MAX31341 Shield Evaluation Kit

Evaluates: MAX31341B/MAX31341C

General Description

The MAX31341 Shield evaluation kit (EV kit) is a fully assembled and tested PCB to evaluate the MAX31341B and MAX31341C, low-cost, extremely accurate, real-time clocks (RTCs) with I2C interface and power management. The EV kit operates from a single supply, either from USB or an external power supply, and the onboard crystal provides a 32.768kHz clock signal. This device is accessed through an I2C serial interface provided by a MAX32625PICO board from a PC USB port.

The MAX31341 Shield EV kit provides the hardware and software user interface (GUI) necessary to evaluate the MAX31341B and MAX31341C. The EV kit includes a MAX31341B and a MAX31341C installed. It connects to the PC through a MAX32625 PICO board and a Micro USB cable.

Features

- Easy Evaluation of the MAX31341B and MAX31341C
- +1.6V to +3.6V Single-Supply Operation
- Proven PCB Layout
- Fully Assembled and Tested

EV Kit Contents

- Assembled MAX32625PICO I2C circuit board
- Micro USB cable
- Assembled circuit board, including the MAX31341B and MAX31341C

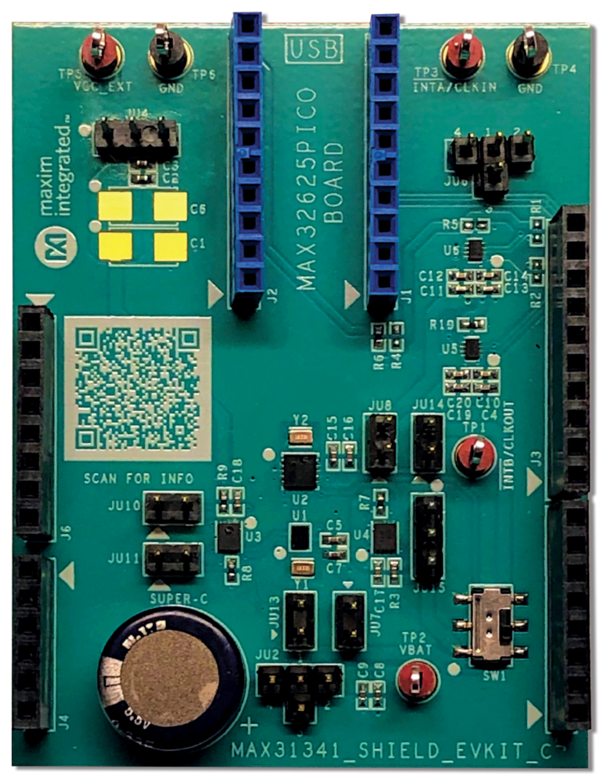
***Ordering Information** appears at end of data sheet.*

Quick Start

Required Equipment

- One DC power supply capable of supplying +1.6V to +3.6V (typical +3.0V used in the following instructions)
- One pico ammeter for measuring the current
- One oscilloscope
- One Micro USB cable
- One assembled MAX32625PICO I2C circuit board
- One MAX31341 Shield EV kit

EV Kit Photo



Procedure

The EV kit is fully assembled and tested. Follow these steps to verify board operation.

1) Place the MAX31341 Shield 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 Figure 1a for testing the WLP IC and Figure 1b for testing the TDFN IC.
3) With the output of the power supply set to +3.0V and disabled, connect the positive terminal of the DC supply to the VCC_EXT and negative terminal to the GND of the EV kit.
4) Connect the MAX32625PICO I2C circuit board to the EV kit at the location shown as DS3900 (Figure 2).
5) Connect the Micro USB cable between the MAX32625PICO Board and PC/laptop.
6) Turn on the +3.0V DC power supply.
7) Visit **here** to download the latest version of the MAX31341 RTC EV kit software, and run the control software.
8) Open the MAX31341B/C RTC Shield software. The MAX31341B/C RTC Shield Software **Configuration & Time** tab will open, showing **USB Connected** (Figure 3) in the lower right corner.
9) At power-up, the MAX31341B/C is in idle mode; no clock is running yet. On the **Configuration & Time** tab, in the **RTC Configuration** section, enable **Oscillator Enable** to start the clock. Verify the clock has started counting by checking the **Auto Update** box in the **Real Time Monitoring** section.

