

## Evaluating the **ADM3065E** 3.0 V to 5.5 V, $\pm 12$ 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
  - $\pm 12$  kV contact discharge and  $\pm 12$  kV air gap discharge
- Screw terminal blocks for logic input/output and RS-485 signals
- Jumper-selectable enable/disable for 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

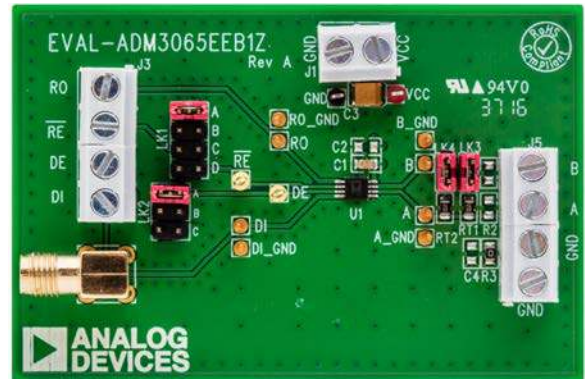


Figure 2. **EVAL-ADM3065EEB1Z** Evaluation Board

**TABLE OF CONTENTS**

Features .....	1	Other Board Components.....	3
Evaluation Kit Contents.....	1	Half duplex RS-485 Transceivers Point to Point Test .....	4
Additional Equipment Needed .....	1	IEC 61000-4-2 ESD Protection to ±12 kV (Contact) and	
General Description .....	1	±12 kV (Air Gap) .....	4
Photograph of the Evaluation Boards .....	1	Evaluation Board Schematics and Artwork.....	5
Revision History .....	2	Ordering Information.....	9
Evaluation Board Hardware.....	3	Bill of Materials.....	9
Setting Up the Evaluation Board.....	3	Related Links.....	10
Input and Output Connections .....	3		

**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  $\mu$ F decoupling capacitor, C3, is fitted at the connector between VCC and GND. The V<sub>CC</sub> 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 ( $\overline{\text{RE}}$ ), 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  $\Omega$  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  $\Omega$  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<sub>CC</sub> 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  $\Omega$  for 3.3 V and 1440  $\Omega$  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 ( $\overline{\text{RE}}$ ) input of the <a href="#">ADM3065E</a> to VCC. This setting disables the receiver.
	B	Connects the $\overline{\text{RE}}$ input of the <a href="#">ADM3065E</a> to GND. This setting enables the receiver.
	C	Connects the $\overline{\text{RE}}$ input of the <a href="#">ADM3065E</a> to the J3-2 terminal block connector.
	D	Connects the $\overline{\text{RE}}$ input of the <a href="#">ADM3065E</a> to the driver enable (DE) input; that is, the input for both $\overline{\text{RE}}$ 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 <a href="#">ADM3065E</a> to VCC. This setting enables the driver.
	B	Connects the DE input of the <a href="#">ADM3065E</a> to GND. This setting disables the driver.
	C	Connects the DE input of the <a href="#">ADM3065E</a> to the J3-3 terminal block connector.
LK3	Inserted	Connects the 120 $\Omega$ RT1 termination resistor across the RS-485 A and B pins
	Not inserted	Disconnects the 120 $\Omega$ RT1 termination resistor across the RS-485 A and B pins
LK4	Inserted	Connects the 120 $\Omega$ RT2 termination resistor across the RS-485 A and B pins
	Not inserted	Disconnects the 120 $\Omega$ 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.

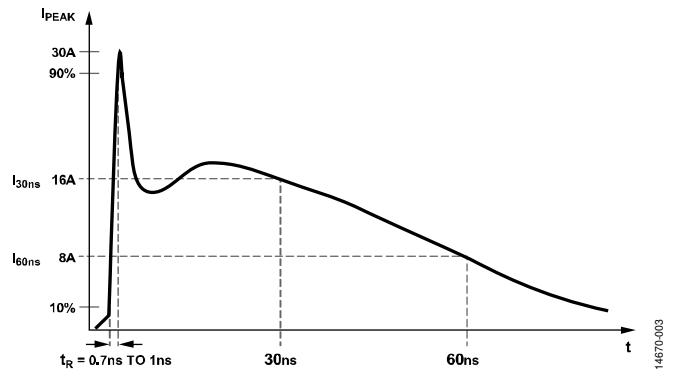


Figure 3. IEC 61000-4-2 ESD Waveform (8 kV)

