19-3994; Rev 0; 2/06

MAX7349 Evaluation Kit

Evaluates: MAX7349/Emulates: MAX7347/MAX7348

General Description

The MAX7349 evaluation kit (EV kit) is an assembled and tested circuit board that demonstrates the MAX7349 2-wire-interfaced, low-EMI key switch and sounder controller. Windows® 98SE/2000/XP software provides a handy user interface to exercise the features of the MAX7349.

Windows is a registered trademark of Microsoft Corp.

Features

- ♦ **Proven PC Board Layout**
- ♦ **Complete Evaluation System**
- ♦ **7 x 8 Key Matrix Included**
- ♦ **Sounder Included**
- ♦ **Fully Assembled and Tested**

Ordering Information

PART	TEMP RANGE	INTERFACE TYPE
MAX7349EVKIT	0°C to +70°C	Windows software

Component List

DESIGNATION	QTY	DESCRIPTION
C1, C12–C16, C23, C24	8	0.1µF, 10V min X7R ceramic capacitors (0603) TDK C1608X7R1E104K
C3	1	22µF, 16V ceramic capacitor (1210) TDK C3225X5R1C226K TDK C3225X5R1C226M
C5	1	0.033µF, 6.3V min X7R ceramic capacitor (0603) TDK C1608X7R1E333K Murata GRM188R71E333K Taiyo Yuden EMK107BJ333KA
C6, C7	2	22pF C0G ceramic capacitors (0603) TDK C1608C0G1H220J Murata GRM1885C1H220J
C8, C9	2	10pF C0G ceramic capacitors (0603) Murata GRM1885C1H100J TDK C1608C0G1H100J
C18, C19	2	1µF, 6.3V min X7R ceramic capacitors (0603) TDK C1608X5R0J105K Murata GRM188R60J105K Taiyo Yuden JMK107BJ105MA
C31	0	0.22µF ceramic capacitor (0603), not installed TDK C1608X7R1A224K
C32	0	0.068µF ceramic capacitor (0603), not installed TDK C1608X7R1E683K
C33	0	0.022µF ceramic capacitor (0603), not installed TDK C1608X7R1H223K
C34	0	220pF ceramic capacitor (0603), not installed TDK C1608X7R1H221K
C35	0	0.1µF ceramic capacitor (0603), not installed TDK C1608X7R1C104K
H1, H2	2	12-pin headers
JU1	1	2 x 4 dual-row vertical header
JU2, JU3, JU6	3	3-pin headers
JU4, JU5, JU9, JU10	4	2-pin headers
JU7, JU8, JU11	0	2-pin headers, not installed
KEY0–KEY55	56	Momentary 6mm pushbutton switches Omron B3F1000
LED1, LED2	2	Red LEDs (T1-3/4)
P1	1	Pizeoelectric sounder Murata PKM22EPPH-4001-B0
P2	1	USB series B right-angle PC mount receptacle
P5 (JTAG)	0	Vertical header, 2 x 5 pins, keyed pin 7
R1	1	2.2kΩ ±5% resistor (1206)
R2, R5, R6	3	1.5kΩ ±5% resistors (1206)
R7, R8, R9	3	470Ω ±5% resistors (1206)
R12, R13	2	27Ω ±5% resistors (1206)
R14, R15	2	10kΩ ±5% resistors (1206)
R21	0	2.61kΩ ±1% resistor (1206), not installed

Component List (continued)

DESIGNATION	QTY	DESCRIPTION
R22	0	21.5kΩ ±1% resistor (1206), not installed
R23	0	32.4kΩ ±1% resistor (1206), not installed
R24	0	21.5kΩ ±1% resistor (1206), not installed
R25	0	10Ω ±5% resistor (1206), not installed
U1	1	Maxim MAX7349AEG (24-pin QSOP)
U2	1	FTDI FT232BM (32-pin TQFP, 7mm x 7mm)
U3	1	Maxim MAX8511EXK25-T ADV top mark (5-pin SC70)
U4	1	93C46 type 3-wire EEPROM 16-bit architecture (8-pin SO)
U5	1	Maxim MAXQ2000-RAX (68-pin QFN)
U6	0	Maxim MAX4366EUA+ (8-pin µMAX)
VR1	1	Volume control, 5kΩ Panasonic EVL-HFAA01A53
Y1	1	16MHz crystal (HC49/US), parallel resonant, 20pF load Citizen HC49US16.000MABJ ECS ECS-160-20-4 Suntsu SCS20B-16.000MHZ-I
Y2	1	6MHz crystal (HC49/US) Citizen HC49US6.000MABJ Suntsu SCS22B-6.000MHZ-I
Y3	1	32.768kHz watch crystal, 12.5pF cylindrical Epson C-001R 32.7680K-A Suntsu SCT3-32.768KHZ
—	8	Shunts
—	1	MAX7349 EV kit PC board
—	4	Rubber bumpers, 0.100in (H) x 0.400in (W) square
—	1	USB high-speed A-to-B cable, 5ft (1.5m)

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Component Suppliers

SUPPLIER	PHONE	WEBSITE
Murata	770-436-1300	www.murata.com
Panasonic	714-373-7366	www.panasonic.com
Suntsu Frequency Control	949-305-0220	www.suntsuinc.com
Taiyo Yuden	800-348-2496	www.t-yuden.com
TDK	847-803-6100	www.component.tdk.com

Note: *Indicate that you are using the MAX7349 when contacting these component suppliers.*

Quick Start

Required Equipment

Before you begin, you need the following equipment:

- Maxim MAX7349 EV kit
- USB-type A-B cable (included with MAX7349EVKIT)
- Windows 98SE/2000/XP computer with a spare USB port
- Administrator privileges may be required when first installing the device on Windows 2000/XP

Procedure

Do not turn on the power until all connections are made.

