USER GUIDE

UG486: Si86S6xx-EVB User Guide

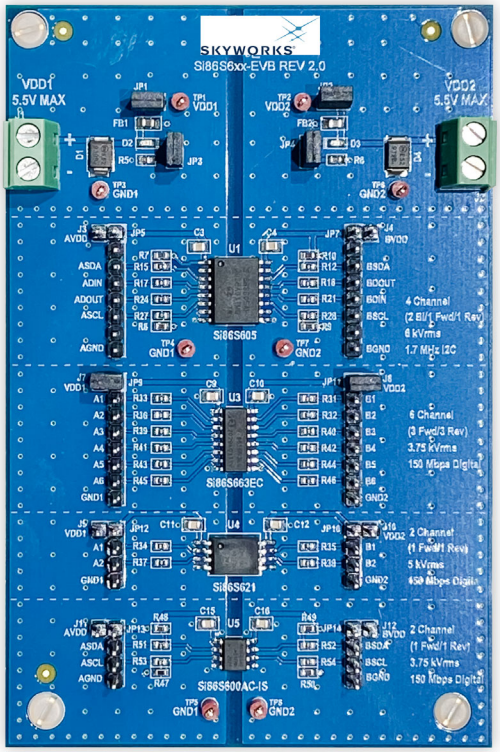
Description

The Si86S6xx-EVB evaluation board allows designers to evaluate Skyworks family of CMOS ultra-low-power isolators. These isolators are CMOS devices employing RF coupler technology to transmit digital information across an isolation barrier. These products are based on Skyworks' proprietary RF isolation technology, with up to 6.0 kVrms isolation rating. They offer shorter propagation delays, lower power consumption, improved noise immunity, less PCB area, and more stable operation with temperature and age vs. optocouplers. The Si86S61x/2x/3x/4x/6x devices include up to six isolated channels in various forward and reverse configurations, permitting bidirectional data transmission up to 150 Mbps.

The Si86S60x devices consist of single-package galvanic isolation solutions for I^2C, SMBus, and other digital power supply communications, including those for bus power management. For more information, refer to the respective family data sheets.

Key Features

- Standard and I^2C isolators
- Test setup
- Demo tests
- Schematic
- Layout
- Bill of Materials



1. Required Equipment

- Si86S6xx-EVB Rev 2.0
- Two power supplies that support 3 to 5.5 V
- Two DMMs in current mode
- 0 V to +5.5 V signal source, up to 150 Mbps or 75 MHz capable, 50% duty cycle (the standard isolator devices can toggle at up to 150 Mbps rate; the signal source/oscillator does not need to be that fast.)
- Oscilloscope
- Various cables and probes

2. Test Setup

The board comes with jumpers applied to JP3 and JP4, which will allow LEDs D2 and D3 to illuminate indicating that power is active at J1 and J2.

Adjust the two power supplies to 5 V out. Disable the outputs or turn them off.

Connect the power supply low outputs together. This is your system ground. This ground is common because you will use an oscilloscope with probe ground leads which are common. The two supply grounds may be separated if you have separate oscilloscopes for the left and right sides of the EVB.

Connect one power supply low output to GND1 at J1 pin 2, and the power supply high output to a DMM current input. Connect the DMM current output to VDD1 of the EVB, at J1 pin 1.

Connect the other power supply low output to GND2 at J2 pin 1, and the power supply high output to the other DMM current input. Connect the DMM current output to VDD2 of the EVB, at J2 pin 2.

Enable or turn on the power supplies. You may verify 5V outputs at TP1 and TP2. Verify that LEDs D2 and D3 both turn on. You may remove the jumpers at JP3 and JP4 to disable the LEDs if you want to measure VDD current in the devices.

Set up the signal source with the low side to system ground, or to the input side ground depending on which side has the input being stimulated. Ground test points are provided on each side of the board for this purpose.

Each device section has headers for VDD1/AVDD and VDD2/BVDD connection to the board supply. Jumpers are provided for these headers to energize one device at a time.

2.1. Digital Isolator Considerations

The Si86S6xx-EVB evaluation board (see Figure 1) provides a means of evaluating the Si86S663 and Si86S621 digital isolator devices as well as the Si86S600 and Si86S605 isolated I^2C devices. After power (3 to 5.5 V) has been supplied to the board, connect a digital input signal (5.5 Vpeak max, with desired clock frequency up to 150 Mbps) to the desired input channel. To view the isolated channel's data transmission, connect a scope probe to the output channel of interest. There are various inputs and outputs on either side of the board depending on the device one chooses to evaluate, as indicated by the silk screen. The board can be used to measure propagation delay, pulse-width distortion, channel-channel matching, pulse-width skew, and various other parameters.

The nominal output impedance of an isolator driver channel is approximately 50 Ω, ±40%, which is a combination of the values of the on-chip series termination resistor and the channel resistance of the output driver FET. When driving loads where transmission line effects are a factor, output pins should be terminated with 50 Ω controlled impedance PCB traces.

Figure 1 illustrates the Si86S621 transmitting a 500 kHz (3 Vpeak) signal through the Si86S621. VDD1 and VDD2 were powered from 3 V. Channel 1 illustrates the input, and Channel 2 illustrates the output.

