Texas Instruments

EV2300

Evaluation Module Interface Board

User's Guide

February 2005

PMP EVMs

SLUU159A

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EVM WARNINGS AND RESTRICTIONS

It is important to operate this EVM within the input voltage range of 5 V and the output voltage range of 3.3 V at 30 mA and 5 V at 50 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 30°C. The EVM is designed to operate properly with certain components above 70°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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Preface

Read This First

About This Manual

This users guide describes the function and operation of the EV2300 evaluation module. A complete description, as well as schematic diagram and bill of materials are included.

How to Use This Manual

This document contains the following chapters:

- ❑ Chapter 1—Introduction
- ❑ Chapter 2—Interfaces
- ❑ Chapter 3—EV2300 Bill of Materials, Component Placement, and Schematic

Information About Cautions and Warnings

This document may contain cautions and warnings.

This is an example of a caution statement.

A caution statement describes a situation that could potentially damage your software or equipment.

This is an example of a warning statement.

A warning statement describes a situation that could potentially cause harm to you.

The information in a caution or a warning is provided for your protection. Please read each caution and warning carefully.

This EVM contains components that can potentially be damaged by electrostatic discharge, Always transport and store the EVM in its supplied ESD bag when not in use. Handle using an antistatic wristband. Operate on an antistatic work surface. For more information on proper handling, refer to SSYA008.

FCC Warning

This equipment is intended for use in a laboratory test environment only. It generates, uses, and can radiate radio frequency energy and has not been tested for compliance with the limits of computing devices pursuant to subpart J of part 15 of FCC rules, which are designed to provide reasonable protection against radio frequency interference. Operation of this equipment in other environments may cause interference with radio communications, in which case the user at his own expense will be required to take whatever measures may be required to correct this interference.

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Chapter 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.

Topic **Page**

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^2C, and HDQ (8/16) interfaces using a simple API

1.2 Kit Contents

- ❑ EV2300 circuit module
- ❑ Standard USB cable

1.3 Ordering Information

Table 1–1. Ordering Information

EVM Part Number
EV2300

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

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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^2PROM I^2C port. The 2-wire SMBus communication port supports both SMBus and I^2C 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.
3	HDQ	HDQ one-wire interface. Pulled up to 3.3-V rail with a 10-kΩ resistor.
4	VOUT	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	I²C clock. This line must be pulled up by the target.
3	SDA	I²C 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.

Chapter 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.

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3.1 Bill of Materials (BOM)

Qty	Ref Des	Description	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 (C)	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

Qty	Ref Des	Description	Size	MFR	Part Number
1	R53	Resistor, chip, 0 Ω, 1/16 W, 5%	603	Std	Std
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	Cryatal, high performance, 12.00 MHz, SMT	0.126 × 0.126	Citizen or Daishinku	CSA-309–12.000MABJ or DSX630G-12.00MHz
0	Y2 or Y3	Crystal, 32,768 MHz, 7–12 pF capacitance	1.9mm × 5mm	Daishinku or ECS	DST520G-32.768kHz or ECS-.327-8-14
1	N/A	Plastic enclosure, bone, Texas Instruments silkscreen		PacTec	84107–501–039
		Wire Cable Assembly			
1	Mate	Connector, female, 0.100 centers		22–01–3047	Molex
4	N/A	Terminals, crimp, tin		08–50–0114	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

Notes: 1) These assemblies are ESD sensitive, ESD precautions should be observed.

