

## Introduction

The Line Card Access Switch (LCAS) evaluation kit was designed to provide customers with a convenient and simple test platform for evaluating the operation of the ISL5571A.

Using basic power supplies and measuring equipment, key features and data sheet parameters can be observed and measured.

This document shows the user how to setup the test platform. It also provides a step by step procedure to verify the correct operation of the switch.

The LCAS evaluation kit consists of the following items:

1. The evaluation mother board, part number: ISL5571A/B EVAL1 REV A
2. The ISL5571 daughter board, part number: ISL5571A/B-DBEVAL1
3. Data Sheet for the ISL5571A (File Number: 4920)  
Note: It is highly encouraged that the user read through the data sheet before performing any exercises with this kit.

## Functional Description

This platform enables the user to evaluate the switch by itself or in a line card application. This design makes use of a daughter card that could be plugged into the mother board (provided with this kit) or Intersil's UniSLIC14 evaluation board (part number HC5514XEVAL1 REV B). *Customers interested in evaluating the LCAS switch along with the UniSLIC14 should consider getting this evaluation board.*

This document will discuss the evaluation of the LCAS switch using the mother board provided in the kit.

The mother board provides the interface between the user and the daughter card. Access to the ISL5571A's logic control, and the T<sub>LINE</sub>, R<sub>LINE</sub>, T<sub>BAT</sub>, R<sub>BAT</sub>, TSD and Ring Generator ports are provide through the mother board. The ISL5571 daughter board is keyed to plug into the mother board in only one direction. A top view of the mother board with the daughter board installed is shown in Figure 1.

The daughter card contains the ISL5571A chip, external surge and power cross protection devices, and an inverter circuit to invert the logic signal apply to the INPUT pin of the ISL5571A. The inverter circuit is included in the design of the daughter board to enable it to function properly with the UniSLIC14 evaluation board. In most line card applications the relay signal from the SLIC must be inverted to work with an LCAS switch.

The board is equipped with two Single Pole Double Throw center open switches (LATCH, INPUT), one Single Pole Double Throw switch (TSD), and one 4 Pole Double Throw switch (MODE). The LATCH, INPUT, and TSD switches control the logic state of the ISL5571A.

If off board logic control of the ISL5571A is desired, the LATCH and INPUT switches can be set in the center position and the TSD switch can be set in the floating position. The ISL5571A can now be controlled by either the logic terminal port (J12) or the banana jacks (J3, J4 and J10).

