

ISL54226IRTZEVAL1Z

Evaluation Board

AN1577  
Rev 0.00  
March 16, 2012

**Description**

The ISL54226IRTZEVAL1Z evaluation board is designed to provide a quick and easy method for evaluating the ISL54226 USB Switch IC.

The ISL54226 device is a unique IC. To use this evaluation board properly requires a thorough knowledge of the operation of the IC. See the [ISL54226 datasheet](#) for an understanding of the functions and features of the device. Studying the device's truth-table along with its pin-out diagram on page 2 of the data sheet is the best way to get a quick understanding of how the part works.

A picture of the evaluation board is shown in Figure 1. The ISL54226 TDFN IC is soldered onto the evaluation board. It is located in the center of the board and is designated as U1.

The evaluation board contains USB connectors, banana jacks, and a toggle switch to allow the user to easily interface with the IC to evaluate its functions, features, and performance. For example, with the board properly powered and configured as shown in Figure 2, the user can control the OE/ALM logic pin with the toggle switch S1 to connect and disconnect an USB device from the USB host (computer).

In a typical application, the ISL54226 dual SPST part is used for switching or isolating a USB source in portable powered products.

This application note guides the user through configuring and using the ISL54226IRTZEVAL1Z evaluation board to evaluate the ISL54226 device.

**ISL54226IRTZEVAL1Z Evaluation Board**

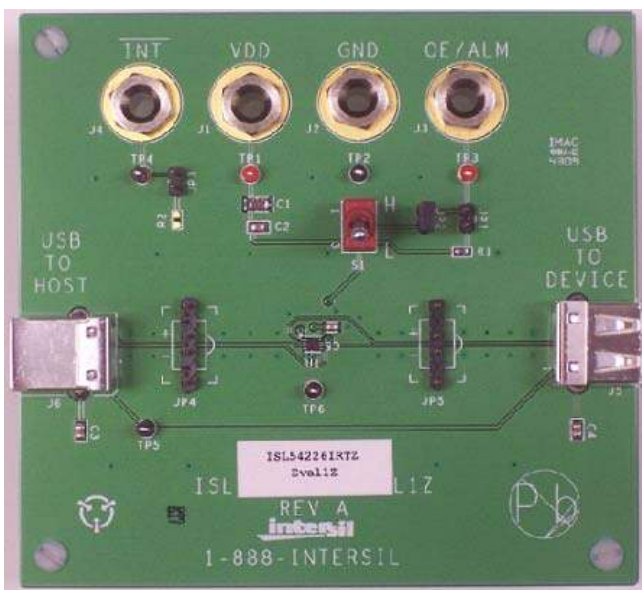


FIGURE 1. ISL54226IRTZEVAL1Z EVALUATION BOARD

**Features**

- Standard USB Connectors
- Banana Jacks for Power, Ground and Logic Input/Output Connections
- Toggle Switch for Easy Control of the OE/ALM Logic Pin
- Convenient Test Points and Connections for Test Equipment

**Board Architecture/Layout**

**Basic Layout of Evaluation Board**

The basic layout of the evaluation board is as follows: (see Figure 1 and “ISL54226IRTZEVAL1Z Board Schematic” on page 4).

- Power and Ground connections are at the banana jacks (J1 and J2) at the top of the board.
- Logic input connection, OE/ALM, is at banana jack J3 located at the top left side of the board. OE/ALM can also be accessed by using the toggle switch S1. To use the toggle switch, jumper JP2 must be installed. To control the logic through the banana jack J3 the JP2 jumper must not be populated.
- Logic output connection,  $\overline{\text{INT}}$  is at the top right side of the board at banana jack J4.
- USB connection to an upstream host controller (Computer) is made at the USB connector J6 located at the left side of the board.
- USB connection to the downstream USB device is made at USB connector J5, located on right side of the board.
- The ISL54226 IC (U1) is located in the center of the board. The evaluation board has a Pin 1 indicator dot to show how the IC should be oriented on the evaluation board. The IC Pin 1 indicator dot should be aligned with the evaluation board Pin 1 indicator dot.

