

## MAX33251E Shield

Evaluates: MAX33251E

### General Description

The MAX33251E Shield is a fully assembled and tested PCB that demonstrates the functionality of the MAX33251E, isolated 1Tx/1Rx RS-232 transceiver, with a galvanic isolation of 600V<sub>RMS</sub> (60s) between the logic UART side and field side. The isolation barrier protects the logic UART side from electrical transient strikes from the field side. It also breaks ground loops and large differences in ground potentials between the two sides that can corrupt the receiving and sending of data. The MAX33251E conforms to the EIA/TIA-232E standard and operates at data rates up to 1Mbps.

### Features

- Single Supply
- On-Board Isolated DC-DC Power Supply
- Arduino/Mbed Shield Interface Form Factor
- DCE/DTE Selectable DB9 Pinout

Ordering Information appears at end of data sheet.

### Quick Start

#### Required Equipment

- MAX33251E Shield
- 5V, 500mA DC power supply
- Function generator
- Digital oscilloscope

#### Procedure

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

- 1) Place the MAX33251E Shield on a nonconductive surface to ensure that nothing on the PCB gets shorted to the workspace.
- 2) Connect T1OUT test point to R1IN test point.
- 3) Disable the output of the function generator.
- 4) Set the output of the function generator to 500kHz (min = 0V, max = 5V) square wave.
- 5) Connect the positive terminal of the function generator to D2 on J6.
- 6) Connect the negative terminal of the function generator to GNDA connector.
- 7) Connect the positive terminal of 5V supply to VCCA\_EXT and VCCB\_EXT connectors.
- 8) Connect the negative terminal of 5V supply to GNDA and GNDB connectors.
- 9) Connect the positive terminal of 5V supply to pin 7 of the J3 connector (IOREF)
- 10) Connect the positive terminal of channel 1 of the oscilloscope to D3 on J6.
- 11) Connect the negative terminal of channel 1 of the oscilloscope to GNDA connector.
- 12) Enable the output of the function generator.
- 13) Verify 500kHz 5V square waves appear on oscilloscope.

## Detailed Description of Hardware

MAX33251E Shield is a fully assembled and tested circuit board for evaluating the MAX33251E 1Mbps, 600V<sub>RMS</sub> isolated RS-232 transceivers. The MAX33251E has a transmitter and a receiver (1Tx/1Rx). The isolation is provided by Maxim's proprietary insulation material that can withstand 600V<sub>RMS</sub> for 60 seconds. The MAX33251E conforms to the EIA/TIA-232 standard and operates at data rates up to 1Mbps over the temperature range of -40°C to +85°C.

The MAX33251E Shield with an on-board DB9 connector, enables Mbed or Arduino platform to communicate on a RS-232 bus. DCE/DTE DB9 pin out is selectable with the SW1 switch. The MAX14850 digital isolator is used as a level translator with a 3V to 5.5V supply range.

To evaluate this device without connecting to a network, a resistive load of 3KΩ to 7KΩ and a capacitive load of 150pF to 1000pF can be placed on R1 and C1, respectively.

## Powering the Board

V<sub>CCA</sub> of MAX33251E can come from external supply or the Arduino/mbed platform supply. See [Table 1](#) for jumper settings to select appropriate V<sub>CCA</sub> source.

The MAX33251E Shield has an on-board isolated power supply that generates an isolated supply for V<sub>CCB</sub>. If the shield board is connected to an Arduino/mbed platform, input of the isolated power supply is connected to the 5V output (pin 4 of J3) of the Arduino/mbed platform. The voltage generated on the isolated output is the same as the input. See [Table 1](#) for jumper settings to select appropriate V<sub>CCB</sub> source.

The isolated supply generated by the transformer driver requires a 5V supply from the mbed/Arduino board. Set JU1 to 1-3 position to connect mbed/Arduino 5V supply to V<sub>CCA</sub>.

