

## Evaluating the **ADM3068E** 3.0 V to 5.5 V, $\pm 12$ kV IEC ESD Protected, 50 Mbps, RS-485 Transceiver

### FEATURES

- Easy evaluation of the **ADM3068E** 50 Mbps, RS-485 transceiver
- Board layout for full duplex, RS-485 footprint, 14-lead SOIC\_N, **ADM3068EBRZ** transceiver
- Power and ground connections through screw terminal blocks
  - 3.0 V to 5.5 V operating voltage range on  $V_{CC}$  power supply
  - 1.62 V to 5.5 V  $V_{IO}$  logic supply
- IEC 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 or disable for  $\overline{RE}$  and DE
- Test points for measuring all signals
- Resistors and footprints for termination and biasing networks

### EVALUATION KIT CONTENTS

EVAL-ADM3068EEBZ evaluation board

### EQUIPMENT NEEDED

- Oscilloscope
- Signal generator
- 3.0 V to 5.5 V supply
- 1.62 V to 5.5 V supply

### DOCUMENTS NEEDED

**ADM3068E** data sheet

### GENERAL DESCRIPTION

The EVAL-ADM3068EEBZ allows quick and easy evaluation of the **ADM3068E** 50 Mbps, RS-485 transceiver with a standard, 14-lead SOIC\_N 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 signals, and RS-485 signals. The evaluation board is powered by a standard configurable benchtop power supply within the 3.0 V to 5.5 V range. A flexible  $V_{IO}$  logic supply allows communication with processors running on voltages as low as 1.62 V.

The EVAL-ADM3068EEBZ evaluation board has a footprint for the **ADM3068EBRZ** full duplex, RS-485 transceiver in a 14-lead SOIC\_N package.

For full details, see the **ADM3068E** data sheet, which must be used in conjunction with this user guide and the EVAL-ADM3068EEBZ evaluation board.

### EVALUATION BOARD PHOTOGRAPH

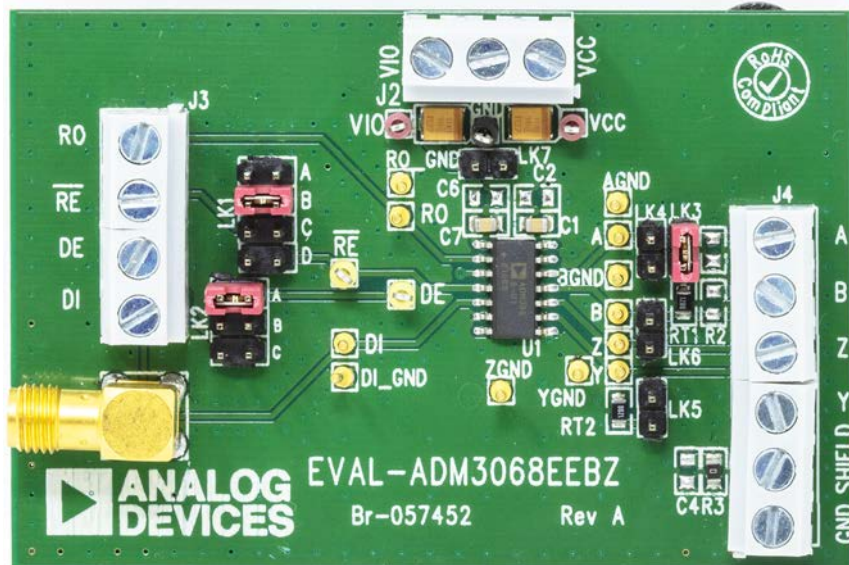


Figure 1.

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**REVISION HISTORY**

5/2019—Revision 0: Initial Version

## EVALUATION BOARD HARDWARE

### SETTING UP THE EVALUATION BOARD

The EVAL-ADM3068EEBZ is powered by connecting a 3.0 V to 5.5 V power supply to the J2 screw terminals, V<sub>CC</sub> and GND, at the top of the evaluation board. A 10 μF decoupling capacitor, C3, is fitted at the connector between V<sub>CC</sub> and GND. The V<sub>CC</sub> pin of the ADM3068E is fitted with a 100 nF decoupling capacitor, C1, with a second footprint for an optional additional decoupling capacitor, C2.

