



## MAX7359 Evaluation Kit

### General Description

The MAX7359 evaluation kit (EV kit) is an assembled and tested printed-circuit board (PCB) that demonstrates the MAX7359 2-wire interfaced low-EMI key switch controller. Windows® 2000/XP/Vista-compatible software provides a handy user interface to exercise the features of the MAX7359.

### Features

- ◆ Windows 2000/XP/Vista (32-Bit)-Compatible Software
- ◆ Proven PCB Layout
- ◆ Complete Evaluation System
- ◆ 8 x 8 Key Matrix Included
- ◆ Optional PORT2–PORT7 Output LEDs
- ◆ Fully Assembled and Tested

### Ordering Information

| PART          | TYPE   |
|---------------|--------|
| MAX7359EVKIT+ | EV kit |

+Denotes lead-free and RoHS-compliant.

### Component List

| DESIGNATION              | QTY | DESCRIPTION                                                                                                                                   |
|--------------------------|-----|-----------------------------------------------------------------------------------------------------------------------------------------------|
| C1, C5–C9, C17, C18, C37 | 9   | 0.1μF ±10%, 10V (min) X7R ceramic capacitors (0603)<br>TDK C1608X7R1C104K<br>Taiyo Yuden EMK107BJ104KA<br>Murata GRM188R71C104K               |
| C2                       | 0   | Not installed, capacitor (0603)                                                                                                               |
| C4                       | 1   | 0.033μF ±10%, 6.3V (min) X7R ceramic capacitor (0603)<br>TDK C1608X7R1E333K<br>Murata GRM188R71E333K<br>Taiyo Yuden EMK107BJ333KA             |
| C10, C39                 | 2   | 1μF ±10%, 16V X5R ceramic capacitors (0603)<br>TDK C1608X5R1C105K<br>Murata GRM188R61C105K<br>AVX 0603YD105MAT<br>KEMET C0603C105K4PAC        |
| C11, C12, C38, C40       | 4   | 10μF ±20%, 16V X5R ceramic capacitors (1206)<br>Murata GRM31CR61C106M<br>TDK C3216X5R1C106M<br>Panasonic ECJ3YB1C106M<br>KEMET C1206C106M4PAC |
| C15, C16                 | 2   | 10pF ±5%, 50V C0G ceramic capacitors (0603)<br>Murata GRM1885C1H100J<br>TDK C1608C0G1H100J<br>Taiyo Yuden UMK107CG100DZ                       |

| DESIGNATION | QTY | DESCRIPTION                                                                                                             |
|-------------|-----|-------------------------------------------------------------------------------------------------------------------------|
| C30, C31    | 2   | 22pF ±5%, 50V C0G ceramic capacitors (0603)<br>Murata GRM1885C1H220J<br>TDK C1608C0G1H220J<br>Taiyo Yuden UMK107CG220KZ |
| H1–H4       | 4   | 6-pin headers                                                                                                           |
| J1          | 1   | USB series type-B right-angle PC-mount receptacle                                                                       |
| J3 (JTAG)   | 1   | Vertical header, 2 x 5 pins (keyed pin 7)                                                                               |
| JU1         | 1   | Dual-row vertical header, 2 x 4 pins                                                                                    |
| JU2         | 1   | 3-pin header                                                                                                            |
| JU3–JU8     | 6   | 2-pin headers                                                                                                           |
| JU9–JU13    | 0   | Not installed, 2-pin headers—PCB shorted trace                                                                          |
| KEY0–KEY63  | 64  | Momentary 6mm pushbutton switches<br>OMRON B3F1000                                                                      |
| L1          | 1   | Ferrite bead (0603)<br>TDK MMZ1608R301A<br>Murata BLM18SG700 TN1                                                        |
| LED1–LED8   | 8   | Red LEDs (T1-3/4)                                                                                                       |
| R1, R2      | 2   | 27Ω ±5% resistors (0603)                                                                                                |
| R3, R7, R8  | 3   | 1.5kΩ ±5% resistors (0603)                                                                                              |
| R4          | 1   | 470Ω ±5% resistor (0603)                                                                                                |
| R5          | 1   | 2.2kΩ ±5% resistor (0603)                                                                                               |

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Evaluates: MAX7359

# MAX7359 Evaluation Kit

## Component List (continued)

| DESIGNATION | QTY | DESCRIPTION                                                                              |
|-------------|-----|------------------------------------------------------------------------------------------|
| R6          | 1   | 10k $\Omega$ $\pm$ 5% resistor (0603)                                                    |
| R9          | 1   | 33k $\Omega$ $\pm$ 5% resistor (0603)                                                    |
| R10–R17     | 8   | 330 $\Omega$ $\pm$ 5% resistors (0603)                                                   |
| R18         | 1   | 0 $\Omega$ resistor (0603)                                                               |
| R19–R23     | 0   | Not installed, resistors—PCB shorted trace (0402)                                        |
| U1          | 1   | Maxim I <sup>2</sup> C interfaced peripheral MAX7359ETG+ (24-pin TQFN-EP, 3.5mm x 3.5mm) |
| U2          | 1   | Maxim LDO linear regulator MAX8511EXK25+ (5-pin SC70) (Top Mark: ADV)                    |
| U3          | 1   | Maxim LDO linear regulator MAX8511EXK33+ (5-pin SC70) (Top Mark: AEI)                    |
| U4          | 1   | Maxim RISC microcontroller MAXQ2000-RAX+ (68-pin QFN)                                    |

| DESIGNATION | QTY | DESCRIPTION                                                                                             |
|-------------|-----|---------------------------------------------------------------------------------------------------------|
| U5          | 1   | FTDI FT232BL (32-pin TQFP, 7mm x 7mm)                                                                   |
| U6          | 1   | 93C46 type 3-wire EEPROM (8-pin SO)                                                                     |
| Y2          | 1   | 16MHz crystal (parallel resonant, 20pF load)<br>Citizen HCM49-16.000MABJUT<br>Suntzu SCD20B-16.000MHZ-I |
| Y3          | 0   | Not installed, 32.768kHz watch crystal                                                                  |
| Y4          | 1   | 6MHz crystal                                                                                            |
| —           | 8   | Shunts                                                                                                  |
| —           | 1   | PCB: MAX7359 Evaluation Kit+                                                                            |
| —           | 4   | Rubber bumpers, 0.100in H x 0.400in W square                                                            |
| —           | 1   | USB high-speed A-to-B cable, 5ft (1.5m)                                                                 |

## Component Suppliers

| SUPPLIER              | PHONE        | WEBSITE               |
|-----------------------|--------------|-----------------------|
| Murata Mfg. Co., Ltd. | 770-436-1300 | www.murata.com        |
| Panasonic Corp.       | 714-373-7366 | www.panasonic.com     |
| Taiyo Yuden           | 800-348-2496 | www.t-yuden.com       |
| TDK Corp.             | 847-803-6100 | www.component.tdk.com |

**Note:** Indicate that you are using the MAX7359 when contacting these component suppliers.

# MAX7359 Evaluation Kit

Evaluates: MAX7359

## Quick Start

### Required Equipment

Before beginning, the following equipment is needed:

- User-supplied Windows 2000/XP/Vista-compatible computer with a spare USB port

**Note:** Administrator privileges may be required when first installing the device.

**Note:** In the following sections, software-related items are identified by bolding. Text in **bold** refers to items directly from the EV kit software. Text in **bold and underlined** refers to items from the Windows operating system.

