

MAX8893 Evaluation Kit

Evaluates: MAX8893A/MAX8893B/MAX8893C

General Description

The MAX8893 evaluation kit (EV kit) is a fully assembled and tested PCB that demonstrates the highly integrated MAX8893C power-management IC. The MAX8893 EV kit operates from a 2.7V to 5.5V input supply range and is controlled by an I²C interface. The MAX8893C integrates a high-efficiency step-down DC-DC converter, five low-dropout (LDO) linear regulators with programmable output voltages, individual power on/off control inputs, a load switch, and a USB high-speed switch. The I²C interface controls all the regulator output voltages, load switch timing, individual enable/disable control, and other parameters.

The MAX8893 EV kit also includes Windows® 2000-, Windows XP®, and Windows Vista®-compatible software that provides a simple graphical user interface (GUI) for exercising the features of the MAX8893C. To evaluate the MAX8893C, order the CMAXQUSB+ command module along with the MAX8893 EV kit.

The MAX8893C evaluation software can be downloaded from www.maximintegrated.com/evkitsoftware. The MAX8893 EV kit can also be used to evaluate the MAX8893A and MAX8893B. To evaluate the MAX8893A or MAX8893B, order a free sample along with this EV kit.

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Features

- ◆ **High-Efficiency Step-Down Converter**
 - Guaranteed 500mA Output Current
 - Up to 4MHz Switching Frequency
 - 0.8V to 2.4V Programmable Output Voltage
 - Dynamic Voltage Scaling with Programmable Ramp Rate
- ◆ **Three Low-Noise LDOs with Programmable Output Voltages**
- ◆ **Two Low-Supply Current LDOs with Programmable Output Voltages**
- ◆ **Low On-Resistance Load Switch**
- ◆ **USB High-Speed Switch with ±15kV ESD**
- ◆ **Individual Enable Control for all Regulators and Switches**
- ◆ **I²C Serial Interface**
- ◆ **Overcurrent and Thermal Protection for all LDOs**
- ◆ **Tiny External Components**
- ◆ **3mm x 2.5mm x 0.64mm 30-Bump WLP Package**
- ◆ **Fully Assembled and Tested**

Ordering Information

PART	TYPE
MAX8893EVKIT+	EV Kit

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

Component List

DESIGNATION	QTY	DESCRIPTION
C1, C2, C3, C5-C10	9	2.2µF ±10%, 6.3V X5R ceramic capacitors (0603) TDK C1608X5R0J225K Taiyo Yuden JMK107BJ225KA Murata GRM188R60J225K
C11	1	1µF ±10% 16V X7R ceramic capacitor (0603) TDK C1608X7R1C105KB
C4	1	0.1µF ±10%, 16V X7R ceramic capacitor (0402) TDK C1005X7R1C104K or 0.1µF ±10%, 6.3V X5R ceramic capacitor (0402) Murata GRM155R60J104K

DESIGNATION	QTY	DESCRIPTION
D1	1	Red LED Panasonic LNJ208R8ARA
J1	1	2 x 10 right-angle receptacle Methode M65S-R220-11-01W
JU1-JU8	8	3-pin headers, 0.1in centers Sullins PEC36SAAN
L1	1	2.2µH ±20% inductor TDK VLF3012ST-2R2M1R4, 72mΩ, 1.4A (2.8mm x 3mm) or 2.2µH ±30% inductor TDK VLCF4028T-2R2N1R9-2, 43mΩ, 1.94A (4mm x 4mm)
L2-L7	0	Not installed chip inductors—PCB trace short (0603)

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

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Component List (continued)

DESIGNATION	QTY	DESCRIPTION
P1	1	USB type-B right-angle PC-mount receptacle FCI 61729-0010BLF Assmann Electronics AU-Y1007-R Molex 67068-9000
P2, P3	2	USB type-A right-angle PC-mount receptacle Assmann Electronics AU-Y1006-R Molex 67643-3911
Q1	1	Dual n-channel MOSFET (6 SSOT) Fairchild FDC6305N

DESIGNATION	QTY	DESCRIPTION
Q2	1	Dual p-channel MOSFET (6 SSOT) Fairchild FDC6312P
R1, R2	2	2.2k Ω \pm 5% resistors (0402)
R3, R4	2	10k Ω \pm 5% resistors (0603)
R5	1	270 Ω \pm 5% resistor (0603)
U1	1	Power-management IC (30 WLP) Maxim MAX8893CEWV+
—	8	Shunts Sullins STC02SYAN
—	1	PCB: MAX8893 EVKIT+

Component Suppliers

SUPPLIER	PHONE	WEBSITE
Assmann Electronic	480-897-7001	www.assmann.com
Fairchild Semiconductor	888-522-5372	www.fairchildsemi.com
Molex	800-786-6539	www.molex.com
Murata Electronics North America, Inc.	770-436-1300	www.murata-northamerica.com
Panasonic Corp	800-344-2112	www.panasonic.com
Sullins Electronics Corp.	760-744-0125	www.sullinselectronics.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 MAX8893C when contacting these component suppliers.

MAX8893 EV Kit Files

FILE	DESCRIPTION
INSTALL.EXE	Installs the EV kit files on your computer
MAX8893.EXE	Application program
UNINST.INI	Uninstalls the EV kit software
TROUBLESHOOTING_USB.PDF	USB driver installation help file

Quick Start

Recommended Equipment

- Variable 6V power supply capable of supplying 2A of output current
- Voltmeter
- User-supplied Windows 2000, Windows XP, or Windows Vista PC with a spare USB port

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 MAX8893 EV kit is a fully assembled and tested surface-mount board. Follow the steps below to verify board operation. **Caution: Do not turn on the power supply until all connections are completed.**

- 1) Visit www.maximintegrated.com/evkitsoftware to download the latest version of the EV kit software, 8893Rxx.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.