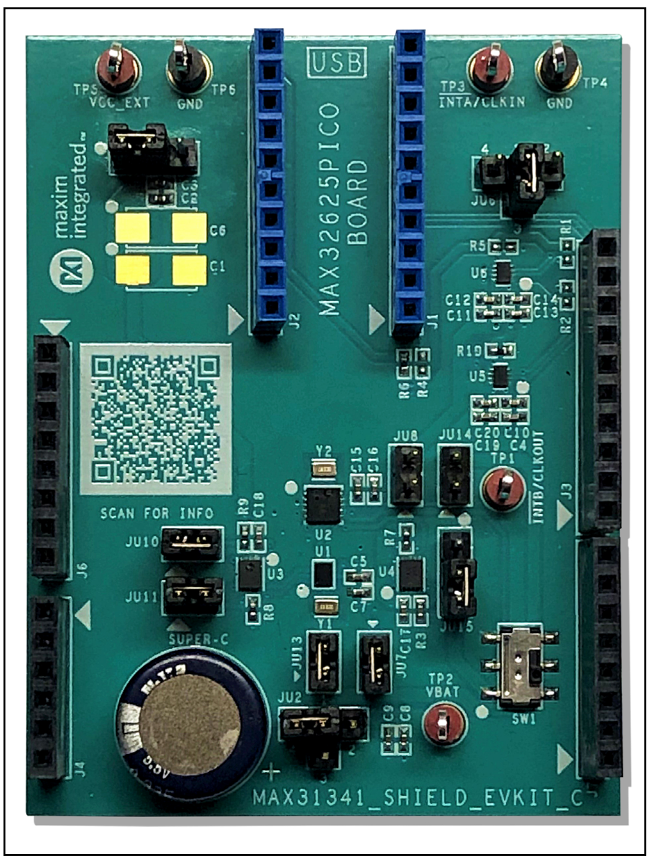


Figure 1a. WLP_Jumper Setting

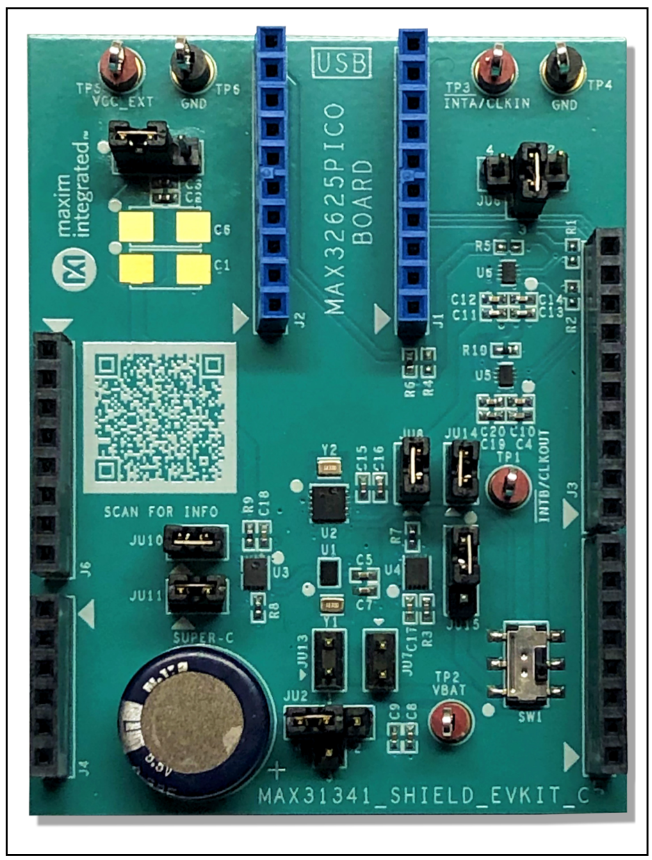


Figure 1b. TDFN_Jumper Setting

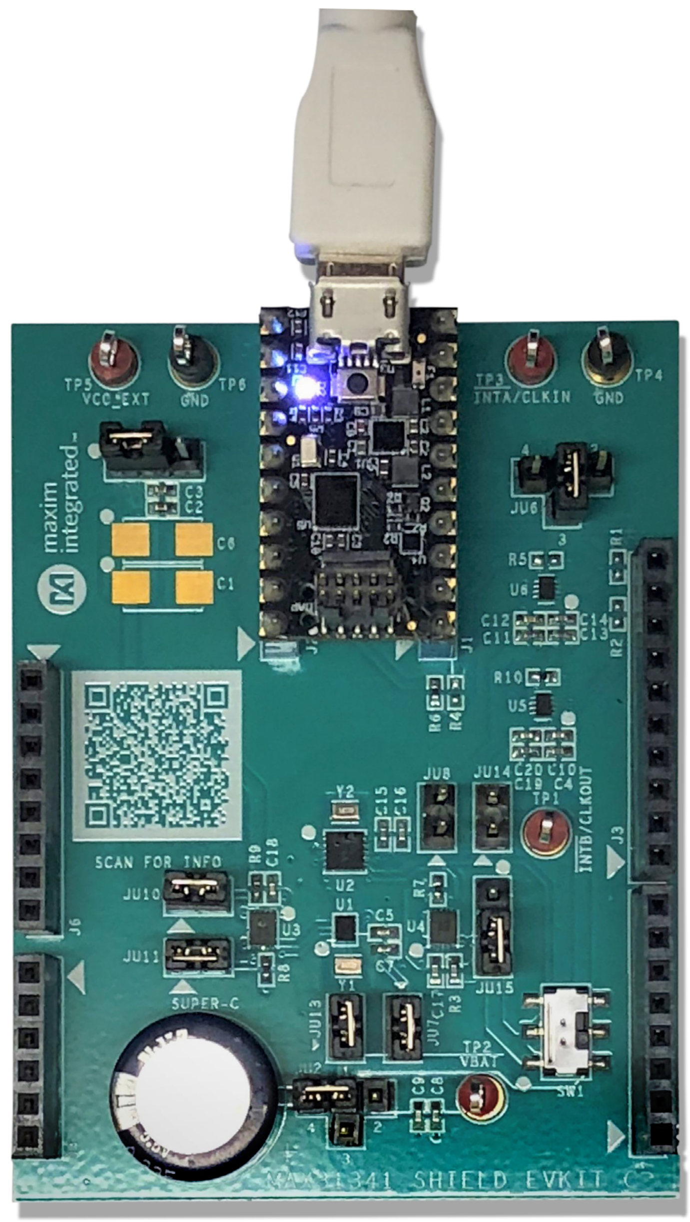


Figure 2. USB Connection

Detailed Description

The MAX31341B/MAX31341C low-current RTCs are time-keeping devices that provide time-keeping current in nanoamperes, thus extending battery life. The MAX31341B/MAX31341C support 6pF high-ESR crystals, which broaden the pool of usable crystals for the devices. These devices are accessed through an I^2C serial interface. The devices feature one digital Schmitt trigger input and one programmable threshold analog input. The devices generate an interrupt output on a falling or rising edge of the digital input (D1), or when the analog input (AIN) voltage crosses a programmed threshold in either direction. An integrated power-on reset function ensures deterministic default register status upon power-up.

Other features include two time-of-day alarms, interrupt outputs, a programmable square-wave output, a serial bus timeout mechanism, and a 64-byte RAM for user data storage. The clock/calendar provides seconds, minutes, hours, day, date, month, and year information. 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 24-hour format. The MAX31341B/MAX31341C also include an input for synchronization. When a reference clock (e.g., 32kHz, 50Hz/60Hz power line, GPS 1PPS) is present at the CLKIN pin and the enable external clock input bit (ECLK) is set to 1, the MAX31341B/MAX31341C RTC is frequency-locked to the external clock and the clock accuracy is determined by the external source.

Functional Test Procedure

Current Draw at Time-Keeping Operation

1) To measure the current draw under normal RTC conditions without any interrupt or clock input/output, do the following:
   - In the **RTC Configuration** section, press the **Read** button.
   - Disable **CLKIN** and **CLKOUT**.
   - Select **1Hz** for **Frequency**.
2) Remove the jumper from JU7 (for the MAX31341B) or JU8 (for the MAX31341C) and connect the pico ammeter between pins 1 and 2 of JU7 or JU8.
3) On the **Registers** tab (Figure 5), in the **Register Map** section, press the **Read** button and make sure that the value of register 0 (Config_reg1) shows 0x41. Otherwise, set it to 0x41 and press the **Write** button. Now the reading in the picometer is the current from the MAX31341B or MAX31341C only. It should be around 210nA.

