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MAX33041E Shield

Evaluates: MAX33041E

General Description

The MAX33041E shield is a fully assembled and tested printed circuit board (PCB) that demonstrates the functionality of the MAX33041E controller area network (CAN) transceiver with $\pm 40V$ fault protection, extended $\pm 25V$ common-mode input range, and $\pm 40kV$ ESD Human Body Model (HBM). The shield features a digital isolator, which is used as a level translator between the CAN transceiver and the controller interface.

Features

- Easy Evaluation of the MAX33041E
- I/O Interface Compatibility from 1.71V to 5.5V
- Proven PCB Layout
- Mbed™/Arduino® Platform Compatible
- Fully Assembled and Tested

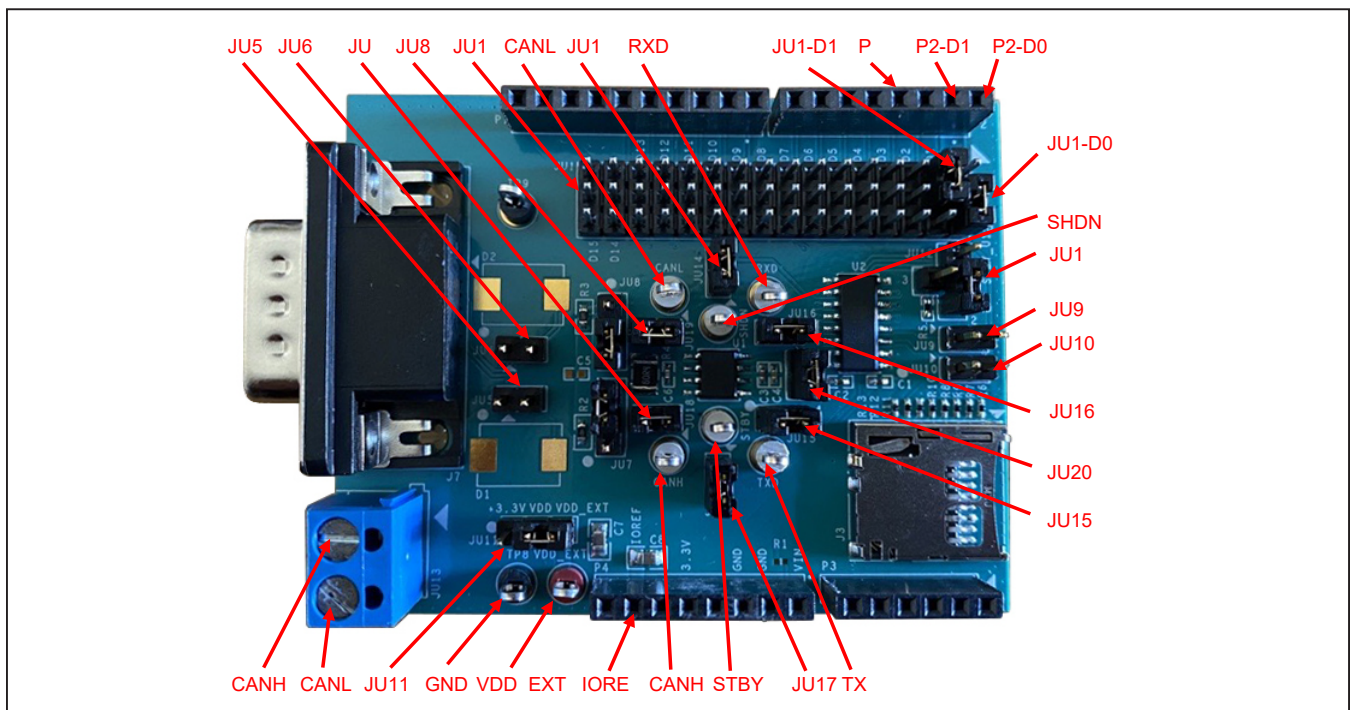
Quick Start

Required Equipment

- MAX33041E shield
- 3.3V, 500mA DC power supply
- Signal/function generator that can generate 2.5MHz square wave signal
- Oscilloscope

Ordering Information appears at end of data sheet.

EV Kit Photo with Jumper and Test Point positions



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Procedure

The following procedure can be used to test the MAX33041E shield as a standalone evaluation board.

