Click here for production status of specific part numbers.

MAX33012E Shield

Evaluates: MAX33012E

General Description

The MAX33012E Shield is a fully assembled and tested Printed Circuit Board (PCB) that demonstrates the functionality of the MAX33012E, a high ±65V fault-protection, ±25V common mode input range, ±25kV ESD Human Body Model (HBM) controller area network (CAN) transceiver. The Mbed/Arduino shield can also be used as a standalone evaluation board. 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 MAX33012E
- I/O Interface Compatibility From 1.71V to 5.5V
- Proven PCB Layout
- Mbed/Arduino Platform Compatible
- Fully Assembled and Tested

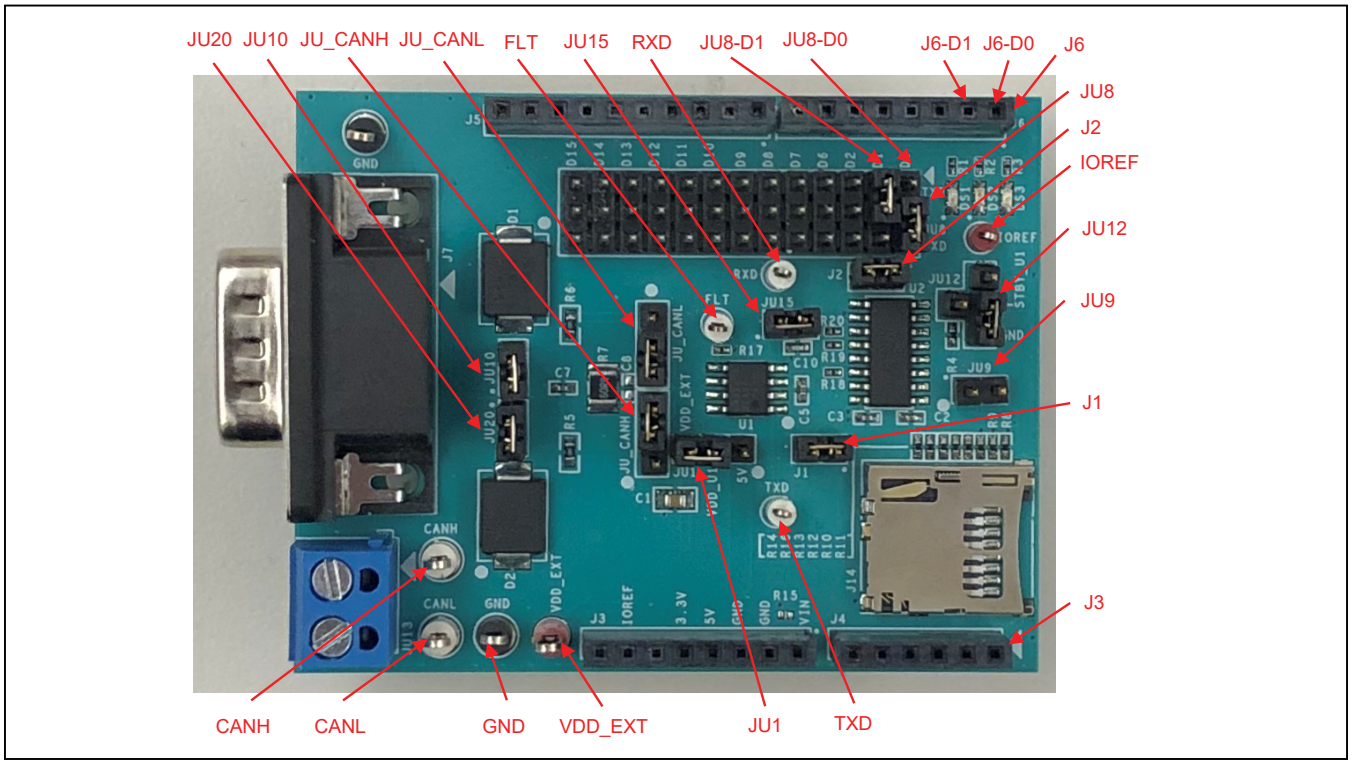
Quick Start

Required Equipments

- MAX33012E Shield
- 5V, 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 Jumpers and Test Points Position



