

## Evaluating the **ADM3061E** 3.0 V to 5.5 V, $\pm 12$ kV IEC ESD Protected, 50 Mbps RS-485 Transceiver

### FEATURES

- Easy evaluation of the **ADM3061E** 50 Mbps RS-485 transceiver
- Board layouts for standard half-duplex RS-485 footprints
  - 8-lead, SOIC, **ADM3061EBRZ** (EVAL-ADM3061EEBZ)
  - 8-lead, MSOP, **ADM3061EBRMZ** (EVAL-ADM3061EEB1Z)
- 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 bus pin and B bus pin
  - $\pm 12$  kV contact discharge and  $\pm 12$  kV air 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-ADM3061EEBZ or EVAL-ADM3061EEB1Z

### ADDITIONAL EQUIPMENT NEEDED

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

### GENERAL DESCRIPTION

The EVAL-ADM3061EEBZ and EVAL-ADM3061EEB1Z allow quick and easy evaluation of the **ADM3061E** 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-ADM3061EEBZ evaluation board has a footprint for the **ADM3061EBRZ** half-duplex RS-485 transceiver in an 8-lead SOIC package. The EVAL-ADM3061EEB1Z evaluation board has a footprint for a full duplex RS-485 transceiver in an 8-lead MSOP package.

Complete specifications for the **ADM3061E** device are provided in the **ADM3061E** data sheet and should be consulted in conjunction with this user guide when using the evaluation board.

### EVALUATION BOARD PHOTOGRAPHS



Figure 1. EVAL-ADM3061EEBZ Evaluation Board



Figure 2. EVAL-ADM3061EEB1Z Evaluation Board

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**REVISION HISTORY**

12/2017—Revision 0: Initial Version

## EVALUATION BOARD HARDWARE

### SETTING UP THE EVALUATION BOARD

The EVAL-ADM3061EEBZ and EVAL-ADM3061EEB1Z 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-ADM3061EEBZ and EVAL-ADM3061EEB1Z include connections for data input (DI), receiver output (RO), receiver enable (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-ADM3061EEBZ and EVAL-ADM3061EEB1Z evaluation boards also have a right hand SMA connector (DI), which is the preferred option for delivering a 50 Mbps signal to the evaluation boards.

Connections to an RS-485 bus are made via a screw terminal block, J5. For the EVAL-ADM3061EEBZ or EVAL-ADM3061EEB1Z half-duplex boards, there are two bus input/output signals, A and B, for noninverting and inverting signals, respectively.

**Table 1. Jumper Configuration**

| Link | Connection   | Description  |
|------|--------------|--|
| LK1  | A            | Connects the receiver enable ( $\overline{\text{RE}}$ ) input of the <a href="#">ADM3061E</a> to VCC. This setting disables the receiver.  |
|      | B            | Connects the $\overline{\text{RE}}$ input of the <a href="#">ADM3061E</a> to GND. This setting enables the receiver.   |
|      | C            | Connects the $\overline{\text{RE}}$ input of the <a href="#">ADM3061E</a> to the J3-2 terminal block connector.  |
|      | D            | Connects the $\overline{\text{RE}}$ input of the <a href="#">ADM3061E</a> to the 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="#">ADM3061E</a> to VCC. This setting enables the driver.   |
|      | B            | Connects the DE input of the <a href="#">ADM3061E</a> to GND. This setting disables the driver.  |
|      | C            | Connects the DE input of the <a href="#">ADM3061E</a> to the J3-3 terminal block connector.  |
| LK3  | Inserted     | Connects the 120 $\Omega$ RT1 termination resistor across the RS-485 A pin and B pin.  |
|      | Not inserted | Disconnects the 120 $\Omega$ RT1 termination resistor across the RS-485 A pin and B pin.   |
| LK4  | Inserted     | Connects the 120 $\Omega$ RT2 termination resistor across the RS-485 A pin and B pin.  |
|      | Not inserted | Disconnects the 120 $\Omega$ RT2 termination resistor across the RS-485 A pin and B pin.   |

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-ADM3061EEBZ and EVAL-ADM3061EEB1Z 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 [ADM3061E](#) 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](#).

**HALF-DUPLEX RS-485 TRANSCEIVERS POINT TO POINT TEST**

A point to point test can be set up with either two EVAL-ADM3061EEBZ evaluation boards or two EVAL-ADM3061EEB1Z 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-ADM3061EEBZ or EVAL-ADM3061EEB1Z 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 ADM3061E.

