



# MAX3160E Evaluation Kit

**Evaluates: MAX3160E**

## General Description

The MAX3160E evaluation kit (EV kit) circuit demonstrates the RS-232/RS-485/RS-422 multiprotocol transceivers using the MAX3160E IC. The circuit can be configured to operate as a dual transceiver in RS-232 mode or as a single transceiver in RS-485/RS-422 mode. The MAX3160E RS-232 data rates can reach 1Mbps, while RS-485/RS-422 data rates can reach 10Mbps. The configurable slew-rate limiting feature reduces data rates for either protocol to achieve reduced EMI.

In RS-485/RS-422 mode, the EV kit demonstrates full-duplex or half-duplex communication. The MAX3160E drivers feature short-circuit and thermal protection as well as fail-safe circuitry for open, shorted, or unconnected RS-485/RS-422 receiver inputs. The MAX3160E EV kit operates from a single 3V to 5.5VDC supply capable of providing 100mA.

## Component List

DESIGNATION	QTY	PART DESCRIPTION
C1, C2, C3, C5	4	0.47 $\mu$ F $\pm$ 10%, 10V X5R ceramic capacitors (0603) Murata GRM188R61A474K
C4	1	0.1 $\mu$ F $\pm$ 10%, 10V X5R ceramic capacitor (0402) Murata GRM155R61A104K
C6	1	10 $\mu$ F $\pm$ 10%, 10V X5R ceramic capacitor (0805) Murata GRM21BR61A106K
J1	1	DB9 male right-angle connector
JU1–JU4, JU9, JU10	6	2-pin headers
JU5–JU8	4	3-pin headers
R1–R4	4	100k $\Omega$ $\pm$ 5% resistors (0603)
R5, R6	2	120 $\Omega$ $\pm$ 1% resistors (1206)
U1	1	MAX3160EEAP+ (20-pin SSOP)
—	10	Shunts (JU1–JU10)
—	1	PCB: MAX3160E Evaluation Kit+

## Features

- ◆ 3V to 5.5V Single-Supply Operation
- ◆ Configurable Multiprotocol Operation
  - 2Tx/2Rx RS-232 Transceivers
  - Single RS-485/RS-422 Transceiver
- ◆ 10Mbps RS-485/RS-422 Data Rates and 1Mbps RS-232 Data Rates
- ◆ Configurable RS-232/RS-485 Transmitter Slew Rates
- ◆ Configurable Full-Duplex/Half-Duplex RS-485/RS-422 Operation
- ◆ Fully Assembled and Tested

## Ordering Information

PART	TEMP RANGE	IC PACKAGE
MAX3160EEVKIT+	0°C to +70°C*	20 SSOP

+ Denotes a lead-free and RoHS-compliant EV kit.

\* This limited temperature range applies to the EV kit PCB only. The MAX3160E IC temperature range is -40°C to +85°C.

## Component Supplier

SUPPLIER	PHONE	WEBSITE
Murata Mfg. Co., Ltd.	770-436-1300	www.murata.com

**Note:** Indicate that you are using the MAX3160E when contacting this component supplier.

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## Quick Start

### Recommended Equipment

- 3.3V, 0.5A DC power supply
- Logic function generator
- Oscilloscope

### Procedure

The MAX3160E EV kit is fully assembled and tested. Follow the steps below to verify board operation. **Caution: Do not turn on the power supply until all connections are completed.**

- 1) Verify that shunts are installed across pins 1-2 of jumpers JU5, JU6, JU7, and JU8 (data communications equipment (DCE) mode).
- 2) Verify that a shunt is installed on jumpers JU3 (RS-232 mode) and JU4 (full-duplex mode).
- 3) Verify that shunts are not installed on jumpers JU1 (MAX3160E enabled), JU2 (fast mode), and JU9 and JU10 (RS-485/RS-422 differential I/O not terminated).
- 4) Set the DC power supply output to 3.3V and disable the output.
- 5) Set the logic function generator to a 3.3V<sub>P-P</sub>, 500kHz, 1.65V<sub>DC</sub> offset square wave and disable the output. Terminate the function generator as needed.
- 6) Connect the DC power-supply positive output to the VCC pad on the EV kit.
- 7) Connect the supply ground to the GND pad next to VCC on the EV kit.
- 8) Connect the logic function generator output to the DI/T1IN PCB pad and connect ground to the GND PCB pad.
- 9) Enable the power-supply output and then the function generator output.
- 10) Use the oscilloscope to measure the transmitter output Z(B)/T1OUT at pin 3 of jumper JU5. Verify that the waveform is a 500kHz square wave and is approximately  $\pm 5V_{P-P}$ .