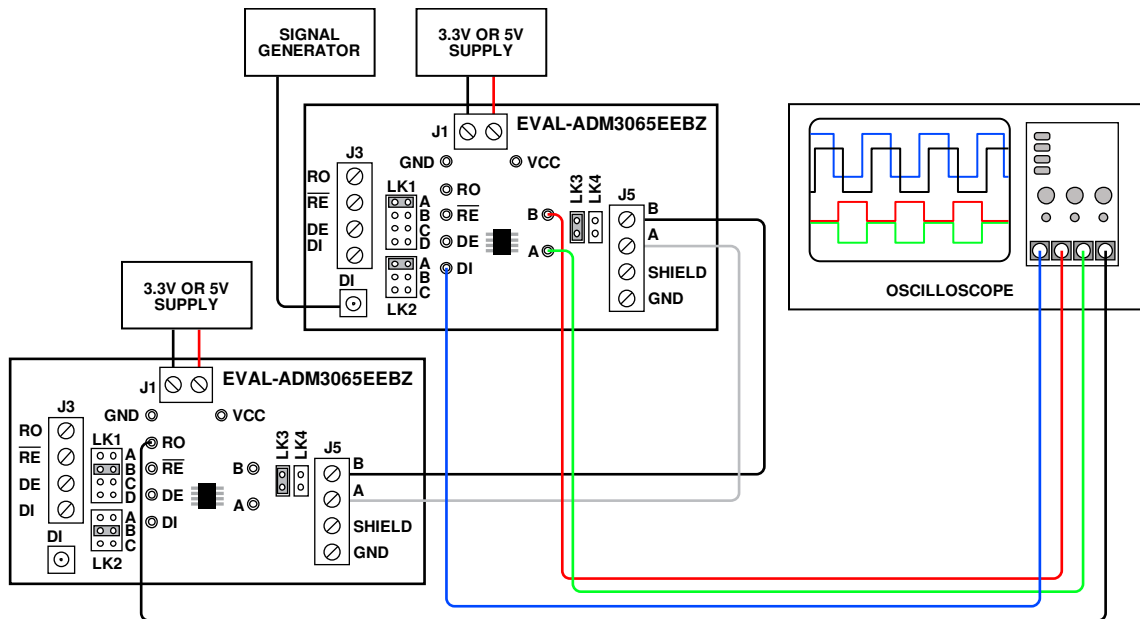


Figure 4. Half Duplex RS-485 Two Board Point to Point Test

# EVALUATION BOARD SCHEMATICS AND ARTWORK

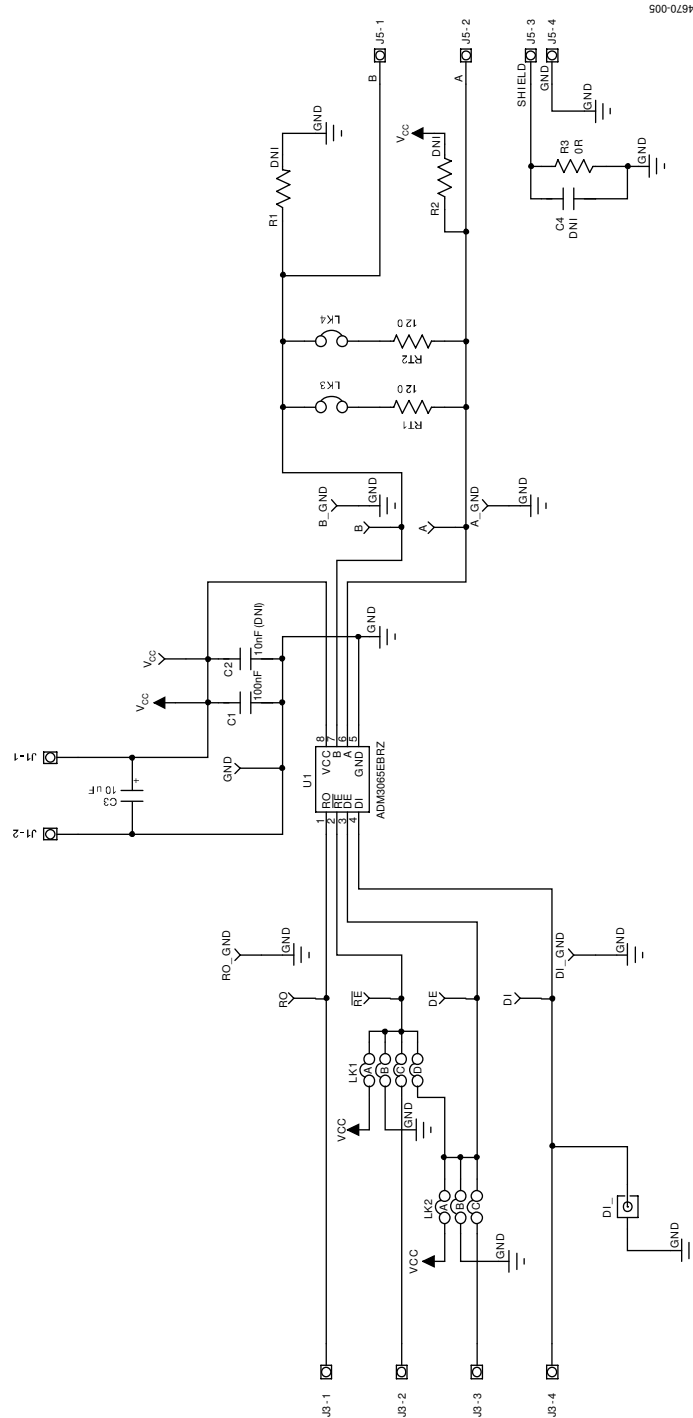


Figure 5. EVAL-ADM3065EEBZ Schematic

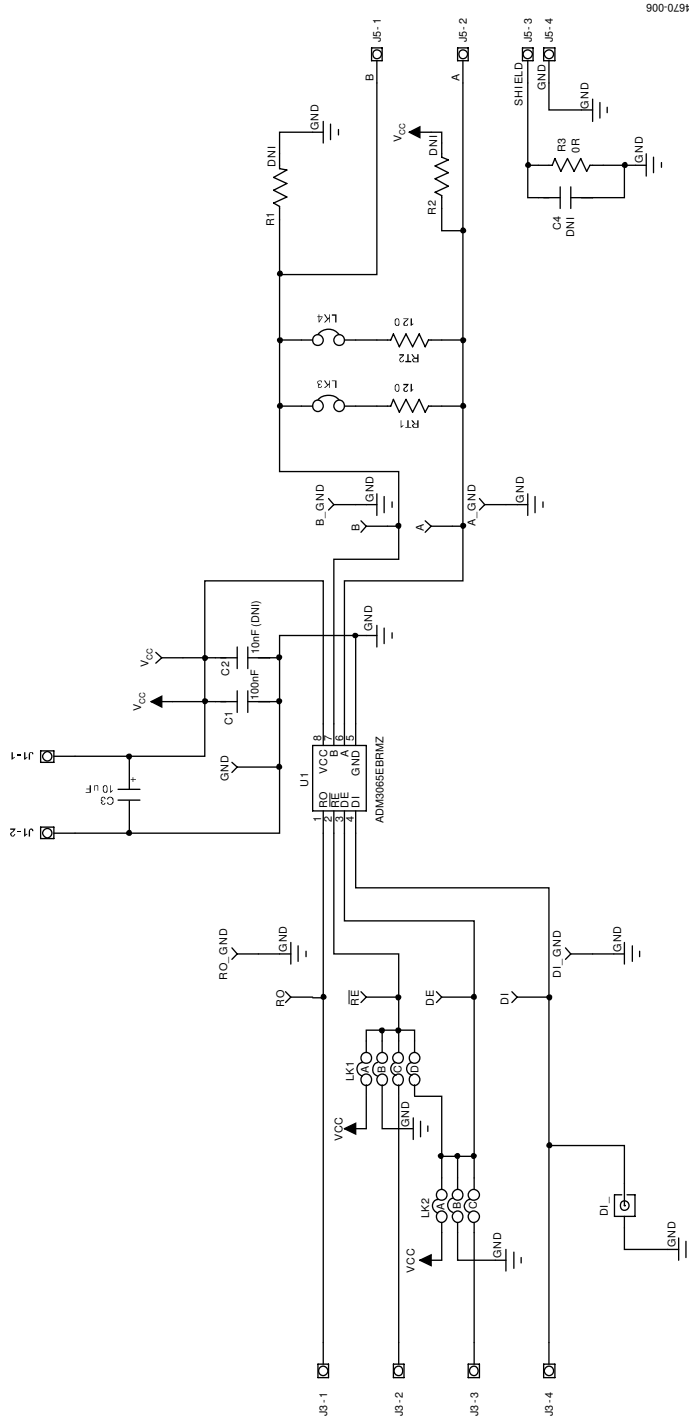


Figure 6. EVAL-ADM3065EEB1Z Schematic

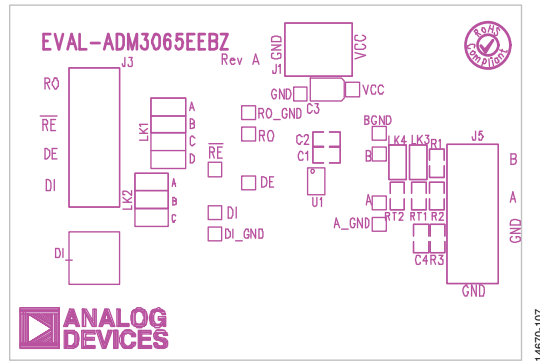


Figure 7. EVAL-ADM3065EEBZ/EVAL-ADM3065EEB1Z Silkscreen

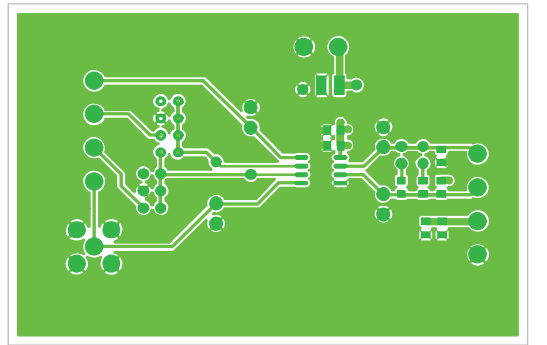


Figure 8. EVAL-ADM3065EEBZ/EVAL-ADM3065EEB1Z Component Side/Layer 1

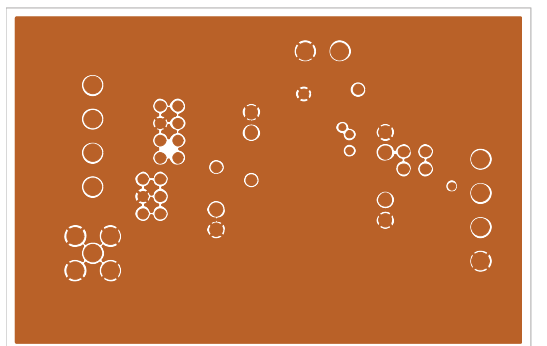


Figure 9. EVAL-ADM3065EEBZ/EVAL-ADM3065EEB1Z Layer 2

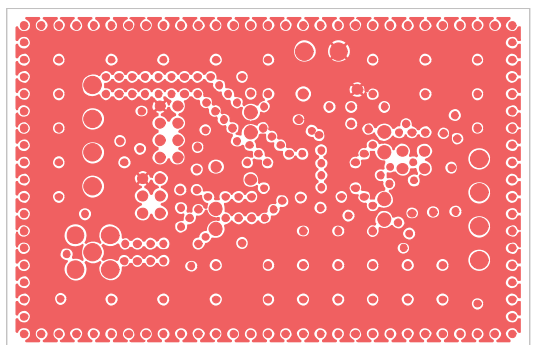