Note: All instruments must be disconnected from the I/O ports of the IC, since any loading would add current consumption. Also, be sure that the waiting duration from power-up to the current reading is long enough (30min) due to on-board capacitor charging.

4) Remove the pico ammeter and put the jumper back on JU7 or JU8.

Setting the Clock

On the **Configuration & Time** tab in the **Date/Time Configuration** section, enter the start point of 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

On 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 INTB/CLKOUT. A frequency counter can also be used to measure the clock frequency accurately.

Alarm Interrupt Output

On the **Alarms & Timer** tab in the **Alarm 1 Configuration** section, select the **Repetition Rate** to set the alarm scenario (such as **Min**, **Sec** at 02:00). In the **Interrupts** subsection of the **Interrupts & Flags** section, check the **Alarm 1 Interrupt** box. In the **Flags** subsection, press 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 INTA/CLKIN will go from high to low. It will change to high again by pressing the **Read** button in the **Flags** subsection. The interrupt status can also be checked by pressing **Read** button in the **Flags** subsection. Repeat the same steps for Alarm 2, but measure the alarm interrupt output at INTB/CLKOUT.

Note: When testing alarm interrupts, CLKIN and CLKOUT in the RTC Configuration section need to be disabled.

Timer Interrupt

Clear all interrupt bits by pressing 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 such as 200. When the **Timer Count** reading reaches 0 from 200, the interrupt output at INTA/CLKIN should go from high to low.

Power Mode Select

On the **Configuration & Time** tab in the **Power Management** section, in the **Comparator Mode** drop-down list there are two options: **AIN Interrupt Mode** for normal I/O operation, and **Power Management & Trickle Charger** mode for Power Management and Trickle Charger mode which charges the on-board supercapacitor as a backup battery.

In **Power Management & Trickle Charger** mode, the **Supply Select** drop-down list can be used to select the source of the power supply. **Force VCC** means the IC uses the main supply and **Force VBAT** means the IC gets the supply from the backup battery; from either source, the on-board supercapacitor or external backup supply is injected from the **TP2 (VBAT)** test point. In **Auto**, the supply switches between VCC and VBAT automatically based on the threshold set in the **Analog Interrupt** section. To verify which supply is utilized, the clock output can be monitored while changing the power-supply mode with VCC and VBAT in different voltages. Also, the supercapacitor voltage at **Analog IN** (JU2-AIN) can be charged to "VCC minus diode drop voltage" at a selectable rate in the pull-down table.

