



# MAX4399 Evaluation System/Evaluation Kit

**Evaluate: MAX4399**

## General Description

The MAX4399 evaluation system (EV system) consists of a MAX4399 evaluation kit (EV kit) and a companion Maxim CMODUSB board.

The MAX4399 EV kit is an assembled and tested printed circuit board (PCB) that demonstrates the MAX4399 triple SCART switch matrix. It routes audio, video, and control signals between an MPEG decoder and the VCR/TV/AUX SCART connectors.

The EV kit also includes Windows® 98SE/2000/XP-compatible software, which provides a simple user interface for exercising the MAX4399's features. The program is menu-driven and offers a graphical user interface (GUI) complete with control buttons and a status display.

The Maxim SMBus™ interface board (CMODUSB) allows an IBM-compatible PC to use its USB port to emulate an I<sup>2</sup>C-compatible 2-wire interface. Order the MAX4399 EV system (MAX4399EVCMODU) for a complete PC-based evaluation of the MAX4399. Order the MAX4399 EV kit (MAX4399EVKIT) if you already have an SMBus interface.

## Features

- ◆ Routes MPEG Decoder Signals to VCR/TV/AUX SCART Connectors
- ◆ On-Board SCART Connectors
- ◆ I<sup>2</sup>C-Compatible 2-Wire Serial Interface
- ◆ Easy-to-Use, Menu-Driven Software
- ◆ Completely Assembled and Tested
- ◆ Includes Windows 98SE/2000/XP-Compatible Software
- ◆ EV System Includes USB Connectivity

## Ordering Information

| PART           | TEMP RANGE   | IC PACKAGE | SMBus INTERFACE TYPE |
|----------------|--------------|------------|----------------------|
| MAX4399EVKIT   | 0°C to +70°C | 68 QFN     | Not included         |
| MAX4399EVCMODU | 0°C to +70°C | 68 QFN     | CMODUSB              |

**Note:** The MAX4399 EV kit software is provided with the MAX4399EVKIT; however, the CMODUSB board is required to interface the EV kit to the computer when using the included software.

## Component Lists

### MAX4399 EV System

| PART         | QTY | DESCRIPTION            |
|--------------|-----|------------------------|
| MAX4399EVKIT | 1   | MAX4399 EV kit         |
| CMODUSB+     | 1   | Serial interface board |

+Denotes lead-free and RoHS compliance.

### MAX4399 EV Kit

| DESIGNATION     | QTY | DESCRIPTION   |
|-----------------|-----|---|
| C1–C12, C14–C21 | 20  | 0.1µF ±20%, 10V X5R ceramic capacitors (0402)<br>TDK C1005X5R1A104M |
| C13, C34–C41    | 9   | 0.1µF ±10%, 20V tantalum capacitors (R-Case)<br>AVX TAJR104K020     |

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Windows is a registered trademark of Microsoft Corp.

| DESIGNATION      | QTY | DESCRIPTION  |
|------------------|-----|--|
| C22              | 1   | 0.47µF ±20%, 10V X5R ceramic capacitor (0603)<br>TDK C1608X5R1A474M          |
| C23, C24         | 2   | 10µF ±20%, 16V X7R ceramic capacitors (1210)<br>TDK C3225X7R1C106M           |
| C28–C33, C45–C47 | 9   | 10µF ±20%, 10V 900mΩ ESR tantalum capacitors (A-Case)<br>AVX TPSA106M010-900 |
| C42, C43, C44    | 3   | 0.01µF ±20%, 25V X7R ceramic capacitors (0402)<br>TDK C1005X7R1E103M         |
| C48              | 1   | 22pF ±5%, 50V C0G ceramic capacitor (0402)<br>TDK C1005C0G1H220J             |

Component List continued on next page.



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## Component Lists (continued)

| DESIGNATION          | QTY | DESCRIPTION  |
|----------------------|-----|--|
| C49                  | 1   | 3–10pF NPO variable capacitor  |
| J1                   | 1   | 2 x 10 right-angle female receptacle                                   |
| J2, J3, J4           | 3   | SCART connectors<br>Kycon K-SCART-021                                  |
| J5, J6               | 2   | Phono jacks (red)  |
| J7, J8               | 2   | Phono jacks (white)  |
| J9                   | 1   | Phono jack (black)   |
| J10                  | 1   | Phono jack (yellow)  |
| JU1, JU2, JU3        | 0   | Not installed, jumpers (SIP-2)   |
| JU4                  | 1   | Jumper, 3-pin header   |
| L1                   | 1   | 220nH $\pm$ 20%, 0.67A chip inductor (1206)<br>Coilcraft 1206CS-221XMB |
| L2                   | 1   | 22 $\mu$ H $\pm$ 5% shielded inductor (1210)<br>API Delevan S1210-223K |
| R1–R6, R80, R81, R82 | 9   | 1M $\Omega$ $\pm$ 5% resistors (0402)                                  |
| R7–R16               | 10  | 10k $\Omega$ $\pm$ 5% resistors (0402)                                 |

| DESIGNATION  | QTY | DESCRIPTION                                     |
|--|-----|---|
| R17–R73  | 57  | 75 $\Omega$ $\pm$ 5% resistors (0402)           |
| R74, R75, R76  | 0   | Not installed, resistors (0402)                 |
| R77, R78   | 2   | 1k $\Omega$ $\pm$ 5% resistors (0402)           |
| R79  | 1   | 1.82k $\Omega$ $\pm$ 1% resistor (0402)         |
| U1   | 1   | AV SCART multiplexer (68-pin QFN) MAX4399CTK    |
| AUX_R/C_in,<br>ENC_B_in,<br>ENC_C_in,<br>ENC_FS_in,<br>ENC_G_in,<br>ENC_R/C_in,<br>ENC_Y/CVBS_in,<br>ENC_Y_in,<br>RF_CVBS_out,<br>TV_R/C_in,<br>VCR_R/C_in | 11  | 75 $\Omega$ BNC connectors                      |
| —  | 1   | Shunts  |
| —  | 1   | PCB: MAX4399 Evaluation Kit                     |
| —  | 1   | Software disk (CD-ROM) "MAX4399 Evaluation Kit" |

## Component Suppliers

| SUPPLIER    | PHONE        | FAX          | WEBSITE               |
|-------------|--------------|--------------|-----------------------|
| API Delevan | 408-865-0344 | 408-865-0343 | www.delevan.com       |
| AVX Corp.   | 843-946-0238 | 843-626-3123 | www.avxcorp.com       |
| KYCON, Inc. | 888-592-6622 | 408-494-0325 | www.kycon.com         |
| TDK Corp.   | 847-803-6100 | 847-390-4405 | www.component.tdk.com |

**Note:** Indicate that you are using the MAX4399 when contacting these component suppliers.

## Quick Start

### Recommended Equipment

Before beginning, the following equipment is needed:

- A user-supplied Windows 98SE/2000/XP PC with a spare USB port
- MAX4399 EV system
  - MAX4399 EV Kit
  - Maxim CMODUSB interface board (USB cabled included)

- 12V, 100mA DC power supply
- 5V, 250mA DC power supply
- 5V, 100mA DC power supply

**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 98SE/2000/XP operating system.

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## Procedure

The MAX4399 EV kit is fully assembled and tested. Follow the steps below to verify board operation. **Caution: Do not turn on the power supplies until all connections are completed.**