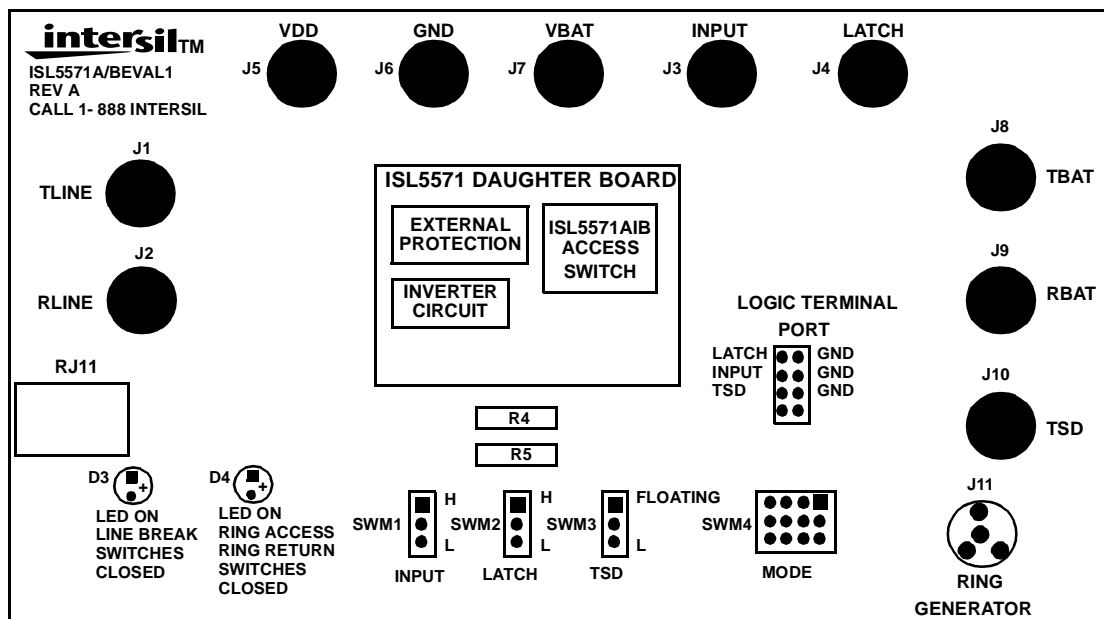


FIGURE 1. TOP VIEW OF MOTHER BOARD WITH DAUGHTER BOARD

The MODE switch configures the mother board in one of two modes. Either the NORMAL mode (where the switch can be configured for normal operation in a line card) or the LED mode. The LED mode connects the onboard LEDs for a quick functional check of the ISL5571A.

## Power Requirements for the Eval Kit

### Power Supply Connections

The ISL5571A mother board requires two external power supplies.  $V_{BAT} = -48V$  (Typ) and  $V_{DD} = +5V$ .

### Ground Connections

The two external power supplies should each be grounded at the evaluation board.

## Getting Started

Verify that the ISL5571 daughter board is plugged firmly into the mother board. Connect the +5V supply to the VDD banana jack (J5) and the -48V supply to the VBAT banana jack (J7).

## Verifying Basic Operation

The operation of the switch can be verified by performing the following tests:

### 1. LED Mode Verification

- Line Break Switches
- TSD Operation
- LATCH Operation
- Ring Return and Ring Access Switches

### 2. Normal Mode Verification

- $r_{ON}$  measurement of Line Break switches
- Operation and Current Limit of Line Break Switch SW1, Ring Return Switch SW3 and the Line Break Switch SW2
- Operation of Thermal Shutdown
- Ringing a Phone

## Test #1, LED Mode Verification

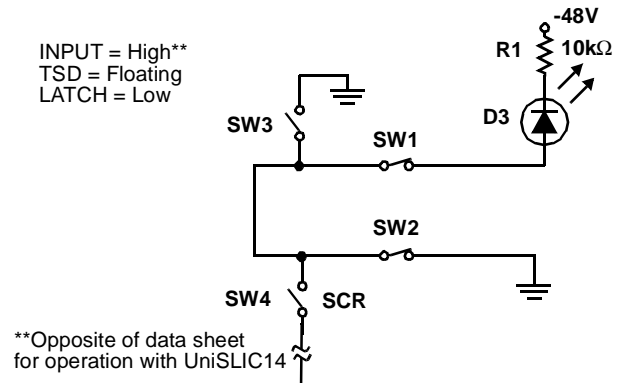
A quick check using the on-board LEDs will verify that the switches of the ISL5571 open and close correctly when the appropriate logic control signals are applied. The state of the 2 LEDs indicate the following:

- When LED D3 is on (illuminate) and LED D4 is off, the Line Break switches (SW1 and SW2) are both ON (Closed). Reference Figure 2.
- When LED D4 is on (illuminate) and LED D3 is off, the Ring Access switch (SW4) and Ring Return switch (SW3) are both ON (Closed). Reference Figure 3.
- When both LEDs (D3 and D4) are on (illuminate), the Line Break switches (SW1 and SW2) and the Ring

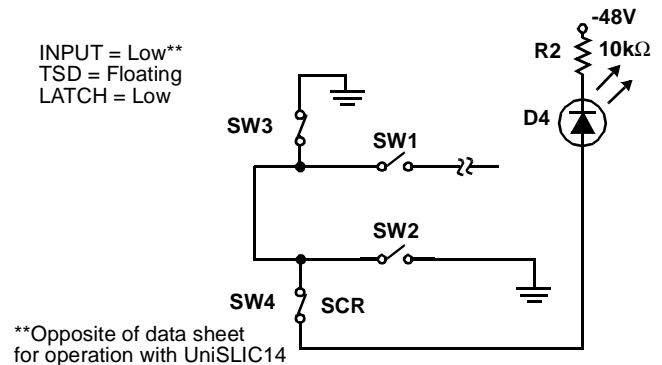
Access switch (SW4) are ON (Closed). The Ring Return switch is off (Open). Reference Figure 4.