1) Ensure that the jumper settings are in the default positions. See Table 1.
2) Install the evaluation software on your computer by running the INSTALL.EXE program on the installation disk. The program files are copied and icons are created for them in the Windows **Start** menu.
3) Connect the USB cable between the MAX7349 EV kit and the computer. When you plug in the MAX7349 EV kit board for the first time, the Windows plug-and-play system detects the new hardware and automatically runs the **Add New Hardware Wizard**. (If the **Add New Hardware Wizard** does not appear after one minute, unplug the USB cable and plug it in again.) Be sure to specify the search location. This EV kit is based on the CMAXQUSB design, so the software includes a copy of the device driver in the installed software directory. Refer to Application Note 3601 *Troubleshooting Windows Plug-and-Play and USB for Maxim Evaluation Kits* for more details.
4) During device driver installation, Windows XP shows a warning message, indicating that the

Table 1. Jumper Functions

JUMPER	SHUNT LOCATION	FUNCTION
JU1	Pins 1 and 2*	AD0 = GND; I²C address 0x70 / 0x72
	Pins 3 and 4	AD0 = SCL; I²C address 0x7C / 0x7E
	Pins 5 and 6	AD0 = VDD; I²C address 0x74 / 0x76
	Pins 7 and 8	AD0 = SDA; I²C address 0x78 / 0x7A
JU2	Pins 1 and 2*	Pizeo Sounder. P1 driven directly by SOUNDER output.
	Pins 2 and 3	Pizeo Sounder. P1 driven through optional active filter circuit. Requires installing U6 and other components.
JU3	Pins 1 and 2*	ALERT Input. Connected to VDD.
	Pins 2 and 3	ALERT Input. Connected to GND.
	No shunt	ALERT Input. Must be connected to an external drive signal.
JU4	Pins 1 and 2*	SDA. Connected to on-board I²C bus
	No shunt	SDA. Must be connected to an external I²C bus.
JU5	Pins 1 and 2*	SCL. Connected to on-board I²C bus.
	No shunt	SCL. Must be connected to an external I²C bus
JU6	Pins 1 and 2*	INT. Pulled up to on-board VDD supply.
	Pins 2 and 3	INT. Pulled up to external INTVDD supply.
	No shunt	Invalid Configuration. Do not use.
JU7	Not installed*	V_{DDIO} = 2.5V from U3
	PC board trace cut open	V_{DDIO}. Must be provided externally. 2.5V < V_{DDIO} < 3.6V.
JU8	Not installed*	V_{DD} = V_{DDIO}
	PC board trace cut open	V_{DD} Power to MAX7349. Must be provided externally. $V_{DD} \le V_{DDIO}$.
JU9	Pins 1 and 2*	SDA. Connected to on-board pullup resistor.
	No shunt	SDA. Pullup resistor must be provided externally.
JU10	Pins 1 and 2*	SCL. Connected to on-board pullup resistor.
	No shunt	SCL. Pullup resistor must be provided externally.
JU11	Not installed*	JTAG Power. Not connected to USB power.
	Pins 1 and 2	JTAG Power. Connected to USB power.

**Default configuration.*

device driver Maxim uses does not contain a digital signature. This is not an error condition. It is safe to proceed with the installation.

5) Verify that the EV kit's LED1 is lit, indicating that the USB is connected and providing power.
6) Start the EV kit software by clicking its icon in the Windows **Start** menu.
7) The software automatically connects to the board after a few seconds.
8) Click the **Initialize EV kit** button to write the power-up command and configure default settings for demonstration. This button writes to three registers: Write(0x04 configuration) = 0xF8; Write(0x01 debounce) = 0x3F; and Write(0x03 interrupt) = 0x10.
9) On the EV kit board, press the buttons in the KEY0–KEY55 matrix. Verify that the key scan codes are reported in the software's history window after 5 to 6 keypress events are queued, depending on the debounce time and interrupt register settings. The

most recent scan code is identified in the **Key Grid**. Click the **0x04 Configuration** group's **Read** button and verify reported status **sound from keypress**.

10) In the **0x05 Ports** group, uncheck the **GPO7** box and click **Write**. Verify LED2 lights up.

11) In the **0x05 Ports** group, check the **GPO7** box and click **Write**. Verify LED2 no longer lights.

12) Move shunt JU3 and observe the sounder beep in response to the ALERT pin. Verify register **0x03 Interrupt** shows ALERT as the source of interrupt. Click the **0x04 Configuration** group's **Read** button and verify reported status **sound from keypress**.

13) In the **Sounder** group, select the sounder commands **125ms** and **C5** from the drop-down menus, check the **BUF = 0** box, and click **Write**. Verify the sounder beeps. Click the **0x04 Configuration** group's **Read** button and verify reported status **sound from keypress**.

Detailed Description of Software

Connecting to Hardware

The software automatically searches for the MAX7349 EV kit hardware when launched. Once the hardware is found and connected, the I²C device address is shown in the upper-left corner.

Autoread

The software automatically reads registers every 2 to 3 seconds if **Auto Read 1-7** is checked. This option should be left unchecked when preparing to write new values.

Registers

Each of the MAX7349 registers is represented on the software's main window. See Figure 1. Each register has its own **Read** and **Write** buttons. Clicking **Read entire FIFO now** reads register 0x00 repeatedly, until the FIFO indicates that all keypress events have been read.

Key Grid

Whenever a keypress event is received, the key location is shown on the **Key Grid**. This grid shows eight rows and up to eight columns. Register **0x01 Debounce / Port Enable** determines how many of the column pins are taken away from the **Key Grid** and used for general-purpose outputs.

Interrupt Response

Although the PC software cannot respond to interrupts with the speed of a true low-level hardware interrupt, the software does offer flexibility for evaluation. The software polls the status of the $\overline{INT}$ output pin every 2 seconds. The **Interrupt Handler Actions** checkboxes determine what action the software takes when $\overline{INT}$ is active.

History Window

Each register read or write event is recorded in a scrollable text window underneath the interrupt handler actions.

Keyboard Navigation

When you type on the PC keyboard, the system must know which control should receive the keys. Press the Tab key to move the keyboard's focus from one control to the next. The focused control is indicated by a dotted outline. Shift+Tab moves the focus to the previously focused control. Buttons respond to the keyboard's spacebar. Some controls respond to the keyboard's Up and Down arrow keys. Activate the program's menu bar by pressing the F10 key, then press the letter of the menu item you want. Most menu items have one letter underlined, indicating their shortcut key.

