MAX31334 Evaluation Kit

General Description

The MAX31334 shield evaluation kit (EV kit) is a fully assembled and tested PCB to evaluate the MAX31334, an ultra-low power, low-cost, real-time clock (RTC) with integrated power switch, I^2C interface, and power management. The shield EV kit operates from a single supply (either from USB or external power supply) and the onboard crystal provides a 32.768kHz clock signal. This device is accessed through an I^2C serial interface provided by a MAX32625PICO board connected to a PC by a USB port.

The MAX31334 shield EV kit provides the hardware and software graphic user interface (GUI) necessary to evaluate the MAX31334. The kit includes an installed MAX31334. It connects to the PC through a MAX32625 PICO board and a micro-USB cable.

Features

- Easy Evaluation of the MAX31334
- +1.1V to +5.5V Single-Supply Operation
- Proven PCB Layout
- Fully Assembled and Tested

EV Kit Contents

- Assembled circuit board, including the MAX31334
- Assembled MAX32625PICO I^2C circuit board
- Micro-USB cable

MAX31334 EV Kit Files

FILE	DESCRIPTION
MAX31334EVKIT.exe	Installs EV kit files onto computer

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

Windows is a registered trademark and registered service mark of Microsoft Corporation.

Quick Start

Required Equipment

- One DC power supply capable of supplying +1.1V to +5.5V (typical +3.0V used in the following instructions)
- One pico ammeter for measuring the current
- One oscilloscope
- One micro-USB cable
- One assembled MAX32625PICO I^2C circuit board
- One MAX31334 shield EV kit

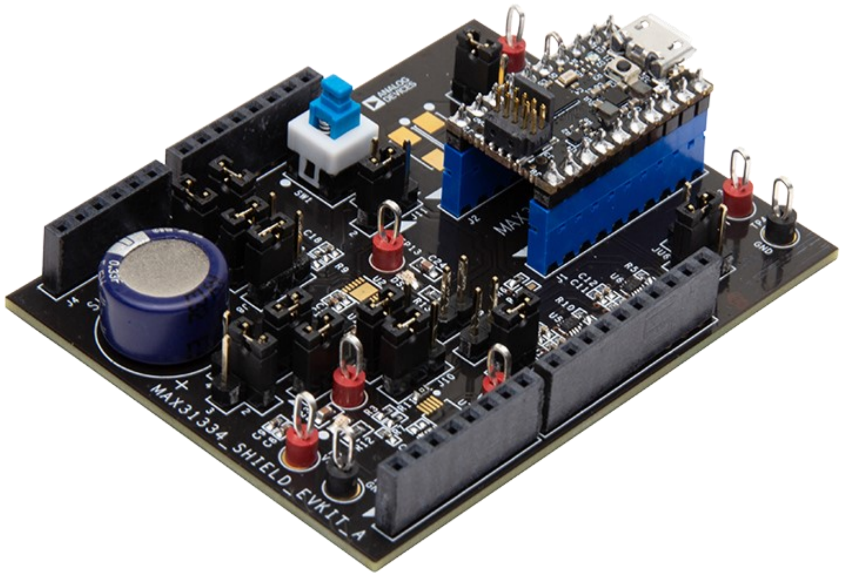
Procedure

The EV kit is fully assembled and tested. Note: In the following sections, software-related items are identified by bolding. Text in **bold** refers to items directly from the evaluation software. Text in **bold and underlined** refers to items from the Windows® operating system. Follow these steps to verify board operation.

1. Place the MAX31334 EV kit on a nonconductive surface to ensure that nothing on the PCB gets shorted to the workspace.
2. Set the jumpers to their default positions as shown in *Table 1* to test the WLP package variant (U1) of MAX31334.
3. With the output of the power supply set to +3.0V and disabled, connect the positive terminal of the DC supply to VCC_EXT and the negative terminal to the GND of the EV kit.
4. Connect the MAX32625PICO I^2C circuit board to the EV kit at its location (*Figure 1*).
5. Connect the micro-USB cable between the MAX32625PICO board and PC/laptop.
6. Enable the +3.0V DC power supply.
7. Click on the Design and Development tab on the *product folder page* to download the latest version of the MAX31334 real-time clock EV kit software, then run the control software.
8. Open the MAX31334 real-time clock EV kit software; this displays the **MAX31334 Real-Time Clock EV Kit Software Monitor** page and shows “USB Connected” in the lower right corner.
9. Verify that the clock has started counting by checking the “**Auto Update**” box under Real Time Monitoring.
10. Configure the desired date and time in the **Date/Time Configuration** section and click the **SET** button to update it in the **Real Time Monitoring** section.

