MAX33072E Shield Evaluation Kit

General Description

The MAX33072E Shield evaluation kit (EV kit) is a fully assembled and tested printed circuit board (PCB) that demonstrates the functionality of the MAX33072E 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 and Benefits

- Easy Evaluation of the MAX33072E
- I/O Interface Compatibility from 1.71V to 5.5V
- Proven PCB Layout
- Compatible with Arm® Mbed™ Platform and Arduino®
- Fully Assembled and Tested

Ordering Information **appears at end of data sheet.**

## Quick Start

Required Equipment

- MAX33072E Shield EV kit
- 3.3V (or 5V), 500mA DC power supply
- Signal/function generator that can generate a 250kHz square-wave signal
- Oscilloscope

Procedure

The EV kit is fully assembled and tested. Use the following steps to verify board operation:

1. Place the MAX33072E Shield EV kit on a nonconductive surface to ensure that nothing on the PCB gets shorted to the workspace.
2. Set JU2 to the 1-2 position (DE = 1) and JU3 to the 1-4 position (POL = 0). Set all 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 the VCC_EXT and IOREF test points. Connect the negative terminal to a 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 the 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 that the D1 output signal (RO) matches the D0 input signal (DI).

EV Kit Photo with Jumpers and Test Point Positions
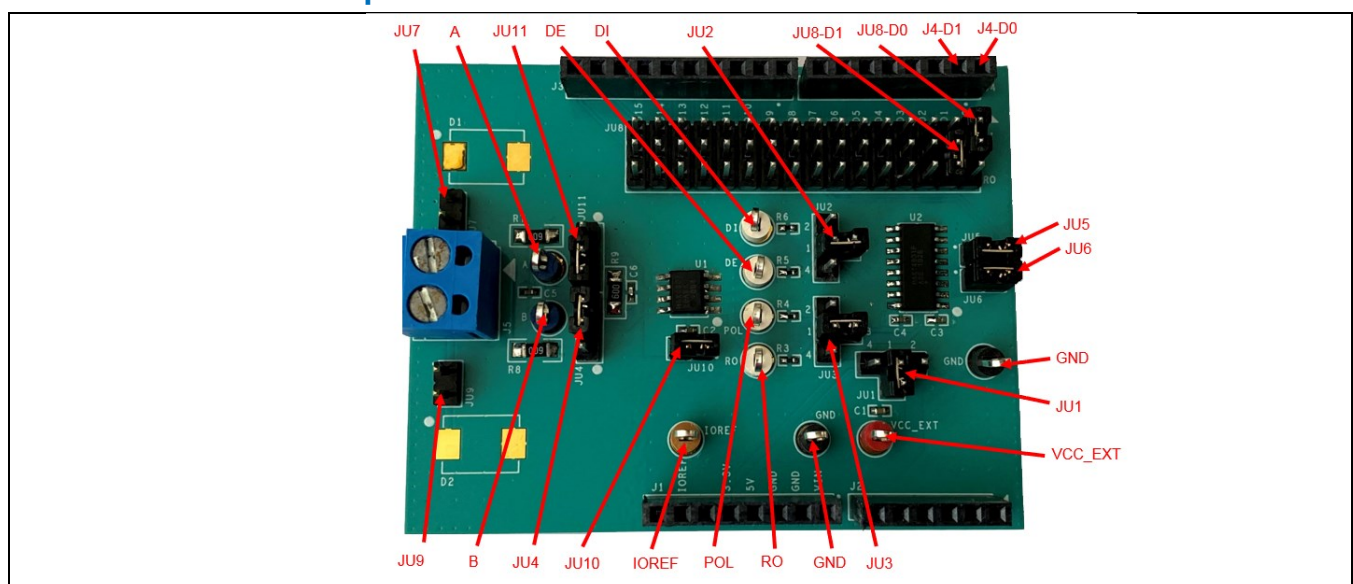
Detailed Description of Hardware

The MAX33072E Shield EV kit is a fully assembled and tested circuit board for evaluating the MAX33072E fault protected half-duplex RS-485 transceiver (U1) with ±65V of fault protection. The EV kit is designed to evaluate the MAX33072E alone or in a RS-485 system. The MAX33073E Shield EV kit enables a Mbed platform or Arduino 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 EV kit also features footprints for TVS diodes (D1 and D2) that can be connected to the A and B lines using JU7 and JU9, respectively.

