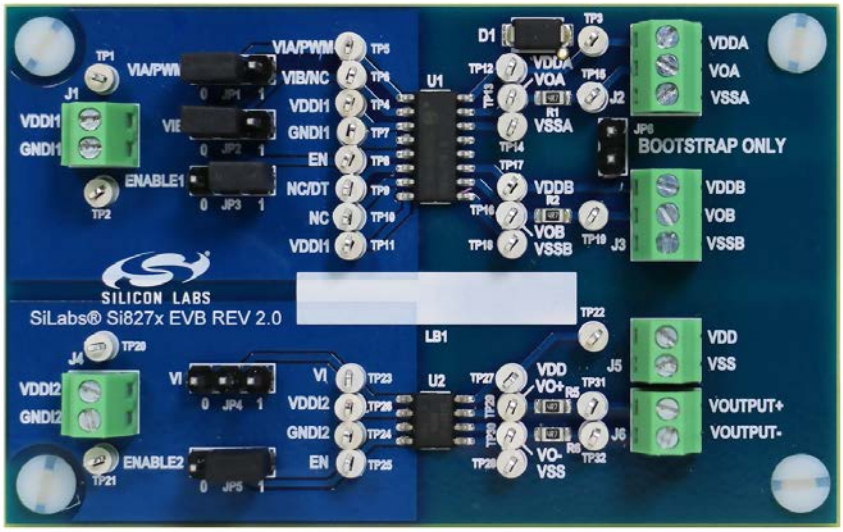
UG186: Si827x-EVB User's Guide

The Si827x isolated gate drivers are ideal for driving power switches used in a wide variety of power supply, inverter, and motor control applications, offering longer service life and dramatically higher reliability compared to opto-coupled gate drivers. The Si827x isolated gate drivers utilize Silicon Laboratories' proprietary silicon isolation technology supporting up to 2.5 kV_{RMS} withstand voltage per UL1577 and VDE0884. This technology enables industry-leading common-mode transient immunity (CMTI), tight timing specifications, reduced variation with temperature and age, better part-to-part matching, and extremely high reliability. It also offers unique features, such as separate pull-up/down outputs, driver shutdown on UVLO fault, and precise dead time programmability. Driver outputs can be grounded to the same or separate grounds or connected to a positive or negative voltage. The TTL level compatible inputs with >400 mV hysteresis are available in individual control input (Si8271/2/3/5) or PWM input (Si8274) configurations. High integration, low propagation delay, small installed size, flexibility, and cost-effectiveness make the family ideal for a wide range of isolated MOSFET/IGBT/SiC/GaN gate drive applications.

The Si827x evaluation board allows designers to evaluate Silicon Lab's Si827x family of high CMTI performance ISOdrivers. The boards come populated with the Si8271 and either the Si8273, Si8274, or Si8275 version of the family. The board includes screw terminals for quick evaluation of the devices' key parameters and also includes test points on each devices' pins to accommodate direct connection to the designer's end system. For more ISOdriver information, visit Silicon Labs web site at www.silabs.com/isolation. The product data sheet and numerous application notes can be referenced to help facilitate designs.

KIT CONTENTS

- Si827x-based evaluation board (Si827x-EVB)
- Si8271, 1-input, 4 A, 2.5 kV_{RMS} Single ISOdriver, and one of the following:
  - Si8273, 2-input, 4 A, 2.5 kV_{RMS} High-Side/Low-Side ISOdriver
  - Si8274, PWM-input, 4 A, 2.5 kV_{RMS} High-Side/Low-Side ISOdriver
  - Si8275, 2-input, 4 A, 2.5 kV_{RMS} Dual ISOdriver



1. Required Equipment

The following equipment is required to demonstrate the evaluation board:

- 1 digital multimeter
- 1 oscilloscope (at least 2 channel)
- 1 dual dc power supply: 0–5 V and 0–15 V (or 2 single supplies)
- 1 function generator
- Assorted cables, leads and probes as necessary to connect equipment to EVB
- Si827x Evaluation Board (board under test)
- Si827x Evaluation Board User's Guide (this document)

Note: Please note the voltage rating for the prepopulated components in the Si827x BOM section of this document before applying power to the ISOdriver and customer-specific output power stage. Applying a voltage to a component that is higher than its rating can cause permanent device damage. If the installed components do not meet the user's requirements, these components need to be replaced before proceeding.

2. Si827x ISOdriver Board Setup and Demo Test

2.1 EVB Demo/Test

To run the demo, follow the instructions below. Refer to Figure 3.1 Si827x Evaluation Board Primary Silkscreen on page 6 and Figure 3.2 7 on page 7 as necessary.

2.2 DC Supply Configuration

1. Set one supply to output 5 VDC.
2. Turn OFF the supply and connect the positive lead to VDDI (J1 pin1 or TP1).
3. Connect the negative lead to GNDI (J1 pin 2 or TP2).
4. Turn ON the dc power supply.
5. Ensure that the current draw is less than 25 mA. If it is larger, this indicates that either the board or Si827x has been damaged or the supply is connected backwards.
6. Set the other supply to output 15 VDC.
7. Turn OFF the supply and connect the positive lead to VDDA (J2 pin 3 or TP3).
8. Connect the negative lead to VSSA (J2 pin 1 or TP15).
9. Turn ON the supply.
10. Ensure that the current draw is less than 100 mA. If it is larger, this indicates that either the board or Si827x has been damaged or the supply is connected backwards.

2.3 Function Generator

1. Turn ON the function generator with the output disabled.
2. Adjust its output to provide a 500 kHz, 0 to 5 V peak square wave (50 percent duty cycle) to its output.
3. Connect the output of the generator to VIA/PWM (JP1 pin2).
4. If this is a board with VIB, apply a jumper to JP2 between pins 2 and 3.
5. Make sure jumper JP3 has a shunt between pins 1 and 2 to enable the device.
6. Enable the output of the waveform generator.

2.4 Oscilloscope Setup

To set up the oscilloscope, perform the following steps:

1. Turn ON the oscilloscope.
2. Set the scope to Trigger on CH1 and adjust the trigger level to approximately 2 V.
3. Set CH1 to 2 V per division and CH2 to 5 V per division.
4. Adjust the seconds/division setting to 500 ns/division.
5. Connect the scope channel 1 probe to VIA/PWM. Ground the probe to GNDI.
6. Connect Channel 2 probe to VOA (J2 pin2 or TP15). Ground the probe to VSSA.
7. Adjust the vertical position of each channel to properly view each channel as shown in the figure below.