319-100946; Rev 0; 8/22

EV Kit Photo



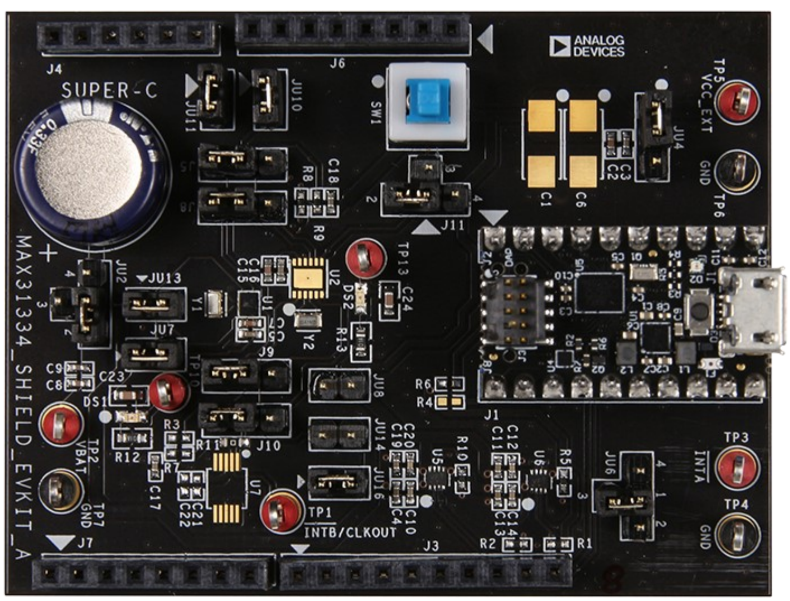


Figure 1. MAX31334 EV Kit Board Connections

Table 1. Jumper Connection Guide

JUMPER	SHUNT POSITION	DESCRIPTION
JU2	1–2*	Connects VBAT pin to TP2.
	1–3	Connects VBAT pin to GND.
	1–4	Connects VBAT pin to supercapacitor.
JU4	1–2*	System VCC is powered by VCC_EXT at TP5.
	2–3	System VCC is powered by a +3.3V supply from Arm® Mbed™/Arduino®/PICO platform.
JU6	1–2	Connects $\overline{INTA}$ pin of U1 to ground.
	1–3*	Connects $\overline{INTA}$ pin of U1 to Mbed/Arduino/PICO platform through a level translator (U5)
	1–4	Connects $\overline{INTA}$ pin of U1 to test point TP3 with a 10kΩ pullup resistor to system VCC.
JU7	1–2*	System VCC connects to VCC pin of U1.
	OPEN	Float VCC pin of U1. Connect an ammeter between pin 1 and pin 2 to measure the current consumption of U1.
JU8	1–2	System VCC powers U2 VCC pin.
	OPEN*	Floats VCC pin of U2. Connect an ammeter between the pins of JU8 to measure the current.
JU10	1–2*	Connects SDA pin of U1 and U2 to Mbed/Arduino/PICO platform for GUI control.
	OPEN	Floats SDA pin for user's own I^2C control.
JU11	1–2*	Connects SCL pin of U1 and U2 to Mbed/Arduino/PICO platform for GUI control.
	OPEN	Floats SCL pin for user's own I^2C control.
JU13	1–2*	Connects power backup selection VBAT at JU2 to VBAT pin of U1.
	OPEN	Floats VBAT pin of U1 for user's signal input.
JU14	1–2	Connects power backup selection VBAT at JU2 to VBAT pin of U2.
	OPEN*	Floats VBAT pin of U2 for user's signal input.
JU16	1-2*	Connects $\overline{INTB}$/CLKOUT pin of U1 to Mbed/Arduino/PICO platform for GUI control.
	OPEN	Floats $\overline{INTB}$/CLKOUT pin for user's own control.
J5	1–2	Connect SDA line to U2
	2-3*	Connect SDA line to U1
J8	1–2	Connect SCL line to U2
	2-3*	Connect SCL line to U1
J9	1–2	Connect $\overline{INTA}$ test point to U2
	2-3*	Connect $\overline{INTA}$ test point to U1
J10	1–2	Connect $\overline{INTB}$ test point to U2
	2-3*	Connect $\overline{INTB}$ test point to U1