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- 3) Carefully connect the CMAXQUSB command module with the MAX8893 EV kit by aligning 20-pin receptacle J1 of the MAX8893 EV kit with 20-pin connector P3 of the CMAXQUSB interface board.
 - 4) Connect the USB cable from the PC to the CMAXQUSB+ command module. A **Building Driver Database** window pops up in addition to a **New Hardware Found** message if this is the first time the EV kit board is connected to the PC. If a window is not seen 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. Refer to the TROUBLESHOOTING_USB.PDF document included with the software if you have any problems during this step.
 - 5) Follow the directions of the **Add New Hardware Wizard** to install the USB device driver. Choose the **Search for the best driver for your device** option. Specify the location of the device driver to be **C:\Program Files\MAX8893** (default installation directory) using the **Browse** button.
 - 6) Verify that the jumpers on the MAX8893 EV kit are configured in their default positions, as shown in Table 1.
 - 7) Preset the power supply to 3.7V. Turn off the power supply.
 - 8) Connect the positive lead of the 3.7V power supply to the BATT pad. Connect the negative lead of the 3.7V power supply to the GND pad.
 - 9) Turn on the power supply.
 - 10) Start the MAX8893 program by opening its icon in the **Start | Programs** menu. The EV kit software main window appears, as shown in Figure 1.
 - 11) Normal device operation is verified when **Command Module Connected, Device Connected** is displayed in the top-left section of the MAX8893A EV kit main window (Figure 1).
 - 12) Check the **Enable BUCK, Enable Load Switch, Enable LDO1, Enable LDO2, Enable LDO3, Enable LDO4, or Enable LDO5** checkboxes and press the **Write** button in the **ON/OFF** group box.
 - 13) Verify that the voltage is 1V at the VBUCK pad.
 - 14) Verify that the voltage is 1.8V at the LDO1 pad.
 - 15) Verify that the voltage is 2.6V at the LDO2 pad.
 - 16) Verify that the voltage is 3.3V at the LDO3 pad.
 - 17) Verify that the voltage is 3.3V at the LDO4 pad.
 - 18) Verify that the voltage is 3V at the LDO5 pad.
 - 19) Verify that the voltage is 1V at the VLS pad.
- Note:** The MAX8893A/MAX8893B LDOs have a different default output voltage. Refer to MAX8893A/MAX8893B/MAX8893C IC data sheet for more details.

Table 1. MAX8893 EV Kit Jumper Setting (JU1–JU8)

JUMPER	SHUNT POSITION	
	1-2	2-3
JU1	Enable LDO1	Disable LDO1*
JU2	Enable LDO2	Disable LDO2*
JU3	Enable LDO3	Disable LDO3*
JU4	Enable LDO4 and LDO5	Disable LDO4 and LDO5*
JU5	Enable VBUCK	Disable VBUCK*
JU6	Enable load switch	Disable load switch*
JU7	Disable USB switch*	Enable USB switch
JU8	COM1 and COM2 connected to NO1 and NO2 (P1-P3)*	COM1 and COM2 connected to NC1 and NC2 (P1-P2)

*Default position.

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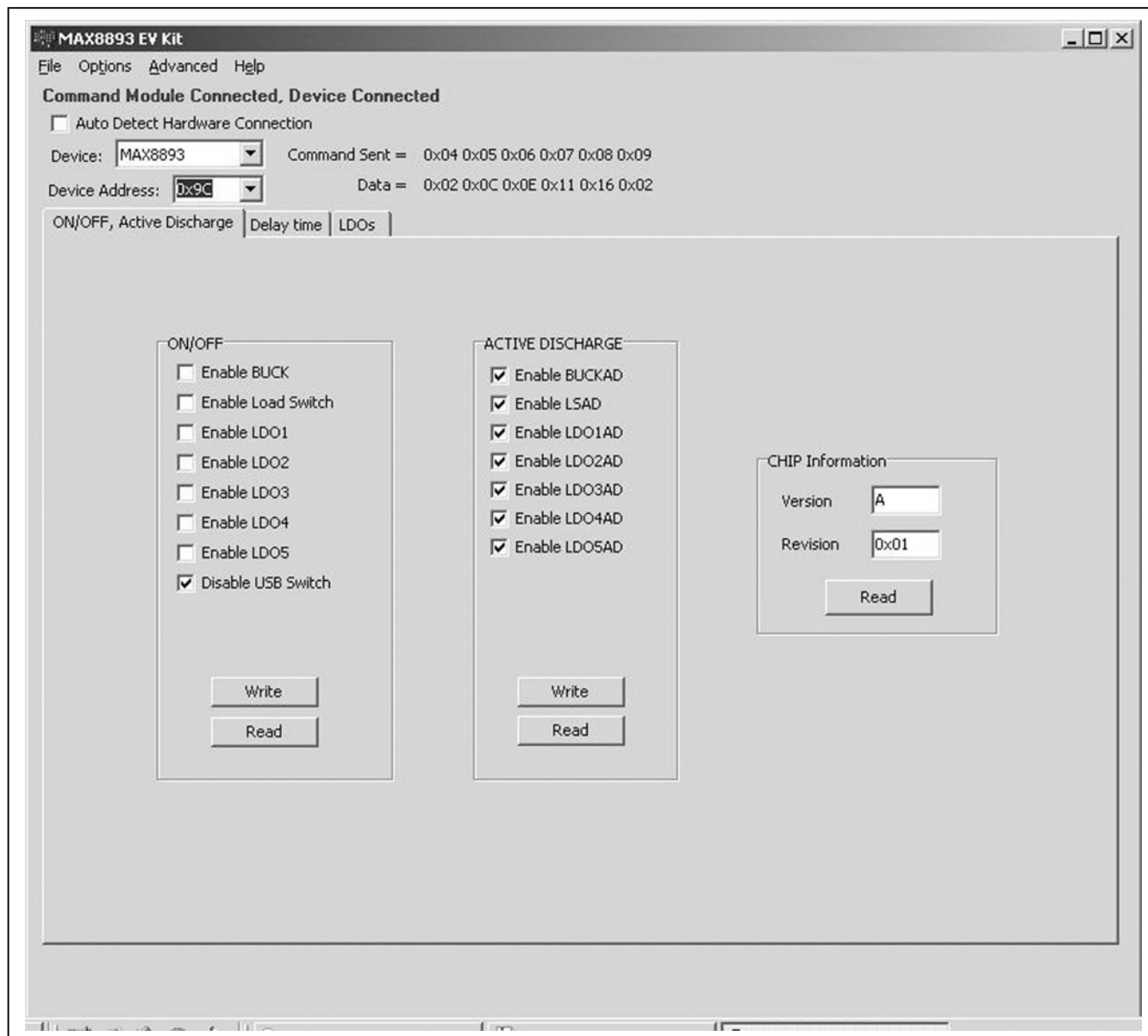