- 1) Place the MAX33041E shield on a nonconductive surface to ensure that nothing on the PCB gets shorted to the workspace.
- 2) Set all the jumpers to their default positions as shown in [Table 1](#).
- 3) With +3.3V power supply disabled, connect the positive terminal to the VDD_EXT test point and IOREF (pin 7 of P4). Connect the negative terminal to the GND test point.
- 4) Connect the positive terminal of the function generator to D1 (pin 2 of P2) and negative terminal to any GND test point on the shield. D1 is connected to MAX33041E's TXD pin through the digital isolator (U2).
- 5) Set function generator to the output a 2.5MHz square wave between 0V and 3.3V, and then enable function generator output.
- 6) Turn on the +3.3V DC power supply.
- 7) Connect an oscilloscope probe on D0 (pin 1 of P2) and verify the D0 output signal (RXD) matches the D1 input signal (TXD).

Detailed Description of Hardware

The MAX33041E shield is a fully assembled and tested circuit board for evaluating the MAX33041E fault-protected high-speed CAN transceiver (U1) with $\pm 40V$ of fault protection. The shield is designed to evaluate the MAX33041E alone or in a CAN system. The MAX33041E shield enables Mbed or Arduino platform to communicate on a CAN bus, or it can be used as a standalone evaluation board. The MAX14931 digital isolator is used as a level translator with a 1.71V to 5.5V supply range. Disconnect jumper JU15 to apply the transmitter input signal directly on the TXD test point. Likewise, disconnect the jumper JU16 to measure the receiver output signal directly on the RXD 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 CANH and CANL lines using JU5 and JU6, respectively.

Powering the Board

The MAX33041E shield requires two power supplies: one 3V–3.6V supply for the MAX33041E (U1) transceiver applied at the VDD_EXT test point, and one 1.71V–5.5V supply for the microcontroller domain applied at the IOREF test point. When the shield board is used with an Arduino/Mbed board, the power supply for U1 can also come from the Arduino/Mbed board's 3.3V rail. Place the shunt on 2-3 position of JU11 to connect VDD to the

VDD_EXT pin. Place the shunt of JU11 on 1-2 position to connect VDD of U1 to the Arduino/Mbed 3.3V supply rail. In this scenario, IOREF is directly taken from the Arduino/Mbed header.

On-Board Termination

A properly terminated CAN bus is terminated at each end with the characteristic impedance of the cable. For CAT5 or CAT6 cables, this is typically 120 Ω on each end for a 60 Ω load on the CAN driver. The MAX33041E shield features a selectable 60 Ω load and a 60 Ω –60 Ω split termination circuit between the CANH and CANL driver outputs. The 60 Ω –60 Ω split termination has a footprint for a capacitor to reduce high-frequency noise and common-mode drift. If the board is evaluated in a system and is connected at the end of the cable, then select the 120 Ω (60 Ω –60 Ω split) termination. The termination resistors on the MAX33041E shield should be changed to 60 Ω with a 100pF load (using JU7 and JU8) to simulate a complete system load during evaluation.

TXD and RXD Configuration

Digital channels for TXD and RXD are selected through JU1. It consists of three columns and 16 rows. The columns labeled TXD and RXD are connected to MAX33041E 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 CAN transceiver. [Table 2](#) shows the list of JU1 jumper options.

DB9 Connector

The MAX33041E shield has a DB9 connector to CANH and CANL (pins 7 and 2, respectively).

The MAX33041E shield allows multiple points of connection to the MAX33041E transceiver. The shield board can be placed on a Arduino/Mbed-compatible board to connect all the digital pins (TXD, RXD, STBY, SHDN) through the P1 and P2 headers. These signals can also be connected directly at their respective test points on the board, bypassing the digital isolator (U2). The CANH and CANL signals are connected to a terminal block (JU13) to easily connect to a twisted pair cable. These signals are also routed to a DB9 connector (CANH and CANL on pins 7 and 2, respectively). Alternately, the CANH and CANL test points can be used.

SD Card

The MAX33041E shield has a microSD card socket for easy use in OBD applications. The microSD card is connected to D10–D13 to interface with the Arduino/Mbed board through the SPI interface.

