

## Evaluating the **ADM3063E** 3.0 V to 5.5 V, $\pm 12$ kV IEC ESD Protected, 500 kbps, RS-485 Transceiver

### FEATURES

Easy evaluation of **ADM3063E** 500 kbps, RS-485 transceiver  
 Board layout for standard, full-duplex, RS-485 footprint  
 14-lead SOIC, **ADM3063EBRZ**  
 Power/ground connections through screw terminal block  
 3.0 V to 5.5 V operating voltage range on  $V_{CC}$   
 IEC61000-4-2 ESD protection on the RS-485 A, B, Y and Z bus pins  
 $\pm 12$  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-ADM3063EEBZ evaluation board

### ADDITIONAL EQUIPMENT NEEDED

Oscilloscope  
 Signal generator  
 3 V to 5 V supply

### GENERAL DESCRIPTION

The EVAL-ADM3063EEBZ allows quick and easy evaluation of the **ADM3063E** 500 kbps, RS-485 transceiver with standard, 14-lead NSOIC footprint. The evaluation board allows 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 board can be powered by a standard configurable bench power supply within the 3.0 V to 5.5 V range.

The EVAL-ADM3063EEBZ evaluation board has a footprint for the **ADM3063EBRZ** full duplex, RS-485 transceiver in a 14-lead SOIC package.

For full details, see the **ADM3063E** data sheet, which must be used in conjunction with this user guide when using the EVAL-ADM3063EEBZ evaluation board.

### EVALUATION BOARD PHOTOGRAPH

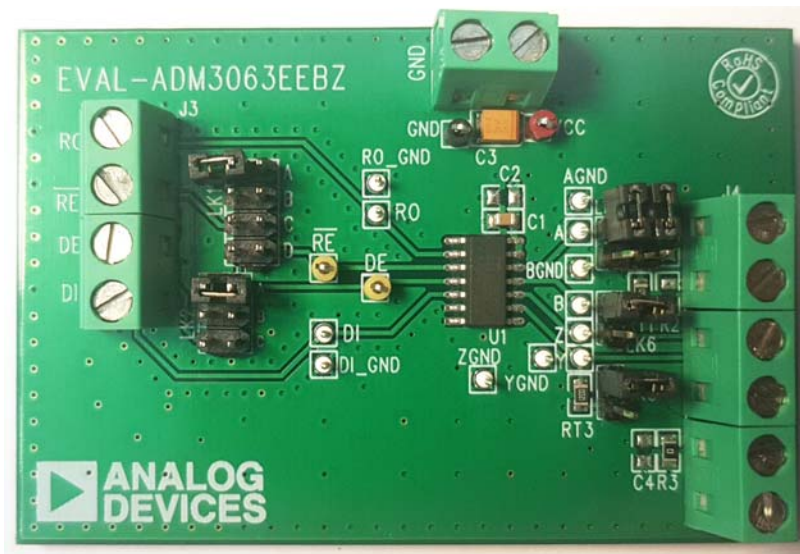


Figure 1.

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REVISION HISTORY

4/2019—Revision 0: Initial Version

## EVALUATION BOARD HARDWARE

### SETTING UP THE EVALUATION BOARD

The EVAL-ADM3063EEBZ evaluation board is powered by connecting a 3.0 V or 5.5 V power supply to the J1 screw terminals for  $V_{CC}$  and GND at the top of the evaluation board. A 10  $\mu$ F decoupling capacitor, C3, is fitted at the connector between  $V_{CC}$  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 the 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 board to a signal generator. The EVAL-ADM3063EEBZ includes connections for data input (DI), receiver output (RO), receiver enable ( $\overline{RE}$ ), and driver enable (DE). Jumper connections on LK1 and LK2 can connect the DE and  $\overline{RE}$  digital inputs to the J3 terminal block, to  $V_{CC}$  or to GND (see Table 1).

Connections to an RS-485 bus are made via a screw terminal block, J4. For the EVAL-ADM3063EEBZ board, there are four bus input/output signals: A and B, for noninverting and inverting input signals, respectively, and Y and Z for noninverting and inverting output signals, respectively. The bus cable can also include a common ground connection or shield, and can be connected to the J4 screw terminal block of the evaluation boards. Test points are available on the evaluation board and are appropriately labeled for all digital and bus input/output signals.

### OTHER BOARD COMPONENTS

The EVAL-ADM3063EEBZ evaluation board includes footprints for termination resistors, RT1 and RT3, as well as pull-up and pull-down resistors, R1 and R2, for the receiver inputs. Termination resistors of 120  $\Omega$  are fitted to the evaluation board; these resistors can be removed or replaced with a different value resistor as needed. Inserting jumper LK3 adds 120  $\Omega$  termination to the receiver inputs. Inserting jumper LK5 adds 120  $\Omega$  termination to the transmitter output.

