User's Manual

ISL71610-710EV1Z

User's Manual: Evaluation Board

High Reliability

Rev.0.00 Dec 2018

ISL71610-710EV1Z

Evaluation Board

UG191
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1. Overview

The ISL71610-710EV1Z evaluation board (shown in Figure 4 on page 8) features the ISL71610M and ISL71710M Magnetoresistive (GMR) digital isolator parts. These ICs are radiation tolerant digital isolators designed for isolated power supply designs and isolated serial communications interfaces, such as CAN, SPI, RS-422, and RS-485 applications.

The ISL71610M is a passive input, active output GMR digital isolator that requires a 3V to 5.5V supply to power its CMOS output. The ISL71710M is an active input, active output GMR digital signal isolator that requires an input supply and an output supply voltage in the range of 3V to 5.5V. The ISL71710M can be used to level shift the digital signal at its input.

These GMR isolators can replace some of the available optocouplers currently used in space applications. Whereas optocoupler lines are susceptible to Total Ionizing Dose (TID) radiation that causes the optics to become cloudy and thus compromising the signal, the GMR inductive structure used in the ISL71610M and ISL717170M is inherently immune to radiation effects.

The ISL71610-710EV1Z evaluation board provides a quick and easy method to individually evaluate the ISL71610M and ISL71710M digital isolator parts. See the ISL71610M and ISL71710M datasheets for information about each of the device's operation, function, and performance.

This user guide explains how to configure and use the ISL71610-710EV1Z board to evaluate the ISL71610M and ISL71710M digital isolators.

1.1 Key Features

- Easy to use design
- Convenient test points and connections for test equipment
- 3V to 5.5V signal operation
- 500V_{DC} rated barrier isolation

1.2 Specifications

The ISL71610-710EV1Z evaluation board is designed for ease of evaluation with a minimum of components and connections. The electrical ratings of the ISL71610-710EV1Z evaluation board are shown in Table 1.

Table 1. Electrical Ratings

Parameter	ISL71610M Rating	ISL71710M Rating
Data Throughput	100Mbps	150Mbps
DC Supply Voltage	3V to 5.5V	3V to 5.5V
Coil Current	±8mA to ±20mA	N/A
Output Current	±4mA	±4mA
Temperature	-55ºC to +125ºC	-55ºC to +125ºC

1.3 Ordering Information

Part Number	Description
ISL71610-710EV1Z	Radiation tolerant ISL71610M and ISL71710M digital isolator evaluation board

1.4 Related Literature

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

• ISL71610M, ISL71710M device pages

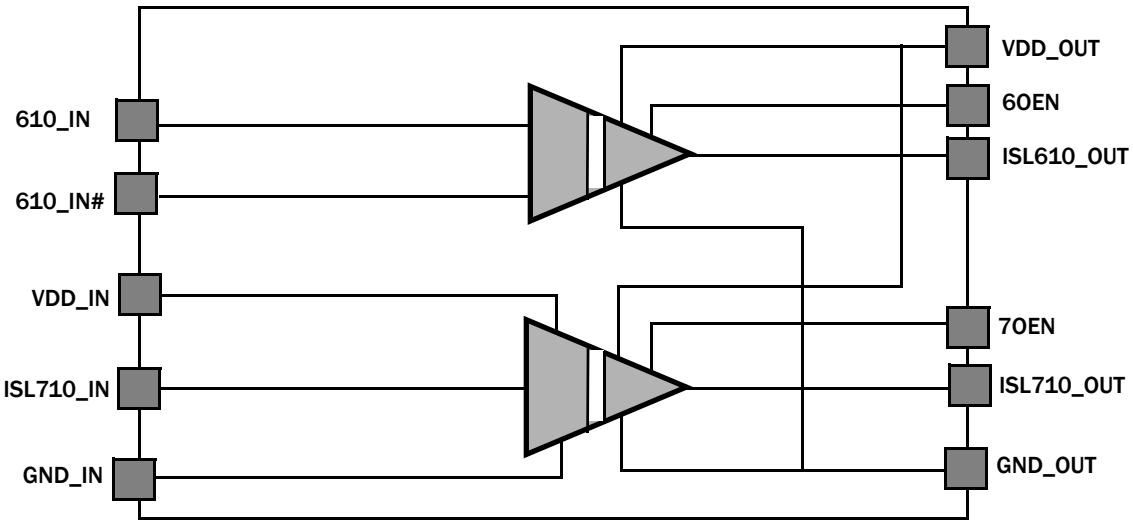

Figure 1. ISL71610-710EV1Z Evaluation Board Block Diagram

2. Functional Description

The ISL71610-710EV1Z evaluation board contains the ISL71610M and the ISL71710M digital signal isolator ICs.

The ISL71610M is a passive input digital signal isolator with a CMOS output that requires a single supply in the range of 3V to 5.5V to power its CMOS output.

The ISL71710M is an active input and active output CMOS digital isolator. It requires two DC supplies of 3V to 5.5V for its operation. One supply powers the input and the other supply powers the output. The ISL71610-710EV1Z takes a digital signal at its input with an amplitude up to the input DC supply rail and passes it to the output when $\overline{OE}$ is low. The input accepts TTL logic input levels and the output drives TTL logic output levels.

