



# MAX9257A/MAX9258A Evaluation Kit

## General Description

The MAX9257A/MAX9258A evaluation kit (EV kit) consists of a MAX9257A/MAX9258A evaluation board and software. The EV kit is a fully assembled and tested PCB that evaluates the MAX9257A serializer and the MAX9258A deserializer (SerDes). The EV kit also emulates an electronic control unit (ECU) and a camera. The MAX9258A receives programming instructions from the emulated ECU during the control channel and transmits to the MAX9257A over the serial video link. The instructions can program or update the MAX9258A, MAX9257A, or an external peripheral device such as a camera. The MAX9257A communicates with the peripheral device with either an I<sup>2</sup>C or UART interface.

The MAX9257A/MAX9258A EV kit includes Windows® 2000/XP- and Windows Vista®-compatible software that provides a simple graphical user interface (GUI) for exercising the features of the MAX9257A and MAX9258A. The EV kit is connected to a PC through the USB.

*Windows and Windows Vista are registered trademarks of Microsoft Corp.*

## Features

- ◆ USB Connectivity
- ◆ On-Board Emulated ECU
- ◆ On-Board Emulated Camera
- ◆ On-Board Connectors for Connection with Pattern Generators or Video Equipment
- ◆ Flexible On-Board Video Pixel Clock Generator
- ◆ Single 5V Power Supply
- ◆ Windows 2000/XP- and Windows Vista (32-Bit)-Compatible Evaluation Software
- ◆ Proven PCB Layout
- ◆ Fully Assembled and Tested

## Ordering Information

PART	TYPE
MAX9257AEVKIT+ or MAX9258AEVKIT+	EV Kit

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

**Note:** The MAX9257A/MAX9258A EV kit can be ordered using either part number.

## Component List

DESIGNATION	QTY	DESCRIPTION
C1–C6, C16–C19, C23–C45, C50–C55, C59–C65, C75–C80, C84–C101, C106–C111, C114, C115, C116	79	0.1µF ±10%, 16V X7R ceramic capacitors (0402) TDK C1005X7R1C104K
C7–C12, C66–C72	13	1nF ±5%, 25V C0G ceramic capacitors (0402) TDK C1005C0G1E102J
C20, C21, C81, C82	4	15pF ±5%, 50V C0G ceramic capacitors (0402) TDK C1005C0G1H150J
C22, C83	2	1µF ±10%, 16V X7R ceramic capacitors (0603) TDK C1608X7R1C105K
C46–C49, C102–C105	8	100µF ±20%, 6.3V X5R ceramic capacitors (1210) TDK C3225X5R0J107M
C56, C57, C112, C113	4	10µF ±10%, 10V X5R ceramic capacitors (1206) TDK C3216X5R1A106K
D1, D3, D4	3	Green LEDs (0603)

DESIGNATION	QTY	DESCRIPTION
D2	1	Red LED (0603)
FB1–FB10	10	470Ω at 100MHz ferrite beads, DC 1000mA (0603) Murata BLM18PG471SH1B
J1, J6	2	40-pin (2 x 20) header sockets
J2, J7	2	LVDS connectors JAE Electronics MX39004NQ1
J3	1	USB type-B right-angle female receptacle
J4, J9	0	Not installed, dual-row 10-pin (2 x 5) headers
J5, J10	2	12-pin (2 x 6) header sockets
J8	0	Not installed, USB type-B right-angle female receptacle
JU1–JU10, JU15, JU16, JU19–JU23, JU30, JU31	19	2-pin headers
JU11, JU14, JU17, JU18, JU24–JU29	10	3-pin headers
Q1, Q2	2	n-channel MOSFETs (SOT23) Fairchild 2N7002
R1, R2, R46, R47	4	49.9Ω ±1% resistors (0402)



# MAX9257A/MAX9258A Evaluation Kit

## Component List (continued)

DESIGNATION	QTY	DESCRIPTION
R3, R4, R15–R19, R48, R49, R63–R67, R71	15	10k $\Omega$ $\pm$ 5% resistors (0402)
R5, R21, R22	3	1k $\Omega$ $\pm$ 5% resistors (0402)
R8, R68	2	100k $\Omega$ $\pm$ 1% resistors (0402)
R9, R69	2	200k $\Omega$ $\pm$ 1% resistors (0402)
R10, R23, R24, R54	4	160 $\Omega$ $\pm$ 5% resistors (0402)
R11, R12, R50, R51	4	22 $\Omega$ $\pm$ 5% resistors (0402)
R13, R14, R44, R45, R52, R53	6	2k $\Omega$ $\pm$ 5% resistors (0402)
R20, R55, R56	3	100 $\Omega$ $\pm$ 5% resistors (0402)
R25–R43, R70	0	Not installed, resistors (0402)
T1, T2	2	Common-mode EMI chokes Würth 744231091
TP1, TP4, TP5	3	Test points (red)
TP2, TP3, TP6, TP7	0	Not installed, test points
TP8, TP15	2	Black Test points
TP9–TP14, TP16–TP21	12	Red Test points

DESIGNATION	QTY	DESCRIPTION
U1	1	Deserializer (48 LQFP) Maxim MAX9258AGCM/V+
U2	1	Serializer (40 TQFN-EP) Maxim MAX9257AGTL/V+
U3, U11	2	500mA LDOs (8 TQFN) Maxim MAX1935ETA+
U4, U12	2	3.3V, 1A LDOs (16 TSSOP-EP) Maxim MAX8869EUE33+
U5, U13	2	3.3V, 200mA LDOs (6 SOT23) Maxim MAX8881EUT33+
U6, U14	2	Microcontrollers (64 QFN-EP)
U7, U15	2	Serial programmable clock generators (16 TSSOP)
U8, U16	2	Cyclone II FPGAs (144 TQFP) Altera EP2C5T144C6N
U9, U17	2	FPGA serial-configuration devices (8 SO) Altera EPCS4SI8N
Y1, Y2	2	8MHz crystals (HCM49)
—	1	2-meter LVDS cable JAE Electronics MX39B-FF-L2000
—	1	USB high-speed A-to-B cable, 6ft
—	25	Shunts
—	1	PCB: MAX9257A/8A EVALUATION Kit

## MAX9257A/MAX9258A EV Kit Files

FILE	DESCRIPTION
INSTALL.EXE	Installs the EV kit files on your computer
MAX9257A_8A.EXE	Application program
ATUSBHID.DLL	USB software library
UNINST.INI	Uninstalls the EV kit software

## Component Suppliers

SUPPLIER	PHONE	WEBSITE
Altera Corp.	800-800-3753	www.altera.com
Digital Core Design	48-32-282-82-66	www.digitalcoredesign.com
JAE Electronics, Inc.	949-753-2600	www.jae.com
Murata Electronics North America, Inc.	770-436-1300	www.murata-northamerica.com
TDK Corp.	847-803-6100	www.component.tdk.com
Würth Elektronik GmbH & Co. KG	201-7850-8800	www.we-online.com

**Note:** Indicate that you are using the MAX9257A and MAX9258A when contacting these component suppliers.

# MAX9257A/MAX9258A Evaluation Kit

## Quick Start

### Recommended Equipment

- MAX9257A/MAX9258A EV kit (USB cable included)
- User-supplied Windows 2000/XP- or Windows Vista-compatible PC with a spare USB port
- 5V, 500mA power supply
- 4-channel oscilloscope

Refer to the MAX9257A/MAX9258A IC data sheet while using this EV kit for a detailed description of the SerDes pair features.

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

- 1) Visit [www.maxim-ic.com/evkitsoftware](http://www.maxim-ic.com/evkitsoftware) to download the latest version of the EV kit software, 9257A\_8ARxx.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 the jumpers are set in their default positions. See Table 1 for default shunt positions.
- 4) Connect the 5V power supply to the +5V and GND pads on both sides of the EV board. Keep the power off.
- 5) Connect the JAE LVDS cable between J2 and J7.
- 6) Connect Ch1 of the oscilloscope to J1-35 (ECU TX line).
- 7) Connect Ch2 of the oscilloscope to J1-37 (ECU RX line).
- 8) Connect Ch3 of the oscilloscope to J5-12 (MAX9258A CCEN pin).
- 9) Connect the USB cable between the PC and J3 (Attention: not J8).
- 10) Turn on the 5V power supply. Verify that D3 and D4 green LEDs are lit.
- 11) Start the MAX9257A/MAX9258A program by opening its icon in the **Start** menu.

- 12) Press the **Yes** button on the popup window (Figure 1), which verifies if the ECU remotely wakes up the MAX9257A. If the REM pin of the MAX9257A is set to high, the ECU should wake up the MAX9257A by setting the REG08 PD bit to low. If the REM pin of the MAX9257A is set to low, the MAX9257A is powered up when VCC is applied.

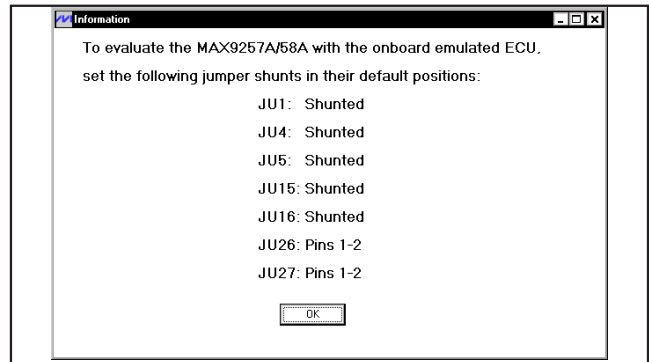


Figure 1. MAX9257A/MAX9258A Evaluation Kit Software—MAX9257 REM Status

- 13) The next popup window (Figure 2) asks if you want to load a previous EV kit setting from a file. If this is the first time the software is run, you can choose from three EV kit setting files included with the software: **NeverComeBackSettings.txt**, **FiniteCTOSettings.txt**, or **I2CSettings.txt**. Press the **No** button.

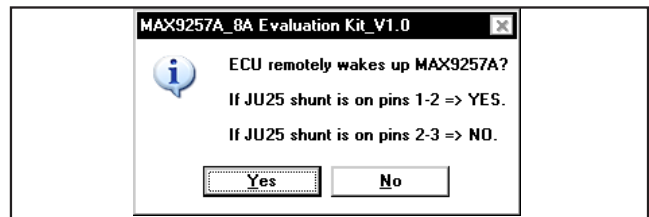


Figure 2. MAX9257A/MAX9258A Evaluation Kit Software—Load Previous EV Kit Settings

- 14) Verify that the software main window shows up next (Figure 3).
- 15) Verify that the **Hardware: Connected** message is displayed on the status bar of the software main window. This indicates the proper connection of the EV kit.
- 16) Press the **ECU Wakes Up MAX9257A** button on the **ECU Control** tab sheet.
- 17) Click on the **Deserializer MAX9258A** tab to move to the **Deserializer MAX9258A** tab sheet (Figure 4).