Detailed Description of Hardware

The MAX7349 (U1) scans a matrix of keys (KEY0–KEY55). The evaluation kit provides a 7 x 8 matrix of keys, although the MAX7349 is capable of scanning an 8 x 8 matrix. To demonstrate general-purpose output capability, one of the scanning columns (COL7/PORT7) is connected to an indicator (LED2).

The FTDI FT232BM (U2) provides the USB engine. The USB 5V power is regulated down to 2.5V by U3. LED1 indicates that USB 5V power is present.

Jumpers JU4 and JU5 optionally disconnect the MAX7349 SCL/SDA, allowing the use of an external user-provided I²C bus. Jumpers JU9 and JU10 optionally disable the on-board 1.5kΩ termination resistors R5 and R6, allowing the use of external user-provided I²C pullup resistors.

To optionally improve the sounder output waveform, space is provided to mount a MAX4366 (U6) and associated passive components C31–C35 and R21–R25 to form a lowpass third-order Chebyshev filter and output stage, as shown in Figure 12 of the MAX7347/MAX7348/MAX7349 data sheet. If these filter components are installed, move JU2 shunt to position 2-3 to use the filter to drive the on-board pizeo transducer.

The low-voltage RISC microcontroller, MAXQ2000-RAX (U5), processes commands sent by a program running on the PC. Each particular EV kit has its own custom software specific to that kit. Connector P5 is used during factory tests to program the MAXQ2000 in-circuit using the JTAG interface. The connector pin configuration is compatible with the MAXQ2000 evaluation kit's

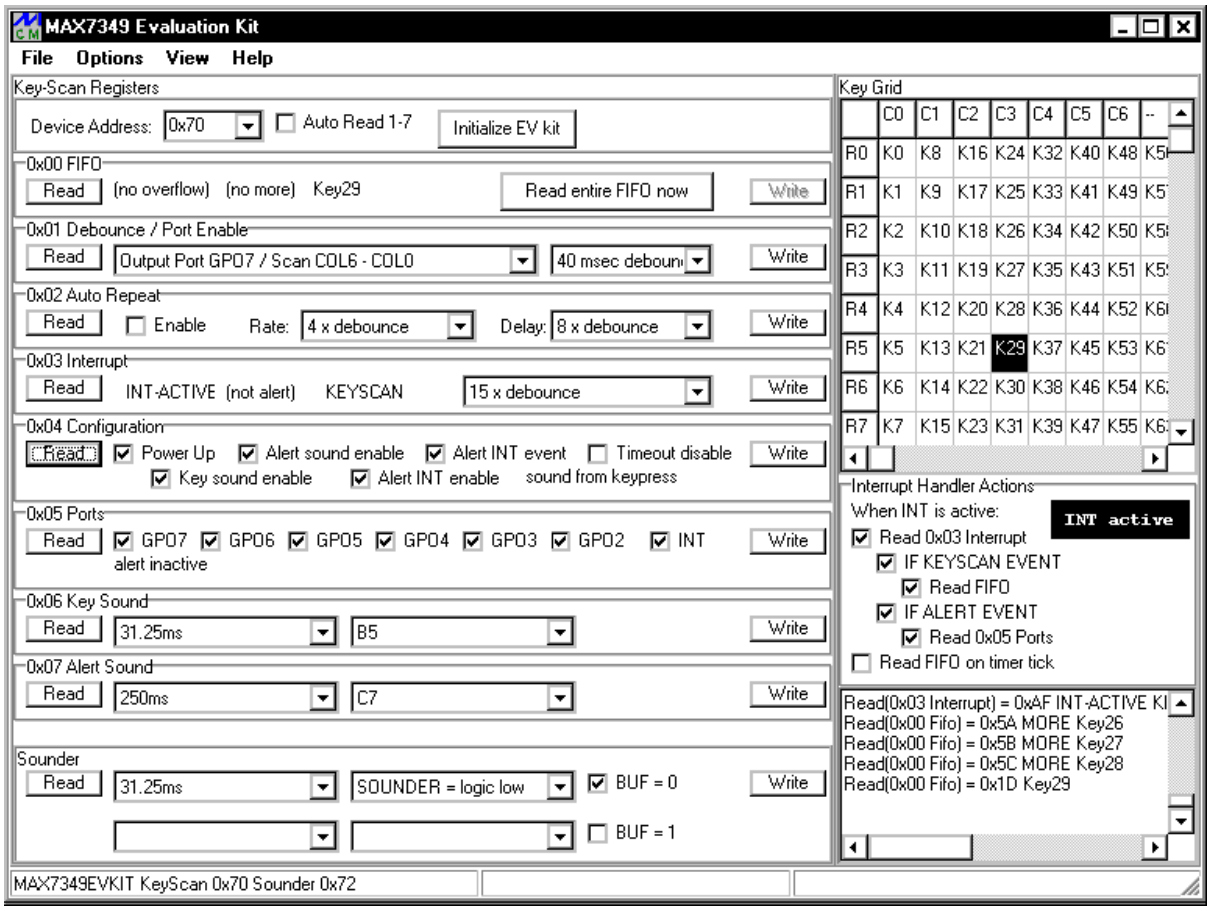

Figure 1. The MAX7349 Evaluation Software's Main Window Provides Direct Access to All Registers and Controls the Interrupt Response

MAXQ-JTAG-001 board. The firmware loaded on this board is identical to the CMAXQUSB interface module.

Using an External I²C Bus Instead of USB

To disconnect from the on-board I²C bus, remove the shunts from jumpers JU4 and JU5. Leave the USB connector, P2, unconnected. Provide 2.5V to 3.6V power to the GND and V+ test points on header H2. Connect the external I²C bus to the SCL and SDA test points. If the external I²C bus already has appropriate pullup resistors, remove shunts from JU9 and JU10.

Emulating the MAX7348

The MAX7348 behaves just like the MAX7349, except it has fewer columns (COL0–COL4) and no ALERT input. Although a MAX7348 could be fitted to the PC board (aligning pin 1 with ROW0), the MAX7348 can be emulated by using a subset of the MAX7349 pins and register bits. See Tables 2 and 3.

