
1	R5	10	Resistor, Chip, 1/16-W, 5%	0603	Std	Std
3	R7, R18, R19	10.0K	Resistor, Chip, 1/16-W, 5%	0603	Std	Std
1	R9	113K	Resistor, Chip, 1/16-W, 1%	0603	Std	Std
1	U1	SN74LVC1G126DCK	IC, Single Bus Buffer Gate With 3-State Output, with positive enable	DCK	SN74LVC1G126DCK	TI
1	U2	BQ8015	IC, Advanced Gas Gauge	DBT38	bq8015DBT	TI
1	U3	TUSB3210PM	IC, USB, General Purpose, Device Controller	0.480 x 0.480""	TUSB3210PM	TI
2	U4, U5	SN74LVC1G125	IC, Single Bus Buffer Gate With 3-State Output, with negative enable	DCK	SN74LVC1G125DCK	TI
1	U6	TPS71533DCK	IC, Regulator, LDO, Micropower, 3uA @ 50mA. Vin 0 - 24V	SOP-5 (DCK)	TPS71533DCK	TI
1	Y1	12 MHz	Crystal, High performance, SMT	6235	CS10-12.000MABJ-UT, orCS10-12.000MABL-UT	Citizen
1	Cable	USB OTG	MiniA to MiniB, 2.6ft, black	2.6ft	688060031	Molex

(1) Reference designators marked with an asterik (*) 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)	Value	Description (2) (3) (4)	Size	Part Number	MFR
1	USB case	USB case Black	Case with USB type A and type MiniA/B slots on each end with TI prints		P3A-201005U-TEX29014	New Age Enclosures(5)
1			PCB		HPA467	

(5) New Age Enclosures 4330-B Santa fe Rd.,San Luis Obispo, Ca. 93401 805-595-1310.