Table 1. Default Jumper Settings

JUMPER	SHUNT POSITION	DESCRIPTION
JU1	-	Refer to Table 2
JU5	1-2	Connects TVS diode (optional, not populated) to CANH
	Open*	Disconnects TVS diode (optional, not populated) from CANH
JU6	1-2	Connects TVS diode (optional, not populated) to CANL
	Open*	Disconnects TVS diode (optional, not populated) to CANL
JU7 and JU8	1-2	Connects 120Ω between CANH and CANL
	2-3*	Connects 60Ω between CANH and CANL
	Open	No load is connected between CANH and CANL
JU9	1-2*	Connects SHDN to D7 of P2
	Open	Disconnects SHDN from D7 of P2
JU10	1-2*	Connects STBY to D6 of P2
	Open	Disconnects STBY from D6 of P2
JU11	1-2	VDD is shorted to 3.3V supply
	2-3*	VDD is shorted to VDD_EXT supply
	Open	VDD is open
JU12	1-2*	Connects STBY to ground
	1-3	Connects STBY to a 39.2kΩ resistor to ground
	1-4	Connects STBY to U2's OUTB1 pin used for Arduino/Mbed interface
	Open	Internal pull up for standby mode
JU14	1-2*	Connects SHDN to U2
	Open	Disconnects SHDN from U2
JU15	1-2*	Connects TXD to U2
	Open	Disconnects TXD from U2
JU16	1-2*	Connects RXD to U2
	Open	Disconnects RXD from U2
JU17	1-2*	Connects STBY to JU12
	Open	Disconnects STBY from JU12
JU18	1-2*	Connects CANH to JU5 and JU7
	Open	Disconnects CANH from JU5 and JU7
JU19	1-2*	Connects CANL to JU6 and JU8
	Open	Disconnects CANL from JU6 and JU8
JU20	1-2*	Connects VDD pin of U1 to VDD supply rail
	Open	Disconnects VDD pin of U1 to VDD supply rail

*Indicates default jumper state.

Table 2. TXD and RXD Jumper Settings

JUMPER	SHUNT POSITION	DESCRIPTION
JU1	1-2	Connects TXD to D0
	4-5*	Connects TXD to D1
	7-8	Connects TXD to D2
	10-11	Connects TXD to D3
	13-14	Connects TXD to D4
	16-17	Connects TXD to D5
	19-20	Connects TXD to D6
	22-23	Connects TXD to D7
	25-26	Connects TXD to D8
	28-29	Connects TXD to D9
	31-32	Connects TXD to D10
	34-35	Connects TXD to D11
	37-38	Connects TXD to D12
	40-41	Connects TXD to D13
	43-44	Connects TXD to D14
	46-47	Connects TXD to D15
	2-3*	Connects RXD to D0
	5-6	Connects RXD to D1
	8-9	Connects RXD to D2
	11-12	Connects RXD to D3
	14-15	Connects RXD to D4
	17-18	Connects RXD to D5
	20-21	Connects RXD to D6
	23-24	Connects RXD to D7
	26-27	Connects RXD to D8
	29-30	Connects RXD to D9
	32-33	Connects RXD to D10
	35-36	Connects RXD to D11
	38-39	Connects RXD to D12
	41-42	Connects RXD to D13
	44-45	Connects RXD to D14
	47-48	Connects RXD to D15

*Indicates default jumper state.

Ordering Information

PART	TYPE
MAX33041ESHLD#	Shield

#Denotes RoHS compliance.

MAX33041E Shield Bill of Materials

ITEM	QTY	REF DES	MFG PART #	DESCRIPTION	MANUFACTURER	STATUS	VALUE
1	3	C1-C3	C0402C104J4RAC; GCM155R71C104JA55	CAPACITOR; SMT (0402); ERAMIC CHIP; 0.1UF; 16V; TOL=5%; MODEL=; TG=- 55 DEGC TO +125 DEGC; TC=X7R	KEMET; MURATA		0.1UF
2	1	C4	C0402X7R160- 103JNP; X7R0402CTT; 0402YC103JAT2A	CAPACITOR; SMT; 0402; CERAMIC; 0.01uF; 16V; 5%; X7R;-55degC to + 125degC; 0 +/-15% degC MAX.	VENKEL LTD;KOA SPEER ELECTRONICS INC;AVX		0.01UF
3	1	C6	C0402C101J5GAC; NMC0402NPO101J; CC0402JRNPO9BN101; GRM1555C1H101JA01; C1005C0G1H101J050BA; CGA2B2C0G1H101J050BA	CAPACITOR; SMT (0402); CERAMIC CHIP; 100PF; 50V; TOL=5%; TG=-55 DEGC TO +125 DEGC; TC=C0G	KEMET; NIC COMPONENTS CORP.; YAGEO PHICOMP; MURATA;TDK;TDK		100PF
4	2	C7, C8	GRM21BR61A106KE19; ECJ-2FB1A106; CL21A106KPCLQNC; GRM219R61A106KE44	CAPACITOR; SMT (0805); CERAMIC CHIP; 10UF; 10V; TOL=10%; MODEL=; TG=- 55 DEGC TO +85 DEGC; TC=X5R	MURATA;PANASONIC; SAMSUNG ELECTRONICS; MURATA		10UF
5	6	CANH, CANL, RXD, SHDN, STBY, TXD	5012	TEST POINT; PIN DIA=0.125IN; TOTAL LENGTH=0.445IN; BOARD HOLE=0.063IN; WHITE; PHOSPHOR BRONZE WIRE SILVER PLATE FINISH;	KEYSTONE		N/A
6	1	J3	502570-0893;5025700893	CONNECTOR; FEMALE; SMT; MICROSD CARD CONNECTOR; RIGHT ANGLE; 10PINS	MOLEX;MOLEX		502570-0893; 5025700893
7	1	J7	182-009-113R531	CONNECTOR; MALE; THROUGH HOLE; D-SUBMINIATURE CONNECTOR; RIGHT ANGLE; 9PINS	NORCOMP		182-009-113R531
8	1	JU1	TSW-116-07-T-T	CONNECTOR; MALE; THROUGH HOLE; 0.025IN SQ POST HEADER; STRAIGHT; 48PINS	SAMTEC		TSW-116-07-T-T
9	11	JU5, JU6, JU9, JU10, JU14-JU20	PBC02SAAN	CONNECTOR; MALE; THROUGH HOLE; BREAKAWAY; STRAIGHT; 2PINS	SULLINS ELECTRONICS CORP.		PBC02SAAN
10	2	JU7, JU8	PBC03SAAN	CONNECTOR; MALE; THROUGH HOLE; BREAKAWAY; STRAIGHT; 3PINS; -65 DEGC TO +125 DEGC	SULLINS		PBC03SAAN