Emulating the MAX7347

The MAX7347 behaves just like the MAX7349, except it has fewer columns (COL0–COL2), no ALERT input, and no SOUNDER output. The MAX7347 cannot be fitted to the PC board due to differences in pin count and pin configuration, but the MAX7347 can be emulated by using a subset of the MAX7349 pins and register bits. MAX7347 has a fixed I²C address, so connect AD0 to GND by placing JU1 in position 1-2. Because there is no ALERT, place JU3 in position 2-3. See Tables 2 and 3.

Table 2. Pin Configuration when Emulating Other Devices

PIN	MAX7349 EV KIT SIGNAL	PIN	MAX7348 FUNCTION	PIN	MAX7347 FUNCTION
1	COL7/PORT7	—	—	—	—
2	ROW0	1	ROW0	1	ROW0
3	ROW1	2	ROW1	2	ROW1
4	ROW2	3	ROW2	3	ROW2
5	ROW3	4	ROW3	4	ROW3
6	COL3/PORT3	5	COL3/PORT3	—	—
7	COL4/PORT4	6	COL4/PORT4	—	—
8	ROW4	7	ROW4	5	ROW4
9	ROW5	8	ROW5	6	ROW5
10	ROW6	9	ROW6	7	ROW6
11	ROW7	10	ROW7	8	ROW7
12	COL6/PORT6	—	—	—	—
24	ALERT	—	—	—	—
23	V+	20	V+	16	V+
22	$\overline{INT}$	19	$\overline{INT}$	15	$\overline{INT}$
21	SCL	18	SCL	14	SCL
20	SDA	17	SDA	13	SDA
19	AD0	16	AD0	—	—
18	GND	15	GND	12	GND
17	SOUNDER	14	SOUNDER	—	—
16	COL0	13	COL0	11	COL0
15	COL1	12	COL1	10	COL1
14	COL2/PORT2	11	COL2/PORT2	9	COL2/PORT2
13	COL5/PORT5	—	—	—	—

Table 3. Registers Affected when Emulating Other Devices

I²C ADDRESS	REGISTER	MAX7348	MAX7347
0111 xx0 R/W	0 FIFO	—	—
0111 xx0 R/W	1 Debounce / Port Enable	No COL7/PORT7 No COL6/PORT6 No COL5/PORT5	No COL7/PORT7 No COL6/PORT6 No COL5/PORT5 No COL4/PORT4 No COL3/PORT3
0111 xx0 R/W	2 Auto Repeat	—	—
0111 xx0 R/W	3 Interrupt	—	—
0111 xx0 R/W	4 Configuration	No ALERT	No ALERT
0111 xx0 R/W	5 Ports	No GPO7 No GPO6 No GOP5	No GPO7 No GPO6 No GPO5 No GPO4 No GPO3
0111 xx0 R/W	6 Key Sound	—	No SOUNDER
0111 xx0 R/W	7 Alert Sound	—	No SOUNDER
0111 xx1 R/W	Sounder command	—	No SOUNDER

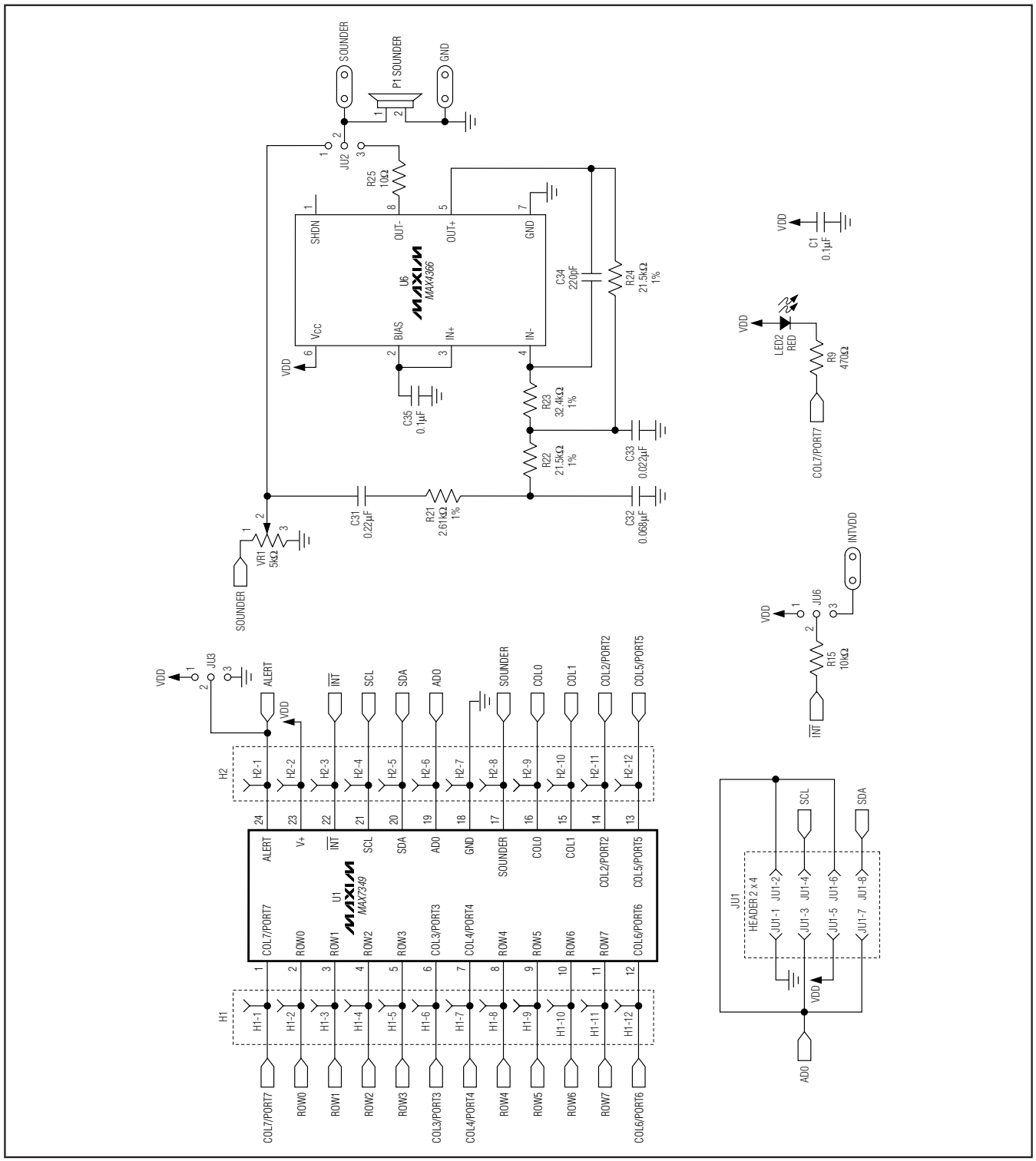

Figure 2. MAX7349 EV Kit Schematic (Sheet 1 of 4)