- When both LEDs (D3 and D4) are off, all the switches of the ISL5571A (SW1, SW2, SW3, SW4) are OFF (Open). This occurs whenever the TSD pin is low.

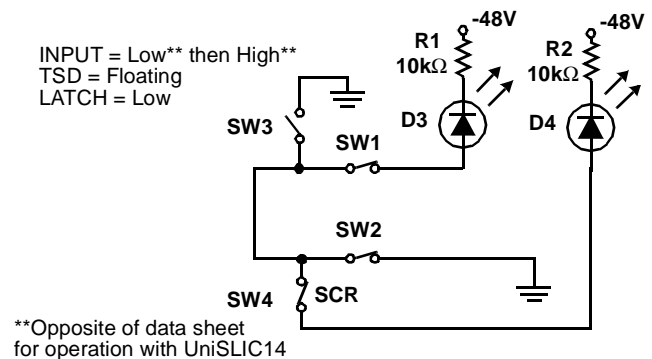
The LED mode will also provide a quick check of the ISL5571A latch feature.



**FIGURE 2. LINE BREAK SWITCH VERIFICATION**



**FIGURE 3. RING ACCESS AND RING RETURN SWITCH VERIFICATION**



**FIGURE 4. ILLUSTRATION WHEN SCR REMAINS ON**

## Discussion

The Ring Access switch (SW4) of the ISL5571A is an SCR. The operation of this SCR requires that the current through it approach zero to enable the SCR to unlatch (turn off). Figure 4 illustrates the condition where the logic has been configured to turn SW4 off, yet it remains on due to the DC

voltage connected to it. To turn SW4 off, open all the switches by taking the TSD pin low.

Note: In normal line card applications the Ring Access switch is connected to an AC ring generator. The zero current crossing of the AC signal will enable SW4 to turn OFF. The maximum time for SW4 and SW2 to simultaneous be ON is 25msec for a 20Hz ring generator.

### Setup

1. Configure the logic switches as follows: TSD = Low, INPUT = High and the LATCH = Low, as defined on the board.  
Note: With TSD pin Low the ISL5571A will be in the ALL OFF state. This means that the Line Break switches, Ring Access switch and Ring Return switch will all be OFF (Open).
2. Connect the power supplies to the Evaluation board.
3. Set  $V_{BAT}$  to -48V and  $V_{DD}$  to +5V.
4. Configure mother board in the LED mode by setting the MODE switch in the LED position.
5. Verify that both LED's (D3 and D4) are off.
6. Set the TSD switch to the floating position.
7. Verify that the Line Break LED (D3) is on. This indicates that both Line Break switches are ON (Closed) and functioning correctly. (INPUT = High) Reference Figure 2.
8. Set the LATCH switch to the high position. Verify that the Line Break LED (D3) is still on.
9. Toggle the INPUT switch back and forth, observing that the Line Break LED (D3) remains on while the Ring Access LED (D4) remains off. Note: When the LATCH is taken high, while the INPUT is high, the ISL5571A Line Break switches will be permanently latched in the ON (closed) position. The ISL5571A will no longer respond to logic level changes at the INPUT pin. This verifies that the LATCH is functioning correctly.
10. Set TSD switch low. Verify that both LEDs are off. This verifies that taking the TSD pin low overrides all other logic controls and is functioning correctly.
11. Set the INPUT and LATCH switches low and the TSD switch in the floating position. Verify the Ring Access LED (D4) is on and the Line Break LED (D3) is off. This indicates that the Ring Access and Ring Return switches are ON (Closed) and are functioning correctly. Reference Figure 3.
12. Set the LATCH switch to the high position. Verify that the Ring Access LED (D4) is still on.
13. Toggle the INPUT switch back and forth, observing that the Ring Access LED (D4) remains on while the Line Break LED (D3) remains off. This verifies that the latch feature of the ISL5571A is functioning correctly.  
Note: When the LATCH is taken high, while the INPUT is low, the ISL5571A Ring Access and Ring Return switches will be permanently latched in the ON (closed) position. The ISL5571A will no longer respond to logic level changes at the INPUT pin.