Figure 1 on page 3 shows the ISL71610-710EV1Z evaluation board block diagram. A picture of the ISL71610-710EV1Z is shown in Figure 4 on page 8. The ISL71610MBZ 8Ld NSOIC IC is soldered onto the ISL71610-710EV1Z evaluation board at the upper center of the board and is designated as ISL71610. The ISL71710MBZ 8Ld NSOIC IC is soldered onto the ISL71610-710EV1Z evaluation board at the lower center of the board and is designated as ISL71710.

The ISL71610-710EV1Z evaluation board provides a simple platform to demonstrate the features and evaluate the performance of both the ISL71610M and ISL71710M digital isolators. It provides easy access to the pins of each device and convenient connectors/test points for connecting test equipment. For more information, refer to the schematic (Figure 5 on page 9), top layer silkscreen (Figure 8 on page 10), and "Bill of Materials" on page 9. Performance data taken using the ISL71610-710EV1Z and basic lab equipment is shown in Figures 9 through 22.

2.1 Basic Layout

The basic layout of the ISL71610-710EV1Z evaluation board is as follows: (See Figure 4 on page 8 for the actual ISL71610-710EV1Z evaluation board).

The evaluation board consists of two sections. The upper half of the board contains the ISL71610M IC along with the connections, input signal conditioning components and test points to access and evaluate the ISL71610M part. The lower half of the board contains the ISL71710M IC along with the connections, load components, and test points to access and evaluate the ISL71710M part.

The board schematic (Figure 5 on page 9) shows the reference designators of the jumpers, resistors, and connectors associated with each I/O.

2.1.1 ISL71610 Section

The ISL71610M digital isolator IC is located in the upper center of the board and is labeled ISL71610.

Power for the active output of the IC is located at the upper right side of the board through the compact clip-on connector labeled VDD_OUT and the compact clip-on connector labeled GND_OUT. A DC voltage source in the range of 3V to 5.5V must be connected from the positive terminal to VDD_OUT connector and from the negative terminal to GND_OUT connector. Note: Connectors VDD_OUT and GND_OUT also power the active output of the ISL71710M part.

The ISL71610M can be configured as either a non-inverting isolator or an inverting isolator with a pair of jumpers installed on the appropriately labeled sides of the J_1 and J_2 jumpers. The waveforms for each are shown in Figure 11 on page 11 and Figure 12 on page 11, respectively.

The current through the coil can be monitored with a current probe and adjusted by the +V and -V amplitude of the signal generator attached using the 610_IN and 610_IN# connectors on the evaluation board. R_1 is the coil current limiting resistor. Although there is no maximum voltage that can be applied to the coil, the current must be between ±8 to ±20mA for both a robust and reliable output in an ion environment and over the operating life.

The output of the ISL71610 is resistively loaded with 1.5k so it does not exceed the ±4mA output current rating and capacitively loaded with 3.9pF to approximate a total 14pF to 15pF with a typical scope probe. The output is monitored on the ISL610_OUT, a scope probe jack.

Access to the $\overline{OE}$ pin of the IC is through the compact clip-on connector labeled 6OEN on the evaluation board. When 6OEN is low (< 0.8V), the output of the IC is active and the signal at the input is passed to the output of the IC. When the output pin is driven high (> 2.4V), the output is disabled, the input is not passed to the output, and the output is put in a high impedance state. The $\overline{OE}$ pin has an internal pull-down of 100kΩ and can be left floating if an application does not require the output disable function.

2.1.2 ISL71710 Section

The ISL71710M digital isolator IC is located in the lower center of the board and is labeled ISL71710. The Pin 1 dot shows how the IC should be oriented on to the evaluation board. The IC Pin 1 dot indicator must be aligned with the evaluation board Pin 1 dot indicator. The IC is soldered onto the evaluation board.

Power for the active input of the IC is located at the middle left side of the board through the compact clip-on connector labeled VDD_IN and the compact clip-on connector labeled GND_IN. Connect a DC voltage source in the range of 3V to 5.5V from the positive terminal to the VDD_IN connector and from the negative terminal to the GND_IN connector.

Power for the active output of the IC is located at the upper right side of the board through the compact clip-on connector labeled VDD_OUT and the compact clip-on connector labeled GND_OUT. Connect a DC voltage source in the range of 3V to 5.5V from the positive terminal to the VDD_OUT connector and from the negative terminal to the GND_OUT connector. Note: Connectors VDD_OUT and GND_OUT also power the active output of the ISL71610M part.

Access to the IN pin of the digital isolator is at the banana jack labeled ISL710_IN located at the lower left side of the evaluation board. Apply a digital signal in the range of 0V to VDD_IN at the ISL710_IN banana jack. The input trace has a 50Ω resistor (labeled R_5) to ground GND_IN for termination of 50Ω function/pulse generators. The input signal trace also has two oscilloscope connection points, labeled 710-S (standard oscilloscope probe connection) and 710_INF (differential probe connection).

Access to the OUT pin of the digital isolator is at the scope probe jack labeled ISL710_OUT or at the + terminal of the two pin differential probe connector labeled 710_OUTF. A differential oscilloscope probe can be connected at the 710_OUTF connector to monitor the output signal on the scope or a typical scope probe can be used at ISL710_Out jack. The output trace is loaded with a 1.5kΩ resistor (R_3) and 3.9pF capacitor (C_6) to ground GND_OUT. The load of 1.5kΩ keeps the output from exceeding its ±4mA output current rating. The capacitive load of 3.9pF approximates a total capacitive load of 14pF to 15pF when a typical scope probe is monitored on the ISL710_OUT scope probe jack.