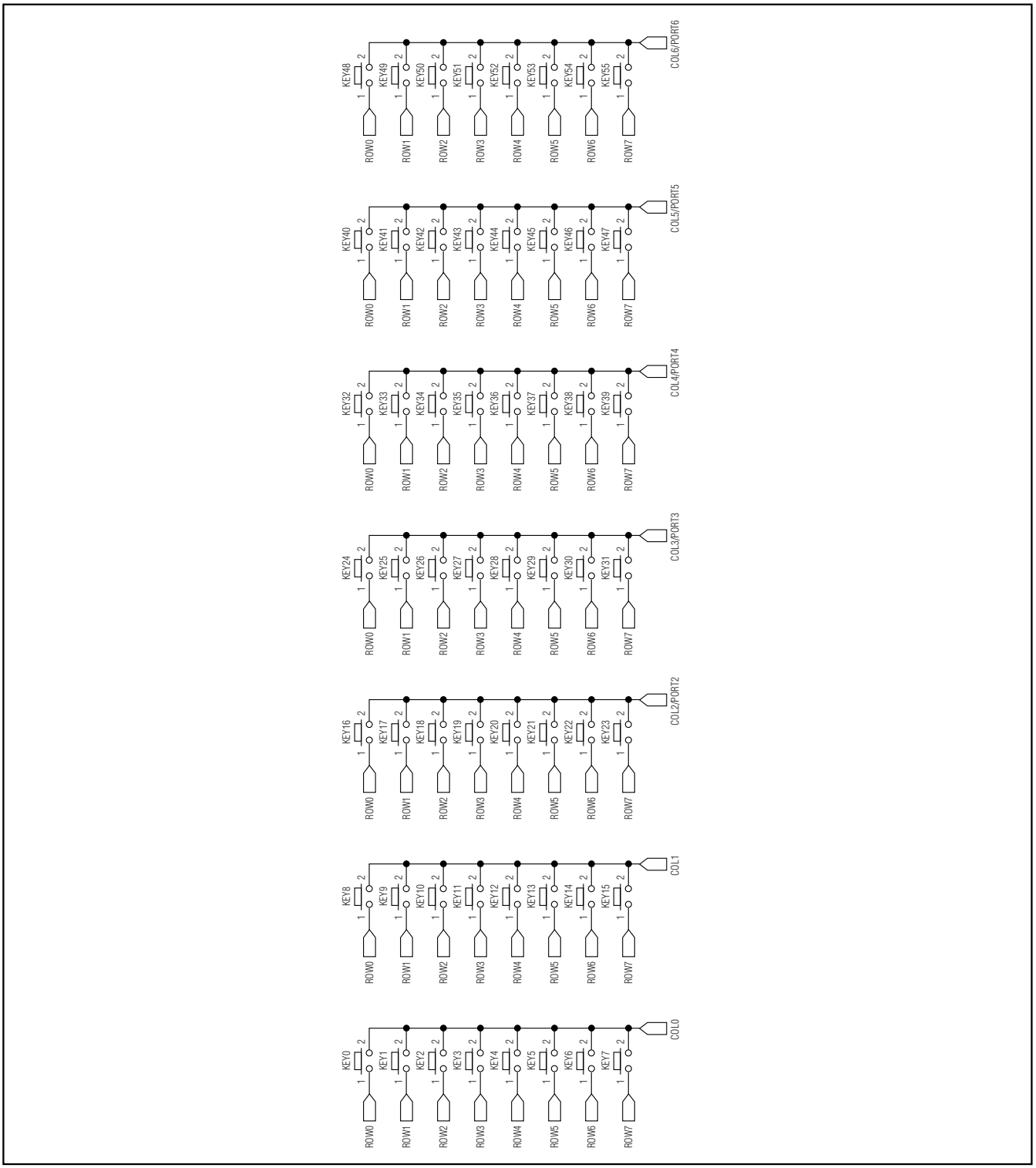

Figure 2. MAX7349 EV Kit Schematic (Sheet 2 of 4)

