Si2456/33/14/03URT-EVB

SILICON LABORATORIES

EVALUATION BOARD FOR THE Si2456/33/14/03 WITH A UART INTERFACE

Description

The Si2456/33/14/03URT-EVB evaluation board provides the system designer an easy way to evaluate the Si2456/33/14/03 ISOmodem®. The Si2456/33/14/03URT-EVB consists of a motherboard with a power supply, an RS-232 and USB interface, other ease-of-use features, and a complete, removable modem module on a daughter card. (A functional block diagram of the Si2456/33/14/03URT-EVB is shown below.) The Si2456/33/14/03 ISOmodem is a complete, controller-based modem chipset with an integrated and programmable direct access arrangement (DAA) that meets global telephone line requirements. Available as a combination of one 16-pin small outline (SOIC) package and one 24-pin thin-shrunk small outline (TSSOP) package, the Si2456/33/14/03 ISOmodem eliminates the need for a separate DSP data pump, modem controller, memories, analog front end (AFE), isolation transformer, relays, opto-isolators, and a 2- to 4-wire hybrid. The Si2456/33/14/03 is ideal for embedded modem applications due to its small board area, controller-based architecture, low power consumption, and global compliance. The Si2456/33/14/03URT-EVB provides an RJ-11 jack, a DB9 or USB connector (for interfacing the Si2456/33/14/03URT-EVB to the phone line), and a PC or data terminal serial port. This allows the ISOmodem to operate as a serial modem for straightforward evaluation of the Si2456/33/14/03.

To evaluate the Si2456/33/14/03 ISOmodem in an embedded system, the daughter card can be used independently or with the motherboard. A direct access header (JP3) is available on the motherboard to bypass the RS-232 transceivers and connect the Si2456/33/14/03 ISOmodem directly to a target system.

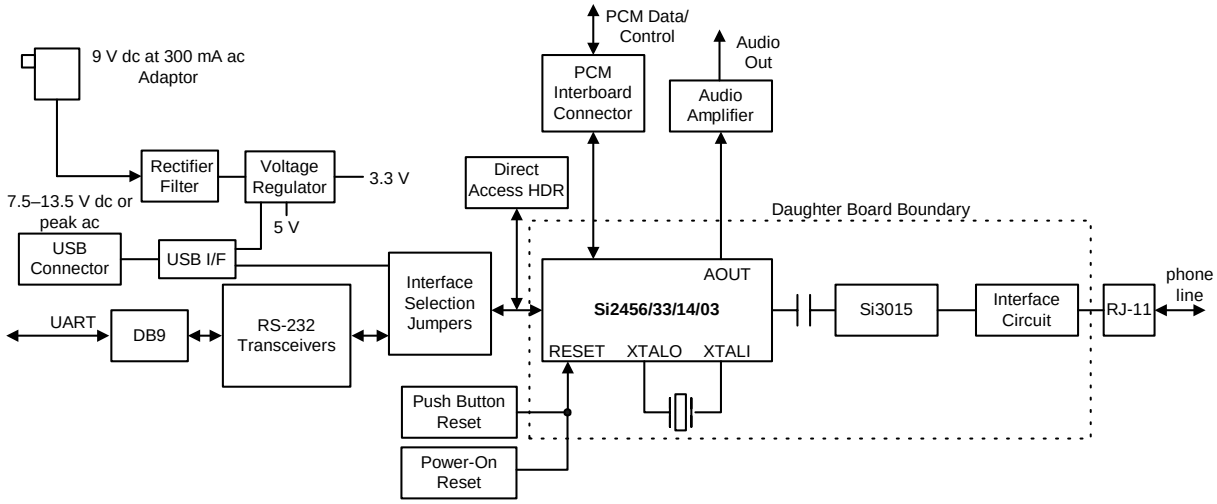
An onboard rectifier, filter, and voltage regulator allow the power input to be 7.5–13 V ac or dc (either polarity) supplied through a screw terminal (J3) or a standard 2 mm power jack (J4). Alternatively, power can be supplied through the USB interface. The Si2456/33/14/03 can drive an external speaker for call monitoring, or a piezoelectric speaker can be mounted directly on the board in the space provided.

Features

The Si2456/33/14/03URT-EVB includes the following:

- Dual RJ-11 connection to phone line
- RS232 and USB interface to PC
- Audio connector for call monitoring
- Direct access to Si2456/33/14/03 for embedded application evaluation
- Easy power connection to common 7.5 V–13.5 V power supplies
- 9 V ac adaptor
- Support for daisy chain operation
- Simple installation and operation

Functional Block Diagram



1. Si2456/33/14/03URT-EVB Setup and Evaluation

This section explains how to set up the Si2456/33/14/03URT-EVB for evaluation as an RS-232 or USB interface modem. Jumper settings, power connection, PC/terminal connections, and terminal program configuration settings are given. The initial modem setup after power is applied as well as a basic tutorial on modem operation are provided. Si2456/33/14/03URT-EVB configurations for evaluating additional features are discussed separately. See the Si2456/33/14/03 data sheet and "AN70: Si2456/Si2433/Si2414/Si2403 Modem Designer's Guide" for complete details.

1.1. Si2456/33/14/03 URT-EVB Quick Start—RS-232 Interface

1. Set jumpers according to Figure 1.
2. Connect:
   - DB-9 to PC COM 1 (with a pass-through cable).
   - RJ-11 to phone line or test box.
   - 9 V ac adaptor (or USB cable).
3. Bring up.
   - Turn on power to modem.
   - Autobaud will automatically adjust modem DTE speed and protocol.
4. Type "AT" followed by a carriage return.
   - Should echo "AT" and then an "OK".

1.2. Si2456/33/14/03 URT-EVB Quick Start—USB Interface

1. Set jumpers according to Figure 2.
2. Connect:
   - USB cable to PC.
   - RJ-11 to phone line or test box.
3. Download USB driver for your operating system from www.ftdichip.com.
4. Install driver.
5. Bring up.
   - Reset the modem.
   - Autobaud will automatically adjust modem DTE speed and protocol.
6. Type "AT" followed by a carriage return.
   - Should echo "AT" and then an "OK".

1.3. Jumper Settings

Check all jumper settings on the Si2456/33/14/03URT-EVB before applying power. Figure 1 shows the standard factory jumper settings. These settings configure the Si2456/33/14/03URT-EVB for RS-232 serial operation with autobaud. Any standard terminal program configured to communicate through a PC COM port can be used to communicate with the Si2456/33/14/03URT-EVB. Figure 2 shows jumper settings for USB operation. The only difference between RS-232 and USB jumper settings is that JP5 must be installed to enable USB.

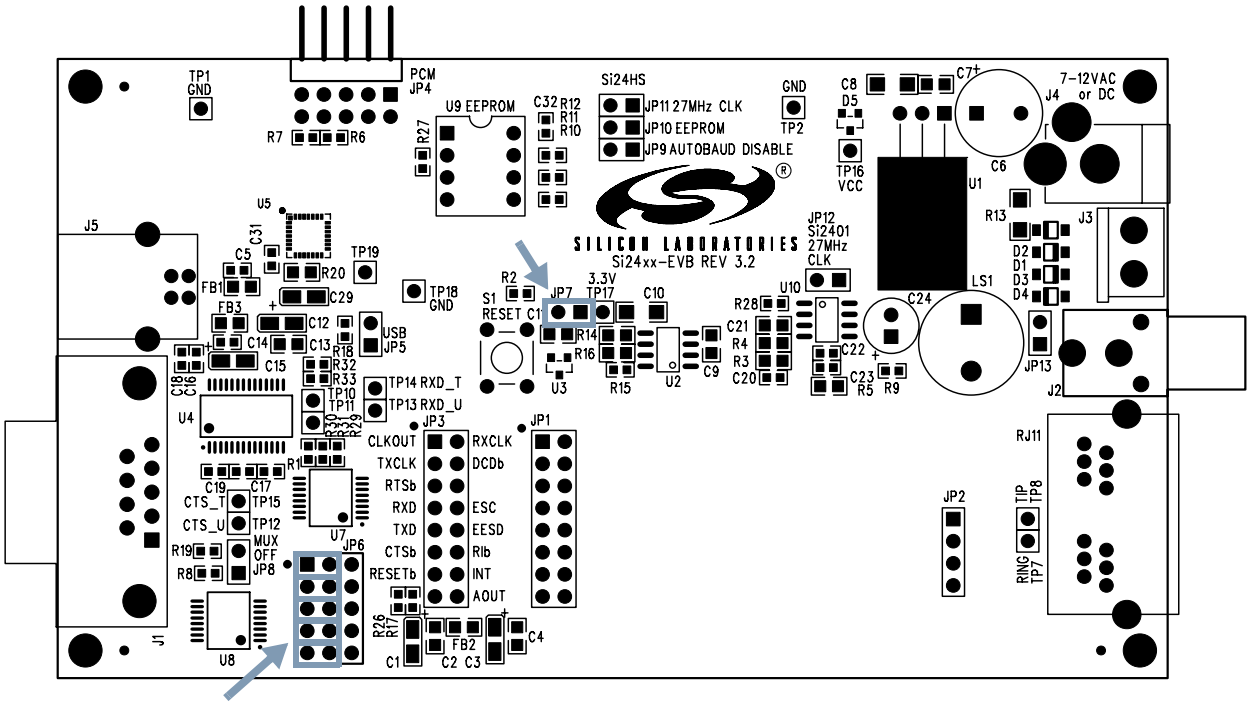


Figure 1. Standard Factory Jumper Settings—RS-232 Interface (Outlined in Gray)

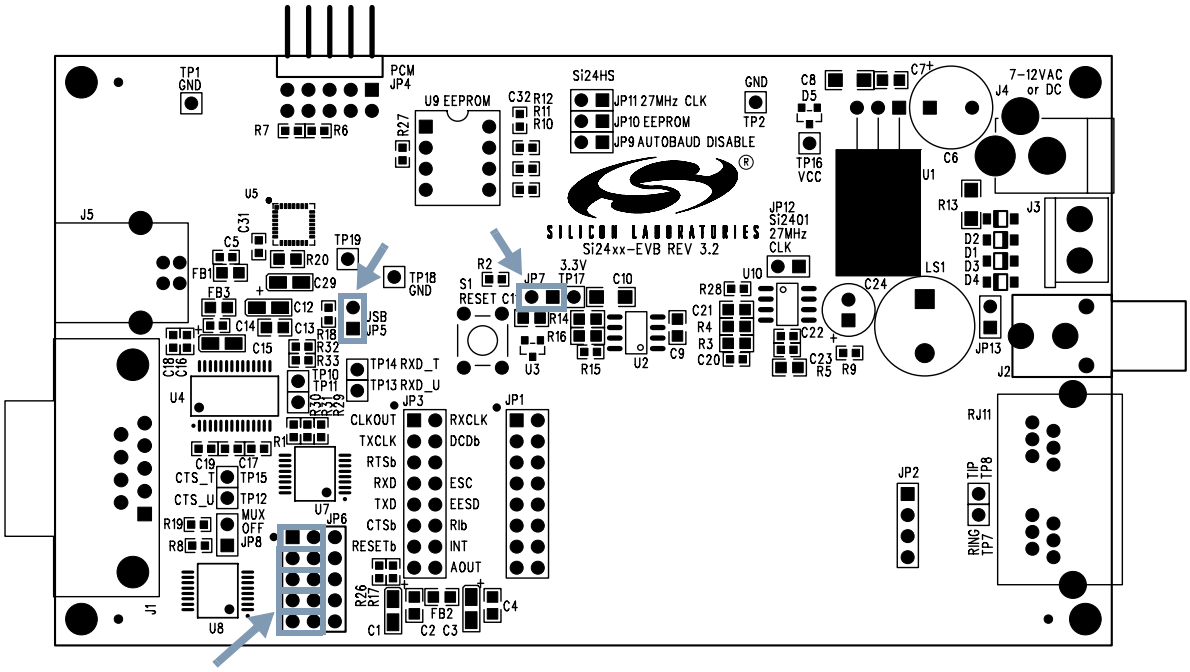


Figure 2. Standard Factory Jumper Settings—USB Interface (Outlined in Gray)

1.4. Power Requirements

The Si2456/33/14/03URT-EVB has an onboard diode bridge, filter capacitor, and voltage regulator (U8). Power can be supplied from any source capable of providing 7.5 V–13 V dc or 7.5 V–13 V peak ac and at least 100 mA. (Additional current may be required if a speaker is connected for monitoring call progress tones.) Power may be applied to the Si2456/33/14/03URT-EVB through the screw terminals (J3), the 2 mm power jack (J4), or the USB cable (even if the modem is configured for RS-232 operation). The onboard full-wave rectifier and filter ensure that the correct polarity is applied to the Si2456/33/14/03URT-EVB. Daughter card power is supplied through voltage regulator (U2) by connecting JP7, pins 1 and 2. Daughter card current can be measured by connecting an ammeter between JP7, pins 1 and 2. Failure to connect pins 1 and 2 of JP7 through either a jumper or a low-impedance ammeter may result in damage to the Si2456/33/14/03URT-EVB.