**Table 1. Jumper Settings**

| JUMPER | SHUNT POSITION | DESCRIPTION                                                                      |
|--------|----------------|----------------------------------------------------------------------------------|
| JU1    | 1-2            | Transceiver V <sub>CCA</sub> connects to 3.3V on Arduino/mbed connector (J3)     |
|        | 1-3            | Transceiver V <sub>CCA</sub> connects to 5V on Arduino/mbed connector (J3)       |
|        | 1-4*           | Transceiver V <sub>CCA</sub> connects to V <sub>CCA_EXT</sub> connector          |
| JU2    | 1-2            | Transceiver V <sub>CCB</sub> connects to the output of the isolated power supply |
|        | 2-3*           | Transceiver V <sub>CCB</sub> connects to V <sub>CCB_EXT</sub> connector          |
| JU3    | 1-2*           | Transceiver T1IN connects to the level translator                                |
|        | OPEN           | Transceiver T1IN disconnects from the level translator                           |
| JU4    | 1-2*           | Transceiver R1OUT connects to the level translator                               |
|        | OPEN           | Transceiver R1OUT disconnects from the level translator                          |
| JU5D0  | 1-2*           | Transceiver T1IN connects to Arduino/mbed connector's D0 signal                  |
|        | 2-3            | Transceiver R1OUT connects to Arduino/mbed connector's D0 signal                 |
|        | OPEN*          | Arduino/mbed connector's D0 signal is not connected                              |
| JU5D1  | 1-2            | Transceiver T1IN connects to Arduino/mbed connector's D1 signal                  |
|        | 2-3            | Transceiver R1OUT connects to Arduino/mbed connector's D1 signal                 |
|        | OPEN*          | Arduino/mbed connector's D1 signal is not connected                              |
| JU5D2  | 1-2*           | Transceiver T1IN connects to Arduino/mbed connector's D2 signal                  |
|        | 2-3            | Transceiver R1OUT connects to Arduino/mbed connector's D2 signal                 |
|        | OPEN           | Arduino/mbed connector's D2 signal is not connected                              |
| JU5D3  | 1-2            | Transceiver T1IN connects to Arduino/mbed connector's D3 signal                  |
|        | 2-3*           | Transceiver R1OUT connects to Arduino/mbed connector's D3 signal                 |
|        | OPEN           | Arduino/mbed connector's D3 signal is not connected                              |

Table 1. Jumper Settings (continued)

| JUMPER | SHUNT POSITION | DESCRIPTION                                                      |
|--------|----------------|------------------------------------------------------------------|
| JU5D6  | 1-2            | Transceiver T1IN connects to Arduino/mbed connector's D6 signal  |
|        | 2-3            | Transceiver R1OUT connects to Arduino/mbed connector's D6 signal |
|        | OPEN*          | Arduino/mbed connector's D6 signal is not connected              |
| JU5D7  | 1-2            | Transceiver T1IN connects to Arduino/mbed connector's D7 signal  |
|        | 2-3            | Transceiver R1OUT connects to Arduino/mbed connector's D7 signal |
|        | OPEN*          | Arduino/mbed connector's D7 signal is not connected              |
| JU5D8  | 1-2            | Transceiver T1IN connects to Arduino/mbed connector's D8 signal  |
|        | 2-3            | Transceiver R1OUT connects to Arduino/mbed connector's D8 signal |
|        | OPEN*          | Arduino/mbed connector's D8 signal is not connected              |
| JU5D9  | 1-2            | Transceiver T1IN connects to Arduino/mbed connector's D9 signal  |
|        | 2-3            | Transceiver R1OUT connects to Arduino/mbed connector's D9 signal |
|        | OPEN*          | Arduino/mbed connector's D9 signal is not connected              |

\*Default position.

## Ordering Information

| PART           | TYPE   |
|----------------|--------|
| MAX33251ESHLD# | SHIELD |

#Denotes RoHS-compliant.