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Procedure

1) Place the MAX33012E Shield on a nonconductive surface to ensure that nothing on the PCB gets shorted to the workspace.
2) Set all jumpers in their default position as shown in Table 1.
3) With +5V power supply disabled, connect the positive terminal to VDD_EXT and IOREF test points. Connect the negative terminal to the GND test point.
4) Connect the positive terminal of the function generator to D1 pin of J6 and negative terminal to any GND test points on the shield.
5) Set function generator to output a 2.5MHz square wave between 0V and 5V, and then enable function generator output.
6) Turn on the +5V DC Power Supply.
7) Connect an oscilloscope probe on RXD test point and verify the RXD output signal matches the TXD input signal.

Transmission Failure, Overcurrent and Overvoltage Fault Detection Procedure

In-order to test the fault detection, 100 pulses on TXD are required to enable the fault detection circuitry. There are 3 different faults that can be tested. After each fault condition is applied, fault pin goes high. Send 16 pulses on TXD to observe the fault code on RXD. Additional 10 pulses on TXD are required to clear the Fault and another 100 pulses on TXD to enable fault detection again.

- Remove jumpers JU_CANH and JU_CANL. As the CAN Bus won't have any termination, MAX33012E will detect "Transmission Failure" fault.
- Connect an oscilloscope probe on RXD test point and verify the RXD output signal shows fault code "110010".
- Overcurrent Fault Detection: Connect a short wire between pin#2 of JU_CANH and pin#2 of JU_CANL. As the CANH and CANL lines are shorted to each other, MAX33012E will detect "Overcurrent" fault.
- Verify that the RXD output signal shows fault code "101010".
- Overvoltage Fault Detection: Remove the wire and follow setup instructions in Figure 1 of the MAX33012E data sheet to observe Overvoltage fault. For Overvoltage fault detection, recommended RCM value is 150Ω and VCM value is 30V.
- Verify that the RXD output signal shows fault code "100110".

Detailed Description of Hardware

The MAX33012E Shield is a fully assembled and tested circuit board for evaluating the MAX33012E fault-protected high-speed CAN transceiver (U1) with ±65V of fault protection, fault detection and reporting. The Shield is designed to evaluate MAX33012E alone or in a CAN system. The MAX33012E Shield enables Mbed or Arduino platform to communicate on a CAN bus. The MAX14932 digital isolator is used as a level translator with a 1.71V to 5.5V supply range.

Powering the Board

The MAX33012E Shield requires one power supply for 5V operation. The power supply can come from an external supply or from the Arduino/Mbed microcontroller's 5V supply. Shunt the JU1 VDD pin to VDD_EXT pin option (2-3 default position) to select the external supply. Shunt JU1 VDD pin to 5V (1-2 position) to connect the Arduino/Mbed 5V supply to VDD.

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 120Ω on each end for a 60Ω load on the CAN driver. The MAX33012E shield features a selectable 60Ω load and a 60Ω-60Ω split termination circuit between the CANH and CANL driver outputs. The 60Ω-60Ω 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 120Ω (60Ω-60Ω split) termination. To simulate a complete system without connecting to another CAN transceiver, change the termination resistors on the MAX33012E Shield to a 60Ω with optional footprint for a 100pF load.

TXD and RXD Configuration

Digital channels for TXD and RXD are selected via JU8. It consists of three columns, and 14 rows. The columns labeled TXD and RXD are connected to MAX33012E through the digital isolator U2. The middle column is the digital I/O pins, D0 to D13. 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 JU8 jumper options.

DB9 Connector

The MAX33012E Shield has a DB9 connector to CANH and CANL (pins 7 and 6, respectively).

SD Card

The MAX33012E Shield has a SD Card socket. The Micro SD card is connected to D10–D13 to interface with Arduino/Mbed board through SPI interface.