- 1) Visit the Maxim website ([www.maxim-ic.com/evkitsoftware](http://www.maxim-ic.com/evkitsoftware)) to download the most recent version of the EV kit software, 4399Rxx.ZIP.
- 2) Install the MAX4399 evaluation software on your computer by running the INSTALL.EXE program. The program files are copied and icons are created in the Windows **Start** menu.
- 3) Carefully connect the boards by aligning the 20-pin connector of the MAX4399 EV kit with the 20-pin header of the CMODUSB interface board. Gently press them together.
- 4) Verify that there is a shunt on pins 1-2 of jumper JU4. Do not turn on the power until all connections are made.
- 5) Connect the 5V, 250mA DC power supply to the V\_VID and G\_VID pads on the MAX4399 EV kit board.
- 6) Connect the 5V, 100mA DC power supply to the V\_DIG and G\_DIG pads on the MAX4399 EV kit board.
- 7) Connect the 12V, 100mA DC power supply to the V12 and G\_AUD pads on the MAX4399 EV kit board.
- 8) Connect the G\_VID, G\_DIG, and G\_AUD pads together at the board.
- 9) Connect an MPEG decoder to the BNCs with the ENC prefix.
- 10) Connect a TV to the TV (J3) SCART connector.
- 11) Connect a VCR to the VCR (J4) SCART connector.
- 12) Connect an auxiliary unit to the AUX (J2) SCART connector.
- 13) Connect the USB cable from the PC to the CMODUSB board. A **Building Driver Database** window pops up in addition to a **New Hardware Found** message. If you do not see a window that is similar to the one described above after 30 seconds, remove the USB cable from the CMODUSB and reconnect it. Administrator privileges are required to install the USB device driver on Windows 98SE/2000/XP. Refer to the TROUBLESHOOTING\_USB.PDF document included with the software if you have any problems during this step.
- 14) 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\MAX4399** (or the directory chosen during installation) using the **Browse** button.

- 15) Turn on the power supplies.
- 16) Start the MAX4399 program by opening its icon in the **Start** menu.
- 17) Observe as the program automatically detects the address of the MAX4399 and starts the main program.

## Detailed Description of Software

### User-Interface Panel

The user interface (Figure 1) is easy to operate; use the mouse, or press the Tab key to navigate with the arrow keys. Each of the buttons corresponds to bits in the command and configuration bytes. By clicking on them, the correct I<sup>2</sup>C-compatible write operation is generated to update the internal registers of the MAX4399. The **Interface** box indicates the current I<sup>2</sup>C-compatible bus **Status, Device Address, Register Address**, and the **Data Sent/Received**, for the last read/write operation. This data is used to confirm proper device operation.

The MAX4399 EV kit software splits and groups the functions of the MAX4399 into four separate categories. **TV, VCR, AUX**, and **Configuration** functions can be accessed by selecting the appropriate tab at the top left of the MAX4399 EV kit software main window. The **TV, VCR**, and **AUX** panels of the MAX4399 EV kit software are again split into two sections (Video Control and Audio Control).

The device status registers (refer to the MAX4399 datasheet for status register information) are displayed in the MAX4399 status panel at the lower right of the main window. To read the status register, click the **Read Status** button or check the **Automatic Status Read** checkbox to automatically read the status register every 250ms.

Click the **POR Reset** button to reset the MAX4399 registers and EV kit software to their power-on-reset configuration.

Enable interrupts by checking the **Enable Interrupt** checkbox in the Interrupt Status panel (Figure 1, right). The message Interrupt Detected will appear when the MAX4399 generates a valid interrupt (refer to the MAX4399 data sheet) and the **Enable Interrupt** checkbox is checked. Clear this interrupt by clicking the **Clear** button.

**Note:** Words in boldface are user-selectable features in

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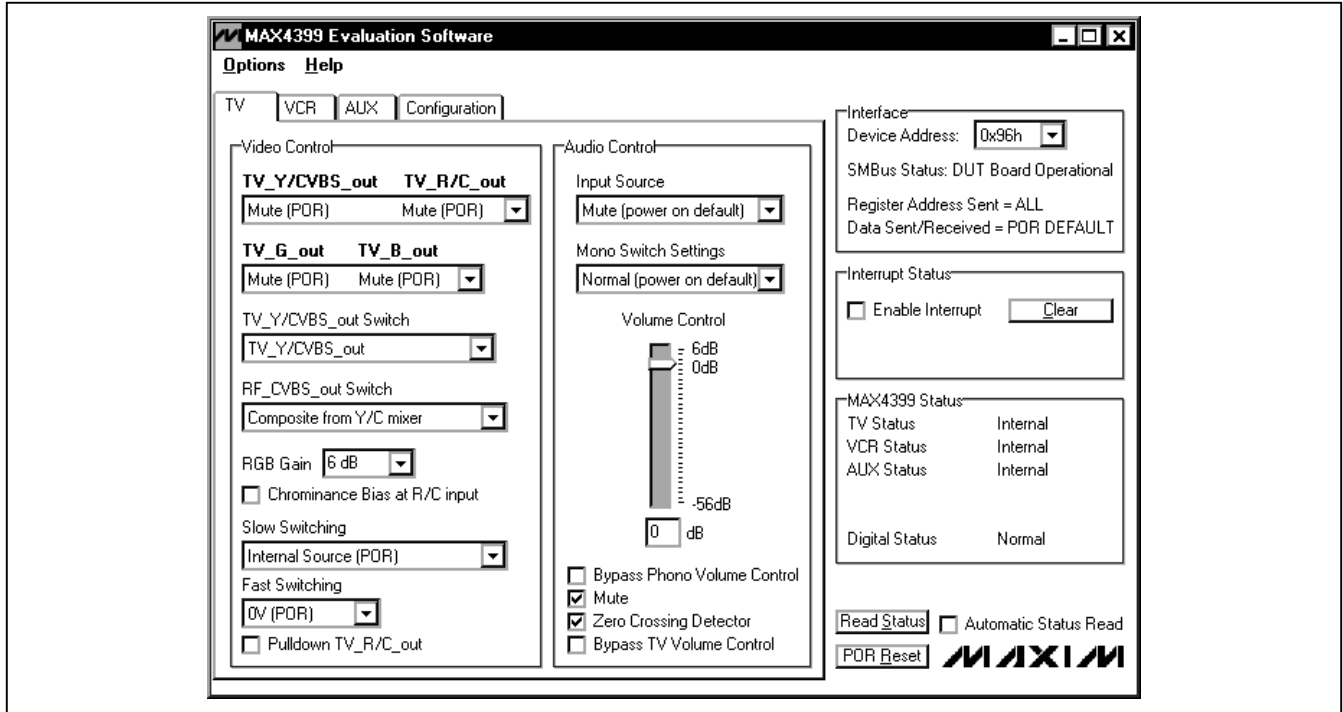