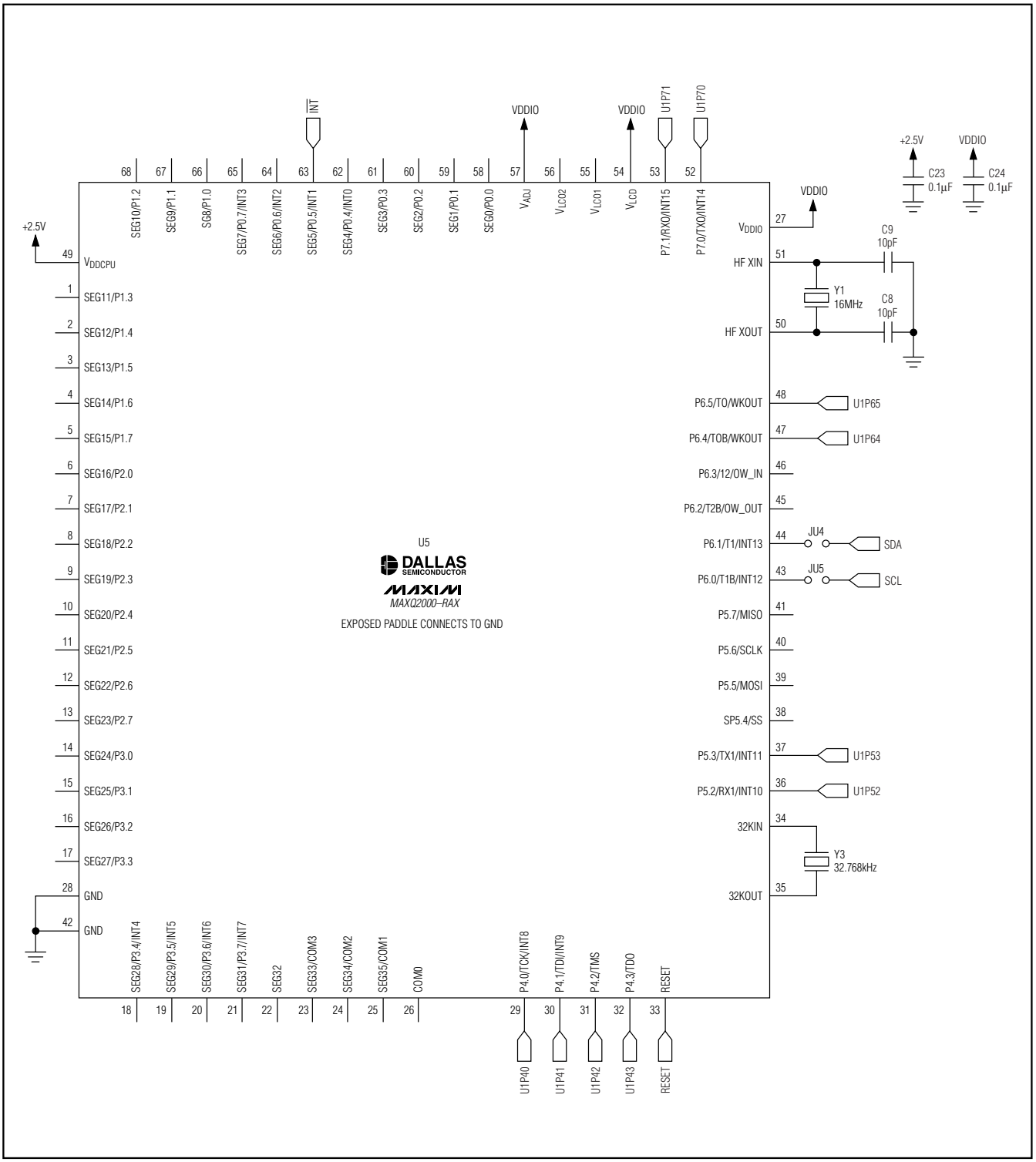

Figure 2. MAX7349 EV Kit Schematic (Sheet 3 of 4)

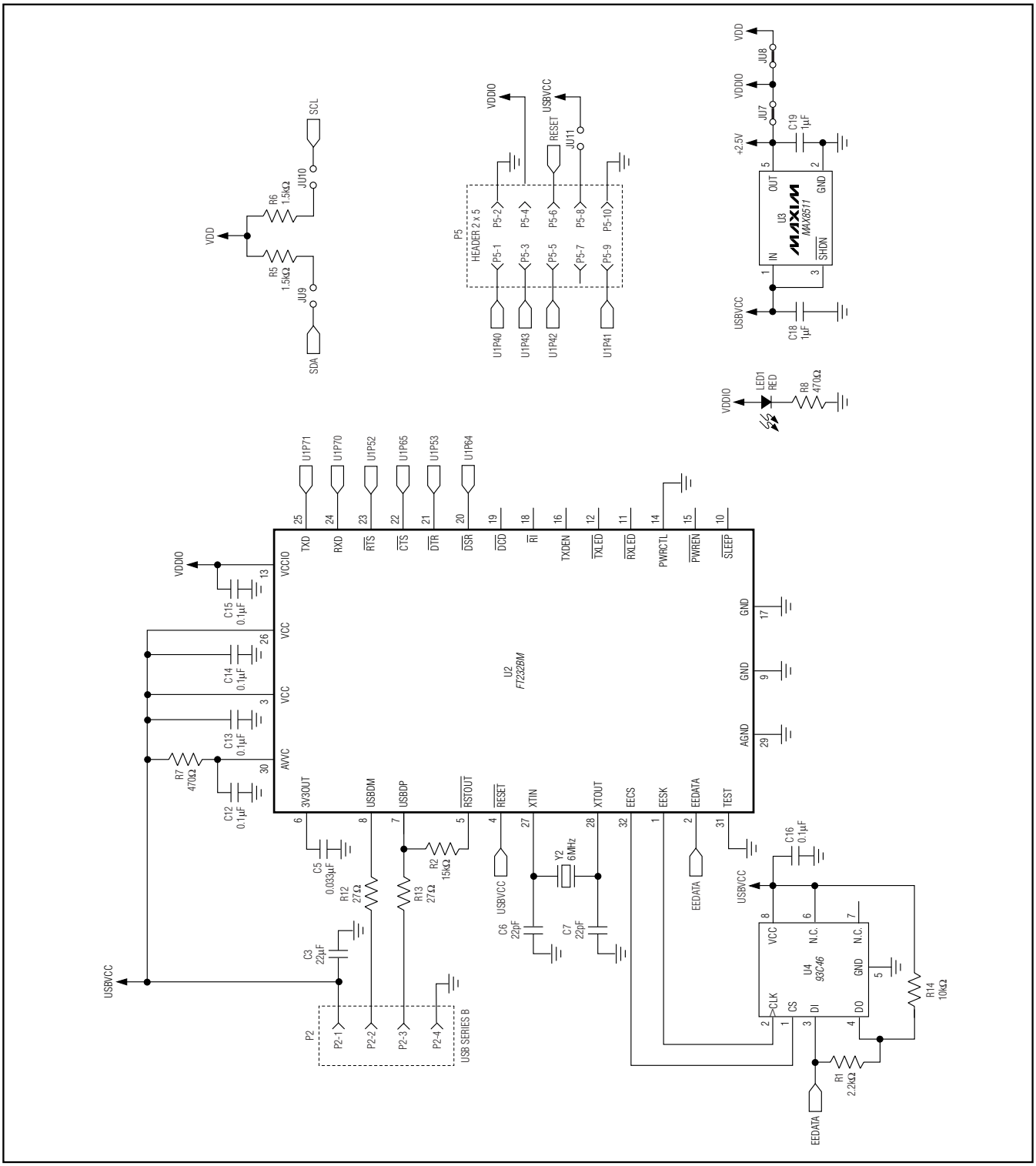

Figure 2. MAX7349 EV Kit Schematic (Sheet 4 of 4)