1.5. Terminal and Line Connections

The Si2456/33/14/03 can be tested as a standard serial data modem by connecting the Si2456/33/14/03URT-EVB to a personal computer or other data terminal equipment (DTE), phone line, and power. Connect a serial port on a PC to the DB9 connector on the Si2456/33/14/03URT-EVB with a pass-through cable. The RS-232 transceivers on the EVB can communicate with the DTE at rates up to 1 Mbps. Any standard terminal program, such as HyperTerminal or ProComm, running on a PC will communicate with the Si2456/33/14/03URT-EVB. The standard factory jumper configuration has autobaud enabled. Autobaud detects the DTE speed, data length, parity, and number of stop bits. If JP9 is removed and autobaud is disabled, configure the terminal emulation program to 19200 bps, eight data bits, no parity, one stop bit, and hardware (CTS) handshaking. Connect the RJ-11 jack on the Si2456/33/14/03URT-EVB to an analog phone line or telephone line simulator, such as a Teltone TLS 5.

1.6. Making Connections

With the terminal program properly configured and running, apply power to the Si2456/33/14/03URT-EVB. Type “AT<cr>”, and the modem should return “OK” indicating the modem is working in the command mode and communicating with the terminal. If the “OK” response is not received, try resetting the modem by pressing the manual reset switch (S1) and retype “AT<cr>.” Next, type “ATI6<cr>.” The modem should respond with “2433” or “2414” indicating the terminal is communicating with an Si2456/33/14/03.

Type “ATS0=2<cr>” to configure the modem to answer on the second ring.

To take the modem off-hook, type “ATH1<cr>.” The modem should go to the off-hook state, draw loop current, and respond with an “OK”. Next, type “ATH<cr>” or “ATH0<cr>”, and the modem should hang up (go on hook) and stop drawing loop current.

To make a modem connection, type “ATDT(called modem phone number)<cr>.” Once the connection is established, a “CONNECT” message will appear indicating the two modems are in the data mode and communicating. Typing on one terminal should appear on the other terminal. To return to the command mode without interrupting the connection between the two modems, type “+++.” Approximately two seconds later, “OK” will appear. The modem is now in command mode and will accept “AT” commands. To return to the data mode, type “ATO.” The modem will resume the data connection and no longer accept AT commands. Type “ATH” (or “ATH0”) to terminate the data connection.

2. Si2456/33/14/03URT-EVB Functional Description

The Si2456/33/14/03URT-EVB is a multipurpose evaluation system. The modem daughter card illustrates the small size and few components required to implement an entire controller-based modem with global compatibility. The daughter card can be used independently of, or in conjunction with, the motherboard. The motherboard adds features that enhance the ease of evaluating the many capabilities of the Si2456/33/14/03 ISOmodem.

2.1. Motherboard

The motherboard provides a convenient interface to the Si2456/33/14/03 DC (daughter card). The versatile power supply allows for a wide range of ac and dc voltages to power the board. RS-232 transceivers and a DB9 connector allow the Si2456/33/14/03URT-EVB to easily be connected to a PC or other terminal device. Jumper options allow direct access to the LVCMOS/TTL level serial inputs to the Si2456/33/14/03, bypassing the RS-232 transceivers or USB interface. This is particularly useful for directly connecting the Si2456/33/14/03 to embedded systems.

The Si24xxURT-EVB motherboard connects to the daughter card through two connectors, JP1 and JP2. JP1 is an 8x2 socket providing connection to all Si2456/33/14/03 digital signals and regulated 3.3 V power for the Si2456/33/14/03. The Si2456/33/14/03 digital signals appearing at JP1 (daughter card interface) are LVCMOS- and TTL-compatible. The Si2456/33/14/

03DC must be powered by 3.3 V. The motherboard is factory configured for 3.3 V with JP7, pins 1 and 2. JP2 is a 4x1 socket providing connection between the daughter card and the RJ-11 phone jack.

2.1.1. Voltage Regulator/Power Supply

The input voltage to either J3 or J4 must be between 7.5 and 13.5 V dc or 7.5 and 13.5 V_{PEAK} ac. The motherboard includes a diode bridge (D1–D4) to guard against a polarity reversal of the dc voltage or to rectify an ac voltage. The power source must be capable of continuously supplying at least 100 mA. C50 serves as a filter cap for an ac input. The voltage regulator, U1, provides 5 V for the motherboard and the input for voltage regulator U2, which outputs 3.3 V for use on the motherboard and to power the daughter card. Si24xxDC power consumption can be measured by placing a meter between pins 1 and 2 of JP7. The connection between JP7, pins 1 and 2, must be made at all times when power is applied to the evaluation board either through a jumper block or a low-impedance meter to avoid damage to the daughter card. Power is supplied to U2 through D5 from the USB.

2.1.2. Reset Circuitry

The Si2456/33/14/03 requires a reset pulse to remain low for at least 5.0 ms after the power supply has stabilized during the powerup sequence or for at least 5.0 ms during a power-on reset. Most production Si2456/33/14/03 modem chipset applications require that $\overline{\text{RESET}}$ be controlled by the host processor. Certain Si2456/33/14/03 operation modes, including powerdown, require a hardware reset to recover.

The Si2456/33/14/03URT-EVB contains two reset options, an automatic power-on reset device, U3 (DS1818) (default), and a manual reset switch (S1) to permit resetting the chip without removing power. A reset, regardless of the mechanism, causes all modem settings to revert to factory default values. See Figure 6 on page 11 and Figure 8 on page 13 for the reset circuit schematic.

2.1.3. DS1818

The DS1818 is a small, low-cost device that monitors the voltage on V_D and an external reset pushbutton. If V_D drops below 3.0 V, the DS1818 provides a 220 ms active-low reset pulse. On power-up, the DS1818 also outputs an active low reset pulse for 220 ms after V_D reaches 90% of the nominal 3.3 V value. The DS1818 outputs a 220 ms reset pulse any time the power supply voltage exceeds the 3.3 V ±10% window.

2.1.4. Manual Reset

The manual reset switch (S1) performs a power-on reset. This resets the Si2456/33/14/03 to factory defaults without turning off power. If S1 is used in conjunction with U6, pressing S1 activates the reset monitor in the DS1818 and produces a 220 ms active low reset pulse.

2.1.5. EEPROM Enable

Connecting JP10 enables the optional EEPROM, U9. See “AN70: Si2456/Si2433/Si2414/Si2403 Modem Designer’s Guide” for programming details.

2.1.6. Interface Selection

The serial interface of the Si2456/33/14/03URT-EVB can be connected to a computer, terminal, embedded system, or any other Data Terminal Equipment (DTE) via a standard RS-232 interface, USB interface, or through a direct TTL serial interface.

The Si2456/33/14/03 can be tested as a standard data modem by connecting the Si2456/33/14/03URT-EVB to a personal computer or other DTE, power supply, and a phone line. A PC can communicate with the Si2456/33/14/03URT-EVB using a standard terminal program, such as HyperTerm or ProComm.

Jumper settings determine how the Si2456/33/14/03URT-EVB is connected to the DTE. Table 1 lists the interface controlled by each motherboard jumper. See Figures 7 and 17.

Table 1. Interface Selection Jumpers

Jumper	Function
JP1	Daughter Card Digital Connector.
JP2	Daughter Card Phone Line Connector.
JP3	Direct Access Header.
JP4	Not Used.
JP5	USB Enable (RS-232 Disable).
JP6	Options.
JP7	3.3 V Power for Daughter Card.
JP8	Disable both RS-232 and USB.
JP9	Autobaud enable.
JP10	EEPROM enable.
JP11	Enable 27 MHz Clock option.
JP12	Not used.
JP13	Onboard speaker enable.

2.1.7. RS-232 Interface

This operation mode uses the standard factory jumper settings illustrated in Figure 1 on page 3. The Maxim MAX3237 transceiver interfaces directly with the TTL levels available at the serial interface of the Si2456/33/14/03 and, using internal charge pumps, makes these

signals compatible with the RS-232 standard. The RS-232 transceiver on the Si2456/33/14/03URT-EVB can communicate at rates between 300 bps and 1 Mbps. This simplifies the connection to PCs and other Data Terminal Equipment (DTE). The signals available on the Si2456/33/14/03URT-EVB serial interface (DB9 connector) are listed in Table 2.

2.1.8. USB Interface

The USB cable connects to J5 on the motherboard and provides both data and power. Installing a jumper on JP5 enables the USB interface and disables the RS-232 interface. The USB interface is provided by U5. A USB driver for this chip is available for most PC and MAC operating systems at www.ftdichip.com.

2.1.9. Direct Access Interface

The motherboard supplies power through J3, J4, or USB, power-on reset, and an RJ-11 jack for the modem. The direct access interface (JP3) is used to connect the motherboard to an embedded system. JP3 provides access to all Si2456/33/14/03 signals available on the daughter card. It is necessary to install a jumper on JP8 to disable both the RS-232 and USB interface and prevent signal contention. *Leave the jumper between JP7 pins 1 and 2.* Figure 3 illustrates the jumper settings required for the direct access mode using the motherboard.

Table 2. DB9 Pin Connections

J1 Name	J1 Symbol	J1 Pin	Si2456/33/14/03 Pin	Si2456/33/14/03 Name
Carrier Detect	CD	1*	See note	$\overline{\text{DCD}}$/EESD
Received Data	RXD	2	9	RXD
Transmit Data	TXD	3	10	TXD
Data Terminal Ready	DTR	4*	See note	ESC/$\overline{\text{RI}}$
Signal Ground	SG	5	6	GND
Data Set Ready	DSR	6*	See note	$\overline{\text{INT}}$/AOUT
Ready to Send	RTS	7*	See note	$\overline{\text{RTS}}$/RXCLK
Clear to Send	CTS	8	11	$\overline{\text{CTS}}$
Ring Indicator	RD	9*	15	$\overline{\text{RI}}$
***Note:** JP6 jumper option.				

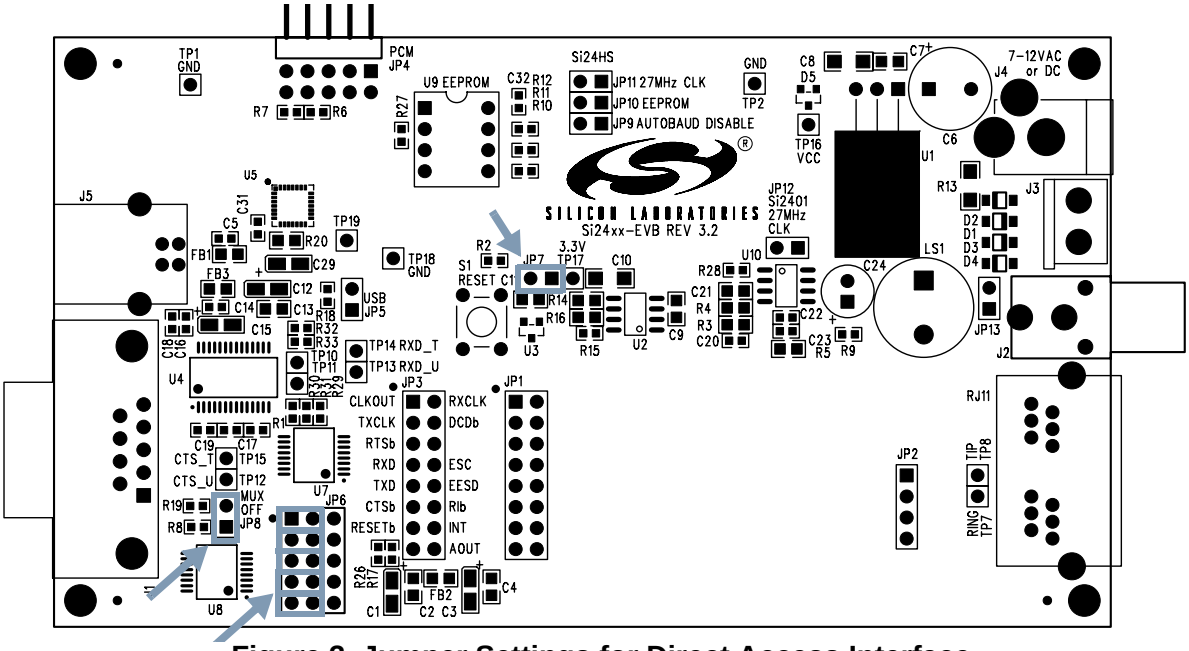


Figure 3. Jumper Settings for Direct Access Interface

2.1.10. Audio Output

Audio output is provided from the Si2456/33/14/03 on the AOUT pin. This signal allows the user to monitor call progress signals, such as dial tone, DTMF dialing, ring, busy signals, and modem negotiation. Control of this signal is provided by AT commands and register settings described in the introduction. The AOUT signal can be connected to an amplifier, such as the LM386 (the default stuffing option on the Si2456/33/14/03URT-EVB), for high-quality output. AOUT can also be connected to a summing amplifier or multiplexer in an embedded application as part of an integrated audio system.

2.1.11. Amplifier (LM386)

The audio amplifier circuit consists of U10 (LM386), C20, R3, R4, C21, C22, C23, R5, C24, and an optional loudspeaker, LS1. The LM386 has an internally-set voltage gain of 20. R3 and R4 provide a voltage divider to reduce the AOUT signal to prevent overdriving the LM386. C20 provides dc blocking for the input signal and forms a high-pass filter with R3+R4, while R4 and C21 form a low-pass filter. These four components limit the bandwidth of the AOUT signal. C22 provides high-frequency power supply bypassing for the LM386 and should be connected to a hard ground and located very close to the amplifier's power supply and ground pins. C23 and R5 form a compensation circuit to prevent oscillation of the high-current PNP transistor in the LM386 output stage on negative signal peaks. These oscillations can occur between 2 and 5 MHz and can pose a radiation compliance problem if C23 and R5 are omitted. C24 provides dc blocking for the output of the LM386, which is biased at approximately 2.5 V ($V_{CC}/2$) and forms a high-pass filter with the impedance of the loudspeaker (LS1). The output from the LM386 amplifier circuit is available on the RCA jack, J2 (not installed). Install jumper JP13 to enable the onboard speaker, LS1.