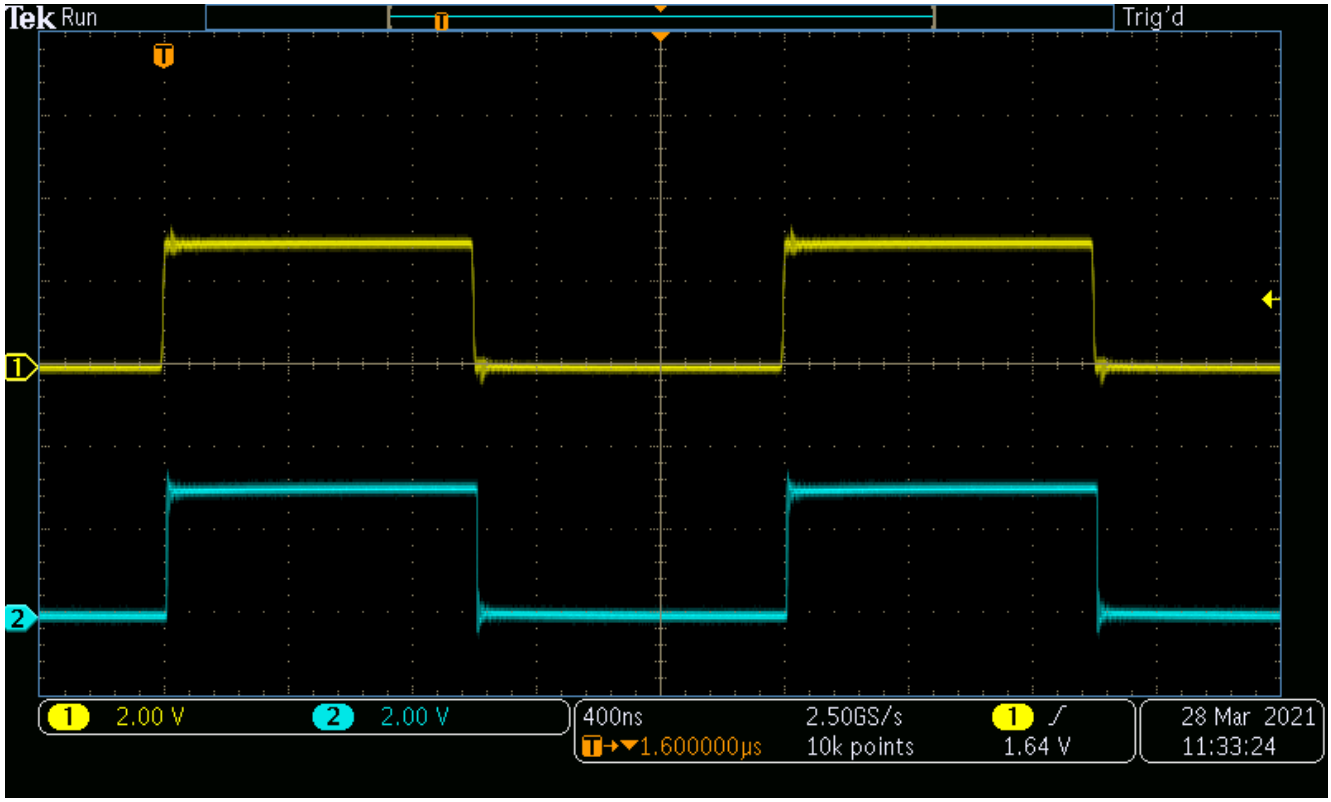


Figure 1. Si86S621 Transmitting a 500 kHz (3 Vpeak) Signal through the Si86S621

2.2. I²C Isolator Considerations

After power (3 to 5.5 V) has been supplied to the board, connect a digital square wave input (5.5 Vpeak max, with desired clock frequency up to 1.7 MHz) to the desired input channel. The Si8600/05 I²C isolators have 1 kΩ pull-up resistors already installed. If these resistors are redundant with another board that is being used to evaluate the Si86S600/05, the user should remove the redundant pull-up resistors to accommodate adequate drive current for the test being performed.

Figure 2 illustrates Side B Pulling Up, with Side A following for the Si86S605. The Si86S605 was powered from 3 V on both sides with a 100 kHz input test signal.

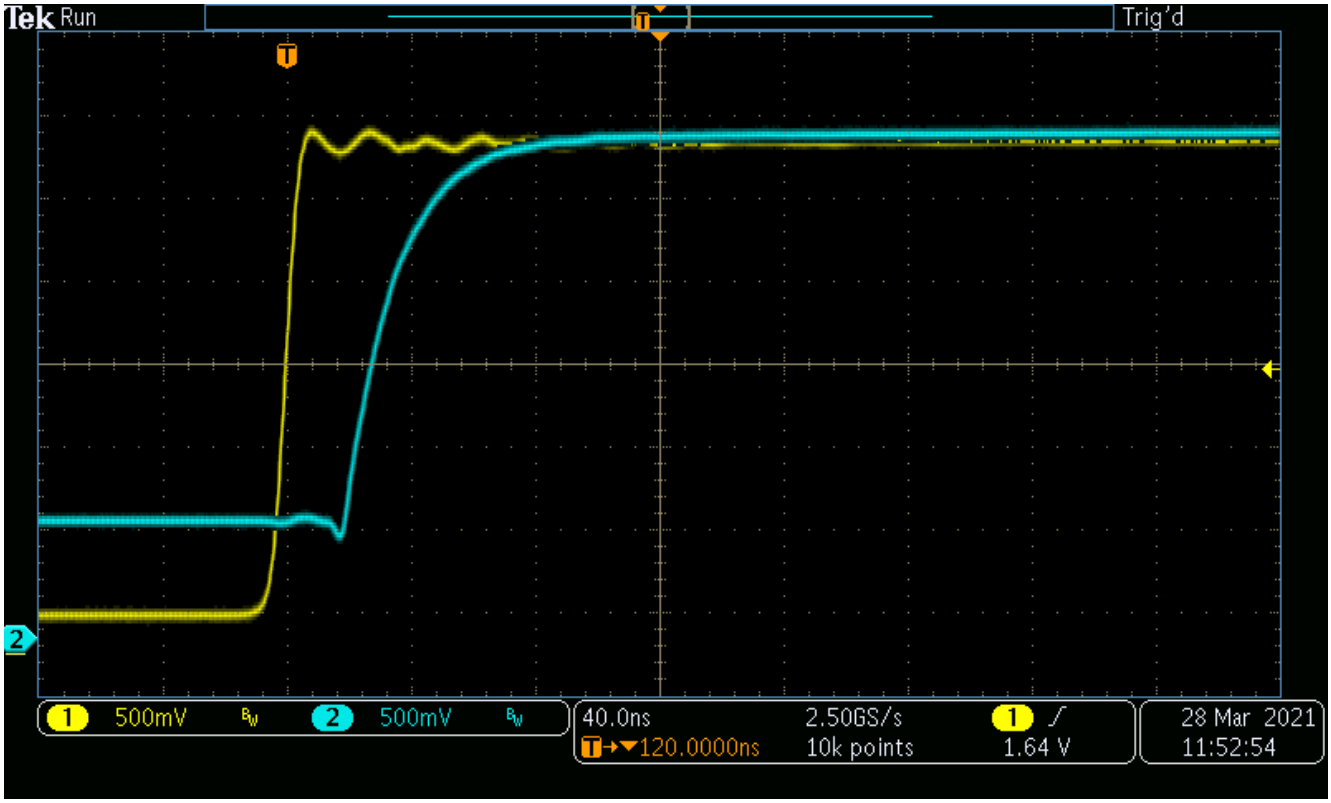


Figure 2. Side B Pulling Up, with Side A Following for the Si86S605

3. Si86S605AE-IS2 (U1 Device) Setup and Demo Test

The Si86S605AE-IS2 is a two-bidirectional channel, one forward channel, and one reverse channel digital isolator device in a 16-pin wide-body small outline package. The two bidirectional channels are designed for I^2C support, while the forward and reverse channels are standard digital isolator channels. The I^2C channels can support data rates up to 1.7 MHz, while the standard digital isolators can support data rates up to 150 Mbps.

Apply jumpers to J3 and J4 to connect the VDD supplies. Verify an increase in VDDx current in both current meters.

Apply the signal to each device input successively, while monitoring the input and the corresponding output with oscilloscope probes. The output state should reflect the input state.

Table 1. U1 Channels

Input	Output
ASDA (left side)	BSDA (right side)
ADIN (left side)	BDOUT (right side)
ADIN (right side)	ADOUT (left side)
ASCL (left side)	BSCL (right side)
BSDA (right side)	ASDA (left side)
BSCL (right side)	ASCL (left side)