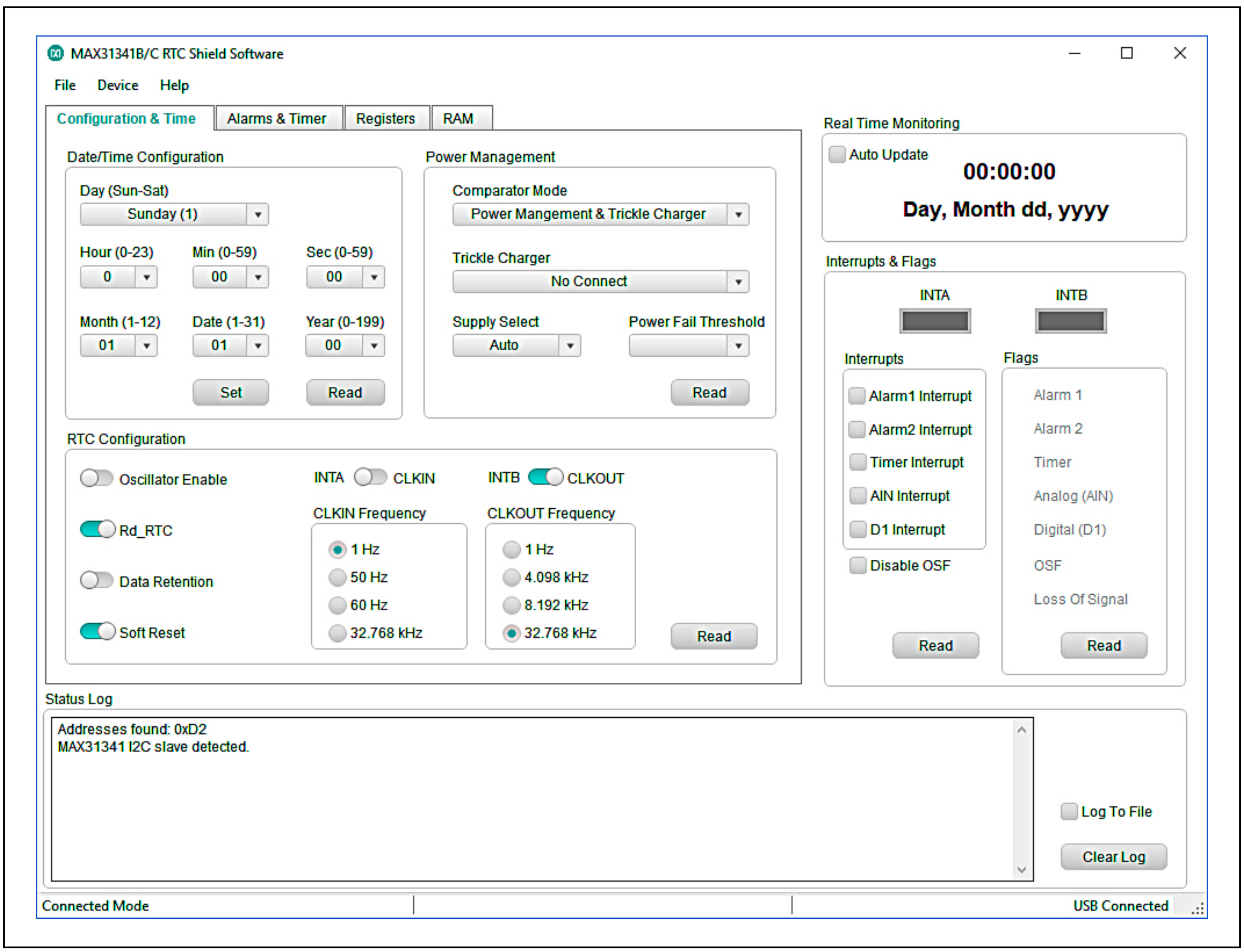


Figure 3. MAX31341B/C RTC Shield Software—Configuration & Time Tab

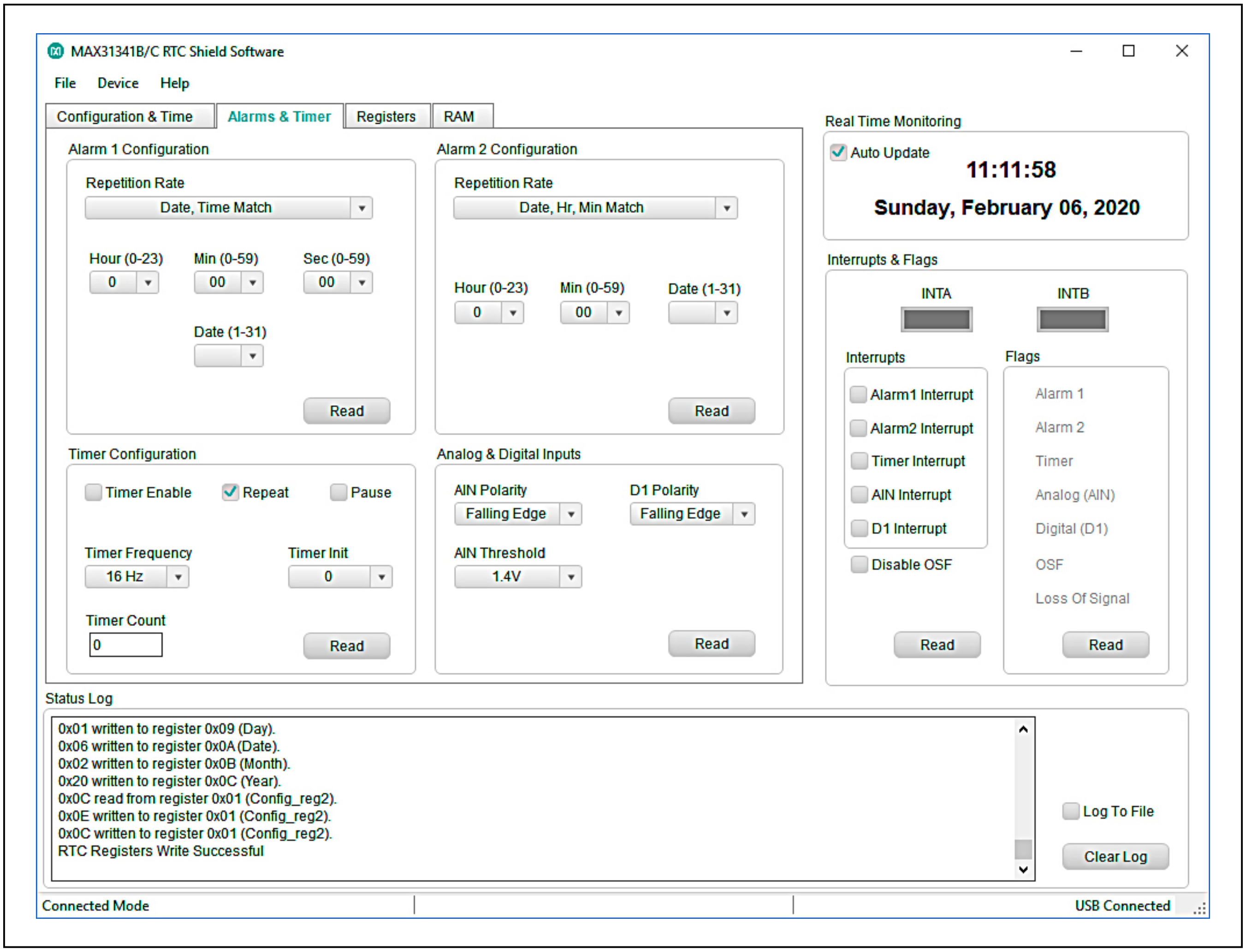


Figure 4. MAX31341B/C RTC Shield Software—Alarms & Timer Tab

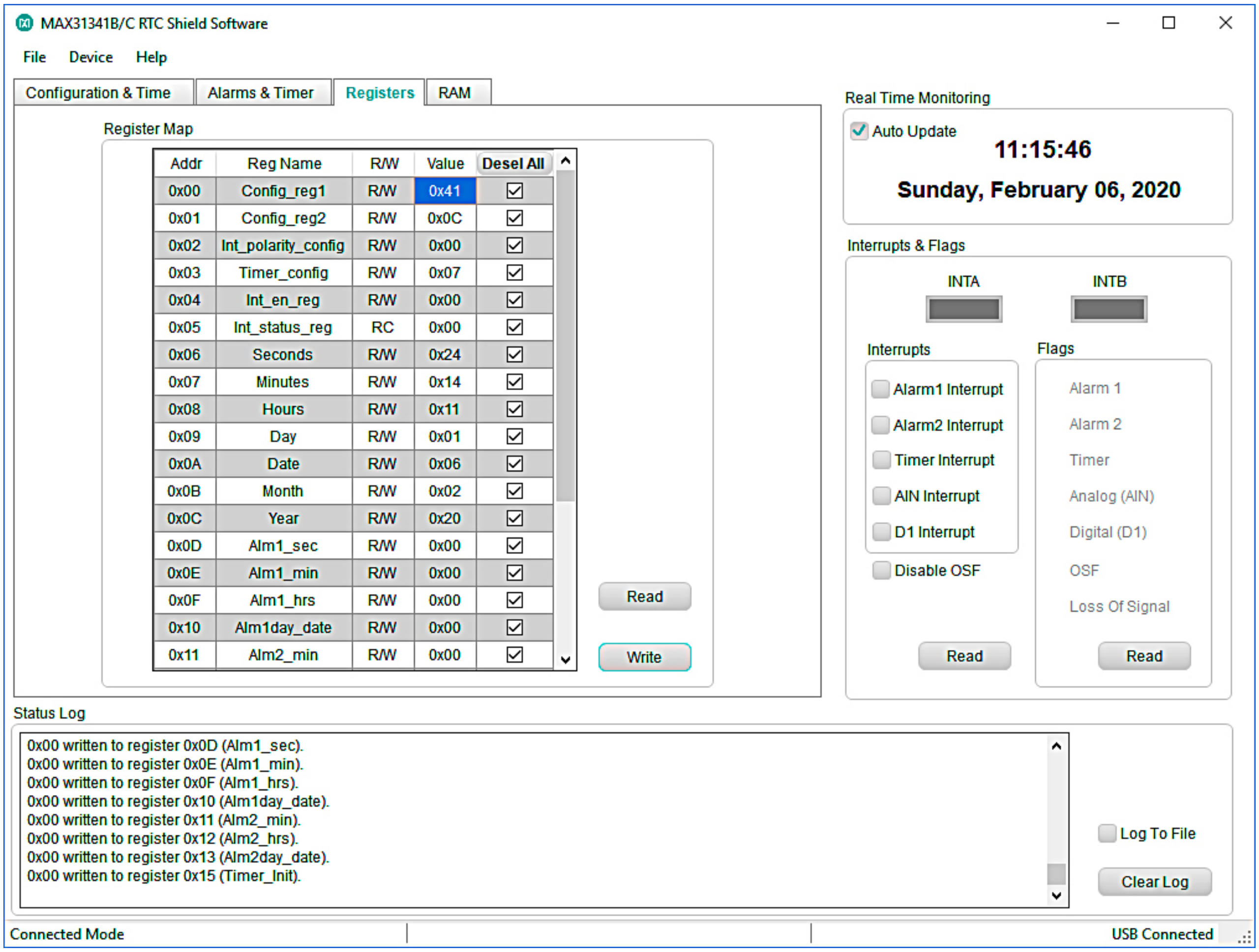


Figure 5. MAX31341B/C RTC Shield Software—Registers Tab

Jumper Settings for Testing WLP IC

JUMPER	SHUNT POSITION	DESCRIPTION
JU2	1–2	Connects AIN to VBAT at TP2.
	1–3	Connects AIN to GND.
	1–4*	Connects AIN to supercapacitor.
JU4	1–2*	System V_{CC}** is powered by VCC_EXT at TP5.
	2–3	System V_{CC} is powered by +3.3V supply from Mbed/Arduino/PICO platform.
JU6	1–2	Connects $\overline{INTA}$/CLKIN pin of U1 to ground.
	1–3*	Connects $\overline{INTA}$/CLKIN pin of U1 to Mbed/Arduino/PICO platform, through a level translator (U5).
	1–4	Connects $\overline{INTA}$/CLKIN pin of U1 to test point TP3 with a 10kΩ pullup resistor to system V_{CC}.
JU7	1–2*	System V_{CC} connects to VCC pin of U1.
	OPEN	Float VCC pin of U1. Connect an ammeter between pin1 and 2 to measure the current consumption of U1.
JU8	1–2	System V_{CC} powers U2 V_{CC} pin.
	OPEN*	Floats VCC pin of U2. Connect an ammeter between the pins of JU8 to measure the current consumption of U2.
JU10	1–2*	Connects SDA pin of U1 and U2 to Mbed/Arduino/PICO platform for GUI control.
	OPEN	Floats SDA pin for users' 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 users' own I^2C control.
JU13	1–2*	Connects power backup selection AIN at JU2 to AIN pin of U1.
	OPEN	Floats AIN pin of U1 for users' signal input.
JU14	1–2	Connects power backup selection AIN at JU2 to AIN pin of U2.
	OPEN*	Floats AIN pin of U2 for users' signal input.
JU15	1–2	U2
	2–3*	U1

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

Jumper Settings for Testing TDFN IC

JUMPER	SHUNT POSITION	DESCRIPTION
JU2	1–2	Connects AIN to VBAT at TP2.
	1–3	Connects AIN to GND.
