

## Evaluating the **ADM3064E** 3.0 V to 5.5 V, $\pm 12$ kV IEC ESD Protected, 500 kbps, RS-485 Transceiver

### FEATURES

Easy evaluation of the **ADM3064E** 500 kbps, RS-485 transceiver  
 Board layout for full duplex, RS-485 footprint, 14-lead SOIC\_N, **ADM3064EBRZ** transceiver  
 Screw terminal blocks for logic input and output signals and RS-485 signals  
 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 61000-4-2 ESD protection on the A, B, Y, and Z bus pins  
 $\geq \pm 12$  kV contact discharge and  $\geq \pm 12$  kV air discharge  
 Jumper-selectable enable and disable for  $\overline{RE}$  and DE signals  
 Test points for measuring all signals  
 Resistors and footprints for termination and biasing networks

### EVALUATION KIT CONTENTS

EVAL-ADM3064EEBZ 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

**ADM3064E** data sheet

### GENERAL DESCRIPTION

The EVAL-ADM3064EEBZ evaluation board allows quick and easy evaluation of the **ADM3064E** 500 kbps, RS-485 transceiver with a standard, 14-lead SOIC\_N footprint. The EVAL-ADM3064EEBZ allows the input and output functions of the **ADM3064E** to be exercised without external components. Screw terminal blocks provide convenient connections for power and ground signals, digital input and output signals, and RS-485 signals. The EVAL-ADM3064EEBZ is powered by a standard, configurable benchtop power supply in 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.

For full details on the **ADM3064E**, see the **ADM3064E** data sheet, which must be consulted in conjunction with this user guide when using the EVAL-ADM3064EEBZ.

### EVALUATION BOARD PHOTOGRAPH

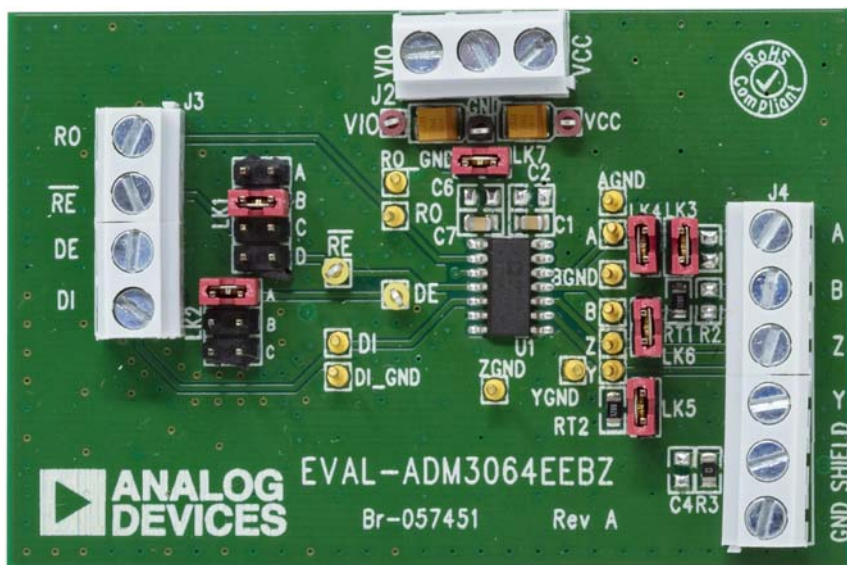


Figure 1.

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REVISION HISTORY

7/2019—Revision 0: Initial Version

## EVALUATION BOARD HARDWARE

### SETTING UP THE EVALUATION BOARD

To power the EVAL-ADM3064EEBZ, connect a 3.0 V to 5.5 V power supply to the J2 screw terminals, VCC and GND, on the top of the EVAL-ADM3064EEBZ. A 10  $\mu$ F decoupling capacitor, C3, is fitted at the connector between the V<sub>CC</sub> pin and GND pin. The V<sub>CC</sub> pin of the ADM3064E is fitted with a 100 nF decoupling capacitor, C1, with a second footprint for an optional additional decoupling capacitor, C2.