Table 1. Table Jumper Settings

JUMPER	SHUNT POSITION	DESCRIPTION
JU_CANH and JU_CANL	1-2	Connects 120.8Ω between CANH and CANL
	2-3*	Connects 60.4Ω between CANH and CANL
	Open	No load is connected between CANH and CANL
JU1	1-2	Connects V_{DD} to 5V supply
	2-3*	Connects V_{DD} to VDD_EXT supply
	Open	Disconnects V_{DD}
JU8	—	Refer to TXD and RXD Configuration in Table 2
JU9 JU10	1-2	Connects STBY to D7 of J6
	Open*	Disconnects STBY from D7 of J6
JU10 JU12	1-2*	Connects TVS diode to CANL
	Open	Disconnects TVS diode from CANL
JU12	1-2*	Connects STBY to ground
	1-3	Connects 26.1KΩ resistor between STBY and ground
	1-4	Connects STBY to the U2's OUTB2 pin used for Arduino/Mbed interface
	Open	Internal pull up for standby mode
JU15	1-2*	Connects 15pF capacitor between receiver output and ground
	Open	Disconnects 15pF capacitor between receiver output and ground
JU20	1-2*	Connects TVS diode to CANH
	Open	Disconnects TVS diode from CANH
J1	1-2*	Connects V_{DDB} on U2 to V_{DD}
	Open	Disconnects V_{DDB} on U2 from V_{DD}
J2	1-2*	Connects FAULT to D2 pin of J6
	Open	Disconnects FAULT

Note: '' indicates default jumper state.*

Table 2. Table TXD and RXD Jumper Setting

JUMPER	SHUNT POSITION	DESCRIPTION
JU8	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

JUMPER	SHUNT POSITION	DESCRIPTION
JU8	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