Figure 1. MAX8893 EV Kit Software Main Window

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___ **Detailed Description of Software**

User-Interface Panel

The MAX8893 EV kit uses the CMAXQUSB+ command module for an I²C interface to control the MAX8893C configurations. The MAX8893 EV kit software displays three tabs to set the MAX8893C configurations, **ON/OFF**, **Active Discharge**, **Delay time**, and **LDOs**. Changes to the controls followed by a **Write** updates the appropriate registers of the MAX8893C. After any write or read operation, the related command and data sent are shown in the top-middle section of the main window.

ON/OFF, Active Discharge Tab

The MAX8893C includes a high-efficiency 500mA step-down DC-DC converter, five LDO linear regulators, a load switch with ultra-low on-resistance, and a USB high-speed switch. These regulators and switches can be turned on/off by individual enable inputs, or by checking the enable bits checkboxes in the **ON/OFF** group box.

The **ACTIVE DISCHARGE** group box controls enable/disable of the active discharge for the step-down converter, load switch, and LDOs.

The **CHIP INFORMATION** group box provides the manufacturer die type and mask revision information.

Delay Time Tab

The **Delay time** tab (Figure 2) provides load switch timing control, step-down converter DVS enable/disable, and ramp-rate control. Refer to the MAX8893A/MAX8893B/MAX8893C IC data sheet for details.

The load-switch-timing control includes **Rising Time (us)**, **Turn On Delay (us)**, and **Turn Off Delay (us)** group boxes.

Check the **Enable DVS** checkbox in the **Buck** group box to ramp the step-down output voltage up/down at the rate set by the **RAMP** register.

LDOs Tab

The **LDOs** tab (Figure 3) programs the buck and LDO 1–LDO 5 output voltage. Press the **Read All LDOs** button to obtain all the regulator's voltage information.

Simple I²C/SMBus Commands

There are two methods for communicating with the MAX8893C, through the normal user-interface panel (Figures 1, 2, and 3), or through the SMBus commands available by selecting the **2-Wire Interface Window** menu item from the **Advanced** menu bar in the main window. The I²C/SMBus commands are used for debugging purposes. The **Maxim Command Module Interface** window (Figure 4) pops up and includes a **2-wire interface** tab that allows for execution of the **SMBusSendByte()** command. Refer to the MAX8893A/MAX8893B/MAX8893C IC data sheet for command-byte format. The **SMBus 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 4 for an illustration of this tool.

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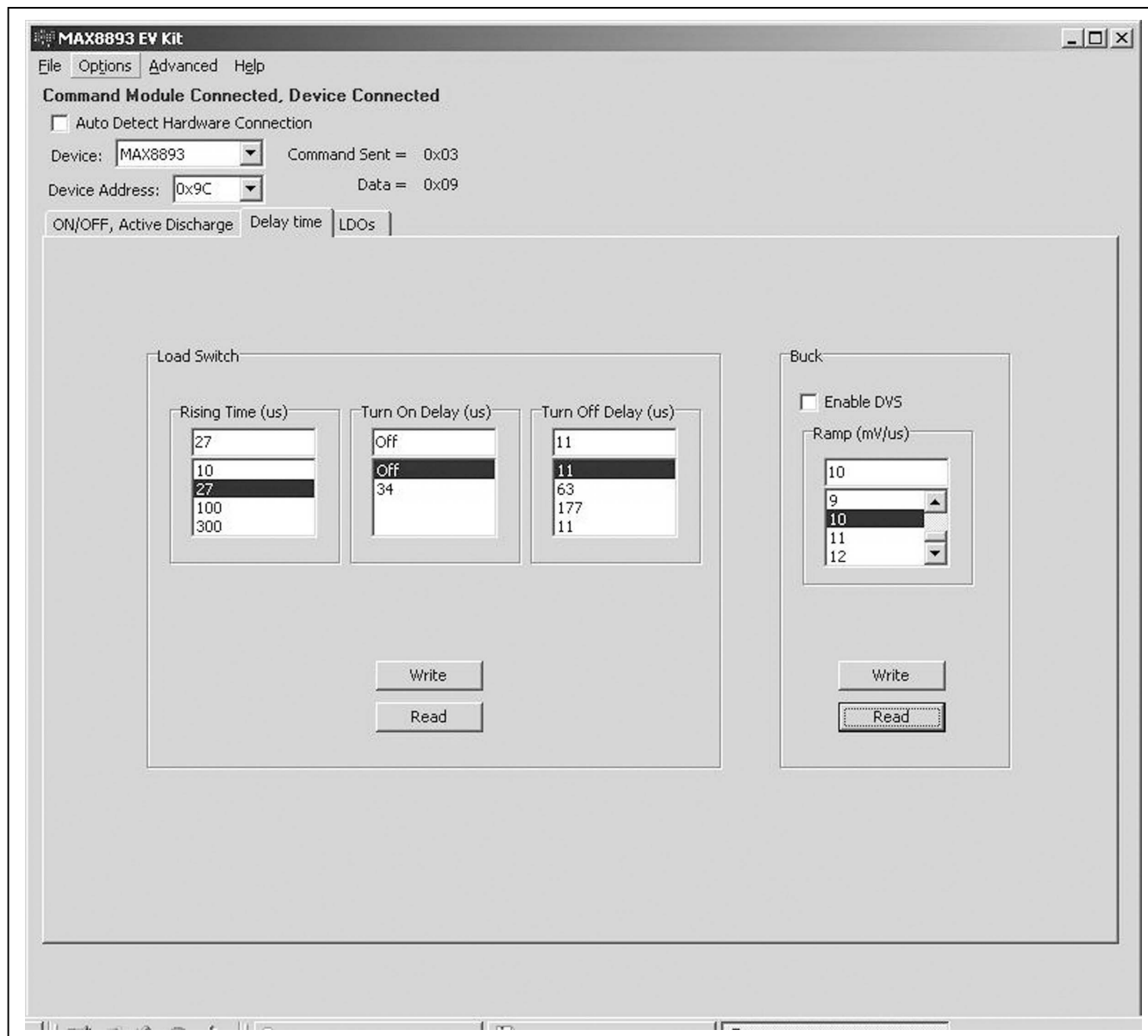