Figure 1. MAX4399 EV Kit Software Main Window

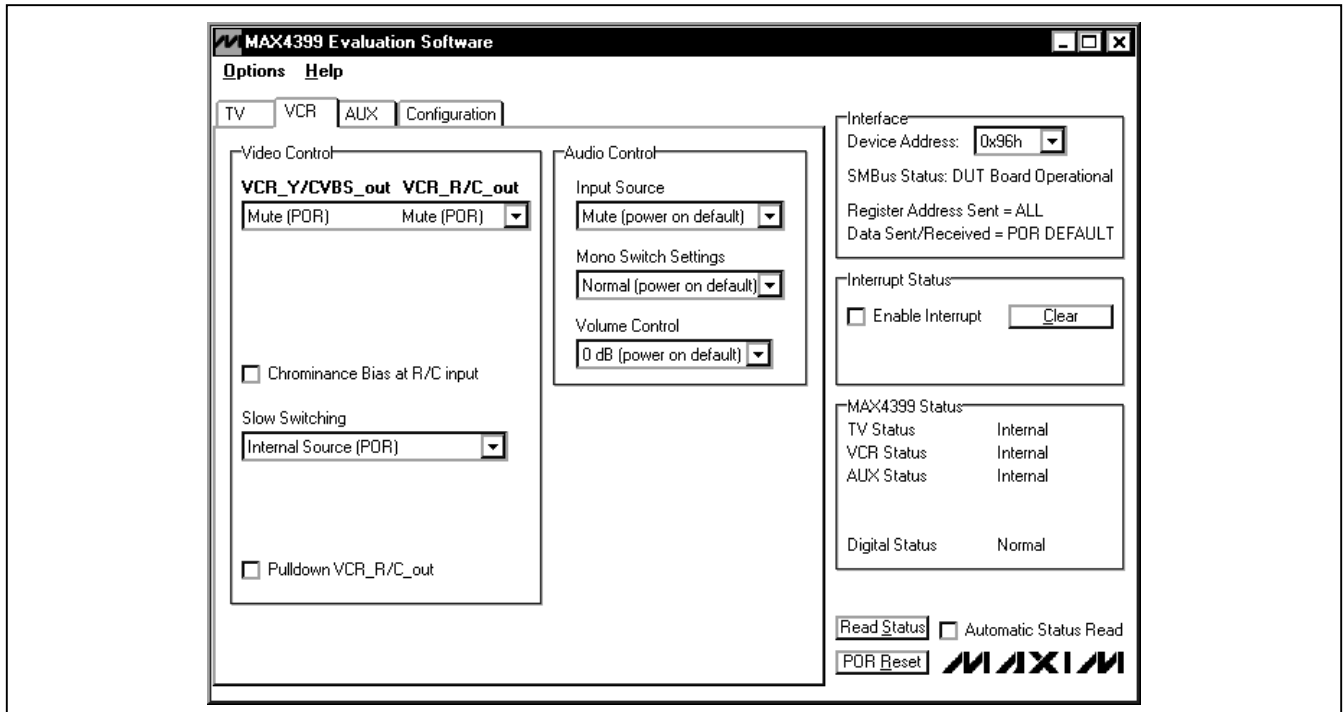


Figure 2. MAX4399 EV Kit Software Main Window (VCR Control Panel)

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Evaluate: MAX4399

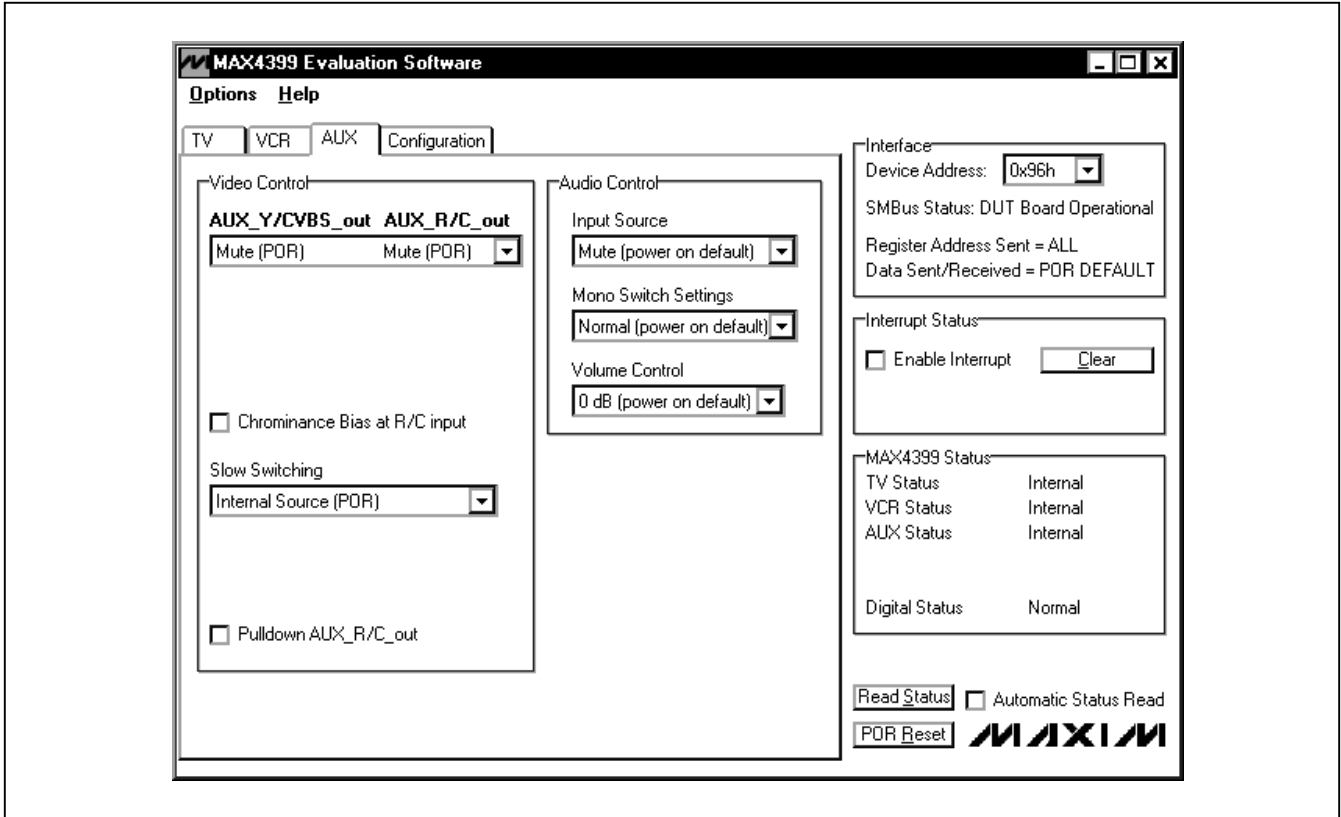


Figure 3. MAX4399 EV Kit Software Main Window (AUX Control Panel)

the software.

## TV Controls (Video Control)

The Video Control panel of the MAX4399 EV kit software (Figure 1) allows the user to route selected signals to the TV SCART connector. Other functions such as **RGB Gain**, **Chrominance Bias at R/C Input**, **Fast Switching**, **Slow Switching**, and **Pulldown TV\_R/C\_Out** can also be changed through the Video Control panel. Manipulate the pulldown menus and checkboxes to achieve the desired result.

## TV Controls (Audio Control)

The Audio Control panel of the MAX4399 EV kit software allows the user to adjust various audio characteristics of the TV output. Adjust the volume by moving the **Volume Control** slider, or enter a number in the edit box below the **Volume Control** slider. **Input Source** selection, **Mono Switch Settings**, a **Mute** function, the **Zero Crossing Detector**, a **Bypass Phono Volume Control**, and a **Bypass TV Volume Control** function can also be accessed from the Audio Control panel (refer to the MAX4399 datasheet for a description of

each of these functions).

## VCR/AUX Controls (Video Control)

The VCR (Figure 2) and AUX (Figure 3) panel of the MAX4399 EV kit software are identical in function with the exception of the SCART output that is being controlled. SCART output signals (**VCR\_Y/CVBS\_out** and **VCR\_R/C\_out**), **Chrominance Bias at R/C Input**, **Slow Switching**, and **Pulldown VCR\_R/C\_Out** functions can all be accessed through the Video Control panel.

## VCR/AUX Controls (Audio Control)

Adjust the **Input Source**, **Mono Switch Settings**, and volume (**Volume Control**) through the Audio Control panel of the MAX4399 EV kit software.