# MAX33251E Shield

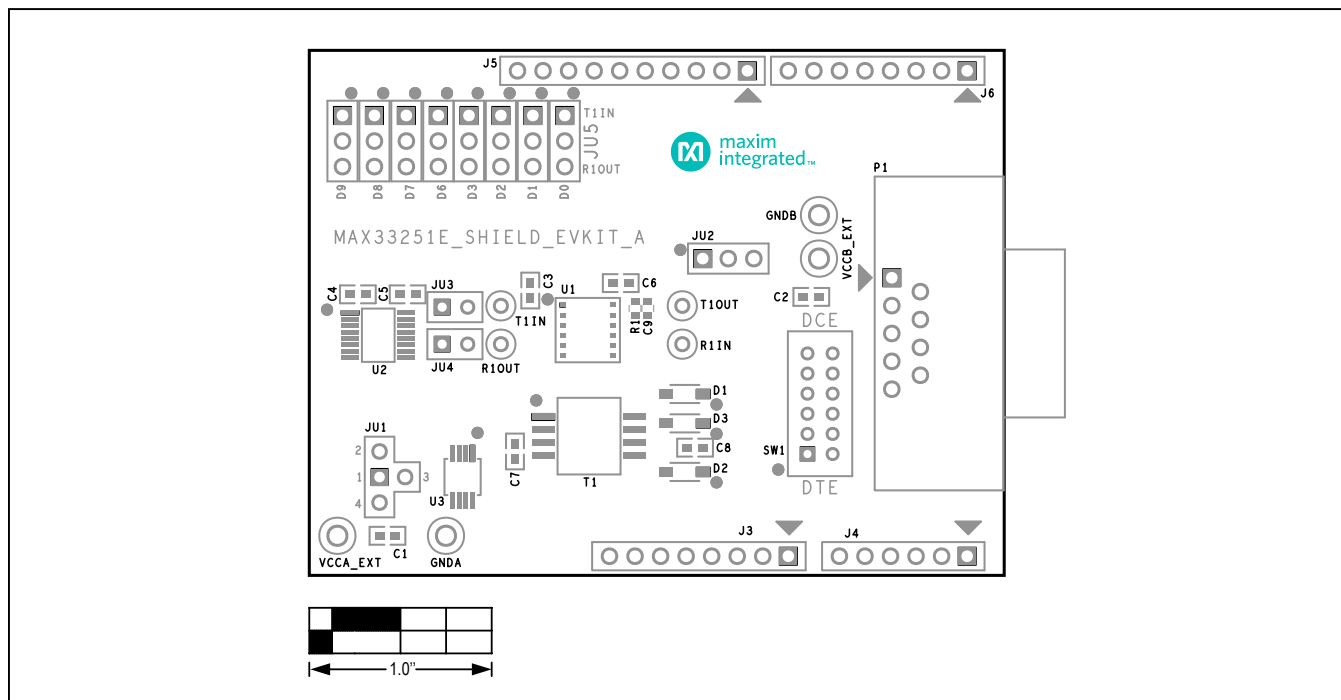
Evaluates: MAX33251E

## MAX33251E Shield Bill of Materials

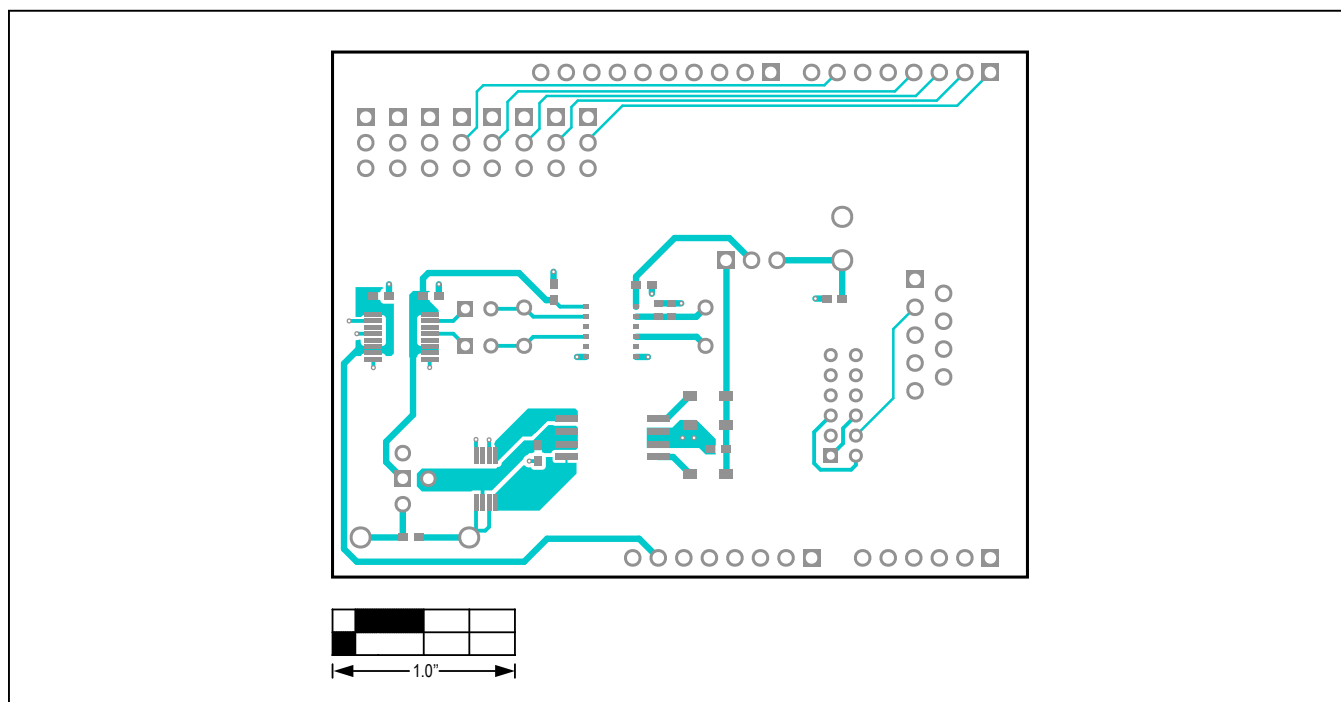
| ITEM  | REF_DES                       |     | QTY | MFG PART #          | MANUFACTURER                 | VALUE           | DESCRIPTION                                                                                                                     |
|-------|-------------------------------|-----|-----|---------------------|------------------------------|-----------------|---------------------------------------------------------------------------------------------------------------------------------|
| 1     | C1, C2                        |     | 2   | C1608X5R1A106K080AC | TDK                          | 10UF            | CAPACITOR; SMT (0603); CERAMIC CHIP; 10UF; 10V; TOL = 10%;<br>MODEL =; TG = -55°C TO +85°C; TC = X5R                            |
| 2     | C3-C7                         |     | 5   | C0603C104K8RAC      | KEMET                        | 0.1UF           | CAPACITOR; SMT (0603); CERAMIC CHIP; 0.1UF; 10V; TOL = 10%;<br>MODEL = C0603 SERIES; TG = -55°C TO +125°C; TC = X7R             |
| 3     | C8                            |     | 1   | C0603C334K4RAC      | KEMET                        | 0.33UF          | CAPACITOR; SMT (0603); CERAMIC CHIP; 0.33uF; 16V; TOL = 10%;<br>MODEL=; TG = -55°C TO +125°C; TC = X7R                          |
| 4     | D1, D2                        |     | 2   | MBR0520L            | FAIRCHILD SEMICONDUCTOR      | MBR0520L        | DIODE; SCHOTTKY, SOD-123, PIV = 20V, VF = 0.385V@If = 0.5A, If(ave) = 0.5A                                                      |
| 5     | D3                            |     | 1   | MMSZ5231B-7-F       | DIODES INCORPORATED          | 5.1V            | DIODE; ZNR; SMT (SOD-123); VZ = 5.1V; IZ = 0.02A                                                                                |
| 6     | GND A, GND B                  |     | 2   | 5006                | KEystone                     | N/A             | TEST POINT; PIN DIA = 0.125IN; TOTAL LENGTH = 0.35IN; BOARD HOLE = 0.063IN;<br>BLACK; PHOSPHOR BRONZE WIRE SILVER PLATE FINISH; |
