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Evaluating the *i*Coupler ADuM3154 with the EVAL-ADuM3154Z Evaluation System

FEATURES

Access to all four data channels
Access to the slave select address lines
Access to the DCLK delayed clock
Multiple connection options
Support for Tektronix active probes
Provision for cable terminations
Support for PCB edge-mounted coaxial connectors
Easy configuration
Installed SPIsolator® digital isolator: ADuM3154BRSZ in the 20-lead SSOP package

SUPPORTED SPIsolator MODELS

ADuM3154ARSZ
ADuM3154BRSZ

GENERAL DESCRIPTION

The EVAL-ADuM3154Z supports the ADuM3154ARSZ and ADuM3154BRSZ, which are, 4-channel SPIsolator isolators optimized for use in SPI applications. They include two low speed address pins to rout the slave select to one of four destinations. The evaluation board provides a JEDEC standard 20-lead SSOP pad layout, support for signal distribution, loopback, and loads referenced to V_{DDx} or GND_x, as well as optimal bypass capacitance. Signal sources can be wired onto the board as well as brought onto the board through edge-mounted SMA connectors (sold separately) or terminal blocks for power connections. The board includes 200 mil header positions for compatibility with Tektronix active probes.

The board follows best printed circuit board (PCB) design practices for 4-layer boards, including a full power and ground plane on each side of the isolation barrier. No other EMI or noise mitigation design features are included on this board. In cases of very high speed operation or when ultralow emissions are required, refer to the AN-1109 application note for additional board layout techniques.

PHOTOGRAPH OF THE EVALUATION BOARD

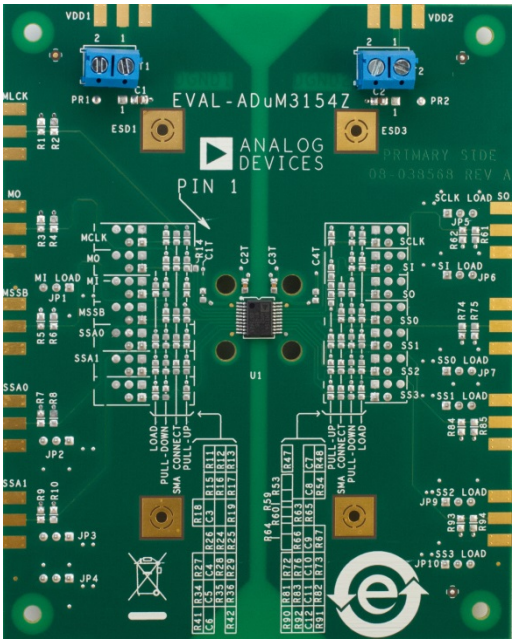

Figure 1. EVAL-ADuM3154Z Evaluation Board

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REVISION HISTORY

7/14—Revision 0: Initial Version

EVALUATION BOARD CIRCUITRY

PCB EVALUATION GOALS

The EVAL-ADuM3154Z board is intended to achieve the following goals:

- Evaluate the full range of SPIsolator data transfer functions.
- Power each side of the SPIsolator isolator independently.
- Allow high differential voltage to be applied between the two sides of the SPIsolator isolator.
- Allow connecting easily to power, other circuit boards and instrumentation.

Although the evaluation board comes with the ADuM3154BRSZ SPIsolator digital isolator installed, the board is also compatible with the ADuM3154ARSZ.

CONNECTORS

The PCB provides support for three types of interconnections:

- SMA edge-mounted connectors.
- Through-hole signal ground pairs.
- Terminal blocks for power connections.

With these three options, both temporary and permanent connections to the board can easily be made.

When coaxial connections are desired, SMA connector positions are available for V_{DD1} and V_{DD2} power supplies, as well as all digital inputs. These SMA connector positions are left unpopulated so that the user can customize the connectors for a given application.

Pins that are outputs only may not have access to a coaxial connection. The native output buffers of the ADuM3154 are not capable of driving a 50 Ω coaxial terminated cable. Bring out signals leaving the board through the provided through holes or headers.

Figure 2 shows examples of installed SMA connectors; these connectors were chosen because they are not only low profile and provide excellent mechanical connections to the PCB but also support 50 Ω coaxial cabling. Because most lab equipment is compatible with BNC connectors, adaptors may be required to use some on-board connectors.