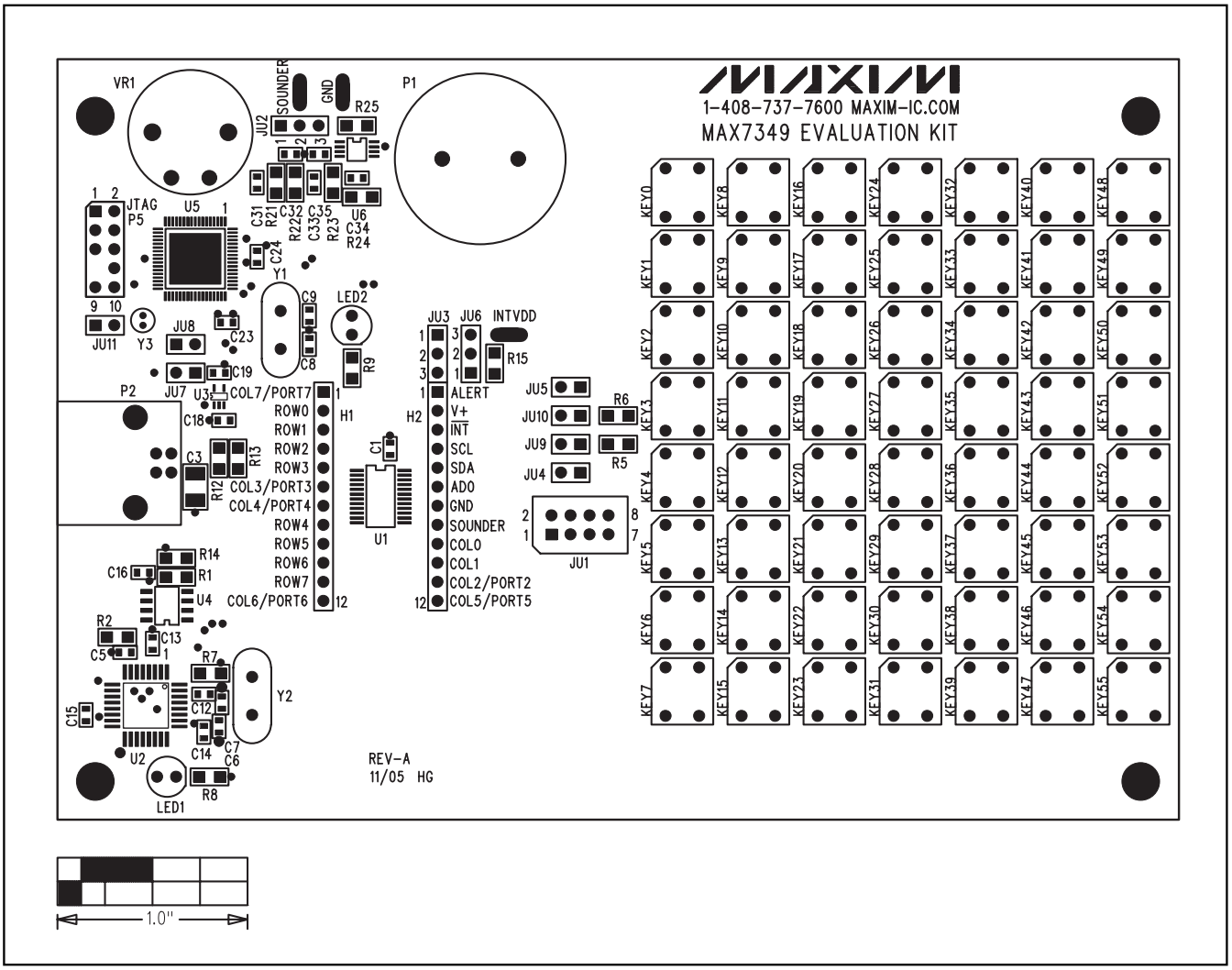

Figure 3. MAX7349 EV Kit Component Placement Guide—Component Side

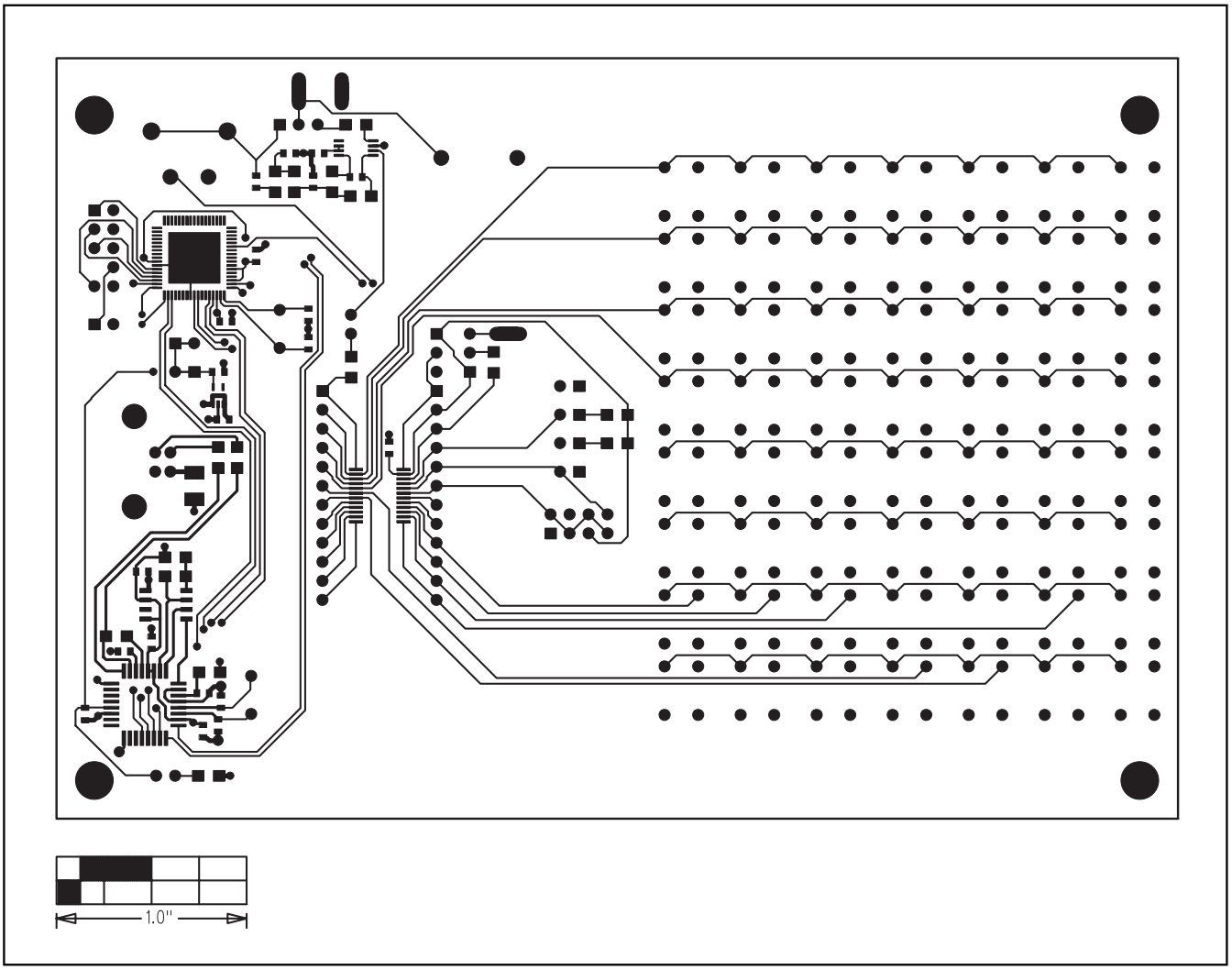