## Configuration Controls

Selecting the Configuration tab (Figure 4) of the MAX4399 EV kit software allows the user to adjust configuration features of the MAX4399.

Checking desired checkboxes in the Output Enable panel enables selected outputs of the MAX4399. A bias

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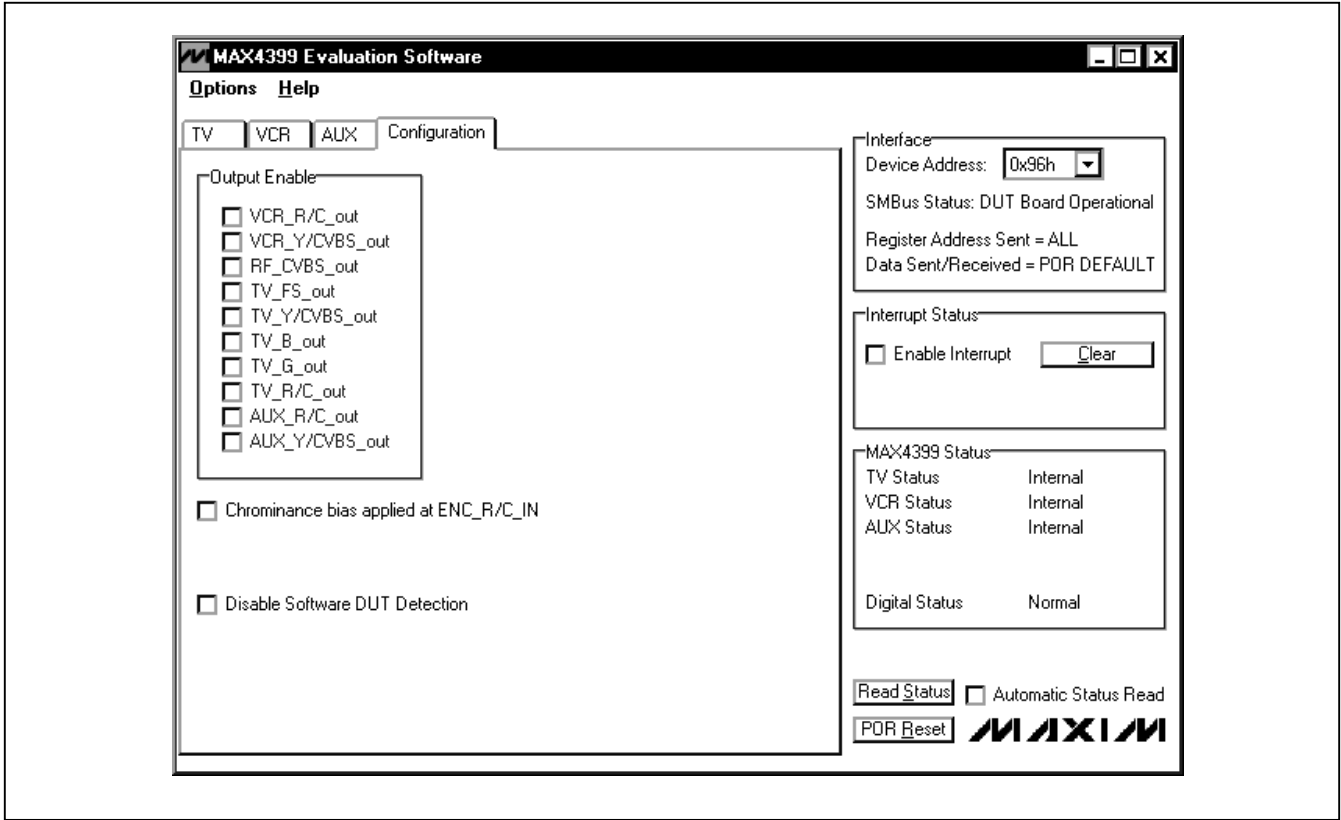


Figure 4. MAX4399 EV Kit Software Main Window (Configuration/Encoder)

voltage may also be applied at the R/C input of the encoder (**Chrominance Bias applied at ENC\_R/C\_IN**).

The MAX4399 EV kit software continuously polls the MAX4399 to make sure that the two boards have not become inadvertently disconnected. An undesired result of this polling is constant activity on the I<sup>2</sup>C-compatible bus. This feature may make it difficult to monitor the I<sup>2</sup>C-compatible interface for desired bit patterns. Disable this feature by checking the **Disable Software DUT Detection** checkbox.

### Simple I<sup>2</sup>C-Compatible Commands

There are two methods for communicating with the MAX4399: through the normal user-interface panel or through the I<sup>2</sup>C-compatible commands available by selecting the **2-Wire Interface Diagnostic** item from the **Options** pulldown menu. A display pops up that allows the SMBus/I<sup>2</sup>C-compatible protocols, such as Read Byte and Write Byte, to be executed.

The dialog boxes accept numeric data in binary, decimal, or hexadecimal. Hexadecimal numbers should be

prefixed by \$ or 0x. Binary numbers must be exactly eight digits. See Figure 5 for an example of this tool. In this example, the software is reading data (0xC0) from Device Address 0x96, Register Address 0x0E. The above sequence reads the status register of the MAX4399.

**Note:** In places where the slave address asks for an 8-bit value, it must be the 7-bit slave address of the MAX4399 as determined by DEV\_ADDR with the last bit set to 1 for a read operation or a zero for a write. Refer to the MAX4399 datasheet for a complete list of registers and functions.

### Detailed Description of Hardware

The MAX4399 EV kit is an assembled and tested PC board that demonstrates the MAX4399 triple SCART switch matrix. It routes audio, video, and control signals between an MPEG decoder and the TV, VCR, and AUX SCART connectors. All video connections are made through 75Ω controlled-impedance traces.

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Evaluate: MAX4399

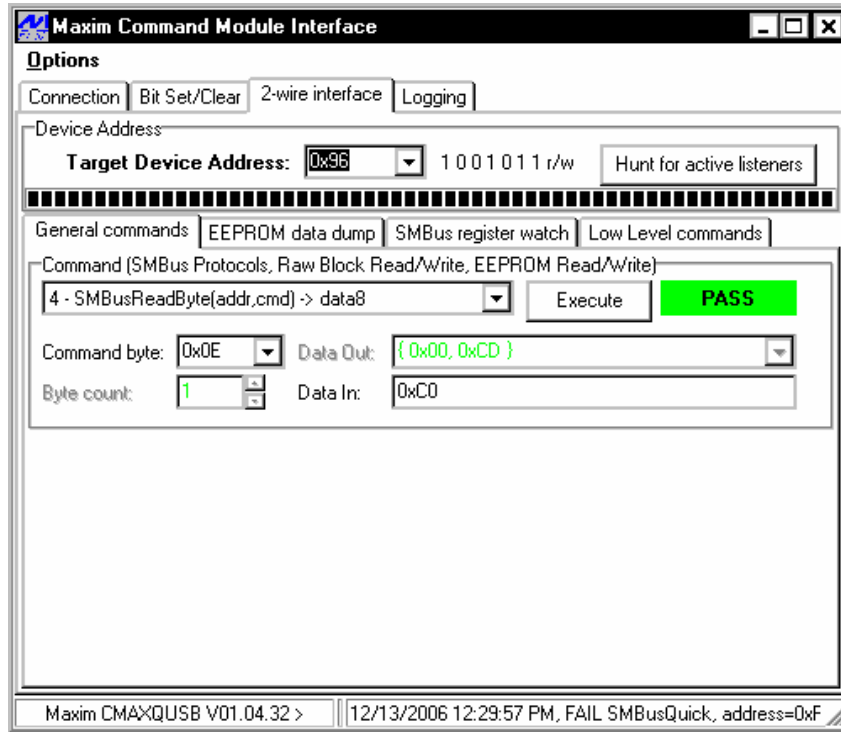


Figure 5. Simple SMBusReadByte Operation Using the Included 2-Wire Interface Diagnostics

Connect a TV, VCR, and Auxiliary unit (DVD player, 2nd VCR, camcorder, etc.) to the TV, VCR, and AUX SCART connectors, respectively (refer to the MAX4399 datasheet for SCART connector pinouts). MPEG decoder video connections are made through the 75Ω BNCs with the ENC prefix. MPEG decoder audio connections are made through the ENC LT and ENC RT (J8 and J6) RCA connectors. Monitor the phono audio outputs through the PHONO RT and PHONO LT (J5 and J7) RCA connectors.