# MAX9257A/MAX9258A Evaluation Kit

- 18) Press the **Read MAX9258A & 9257A** button to read all the registers of the MAX9258A and MAX9257A.
- 19) Set both MAX9258A REG03 and MAX9257A REG03 ETOCNT to **0100** by selecting the **ETOCNT** drop-down list. Press the **Write** button on the right of the **Reg03** controls.
- 20) Set both MAX9258A REG07 CTO and MAX9257A REG08 CTO to **111** by selecting the **CTO** drop-down list. Press the **Write** button on the right of the **Reg07** controls.
- 21) Click on the **Serializer MAX9257A** tab to move to the **Serializer MAX9257A** tab sheet (Figure 5).
- 22) Enable the MAX9257A REG04 SEREN bit by selecting enable in the **SEREN** drop-down list. Press the **Write** button on the right of the **Reg04** controls.
- 23) Click on the **Camera Control** tab to move to the **Camera Control** tab sheet (Figure 6).
- 24) Press the **Slow Blink D4** button and verify that LED D4 flashes for about five seconds.
- 25) Press the **Enable PCLK\_IN/HSYNC\_IN/VSYSYNC\_IN** button and verify that LOCK indicator LED D1 turns on.
- 26) Use the oscilloscope to check the waveforms during the evaluation.

## **Detailed Description of Software**

The MAX9257A/MAX9258A EV kit software contains four tab sheets: **ECU Control**, **Deserializer MAX9258A**, **Serializer MAX9257A**, and **Camera Control**.

**Warning:** When the MAX9257A/MAX9258A UART baud rate ranges are changed, they do not take effect until the next control channel is entered. The ECU baud rate should not be changed during the current control channel.

### **ECU Control Tab**

The **ECU Control** tab sheet (Figure 3) lets the ECU configure the MAX9258A, MAX9257A, and the camera.

The ECU UART baud rate can be selected by choosing the appropriate baud rate in the **Select ECU UART Baud Rate** drop-down list. By default, the UART speed is 400kbps. In base mode, the UART baud rate should not be higher than 4.25Mbps.

Except for the menu-driven commands that can be generated on the **Deserializer MAX9258A**, **Serializer MAX9257A**, and **Camera Control** tab sheets, the ECU commands can be written by typing commands in the **ECU Writes N Bytes to MAX9257A/58A/Camera** edit

box. Similarly, the ECU commands can be read by typing commands in the **ECU Reads N Bytes from MAX9257A/58A/Camera** edit box. The write or read commands are not executed until the corresponding **Write** or **Read** button is pressed. Follow the instructions displayed on the software GUI.

When the EV kit is powered up the first time, and the MAX9257A is configured to be powered up remotely by the ECU (REM is high), press the **ECU Wakes Up MAX9257A** button to wake up the MAX9257A. Refer to the *Remote Power-Up of the MAX9257A (REM = Pulled Up to VCC)* section in the MAX9257A/MAX9258A IC data sheet for timing requirements of the remote wake-up.

Check the **Prefix a SYNC frame everytime a read/write command is sent** checkbox when a SYNC frame is desired before sending a command to the MAX9258A, MAX9257A, or the camera. A SYNC frame is needed only once every control channel.

Check the **Postfix an END frame everytime a read/write command is sent** checkbox when an END frame is desired after sending a command to the MAX9258A, MAX9257A, or the camera. Do not send END frame after a READ command. In a real application, the ECU can send END frame after the READ operation is completed.

Press the **Reset the EVKIT** button to reset the EV kit software and hardware. The user must manually disconnect and reconnect the power supply to reset the EV kit hardware.

### **Deserializer MAX9258A Tab**

On the **Deserializer MAX9258A** tab sheet (Figure 4), the ECU can write or read all registers on the MAX9258A by pressing the **Write** or **Read** buttons on the right of each register. Refer to the MAX9257A/MAX9258A IC data sheet for the definition of each register.

Four registers on each of the MAX9258A and MAX9257A should have the same values. They should be configured simultaneously for the SerDes pair to work properly. Check the **Write Both 9258A&9257A** checkbox to enable the write operation of the two devices on the same control channel.

On the bottom-left side of the software window, press the **Reset MAX9258A GUI** button to set all of the GUI values to the MAX9258A power-on-reset values. No operations are executed on the actual MAX9258A device. The other four buttons: **Read MAX9258A & 9257A**, **Write MAX9258A & 9257A**, **Read MAX9258A**, and **Write MAX9258A** let the user read or write to the MAX9258A and the MAX9257A simultaneously or individually.

# MAX9257A/MAX9258A Evaluation Kit

Evaluates: MAX9257A/MAX9258A

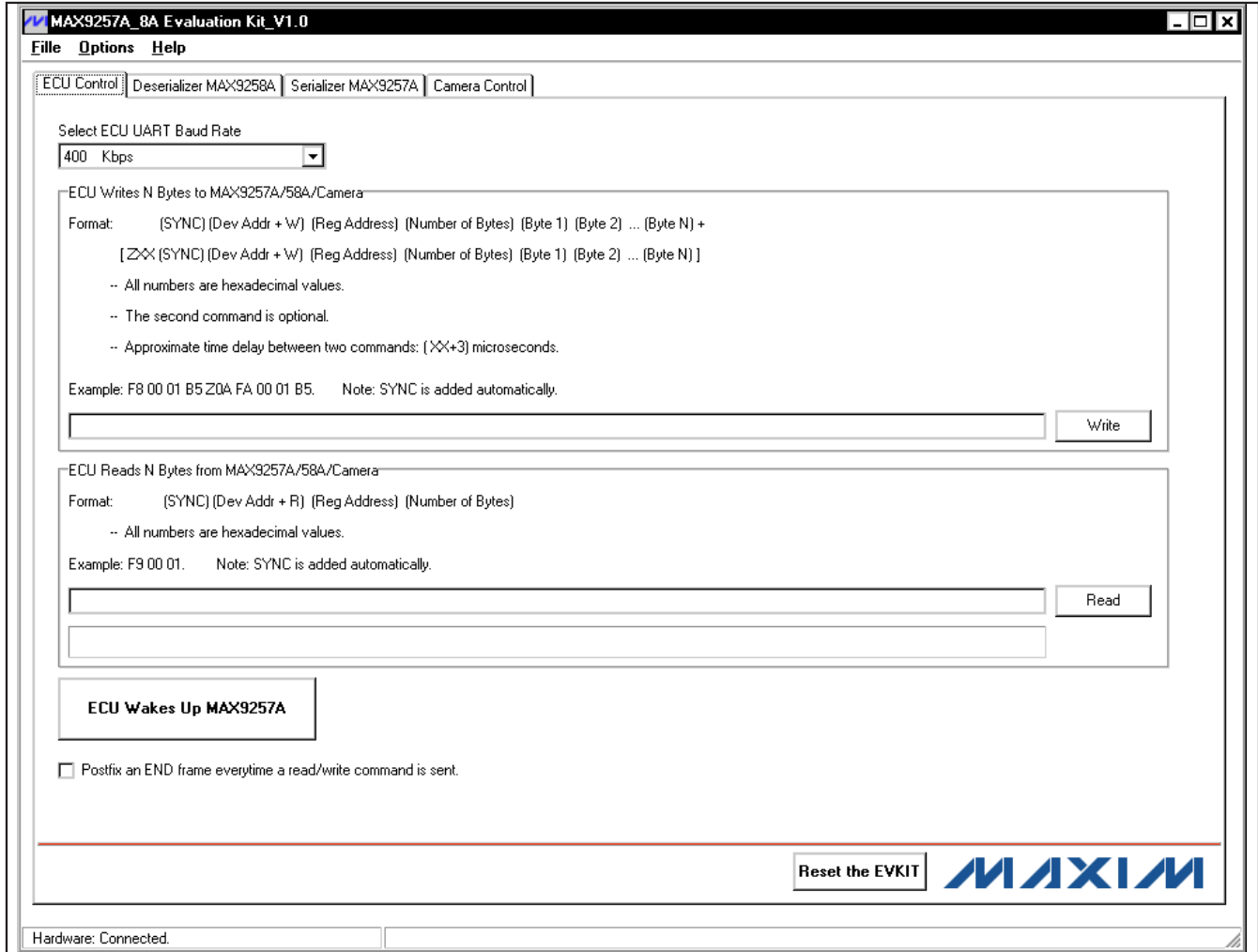


Figure 3. MAX9257A/MAX9258A Evaluation Kit Software—ECU Control Tab

## Serializer MAX9257A Tab

On the **Serializer MAX9257A** tab sheet (Figure 5), the ECU can write or read all registers on the MAX9257A by pressing the **Write** or **Read** buttons on the right of each register. Refer to the MAX9257A/MAX9258A IC data sheet for the definition of each register.

Four registers on each of the MAX9257A and the MAX9258A should have the same values. They should be configured simultaneously for the SerDes pair to work properly. Check the **Write Both 9258A&9257A** checkbox to enable the write operation of the two devices on the same control channel.

On the bottom-left side of the software window, press the **Reset MAX9257A GUI** button to set all the GUI values to the MAX9257A power-on-reset values. No operations are executed on the actual MAX9257A device. The other four buttons: **Read MAX9258A & 9257A**, **Write MAX9258A & 9257A**, **Read MAX9257A**, and **Write MAX9257A** let the user read or write to the MAX9258A and the MAX9257A simultaneously or individually.

## Camera Control Tab

On the **Camera Control** tab sheet (Figure 6), the ECU can communicate to the emulated camera during a control-channel session.