Access to the $\overline{OE}$ pin of the IC is through the compact clip-on connector labeled 7OEN on the evaluation board. When 7OEN is low (< 0.8V), the output of the IC is active and the signal at the input is passed to the output of the IC. When the output pin is driven high (> 2.4V), the output of the IC is disabled, the input is not passed to the output, and the output is put in a high impedance state. The $\overline{OE}$ pin has an internal pull-down of 100kΩ and can be left floating if an application does not require the output disable function.

2.1.3 Power Supply

The ISL71610M IC requires a single DC power supply in the range of 3.0V to 5.5V to power the active output of the part. The power supply is connected at VDD_OUT and GND_OUT and should be capable of delivering 100mA of current.

The ISL71710M IC requires two DC power supplies in the range of 3.0V to 5.5V for proper operation. One supply provides power for the active input and the other supply provides power for the active output of the part. The power supply for the input is connected at VDD_IN and GND_IN. The power supply for the output is connected at VDD_OUT and GND_OUT. These supplies should be capable of delivering 100mA of current.

2.2 Quick Start Guide for the ISL71610 Portion of Board

2.2.1 Required Equipment

The following equipment is recommended for testing:

- 5V power supply
- Square wave signal generator
- Digital Multimeter (DMM)
- Current probe to observe coil current
- 100MHz quad-trace oscilloscope

2.2.2 Using the Board

(1) Configure the board as shown in Figure 2.

(2) Use the signal generator drive a +2V to -2V signal into the coil using the 610_IN and 610_IN# inputs. Observe the coil current with the oscilloscope and adjust the +V and -V levels of the generator to adjust the coil current level. Look at the voltage across the IN to IN# test points to make timing measurements as the current probe display may lag in time.

(3) Connect and turn on a 3V to 5.5V power supply to the output.

(4) Observe the coil voltage input to the voltage output relationship, moving the pair of jumpers from the inverting (INV) to non-inverting (NINV) set of connectors allows you to see the inverting or non inverting input to output waveform relationships.

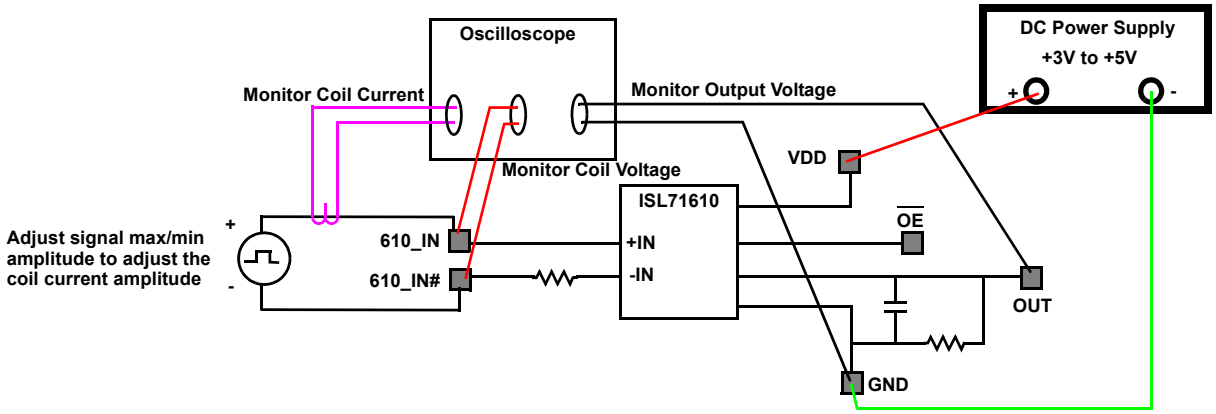

Figure 2. ISL71610M Basic Evaluation Test Setup Block Diagram

2.3 Quick Start Guide for the ISL71710 Portion of Board

2.3.1 Required Equipment

The following equipment is needed to operate the board:

- Two 5V power supplies
- Pulse/pattern generator such as the Agilent B111DA
- Two/four channel oscilloscope such as Tektronix TDS 5104
- Two differential oscilloscope probes

2.3.2 Using the Board

(1) Configure the board as shown in Figure 3 on page 7.

(2) Connect a 5V power supply to VDD_IN and GND_IN. With the power supply disabled, set the supply to 5V.

(3) Connect a 5V power supply to VDD_OUT and GND_OUT. With the power supply disabled, set the supply to 5V.

(4) Connect a pulse/pattern generator to the ISL710_IN banana jack. With the generator disabled, set it up to output a 10MHz square wave with a signal level of 0V to 5V.

(5) Connect one channel of the oscilloscope with a differential probe to the input of the isolator at the differential connector 710_INF.

(6) Connect a second channel of the oscilloscope with a differential probe to the output of the digital isolator at differential connector 710_OUTF.

(7) Enable the DC supply connected at VDD_IN. Then enable the DC supply connected at VDD_OUT.

(8) Enable the pulse generator. The 0V to 5V, 75MHz signal from the generator displays on both channels of the oscilloscope.

(9) Turn the VDD_OUT supply voltage down to 3V. The output signal level decreases to 3V.

(10) Turn the input signal amplitude down to 3V. Increase the VDD_OUT supply voltage up to 5V. The output signal level increases to 5V.