Powering the Board

The MAX33072E Shield EV kit requires two power supplies: one 3V to 5.5V supply for the MAX33072E (U1) transceiver applied at the VCC_EXT test point, and one 1.71V to 5.5V supply for the microcontroller domain applied at the IOREF test point. When the EV kit board is used with a Mbed device or board compatible with Arduino, the power supply for U1 can also come from the 3.3V or 5V rail of the board of the Mbed device or Arduino. Place the shunt on the 2-3 position of JU1 to connect VCC to the VDD_EXT pin. Place the shunt of JU1 on the 1-2 position or 1-4 position to connect the VCC of U1 to the Arduino/Mbed device 3.3V or 5V supply rail. In this scenario, IOREF is directly taken from the header of the Mbed device or from Arduino.

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. The MAX33072E Shield 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 MAX33072E Shield EV kit should be changed to 60Ω with a 100pF load, to simulate a complete system load during evaluation.

DI and RO Configuration

The 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 the MAX33072E through the digital isolator (MAX14931FASE+ (U2)). The middle column is the digital I/O pins, D0 to D15, from the header of the Mbed device or from Arduino. 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.

Flexible Interface Options

The MAX33072E Shield EV kit allows multiple points of connection to the MAX33072E transceiver. The shield board could be placed on a Mbed device or a board compatible with Arduino to connect all the digital pins (DI, DE, RO, POL) 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 MAX33072E Shield EV kit is designed to maximize thermal performance in such cases. Large copper pads are used for all of 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 VCC pin.

Table 1. Table 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	POL is shorted to VCC
	1-3*	POL is connected to level shifter output
	1-4	POL is shorted to GND
	Open	POL is open
JU4 and 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
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

*Default jumper state

Table 2. Table DI and RO Jumper Setting

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

*Default jumper state

Ordering Information

PART	TYPE
MAX33072ESHLD#	Shield

MAX33072E Shield EV Kit Bill of Materials

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

ITEM	REF_DES	QTY	MFG PART #	MANUFACTURER	VALUE	DESCRIPTION
10	J3	1	SSQ-110-24-G-S	SAMTEC	SSQ-110-24-G-S	CONNECTOR; FEMALE; THROUGH HOLE; .025INCH SQ POST SOCKET; STRAIGHT; 10PINS
11	J5	1	OSTTA024163	ON-SHORE TECHNOLOGY INC.	OSTTA024163	CONNECTOR; FEMALE; THROUGH HOLE; 5.08MM TERM BLOCK CONNECTOR; STRAIGHT; 2PINS; -30DEGC TO +105DEGC
12	JU1-JU3	3	PEC04SAAN	SULLINS ELECTRONICS CORP.	PEC04SAAN	CONNECTOR; MALE; THROUGH HOLE; BREAKAWAY; STRAIGHT; 4PINS
13	JU4, JU11	2	PEC03SAAN	SULLINS	PEC03SAAN	CONNECTOR; MALE; THROUGH HOLE; BREAKAWAY; STRAIGHT; 3PINS
14	JU5-JU7, JU9, JU10	5	PCC02SAAN	SULLINS	PCC02SAAN	CONNECTOR; MALE; THROUGH HOLE; BREAKAWAY; STRAIGHT THROUGH; 2PINS; -65DEGC TO +125DEGC
15	JU8	1	TSW-116-07-T-T	SAMTEC	TSW-116-07-T-T	CONNECTOR; MALE; THROUGH HOLE; 0.025IN SQ POST HEADER; STRAIGHT; 48PINS
16	R3-R6	4	ERJ-2GE0R00	PANASONIC	0	RESISTOR; 0402; 0 OHM; 0%; JUMPER; 0.10W; THICK FILM
17	R7-R9	3	CRCW120660R0KNEAIF	VISHAY DALE	60	RESISTOR; 1206; 60 OHM; 10%; 200PPM; 0.25W; THICK FILM
18	SU1-SU3, SU5, SU6, SU8- SU10	8	S1100-B; SX1100-B; STC02SYAN	KYCON; KYCON; SULLINS ELECTRONICS CORP	SX1100-B	TEST POINT; JUMPER; STR; TOTAL LENGTH=0.24IN; BLACK; INSULATION=PBT; PHOSPHOR BRONZE CONTACT=GOLD PLATED

