Evaluates: MAX31341B

General Description

The MAX31341 evaluation kit (EV kit) is a fully assembled and tested PCB to evaluate the MAX31341B, low-current, real-time clock with I²C interface and power management. The EV kit operates from a single supply and the onboard crystal provides a 32.768 kHz clock signal. This device is accessed through an I2C serial interface.

The MAX31341 EV kit provides the hardware and software user interface (GUI) necessary to evaluate the MAX31341B. The EV kit includes a MAX31341B installed. The EV kit connects to the PC through a DS3900H2 I²C circuit board and a mini-USB cable.

Features

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

EV Kit Contents

- Assembled MAXIM DS3900H2 I²C circuit board
- Mini-USB cablec
- Assembled circuit board including MAX31341B

Ordering Information appears at end of data sheet.

Quick Start

Required Equipment

- One DC power supply capable of supplying +1.6 to +3.6V (typical 3.0V used in the following instructions)
- One pico ammeter for measuring the current
- One oscilloscope
- One mini-USB cable
- One assembled DS3900H2 I²C circuit board
- One MAX31341 EV kit

EV Kit Photo





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Procedure

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

- Place the MAX31341 EV kit on a nonconductive surface to ensure that nothing on the PCB gets shorted to the workspace.
- 2) Set the jumpers of JU2, JU3 JU4, JU5, JU6, and JU7, as shown on (Figure 1). Leave JU1 open.
- With the output of the power supply set to +3.0V and disabled, connect the positive terminal of the DC supply to the VCC and negative terminal to the GND of the EV kit.
- Connect the DS3900H2 I²C Circuit Board to the EV kit at the location shown as DS3900 (Figure 2).
- 5) Connect the mini-USB cable between the **DS3900H2 Circuit Board** and PC/laptop.



Figure 1. Jumpers Position

- 6) Turn on the +3.0V DC power supply.
- Visit <u>here</u> to download the latest version of the MAX31341 real-time clock EV kit software, and run the control software.
- Open the MAX31341 real-time clock EV kit software. MAX31341 Real-Time Clock EV Kit Software Monitor page will be opened and it shows USB Connected (Figure 3).
- 9) At power up, MAX31341B is in idle mode; no clock is running yet. On the Monitor page and under the Real Time Clock Configuration section, press the Read button and then the Write button to start the clock. Verify clock has started counting by pressing Start RTM button in the Real-Time Clock Configuration section. Press Stop RTM to go back to configuration view.



Figure 2. USB Connection

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Detailed Description

The MAX31341B low-current real-time clock (RTC) is timekeeping device that provides an extremely low

timekeeping current, which permits longer life from a power supply. The MAX31341B supports 6pF high-ESR crystals, which broaden the pool of usable crystals for the devices. This device is accessed through an I²C serial interface. The device features one digital Schmitt trigger inputs and one programmable threshold analog input. The device generates 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.

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 MAX31341B also includes 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 RTC is frequency-locked to the external clock and the clock accuracy is determined by the external source. In case of external clock failure, the clock is switched to the crystal oscillator.

Functional Test Procedure

Current Draw at Time-Keeping Operation

- To measure the current draw under normal Real-Time Clock conditions without any interrupt or clock input/output, do the following:
 - On Clock Configuration window, press the Read button,
 - Uncheck Enable of CLKIN and CLKOUT,
 - Select **1Hz** for **Frequency**,
 - Press Write button.
- Connect the Pico Ammeter between 3.0V power supply and V_{CC} of the EV kit.
- Remove the jumper from JU3 and connect another 3.0V supply to the upper-side of the JU3. This supplies power to the I2C interface of DS3900H2. This setup allows measurements of current draw from MAX31341B only.

4) On Registers Page (Figure 5), under Register Map window, press Read button and make sure that the value of register 0 (Config_reg1) shows 0x41. Otherwise, set it to 0x41 and press Write button. Now the reading in the picometer is the current from MAX31341B only. It should be around 210nA.

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

 Disconnect the additional 3.0V from JU3, put the jumper on JU3, remove the Pico Ammeter, and connect 3.0V power supply directly to the VCC of the EV kit.

Setting the Clock

Under **Real Time Clock Configuration** section, enter the start point of date and time, and then click **Write**. The clock starts to count from the set point after the log shows Write successful. Click **Start RTM** to verify the clock counting from the written start date and time.