# MAX9257A/MAX9258A Evaluation Kit

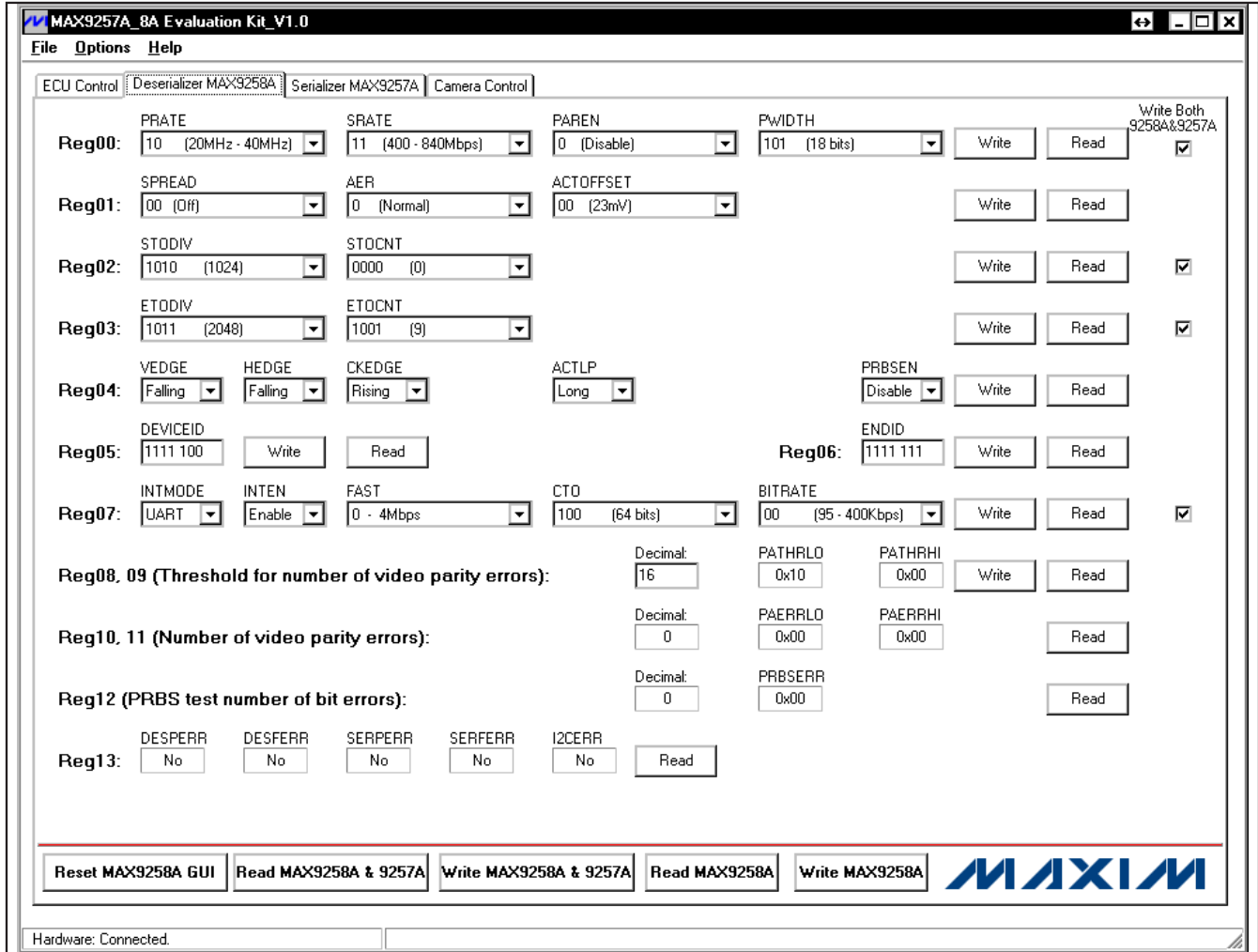


Figure 4. MAX9257A/MAX9258A Evaluation Kit Software—Deserializer MAX9258A Tab

By default, the MAX9258A, MAX9257A, and the emulated camera use the UART interface (JU26 and JU27 shunts are set across pins 1-2). Press the **Turn On D4**, **Turn Off D4**, **Fast Blink D4**, and **Slow Blink D4** buttons to demonstrate several simple communication transactions between the ECU and the camera.

A user can change the UART speed, enable/disable the video clocks (PCLK\_IN, HSYNC\_IN, and VSYNC\_IN), select different video clock speeds, and switch the camera to the I<sup>2</sup>C interface. See the *Configuration Examples* section for details.

The EV kit can generate PCLK\_IN, HSYNC\_IN, and VSYNC\_IN signals with the following relationships:  $HSYNC\_IN = PCLK\_IN/1000$  and  $VSYNC\_IN = PCLK\_IN/500000$ . By default they are not enabled, so

that an external pattern generator or piece of video equipment can be connected to J6. If the **Enable PCLK\_IN/HSYNC\_IN/VSYNC\_IN** button is pressed, the signals are enabled and the status of these three signals are displayed in the **Onboard PCLK\_IN, HSYNC\_IN, VSYNC\_IN Status** group box.

By default, PCLK\_IN is 30MHz, HSYNC\_IN is 30kHz, and VSYNC\_IN is 60Hz. The duty cycles of all the signals are fixed at 50%.

## Configuration Examples

This section describes how to configure the SerDes to work in **UART Never Come Back Operation**, **UART With Finite CTO Operation**, and **I<sup>2</sup>C Mode**. Use an oscilloscope to monitor the activity on the MAX9258A TX, RX, and CCEN pins.

# MAX9257A/MAX9258A Evaluation Kit

Evaluates: MAX9257A/MAX9258A

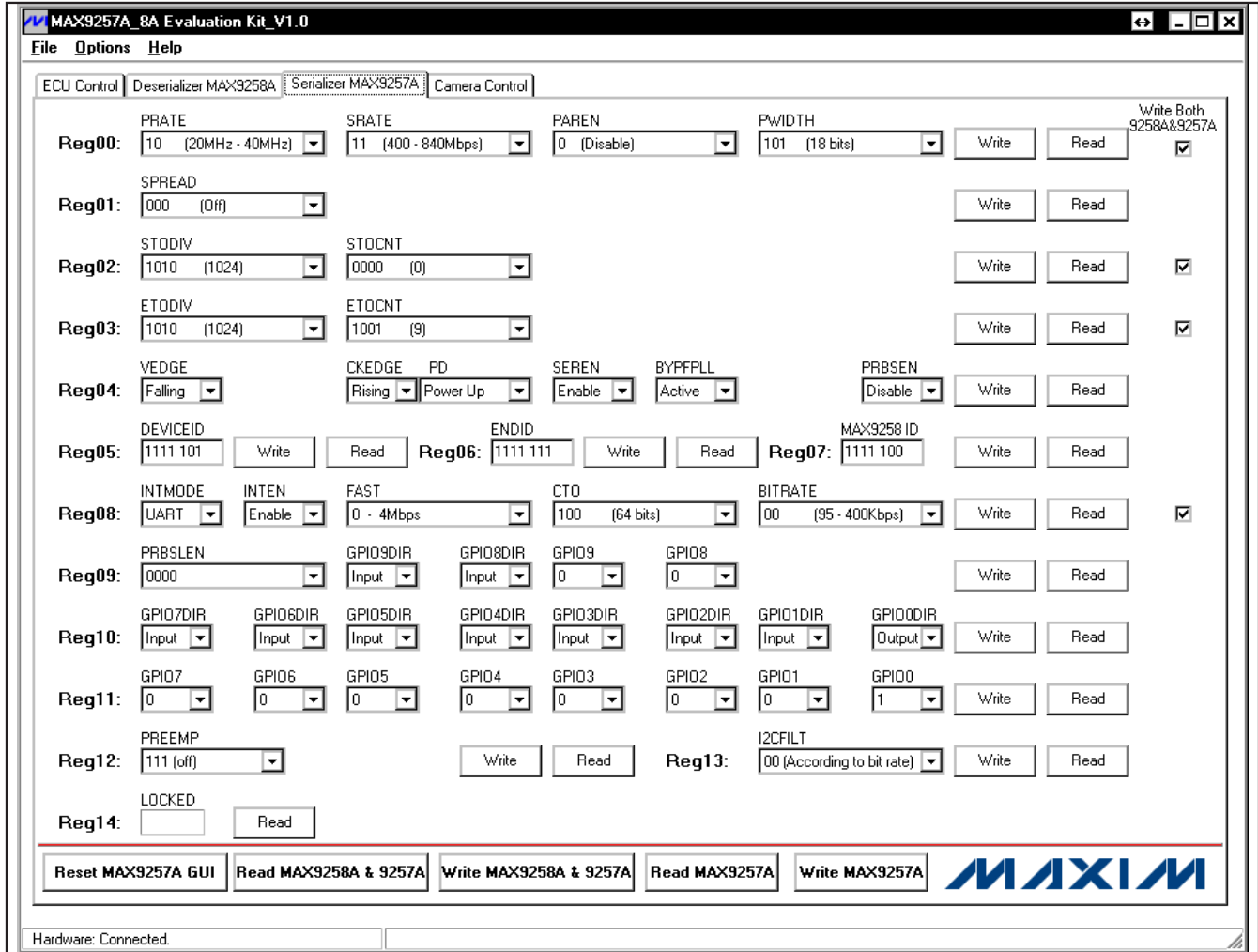


Figure 5. MAX9257A/MAX9258A Evaluation Kit Software—Serializer MAX9257A Tab

## UART Never Come Back Operation

This operation is used in an application when the ECU completes the configuration of the MAX9257A/MAX9258A right after power-up and does not want to access the MAX9257A/MAX9258A once the video transmission begins. The following procedure is an example of one of many possible configurations:

- 1) Start the program or press the **Reset the EVKIT** button on the **ECU Control** tab sheet (Figure 3).
- 2) If MAX9257A REM is set to high (JU25 shunt is set across pins 1-2), press the **ECU Wakes Up MAX9257A** button on the **ECU Control** tab sheet. If MAX9257A REM is set to low (JU25 shunt is set across pins 2-3), skip this step.
- 3) Navigate to the **Deserializer MAX9258A** tab sheet (Figure 4). Press the **Read MAX9258A & 9257A** button to refresh the current register values on the GUI.
- 4) Keep the four **Write Both 9258A&9257A** checkboxes checked.
- 5) Set **t<sub>STO</sub>** and **t<sub>ETO</sub>** on both the MAX9258A and MAX9257A to expected values. Note that the **t<sub>STO</sub>** and **t<sub>ETO</sub>** times are based on the pixel clock (PCLK\_IN) time. For example, if PCLK\_IN is 30MHz, set STODIV to 1024 and STOCNT to 0, **t<sub>STO</sub>** =  $(1024 \times 1/30)\mu\text{s} \approx 34\mu\text{s}$ . Set ETODIV to 1024 and ETOCNT to 4, **t<sub>ETO</sub>** =  $(1024 \times 5/30)\mu\text{s} \approx 170\mu\text{s}$ .
- 6) Set other MAX9258A registers as desired.

