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MAX5591 Evaluation Kit/Evaluation System

Evaluate: MAX5591/MAX5593/MAX5595

General Description

The MAX5591 evaluation system (EV system) (MAX5591EVCMOD2) is a complete 8-channel, 12-bit data-generation system consisting of a MAX5591 evaluation kit (EV kit) and the Maxim CMOD232 command module. Order the EV kit (MAX5591EVKIT) separately if the user has an SPI™ master or if the CMOD232 command module has been purchased previously.

The EV kit comes with the MAX5591AEUI installed. Contact the factory for free samples of the pin-compatible MAX5591_EUI/MAX5593_EUI/MAX5595_EUI to evaluate these devices.

Features

♦ **Proven PC Board Layout**

♦ **Windows® 95-/98-/2000-/XP-Compatible Evaluation Software**

♦ **Pushbutton Switches for Easy UPIO_ Evaluation**

♦ **Fully Assembled and Tested**

Component List

DESIGNATION	QTY	DESCRIPTION
C1, C4	2	10µF ±20%, 6.3V X5R ceramic capacitors (0805) TDK C2012X5R0J106M
C2, C3, C5, C6, C7	5	0.1µF ±10%, 16V X7R ceramic capacitors (0603) TDK C1608X7R1C104KT
FB1	1	Surface-mount ferrite bead (0603) TDK MMZ1608B601C
J1	1	2 x 20 right-angle female connector
J2	1	20-pin 2 x 10 header
JU1, JU2, JU6	3	3-pin headers
JU3, JU4, JU5	0	Not installed (pins shorted on PC board for customer to cut)
R1–R16	16	10kΩ ±0.1% resistors (0805)
R17–R32	0	Not installed, thru-hole resistors
R33, R35	2	100kΩ ±5% resistors (0805)
R34, R36	2	1kΩ ±5% resistors (0805)
R37	1	10kΩ ±5% resistor (0805)
SW1, SW2	2	Pushbutton switches, momentary, normally open
U1	1	MAX5591AEUI (28-pin TSSOP)
U2	1	+2.5V voltage reference (8-pin SO) Maxim MAX6126AASA25
—	3	Shunts
—	1	MAX5591 EV kit PC board
—	1	MAX5591 EV kit software CD

SPI is a trademark of Motorola, Inc.

Windows is a registered trademark of Microsoft Corp.

Ordering Information

PART	TEMP RANGE	INTERFACE TYPE
MAX5591EVKIT	0°C to +70°C	User-supplied SPI master
MAX5591EVCMOD2	0°C to +70°C	Windows software

Note: *The MAX5591 software is included with the MAX5591 EV kit but is designed for use with the complete EV system. The EV system includes both the Maxim command module and the EV kit. If the Windows software will not be used, the EV kit board can be purchased without the Maxim command module.*
Note: *To evaluate the MAX5591_EUI/MAX5593_EUI/ MAX5595_EUI, request a free sample when ordering the MAX5591 EV kit.*

MAX5591EVCMOD2 Component List

PART	QTY	DESCRIPTION
MAX5591EVKIT	1	MAX5591 EV kit
CMOD232	1	CMOD232 command module

Component Suppliers

SUPPLIER	PHONE	WEBSITE
TDK	847-803-6100	www.component.tdk.com

Note: *Indicate you are using the MAX5591 when contacting these component suppliers.*

MAX5591 EV Kit Files

FILE	DESCRIPTION
INSTALL.EXE	Installs the EV kit files on your computer
MAX5591.EXE	Application program
HELPFILE.HTM	MAX5591 EV kit help file
UNINST.INI	Uninstalls the EV kit software

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Quick Start

Recommended Equipment

- Maxim MAX5591EVCMOD2 EV system (contains the MAX5591 EV kit and the CMOD232 command module)
- Wall cube: +9V at 200mA (included with the CMOD232)
- Power supply: +5V at 100mA (AV_{DD})
- Digital voltage meter (DVM)
- User-supplied 9-pin I/O extension cable
- User-supplied Windows 95/98/2000/XP PC with an available RS-232 serial port

Note: In the following section(s), sotware-related items are identified by bolding. Text in **bold** refers to items directly from the EV kit software. Text in **<u>bold and underline</u>** refers to items from the Windows 98SE/2000/XP operating system.

Procedure

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

1) Verify the shunt for jumper J1 on the CMOD232 module is connected to pins 2-3. This sets the logic supply to 5V (see Table 2).

2) Verify the shunt for jumper JU1 on the MAX5591 EV kit is connected to pins 2-3. This sets the DAC outputs to zero on power-up.

3) Verify the shunt for jumper JU2 on the MAX5591 EV kit is connected to pins 2-3. This connects the UPIO1 line to the SPI MISO line of the CMOD232 module.

4) Verify the shunt for jumper JU6 on the MAX5591 EV kit is connected to pins 1-2. This ensures SPI data is clocked in on the rising edge of SCLK.

5) Connect the 40-pin female connector (J1) of the MAX5591 EV kit to the 40-pin male connector (P4) of the CMOD232 module.

6) Connect the 9-pin serial cable from the computer's serial port to the DB9 connector (P2) of the CMOD232 module. The EV kit software checks the modem status lines (CTS, DSR, and DCD) to confirm that the correct port has been selected.

7) Install the MAX5591 evaluation software on your computer by running the INSTALL.EXE program from the installation CD-ROM. The program files are copied and icons are created for them in the Windows **<u>Start</u>** Menu.

8) Connect the +5V power supply between the MAX5591 EV kit's AVDD and AGND pads. Turn on the +5V power supply.

9) Connect the +9V wall cube to the power connector (P1) of the CMOD232.

10) Start the MAX5591 EV kit software by opening its icon in the Start Menu.

11) Using the **Load Input and Output (From Shift)** tab, press the **Load All DACs** button.

12) Verify that all **Output Register Code** and **Voltage** labels update with 0x800 and 1.25V respectively at the bottom of the MAX5591 EV kit software's main window.

