



MAX13325 Evaluation Kit

General Description

The MAX13325 evaluation kit (EV kit) provides a proven design to evaluate the MAX13325 dual, audio line driver, which provides a robust differential interface between automotive audio components. The 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 MAX13325.

The MAX13325 EV kit comes with a MAX13325GUI/V+ installed. Contact the factory for free samples of the pin-compatible MAX13326GUI/V+ to evaluate this device.

Features

- ◆ Fully Differential Inputs and Outputs
- ◆ Jumper-Selectable I²C Slave Address
- ◆ On-Board USB Interface Circuit Generates I²C-Compatible Signals
- ◆ PCB Pads for Audio Inputs and Outputs
- ◆ PCB Pads for User-Supplied I²C-Compatible Signals
- ◆ Windows 2000-, Windows XP-, and Windows Vista (32-Bit)-Compatible Software
- ◆ USB-PC Connection (Cable Included)
- ◆ Proven PCB Layout
- ◆ Fully Assembled and Tested

Ordering Information

PART	TYPE
MAX13325EVKIT+	EV Kit

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

Component List

DESIGNATION	QTY	DESCRIPTION
C1, C12, C14, C24	4	10 μ F \pm 10%, 16V X7R ceramic capacitors (1206) Murata GCM31CR71C106K
C2, C3	2	22pF \pm 5%, 50V C0G ceramic capacitors (0603) Murata GRM1885C1H220J
C4	1	0.033 μ F \pm 10%, 16V X5R ceramic capacitor (0603) Taiyo Yuden EMK107BJ333KA
C5–C10, C17, C18, C19	9	0.1 μ F \pm 10%, 16V X7R ceramic capacitors (0603) TDK C1608X7R1C104K
C11, C13, C29–C32	6	1 μ F \pm 10%, 16V X5R ceramic capacitors (0603) TDK C1608X5R1C105K
C15, C16	2	10pF \pm 5%, 50V C0G ceramic capacitors (0603) Murata GRM1885C1H100J
C20–C23	4	2.2 μ F \pm 10%, 16V X5R ceramic capacitors (0603) Murata GRM188R61C225K

DESIGNATION	QTY	DESCRIPTION
C25	1	0.22 μ F \pm 10%, 16V X7R ceramic capacitor (0603) Murata GRM188R71C224K
C26	1	0.47 μ F \pm 10%, 16V X7R ceramic capacitor (0603) Murata GRM188R71C474K
C27, C28	2	1 μ F \pm 10%, 35V X7R ceramic capacitors (0805) Taiyo Yuden GMK212B7105KG
C33–C38	6	1000pF \pm 10%, 50V X7R ceramic capacitors (0603) Murata GRM188R71H102K
C39–C42	0	Not installed, ceramic capacitors (0603)
D1	1	Zener diode (3 SOT23) Fairchild BZX84C5V6
J1	1	USB type-B, right-angle female receptacle
JU1, JU4–JU9	7	3-pin headers
JU2, JU3	2	5-pin headers
L1	1	Ferrite bead (0603)

Windows, Windows XP, and Windows Vista are registered trademarks of Microsoft Corp.



MAX13325 Evaluation Kit

Component List (continued)

DESIGNATION	QTY	DESCRIPTION
Q1	1	30V, 1.2A, 250mΩ n-channel MOSFET (3 SOT23) International Rectifier IRLML2803TRPBF
R1, R2	2	27Ω ±5% resistors (0603)
R3	1	1.5kΩ ±5% resistor (0603)
R4	1	470Ω ±5% resistor (0603)
R5	1	2.2kΩ ±5% resistor (0603)
R6	1	10kΩ ±5% resistor (0603)
R10	1	169kΩ ±1% resistor (0603)
R11	1	100kΩ ±1% resistor (0603)
R12–R16	0	Not installed, resistors—short (PC trace) (0603)
R17, R18, R19	3	4.7kΩ ±5% resistors (0603)
R20	1	1kΩ ±5% resistor (0603)
R21–R24	4	0Ω ±5% resistors (0603)
U1	1	Dual, audio line driver (28 TSSOP-EP*) Maxim MAX13325GUI/V+
U2	1	Adjustable-output LDO regulator (5 SC70) Maxim MAX8512EXK+

DESIGNATION	QTY	DESCRIPTION
U3	1	LDO regulator (5 SC70) Maxim MAX8511EXK25+
U4	1	USB-to-UART converter (32 TQFP)
U5	1	93C46-type 3-wire EEPROM 16-bit architecture (8 SO)
U6	1	Microcontroller (68 QFN-EP*) Maxim MAXQ2000-RAX+
U7, U8	2	Level translators (10 μMAX®) Maxim MAX1840EUB+
Y1	1	16MHz crystal Hong Kong X'tals SSM16000N1HK188F0-0
Y2	1	6MHz crystal Hong Kong X'tals SSL60000N1HK188F0-0
Y3	0	Not installed, crystal
—	1	USB high-speed A-to-B cable, 6ft
—	9	Shunts
—	1	PCB: MAX13325 EVALUATION KIT+

*EP = Exposed pad.