# MAX9257A/MAX9258A Evaluation Kit

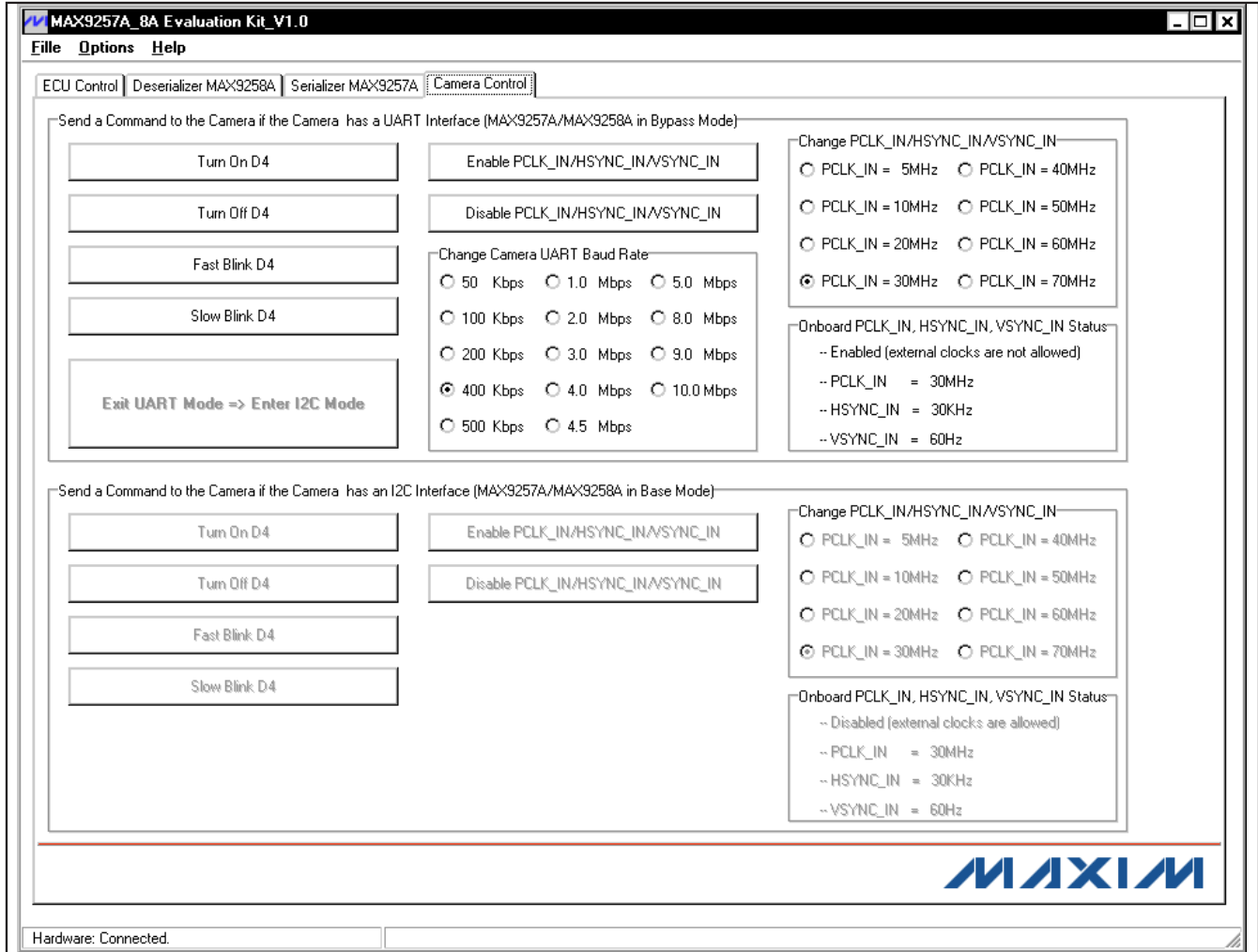


Figure 6. MAX9257A/MAX9258A Evaluation Kit Software—Camera Control Tab

- 7) Navigate to the **Serializer MAX9257A** tab sheet (Figure 5). Select **Enable** in the **SEREN** drop-down list within the **Reg04** controls if it is not enabled.
- 8) Select **Enable** in the **INTEN** drop-down list within the **REG08** controls of the **Serializer MAX9257A** tab sheet. **INTEN** is changed in both MAX9258A and MAX9257A when the **INTEN** drop-down list is changed on either tab sheet.
- 9) *From this step on, the MAX9257A and the MAX9258A registers are no longer accessible. The ECU can only communicate with the camera in bypass mode because CTO is set to 0 (never come back).*
- 10) Navigate to the **Camera Control** tab sheet (Figure 6). Press the **Turn On D4**, **Turn Off D4**, **Fast Blink D4**, and **Slow Blink D4** buttons, respectively, to verify that the ECU is communicating to the camera properly.
- 11) Press the **Enable PCLK\_IN/HSYNC\_IN/VSYNC\_IN** button to enable the pixel clock, the horizontal synchronization clock, and the vertical synchronization clock. The frequencies are displayed in the **Onboard PCLK\_IN, HSYNC\_IN, VSYNC\_IN Status** group box.
- 12) Use an oscilloscope to check that CCEN is toggling and the D1 green LED is lit up (MAX9258A LOCK pin is asserted high).
- 13) Exercise different pixel clocks by selecting different options in the **Change PCLK\_IN/HSYNC\_IN/VSYNC\_IN** group box. The selected pixel clock



# MAX9257A/MAX9258A Evaluation Kit

Evaluates: MAX9257A/MAX9258A

should be in the range of the configured **PRATE** range, and the following relationship formula must be met:

$$\text{Serial Word Length} \times \text{Pixel Clock} = \text{Serial Data Rate} \leq 840\text{Mbps}$$

It is preferred to select the pixel clock frequency before the clock is enabled.

- 14) To select a different UART speed, change the camera UART speed first and then go to the **ECU Control** tab sheet to change the ECU UART speed accordingly. Ensure that **tSTO** and **tETO** values are set correctly in order for the UART speed to work properly. The MAX9258A REG07 FAST bit and MAX9257A REG08 FAST bit should be configured correctly before going to the never come back operation.
- 15) Press the **Disable PCLK\_IN/HSYNC\_IN/VSYNC\_IN** button to disable the video clock inputs to the MAX9257A. Check that the D1 green LED is turned off (MAX9258A LOCK pin stays low) and that the control channel is available indefinitely (MAX9258A CCEN pin stays high).
- 16) Press the **Enable PCLK\_IN/HSYNC\_IN/VSYNC\_IN** button again to enable the video clock inputs to the MAX9257A. Check that the D1 green LED lights up again.

## UART with Finite CTO Operation

If **tCTO** < **tETO** then the MAX9257A and the MAX9258A registers can be accessed and UART communication with the camera in bypass mode is possible.

- 1) Start the program or press the **Reset the EVKIT** button on the **ECU Control** tab sheet (Figure 3).
- 2) If MAX9257A REM is set to high (JU25 shunt is set across pins 1-2), then press the **ECU Wakes Up MAX9257A** button on the **ECU Control** tab sheet. If MAX9257A REM is set to low (JU25 shunt is set across pins 2-3), then skip this step.
- 3) Navigate to the **Deserializer MAX9258A** tab sheet (Figure 4). Press the **Read MAX9258A & 9257A** button to refresh the current register values on the GUI.
- 4) Keep the four **Write Both 9258A&9257A** checkboxes checked.
- 5) Set **tSTO** and **tETO** on both the MAX9258A and MAX9257A to desired values. Note that the **tSTO** and **tETO** times are based on pixel clock (PCLK\_IN) time. For example, if PCLK\_IN is 30MHz, set STODIV to 1024 and STOCNT to 0, **tSTO** = (1024 x

1/30) $\mu$ s  $\approx$  34 $\mu$ s. Set ETODIV to 1024 and ETOCNT to 9, **tETO** = (1024 x 10/30) $\mu$ s  $\approx$  340 $\mu$ s.

- 6) Set **tCTO** on both MAX9258A and MAX9257A to desired values. Note that the **tCTO** time is based on the UART bit time. For example, if the UART speed is 400kbps, set CTO to 64, **tCTO** = (64 x 2.5) $\mu$ s = 140  $\mu$ s.
- 7) Set other MAX9258A registers as desired.
- 8) Navigate to the **Serializer MAX9257A** tab sheet (Figure 5). Select enable in the **SEREN** drop-down list within the **Reg04** controls if it is not enabled.
- 9) Select enable in the **INTEN** drop-down list within the **Reg08** controls on the **Serializer MAX9257A** tab sheet. INTEN is changed in both MAX9258A and MAX9257A when the **INTEN** drop-down list is changed on either tab sheet.
- 10) Press the **Read** button to read back the contents of Reg08. Ensure that the **INTEN** drop-down list displays disabled because CTO expired by the time the read operation executed and STO/ETO are not counting yet since the pixel clock is not activated.
- 11) Navigate to the **Camera Control** tab sheet (Figure 6). On this tab sheet, all ECU commands to the camera follow this order in one control-channel session:
  - a) SYNC frame
  - b) Set MAX9258A INTEN to 1
  - c) Wait for 15 UART bit times
  - d) Set MAX9257A INTEN to 1
  - e) ECU command to the camera

After every command, CTO expires first because of **tCTO** < **tETO**. This resets INTEN on both MAX9258A and MAX9257A to 0 so that they become accessible again when the next control channel is available.

- 12) Press the **Turn On D4, Turn Off D4, Fast Blink D4,** and **Slow Blink D4** buttons to verify that the ECU communicates to the camera properly.
- 13) Press the **Enable PCLK\_IN/HSYNC\_IN/VSYNC\_IN** button to enable the pixel clock, the horizontal synchronization clock, and the vertical synchronization clock. The frequencies are displayed in the **Onboard PCLK\_IN, HSYNC\_IN, VSYNC\_IN Status** group box.
- 14) Use an oscilloscope to check that CCEN is toggling and the D1 green LED is lit (MAX9258A LOCK pin is asserted high).

# MAX9257A/MAX9258A Evaluation Kit

- 15) Exercise different pixel clocks by selecting different options in the **Change PCLK\_IN/HSYNC\_IN/VSYNC\_IN** group box. The selected pixel clock should be in the range of the configured **PRATE** range, and the following relationship formula must be met:

$$\text{Serial Word Length} \times \text{Pixel Clock} = \text{Serial Data Rate} \leq 840\text{Mbps}$$

It is preferred to select the pixel clock frequency before the clock is enabled.

- 16) To select a different UART speed, change the camera UART speed first and then go to the **ECU Control** tab sheet to change ECU UART speed accordingly. Ensure that **tSTO** and **tETO** values are set correctly in order for the UART speed to work properly. The MAX9258A REG07 FAST bit and MAX9257A REG08 FAST bit should be configured correctly before choosing a different UART speed.
- 17) Press the **Disable PCLK\_IN/HSYNC\_IN/VSYNC\_IN** button to disable the video clock inputs to the MAX9257A. Check that the D1 green LED is turned off (MAX9258A LOCK pin stays low) and that the control channel is available indefinitely (MAX9258A CCEN pin stays high).
- 18) During any step above, the user can navigate to the **Deserializer MAX9258A** or **Serializer MAX9257A** tab sheets and perform read or write operations because INTEN is reset to 0 after every operation.