13) Measure the voltage at OUTA (J2-3) using the DVM and verify that the voltage is 1.25V.

Detailed Description of Software

The main window of the evaluation software (shown in Figure 1) displays the voltage and code for all DAC input and output registers. In addition, the main window also shows the shutdown and settling time status for all of the DACs. Table 1 describes the controls that are always present on the evaluation software's main window.

The **Load Input (From Shift)** tab, shown in Figure 2, allows the user to load the input register of the corresponding DAC with the data that is sent to the shift register. The user can load all four DACs individually or all at once by pressing the appropriate button. If the **AutoRead All Registers** checkbox is checked (see Figure 1), the new input register value is updated to the software's main window.

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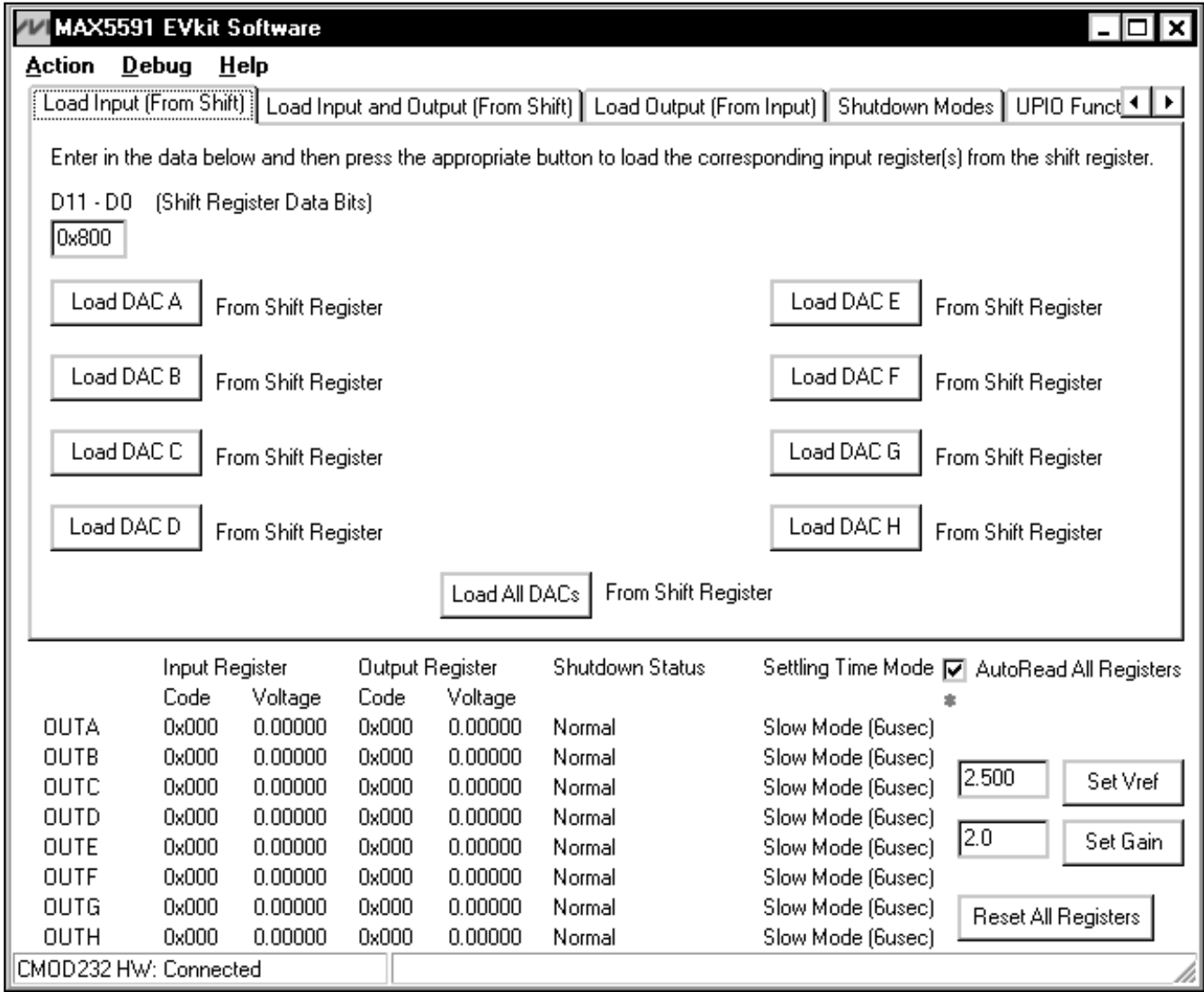
Figure 1. Main Window of the MAX5591 Evaluation Software

Table 1. Main Window Control Descriptions of the MAX5591 EV Kit Software

CONTROL	DESCRIPTION
Action	Allows the user to select the active tab.
Debug	Shows the CMOD232 debugging tools.
Help	Gives access to the help file and the about box.
Input Register Code Voltage 0x000 0.00000 0x000 0.00000 0x000 0.00000 0x000 0.00000 0x000 0.00000 0x000 0.00000 0x000 0.00000 0x000 0.00000	Shows the code and voltage for the input register of DACA–DACH.
Output Register Code Voltage 0x000 0.00000 0x000 0.00000 0x000 0.00000 0x000 0.00000 0x000 0.00000 0x000 0.00000 0x000 0.00000 0x000 0.00000	Shows the code and voltage for the output register of DACA–DACH.
Shutdown Status Shutdown (1k) Shutdown (1k) Normal Normal Normal Normal Shutdown High-Z Shutdown High-Z	Shows the shutdown mode and shutdown status of DACA–DACH.
Settling Time Mode Slow Mode (6usec) Slow Mode (6usec) Fast Mode (3usec) Fast Mode (3usec) Slow Mode (6usec) Fast Mode (3usec) Slow Mode (6usec) Fast Mode (3usec)	Shows the settling time mode of DACA–DACH.