	1–4*	Connects AIN to supercapacitor.
JU4	1–2*	System V_{CC}** is powered by VCC_EXT at TP5.
	2–3	System V_{CC} powered by +3.3V supply from Mbed/Arduino/PICO platform.
JU6	1–2	Connects $\overline{INTA}$/CLKIN pin of U2 to ground.
	1–3*	Connects $\overline{INTA}$/CLKIN pin of U2 to Mbed/Arduino/PICO platform through a level translator (U5).
	1–4	Connects $\overline{INTA}$/CLKIN pin of U2 to test point TP3 with a 10kΩ pullup resistor to system V_{CC}.
JU7	1–2	System V_{CC} connects to VCC pin of U1.
	OPEN*	Float VCC pin of U1. Connect an ammeter between pin1 and 2 to measure the current consumption of U1.
JU8	1–2*	System V_{CC} powers U2 V_{CC} pin.
	OPEN	Floats VCC pin of U2. Connect an ammeter between the pins of JU8 to measure the current consumption of U2.
JU10	1–2*	Connects SDA pin of U2 to Mbed/Arduino/PICO platform for GUI control.
	OPEN	Floats SDA pin for users' own I^2C control.
JU11	1–2*	Connects SCL pin of U2 to Mbed/Arduino/PICO platform for GUI control.
	OPEN	Floats SCL pin for users' own I^2C control.
JU13	1–2	Connects power backup selection AIN at JU2 to AIN pin of U1.
	OPEN*	Floats AIN pin of U1 for users' signal input.
JU14	1–2*	Connects power backup selection AIN at JU2 to AIN pin of U2.
	OPEN	Floats AIN pin of U2 for users' signal input.
JU15	1–2*	U2
	2–3	U1

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

Component Suppliers

SUPPLIER	WEBSITE
Murata	http://www.murata.com/
Yageo	http://www.yageo.com/
Eaton	http://www.eaton.com/
Amphenol FCI	http://www.fci.com/
Samtec	https://www.samtec.com/
TE Connectivity	http://www.te.com/usa-en/home.html
Keystone Electronics	http://www.keyelco.com/
ECS	https://www.ecsxtal.com/
ON Semiconductor	http://www.onsemi.com/

Note: *Indicate that you are using the MAX31341 when contacting these component suppliers.*

Ordering Information

PART NUMBER	TYPE
MAX31341SHLD#	EV Kit

#Denotes RoHS compliant.