The V<sub>IO</sub> pin is connected to the V<sub>CC</sub> pin by inserting the LK7 jumper. Alternatively, the V<sub>IO</sub> terminal of the J2 screw terminal is connected to a separate low voltage logic supply in the 1.62 V to 5.5 V range. The V<sub>IO</sub> pin allows the ADM3064E to interface with processors that have operating voltages less than 3.3 V. A 10  $\mu$ F decoupling capacitor, C5, is fitted at the connector between the V<sub>IO</sub> pin and GND pin. The V<sub>IO</sub> pin of the ADM3064E is fitted with a 100 nF decoupling capacitor, C7, with a second footprint for an optional capacitor, C6.

Corresponding labeled test points allow power supply monitoring of the EVAL-ADM3064EEBZ 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 EVAL-ADM3064EEBZ to a signal generator. The EVAL-ADM3064EEBZ has connections to the data input (DI) pin, the receiver output (RO) pin, the receiver enable (RE) pin, and the driver enable (DE) pin. Alternatively, jumper connections can drive these inputs and/or connect them to the V<sub>CC</sub> pin and GND pin (see Table 1).

Connections to an RS-485 network are made via the J4 screw terminal block. The EVAL-ADM3064EEBZ has four RS-485 bus signals: Noninverting Input Signal A, Inverting Input Signal B, Noninverting Output Signal Y, and Inverting Output Signal Z. The bus cables also include a common ground connection or shield and can be connected to the J4 screw terminal block of the EVAL-ADM3064EEBZ. Test points are available on the EVAL-ADM3064EEBZ and are appropriately labeled for all digital and bus input and output signals.

### OTHER BOARD COMPONENTS

The EVAL-ADM3064EEBZ has footprints for the RT1 and RT2 termination resistors, as well as the R1 and R2 pull-up and pull-down resistors. Termination resistors of 120  $\Omega$  are fitted to the EVAL-ADM3064EEBZ. These termination resistors can be removed or replaced with a different value resistor as needed. Inserting the LK3 and LK5 jumpers adds an on-board 60  $\Omega$  load to the RS-485 driver.

Table 1. Jumper Configurations

| Link | Jumper Connection | Description                                                                                                                                                                                                                                                                                                                     |
|------|-------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| LK1  | A                 | Connects the $\overline{\text{RE}}$ input of the ADM3064E to the V <sub>IO</sub> pin. This setting disables the receiver.                                                                                                                                                                                                       |
|      | B                 | Connects the $\overline{\text{RE}}$ input of the ADM3064E to the GND pin. This setting enables the receiver.                                                                                                                                                                                                                    |
|      | C                 | Connects the $\overline{\text{RE}}$ input of the ADM3064E to the J3-2 terminal block connector.                                                                                                                                                                                                                                 |
|      | D                 | Connects the $\overline{\text{RE}}$ input of the ADM3064E to the J3-3 terminal block connector. Therefore, the input for both $\overline{\text{RE}}$ and DE is set by LK2 jumper. This setting ensures that when the driver is enabled, the receiver is disabled, or that when the driver is disabled, the receiver is enabled. |
| LK2  | A                 | Connects the DE input of the ADM3064E to the V <sub>IO</sub> pin. This setting enables the driver.                                                                                                                                                                                                                              |
|      | B                 | Connects the DE input of the ADM3064E to the GND pin. This setting disables the driver.                                                                                                                                                                                                                                         |
|      | C                 | Connects the DE input of the ADM3064E to the J3-3 terminal block connector.                                                                                                                                                                                                                                                     |
| LK3  | Inserted          | Connects the 120 $\Omega$ RT1 termination resistor across the A and B pins of the ADM3064E.                                                                                                                                                                                                                                     |
|      | Not inserted      | Disconnects the 120 $\Omega$ RT1 termination resistor across the A and B pins of the ADM3064E.                                                                                                                                                                                                                                  |
| LK5  | Inserted          | Connects the 120 $\Omega$ RT2 termination resistor across the Y and Z pins of the ADM3064E.                                                                                                                                                                                                                                     |
|      | Not inserted      | Disconnects the 120 $\Omega$ RT2 termination resistor across the Y and Z pins of the ADM3064E.                                                                                                                                                                                                                                  |
| LK6  | Inserted          | Connects Pin B to Pin Z of the ADM3064E.                                                                                                                                                                                                                                                                                        |
|      | Not inserted      | Disconnects Pin B from Pin Z of the ADM3064E.                                                                                                                                                                                                                                                                                   |
| LK4  | Inserted          | Connects Pin A to Pin Y of the ADM3064E.                                                                                                                                                                                                                                                                                        |
|      | Not inserted      | Disconnects Pin A from Pin Y of the ADM3064E.                                                                                                                                                                                                                                                                                   |
| LK7  | Inserted          | Connects the V <sub>CC</sub> pin to the V <sub>IO</sub> pin on the ADM3064E.                                                                                                                                                                                                                                                    |
|      | Not inserted      | Disconnects the V <sub>CC</sub> pin from the V <sub>IO</sub> pin on the ADM3064E.                                                                                                                                                                                                                                               |