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Table 1. Main Window Control Descriptions of the MAX5591 EV Kit Software (continued)

| CONTROL	DESCRIPTION
☐ AutoRead All Registers ✱	When checked, automatically reads and updates all the register information for the registers that are permanently on the bottom of the software's main window. A flashing asterisk indicates that **AutoRead All Registers** is active.
2.500 Set Vref	Allows the user to enter the actual measured on-board reference value or the actual value of a user-supplied external reference. Pressing the **Set Vref** button uses the value typed in the edit field to calculate the corresponding input and output register voltages.
2.0 Set Gain	Allows the user to enter the gain of the output amplifier. Pressing the **Set Gain** button uses the value typed in the edit box to calculate the corresponding input and output register voltages. The MAX5591 EV kit board has on-board resistors that set the default gain to 2. To change the gain, modify the onboard gain-setting resistors by referring to the MAX5591 data sheet before changing the gain in the software. For unity-gain device evaluation, set the gain to 1 and remove the output feedback resistors to prevent loading the output.
Reset All Registers	Resets all the registers and status information that is permanently on the bottom of the software's main window.
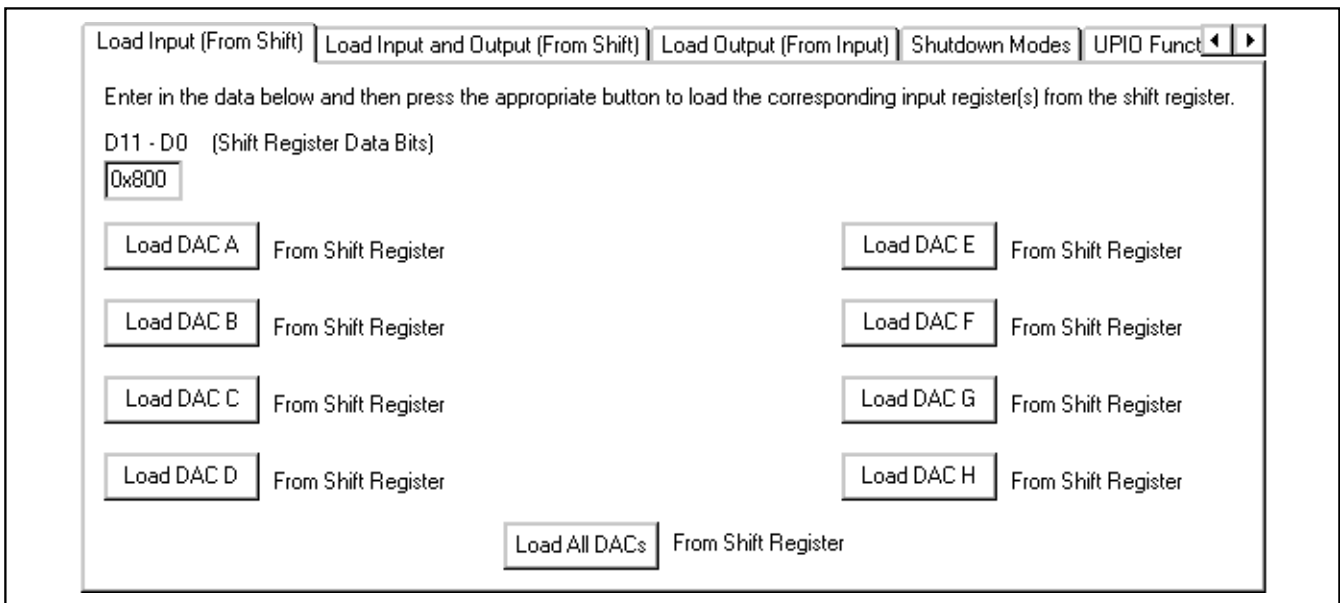
Figure 2. Load Input (From Shift) Tab

The **Load Input and Output (From Shift)** tab, shown in Figure 3, allows the user to load the input and output registers of the corresponding DAC with the data that is sent to the shift register. The user can load all four DACs at once by pressing the **Load All DACs** button. If the **AutoRead All Registers** checkbox is checked (see Figure 1), the new input and output register values are updated to the software's main window.

The **Load Output (From Input)** tab, shown in Figure 4, allows the user to load the output register of the corresponding DAC with the data that is present in the corresponding input register. The user can load the four DACs simultaneously in any combination by checking the appropriate **DAC_** checkbox and then pressing the **Load Checked DACs** button. It is also possible to load all of the DACs at once by pressing the **Load All DACs** button. If the **AutoRead All Registers** checkbox is checked (see Figure 1), the new output register values are updated to the software's main window.
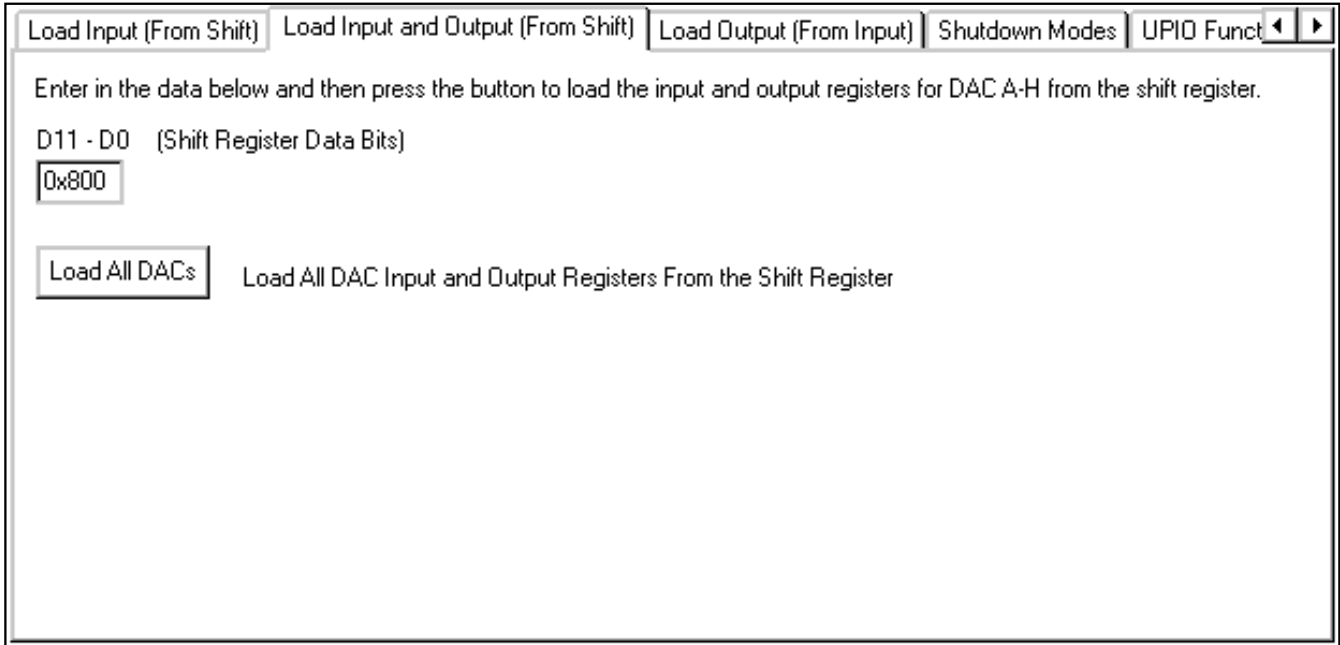
Evaluate: MAX5591/MAX5593/MAX5595