### Detailed Description

The MAX3160E EV kit demonstrates the MAX3160E RS-232/RS-485/RS-422 multiprotocol transceiver IC. The EV kit operates from a 3V to 5.5VDC source capable of supplying 100mA.

The EV kit features jumpers to configure the communication protocol to RS-232 operation or RS-485/RS-422 operation. In RS-232 mode operation, the MAX3160E communicates at data rates up to 1Mbps. In RS-485/RS-422 mode operation, the differential driver and

receiver operate in full-duplex or half-duplex mode and communicate at data rates up to 10Mbps. The MAX3160E receiver represents a 1/8 unit load on the RS-485/RS-422 bus. Resistors R5 and R6 provide a configurable termination for the RS-485/RS-422 bus.

PCB pads and DB9 connector J1 are available for interfacing with an RS-232/RS-485/RS-422 serial line. See Table 5 and Figures 1, 2, and 3 for the respective signal pins or pads.

### Jumper Selection

The MAX3160E EV kit utilizes several jumpers to reconfigure circuit features and functionality: IC enable, slew-rate selection, communication-protocol selection, full-duplex/half-duplex communication, DTE/DCE connections, and RS-485/RS-422 differential I/O termination.

#### Enable

The MAX3160E EV kit features jumper JU1 to enable the MAX3160E or place the IC in shutdown mode, thus reducing quiescent current. A  $\overline{\text{SHDN}}$  PCB pad is also provided for the shutdown signal to interface with an external controller. See Table 1 for configuring jumper JU1.

**Table 1. MAX3160E Enable (Jumper JU1)**

SHUNT POSITION	$\overline{\text{SHDN}}$ PIN	EV KIT FUNCTION
Installed	Connected to GND	MAX3160E shutdown
Not installed	Connected to VCC through resistor R1	MAX3160E enabled

#### Slew-Rate Selection

Jumper JU2 on the EV kit configures the MAX3160E communication slew-rate mode. Slew-rate limited-mode operation minimizes EMI radiation, while fast-mode operation optimizes maximum data rates for either protocol. See Table 2 for configuring jumper JU2 and refer to the MAX3160E IC data sheet for more information on slew-rate configuration.

**Table 2. Slew Rate (Jumper JU2)**

SHUNT POSITION	FAST PIN	EV KIT FUNCTION
Installed	Connected to GND	Slew-rate limited mode. RS-232/RS-485/RS-422 250kbps maximum data rate
Not installed	Connected to VCC through resistor R2	Fast mode. RS-232 1Mbps maximum data rate; RS-485/RS-422 10Mbps maximum data rate

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## RS-232/RS-485/RS-422 Protocol Selection

EV kit jumper JU3 sets the communication protocol to either RS-232 or RS-485/RS-422. See Table 3 for configuring jumper JU3. For additional protocol-configuration information, refer to the *Functional Diagrams* section of the MAX3160E IC data sheet.

## RS-485/RS-422 Communication Mode

EV kit jumper JU4 configures the MAX3160E IC's RS-485/RS-422 communication mode to full duplex or half duplex. To receive RS-485 data, disable the RS-485 outputs by driving the DE485/T2IN PCB pad low. See Table 4 to configure jumper JU4 for the desired mode of communication.

## DTE/DCE Connections

The EV kit features jumpers JU5, JU6, JU7, and JU8 to configure the RS-232 connector J1 as a data terminal equipment (DTE) or as a data communications equipment (DCE) connector. See Table 5 for configuring the respective jumpers for DTE or DCE connection mode.

## RS-485/RS-422 Termination

EV kit jumpers JU9 and JU10 configure the RS-485/RS-422 termination. JU9 sets the input termination with resistor R6. JU10 sets the output termination with resistor R5. See Table 6 for the RS-485/RS-422 termination options.