MAX31341 Shield EV Kit Bill of Materials

ITEM	REF_DES	DNI/DNP	QTY	MFG PART #	MANUFACTURER	VALUE	DESCRIPTION
1	C2, C7, C8, C15	—	4	CL05B105KQ5NQNC; GRM155R70J105KA12	SAMSUNG ELECTRONICS; MURATA	1μF	CAPACITOR; SMT (0402); CERAMIC CHIP; 1μF; 6.3V; TOL = 10%; TG = -55°C TO +125°C; TC = X7R
2	C3, C5, C9, C16-C18	—	6	CL05B104KQ5NNN	SAMSUNG	0.1μF	CAP; SMT (0402); 0.1μF; 10%; 6.3V; X7R; CERAMIC CHIP ;
3	C4, C11, C13, C19	—	4	C1005X7R1C104K050BC; ATC530L104KT16; 0402YC104KAT2A; CGA2B1X7R1C104K050BC; GCM155R71C104KA55; C0402X7R160-104KNE; CL05B104KO5NNNC; GRM155R71C104KA88; C1005X7R1C104K; CC0402KRX7R7BB104; EMK105B7104KV; CL05B104KO5	TDK;AMERICAN TECHNICAL CERAMICS; AVK;TDK;MURATA; VENKEL LTD.;SAMSUNG ELECTRONICS; MURATA; TDK; YAGEO PHICOMP; TAIYO YUDEN; SAMSUNG ELECTRONICS	0.1μF	CAPACITOR; SMT (0402); CERAMIC CHIP; 0.1μF; 16V; TOL = 10%; TG = -55°C TO +125°C; TC = X7R
4	C10, C12, C14, C20	—	4	C0402C103J3RAC	KEMET	0.01μF	CAPACITOR; SMT (0402); CERAMIC CHIP; 0.01μF; 25V; TOL = 5%; TG = -55°C TO +125°C; TC = X7R
5	J1, J2	—	2	75915-310LF	FCI CONNECT	75915-310LF	CONNECTOR; FEMALE; THROUGH HOLE; STRAIGHT; 10PINS
6	J3	—	1	SSQ-110-04-G-S	SAMTEC	SSQ-110-04-G-S	CONNECTOR; FEMALE; THROUGH HOLE; .025IN SQ POST SOCKET; STRAIGHT; 10PINS ;
7	J4	—	1	SSQ-106-03-G-S	SAMTEC	SSQ-106-03-G-S	CONNECTOR; MALE; THROUGH HOLE; THROUGH-HOLE .025 SQ POST SOCKET ; STRAIGHT; 6PINS

MAX31341 Shield EV Kit Bill of Materials (continued)

ITEM	REF_DES	DNI/DNP	QTY	MFG PART #	MANUFACTURER	VALUE	DESCRIPTION
8	J6	—	1	SSQ-108-03-G-S	SAMTEC	SSQ-108-03-G-S	CONNECTOR; FEMALE; THROUGH HOLE; .025IN SQ POST SOCKET; STRAIGHT; 8PINS
9	J7	—	1	SSQ-108-04-G-S	SAMTEC	SSQ-108-04-G-S	CONNECTOR; FEMALE; THROUGH HOLE; .025IN SQ POST SOCKET; STRAIGHT; 8PINS ;
10	JU2, JU6	—	2	TSW-104-07-L-S	SAMTEC	TSW-104-07-L-S	EVKIT PART-CONNECTOR; MALE; THROUGH HOLE; TSW SERIES; SINGLE ROW; STRAIGHT; 4PINS
11	JU4, JU15	—	2	PEC03SAAN	SULLINS	PEC03SAAN	CONNECTOR; MALE; THROUGH HOLE; BREAKAWAY; STRAIGHT; 3PINS
12	JU7, JU8, JU10, JU11, JU13, JU14	—	6	PBC02SAAN	SULLINS ELECTRONICS CORP.	PBC02SAAN	EVKIT PART-CONNECTOR; MALE; THROUGH HOLE; BREAKAWAY; STRAIGHT; 2PINS; -65°C TO +125°C;
13	R3, R7-R9	—	4	CRCW040210K0FK; RC0402FR-0710KL	VISHAY DALE; YAGEO PHICOMP	10K	RESISTOR; 0402; 10K; 1%; 100PPM; 0.0625W; THICK FILM
14	R6	—	1	RC0402JR-070RL; CR0402-16W-000RJT	YAGEO PHYCOMP; VENKEL LTD.	0	RESISTOR; 0402; 0Ω; 5%; JUMPER; 0.063W; THICK FILM
15	R10	—	1	ERJ-2GEJ103	PANASONIC	10K	RESISTOR; 0402; 10KΩ; 5%; 200PPM; 0.10W; THICK FILM
16	SUPER-C	—	1	KW-5R5C334-R	EATON POWERING BUSINESS WORLDWIDE	0.33F	CAP; THROUGH HOLE-RADIAL LEAD; 0.33F; +80%/-20%; 5.5V; ALUMINUM-ELECTROLYTIC ;
17	SW1	—	1	AYZ0202AGRLC	C&K COMPONENTS	AYZ0202AGRLC	SWITCH; DPDT; SMT; 12V; 0.1A; MINIATURE SLIDE SWITCHES; RCOIL = 0.08Ω; RINSULATION=100M OHM
18	TP1-TP3, TP5	—	4	5010	KEYSTONE	N/A	TEST POINT; PIN DIA = 0.125IN; TOTAL LENGTH = 0.445IN; BOARD HOLE = 0.063IN; RED; PHOSPHOR BRONZE WIRE SIL;
19	TP4, TP6	—	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	MAX31341BEWC+	MAXIM	MAX31341BEWC+	IC; RTC; LOW-CURRENT; REAL-TIME CLOCK WITH I2C INTERFACE AND POWER MANAGEMENT; WLP12 ;
21	U2	—	1	MAX31341C	MAXIM	MAX31341C	EVKIT PART - IC; MAX31341C; PACKAGE OUTLINE DRAWING: 21-0137; LAND PATTERN DRAWING: 90-0061
22	U3, U4	—	2	MAX14689AETB+	MAXIM	MAX14689AETB+	IC; ASW; ULTRA-SMALL LOW-RON BEYOND-THE-RAILS DPDT ANALOG SWITCHES; TDFN10-EP
23	U5, U6	—	2	NLSX4373MUTAG	ON SEMICONDUCTOR	NLSX4373MUTAG	IC; TRANS; 2-BIT 20 MB/S DUAL-SUPPLY LEVEL TRANSLATOR; UDFN8
24	Y1, Y2	—	2	ECS-.327-6-12	ECS INC	32.768KHZ	CRYSTAL; SMT 2.0 MM X 1.2 MM; 6PF; 32.768KHZ; ±20PPM; -0.03PPM/°C2
25	PCB	—	1	MAX31341SHIELD	MAXIM	PCB	PCB:MAX31341SHIELD
26	C1, C6	DNP	0	TAJC106K016RNJ	AVX	10µF	CAPACITOR; SMT (6032); TANTALUM CHIP; 10µF; 16V; TOL = 10%; MODEL = TAJ SERIES; TG = -55°C TO +125°C
27	R1, R2, R5	DNP	0	ERJ-2GEJ103	PANASONIC	10K	RESISTOR; 0402; 10KΩ; 5%; 200PPM; 0.10W; THICK FILM
28	R4	DNP	0	N/A	N/A	OPEN	PACKAGE OUTLINE 0402 RESISTOR
TOTAL			57				