### Biasing Resistors for Bus Idle Fail-Safe

Although the [ADM3064E](#) has a built in receiver fail-safe for the bus idle condition, there are footprints on the EVAL-ADM3064EEBZ for fitting the R2 pull-up resistor to the V<sub>CC</sub> supply on Pin A of the [ADM3064E](#), and for fitting the R1 pull-down resistor to the GND rail on Pin B of the [ADM3064E](#). These resistors can be fitted if the user is connecting the [ADM3064E](#) 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  $\Omega$  is required for a 3.3 V supply, and 1440  $\Omega$  is required for a 5 V supply.

See the [AN-960 Application Note](#) for more information on the bus idle fail-safe.

### FULL DUPLEX RS-485 TRANSCEIVERS LOOPBACK TEST

To set up a loopback test for the EVAL-ADM3064EEBZ, connect the benchtop power supply to the VCC and VIO terminals of the J2 connector. Close the LK4 and LK6 jumpers. This test setup is shown in Figure 3. A signal generator is connected to the DI pin to allow verification of the bus signals and the receiver output. Note the jumper positions of LK1 (B) and LK2 (A) for the EVAL-ADM3064EEBZ. Ensure that the LK3 and LK5 jumpers are also closed. The default termination resistors can be used in this configuration because both 120  $\Omega$  resistors on the EVAL-ADM3064EEBZ are connected in parallel by the loopback. These connections ensure that the test is conducted with a standard RS-485 load of 60  $\Omega$  with the bus terminated at both ends by 120  $\Omega$ .

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

The EVAL-ADM3064EEBZ is tested to achieve protection against IEC 61000-4-2 ESD up to  $\pm 12$  kV (contact) and  $\pm 12$  kV (air) on the RS-485 bus A and B pins.

The IEC 61000-4-2 ESD standard describes testing using two coupling methods known as contact discharge and air discharge. Contact discharge implies 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-ADM3064EEBZ 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.

Figure 2 shows the 8 kV contact discharge current waveform as described in the [ADM3064E](#) data sheet. Some key IEC 61000-4-2 waveform parameters are rise times ( $t_R$ ) of  $<1$  ns and pulse widths of  $\sim 60$  ns.

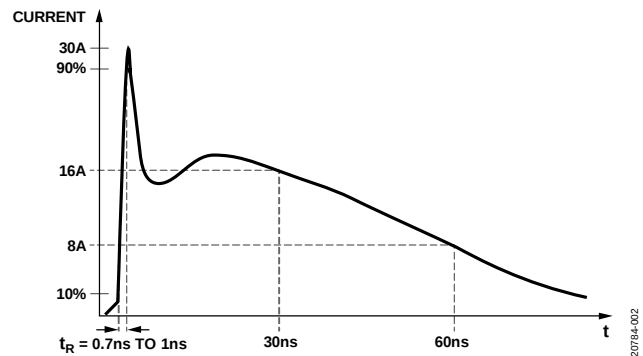


Figure 2. IEC 61000-4-2 ESD Waveform (8 kV)

