*Click **here** to ask about the production status of specific part numbers.*

# MAX33071E Shield Evaluation Kit

# Evaluates: MAX33071E/MAX33070E

## General Description

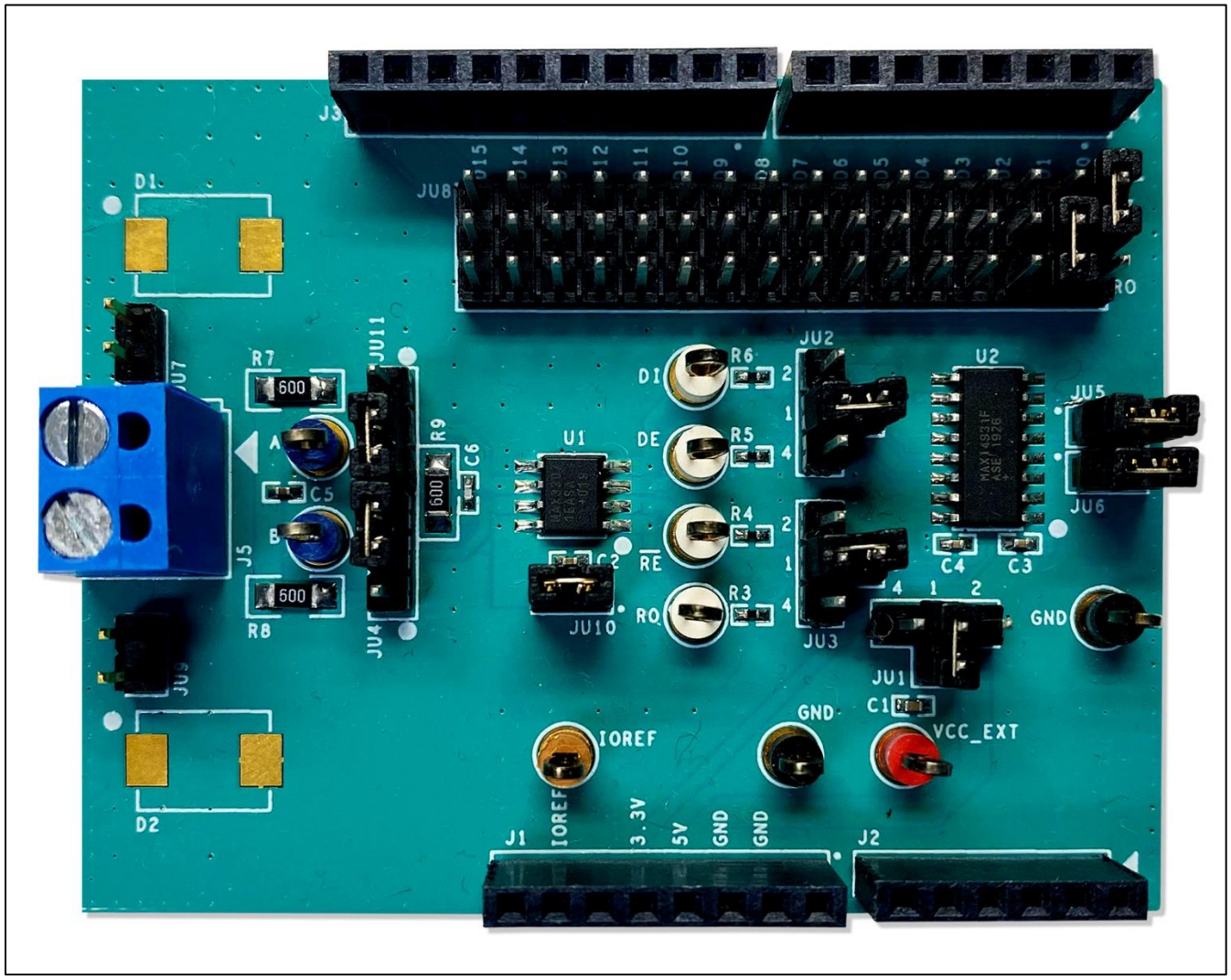
The MAX33071E Shield evaluation kit (EV kit) is a fully assembled and tested printed circuit board (PCB) that demonstrates the functionality of the MAX33071E half-duplex RS-485 transceiver, with ±65V fault protection, extended ±40V common-mode range, and ±40kV ESD Human Body Model (HBM) for A, B data lines. The EV kit features a digital isolator, which is used as a level translator between the RS-485 transceiver and the controller interface.