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

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

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

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 3−1. Board Layer 1

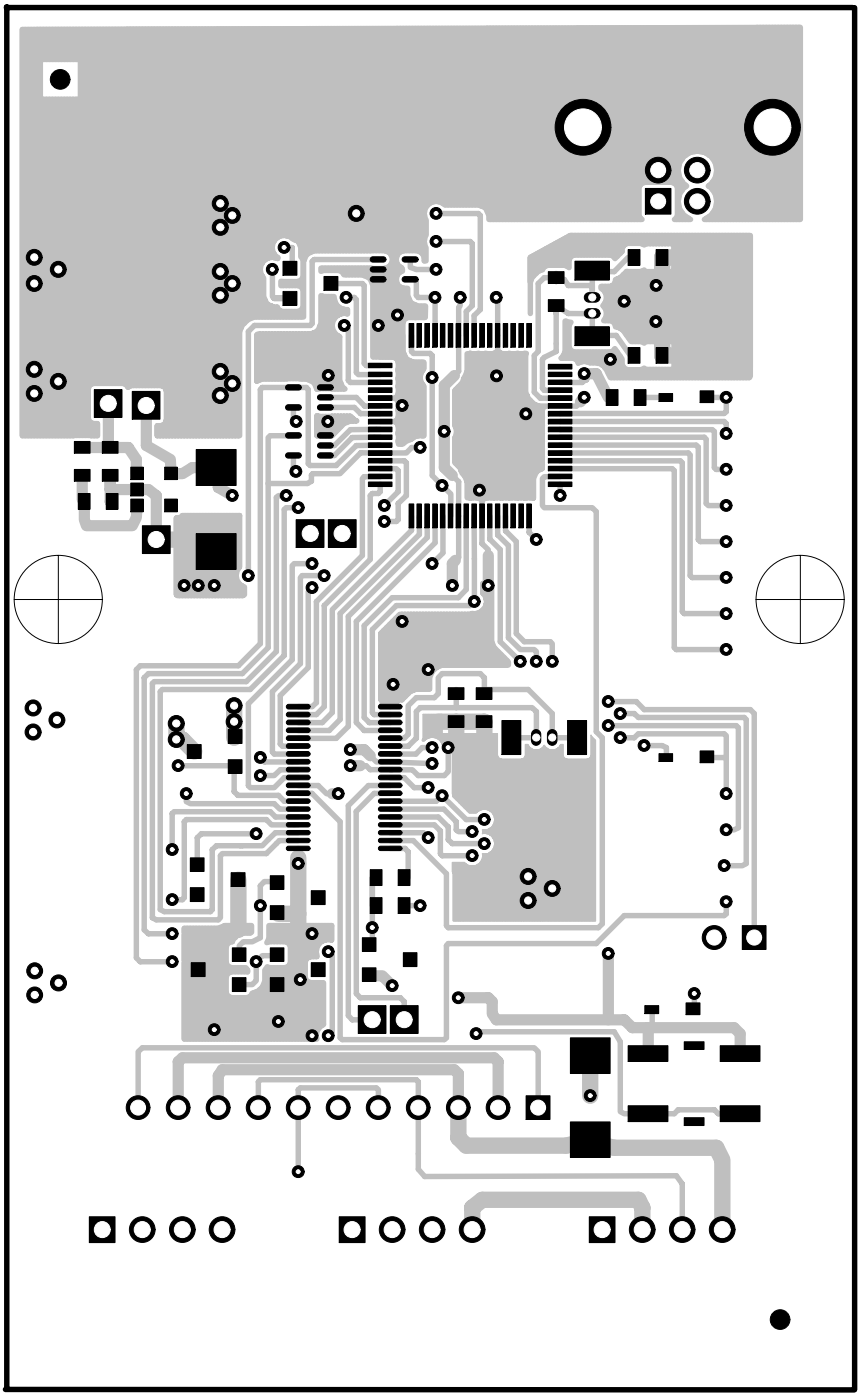


Figure 3–2. Solder Mask 1

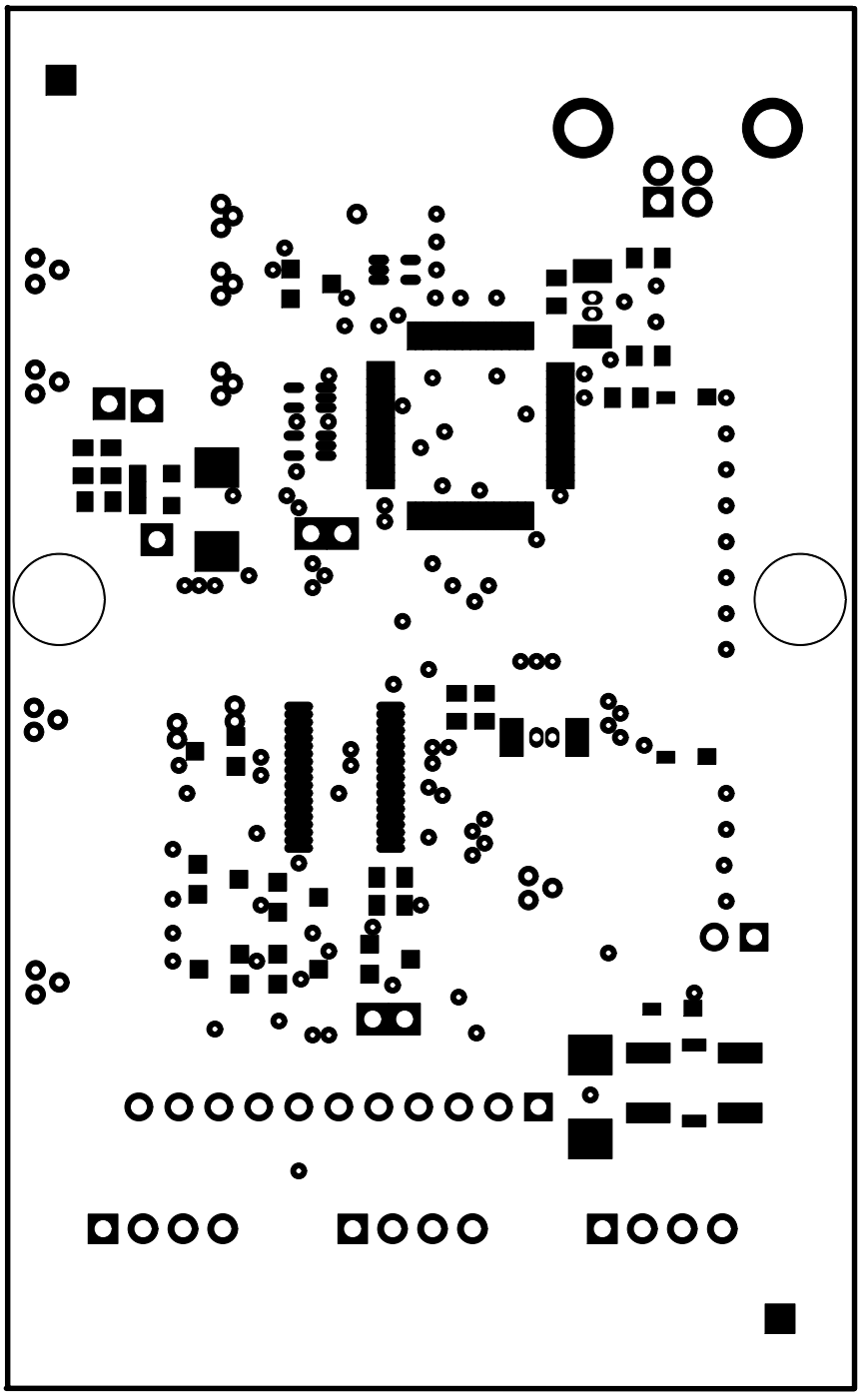


Figure 3–3. Solder Mask 2