### Procedure

The MAX7359 EV kit is fully assembled and tested. Follow the steps below to verify board operation.

- 1) Visit [www.maxim-ic.com/evkitsoftware](http://www.maxim-ic.com/evkitsoftware) to download the latest version of the EV kit software, 7359Rxx.ZIP. Save the EV kit software to a temporary folder and uncompress the ZIP file.
- 2) Install the EV kit software on your computer by launching the 7359Rxx.MSI program inside the zip file. The program files are copied and icons are created in the Windows **Start | Programs** menu.
- 3) Ensure that the jumper settings are in the default positions (see Table 1).
- 4) Connect the USB cable from the PC to the MAX7359 EV kit board. A **Building Driver Database** window pops up in addition to a **New Hardware Found** message when installing the USB driver for the first time. If you do not see a window that is similar to the one described above after 30s, remove the USB cable from the board and reconnect it. Administrator privileges are required to install the USB device driver on Windows 2000 and XP. Refer to *Application Note 3601: Troubleshooting Windows Plug-and-Play and USB for Maxim Evaluation Kits* if you have any problems during this step.

- 5) Follow the directions of the **Add New Hardware Wizard** to install the USB device driver. Choose the **Search for the best driver for your device** option. Specify the location of the device driver to be **C:\Program Files\Maxim MAX7359EVKIT** (default installation directory) using the **Browse** button. During device driver installation, Windows XP shows a warning message indicating that the device driver Maxim uses does not contain a digital signature. This is not an error condition. It is safe to proceed with the installation.
- 6) Verify that the EV kit's LED8 is lit, indicating that the USB is connected and providing power.
- 7) Start the EV kit software by clicking its icon in the Windows **Start** menu.
- 8) The software automatically connects to the board after a few seconds.
- 9) 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(0x01 Configuration) = 0xAA; Write(0x02 Debounce) = 0x1F; and Write(0x03 Interrupt) = 0x2F.
- 10) On the EV kit board, press buttons in the KEY0-KEY63 matrix. Verify that the key scan codes are reported in the software's history window after five to six key-press events are queued, depending on the debounce time and interrupt register settings. The most recent scan code is identified in the **Key Grid**.

## Detailed Description of Software

### Connecting to Hardware

The MAX7359 EV kit software main window (Figure 1) provides direct access to all registers and controls the interrupt response. The software automatically searches for the MAX7359 EV kit hardware when launched. Once the hardware is found and connected, the I<sup>2</sup>C **Device Address** is shown in the upper-left corner.

### Auto Read

The software automatically reads registers every 2s to 3s if the **Auto Read all** checkbox is checked.

# MAX7359 Evaluation Kit

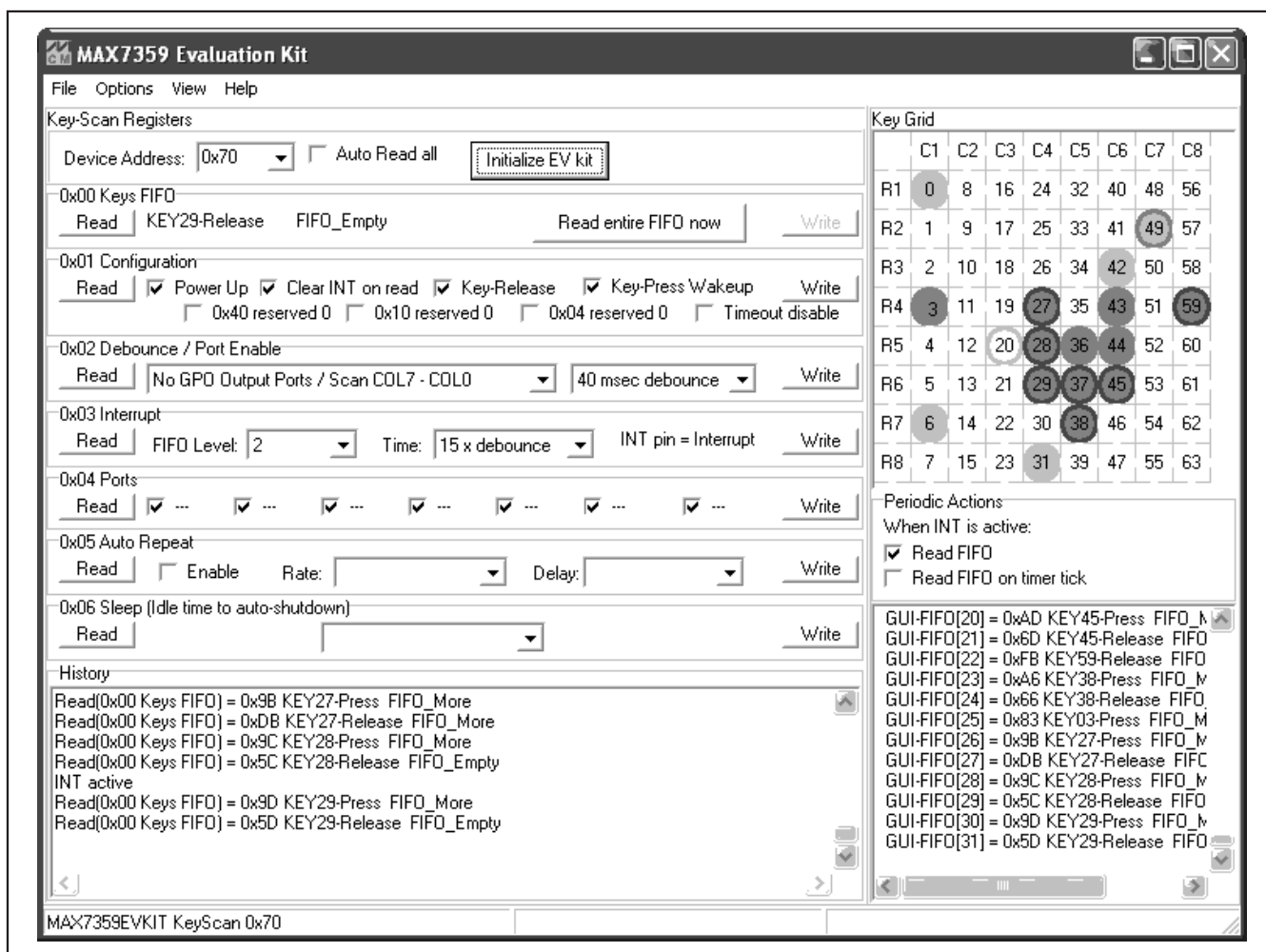


Figure 1. The MAX7359 EV Kit Software Main Window

## Registers

Each of the MAX7359 registers is represented on the software's main window (Figure 1). Each register has its own **Read** and **Write** buttons. Clicking the **Read entire FIFO now** button reads register 0x00 repeatedly, until the FIFO indicates that all key-press events have been read.