(11) Connect a jumper wire from the 70EN connector to GND_OUT to disable the input signal from passing to the output of the IC. The oscilloscope channel connected at the output of the part should no longer be present. Remove the jumper wire and the output signal should now be present on the oscilloscope.

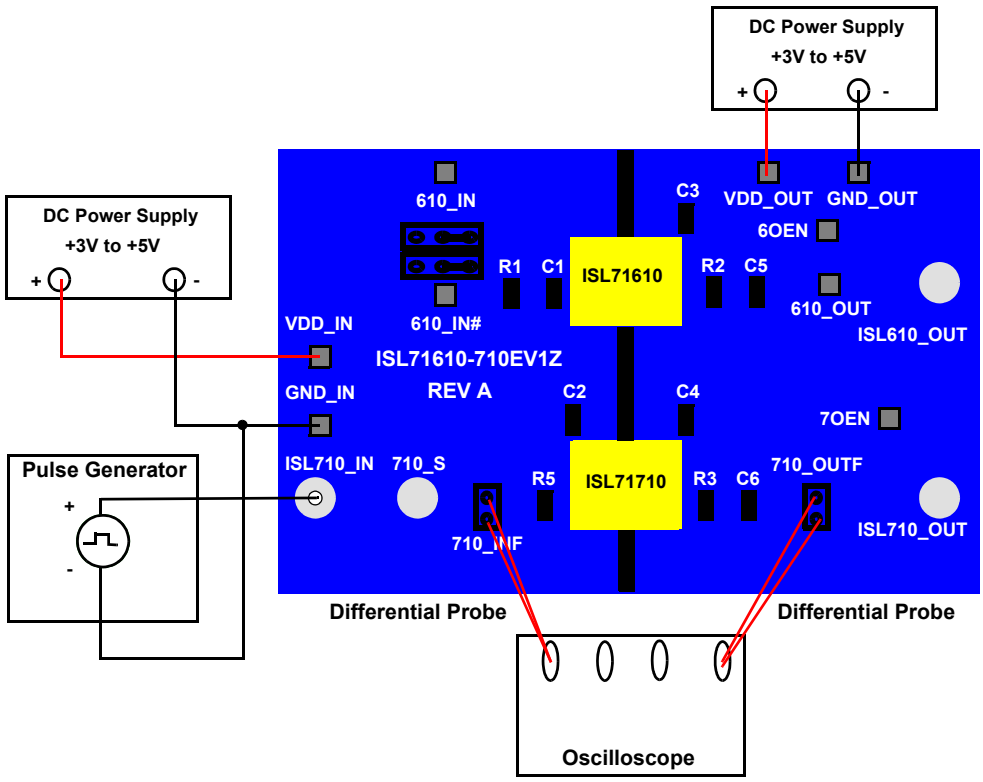

Figure 3. ISL71710M Basic Evaluation Test Setup Block Diagram

3. PCB Layout Guidelines

PCB design is critical to preserve the $500V_{DC}$ isolation rating of the input to the output. A minimum gap spacing across the device (Pins 1, 2, 3, 4 to Pins 5, 6, 7, 8) of 2.54 mm should be observed. Place the components close to the IC to minimize stray inductance and resistance.