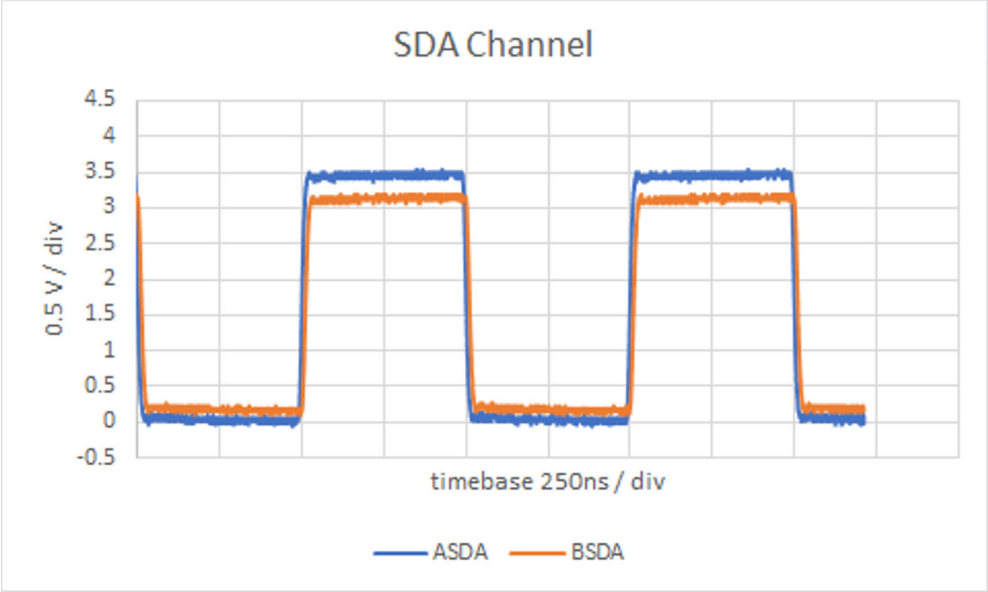


Figure 3. Si86S605 SDA Channel, ASDA Driven

4. Si86S663EC-IS1 (U3 Device) Setup and Demo Test

The Si86S663EC-IS1 is a three-forward channel, three-reverse channel digital isolator device in a 16-pin narrow body small outline package. The forward and reverse channels are standard digital isolator channels. Standard digital isolators can support data rates up to 150 Mbps.

The board can be used to measure propagation delay, pulse-width distortion, channel-channel matching, pulse-width skew, and various other parameters.

Apply jumpers to J7 and J8 to connect the VDD supplies. Verify an increase in VDDx current in both current meters.

Apply the signal to each device input successively, while monitoring the input and the corresponding output with the oscilloscope probes. The output state should reflect the input state.

Table 2. U3 Channels

Input	Output
A1 (left side)	B1 (right side)
A2 (left side)	B2 (right side)
A3 (left side)	B3 (right side)
B4 (right side)	A4 (left side)
B5 (right side)	A5 (left side)
B6 (right side)	A6 (left side)

5. Si86S621BE-IS4 (U4 Device) Setup and Demo Test

The Si86S621BE-IS4 is a one-forward channel, one-reverse channel digital isolator device in an 8-pin stretch small outline package. The forward and reverse channels are standard digital isolator channels. Standard digital isolators can support data rates up to 150 Mbps.

Apply jumpers to J9 and J10 to connect the VDD supplies. Verify an increase in VDDx current in both current meters.

Apply the signal to each device input successively, while monitoring the input and the corresponding output with the oscilloscope probes. The output state should reflect the input state.

Table 3. U4 Channels

Input	Output
A1 (left side)	B1 (right side)
B2 (right side)	A2 (left side)

6. Si86S600AC-IS (U5 Device) Setup and Demo Test

The Si86S600AC-IS is a two-bidirectional channel digital isolator device in an 8-pin narrow-body small outline package. The two bidirectional channels are designed for I^2C support. The I^2C channels can support data rates up to 1.7 MHz.

Apply jumpers to J11 and J12 to connect the VDD supplies. Verify an increase in VDDx current in both current meters.

Apply the signal to each device input successively, while monitoring the input and the corresponding output with the oscilloscope probes. The output state should reflect the input state.

Table 4. U5 Channels

Input	Output
ASDL (left side)	BSDL (right side)
ASCL (left side)	BSCL (right side)
BSDL (right side)	ASDL (left side)
BSCL (right side)	ASCL (left side)

7. Additional Board Features

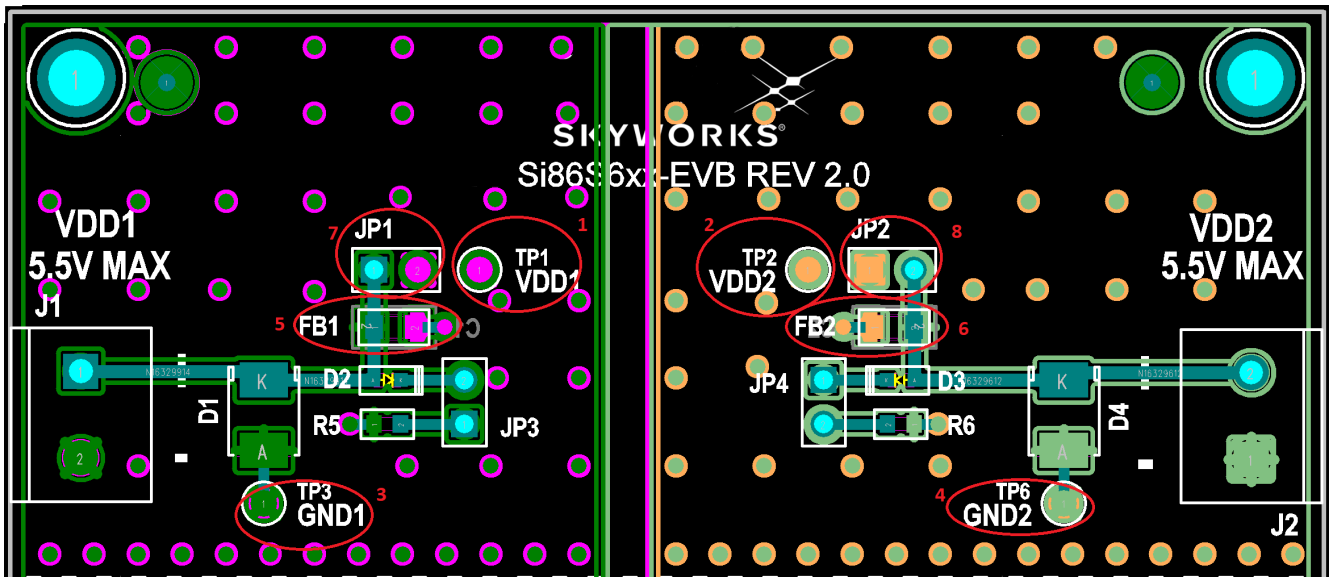


Figure 4. Board Features (Top End of Board)

1. **VDD Attachments**—If you prefer to attach VDD on either side using clip leads instead of stripped wires, you may use the test point, such as TP1 (1) for VDD1, TP3 (3) for GND1, TP2 (2) for VDD2, TP6 (4) for GND2. The indicator LEDs will still illuminate.
2. **Ferrite Beads**—Each VDD path at the top of the board contains a ferrite bead (5, 6). This may be shorted out with a jumper (7, 8), for instance at JP1. Alternatively, the ferrite bead may be replaced with a current sensing resistor, and its voltage measured across the header. A third use of the header would be to remove the ferrite bead and use the jumper to route the supply through a current meter and back to the board.
3. **Pin Series Resistors**—Each signal pin has a 0 Ω 0603 resistor in series. These may be replaced by a different value to limit input current or to provide termination.