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

The EVAL-ADM3061EEBZ and EVAL-ADM3061EEB1Z evaluation boards are tested to achieve protection against IEC 61000-4-2 ESD to ±12 kV (contact), ±12 kV (air) on the RS-485 A bus pin and B bus pin.

IEC 61000-4-2 ESD describes testing using two coupling methods, known as contact discharge and air 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-ADM3061EEBZ and EVAL-ADM3061EEB1Z A pin and B pin 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 ADM3061E 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.

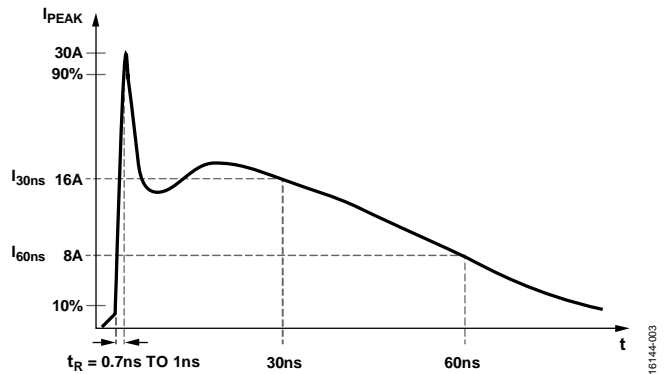


Figure 3. IEC 61000-4-2 ESD Waveform (8 kV)