Note: '' Indicates default jumper state.*

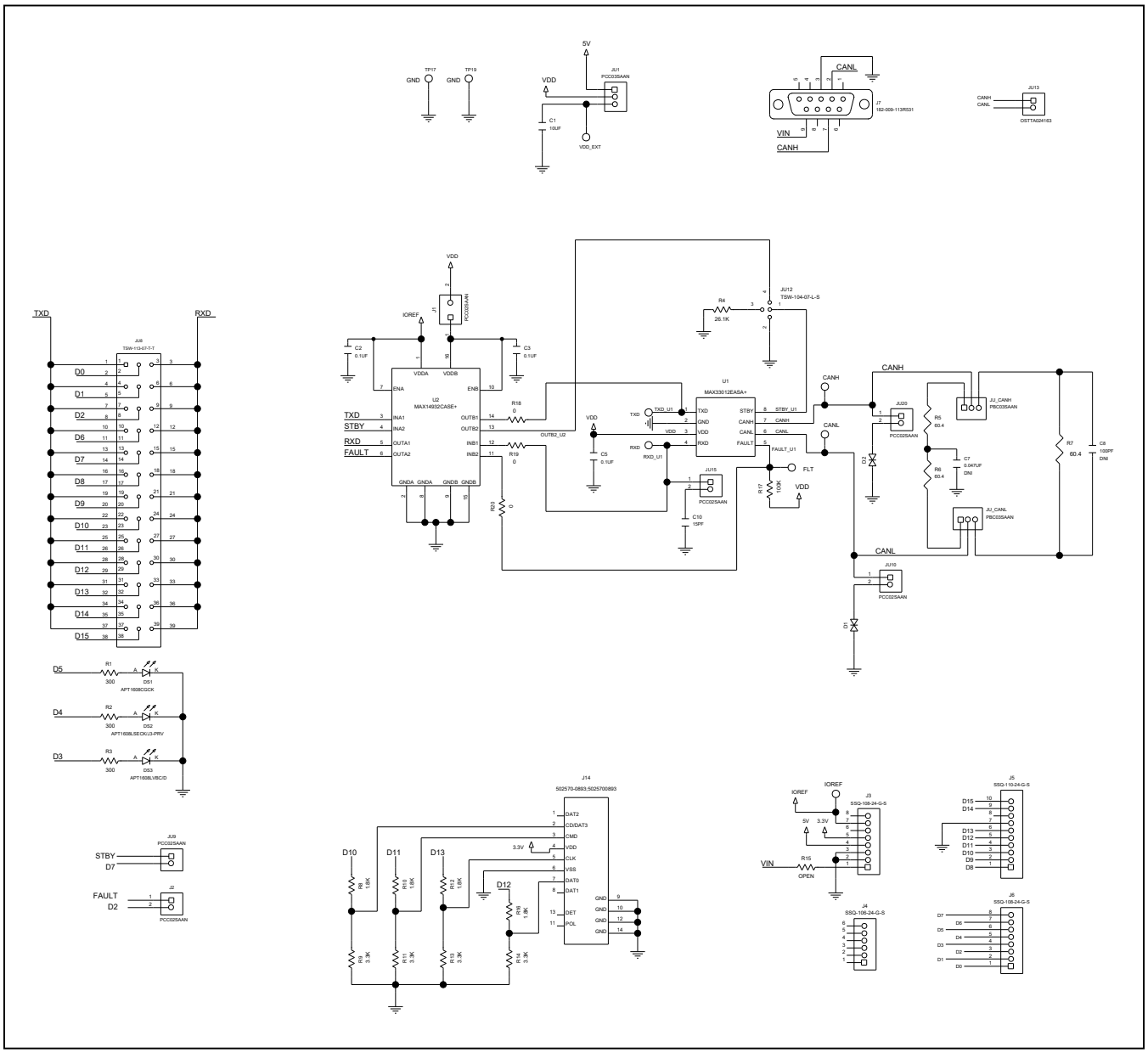
Ordering Information

PART	TYPE
MAX33012ESHLD#	Shield

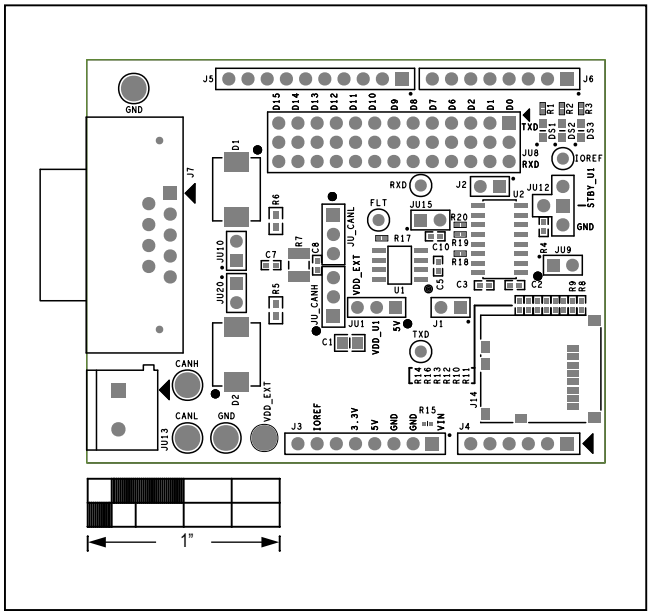
MAX33012E Shield Bill of Materials

ITEM	REF_DES	DNI/DNP	QTY	MFG PART #	MANUFACTURER	VALUE	DESCRIPTION	COMMENTS
1	C1	-	1	CL21B106KPQNNN; LMK212AB7106KG; C0805X106K8RACAUTO	SAMSUNG;TAIYO YUDEN;KEMET	10UF	CAP; SMT (0805); 10UF; 10%; 10V; X7R; CERAMIC CHIP	
2	C2, C3, C5	-	3	C0402C104J4RAC; GCM155R71C104JA55	KEMET;MURATA	0.1UF	CAPACITOR; SMT (0402); CERAMIC CHIP; 0.1UF; 16V; TOL=5%; MODEL=; TG=-55 DEGC TO +125 DEGC; TC=X7R	
3	C7	-	1	C1005X7R1E473K050BC; GRM155R71E473K; GCM155R71E473KA55	TDK;MURATA;MURATA	0.047UF	CAPACITOR; SMT (0402); CERAMIC CHIP; 0.047UF; 25V; TOL=10%; TG=-55 DEGC TO +125 DEGC	
4	C10	-	1	C0402C0G500-150JNP; GRM1555C1H150JA01; GCM1555C1H150JA16	VENKEL LTD.;MURATA;MURATA	15PF	CAPACITOR; SMT (0402); CERAMIC CHIP; 15PF; 50V; TOL=5%; TG=-55 DEGC TO +125 DEGC; TC=C0G	
5	CANH, CANL	-	2	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;	
6	D1, D2	-	2	SM15T30CA	ST MICROELECTRONICS	25.6V	DIODE; TVS; SMC (DO-214AB); VRM=25.6V; IPP=36A	
7	DS1	-	1	APT1608CGCK	KINGBRIGHT	APT1608CGCK	DIODE; LED; STANDARD; GREEN; SMT (0603); PIV=2.1V; IF=0.02A; -40 DEGC TO +85 DEGC	
8	DS2	-	1	APT1608LSECK/J3-PRV	KINGBRIGHT	APT1608LSECK/J3-PRV	DIODE; LED; HYPER RED WATER CLEAR; RED; SMT (0603); VF=1.8V; IF=0.002A	
9	DS3	-	1	APT1608LVBC/D	KINGBRIGHT	APT1608LVBC/D	DIODE; LED; BLUE WATER CLEAR; BLUE; SMT (0603); VF=2.65V; IF=0.002A	
10	FLT, RXD, TXD	-	3	5002	KEYSTONE	N/A	TEST POINT; PIN DIA=0.1IN; TOTAL LENGTH=0.3IN; BOARD HOLE=0.04IN; WHITE; PHOSPHOR BRONZE WIRE SILVER;	