## EV Kit I/O Connections

The MAX3160E EV kit features PCB pads for interfacing with logic signals. PCB pads and a DB9 connector (J1) are available to interface with an RS-232/RS-485/RS-422 serial line. See Figures 1 or 2 for RS-232 or RS-485/RS-422 transceiver functional modes.

The RS-232/RS-485/RS-422 input range is  $\pm 25V$  and the output range is  $\pm 5V$ .

**Table 3. RS-232/RS-485/RS-422 Protocol (Jumper JU3)**

SHUNT POSITION	RS-485/RS-232 PIN	EV KIT FUNCTION
Installed	Connected to GND	RS-232 mode
Not installed	Connected to VCC through resistor R3	RS-485/RS-422 mode

**Table 4. Communication Mode (Jumper JU4)**

SHUNT POSITION	HDPLX PIN	RS-485/RS-422 MODE
Installed	Connected to GND	Full-duplex mode
Not installed	Connected to VCC through resistor R4	Half-duplex mode

**Table 5. DTE/DCE Modes (Jumpers JU5, JU6, JU7, and JU8)**

SHUNT POSITION	JU5	JU6	JU7	JU8	J1 CONNECTION MODE
	J1 PIN 2 CONNECTED TO	J1 PIN 3 CONNECTED TO	J1 PIN 7 CONNECTED TO	J1 PIN 8 CONNECTED TO	
1-2	B/R1IN	Z(B)/T1OUT	Y(A)/T2OUT	A/R2IN	DCE
2-3	Z(B)/T1OUT	B/R1IN	A/R2IN	Y(A)/T2OUT	DTE

**Table 6. RS-485/RS-422 Termination (Jumpers JU9 and JU10)**

SHUNT POSITION	JU9	JU10	TERMINATION VALUE
	RS-485 INPUT	RS-485 OUTPUT	
Installed	A/R2IN connected to B/R1IN through resistor R6	Y(A)/T2OUT connected to Z(B)/T1OUT through resistor R5	120 $\Omega$ termination
Not installed	Not connected	Not connected	—

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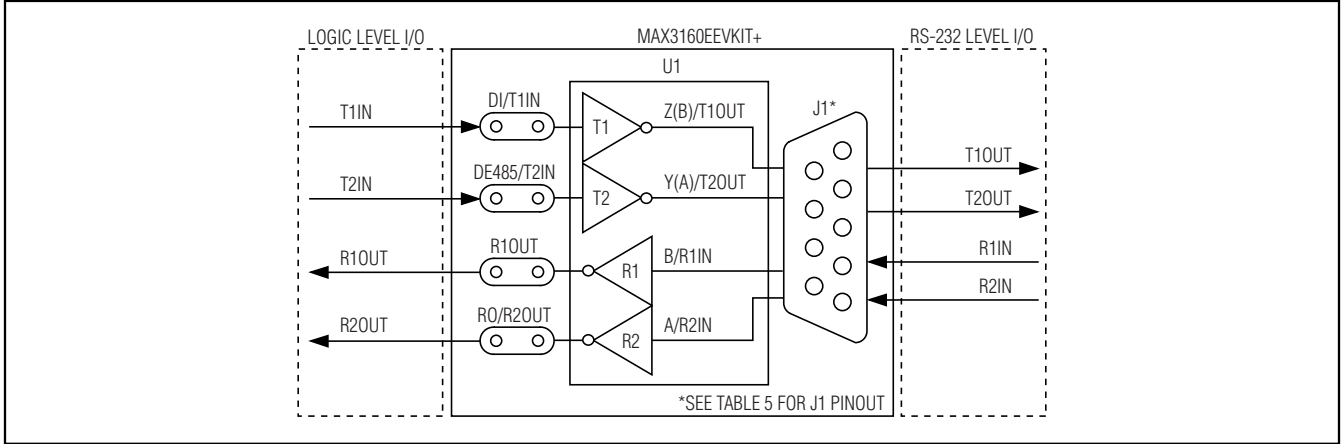