## Features

- Easy Evaluation of the MAX33071E
- I/O Interface Compatibility from 1.71V to 5.5V
- Proven PCB Layout
- Mbed™/Arduino® Platform Compatible
- Fully Assembled and Tested

*Ordering Information appears at end of data sheet.*

## MAX33071E Shield EV Kit Photo




*319-100699; Rev 0; 3/21*

maxim integrated™

## Quick Start

### Required Equipment

- MAX33071E Shield EV kit
- 3.3V (or 5V), 500mA DC power supply
- Signal/function generator that can generate 250kHz square wave signal
- Oscilloscope

### Procedure

The EV kit is fully assembled and tested. Follow these steps to verify board operation:

1. Place the MAX33071E Shield EV kit on a nonconductive surface to ensure that nothing on the PCB gets shorted to the workspace.
2. Set JU2 to 1-2 position (DE = 1) and JU3 to 1-4 position ($\overline{RE}$ = 0). Set all the other jumpers to their default position as shown in *Table 1*.
3. With +3.3V (or 5V) power supply disabled, connect the positive terminal to VCC_EXT and IOREF test points. Connect the negative terminal to the GND test point.
4. Connect the positive terminal of the function generator to D0 (pin 1 of J4) and negative terminal to any GND test points on the shield.
5. Set function generator to output a 250kHz square wave between 0V and 3.3V (or 5V), and then enable function generator output.
6. Turn on the +3.3V (or 5V) DC power supply.
7. Connect an oscilloscope probe on D1 (pin 2 of J4) and verify the D1 output signal (RO) matches the D0 input signal (DI).

## Table 1. Jumper Settings

| JUMPER | SHUNT POSITION | DESCRIPTION |
|---|---|---|
| JU1 | 1-2 | VCC is shorted to +5V supply from shield header |
| | 1-3* | VCC is shorted to VCC_EXT external supply |
| | 1-4 | VCC is shorted to +3.3V supply from shield header |
| | Open | VCC is open |
| JU2 | 1-2 | DE is shorted to VCC |
| | 1-3* | DE is connected to level shifter output |
| | 1-4 | DE is shorted to GND |
| | Open | DE is open |
| JU3 | 1-2 | $\overline{RE}$ is shorted to VCC |
| | 1-3* | $\overline{RE}$ is connected to level shifter output |
| | 1-4 | $\overline{RE}$ is shorted to GND |
| | Open | $\overline{RE}$ is open |
| JU4 & JU11 | 1-2 | Connects 120Ω between A and B |
| | 2-3* | Connects 60Ω between A and B |
| | Open | No load is connected between A and B |
| JU5 | 1-2* | Connects POL to D7 of J4 |
| | Open | Disconnects POL from D7 of J4 |
| JU6 | 1-2* | Connects DE to D6 of J4 |
| | Open | Disconnects DE from D6 of J4 |

| JUMPER | SHUNT POSITION | DESCRIPTION |
|---|---|---|
| JU7 | 1-2* | TVS Diode (DNI) connected to A |
| | Open | TVS Diode (DNI) disconnected from A |
| JU9 | 1-2* | TVS Diode (DNI) connected to B |
| | Open | TVS Diode (DNI) disconnected from B |
| JU10 | 1-2* | Connects VCC pin of U1 to supply rail |
| | Open | Disconnects VCC pin of U1 from supply rail |

*Note: *indicates default jumper state.*

## Detailed Description of Hardware

The MAX33071E Shield EV kit is a fully assembled and tested circuit board for evaluating the MAX33071E fault-protected half-duplex RS-485 transceiver (U1) with ±65V of fault protection. The EV kit is designed to evaluate MAX33071E alone or in a RS-485 system. The EV kit enables Mbed or Arduroino platform to communicate on a RS-485 bus. The MAX14931 digital isolator is used as a level translator with a 1.71V to 5.5V supply range. Remove the 0Ω resistor R6 to apply the transmitter input signal directly on the DI test point. Likewise, remove the 0Ω resistor R3 to measure the receiver output signal directly on the RO test point.