Connect the V<sub>IO</sub> pin to the V<sub>CC</sub> pin by inserting Jumper LK7. Alternatively, connect the V<sub>IO</sub> terminal of J2 to a separate low voltage logic supply in the range of 1.62 V to 5.5 V, which allows the ADM3068E to interface with processors with operating voltages less than 3.3 V. A 10 μF decoupling capacitor, C5, is fitted at the connector between V<sub>IO</sub> and GND. The V<sub>IO</sub> pin of the RS-485 transceiver is fitted with a 100 nF decoupling capacitor, C7, with a second footprint for an optional capacitor, C6.

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

### INPUT AND OUTPUT CONNECTIONS

Digital input and output signals are accessible via the J3 screw terminal block, allowing wire connections from the evaluation board to a signal generator. The EVAL-ADM3068EEBZ includes 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 V<sub>CC</sub> and GND (see Table 1). The EVAL-ADM3068EEBZ evaluation board also has Subminiature Version A (SMA) right angle jack (DI<sub>-</sub>), which is the preferred option for delivering a high speed, 50 Mbps signal to the evaluation board.

Connections to an RS-485 bus are made via a screw terminal block, J4. For the EVAL-ADM3068EEBZ, there are four bus input and 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 cables also include a common ground connection or shield and can be connected to the J4 screw terminal block of the evaluation board. Test points are available on the evaluation board and are appropriately labeled for all digital and bus input and output signals.

### OTHER BOARD COMPONENTS

The EVAL-ADM3068EEBZ evaluation board includes footprints for termination resistors, RT1 and RT3, as well as pull-up and pull-down resistors, R1 and R2. Termination resistors of 120 Ω are fitted to the evaluation board, but these resistors can be removed or replaced with a different value resistor as needed. Inserting the LK3 and LK5 jumpers adds an on-board 60 Ω load to the RS-485 driver.

Table 1. Jumper Configurations

Link	Jumper Connection	Description
LK1	A	Connects the $\overline{RE}$ input of the ADM3068E to V <sub>IO</sub> . This setting disables the receiver.
	B	Connects the $\overline{RE}$ input of the ADM3068E to GND. This setting enables the receiver.
	C	Connects the $\overline{RE}$ input of the ADM3068E to the J3-2 terminal block connector.
	D	Connects the $\overline{RE}$ input of the ADM3068E to the J3-3 terminal block connector. Therefore, the input for both $\overline{RE}$ and DE is set by LK1. This setting ensures 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 ADM3068E to V <sub>IO</sub> . This setting enables the driver.
	B	Connects the DE input of the ADM3068E to GND. This setting disables the driver.
	C	Connects the DE input of the ADM3068E to the J3-2 terminal block connector.
LK3	Inserted	Connects the 120 Ω RT1 termination resistor across the A and B pins of the RS-485.
	Not inserted	Disconnects the 120 Ω RT1 termination resistor across the A and B pins of the RS-485.
LK4	Inserted	Connects Pin A to Pin Y.
	Not inserted	Disconnects Pin A from Pin Y.
LK5	Inserted	Connects the 120 Ω RT3 termination resistor across the Y and Z pins of the RS-485.
	Not inserted	Disconnects the 120 Ω 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.
LK7	Inserted	Connects Pin V <sub>CC</sub> with Pin V <sub>IO</sub> on the ADM3068E device.
	Not inserted	Disconnects Pin V <sub>CC</sub> from Pin V <sub>IO</sub> on the ADM3068E device.

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

Although the ADM3068E has a built-in receiver fail-safe for the bus idle condition, there are footprints on the evaluation board for fitting the R2 pull-up resistor to V<sub>CC</sub> 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 Ω for 3.3 V and 1440 Ω for 5 V).