| ITEM	REF_DES	QTY	MFG PART #	MANUFACTURER	VALUE	DESCRIPTION
19	TP18, TP19	2	5011	KEYSTONE	N/A	TEST POINT; PIN DIA=0.125IN; TOTAL LENGTH=0.445IN; BOARD HOLE=0.063IN; BLACK; PHOSPHOR BRONZE WIRE SILVER PLATE FINISH;
20	U1	1	MAX33072E	MAXIM	MAX33072E	EVKIT PART - IC; MAX33072E; CI25 - 70V FAULT PROTECTED HALF DUPLEX RS-485; TRANSCEIVER; PACKAGE OUTLINE DRAWING: 21-0041; LAND PATTERN NUMBER: 90-0096; PACKAGE CODE: S8+4; NSOIC8
21	U2	1	MAX14931FASE+	MAXIM	MAX14931FASE+	IC; DISO; 3/1 CHANNEL; 150MBPS; DEFAULT LOW; 2.75KVRMS DIGITAL ISOLATOR; NSOIC16 150MIL
22	VCC_EXT	1	5010	KEYSTONE	N/A	TEST POINT; PIN DIA=0.125IN; TOTAL LENGTH=0.445IN; BOARD HOLE=0.063IN; RED; PHOSPHOR BRONZE WIRE SIL;
23	PCB	1	MAX33072ESHIELD	MAXIM	PCB	PCB:MAX33072ESHIELD
24	D1, D2	0	SM15T30CA	ST MICRO ELECTRONICS	25.6V	DIODE; TVS; SMC (DO-214AB); VRM=25.6V; IPP=36A