Monitor the R/C inputs of the TV, VCR, and AUX connections through the TV\_R/C\_IN, VCR\_R/C\_IN, and AUX\_R/C\_IN BNCs, respectively. Apply a satellite dish tone input through the ST AUX IN (J10) RCA connector.

Monitor the RF modulator mono audio output through the RF MONO RCA connector. Monitor the RF modulator composite video output through the RF\_CVBS\_OUT BNC.

## Address Selection

Jumper JU4 sets the MAX4399 slave address. The default address is 1001 011Y (DEV\_ADDR = V\_DIG). See Table 1 for a complete list of addresses.

**Note:** The first 7 bits shown are the address. Y (bit 0) is the SMBus read/write bit. This bit is a 1 for a read operation or a zero for a write.

**Table 1. Shunt Settings for SMBus Address (JU4)**

| SHUNT POSITION | MAX4399 ADDRESS PIN | MAX4399 ADDRESS |             |
|----------------|---------------------|-----------------|-------------|
|                |                     | BINARY          | HEXADECIMAL |
| 1-2*           | V_DIG               | 1001 011Y       | 0x96        |
| 2-3            | G_DIG               | 1001 010Y       | 0x94        |

\*Default configuration: JU4 (1-2).



# MAX4399 Evaluation System/Evaluation Kit

Evaluate: MAX4399