3.1 ISL71610-710EV1Z Evaluation Board

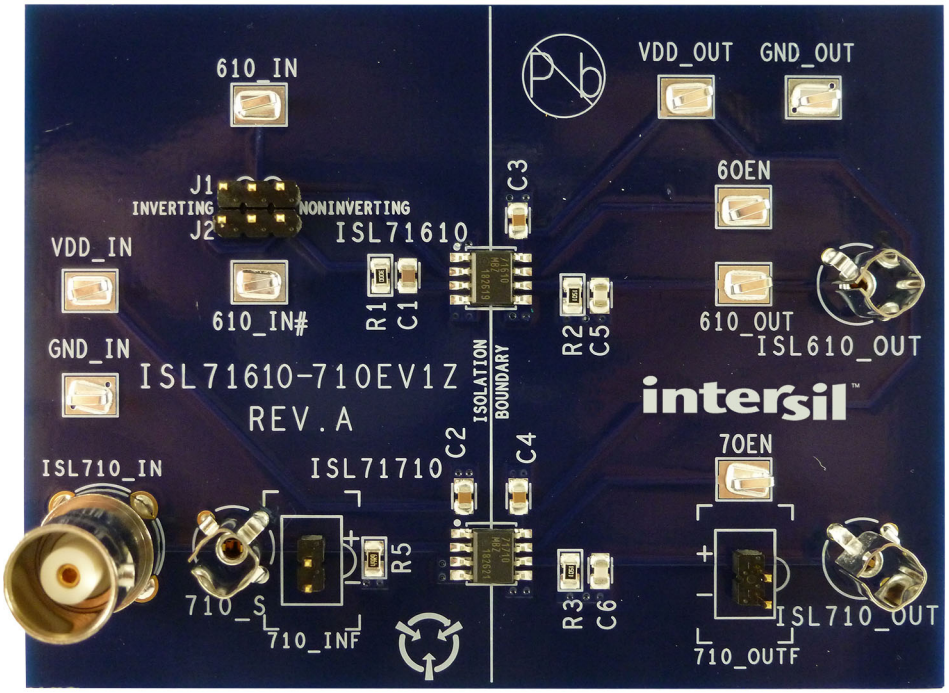

Figure 4. ISL71610-710EV1Z Evaluation Board Top Side

3.2 ISL71610-710EV1Z Circuit Schematic

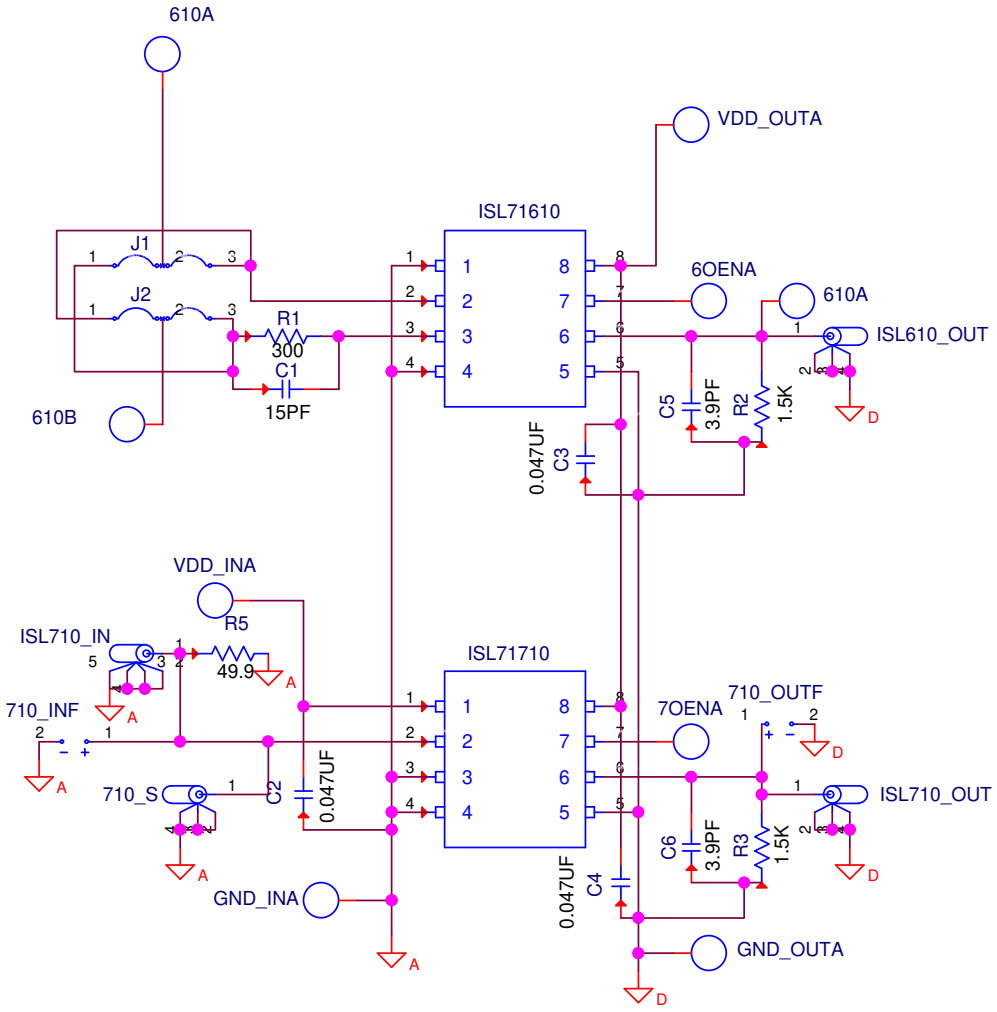

Figure 5. Schematic

3.3 Bill of Materials

Qty	Reference Designator	Description	Mfr	Manufacturer Part Number
1	ISL71610	IC-RAD TOLERANT, DIGITAL ISOLATOR, 8 PiIN 157 MIL BODY SOIC PACKAGE (SOIC8-157)	Renesas	ISL71610MBZ
1	ISL71710	IC-RAD TOLERANT, DIGITAL ISOLATOR, 8 PiIN 157 MIL BODY SOIC PACKAGE (SOIC8-157)	Renesas	ISL71710MBZ
1	C1	MULTILAYER CAP, 15pF	Generic	Various
2	C5, C6	MULTILAYER CAP, 3.9pF	Generic	Various
3	C2, C3, C4	MULTILAYER CAP, 0.047µF	Generic	Various
2	R2, R3	THICK FILM CHIP RESISTOR, 1.5kΩ	Generic	Various
1	R1	THICK FILM CHIP RESISTOR, 300Ω	Generic	Various
1	R5	THICK FILM CHIP RESISTOR, 49.9Ω	Generic	Various

Qty	Reference Designator	Description	Mfr	Manufacturer Part Number
2	J1, J2	THREE PIN JUMPER	Generic	JUMPER-3-100
2	710_INF, 710_OUTF	TWO PIN DIFFERENTIAL PROBE	Generic	P6248
3	710_S, ISL610_OUT, ISL710_OUT	PROBE TEST POINT PCB MOUNT	Tektronix	131-4353-00
1	ISL710_IN	GOLD PLATED 50 OHM BNC PCB MOUNT RECEPTACLE	Amphenol	31-5329-52RFX
9	6OEN, 70EN, 610_IN, GND_IN, VDD_IN, 610_IN#, 610_OUT, GND_OUT, VDD_OUT	COMPACT SURFACE MOUNT TEST POINT, 0.135 X 0.185 PAD	Keystone	5016