2.2. Modem Module Operation

The Si2456/33/14/03URT-EVB daughter card is a complete modem solution perfectly suited for use in an embedded system. The daughter card requires a 3.3 V supply capable of providing at least 35 mA and communicates with the system via LVCMOS/TTL-compatible digital signals on JP1. The RJ-11 jack (TIP and RING) is connected via JP2. Be sure to provide the proper power-on reset pulse to the daughter card if it is used in the stand-alone mode.

2.2.1. Reset Requirements

The Si2456/33/14/03 ISOmodem daughter card must be properly reset at powerup. The reset pin (pin 8) of the Si2456/33/14/03, (JP1, pin 13), must be held low for at least 5.0 ms after power is applied and stabilized to ensure that the device is properly reset.

2.2.2. Crystal Requirements

Clock accuracy and stability are important in modem applications. To ensure reliable communication between modems, the clock must remain within ±100 ppm of the design value over the life of the modem. The crystal selected for use in a modem application must have a frequency tolerance of less than ±100 ppm for the combination of initial frequency tolerance, drift over the normal operating temperature range, and five-year aging. Other considerations, such as production variations in PC board capacitance and the tolerance of loading capacitors, must also be taken into account.

2.2.3. Protection

The Si2456/33/14/03URT-EVB meets or exceeds all FCC and international PTT requirements and recommendations for high-voltage surge and isolation testing without any modification. The protection/isolation circuitry includes C1, C2, C8, C9, FB1, FB2, and RV1. The PCB layout is also a key "component" in the protection circuitry. The Si2456/33/14/03URT-EVB provides isolation to 3 kV. Contact Silicon Laboratories for information about designing to higher levels of isolation.

3. Design

The following pages contain the schematics, bill of materials, and layout for the Si2456/33/14/03 including the daughter card and motherboard.

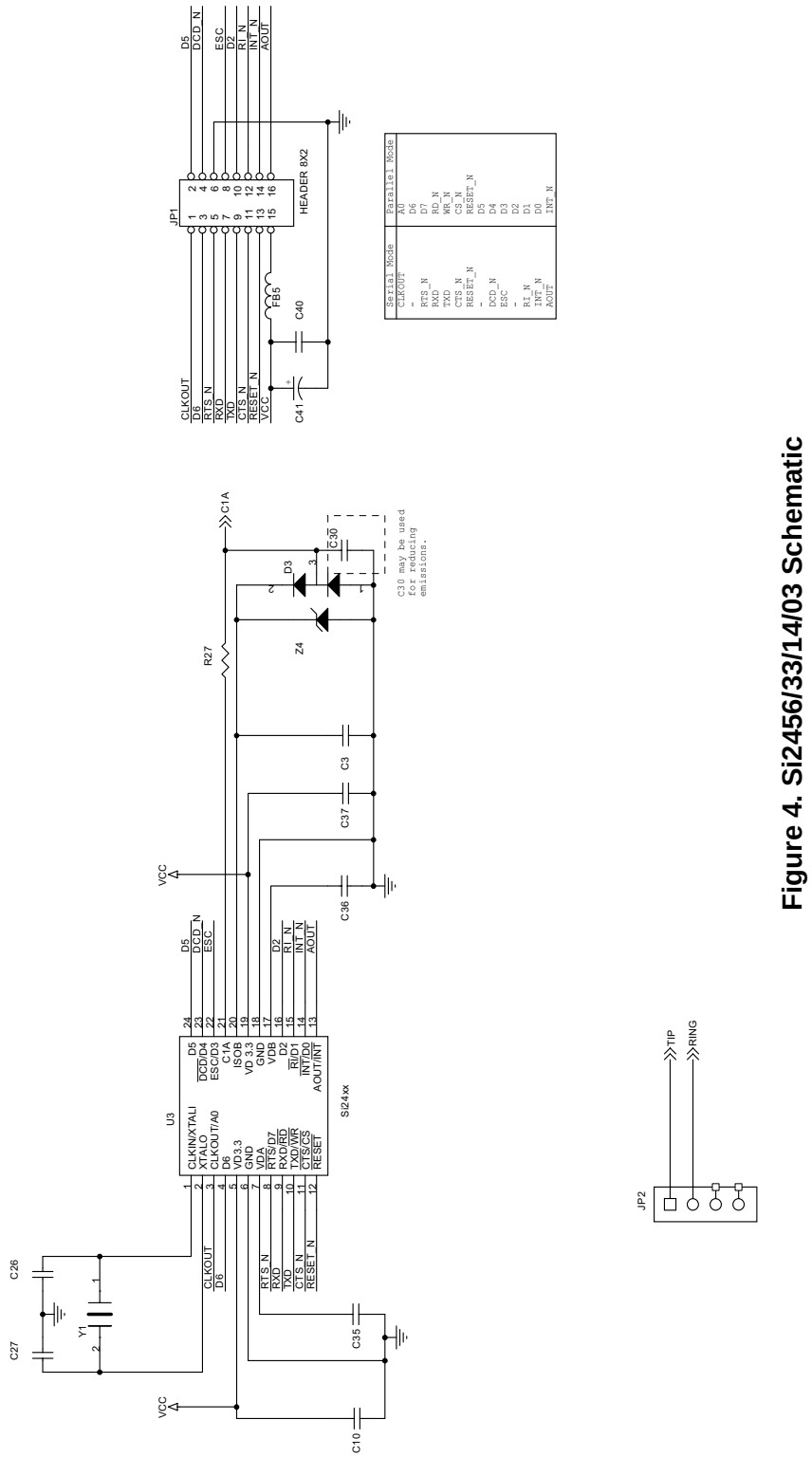


Figure 4. Si2456/33/14/03 Schematic

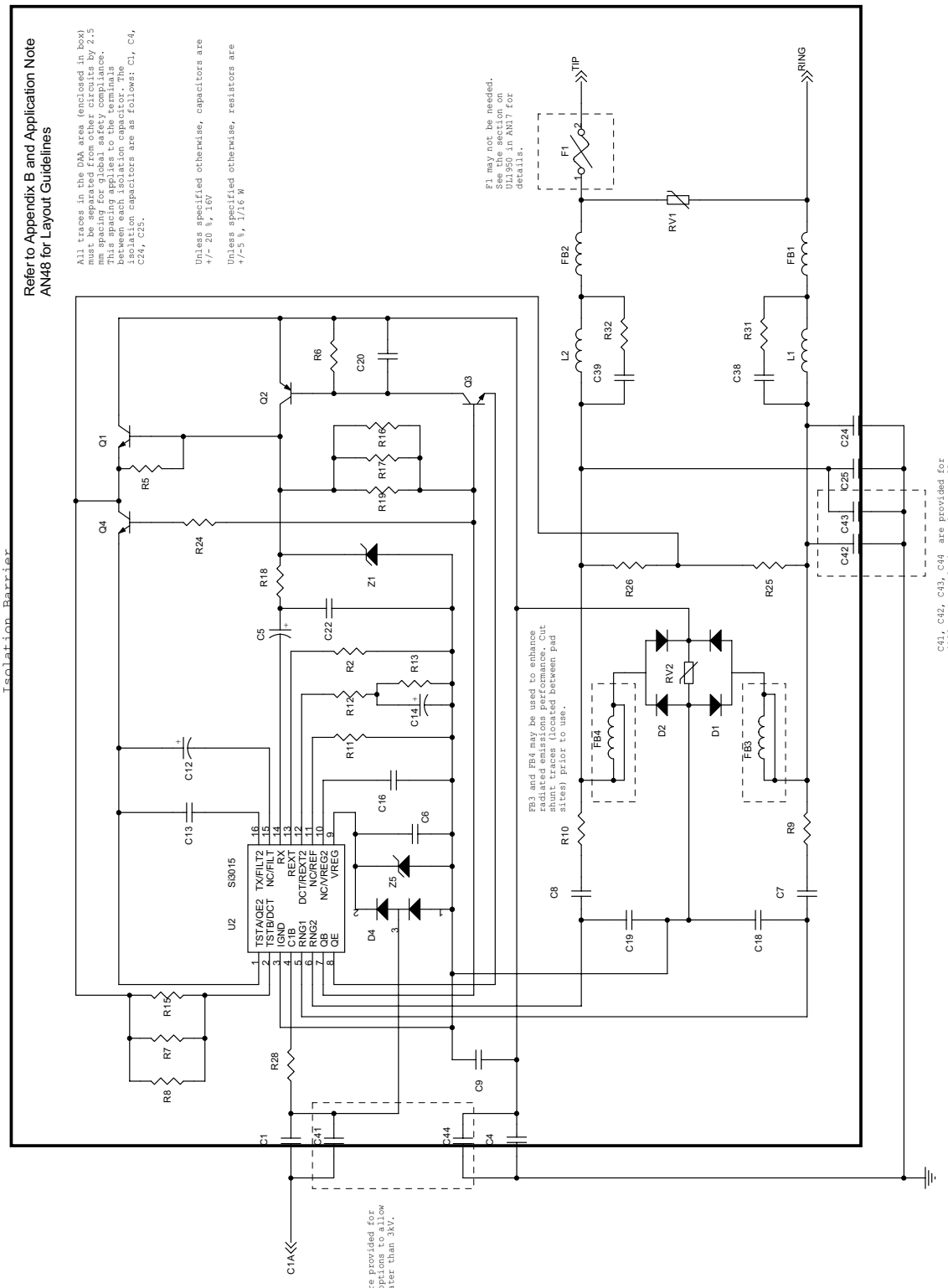


Figure 5. Si3015 DAA Schematic

4. Bill of Materials: Si24xx Daughter Card

Item	Quantity	Reference	Value	Rating	Tolerance	Foot Print	Part Dielectric	Manufacturer Number	Manufacturer
1	2	C4,C1	150 pF	3 kV	±10%	1812	X7R	NOVASL0001	Novacap
2	5	C3,C13,C35,C36,C40	0.22 uF	25 V	±20%	0805	X7R	C0805X7R250-224MNE	Venkel
3	1	C5	0.1 uF	50 V	±20%	Case A	Tant	TA050TCM104-MAL	Venkel
4	5	C6,C10,C16,C37,C47	0.1 uF	16 V	±20%	0603	X7R	C0603X7R160-104MNE	Venkel
5	2	C8,C7	560 pF	250 V	±10%	0805	X7R	C0805X7R251-561KNE	Venkel
6	1	C9	22 nF	250 V	±10%	0805	X7R	C0805X7R251-103KNE	Venkel
7	3	C12, C45, C46	1.0 uF	35 V	±10%	Case A	Tant	TA035TCM105-KAL	Venkel
8	1	C14	0.68 uF	16 V	±10%	1206	Tant	1206YC684KATMA	AVX
9	2	C18,C19	3.9 nF	16 V	±10%	0603	X7R	C0603X7R160-392KNE	Venkel
10	1	C20	0.01 uF	16 V	±10%	0603	X7R	C0603X7R160-103KNE	Venkel
11	1	C22	1800 pF	50 V	±10%	0603	X7R	C0603X7R500-182KNE	Venkel
12	2	C25,C24	1000 pF	3 kV	±10%	1812	X7R	NOVASL0002	Novacap
13	2	C26,C27	33 pF	16 V	±5%	0603	NPO	C0603NPO160-330JNE	Venkel
14	1	C30	10 pF	10 V	±20%	0603	X7R	C0603X7R100-100MNE	Venkel
15	2	C39,C38	47 pF	16 V	±10%	0603	X7R	C0603X7R160-470KNE	Venkel
16	2	D2,D1	Dual Diode	225 mA	300 V	SOT-23		CMPD2004S	Central Semiconductor
17	2	D4,D3	BAV99	300 mA	100 V	SOT-23		BAV99	Diodes, Inc.
18	3	FB1,FB2,FB5	Ferrite Bead			0805		BLM21A601S	Murata
19	1	F1	Fuse			FSOD6		F1250T	Teccor
20	1	JP1	HEADER 8X2			2x8 Surface Mount Header, .1 space		TSM-108-01-T-DV	Samtec
21	1	JP2	4X1 Header_0					68000-403	Berg
22	2	L1,L2	68 uH	150mA, 4ohm max	±10%	1210		NLC322522T-680K	TDK
23	2	Q1,Q3	NPN	300 V		SOT-23		MMBTA42LT1	Motorola
24	1	Q2	PNP	300 V		SOT-23		MMBTA92LT1	Motorola
25	1	Q4	NPN	80 V		SOT-223		BCP56T1	Motorola
26	1	RV1	SiDactor	275 V	100 A	SOD 6		P3100SB	Teccor
27	1	RV2	MOV	270V	1250A			ERZ-V05D271	Panasonic
28	1	R2	402	1/16 W	±1%	1206		CR1206-16W-4020FT	Venkel
29	1	R5	100 K	1/16 W	±1%	0603		CR0603-16W-104FT	Venkel
30	1	R6	120 K	1/16 W	±5%	0603		CR0603-16W-124JT	Venkel
31	6	R7,R8,R15,R16,R17,R19	5.36 K	1/4 W	±1%	1206		CR1206-4W-5361FT	Venkel
32	2	R10,R9	56 K	1/10 W	±5%	0805		CR0805-10W-563JT	Venkel
33	1	R11	9.31 K	1/16 W	±1%	0603		CR0603-16W-9311FT	Venkel
34	1	R12	78.7	1/16 W	±1%	0603		CR0603-16W-78R7FT	Venkel
35	1	R13	215	1/16 W	±1%	0603		CR0603-16W-2150FT	Venkel
36	1	R18	2.2 K	1/10 W	±5%	0805		CR0805-10W-222JT	Venkel
37	1	R24	150	1/10 W	±5%	0603		CR0603-10W-150JT	Venkel
38	2	R25,R26	10 M	1/10 W	±5%	0805		CR0805-10W-106JT	Venkel
39	2	R28,R27	10	1/16 W	±5%	0603		CR0603-16W-100JT	Venkel
40	2	R32,R31	470	1/16 W	±5%	0603		CR0603-16W-471JT	Venkel
41	1	U2	Si3015			16SOIC		Si3015-KS Rev. D	Silicon Labs
42	1	U3	Si24xx			24pin TSSOP		Si2456-KS	Silicon Laboratories
43	1	Y1	4.9152Mhz	20pF load, 150 ESR	50 ppm	ATS-SM		559-FOXSD049-20	CTS Reeves
44	1	Z1	Zener	43 V	300 mW	SOD-80		ZMM43	General Semi
45	2	Z5,Z4	Zener	5.6 V	500 mW	MiniMELF		ZMM5232B	Diodes, Inc.
Non-installed Components									
47	2	C41,C44	150 pF	250 V	±10%	2220	Y2	GHM3045X7R151KGC	Murata
48	2	C43,C42	1000 pF	250 V	±10%	2220	Y2	GHM3045X7R102KGC	Murata
49	2	FB3,FB4	Ferrite Bead			0805		BLM21A601S	Murata