A 500 kHz square wave should display on Channel 1 of the scope for the input and a 15 V version should display on Channel 2, as shown in the following figure.

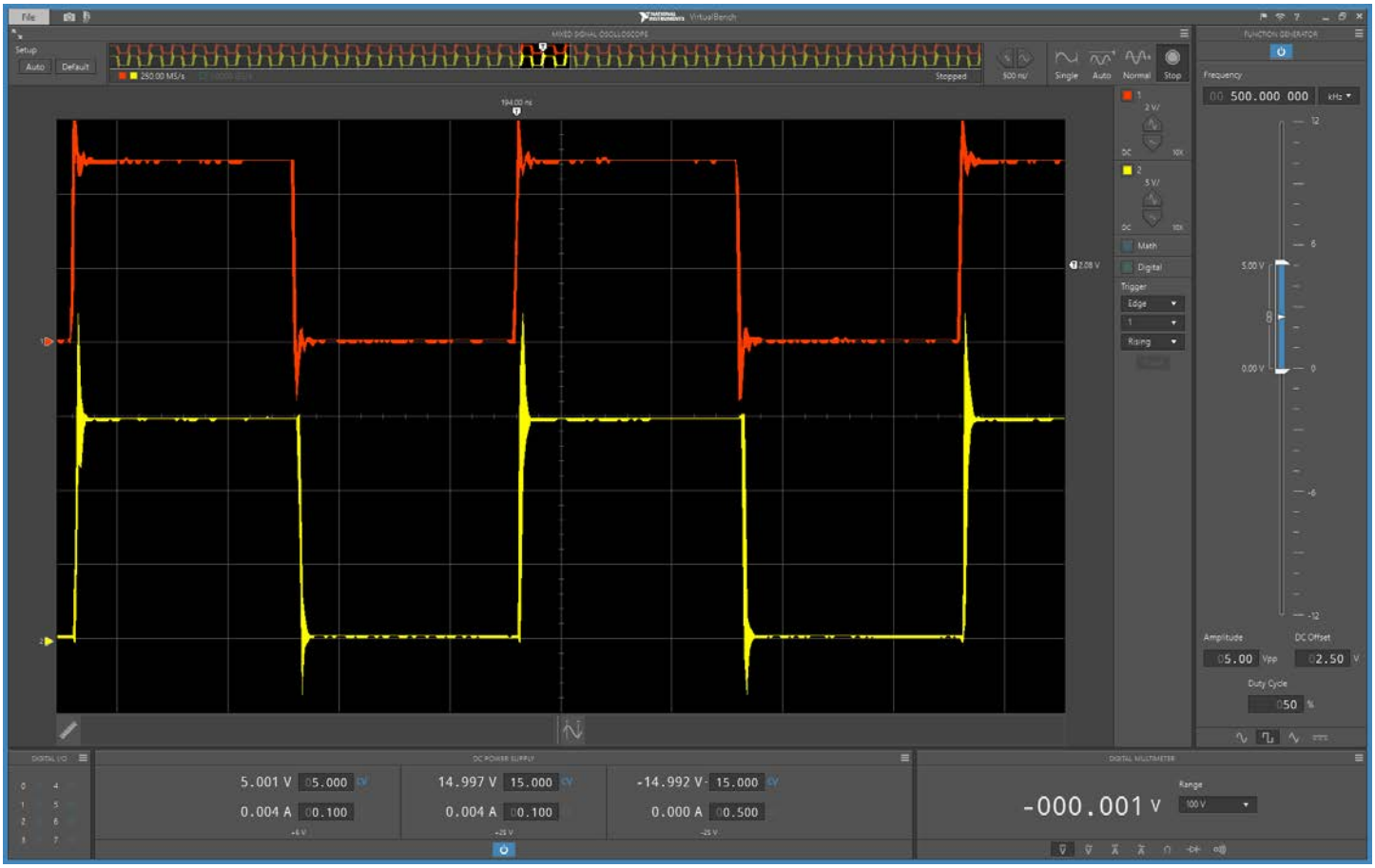


Figure 2.1. 500 kHz Square Wave

2.5 Repeat for Second Channel

1. Disable the function generator output.
2. Turn OFF the 15 V supply.
3. Disconnect 15 V supply from VDDA/VSSA.
4. Connect the 15 V supply to VDDB and VSSB (J3 pins 3 and 1 or TP17 and TP18).
5. Move the channel 2 scope probe to VOB/VSSB (J3 pin 2/1 or TP19/TP18).
6. Move the function generator to VIB (JP2 pin 2 or TP6). NOTE: If this board is populated with the Si8274 device, leave the function generator connected to VIA/PWM. Otherwise, move the shunt from JP2 to JP1.
7. Turn ON the dc supply.
8. Ensure that the current draw is less than 100 mA. If it is larger, this indicates that either the board or Si827x has been damaged or the supply is connected backwards.
9. Enable the function generator output.
10. The scope display should show both the input and output waveforms as before. NOTE: If this board is populated with the Si8274 device, the output waveform will be inverted with respect to the input.

2.6 Test the Si8271

1. Disable the function generator output.
2. Turn OFF the 15 V supply.
3. Turn OFF the 5 V supply.
4. Disconnect 15 V supply from VDDA/VSSA.
5. Connect the 15 V supply to VDD and VSS (J5 pins 2 and 1 or TP22 and TP28).
6. Connect the 5 V supply to VDDI2 and GNDI2 (J4 pins 1 and 2 or TP20 and TP21).
7. Short the VOUTPUT+ and VOUTPUT- pins together (J6 pins 1 and 2) and connect them to the channel 2 scope probe.
8. Ground the probe at VSS (J5 pin 1 or TP28).
9. Move the function generator to VI (JP4 pin 2 or TP23).
10. Move the channel 1 scope probe to be connected to the same points as the function generator.
11. Make sure jumper JP5 has a shunt between pins 1 and 2 to enable the device.
12. Turn ON the dc supplies.
13. Ensure that the current draw is less than 100 mA on the 15 V supply and 25 mA on the 5 V supply. If either is larger, this indicates that either the board or Si827x has been damaged or the supply is connected backwards.
14. Enable the function generator output.
15. The scope display should show both the input and output waveforms as before.