Clock Output measurement

Under the **Clock Configuration** section and **CLKOUT** sub-section, check the **Enable** box and the desired frequency. Then click **Write**. 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

Under Alarm 1 Configuration section select the Repetition Rate to set the alarm scenario (such as Min, Sec match at 02:00). Check Enable Interrupt box and then click Write. Under the Flag Status section of the Interrupts/ Flags page, press the Read button twice to clear alarm flag bit if it has been previously set. When the Real-Time clock reaches the alarm time set in Alarm 1 Configuration, alarm output at INTA/CLKIN will go from high to low. It will change to high again by clicking the Read button on the Flags Status window. The interrupt status can also be checked by pressing Read button under Flags Status section in the Interrupts/Flags window. Repeat the same steps for Alarm2, but measure the alarm interrupt output at INTB/CLKOUT.

Note: When testing alarm interrupts, CLKIN and CLKOUT, under Clock Configuration section need to be disabled.

Analog Interrupt

Go to Interrupts/Flags Page (Figure 4), under Analog Input (AIN) section, check the Enable Intr box. Select the polarity (rising edge for example) and threshold for AIN. Then, click Write Interrupts/Timer. Clear all previously set Interrupt bits by pressing Read button under Flags Status section. Now apply a voltage slightly above the selected threshold to Analog IN (JU2-AIN). The interrupt output at INTA/CLKIN should go from high to low. It will change back to High by pressing Read button under Flags Status section.

Digital Interrupt

Under Digital Input (D1) section, check the Enable Intr box. Select the Rising Edge under polarity and click Write Interrupts/Timer. Then apply V_{CC} to D1 input by changing jumper JU5 to lower side. The interrupt output at INTA/CLKIN should go from high to low. It will change back to high by pressing Read button under Flags Status section. Disable/uncheck Enable Intr for both Analog Input and Digital Input and click Write Interrupts/Timer.

Timer Interrupt

Clear all interrupt bits by pressing **Read** button under **Flags Status** section. Enable the Timer and Interrupt by checking **Timer Enable** and **Enable Intr** under **Timer Configuration** section. Select **16Hz** on **Timer Frequency**. Set the **Timer Init** number such as 200. Click **Write Interrupts/Timer**. When the **Timer Count** reading reaches to 0 from 200, the interrupt output at **INTA/CLKIN** should go from high to low.

Power Mode Select

Under Power Mode Configuration section, Comparator Operation Mode sub-section there are two selections: AIN Interrupt Mode for normal I/O operation; Power Mgmt & Trickle Charger mode for Power management and Trickle Charger mode for charging the on-board super capacitor as a backup battery.

In Power Mgmt & Trickle Charger mode, the Power Supply Mode can be used to select the source of power supply. Force VCC means the IC uses main supply, Force VBACK means the IC gets supply from backup battery, from either the on-board super capacitor or external backup supply injected from JU5. In Auto mode, supply switches between VCC and VBACK automatically based on the threshold set under the Analog Interrupt section. To verify which supply is utilized, Clock Output can be monitored while changing power supply mode with VCC and VBACK in different voltages. Also, super capacitor voltage at Analog IN (JU2-AIN) can be charged to "VCC minus diode drop voltage" at selectable rate in the pulldown table.

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Monitor Interr	upts/Flags Registers					
Real Time Clock	Configuration			Alarm 1 Configuration		
Hour (0-23) Day (1-7) Year (0-199) Start RTP	00 Min (0-59) 01 Date (1-31) 00	00 Sec	(0-59) 00 mth (1-12) 01	Enable Interrupt Seconds (0-59) Minutes (0-59) Hour (0-23) Date (1-31)	00 00 00 00 Test	Repetition Rate Once per sec Sec Match Min, Sec Match Hr, Min, Sec Match Date, Hr, Min, Sec Match Day, Hr, Min, Sec Match Read
lock Configure	500			Alarm 2 Configuration		
CLKN CLKOUT				Addin 2 Conliguiation		Repetition Rate
Enable	Frequency 1 Hz 50 Hz 60 Hz 32 768 kHz	Enable	Frequency 1 Hz 4.098 kHz 8.192 kHz 32.768 kHz	Minutes (0-59) Hour (0-23) Date (1-31)	00	 Once per Min Min Match Hr, Min Match Date, Hr, Min Match Day, Hr, Min Match
Start Oscill	ator	Read	d Write			Read Write
atus Log						
Addresses four	id: 0xD2				Log To F	ile Data Retention