/V denotes an automotive qualified part.

Component Suppliers

SUPPLIER	PHONE	WEBSITE
Fairchild Semiconductor	888-522-5372	www.fairchildsemi.com
Hong Kong X'tals Ltd.	852-35112388	www.hongkongcrystal.com
International Rectifier	310-322-3331	www.irf.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 MAX13325 when contacting these component suppliers.

MAX13325 EV Kit Files

FILE	DESCRIPTION
INSTALL.EXE	Installs the EV kit files on your computer
MAX13325.EXE	Application program
FTD2XX.INF	USB device driver file
UNINST.INI	Uninstalls the EV kit software
USB_Driver_Help.PDF	USB driver installation help file

μMAX is a registered trademark of Maxim Integrated Products, Inc.

MAX13325 Evaluation Kit

Evaluates: MAX13325/MAX13326

Quick Start

Required Equipment

- MAX13325 EV kit (USB cable included)
- User-supplied Windows 2000, Windows XP, or Windows Vista PC with a spare USB port
- 12V power supply
- Function generator
- 2-channel oscilloscope (with math functions)

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 MAX13325 EV kit is fully assembled and tested. Follow the steps below to verify board operation.

Caution: Do not turn on the power supply and the signal generator until all connections are completed.

- 1) Visit www.maxim-ic.com/evkitsoftware to download the latest version of the EV kit software, 13325Rxx.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 are in their default positions, as shown in Table 1.
- 4) Connect the negative terminal of the 12V power supply to the PGND pad.
- 5) Connect the positive terminal of the 12V power supply to the VBAT pad.
- 6) Set the output of the signal generator to a 1V_{P-P} sinusoidal signal.
- 7) Disable the output of the signal generator.
- 8) Connect the negative terminal of the function generator to the INLM pad.
- 9) Connect the positive terminal of the function generator to the INLP pad.
- 10) Connect the oscilloscope's channel 1 positive terminal to the OUTLP pad.
- 11) Connect the oscilloscope's channel 2 positive terminal to the OUTLM pad.
- 12) Connect the ground terminal of the oscilloscope to the PGND pad.
- 13) Enable the CH1 - CH2 math operation on the oscilloscope. This calculates the difference of CH1 minus CH2.
- 14) Turn on the power supply and the function generator.
- 15) Connect the USB cable from the PC to the EV kit board. A **New Hardware Found** window pops up when installing the USB driver for the first time. 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.
- 16) Follow the directions of the **Found New Hardware** window to install the USB device driver. Manually specify the location of the device driver to be **C:\Program Files\MAX13325** (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.
- 17) Start the MAX13325 EV kit software by opening its icon in the **Start | Programs** menu. The EV kit software main window appears, as shown in Figure 1.
- 18) Check the **Enable** checkbox in the **Configuration** group box.
- 19) Press the **Write** button in the **Configuration** group box.
- 20) Verify that CH1 - CH2 is a 1V_{P-P} sinusoidal signal on the oscilloscope.

MAX13325 Evaluation Kit

Detailed Description of Software

The main window of the evaluation software (Figure 1) provides a convenient means to control the MAX13325.

GPIO-Controlled Signals

To set the $\overline{\text{MUTE}}$ pin of the MAX13325 to logic-low, which mutes the output, check the **Mute** checkbox located at the top of the GUI window.

To set the $\overline{\text{SHDN}}$ pin of the MAX13325 to logic-low, which puts the device into the low-power shutdown mode, check the **Shutdown** checkbox located at the top of the GUI window.

Configuration

In the **Configuration** group box, each of the checkboxes correspond to bits of the MAX13325's configuration register. By checking them and pressing the **Write** button, the correct I²C write operation is generated to update the configuration register.

Press the **Read** button to read the configuration register.

Fault/Flag Tab

In the **Fault/Flag** tab sheet (Figure 1), press the **Read** button to read the device ID, flag, and all fault registers of the MAX13325. The status of the registers is displayed in the corresponding **Device ID**, **Flag**, **General Faults**,

Left Channel, and **Right Channel** group boxes. Check the **Automatic Read** checkbox to automatically update the **Fault/Flag** tab sheet every second.