14. Set the INPUT switch low and the LATCH switch low. Verify that the Ring Access LED (D4) is still on.
15. Set the TSD switch low. Verify that the LED D3 and D4 are off. This once again verifies that taking the TSD pin low overrides all other logic controls and is functioning correctly.
16. Set the TSD switch in the floating position and verify that the Ring Access switch LED (D4) is back on.
17. Set the INPUT switch to the high position. Verify that both the Line Break LED (D3) and the Ring Access LED (D4) are both on. Reference Figure 4 and discussion of SCR above.
18. Set the TSD switch low. Verify that both LEDs are off.
19. Set the TSD switch in the floating position and verify that the LED D3 is on. This verifies that the Ring Access switch turned off when its current went to zero.

### Test #2, Normal Mode Verification

In the NORMAL mode, the on resistance ( $r_{ON}$ ), the current limiting and the thermal shutdown features of the MOSFET type switches (SW1, SW2, SW3) will be evaluated. This section will also demonstrate the operation of the ISL5571A when ringing a phone.

### Equipment Requirements

The following equipment is required:

- One 50V 500mA DC power supply
- One Ohm meter
- One DC current meter
- One DC volt meter.

To illustrate the operation of the switch when ringing a phone, the following additional equipment will be required:

- One battery backed 20Hz 90V<sub>RMS</sub> ring generator referenced to -48V offset
- One phone.

### $r_{ON}$ Verification of the ISL5571A MOSFET Type Switches (SW1, SW2, SW3)

1. Configure the logic switches as follows: TSD = low, INPUT = high and the LATCH = low, as defined on the board.
2. Connect the power supplies to the Evaluation board.
3. Set  $V_{BAT}$  to -48V and  $V_{DD}$  to +5V.
4. Configure mother board in the NORMAL mode by setting the MODE switch in Normal position.
5. Set the TSD = Floating.
6. Measure the  $r_{ON}$  resistance of Line Break switch SW1 by connecting the positive terminal of an Ohm meter at TLINE (J1) and the negative terminal at TBAT (J8).  $r_{ON}$  SW1 should measure approximately 17 $\Omega$ .
7. Measure the  $r_{ON}$  resistance of Line Break switch SW2 by connecting the positive terminal of the Ohm meter at

RLINE (J2) and the negative terminal at RBAT (J9).  
 $r_{ON}$  SW2 should also measure approximately  $17\Omega$ .

8. Set the INPUT switch = low.
9. Measure the  $r_{ON}$  resistance of Ring Return switch SW3 by connecting the positive terminal of an Ohm meter at TLINE (J1) and the negative terminal at GND (J6).  
 $r_{ON}$  SW3 should measure approximately  $44\Omega$ .
10. Note: The IV characteristics of an SCR (SW4) has a diode offset through the origin. Because of this offset, a digital Ohm meter can not be used to measure the on resistance of this switch.

### Current Limit verification of the ISL5571A MOSFET type switches (SW1, SW2, SW3), and the operation of the TSD pin as an indication that the switch has entered Thermal Shutdown.

1. Configure the logic switches as follows: TSD = low, INPUT = high and the LATCH = low, as defined on the board.
2. Connect the power supplies to the Evaluation board.
3. Set  $V_{BAT}$  to -48V and  $V_{DD}$  to +5V.
4. Configure mother board in the NORMAL mode by setting the MODE switch in Normal position.
5. Connect TBAT (J8) to the GND terminal (J6).
6. To measure the current limit of SW1, connect the positive terminal of an external voltage source ( $V_S$ ) through an amp meter to the TLINE terminal (J1). Connect the negative terminal of  $V_S$  to GND (J6). Start with  $V_S$  voltage set to zero volts.
7. Connect the positive terminal of a DC volt meter to the TSD banana jack (J10) and the negative terminal to GND (J6). The expected voltage reading is 0 volts.
8. Set the logic switch TSD in the floating position. Verify that the TSD voltage is approximately 5 volts.
9. Slowly increase the  $V_S$  voltage while monitoring the current through the amp meter. At approximately around 156mA the switch will enter into current limit. When current through the switch reaches the current limit of the switch, the current is clamped and held at a constant value. The switch then operates as a constant current source. Increasing the voltage beyond this point will not change the value of this current. As the temperature of the device increases the DC current limit of the switch will decrease.
10. Continue to increase the  $V_S$  voltage until the TSD voltage starts to cycle between 5V and ground (approximately 40V- 50V). The switch is now in Thermal Shutdown.
11. Return the  $V_S$  supply voltage to 0V.
12. Set the INPUT logic switch to low (Ring Return switch on).
13. Verify that the TSD Voltage is approximately 5V.
14. To measure the current limit of SW3, start with the  $V_S$  voltage set to zero volts.
15. Slowly increase the  $V_S$  voltage while monitoring the current through the amp meter. At approximately around 200mA the switch will enter into current limit. When