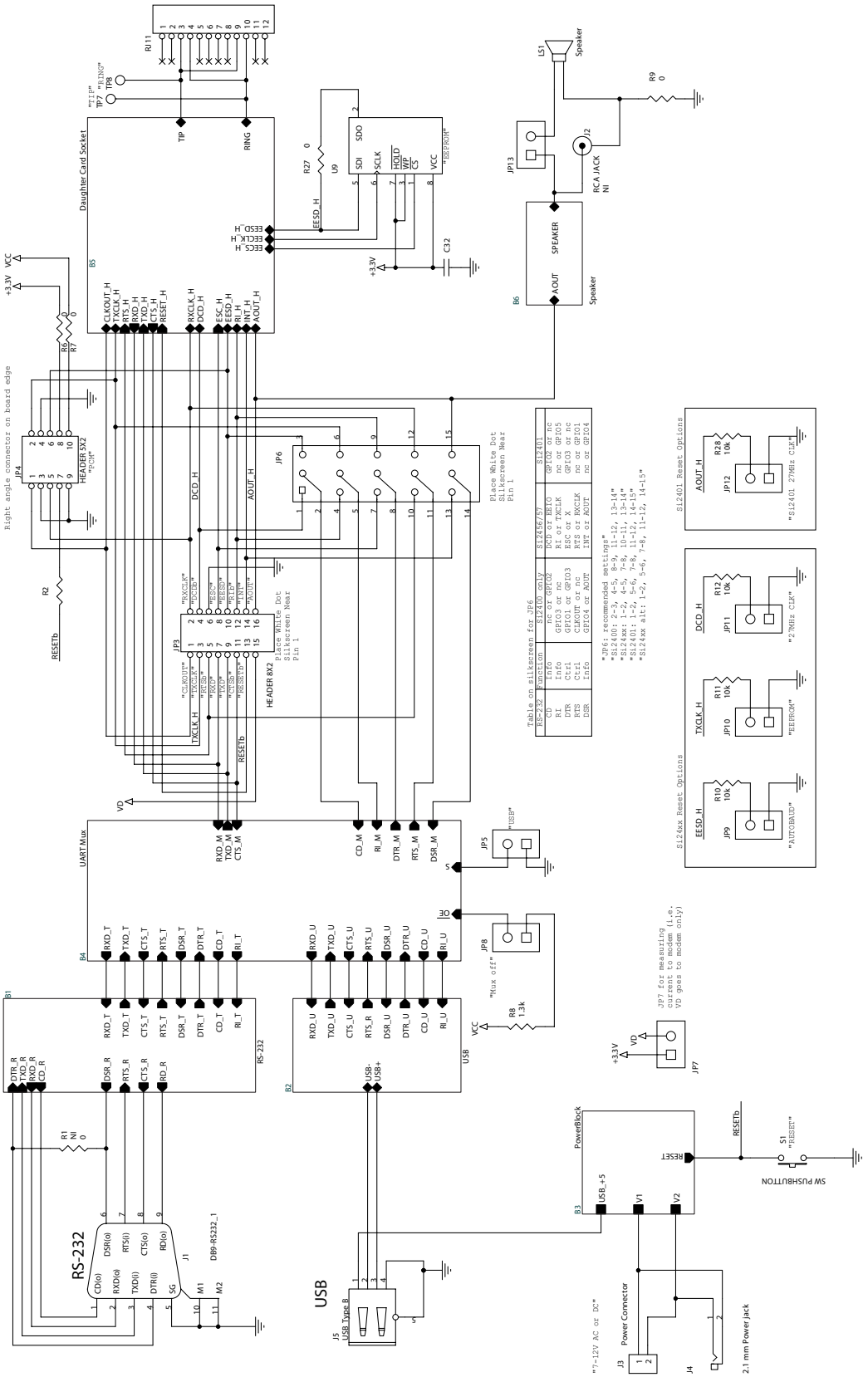


Figure 6. Motherboard Top-Level Schematic

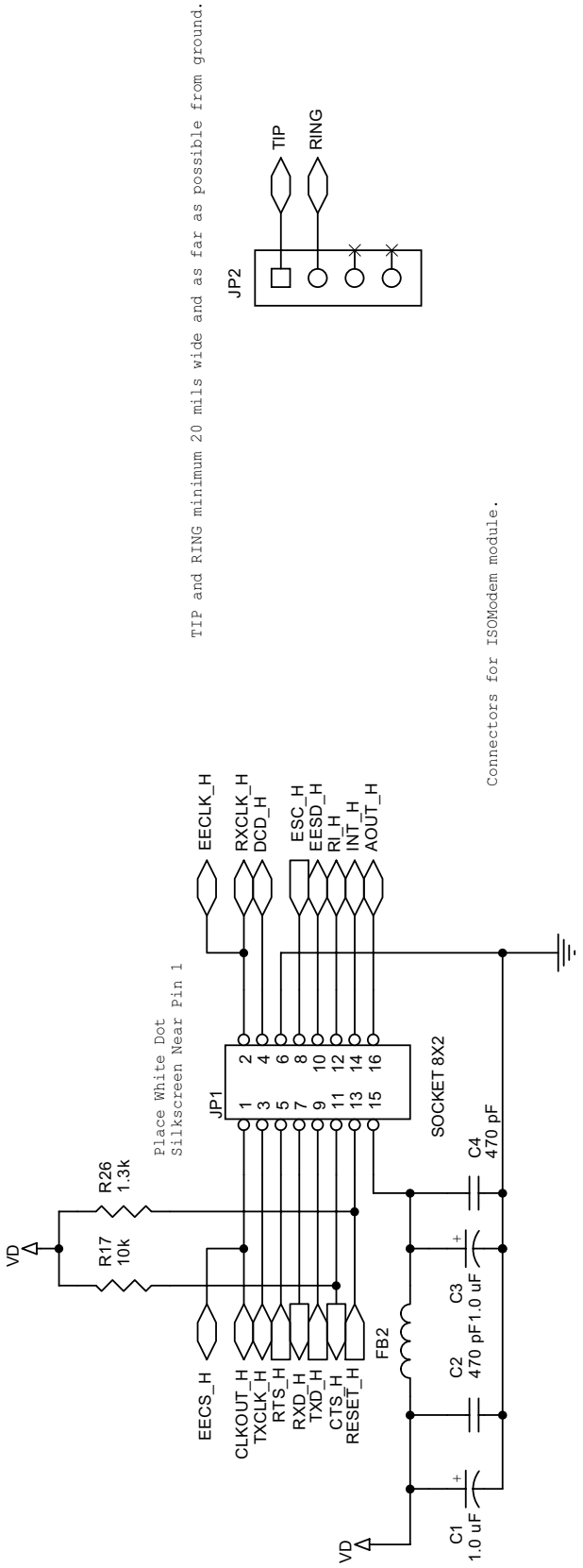


Table NOT on silkscreen

JP1/3	Si2400	Si24xx	Si2401
1	NC	CLKOUT/A0/EECS	NC
2	NC	EECLK/D5/RXCLK	GPIO1
3	NC	alt_RIb/TXCLK/D6	GPIO5
4	NC	DCD/D4	GPIO2
5	CLKOUT	RTS/D7	NC
6	GND	GND	GND
7	TXD	TXD/WR	TXD
8	GPIO1	ESC/D3	GPIO3
9	RXD	RXD/RD	RXD
10	GPIO2	EESD/D2	NC
11	CTS	CTS/CS	CTS
12	GPIO3	RI/D1	NC
13	RESET	RESET	RESET
14	GPIO4	INT/D0	NC
15	VD	VD	VD
16	AOUT	AOUT/INT	GPIO4