If external protection is desired beyond the device's built-in protection, the shield also features footprints for TVS diodes (D1 and D2) that can be connected to the A and B lines using JU7 and JU9, respectively.

This evaluation kit should be used with the following documents:

- MAX33071E data sheet
- MAX33071E Shield EV kit (this document)

These documents, or links to them, are included on the MAX33071E Shield page. For the latest versions of the documents listed, use this link: **www.maximintegrated.com/MAX33071ESHLD**

### Powering the Board

This EV Kit requires two power supplies: one 3V–5.5V supply for the MAX33071E (U1) transceiver applied at the VCC_EXT test point, and one 1.71V–5.5V supply for the microcontroller domain applied at the IOREF test point. When the EV kit board is used with an Arduino/Mbed board, the power supply for U1 can also come from the Arduino/Mbed board's 3.3V or 5V rail. Place the shunt on 2-3 position of JU1 to connect VCC to VCC_EXT pin. Place the shunt of JU1 on 1-2 position or 1-4 position to connect the VCC of U1 to the Arduino/Mbed 3.3V or 5V supply rail. In this scenario, IOREF is directly taken from the Arduino/Mbed header.

### On-Board Termination

A properly terminated RS-485 bus is terminated at each end with the characteristic impedance of the cable. For CAT5 or CAT6 cables, this is typically 120Ω on each end for a 60Ω load on the RS-485 driver. This EV kit features a selectable 60Ω or 120Ω load circuit between the A and B driver outputs. If the board is evaluated in a system and is connected at the end of the cable, then select the 120Ω termination. The termination resistors on the EV kit should be changed to 60Ω with a 100pF load to simulate a complete system load during evaluation.

### DI and RO Configuration

Digital channels for DI and RO are selected through JU8. It consists of three columns and 16 rows. The columns labeled DI and RO are connected to MAX33071E through the digital isolator (MAX14931FASE+ (U2)). The middle column is the digital I/O pins, D0 to D15, from the Arduino/Mbed header. This provides flexibility for the user to select different resources on the microcontroller to transmit and receive signals to and from the RS-485 transceiver. *Table 2* shows the list of JU8 jumper options.

## Table 2. DI and RO Jumper Settings

| JUMPER | SHUNT POSITION | DESCRIPTION |
|---|---|---|
| JU8 | 1-2* | Connects DI to D0 |
| | 4-5 | Connects DI to D1 |
| | 7-8 | Connects DI to D2 |
| | 10-11 | Connects DI to D3 |
| | 13-14 | Connects DI to D4 |
| | 16-17 | Connects DI to D5 |
| | 19-20 | Connects DI to D6 |
| | 22-23 | Connects DI to D7 |
| | 25-26 | Connects DI to D8 |
| | 28-29 | Connects DI to D9 |
| | 31-32 | Connects DI to D10 |
| | 34-35 | Connects DI to D11 |
| | 37-38 | Connects DI to D12 |
| | 40-41 | Connects DI to D13 |
| | 43-44 | Connects DI to D14 |
| | 46-47 | Connects DI to D15 |
| | 2-3 | Connects RO to D0 |
| | 5-6* | Connects RO to D1 |
| | 8-9 | Connects RO to D2 |
| | 11-12 | Connects RO to D3 |
| | 14-15 | Connects RO to D4 |
| | 17-18 | Connects RO to D5 |
| | 20-21 | Connects RO to D6 |
| | 23-24 | Connects RO to D7 |
| | 26-27 | Connects RO to D8 |
| | 29-30 | Connects RO to D9 |
| | 32-33 | Connects RO to D10 |
| | 35-36 | Connects RO to D11 |
| | 38-39 | Connects RO to D12 |
| | 41-42 | Connects RO to D13 |
| | 44-45 | Connects RO to D14 |
| | 47-48 | Connects RO to D15 |

*Note: *indicates default jumper state.*

### Flexible Interface Options

The EV kit allows multiple points of connection to the MAX33071E transceiver. This EV kit board could be placed on a Arduino/Mbed compatible board to connect all the digital pins (DI, DE, RO, $\overline{RE}$) through the J3, J4 headers. These signals could also be connected directly at their respective test points on the board, bypassing the digital isolator (U2). The A, B signals are connected to a terminal block (J5) to easily connect to a twisted pair cable. Alternately, the A, B test points may be used.