Figure 2. Delay Time Tab

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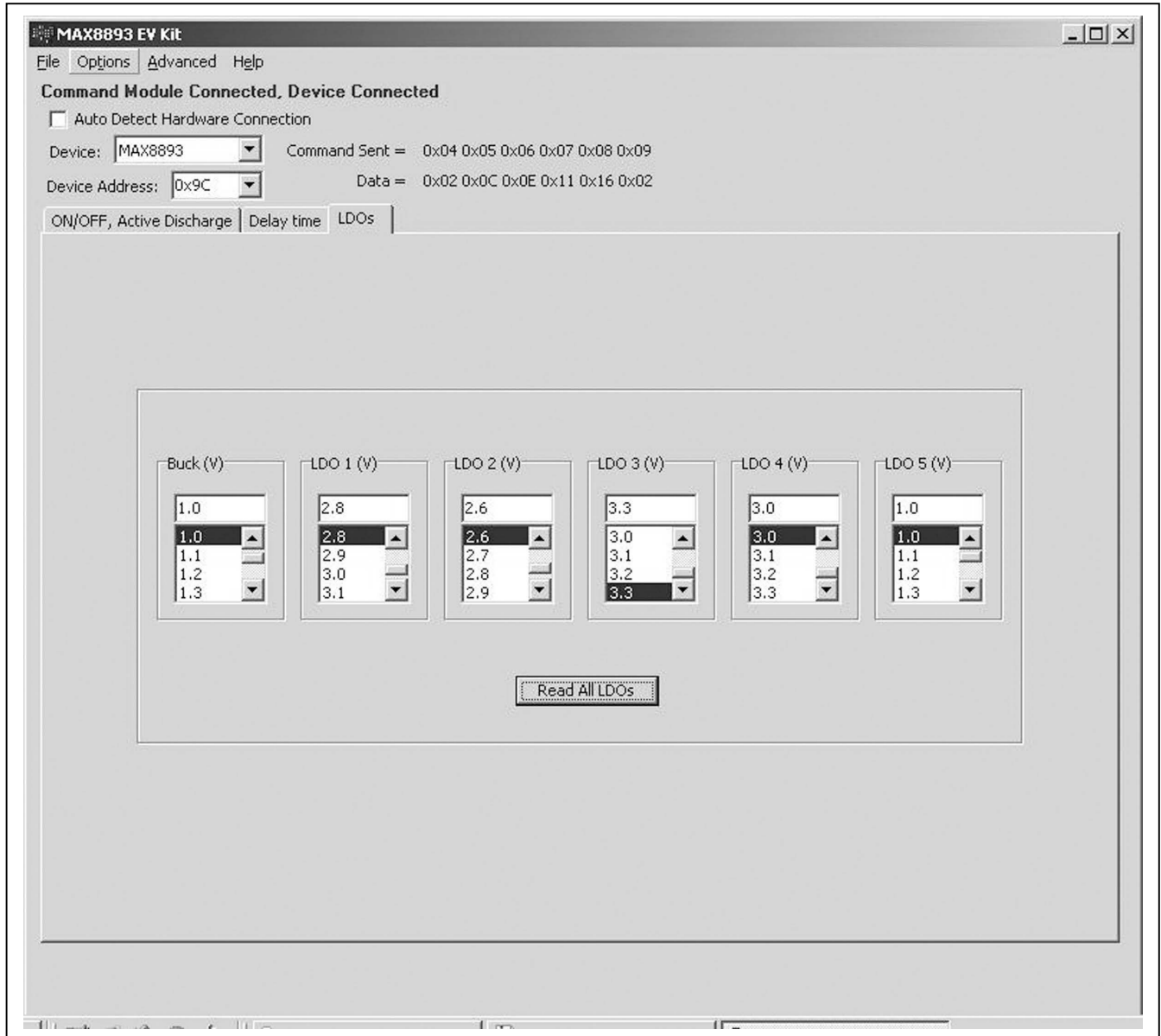