11	IOREF	-	1	5000	KEYSTONE	N/A	TEST POINT; PIN DIA=0.1IN; TOTAL LENGTH=0.3IN; BOARD HOLE=0.04IN; RED; PHOSPHOR BRONZE WIRE SILVER PLATE FINISH;	
12	J1, J2, JU9, JU10, JU15, JU20	-	6	PCC02SAAN	SULLINS	PCC02SAAN	CONNECTOR; MALE; THROUGH HOLE; BREAKAWAY; STRAIGHT THROUGH; 2PINS; -65 DEGC TO +125 DEGC	
13	J3, J6	-	2	SSQ-108-24-G-S	SAMTEC	SSQ-108-24-G-S	CONNECTOR; FEMALE; THROUGH HOLE; .025INCH SQ POST SOCKET; STRAIGHT; 8PINS ;	
14	J4	-	1	SSQ-106-24-G-S	SAMTEC	SSQ-106-24-G-S	CONNECTOR; FEMALE; THROUGH HOLE; .025INCH SQ POST SOCKET; STRAIGHT; 6PINS ;	
15	J5	-	1	SSQ-110-24-G-S	SAMTEC	SSQ-110-24-G-S	CONNECTOR; FEMALE; THROUGH HOLE; .025INCH SQ POST SOCKET; STRAIGHT; 10PINS ;	
16	J7	-	1	182-009-113R531	NORCOMP	182-009-113R531	CONNECTOR; MALE; THROUGH HOLE; D-SUBMINIATURE CONNECTOR; RIGHT ANGLE; 9PINS	
17	J14	-	1	502570-0893;5025700893	MOLEX;MOLEX	502570-0893;5025700893	CONNECTOR; FEMALE; SMT; MICROSD CARD CONNECTOR; RIGHT ANGLE; 10PINS	
18	JU1	-	1	PCC03SAAN	SULLINS	PCC03SAAN	CONNECTOR; MALE; THROUGH HOLE; BREAKAWAY; STRAIGHT THROUGH; 3PINS; -65 DEGC TO +125 DEGC	
19	JU8	-	1	TSW-113-07-T-T	SAMTEC	TSW-113-07-T-T	CONNECTOR; MALE; THROUGH HOLE; 0.025IN SQ POST HEADER; STRAIGHT; 39PINS ;	
20	JU12	-	1	TSW-104-07-L-S	SAMTEC	TSW-104-07-L-S	EVKIT PART-CONNECTOR; MALE; THROUGH HOLE; TSW SERIES; SINGLE ROW; STRAIGHT; 4PINS	
21	JU13	-	1	OSTTA024163	ON-SHORE TECHNOLOGY INC.	OSTTA024163	CONNECTOR; FEMALE; THROUGH HOLE; 5.08MM TERM BLOCK CONNECTOR; STRAIGHT; 2PINS; -30 DEGC TO +105 DEGC	
22	JU_CANH, JU_CANL	-	2	PBC03SAAN	SULLINS	PBC03SAAN	CONNECTOR; MALE; THROUGH HOLE; BREAKAWAY; STRAIGHT; 3PINS; -65 DEGC TO +125 DEGC	
23	R1-R3	-	3	CRCW0201300RFK	VISHAY DALE	300	RES; SMT (0201); 300; 1%; +/-100PPM/DEGK; 0.05W	