Figure 3. MAX31341 RTC EV Kit Software—Monitor Page

Evaluates: MAX31341B

Analog Input (AIN)					
Analog Input (AIN)					
		Digital Input (D1)	Timer Configuration		
Polarity Falling Edge Rising Edge	Comparator Threshold 1.4V 1.8V 2.1V 2.4V	Polarity Polarity Falling Edge Rising Edge	Timer Enable Repeat Timer Init	Pause Timer Count	Timer Frequency 1024Hz 256Hz 64Hz 16Hz
ower Mode Configuration			Flags Status	Read Interrupts/T	Write Interrupts/Timer
Comparator Operatio	n Mode Po	wer Supply Mode	Loss of Signal	Timer Intr	OSF
Trickle Charger Path			Alarm1	AIN Intr	
		Read Write	Alarm2	D1 Intr	Disable OSF Read
tus Log					
larm1 Registers read succ x00 read from register 0x0x x00 read from register 0x1 x00 read from register 0x12 x00 read from register 0x13	essfully ((Int_en_reg). (AIm2_min). ((AIm2_hrs). (AIm2day_date). essfully			Log To File	Data Retention

Figure 4. MAX31341 RTC EV Kit Software—Interrupts/Flags Page

Evaluates: MAX31341B

R/W kg1 R/W kg2 R/W kg1 R/W kg2 R/W kg3 R/W kg4 R/W kg5 R/W kg6 R/W kg7 R/W	Value 0x41 0x0C 0x00 0x07 0x00 0x00 0x54 0x01	Desel All	~		A 01	x16 x17 x18 x19	Reg Name RAM_Reg_0 RAM_Reg_1 RAM_Reg_2	R/W R/W R/W	Value 0x00 0x00 0x00	Desel All	^	
ne R/W gg1 R/W gg2 R/W confile R/W ofg R/W ofg R/W reg RC s R/W s R/W R/W R/W	Value 0x41 0x0C 0x00 0x00 0x00 0x00 0x54 0x01		<u></u>		A 01 01 01 01	x16 x17 x18 x19	Reg Name RAM_Reg_0 RAM_Reg_1 RAM_Reg_2	R/W R/W R/W	0x00 0x00 0x00		C	
ig1 R/W ig2 R/W config R/W reg R/W reg R/W s R/W s R/W R/W R/W	0x41 0x0C 0x00 0x07 0x00 0x00 0x00 0x54 0x01				01	x16 x17 x18 x19	RAM_Reg_0 RAM_Reg_1 RAM_Reg_2	R/W R/W R/W	0x00 0x00 0x00	N		
g2 R/W confile R/W eg R/W reg RC s R/W s R/W R/W R/W	0x0C 0x00 0x07 0x00 0x00 0x54 0x01				01	x17 x18 x19	RAM_Reg_1 RAM_Reg_2	R/W	0x00			
config R/W eg R/W eg R/W reg R/W s R/W s R/W R/W R/W	0x00 0x07 0x00 0x00 0x00 0x54 0x01				01	x18 x19	RAM_Reg_2	R/W	0x00			
ntig R/W eg R/W reg RC s R/W s R/W R/W R/W	0x07 0x00 0x00 0x54 0x01	N N N			01	x19		-				
eg R/W _reg RC s R/W s R/W R/W	0x00 0x00 0x54 0x01	N N					RAM_Reg_3	R/W	0x00			
reg RC s R/W s R/W R/W	0x00 0x54 0x01				07	x1A	RAM_Reg_4	R/W	0x00			
s R/W R/W R/W	0x54 0x01				05	x1B	RAM_Reg_5	R/W	0x00			
R/W	0x01	press.			Go	x1C	RAM_Reg_6	R/W	0x00			
R/W					0	x1D	RAM_Reg_7	R/W	0x00			
	0x00				00	x1E	RAM_Reg_8	R/W	0x00			
R/W	0x01				0	x1F	RAM_Reg_9	R/W	0x00			
R/W	0x01				0)	x20	RAM_Reg_10	R/W	0x00			