Figure 3. LDOs Tab

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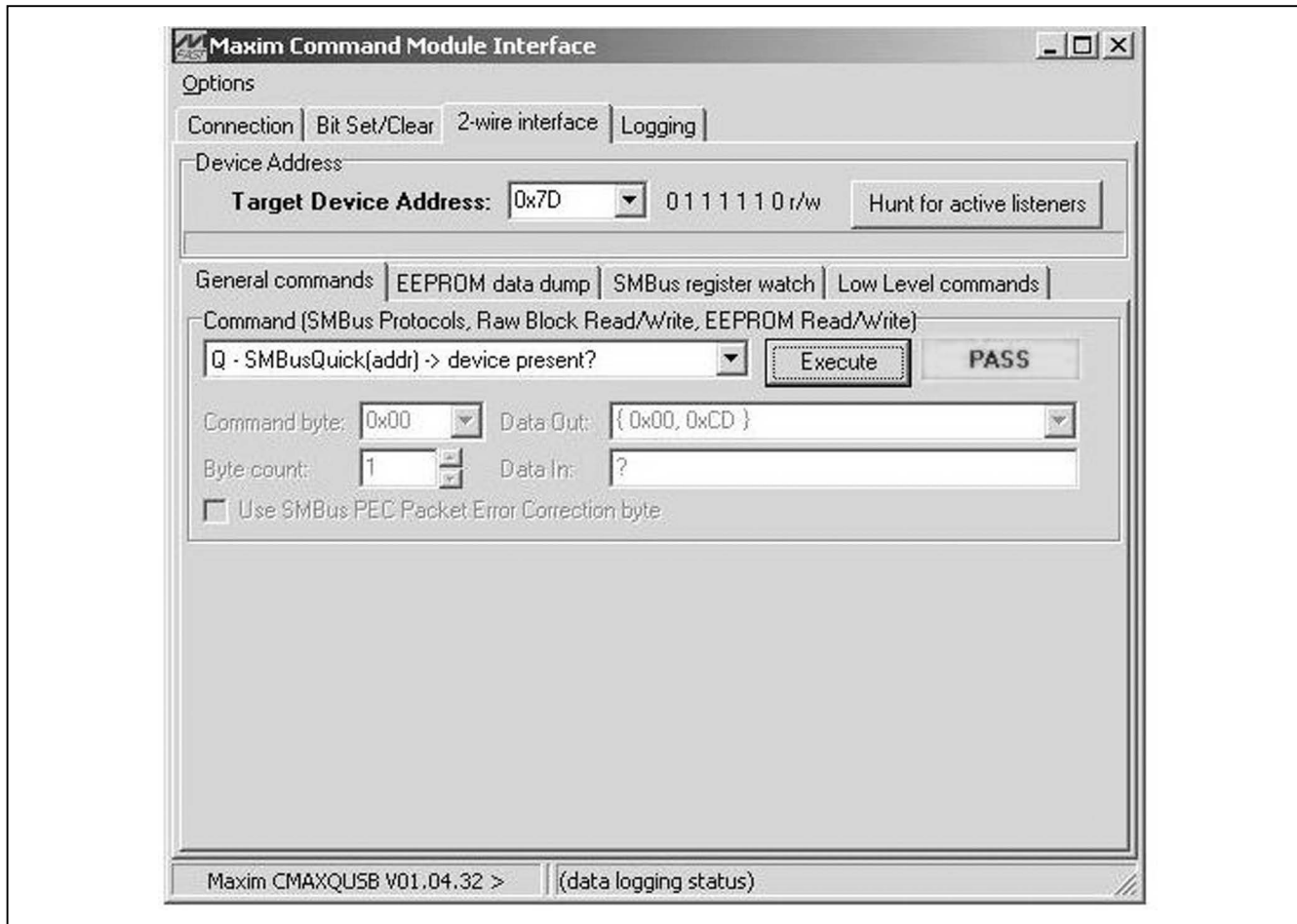


Figure 4. Maxim Command Module Interface Window

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Detailed Description of Hardware

The MAX8893 EV kit default jumper settings are shown in Table 1.

USB Switch Control (CB)

The USB signals are routed between P1 and P2, or between P1 and P3, depending on the state of the USB DPDT switch. The DPDT switch is controlled through jumper JU8 (see Table 2).

On-Board VBUS Power Switching

The MAX8893 EV kit includes a power-switching circuit, designed with n-channel and p-channel MOSFETs that route the P1 USB bus voltage (V1) to the P2 or P3 USB ports. The power-switching circuit is controlled by the

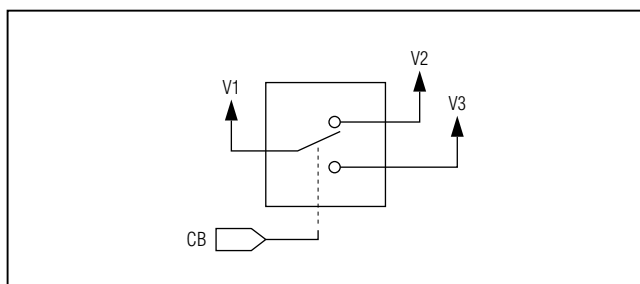


Figure 5. VBUS Power Switching

state of the CB control pin, which is set through jumper JU8 (see Table 2 for operation).

User-Supplied I²C Interface

To use the MAX8893 EV kit with a user-supplied I²C interface, connect SDA, SCL, and GND lines from the user-supplied I²C interface to the TP2, TP3, and GND pads on the MAX8893 EV kit.

Evaluating the MAX8893A and MAX8893B

To evaluate the MAX8893A or MAX8893B, carefully remove the MAX8893C (U1) and install the MAX8893A or MAX8893B. All other components remain the same.

Table 2. Relay Operation (JU8)

SHUNT POSITION	CB PIN	DESCRIPTION
1-2*	Connected to BATT	P1 USB bus voltage (V1) routed to USB port P3 (V3 = V1)
2-3*	Connected to GND	P1 USB bus voltage (V1) routed to USB port P2 (V2 = V1)

*Default position.