24	R4	-	1	CRCW040226K1FK	VISHAY DALE	26.1K	RESISTOR; 0402; 26.1K OHM; 1%; 100PPM; 0.063W; THICK FILM	
25	R5, R6	-	2	CRCW060360R4FK	VISHAY DALE	60.4	RESISTOR; 0603; 60.4 OHM; 1%; 100PPM; 0.10W; THICK FILM	
26	R7	-	1	CRCW121060R4FKEAHP	VISHAY DRALORIC	60.4	RES; SMT (1210); 60.4R; 1%; +/-100PPM/DEGK; 0.75W	
27	R8, R10, R12, R16	-	4	CRCW04021K80FK; RC0402FR-071K8L	VISHAY DALE;YAGEO PHICOMP	1.8K	RESISTOR, 0402, 1.8K OHM, 1%, 100PPM, 0.0625W, THICK FILM	
28	R9, R11, R13, R14	-	4	CRCW04023K30FK	VISHAY DALE	3.3K	RESISTOR, 0402, 3.3K OHM, 1%, 100PPM, 0.0625W, THICK FILM	
29	R17	-	1	CRCW0201100KFK	VISHAY DALE	100K	RESISTOR; 0201; 100K OHM; 1%; 100PPM; 0.05W; THICK FILM	
30	R18-R20	-	3	RC0201JR-070RL	YAGEO	0	RESISTOR; 0201; 0 OHM; 0%; JUMPER; 0.05W; THICK FILM	
31	TP17, 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;	
32	U1	-	1	MAX33012EASA+	MAXIM	MAX33012EASA+	EVKIT PART - IC; TXRX; +5V; 5MBPS CAN TRANSCEIVER WITH +/-65V FAULT PROTECTION FAULT DETECTION AND REPORTING; +/-30V CMR AND +/-25KV ESD PROTECTION; PACKAGE OUTLINE DRAWING: 21-0041; LAND PATTERN NUMBER: 90-0096; PACKAGE CODE: S8+4; NSOIC8	
33	U2	-	1	MAX14932CASE+	MAXIM	MAX14932CASE+	IC; DISO; 4-CHANNEL; 2.75KVRMS DIGITAL ISOLATOR; NSOIC16	
34	VDD_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;	
35	PCB	-	1	MAX33012ESHIELD	MAXIM	PCB	PCB:MAX33012ESHIELD	-
36	C8	DNP	0	C0402C101J5GAC; NMC0402NPO101J; CC0402JRNPO9BN101; GRM1555C1H101JA01; C1005C0G1H101J050BA; CGA2B2C0G1H101J050BA	KEMET;NIC COMPONENTS CORP.; YAGEO PHICOMP;MURATA;TDK;TDK	100PF	CAPACITOR; SMT (0402); CERAMIC CHIP; 100PF; 50V; TOL=5%; TG=-55 DEGC TO +125 DEGC; TC=C0G	
37	R15	DNP	0	N/A	N/A	OPEN	RESISTOR; 0402; OPEN; FORMFACTOR	
TOTAL			60					