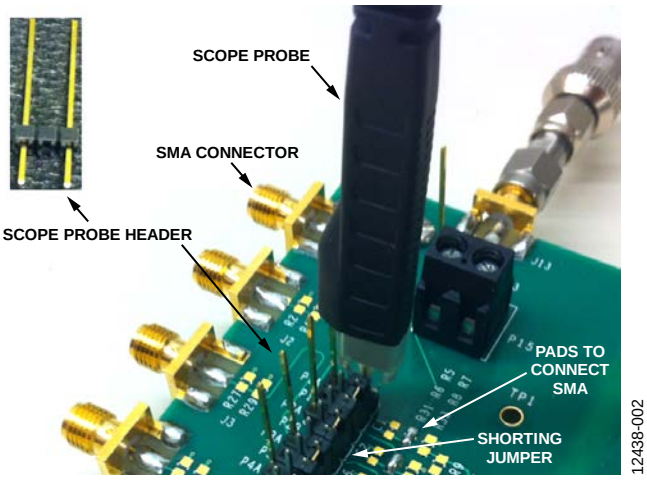

Figure 2. Optional Components

Power can be connected through the T1 and T2 terminal blocks or can be wired directly to the PCB via the PR1 and PR2 through-hole positions or the VDD1 and VDD2 SMA connectors can be populated to connect the coaxial cable. Each through-hole pair provides a power and ground with the power on the Pin 1 hole. The pin spacing of each through-hole connector is 200 mil between centers. This matches the pin spacing required for Tektronix active scope probes. If a scope probe connection is desired, the header shown in Figure 2 can be soldered into the through-hole positions, and the signal pin can be trimmed to match the height requirements of a Tektronix active scope probe.

POWER INPUT

Each side of the EVAL-ADuM3154Z SPIsolator isolator requires an off-board power source. Each power source must be independent if common-mode voltages are to be applied across the isolation barrier. Sharing a single supply for both sides of the part across the isolation barrier does not harm the isolator, and it is useful for functional testing of the ADuM3154 SPIsolator isolator when common-mode voltages are not present.

A ground plane and a power plane are present on Layer 2 and Layer 3 of the PCB on each side of the isolation barrier. Power connects to the V_{DD1} and GND_1 planes for Side 1 and connects to the V_{DD2} and GND_2 planes for Side 2.

DATA I/O STRUCTURES

Each data channel has a variety of structures to help configure, load, and monitor both the input and output. Figure 3 shows one of the datapaths from an external connection to the DUT pin. Each channel has the same or a subset of these connections depending on the particular I/O.

Starting at the external connection, the signal path is

1. Pad layout for a PCB board edge-mounted SMA connector.
2. Two 0805 pads are provided where 100 Ω resistors to ground can be installed. The combined resistance of 50 Ω provides a termination for a standard coaxial cable.
3. A 3-pin 100 mil header is provided, where Pin 1 is connected to ground through a 10 kΩ resistor, and Pin 3 is connected to VDD through a 10 kΩ resistor. Temporary pull-up or pull-down can be implemented with a shorting jumper between Pin 2 and either Pin 1 or Pin 3.
4. A 2-pin 100 mil header provides a signal ground pair that can be used for clip leads or for shorting a channel to ground temporarily.
5. There are groupings of three open through holes, consisting of a signal and two ground connections. These holes can be used for hardwiring signal wires into the PCB, installing a header to accept a Tektronix active probe, or installing a 2-pin header to allow adjacent channels to temporarily be shorted together.

Figure 3 shows four 0603 pad layouts between the signal path and optional connections. Pads with similar functions are arranged in vertical rows and their function is labeled on the PCB.

- **LOAD** is a connection to load structures located on the reverse side of the board. These structures consist of 100 kΩ resistors to power and ground to pull high-Z outputs to a midrange voltage when not being actively driven. This is useful during debugging because it allows easy identification floating outputs. The header and associated resistors identified in Point 3 are also connected to the signal path by this pad.
- **PULL-DOWN** is an 0603 pad layout between the signal path and GND_1 or GND_2 can be used for installing a permanent pull-down resistor or load capacitor.
- **SMA CONNECT** is an 0603 pad layout that allows connection of the data path to the board edge SMA pad layout and terminations.
- **PULL-UP** is an 0603 pad layout between the signal path and V_{DD1} or V_{DD2} can be used for installing a permanent pull-up resistor.

Figure 2 shows many of the optional components installed, as well as how jumpers can be used to temporarily connect channels. This figure shows a signal connected to the first channel SMA and then fanned out to the top three channels and monitored by an active scope probe.