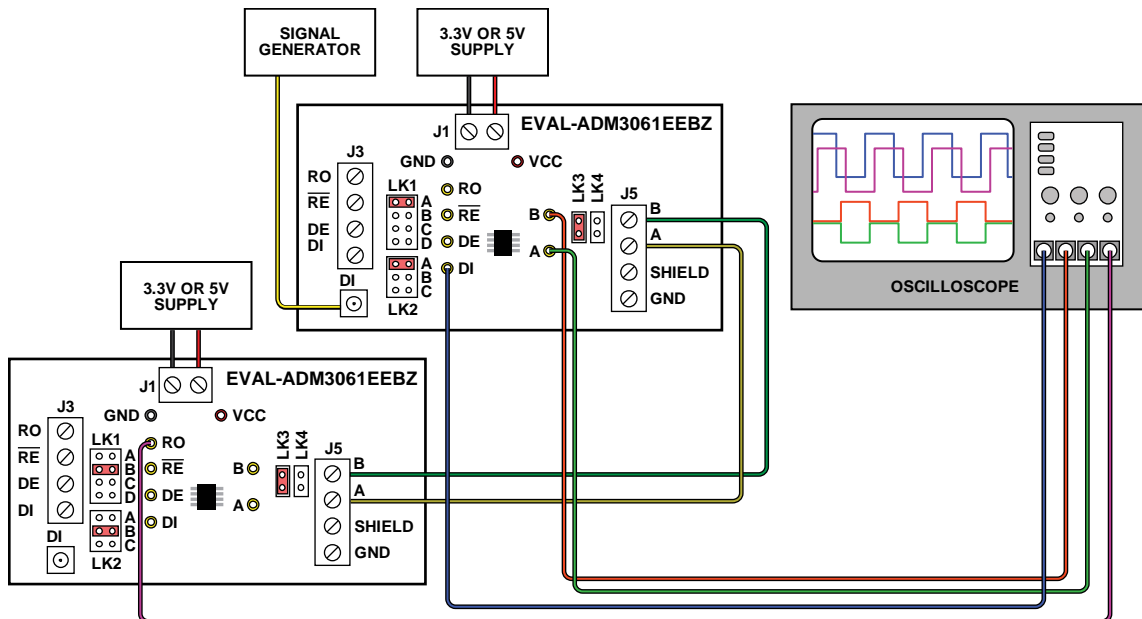


Figure 4. Half-Duplex RS-485 Two Board Point to Point Test

EVALUATION BOARD SCHEMATICS AND ARTWORK

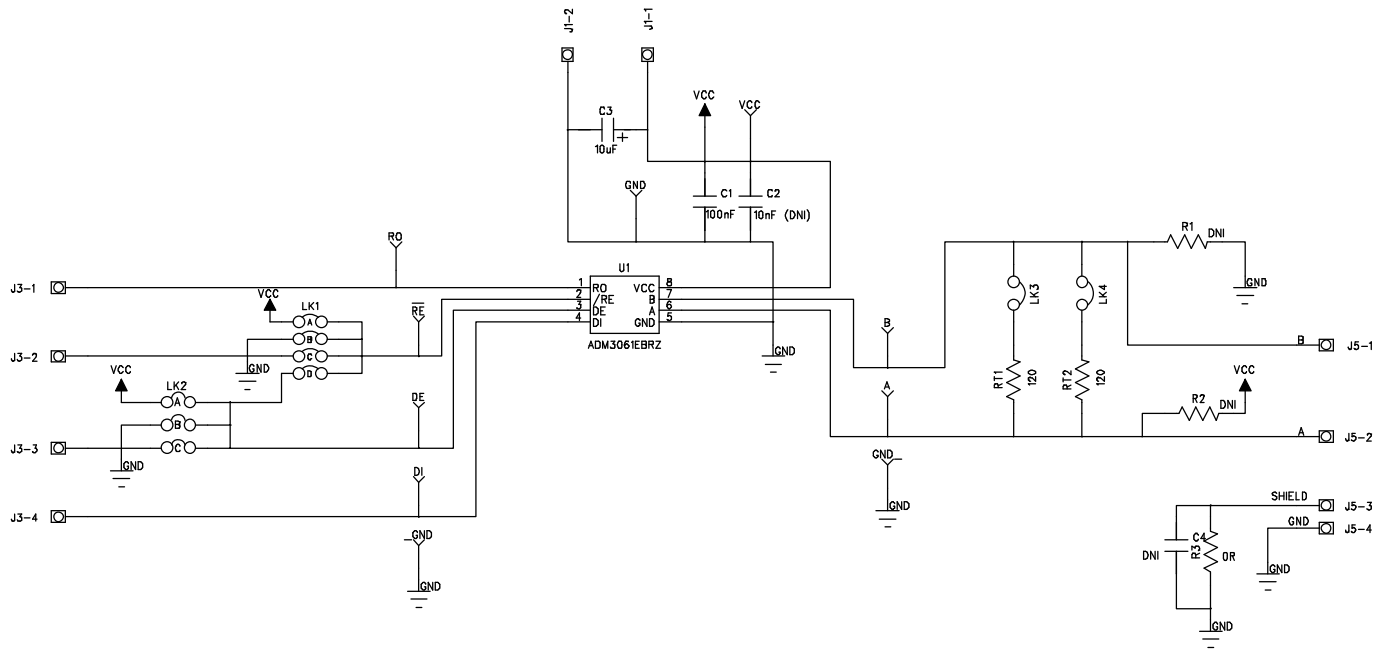