### PCB Layout for Thermal Dissipation

PCB layout can affect the performance of the transceiver in conditions with high common-mode voltage at high ambient temperatures. The layout of the EV kit is designed to maximize thermal performance in such cases. Large copper pads are used for all the pins. The GND pad is connected to a large copper plane on the top layer, with vias throughout the plane connecting to the GND plane on the bottom layer. A thick trace from the VCC pad to JU10 allows for greater heat dissipation at the $V_{CC}$ pin.

## Ordering Information

| PART NUMBER | TYPE |
|---|---|
| MAX33071ESHLD# | EV Kit |

*#Denotes RoHS-compliant.*

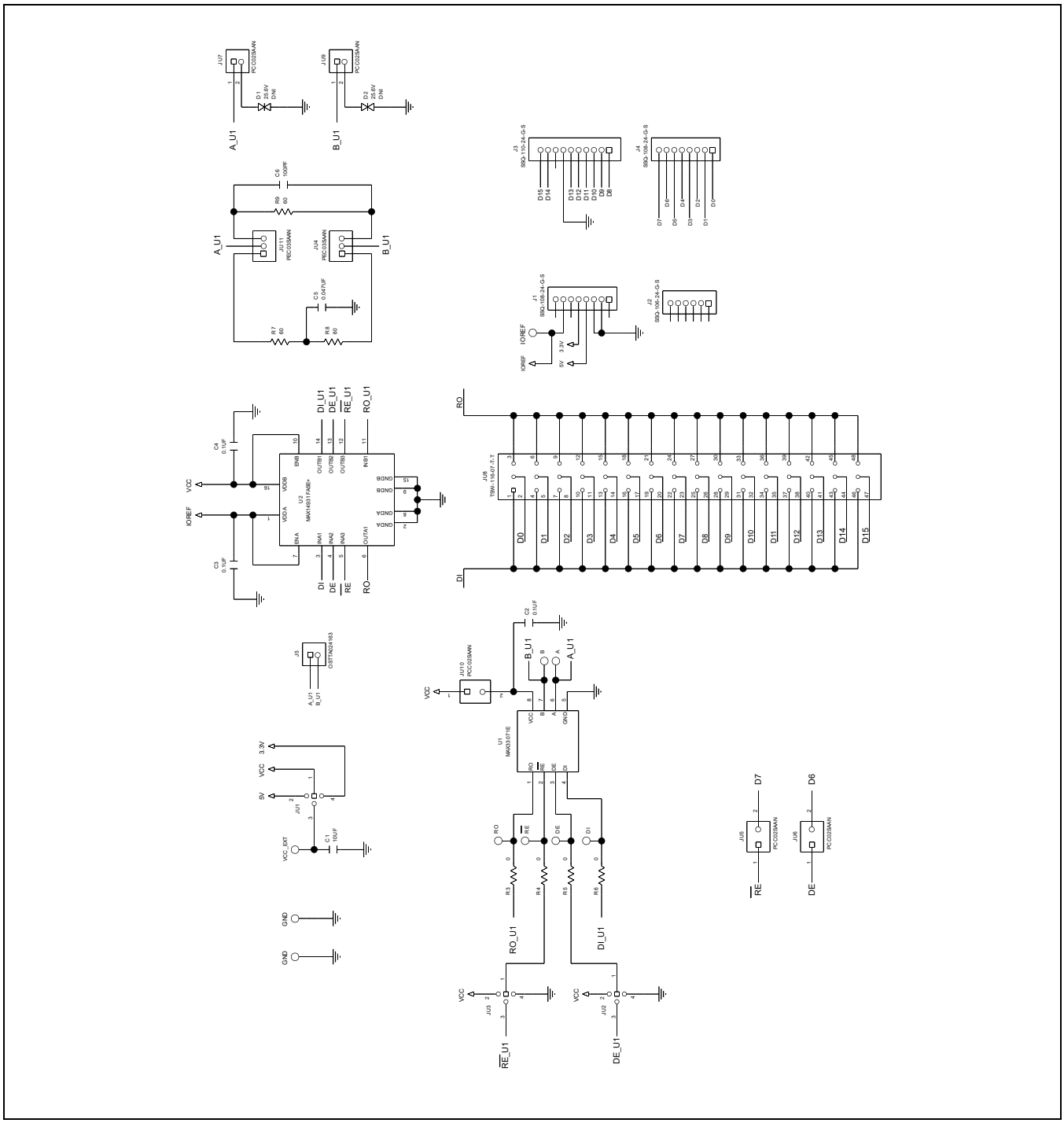
## MAX33071E Shield EV Kit Bill of Materials