| 7     | J3, J6                        |     | 2   | SSQ-108-04-G-S      | SAMTEC                       | SSQ-108-04-G-S  | CONNECTOR; FEMALE; THROUGH HOLE; .025IN SQ POST SOCKET; STRAIGHT; 8PINS ;                                                       |
| 8     | J4                            |     | 1   | SSQ-106-04-G-S      | SAMTEC                       | SSQ-106-04-G-S  | CONNECTOR; FEMALE; THROUGH HOLE; .025IN SQ POST SOCKET; STRAIGHT; 6PINS ;                                                       |
| 9     | J5                            |     | 1   | SSQ-110-04-G-S      | SAMTEC                       | SSQ-110-04-G-S  | CONNECTOR; FEMALE; THROUGH HOLE; .025IN SQ POST SOCKET; STRAIGHT; 10PINS ;                                                      |
| 10    | JU1                           |     | 1   | PEC04SAAN           | SULLINS ELECTRONICS CORP.    | PEC04SAAN       | CONNECTOR; MALE; THROUGH HOLE; BREAKAWAY; STRAIGHT; 4PINS                                                                       |
| 11    | JU2, JU5D0-JU5D3, JU5D6-JU5D9 |     | 9   | PEC03SAAN           | SULLINS                      | PEC03SAAN       | CONNECTOR; MALE; THROUGH HOLE; BREAKAWAY; STRAIGHT; 3PINS                                                                       |
| 12    | JU3, JU4                      |     | 2   | PBC02SAAN           | SULLINS ELECTRONICS CORP.    | PBC02SAAN       | EVKIT PART-CONNECTOR; MALE; THROUGH HOLE; BREAKAWAY; STRAIGHT; 2PINS;<br>-65°C TO +125°C;                                       |
| 13    | P1                            |     | 1   | 182-009-213R531     | NORCOMP                      | 182-009-213R531 | CONNECTOR; FEMALE; THROUGH HOLE; D-SUBMINIATURE CONNECTOR;<br>RIGHT ANGLE; 9PINS                                                |
| 14    | R1IN, R1OUT, T1IN, T1OUT      |     | 4   | 5004                | KEystone                     | N/A             | TEST POINT; PIN DIA = 0.1IN; TOTAL LENGTH = 0.3IN; BOARD HOLE = 0.04IN;<br>YELLOW; PHOSPHOR BRONZE WIRE SILVER PLATE FINISH;    |
| 15    | SW1                           |     | 1   | MFS401N-2-Z         | NIDEC COPAL ELECTRONICS CORP | MFS401N-2-Z     | SWITCH; 4PDT; THROUGH HOLE; STRAIGHT; +5V TO +30V; 0.01A-0.3A;<br>MFS SERIES; RCONTACT = 0.02Ω; RINSULATION = 100MΩ             |