3.2 Thumbus Component Placement

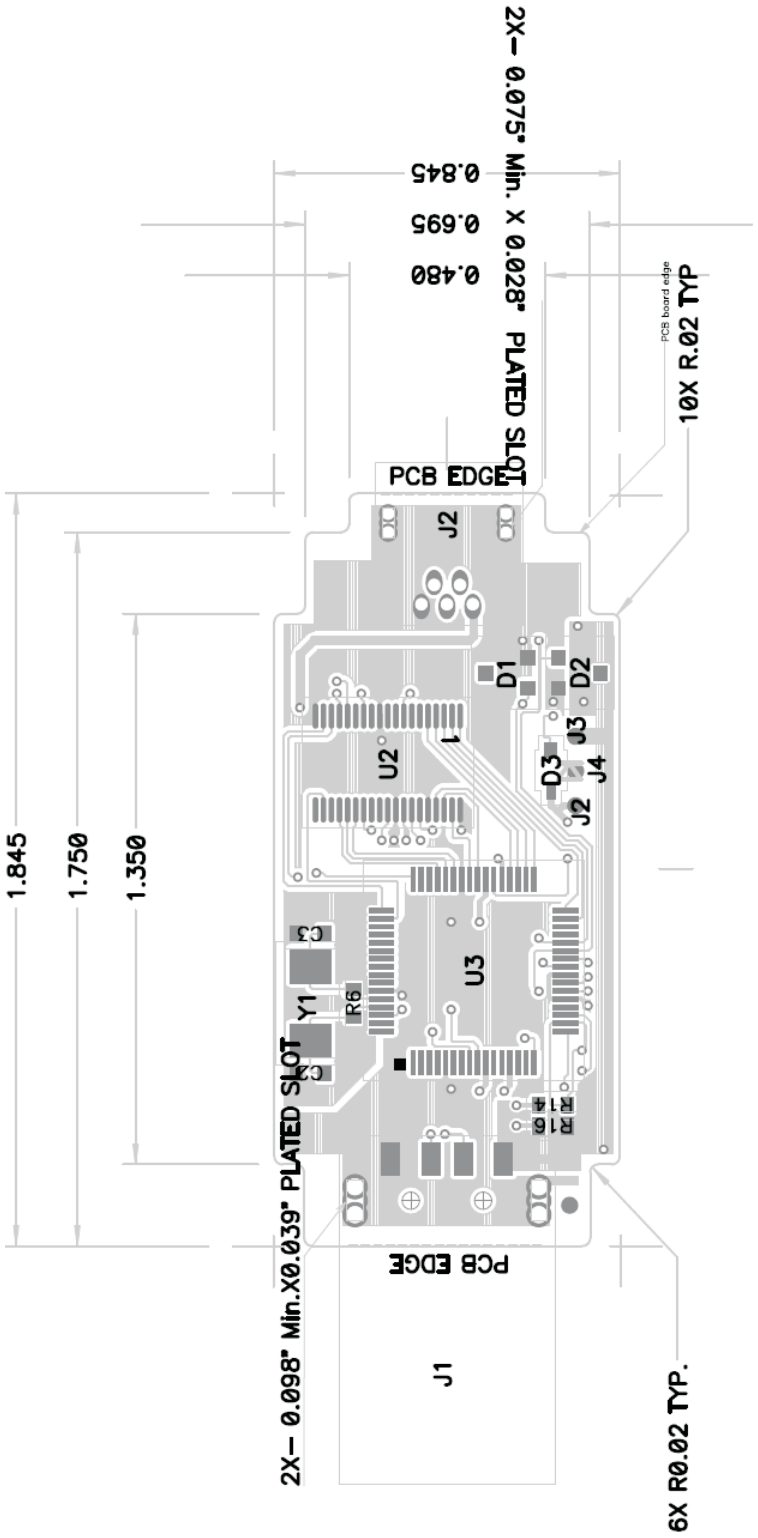

Figure 1. Board Layer 1

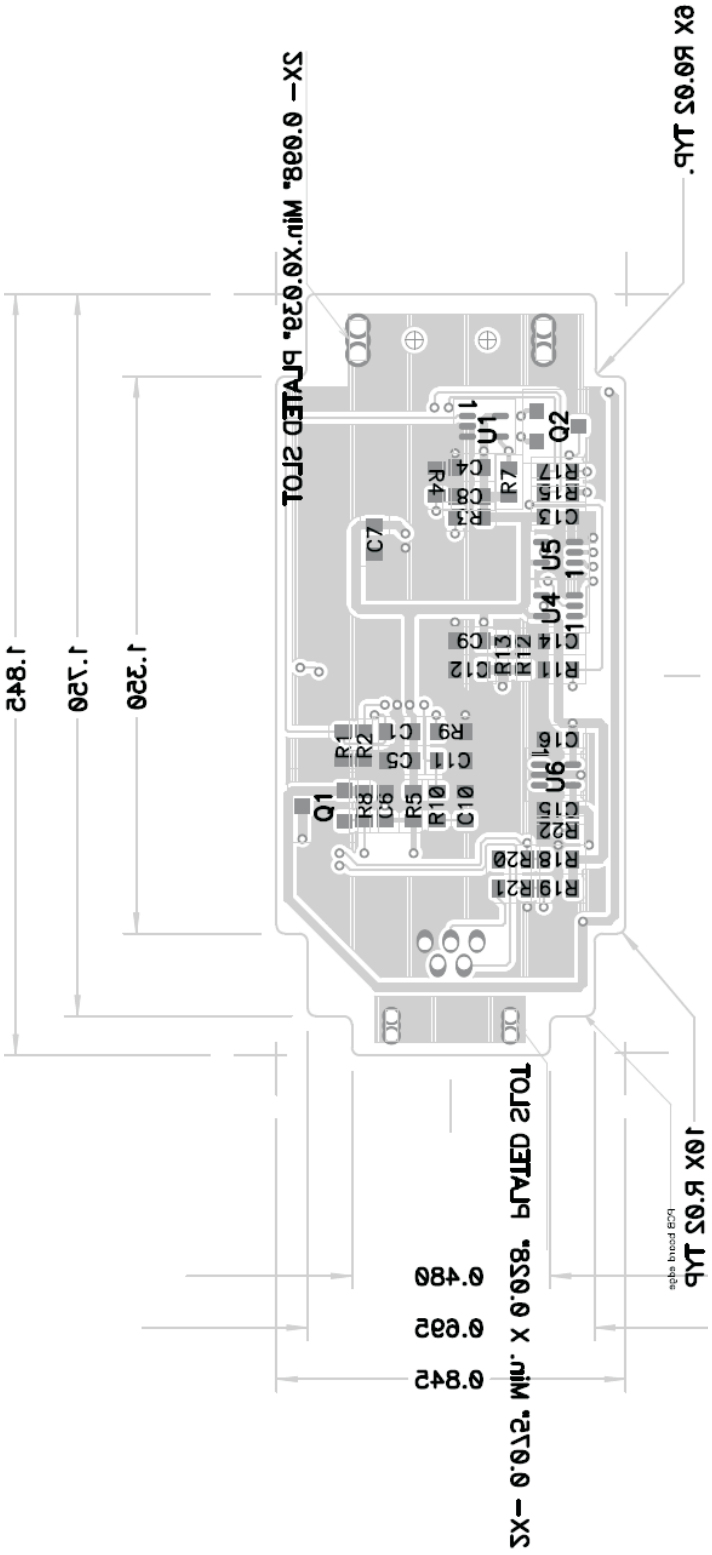

Figure 2. Board Layer 2

3.3 Thumbus Schematic

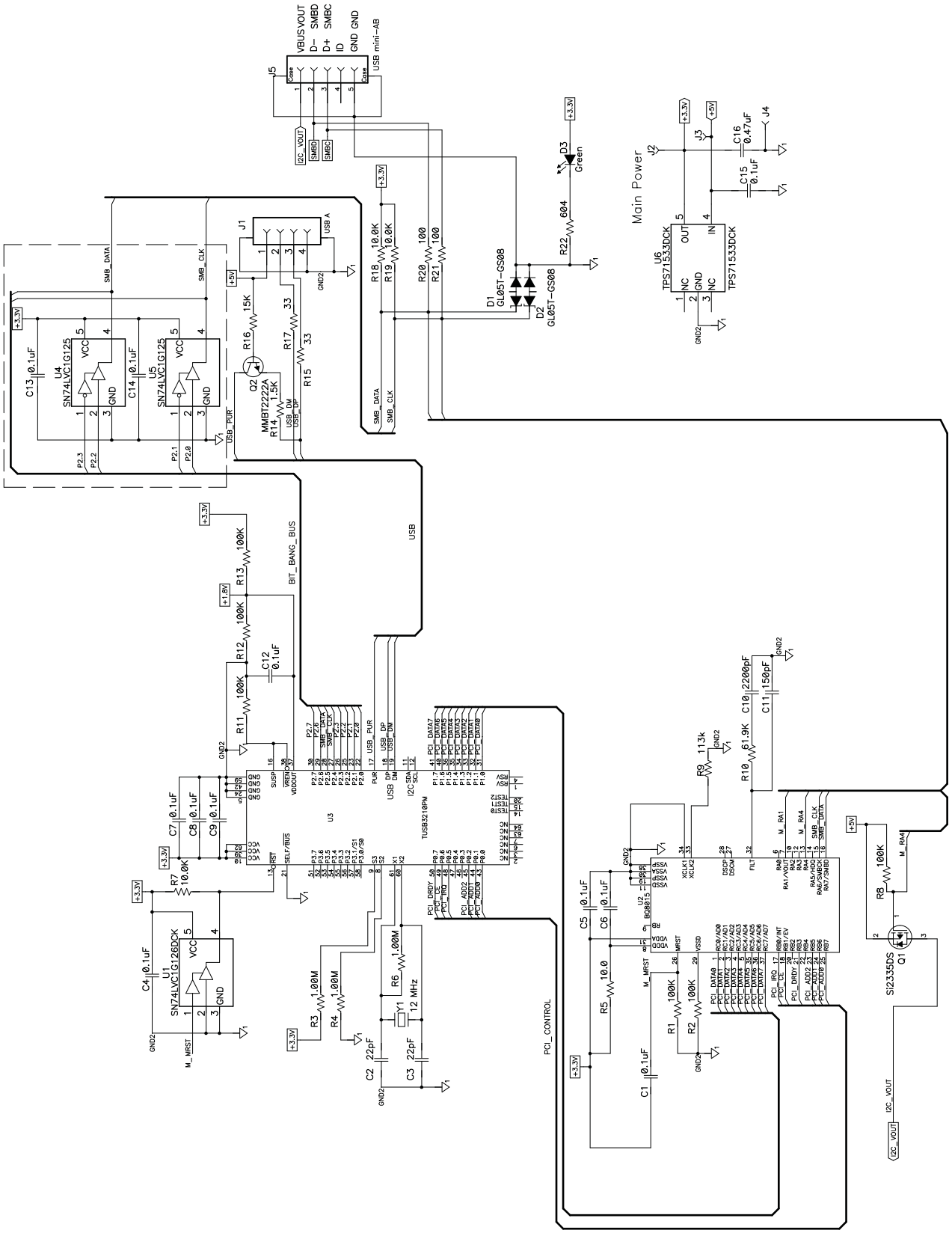

Figure 3. Schematic

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EVM Warnings and Restrictions

It is important to operate this EVM within the input voltage range of 5.0 V (computer USB port) and the output voltage range of 3.3 V at 10 mA and 5.0 V at 10 mA .

Exceeding the specified input range may cause unexpected operation and/or irreversible damage to the EVM. If there are questions concerning the input range, please contact a TI field representative prior to connecting the input power.

Applying loads outside of the specified output range may result in unintended operation and/or possible permanent damage to the EVM. Please consult the EVM User's Guide prior to connecting any load to the EVM output. If there is uncertainty as to the load specification, please contact a TI field representative.

During normal operation, some circuit components may have case temperatures greater than 85° C. The EVM is designed to operate properly with certain components above 85° C as long as the input and output ranges are maintained. These components include but are not limited to linear regulators, switching transistors, pass transistors, and current sense resistors. These types of devices can be identified using the EVM schematic located in the EVM User's Guide. When placing measurement probes near these devices during operation, please be aware that these devices may be very warm to the touch.

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