| REF_DES | QTY | MFG PART # | VALUE | DESCRIPTION |
|---|---|---|---|---|
| A, B | 2 | 5127 | N/A | TEST POINT; PIN DIA=0.125IN; TOTAL LENGTH=0.445IN; BOARD HOLE=0.063IN; BLUE; PHOSPHOR BRONZE WIRE SILVER PLATE FINISH; |
| C1 | 1 | GRM155R60J106ME44; GRM155R60J106ME47; C1005X5R0J106M050BC; CL05A106MQ5NUN; C0402C106M9PAC | 10UF | CAPACITOR; SMT (0402); CERAMIC CHIP; 10UF; 6.3V; TOL=20%; TG=-55 DEGC TO +85 DEGC; TC=X5R |
| C2-C4 | 3 | C0402C104J4RAC; GCM155R71C104JA55 | 0.1UF | CAPACITOR; SMT (0402); CERAMIC CHIP; 0.1UF; 16V; TOL=5%; MODEL=; TG=-55 DEGC TO +125 DEGC; TC=X7R |
| C5 | 1 | C1005X7R1E473K050BC; GRM155R71E473K; GCM155R71E473KA55 | 0.047UF | CAPACITOR; SMT (0402); CERAMIC CHIP; 0.047UF; 25V; TOL=10%; TG=-55 DEGC TO +125 DEGC |
| C6 | 1 | C0402C101K5GAC; C1005C0G1H101K050BA | 100PF | CAPACITOR; SMT; 0402; CERAMIC; 100pF; 50V; 10%; C0G; -55degC to + 125degC; 0 +/-30PPM/degC |
| DE, DI, RE, RO | 4 | 5012 | N/A | TEST POINT; PIN DIA=0.125IN; TOTAL LENGTH=0.445IN; BOARD HOLE=0.063IN; WHITE; PHOSPHOR BRONZE WIRE SILVER PLATE FINISH; |
| IOREF | 1 | 5125 | N/A | TEST POINT; PIN DIA=0.125IN; TOTAL LENGTH=0.445IN; BOARD HOLE=0.063IN; BROWN; PHOSPHOR BRONZE WIRE SILVER PLATE FINISH; |
| J1, J4 | 2 | SSQ-108-24-G-S | SSQ-108-24-G-S | CONNECTOR; FEMALE; THROUGH HOLE; .025INCH SQ POST SOCKET; STRAIGHT; 8PINS ; |
| J2 | 1 | SSQ-106-24-G-S | SSQ-106-24-G-S | CONNECTOR; FEMALE; THROUGH HOLE; .025INCH SQ POST SOCKET; STRAIGHT; 6PINS ; |
| J3 | 1 | SSQ-110-24-G-S | SSQ-110-24-G-S | CONNECTOR; FEMALE; THROUGH HOLE; .025INCH SQ POST SOCKET; STRAIGHT; 10PINS ; |

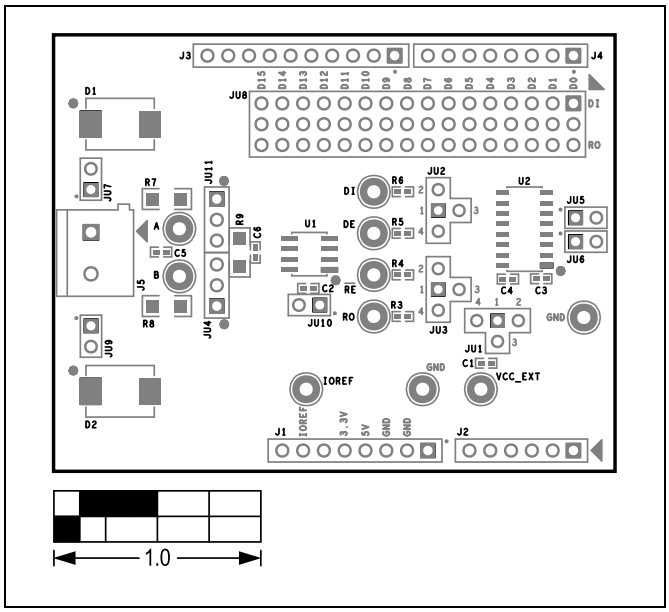
## MAX33071E Shield EV Kit Bill of Materials (continued)