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

**FULL DUPLEX RS-485 TRANSCEIVERS LOOPBACK TEST**

For the EVAL-ADM3068EEBZ, a loopback test can be set up by closing the LK4 and LK6 jumpers. Figure 3 shows how to set up a loopback test. A signal generator is connected to the DI pin, which allows verification of the bus signals and the receiver output. Note the jumper positions of LK1 (B) and LK2 (A) for the EVAL-ADM3068EEBZ evaluation board. Ensure that LK3 and LK5 are also closed. In this configuration, the default termination resistors can be used because both 120 Ω 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 Ω (bus terminated at both ends by 120 Ω).

**IEC 61000-4-2 ELECTROSTATIC DISCHARGE (ESD) PROTECTION**

The EVAL-ADM3068EEBZ evaluation board protects against IEC 61000-4-2 ESD to ±12 kV (contact) and ±12 kV (air) on the RS-485 A, B, Y and Z 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 moves 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-ADM3068EEBZ 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 2 shows the 8 kV contact discharge current waveform as described in the ADM3068E data sheet. Some key IEC 61000-4-2 waveform parameters are rise times of <1 ns and pulse widths of ~60 ns.

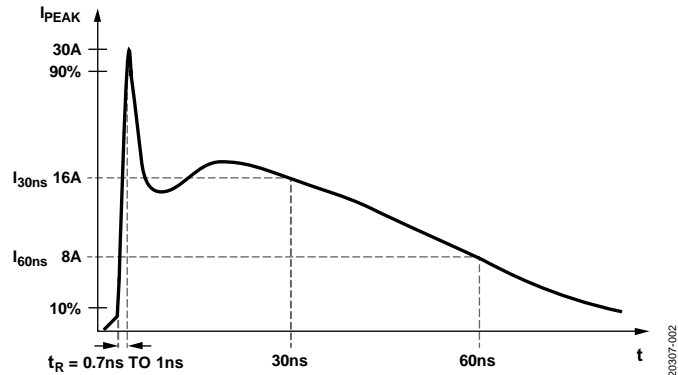


Figure 2. IEC 61000-4-2 ESD Waveform (8 kV)