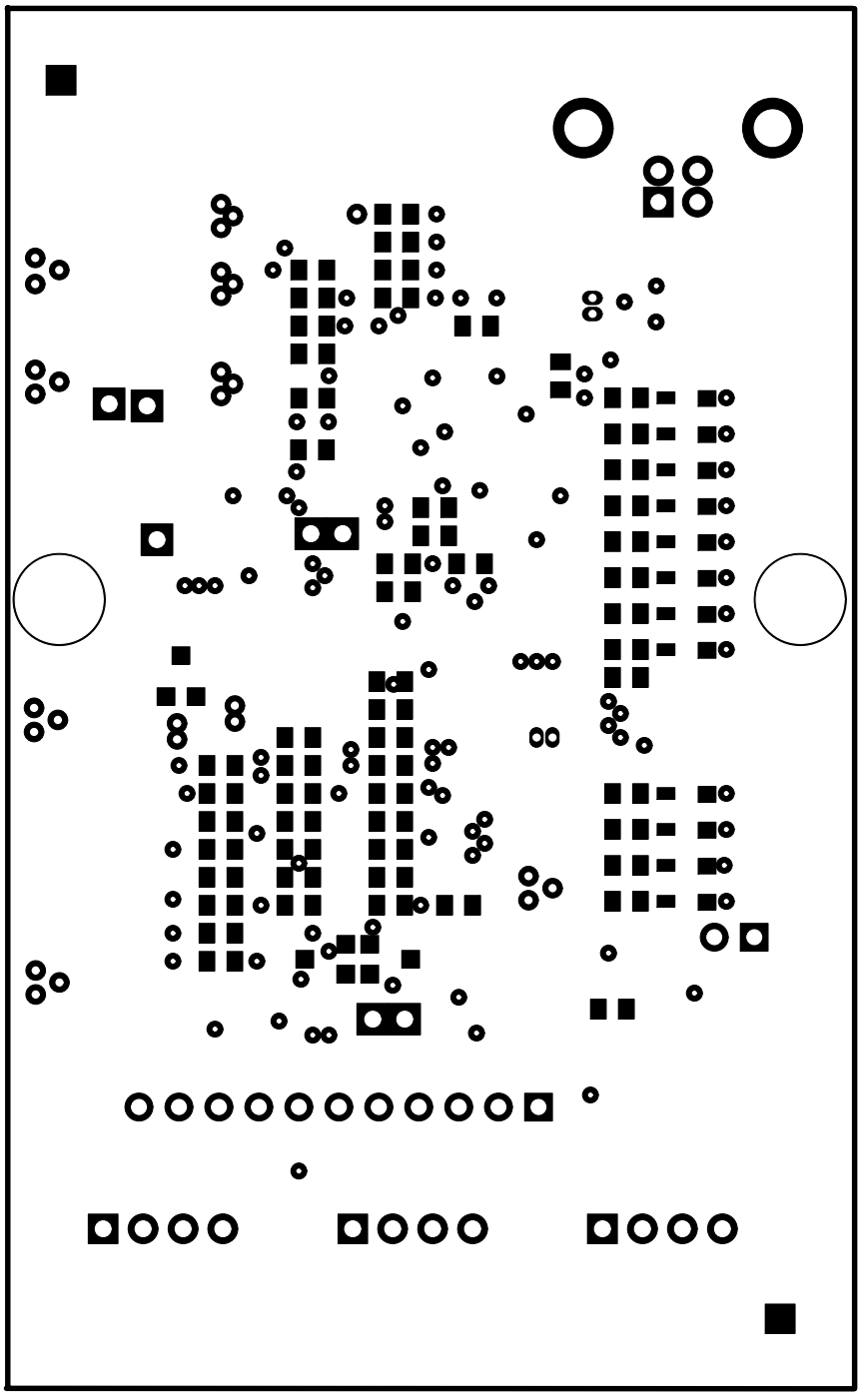


Figure 3–4. Board Layer 2

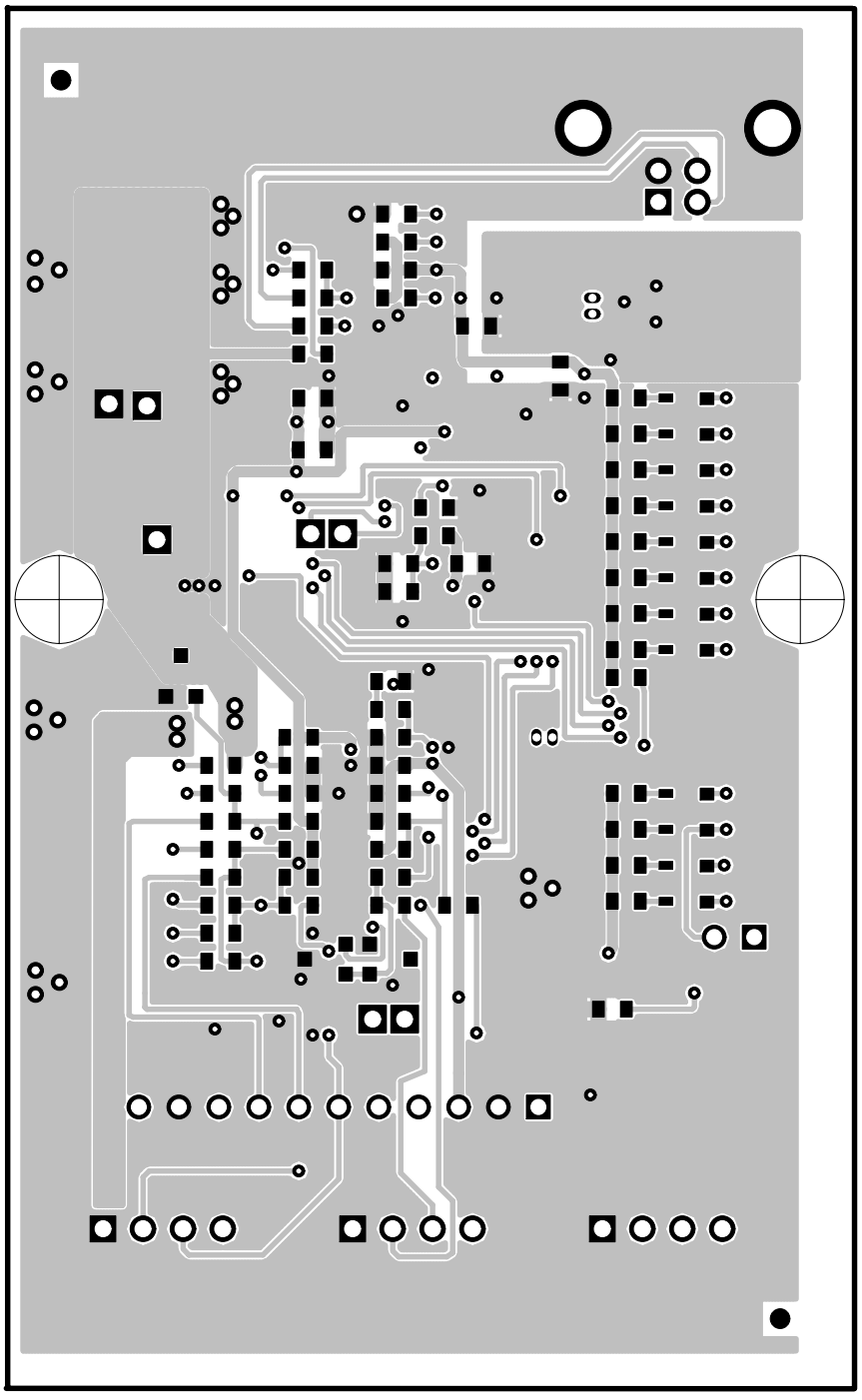


Figure 3−5. Component Placement 1

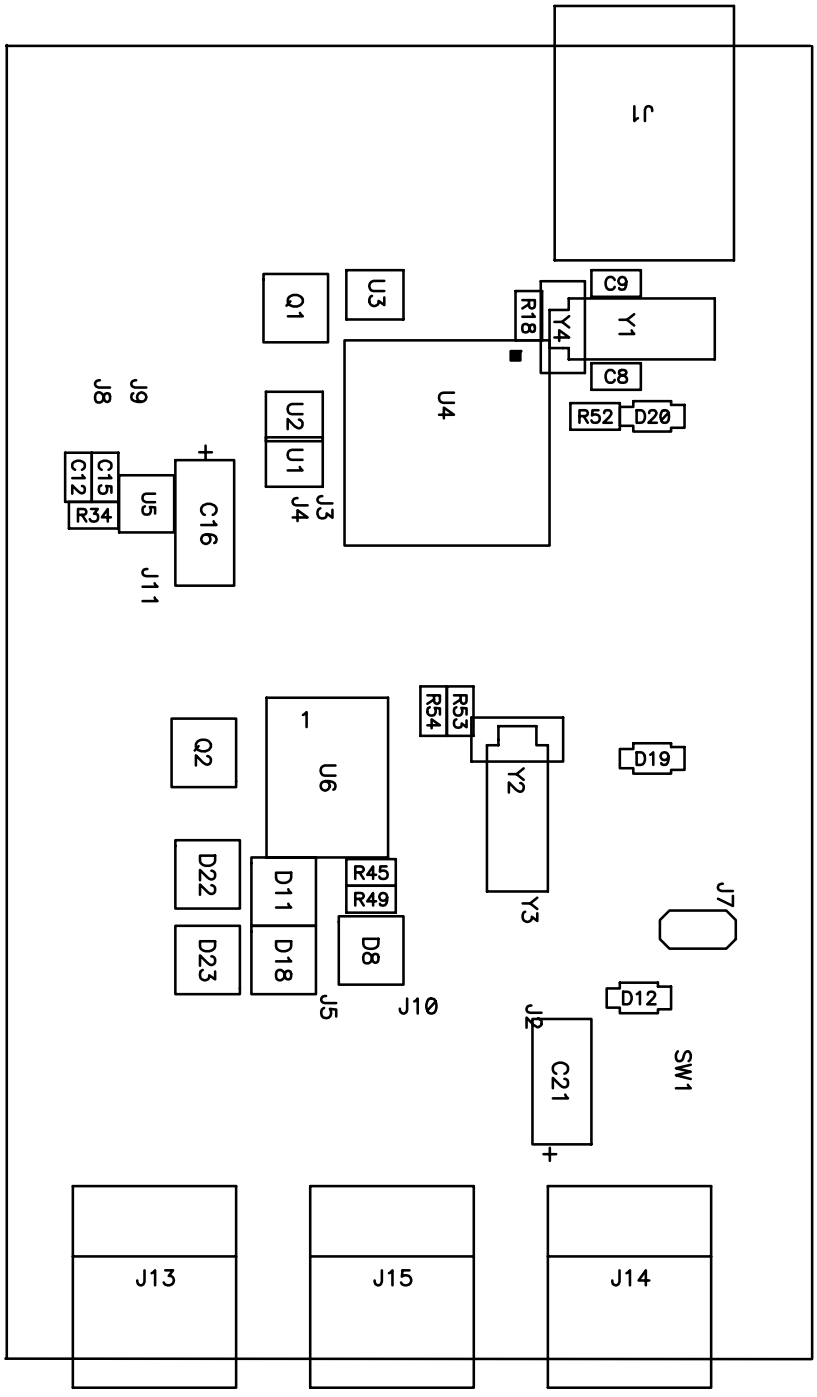


