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Evaluating the ADM3065E 3.0 V to 5.5 V, ± 12 kV IEC ESD Protected, 50 Mbps RS-485 Transceiver

FEATURES

- Easy evaluation of ADM3065E 50 Mbps RS-485 transceiver
- Board layouts for standard half duplex RS-485 footprints
  - 8-lead, SOIC, ADM3065EBRZ (EVAL-ADM3065EEBZ)
  - 8-lead, MSOP, ADM3065EBRMZ (EVAL-ADM3065EEB1Z)
- Power/ground connections through screw terminal block
  - 3.0 V to 5.5 V operating voltage range on V_{CC}
- IEC ESD protection on the RS-485 A and B bus pins
  - ±12 kV contact discharge and ±12 kV air gap discharge
- Screw terminal blocks for logic input/output and RS-485 signals
- Jumper-selectable enable/disable for $\overline{RE}$ and DE
- Test points for measuring all signals
- Resistors and footprints for termination and biasing networks

EVALUATION KIT CONTENTS

EVAL-ADM3065EEBZ or EVAL-ADM3065EEB1Z

ADDITIONAL EQUIPMENT NEEDED

- Oscilloscope
- Signal generator or UART
- 3 V to 5 V supply

GENERAL DESCRIPTION

The EVAL-ADM3065EEBZ and EVAL-ADM3065EEB1Z allow quick and easy evaluation of the ADM3065E 50 Mbps RS-485 transceiver with standard SOIC and MSOP footprints respectively. The evaluation boards allow the input and output functions to be exercised without external components. Screw terminal blocks provide convenient connections for power and ground, digital input and output, and RS-485 signals. The evaluation boards can be powered by a standard configurable bench power supply within a 3 V to 5 V range.

The EVAL-ADM3065EEBZ evaluation board has a footprint for the ADM3065EBRZ half duplex RS-485 transceiver in an 8-lead SOIC package. The EVAL-ADM3065EEB1Z evaluation board has a footprint for a full duplex RS-485 transceiver in an 8-lead MSOP package.

Complete specifications for the ADM3065E device are provided in the ADM3065E data sheet and should be consulted in conjunction with this user guide when using the evaluation board.

PHOTOGRAPH OF THE EVALUATION BOARDS

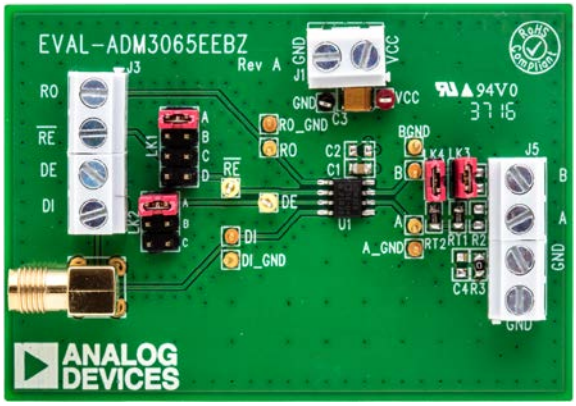

Figure 1. EVAL-ADM3065EEBZ Evaluation Board

Figure 2. EVAL-ADM3065EEB1Z Evaluation Board

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REVISION HISTORY

3/2017—Revision 0: Initial Version

EVALUATION BOARD HARDWARE

SETTING UP THE EVALUATION BOARD

The EVAL-ADM3065EEBZ and EVAL-ADM3065EEB1Z evaluation boards are powered by connecting a 3.3 V or 5 V power supply to the J1 screw terminals for VCC and GND at the top of the evaluation board. A 10 µF decoupling capacitor, C3, is fitted at the connector between VCC and GND. The V_{CC} pin of the RS-485 transceiver is fitted with a 100 nF decoupling capacitor, C1, with a second footprint for an optional additional capacitor, C2.

Corresponding labeled test points allow monitoring of the power supply to the evaluation board and probe reference to ground.