## I<sup>2</sup>C Mode

If the camera uses an I<sup>2</sup>C interface, both the MAX9257A and MAX9258A should be configured to use the I<sup>2</sup>C interface. Because the on-board emulated camera uses the default UART interface, the camera must first be switched from the UART interface to an I<sup>2</sup>C interface. Follow the steps below to evaluate the SerDes link in base mode when the I<sup>2</sup>C interface is enabled:

- 1) Start the program or press the **Reset the EVKIT** button on the **ECU Control** tab sheet (Figure 3).
- 2) If MAX9257A REM is set to high (JU25 shunt is set across pins 1-2), then press the **ECU Wakes Up MAX9257A** button on the **ECU Control** tab sheet. If MAX9257A REM is set to low (JU25 shunt is set across pins 2-3), then skip this step.
- 3) Navigate to the **Deserializer MAX9258A** tab sheet (Figure 4). Press the **Read MAX9258A & 9257A** button to refresh the current register values on the GUI.

- 4) Keep the four **Write Both 9258A&9257A** checkboxes checked.
- 5) Set **tCTO** on both the MAX9257A and MAX9258A to 64.
- 6) Navigate to the **Camera Control** tab sheet (Figure 6) and press the **Exit UART Mode** → **Enter I<sup>2</sup>C Mode** button (this button is available only when CTO is not equal to 0).
- 7) Follow the reminder message by moving the shunts from JU26 and JU27 (pins 1-2) to pins 2-3. Press the OK button.
- 8) Now the camera and the SerDes use an I<sup>2</sup>C interface. Navigate to any tab sheet and exercise the features of the SerDes.
- 9) The I<sup>2</sup>C interface on the emulated camera can operate at speeds up to 4.25MHz. This is the same as the MAX9257A and MAX9258A. Before changing the ECU UART baud rate, the bit rates of the MAX9257A and MAX9258A must be configured properly.

## Detailed Description of Hardware

The MAX9257A/MAX9258A EV kit is a complete SerDes pair evaluation system for the MAX9257A serializer and MAX9258A deserializer. Check the schematic for detailed EV kit hardware. The following is a brief description of the EV kit design.

### **Deserializer Side (Right Side of the EV Kit Board)**

Figure 7a shows the schematic for the MAX9258A. Figure 7b shows the schematic for the power supplies, a clock generator, and a microcontroller that communicates with the PC. The microcontroller, together with an FPGA, emulates an ECU.

Figure 7c shows the FPGA, which implements a high-speed UART interface for the emulated ECU.

### **Serializer Side (Left Side of the EV Kit Board)**

Figure 7d shows the schematic for the MAX9257A. Figure 7e shows the schematic for the power supplies, a clock generator, and a microcontroller that, together with an FPGA, emulate a camera.

Figure 7f shows the FPGA, which implements a high-speed UART and a high-speed I<sup>2</sup>C interface for the emulated camera. The FPGA also generates PCLK\_IN, HSYNC\_IN, and VSYNC\_IN for the emulated camera.

# MAX9257A/MAX9258A Evaluation Kit

## Description of IP Cores

The EV kit implements two digital cores on the FPGA devices to generate high-speed UART signals and to emulate a high-speed I<sup>2</sup>C slave device.

### D16750 Core (Provided by Digital Core Design)

The D16750 is an IP core of a universal asynchronous receiver-transmitter (UART), functionally identical to the TL16C750. Contact Digital Core Design for questions relating to the D16750 IP core. See the *Component Suppliers* section for contact information or email Digital Core Design at info@dcd.pl for more information.

### DI2CS Core (Provided by Digital Core Design)

The DI2CS is an IP core that provides an interface between a microprocessor and an I<sup>2</sup>C bus. It can work as a slave receiver or transmitter depending on the working mode determined by a microprocessor/micro-controller. The DI2CS core supports all of the transmission modes required by the I<sup>2</sup>C specification (standard, fast, and high speed). Contact Digital Core Design for any questions relating to the DI2CS IP core. See the *Component Suppliers* section for contact information or email Digital Core Design at info@dcd.pl for more information.

Evaluates: MAX9257A/MAX9258A

**Table 1. EV Kit Jumper Settings**

JUMPER	SETTING	DESCRIPTION
JU1	1-2*	MAX9258A $\overline{\text{PD}}$ pin is pulled up to $V_{\text{CC}}$ by a 1k $\Omega$ resistor
	Open	MAX9258A $\overline{\text{PD}}$ pin is internally pulled down to ground
JU2	Open*	MAX9258A LVDS line probing connector
JU3	Open*	MAX9258A LVDS line probing connector
JU4	1-2*	MAX9258A $\overline{\text{ERROR}}$ pin is pulled up to $V_{\text{CCOUT}}$ by a 1k $\Omega$ resistor
	Open	MAX9258A $\overline{\text{ERROR}}$ pin is open-drain output
JU5	1-2*	MAX9258A LOCK pin is pulled up to $V_{\text{CCOUT}}$ by a 1k $\Omega$ resistor
	Open	MAX9258A LOCK pin is open-drain output
JU6	1-2*	MAX9258A $V_{\text{CC}}$ connected to on-board LDO 3.3V output
	Open	MAX9258A $V_{\text{CC}}$ connected to an external power supply
JU7	1-2*	MAX9258A $V_{\text{CCOUT}}$ connected to on-board LDO 3.3V output
	Open	MAX9258A $V_{\text{CCOUT}}$ connected to an external power supply
JU8	1-2*	MAX9258A $V_{\text{CCPLL}}$ connected to on-board LDO 3.3V output
	Open	MAX9258A $V_{\text{CCPLL}}$ connected to an external power supply
JU9	1-2*	MAX9258A $V_{\text{CCSPLL}}$ connected to on-board LDO 3.3V output
	Open	MAX9258A $V_{\text{CCSPLL}}$ connected to an external power supply
JU10	1-2*	MAX9258A $V_{\text{CCLVDS}}$ connected to on-board LDO 3.3V output
	Open	MAX9258A $V_{\text{CCLVDS}}$ connected to an external power supply
JU11	1-2	MAX9258A is powered by on-board LDO U5, whose $V_{\text{DD}}$ input range is 3.5V to 12V
	2-3*	MAX9258A is powered by on-board LDO U4, whose input is 5V
JU14	1-2	MAX9258A LVDS cable line-1 connected to VDD
	2-3*	MAX9258A LVDS cable line-1 connected to ground
JU15	1-2*	MAX9258A RX pin is connected to the on-board emulated ECU RX line
	Open	MAX9258A RX pin is disconnected from the on-board emulated ECU RX line (an external ECU RX line can connect to J1-37)
JU16	1-2*	MAX9258A TX pin is connected to the on-board emulated ECU TX line
	Open	MAX9258A TX pin is disconnected from the on-board emulated ECU TX line (an external ECU TX line can connect to J1-35)

# MAX9257A/MAX9258A Evaluation Kit

Table 1. EV Kit Jumper Settings (continued)

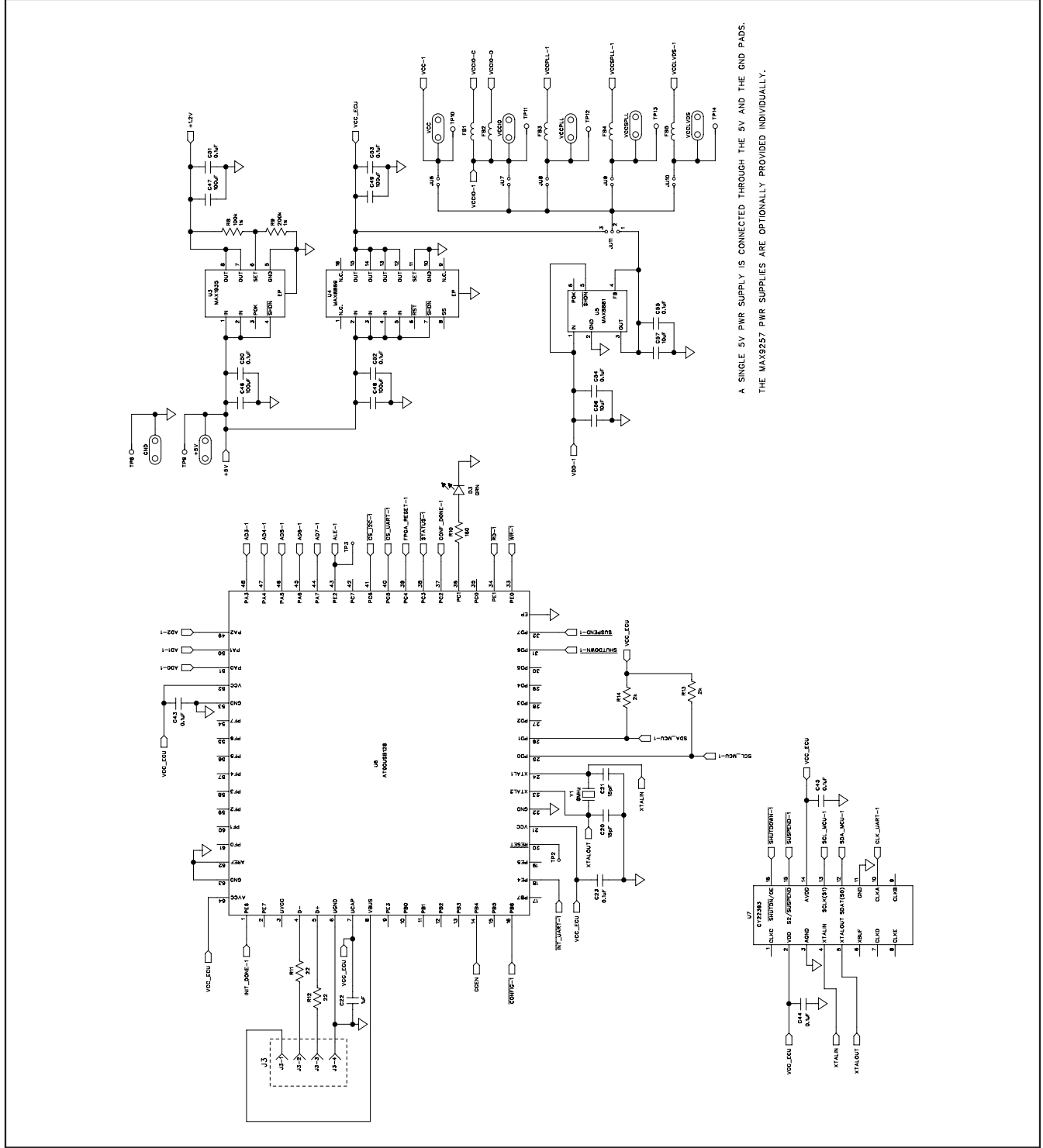
JUMPER	SETTING	DESCRIPTION
JU17	1-2	MAX9257A SCL/TX pin is pulled up to V <sub>CC</sub>
	2-3*	MAX9257A SCL/TX pin is pulled up to V <sub>CCIO</sub>
JU18	1-2	MAX9257A SDA/RX pin is pulled up to V <sub>CC</sub>
	2-3*	MAX9257A SDA/RX pin is pulled up to V <sub>CCIO</sub>
JU19	1-2*	MAX9257A V <sub>CC</sub> connected to on-board LDO 3.3V output
	Open	MAX9257A V <sub>CC</sub> connected to an external power supply
JU20	1-2*	MAX9257A V <sub>CCIO</sub> connected to on-board LDO 3.3V output
	Open	MAX9257A V <sub>CCIO</sub> connected to an external power supply
JU21	1-2*	MAX9257A V <sub>CCFPLL</sub> connected to on-board LDO 3.3V output
	Open	MAX9257A V <sub>CCFPLL</sub> connected to an external power supply
JU22	1-2*	MAX9257A V <sub>CCSPLL</sub> connected to on-board LDO 3.3V output
	Open	MAX9257A V <sub>CCSPLL</sub> connected to an external power supply
JU23	1-2*	MAX9257A V <sub>CCLVDS</sub> connected to on-board LDO 3.3V output
	Open	MAX9257A V <sub>CCLVDS</sub> connected to an external power supply
JU24	1-2	MAX9257A J6 connector one side connected to V <sub>CCIO</sub>
	2-3*	MAX9257A J6 connector one side connected to ground
JU25	1-2*	MAX9257A REM pin connected to V <sub>CC</sub> (ECU needs to remotely wake up MAX9257A)
	2-3	MAX9257A REM pin connected to ground
JU26	1-2*	MAX9257A SCL/TX pin is connected to the on-board emulated camera RX line
	2-3	MAX9257A SCL/TX pin is connected to the on-board emulated camera SCL line
	Open	MAX9257A SCL/TX pin is disconnected from the on-board emulated camera (an external camera RX or SCL line might connect to J6-35)
JU27	1-2*	MAX9257A SDA/RX pin is connected to the on-board emulated camera TX line
	2-3	MAX9257A SDA/RX pin is connected to the on-board emulated camera SDA line
	Open	MAX9257A SDA/RX pin is disconnected from the on-board emulated camera (an external camera TX or SDA line may connect to J6-37)
JU28	1-2	MAX9257A is powered by on-board LDO U13, whose V <sub>DD</sub> input range is 3.5V to 12V
	2-3*	MAX9257A is powered by on-board LDO U12, whose input is +5V
JU29	1-2	LVDS cable line-1 connected to V <sub>DD</sub>
	2-3*	LVDS cable line-1 connected to ground
JU30	Open*	LVDS line probing connector
JU31	Open*	LVDS line probing connector