R/W	0x01				01	x21	RAM_Reg_11	R/W	0x00			
R/W	0000				01	x22	RAM_Reg_12	R/W	0x00			
c R/W	0x00				0:	x23	RAM_Reg_13	R/W	0x00			
in R/W	0x00				0:	x24	RAM_Reg_14	R/W	0x00			
s R/W	0x00				0:	x25	RAM_Reg_15	R/W	0x00			
date R/W	0x00		F	Read	0:	x26	RAM_Reg_16	R/W	0x00			Read
in R/W	0x00				0	x27	RAM_Reg_17	R/W	0x00			
s R/W	0x00		~ 1	Write	01	x28	RAM_Reg_18	R/W	0x00		~	Write
data Data	0-00						D311 D1- 40	DAA	0-00		100	
1	R/W ec R/W nin R/W rs R/W date R/W nin R/W rs R/W	R/W 0x00 ec R/W 0x00 iin R/W 0x00 rs R/W 0x00 date R/W 0x00 iin R/W 0x00 rs R/W 0x00	R/W 0x00 Image: Constraint of the state	R/W 0x00 Image: Constraint of the second se	R/W 0x00 Image: Constraint of the second se	R/W 0x00 Image: Constraint of the second se	R/W 0x00 Image: Constraint of the constraint	R/W 0x00 Image: Constraint of the constraint	R/W 0x00 Image: Constraint of the second se	R/W 0x00 Image: constraint of the system 0x22 RAM_Reg_12 R/W 0x00 ec R/W 0x00 Image: constraint of the system 0x23 RAM_Reg_13 R/W 0x00 inin R/W 0x00 Image: constraint of the system 0x24 RAM_Reg_14 R/W 0x00 inin R/W 0x00 Image: constraint of the system 0x25 RAM_Reg_16 R/W 0x00 date R/W 0x00 Image: constraint of the system 0x26 RAM_Reg_17 R/W 0x00 inin R/W 0x00 Image: constraint of the system 0x27 RAM_Reg_17 R/W 0x00 inin R/W 0x00 Image: constraint of the system 0x28 RAM_Reg_18 R/W 0x00 0x28 RAM_Reg_18 R/W 0x00 0x28 RAM_Reg_18 R/W 0x00	R/W 0x00 Image: constraint of the system 0x22 RAM_Reg_12 R/W 0x00 Image: constraint of the system 0x23 RAM_Reg_13 R/W 0x00 Image: constraint of the system 0x23 RAM_Reg_13 R/W 0x00 Image: constraint of the system 0x24 RAM_Reg_14 R/W 0x00 Image: constraint of the system 0x25 RAM_Reg_15 R/W 0x00 Image: constraint of the system 0x26 RAM_Reg_16 R/W 0x00 Image: constraint of the system 0x27 RAM_Reg_17 R/W 0x00 Image: constraint of the system 0x28 RAM_Reg_18 R/W 0x00 Image: constraint of the system 0x28 RAM_Reg_18 R/W 0x00 Image: constraint of the system 0x28 RAM_Reg_18 R/W 0x00 Image: constraint of the system 0x28 RAM_Reg_18 R/W 0x00 Image: constraint of the system 0x28 RAM_Reg_18 R/W 0x00 Image: constraint of the system 0x28 RAM_Reg_18 R/W 0x00 Image: constraint of the system 0x28 RAM_Reg_18 R/W 0x00	R/W 0x00 Image: constraint of the state



Evaluates: MAX31341B

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	TYPE	
MAX31341EVKIT#	EV Kit	

#Denotes RoHS compliant.