## Key Grid

Whenever a key-press event is received, the key location is shown on the **Key Grid**. This grid shows eight rows and eight columns. Register **0x02 Debounce / Port Enable** determines how many of the column pins are taken away from the **Key Grid** and used for general-purpose outputs (GPOs).

## 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 INT output pin twice every second. The **Periodic Actions** checkboxes determine what action the software will take when INT is active.

## History Window

Each register read or write event is recorded in the scrollable **History** window.

# MAX7359 Evaluation Kit

Evaluates: MAX7359

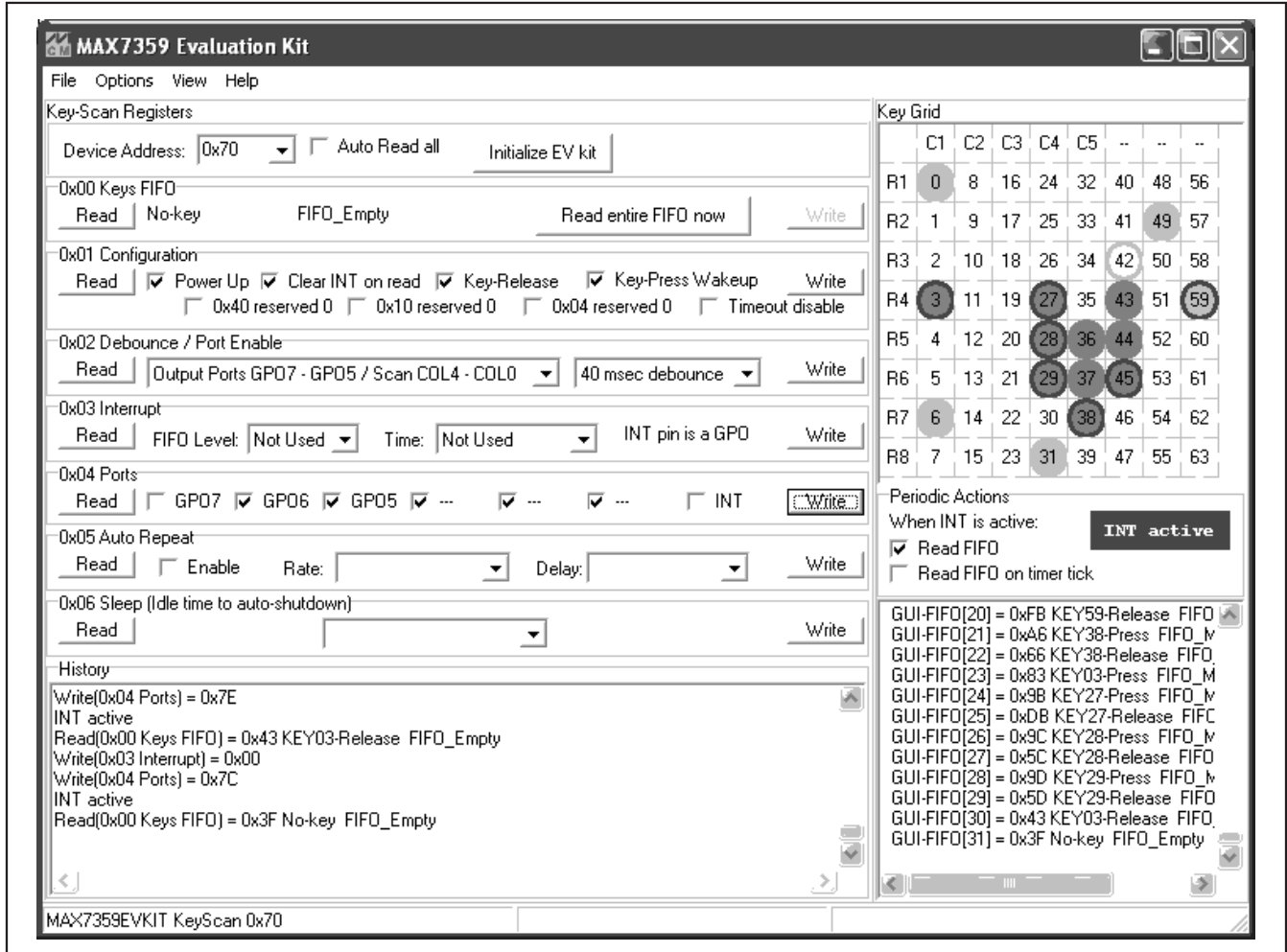


Figure 2. Using the LEDs as GPO Indicators

## Using the LEDs as GPO Indicators

To configure the COL/PORT7 pin as an open-drain GPO, first change the key scan partition by changing the value of the **0x02 Debounce / Port Enable** register to **Output Ports GP07 / Scan COL6 - COL0**. Next, click its **Write** button. Finally, connect LED7 to the COL7/PORT7 pin by installing a shunt at JU8. To drive PORT7 low, illuminating the LED, set the value of the **0x04 Ports** register so that the **GP07** checkbox is unchecked, and click its **Write** button (Figure 2).

To configure additional COL/PORT pins as open-drain GPOs, the procedure is similar. Write the **0x02 Debounce / Port Enable** register to select how many of

the COL/PORT pins will be used for key scanning and how many for output ports. Key scanning always uses the lowest numbered COL/PORT pins. Set the JU3–JU8 jumpers to enable the LED outputs as needed. Write the port data into the **0x04 Ports** register (unchecked = output low, checked = output undriven). Refer to the MAX7359 IC data sheet for more information about the ports register.

To configure the INT pin for use as a GPO pin, set both the **FIFO Level** and **Time** combo box of register **0x03 Interrupt** to **Not Used**, then click the **Write** button. When configured for GPO, the INT pin is controlled from the **0x04 Ports** register (Figure 2).

# MAX7359 Evaluation Kit

## Detailed Description of Hardware

The MAX7359 (U1) scans a matrix of keys (KEY0–KEY63). The EV kit provides an 8 x 8 matrix of keys. To demonstrate GPO capability, LED indicators are jumper-selectable for COL2/PORT2–COL7/PORT7.

The FTDI FT232BL (U5) provides the USB engine. The USB 5V power is regulated down to 2.5V by U2. LED8 indicates that USB 5V power is present.

Jumpers JU10 and JU11 optionally disconnect the MAX7359 SCL/SDA, allowing the use of an external user-provided I<sup>2</sup>C bus. Jumpers JU12 and JU13 optionally disable the on-board 1.5k $\Omega$  termination resistors (R7 and R8), allowing the use of external user-provided I<sup>2</sup>C pullup resistors.

The low-voltage RISC microcontroller, MAXQ2000 (U4), processes commands sent by a program running on the PC. Each particular EV kit has its own custom software specific to that kit. The firmware loaded on this board is identical to the MINIQUEB interface module.