**Default options*

System V_{CC} is labeled VCC on the PCB.

Detailed Description

The MAX31334 is an ultra-low power, real-time clock (RTC) time-keeping device that consumes a nominal 70nA timekeeping current, extending battery life. It features an integrated high-side power pass switch that enables ultra-low-power idle modes on duty-cycled applications by disconnecting power to other devices on the system. The MAX31334 supports a wide range of 32.768kHz crystals. Crystals with any capacitive loading (CL) spec can be used, which broadens the pool of usable crystals for this device. This device is accessed through an I^2C serial interface. The device also features a backup supply (VBAT) and automatically switches over to the backup supply (VBAT) when the main supply (VCC) drops below the programmed threshold voltage and the backup supply (VBAT) voltage.

Other features include two time-of-day alarms, interrupt outputs, a programmable square-wave output, event detection input with timestamping, and a serial bus timeout mechanism. The 32-byte timestamp registers double as RAM storage. The device features a digital Schmitt trigger input (DIN) which can be used to record timestamps and/or generate an interrupt on the falling/rising edge of the DIN signal. The clock/calendar provides seconds, minutes, hours, day, month, year, and date information. A 1/128 second register is available for a sub-second timestamp resolution. The date at the end of the month is automatically adjusted for months with fewer than 31 days, including corrections for leap year. The clock operates in a 24-hour/12-hour format.

Functional Test Procedure

Current Draw at Time-Keeping Operation

1. To measure the current drawn under normal Real-Time Clock conditions without any interrupt or clock input/output, do the following:
    a. In the **RTC Configuration** section, click the **Read** button.
    b. Disable CLKOUT.
    c. Select 1Hz for Frequency.
2. For WLP version (U1), remove the jumper from JU7 and connect the pico ammeter between pin 1 and pin 2 of JU7.
3. In the **Registers** tab under the **Register Map** section, click the **Read** button and ensure that the value of register 0x03 (RTC_Config1) shows 0x01. Otherwise, set it to 0x01 and click the **Write** button. Now the reading in the picometer is the current from MAX31334 only. It should be around 70nA.

NOTE: All instruments need to be disconnected from the I/O ports of the IC, since any loading would add current consumption.

4. Remove pico ammeter and replace the jumper on JU7 (for WLP version)

Setting the Clock

In the **Configuration & Time** tab in the **Date/Time Configuration** section, enter the start point of the date and time and then click **Set**. The clock starts to count from the set point after the **Status Log** shows “Write successful”. In the **Real Time Monitoring** section, verify that the clock is counting from the written start date and time.

Clock Output Measurement

In the **Configuration & Time** tab in the **RTC Configuration** section, enable CLKOUT and select the desired CLKOUT frequency. The clock output can be monitored using an oscilloscope connected to $\overline{INTB}$/CLKOUT. A frequency counter can also be used to measure the clock frequency accurately. Refer to the *Oscillator Circuit and Clock Accuracy* section in the MAX31334 data sheet to correct any clock accuracy error.