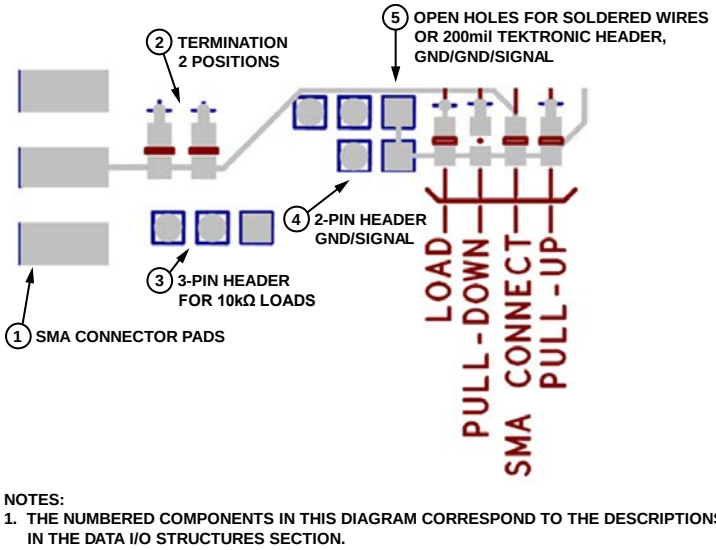

Figure 3. Configuration and Monitoring Structures (Showing a Data Path from an External Connection to the DUT Pin)

BYPASS ON THE PCB

Several positions and structures are provided to allow optimum bypass of the evaluation board. Provision has been made for optional surface-mount bulk capacitors to be installed near the power connectors to compensate for long cables to the power supply. Parallel bypass capacitors are installed near the ADuM3154BRSZ and consist of a 0.1 µF capacitor for V_{DD1} on the top side and bottom side and a 0.1 µF capacitor for V_{DD2} on the top and bottom side of the board. It is best to use the top side bypass positions if possible.

The PCB also implements a distributed capacitive bypass on the PCB. This consists of power and ground planes closely spaced on the inner layers of the PCB. This minimizes noise and the transmission of EMI without using complex design features.

HIGH VOLTAGE CAPABILITY

This PCB is designed in adherence with 3750 V basic insulation practices. High voltage testing beyond 3750 V is not recommended. Take appropriate care when using this evaluation board at high voltages, and do not rely on the PCB for safety functions because it has not been high potential tested (also known as hipot tested or dielectric withstanding voltage tested) or certified for safety.