### Using an External I<sup>2</sup>C Bus Instead of USB

To disconnect from the on-board I<sup>2</sup>C bus, cut the links at jumper locations JU10 and JU11. If the external I<sup>2</sup>C bus already has appropriate pullup resistors, cut the links at jumper locations JU12 and JU13. Leave the USB connector (J1) unconnected. Move the JU2 shunt to pins 2-3, and provide 2.5V to 3.6V power to the GND and EXT V+ oval pads. Connect the external I<sup>2</sup>C bus to the SCL and SDA test points of header H3.

**Table 1. Jumper Functions**

| JUMPER | SIGNAL                  | SHUNT POSITION     | EXPLANATION                                                        |
|--------|-------------------------|--------------------|--------------------------------------------------------------------|
| JU1    | AD0                     | 1-2*               | AD0 = GND; I <sup>2</sup> C address 0x70 / 0x72                    |
|        |                         | 3-4                | AD0 = SCL; I <sup>2</sup> C address 0x7C / 0x7E                    |
|        |                         | 5-6                | AD0 = V <sub>CC</sub> ; I <sup>2</sup> C address 0x74 / 0x76       |
|        |                         | 7-8                | AD0 = SDA; I <sup>2</sup> C address 0x78 / 0x7A                    |
| JU2    | VCC                     | 1-2                | U1 V <sub>CC</sub> = V <sub>DDIO</sub> (3.3V)                      |
|        |                         | 2-3                | U1 V <sub>CC</sub> = external user-provided power                  |
| JU3    | COL2/PORT2              | 1 only*            | Use COL2 for key scan                                              |
|        |                         | 1-2                | Use PORT2 to drive LED2                                            |
| JU4    | COL3/PORT3              | 1 only*            | Use COL3 for key scan                                              |
|        |                         | 1-2                | Use PORT3 to drive LED3                                            |
| JU5    | COL4/PORT4              | 1 only*            | Use COL4 for key scan                                              |
|        |                         | 1 and 2            | Use PORT4 to drive LED4                                            |
| JU6    | COL5/PORT5              | 1 only*            | Use COL5 for key scan                                              |
|        |                         | 1 and 2            | Use PORT5 to drive LED5                                            |
| JU7    | COL6/PORT6              | 1 only*            | Use COL6 for key scan                                              |
|        |                         | 1 and 2            | Use PORT6 to drive LED6                                            |
| JU8    | COL7/PORT7              | 1 only*            | Use COL7 for key scan                                              |
|        |                         | 1 and 2            | Use PORT7 to drive LED7                                            |
| JU9    | $\overline{\text{INT}}$ | Not installed*     | $\overline{\text{INT}}$ connected to MAXQ2000                      |
|        |                         | PCB trace cut open | $\overline{\text{INT}}$ connected to user-supplied microcontroller |
| JU10   | SDA                     | Not installed*     | SDA connected to on-board I <sup>2</sup> C bus                     |
|        |                         | PCB trace cut open | SDA must be connected to an external I <sup>2</sup> C bus          |
| JU11   | SCL                     | Not installed*     | SCL connected to on-board I <sup>2</sup> C bus                     |
|        |                         | PCB trace cut open | SCL must be connected to an external I <sup>2</sup> C bus          |
| JU12   | SDA                     | Not installed*     | SDA connected to on-board pullup resistor                          |
|        |                         | PCB trace cut open | SDA pullup resistor must be provided externally                    |
| JU13   | SCL                     | Not installed*     | SCL connected to on-board pullup resistor                          |
|        |                         | PCB trace cut open | SCL pullup resistor must be provided externally                    |

\*Default position.

# MAX7359 Evaluation Kit

Evaluates: MAX7359

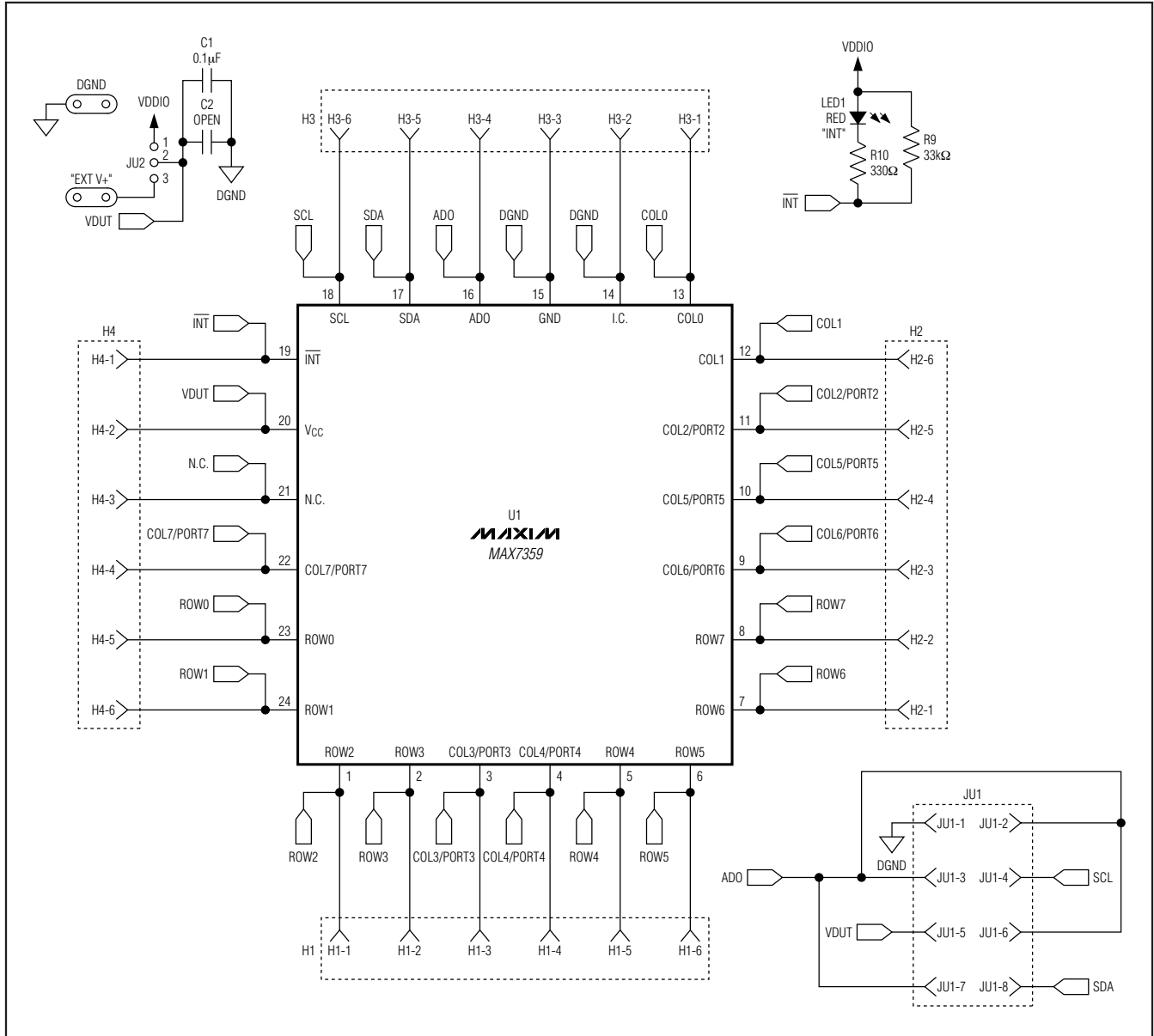


Figure 3a. MAX7359 EV Kit Schematic (Sheet 1 of 5)