Figure 1. MAX3160E EV Kit I/O Function in RS-232 Mode

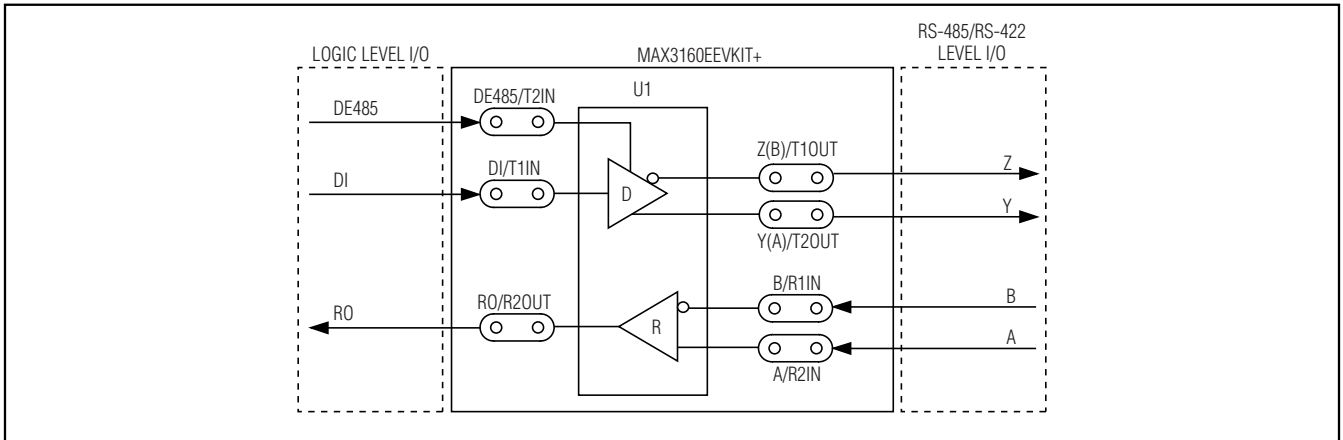


Figure 2. MAX3160E EV Kit I/O Function in RS-485/RS-422 Mode (Full Duplex)



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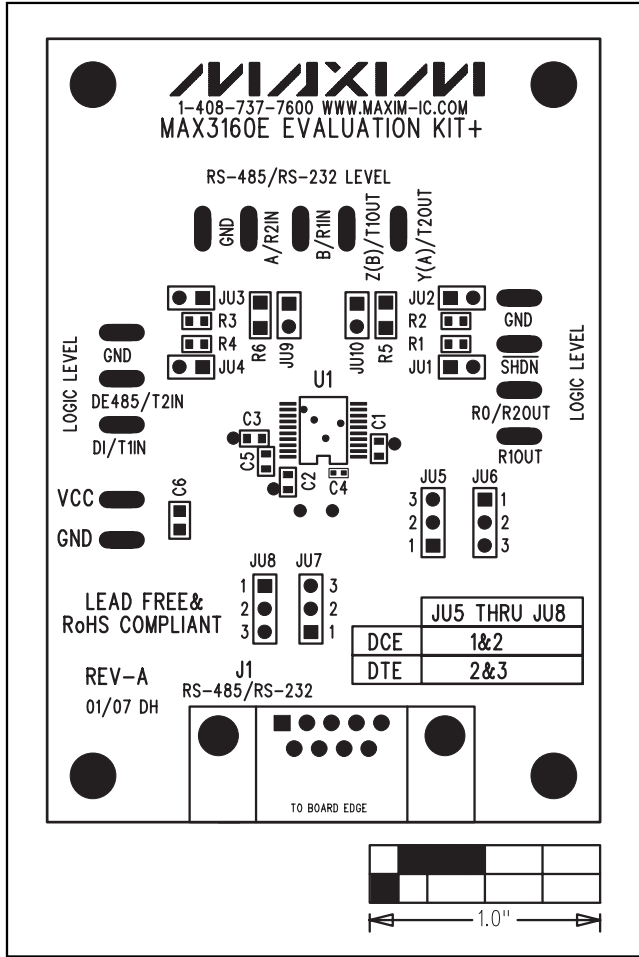