\*Default position.



# Evaluates: MAX9257A/MAX9258A

## MAX9257A/MAX9258A Evaluation Kit

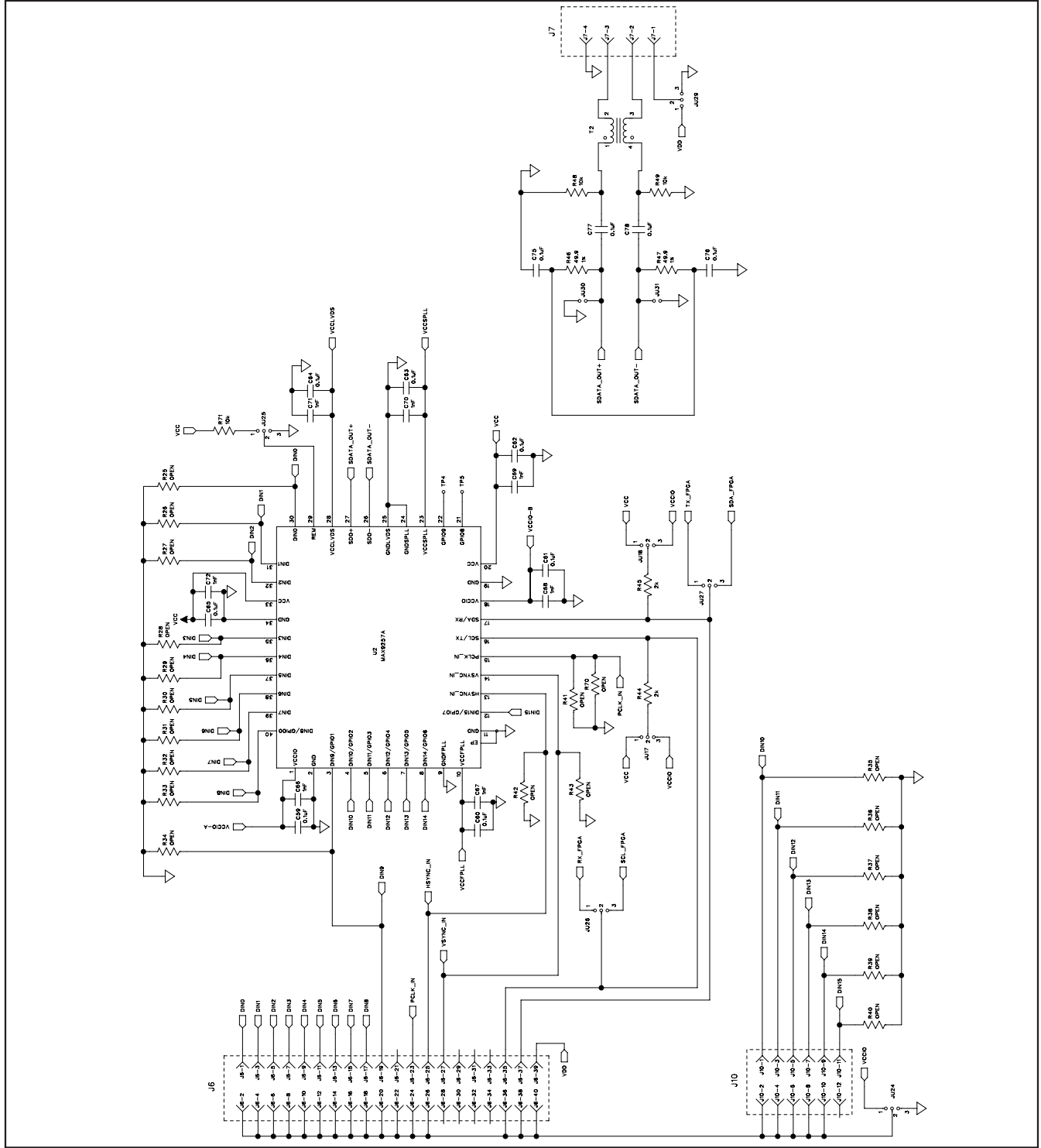


A SINGLE 5V PWR SUPPLY IS CONNECTED THROUGH THE 5V AND THE GND PADS.  
THE MAX9257 PWR SUPPLIES ARE OPTIONALLY PROVIDED INDIVIDUALLY.

Figure 7b. MAX9257A/MAX9258A EV Kit Schematic (Sheet 2 of 6)



# MAX9257A/MAX9258A Evaluation Kit







# MAX9257A/MAX9258A Evaluation Kit

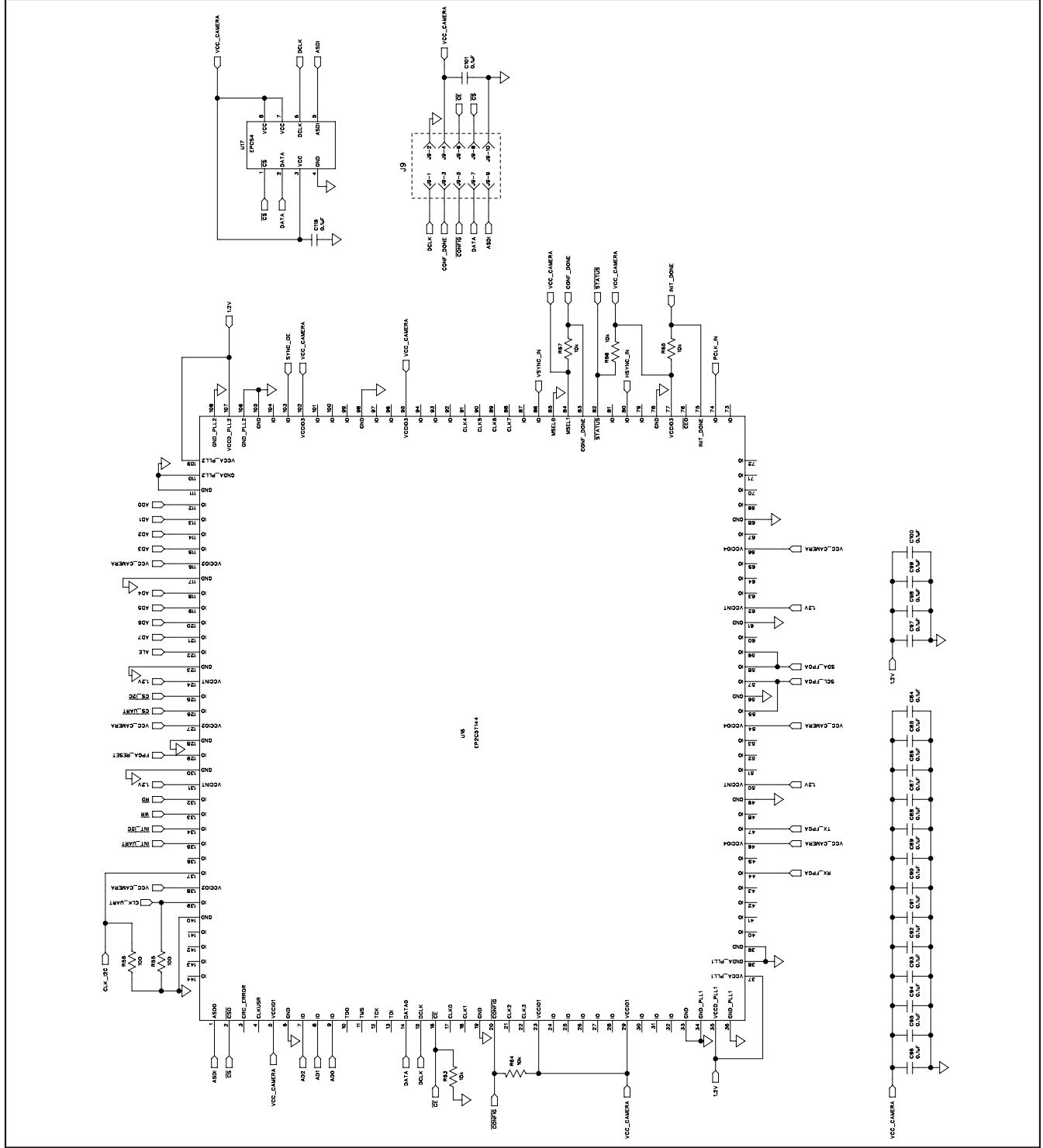


Figure 7f. MAX9257A/MAX9258A EV Kit Schematic (Sheet 6 of 6)