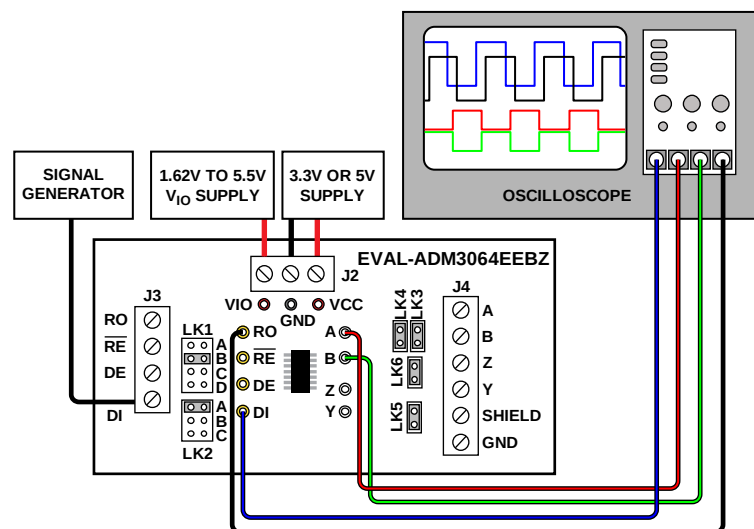


Figure 3. Full Duplex RS-485 Loopback Test

## EVALUATION BOARD SCHEMATIC AND ARTWORK

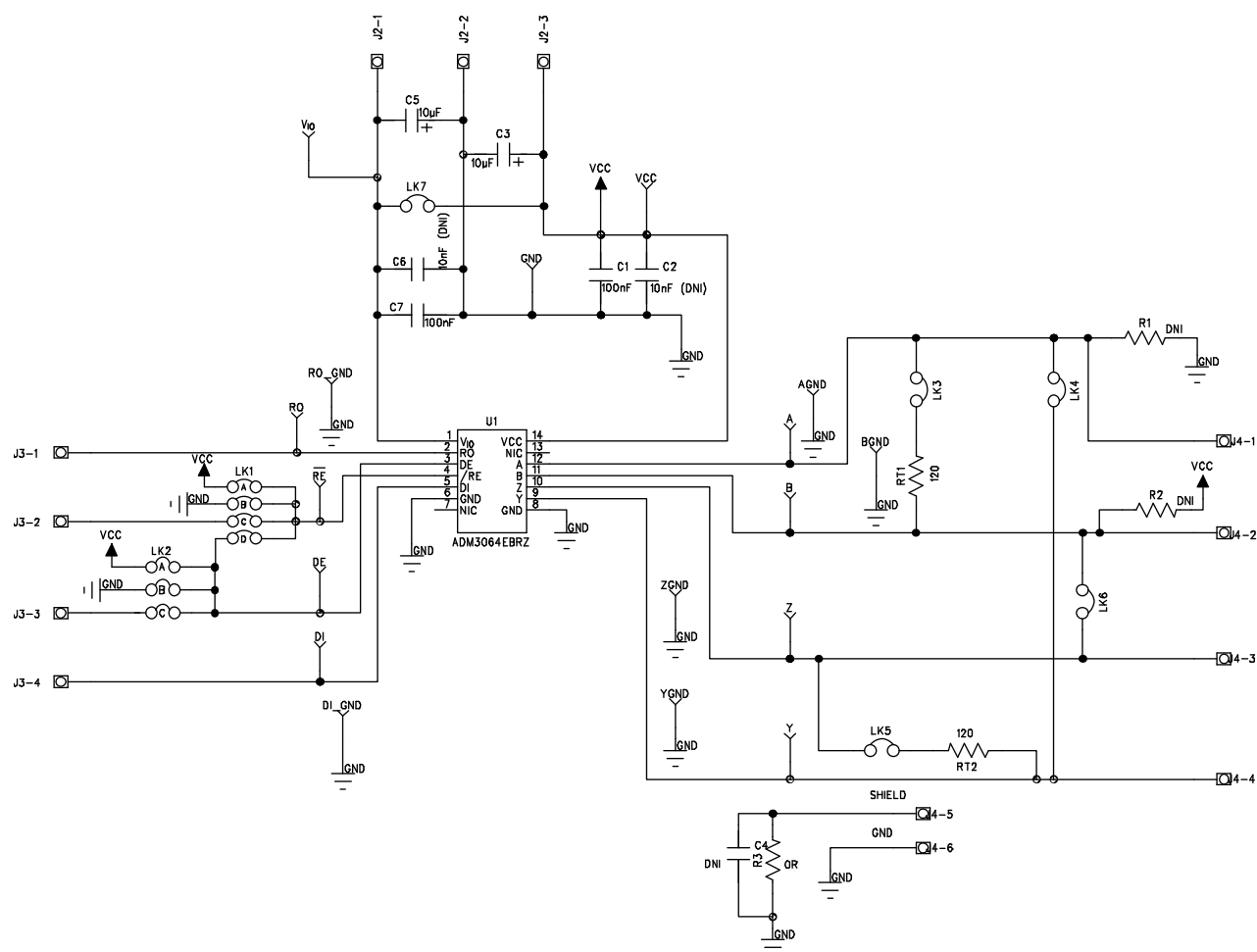