Mask Tab

To unmask the fault conditions, check the appropriate checkboxes in the **Mask** tab sheet (Figure 2) and press the **Write** button. Press the **Read** button to read the mask registers.

Read/Write Status

The **Read/Write Status** group box displays the last I²C command sent to the MAX13325.

Advanced User Interface

There are two methods for communicating with the MAX13325. The first is through the windows shown in Figures 1 and 2. The second is through the **Advanced User Interface** window shown in Figure 3. The **Advanced User Interface** window becomes available when selecting the **Option 1 Interface (Advanced User)** menu item and allows execution of serial commands manually.

The **Advanced User Interface** window can also be used as a debug tool because it is capable of manually reading and writing to every register of the MAX13325.

MAX13325 Evaluation Kit

Evaluates: MAX13325/MAX13326

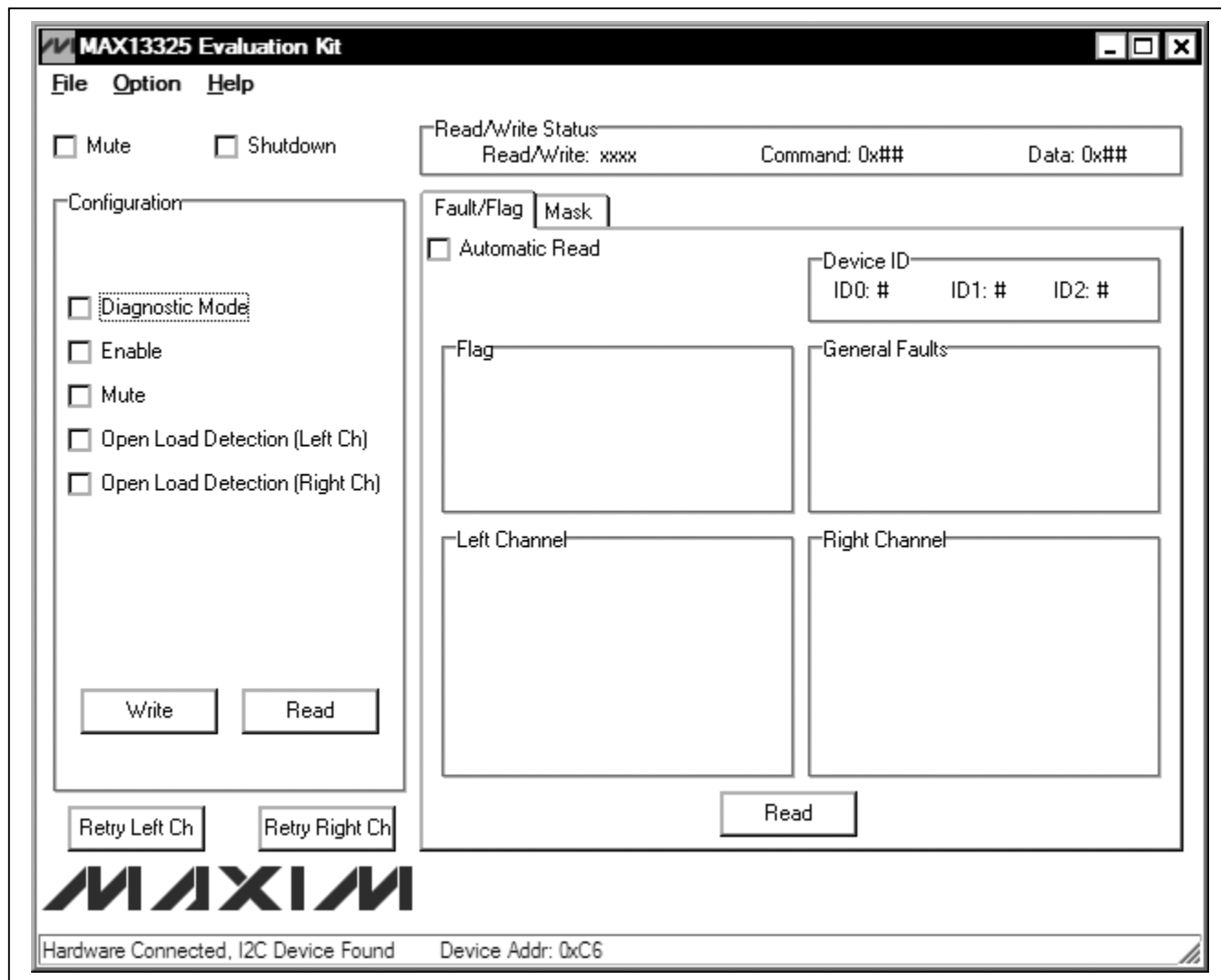


Figure 1. MAX13325 EV Kit Software Main Window (Fault/Flag Tab)