Load Input (From Shift) | Load Input and Output (From Shift) | Load Output (From Input) | Shutdown Modes | UPIO Funct ◄ | ►

Enter in the data below and then press the button to load the input and output registers for DAC A-H from the shift register.

D11 - D0   (Shift Register Data Bits)

0x800

Load All DACs   Load All DAC Input and Output Registers From the Shift Register

Figure 3. Load Input and Output (From Shift) Tab

Load Input (From Shift) | Load Input and Output (From Shift) | Load Output (From Input) | Shutdown Modes | UPIO Funct ◄ | ►

Select the appropriate DAC(s) to load the output register(s) from the input register(s).

Checked = Logic 1

☐ DAC A   Load Checked DACs   Load Checked DAC Output Registers From Input Registers

☐ DAC B

☐ DAC C   Load All DACs   Load All DAC Output Registers From Input Registers

☐ DAC D

☐ DAC E

☐ DAC F

☐ DAC G

☐ DAC H

Figure 4. Load Output (From Input) Tab

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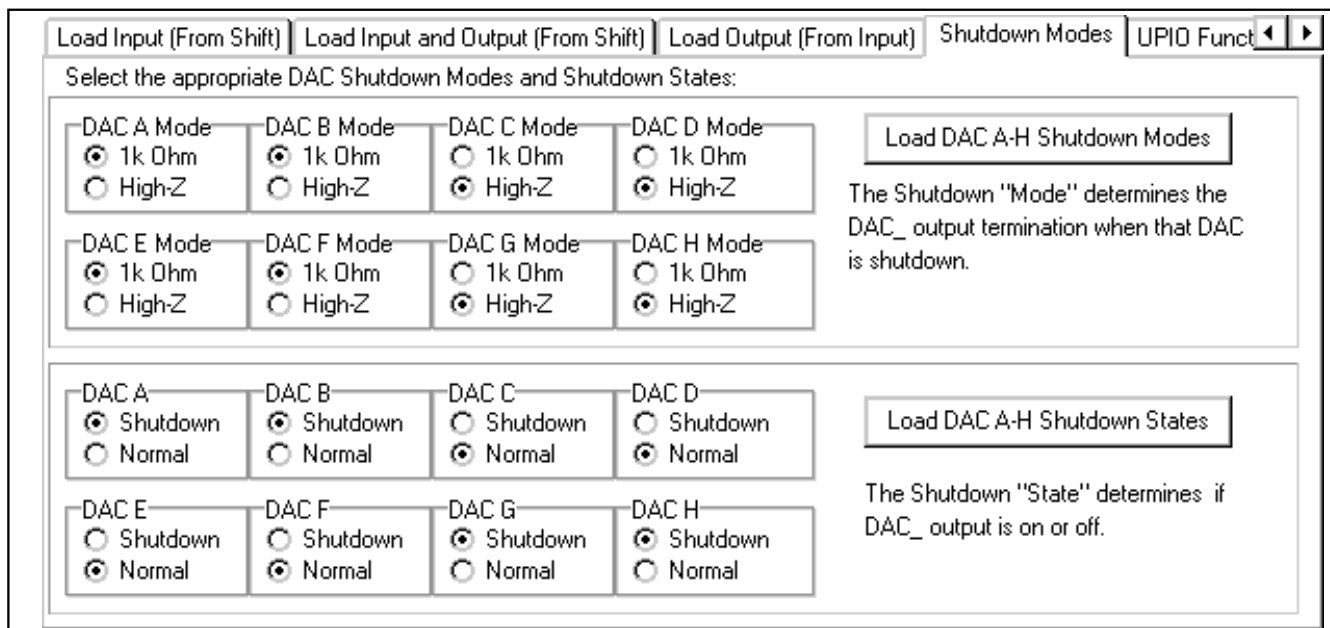# MAX5591 Evaluation Kit/Evaluation System

Figure 5. Shutdown Modes Tab

The **Shutdown Modes** tab, shown in Figure 5, allows the user to select the appropriate DAC shutdown mode individually for all eight DACs. The selected shutdown modes will not be loaded until the **Load DAC A-H Shutdown Modes** button is pressed. In addition, the user can select the appropriate DAC shutdown state individually for all eight DACs. The selected shutdown states will not be loaded until the **Load DAC A-H Shutdown States** button is pressed. If the **AutoRead All Registers** checkbox is checked (see Figure 1), the new shutdown status for each DAC is updated to the software's main window.

The **UPIO Functions** tab, shown in Figure 6, allows the user to select the appropriate UPIO1 and UPIO2 functions using the corresponding combo box. The current UPIO1 and UPIO2 function status is displayed by pressing the **Read** button.

