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Maxim Integrated
MAX9671EVKIT+

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19-4704; Rev 0; 7/09

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MAX9671 Evaluation Kit

Evaluates: MAX9671

General Description

The MAX9671 evaluation kit (EV kit) is an assembled and tested PCB used to evaluate the MAX9671 dual SCART audio/video switch matrix. It routes audio, video, and control signals between a set-top box decoder chip and the VCR/TV SCART connectors. The on-board microcontroller, which is connected to the PC through the universal serial bus (USB) port, acts as the I^2C master.

The EV kit also includes Windows® 2000-, Windows XP®-, and Windows Vista®-compatible software that provides a simple user interface for exercising the MAX9671 features. The program is menu driven and offers a graphical user interface (GUI) complete with control buttons and status displays. The EV kit comes with the MAX9671CTH+ installed.

Features

♦ **Windows 2000-, Windows XP-, and Windows Vista (32-Bit)-Compatible Software**

♦ **VCR/TV SCART Connectors**

♦ **On-Board Microcontroller to Generate I^2C Commands**

♦ **Easy-to-Use, Menu-Driven Software**

♦ **USB-PC Connection (Cable Included)**

♦ **Lead(Pb)-Free and RoHS Compliant**

Ordering Information

PART	TYPE
MAX9671EVKIT+	EV Kit

+Denotes lead(Pb)-free and RoHS compliant.

Component List

DESIGNATION	QTY	DESCRIPTION
C1, C12, C14, C55, C56	5	10µF ±10%, 16V X5R ceramic capacitors (0805) KEMET C0805C106K4PACTU
C2, C3	2	22pF ±5%, 50V C0G ceramic capacitors (0603) Murata GRM1885C1H220J
C4	1	0.033µF ±10%, 16V X5R ceramic capacitor (0603) Taiyo Yuden EMK107BJ333KA
C5–C10, C17, C18, C21–C38, C41–C50, C53, C59–C64, C66–C71	49	0.1µF ±10%, 16V X7R ceramic capacitors (0603) TDK C1608X7R1C104K
C11, C13, C39, C40, C57	5	1µF ±10%, 16V X5R ceramic capacitors (0603) TDK C1608X5R1C105K
C15, C16	2	10pF ±5%, 50V C0G ceramic capacitors (0603) Murata GRM1885C1H100J
C19, C20, C51, C52, C72, C73	6	1µF ±10%, 16V X7R ceramic capacitors (0805) TDK C2012X7R1C105K

DESIGNATION	QTY	DESCRIPTION
C54, C58	2	0.47µF ±10%, 16V X7R ceramic capacitors (0603) Murata GRM188R71C474K
C65	0	Not installed, capacitor (0603)
D1–D20, D22, D23	22	Dual 100V, 200mA diodes (3 SOT23) Central Semi CMPD7000 LEAD FREE
D21	0	Not installed, diode (3 SOT23)
ENC_B_IN, ENC_C_IN, ENC_G_IN, ENC_R/C_IN, ENC_Y_IN, ENC_Y/CVBS_IN, VCR_R/C_IN	7	75Ω BNC female jacks, 4-pin, 0.250in spacing (top mount)
H1	0	Not installed, 2 x 5-pin header
JU1	1	5-pin header
JU2–JU7	6	3-pin headers
L1	1	Ferrite bead (0603) TDK MMZ1608R301A
P1	1	USB type-B right-angle PC-mount receptacle

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For pricing, delivery, and ordering information, please contact Maxim Direct at 1-888-629-4642, or visit Maxim's website at www.maxim-ic.com.

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Component List (continued)

DESIGNATION	QTY	DESCRIPTION
P2, P3	2	SCART connectors (side-entry PCB mount)
P4	1	RCA phono jack (side-entry PCB mount), white
P5	1	RCA phono jack (side-entry PCB mount), red
R1, R2	2	27Ω ±5% resistors (0603)
R3, R31, R32, R33	4	1.5kΩ ±5% resistors (0603)
R4	1	470Ω ±5% resistor (0603)
R5	1	2.2kΩ ±5% resistor (0603)
R6	1	10kΩ ±5% resistor (0603)
R7	1	169kΩ ±1% resistor (0603)
R8	1	100kΩ ±1% resistor (0603)
R9–R13	0	Not installed, resistors—shorted by PCB trace (0402)
R14, R17, R20–R30, R34–R55, R68	36	75Ω ±5% resistors (0603)
R15, R18, R69, R70	4	7.68kΩ ±1% resistors (0603)
R16, R19, R71, R72	4	2.55kΩ ±1% resistors (0603)
R56, R58	2	6.65kΩ ±1% resistors (0603)
R57, R59	2	4.53kΩ ±1% resistors (0603)

DESIGNATION	QTY	DESCRIPTION
R60, R61	2	5.60kΩ ±1% resistors (0603)
R62–R67	0	Not installed, resistors—shorted by PCB trace (0603)
U1	1	Dual SCART audio/video switch matrix (44 TQFN-EP*) Maxim MAX9671CTH+
U2	1	Microcontroller (68 QFN-EP*) Maxim MAXQ2000-RAX+
U3	1	LDO regulator (5 SC70) Maxim MAX8511EXK25+
U4	1	Adjustable output LDO regulator (5 SC70) Maxim MAX8512EXK+
U5	1	UART-to-USB converter (32 TQFP-L)
U6	1	93C46A type 3-wire EEPROM (8 SO)
Y1	1	16MHz crystal (HCM49) Hong Kong X'tals SSM16000N1HK188F0-0
Y2	1	6MHz crystal (HCM49) Hong Kong X'tals SSL60000N1HK188F0-0
—	7	Shunts
—	1	USB high-speed A-to-B cables, 6ft
—	1	PCB: MAX9671 EVALUATION KIT+

EP = Exposed pad.

Component Suppliers

SUPPLIER	PHONE	WEBSITE
Central Semiconductor Corp.	631-435-1110	www.centralsemi.com
Hong Kong X'tals, Ltd.	852-35112388	www.hongkongcrystal.com
KEMET Corp.	864-963-6300	www.kemet.com
Murata Electronics North America, Inc.	770-436-1300	www.murata-northamerica.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 MAX9671 when contacting these component suppliers.*

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MAX9671 EV Kit Files

FILE	DESCRIPTION
INSTALL.EXE	Installs the EV kit files on your computer
MAX9671.EXE	Application program
FTD2XX.INF	USB driver file
UNINST.INI	Uninstalls the EV kit software
USB_Driver_Help.PDF	USB driver installation help file

Quick Start

Recommended Equipment

- MAX9671 EV kit (USB cable included)
- User-supplied Windows 2000, Windows XP, or Windows Vista PC with a spare USB port
- 12V/100mA DC power supply (V12)
- 3.3V/250mA DC power supply (VVID)
- 3.3V/100mA DC power supply (VAUD)
- Two DVD players with S-video, composite, or RGB outputs
- S-video to BNC Y connector

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 MAX9671 EV kit is fully assembled and tested. Follow the steps below to verify board operation. **Caution: Do not turn on power supplies until all connections are completed.**

1) Visit **www.maxim-ic.com/evkitsoftware** to download the latest version of the EV kit software, 9671Rxx.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 running the INSTALL.EXE program inside the temporary folder. The program files are copied and icons are created in the Windows **Start | Programs** menu.

3) Verify that all jumpers (JU1–JU7) are in their default positions, as shown in Tables 1 and 2. **Do not turn on the power until all connections are completed.**

4) Connect the 12V/100mA DC power supply to the V12 and the V12GND pads on the MAX9671 EV kit board.

5) Connect the 3.3V/250mA DC power supply to the VVID and the GNDVID pads on the MAX9671 EV kit board.

6) Connect the 3.3V/100mA DC power supply to the VAUD and the GNDAUD pads on the MAX9671 EV kit board.

7) Connect the GNDVID and GNDAUD pads together at the board.