Evaluates: MAX31341B

1 2 C1, C6 NL 10UF_10%_TR\TAJR\6104VX_0805 NL 805 2 4 C2, C4-C5, C8 GRM155R70J105KA12 Murata 1µF ±10% 6.3V Ceramic Capacitor X7R 0402 (1005 Metric) 1µF 0402 3 6 C3, C7, C9-10, C12, C14 GRM155R70J104KA01 Murata 0.1µF ±10% 6.3V Ceramic Capacitor X7R 0402 (1005 Metric) 1µDF 0402	005 805 0402\GRP15\MURAA 0402\G 0402\GRP15\MURAA 0402\G	5)2\GRP15\MURAA)2\GRP15\MURAA
2 4 C2, C4-C5, C8 GRM155R70.105KA12 Murata 1µF ±10% 6.3V Ceramic Capacitor X7R 0402 (1005 Metric) 1µF 0402 3 6 C3, C7, C9-10, C12, C14 GRM155R70.1104KA01 Murata 0.1µF ±10% 6.3V Ceramic Capacitor X7R 0402 (1005 Metric) 1µDF 0402	0402\GRP15\MURAA 0402\C 0402\GRP15\MURAA 0402\C	02\GRP15\MURAA 02\GRP15\MURAA
3 6 C3 C7 C9-10 C12 C14 GRM155R70.1104KA01 Murata 0 1 uE +10% 6 3V Ceramic Capacitor X7R 0402 (1005 Metric) 100nE 0402	0402\GRP15\MURAA 0402\G	2\GRP15\MURAA
4 2 C11, C13 GRM15XR71C103KA86 Murata 10nF ±10% 16V Ceramic Capacitor X7R 0402 (1005 Metric) 10nF 0402	0402\GRP15\MURAA 0402\0	2\GRP15\MURAA
5 3 R1-R2, R5 RC0402FR-0710K YAGEO 10 kOhms ±1% 1/16W Chip Resistor 0402 (1005 Metric) 10 kOhm RES	RES1005 RES10	S1005
6 1 R13 RC0402FR-074K7 YAGEO 4.7 kOhms ±1% 1/16W Chip Resistor 0402 (1005 Metric) 4.7 kOhm RES	RES1005 RES10	S1005
7 2 J1-J2 67997-116HLF Amphenol FCI 2x8 pin Headers HEA	IEADER16	
8 1 J3 SSQ-110-04-G-S Samtec 10 PIN POLARIZED HEADER HEA	HEADER10 HEAD	ADER10
9 1 J4 SSQ-106-04-G-S Samtec 6 PIN POLARIZED HEADER HEA/	HEADER6 HEAD	ADER6
10 2 J6-7 SSQ-108-04-G-S Samtec 8 PIN POLARIZED HEADER HEA/	HEADER8 HEAD	ADER8
11 3 JU1, JU3, JU7 9-146280-0-02 TE Connectivity 2 Positions Header SIP4	SIP\2P	
12 1 JU5 9-146280-0-03 TE Connectivity 3 Positions Header SIP(3	SIP\3P	
13 3 UI2 UI4 UI6 9-146280-0-03 TE Connectivity 3 Positions Header SIP(3	SIP\3P	
9-146280-0-01 TE Connectivity 1 Positions Header SIP(1	SIP\1P	
14 2 TP1, TP4 5012 Keystone Electronics Test Point- White MTH	ITHOLE_1	
15 2 TP2, TP5 5010 Keystone Electronics Test Point- Red MTH	ITHOLE_1	
16 2 TP6, TP7 5011 Keystone Electronics Test Point- Black MTH	ITHOLE_1	
17 1 SUPER_C KW-5R5C334-R Eaton Super cap KW-5	(W-5R5C334-R	
18 1 Y1 ECS-327-6-12-TR ECS Crystal, 32.768kHz ±20ppm, 6pF 90 kOhms 2-SMD, No Lead ECS-327-6-12-TR ECS	ECS327-6-12-TR	
19 1 U1 MAX31341BEWC+ Maxim RTC IC; 12WLP 12W	2WLP	
20 1 U2 NLSX4373DR2G ON Semiconductor Buffer ; 1.5V- 5.5V; TRANSLATOR 2BIT DUAL BIDIR 8SOIC 8-SC	I-SOIC	
21 1 DS3900H2 DS3900H2 Maxim Controller board		

MAX31341 EV Kit Bill of Materials

MAX31341 EV Kit Schematic



Figure 6. MAX31341 EV Kit Schematic

Evaluates: MAX31341B



MAX31341 EV Kit PCB Layout Diagrams



MAX31341 EV Kit—PCB Bottom Layer



MAX31341 EV Kit—Assembly Top

Evaluates: MAX31341B

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

For pricing, delivery, and ordering information, please visit Maxim Integrated's online storefront at https://www.maximintegrated.com/en/storefront/storefront.html.

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