Figure 7. Daughter Card Interface Schematic

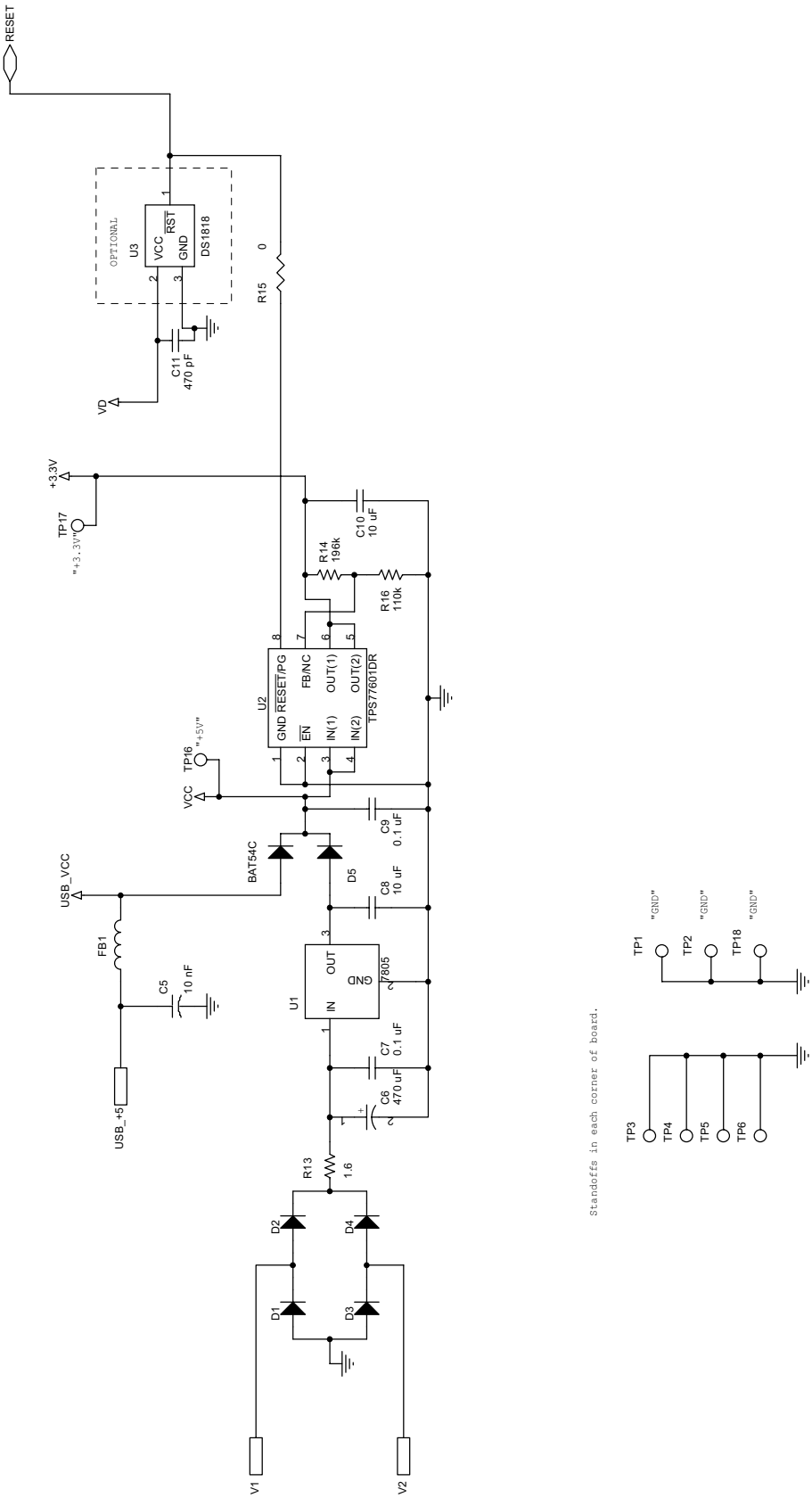


Figure 8. Power Supply Schematic

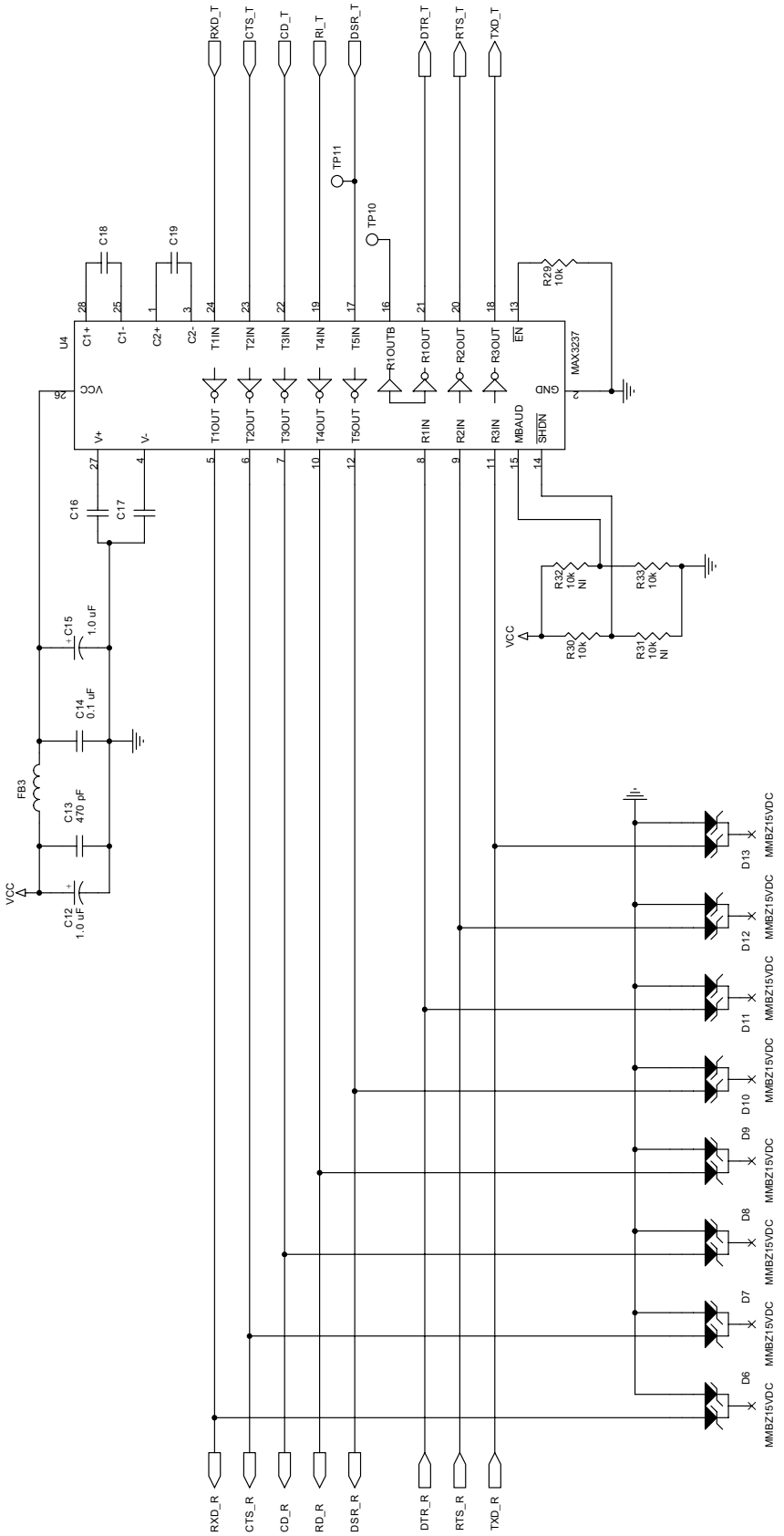


Figure 9. RS-232 Interface Schematic

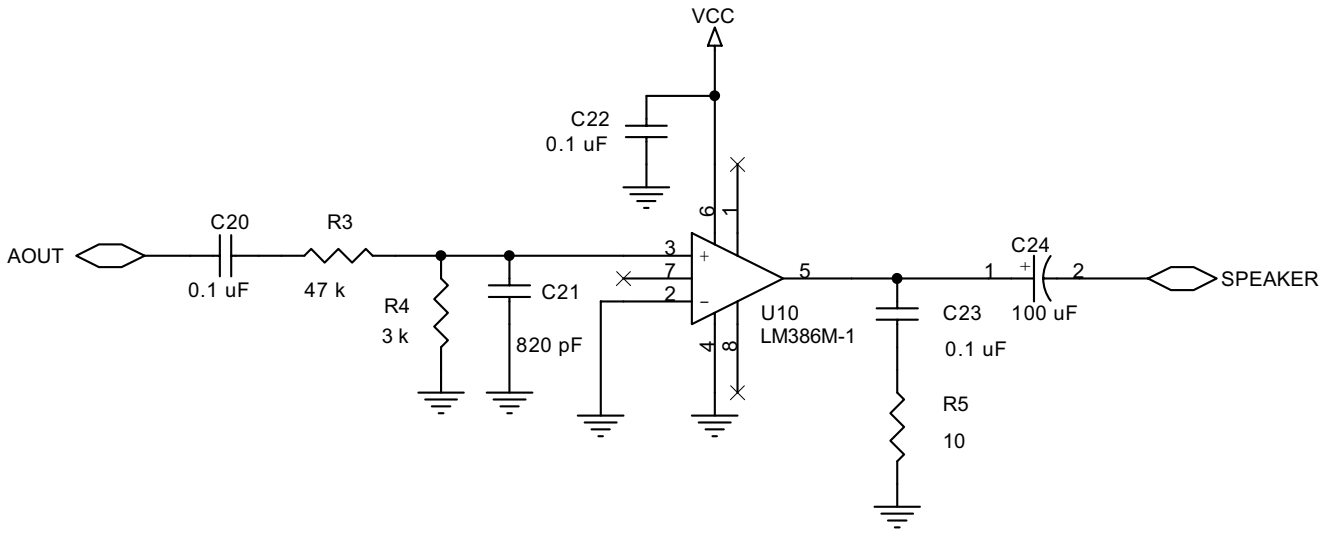


Figure 10. Audio Amplifier Schematic

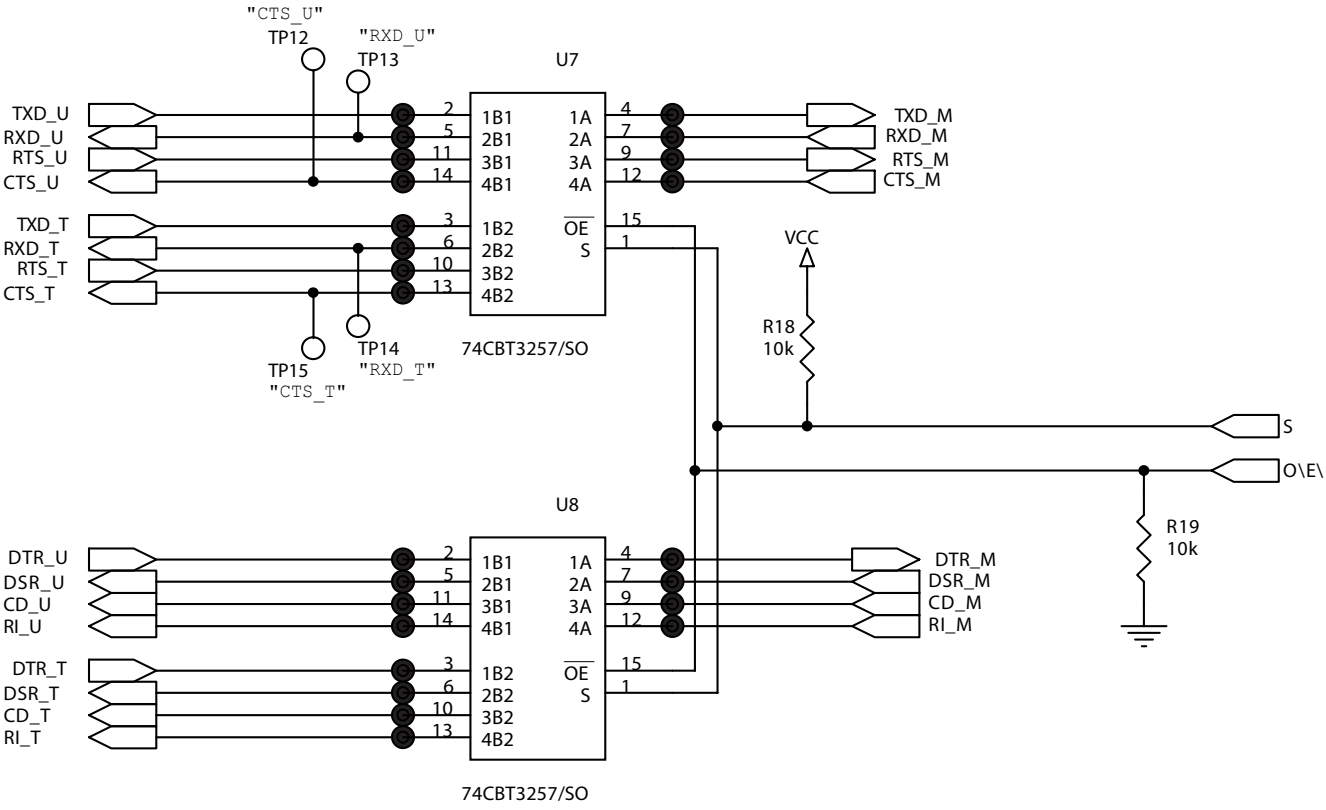


Figure 11. UART MUX Schematic

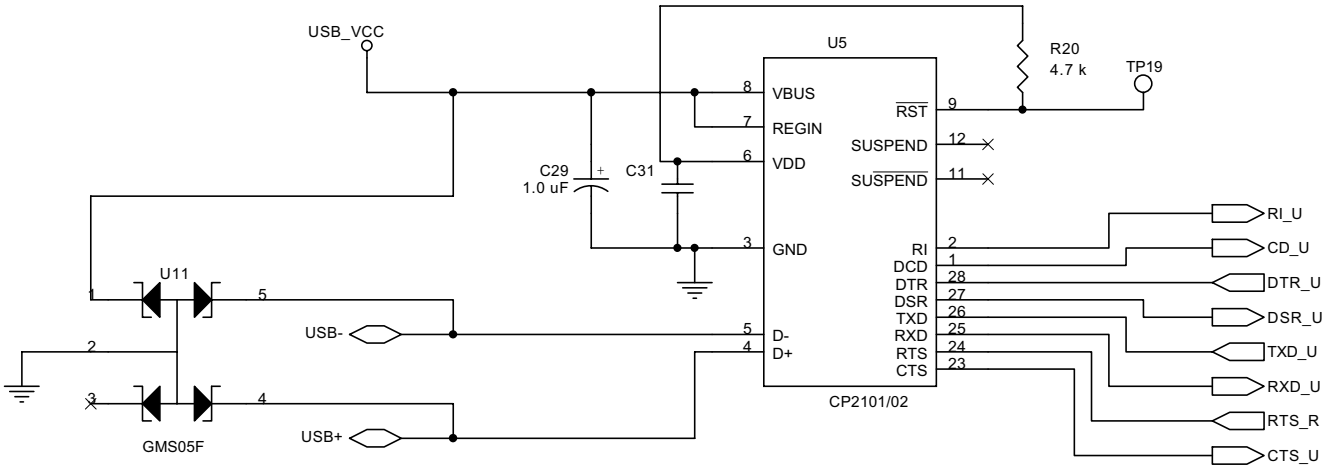


Figure 12. USB Interface Schematic

5. Bill of Materials: Si24xx Motherboard

Item	Quantity	Reference	Value	Rating	Tolerance	Foot Print	Dielectric	Manufacturer Number	Manufacturer
1	5	C1,C3,C12,C15,C29	1.0 uF	10 V	±10%	3216_EIAA	Tant	TA010TCM105-KAL	Venkel
2	4	C2,C4,C11,C13	470 pF	25V	±5%	CC0805	X7R	C0805C471J5GACTU	TTI
3	1	C5	10 nF	16 V	±10%	CC0603	X7R	C0603X7R160-103KNE	Venkel
4	1	C6	470 uF	25 V	±20%	C5X10MM-RAD	Electrolytic	UVX1E471MPA	NIC Components
5	2	C7,C9	0.1 uF	25 V	±10%	CC0805	X7R	C0805X7R250-104KNE	Venkel
6	2	C10,C8	10 uF	16V	±10%	CC1206	X7R	C1206X7R100-106KNE	Venkel
7	10	C14,C16,C17,C18,C19,C20,C22,C23,C31,C32	0.1 uF	16 V	±20%	CC0603	X7R	C0603X7R160-104MNE	Venkel
8	1	C21	820 pF	50 V	±5%	CC0805	NPO	C0805COG500-821JNE	Venkel
9	1	C24	100 uF	16 V	±10%	C2.5X6.3MM-RAD	Electrolytic	UVX1C101MEA1TD	Nichicon
10	4	D1,D2,D3,D4	DIODE	30 V	0.5 A	SOD123		MBR0530T1	Motorola
11	1	D5	BAT54C			SOT-23		BAT54C	Diodes Inc.
12	8	D6,D7,D8,D9,D10,D11,D12,D13	MMBZ15VDC			SOT-23		MMBZ15VDC	General Semiconductor
13	3	FB1,FB2,FB3	Ferrite Bead			RC0805		BLM21A601S	Murata
14	1	JP1	SOCKET 8X2			CONN2X8		SSW-108-01-T-D	Samtec
15	1	JP2	4X1 Socket			CONN4[6238]		SSW-104-01-T-S	Samtec
16	1	JP3	HEADER 8X2			CONN2X8		517-6121TN	Samtec
17	1	JP4	HEADER 5X2			CONN2X5[6238]RA		TSW-105-25-T-D-RA	Samtec
18	8	JP5,JP7,JP8,JP9,JP10,JP11,JP12,JP13	2X1 Header			CONN2[6040]		517-611TN	Berg
19	1	JP6	3x5 Header			CONN3X5			
20	1	J1	DB9-RS232_1			CONN9[6543]DBF		K22-E9S-030	Kycon