8) Connect the V12GND and GNDAUD pads together at the board.

9) Connect the DIGGND and GNDAUD pads together at the board.

10) Connect the first DVD player output to the appropriate ENC input(s).

11) Connect the second DVD player to the VCR SCART (P2) connector.

12) Connect a TV to the TV SCART (P3) connector.

13) Connect the USB cable from the PC to the EV kit board. A **New Hardware Found** windows pops up 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.

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\MAX9671** (default installation directory) using the **Browse** button. During device driver installation, Windows may show a warning message indicating that the device driver Maxim uses does not contain a digital signature. This is not an error condition and it is safe to proceed with installation. Refer to the USB_Driver_Help.PDF document included with the software for additional information.

15) Turn on the power supplies.

16) Start the EV kit software by opening its icon in the **Start | Programs** menu. The EV kit software main window appears, as shown in Figure 1. Observe as the program automatically detects the address of the MAX9671 and starts the main program.

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___Detailed Description of Software
User Interface

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 correspond to bits in the command and configuration bytes. By pressing them, the correct I^{2}C-compatible write operation is generated to update the internal registers of the MAX9671. The **Interface** group box indicates the current I^{2}C-compatible **Device Address**, **Register Address Sent**, and the **Data Sent/Received** for the last read/write operation. This data is used to confirm proper device operation.

The MAX9671 EV kit software splits and groups the functions of the MAX9671 into three separate categories. **TV**, **VCR**, and **Configuration** functions can be accessed by selecting the appropriate tab at the top

left of the MAX9671 EV kit software main window. The **TV** and **VCR** tab sheets of the MAX9671 EV kit software are again split into two sections, **Video Control** and **Audio Control**.

The device status registers (refer to the MAX9670/MAX9671 IC data sheet for status register information) are displayed in the **MAX9671 Status** group box and the **Video Activity Status** group box at the bottom right of the main window. To read the status register, press the **Read Status** button, or check the **Automatic Status Read** checkbox to automatically read the status register every 250ms. The **Interrupt Status** group box allows the user to detect interrupts by checking the **Interrupt Enable** checkbox.

Press the **POR Reset** button to reset the MAX9671 registers and EV kit software to their power-on-reset configuration.

Table 1. Shunt Setting for SMBus/I^{2}C Address (JU1)

SHUNT POSITION	DEV_ADDR	B7	B6	B5	B4	B3	B2	B1	B0	WRITE ADDRESS (HEX)	READ ADDRESS (HEX)
1-2*	VDD	1	0	0	1	0	1	1	R/$\overline{W}$	0x96	0x97
1-3	SCL	1	0	0	1	1	0	0	R/$\overline{W}$	0x98	0x99
1-4	DIGGND	1	0	0	1	0	1	0	R/$\overline{W}$	0x94	0x95
1-5	SDA	1	0	0	1	1	0	1	R/$\overline{W}$	0x9A	0x9B

Default position.

Table 2. MAX9671 EV Kit Jumper Description (JU2–JU7)

JUMPER	SHUNT POSITION	DESCRIPTION
JU2	1-2*	Connect to 1.2V$_{RMS}$ FS
	2-3	Connect to 1.1V$_{RMS}$ FS
JU3	1-2*	Connect to 1.2V$_{RMS}$ FS
	2-3	Connect to 1.1V$_{RMS}$ FS
JU4	1-2*	Connect to on-board SDA
	2-3	Connect to user-supplied SDA
JU5	1-2*	Connect to on-board SCL
	2-3	Connect to user-supplied SCL
JU6	1-2*	Connect the MAX9671's interrupt output to the on-board MAXQ2000's on-board interrupt input
	2-3	Connect to user-supplied interrupt
JU7	1-2*	Connect to on-board +3.3V supply
	2-3	Connect to user-supplied +3.3V

Default position.

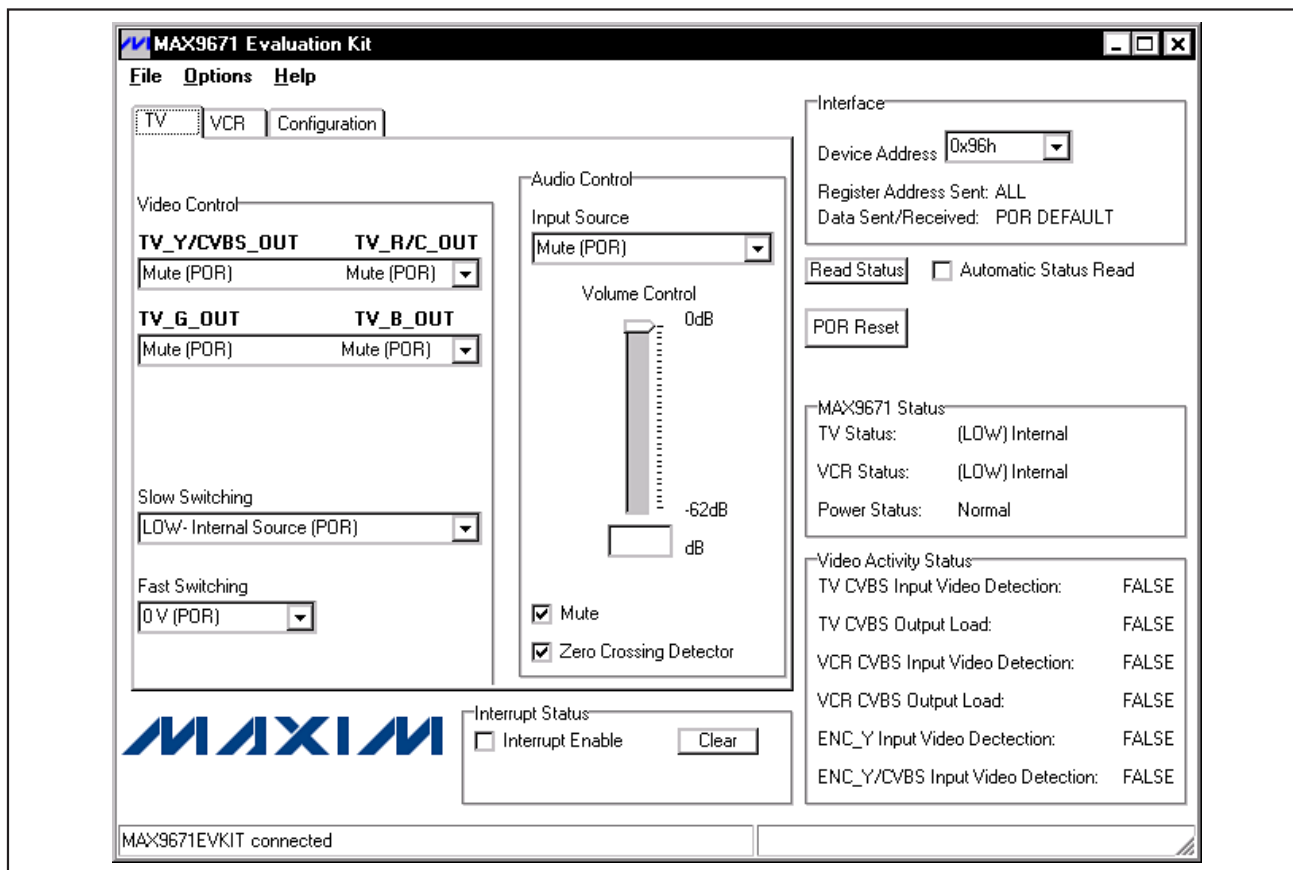***MAXIM***

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Figure 1. MAX9671 EV Kit Software Main Window (TV Control Tab)

TV Controls (Video Control)

The **Video Control** group box of the MAX9671 EV kit software (Figure 1) allows the user to reroute selected signals to the TV SCART connector. Other functions, such as **Fast Switching** and **Slow Switching**, can also be changed through the **Video Control** group box. Manipulate the drop-down lists to achieve the desired result.