MAX13325 Evaluation Kit

Evaluates: MAX13325/MAX13326

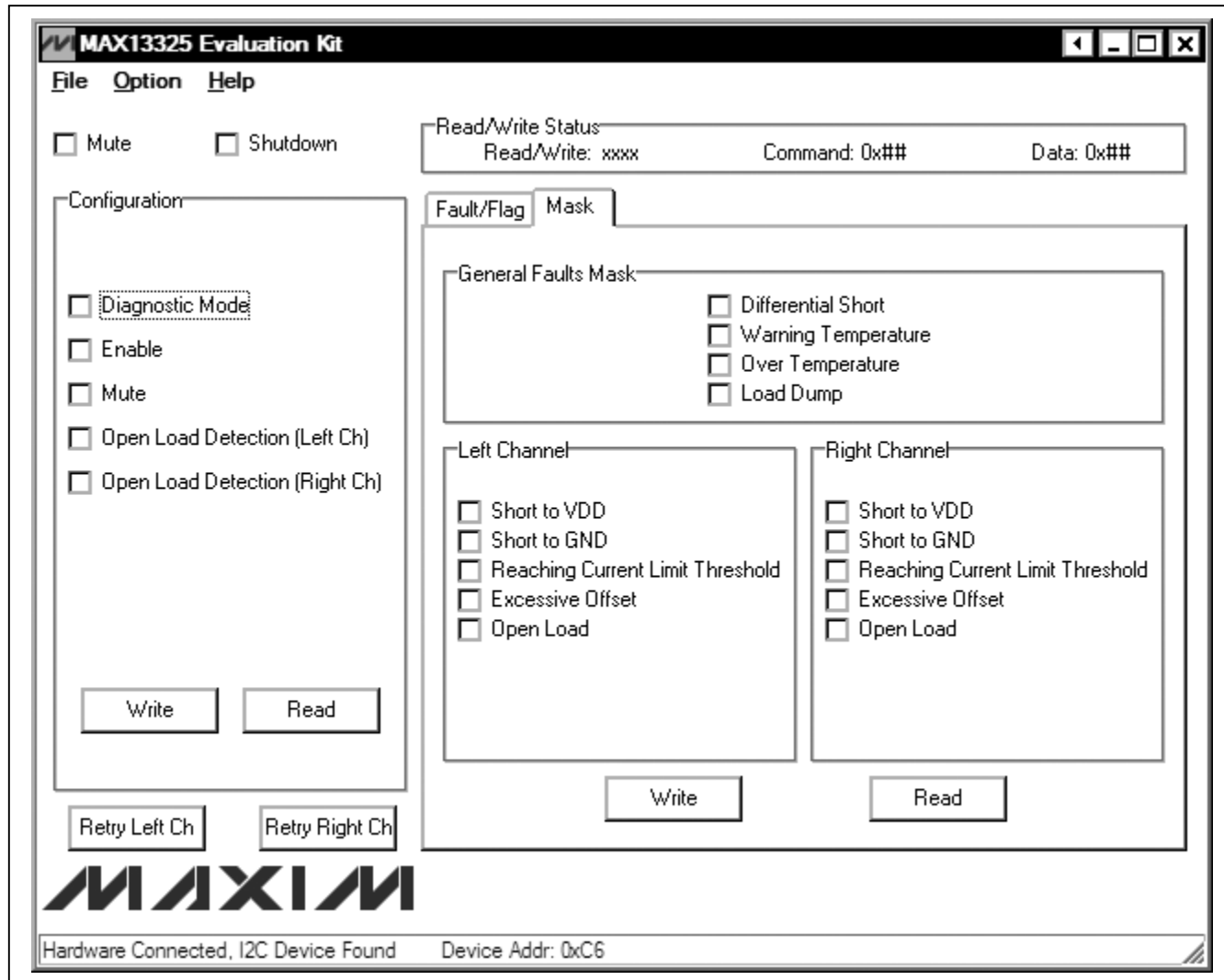


Figure 2. MAX13325 EV Kit Software Main Window (Mask Tab)

