

# ISL72814SEHEV1Z

## User's Manual: Evaluation Board

High Reliability

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## ISL72814SEHEV1Z

Evaluation Board

### 1. Overview

The ISL72814SEHEV1Z evaluation board (shown in [Figure 4 on page 10](#)) features the [ISL72814SEH](#) 16-channel driver circuit IC. The IC is a radiation hardened, high-voltage, high-current 16-channel driver circuit with an integrated decoder for driving and selecting between a bank of relays, waveguide, and coaxial switches in space applications. The ISL72814SEHEV1Z is fabricated using the Renesas proprietary PR40 silicon-on-insulator process technology to mitigate single-event effects. It integrates 16 current drivers that feature high-voltage (42V), high-current (700mA) open-emitter PNP and common collector output stage.

The ISL72814SEHEV1Z provides a quick and easy method to evaluate the ISL72814SEH 16-channel driver circuit IC. This device is a unique IC. To use this evaluation board properly requires a thorough knowledge of the operation of the IC. See the [ISL72814SEH](#) datasheet for information about the devices's operation, function, and performance.

This user manual explains how to configure and use the ISL72814SEHEV1Z board to evaluate the ISL72814SEH 16-channel driver circuit IC.

#### 1.1 Key Features

1. Toggle switches for easy control of logic pins
2. LED circuitry for quick functional testing
3. Convenient test points and connections for test equipment
4. Banana jacks for power and ground connections and turret connectors for CH0 - CH15 channel connections

#### 1.2 Specifications

The evaluation board is configured and optimized for the following conditions:

- $V_{CC} = 3V$  to 13.2V
- $V_{CHx} = 34V$
- Channel output (CHx) load to 34V supply of  $\geq 48\Omega$  ( $\leq 700mA$ )
- Board temperature: +25°C

#### 1.3 Ordering Information

Part Number	Description
ISL72814SEHEV1Z	ISL72814SEH evaluation board

#### 1.4 Related Literature

For a full list of related documents, visit our website:

- [ISL72814SEH](#) device page

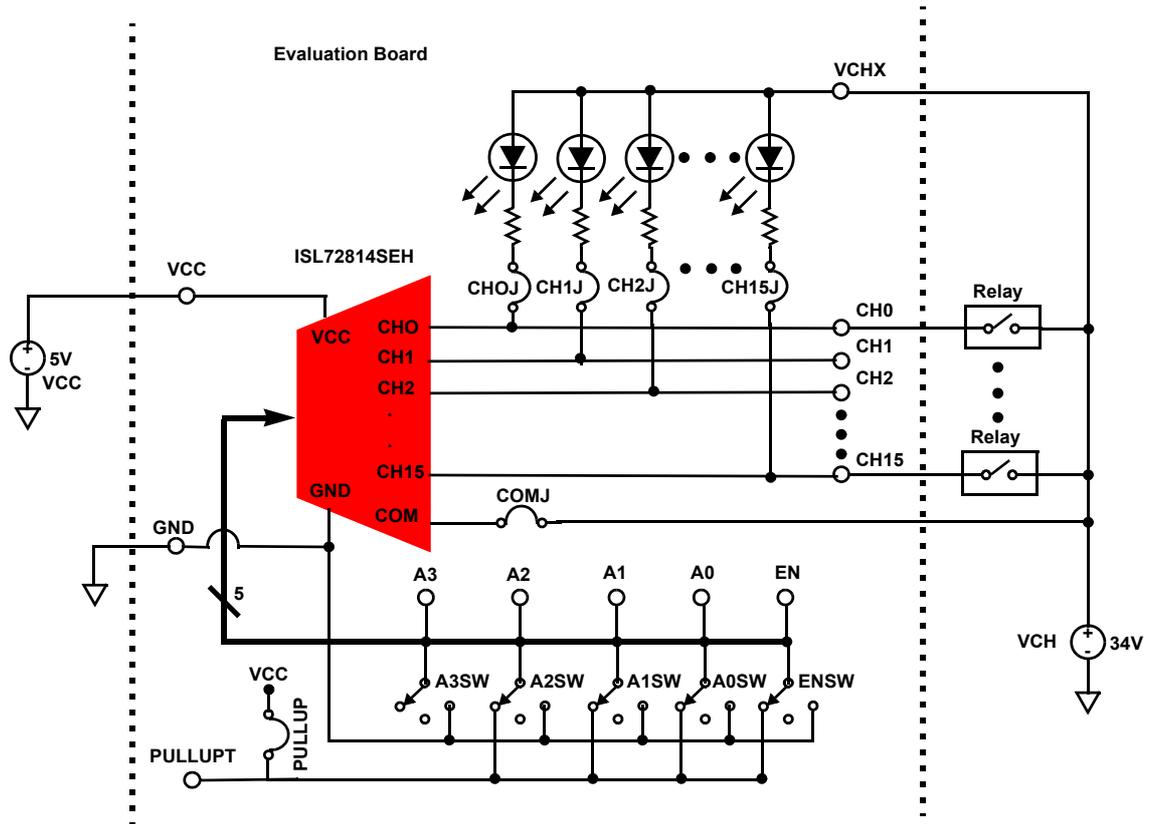


Figure 1. ISL72814SEHEV1Z Evaluation Board Block Diagram

## 2. Functional Description

The ISL72814SEHEV1Z evaluation board contains the ISL72814SEH radiation hardened 16-channel current driver IC.