TV Controls (Audio Control)

The **Audio Control** group box of the MAX9671 EV kit software allows the user to adjust various audio characteristics of the TV output. **Input Source**, **Volume Control**, **Mute**, and **Zero Crossing Detector** can also be accessed from the **Audio Control** group box (refer to the MAX9670/MAX9671 IC data sheet for a description of each of these functions).

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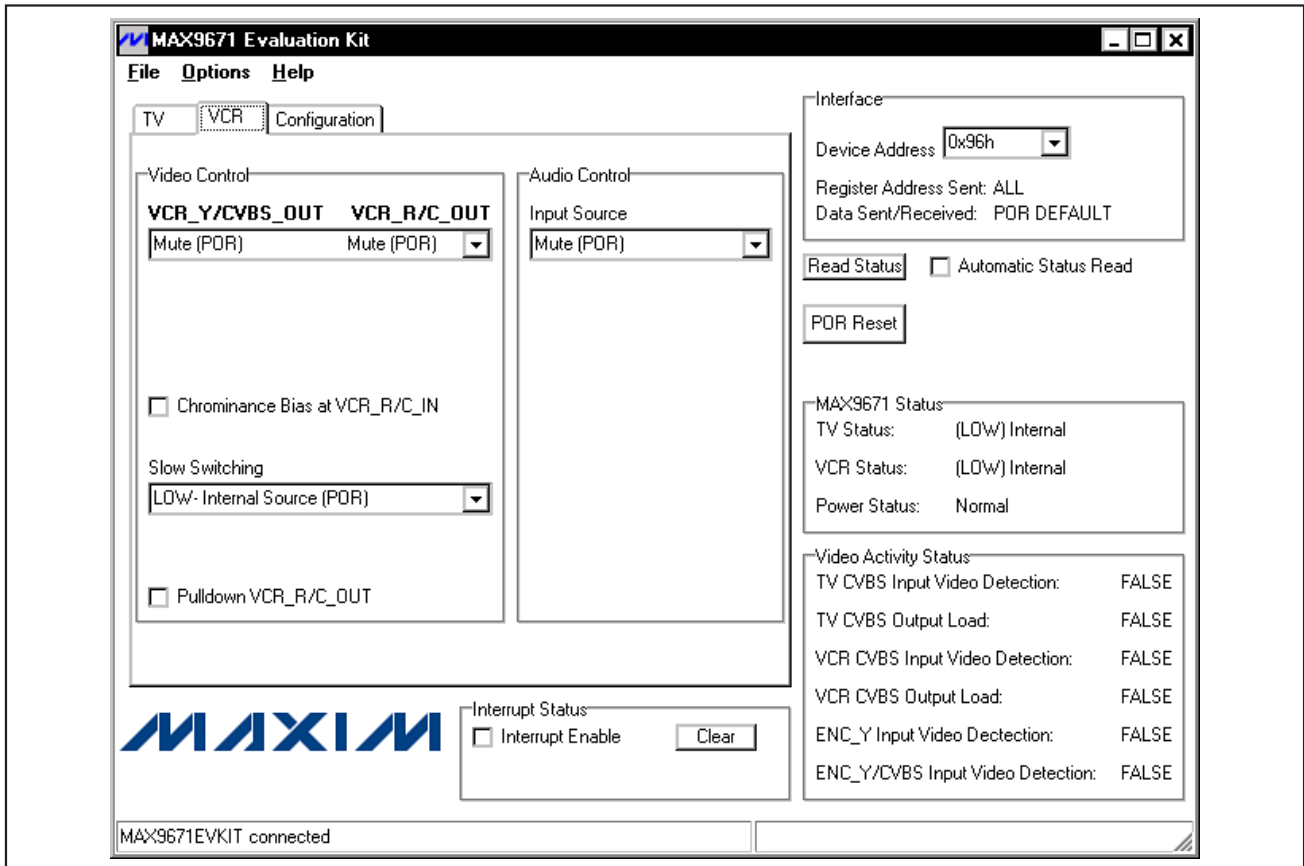
Figure 2. MAX9671 EV Kit Software Main Window (VCR Control Tab)

VCR Controls (Video Control)
The **VCR** tab sheet of the MAX9671 EV kit software is shown in Figure 2. SCART output signals (**VCR_Y/ CVBS_OUT** and **VCR_R/C_OUT**), **Chrominance Bias at VCR_R/C_IN**, **Slow Switching**, and **Pulldown VCR_R/C_OUT** functions can all be accessed through the **Video Control** group box.

VCR Controls (Audio Control)
Adjust the **Input Source** through the **Audio Control** group box of the MAX9671 EV kit software.

Configuration Controls
Selecting the **Configuration** tab sheet (Figure 3) of the MAX9671 EV kit software allows the user to adjust configuration features of the MAX9671. Checking desired checkboxes in the **Output Enable** group box enables selected outputs of the MAX9671. The **Operating Modes** group box allows the user to select one of four power modes. When the **Automatic Read** checkbox is checked, it automatically reads all registers and reconfigures the software appropriately to the register that was read. When in standby mode, the context of the registers does not change to reflect the standby state. A bias voltage can also be applied at the R/C input of the encoder (**Chrominance Bias at ENC_R/C_IN**). The EV kit software checks to see if the slave is present every second. Checking the **Disable I2C Activity** checkbox stops activity between the microcontroller and the MAX9671 when the software is idle.
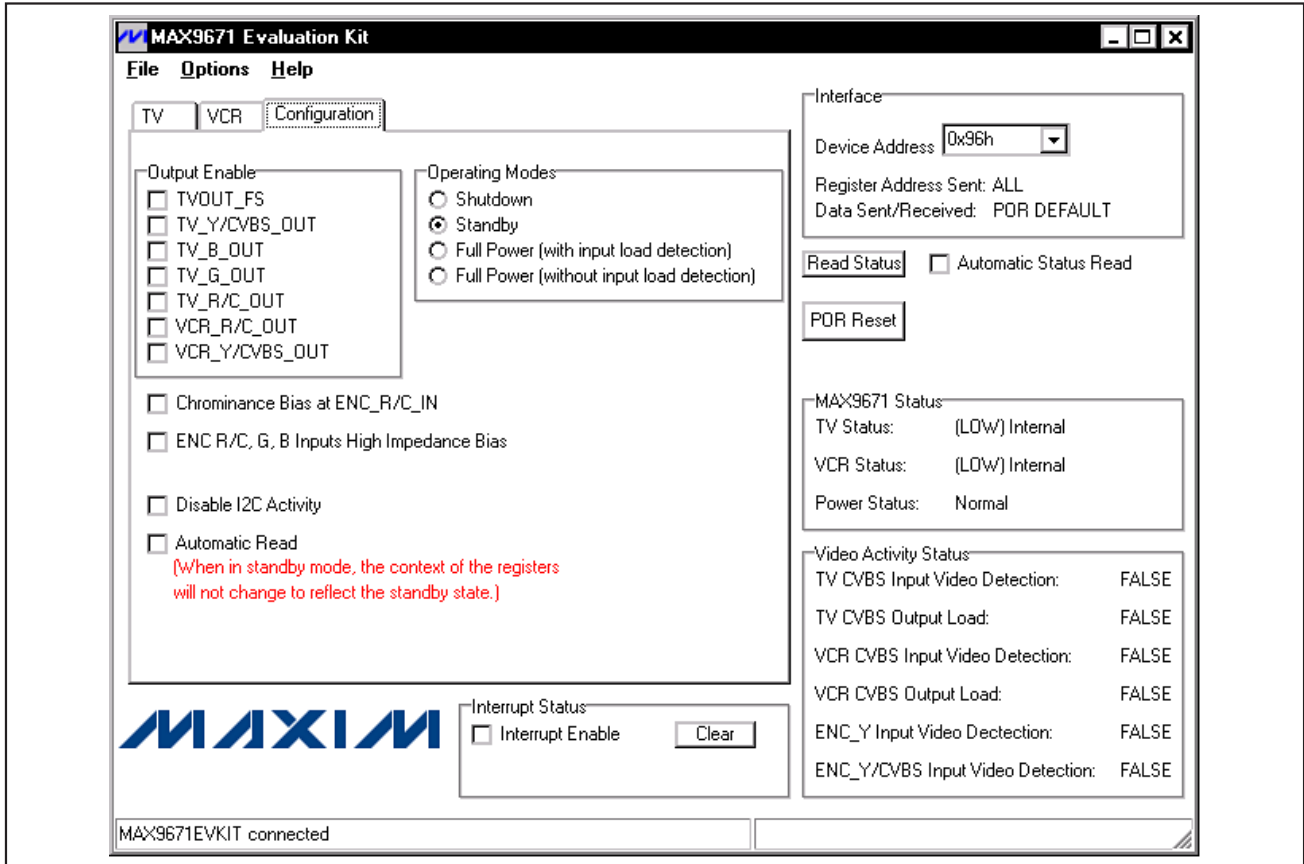
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Figure 3. MAX9671 EV Kit Software Main Window (Configuration Control Tab)