Figure 5. EVAL-ADM3061EEBZ Schematic

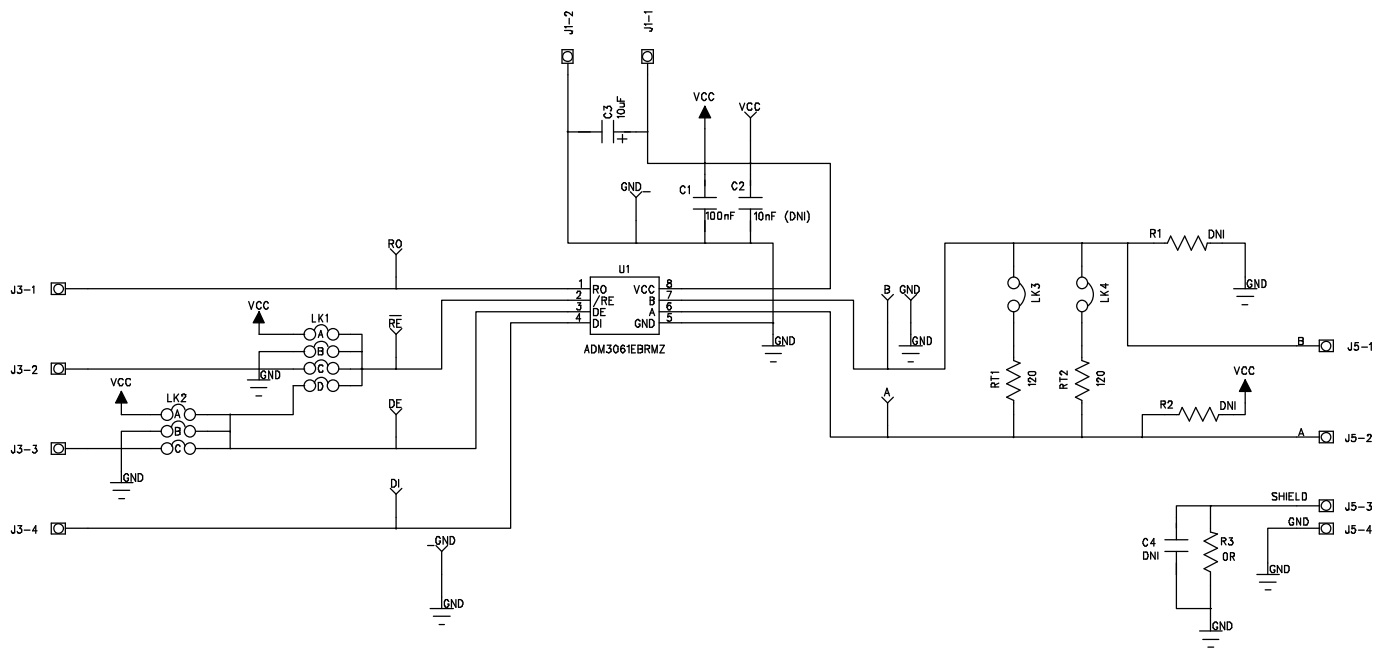
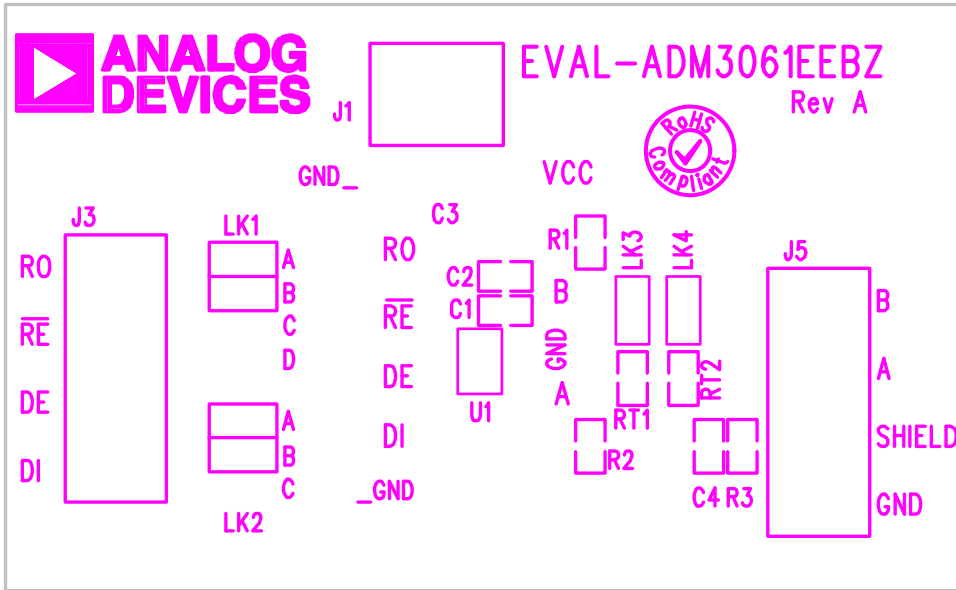
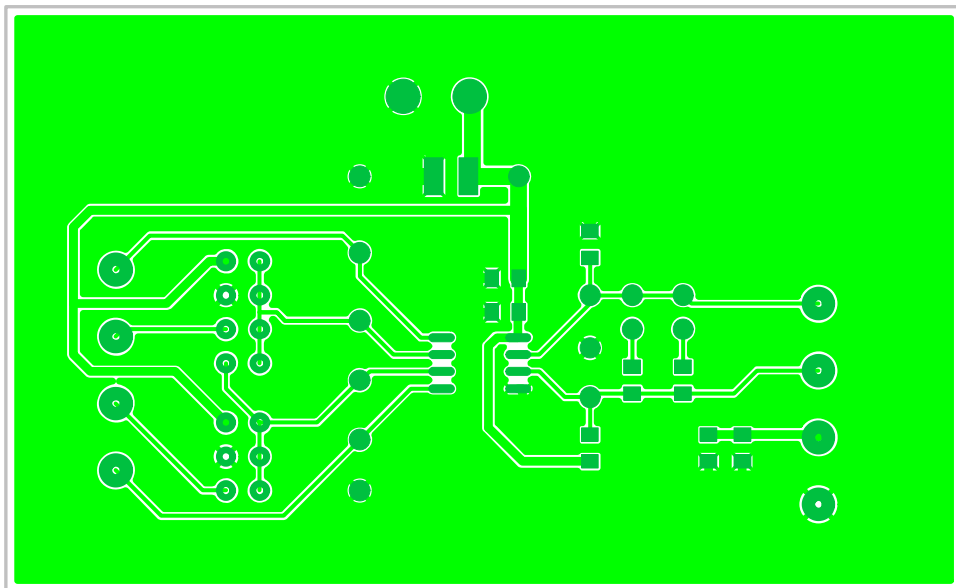