3. Si827x-EVB Power and Jumper Connection Descriptions

The power and jumper connections are summarized here:

- J1 Screw terminal block used to connect external power supply for input side of Si827x.
- J2 Screw terminal block used to connect external power supply for output side A as well as bring out output A of Si827x.
- J3 Screw terminal block used to connect external power supply for output side B as well as bring out output B of Si827x.
- J4 Screw terminal block used to connect external power supply for input side of Si8271.
- J5 Screw terminal block used to connect external power supply for output side of Si8271.
- J6 Screw terminal block used to bring out V+ and V– outputs of Si8271.
- JP1 Header to facilitate connection of external signal for VIA/PWM of Si827x.
- JP2 Header to facilitate connection of external signal for VIB of Si827x (not populated for Si8274 version of EVB).
- JP3 Header to facilitate connection of external signal for ENABLE of Si827x.
- JP4 Header to facilitate connection of external signal for VI Si8271.
- JP5 Header to facilitate connection of external signal for ENABLE of Si8271.
- JP6 Header to facilitate evaluation of BOOTSTRAP circuitry.

3.1 Voltage and Current Sense Test Points

The Si827x evaluation board has several test points. These test points correspond to the respective pins on the Si827x integrated circuits as well as other useful inspection points. See the figure below for a silkscreen overview. See the schematic drawings for more details.