**IC Power Supply**

A DC power supply connected at banana jacks J1 (VDD) and J2 (GND) provides power to the ISL54226 IC. The IC requires a 2.7VDC to 5.25VDC power supply for proper operation. The power supply should be capable of delivering 100µA of current.

**Logic Control**

The state of the ISL54226 device is determined by the voltage at the OE/ALM pin. Access to the OE/ALM pin is through the banana jack J3 (OE/ALM) or the toggle switch S1. To use the toggle switch to control the logic, a jumper must be installed at JP2. Remove jumper to control the logic through the banana jack.

The OE/ALM pin is an open drain connection. It needs to be pulled “HIGH” with an external 100kΩ pull-up resistor to VDD. The OE/ALM pin can then be driven “LOW” by a µProcessor to

open all switches or it can be monitored by the  $\mu$ Processor for a “LOW” when the part goes into an overvoltage condition. The evaluation board has a 100k $\Omega$  pull-up resistor to VDD that can be put on the OE/ALM pin by putting a jumper at JP1.

If OE/ALM is driven “LOW” (to ground) and the signal voltage is in the range of 0V to 3.6V, the SPST switches will be OFF. The USB host controller (computer) connected at J6 (USB TO HOST) will be disconnected from the USB device connected at J5 (USB TO DEVICE) and no data will be transferred.

If OE/ALM is driven “HIGH” (pulled up to VDD) and the signal voltage is in the range 0V to 3.6V, the high-speed (HS) switches will be ON. In this state, the USB host controller (computer) connected at J6 (USB TO HOST) will be connected through to the USB device connected at J5 (USB TO DEVICE) and data will be able to be transmitted between the computer and the device.

If the signal at the host (computer side) of the switch is >3.8V (typ) or <-0.45V (typ) the ISL54226 IC will turn the switches OFF and internally pull the OE/ALM pin “LOW”.

## INT OUTPUT

Access to the ISL54226  $\overline{\text{INT}}$  pin is at banana jack J4 ( $\overline{\text{INT}}$ ). During normal USB transmission and an OVP condition, this pin outputs a “HIGH”. The ISL54226 part internally pulls this pin “LOW” when the COM pins have been tied together and the OE/ALM pin is “LOW”. The purpose of the pin is to be monitored by a  $\mu$ P to tell when a charger has been connected into the USB port. See the [ISL54226 datasheet](#), page 6 for description of “Charger Port Detection”.

## USB Connections

A “B” type USB receptacle labeled “USB TO HOST” (J6) is located at the right side of the board. This receptacle should be connected, using a standard USB cable, to the upstream USB host controller, which is usually a PC computer or hub.

An “A” type USB receptacle labeled “USB TO DEVICE” (J5) is located on the right side of the board. A USB device can be plugged directly into this receptacle or through a standard USB cable.

The USB switches are bi-directional, which allows the host (computer) and downstream USB device to both send and receive data.

## High-Speed Switches

The two SPST switches are bi-directional switches that can pass signals up to 3.6V with a VDD supply voltage in the range of 2.7V to 5.25V.

When powered with a 2.7V supply, these switches have a nominal  $r_{\text{ON}}$  of 3.5 $\Omega$  over the signal range of 0V to 400mV with a  $r_{\text{ON}}$  flatness of 0.26 $\Omega$ . The  $r_{\text{ON}}$  matching between the SPST switches over this signal range is only 0.2 $\Omega$  ensuring minimal impact by the switches to USB high speed signal transitions. As the signal level increases, the  $r_{\text{ON}}$  switch resistance increases. At a signal level of 3.3V, the switch resistance is nominally 6.8 $\Omega$ .