Note: For the MAX5591 EV kit software to read from the MAX5591 device, UPIO1 must be configured for DOUTRB.

The **Settling Time Modes** tab, shown in Figure 7, allows the user to select the appropriate DAC settling time mode individually for all eight DACs. The selected settling-time modes will not be loaded until the **Load DAC A-H Settling Time Modes** button is pressed. If the **AutoRead All Registers** checkbox is checked (see Figure 1), the new settling time modes for each DAC are updated to the software's main window.

The **Read UPIO Inputs** tab, shown in Figure 8, allows the user to read the GPI status for UPIO2. Pressing the **Read** button tells the user whether a falling edge or rising edge has occurred since the last read as well as the current state of the pin.

Note: This read requires that UPIO1 be configured for DOUTRB and UPIO2 as a GPI.

Detailed Description of Hardware

MAX5591EVCMOD2 EV System
The MAX5591EVCMOD2 is a complete 8-channel, 12-bit data-generation system consisting of a MAX5591 EV kit and the Maxim CMOD232 command module.

CMOD232 Command Module
The CMOD232 uses a proprietary design to provide SPI- and I2C-compatible interfaces to communicate with various Maxim devices. Maxim reserves the right to change the implementation of this module at any time with no advance notice. The CMOD232 board uses a MAX1659 linear regulator and a MAX3232E level shifter.

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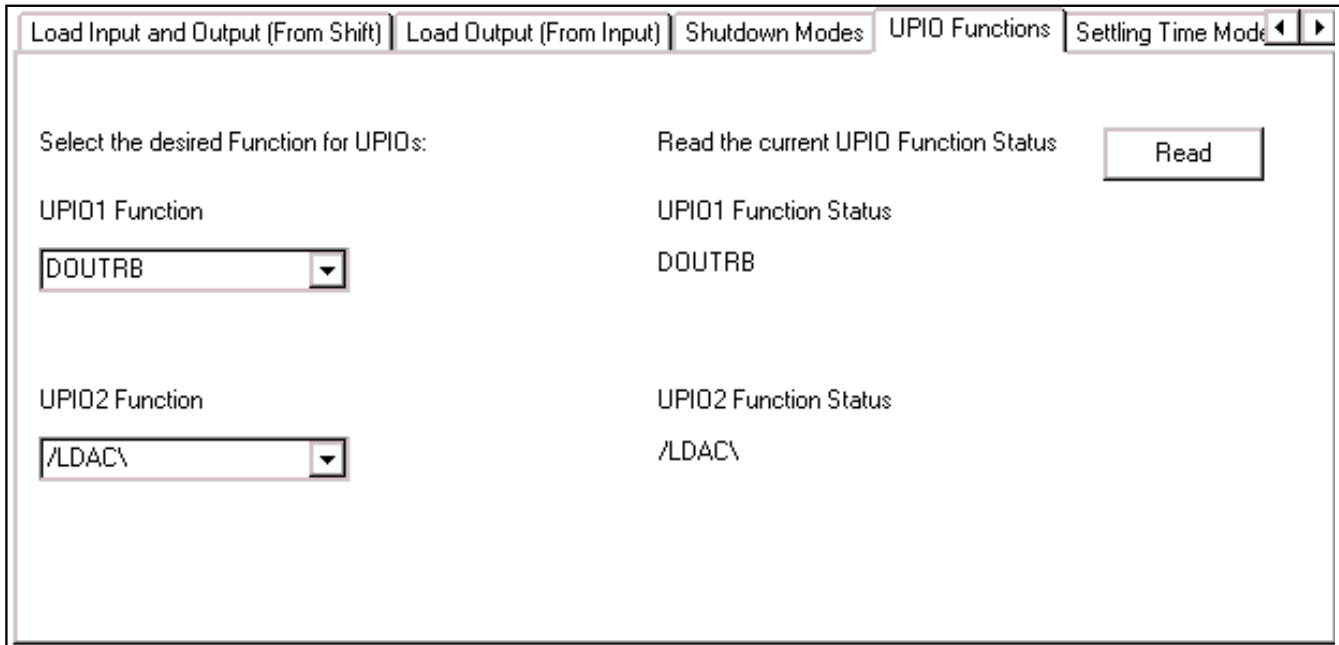*MAXIM* _____ 7

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Evaluate: MAX5591/MAX5593/MAX5595