INPUT AND OUTPUT CONNECTIONS

Digital input and output signals are connected via the J3 screw terminal block allowing wire connections from the evaluation boards to a signal generator or a universal asynchronous receiver/transmitter (UART). The EVAL-ADM3065EEBZ and EVAL-ADM3065EEB1Z include connections for data input (DI), receiver output (RO), receiver enable ($\overline{RE}$), and driver enable (DE). Alternatively, jumper connections can drive these inputs and/or connect them to VCC and GND (see Table 1). The EVAL-ADM3065EEBZ and EVAL-ADM3065EEB1Z evaluation boards also have a right hand SMA connector (DI), which is the preferred option for delivering a high speed 50 Mbps signal to the evaluation boards.

Connections to an RS-485 bus are made via a screw terminal block, J5. For the EVAL-ADM3065EEBZ or EVAL-ADM3065EEB1Z half duplex boards, there are two bus input/output signals, A and B, for noninverting and inverting signals, respectively.

The bus cable can also include a common ground connection or shield and can also be connected to the J5 screw terminal block on the right of the evaluation boards. Test points are available on the evaluation boards and are appropriately labeled for all digital and bus input/output signals.

OTHER BOARD COMPONENTS

The EVAL-ADM3065EEBZ and EVAL-ADM3065EEB1Z evaluation boards include footprints for termination resistors, RT1 and RT2, as well as pull-up and pull-down resistors, R1 and R2. Termination resistors of 120 Ω are fitted to the evaluation board; these can be removed or replaced with a different value resistor as needed. Inserting both LK3 and LK4 presents a 60 Ω load to the RS-485 driver.

Biasing Resistors for Bus Idle Failsafe

Although the ADM3065E has a built in receiver fail-safe for the bus idle condition, there are footprints on the evaluation boards for fitting the R2 pull-up resistor to V_{CC} on A, as well as the R1 pull-down resistor to GND on B. These resistors can be fitted if the user is connecting to other devices that require such external biasing resistors on the bus. The exact value required for a 200 mV minimum differential voltage in the bus idle condition depends on the supply voltage (for example, 960 Ω for 3.3 V and 1440 Ω for 5 V).

For more information about the bus idle fail-safe, see the AN-960 Application Note, *RS-485/RS-422 Circuit Implementation Guide*.

Table 1. Jumper Configuration

Link	Connection	Description
LK1	A	Connects the receiver enable ($\overline{RE}$) input of the ADM3065E to VCC. This setting disables the receiver.
	B	Connects the $\overline{RE}$ input of the ADM3065E to GND. This setting enables the receiver.
	C	Connects the $\overline{RE}$ input of the ADM3065E to the J3-2 terminal block connector.
	D	Connects the $\overline{RE}$ input of the ADM3065E to the driver enable (DE) input; that is, the input for both $\overline{RE}$ and DE is set by LK1. This setting ensures that when the driver is enabled, the receiver is disabled, or when the driver is disabled, the receiver is enabled.
LK2	A	Connects the DE input of the ADM3065E to VCC. This setting enables the driver.
	B	Connects the DE input of the ADM3065E to GND. This setting disables the driver.
	C	Connects the DE input of the ADM3065E to the J3-3 terminal block connector.
LK3	Inserted	Connects the 120 Ω RT1 termination resistor across the RS-485 A and B pins
	Not inserted	Disconnects the 120 Ω RT1 termination resistor across the RS-485 A and B pins
LK4	Inserted	Connects the 120 Ω RT2 termination resistor across the RS-485 A and B pins
	Not inserted	Disconnects the 120 Ω RT2 termination resistor across the RS-485 A and B pins

HALF DUPLEX RS-485 TRANSCEIVERS POINT TO POINT TEST

A point to point test can be set up with either two EVAL-ADM3065EEBZ evaluation boards or two EVAL-ADM3065EEB1Z evaluation boards. Figure 4 shows two half duplex evaluation boards in this configuration. Note the positions of LK1 and LK2 on each evaluation board that enable the driver on one evaluation board and the receiver on the other evaluation board. Remove LK4 from the EVAL-ADM3065EEBZ or EVAL-ADM3065EEB1Z evaluation board to ensure both ends of the bus have only a 120 Ω load. Differential signals on the bus are monitored with an oscilloscope, as well as the DI pin and RO pin of the ADM3065E.