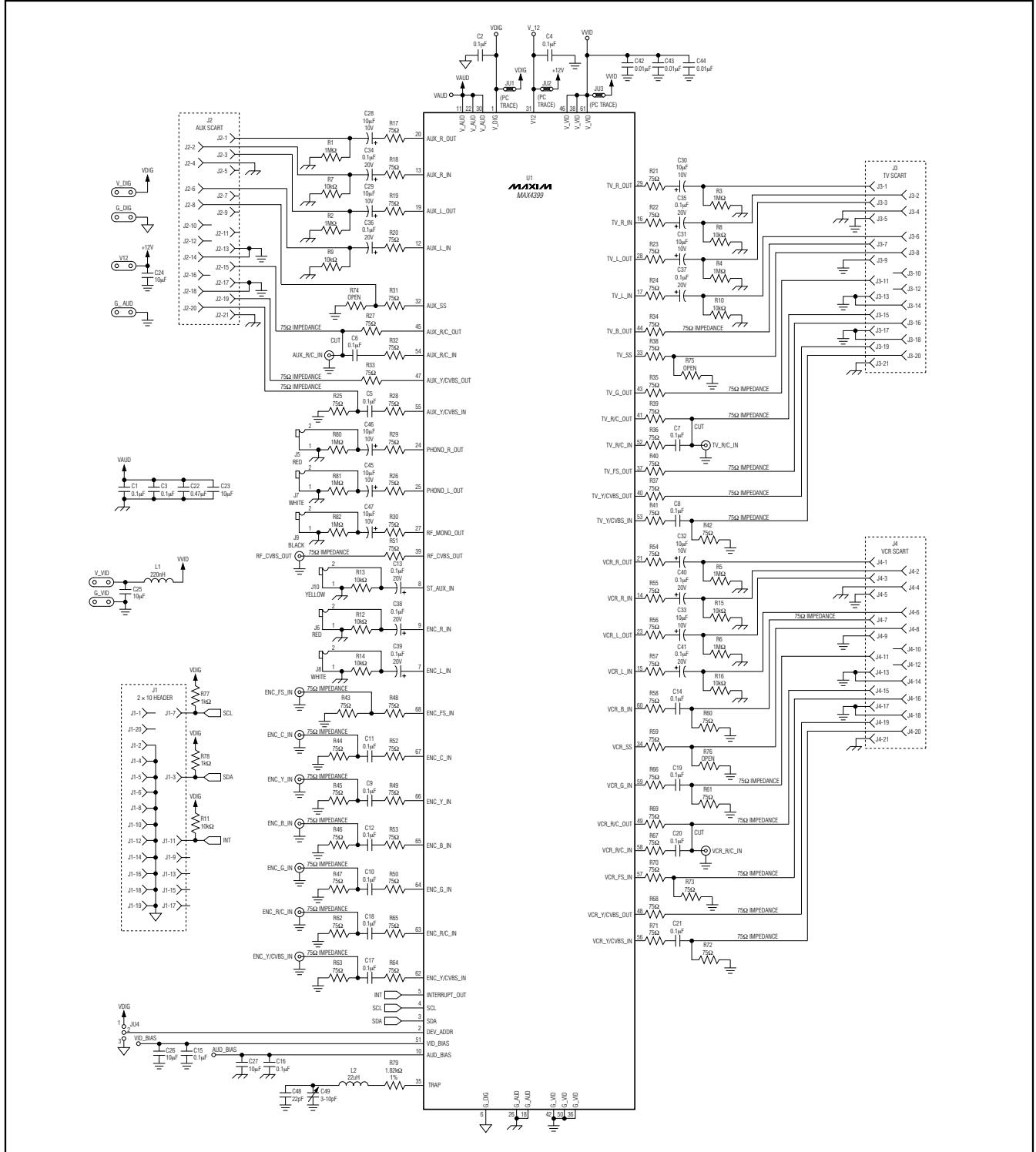


Figure 6. MAX4399 EV Kit Schematic



# MAX4399 Evaluation System/Evaluation Kit

Evaluate: MAX4399

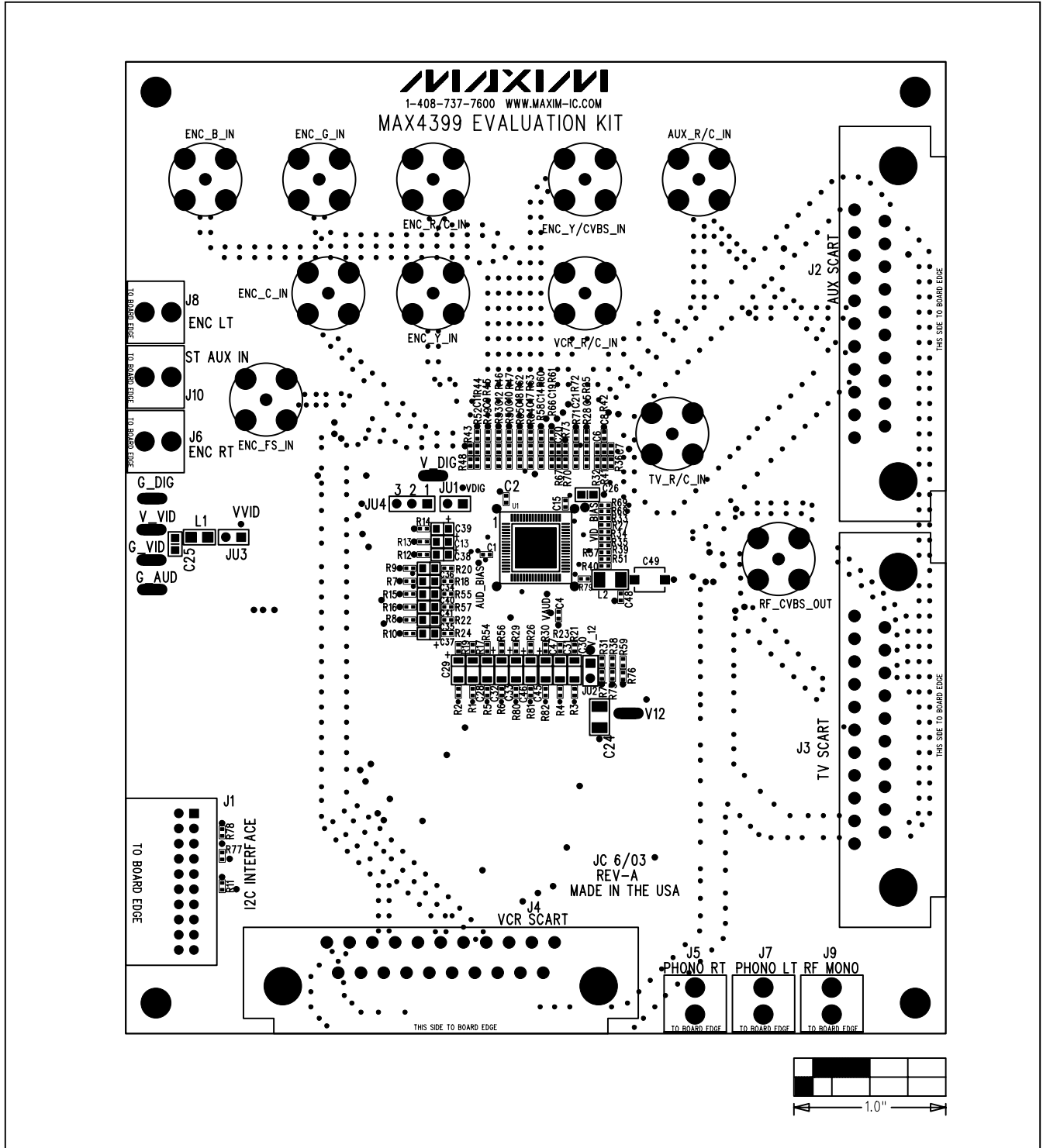


Figure 7. MAX4399 EV Kit Component Placement Guide—Component Side

# MAX4399 Evaluation System/Evaluation Kit

Evaluate: MAX4399

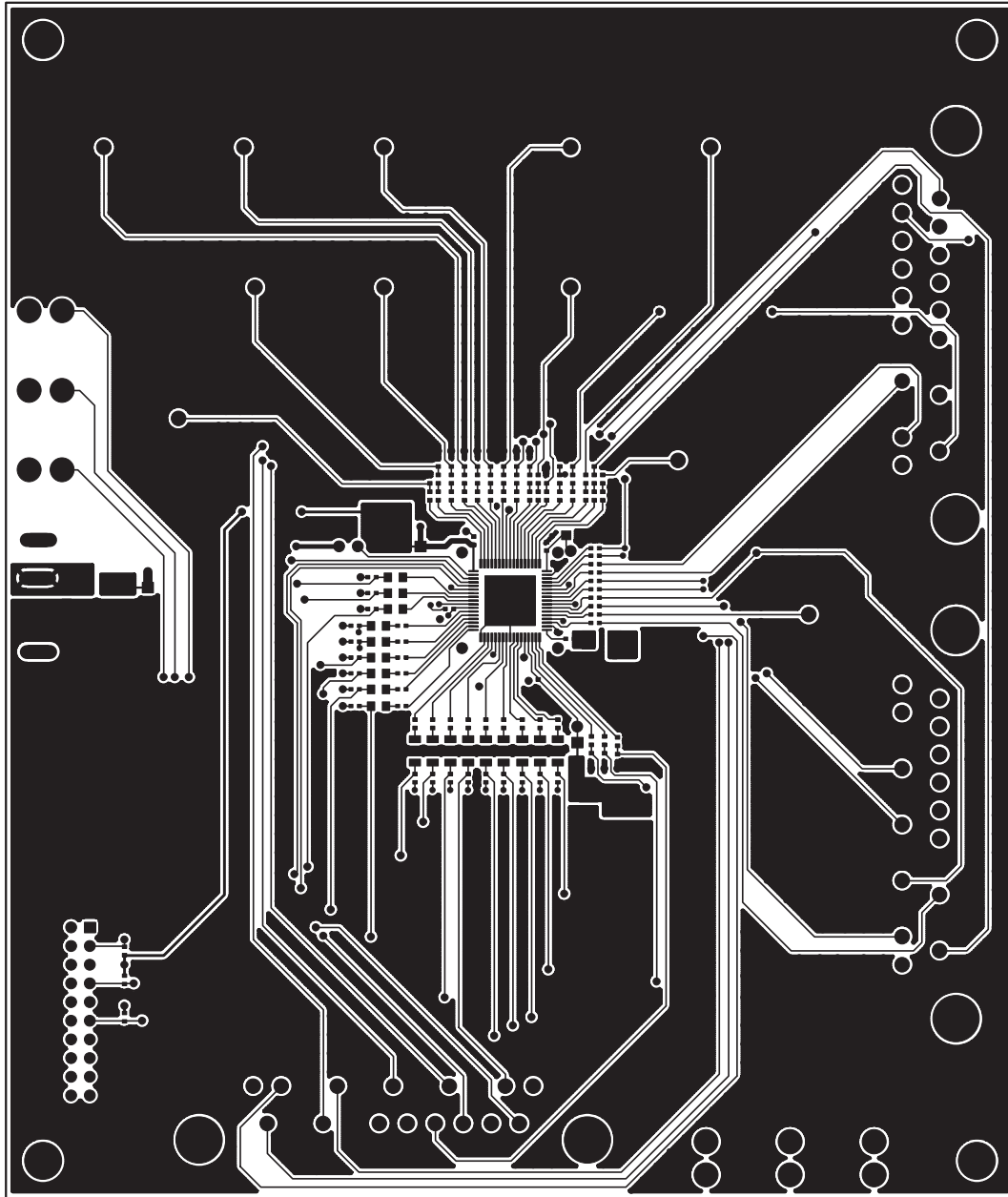


Figure 8. MAX4399 EV Kit PCB Layout—Component Side

# MAX4399 Evaluation System/Evaluation Kit

Evaluate: MAX4399

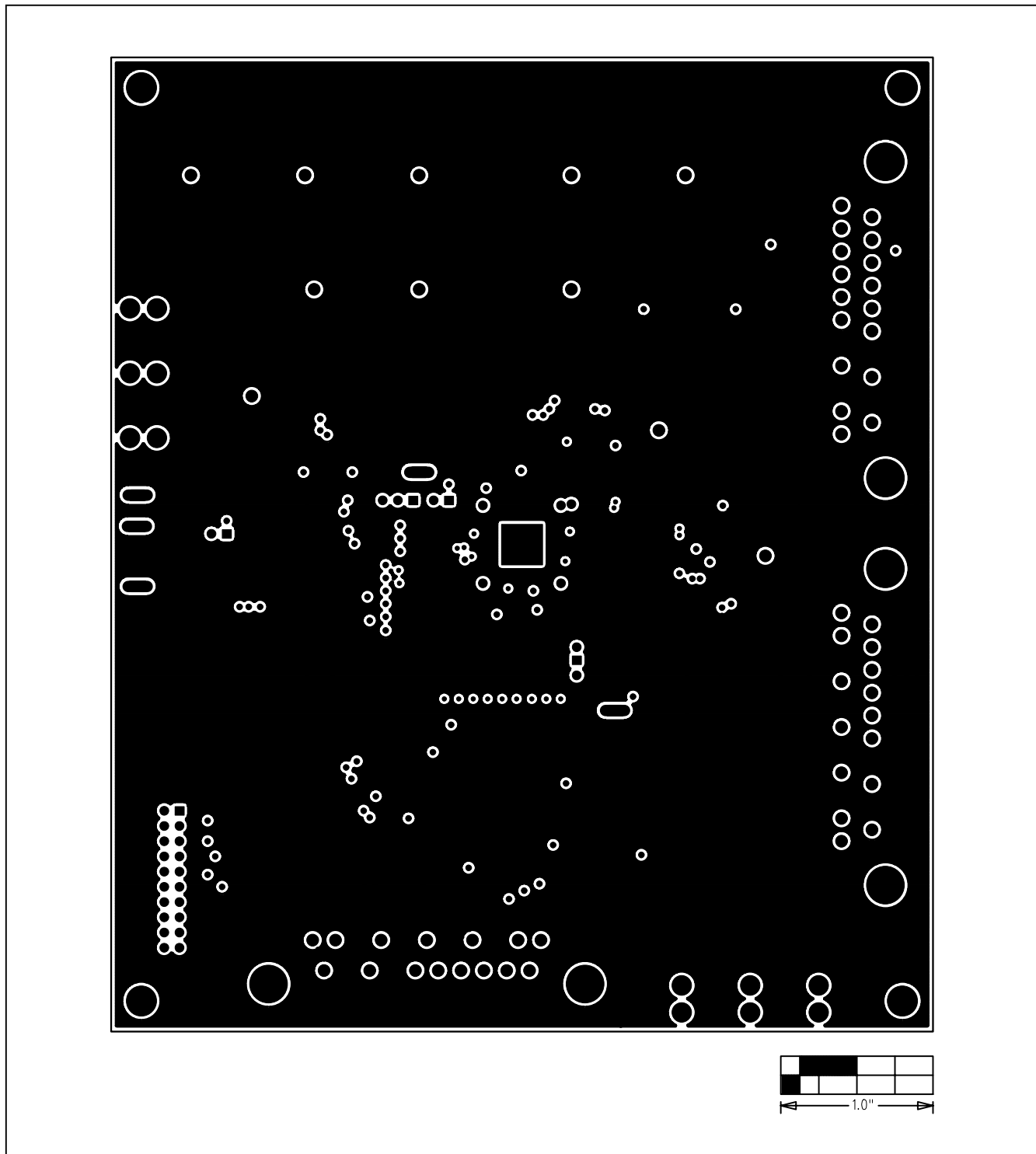


Figure 9. MAX4399 EV Kit PCB Layout—Inner Layer 2