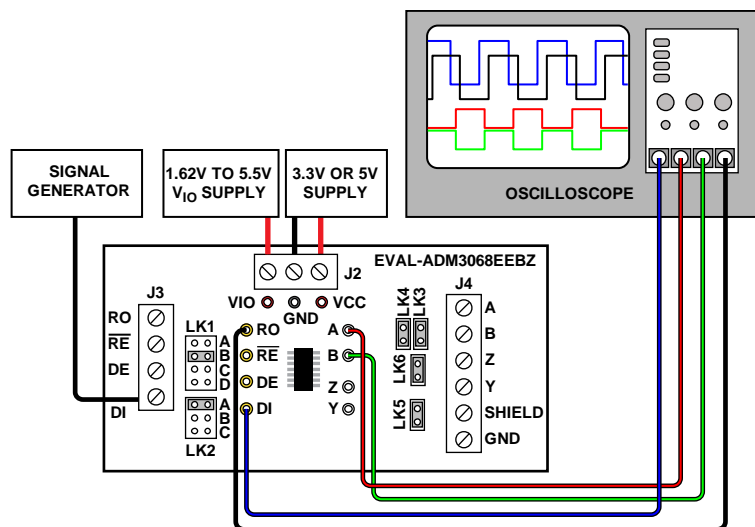


Figure 3. Full Duplex RS-485 Loopback Test

# EVALUATION BOARD SCHEMATICS AND ARTWORK

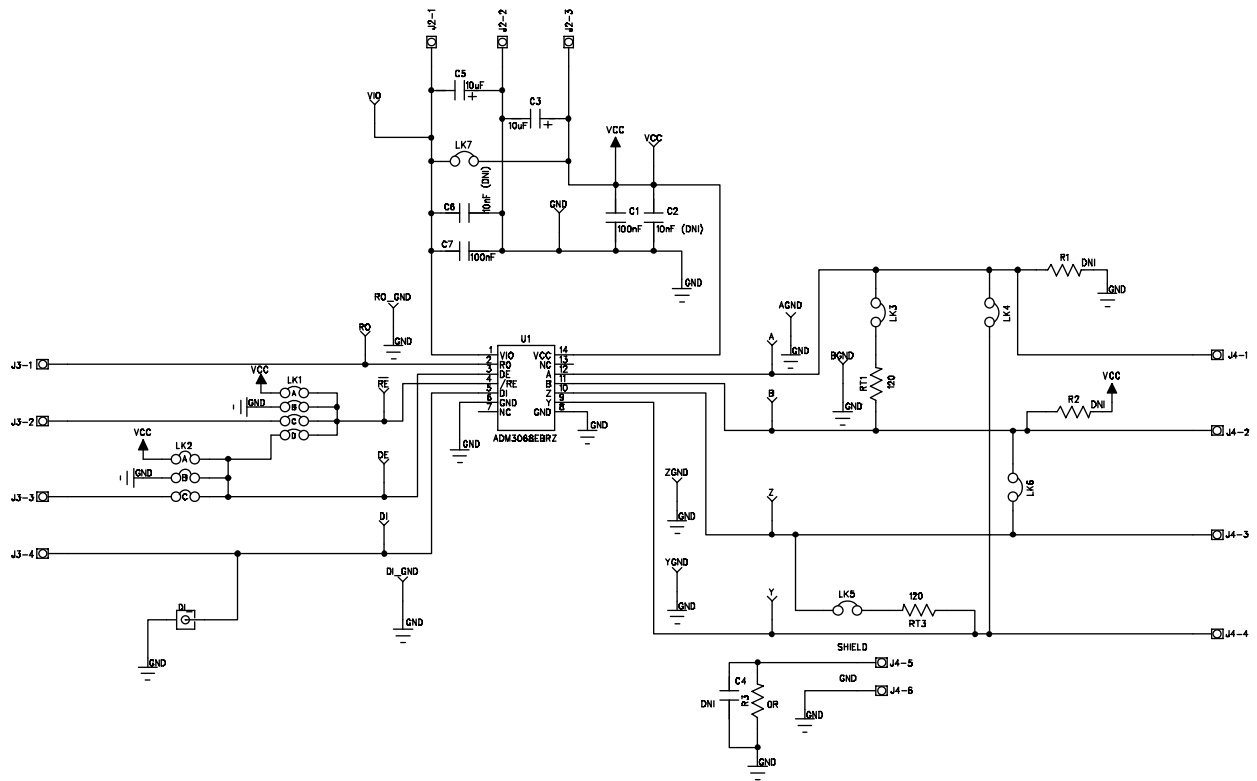


Figure 4. EVAL-ADM3068EEBZ Schematic

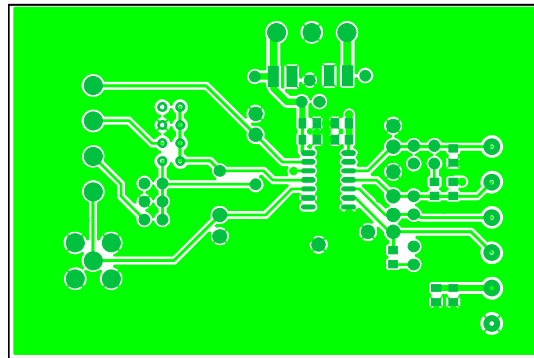
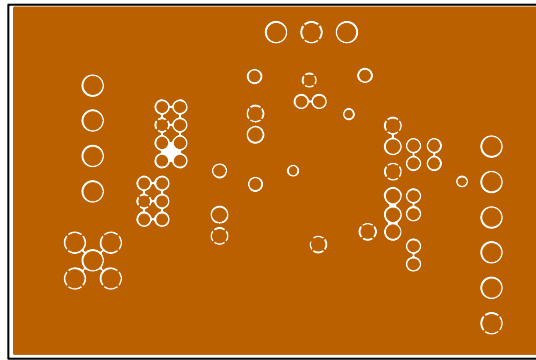
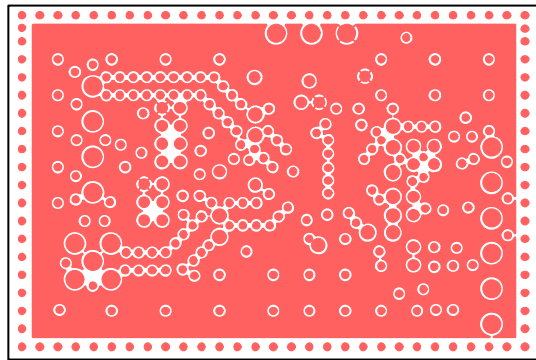