IEC 61000-4-2 ESD PROTECTION TO ±12 kV (CONTACT) AND ±12 kV (AIR GAP)

The EVAL-ADM3065EEBZ and EVAL-ADM3065EEB1Z evaluation boards are tested to achieve protection against IEC 61000-4-2 ESD to ±12 kV (contact), ±12 kV (air gap) on the RS-485 A and B bus pins.

IEC 61000-4-2 ESD describes testing using two coupling methods, known as contact discharge and air-gap discharge. Contact discharge implies a direct contact between the discharge gun and the equipment under test (EUT).

During air discharge testing, the charged electrode of the discharge gun is moved toward the EUT until a discharge occurs as an arc across the air gap. The discharge gun does not make direct contact with the EUT.

During testing, the EVAL-ADM3065EEBZ and EVAL-ADM3065EEB1Z A and B pins are subjected to at least 10 positive and 10 negative single discharges with a 1 sec interval between each pulse. The highest specified IEC 61000-4-2 ESD test is Level 4, which defines a contact discharge voltage of ±8 kV and an air discharge voltage of ±15 kV.

Figure 3 shows the 8 kV contact discharge current waveform as described in the ADM3065E data sheet. Some key IEC 61000-4-2 waveform parameters are rise times of less than 1 ns and pulse widths of approximately 60 ns.

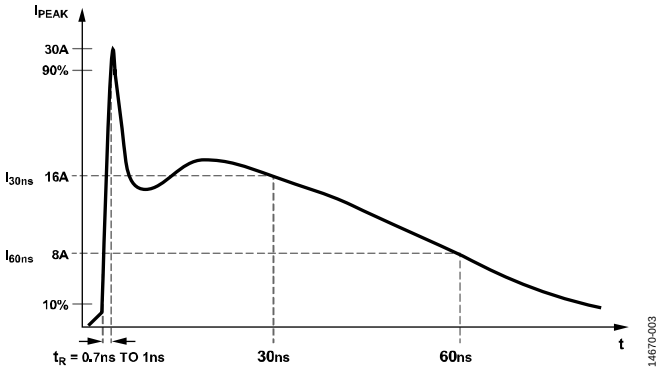

Figure 3. IEC 61000-4-2 ESD Waveform (8 kV)