21	1	J2	RCA JACK			CONN2[12090]RCA		16PJ097	Mouser
22	1	J3	Power Connector			TB2[12065]TSA		506-5ULD02	Mouser
23	1	J4	2.1 mm Power jack			CONN3[175120]PWR		ADC-002-1	Adam Tech
24	1	J5	USB Type B			CONN-USB-B		897-30-004-90-000000	Mill-Max
25	1	LS1	Speaker			HCM12A[9052]		HCM1206A	JL World
26	1	RJ11	MTJG-2-64-2-2-1			RJ11[6238]DUAL		MTJG-2-64-2-2-1	Adam Tech
27	6	R2,R6,R7,R9,R15,R27	0	1/10 W		RC0603		CR0603-10W-000JT	Venkel
28	1	R3	47 k	1/10 W	±5%	RC0805		NRC10J473TR	NIC Components
29	1	R4	3 k	1/10 W	±5%	RC0805		NRC10J302TR	NIC Components
30	1	R5	10	1/10 W	±1%	RC0805		NRC10F10R0TR	NIC Components
31	2	R26,R8	1.3k	1/16 W	±5%	RC0603		CR0603-16W-132JT	Venkel
32	10	R10,R11,R12,R17,R18,R19,R28,R29,R30,R33	10k	1/16 W	±5%	RC0603		CR0603-16W-103JT	Venkel
33	1	R13	1.6	1/8 W	-0.05	RC1206		CR1206-8W-1R6JT	Venkel
34	1	R14	196k			RC0805		MCHRIDEZHFX1963E	Classic Comp
35	1	R16	110k			RC0805		CR21-114J-T	Classic Comp
36	1	R20	4.7 k	1/10 W	±5%	RC0805		NRC10J472TR	NIC Components
37	1	S1	SW PUSHBUTTON			SW4[6240]PB		101-0161	Mouser
38	3	TP1,TP2,TP18	Black Test Point			CONN1[6040]		151-203	Mouser
39	4	TP3,TP4,TP5,TP6	Stand off			MH-125			
40	8	TP7,TP8,TP10,TP11,TP12,TP13,TP14,TP15	Blue Test Point			CONN1[6040]		151-205	Mouser
41	2	TP16,TP17	Red Test Point			CONN1[6040]		151-207	Mouser
42	1	TP19	Blue Test Point			CONN1[6040]		151-207	Mouser
43	1	U1	7805			TO-220-LD		uA7805CKC	Texas Instruments
44	1	U2	TPS77601DR			SO8		TPS77601DR	Texas Instruments
45	1	U3	DS1818			SOT-23		DS1818-10	Dallas Semiconductor
46	1	U4	MAX3237			SOP65X780-28N		MAX3237E (Sipex SP3238E 2nd source)	Maxim
47	1	U5	CP2101/02			28-pin MLP		CP2101/02	Silicon Laboratories
48	2	U8,U7	74CBT3257/SO			SOP65X780-16N		SN74CBT3257DBR	Texas Instruments
49	1	U9	PDIP Socket			DIP8-SKT		210-93-308-41-001000	Mill-Max
50	1	U10	OP-AMP			SO8		LM386M-1	National Semi
51	1	U11	GMS05F			SOT-23-5N		GMS05F	Vishay