| REF_DES | QTY | MFG PART # | VALUE | DESCRIPTION |
|---|---|---|---|---|
| J5 | 1 | OSTTA024163 | OSTTA024163 | CONNECTOR; FEMALE; THROUGH HOLE; 5.08MM TERM BLOCK CONNECTOR; STRAIGHT; 2PINS; -30 DEGC TO +105 DEGC |
| JU1-JU3 | 3 | PEC04SAAN | PEC04SAAN | CONNECTOR; MALE; THROUGH HOLE; BREAKAWAY; STRAIGHT; 4PINS |
| JU4, JU11 | 2 | PEC03SAAN | PEC03SAAN | CONNECTOR; MALE; THROUGH HOLE; BREAKAWAY; STRAIGHT; 3PINS |
| JU5-JU7, JU9, JU10 | 5 | PCC02SAAN | PCC02SAAN | CONNECTOR; MALE; THROUGH HOLE; BREAKAWAY; STRAIGHT THROUGH; 2PINS; -65 DEGC TO +125 DEGC |
| JU8 | 1 | TSW-116-07-T-T | TSW-116-07-T-T | CONNECTOR; MALE; THROUGH HOLE; 0.025IN SQ POST HEADER; STRAIGHT; 48PINS |
| R3-R6 | 4 | ERJ-2GE0R00 | 0 | RESISTOR; 0402; 0 OHM; 0%; JUMPER; 0.10W; THICK FILM |
| R7-R9 | 3 | CRCW120660R0KNEAIF | 60 | RESISTOR; 1206; 60 OHM; 10%; 200PPM; 0.25W; THICK FILM |
| SU1-SU3, SU5, SU6, SU8-SU10 | 8 | S1100-B;SX1100-B;STC02SYAN | SX1100-B | TEST POINT; JUMPER; STR; TOTAL LENGTH=0.24IN; BLACK; INSULATION=PBT;PHOSPHOR BRONZE CONTACT=GOLD PLATED |
| TP18, TP19 | 2 | 5011 | N/A | TEST POINT; PIN DIA=0.125IN; TOTAL LENGTH=0.445IN; BOARD HOLE=0.063IN; BLACK; PHOSPHOR BRONZE WIRE SILVER PLATE FINISH; |
| U1 | 1 | MAX33071EASA+ | MAX33071EASA+ | EVKIT PART - IC; MAX33071E; CI25 - 70V FAULT PROTECTED HALF DUPLEX RS-485; TRANSCEIVER; PACKAGE OUTLINE DRAWING: 21-0041; LAND PATTERN NUMBER: 90-0096; PACKAGE CODE: S8+4; NSOIC8 |
| U2 | 1 | MAX14931FASE+ | MAX14931FASE+ | IC; DISO; 3/1 CHANNEL; 150MBPS; DEFAULT LOW; 2.75KVRMS DIGITAL ISOLATOR; NSOIC16 150MIL |
| VCC_EXT | 1 | 5010 | N/A | TEST POINT; PIN DIA=0.125IN; TOTAL LENGTH=0.445IN; BOARD HOLE=0.063IN; RED; PHOSPHOR BRONZE WIRE SIL; |
| PCB | 1 | MAX33071ESHIELD | PCB | PCB:MAX33071ESHIELD |
| D1, D2 | 0 | SM15T30CA | 25.6V | DIODE; TVS; SMC (DO-214AB); VRM=25.6V; IPP=36A |