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Advanced User Interface

There are two methods for communicating with the MAX9671, through the normal user-interface main window or through the I2C commands available by selecting the **Options | Interface (Advanced Users)** from the menu bar. An **Advanced User Interface** window pops up with the **2-wire interface** tab selected, which allows the SMBus™/I2C-compatible protocols, such as **Read Byte** and **Write Byte**, to be executed. The only SMBus/I2C-compatible protocols used by the MAX9671 are:

- **1 - SMBusWriteByte(addr,cmd,data8)**

- **4 - SMBusReadByte(addr,cmd) → data8**

The combo and edit boxes accept numeric data in hexadecimal and should be prefixed by 0x. See Figure 4 for an example of this tool.

_Detailed Description of Hardware

The MAX9671 EV kit is an assembled and tested PCB that demonstrates the features of the MAX9671 dual SCART audio/video switch matrix. It routes audio, video, and control signals between a set-top box decoder chip and the TV and VCR SCART connectors. All video connections are made through 75Ω controlled-impedance traces. Connect a TV and VCR to the corresponding SCART connectors. The set-top box decoder video connections are made through the 75Ω BNC jacks with the ENC prefix. Audio signals from the stereo audio DAC are connected to the white and red (P4 and P5) RCA phono jacks. Monitor the R/C inputs of the VCR connections through the VCR_R/C_IN BNC jack.

SMBus is a trademark of Intel Corp.
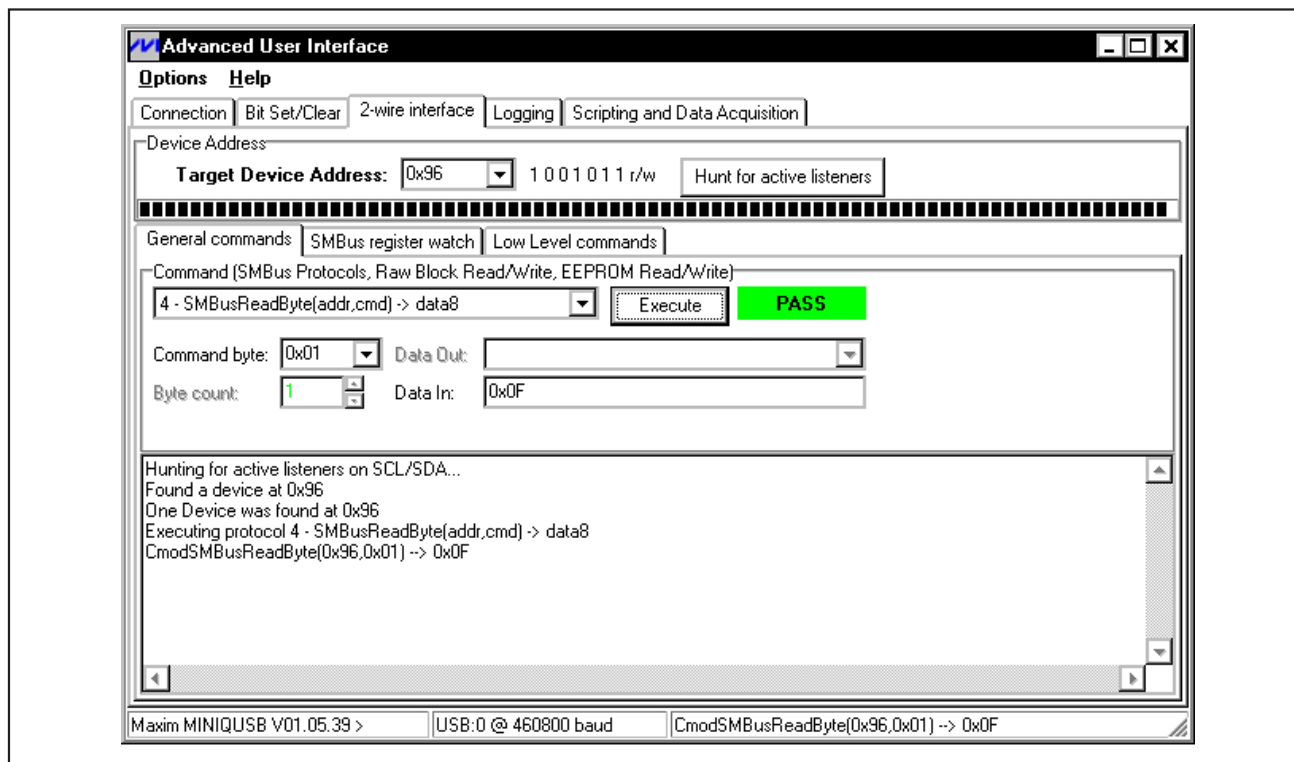
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Figure 4. Example of a Simple SMBusReadByte Operation Using the Advanced User Interface

Address Selection

Jumper JU1 sets the MAX9671 slave address. The default address is 1001 011(R/$\overline{W}$) (DEV_ADDR = VDD). See Table 1 for a complete list of addresses.

Audio Encoder Inputs

Connect a stereo audio source that represents the encoder audio to P4 (left audio) and P5 (right audio). The Cirrus CS4334/5/8/9 and Burr-Brown PCM1742 are commonly used in set-top boxes to convert a digital I^{2}S audio stream to analog-stereo audio signals. The full-scale audio level of the CS4334 is 1.2V$_{RMS}$, while the full-scale audio level of the PCM1742 is 1.1V$_{RMS}$. Both parts center their audio outputs in the middle of their analog supply voltage range.

The ENC_INL and ENC_INR inputs expect the incoming audio signal to have a full scale of 0.5V$_{RMS}$ and to be centered around ground. Therefore, the audio signals presented to P4 and P5 are AC-coupled and attenuated by a resistor-divider network. The amount of attenuation is determined by jumpers JU2 and JU3. If the shunt position is 1-2, the resistor-divider network attenuates a 1.2V$_{RMS}$ full-scale audio signal to a 0.5V$_{RMS}$ full-scale audio signal. If the shunt position is 2-3, the resistor-divider network attenuates a 1.1V$_{RMS}$ full-scale audio signal to a 0.5V$_{RMS}$ full-scale audio signal.

If the audio source does not have either a 1.2V$_{RMS}$ or 1.1V$_{RMS}$ full-scale signal, then the resistor-divider network can be adjusted to accommodate another full-scale audio level. For example, if the incoming audio signal is 2V$_{RMS}$ full scale, then the signal must be attenuated by a factor of 4. Set the shunt positions of JU2 and JU3 to 1-2. Change resistors R57 and R59 from a 4.53kΩ resistor to a 2.2kΩ resistor.