# MAX7359 Evaluation Kit

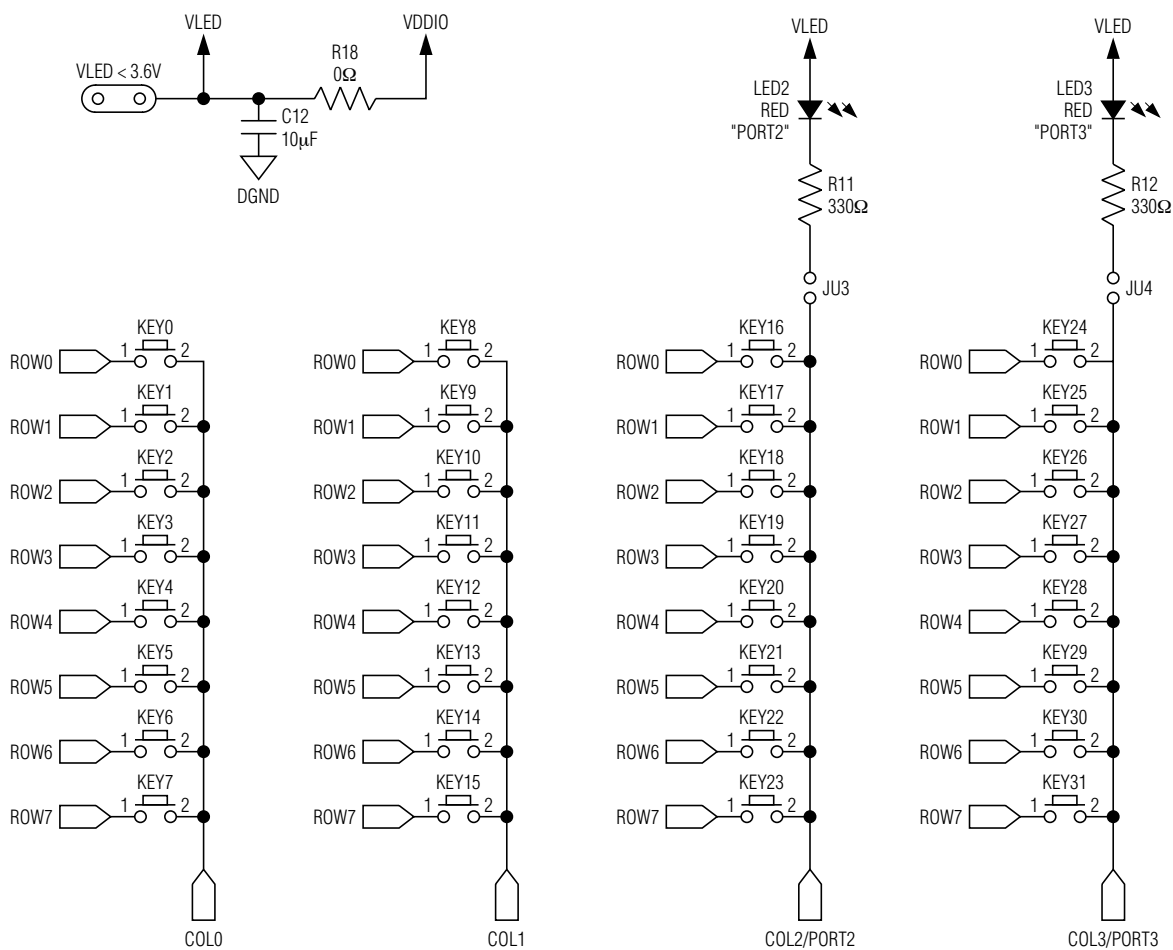


Figure 3b. MAX7359 EV Kit Schematic (Sheet 2 of 5)