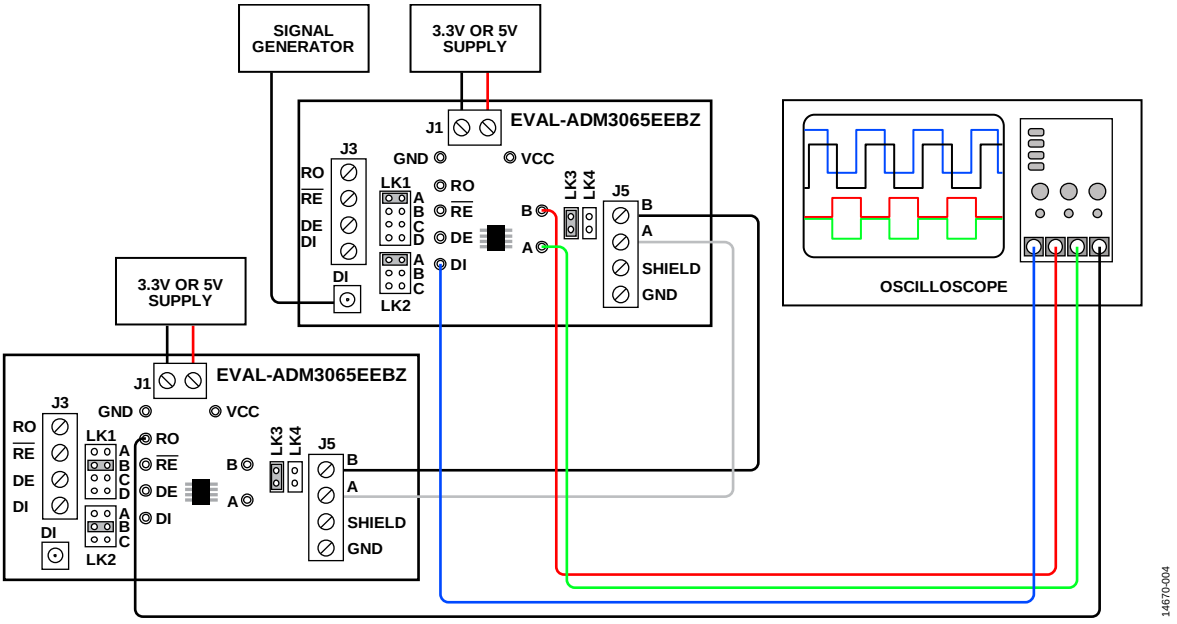

Figure 4. Half Duplex RS-485 Two Board Point to Point Test

EVALUATION BOARD SCHEMATICS AND ARTWORK

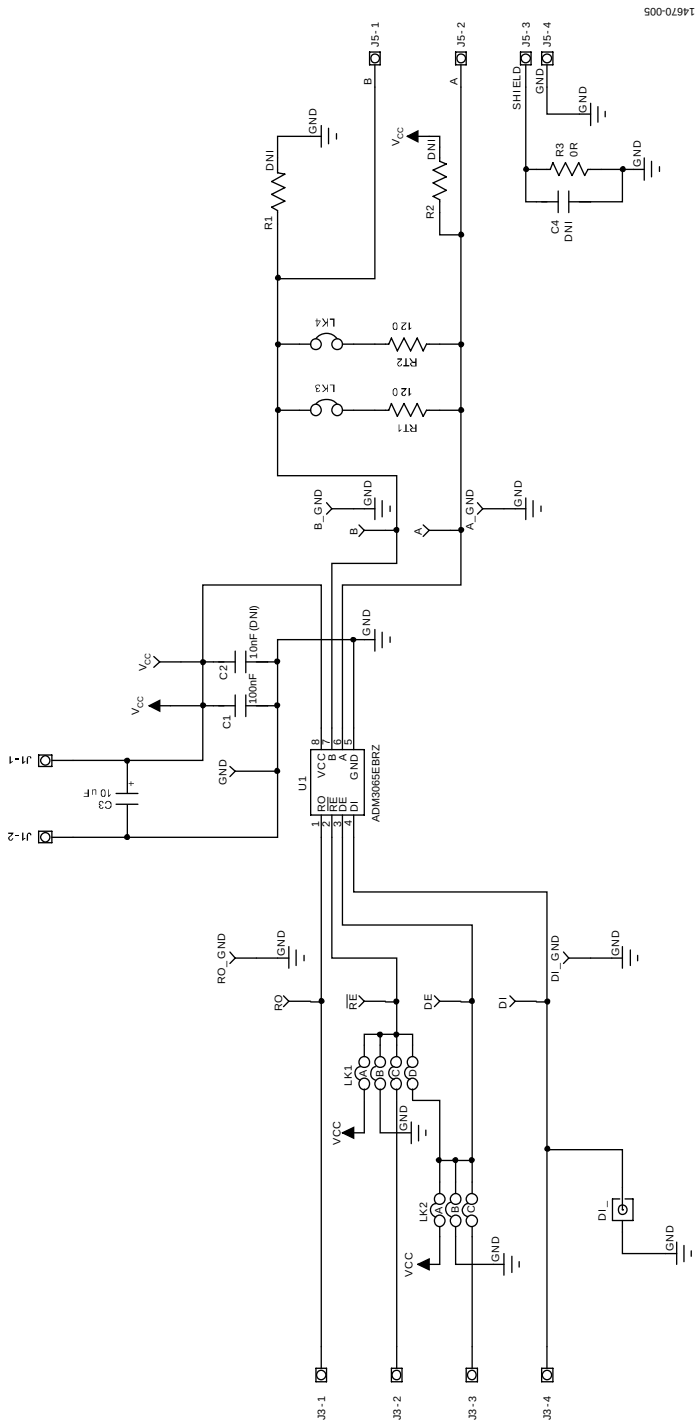

Figure 5. EVAL-ADM3065EEBZ Schematic

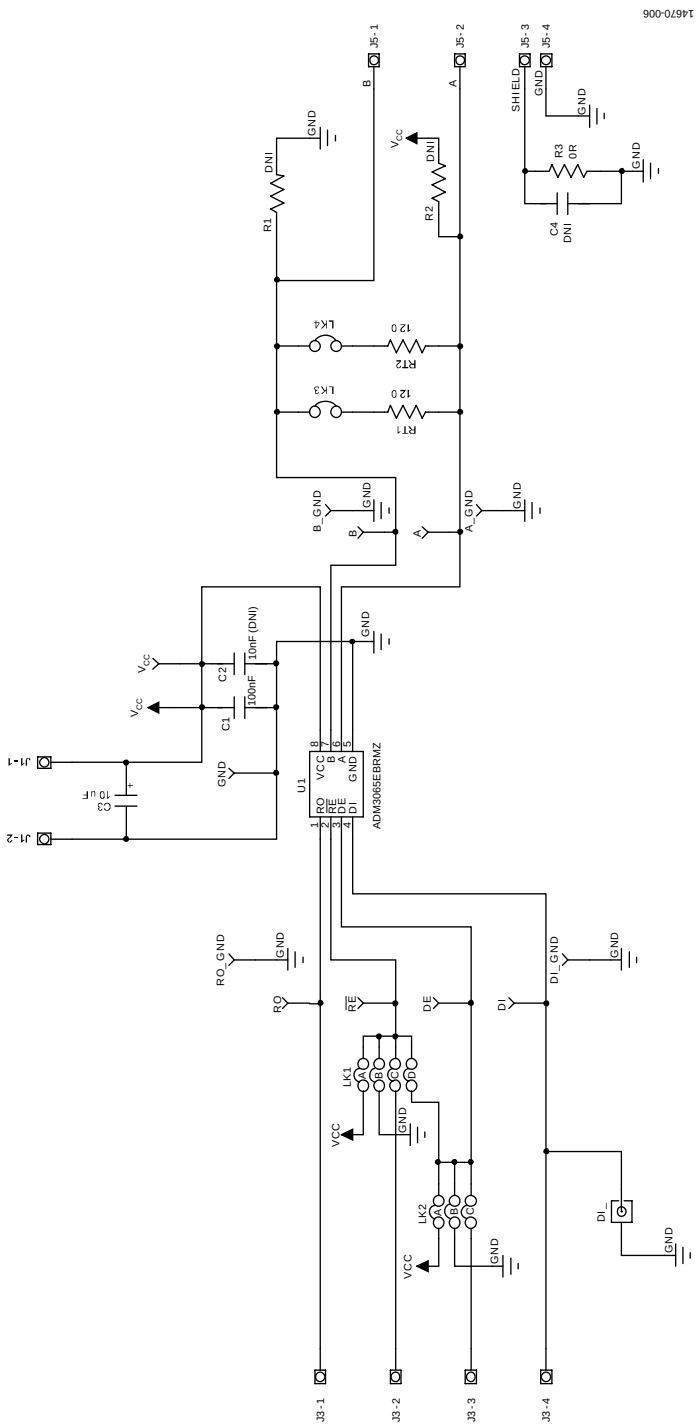

Figure 6. EVAL-ADM3065EEB1Z Schematic

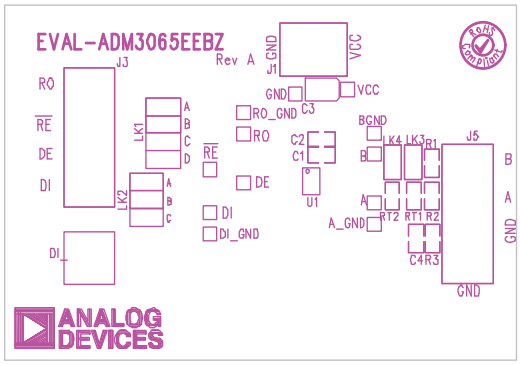

Figure 7. EVAL-ADM3065EEBZ/EVAL-ADM3065EEB1Z Silkscreen

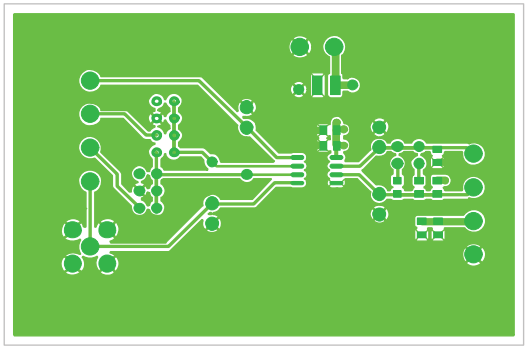

Figure 8. EVAL-ADM3065EEBZ/EVAL-ADM3065EEB1Z Component Side/Layer 1

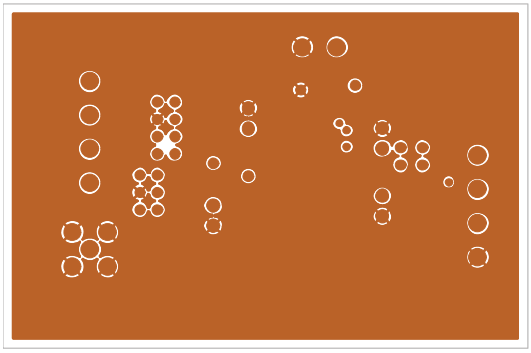

Figure 9. EVAL-ADM3065EEBZ/EVAL-ADM3065EEB1Z Layer 2

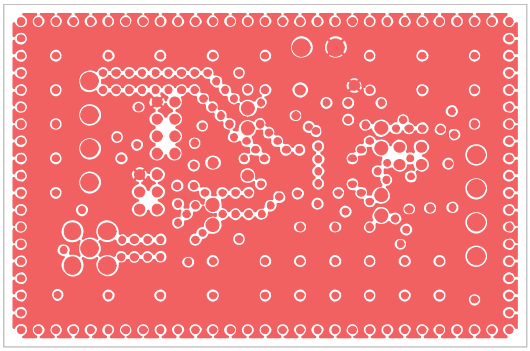

Figure 10. EVAL-ADM3065EEBZ/EVAL-ADM3065EEB1Z Layer 3

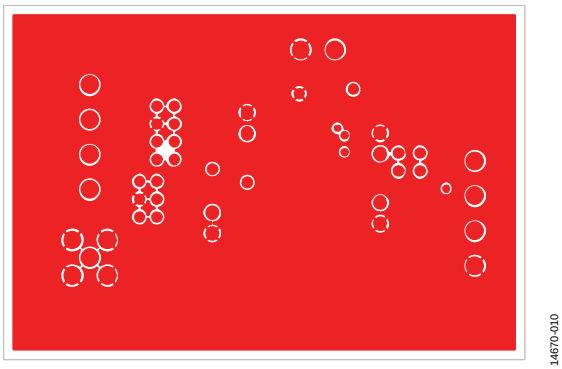

Figure 11. EVAL-ADM3065EEBZ/EVAL-ADM3065EEB1Z Layer 4

ORDERING INFORMATION

BILL OF MATERIALS

Table 2. EVAL-ADM3065EEBZ