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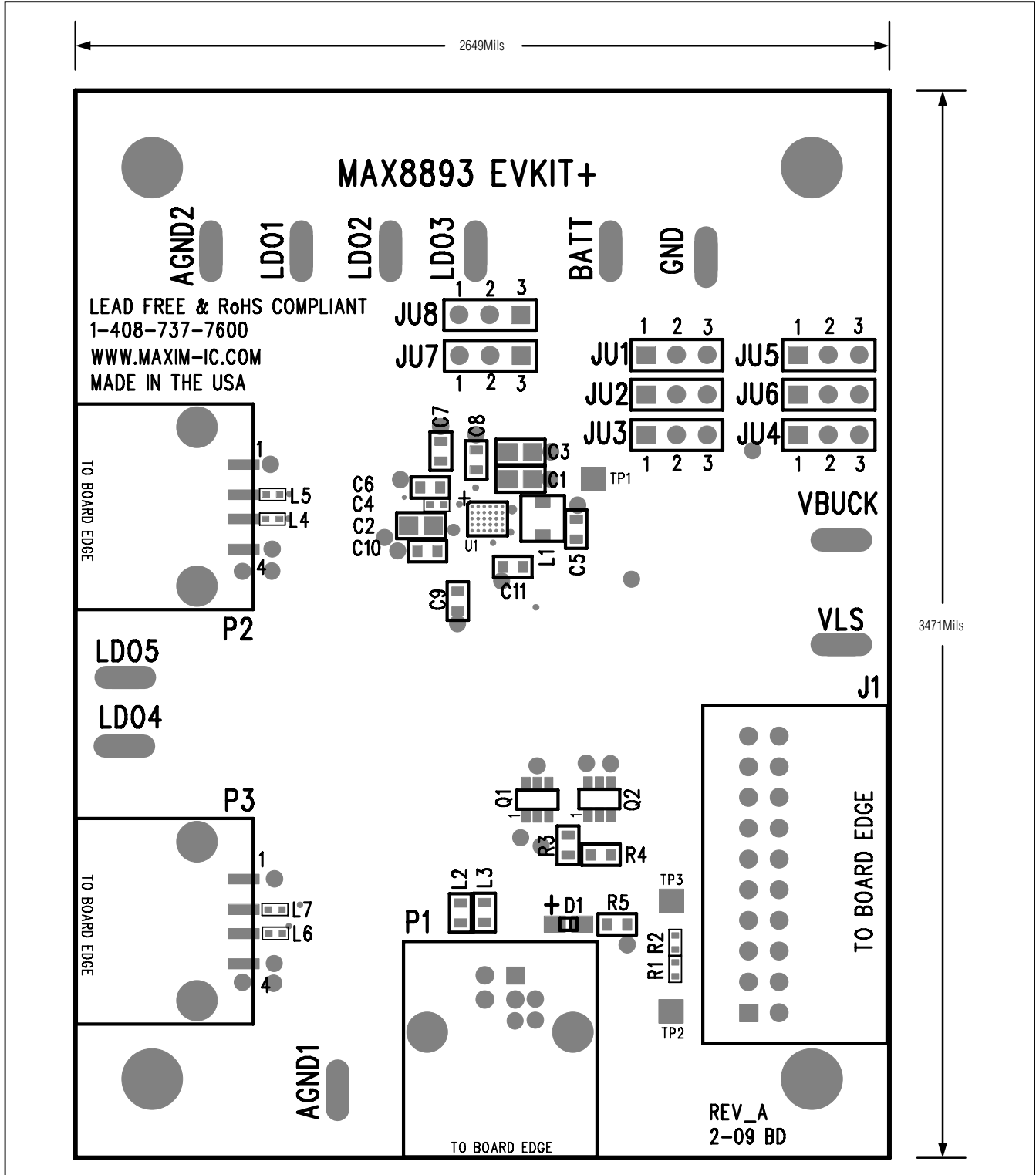


Figure 7. MAX8893 EV Kit Component Placement Guide—Top Layer

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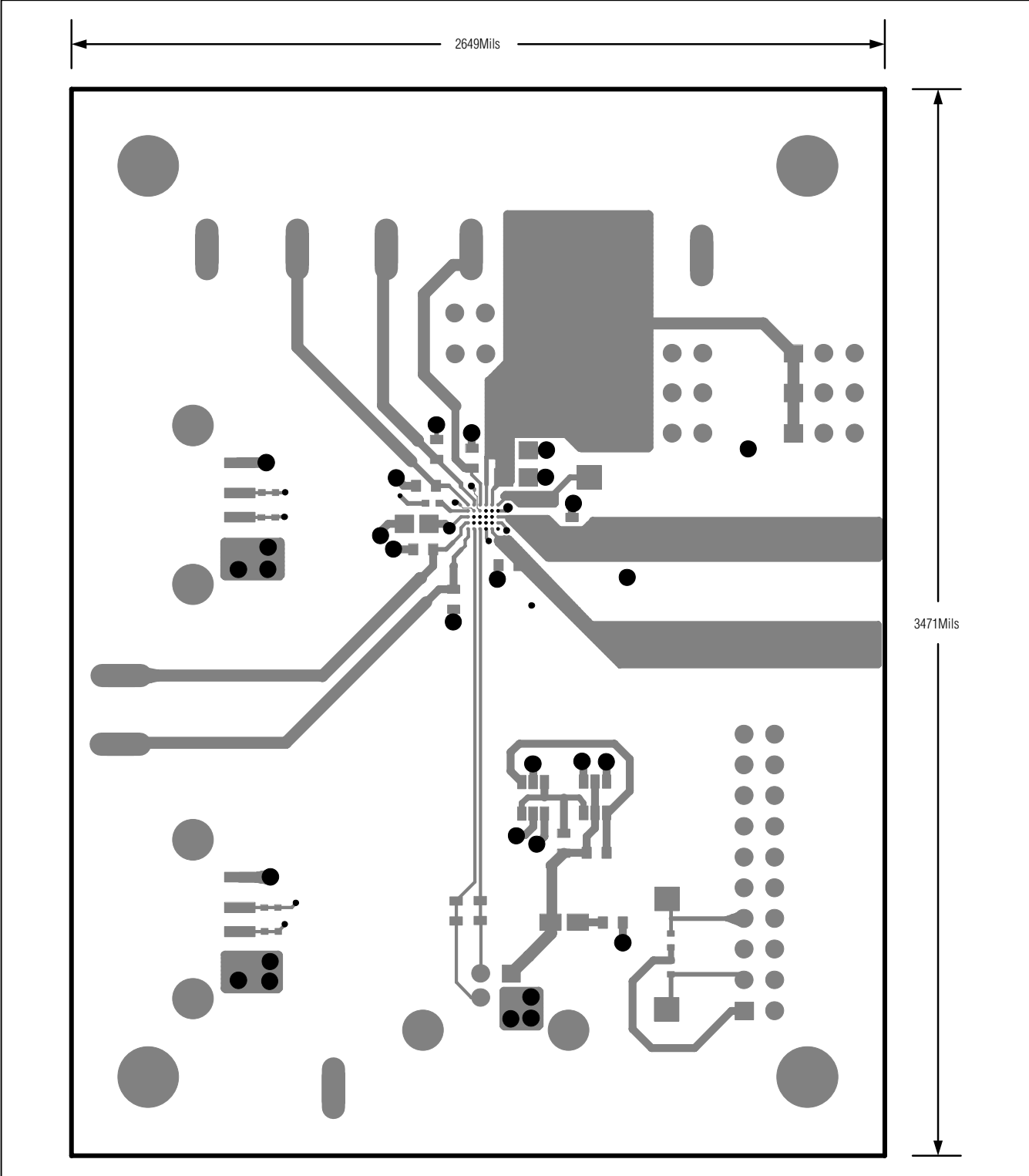