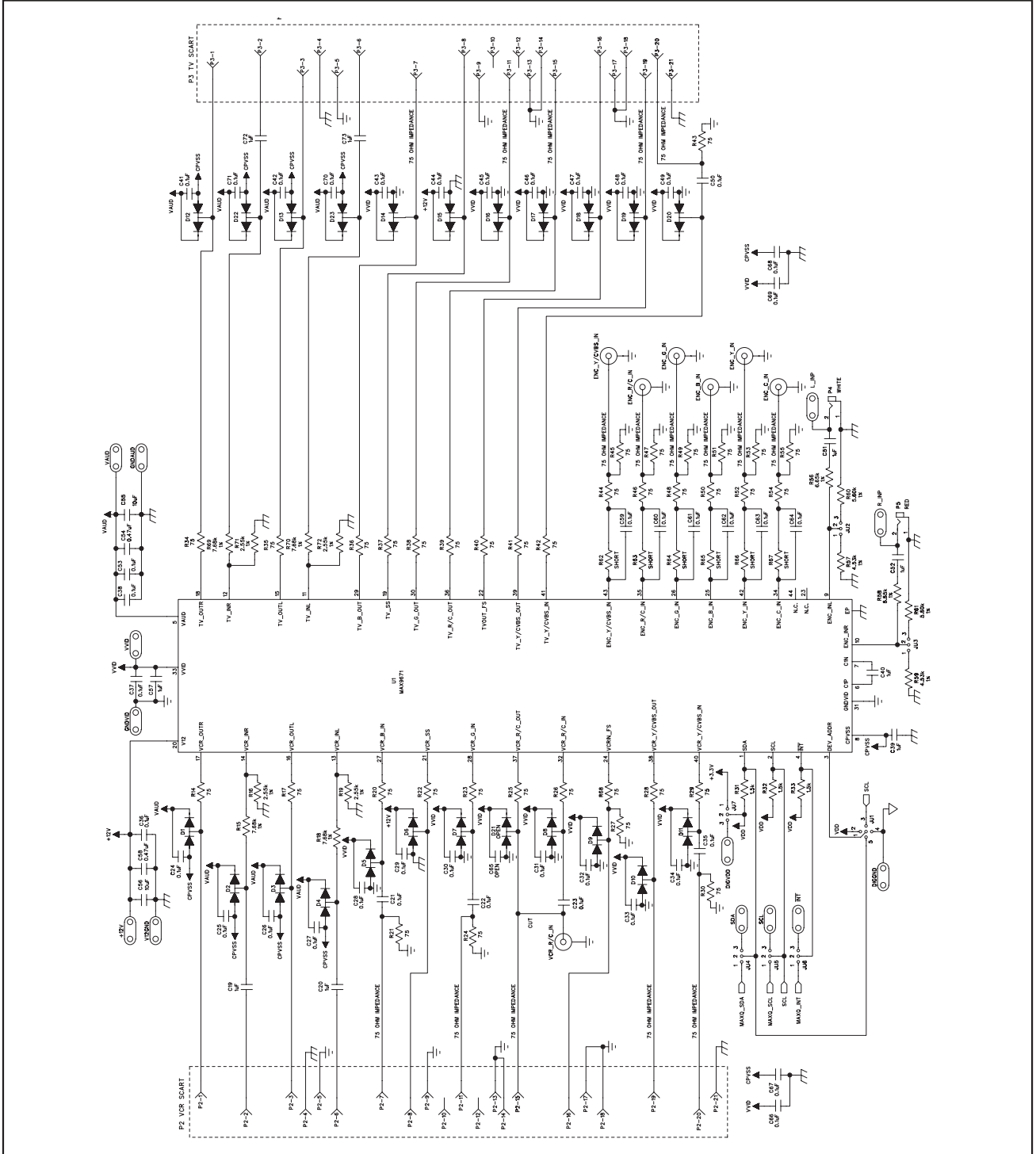# MAX9671 Evaluation Kit

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Figure 5a. MAX9671 EV Kit Schematic (Sheet 1 of 2)

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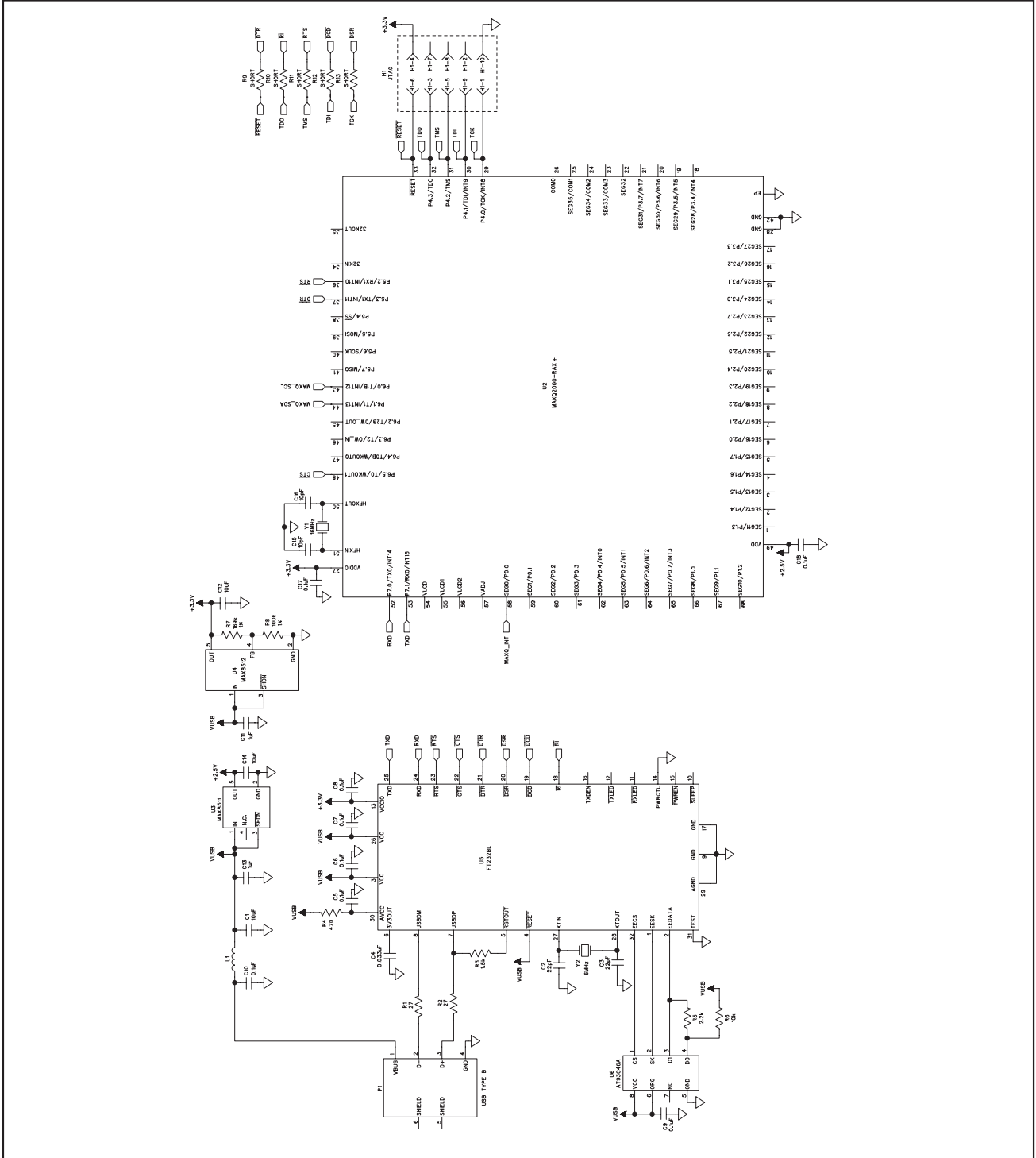
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Figure 5b. MAX9671 EV Kit Schematic (Sheet 2 of 2)