3.4 Board Layout

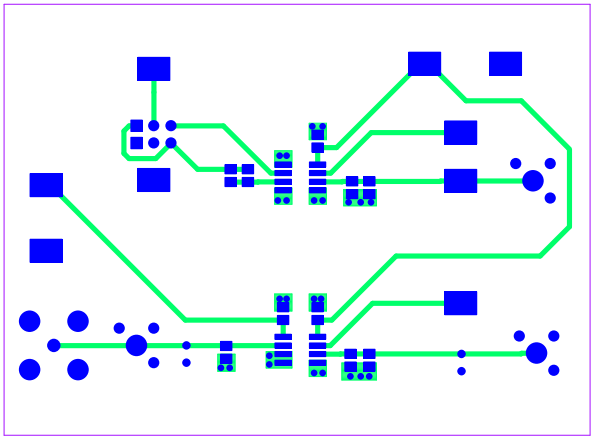

Figure 6. Top Layer

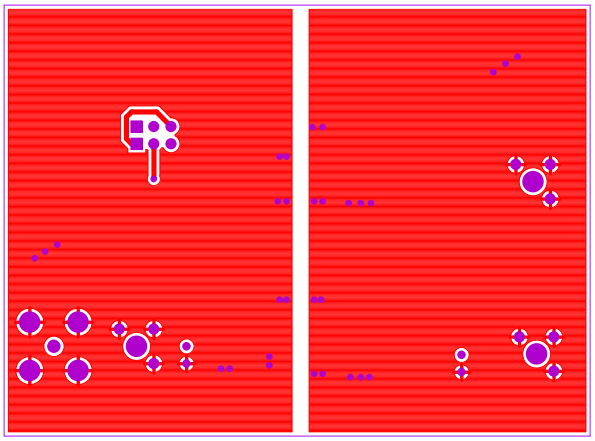

Figure 7. Bottom Layer

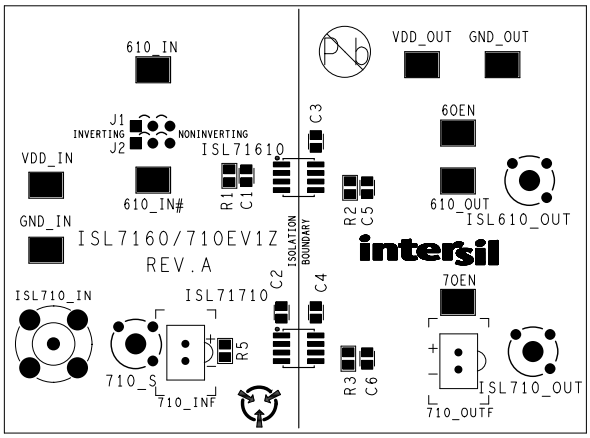

Figure 8. Top Layer Silk Screen

4. Typical Performance Curves

Unless otherwise noted, +V = 5V; T_A = +25ºC

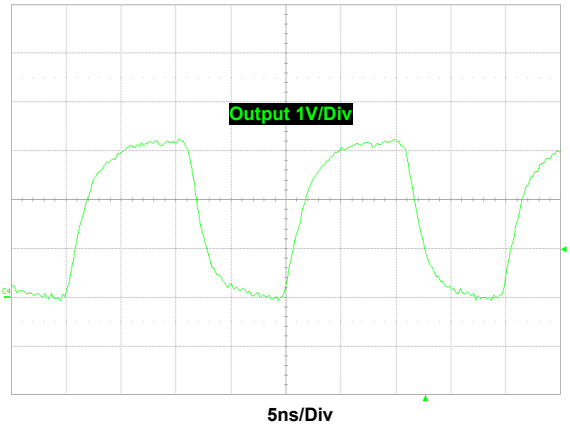

Figure 9. ISL71610M Output at 100Mbps, C_{BOOST} = 15pF, C_{OUT} = 15pF, V_{DD} = 3.3V

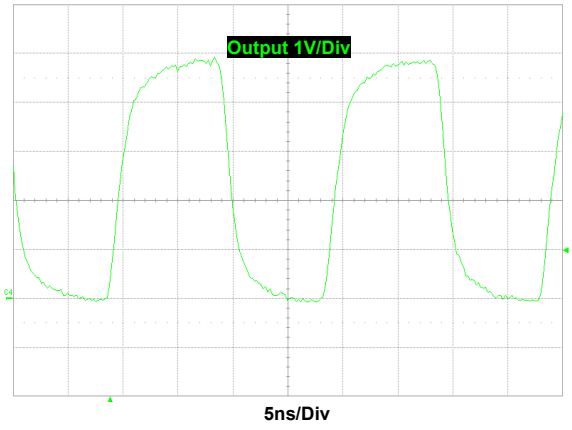

Figure 10. ISL71610M Output at 100Mbps, C_{BOOST} = 15pF, C_{OUT} = 15pF, V_{DD} = 5V

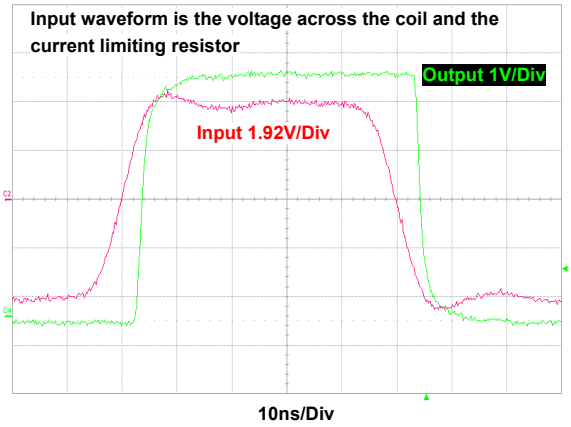

Figure 11. ISL71610M Noninverting Switching, Coil Current ~±10mA, C_{BOOST} = 15pF, C_{OUT} = 15pF, V_{DD} = 5V