Figure 6. EVAL-ADM3061EEB1Z Schematic



16144-007

Figure 7. EVAL-ADM3061EEBZ Silkscreen



16144-008

Figure 8. EVAL-ADM3061EEBZ Component Side/Layer 1

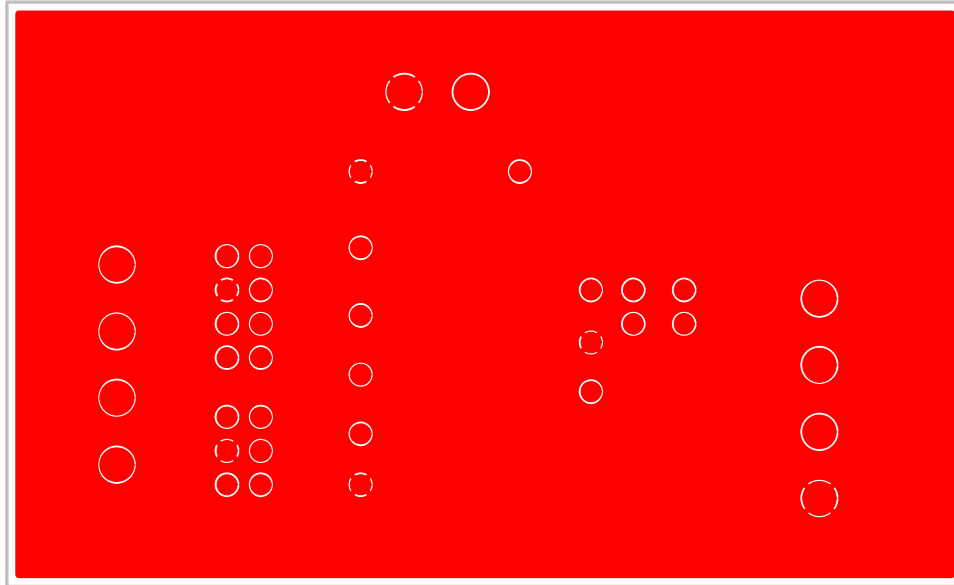


Figure 9. EVAL-ADM3061EEBZ Layer 2

## ORDERING INFORMATION

## BILL OF MATERIALS

Table 2. EVAL-ADM3061EEBZ

| 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, DE, DI, GND_, $\overline{RE}$ , RO, _GND | Test points, yellow                                 | Vero Technologies    | 20-313140                   |
| 1   | GND  | Test point, black                                   | Vero Technologies    | 20-2137                     |
| 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                                       | Resistors, 120 $\Omega$ , 0805                      | Multicomp            | MC 0.1W 0805 1% 120R        |
| 1   | U1   | 8-lead SOIC   | Analog Devices, Inc. | <a href="#">ADM3061EBRZ</a> |
| 1   | VCC  | Test point, red                                     | Vero Technologies    | 20-313137                   |

Table 3. EVAL-ADM3061EEB1Z

| 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, DE, DI, GND_, $\overline{RE}$ , RO, _GND | Test points, yellow                                 | Vero Technologies    | 20-313140                    |
| 1   | GND  | Test point, black                                   | Vero Technologies    | 20-2137                      |
| 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       | Not applicable               |
| 1   | R3   | Resistor, 0 $\Omega$ , 0805                         | Vishay Draloric      | CRCW08050000Z0EA             |
| 2   | RT1, RT2                                       | Resistors, 120 $\Omega$ , 0805                      | Multicomp            | MC 0.1W 0805 1% 120R         |
| 1   | U1   | 8-lead MSOP   | Analog Devices, Inc. | <a href="#">ADM3061EBRMZ</a> |
| 1   | VCC  | Test point, red                                     | Vero Technologies    | 20-313137                    |



## RELATED LINKS

| Resource                                    | Description  |
|---|--|
| <a href="#">ADM3061E</a>                    | 3.0 V to 5.5 V, ±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.

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