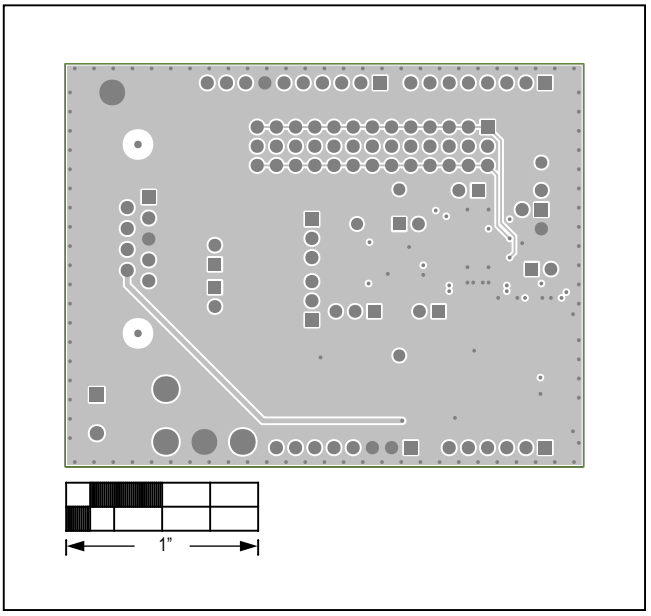
MAX33012E Shield Schematic



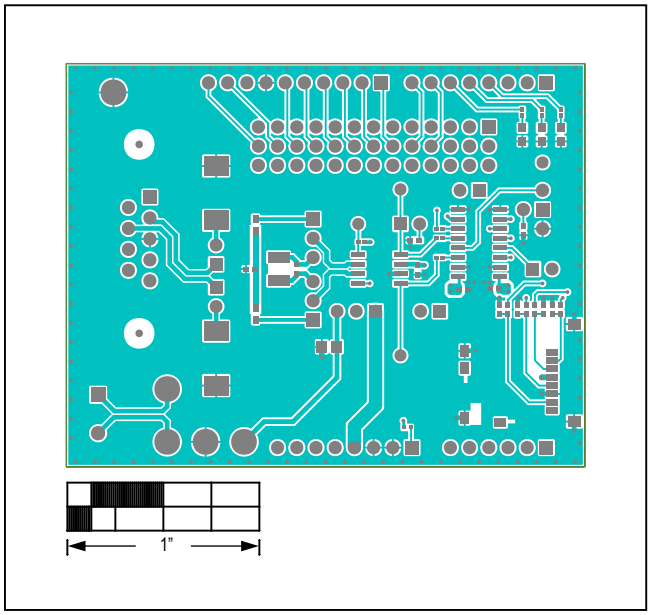
MAX33012E Shield PCB Layout Diagrams



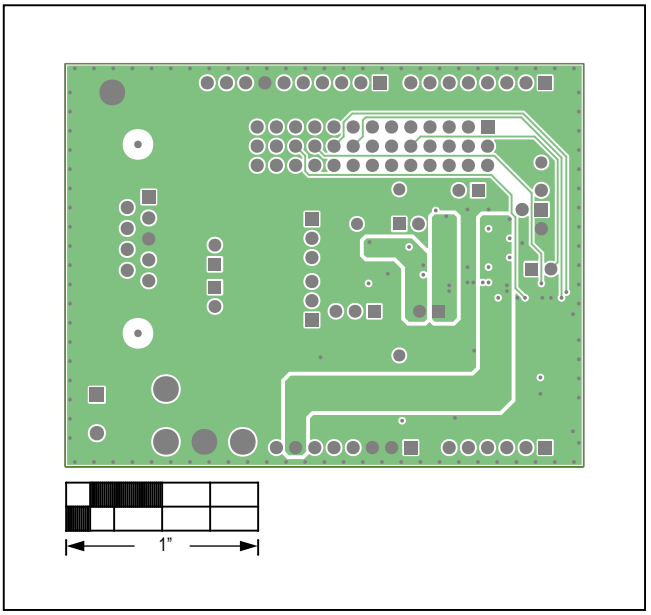
MAX33012E Shield—Top Silkscreen



MAX33012E Shield—Internal 2

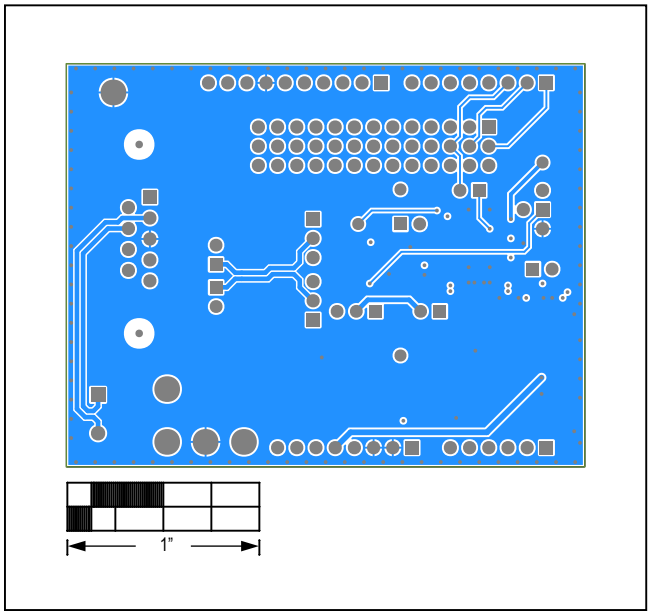


MAX33012E Shield—Top

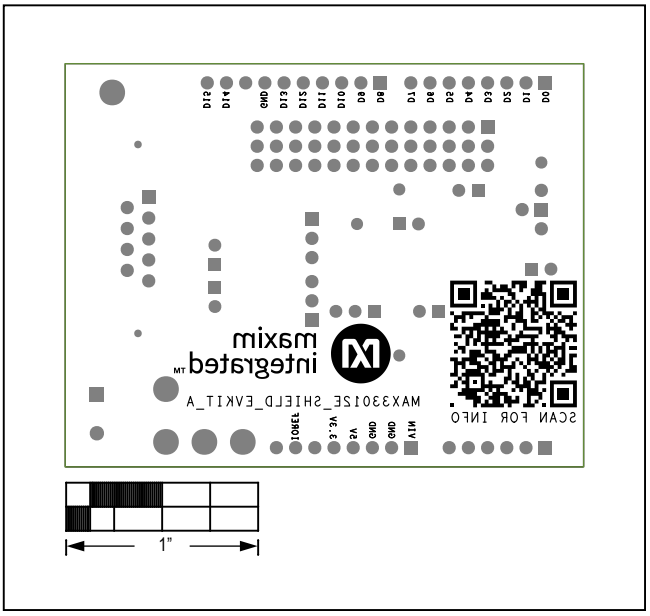


MAX33012E Shield—Internal 3

MAX33012E Shield PCB Layout Diagrams (continued)



MAX33012E Shield—Bottom



MAX33012E Shield—Bottom Silkscreen

Revision History

REVISION NUMBER	REVISION DATE	DESCRIPTION	PAGES CHANGED
0	11/19	Initial release	—

MAXESSENTIAL01+

Description

The Essential Analog toolkit contains a unique collection of Maxim's high-performance, analog building block products. This curated group of parts represent a selection of Maxim’s vast product lines, specific to 20 product categories, from key performance areas including power efficiency, precise measurement, reliable connectivity, and robust protection.

The ICs in the toolkit offer the breadth of each product category: low power, low noise, multi-channel, high resolution, high accuracy, and high speed. All these features empower your designs and bring value to your systems.