MAX13325 Evaluation Kit

Evaluates: MAX13325/MAX13326

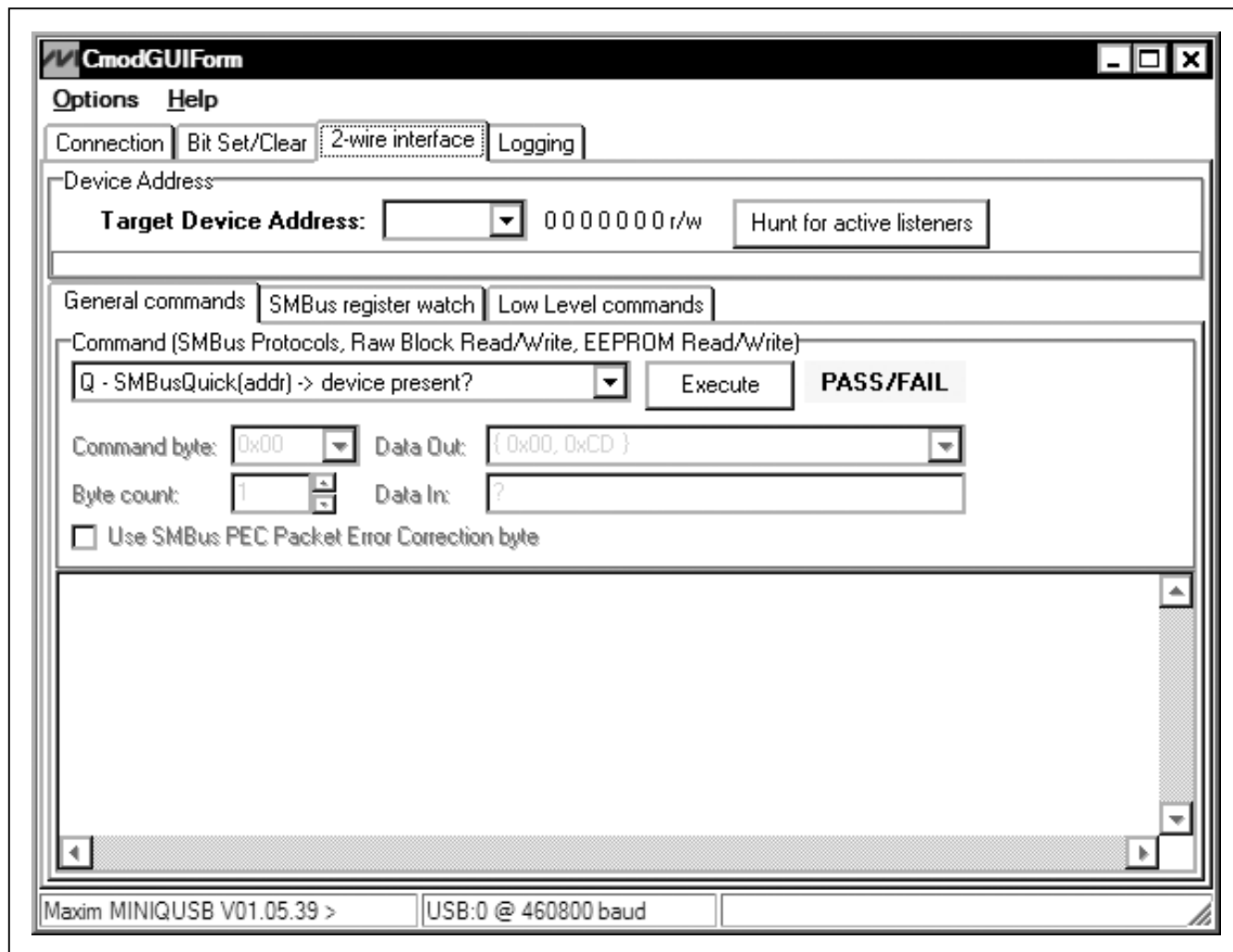


Figure 3. Advanced User Interface Window (2-Wire Interface Tab)

Detailed Description of Hardware

The MAX13325 EV kit provides a proven design to evaluate the MAX13325 dual, audio line driver, which provides a robust differential interface between automotive audio components. On-board level translators, I²C interface pads, and an easy-to-use USB-PC connection are included on the EV kit.

Audio Inputs/Outputs

The MAX13325 has two audio input channels. Connect the left-channel audio signal to the INLP and INLM pads. Connect the right-channel audio signal to the INRP and INRM pads. For a single-ended input application, connect INLM and INRM to ground. The left-channel

differential output signals are connected to the OUTLP and OUTLM pads. The right-channel differential output signals are connected to the OUTRP and OUTRM pads.

User-Supplied Digital I/O and I²C Interface

To use the MAX13325 EV kit with a user-supplied digital I/O and an I²C interface, first move the shunts of JU1 and JU4-JU8 to the 2-3 position. Next, apply a 2.7V to 5.5V power supply at the VL pad. Lastly, connect the user-supplied SCL, SDA, $\overline{\text{MUTE}}$, $\overline{\text{SHDN}}$, and $\overline{\text{FLAG}}$ signals to the corresponding SCL, SDA, $\overline{\text{MUTE}}$, $\overline{\text{SHDN}}$, and $\overline{\text{FLAG}}$ pads on the MAX13325 EV kit board.