MAX31341 Shield EV Kit Schematic Diagram

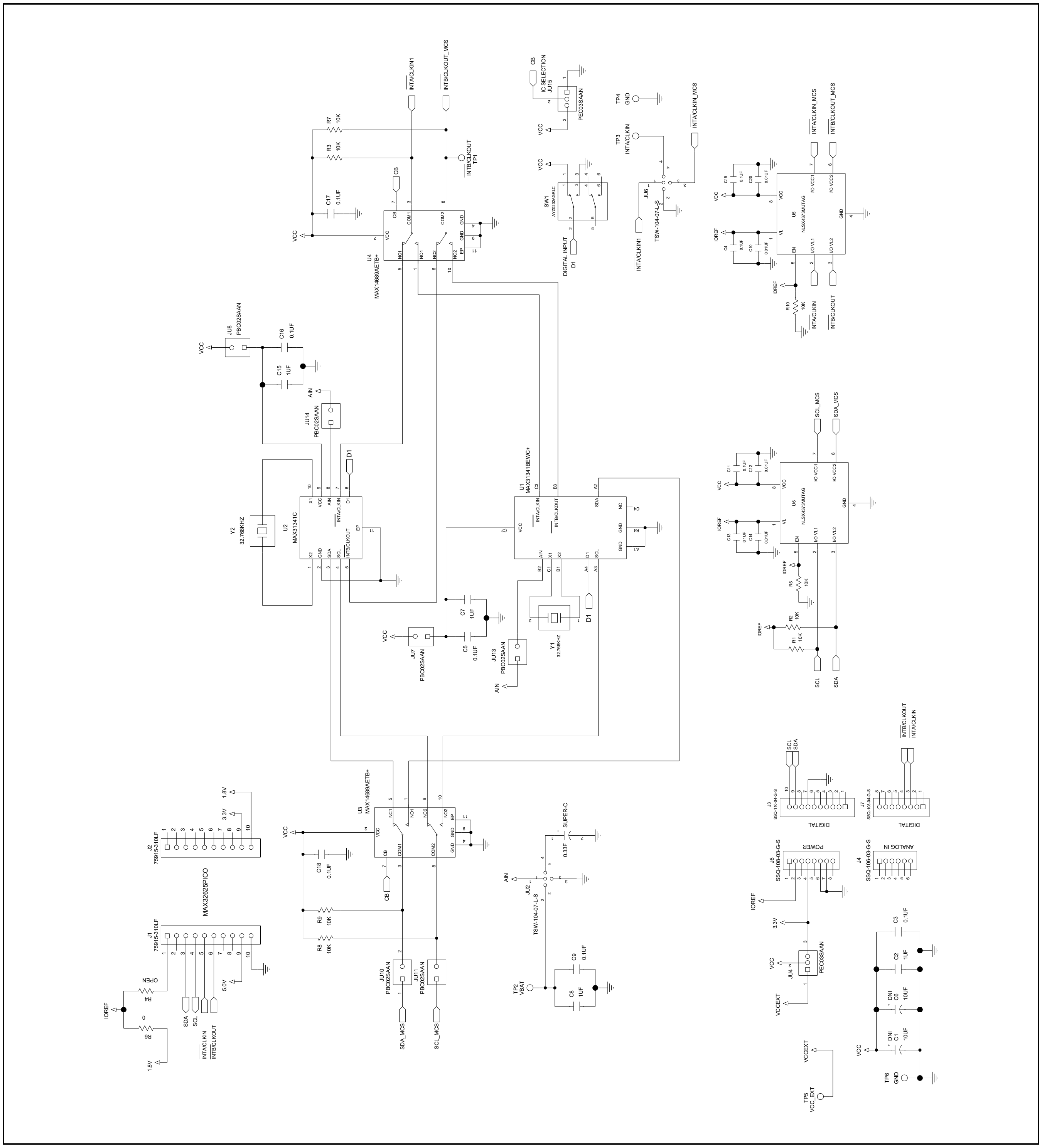
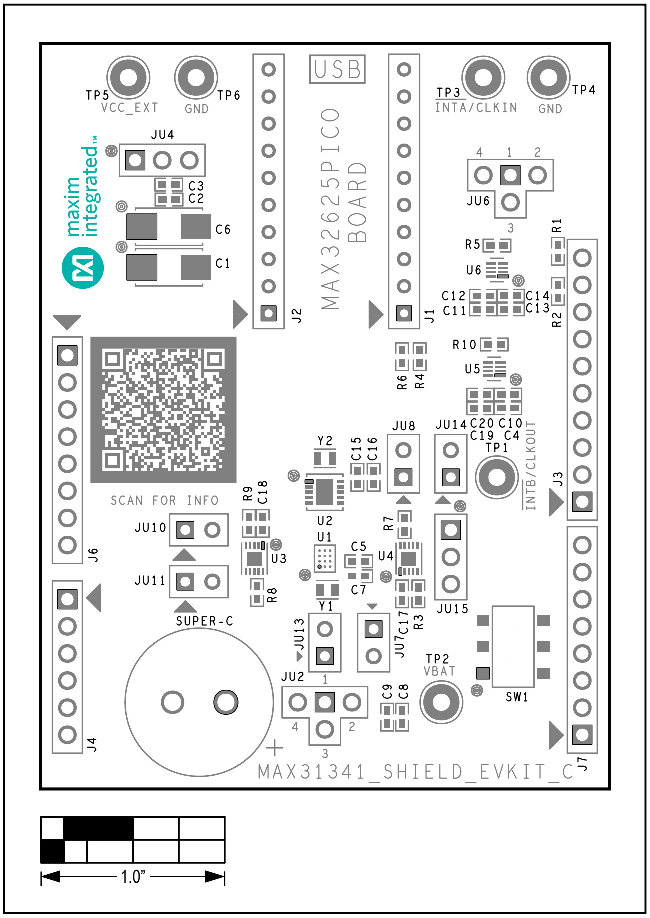
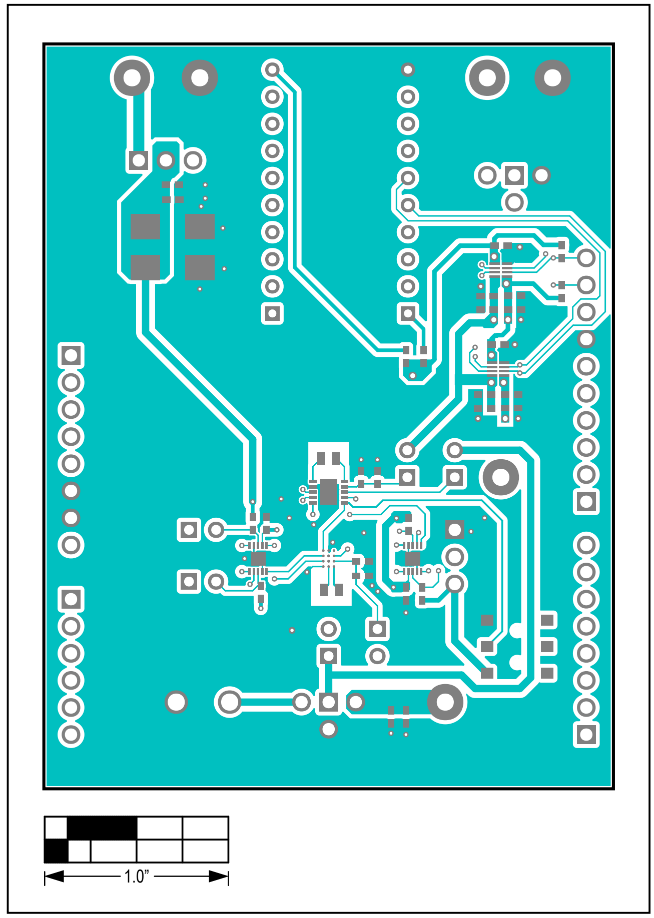