8. Schematics

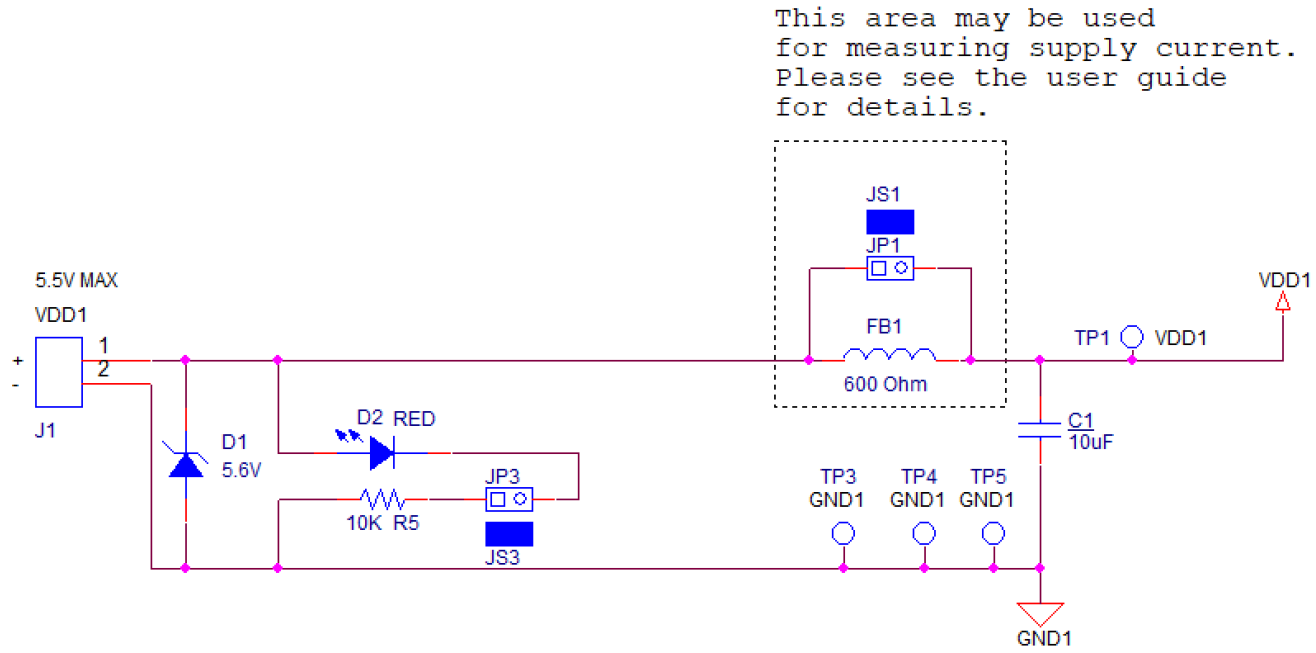


Figure 5. VDD1 Connection

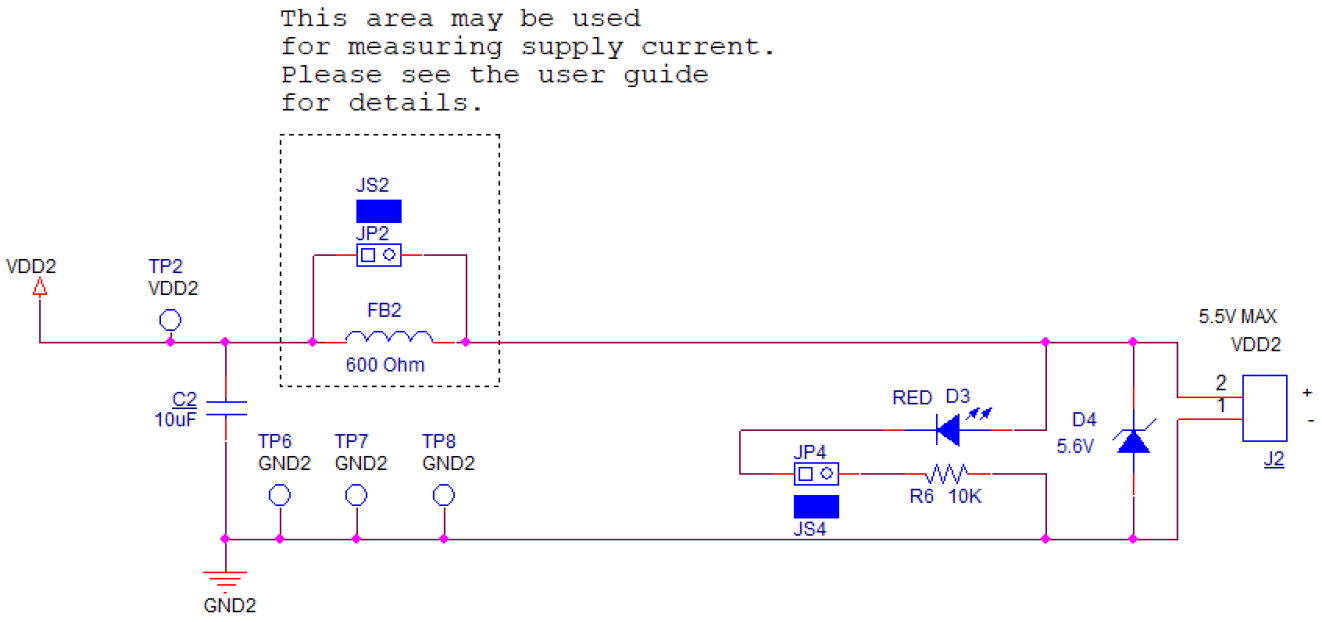


Figure 6. VDD2 Connection

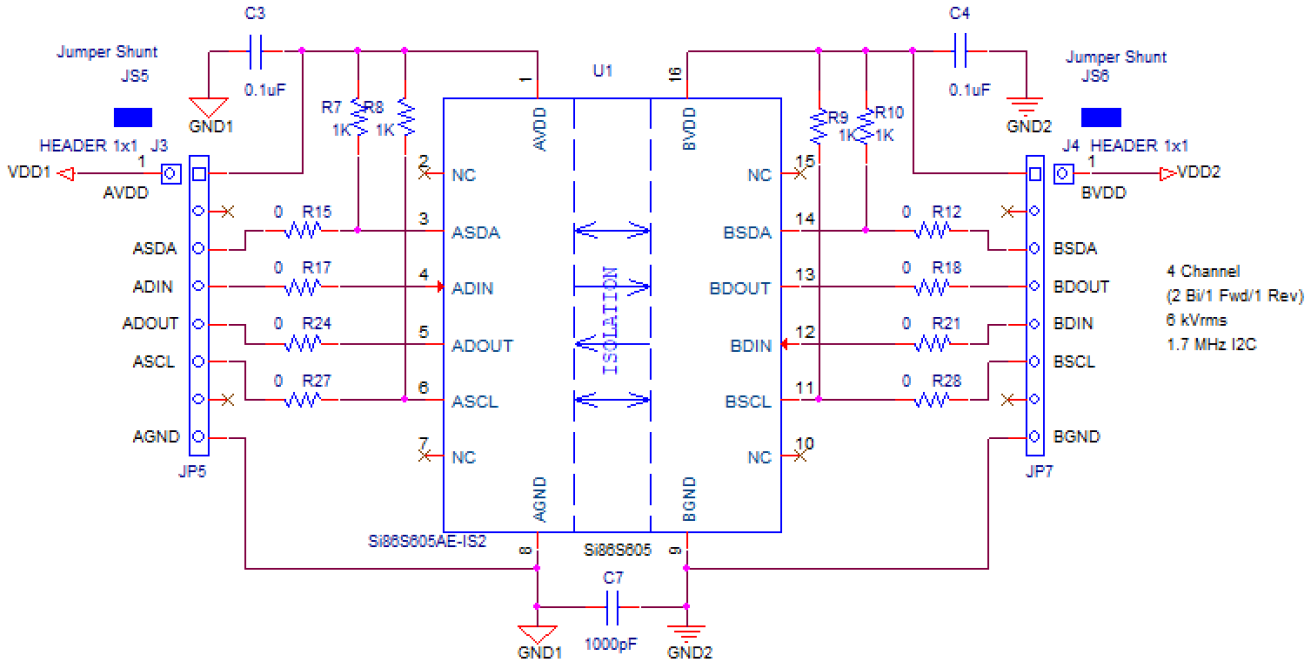