# MAX9257A/MAX9258A Evaluation Kit

Evaluates: MAX9257A/MAX9258A

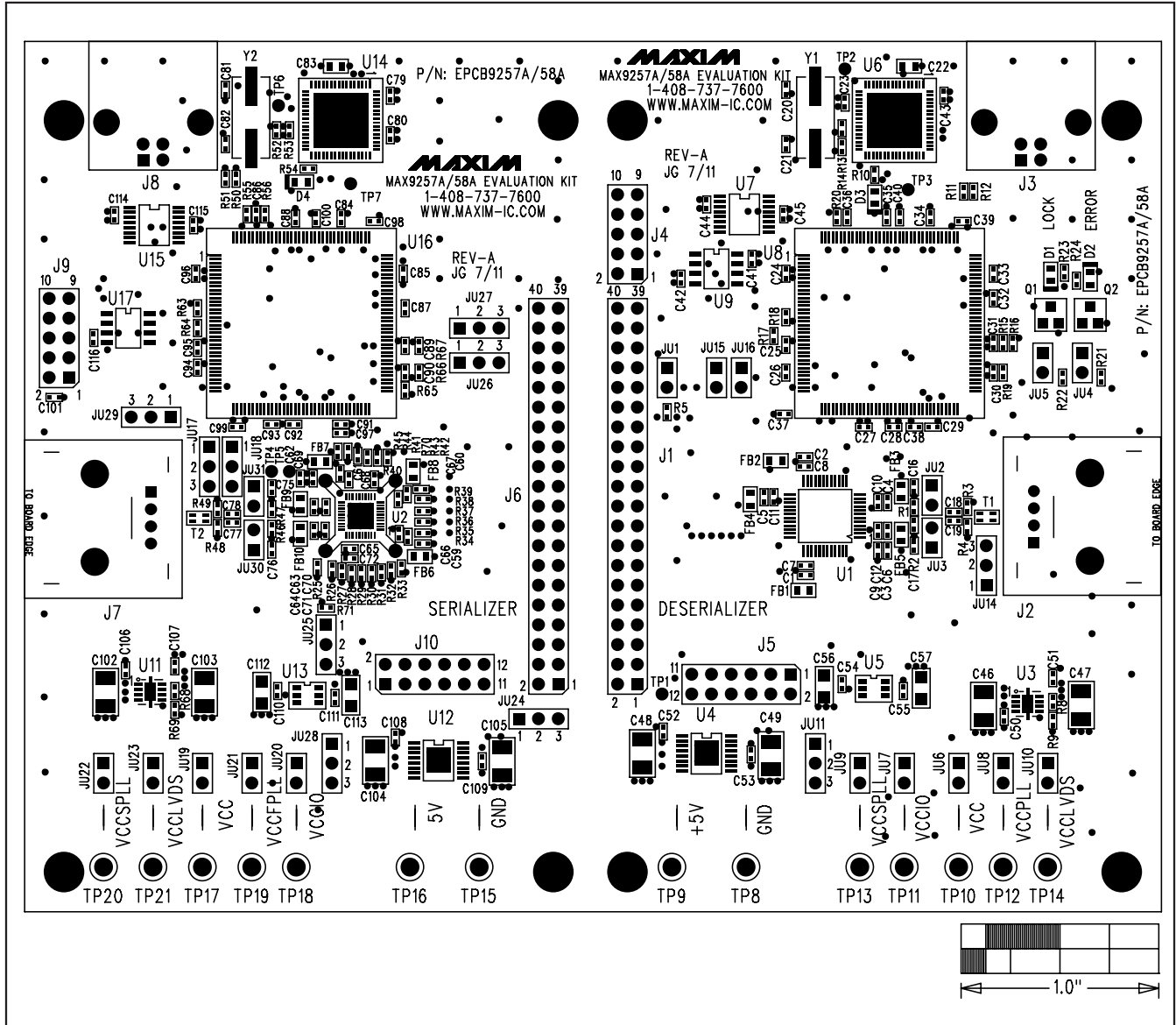


Figure 8. MAX9257A/MAX9258A EV Kit Component Placement Guide—Component Side

# MAX9257A/MAX9258A Evaluation Kit

**Evaluates: MAX9257A/MAX9258A**

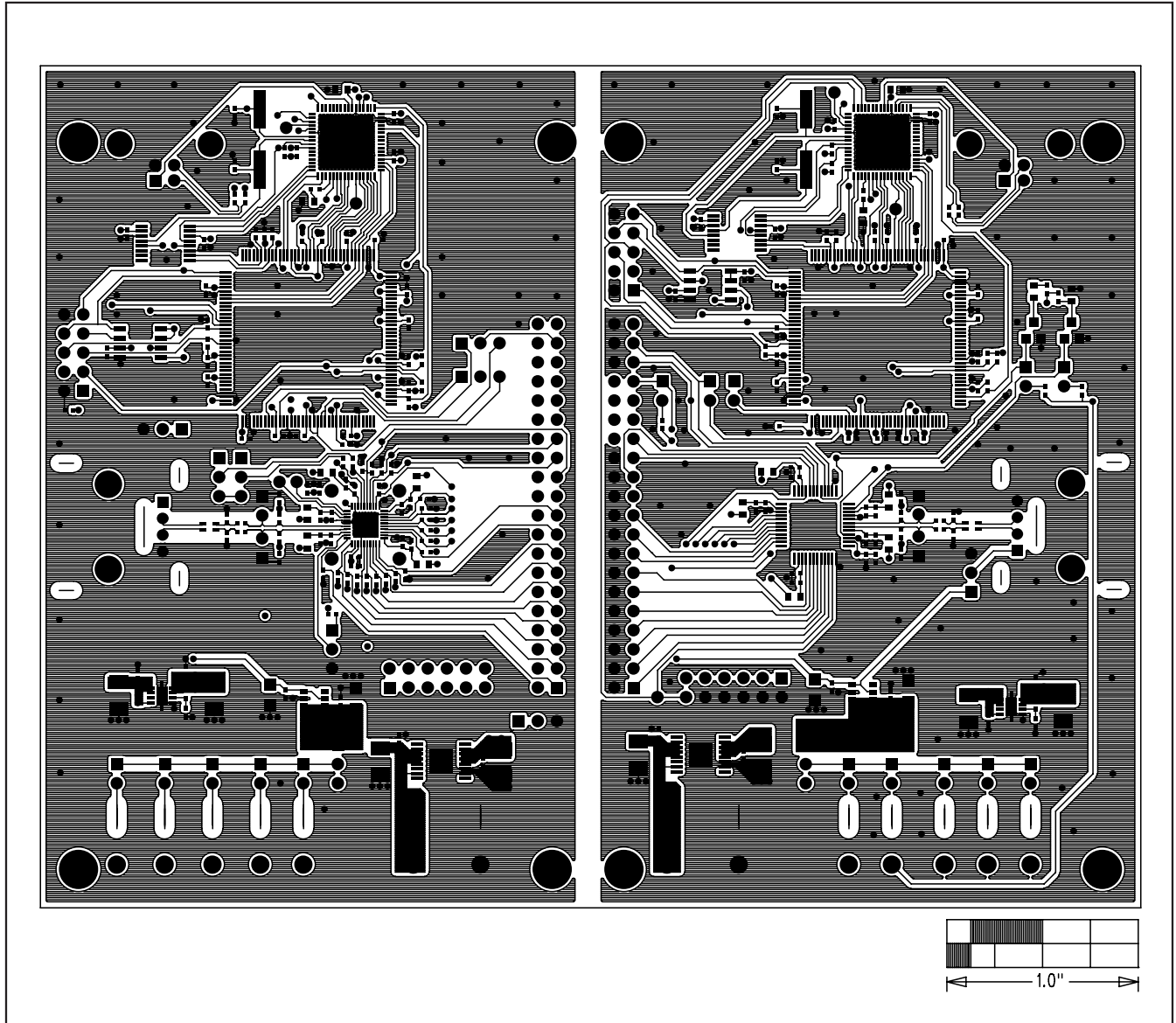


Figure 9. MAX9257A/MAX9258A EV Kit PCB Layout—Component Side

# MAX9257A/MAX9258A Evaluation Kit

Evaluates: **MAX9257A/MAX9258A**

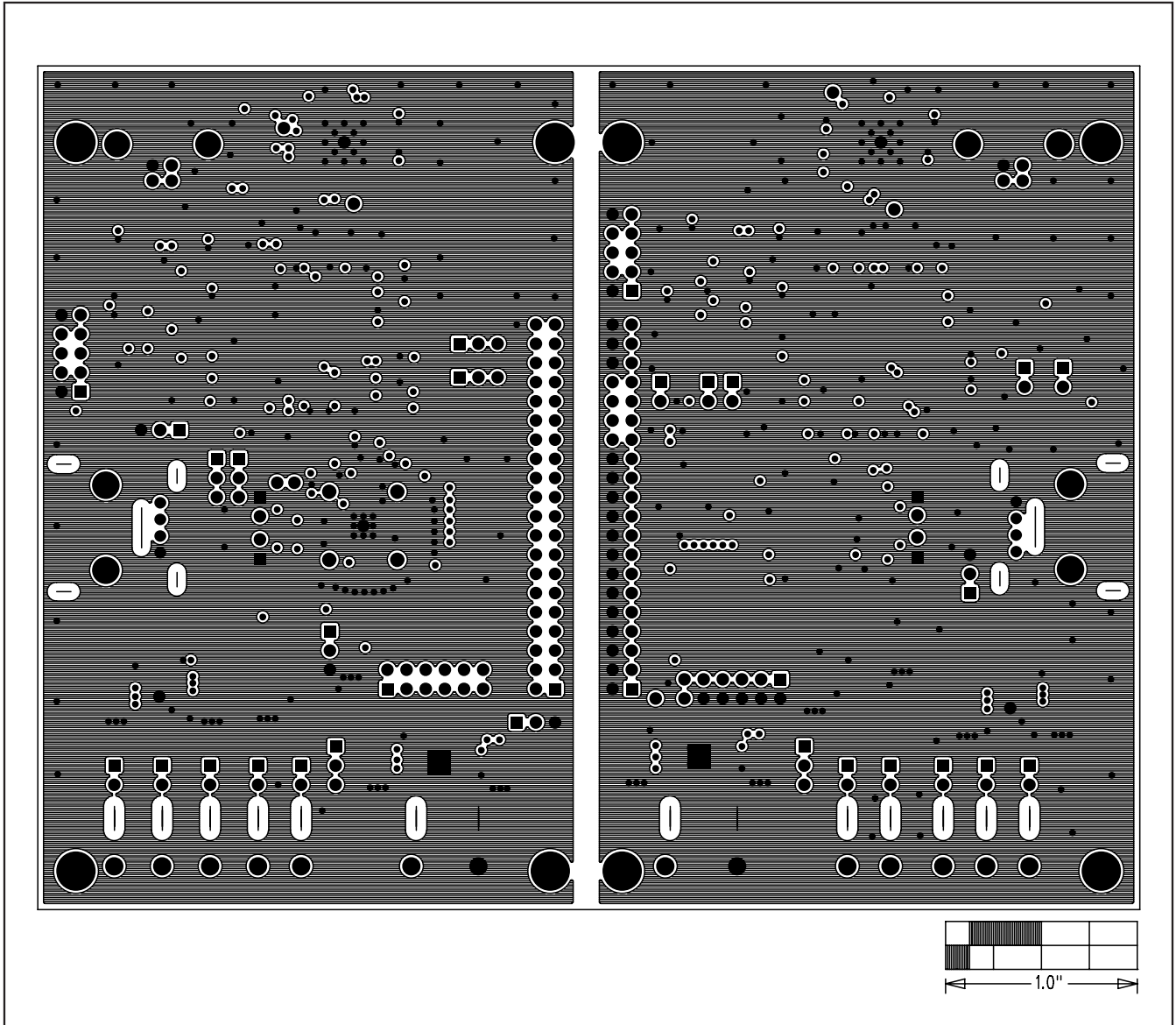


Figure 10. MAX9257A/MAX9258A EV Kit PCB Layout—Inner Layer 2

# MAX9257A/MAX9258A Evaluation Kit

**Evaluates: MAX9257A/MAX9258A**

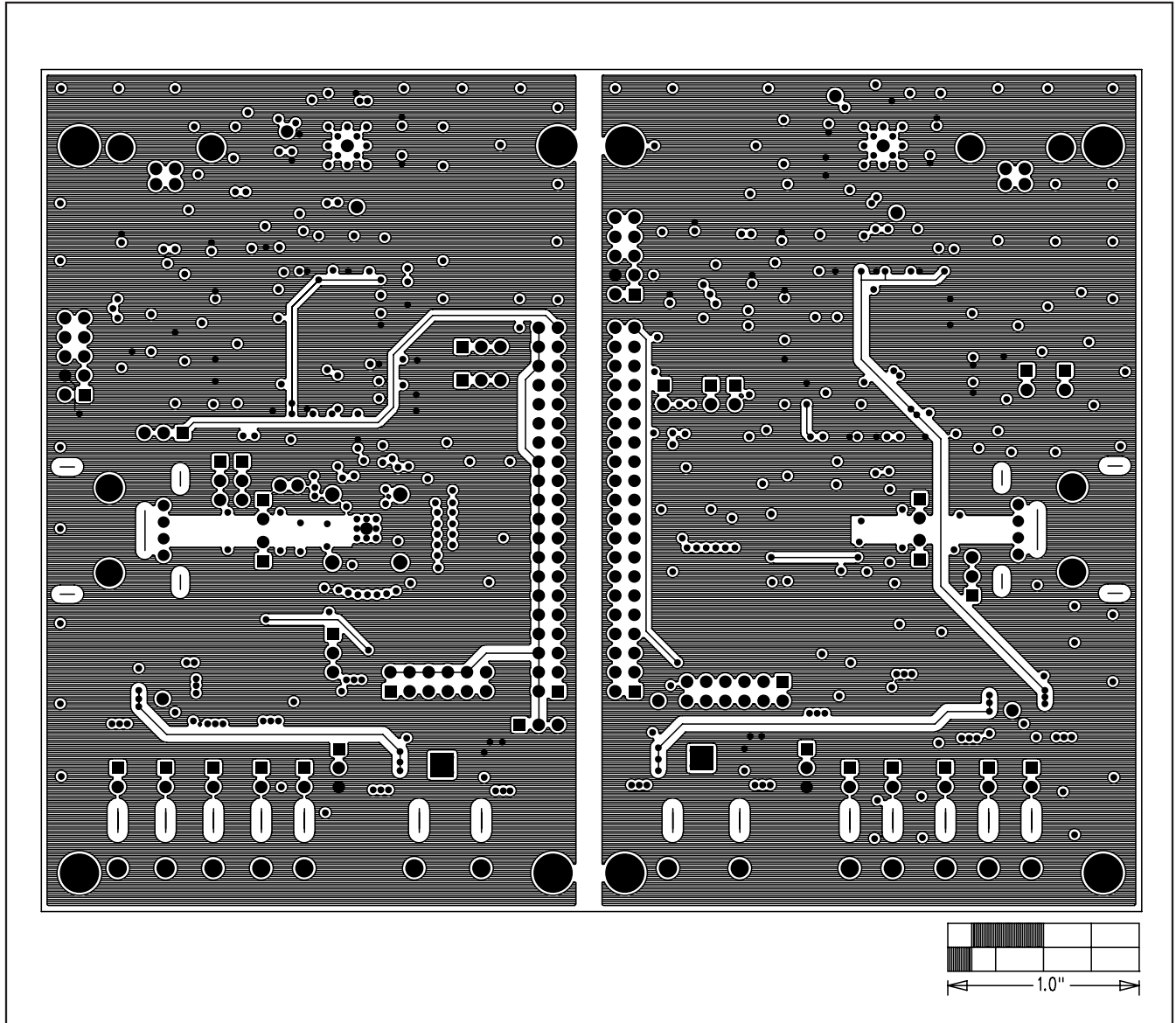


Figure 11. MAX9257A/MAX9258A EV Kit PCB Layout—Inner Layer 3