Figure 3−6. Component Placement 2

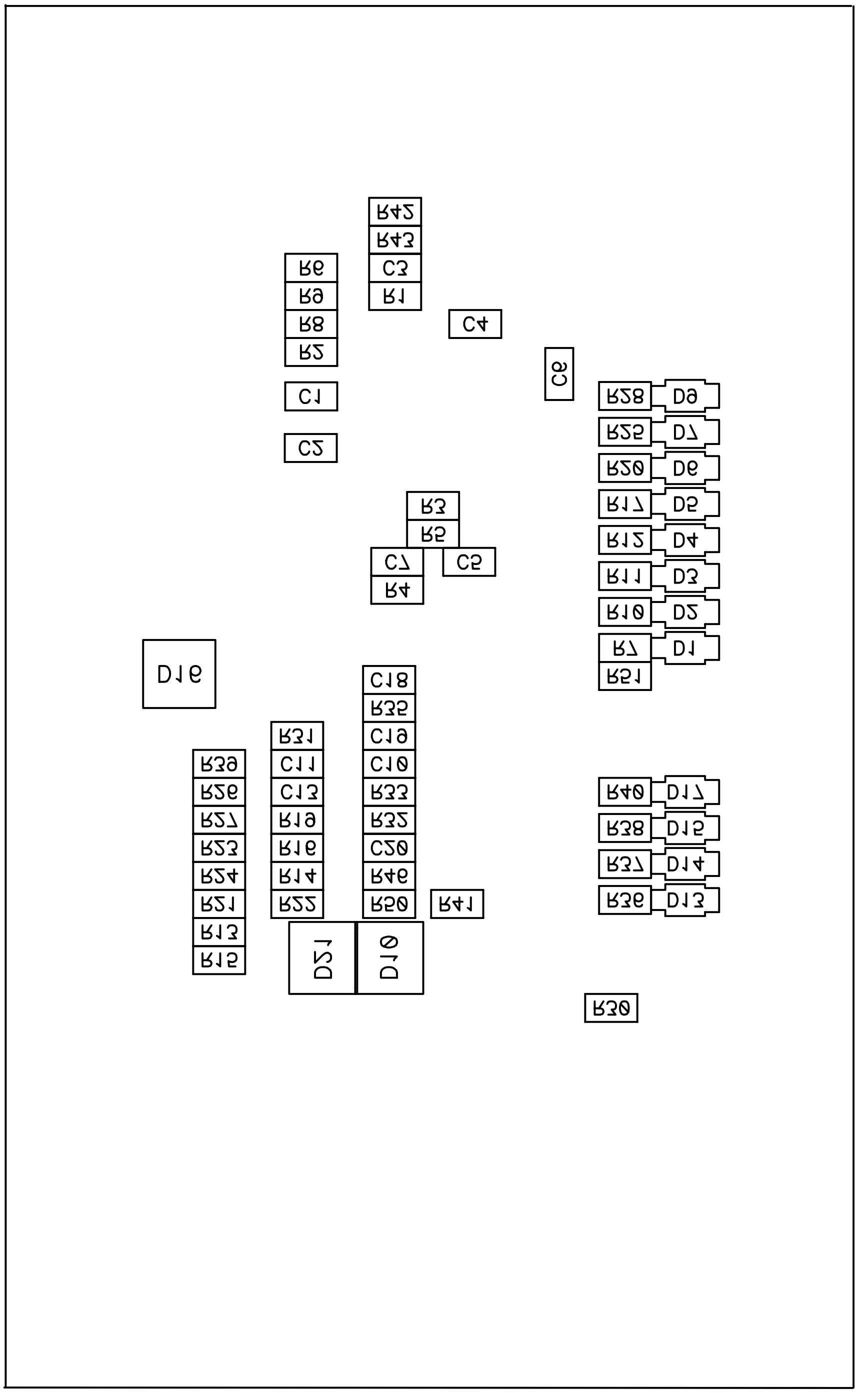


Figure 3−7. Internal Board Layer 1

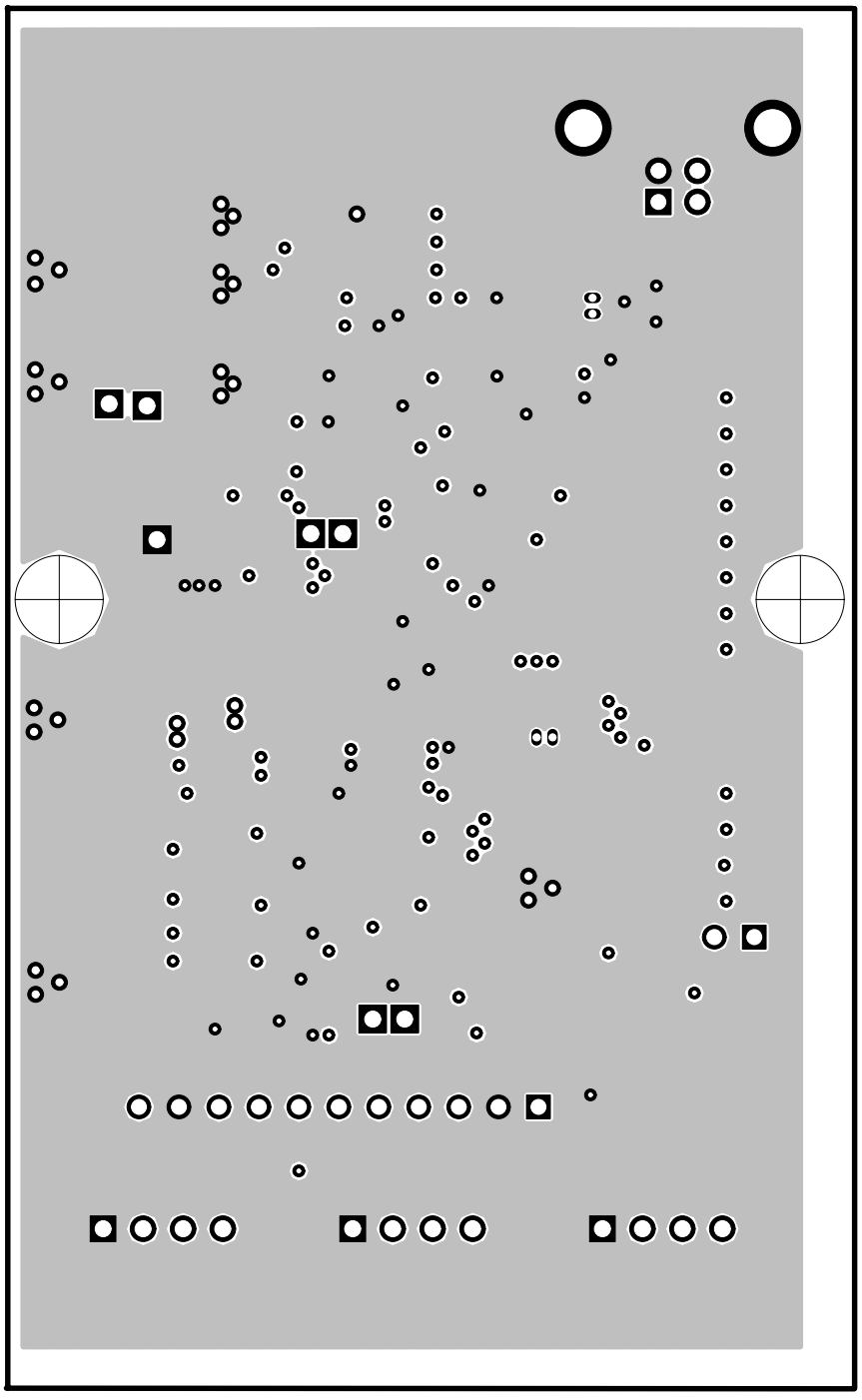
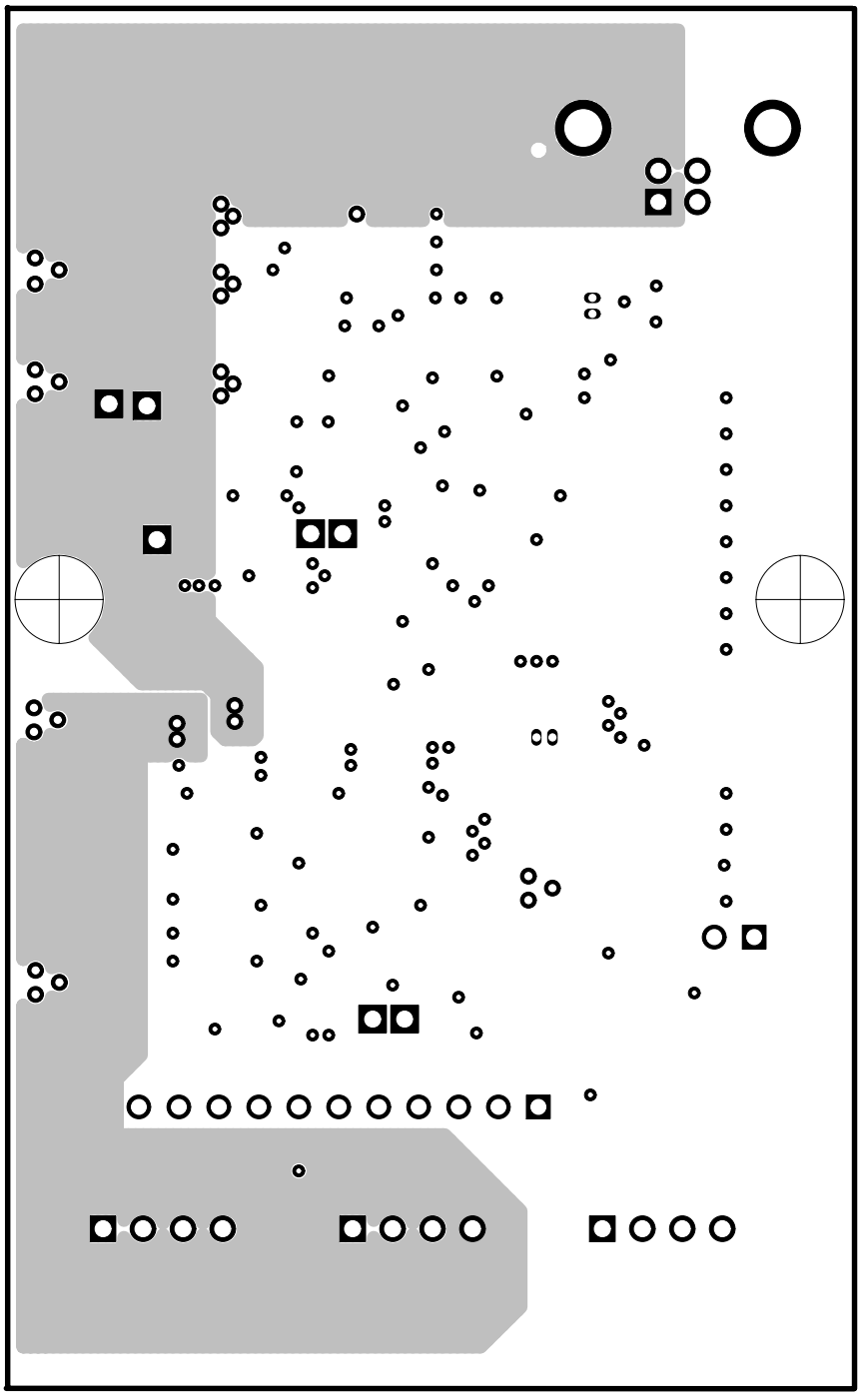