#### ***Biasing Resistors for Bus Idle Fail-Safe***

Although the [ADM3063E](#) 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 Pin A, as well as the R1 pull-down resistor to GND on Pin B. These resistors can be fitted if the user is connecting to other devices that require external biasing resistors on the bus. The exact value required for a 200 mV minimum differential voltage in 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 Configurations**

| Link | Jumper Connection | Description                                                                                                                                                                                                                                                                                                         |
|------|-------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| LK1  | A                 | Connects the receiver enable ( $\overline{RE}$ ) input of the ADM3063E to $V_{CC}$ . This setting disables the receiver.                                                                                                                                                                                            |
|      | B                 | Connects the $\overline{RE}$ input of the <a href="#">ADM3063E</a> to GND. This setting enables the receiver.                                                                                                                                                                                                       |
|      | C                 | Connects the $\overline{RE}$ input of the <a href="#">ADM3063E</a> to the J3-2 terminal block connector.                                                                                                                                                                                                            |
|      | D                 | Connects the $\overline{RE}$ input of the <a href="#">ADM3063E</a> to the J3-3 terminal block connector; 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 <a href="#">ADM3063E</a> to $V_{CC}$ . This setting enables the driver.                                                                                                                                                                                                                |
|      | B                 | Connects the DE input of the <a href="#">ADM3063E</a> to GND. This setting disables the driver.                                                                                                                                                                                                                     |
|      | C                 | Connects the DE input of the <a href="#">ADM3063E</a> to the J3-2 terminal block connector.                                                                                                                                                                                                                         |
| LK3  | Inserted          | Connects the 120 $\Omega$ RT1 termination resistor across the A and B pins of the RS-485.                                                                                                                                                                                                                           |
|      | Not inserted      | Disconnects the 120 $\Omega$ RT1 termination resistor across the A and B pins of the RS-485.                                                                                                                                                                                                                        |
| LK5  | Inserted          | Connects the 120 $\Omega$ RT3 termination resistor across the Y and Z pins of the RS-485.                                                                                                                                                                                                                           |
|      | Not inserted      | Disconnects the 120 $\Omega$ RT3 termination resistor across the Y and Z pins of the RS-485.                                                                                                                                                                                                                        |
| LK6  | Inserted          | Connects Pin B to Pin Z.                                                                                                                                                                                                                                                                                            |
|      | Not inserted      | Disconnects Pin B from Pin Z.                                                                                                                                                                                                                                                                                       |
| LK4  | Inserted          | Connects Pin A to Pin Y.                                                                                                                                                                                                                                                                                            |
|      | Not inserted      | Disconnects Pin A from Pin Y.                                                                                                                                                                                                                                                                                       |

## FULL-DUPLEX RS-485 TRANSCEIVERS LOOPBACK TEST

For the EVAL-ADM3063EEBZ, a loopback test can be set up by closing the LK4 and LK6 jumpers. This test is shown in Figure 3. A signal generator is connected to the DI pin and this allows verification of the bus signals and the receiver output. Note the jumper positions of LK1 (B) and LK2 (A) for the EVAL-ADM3063EEBZ evaluation board. Ensure that LK3 and LK5 are also closed to loop back the transmitter outputs to the receiver inputs. In this configuration, the default termination resistors can be used, because both 120  $\Omega$  resistors on the board are connected in parallel by the loopback, ensuring that the test is conducted with a standard RS-485 load of 60  $\Omega$  (bus terminated at both ends by 120  $\Omega$ ).

## IEC 61000-4-2 ELECTROSTATIC DISCHARGE (ESD) PROTECTION TO $\pm 12$ kV (CONTACT) AND $\pm 12$ kV (AIR)

The EVAL-ADM3063EEBZ evaluation board is tested to achieve protection against IEC 61000-4-2 ESD to  $\pm 12$  kV (contact), and  $\pm 12$  kV (air) on the RS-485 A and B bus pins.

The IEC 61000-4-2 ESD standard 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 A, B, Y, and Z pins of the EVAL-ADM3063EEBZ 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  $\pm 8$  kV and an air discharge voltage of  $\pm 15$  kV. Transceivers quoting IEC 61000-4-2 levels of protection, such as the [ADM3063E](#), far exceed the robustness offered by transceivers with varying levels of Human Body Model (HBM) protection.