EVALUATION BOARD SCHEMATICS AND ARTWORK

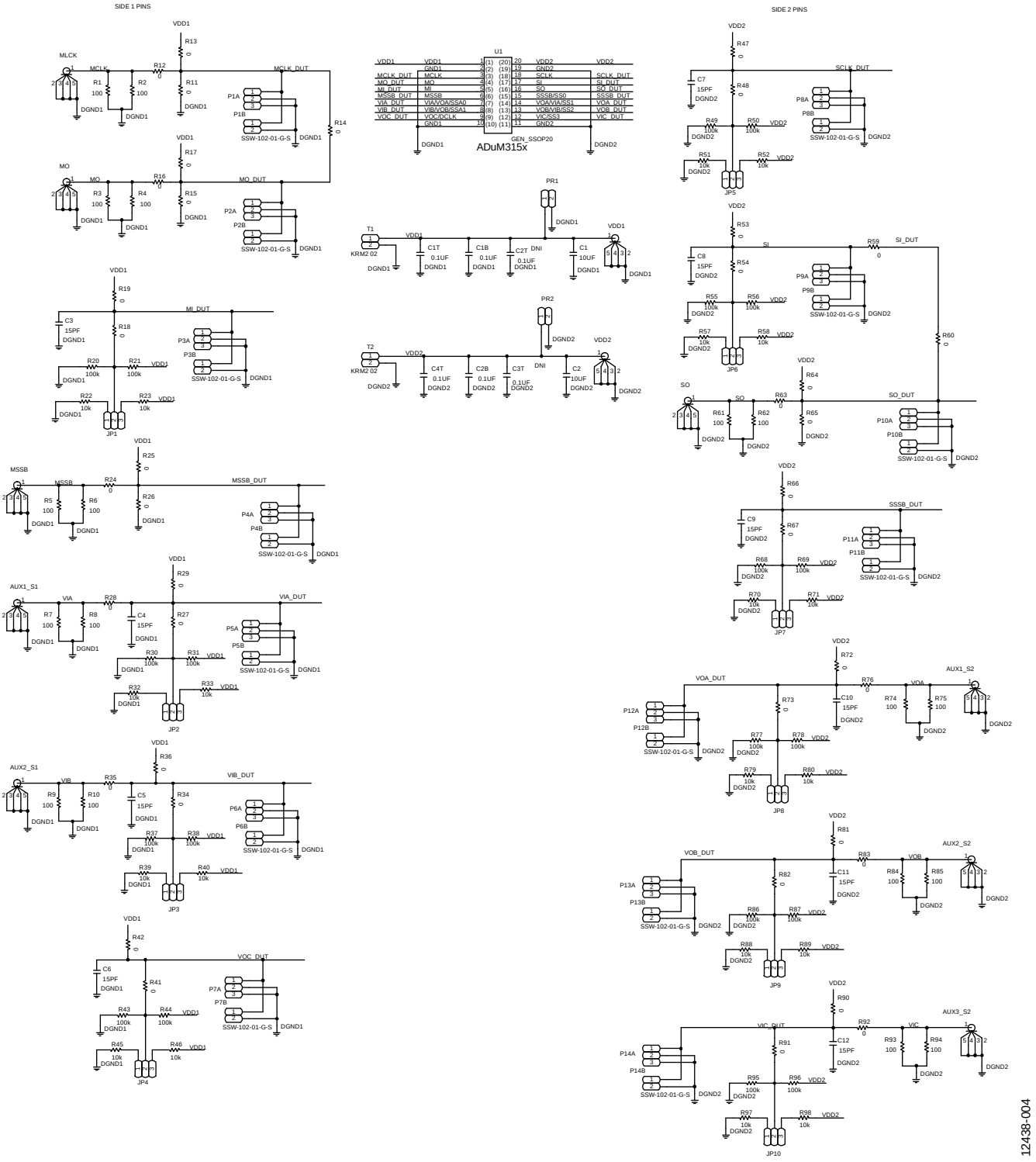

Figure 4. EVAL-ADuM3154Z Schematic

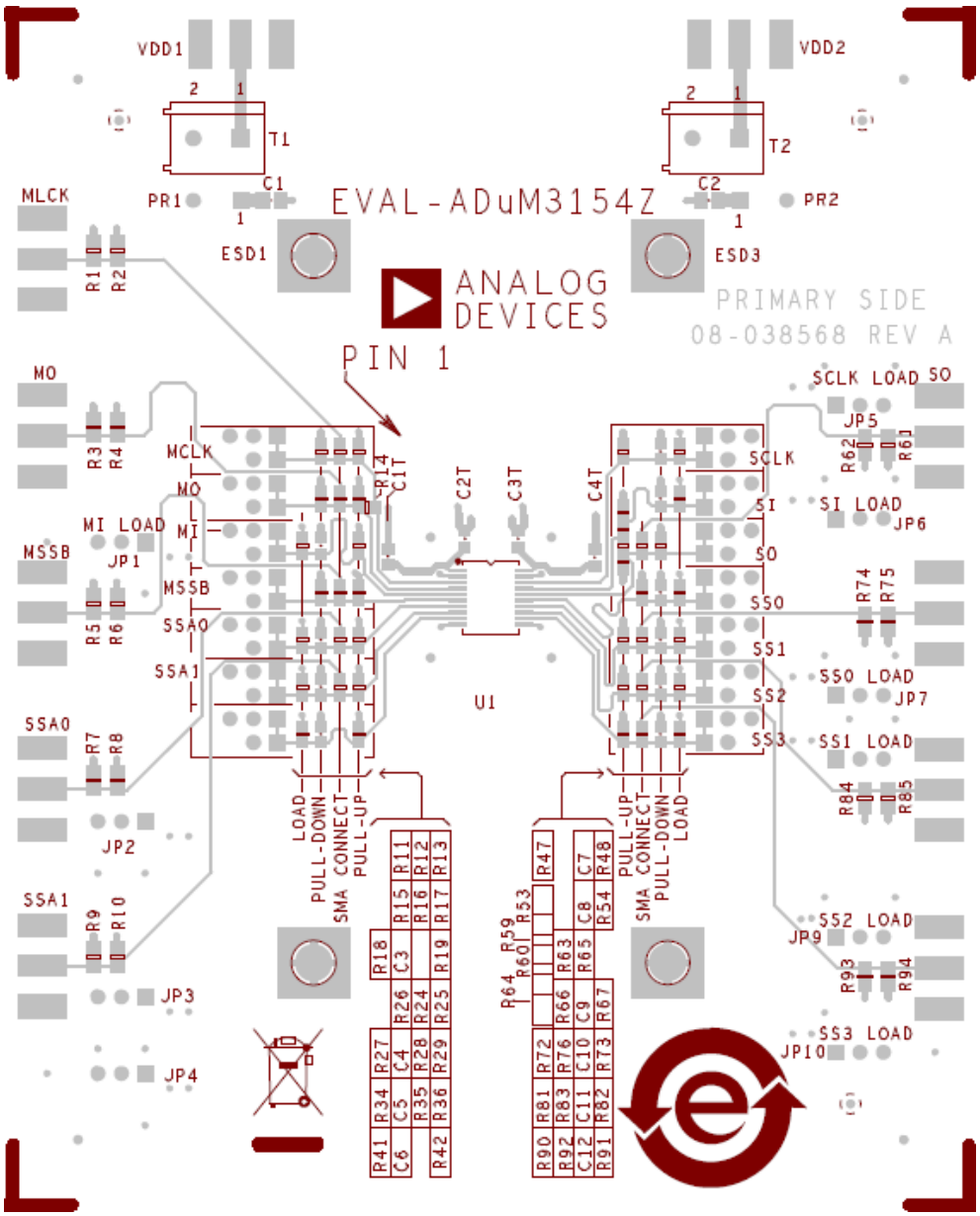

Figure 5. Top Side Layout

ORDERING INFORMATION

BILL OF MATERIALS

Table 1. Installed Components

Quantity	Reference Designator(s)	Value	Voltage	Tolerance	Package	Manufacturer/Part Number
1	EVAL-ADuM3154Z					Analog Devices, Inc. 08-038568 Rev A
1	U1				SSOP20	Analog Devices, Inc. ADuM3151BRSZ
2	C1, C2	10 µF	6.3 V	10%	0805	Taiyo Yuden JMK212B7106KG-T
2	C2T, C3T	0.1 µF	16 V	5%	0603	Kemet C0603C104J4RACTU
10	JP1 to JP10	Jumper (3-pin)			1 × 3 pin header	Harwin M20-9990345
14	P1B to P14B	Jumper (2-pin)			IDC 2×1 IDC 2×1	FCI 90726-402HLF
20	R20, R21, R30, R31, R37, R38, R43, R44, R49, R50, R55, R56, R68, R69, R77, R78, R86, R87, R95, R96	100 kΩ	1/10 W	1	R0603	Stackpole RMCF0603FT100K
20	R22, R23, R32, R33, R39, R40, R45, R46, R51, R52, R57, R58, R70, R71, R79, R80, R88, R89, R97, R98	10 kΩ		1%	0603	Panasonic ERJ-3EKF1002V
2	T1, T2	5.08 mm 2 × 1 screw terminal block				DIG01 ED2609-ND

Table 2. Optional Components—Not Installed

Quantity	Reference Designator(s)	Value	Voltage	Tolerance	Package	Manufacturer/Part Number
4	C1B, C1T, C2B, C4T	0.1 µF	16 V	5%	0603	Kemet C0603C104J4RACTU