The ISL72814SEH was specifically designed to drive the coils in a bank of relay circuits, waveguide switches, and coaxial switches. Only one channel is active at a time. A channel is selected by the logic level applied at the A0 - A3 logic pins. It has an enable pin (EN) that can deactivate all the channels when it is driven LOW. A channel can drive a relay coil that requires up to 700mA of current. The ISL72814SEH is designed to operate in the harsh environment of space.

[Figure 1 on page 3](#) shows the ISL72814SEHEV1Z evaluation board block diagram. A picture of the ISL72814SEHEV1Z is shown in [Figure 4 on page 10](#). The ISL72814SEHF/PROTO 28 Ld CDFP IC is soldered onto the ISL72814SEHEV1Z evaluation board at the center of the board and is designated as U1.

The ISL72814SEHEV1Z evaluation board provides a simple platform to demonstrate the features and evaluate the performance of the ISL72814SEH IC. It provides easy access to the ISL72814SEH pins and convenient connectors/test points for connecting test equipment. For more information, see the schematic ([Figure 5 on page 11](#)), top layer silkscreen ([Figure 8 on page 12](#)), and "[Bill of Materials](#)" on [page 11](#). Performance data taken using the ISL72814SEHEV1Z and basic lab equipment is shown in [Figures 9](#) through [14](#).

### 2.1 Basic Layout

The basic layout of the evaluation board is as follows (see [Figure 4 on page 10](#) or the actual ISL72814SEHEV1Z evaluation board):

Located in the center of the board is the ISL72814SEHF/PROTO driver circuit (U1). The evaluation board has a Pin 1 dot, to show how the IC should be oriented onto the evaluation board. The ISL72814SEH Pin 1 indicator lead needs to be aligned with the evaluation board Pin 1 dot indicator. The board is provided with the IC soldered onto it.

Power to bias the logic decoder and the ISL72814SEH's level shift circuitry is located at the bottom of the board through banana jacks labeled VCC and GND. A DC voltage source of 3V to 13.2V must be connected between VCC and GND.

The toggle switches labeled A3SW, A2SW, A1SW, A0SW, and ENSW located at the upper center of the evaluation board control the logic pins A0 - A3 and the EN pin.

Access to the 16 open-emitter PNP driver channels (CH0 - CH15) is through the board CH0 - CH15 silver turret connectors. A relay load or resistor simulating the relay load should be connected at these turret posts and to a DC voltage source in the range of 10V to 34V. Each CH0 - CH15 turret post is connected in parallel with an LED and resistor that can be connected through a jumper to check the functionality of the device. When jumpers CH0J - CH15J are installed, the LED circuitry is connected to the IC's CH0 - CH15 channels. Power for the LED circuitry is located at the top of the board through banana jacks labeled VCHX and GND. A DC voltage source of 34V must be connected between VCHX and GND to power the LED circuitry. See [Figure 1 on page 3](#). When ENSW = HIGH, the LED lights up for the channel selected by the logic levels at the A0-A3 pins.

Access to the COM pin is through the COM silver turret connector. It must be tied to the supply rail of the CHx channel with the highest voltage. With jumper COMJ installed, the board connects the supply voltage at banana jack VCHX to the COM pin.

The board schematic ([Figure 5 on page 11](#)) shows the reference designators of the jumpers, resistors, and connectors associated with each I/O.

#### 2.1.1 V<sub>CC</sub> Power Supply

The ISL72814SEH requires a V<sub>CC</sub> DC voltage supply in the range of 3.0V to 13.2V for proper operation. The V<sub>CC</sub> powers the logic circuitry.

The VCC power supply is connected at banana jacks VCC and GND. The power supply should be capable of delivering 100mA of current.

### 2.1.2 Logic Control

The ISL72814SEH has five logic control input pins; A0 - A3 (Pins 1 - 3 and 28) and EN (Pin 27).

The Logic 1  $V_{IH}$  level for the logic pins is from 2.0V to  $V_{CC}$ . The Logic 0  $V_{IL}$  level is from 0.8V to 0V. The  $V_{CC}$  voltage can be 3.0V to 13.2V.

The A0 - A3 digital input pins select between the 16 current driver circuit channels per the truth table in the [ISL72814SEH](#) datasheet. The selected channel is activated when the EN pin is HIGH (Logic 1).

The EN digital input enables and disables the current driver channels. When EN = LOW (Logic 0), all channels are deactivated (OFF). When EN = HIGH (Logic 1), the channel selected by the logic levels at A0 - A3 is activated (ON).

The toggle switches labeled A3SW, A2SW, A1SW, A0SW, and ENSW located at the upper center of the evaluation board control the logic pins A0 - A3 and the EN pin. In addition to the switches, the logic can be controlled by connecting your logic drivers at the A3, A2, A1, A0, and EN turret pins. When driving these pins, the toggle switches need to be in the center position. These turret pins can also monitor the voltage levels at the logic pins with a voltmeter or oscilloscope.