MAX13325 Evaluation Kit

Logic Supply

The logic supply of the MAX13325 EV kit is powered from the USB port by default. Move the shunt of JU1 to the 2-3 position to apply your own 2.7V to 5.5V power supply at the VL pad.

Operating Supply

There are two ways to supply the operating power to the MAX13325. By default, the user should connect the

4.5V to 18V supply to the VBAT pad. The charge pump of the MAX13325 is used to drive the gate of the external n-channel MOSFET (Q1), which powers the MAX13325 and protects the MAX13325 from a load-dump transient. To connect the operating supply input (VDD) directly to the power supply, move the shunt of JU9 to the 2-3 position and connect the 4.5V to 18V output of the power supply to the VDD pad.

Table 1. MAX13325 EV Kit Jumper Descriptions (JU1–JU9)

JUMPER	SHUNT POSITION	DESCRIPTION
JU1	1-2*	MAX13325 VL is set to the on-board 5V supply powered from the USB port
	2-3	Connects an external 2.7V to 5.5V supply to the VL pad
JU2	1-2	ADD1 connected to GND
	1-3	ADD1 connected to the SDA signal
	1-4*	ADD1 connected to VL
	1-5	ADD1 connected to the SCL signal
JU3	1-2	ADD0 connected to GND
	1-3	ADD0 connected to the SDA signal
	1-4*	ADD0 connected to VL
	1-5	ADD0 connected to the SCL signal
JU4	1-2*	MAX13325 SDA signal connected to the on-board microcontroller
	2-3	Connects user-supplied SDA signal to the on-board SDA pad
JU5	1-2*	MAX13325 SCL signal connected to the on-board microcontroller
	2-3	Connects user-supplied SCL signal to the on-board SCL pad
JU6	1-2*	MAX13325 $\overline{\text{FLAG}}$ signal connected to the on-board microcontroller
	2-3	Connects user-supplied $\overline{\text{FLAG}}$ signal to the on-board $\overline{\text{FLAG}}$ pad
JU7	1-2*	MAX13325 $\overline{\text{MUTE}}$ signal connected to the on-board microcontroller
	2-3	Connects user-supplied $\overline{\text{MUTE}}$ signal to the on-board $\overline{\text{MUTE}}$ pad
JU8	1-2*	MAX13325 $\overline{\text{SHDN}}$ signal connected to the on-board microcontroller
	2-3	Connects user-supplied $\overline{\text{SHDN}}$ signal to the on-board $\overline{\text{SHDN}}$ pad
JU9	1-2*	VDD powered from the VBAT pad through external n-channel MOSFET Q1
	2-3	VDD connected to the VDD pad

*Default position.