Qty	Reference Designator	Description	Supplier	Part Number
1	C1	Capacitor, 100 nF, 0805	Multicomp	MCCA000274
2	C2, C4	Capacitors, not placed/optional	Not applicable	Not applicable
1	C3	Capacitor, 10 µF, Case B	Kemet	B45196H3106K209
8	A, B, DI, RO, A_GND, B_GND, DI_GND, RO_GND	High speed test points, silver pin	Not applicable	040/30P/LA/KP2 SILVER
2	DE, $\overline{RE}$	Test points, yellow	Vero Technologies	20-313140
1	GND	Test point, black	Vero Technologies	20-2137
1	DI_	SMA right angle jack	Not applicable	5-1814400-1
1	J1	2-way terminal block	Lumberg	KRM 02
2	J3, J5	4-way terminal blocks	Lumberg	KRM 04
1	LK1	8-pin (4 × 2) 0.1" header and shorting block	Harwin	M20-9953646 and M7566-05
1	LK2	6-pin (3 × 2) 0.1" header and shorting block	Harwin	M20-9953646 and M7566-05
2	LK3, LK4	Jumper blocks, 2-pin, 0.1" spacing	Harwin	M20-9990246 and M7566-05
2	R1, R2	Resistors, not placed/optional		Not applicable