Figure 4. EVAL-ADM3064EEBZ Schematic

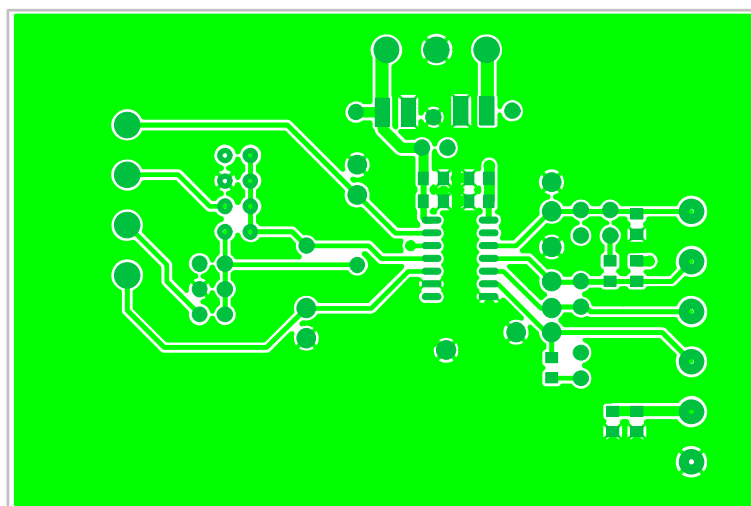
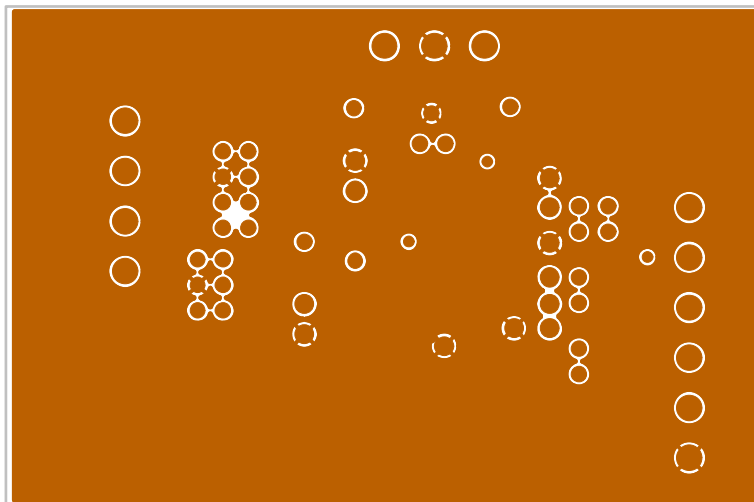
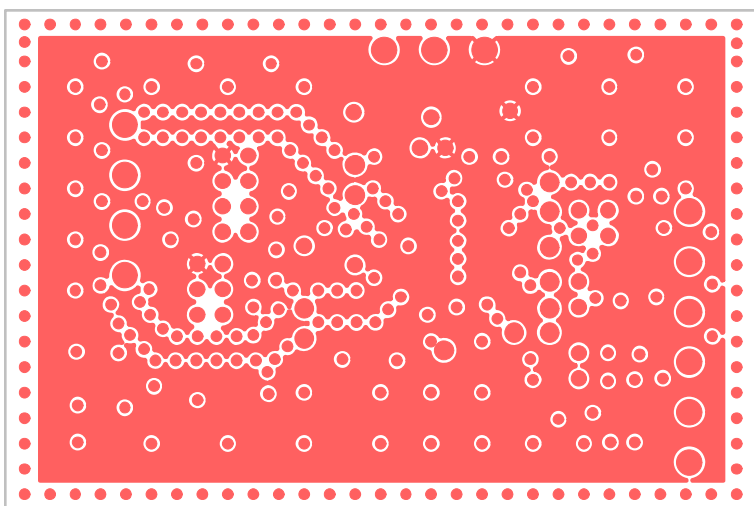