Alarm Interrupt Output

On the **Alarms & Timer** tab in the **Alarm 1 Configuration** section, select the **Repetition Rate** to set the alarm scenario. In the **Interrupts** subsection of the **Interrupts & Flags** section, check the **Alarm 1 Interrupt** box. In the **Flags** subsection, click the **Read** button twice to clear the alarm flag bit if it has been previously set. When the RTC reaches the alarm time set in **Alarm 1 Configuration**, the alarm output at $\overline{INTB}$ goes from high to low. It changes to high again by clicking the **Read** button in the **Flags** subsection. The interrupt status can also be checked by clicking the **Read** button in the **Flags** subsection. Repeat the same steps for Alarm 2, but measure the alarm interrupt output at $\overline{INTA}$.

Note: Both Alarm 1 and Alarm 2 can be output on $\overline{INTA}$ when CLKOUT is enabled.

Timer Interrupt

Clear all interrupt bits by clicking the **Read** button in the **Flags** subsection. Enable the timer and interrupt by checking **Timer Enable** in the **Timer Configuration** section and **Timer Interrupt** in the **Interrupts** subsection, then select 16Hz on **Timer Frequency**. Set the **Timer Init** number to a value, such as 200. When the Timer Count reading reaches 0 from 200, the interrupt output at $\overline{INTA}$/CLKIN should go from high to low.

Power Switch

1. On **Power Switch Configuration** tab, clear the SLP bit by clicking the **Read** button in the configuration subsection.
2. Check the power switch status at **Real time Monitoring** section, the status should be ON.
3. Select the Timer selection at Configuration/Wakeup Enable section.
4. Toggle SLP bit from 0 to 1, check the power switch status in the Real time Monitoring section; the status should be OFF.
5. On the **Alarms & Timer** tab, enable the timer based on “Timer Interrupt” setup guide.
6. When the timer count reading reaches 0, the power switch status should be back to ON.

Power Mode Select

On the **Configuration & Time** tab in the **Power Management** section, the trickle charger can be enabled to charge the onboard supercapacitor as a backup battery. The **Supply Select** drop-down list can be used to select the source of the power supply. VCC means that the IC uses the main supply and VBAT means that the IC uses the supply from the backup battery. The backup battery source can be either be the onboard supercapacitor or external backup supply that is connected to the TP2 (VBAT) test point. In Auto, the supply switches between VCC and VBAT automatically based on the PV Fail threshold setting. To verify which supply is utilized, click the **READ** button in the **Flags** subsection. Also, the supercapacitor voltage at VBAT (JU2-VBAT) can be charged to “VCC minus diode drop voltage” at a selectable rate in the drop-down list.

Time Stamping Mode

On the **TimeStamp** tab in the **TimeStamp Configuration** section, click on the **TimeStamp Enable** toggle button to enable the TimeStamp Mode. Any of the three TimeStamp event log conditions can be configured by toggling the respective event enable toggle buttons in the **Record TimeStamp on** section. The **TimeStamps** sub tab displays the exact time of four consecutive event logs with appropriate event flag. The **TimeStamp Overwrite** toggle button can be used to log the first four events or the last four events. Using the RESET button clears all the four TimeStamp Registers. Refer to the *TimeStamp* section in the MAX31334 data sheet for more information.

RAM Register Mode

On the **TimeStamp tab** in the **TimeStamp Configuration** section, disable the **TimeStamp Enable** toggle button (default) to use the TimeStamp Mode. Reset the TimeStamp registers by clicking the **RESET** button each time after entering RAM Register Mode. The 32-byte TimeStamp registers are now available for use as RAM registers as displayed in the **RAM** sub tab.