Figure 4. MAX3160E EV Kit Component Placement Guide—Component Side

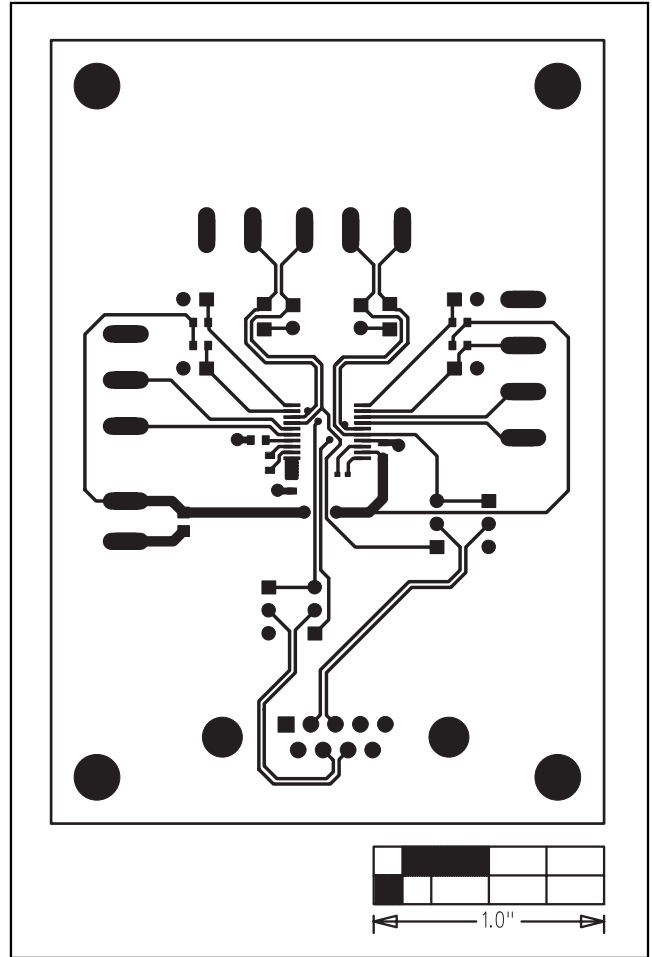


Figure 5. MAX3160E EV Kit PCB Layout—Component Side

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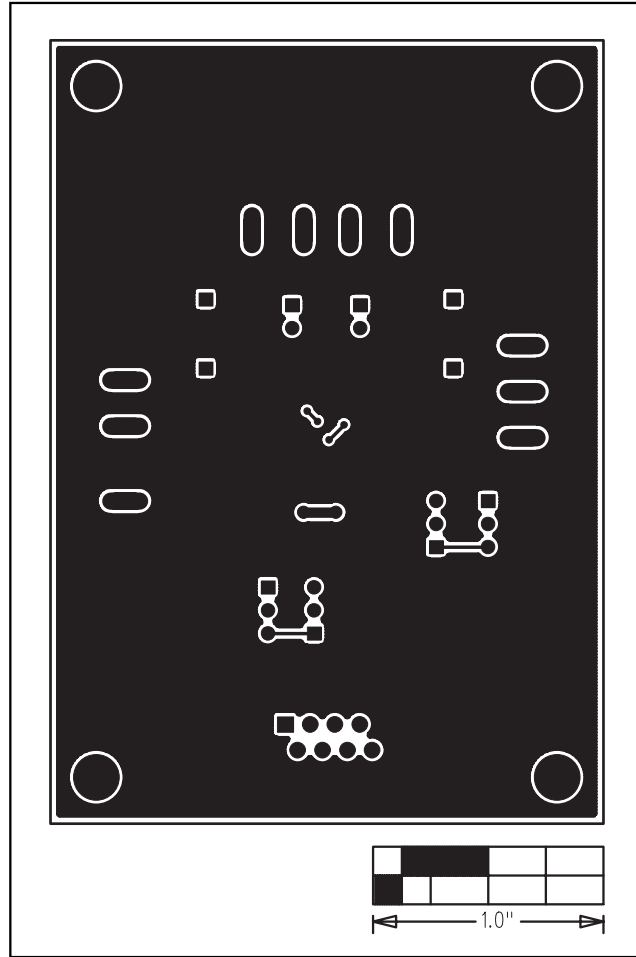


Figure 6. MAX3160E EV Kit PCB Layout—Solder Side

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