Figure 4. MAX7349 EV Kit PC Board Layout—Component Side

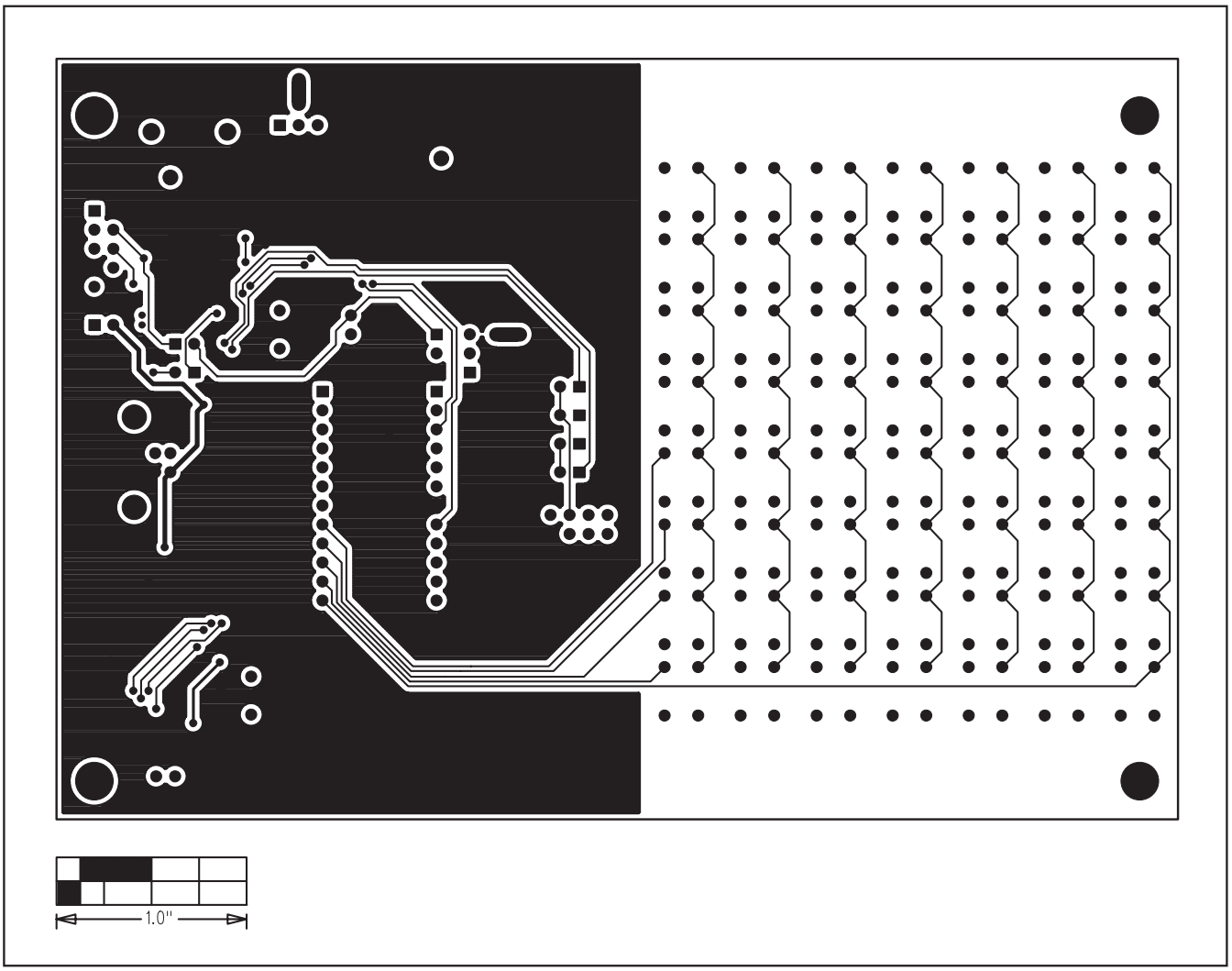

Figure 5. MAX7349 EV Kit PC Board Layout—Solder Side