The SPST switches were specifically designed to pass USB 2.0 high-speed (480Mbps) differential signals typically in the range of 0V to 400mV. They have low capacitance and high bandwidth to pass the USB high-speed signals with minimum edge and

phase distortion to meet USB 2.0 high speed signal quality specifications.

The SPST switches can also pass USB full-speed signals (12Mbps) with minimal distortion and meet all the USB requirements for USB 2.0 full-speed signaling.

The maximum normal operating signal range for the SPST switches is from 0V to 3.6V. For normal operation, the signal voltage should not be allowed to exceed this voltage range or go below ground by more than -0.3V.

However, in the event that a positive voltage >3.8V (typ) to 5.25V, such as the USB 5V  $V_{\text{BUS}}$  voltage, gets shorted to one or both of the COM+ and COM- pins or a negative voltage <-0.5V (typ) to -5V gets shorted to one or both of the COM pins, the ISL54226 has OVP circuitry to detect the overvoltage condition and open the SPST switches to prevent damage to the USB down-stream transceiver connected at the signal pins (D+ and D-).

The OVP and power-off protection circuitry allows the COM pins (COM-, COM+) to be driven up to 5.25V while the  $V_{\text{DD}}$  supply voltage is in the range of 0V to 5.25V. In this condition, the part draws <100 $\mu$ A of  $I_{\text{COMx}}$  and  $I_{\text{DD}}$  current and causes no stress to the IC. In addition, the SPST switches are OFF and the fault voltage is isolated from the other side of the switch.

The OE/ALM pin gets internally pulled “LOW” whenever the part senses an overvoltage condition. The pin can be monitored for a “LOW” to determine when an overvoltage condition has occurred.

## Board Component Definitions

Evaluation board components and their functions are shown in Table 1.

TABLE 1. BOARD COMPONENT DESCRIPTIONS

DESIGNATOR	DESCRIPTION
U1	ISL54226IRTZ IC
J6	“B” type USB Receptacle
J5	“A” type USB Receptacle
J1	VDD Positive Connection
J2	VDD Negative Connection
J3	OE/ALM Logic Control
J4	$\overline{\text{INT}}$ Logic Output
S1	OE/ALM Toggle Switch
JP4, JP5	D-/D+ Differential Probe Connection
JP1	Connects 100k $\Omega$ Pullup from OE/ALM Pin to VDD
JP2	Toggle Switch S1 (OE/ALM) Jumper
JP3	$\overline{\text{INT}}$ Output Load Jumper