current through the switch reaches the current limit of the switch, the current is clamped and held at a constant value. The switch then operates as a constant current source. Increasing the voltage beyond this point will not change the value of this current. As the temperature of the device increases the DC current limit of the switch will decrease.

16. Continue to increase the  $V_S$  voltage until the TSD voltage starts to cycle between 5V and ground (approximately 20V). The switch is now in Thermal Shutdown.
17. Return the  $V_S$  supply voltage to 0V.
18. Set the INPUT logic switch to High (Line Break switches on).
19. Verify that the TSD Voltage is approximately 5V.
20. Connect RBAT (J9) to the GND terminal (J6).
21. To measure the current limit of SW2, move the positive terminal of  $V_S$  to the RLINE terminal (J2). Start with  $V_S$  voltage set to zero volts.
22. Slowly increase the  $V_S$  voltage while monitoring the current through the amp meter. At approximately around 156mA the switch will enter into current limit. When current through the switch reaches the current limit of the switch, the current is clamped and held at a constant value. The switch then operates as a constant current source. Increasing the voltage beyond this point will not change the value of this current. As the temperature of the device increases the DC current limit of the switch will decrease.
23. Continue to increase the  $V_S$  voltage until the TSD voltage starts to cycle between 5V and ground (approximately 40V- 45V). The switch is now in Thermal Shutdown.
24. Return the  $V_S$  supply voltage to 0V.

### Ringling a Phone with the ISL5571A

1. Configure the logic switches as follows: TSD = low, INPUT = high and the LATCH = low, as defined on the board.  
 Note: With TSD grounded the ISL5571A will be in the ALL OFF state. This means that the Line Break switches, Ring Access switch and Ring Return switch will all be OFF (Open).
2. Connect the power supplies to the Evaluation board.
3. Set  $V_{BAT}$  to -48V and  $V_{DD}$  to +5V.
4. Configure mother board in the NORMAL mode by setting the MODE switch in Normal position.
5. Connect the telephone to the RJ11 phone jack (J12).
6. Connect the battery backed Ring Generator to the ring generator BNC (J11) on the mother board. Set the ring generator to 20Hz 90V<sub>RMS</sub> referenced to a -48V offset.
7. Set TSD switch in the floating position.
8. Set the INPUT switch low and the phone will begin to ring.
9. Set the INPUT switch high and the phone will stop ringing.
10. Toggling the INPUT switch will simulate a normal phone cadence.