Figure 7. U1 Circuit

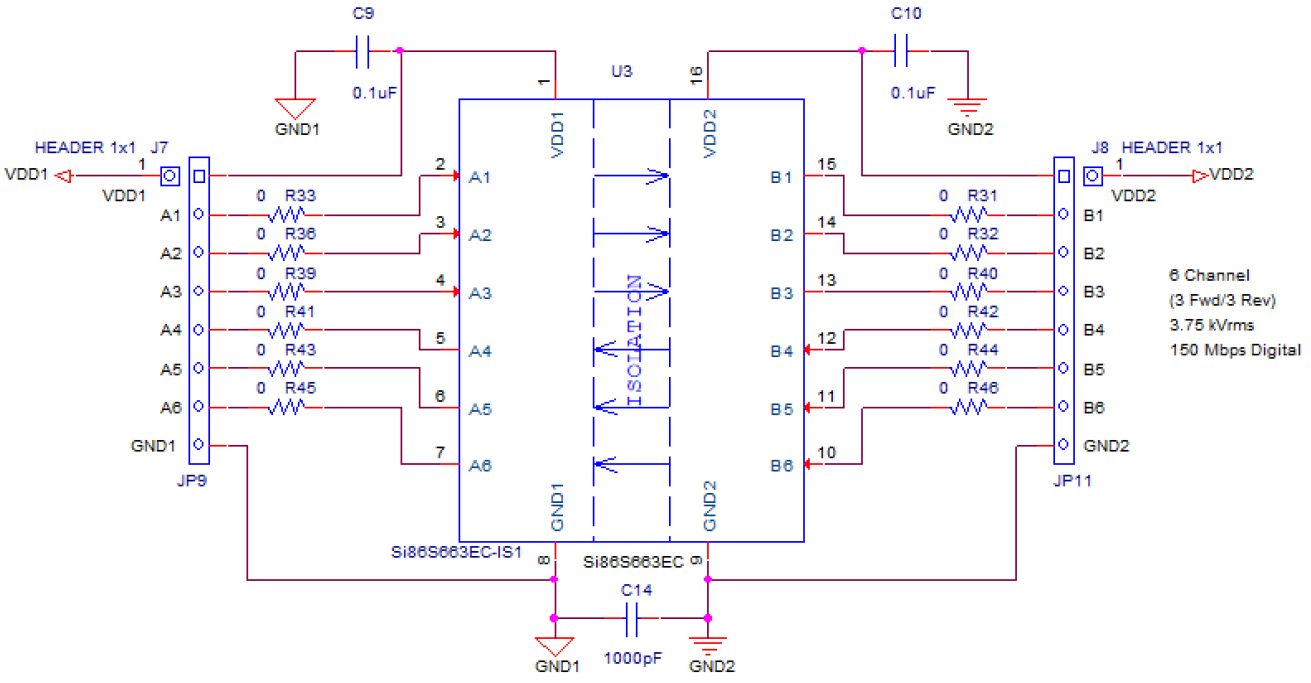


Figure 8. U3 Circuit

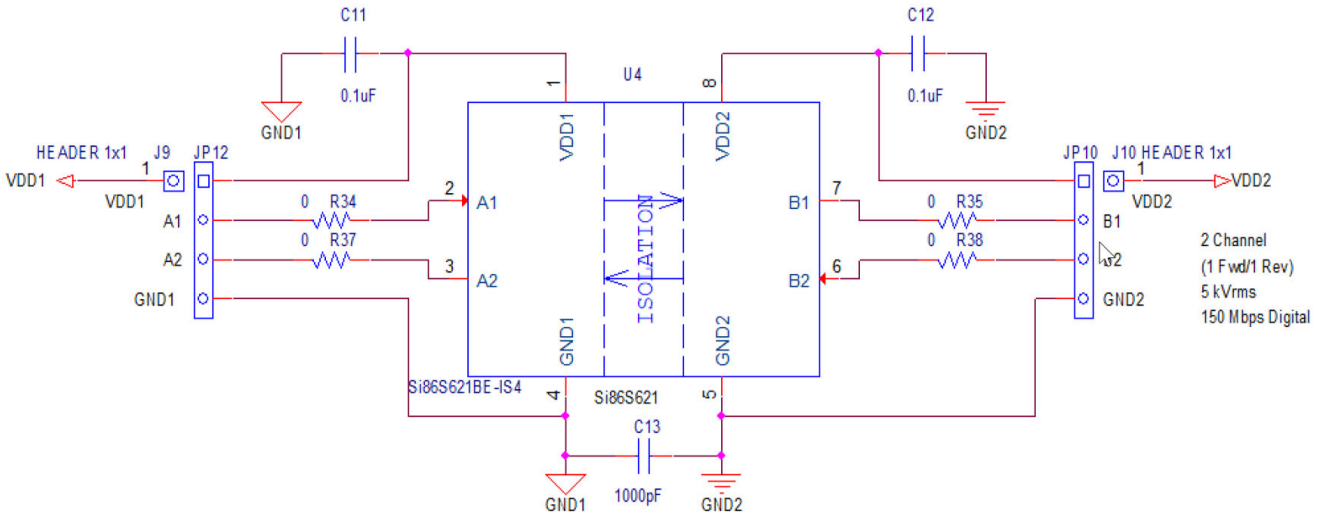


Figure 9. U4 Circuit