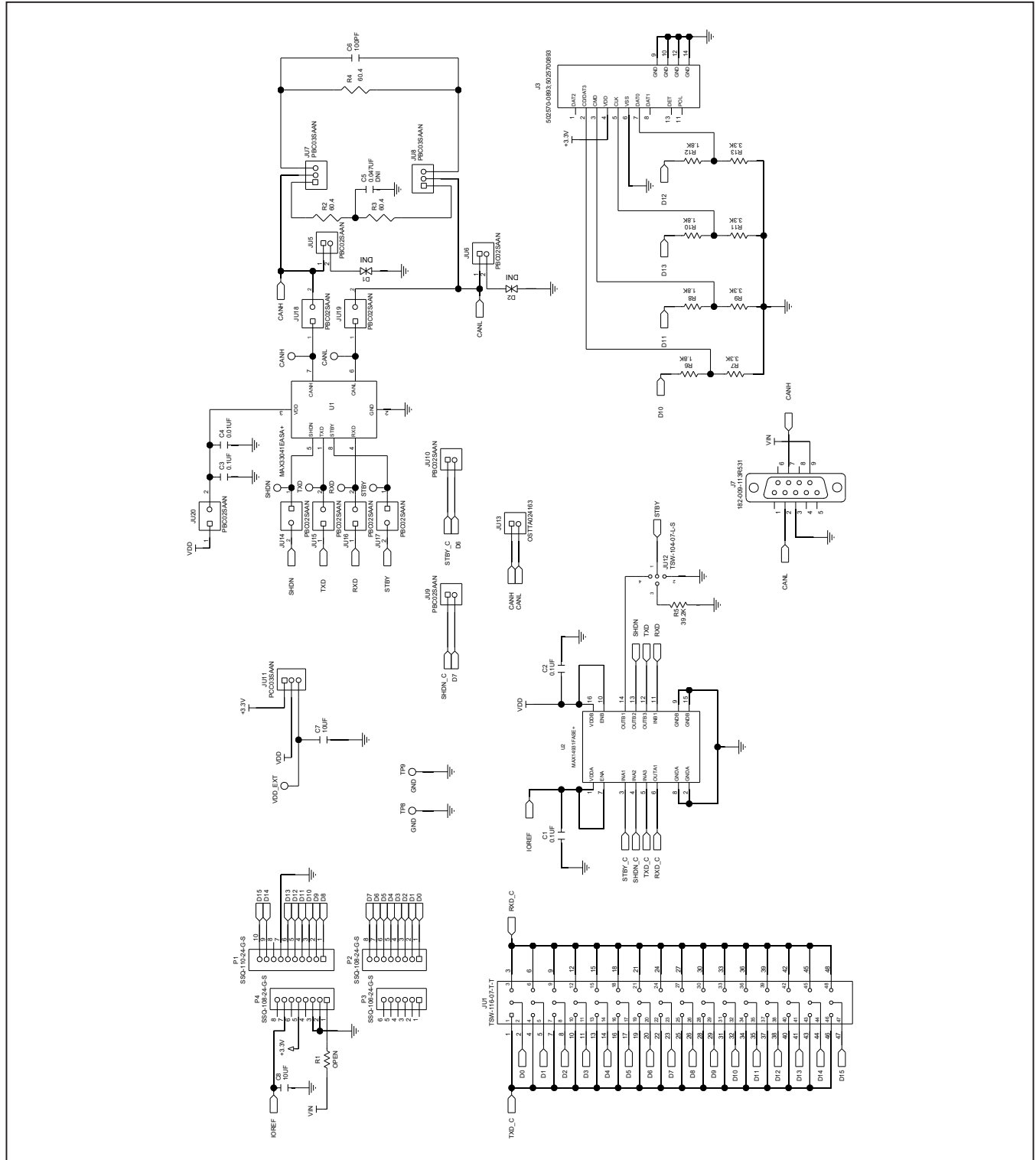
MAX33041E Shield Bill of Materials (continued)