Figure 5. EVAL-ADM3064EEBZ Component Side, Layer 1



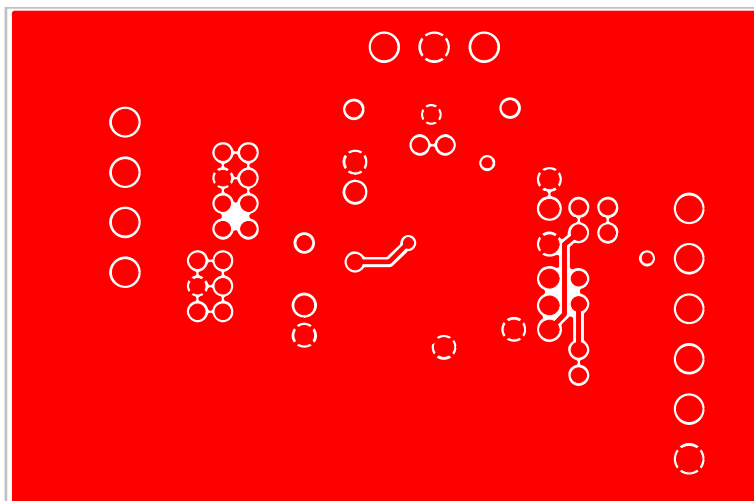
20784-006

Figure 6. EVAL-ADM3064EEBZ, Layer 2



20784-007

Figure 7. EVAL-ADM3064EEBZ, Layer 3



20784-008

Figure 8. EVAL-ADM3064EEBZ, Layer 4

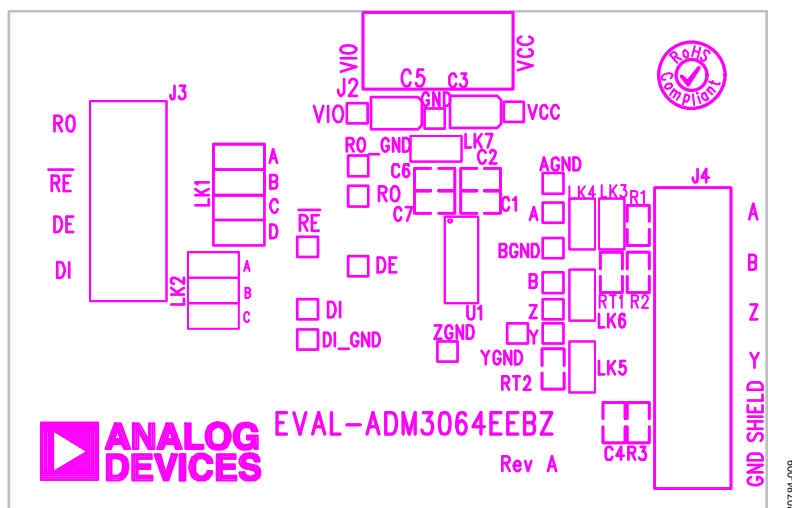


Figure 9. EVAL-ADM3064EEBZ, Silkscreen

## 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                | Do not insert (DNI)      |
| 2   | C3, C5                                                     | Capacitors, 10 $\mu$ F, 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, $\overline{RE}$                                        | Test points, yellow                                   | Vero Technologies    | 20-313140                |
| 1   | GND                                                        | Test point, black                                     | Vero Technologies    | 20-2137                  |
| 1   | J2                                                         | 3-way terminal blocks                                 | Campden              | CTB5000/3                |
| 1   | J3                                                         | 4-way terminal blocks                                 | Lumberg              | KRM 04                   |
| 1   | J4                                                         | 6-way terminal blocks                                 | Campden              | CTB5000/6                |
| 1   | LK1                                                        | Shorting block, 8-pin (4 $\times$ 2), 0.1 inch header | Harwin               | M20-9953646 and M7566-05 |
| 1   | LK2                                                        | Shorting block, 6-pin (3 $\times$ 2), 0.1 inch header | 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)                      |                      | DNI                      |
| 1   | R3                                                         | Resistor, 0 $\Omega$ , 0805                           | Vishay               | CRCW08050000Z0EA         |
| 2   | RT1, RT2                                                   | Resistors, 120 $\Omega$ , 0805                        | Multicomp            | MC01W08051120R           |
| 1   | U1                                                         | 14-lead SOIC_N                                        | Analog Devices, Inc. | ADM3064EBRZ              |
| 2   | V <sub>CC</sub> , V <sub>IO</sub>                          | 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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