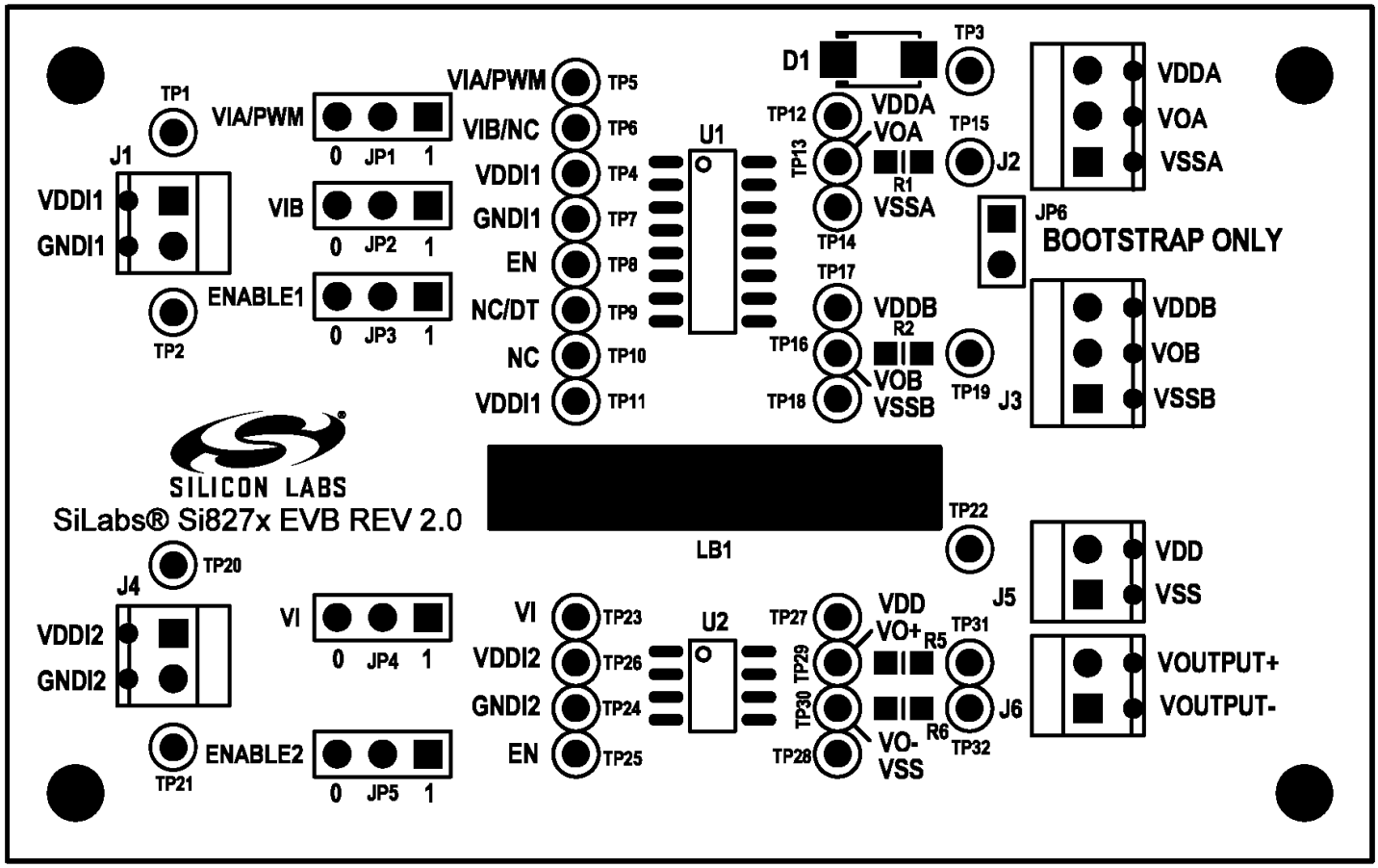


Figure 3.1. Si827x Evaluation Board Primary Silkscreen

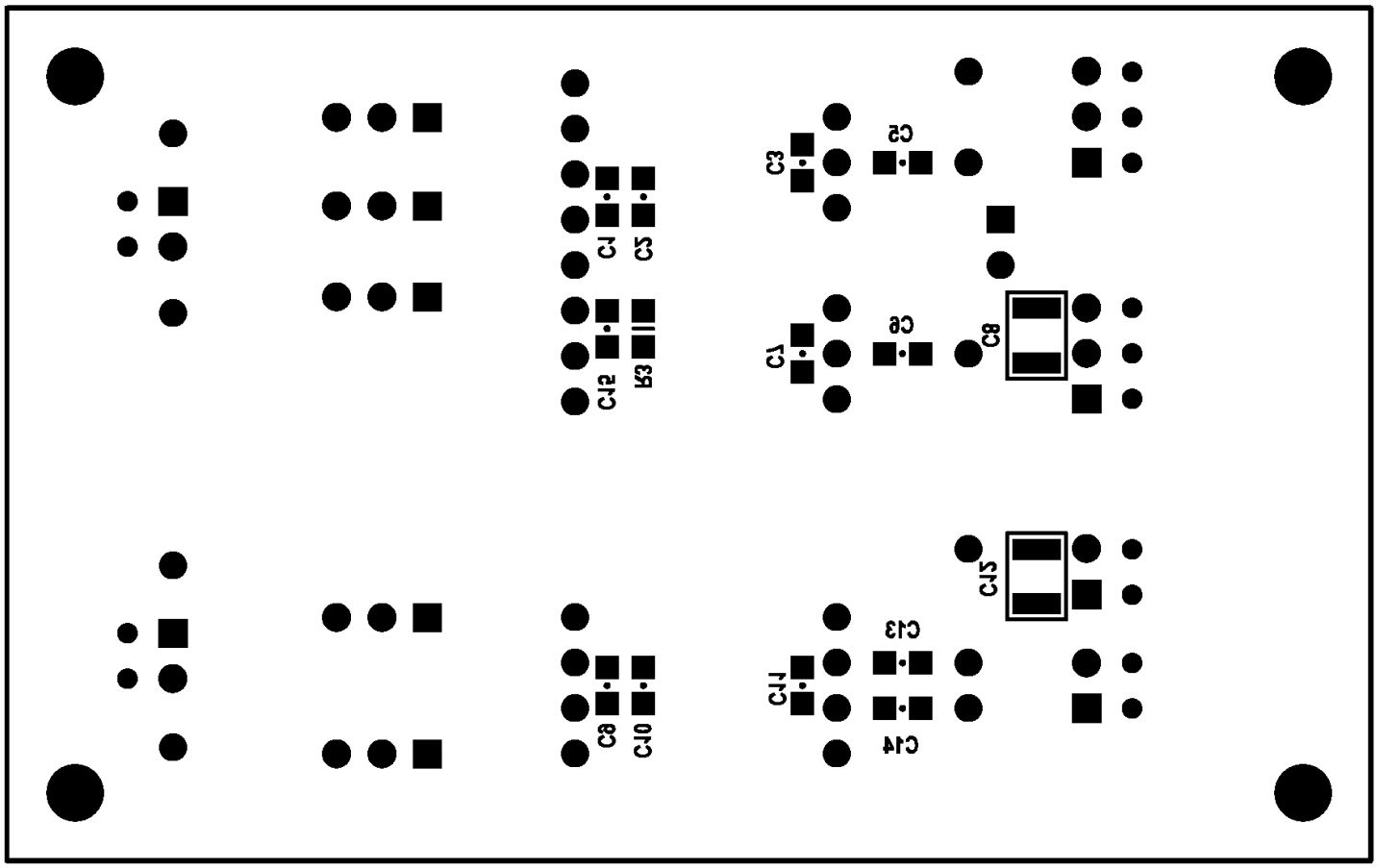


Figure 3.2. Si827x Evaluation Board Secondary Silkscreen

4. Si827x Evaluation Board Schematics

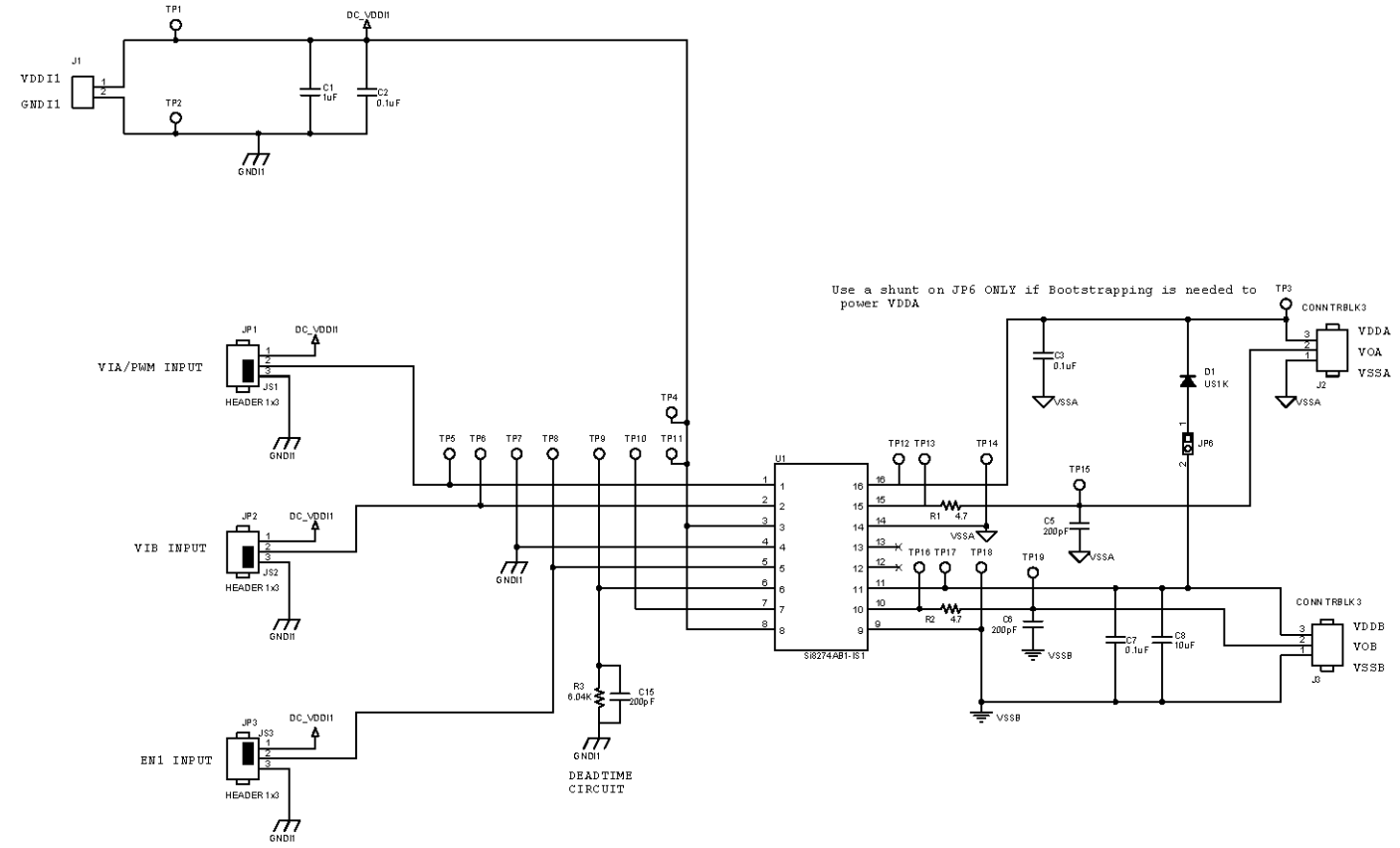


Figure 4.1. Si827x Evaluation Board Schematic (1 of 2)