ITEM	QTY	REF DES	MFG PART #	DESCRIPTION	MANUFACTURER	STATUS	VALUE
11	1	JU11	PCC03SAAN	CONNECTOR; MALE; THROUGH HOLE; BREAKAWAY; STRAIGHT THROUGH; 3PINS; -65 DEGC TO +125 DEGC	SULLINS		PCC03SAAN
12	1	JU12	TSW-104-07-L-S	EVKIT PART-CONNECTOR; MALE; THROUGH HOLE; TSW SERIES; SINGLE ROW; STRAIGHT; 4PINS	SAMTEC		TSW-104-07-L-S
13	1	JU13	OSTTA024163	CONNECTOR; FEMALE; THROUGH HOLE; 5.08MM TERM BLOCK CONNECTOR; STRAIGHT; 2PINS; -30 DEGC TO +105 DEGC	ON-SHORE TECHNOLOGY INC.		OSTTA024163
14	1	P1	SSQ-110-24-G-S	CONNECTOR; FEMALE; THROUGH HOLE; .025INCH SQ POST SOCKET; STRAIGHT; 10PINS ;	SAMTEC		SSQ-110-24-G-S
15	2	P2, P4	SSQ-108-24-G-S	CONNECTOR; FEMALE; THROUGH HOLE; .025INCH SQ POST SOCKET; STRAIGHT; 8PINS ;	SAMTEC		SSQ-108-24-G-S
16	1	P3	SSQ-106-24-G-S	CONNECTOR; FEMALE; THROUGH HOLE; .025INCH SQ POST SOCKET; STRAIGHT; 6PINS ;	SAMTEC		SSQ-106-24-G-S
17	2	R2, R3	CRCW060360R4FK	RESISTOR; 0603; 60.4 OHM; 1%; 100PPM; 0.10W; THICK FILM	VISHAY DALE		60.4
18	1	R4	CRCW121060R4FKEAHP	RES; SMT (1210); 60.4R; 1%; +/-100PPM/DEGK; 0.75W	VISHAY DRALORIC		60.4
19	1	R5	ERJ-2RKF3922	RESISTOR; 0402; 39.2K OHM; 1%; 100PPM; 0.10W; METAL FILM	PANASONIC		39.2K
20	4	R6, R8, R10, R12	CRCW04021K80FK; RC0402FR-071K8L	RESISTOR, 0402, 1.8K OHM, 1%, 100PPM, 0.0625W, THICK FILM	VISHAY DALE; YAGEO PHICOMP		1.8K
21	4	R7, R9, R11, R13	CRCW04023K30FK	RESISTOR, 0402, 3.3K OHM, 1%, 100PPM, 0.0625W, THICK FILM	VISHAY DALE		3.3K
22	2	TP8, TP9	5011	TEST POINT; PIN DIA=0.125IN; TOTAL LENGTH=0.445IN; BOARD HOLE=0.063IN; BLACK; PHOSPHOR BRONZE WIRE SILVER PLATE FINISH;	KEYSTONE		N/A