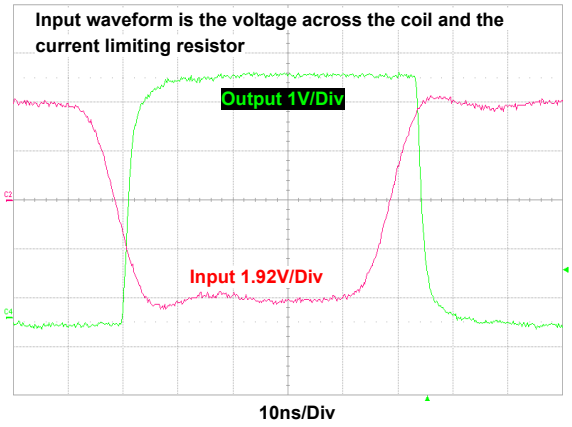

Figure 12. ISL71610M Inverting Switching, Coil Current ~±10mA, C_{BOOST} = 15pF, C_{OUT} = 15pF, V_{DD} = 5V

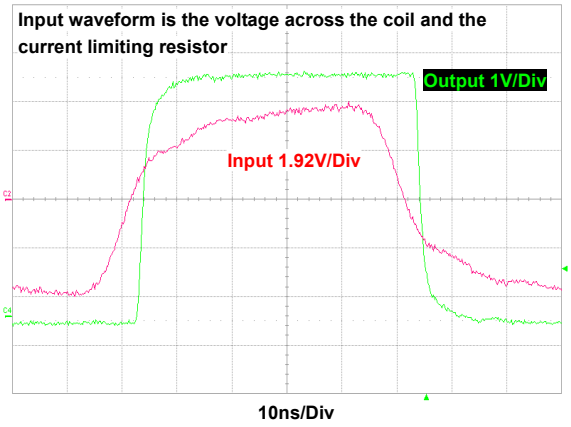

Figure 13. ISL71610M Switching, Coil Current ~±8mA, C_{BOOST} = 220pF, C_{OUT} = 15pF, V_{DD} = 5V

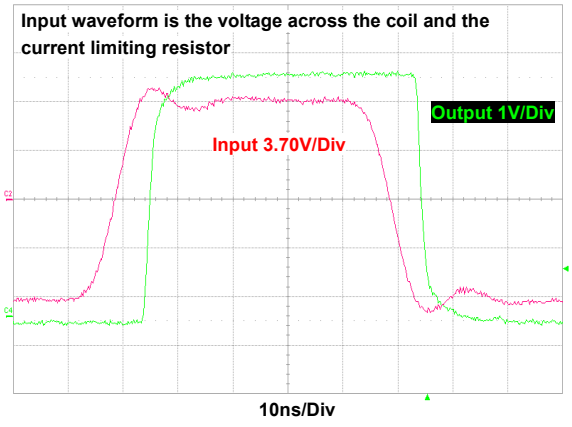

Figure 14. ISL71610M Switching, Coil Current ~±20mA, C_{BOOST} = open, C_{OUT} = 15pF, V_{DD} = 5V