Figure 6. MAX31341 Shield EV Kit Schematic

MAX31341 Shield EV Kit PCB Layout Diagrams

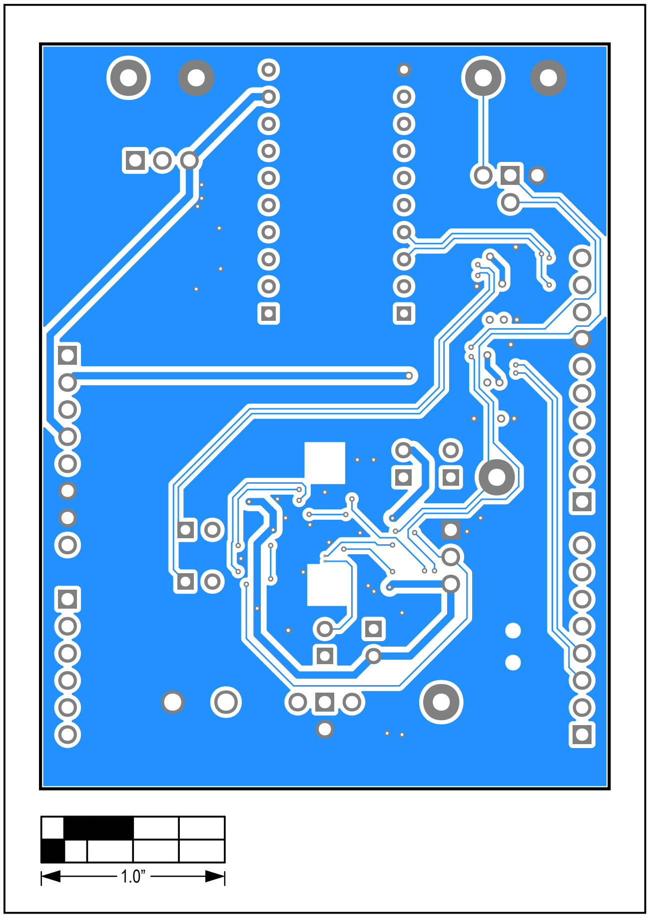


MAX31341 Shield EV Kit—Assembly Top

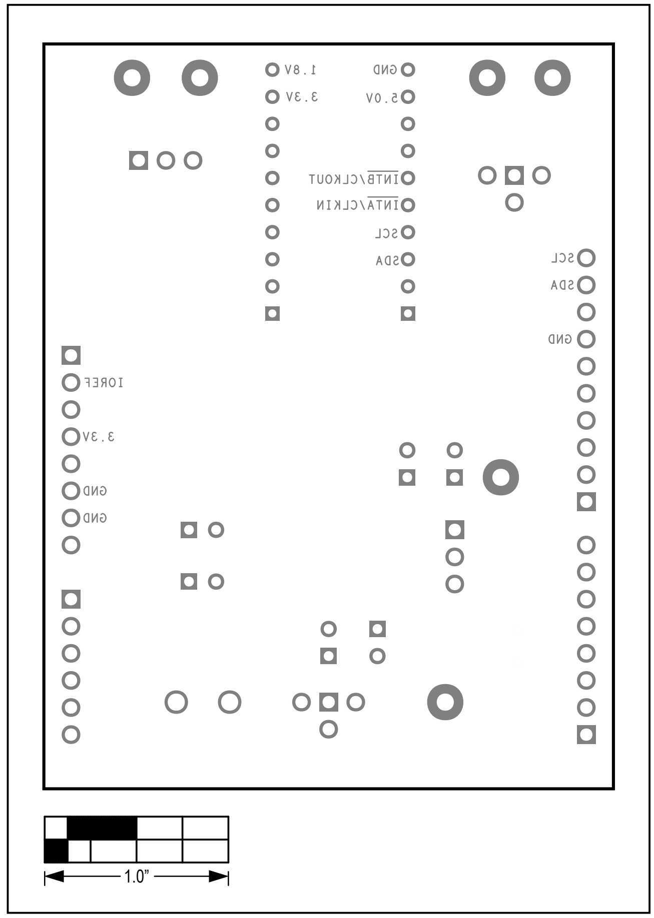


MAX31341 Shield EV Kit—PCB Top Layer

MAX31341 Shield EV Kit PCB Layout Diagrams (continued)



MAX31341 Shield EV Kit—PCB Bottom Layer



MAX31341 Shield EV Kit—PCB Bottom Silkscreen

Revision History

REVISION NUMBER	REVISION DATE	DESCRIPTION	PAGES CHANGED
0	1/18	Initial release	—
1	2/19	Updated data sheet figures, BOM, and PCB layout diagrams	1–12
2	3/19	Updated title to include MAX31341B, updated BOM and schematic	1–12
3	5/19	Updated Procedure section and added Jumper Settings table	2, 8
4	4/20	Updated throughout to add Shield and MAX31341C; updated all sections, figures, tables, BOM, schematic, and layout diagrams	1–12