MAX33072E Shield EV Kit Schematic
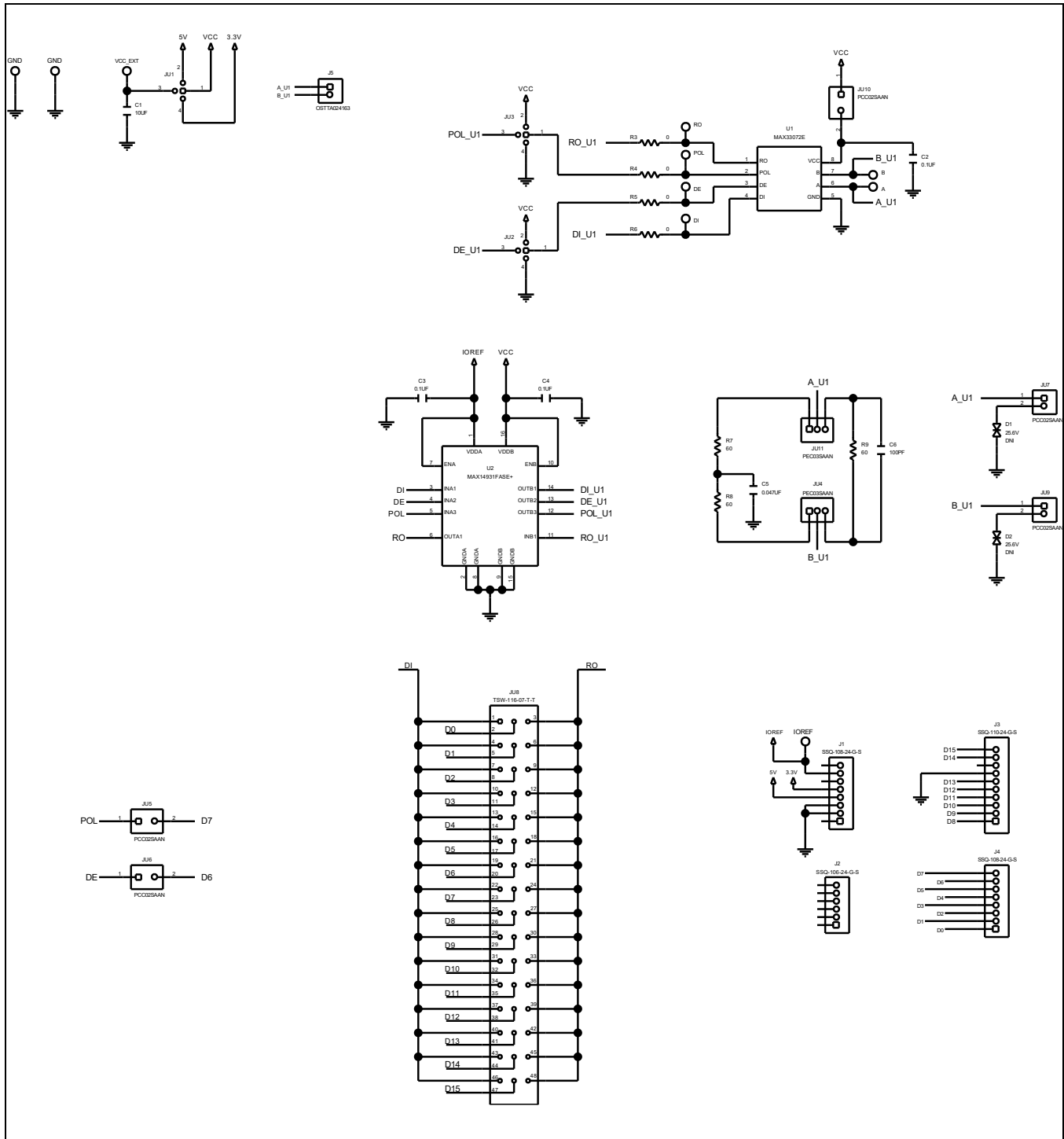
MAX33072E Shield EV Kit PCB Layout
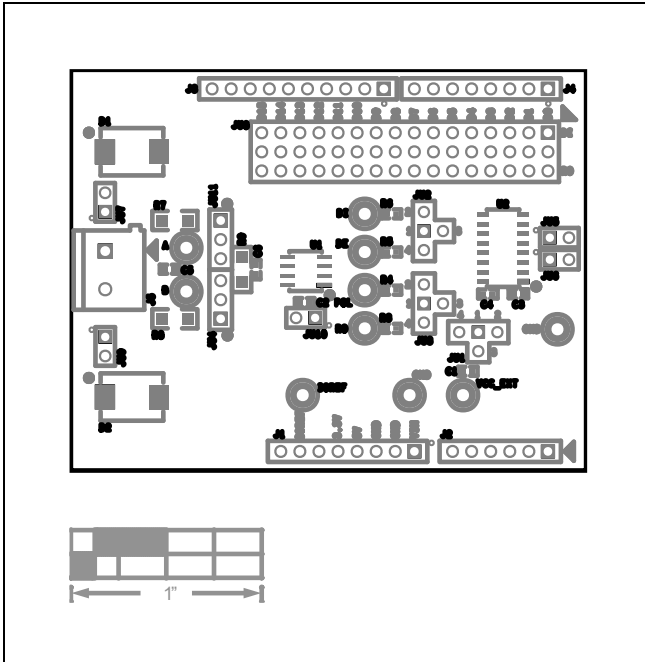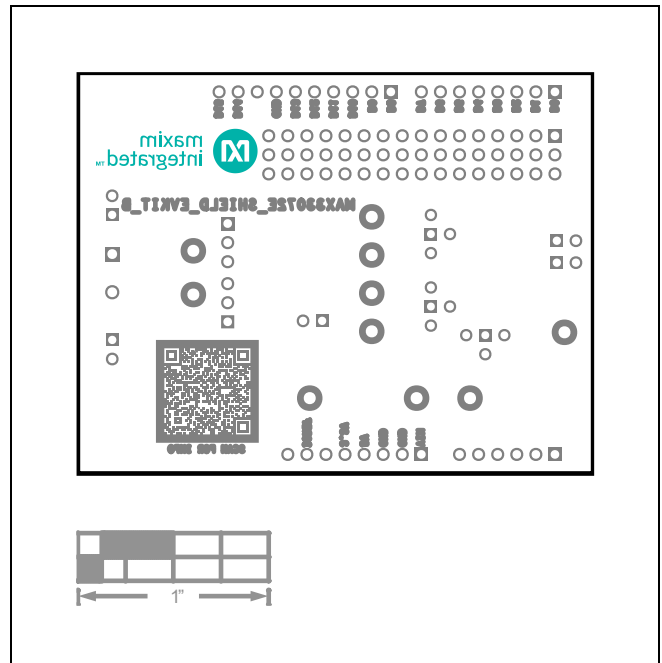