Unless otherwise noted, +V = 5V; T_A = +25ºC **(Continued)**

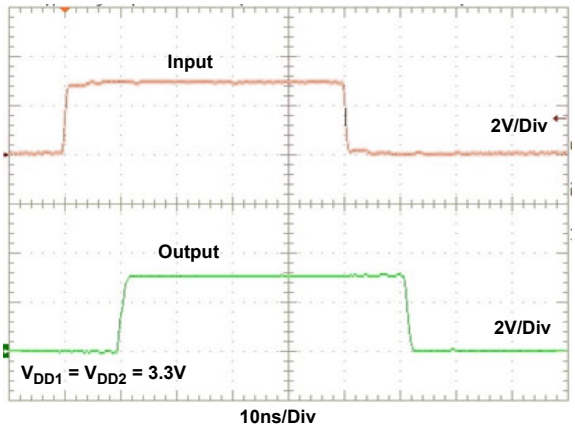

Figure 15. ISL71710M 10MHz Input and Output Waveforms

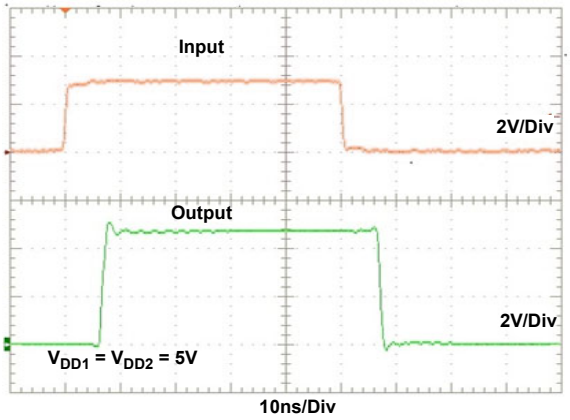

Figure 16. ISL71710M 10MHz Input and Output Waveforms

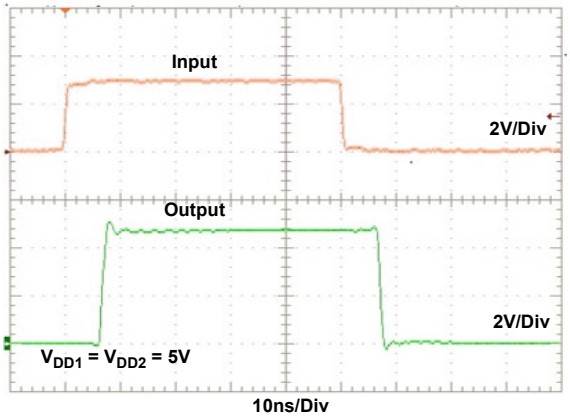

Figure 17. ISL71710M 10MHz Input and Output Waveforms

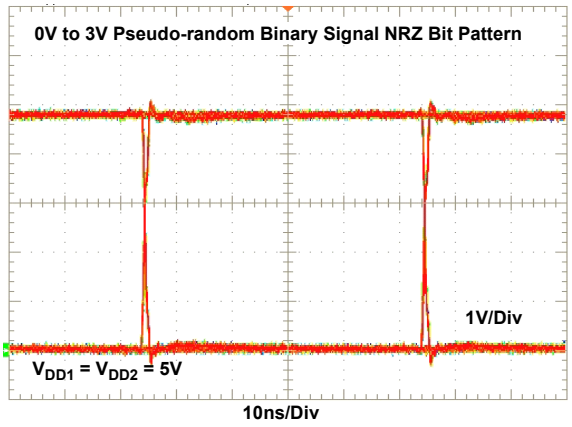

Figure 18. ISL71710M 20Mbps Eye Diagram

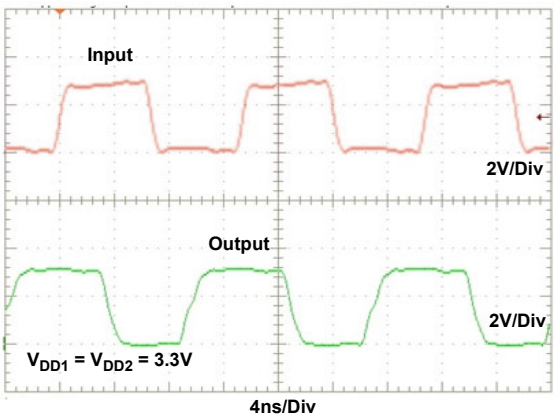

Figure 19. ISL71710M 75MHz Input and Output Waveforms

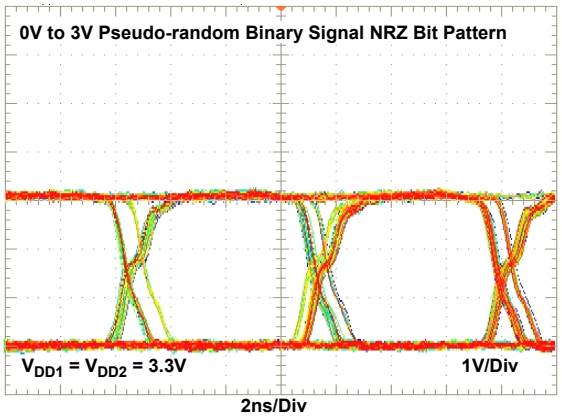

Figure 20. ISL71710M 150Mbps Eye Diagram

Unless otherwise noted, +V = 5V; T_A = +25ºC **(Continued)**

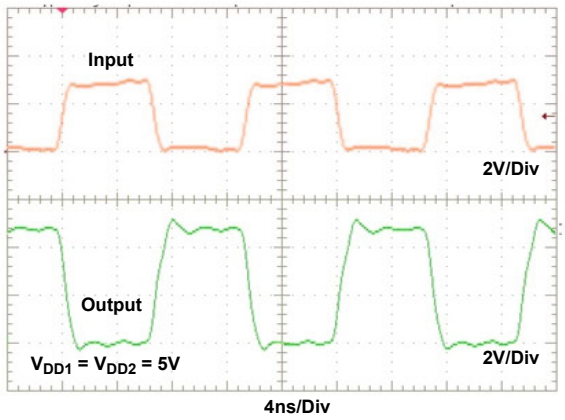

Figure 21. ISL71710M 75MHz Input and Output Waveforms

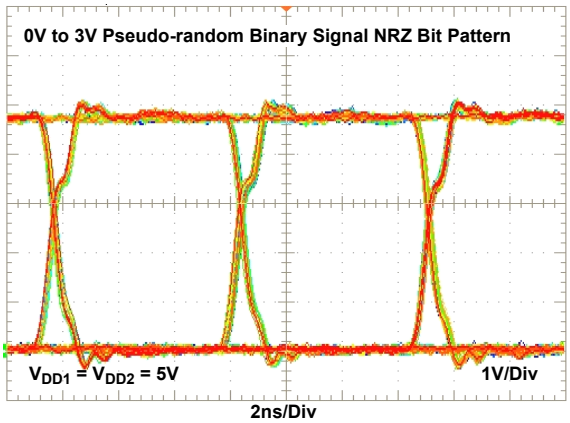

Figure 22. ISL71710M 150Mbps Eye Diagram

5. Revision History

Rev.	Date	Description
0.00	Dec 5, 2018	Initial release

Notice

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