# MAX9257A/MAX9258A Evaluation Kit

Evaluates: MAX9257A/MAX9258A

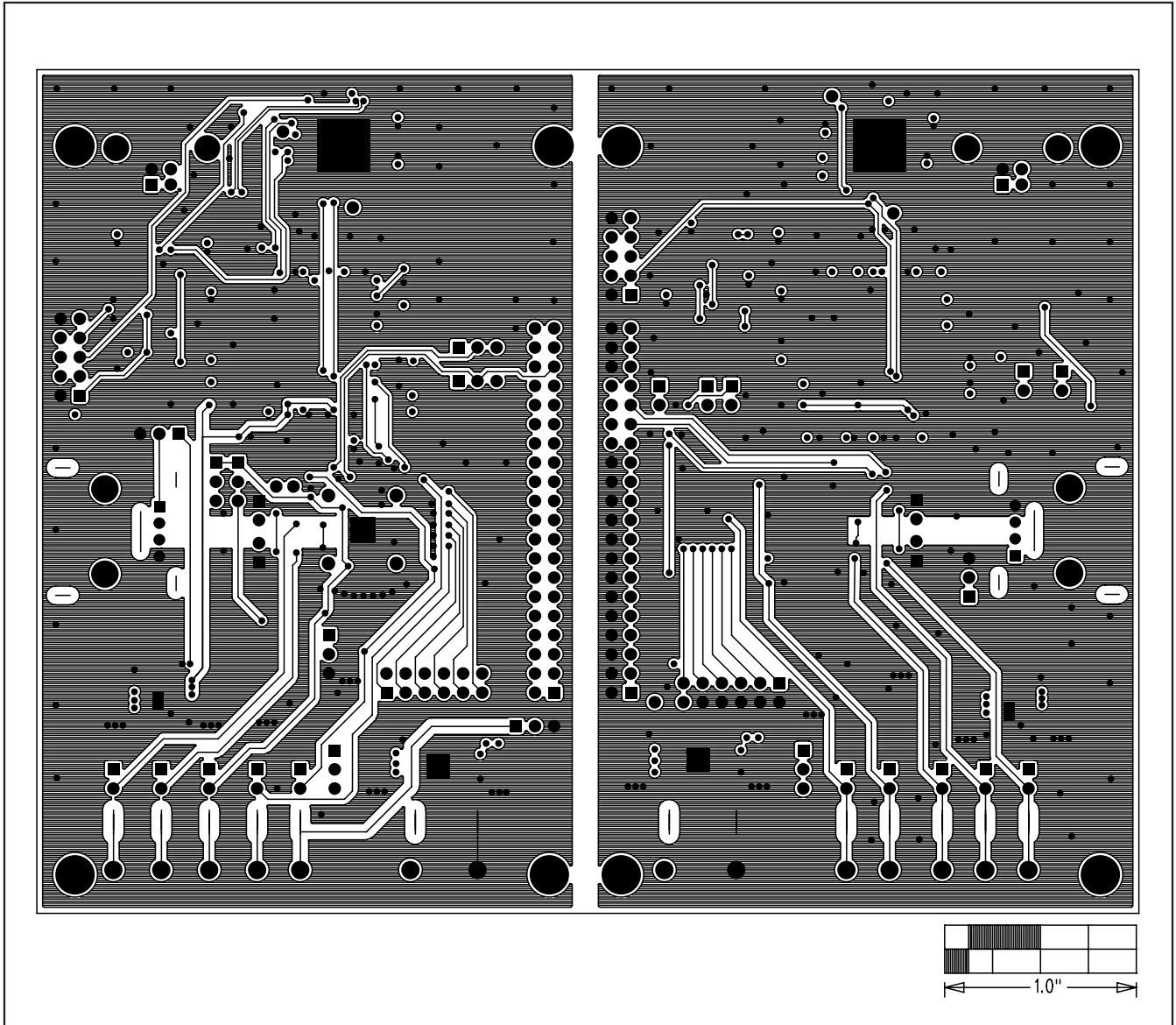


Figure 12. MAX9257A/MAX9258A EV Kit PCB Layout—Solder Side

# **MAX9257A/MAX9258A Evaluation Kit**

## **Revision History**

<b>REVISION NUMBER</b>	<b>REVISION DATE</b>	<b>DESCRIPTION</b>	<b>PAGES CHANGED</b>
0	9/11	Initial Release	—

*Maxim cannot assume responsibility for use of any circuitry other than circuitry entirely embodied in a Maxim product. No circuit patent licenses are implied. Maxim reserves the right to change the circuitry and specifications without notice at any time.*

**24** \_\_\_\_\_ **Maxim Integrated Products, 120 San Gabriel Drive, Sunnyvale, CA 94086 408-737-7600**