Ordering Information

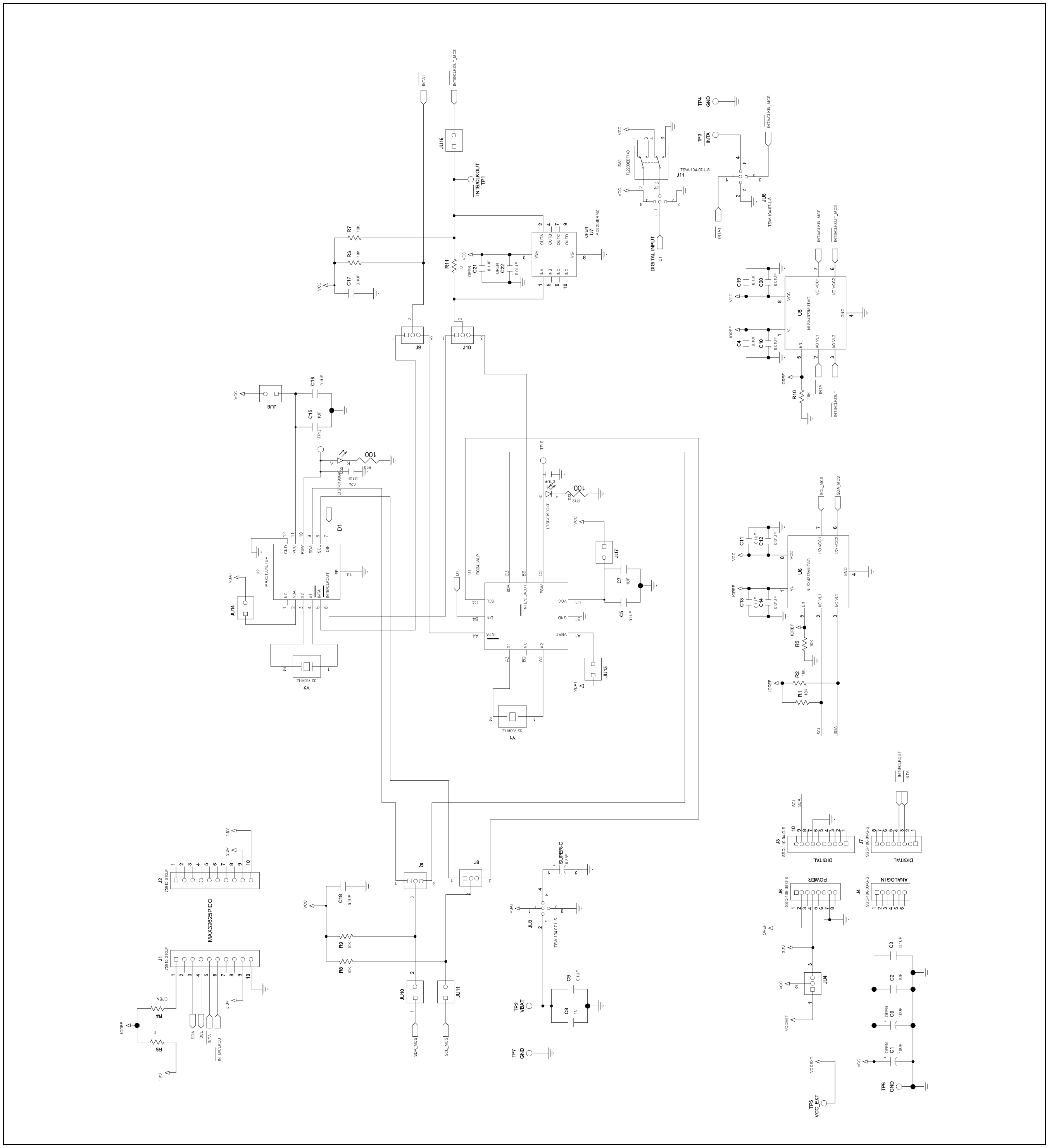
PART	TYPE
MAX31334SHLD#	EV Kit

#Denotes RoHS-compliant.