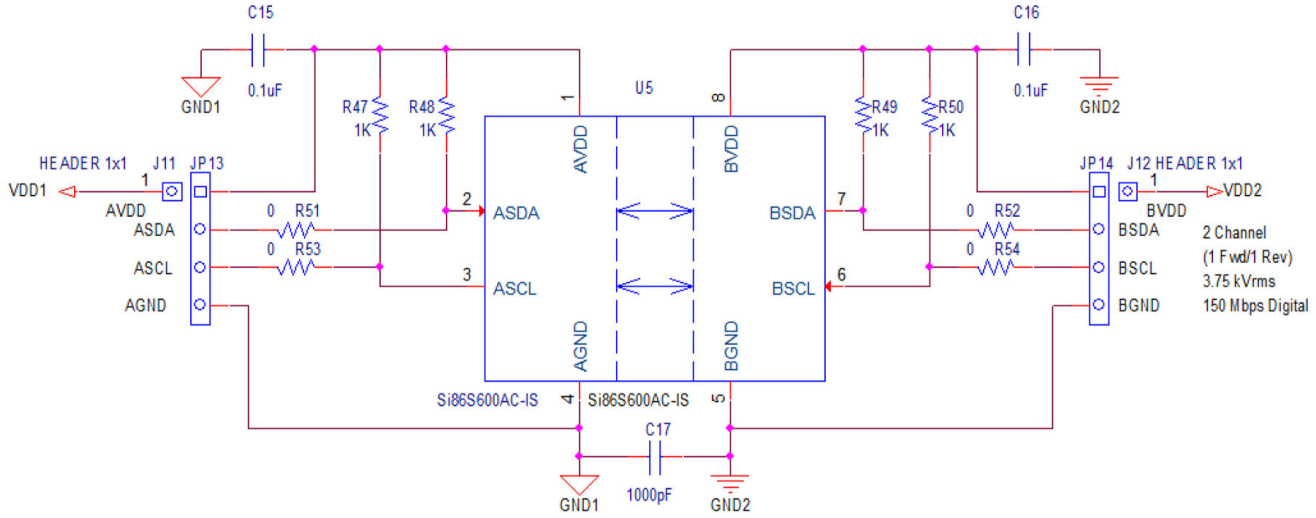


Figure 10. U5 Circuit

9. Layout

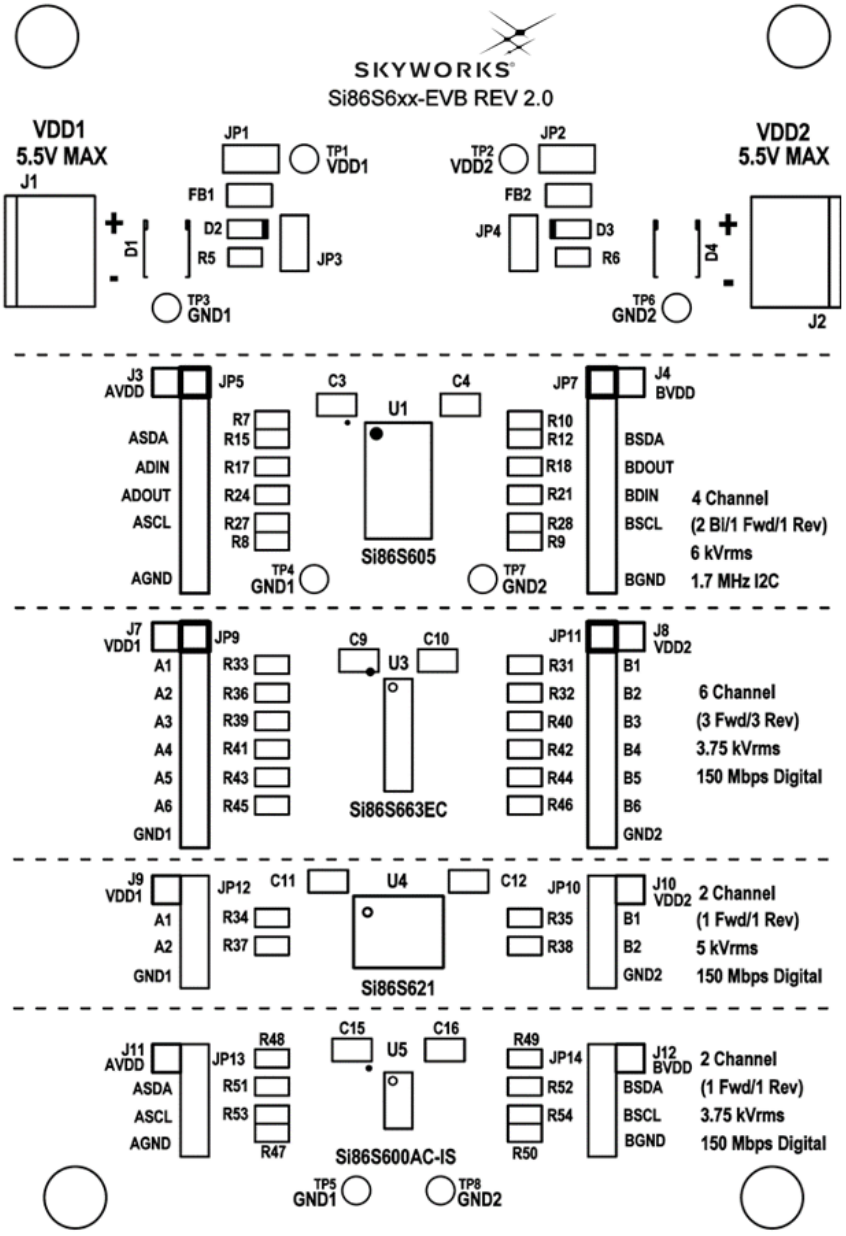


Figure 11. Primary Silkscreen

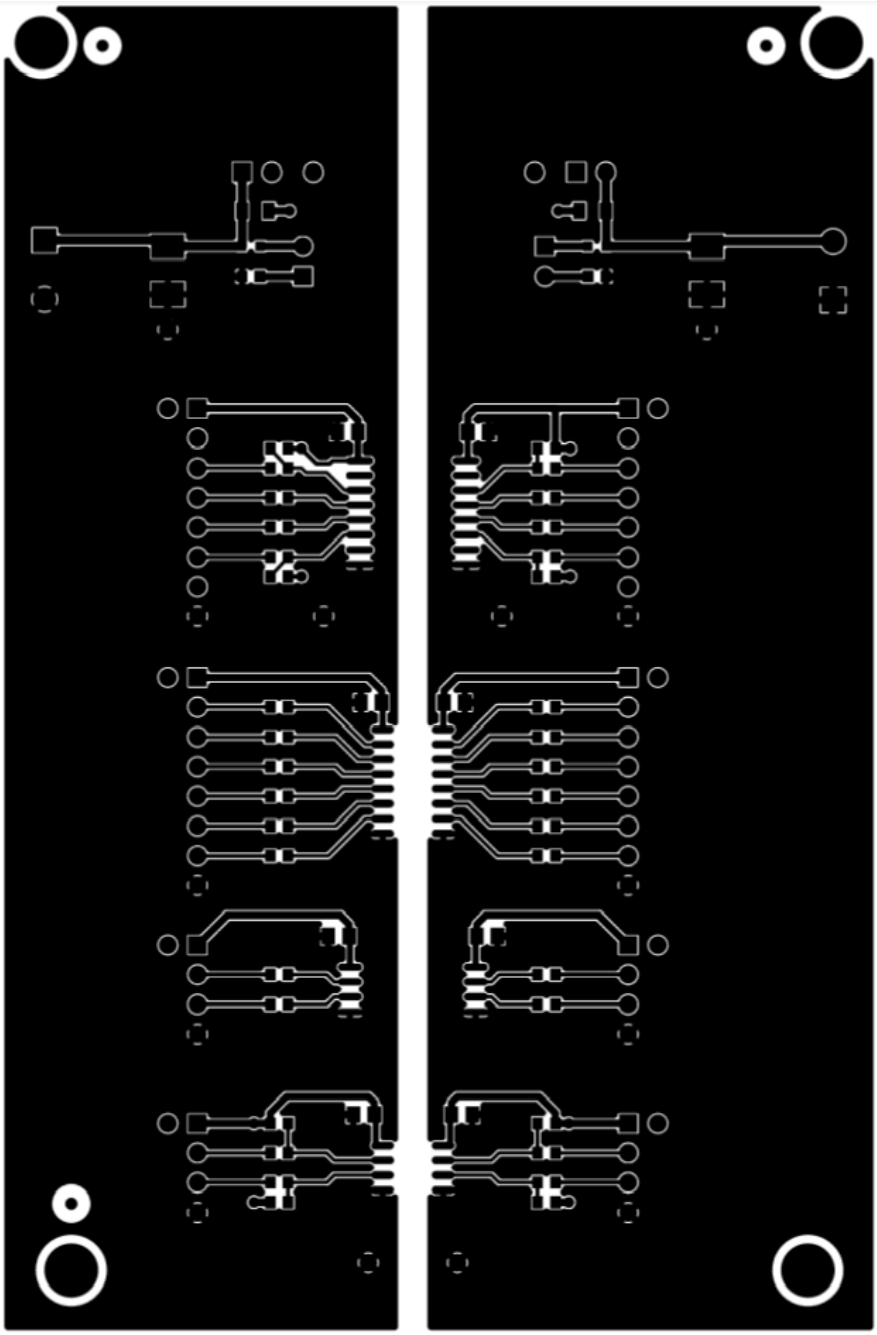