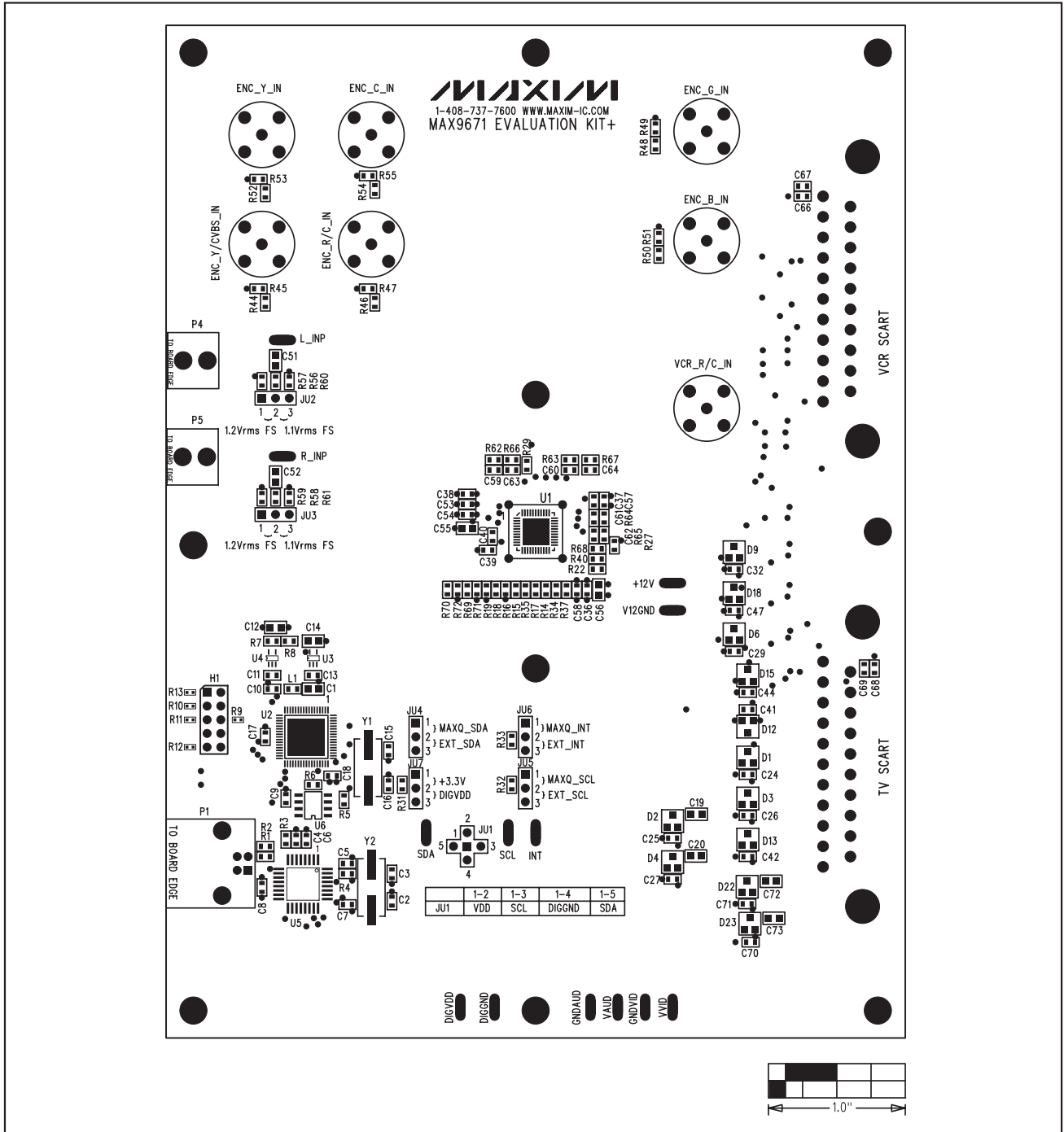# MAX9671 Evaluation Kit

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Figure 6. MAX9671 EV Kit Component Placement Guide—Component Side
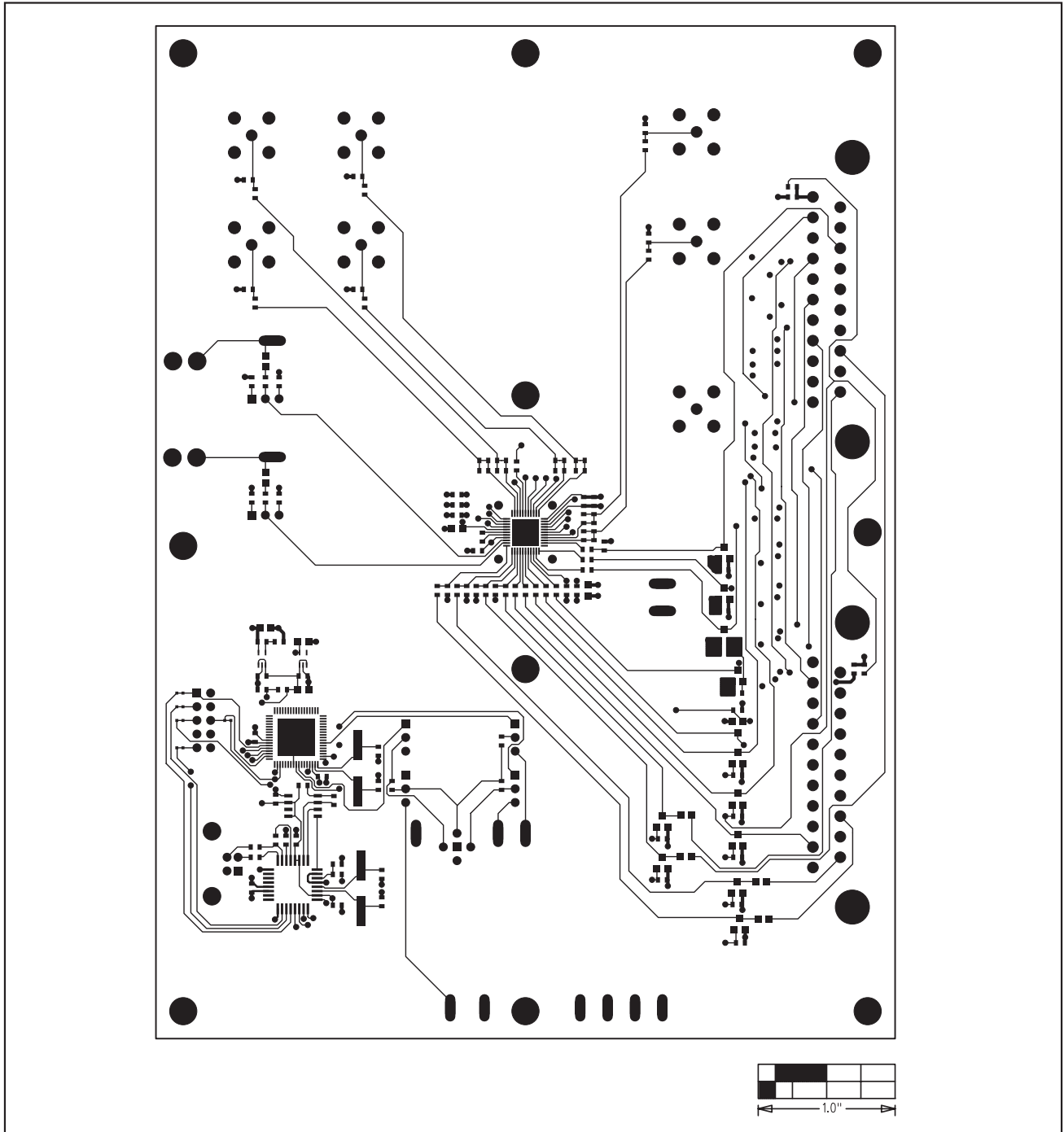
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Figure 7. MAX9671 EV Kit Component PCB Layout—Component Side