# MAX7359 Evaluation Kit

Evaluates: MAX7359

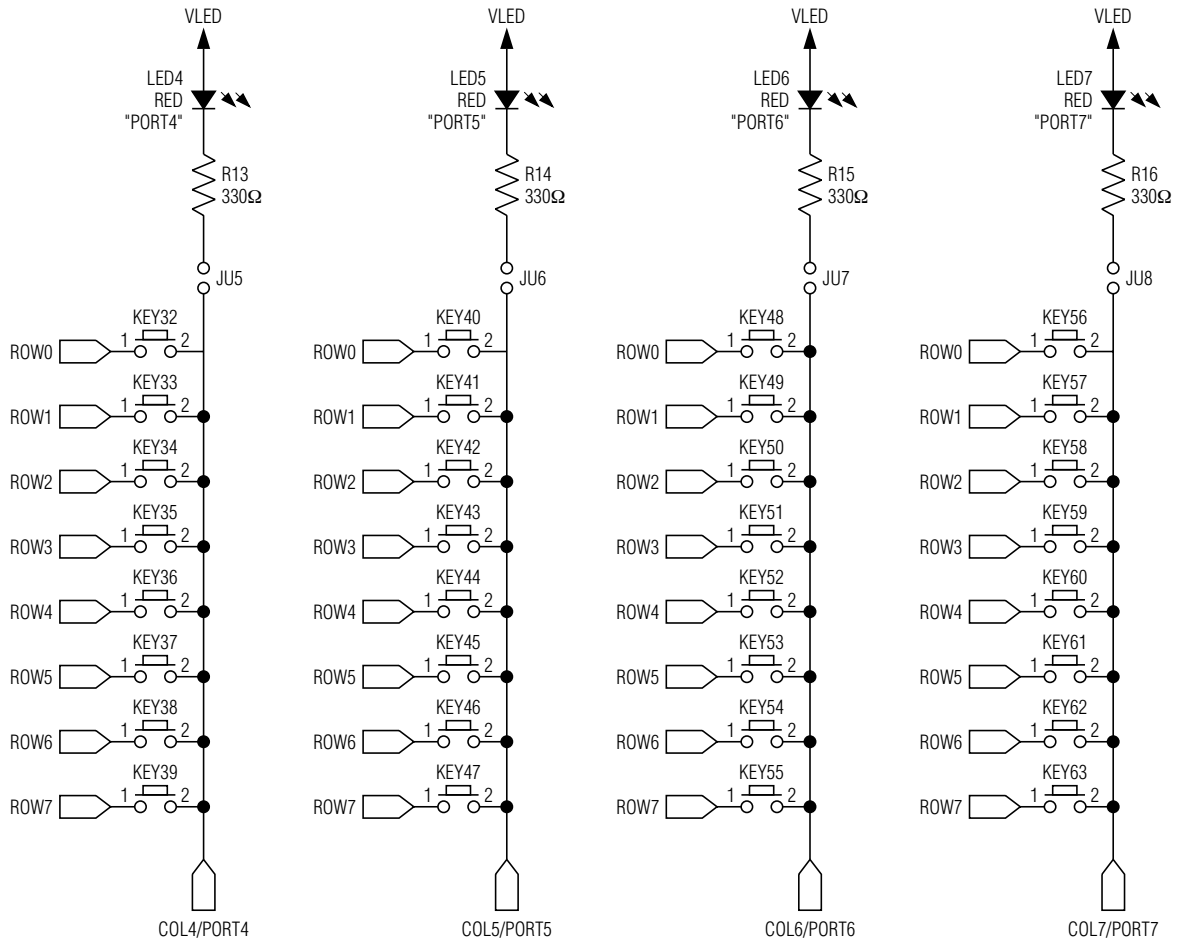


Figure 3c. MAX7359 EV Kit Schematic (Sheet 3 of 5)

# MAX7359 Evaluation Kit

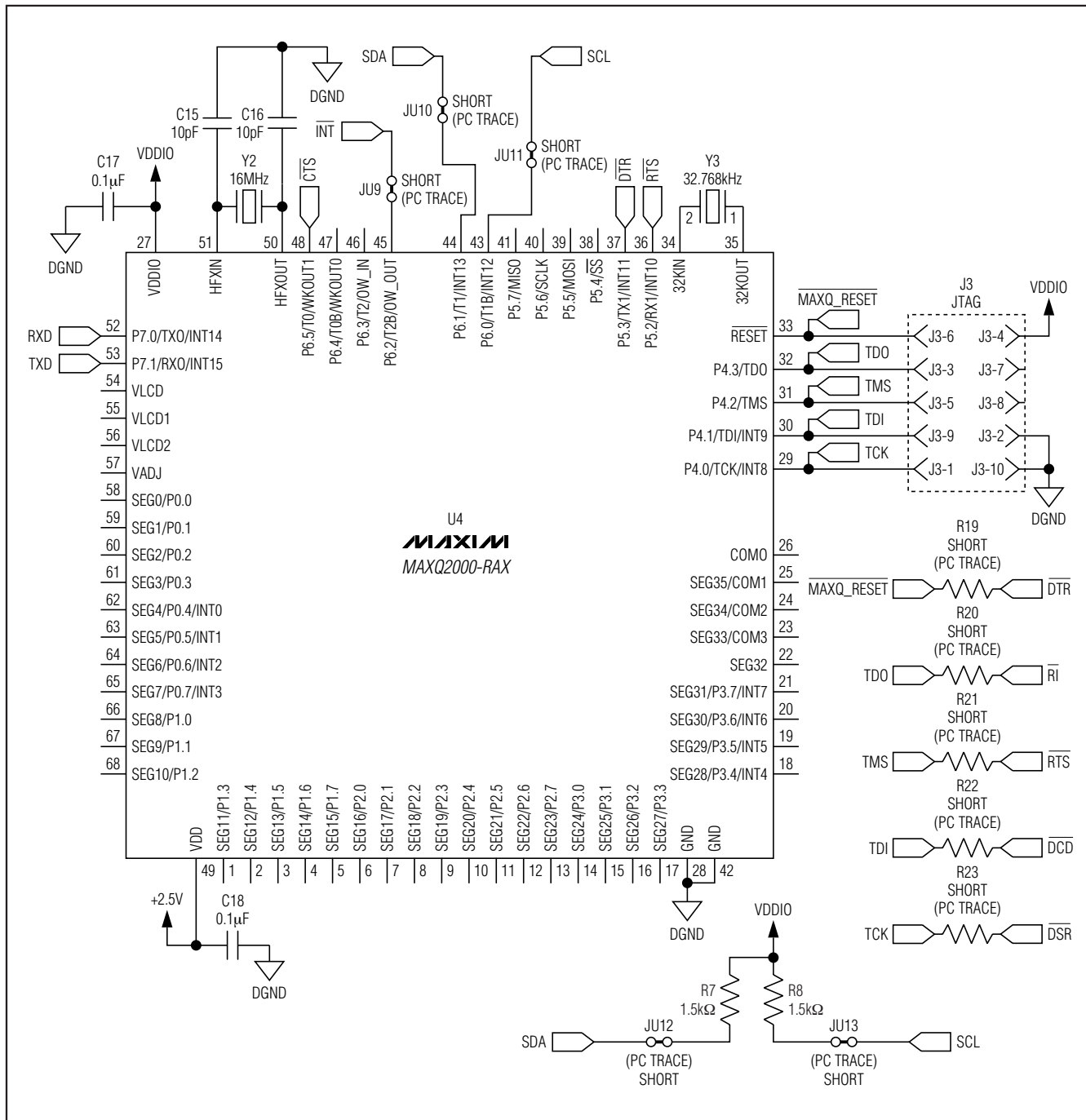
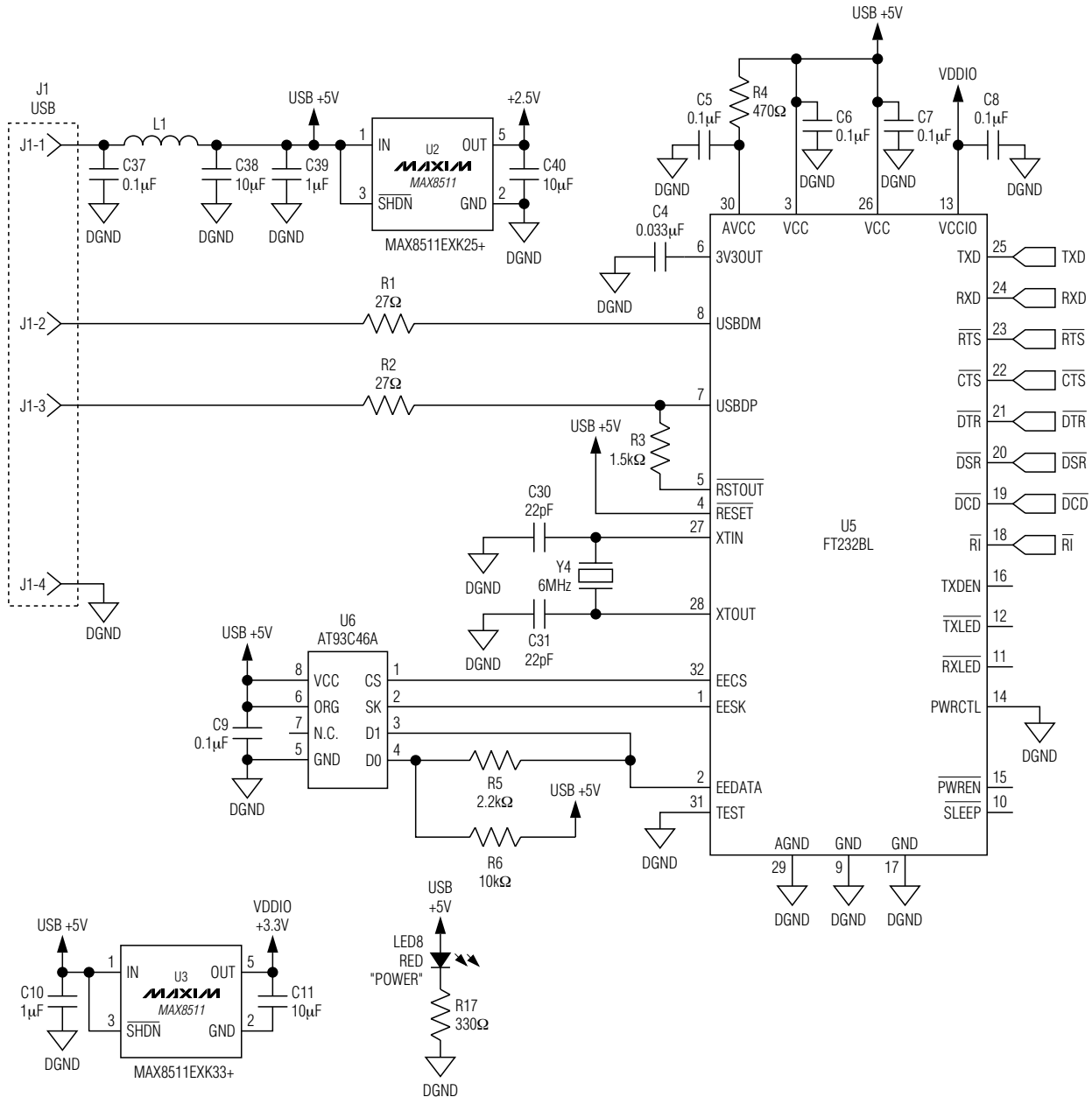