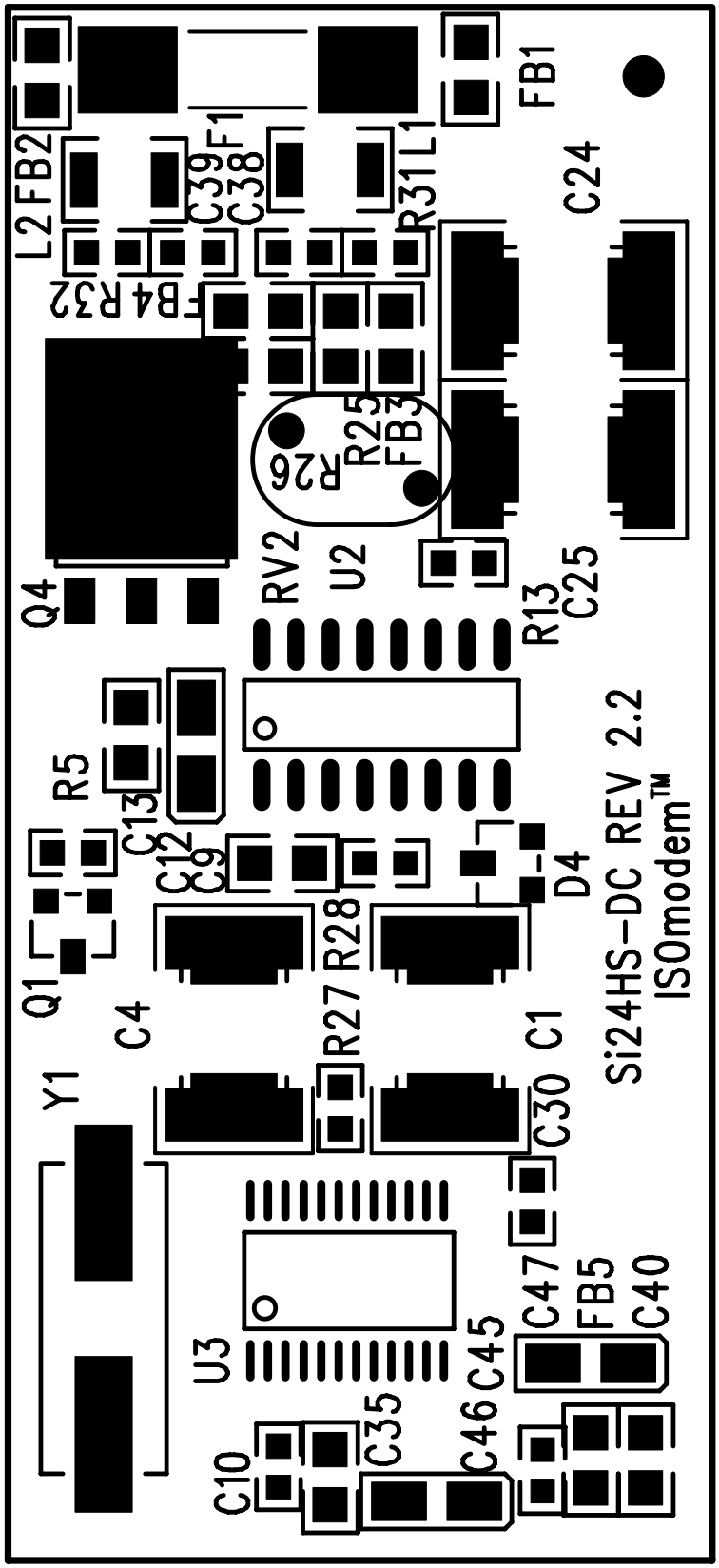


Figure 13. Daughter Card Component Side Silkscreen

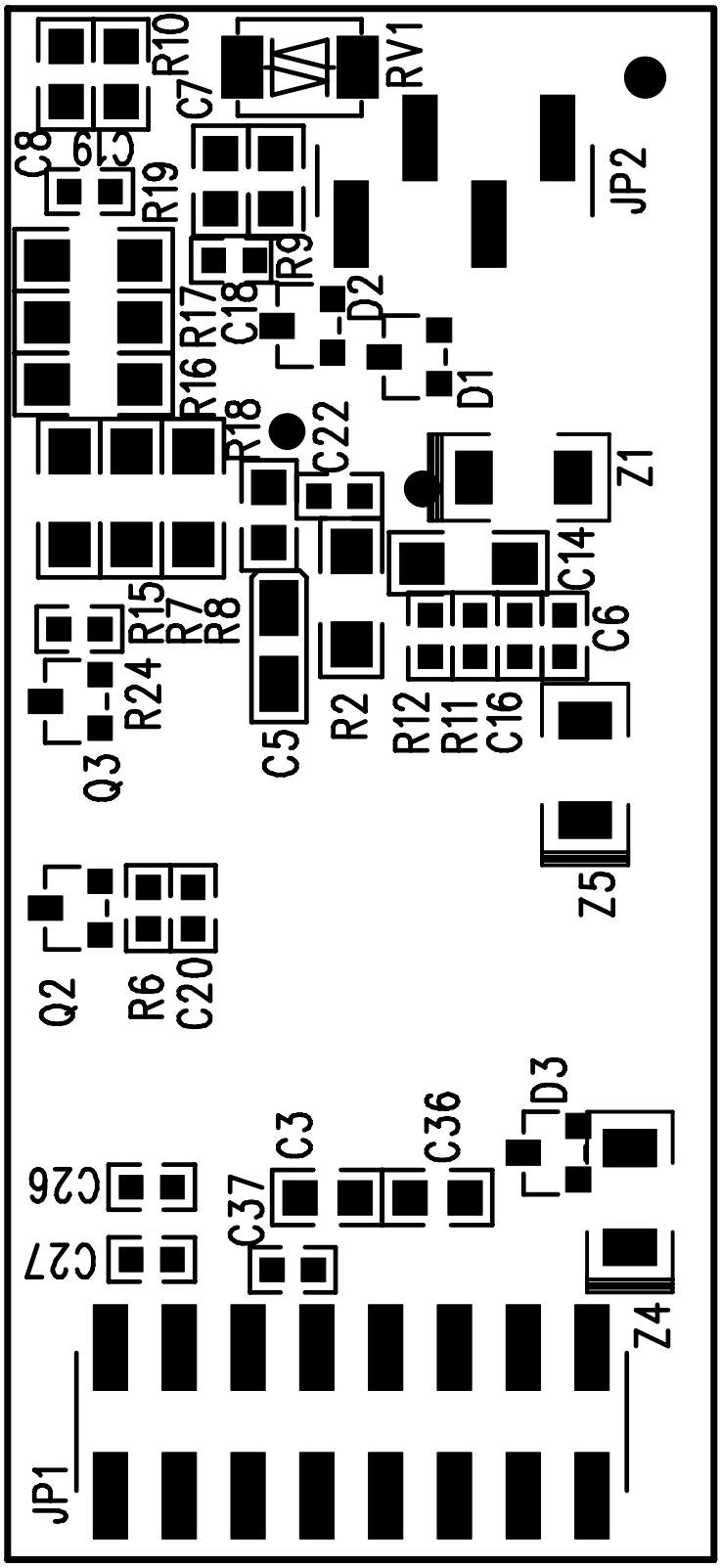


Figure 14. Daughter Card Solder Side Silkscreen

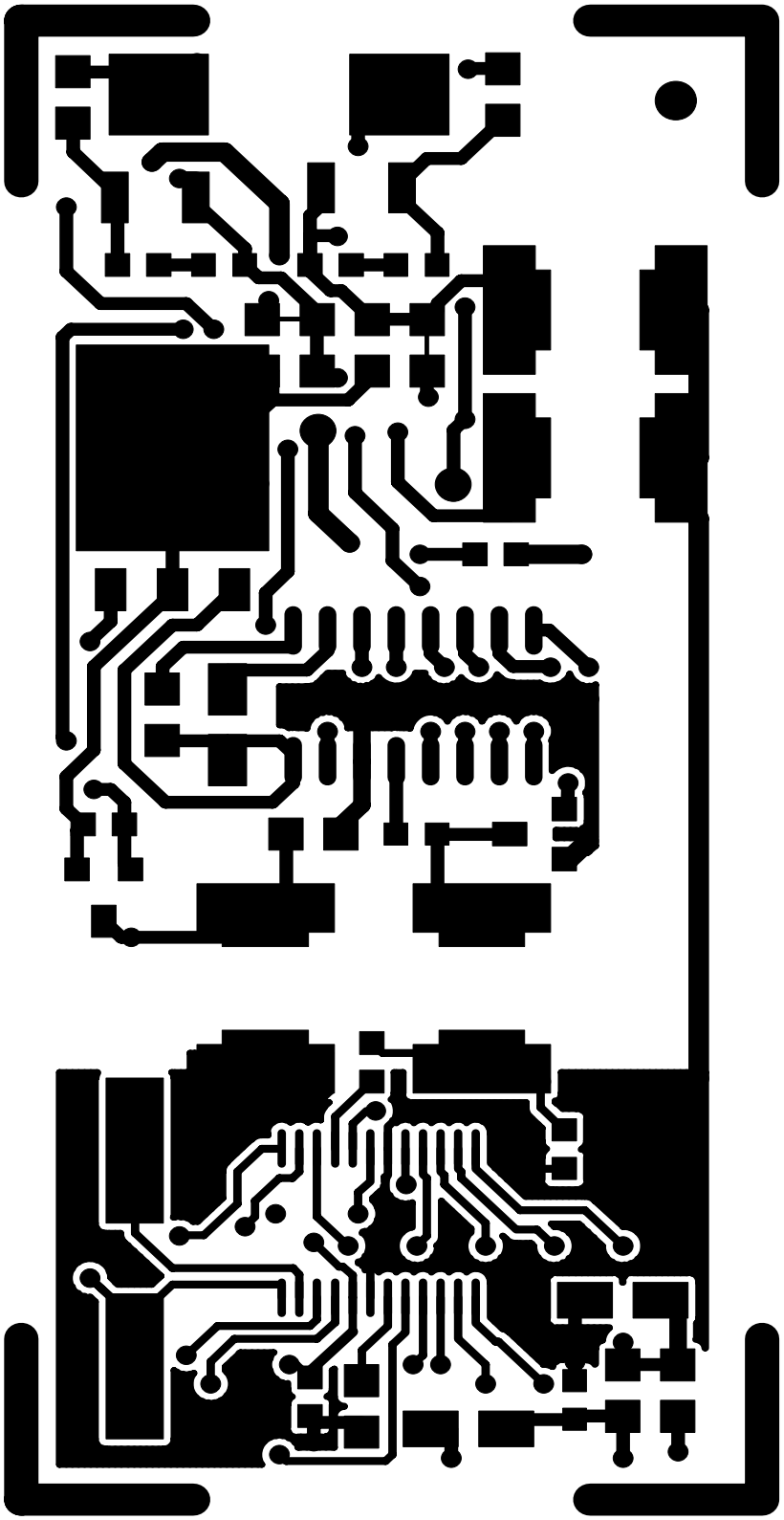


Figure 15. Daughter Card Component Side Layout

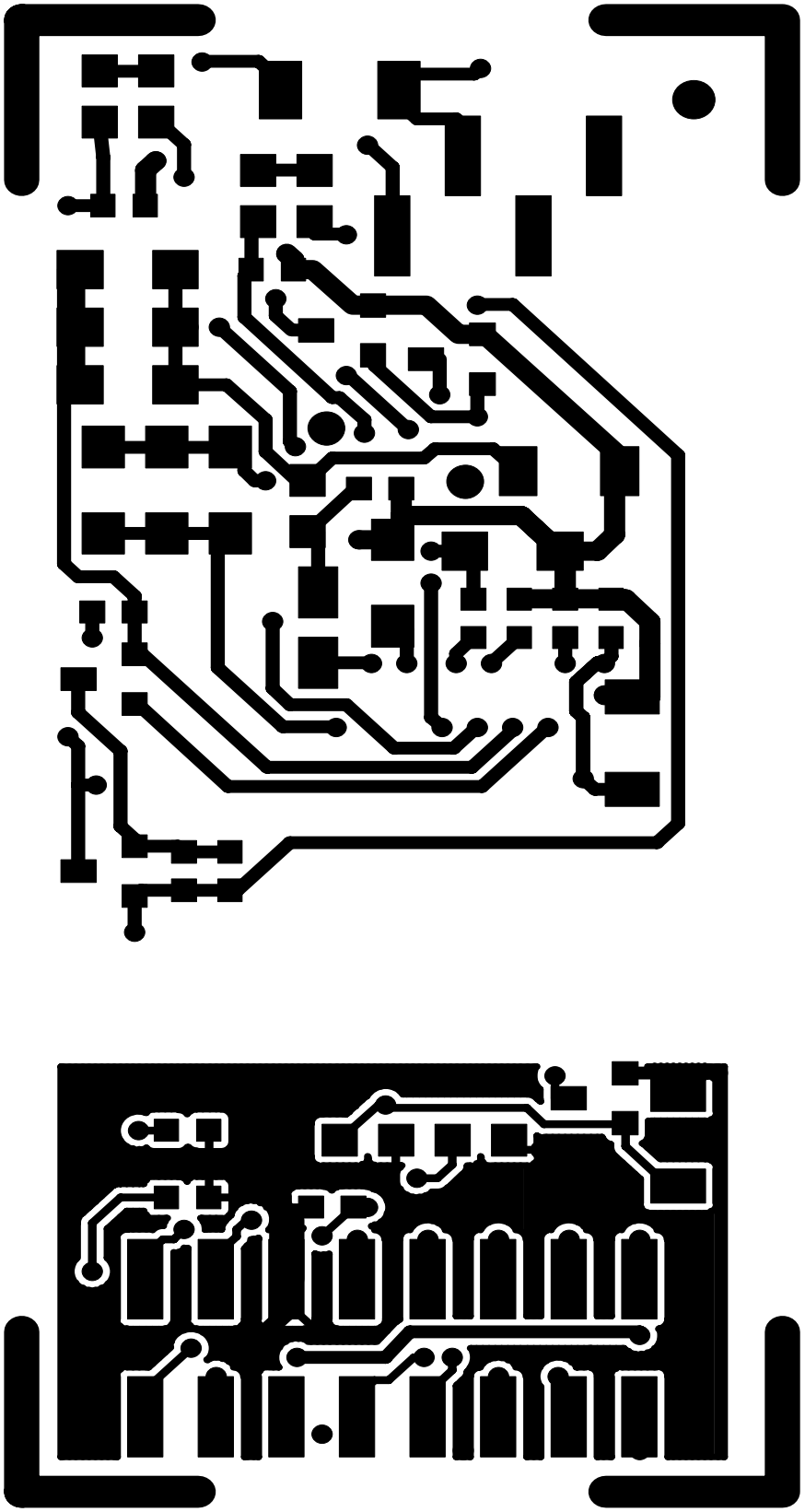


Figure 16. Daughter Card Solder Side Layout

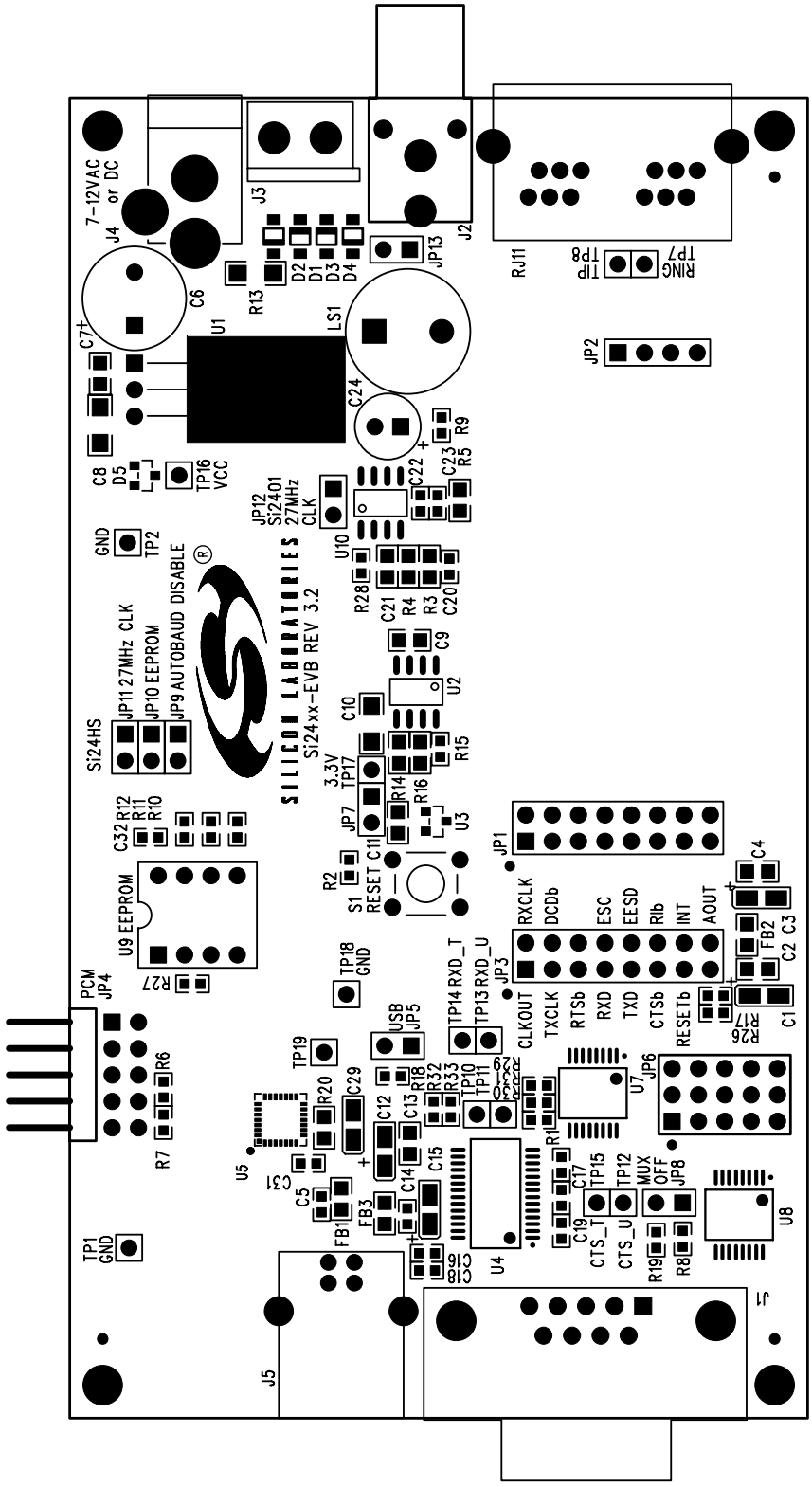
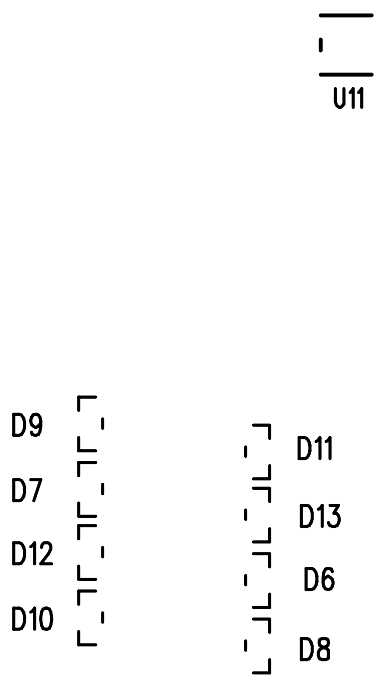


Figure 17. Motherboard Silkscreen



Si2401	Si24HS	Si2400	Function	RS-232
GPIO2 or NC	DCD or EESD	NC or GPIO2	Info	CD
NC or GPIO5	RI or TXCLK	GPIO3 or NC	Info	RI
GPIO3 or NC	ESC or X	GPIO1 or GPIO3	Ctrl	DTR
NC or GPIO1	RTS or RXCLK	CLKOUT or NC	Ctrl	RTS
NC or GPIO4	INT or AOUT	GPIO4 or AOUT	Info	DSR

JP6 recommended settings
Si2400: 2–3, 4–5, 8–9, 11–12, 13–14
Si24HS: 1–2, 4–5, 7–8, 10–11, 13–14
Si2401: 1–2, 5–6, 7–8, 11–12, 14–15
Si24HS alt: 1–2, 5–6, 7–8, 11–12, 14–15

Figure 18. Motherboard Silkscreen (Back Side)