Figure 8. MAX8893 EV Kit PCB Layout—Top Layer 1

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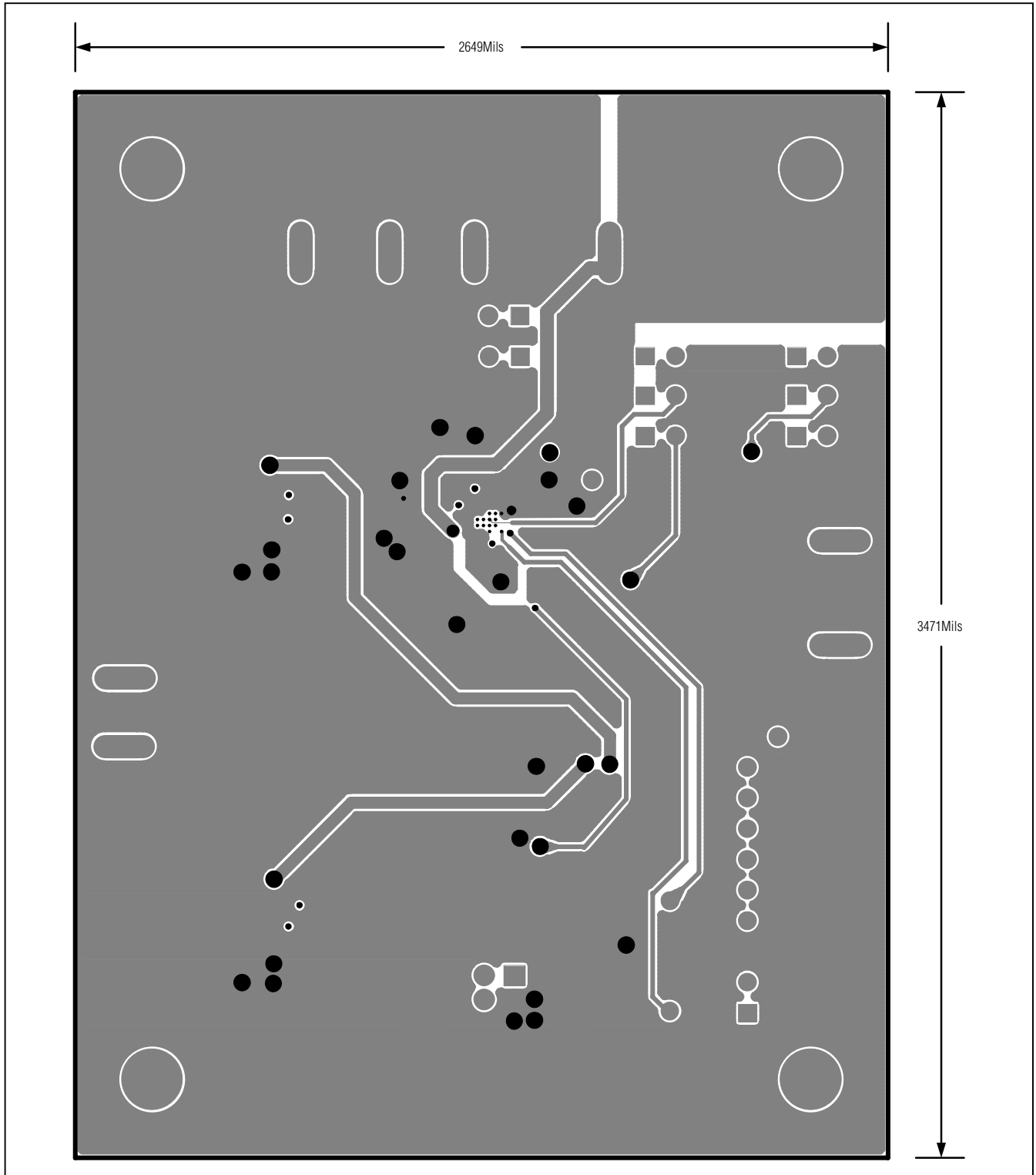