### 2.1.3 Test Points

The board has various test points for ease of connecting probes to make measurements. The test points available are described in [Table 1](#).

**Table 1. Test Points**

Designator	Description
GND1 - GND3	Ground test point
A3	A3 logic input test point
A2	A2 logic input test point
A1	A1 logic input test point
A0	A0 logic input test point
EN	EN logic input test point
COM	COM test point
CH0 - CH15	Open emitter output test points

**Table 2. Board Component Definitions**

Designator	Description
U1	ISL72814SEHL/PROTO CLCC IC
VCC	$V_{CC}$ power supply connection ( $3V_{DC}$ to $13.2V_{DC}$ )
GND	Ground connection
VCHX	VCHX power supply connection ( $34V_{DC}$ ) - Powers the CH0 - CH15 LED circuitry if CH0J - CH15J jumpers are installed. Connects the COM pin to VCHX voltage if the COMJ jumper is installed.
A0SW	Toggle switch for logic input A0
A1SW	Toggle switch for logic input A1
A2SW	Toggle switch for logic input A2
A3SW	Toggle switch for logic input A3
ENSW	Toggle switch for logic input EN
COM	COM connection (Tie to the CHx channel supply rail with the highest voltage)
CHO - CH15	Open emitter outputs load connections or test points
LED0 - LED15	LEDs for quick functional ISL72814SEH testing
R1, R2, R4, R6, R8 - R15, R17, R19 - R21	Load resistor for the LEDs

**Table 2. Board Component Definitions (Continued)**

Designator	Description
CH0J - CH15J	Jumpers to connect LED circuitry to the open emitter channels

## 2.2 Quick Start Guide

### 2.2.1 Required Equipment

The following equipment is recommended for testing:

- 5V power supply
- 34V power supply

### 2.2.2 Using the Board

1. Configure the board as shown in [Figure 2 on page 7](#).
2. Verify that jumpers CH0J - CH15J are installed on the board. This connects the LED circuitry to each driver channel.
3. Verify that the jumper PULLUP is installed on the board. The PULLUP jumper connects the VCC voltage to the toggle switches (A3SW, A2SW, A1SW, A0SW, and ENSW) high side.
4. Verify that the jumper COMJ is installed on the board. The COMJ jumper connects the VCHX voltage to the COM pin.
5. Put all of the toggle switches (A3SW, A2SW, A1SW, A0SW, and ENSW) in the LOW position, which connects the A0 - A3, and EN logic pins to ground. EN = LOW turns all channels off.
6. Apply 5V<sub>DC</sub> at the VCC banana jack.
7. Apply 34V<sub>DC</sub> at the VCHx banana jack.
8. Move the ENSW toggle switch to the high position (EN = V<sub>CC</sub>) to enable the current driver. The LED for the CH0 channel lights up indicating channel CH0 is ON.
9. Move the A0SW toggle switch to the high position. The LED for the CH1 channel lights up indicating that channel CH1 is ON.
10. Adjust the toggle switches to cycle through the various 16 driver channels by changing the logic at the A0 - A3 pins per the truth table in the [ISL72814SEH](#) datasheet.

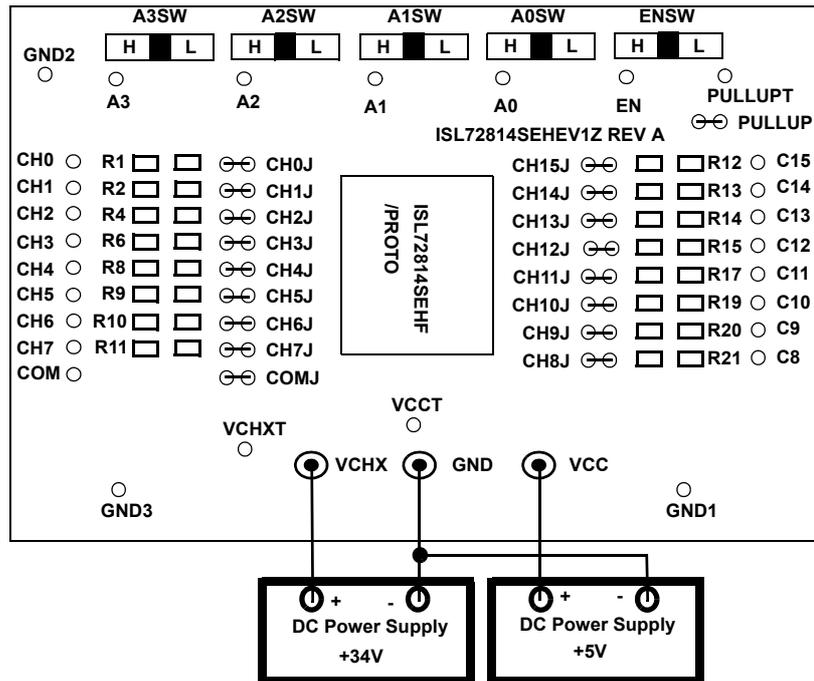


Figure 2. Basic Evaluation Test Setup for Functional Operation Testing

## 2.3 Using the Board to Measure VCH(SAT) vs Channel CH0 IEE

### 2.3.1 Required Equipment

The following equipment is needed to operate the board:

- DC power supply (3V to 13V)
- DC power supply (5V to 34V) capable of sinking 1A
- Resistor decade box or keysight B2902A precision source/measurement unit or equivalent

### 2.3.2 Initial Board Setup Procedure

1. Configure the board as shown in [Figure 3 on page 8](#).
2. Remove the CH0J - CH15J jumpers to disconnect the LED circuitry from the CH0 - CH15 channels.
3. Install jumpers at COMJ and PULLUP.
4. Put the A3SW, A2SW, A1SW, A0SW, and ENSW toggle switches in the LOW position. With the ENSW in the LOW position all channels are disabled (OFF).
5. Attach the 5V<sub>DC</sub> power supply to the banana jacks labeled VCC and GND as shown in [Figure 3](#). Positive terminal at VCC and negative terminal at GND. The supply should be capable of delivering 3V to 15V and 100mA of current. Set the supply voltage to 5V.
6. Attach the 34V<sub>DC</sub> power supply to the banana jacks labeled VCHX and GND as shown in [Figure 3](#). Positive terminal at VCHX and negative terminal at GND. The supply should be capable of delivering 34V and 1A of current. Set the supply voltage to 34V.
7. Connect the resistor decade box and Ammeter (A) to the CH0 pin on the evaluation board as shown in [Figure 3](#). One end of the decade box resistor should be connected to the CH0 pin through the ammeter to measure the ICH0 current. The other end of the resistor decade box connected to the 34V<sub>DC</sub> power supply. Set the decade box resistance to 170Ω.
8. Connect a voltmeter (V) between the CH0 pin and GND as shown in [Figure 3](#). The voltmeter measures the VCH (SAT) voltage.

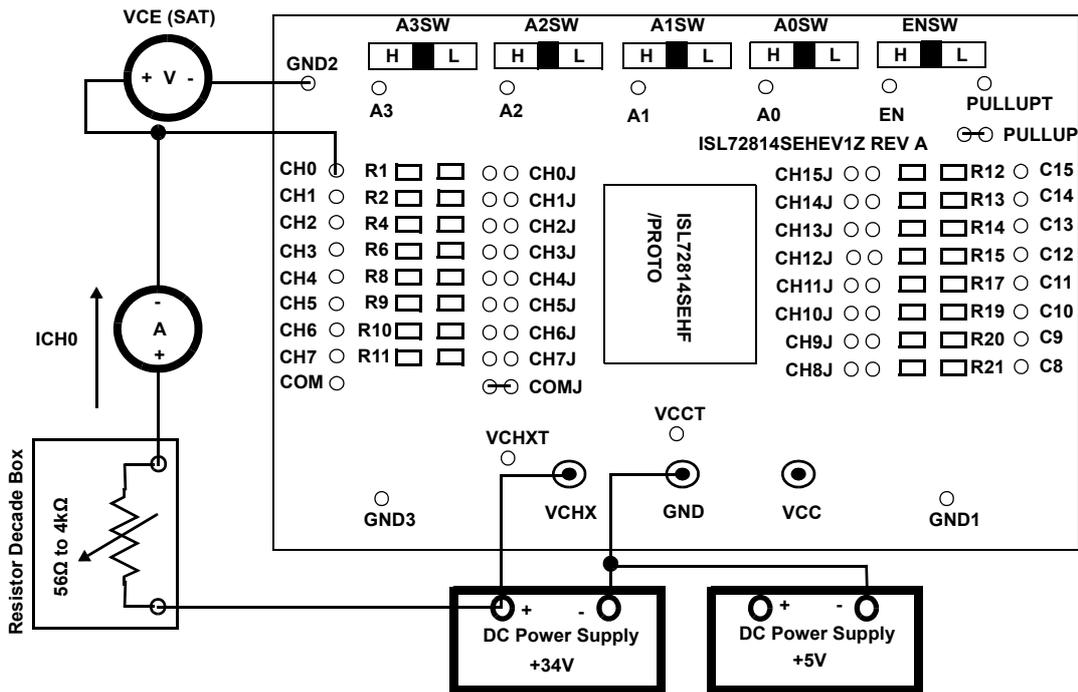


Figure 3. Basic Evaluation Test Setup Block Diagram (Measuring VCE (SAT) vs ICx)

### 2.3.3 VCH (SAT) Measurement for Channel CH0

1. Configure the board as described in [“Initial Board Setup Procedure” on page 7.](#)
2. Put the ENSW toggle switch in the HIGH position to enable the IC. The ICH0 current should read approximately 200mA and the VCH (SAT) voltage should read around 0.88V.
3. Change the decade box resistance to 97Ω. The ICH0 current should read approximately 350mA and the VCH (SAT) voltage should read around 0.997V.
4. Change the decade box resistance to 68Ω. The ICH0 current should read approximately 500mA and the VCH (SAT) voltage should read around 1.08V
5. Change the decade box resistance to 56.7Ω. The ICH0 current should read approximately 600mA and the VCH (SAT) voltage should read around 1.15V.
6. Change the decade box resistance to 48.6Ω. The ICH0 current should read approximately 700mA and the VCH (SAT) voltage should read around 1.23V.