Figure 3d. MAX7359 EV Kit Schematic (Sheet 4 of 5)

# MAX7359 Evaluation Kit

Evaluates: MAX7359



# MAX7359 Evaluation Kit

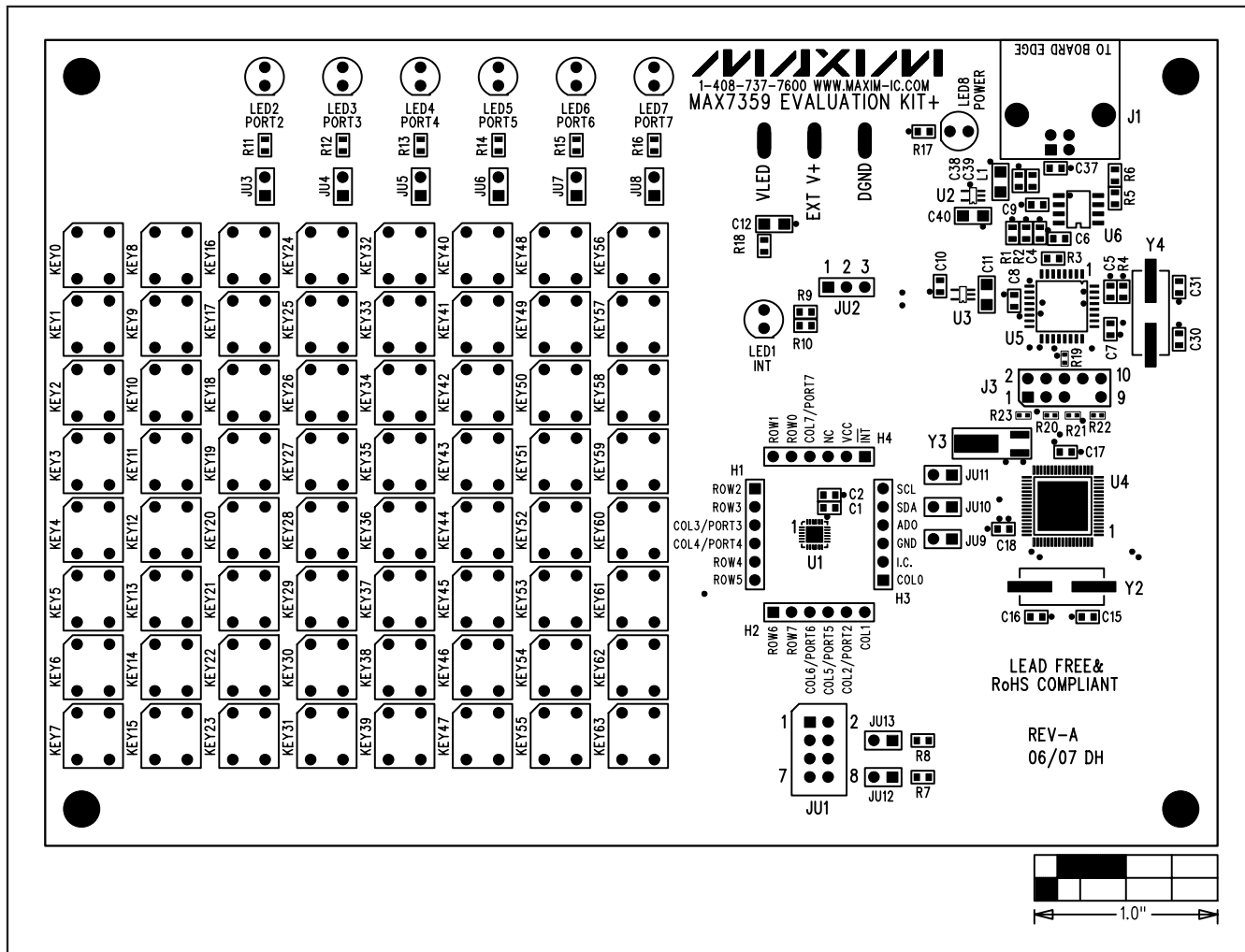


Figure 4. MAX7359 EV Kit Component Placement Guide—Component Side

# MAX7359 Evaluation Kit

Evaluates: MAX7359