| 16    | T1                            |     | 1   | TGM-050P3RL         | HALO ELECTRONICS INC         | TGM-050P3RL     | TRANSFORMER; SMT; 1:1:1:1; PCMCIA DC/DC CONVERTER                                                                               |
| 17    | U1                            |     | 1   | MAX33251EELC+       | MAXIM                        | MAX33251EELC+   | EVKIT PART-IC; MAX33251E; LGA12; 6X6MM; 1MM PITCH;<br>PACKAGE OUTLINE DRAWING: 21-100222; PACKAGE CODE: L1266M+1                |
| 18    | U2                            |     | 1   | MAX14850AEE+        | MAXIM                        | MAX14850AEE+    | IC; ISO; SIX-CHANNEL DIGITAL ISOLATOR; QSOP16                                                                                   |
| 19    | U3                            |     | 1   | MAX845EUA+          | MAXIM                        | MAX845EUA+      | IC; DRV; ISOLATED TRANSFORMER DRIVER; UMAX8                                                                                     |
| 20    | VCCA_EXT, VCCB_EXT            |     | 2   | 5005                | KEystone                     | N/A             | TEST POINT; PIN DIA=0.125IN; TOTAL LENGTH = 0.35IN; BOARD HOLE = 0.063IN;<br>RED; PHOSPHOR BRONZE WIRE SILVER PLATE FINISH;     |
| 21    | PCB                           |     | 1   | MAX33251E PCB       | MAXIM                        | PCB             | PCB-MAX33251ESHIELD                                                                                                             |
| 22    | R1                            | DNP | 0   | N/A                 | N/A                          | OPEN            | RESISTOR; 0603; OPEN; FORMFACTOR                                                                                                |
| 23    | C9                            | DNP | 0   | N/A                 | N/A                          | OPEN            | CAPACITOR; SMT (0603); OPEN; FORMFACTOR                                                                                         |
| TOTAL |                               |     | 42  |                     |                              |                 |                                                                                                                                 |