MAX13325 Evaluation Kit

Evaluates: MAX13325/MAX13326

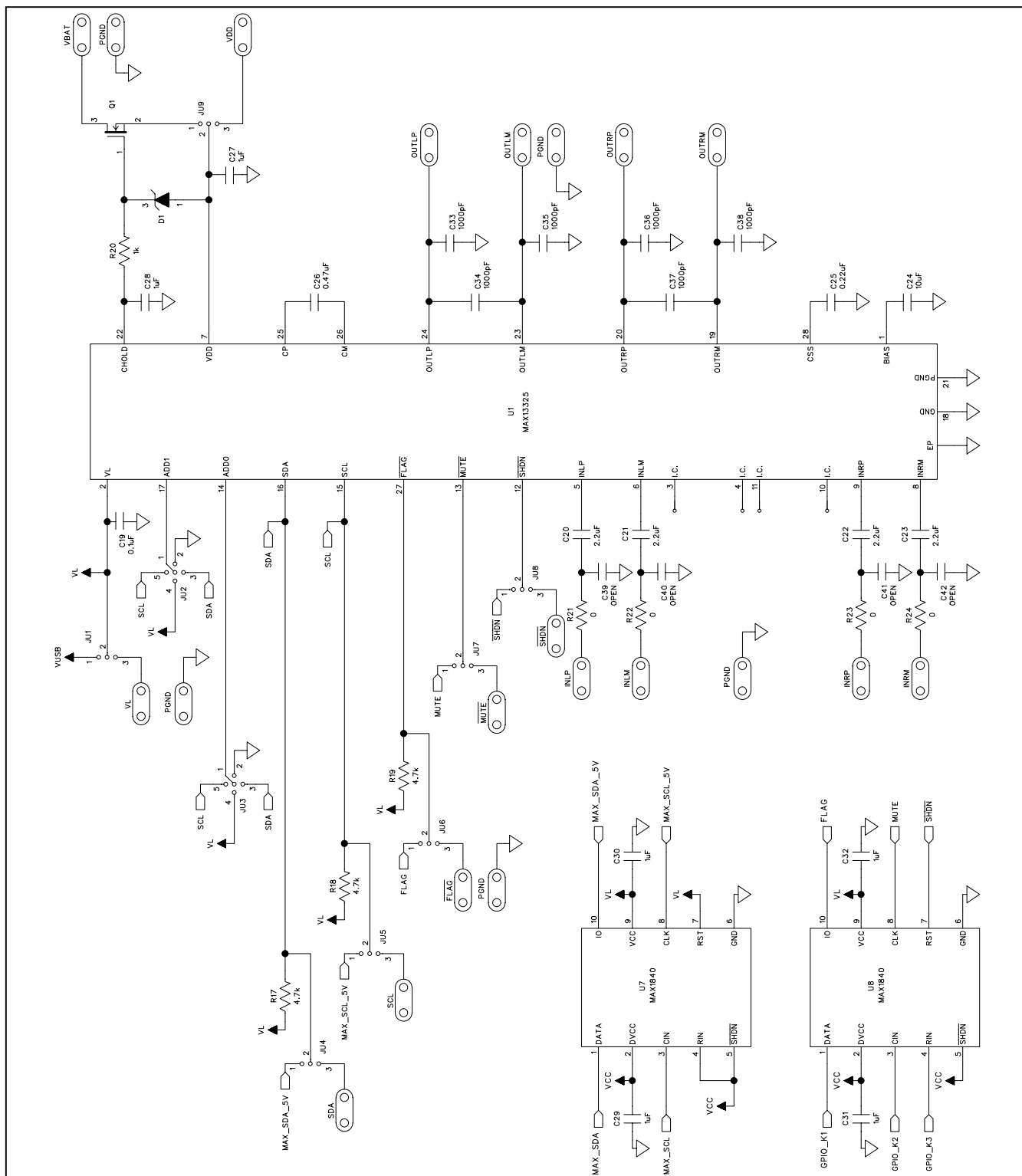


Figure 4a. MAX13325 EV Kit Schematic (Sheet 1 of 2)