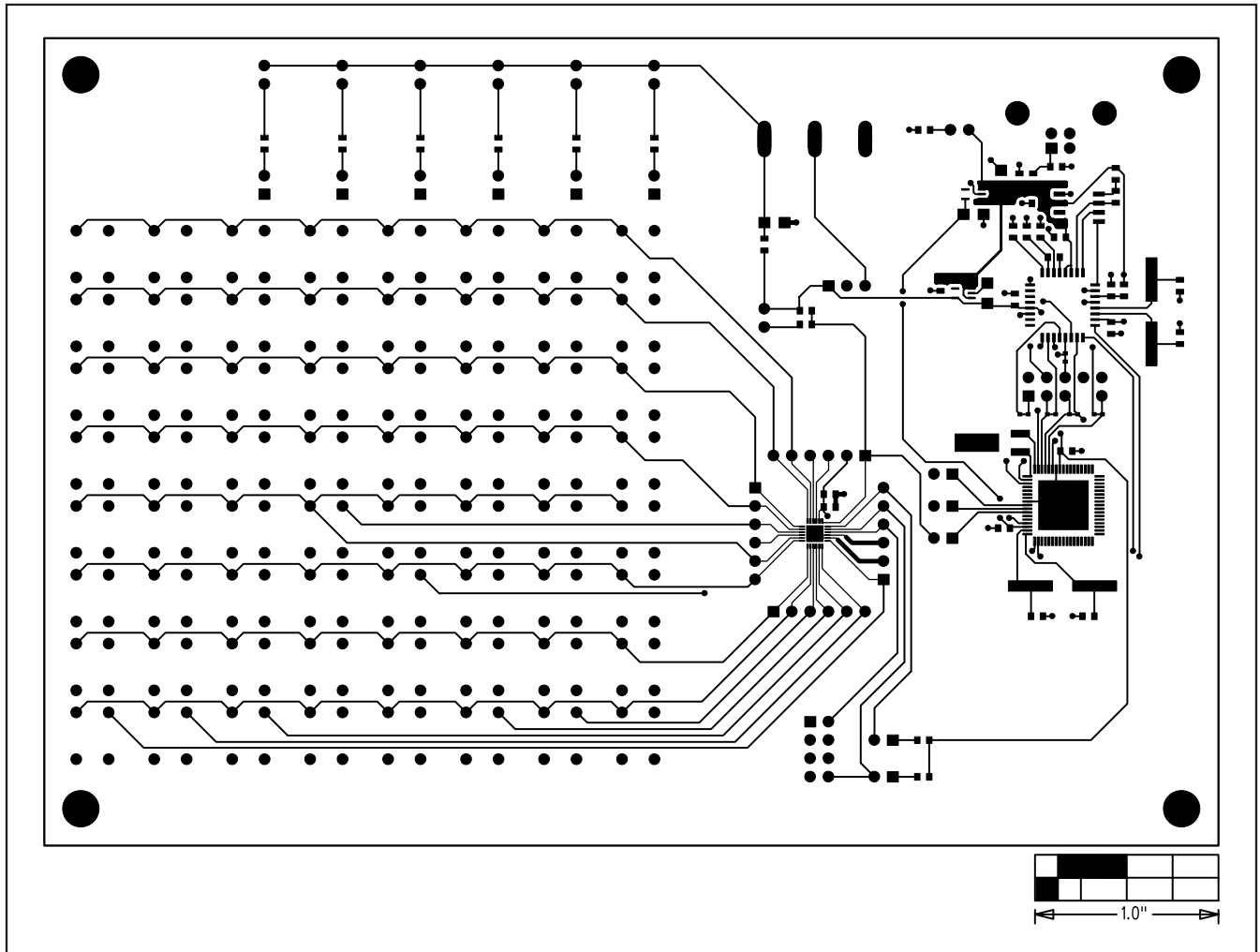


Figure 5. MAX7359 EV Kit PCB Layout—Component Side

## MAX7359 Evaluation Kit

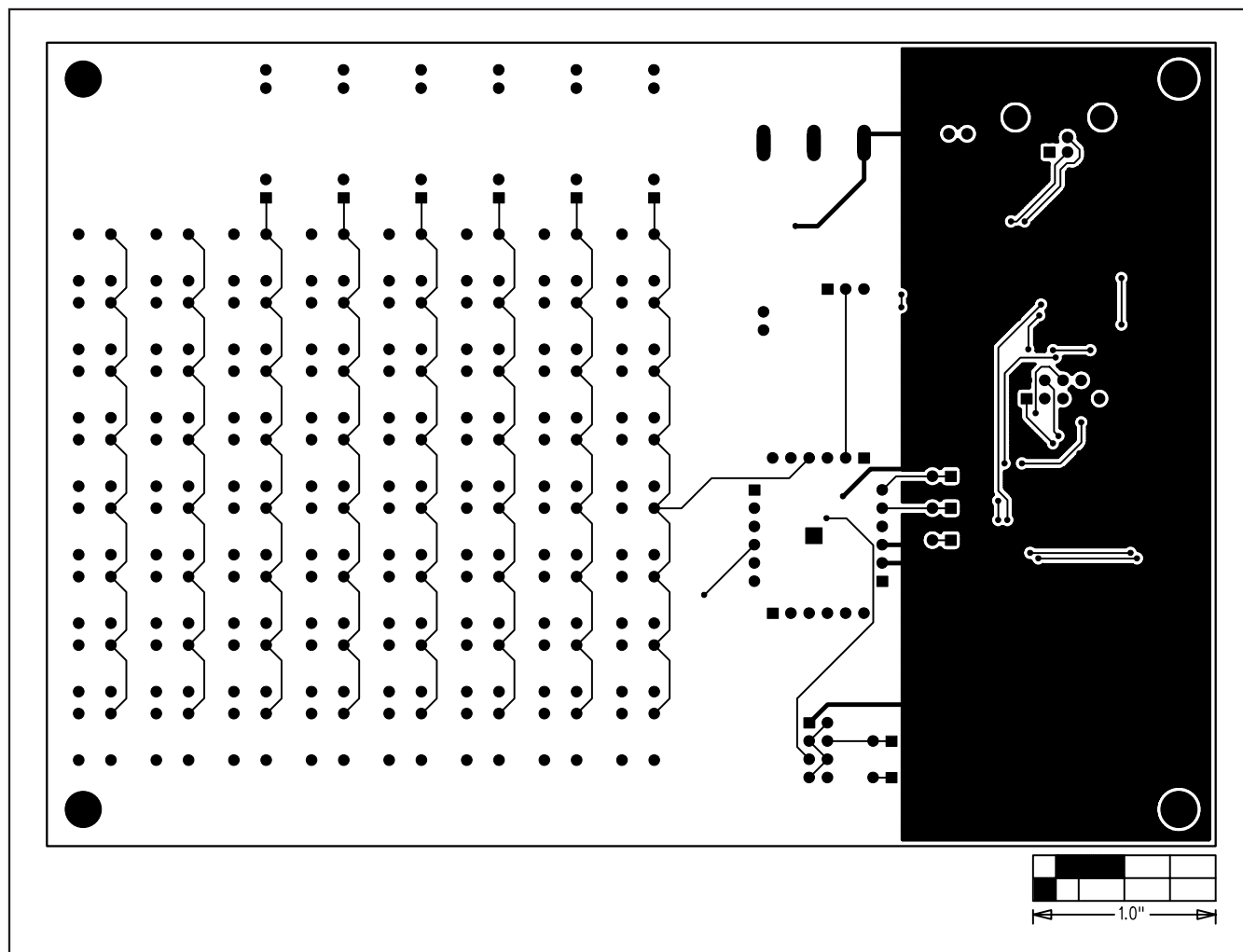


Figure 6. MAX7359 EV Kit PCB Layout—Solder Side

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