ANALOG DEVICES

EVAL-ADM3064EEBZ User Guide

UG-1581

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Evaluating the ADM3064E 3.0 V to 5.5 V, ±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
  - ≥±12 kV contact discharge and ≥±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

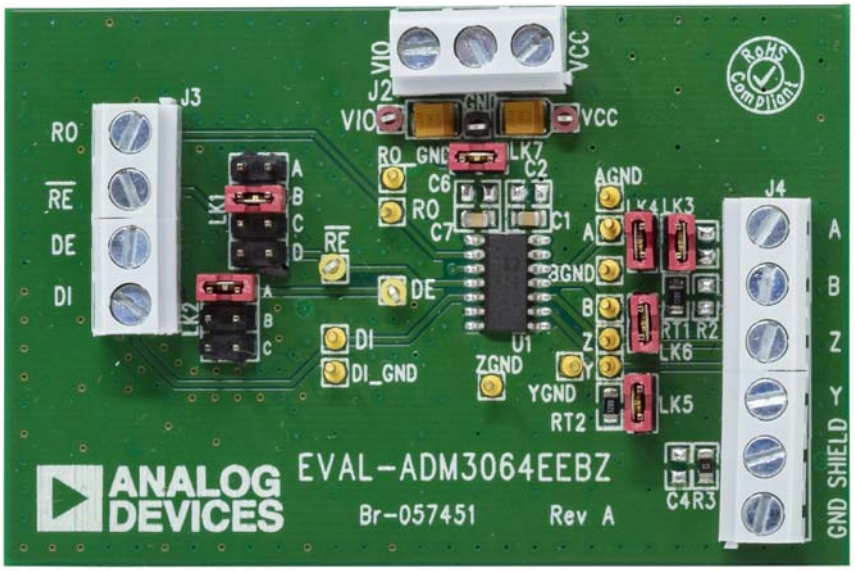

Figure 1.

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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 µF decoupling capacitor, C3, is fitted at the connector between the V_{CC} pin and GND pin. The V_{CC} 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_{IO} pin is connected to the V_{CC} pin by inserting the LK7 jumper. Alternatively, the VIO 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_{IO} pin allows the ADM3064E to interface with processors that have operating voltages less than 3.3 V. A 10 µF decoupling capacitor, C5, is fitted at the connector between the V_{IO} pin and GND pin. The V_{IO} 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 ($\overline{RE}$) pin, and the driver enable (DE) pin. Alternatively, jumper connections can drive these inputs and/or connect them to the V_{CC} 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 Ω 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 Ω load to the RS-485 driver.

Table 1. Jumper Configurations

Link	Jumper Connection	Description
LK1	A	Connects the $\overline{RE}$ input of the ADM3064E to the V_{IO} pin. This setting disables the receiver.
	B	Connects the $\overline{RE}$ input of the ADM3064E to the GND pin. This setting enables the receiver.
	C	Connects the $\overline{RE}$ input of the ADM3064E to the J3-2 terminal block connector.
	D	Connects the $\overline{RE}$ input of the ADM3064E to the J3-3 terminal block connector. Therefore, the input for both $\overline{RE}$ 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_{IO} 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 Ω RT1 termination resistor across the A and B pins of the ADM3064E.
	Not inserted	Disconnects the 120 Ω RT1 termination resistor across the A and B pins of the ADM3064E.
LK5	Inserted	Connects the 120 Ω RT2 termination resistor across the Y and Z pins of the ADM3064E.
	Not inserted	Disconnects the 120 Ω 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_{CC} pin to the V_{IO} pin on the ADM3064E.
	Not inserted	Disconnects the V_{CC} pin from the V_{IO} 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_{CC} 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 Ω is required for a 3.3 V supply, and 1440 Ω 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 Ω 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 Ω with the bus terminated at both ends by 120 Ω.

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

The EVAL-ADM3064EEBZ is tested to achieve protection against IEC 61000-4-2 ESD up to ±12 kV (contact) and ±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 ±8 kV and an air discharge voltage of ±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 ~60 ns.