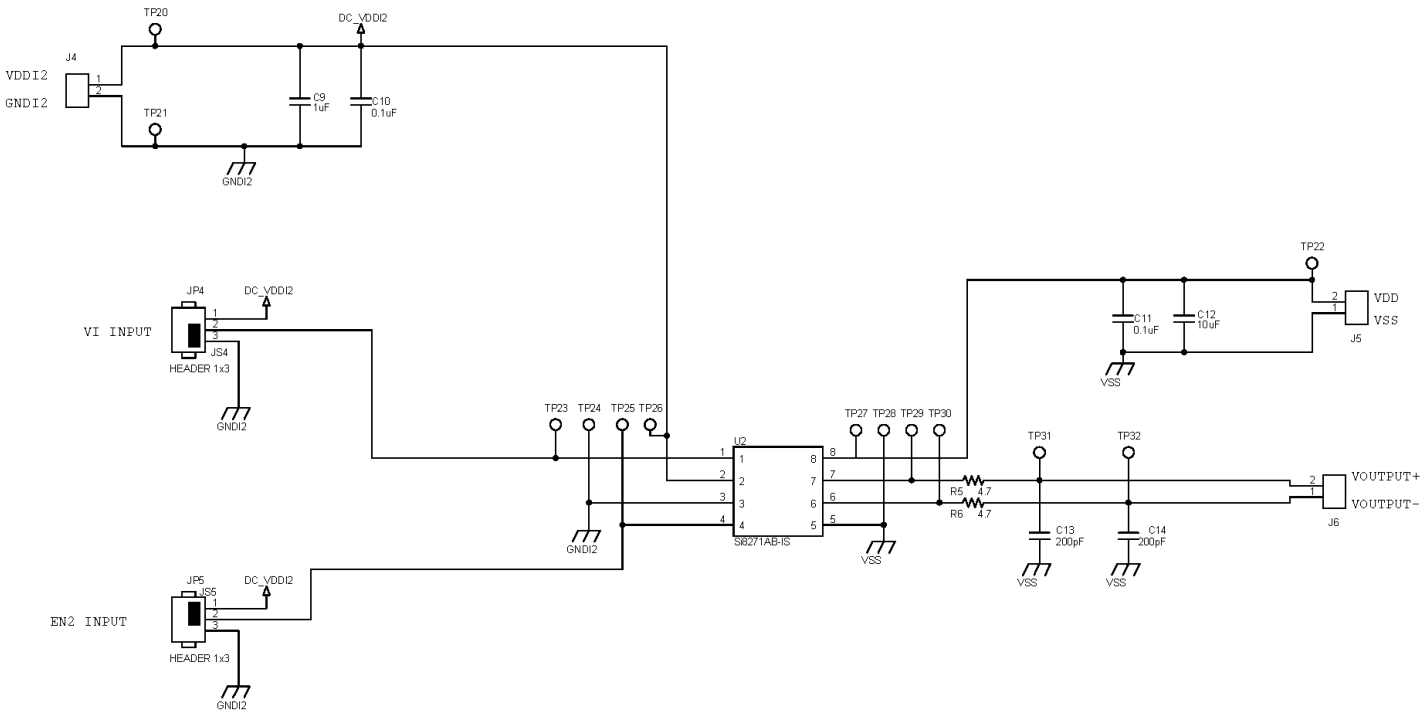


Figure 4.2. Si827x Evaluation Board Schematic (2 of 2)