Figure 12. Top Interconnect Layer

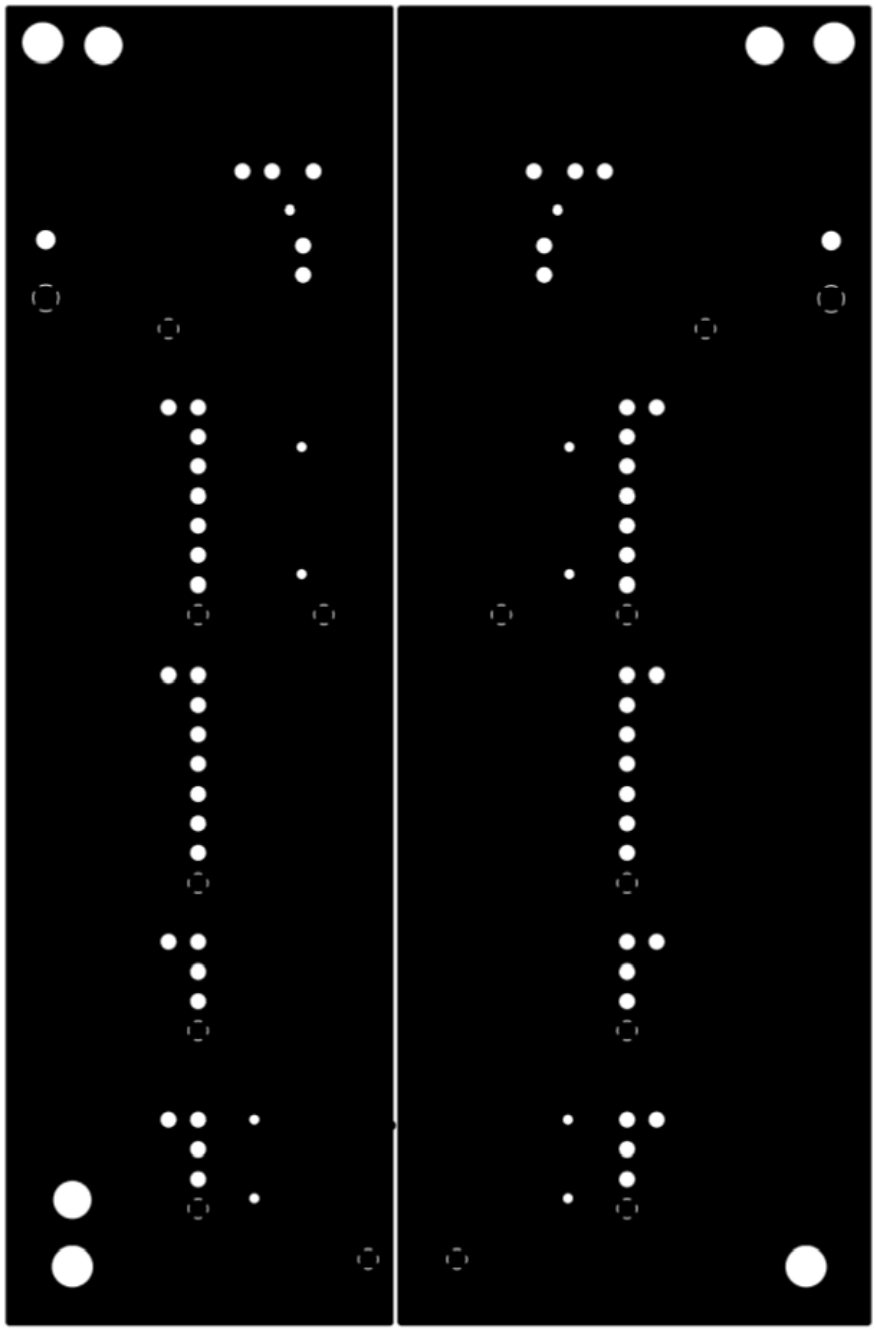


Figure 13. Ground Layer (2nd)

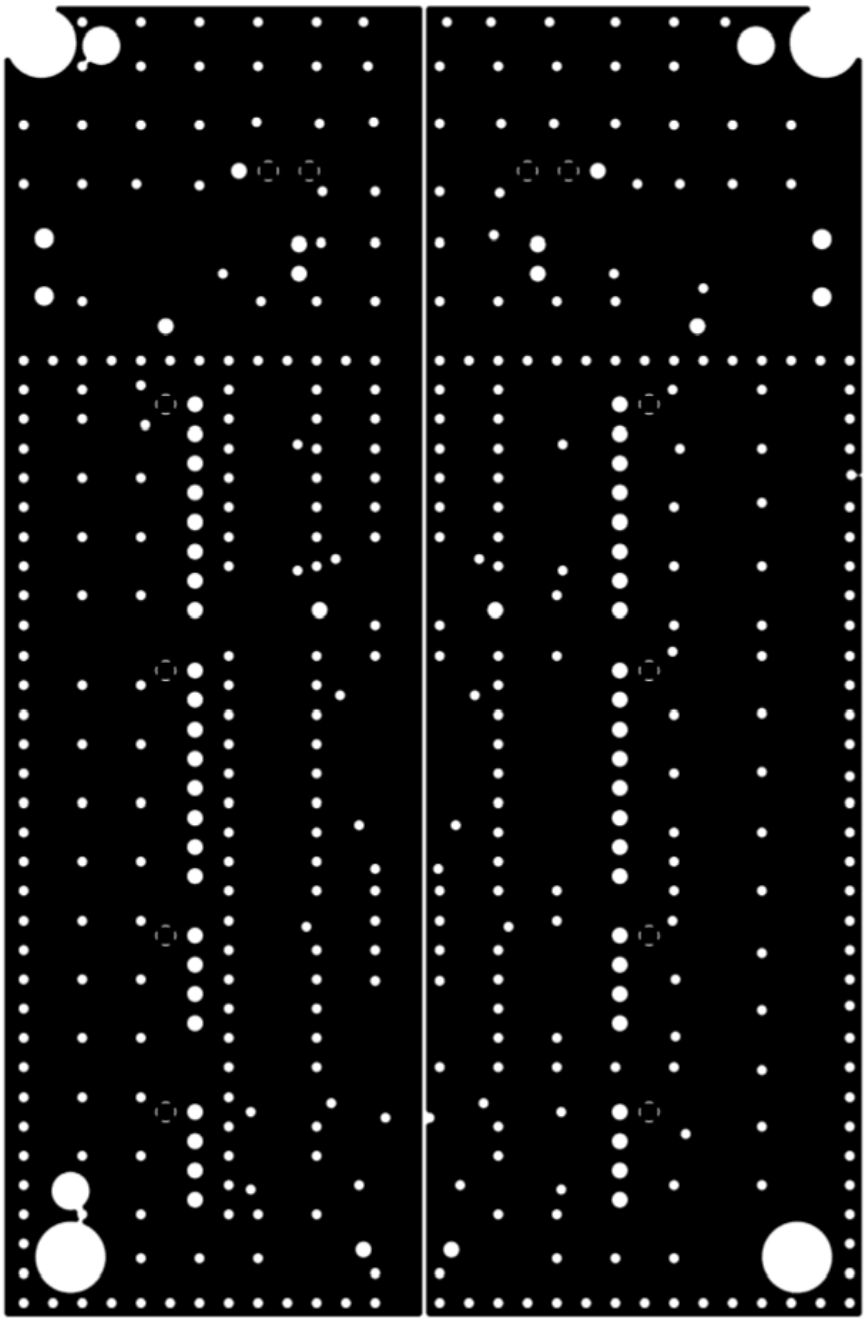


Figure 14. Power Layer (3rd)