Figure 9. MAX8893 EV Kit PCB Layout—BATT/PGND/AGND Layer 2

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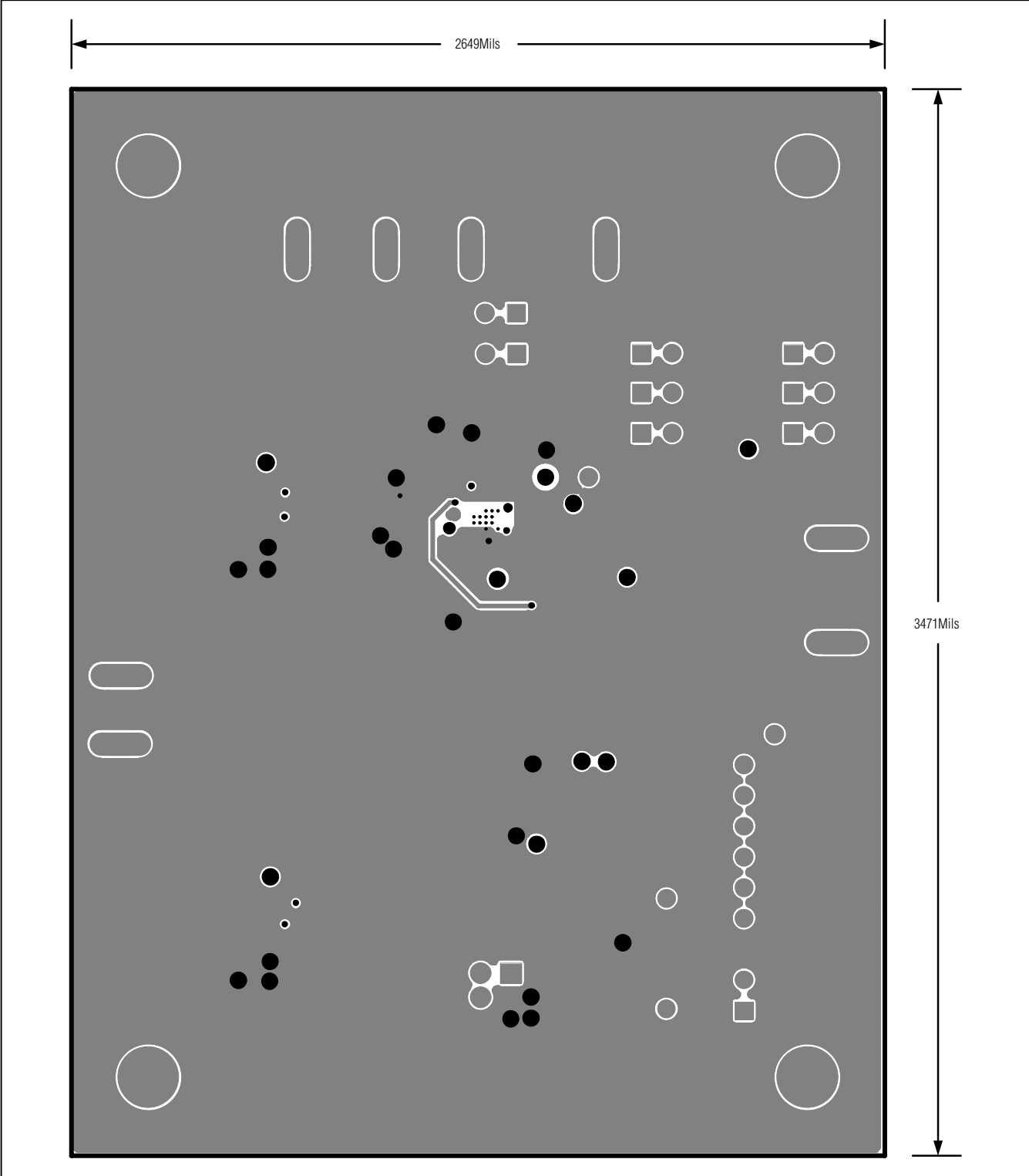
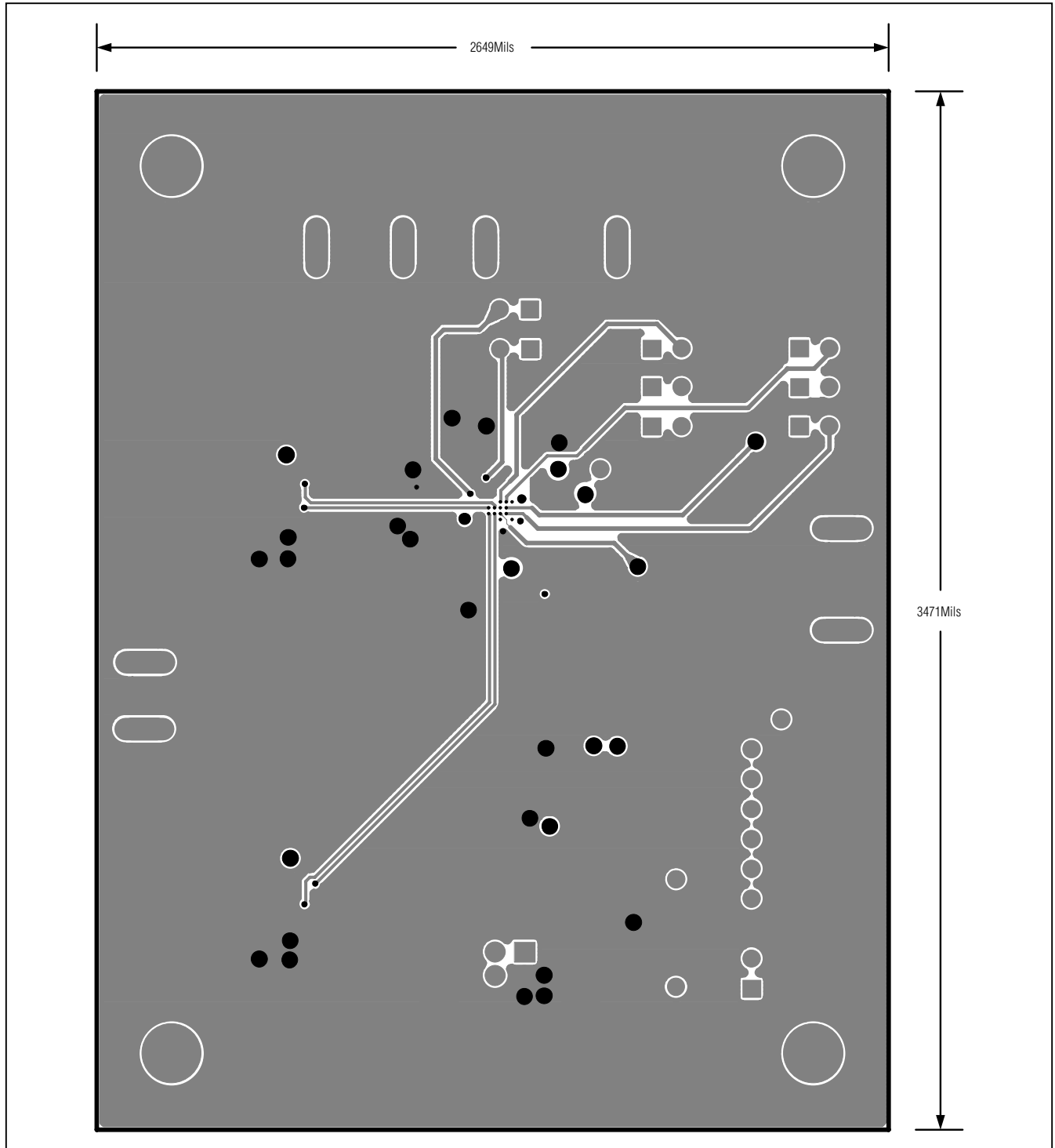


Figure 10. MAX8893 EV Kit PCB Layout—AGND Layer 3

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Figure 11. MAX8893 EV Kit PCB Layout—Bottom Layer 4

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