Figure 2 shows the 8 kV contact discharge current waveform as described in the [ADM3063E](#) data sheet. Some key IEC 61000-4-2 waveform parameters are rise times of  $< 1$  ns and pulse widths of  $\sim 60$  ns.

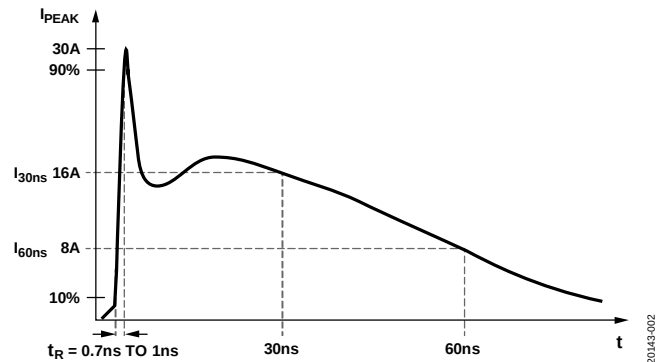


Figure 2. IEC 61000-4-2 ESD Waveform (8 kV)

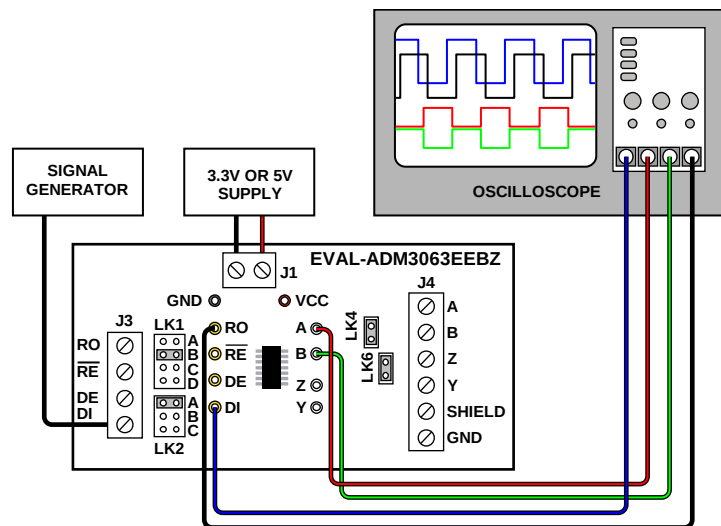


Figure 3. Full-Duplex RS-485 Loopback Test

## EVALUATION BOARD SCHEMATICS AND ARTWORK

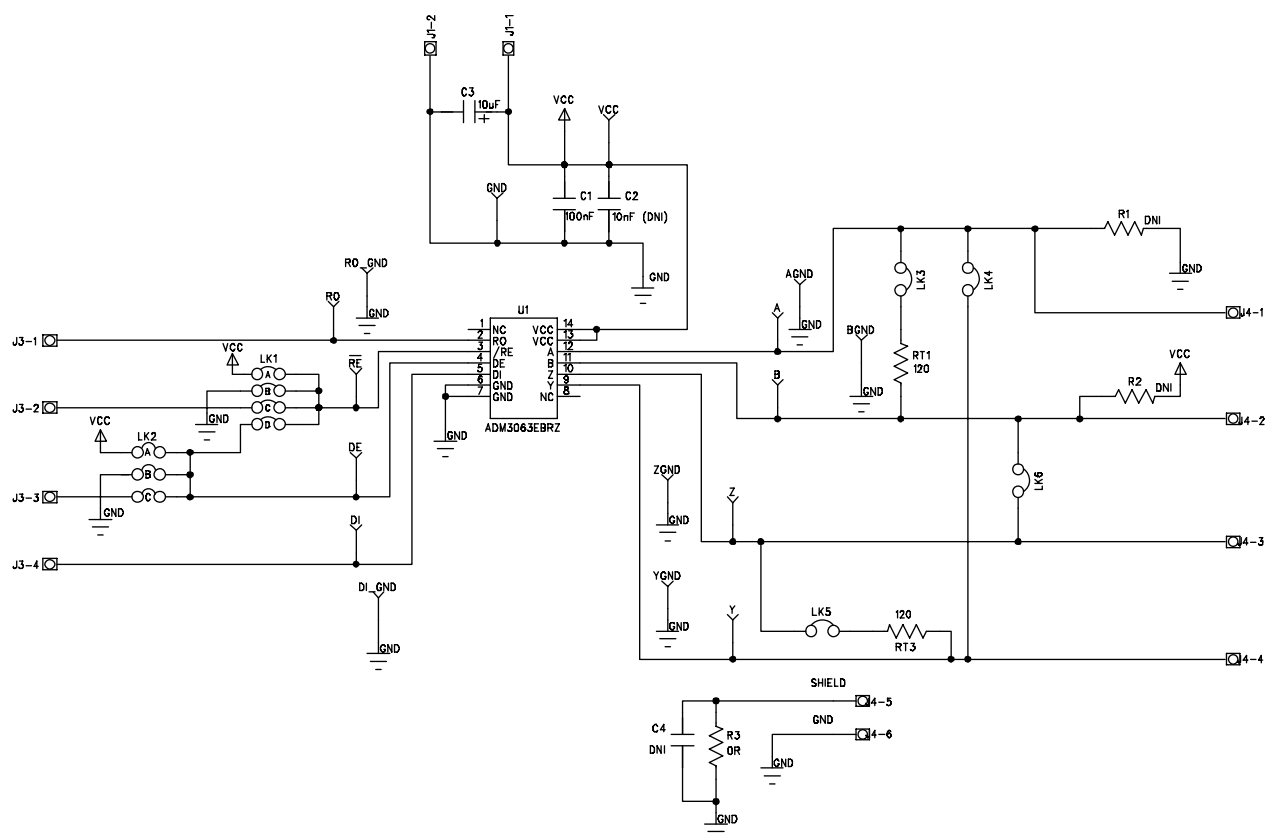


Figure 4. EVAL-ADM3063EEBZ Schematic

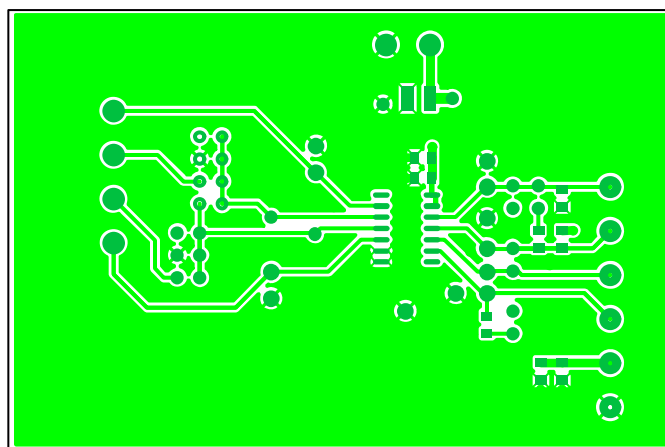
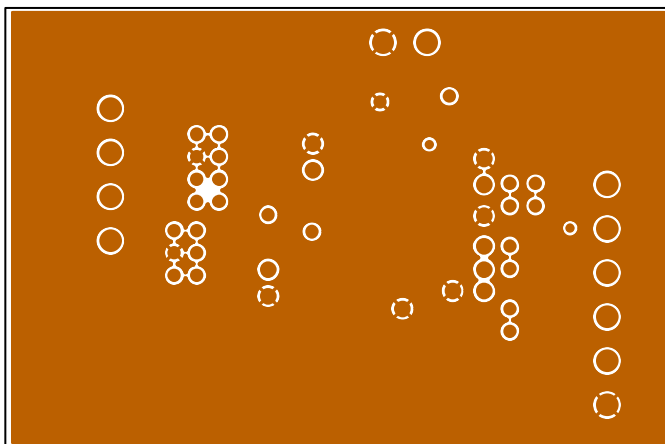
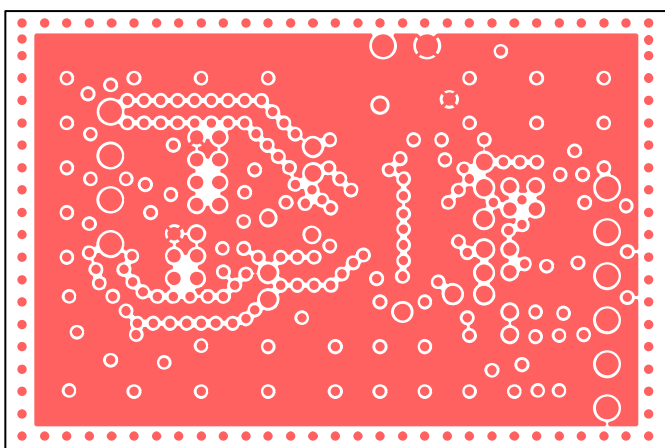