At 6.4cm x 8.9cm x 1.3cm, the box itself is small, lightweight, and easy to carry. Products are guarded from ESD using a gel and ESD-protected box.

A guide that labels each of the part types inside the box supports the toolkit. Go to the Maxim website to find more information for the individual part numbers.

When planning your next design, pick up an Essential Analog toolkit to review Maxim’s high-performance analog products.

Key Features

- Small, 6.4cm x 8.9cm x 1.3cm Package
- ESD Protection-Lined Package
- Accelerate Your Design with Quick Access

What's Included in the Box?

Efficient Power				
Buck	**Boost**	**Buck-Boost**	**LDO**	**Continua**
MAX38640 MAX15026	MAX17225 MAX668	MAX77827 MAX77816	MAX38902B MAX1510	MAX38888
Precision Measurement				
ADC	**DAC**	**Audio Amp**	**Op Amp**	**CSA**
MAX11410 MAX11168	MAX5541 MAX5715	MAX98357A MAX98390	MAX40075 MAX40100	MAX44284 MAX40201
Reliable Connectivity				
RS-485	**RS-232**	**CAN**	**BTR Switch**	**Wireless**
MAX14780E MAX3485AE	MAX13235E MAX33250E	MAX13054A MAX33054E	MAX14778 MAX14763	MAX41460 MAX7034
Robust Protection				
Supervisor	**Temp Sensor**	**Isolator**	**Ideal Diode/V_{REF}**	**RTC**
MAX16150 MAX16140	MAX6680 MAX31875	MAX12930 MAX22445	MAX40203 MAX6078A	MAX31341B DS3231MZ