### 2.3.4 Measuring VCH (SAT) on Other Channels

1. Configure the board as described in [“Initial Board Setup Procedure” on page 7](#).
2. Ensure that ENSW toggle switch is in the LOW position to disable the IC.
3. Move the ammeter and decade box to the new CHx channel to be tested. Move the voltmeter to measure the voltage from the new CHx channel to GND.
4. Configure the A3SW, A2SW, A1SW, and A0SW toggle switches to the appropriate logic levels to select the new CHx channel. See the truth table in the [ISL72814SEH](#) datasheet. For example, if you want to perform the measurement on the C15 channel, connect the ammeter/decade box at the CH15 turret on the evaluation board. Connect the voltmeter across the CH15 turret and GND1. Set the toggle switches as A3SW = HIGH, A2SW = HIGH, A1SW = HIGH, and A0SW = HIGH.
5. Repeat steps 2 - 5 in [“VCH \(SAT\) Measurement for Channel CH0” on page 8](#) for the new CHx channel.
6. Note: The performance curves shown in [Figure 9 on page 13](#) were taken using the evaluation board and a Keysight B2902A precision source/measurement unit. Test conditions:
  - a. The B2902A unit is set to measure and graph VCH (SAT) vs ICHX as you sweep the ICHX in 10mA increments from 0mA to 700mA.
  - b.  $V_{CC} = 5V$ ,  $V_{CHX} = 34V$ ,  $EN = V_{CC}$ , A3SW, A2SW, A1SW, and A0SW = Set to have the CHx channel ON.
  - c. Channels CH0, CH8, CH16, CH24, and CH31 were measured. The plots in [Figure 9](#) are the average of these channels.

### 3. PCB Layout Information

This section contains the evaluation board picture, schematic, bill of materials, and board layout.