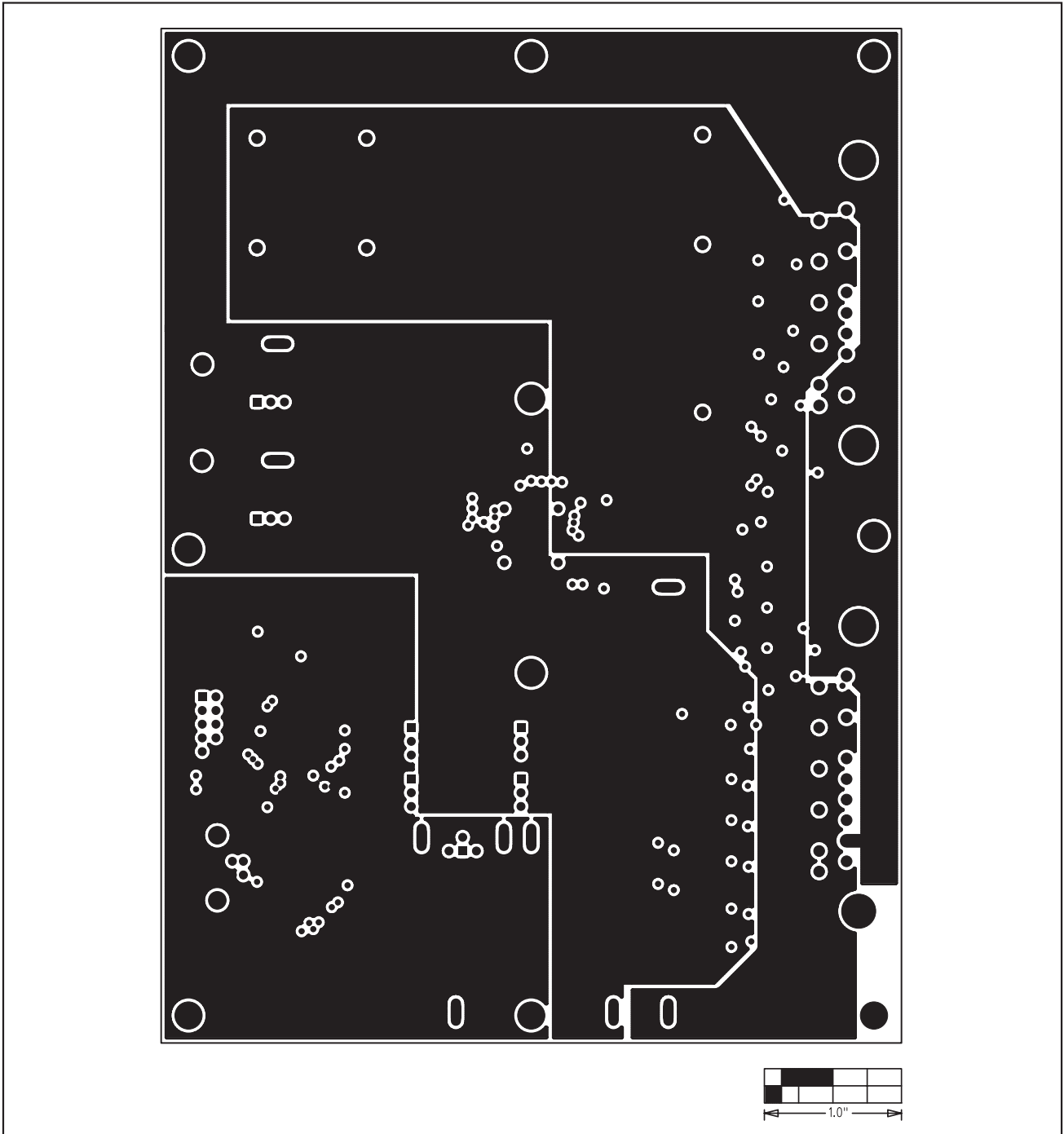
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Figure 8. MAX9671 EV Kit PCB Layout—Inner Layer 2
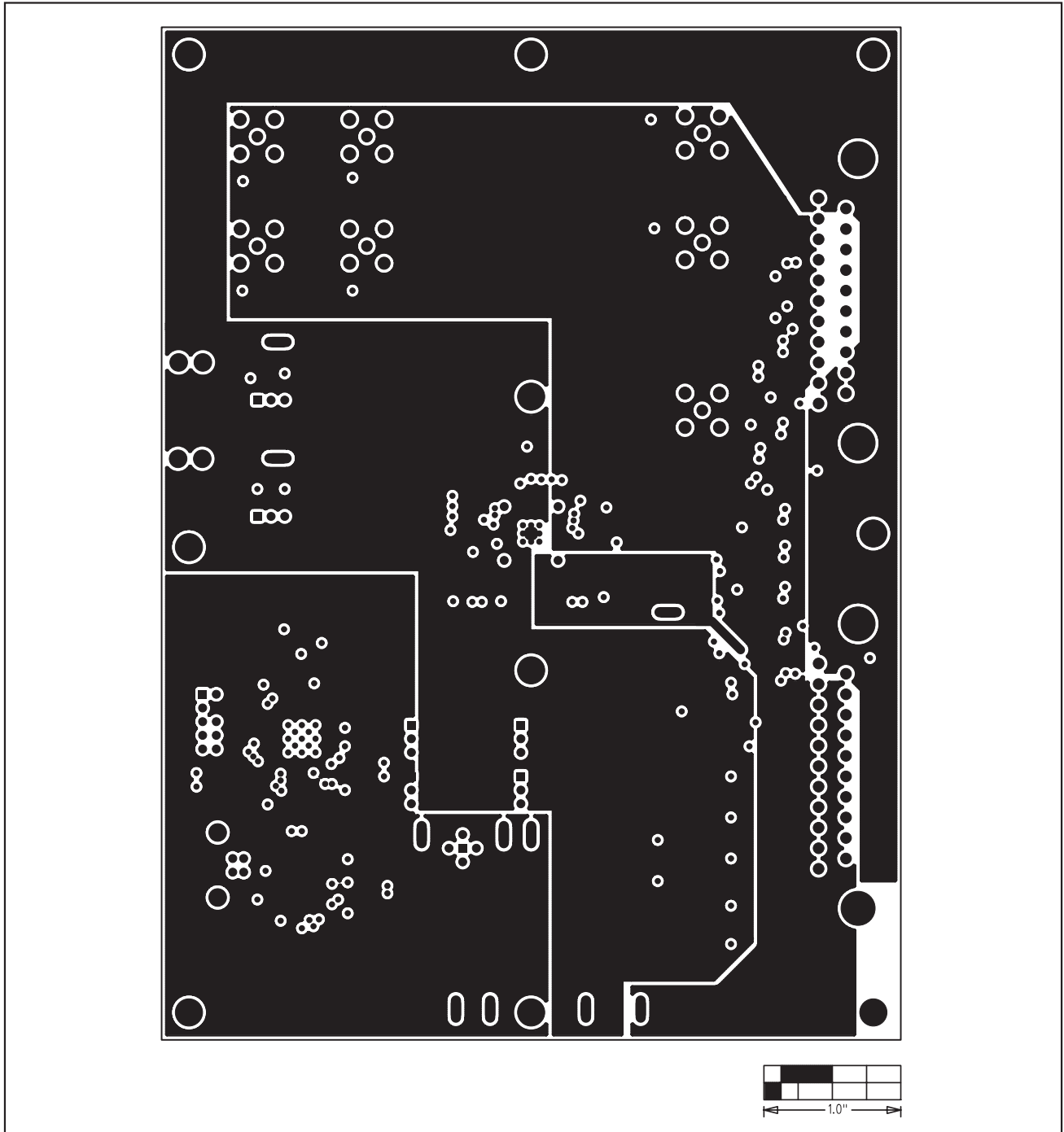
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Figure 9. MAX9671 EV Kit PCB Layout—Inner Layer 3
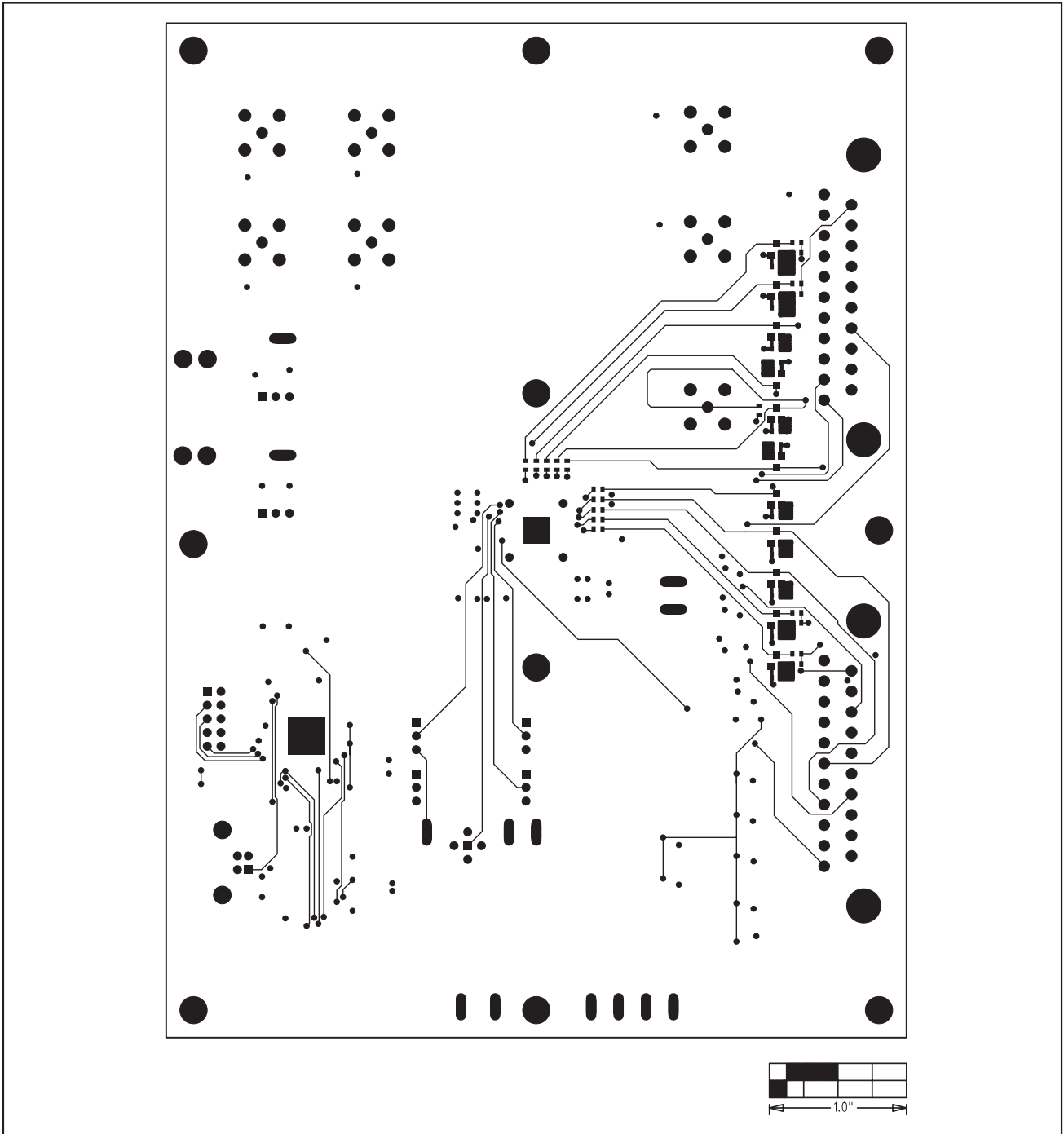