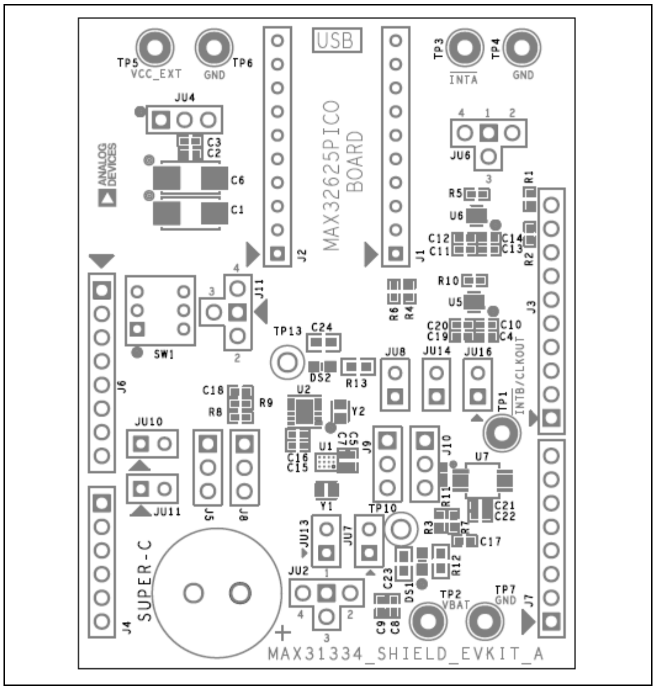
MAX31334 EV Kit Bill of Materials

REF DES	MFG PART #	VALUE	DESCRIPTION
C2, C7, C8, C15	CL05B105KQ5NQNC	1UF	CAP; SMT (0402)
C3, C5, C9, C16-C18	CL05B104KQ5NNN	0.1UF	CAP; SMT (0402)
C4, C11, C13, C19	C1005X7R1C104K050BC	0.1UF	CAP; SMT (0402)
C10, C12, C14, C20	C0402C103J3RAC	0.01UF	CAP; SMT (0402)
C23, C24	C1608X7R1E104K080AA	0.1UF	CAP; SMT (0603)
J1, J2			CONNECTOR; 10PINS
J5, J8-J10, JU4			CONNECTOR; 3PINS
J11, JU2, JU6			CONNECTOR; 4PINS
JU7, JU8, JU10, JU11, JU13, JU14, JU16			CONNECTOR; 2PINS
R1, R2, R5, R10	ERJ-2GEJ103	10K	RES; SMT (0402); 10K
R3, R7-R9	RC0402FR-0710KL	10K	RES; SMT (0402); 10K
R6	RC0402JR-070RL	0	RES; SMT (0402
R11	CRCW06030000Z0	0	RES; SMT (0603
SU2, SU4, SU6-SU8, SU10, SU11, SU13-SU16			TEST POINT
SUPER-C	KW-5R5C334-R	0.33F	CAP; THROUGH HOLE-RADIAL LEAD; 0.33F
SW1	TL2230EEF140		SWITCH
TP1-TP3, TP5			TEST POINT
TP4, TP6, TP7			TEST POINT
TP10, TP13			TEST POINT
U1	MAX31334EWC+		ADI RTC IC WLP
U2	MAX31334ETB+		ADI RTC IC QTFN
U5, U6	NLSX4373MUTAG	NLSX4373MUTAG	IC; LEVEL TRANSLATOR
Y1, Y2	NX2012SA-32.768K-EXS00A	32.768KHZ XTAL	CRYSTAL; SMT; 32.768KHZ; 6PF
C1, C6			DO NOT INSTALL
C21			DO NOT INSTALL
C22			DO NOT INSTALL
J3			DO NOT INSTALL
J4			DO NOT INSTALL
J6			DO NOT INSTALL
J7			DO NOT INSTALL
R4			DO NOT INSTALL
U7			DO NOT INSTALL
DS1, DS2			DO NOT INSTALL
R12, R13			DO NOT INSTALL