5. Si827x Evaluation Board Layout

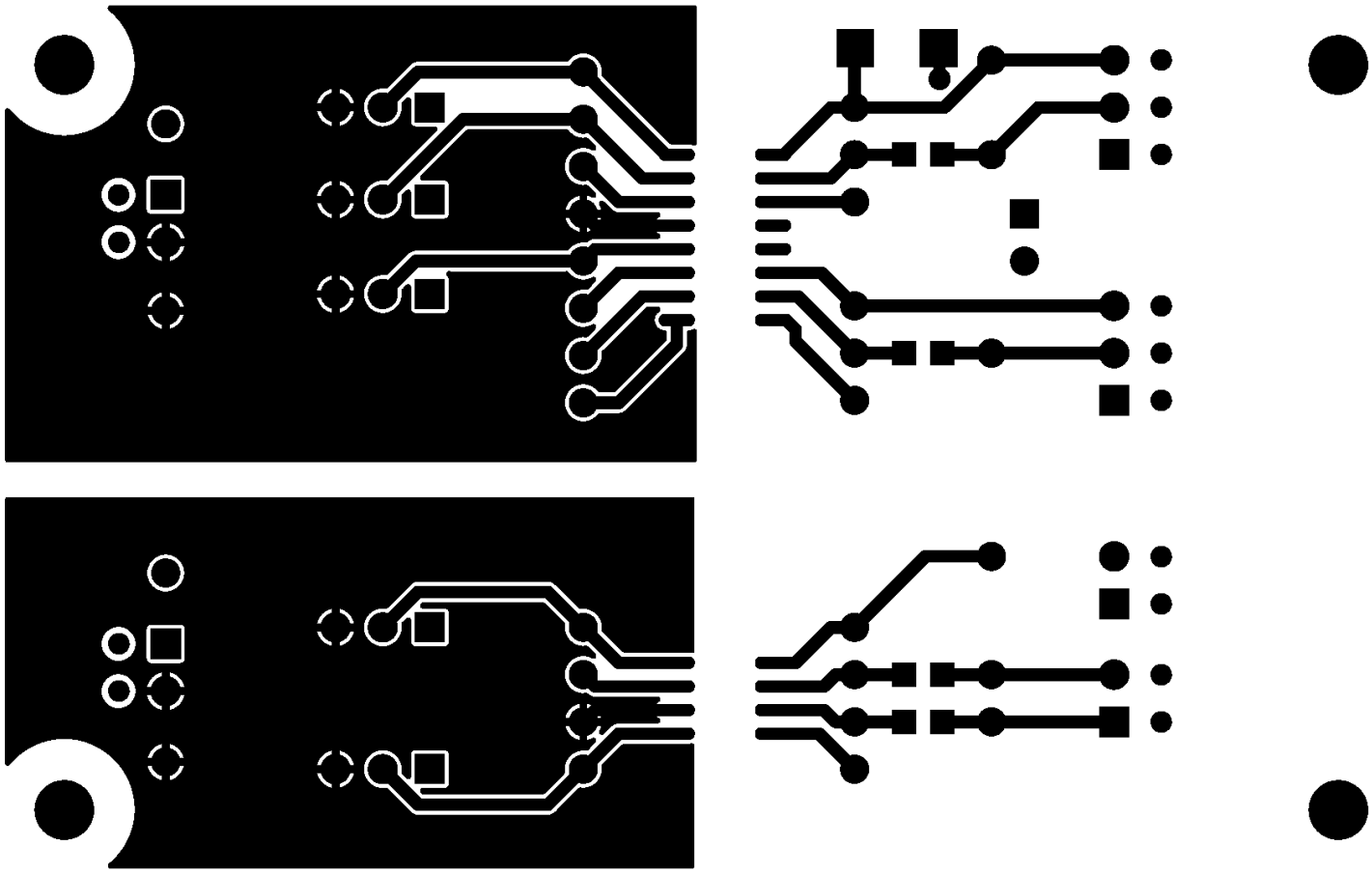


Figure 5.1. Si827x Layer 1: Primary Side

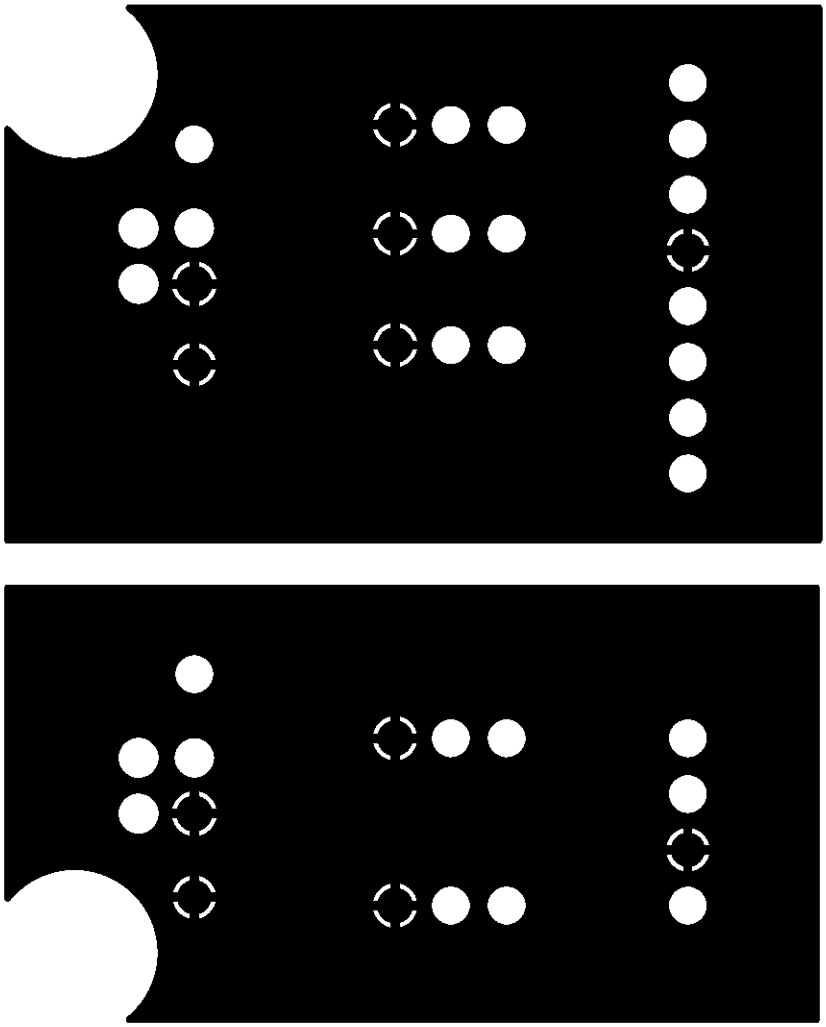


Figure 5.2. Si827x Layer 2: Ground Plane

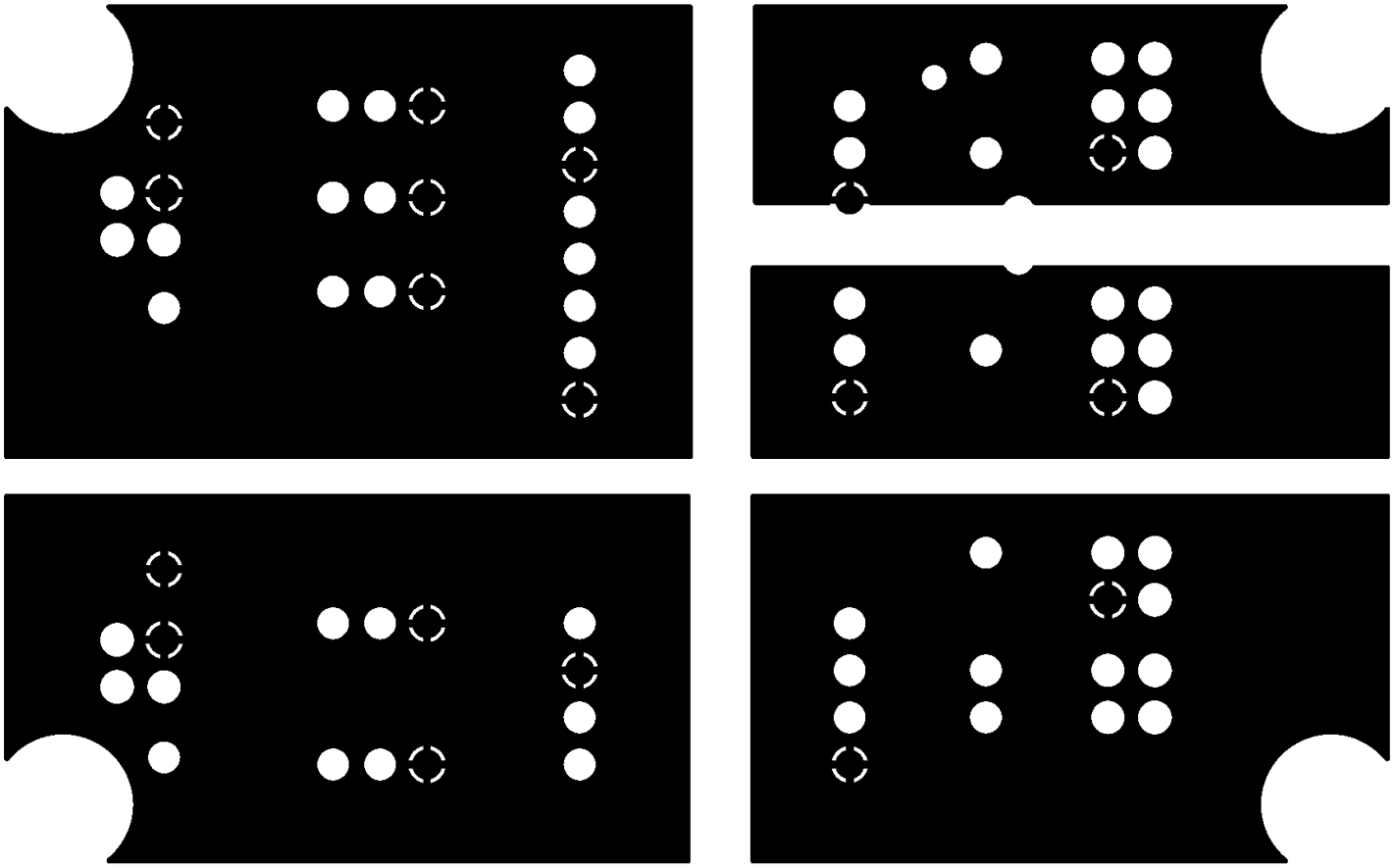


Figure 5.3. Si827x Layer 3: Power Plane

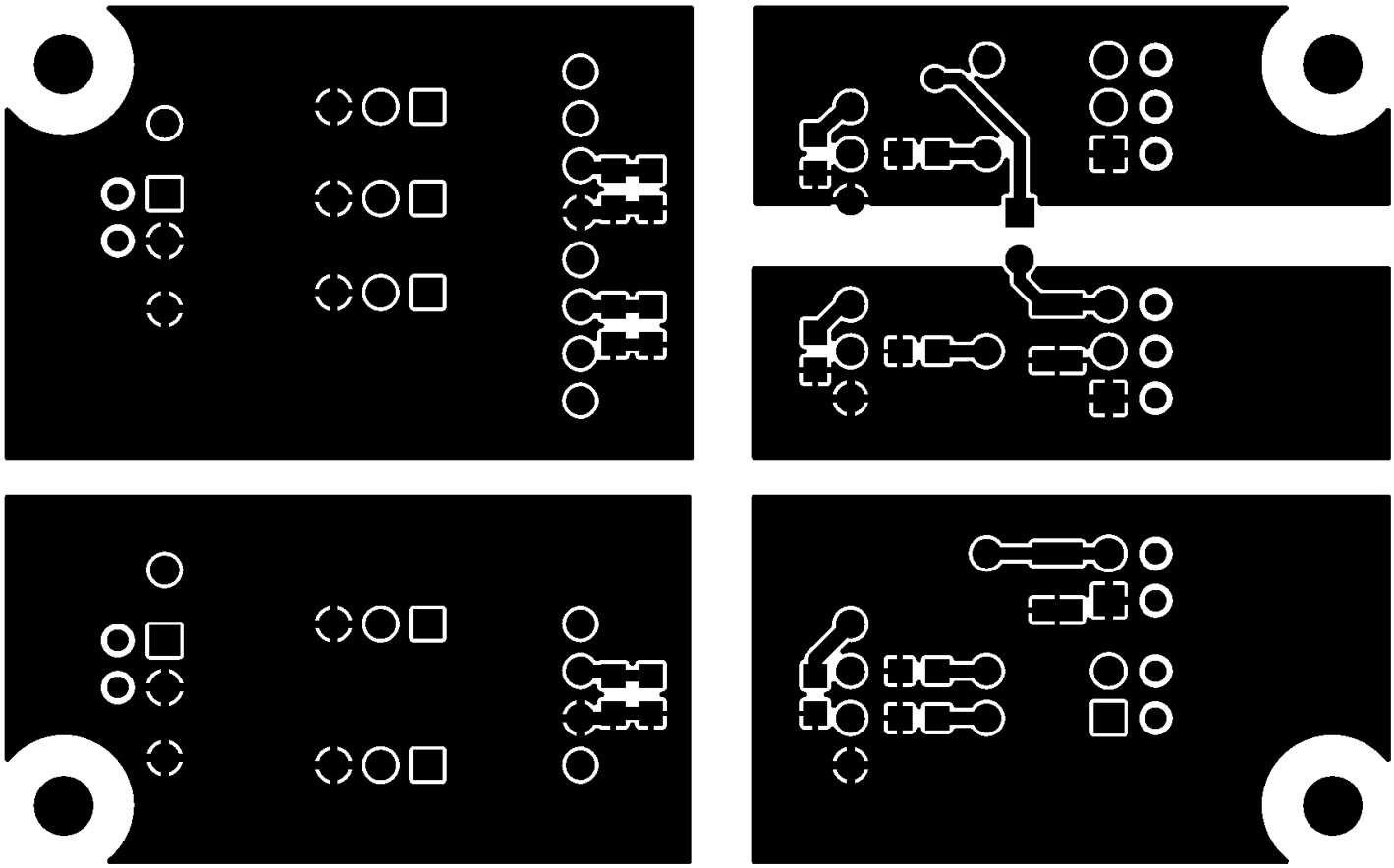


Figure 5.4. Si827x Layer 4: Secondary Side

6. Bill of Materials

Table 6.1. Si827x-EVB Bill of Materials

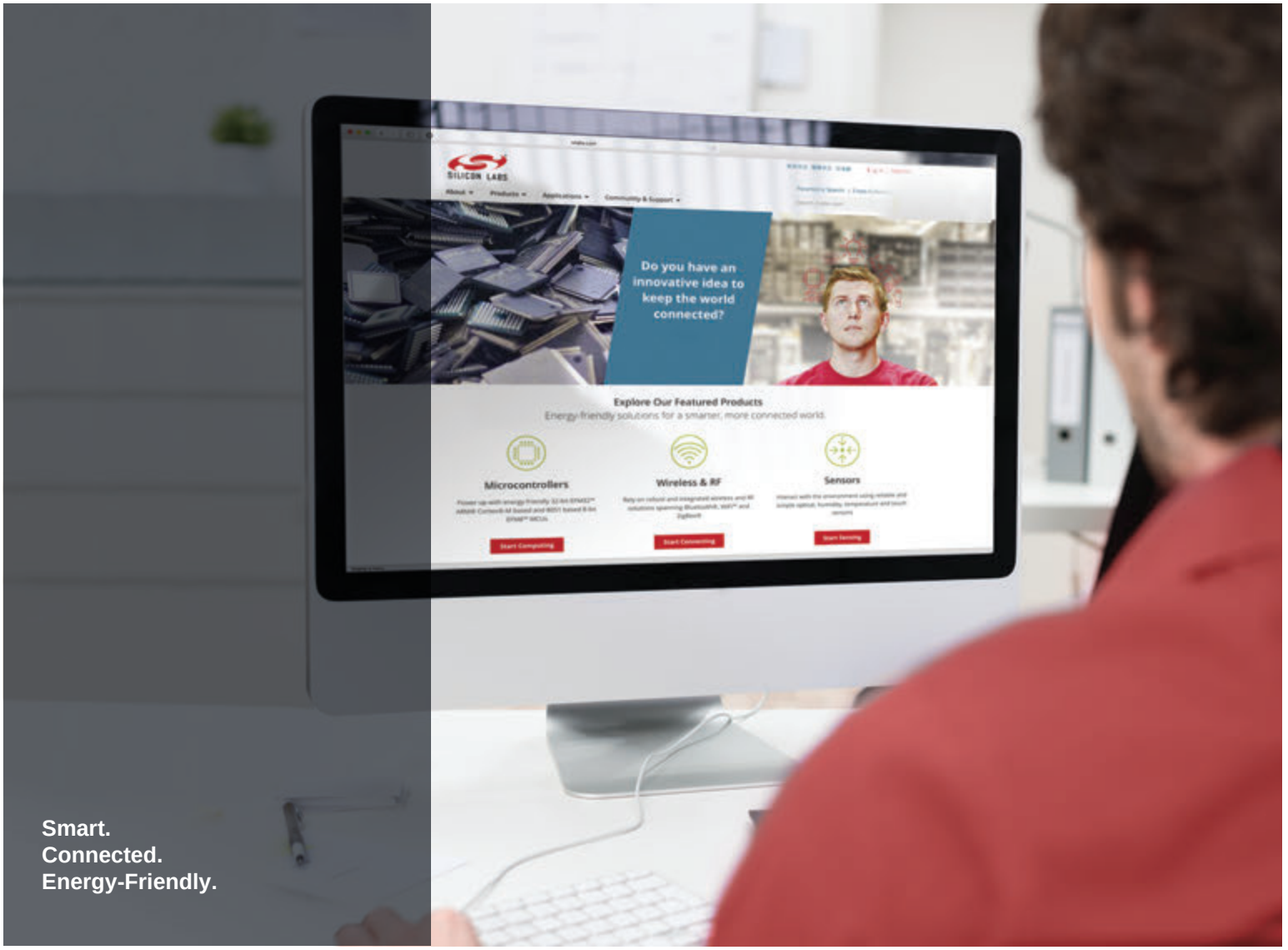
Qty	Ref	Value	Rating	Voltage	Tol	Type	PCB Footprint	Mfr Part Number	Mfr
2	C1, C9	1 µF		50 V	±10%	X7R	C0805	CL21B105KBFNNNE	Samsung
1	C15	200 pF		50 V	±10%	C0G	C0805	C0805C0G500-201K	Venkel
5	C2, C3, C7, C10, C11	0.1 µF		100 V	±10%	X7R	C0805	C0805X7R101-104K	Venkel
2	C8, C12	10 µF		50 V	+80/–20%	Y5V	C1210	GRM32DF51H106ZA01L	Murata