The schematic diagram illustrates a multi-channel signal conditioning circuit. It features two input sections, each with 10 channels (D0-D9). Each input channel is connected to a 3.3V supply and a 5V supply, with a 10kF feedback capacitor (C1) and a 10kF pull-up resistor (R1). The input signals are processed by two MAX4850EE+ comparators (U1, U2), which are powered by a 5V supply and have decoupling capacitors (C2, C3). The comparators output signals to two MAX9224L multiplexers (U3, U4), which are also powered by a 5V supply and have decoupling capacitors (C4, C5). The multiplexers output signals to two 10-channel output buses (D0-D9). The output section includes two 10-channel output buses (D0-D9) and a 5VISO signal line. The circuit is powered by a 5V supply and includes various decoupling capacitors (C1-C8) and pull-up/pull-down resistors (R1, R2).

## MAX33251E Shield Layout Diagrams

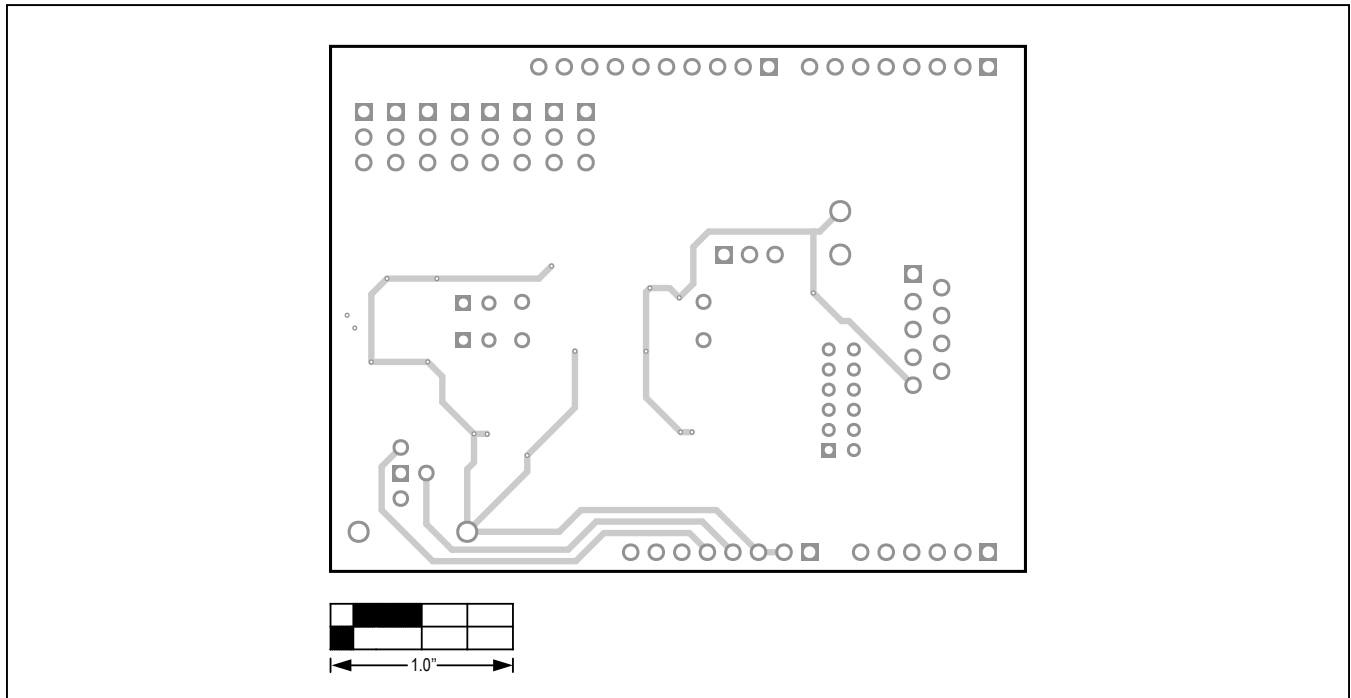


MAX33251E Shield—Top Silkscreen

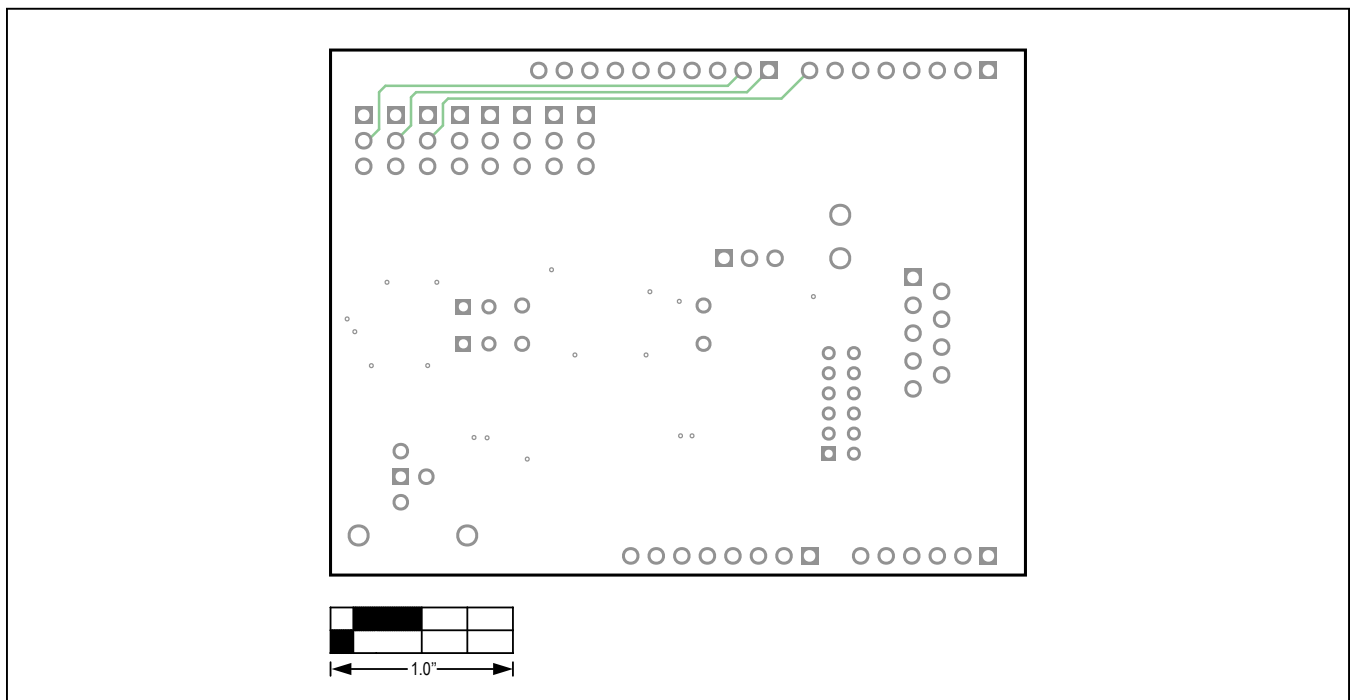


MAX33251E Shield—Top View

## MAX33251E Shield Layout Diagrams (continued)

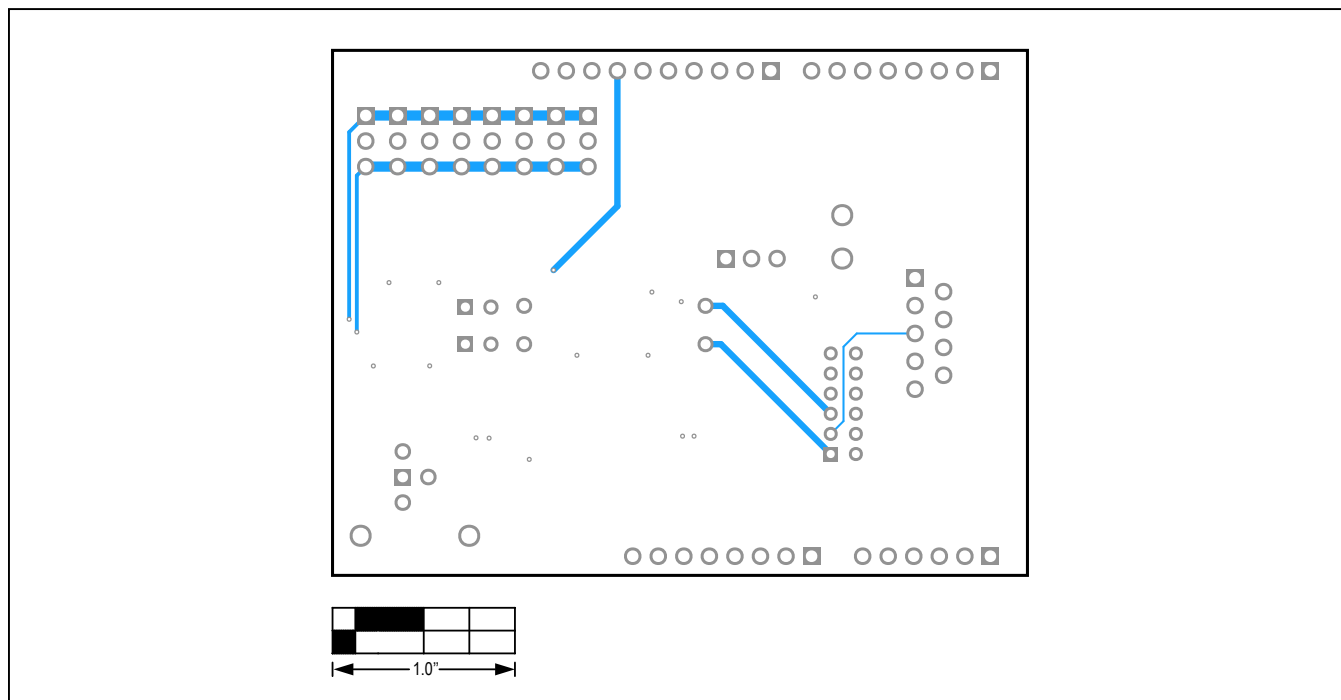