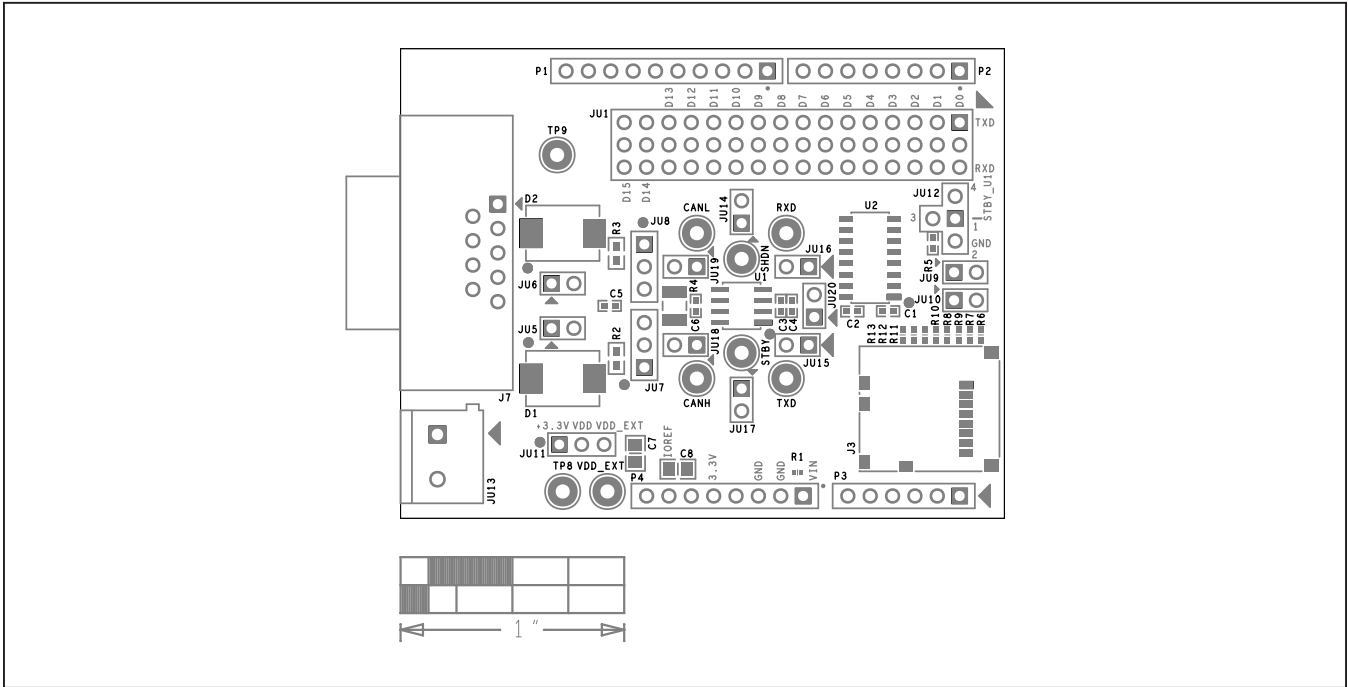
MAX33041E Shield Bill of Materials (continued)

ITEM	QTY	REF DES	MFG PART #	DESCRIPTION	MANUFACTURER	STATUS	VALUE
23	1	U1	MAX33041EASA+	EVKIT PART - IC; MAX33041EASA+; +3.3V; 5MBPS CAN TRANSCEIVER WITH +/-40V FAULT PROTECTION; +/-25VCMR AND +/-40KV ESD; PACKAGE OUTLINE DRAWING: 21-0041; PACKAGE CODE: S8+4; LAND PATTERN DRAWING: 90-0096	MAXIM		MAX33041EASA+
24	1	U2	MAX14931FASE+	IC; DISO; 3/1 CHANNEL; 150MBPS; DEFAULT LOW; 2.75KVRMS DIGITAL ISOLATOR; NSOIC16 150MIL	MAXIM		MAX14931FASE+
25	1	VDD_EXT	5010	TEST POINT; PIN DIA=0.125IN; TOTAL LENGTH=0.445IN; BOARD HOLE=0.063IN; RED; PHOSPHOR BRONZE WIRE SIL;	KEYSTONE		N/A
26	1	PCB	MAX33041ESHIELD	PCB:MAX33041ESHIELD	MAXIM		PCB
27	0	C5	C1005X7R1E473K050BC; GRM155R71E473K; GCM155R71E473KA55	CAPACITOR; SMT (0402); CERAMIC CHIP; 0.047UF; 25V; TOL=10%; TG=-55 DEGC TO +125 DEGC	TDK;MURATA; MURATA	DNP	0.047UF
28	0	D1, D2	SM15T30CA	DIODE; TVS; SMC (DO- 214AB); VRM=25.6V; IPP=36A	ST MICROELECTRONICS	DNP	25.6V
29	0	R1	N/A	RESISTOR; 0402; OPEN; FORMFACTOR	N/A	DNP	OPEN