1	D1	US1K	1.0 A	800 V		Switch, Ultra-Fast	DO-214AC	US1K-13-F	Diodes Inc.
4	J1, J4, J5, J6	CONN TRBLK 2				Term Black	CON1X2-1725656	1725656	Phoenix Contact
2	J2, J3	CONN TRBLK 3				Term, Black	CON1X3-1725669	1725669	Phoenix Contact
5	JP1, JP2, JP3, JP4, JP5	Header 1 x 3				Header	CONN1X3	TSW-103-07-T-S	Samtec
1	JP6	Jumper				Header	CONN1X2	TSW-102-07-T-S	Samtec
5	JS1, JS2, JS3, JS4, JS5	Jumper Shunt				Shunt	N/A	SNT-100-BK-T	Samtec
1	LB1	OPN: Si8273ISO-EVB				Poly-mide, White	PTL-14-477	LABEL-Si8273ISO-EVB	Silicon Labs
4	MH1, MH2, MH3, MH4	Screw/Standoff				HDW		NSS-4-4-01/2397	Various
1	PCB1	Si827x_EVB REV 2.0				Bare PCB	N/A	Si827x_EVB REV 2.0	Silicon Labs
4	R1, R2, R5, R6	4.7	1/10W		±5%	Thick Film	R0805	CR0805-10W-4R7J	Venkel
1	R3	6.04 k	1/10W		±1%	Thick Film	R0805	CR0805-10W-6041F	Venkel