Figure 6. UPIO Functions Tab
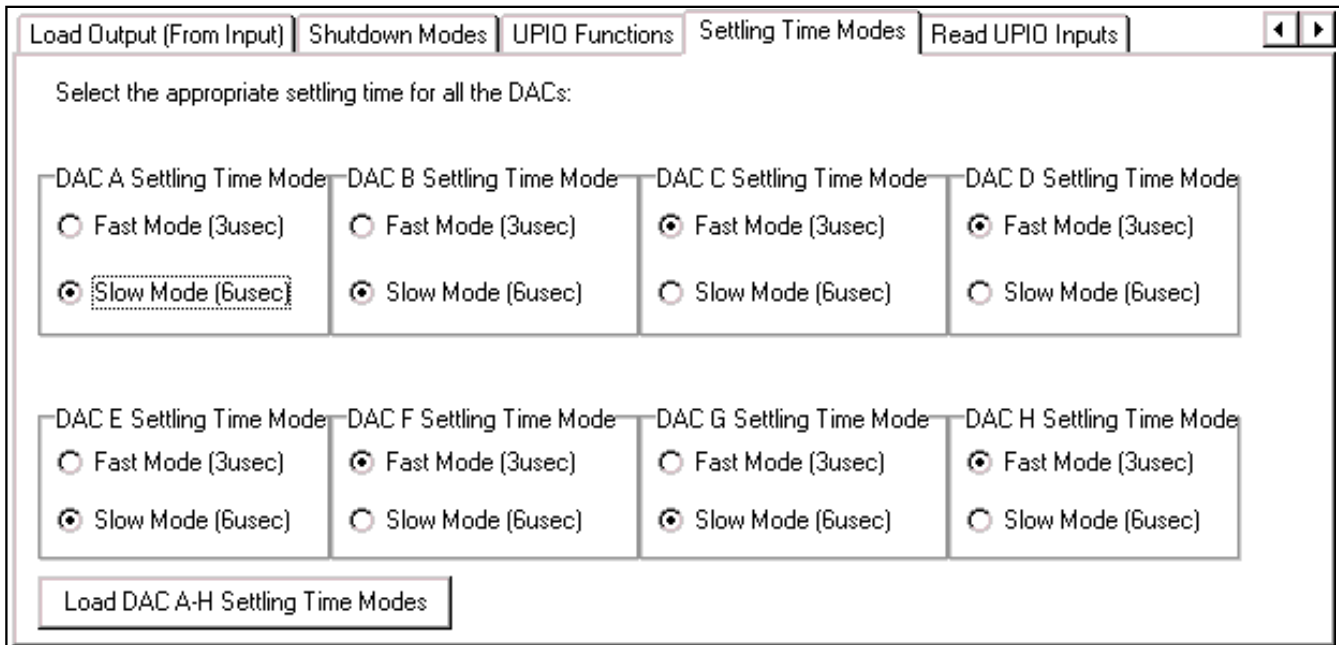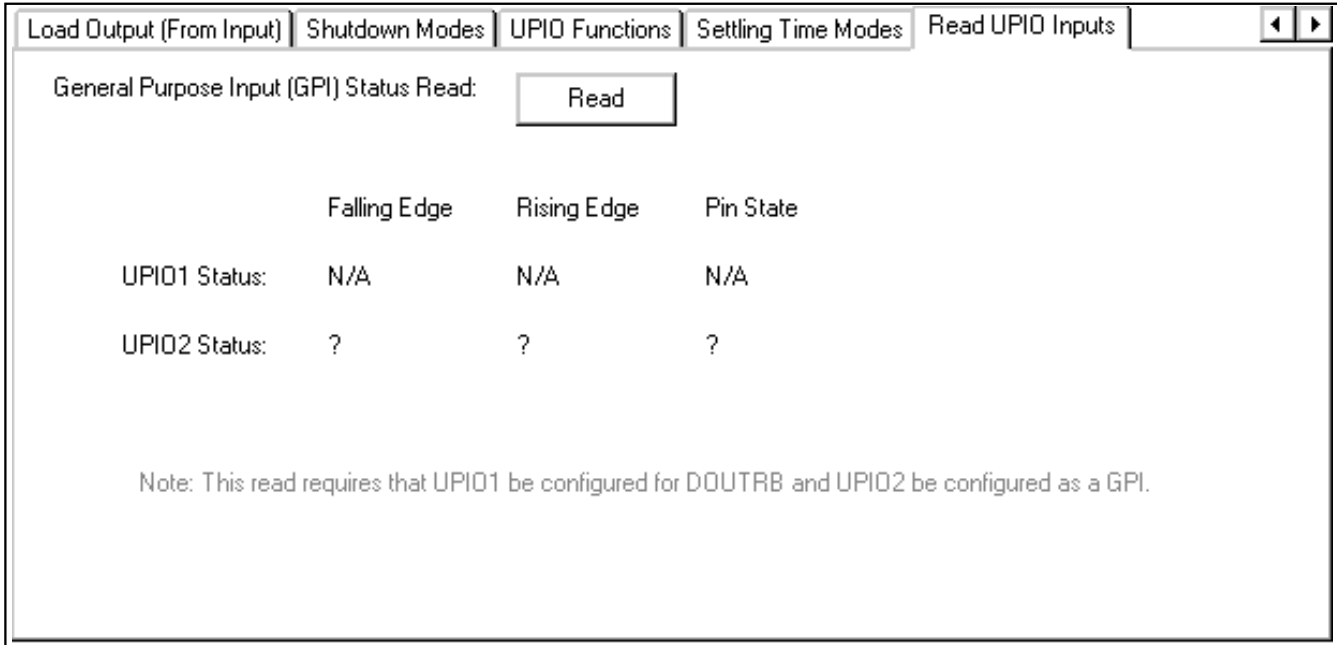

Figure 7. Settling Time Modes Tab

Figure 8. Read UPIO Tab

CMOD232 Power Supply

The CMOD232 board uses a MAX1659 linear voltage regulator. Jumper J1 selects between the MAX1659's 5V preset output voltage and a 3.3V output voltage. The included plug-in transformer (Digi-Key T402-P5P-ND) provides 9VDC at 200mA from a 120V AC line. Other DC power supplies can be used. The power connector accepts a 2.1mm barrel connector and DC power in either polarity. (AC input is not tested or recommended.)

MAX5591 EV Kit

The MAX5591 EV kit board provides a proven layout for evaluating the MAX5591 8-channel, 12-bit DAC and can be obtained separately without the CMOD232 command module. The MAX5591 EV kit contains an on-board refer-ence and two momentary pushbutton switches for testing the UPIO functions. The MAX5591AEUI (U1) is powered from two sources. The user must supply +5V to AV_{DD}. DV_{DD} is provided by the CMOD232 com-mand module.

The DAC outputs can be set to full scale, midscale or zero at power-up. Jumper JU1 configures the DAC out-puts at power-up as shown in Table 3.

Jumper JU2 gives the user the flexibility to connect UPIO1 to the CMOD232 command module's SPI MISO line (DOUT) or to a UPIO1 user pad on the MAX5591 EV kit board. Table 4 shows the UPIO1 route selection.

Table 2. CMOD232 Jumper J1 (System DV$_{DD}$ Voltage)

SHUNT POSITION	DV$_{DD}$ VOLTAGE (V)
1-2	3.3
2-3*	5.0
Open	**DO NOT OPERATE KIT WITH J1 OPEN! PERMANENT DAMAGE WILL OCCUR.**

*Default configuration.