# MAX4399 Evaluation System/Evaluation Kit

Evaluate: MAX4399

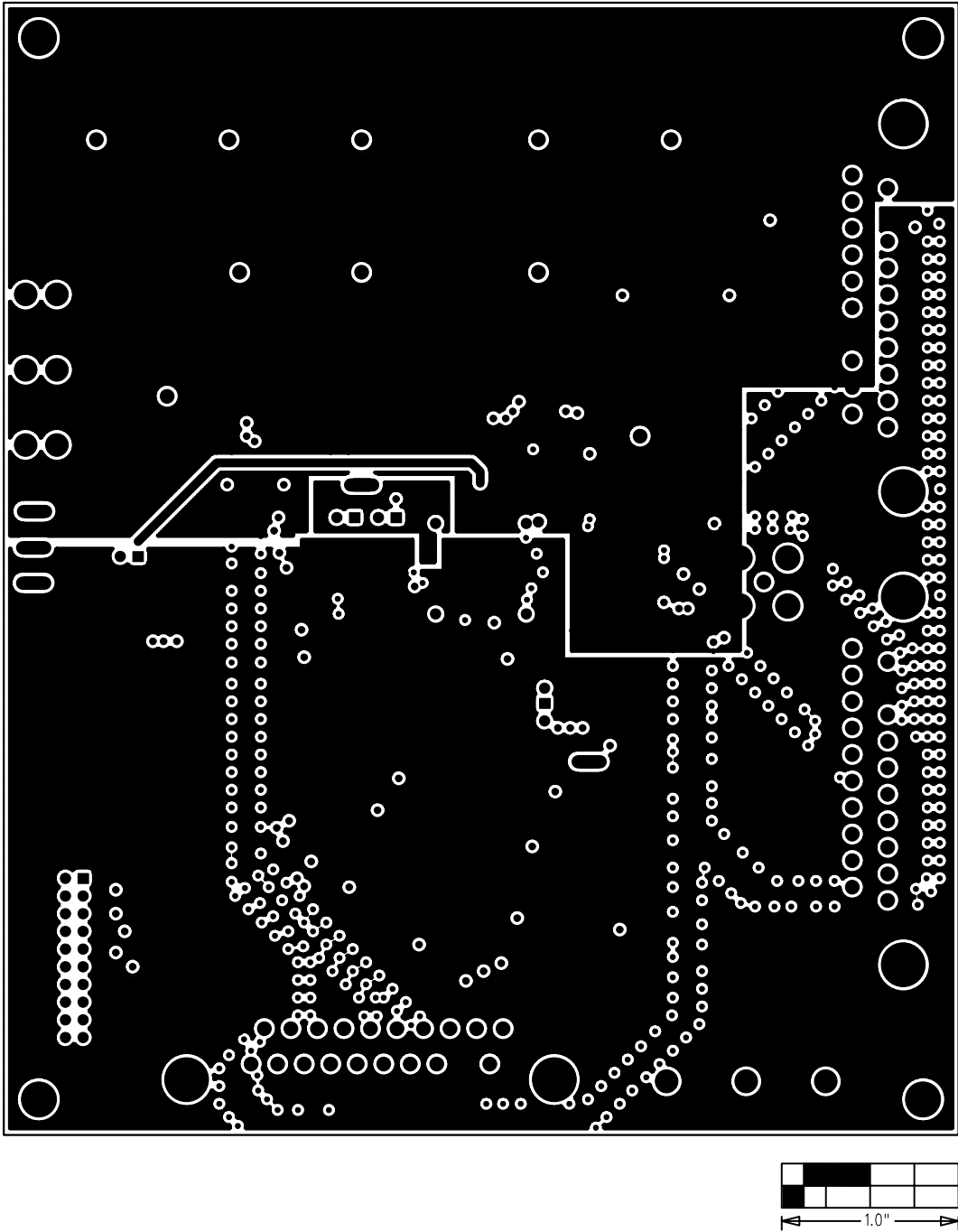


Figure 10. MAX4399 EV Kit PCB Layout—Inner Layer 3

# MAX4399 Evaluation System/Evaluation Kit

Evaluate: MAX4399

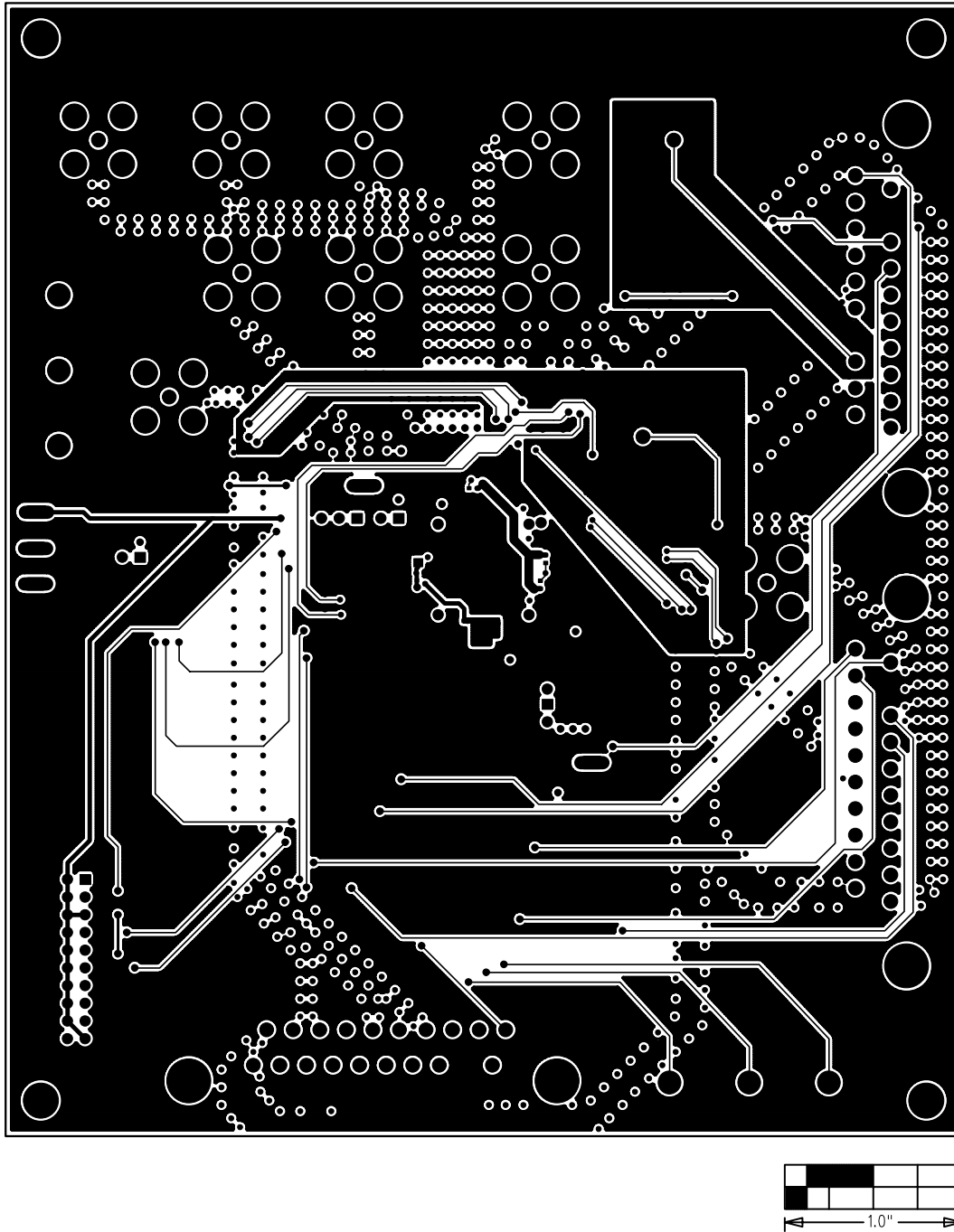


Figure 11. MAX4399 EV Kit PCB Layout—Solder Side

# MAX4399 Evaluation System/Evaluation Kit

Evaluate: MAX4399

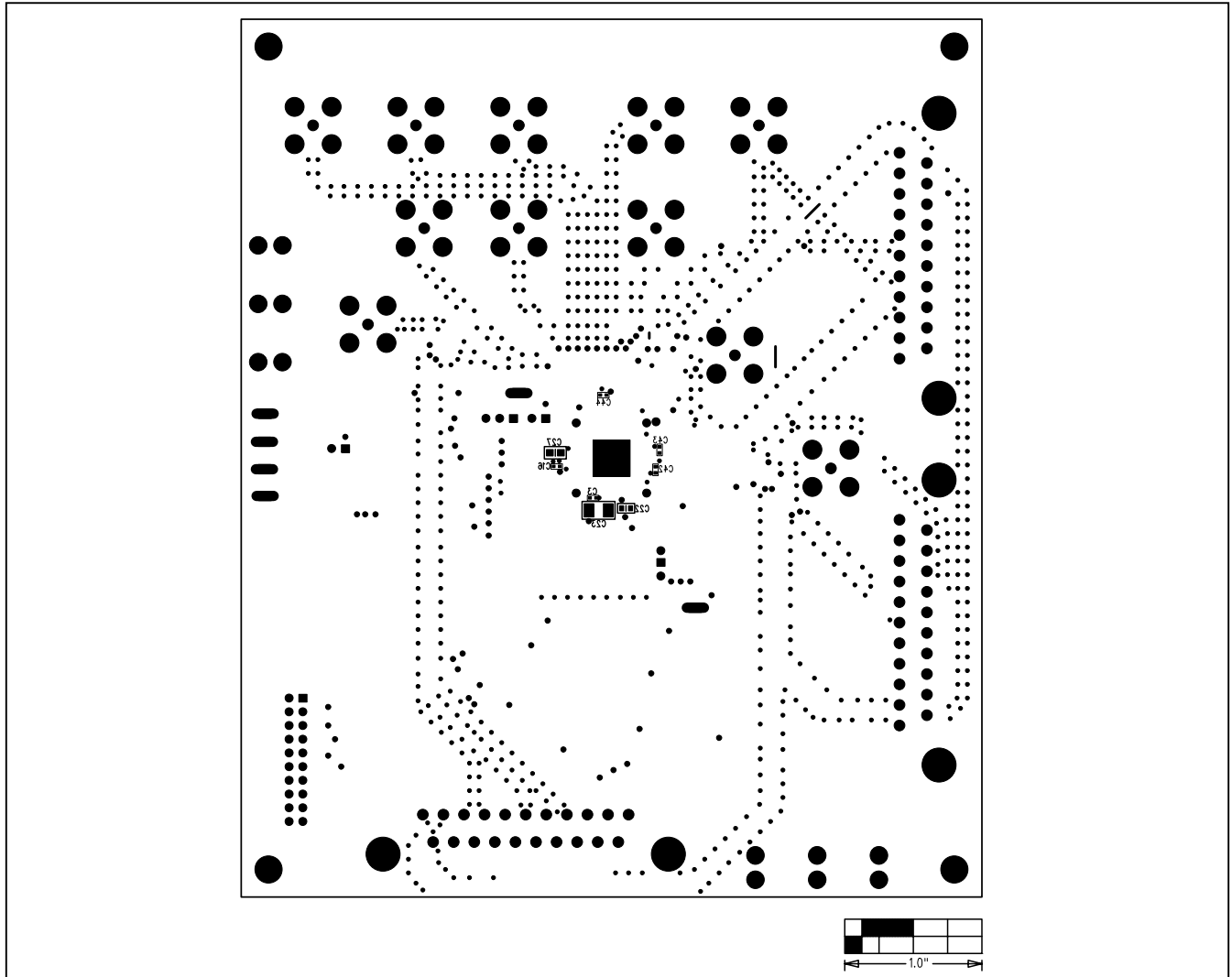


Figure 12. MAX4399 EV Kit Component Placement Guide—Solder Side

## Revision History

Pages changed at Rev 1: 1, 2, 3, 6, 7, 10–14

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