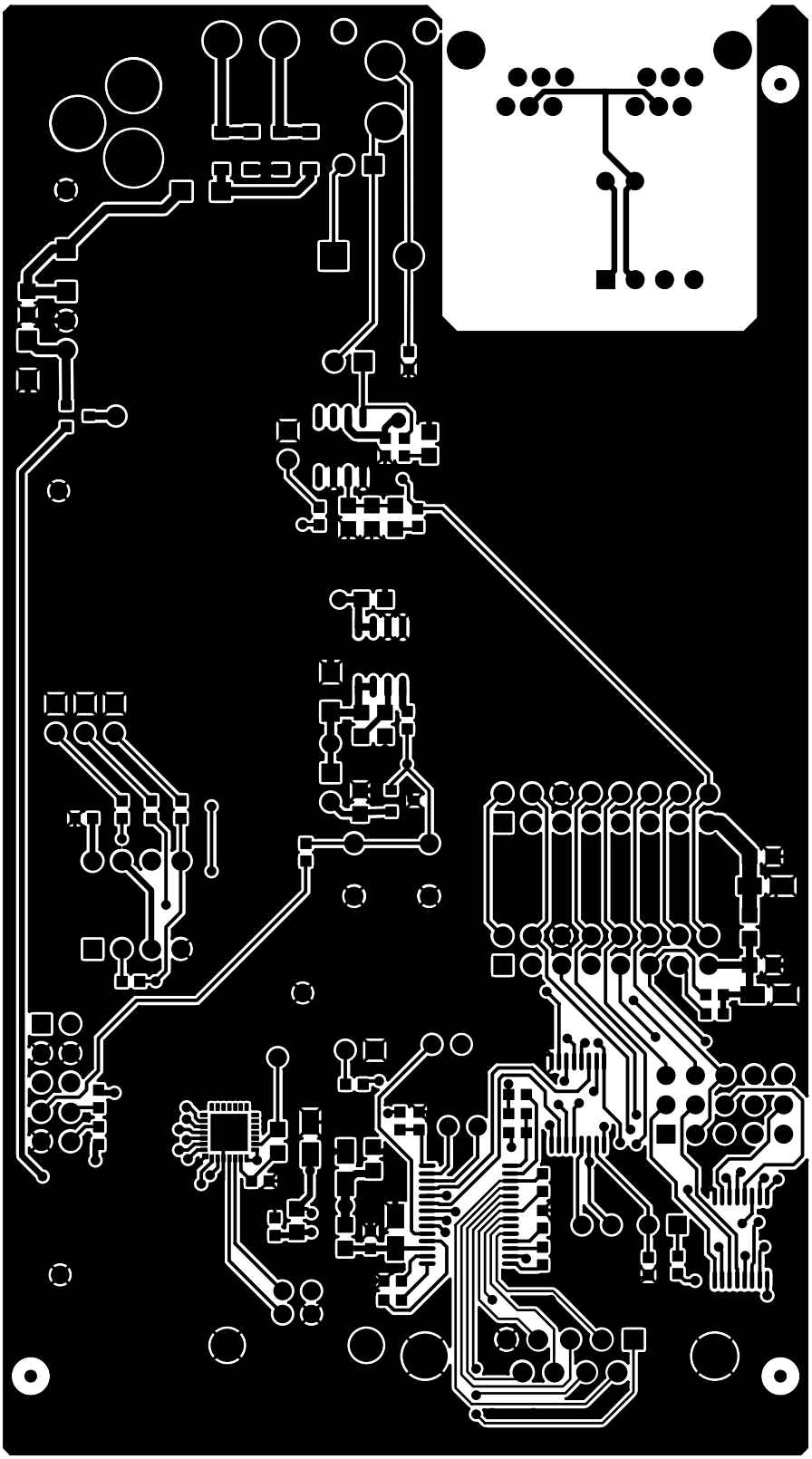


Figure 19. Motherboard Component Layout

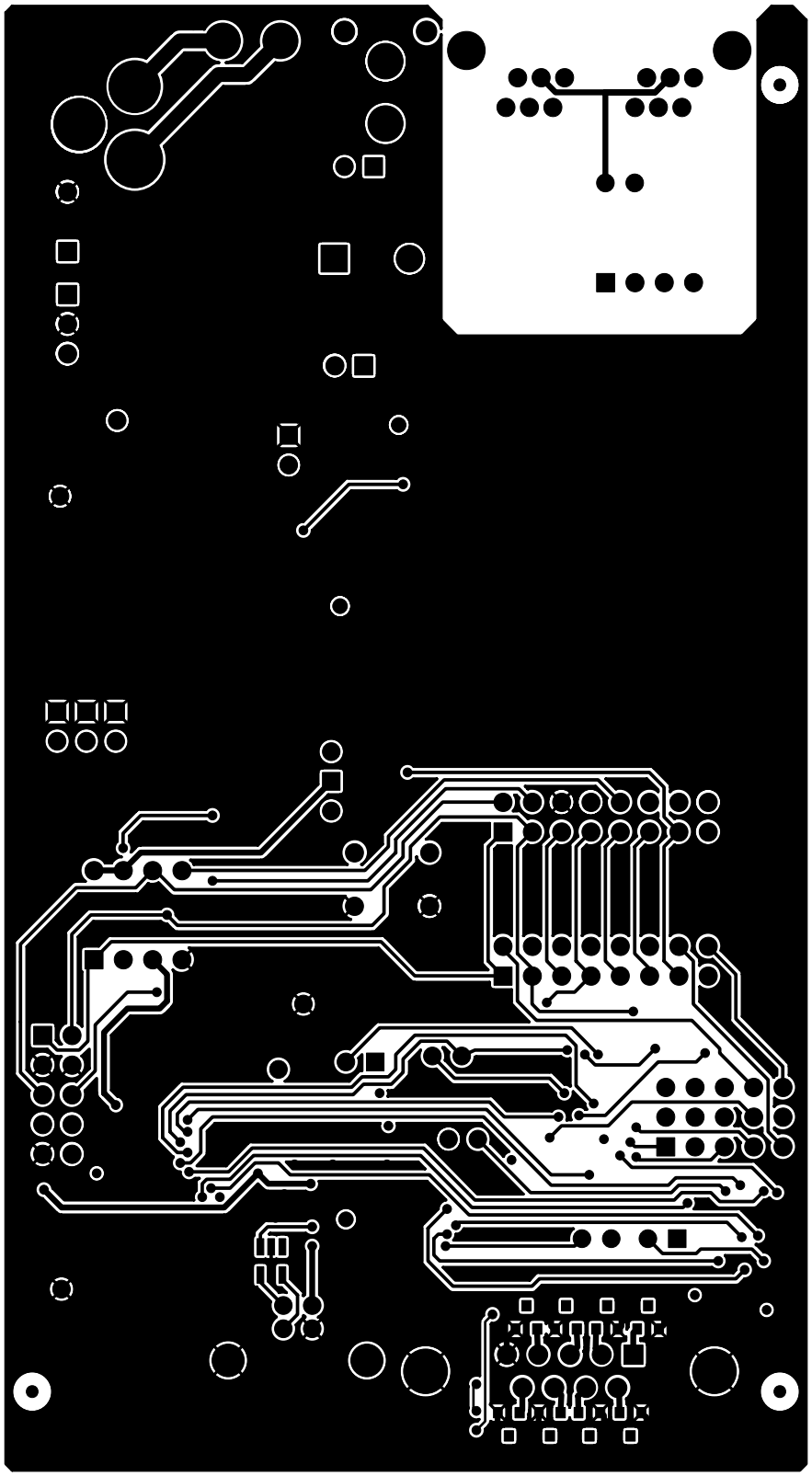


Figure 20. Motherboard Solder Side Layout

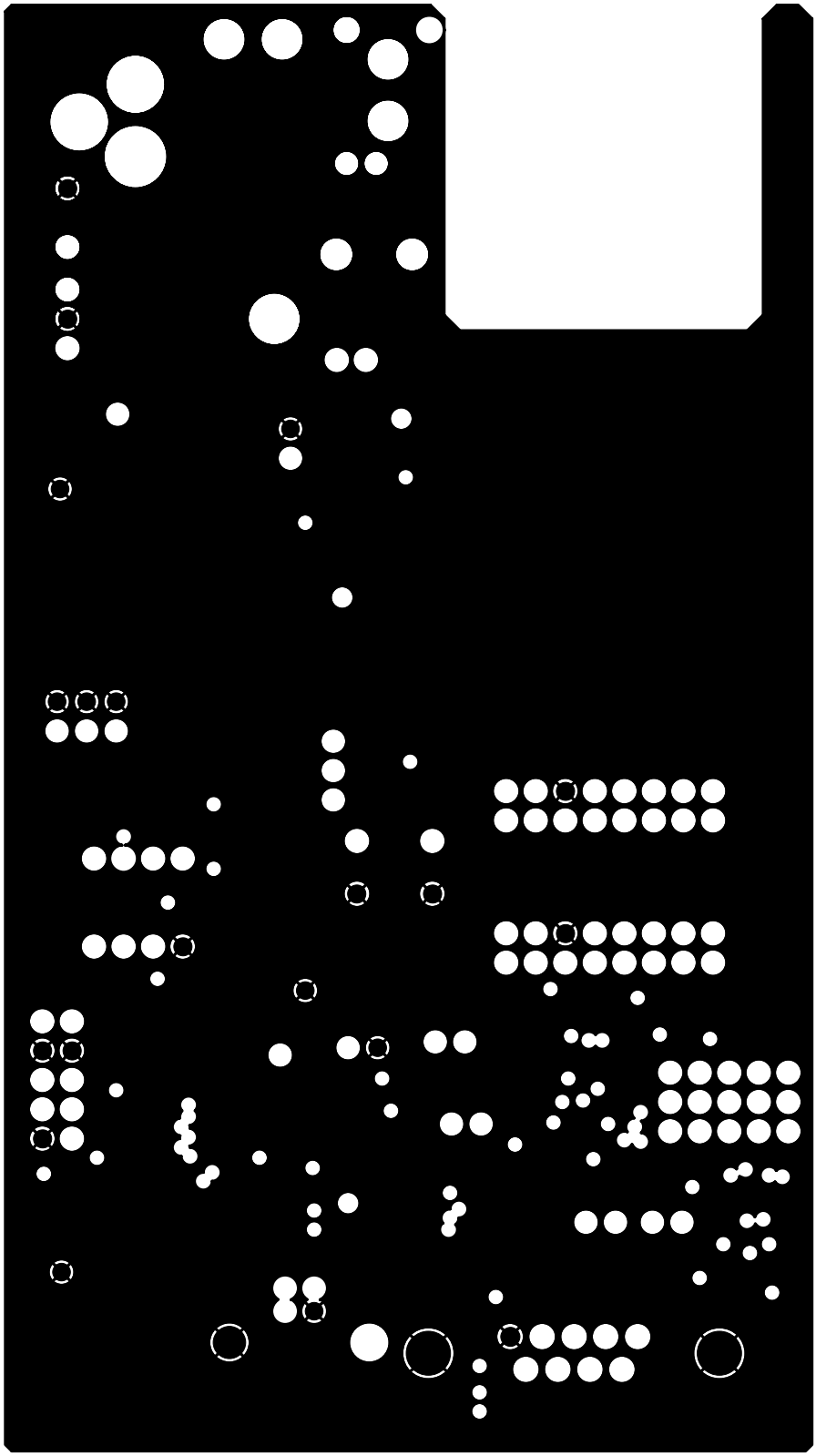


Figure 21. Motherboard Ground Plane Layout

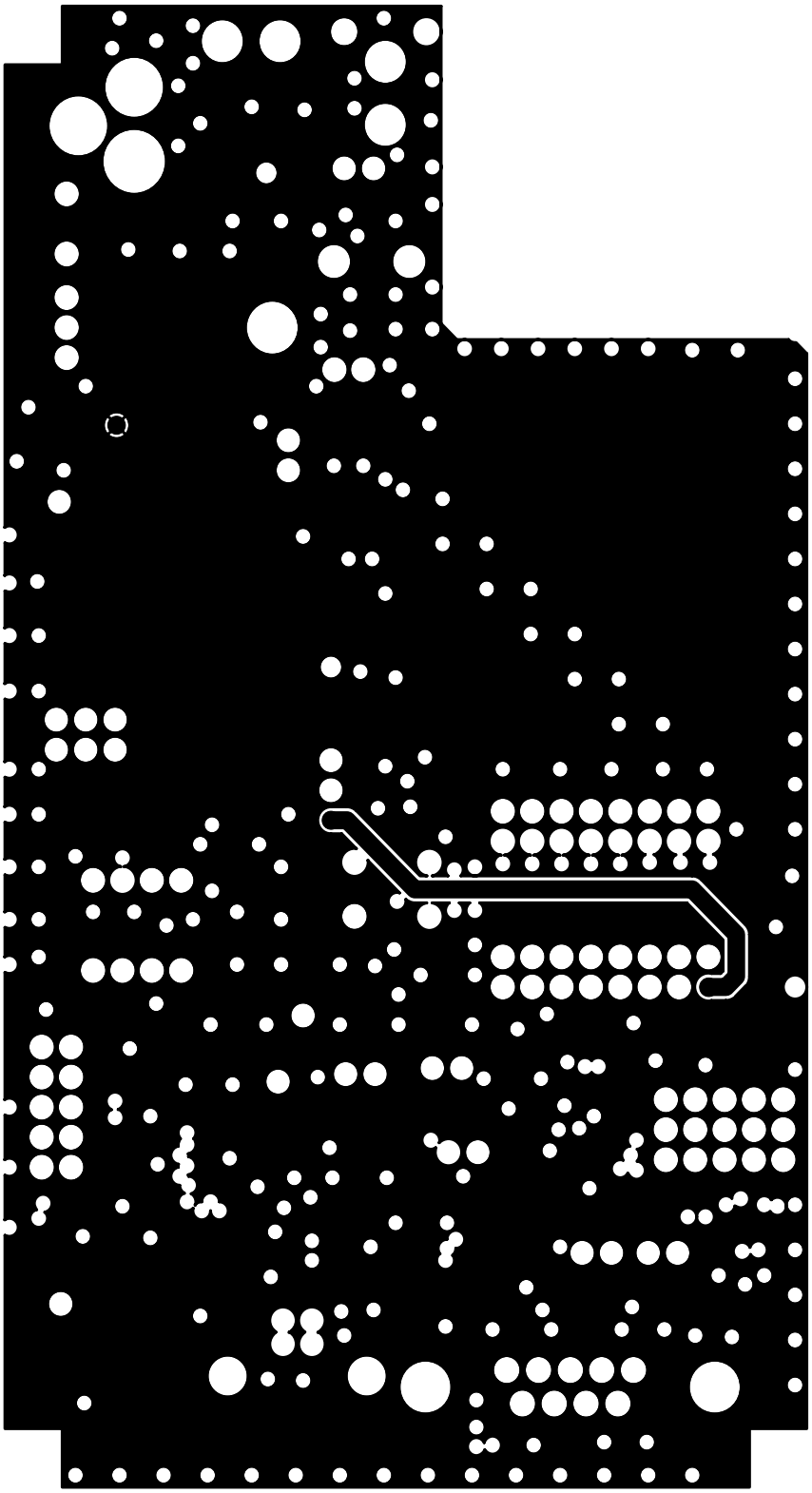


Figure 22. Motherboard Power Plane Layout

6. Complete Design Package on CD (see sales representative for details)

Silicon Laboratories can provide a complete design package of the Si2456/33/14/03URT-EVB including the following:

OrCad Schematics
Gerber Files
BOM
Documentation

Please contact your local sales representative or Silicon Laboratories headquarter sales for ordering information.

DOCUMENT CHANGE LIST

Revision 0.8 to Revision 0.9

- Updated Figure 1 on page 3
- Updated Figure 2 on page 3
- Updated Figure 3 on page 6

Revision 0.9 to Revision 1.0

- Updated Figures 1, 2, 3, 6, 7, 8, 9, 10, 11, 12, 17, 18, 19, 20, 21, and 22.
- Updated "Bill of Materials: Si24xx Motherboard," on page 17.

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