Table 3. Power-Up State Input (PU)

JUMPER	SHUNT POSITION	DESCRIPTION
JU1	1-2	DAC outputs set to full scale upon power-up.
	2-3*	DAC outputs set to zero upon power-up.
	Open	DAC outputs set to midscale upon power-up.

*Default configuration.

Table 4. UPIO1 Route Selection (DOUT/UPIO1)

JUMPER	SHUNT POSITION	DESCRIPTION
JU2	1-2	UPIO1 user pad.
	2-3*	CMOD232's SPI MISO line (DOUT). Required for readback commands in the MAX5591 EV kit software.

*Default configuration.

Table 5. Reference Selection (REF)

JUMPER	PC BOARD TRACE	DESCRIPTION
JU3	Short*	On-board MAX6126 +2.5V reference option.
	Open	Cut trace and attach an external reference to the REF pad.

*Default configuration.

Table 6. Supply-Current Measurement (I_{AVDD}/I_{DVDD})

JUMPER	PC BOARD TRACE	DESCRIPTION
JU4/JU5	Short*	Normal operation.
	Open	Cut traces and attach a current meter in series with the two open terminals to measure the supply current of AV_{DD} (JU4) and DV_{DD} (JU5).

*Default configuration.

Table 7. Data Latch-In Clock Edge Select (DSP)

JUMPER	SHUNT POSITION	DESCRIPTION
JU6	1-2*	Data latched in on the rising edge of SCLK.
	2-3	Data latched in on the falling edge of SCLK.

*Default configuration.

The MAX5591 EV kit has an on-board MAX6126 +2.5V reference, but also allows for a user-supplied external reference (0.25V to AV_{DD}). Cut the PC board trace designated by jumper JU3 and apply an external reference to the REF pad. Table 5 shows the jumper JU3 reference type options.

Measure supply current using jumpers JU4 and JU5. Cut the PC board traces and place a current meter in series with the two terminals of the corresponding jumper. Table 6 shows the jumper JU4/JU5 current-measurement options.

Jumper JU6 allows the user to select the clock edge that latches in the SPI data. Table 7 shows the jumper JU6 clock edge options.

General Troubleshooting

Problem 1: CMOD232 module hardware not found (see Figure 9).

Figure 9. EV Kit Software Warning Message

Solution 1:
- Verify that the power LED is lit.
- Verify that the 2.1mm power cable is connected.
- Verify that the DB9 serial communications cable is connected.
- Verify that another application, such as PDA desktop software, is not using the com port.

Problem 2: The register data at the bottom of the MAX5591 evaluation software's main window is not correct (see Figure 1).

Solution 2:
- Verify that UPIO1 is configured for DOUTRB.
- Verify that the **AutoRead All Registers** checkbox is checked.
- Verify that the shunt for jumper JU6 is connected to pins 1-2.
- Verify that the shunt for jumper JU2 is connected to pins 2-3.
- Verify that the DB9 serial communications cable is connected.

Problem 3: Pressing the **Read** button in the **Read UPIO Inputs** tab gives incorrect status (see Figure 8).

Solution 3:
- Verify that UPIO2 is configured as a GPI.
- Verify that UPIO1 is configured for DOUTRB.
- Verify that the shunt for jumper JU6 is connected to pins 1-2.
- Verify that the shunt for jumper JU2 is connected to pins 2-3.
- Verify that the DB9 serial communications cable is connected.

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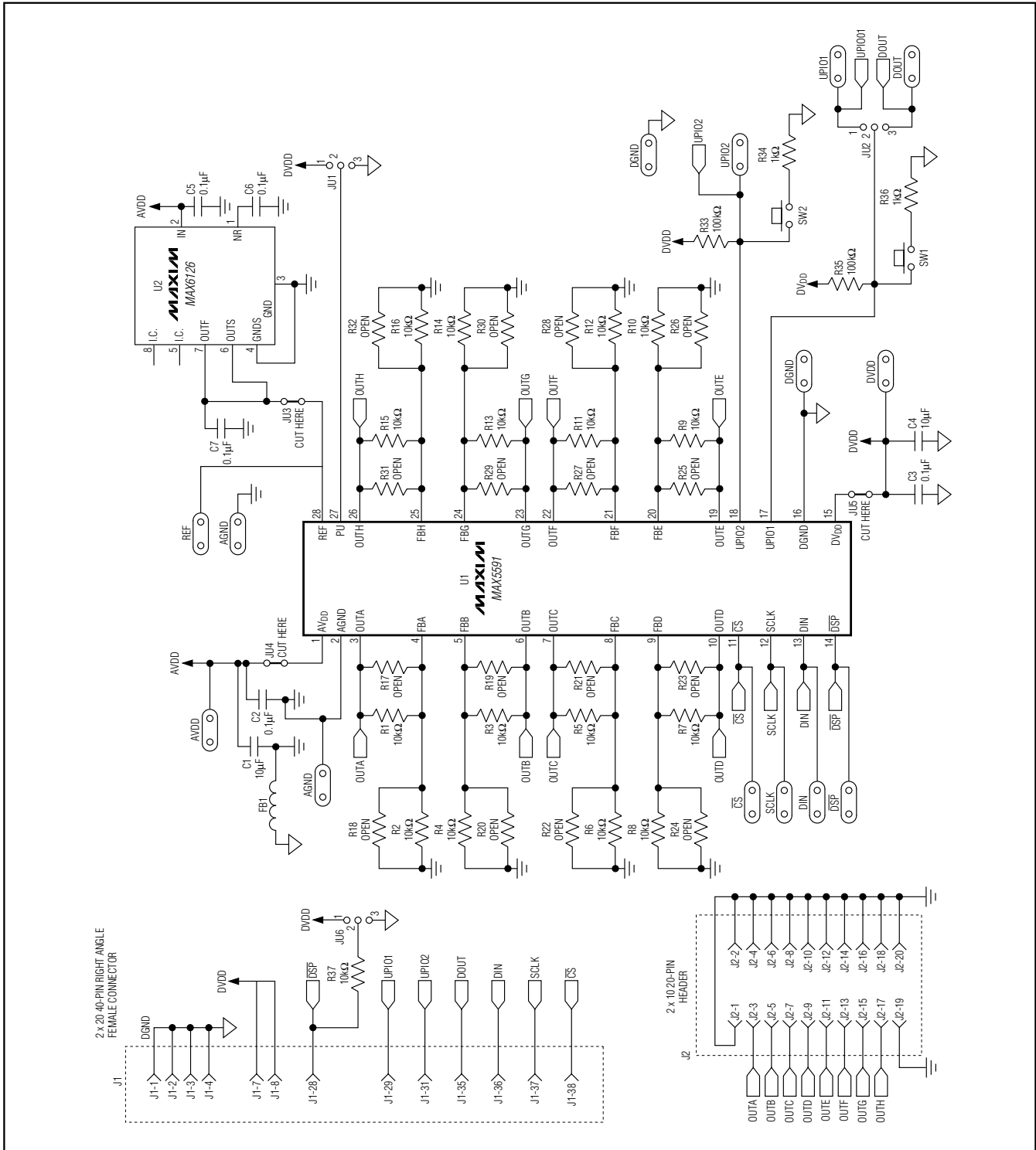# MAX5591 Evaluation Kit/Evaluation System