MAX13325 Evaluation Kit

Evaluates: MAX13325/MAX13326

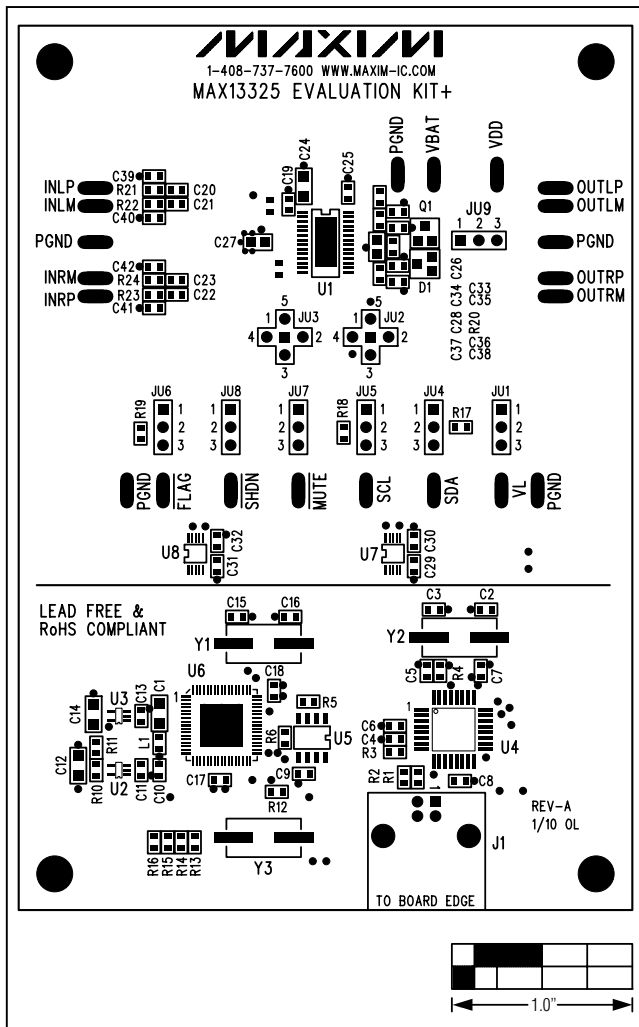


Figure 5. MAX13325 EV Kit Component Placement Guide—Component Side

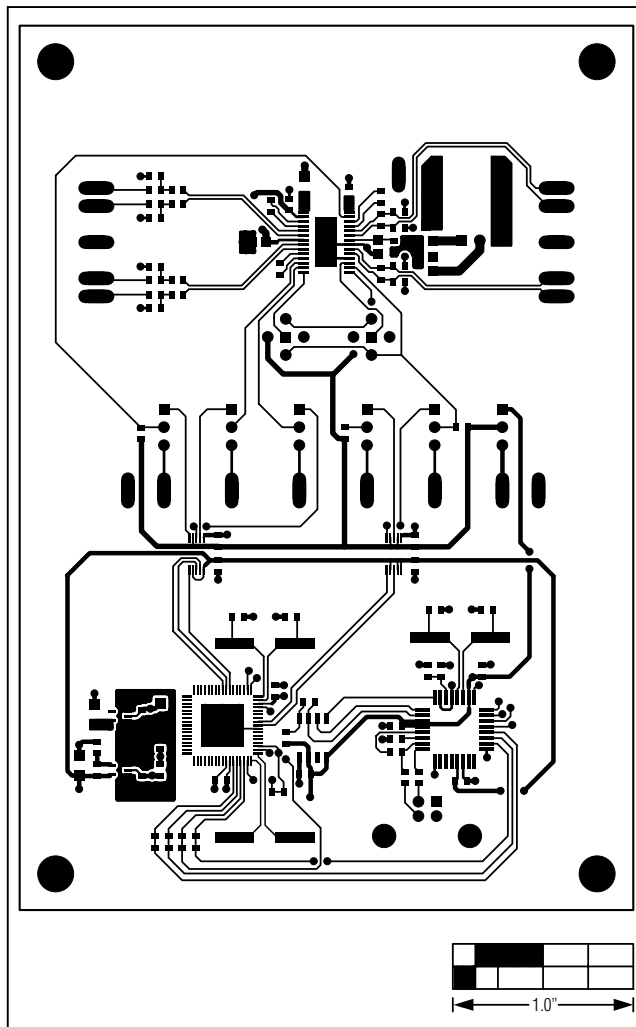


Figure 6. MAX13325 EV Kit PCB Layout—Component Side

MAX13325 Evaluation Kit

Evaluates: MAX13325/MAX13326

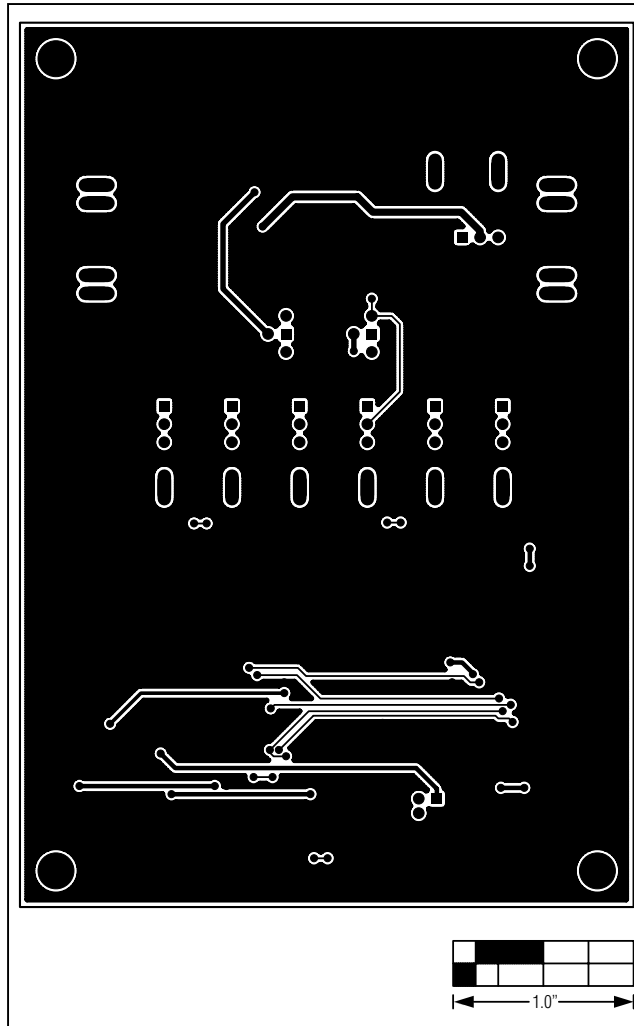


Figure 7. MAX13325 EV Kit PCB Layout—Solder Side

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.

12 _____ **Maxim Integrated Products, 120 San Gabriel Drive, Sunnyvale, CA 94086 408-737-7600**

© 2010 Maxim Integrated Products

Maxim is a registered trademark of Maxim Integrated Products, Inc.