16	P1A to P14A, PR1, PR2	Jumper (2-pin)			1 × 2 pin header 200 mil	Samtec MTSW-202-12-G-S-730 ZZZ
10	C3 to C12	15 pF	50 V	5%	0603	Kemet 15PF 50V 5% 0603 NPO ZZZ
11	MO, SO, MLCK, MSSB, VDD1, VDD2, AUX1_S1, AUX1_S2, AUX2_S1, AUX2_S2, AUX3_S2	SMA connector			CONN-PCB coax SMA end launch	Johnson 142-0701-851
18	R1 to R10, R61, R62, R74, R75, R84, R85, R93, R94	100 Ω	1/10 W	1	R0805	Panasonic ERJ-6ENF1000V
40	R11 to R19, R24 to R29, R34 to R36, R41, R42, R47, R48, R53, R54, R59, R60, R63 to R67, R72, R73, R76, R81 to R83, R90 to R92	0 Ω	1/10 W	1	R0603	Panasonic ERJ-3GEY0R00V

RELATED LINKS

Resource	Description
ADuM3154	Product Page, 3.75 kV, 7-Channel, SPIsolator Multiple Slave Digital Isolator for SPI
AN-1109	Application Note, Recommendations for Control of Radiated Emissions with *i*Coupler Devices

ESD Caution
ESD (electrostatic discharge) sensitive device. Charged devices and circuit boards can discharge without detection. Although this product features patented or proprietary protection circuitry, damage may occur on devices subjected to high energy ESD. Therefore, proper ESD precautions should be taken to avoid performance degradation or loss of functionality.

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