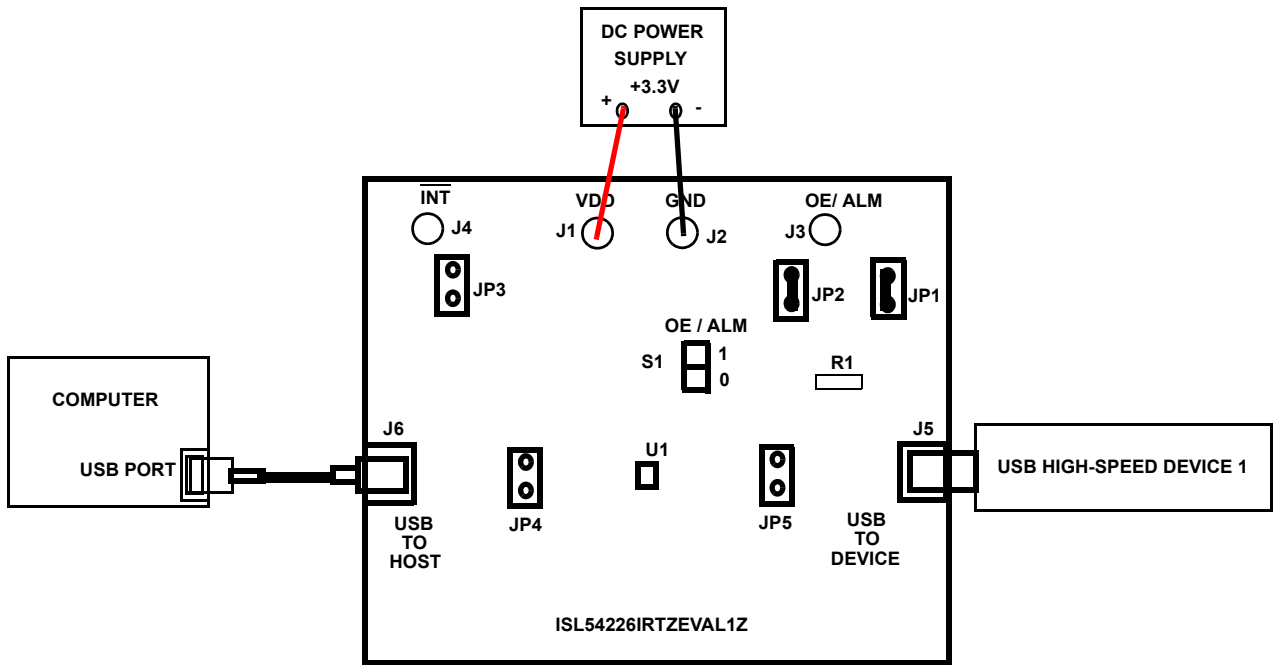


FIGURE 2. BASIC EVALUATION TEST SETUP BLOCK DIAGRAM

## Using the ISL54226IRTZEVAL1Z Evaluation Board (see Figure 2)

### Lab Equipment

The equipment, external supplies and signal sources needed to operate the board are listed below:

1. +2.7V to +5.25V DC Power Supply
2. One High-Speed USB Device (i.e., USB memory stick, MP3 Player, etc.)
3. Computer with 2.0 High-Speed USB Port
4. Standard USB Cable

### Initial Board Setup Procedure

1. Install jumpers at JP1 and JP2. Allows logic control of OE/ALM using the S1 switch and connects 100kΩ pull-up resistor from OE/ALM to VDD.
2. Attach the main evaluation board to a DC power supply at J1 (VDD) and J2 (GND). Positive terminal at J1 and negative terminal at J2. The supply should be capable of delivering 2.7V to 5.25V and 100μA of current. Set the supply voltage to 3.3V.
3. Connect the high-speed USB device at USB connector J5 (USB TO DEVICE). This connector is located on the right side of the evaluation board.
4. Drive the OE/ALM control pin “LOW” to open the ISL54226 SPST switches by putting toggle switch S1 in the down position.
5. Connect the USB cable from the host (PC computer) to the USB “B” type receptacle, J6 (USB TO HOST).

### High-Speed Operation

1. Apply a logic “HIGH” to the OE/ALM pin by putting toggle switch S1 in the up position.
2. You should now be able to send and receive data between the computer and the USB device connected at J5.
3. To disconnect the USB device from the computer take the OE/ALM pin LOW by putting toggle switch S1 in the down position.

### Test Points

The board has various test points to allow the user to connect probes to make measurements. The test points are described in Table 2.