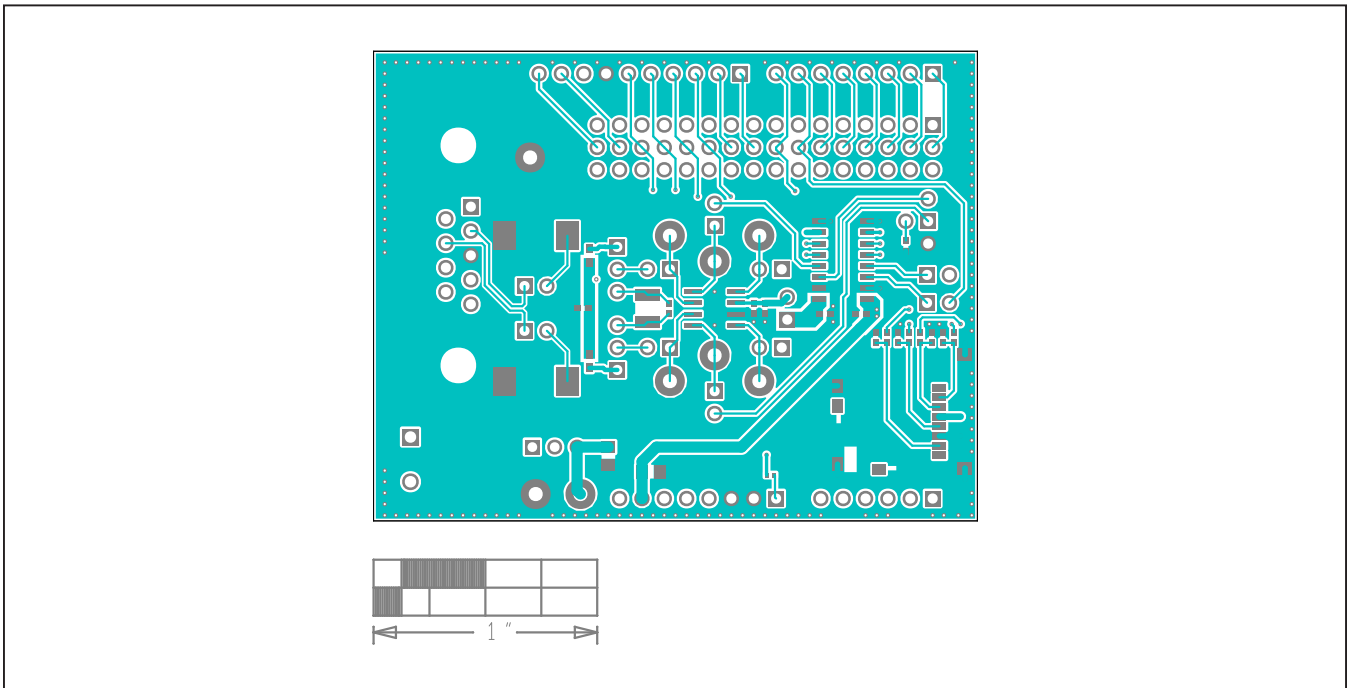
MAX33041E Shield Schematics



MAX33041E Shield PCB Layouts

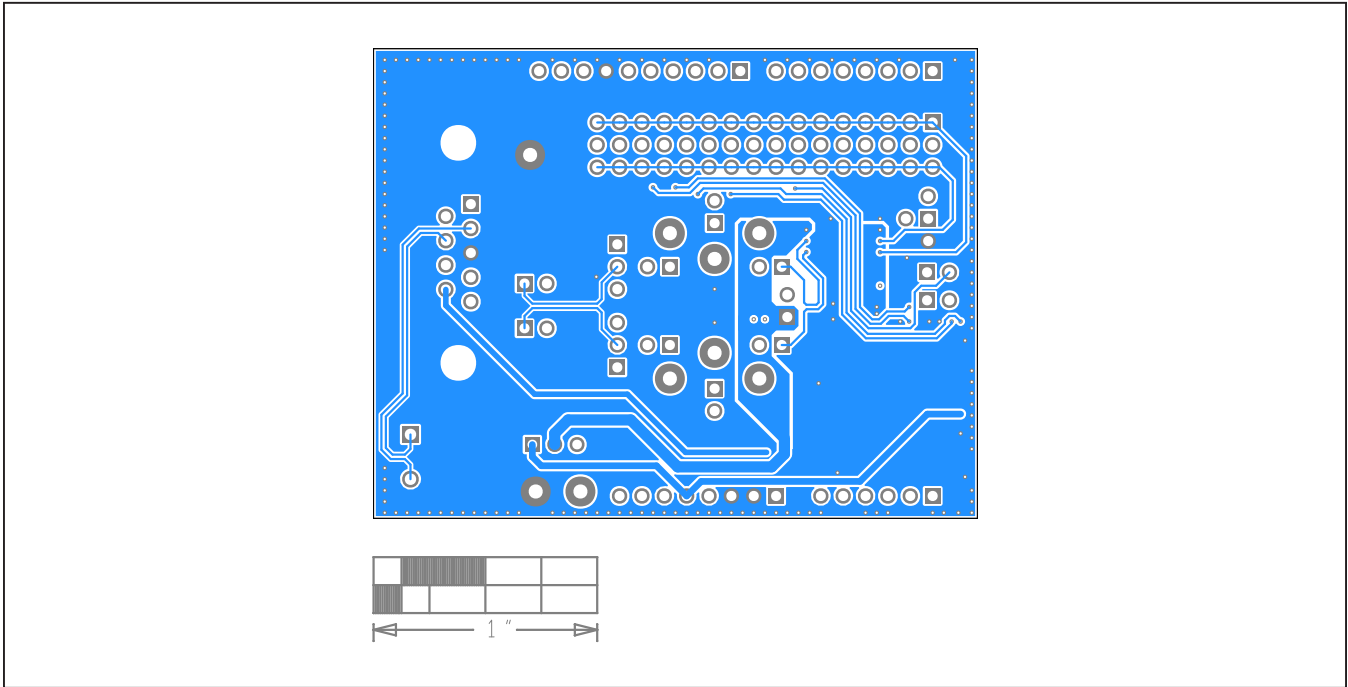


MAX33041E Shield PCB Layout—Top Silkscreen

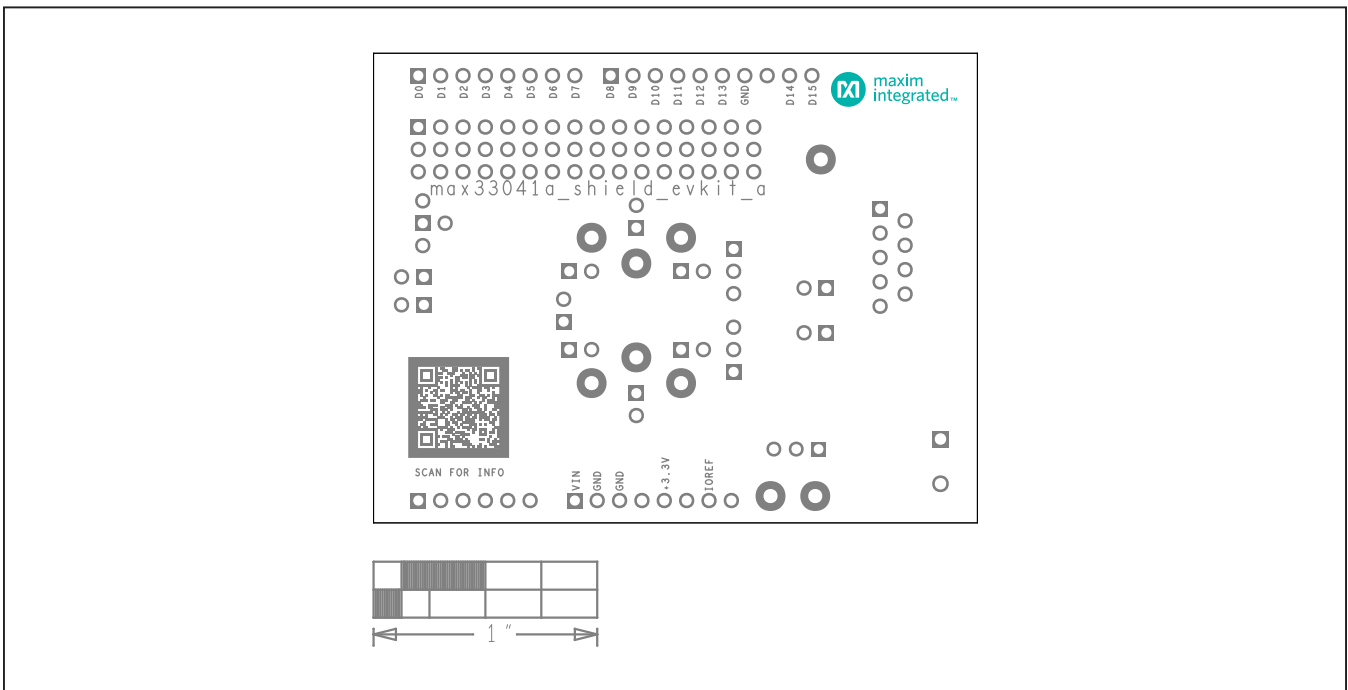


MAX33041E Shield PCB Layout—Top

MAX33041E Shield PCB Layouts (continued)



MAX33041E Shield PCB Layout—Bottom



MAX33041E Shield PCB Layout—Bottom Silkscreen

Revision History

REVISION NUMBER	REVISION DATE	DESCRIPTION	PAGES CHANGED
0	6/21	Initial release	—

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