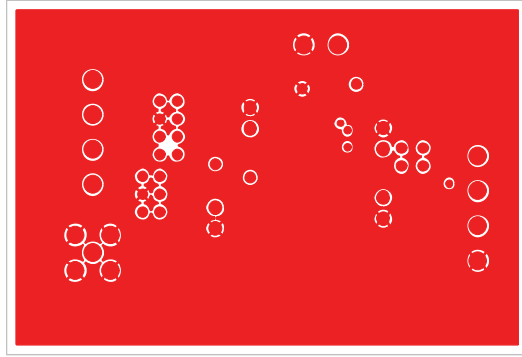


Figure 10. EVAL-ADM3065EEBZ/EVAL-ADM3065EEB1Z Layer 3



14670-010

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 $\mu$ F, 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 $\times$ 2) 0.1" header and shorting block	Harwin	M20-9953646 and M7566-05
1	LK2	6-pin (3 $\times$ 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 $\Omega$ , 0805	Vishay Draloric	CRCW08050000Z0EA
2	RT1, RT2	Resistor, 120 $\Omega$ , 0805	Multicomp	MC 0.1W 0805 1% 120R
1	U1	8-lead SOIC	Analog Devices, Inc.	<a href="#">ADM3065EBRZ</a>
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 $\mu$ F, 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 $\times$ 2) 0.1" header and shorting block	Harwin	M20-9953646 and M7566-05
1	LK2	6-pin (3 $\times$ 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 $\Omega$ , 0805	Vishay Draloric	CRCW08050000Z0EA
2	RT1, RT2	Resistor, 120 $\Omega$ , 0805	Multicomp	MC 0.1W 0805 1% 120R
1	U1	8-lead MSOP	Analog Devices, Inc.	<a href="#">ADM3065EBRMZ</a>
1	VCC	Test point, red	Vero Technologies	20-313137

## RELATED LINKS

Resource	Description
<a href="#">ADM3065E</a>	3.0 V to 5.5 V, $\pm$ 12 kV IEC ESD Protected, 50 Mbps RS-485 Transceiver
<a href="#">AN-960</a>	RS-485/RS-422 Circuit Implementation Guide
<a href="#">Interface RS-485 and RS-422</a>	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.