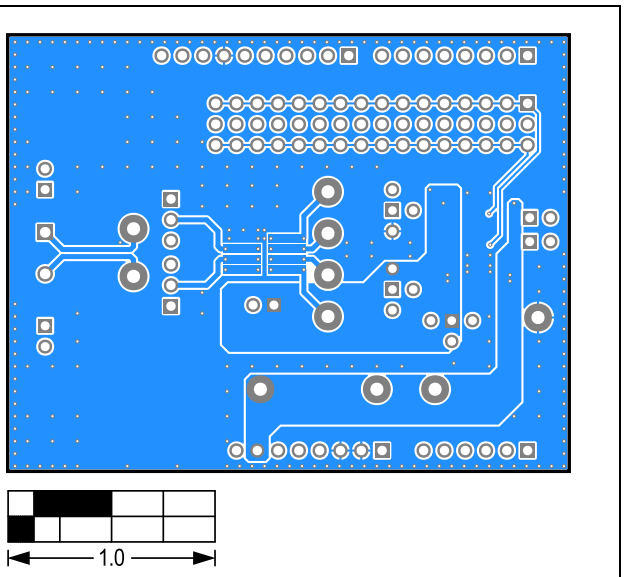
## MAX33071E Shield EV Kit Schematic Diagram



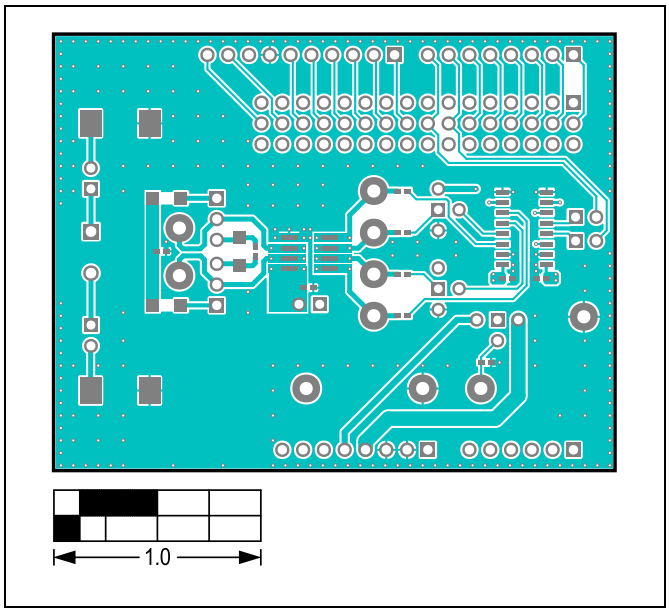
## MAX33071E Shield EV Kit PCB Layout Diagrams



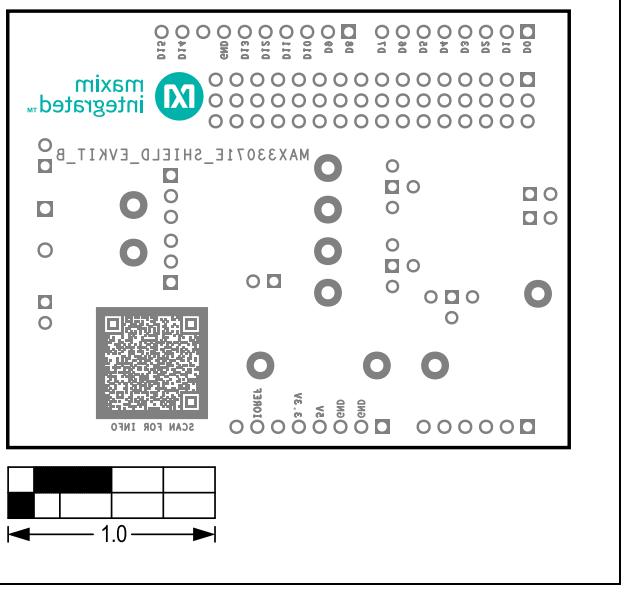

*MAX33071E Shield EV Kit PCB Layout Diagram—Top Silkscreen*




*MAX33071E Shield EV Kit PCB Layout Diagram—Bottom View*




*MAX33071E Shield EV Kit PCB Layout Diagram—Top View*




*MAX33071E Shield EV Kit PCB Layout Diagram—Bottom Silkscreen*

## Revision History

| REVISION NUMBER | REVISION DATE | DESCRIPTION | PAGES CHANGED |
|---|---|---|---|
| 0 | 3/21 | Release for market intro | — |

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