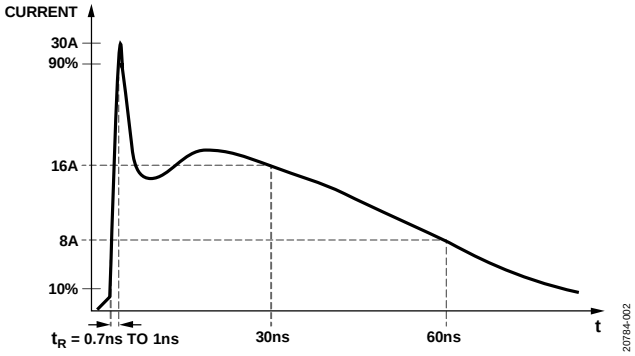

Figure 2. IEC 61000-4-2 ESD Waveform (8 kV)

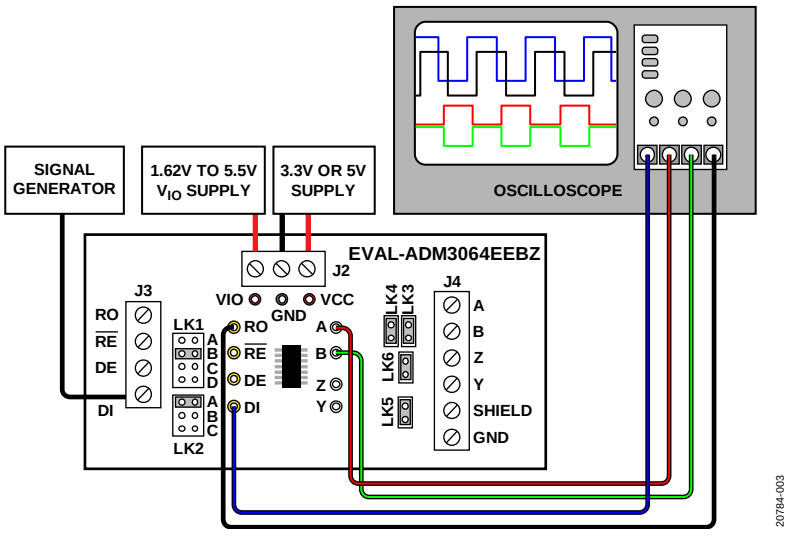

Figure 3. Full Duplex RS-485 Loopback Test

EVALUATION BOARD SCHEMATIC AND ARTWORK

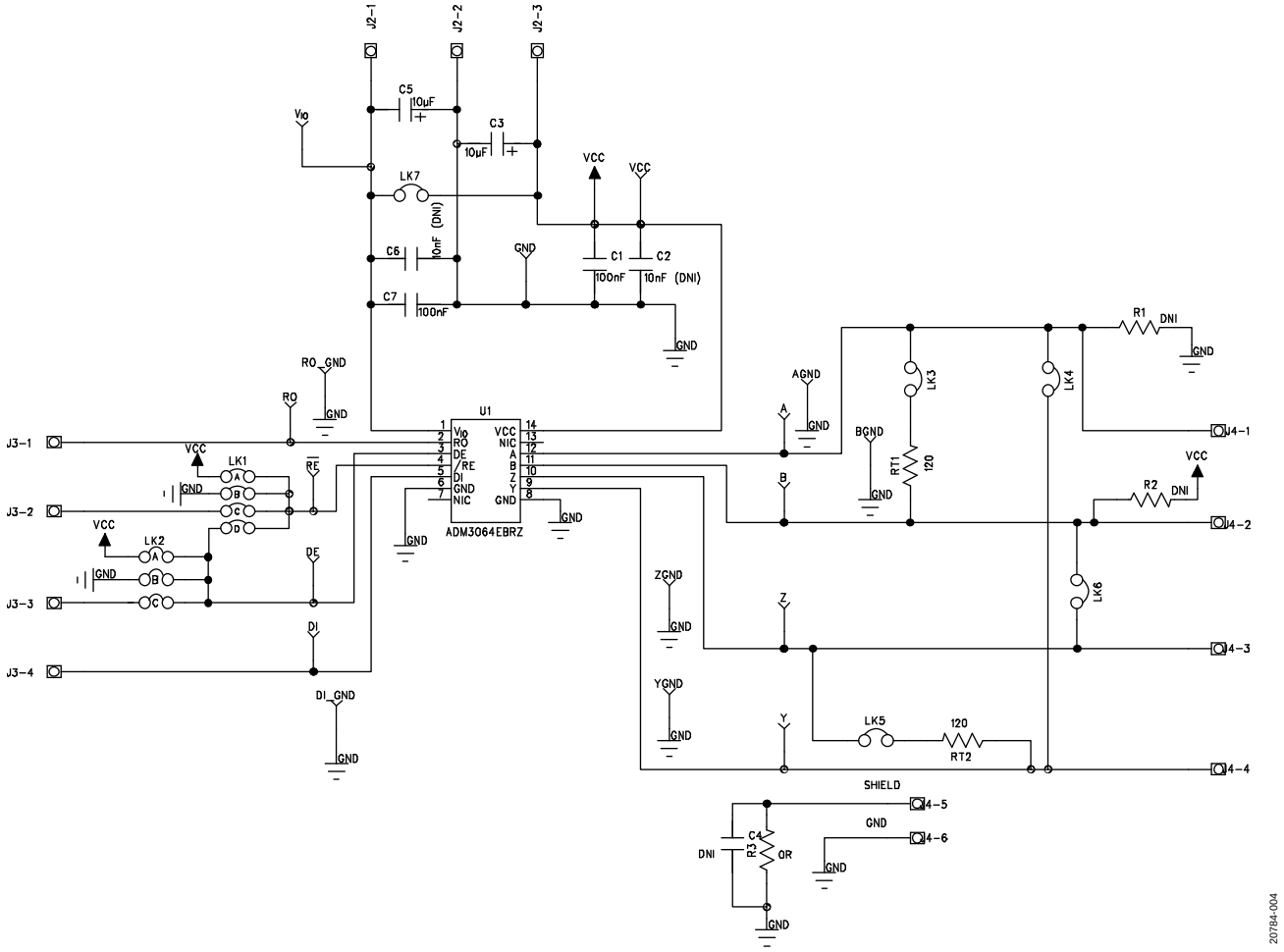

Figure 4. EVAL-ADM3064EEBZ Schematic

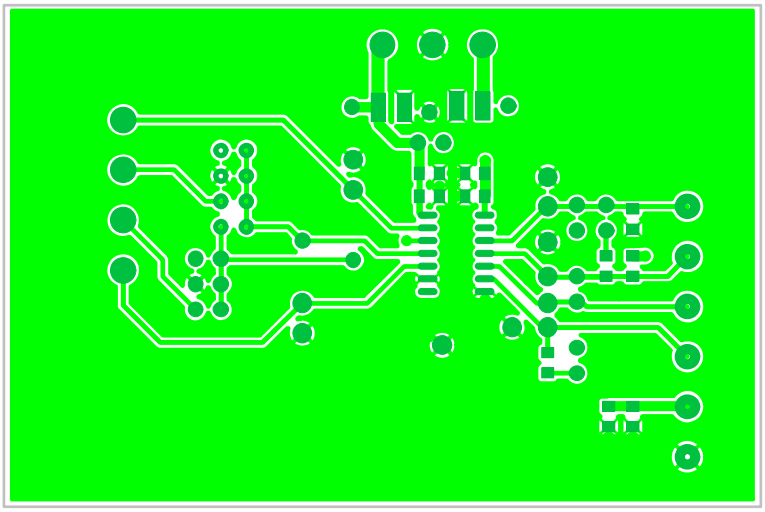

Figure 5. EVAL-ADM3064EEBZ Component Side, Layer 1

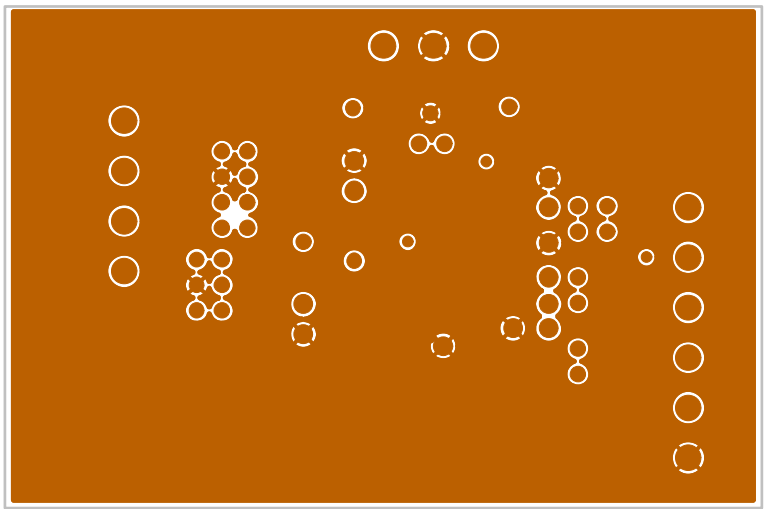