MAX33072/3E EV Kit PCB Layout—Silk Top
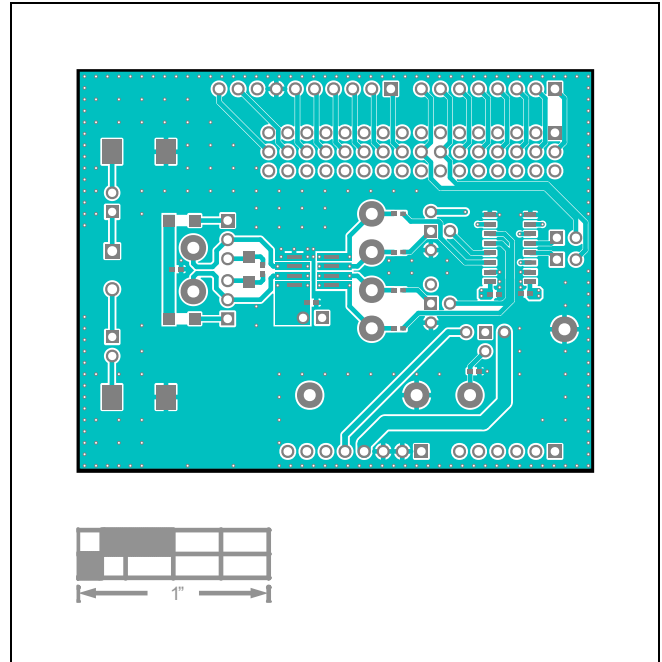
MAX33072/3E EV Kit PCB Layout—Top Layer
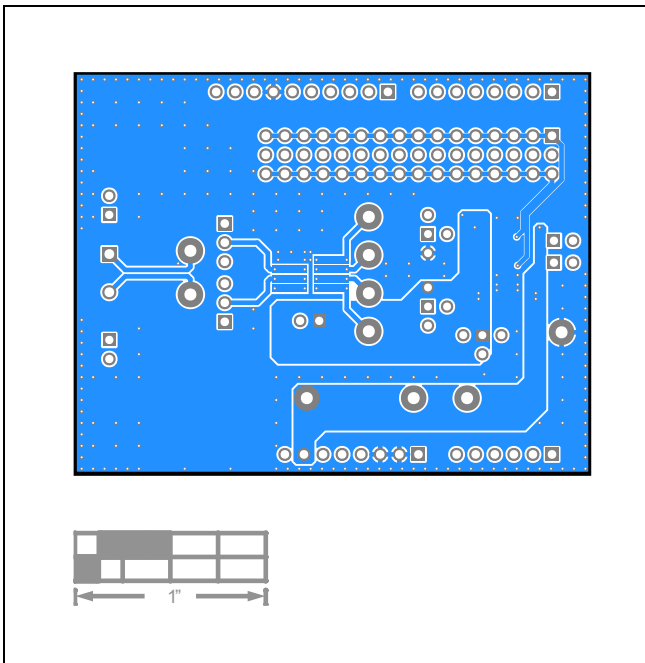
MAX33072/3E EV Kit PCB Layout—Bottom Layer

MAX33072/3E EV Kit PCB Layout—Silk Bottom

Revision History

REVISION NUMBER	REVISION DATE	DESCRIPTION	PAGES CHANGED
0	6/20	Initial release	—
1	7/22	Updated part number in header	All pages

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