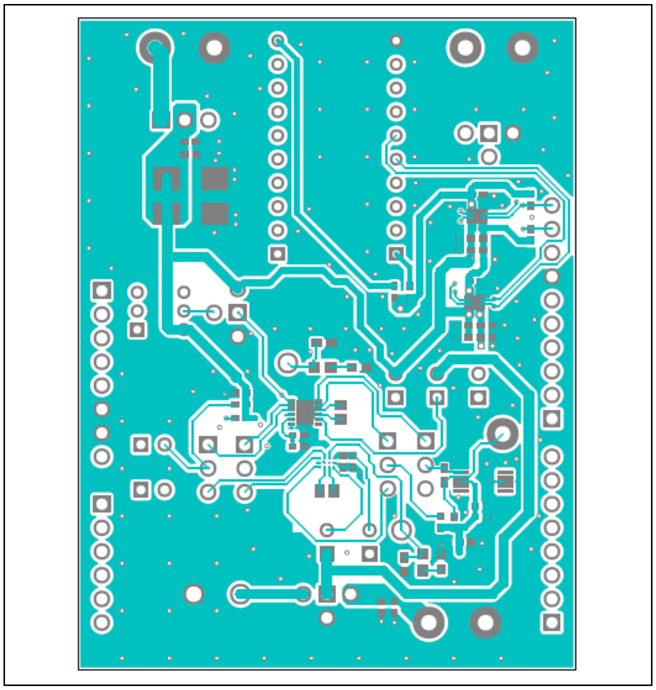
MAX31334 EV Kit Schematic



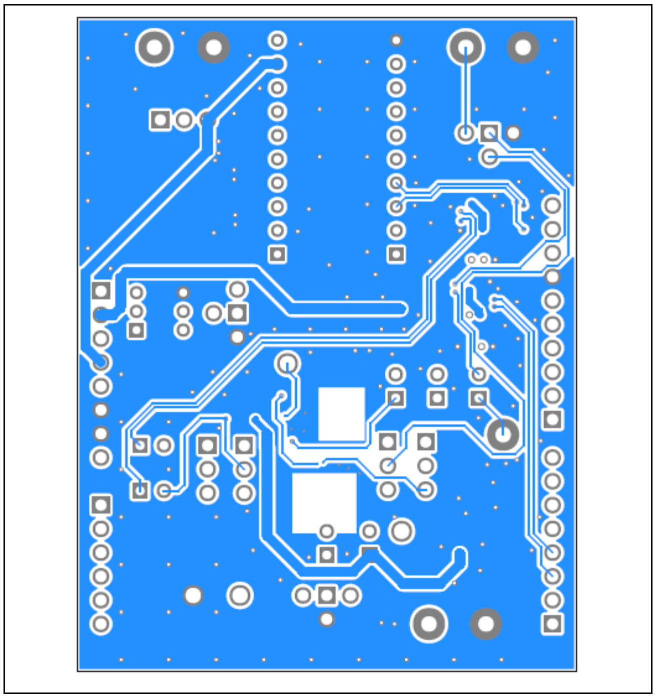
MAX31334 EV Kit PCB Layout



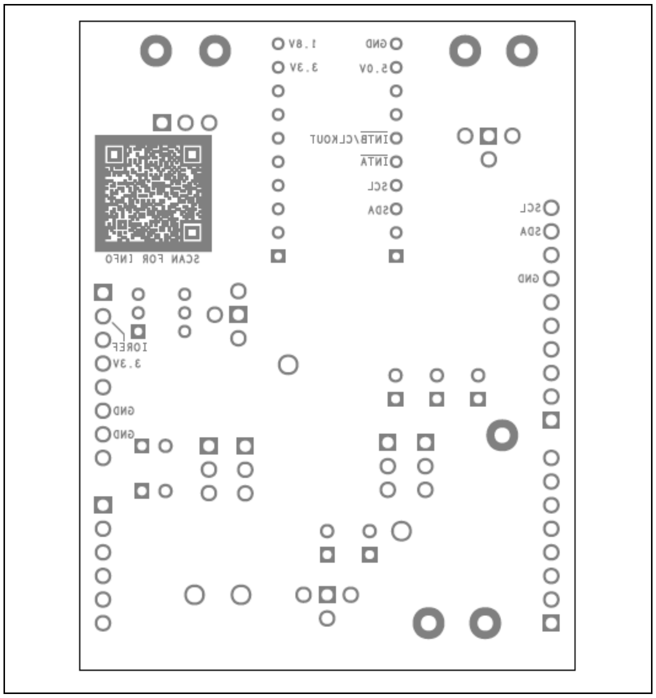
MAX31334 EV Kit PCB Layout—Top Silkscreen



MAX31334 EV Kit PCB Layout—Top Layer



MAX31334 EV Kit PCB Layout—Bottom Layer



MAX31334 EV Kit PCB Layout— Bottom Silkscreen