**Legal Terms and Conditions**

By using the evaluation board discussed herein (together with any tools, components documentation or support materials, the "Evaluation Board"), you are agreeing to be bound by the terms and conditions set forth below ("Agreement") unless you have purchased the Evaluation Board, in which case the Analog Devices Standard Terms and Conditions of Sale shall govern. Do not use the Evaluation Board until you have read and agreed to the Agreement. Your use of the Evaluation Board shall signify your acceptance of the Agreement. This Agreement is made by and between you ("Customer") and Analog Devices, Inc. ("ADI"), with its principal place of business at One Technology Way, Norwood, MA 02062, USA. Subject to the terms and conditions of the Agreement, ADI hereby grants to Customer a free, limited, personal, temporary, non-exclusive, non-sublicensable, non-transferable license to use the Evaluation Board FOR EVALUATION PURPOSES ONLY. Customer understands and agrees that the Evaluation Board is provided for the sole and exclusive purpose referenced above, and agrees not to use the Evaluation Board for any other purpose. Furthermore, the license granted is expressly made subject to the following additional limitations: Customer shall not (i) rent, lease, display, sell, transfer, assign, sublicense, or distribute the Evaluation Board; and (ii) permit any Third Party to access the Evaluation Board. As used herein, the term "Third Party" includes any entity other than ADI, Customer, their employees, affiliates and in-house consultants. The Evaluation Board is NOT sold to Customer; all rights not expressly granted herein, including ownership of the Evaluation Board, are reserved by ADI. CONFIDENTIALITY. This Agreement and the Evaluation Board shall all be considered the confidential and proprietary information of ADI. Customer may not disclose or transfer any portion of the Evaluation Board to any other party for any reason. Upon discontinuation of use of the Evaluation Board or termination of this Agreement, Customer agrees to promptly return the Evaluation Board to ADI. ADDITIONAL RESTRICTIONS. Customer may not disassemble, decompile or reverse engineer chips on the Evaluation Board. Customer shall inform ADI of any occurred damages or any modifications or alterations it makes to the Evaluation Board, including but not limited to soldering or any other activity that affects the material content of the Evaluation Board. Modifications to the Evaluation Board must comply with applicable law, including but not limited to the RoHS Directive. TERMINATION. ADI may terminate this Agreement at any time upon giving written notice to Customer. Customer agrees to return to ADI the Evaluation Board at that time. LIMITATION OF LIABILITY. THE EVALUATION BOARD PROVIDED HEREUNDER IS PROVIDED "AS IS" AND ADI MAKES NO WARRANTIES OR REPRESENTATIONS OF ANY KIND WITH RESPECT TO IT. ADI SPECIFICALLY DISCLAIMS ANY REPRESENTATIONS, ENDORSEMENTS, GUARANTEES, OR WARRANTIES, EXPRESS OR IMPLIED, RELATED TO THE EVALUATION BOARD INCLUDING, BUT NOT LIMITED TO, THE IMPLIED WARRANTY OF MERCHANTABILITY, TITLE, FITNESS FOR A PARTICULAR PURPOSE OR NON-INFRINGEMENT OF INTELLECTUAL PROPERTY RIGHTS. IN NO EVENT WILL ADI AND ITS LICENSORS BE LIABLE FOR ANY INCIDENTAL, SPECIAL, INDIRECT, OR CONSEQUENTIAL DAMAGES RESULTING FROM CUSTOMER'S POSSESSION OR USE OF THE EVALUATION BOARD, INCLUDING BUT NOT LIMITED TO LOST PROFITS, DELAY COSTS, LABOR COSTS OR LOSS OF GOODWILL. ADI'S TOTAL LIABILITY FROM ANY AND ALL CAUSES SHALL BE LIMITED TO THE AMOUNT OF ONE HUNDRED US DOLLARS (\$100,000). EXPORT. Customer agrees that it will not directly or indirectly export the Evaluation Board to another country, and that it will comply with all applicable United States federal laws and regulations relating to exports. GOVERNING LAW. This Agreement shall be governed by and construed in accordance with the substantive laws of the Commonwealth of Massachusetts (excluding conflict of law rules). Any legal action regarding this Agreement will be heard in the state or federal courts having jurisdiction in Suffolk County, Massachusetts, and Customer hereby submits to the personal jurisdiction and venue of such courts. The United Nations Convention on Contracts for the International Sale of Goods shall not apply to this Agreement and is expressly disclaimed.