MAX33251E Shield—Internal Layer 2

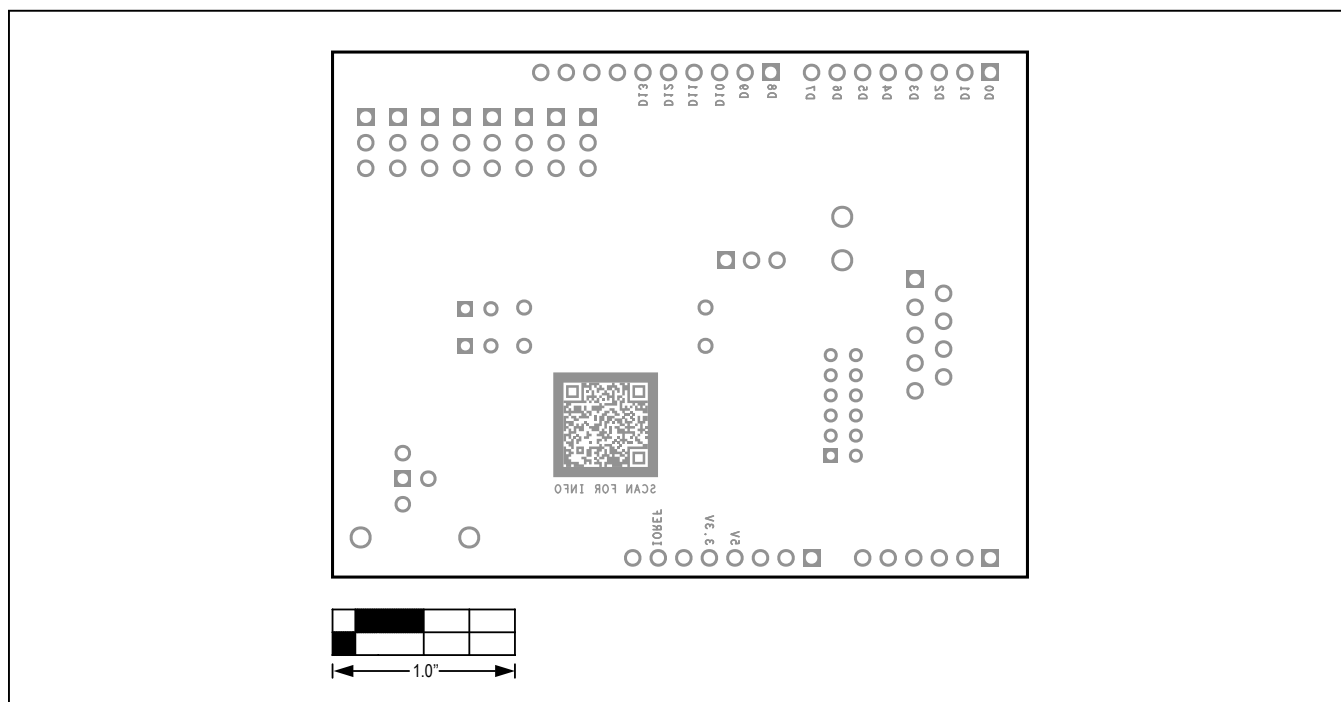


MAX33251E Shield—Internal Layer 3

## MAX33251E Shield Layout Diagrams (continued)



MAX33251E Shield—Bottom View



MAX33251E Shield—Silkscreen Bottom



## Revision History

| REVISION<br>NUMBER | REVISION<br>DATE | DESCRIPTION     | PAGES<br>CHANGED |
|--------------------|------------------|-----------------|------------------|
| 0                  | 2/19             | Initial release | —                |

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