Figure 5. EVAL-ADM3063EEBZ Component Side, Layer 1



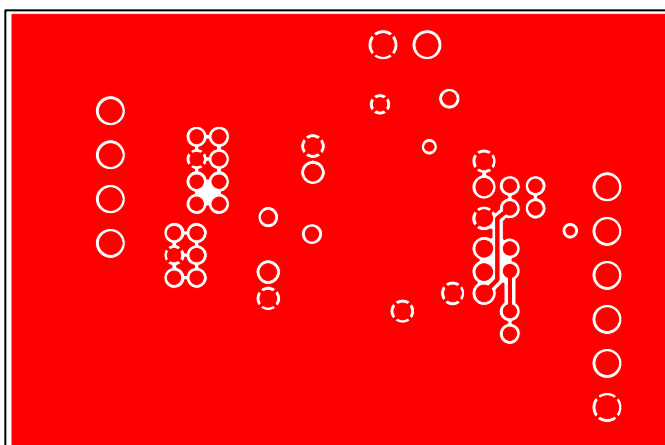
20143-006

Figure 6. EVAL-ADM3063EEBZ, Layer 2



20143-007

Figure 7. EVAL-ADM3063EEBZ, Layer 3



20143-008

Figure 8. EVAL-ADM3063EEBZ, Layer 4

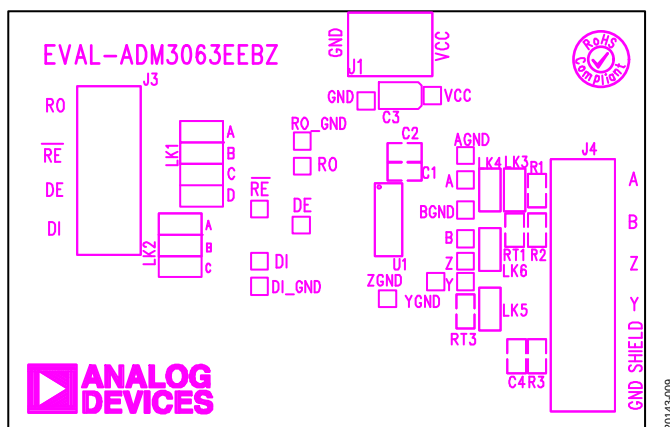


Figure 9. EVAL-ADM3063EEBZ, Silkscreen

## ORDERING INFORMATION

## BILL OF MATERIALS

Table 2.

| Qty | Reference Designator                                       | Description                                              | Manufacturer         | Part Number                 |
|-----|------------------------------------------------------------|----------------------------------------------------------|----------------------|-----------------------------|
| 1   | C1                                                         | Capacitor, 100 nF, 0805                                  | Multicomp            | MCCA000274                  |
| 2   | C2, C4                                                     | Capacitor, not placed/optional                           | Not applicable       | Not applicable              |
| 1   | C3                                                         | Capacitor, 10 $\mu$ F, Case B                            | Kemet                | B45196H3106K209             |
| 12  | A, B, Y, Z, AGND, BGND, YGND, ZGND, DI, RO, DI_GND, RO_GND | High speed test point, silver pin                        | Oxley                | 040/30P/LA/KP2 SILVER       |
| 2   | DE, RE                                                     | Test point, yellow                                       | Vero Technologies    | 20-313140                   |
| 1   | GND                                                        | Test point, black                                        | Vero Technologies    | 20-2137                     |
| 1   | J1                                                         | Two-way terminal block                                   | Lumberg              | KRM 02                      |
| 1   | J3                                                         | Four-way terminal block                                  | Lumberg              | KRM 04                      |
| 1   | J4                                                         | Six-way terminal block                                   | Camden               | CTB5000/6                   |
| 1   | LK1                                                        | 8-pin (4 $\times$ 2), 0.1 inch header and shorting block | Harwin               | M20-9953646 and M7566-05    |
| 1   | LK2                                                        | 6-pin (3 $\times$ 2), 0.1 inch header and shorting block | Harwin               | M20-9953646 and M7566-05    |
| 4   | LK3, LK4, LK5, LK6                                         | Jumper block, 2-pin, 0.1 inch spacing                    | Harwin               | M20-9990246 and M7566-05    |
| 2   | R1, R2                                                     | Resistor, not placed/optional                            |                      | Not applicable              |
| 1   | R3                                                         | Resistor, 0 $\Omega$ , 0805                              | Vishay               | CRCW08050000Z0EA            |
| 2   | RT1, RT3                                                   | Resistor, 120 $\Omega$ , 0805                            | Multicomp            | MC01W08051120R              |
| 1   | U1                                                         | 14-lead NSOIC                                            | Analog Devices, Inc. | <a href="#">ADM3063EBRZ</a> |
| 2   | VCC                                                        | Test point, red                                          | Vero Technologies    | 20-313137                   |

**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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