Figure 6. EVAL-ADM3064EEBZ, Layer 2

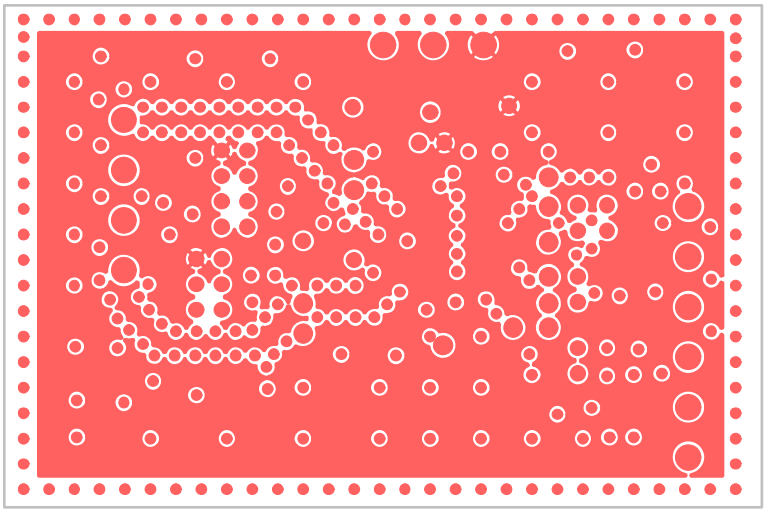

Figure 7. EVAL-ADM3064EEBZ, Layer 3

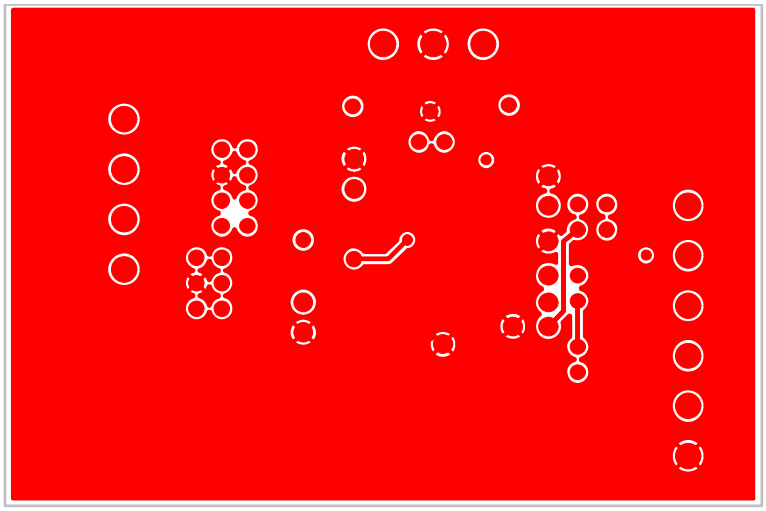

Figure 8. EVAL-ADM3064EEBZ, Layer 4

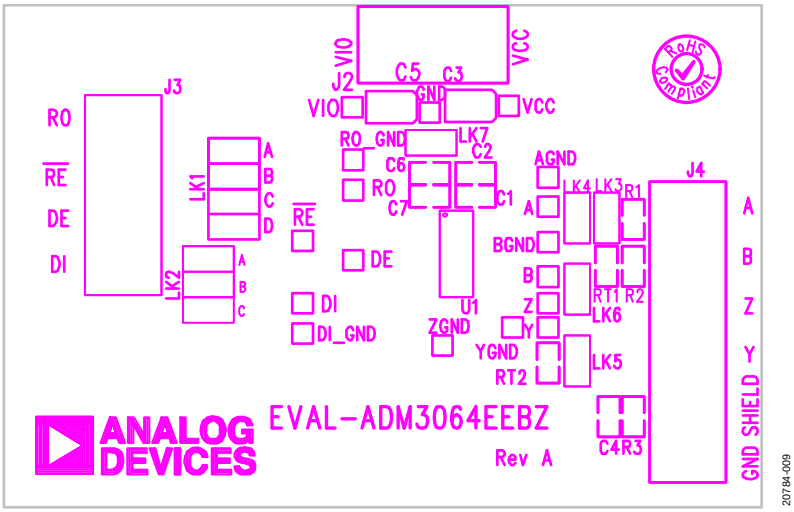

Figure 9. EVAL-ADM3064EEBZ, Silkscreen

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 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, $\overline{RE}$	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 × 2), 0.1 inch header	Harwin	M20-9953646 and M7566-05
1	LK2	Shorting block, 6-pin (3 × 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 Ω, 0805	Vishay	CRCW08050000Z0EA
2	RT1, RT2	Resistors, 120 Ω, 0805	Multicomp	MC01W08051120R
1	U1	14-lead SOIC_N	Analog Devices, Inc.	ADM3064EBRZ
2	V_{CC}, V_{IO}	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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