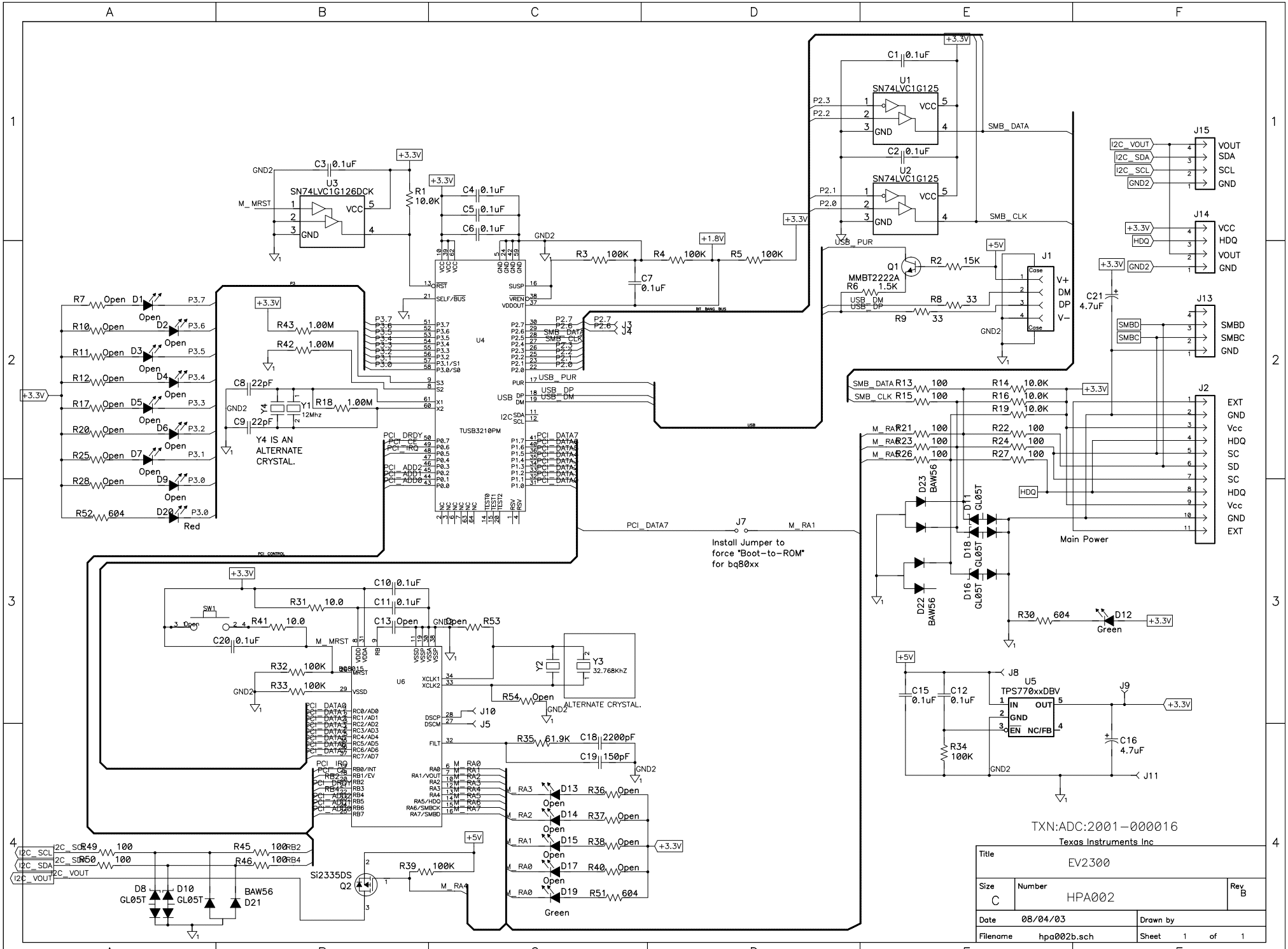


Figure 3–8. Internal Board Layer 2



3.3 EV2300 Schematic


U1
SN74LVC1G125
U2
SN74LVC1G125
U3
SN74LVC1G126DCK
U4
TUSB3210PM
U5
TPS770xxDBV
U6
Q1
MMBT2222A
Q2
Si2335DS
J1
J2
J3
J4
J5
J7
J8
J9
J10
J11
J13
J14
J15
SW1
Y1
12Mhz
Y2
Y3
32.768KhZ
Y4 IS AN ALTERNATE CRYSTAL.
ALTERNATE CRYSTAL.
Install Jumper to force "Boot-to-ROM" for bq80xx
Main Power
Red
Green
BAW56
GL05T
TXN:ADC:2001-000016
Texas Instruments Inc
Title
EV2300
Size
C
Number
HPA002
Rev
B
Date
08/04/03
Drawn by
Filename
hpa002b.sch
Sheet
1
of
1