31	TP1, TP2, TP3, TP4, TP5, TP6, TP7, TP8, TP9, TP11, TP12, TP13, TP14, TP15, TP16, TP17, TP18, TP19, TP20, TP21, TP22, TP23, TP24, TP25, TP26, TP27, TP28, TP29, TP30, TP31, TP32	White				Loop	Testpoint	151-201-RC	Kobiconn

Qty	Ref	Value	Rating	Voltage	Tol	Type	PCB Footprint	Mfr Part Number	Mfr
1	U1	Si8273AB-IS1					SO16N6.0P1.27	Si8273AB-IS1	Silicon Labs
1	U2	Si8271AB-IS					SO8N6.0P1.27	Si8271AB-IS	Silicon Labs
Not-Installed Components									
4	C5, C6, C13, C14	200 pF		50 V	±10%	C0G	C0805	C0805C0G500-201K	Venkel
1	TP10	White				Loop	Testpoint	151-201-RC	Kobiconn

7. Ordering Guide

Table 7.1. Si827x ISOdriver EVB Ordering Guide

Ordering Part Number (OPN)	Description
Si8273ISO-KIT	Si8273 ISOdriver evaluation board kit
Si8274ISO-KIT	Si8274 ISOdriver evaluation board kit
Si8275ISO-KIT	Si8275 ISOdriver evaluation board kit



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