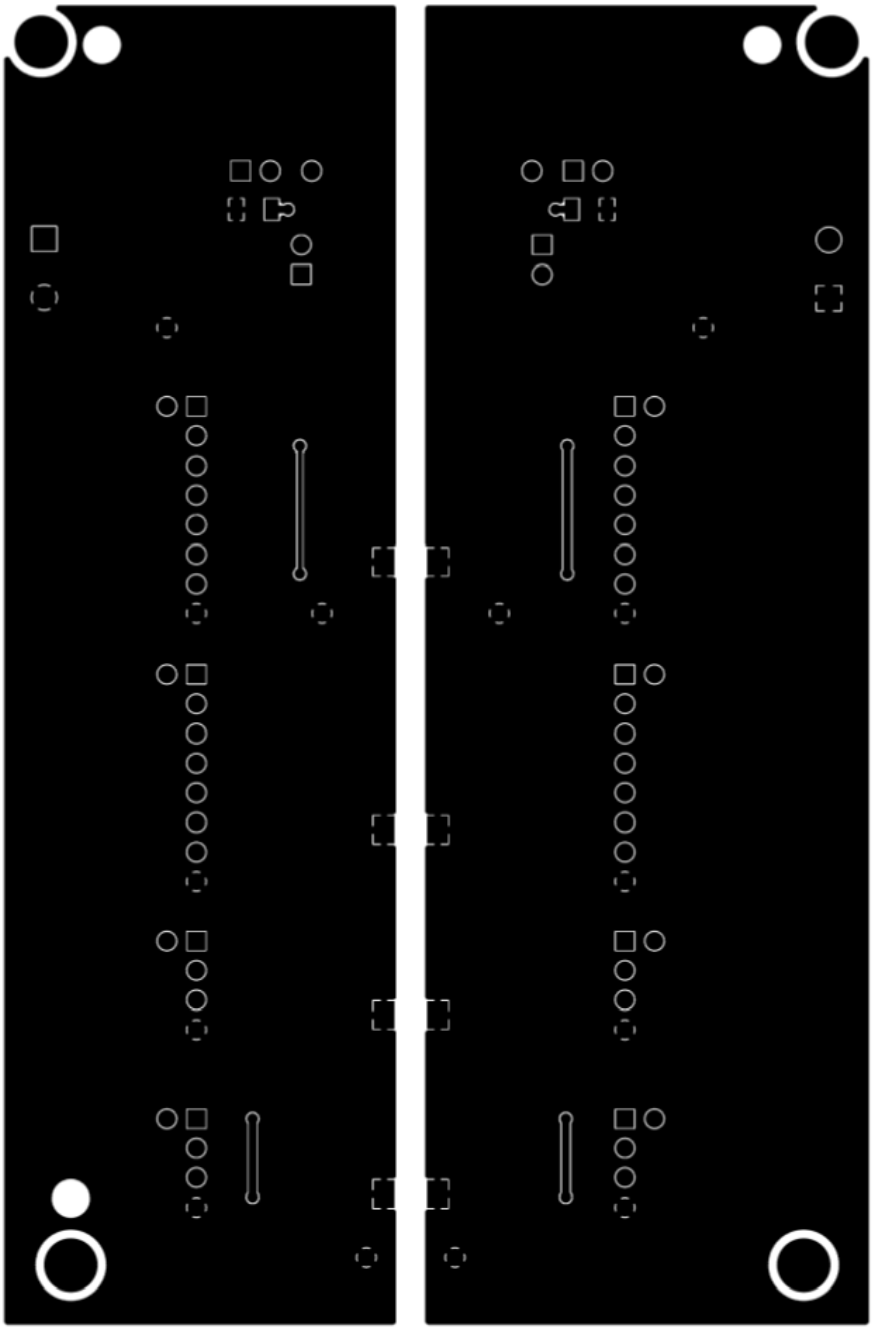


Figure 15. Bottom Side Interconnect

10. Bill of Materials

Table 5. Si86S6xx-EVB Bill of Materials

Qty	Ref	Value	Rating	Voltage	Tol	Type	PCB Footprint	Mfr	Mfr PN
2	C1, C2	10 µF		10 V	±10%	X7R	C1206	Venkel	C1206X7R100-106K
8	C3, C4, C9, C10, C11, C12, C15, C16	0.1 µF		16 V	±10%	X7R	C0805	Venkel	C0805X7R160-104K
2	D1, D4	5.6 V	3 W	5.6 V	5%	Zener	DO-214AA	On Semi	1SMB5919BT3
2	D2, D3	Red					LED0603-KA	Lite-On Technology Corp.	LTST-C190KRKT
2	FB1, FB2	600 Ω	200 mA			SMT	L0805	Murata	BLM21AG601SN1
4	JP1, JP2, JP3, JP4	Header 1x2				Header	CONN1X2	Samtec	TSW-102-07-T-S
4	JP5, JP7, JP9, JP11	Header 1x8				Header	CONN-1X8	Samtec	TSW-108-07-T-S
4	JP10, JP12, JP13, JP14	Header 4X1				Header	CONN-1X4	Samtec	TSW-104-07-T-S
6	JS1,JS2, JS3, JS4, JS5, JS6	Jumper Shunt				Shunt	N/A	Samtec	SNT-100-BK-T
2	J1, J2	CONN TRBLK 2				Term Black	CONN-1X2-TB	Phoenix Contact	1729018
8	J3, J4, J7, J8, J9, J10, J11, J12	Header 1x1				Header	HDR1X1	Samtec	TSW-101-07-T-S
4	MH1, MH2, MH3, MH4	Apr-40				Screw	MH-125NP	Richco Plastic Co.	NSS-4-4-01
1	PCB1	Si86S6xx-EVB REV 2.0				Bare PCB	N/A	Skyworks Solutions, Inc.	Si86S6xx-EVB REV 2.0
2	R5, R6	10 kΩ	1/10 W		±1%	Thick Film	R0603	Venkel	CR0603-10W-1002F
8	R7, R8, R9, R10, R47, R48, R49, R50	1 kΩ	1/10 W		±1%	Thick Film	R0603	Venkel	CR0603-10W-1001F
28	R12, R15, R17, R18, R21, R24, R27, R28, R31, R32, R33, R34, R35, R36, R37, R38, R39, R40, R41, R42, R43, R44, R45, R46, R51, R52, R53, R54	0	1 A			Thick Film	R0603	Venkel	CR0603-16W-000
4	SO1, SO2, SO3, SO4	Standoff				Standoff		Keystone Electronics	1902D
8	TP1, TP2, TP3, TP4, TP5, TP6, TP7, TP8	Red				Loop	Testpoint	Kobiconn	151-207-RC
1	U1	Si86S605AE-IS2	6 kVrms			Isolator	SO16N10.3P1.27	Skyworks Solutions, Inc.	Si86S605AE-IS2
1	U3	Si86S663EC-IS1	3.7 5 kV Vrms			Isolator	SO16N6.0P1.27	Skyworks Solutions, Inc.	Si86S663EC-IS1
1	U4	Si86S621BE-IS4	6 kVrms			Isolator	SO8N11.5P1.27-ISO	Skyworks Solutions, Inc.	Si86S621BE-IS4
1	U5	Si86S600AC-IS	3.75 kVrms			I^2C Isolator	SO8N6.0P1.27	Skyworks Solutions, Inc.	Si86S600AC-IS
4	C7, C13, C14, C17	1000 pF	X2/Y3	250 V	±10%	Y3	C1808	Yageo	SC1808KKX7RTBB102

11. Ordering Guide

Table 6. Ordering Guide

Ordering Part Number (OPN)	Description
Si86S6xx-KIT	Si86S6xx Digital Isolator Evaluation Board Kit