Figure 5. EVAL-ADM3068EEBZ Component Side, Layer 1



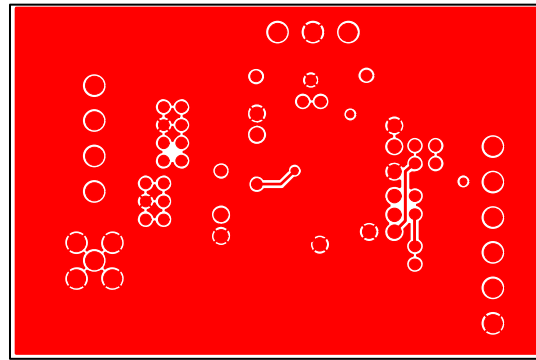
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Figure 6. EVAL-ADM3068EEBZ, Layer 2



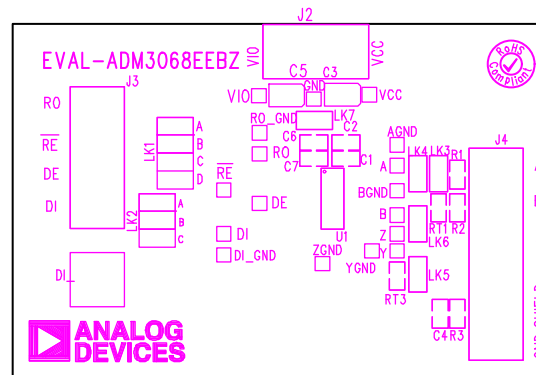
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Figure 7. EVAL-ADM3068EEBZ, Layer 3



20307-008

Figure 8. EVAL-ADM3068EEBZ, Layer 4



20307-009

Figure 9. EVAL-ADM3068EEBZ, Silkscreen

## ORDERING INFORMATION

### BILL OF MATERIALS

Table 2.

Qty	Reference Designator	Description	Manufacturer	Part Number
2	C1, C7	Capacitors, 100 nF, 0805	Multicomp	MCCA000274
3	C2, C4, C6	Capacitors, not placed/optional	Oxley	Not applicable
2	C3, C5	Capacitors, 10 µF, Case B	Kemet	B45196H3106K209
12	DI, RO, A, B, Y, Z, AGND, BGND, YGND, ZGND, DI_GND, RO_GND	High speed test points, silver pin	Not applicable	040/30P/LA/KP2 SILVER
2	DE, 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	J2	Three-way terminal block	Campden	CTB5000/3
1	J3	Four-way terminal block	Lumberg	KRM 04
1	J4	Six-way terminal block	Campden	CTB5000/6
1	LK1	8-pin (4 × 2), 0.1 inch header and shorting block	Harwin	M20-9953646 and M7566-05
1	LK2	6-pin (3 × 2), 0.1 inch header and shorting block	Harwin	M20-9953646 and M7566-05
5	LK3, LK4, LK5, LK6, LK7	Jumper blocks, 2-pin, 0.1 inch spacing	Harwin	M20-9990246 and M7566-05
2	R1, R2	Resistors, not placed/optional		Not applicable
1	R3	Resistor, 0 Ω, 0805	Vishay	CRCW08050000Z0EA
2	RT1, RT3	Resistors, 120 Ω, 0805	Multicomp	MC01W08051120R
1	U1	14-lead SOIC_N	Analog Devices, Inc.	<a href="#">ADM3068EBRZ</a>
2	VCC, VIO	Test points, 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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