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Figure 10. MAX9671 EV Kit PCB Layout—Solder Side
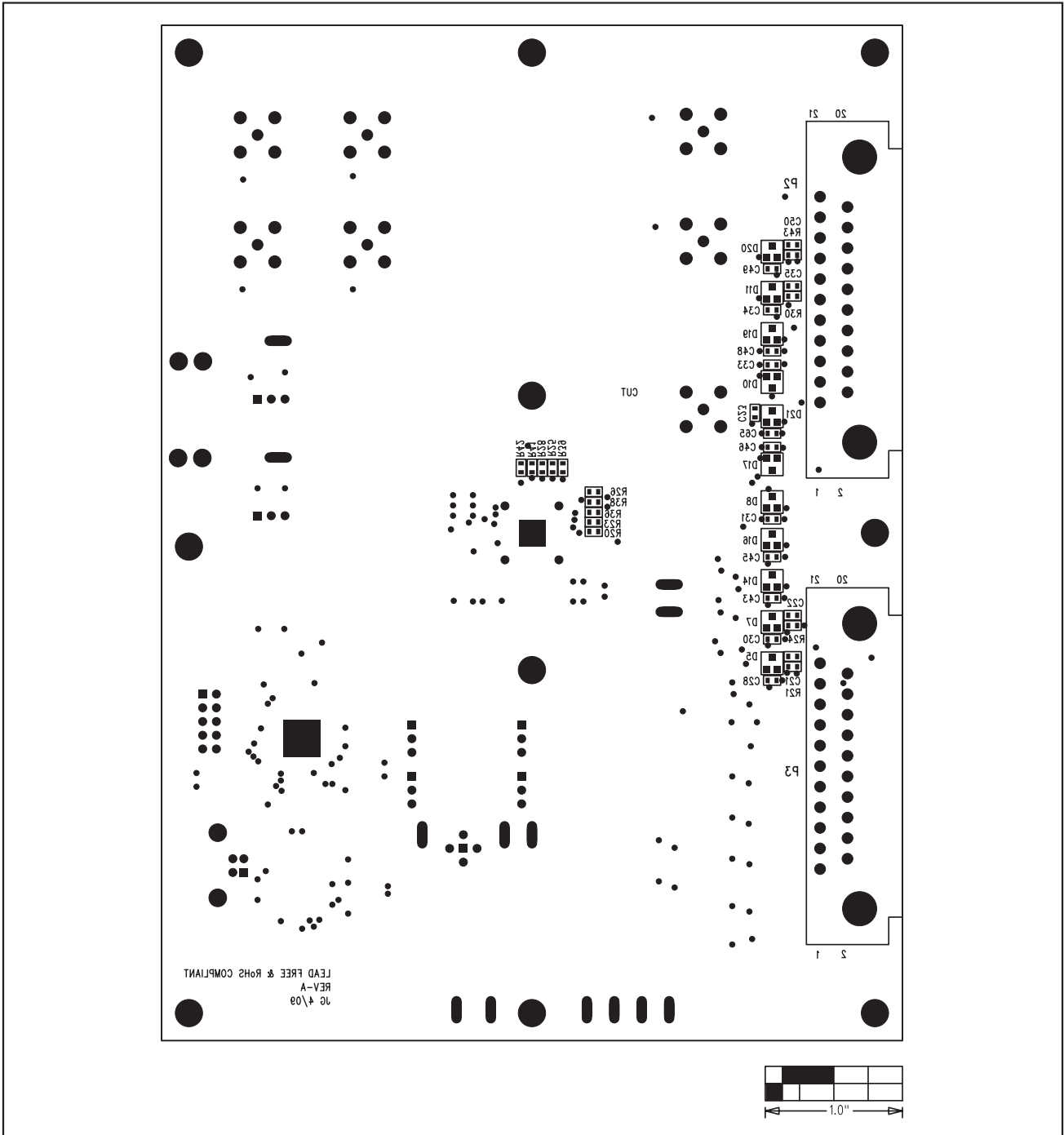
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Figure 11. MAX9671 EV Kit Component Placement Guide—Solder Side

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