#### 3.1 ISL72814SEHEV1Z Evaluation Board

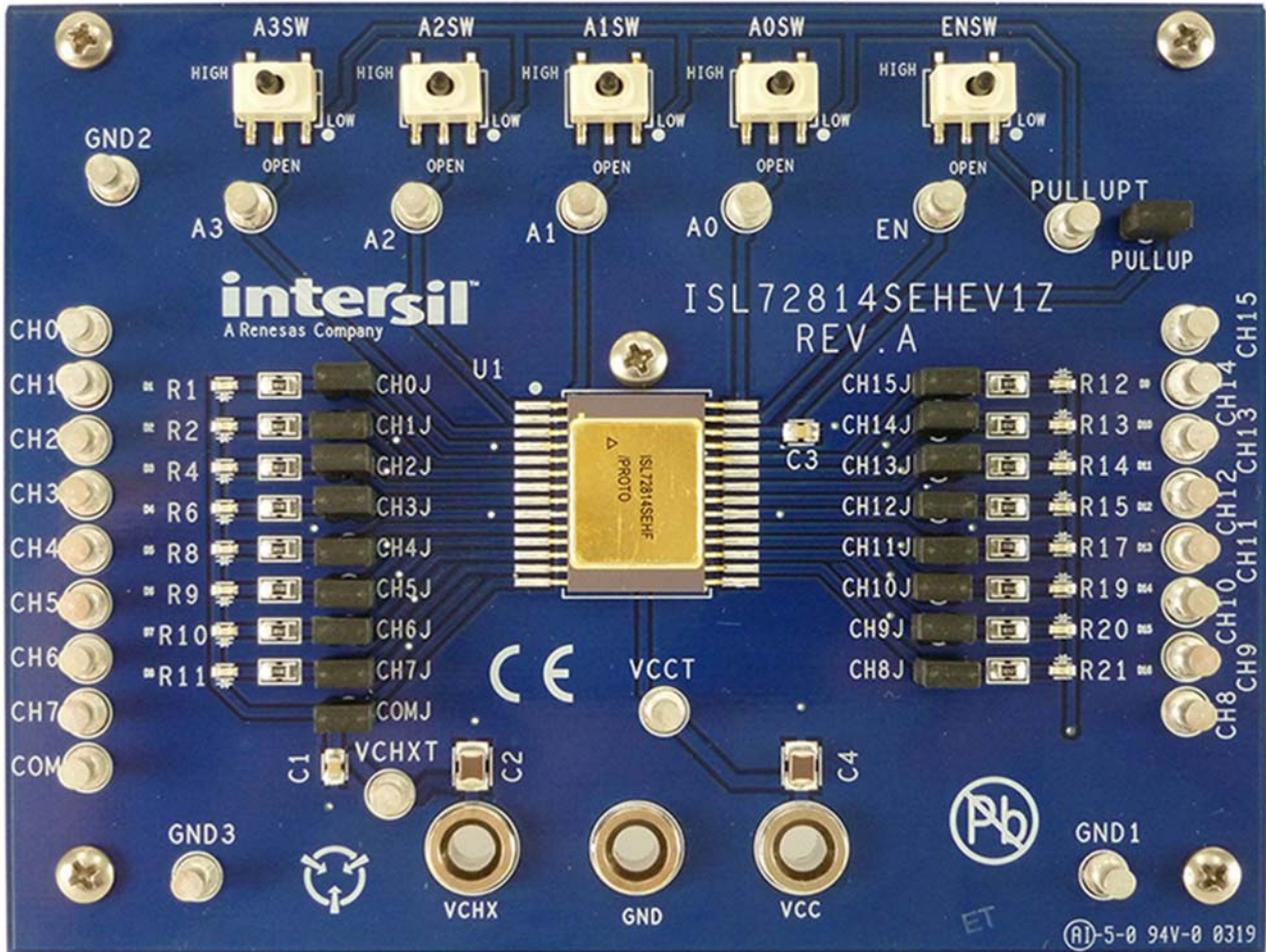


Figure 4. ISL72814SEHEV1Z Evaluation Board (Top View)