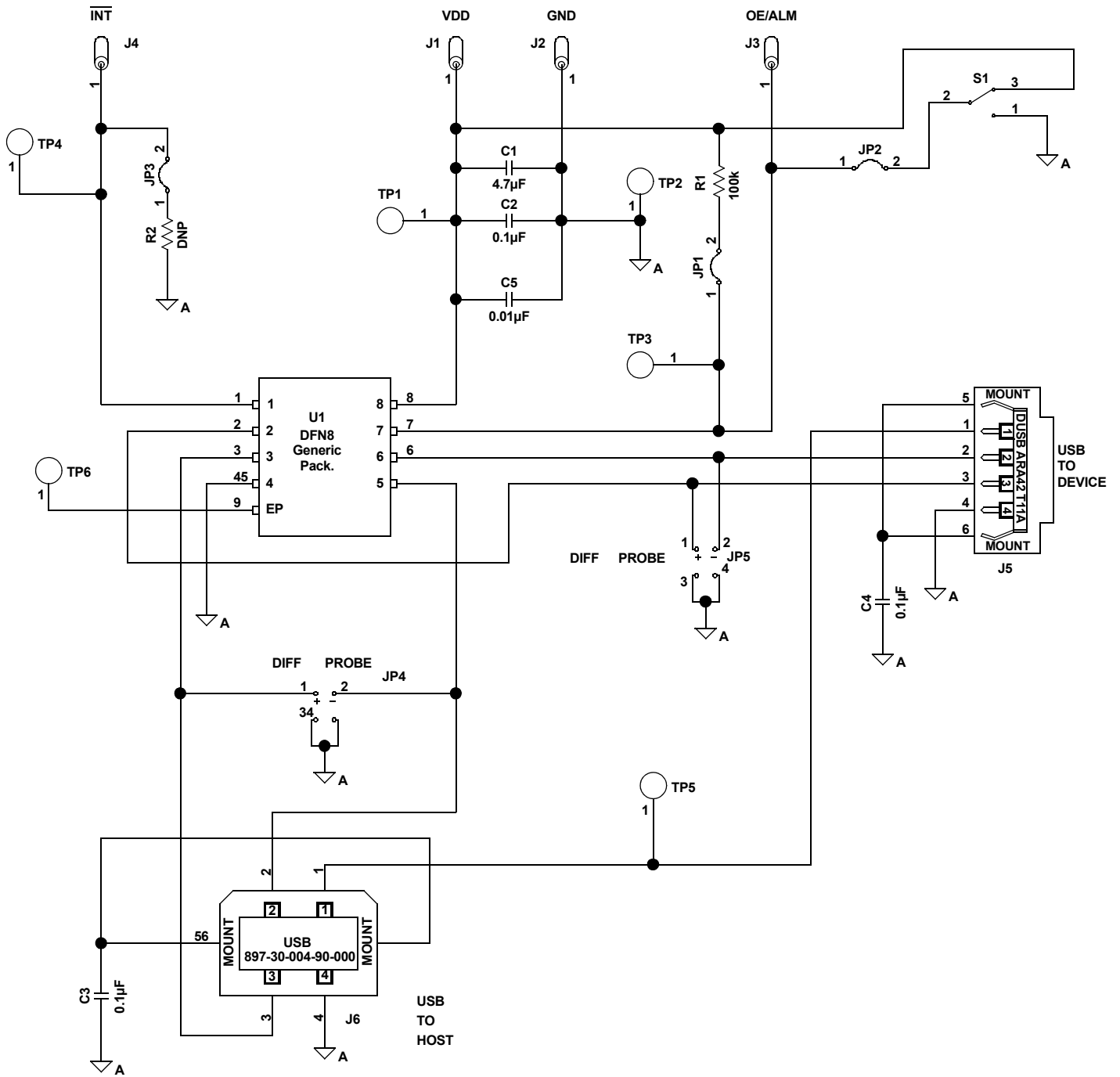
TABLE 2.

DESIGNATOR	DESCRIPTION
TP1	VDD Test Point
TP2	Ground Test Point
TP3	OE /ALM Test Point
TP4	$\overline{\text{INT}}$ Test Point
TP5	VBUS Test Point
JP4	D-/D+ Differential Probe Connection - COM Side of Switch
JP5	D-/D+ Differential Probe Connection - USB Device Side of Switch

You can observe the D- and D+ USB signal on an oscilloscope or other test equipment by connecting a differential probe at JP5.

You can observe the D- and D+ USB signal at the COM side of the switch on an oscilloscope or other test equipment by connecting a differential probe at JP4.

# ISL54226IRTZEVAL1Z Board Schematic



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(Rev.4.0-1 November 2017)



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