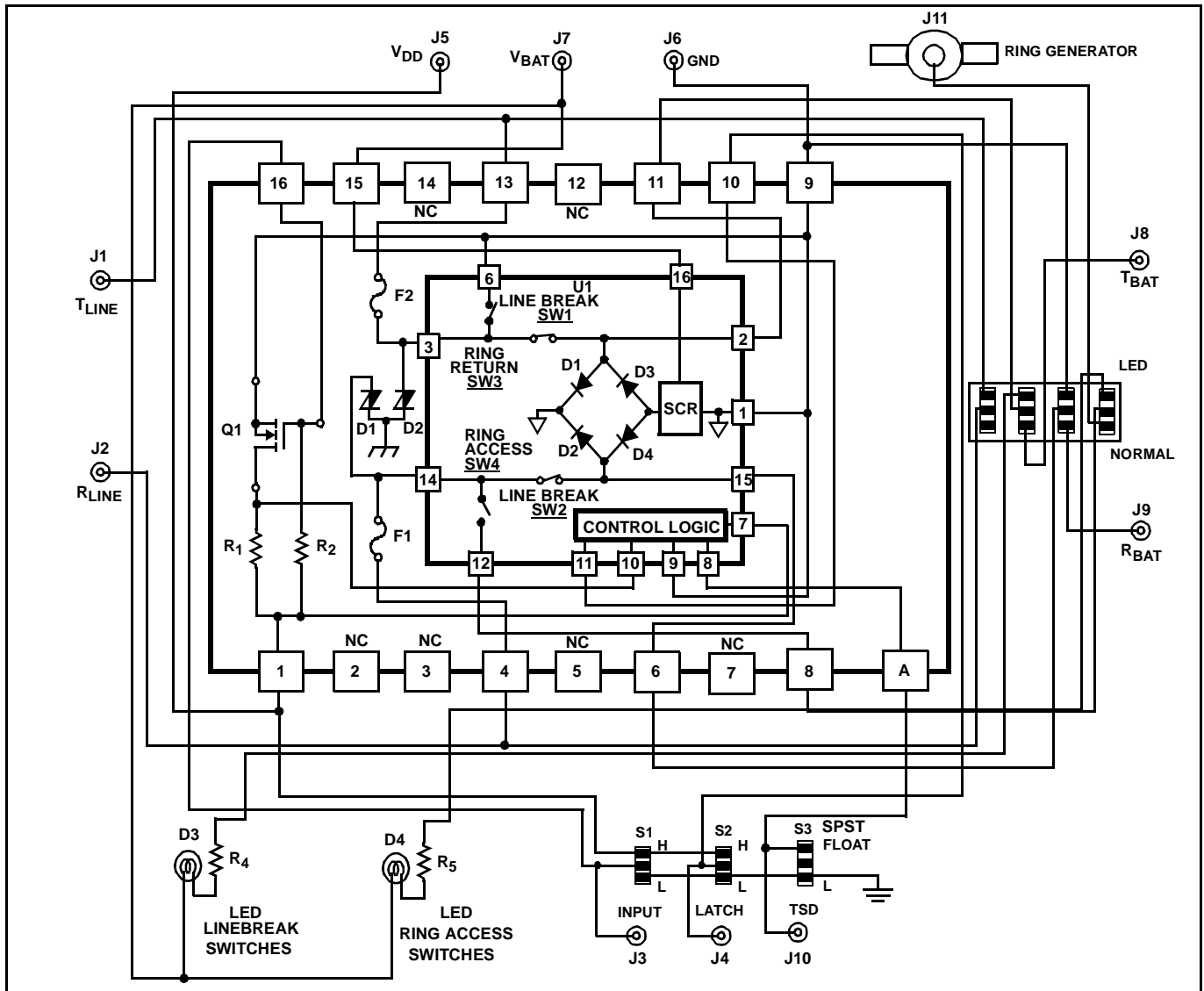


FIGURE 5. ISL5571A DEMO BOARDS SCHEMATIC

TABLE 1. CIRCUIT COMPONENT LIST

DAUGHTER BOARD			
COMPONENT	VALUE	TOLERANCE	RATING
Complete Daughter Card	ISL5571A/B-DBEVAL1	N/A	N/A
U1 - ISL5571A	ISL5571AIB	N/A	N/A
D1 - Teccor SIDACtor	P2000SC	N/A	N/A
D2 - Teccor SIDACtor	P1200SC	N/A	N/A
F1, F2 Teccor Telelink Fuses	F1250T	N/A	N/A
Q1 - Transistor	IRFD120	N/A	N/A
R1 - Drain Current Limiting Resistor	10k $\Omega$	10%	1/16 W
R2 - Pull-Up Resistor for the UniSLIC14	1k $\Omega$	10%	1/16W
R3	Not Populated	N/A	N/A

## Application Note 9870

MOTHER BOARD			
COMPONENT	VALUE	TOLERANCE	RATING
Complete Mother Board	ISL5571A/BEVAL1 REV A	N/A	N/A
R4, R5 - LED Current Limiting Resistor	10k $\Omega$	10%	1/2 W
D3, D4 - LED	Red	N/A	N/A

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