### 3.2 ISL72814SEH Circuit Schematic

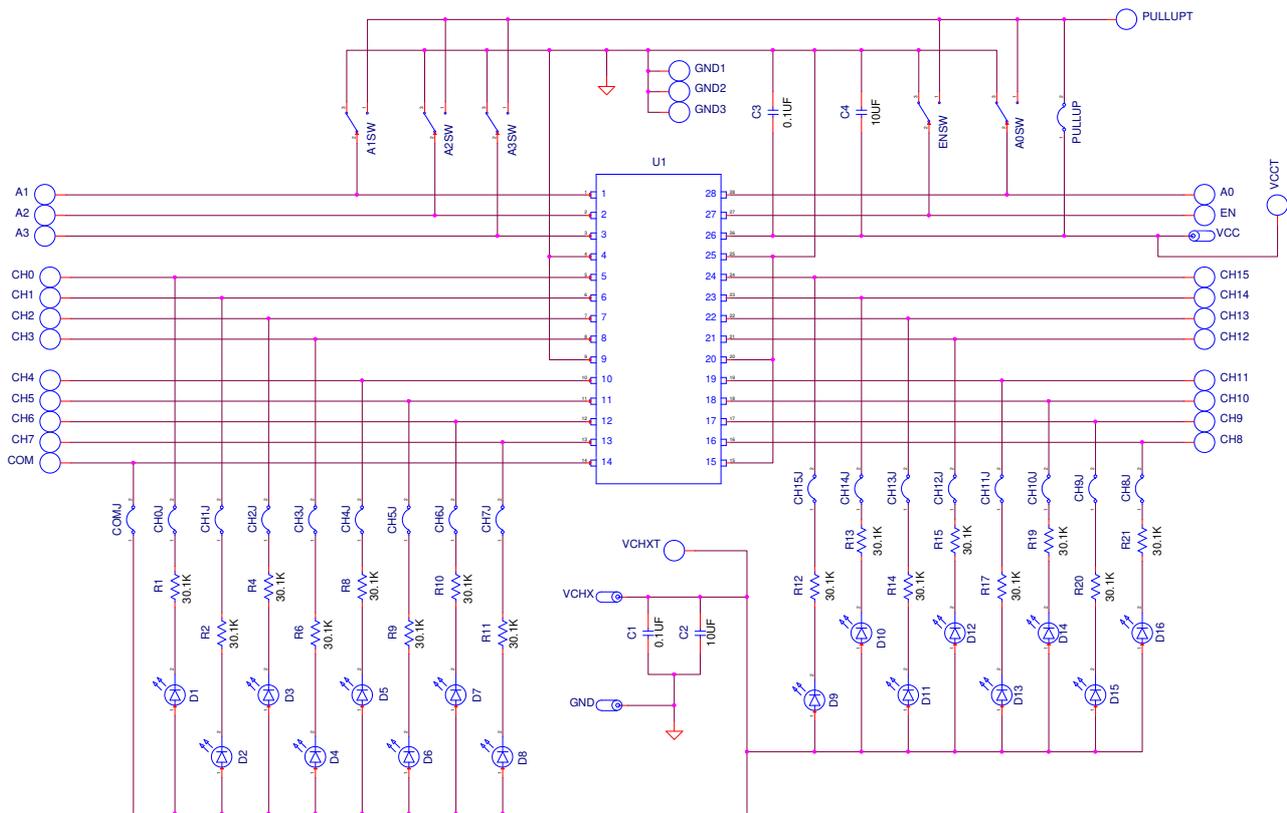


Figure 5. ISL72814SEHEV1Z Rev. A Evaluation Board Schematic

### 3.3 Bill of Materials

Qty	Reference Designator	Description	Manufacturer	Manufacturer Part Number
28		CONN-TURRET, Terminal Post, TH, ROHS	Keystone	1514-2
3	GND, VCC, VCHX	CONN-JACK, STD Banana, SDRLESS, Nickel/Brass, 0.350inch, ROHS	Keystone	575-8
18	CH0J - CH15J, COMJ, PULLUP	CONN-HEADER, 1x2, Retentive, 2.54mm, 0.230 x 0.120, ROHS	BERG/FCI	69190-202HLF
2	C2, C4	CAP, SMD, 1210, 10µF, 50V, 10%, X7S, ROHS	TDK	C3225X7S1H106K
2	C1, C3	CAP, SMD, 0805, 0.1µF, 50V, 5%, X7R, ROHS	Kemet	C0805C104J5RACTU
16	D1 - D16	LED - SMART, SMD, 0603, Green, 1.7V, 2mA, 570nm, 3.9mcd, ROHS	Osram	LGL29K-G2J1-24-Z
16	R1, R2, R4, R6, R8 - R15, R17, R19-R21	Resistor, RES-AEC-Q200, SMD, 0805, 30.1kΩ, 1/8W, 1%, ROHS	Panasonic	ERJ-6ENF-3012
5	A0SW - A3SW, ENSW	SWITCH-TOGGLE, SMD, 6PIN, SPDT, 3POS, ON-OFF, ROHS	ITT Industries/C&K Division	GT13MSCBE
1	U1	16-Channel Driver Circuit with Integrated Decoder	Renesas	ISL72814SEHF/PROTO