Figure 10. MAX5591 EV Kit Schematic

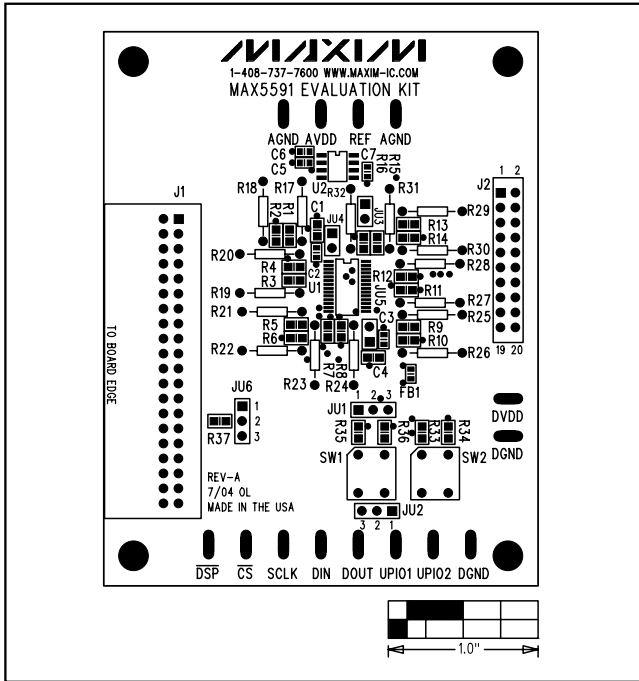# MAX5591 Evaluation Kit/Evaluation System

Figure 11. MAX5591EV Kit Component Placement Guide—
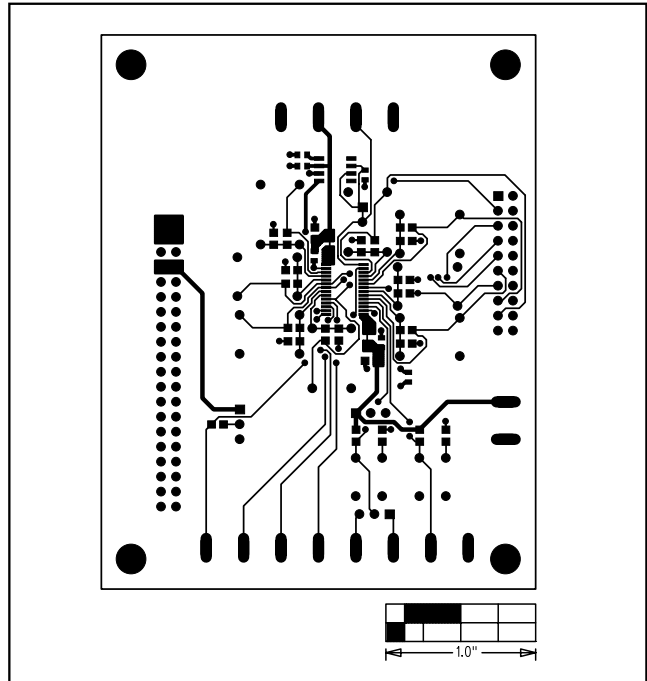Component Side

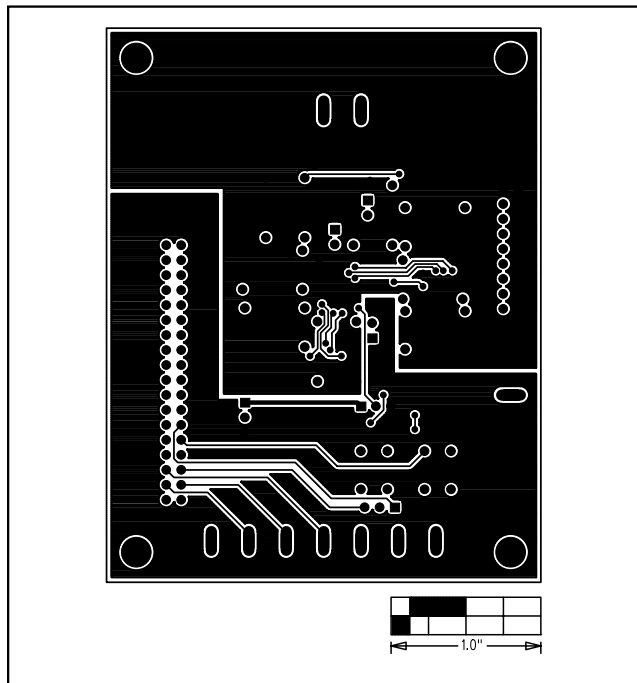Figure 12. MAX5591 EV Kit PC Board Layout—Component Side

Figure 13. MAX5591 EV Kit PC Board Layout—Solder Side

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