1	R3	Resistor, 0 Ω, 0805	Vishay Draloric	CRCW08050000Z0EA
2	RT1, RT2	Resistor, 120 Ω, 0805	Multicomp	MC 0.1W 0805 1% 120R
1	U1	8-lead SOIC	Analog Devices, Inc.	ADM3065EBRZ
1	VCC	Test point, red	Vero Technologies	20-313137

Table 3. EVAL-ADM3065EEB1Z

Qty	Reference Designator	Description	Supplier	Part Number
1	C1	Capacitor, 100 nF, 0805	Multicomp	MCCA000274
2	C2, C4	Capacitors, not placed/optional	Not applicable	Not applicable
1	C3	Capacitor, 10 µF, Case B	Kemet	B45196H3106K209
8	A, B, DI, RO, A_GND, B_GND, DI_GND, RO_GND	High speed test points, silver pin	Not applicable	040/30P/LA/KP2 SILVER
2	DE, $\overline{RE}$	Test points, yellow	Vero Technologies	20-313140
1	GND	Test point, black	Vero Technologies	20-2137
1	DI_	SMA right angle jack	Not applicable	5-1814400-1
1	J1	2-way terminal block	Lumberg	KRM 02
2	J3, J5	4-way terminal blocks	Lumberg	KRM 04
1	LK1	8-pin (4 × 2) 0.1" header and shorting block	Harwin	M20-9953646 and M7566-05
1	LK2	6-pin (3 × 2) 0.1" header and shorting block	Harwin	M20-9953646 and M7566-05
2	LK3, LK4	Jumper blocks, 2 pin, 0.1" spacing	Harwin	M20-9990246 and M7566-05
2	R1, R2	Resistors, not placed/optional		Not applicable
1	R3	Resistor, 0 Ω, 0805	Vishay Draloric	CRCW08050000Z0EA
2	RT1, RT2	Resistor, 120 Ω, 0805	Multicomp	MC 0.1W 0805 1% 120R
1	U1	8-lead MSOP	Analog Devices, Inc.	ADM3065EBRMZ
1	VCC	Test point, red	Vero Technologies	20-313137

RELATED LINKS

Resource	Description
ADM3065E	3.0 V to 5.5 V, ± 12 kV IEC ESD Protected, 50 Mbps RS-485 Transceiver
AN-960	RS-485/RS-422 Circuit Implementation Guide
Interface RS-485 and RS-422	RS-485/RS-422 Product Selection

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.

UG14670-0-3/17(0)

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