### 3.4 Board Layout

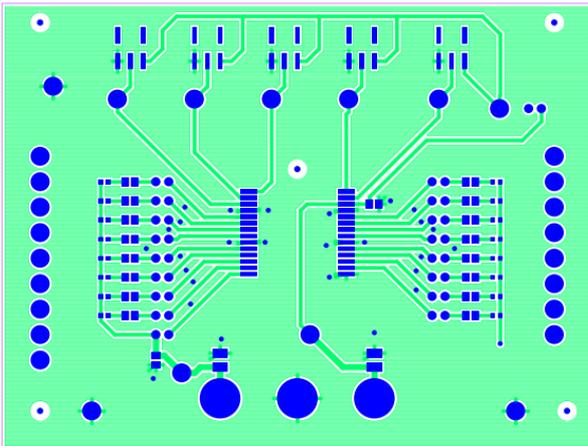


Figure 6. Top Layer

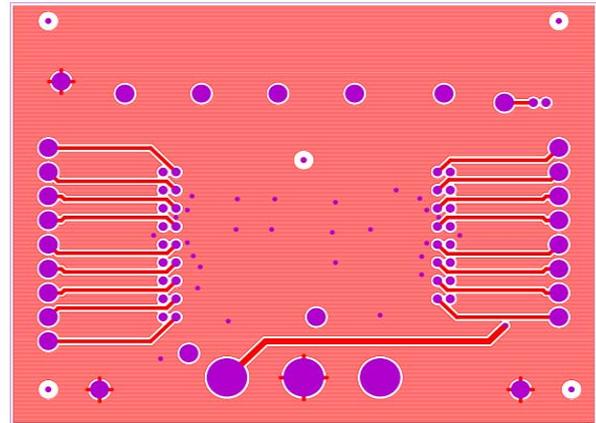


Figure 7. Bottom Layer

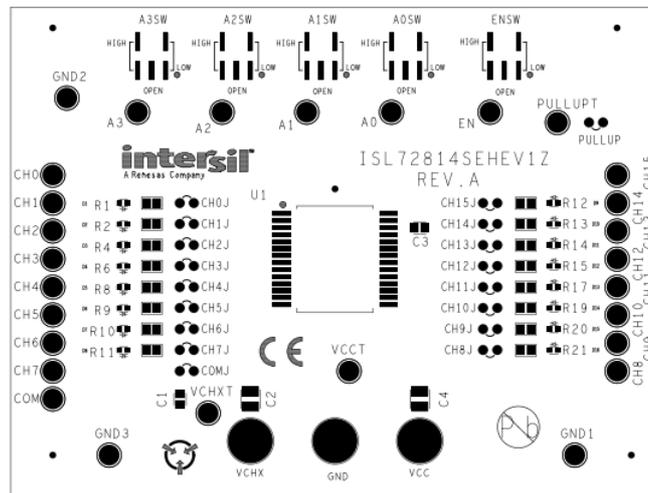


Figure 8. Top Layer Silk Screen

### 4. Typical Performance Curves

Unless otherwise noted,  $V_{CC} = 5.5V$ ,  $CH_X = 34V$ ;  $T_A = +25^\circ C$

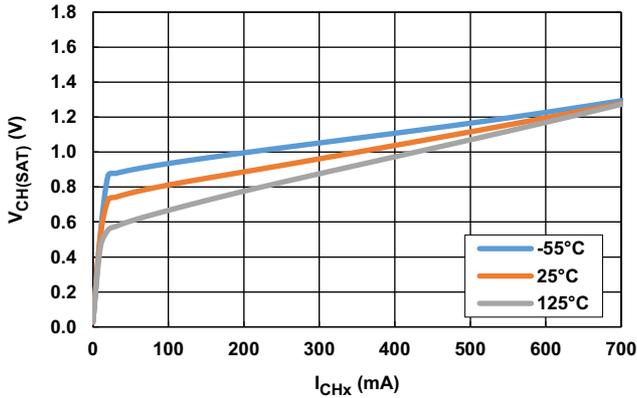


Figure 9.  $V_{CH(SAT)}$  vs  $I_{CHX}$  vs Temperature

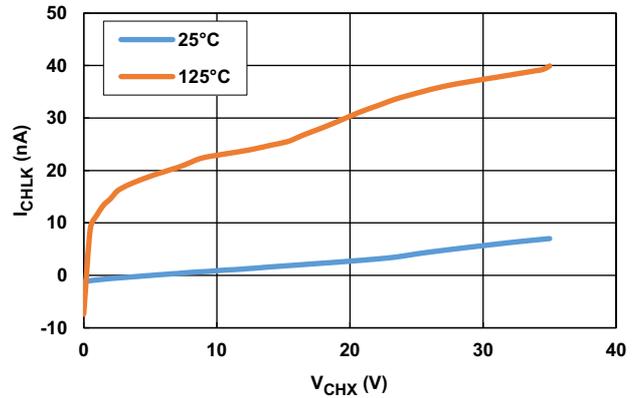


Figure 10. Single Channel Leakage vs Channel Voltage vs Temperature

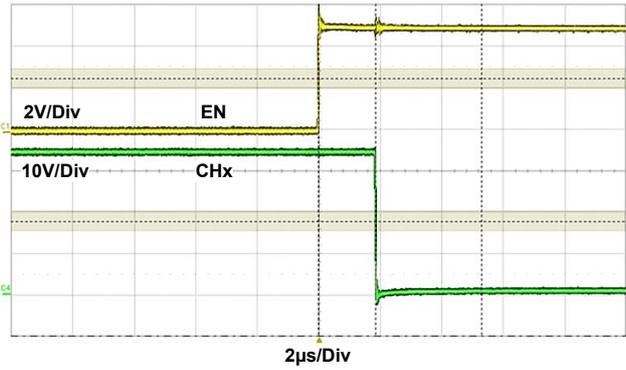


Figure 11.  $t_{ENABLE}$  ( $t_{EN}$ )

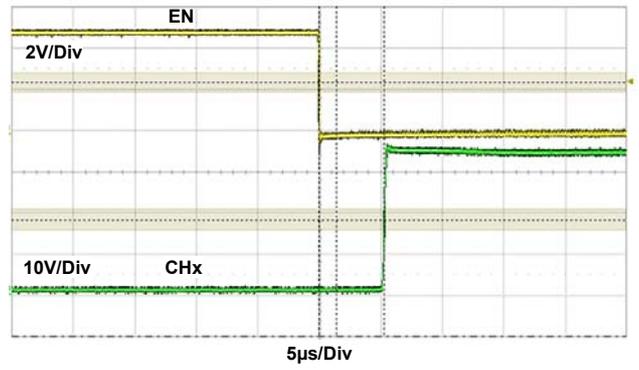


Figure 12.  $t_{DISABLE}$  ( $t_{DIS}$ )

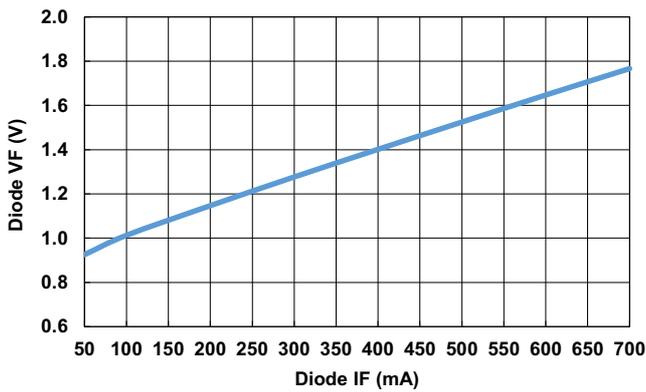


Figure 13. Clamp Diode Forward Voltage vs Diode Current

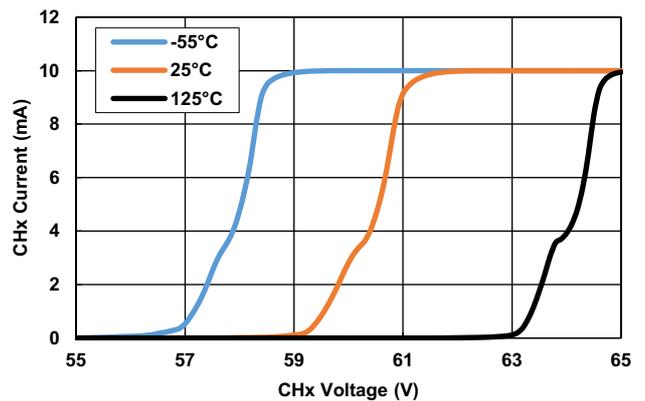


Figure 14.  $CHx$  Channel Breakdown Voltage (Current Limited to 10mA)

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## 5. Revision History

Rev.	Date	Description
1.00	Apr.5.19	Initial release

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