



MAX9765 Evaluation System/Evaluation Kit

General Description

The MAX9765 evaluation system (EV system) consists of a MAX9765 evaluation kit (EV kit) and a companion Maxim CMAXQUSB board.

The MAX9765 EV kit is a fully assembled and tested surface-mount printed circuit board (PCB) that evaluates the MAX9765 750mW stereo audio power amplifier plus headphone driver and microphone amplifier. The EV kit is designed to be driven by any stereo audio source such as a CD player. The MAX9765 EV kit includes RCA jacks and a 3.5mm microphone jack on the inputs as well as a 3.5mm headphone jack and terminal blocks on the output to facilitate easy connections to the PCB. The MAX9765 EV kit includes Windows® 98SE/2000/XP-compatible software, which provides a user interface for exercising the MAX9765 features.

The CMAXQUSB interface board allows a PC to use its USB port to emulate an SMBus™/I²C-compatible 2-wire interface. Windows 98SE/2000/XP-compatible software provides a user-friendly interface to exercise the MAX9765 features. The program is menu driven and offers a graphic interface with control buttons and status display.

The MAX9765 EV system (MAX9765EVCMAXQU) includes both the MAX9765 EV kit and the CMAXQUSB interface board. Order only the MAX9765 EV kit if you already have an SMBus interface board.

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Windows is a registered trademark of Microsoft Corp.

Features

- ◆ 2.7V to 5.5V Single-Supply Operation
- ◆ 750mW Stereo Bridge-Tied-Load (BTL) Amplifier
- ◆ 95dB Power-Supply Rejection Ratio
- ◆ SMBus/I²C-Compatible 2-Wire Serial Interface
- ◆ 2:1 Stereo Input Mux
- ◆ Low-Profile (2.0mm, max) Design
- ◆ No Detectable Clicks or Pops
- ◆ Easy-to-Use, Menu-Driven Software
- ◆ Assembled and Tested
- ◆ Software-Controlled Mute, Input MUX, and Mic Gain
- ◆ Automatic Headphone Sensing Circuitry
- ◆ Includes Windows 98SE/2000/XP-Compatible Software and Demo PCB
- ◆ EV System Includes USB Connectivity

Ordering Information

| PART | TEMP RANGE | IC PACKAGE | SMBus INTERFACE TYPE |
|-----------------|--------------|-------------|----------------------|
| MAX9765EVKIT | 0°C to +70°C | 32 Thin QFN | Not included |
| MAX9765EVCMAXQU | 0°C to +70°C | 32 Thin QFN | CMAXQUSB |

Note: The MAX9765 EV kit software is provided with the MAX9765EVKIT. However, the CMAXQUSB board is required to interface the EV kit to the computer when using the software.

Component Lists

MAX9765 EV System

| PART | QTY | DESCRIPTION |
|--------------|-----|------------------------|
| MAX9765EVKIT | 1 | MAX9765 EV kit |
| CMAXQUSB+ | 1 | Serial interface board |

+Denotes lead free and RoHS compliance.

MAX9765 EV Kit

| DESIGNATION | QTY | DESCRIPTION |
|-----------------------|-----|---|
| C1-C4 | 4 | 0.68µF ±10%, 20V tantalum capacitors (R-case) AVX TAJR684K020 |
| C5, C6 | 2 | 100pF ±5%, 50V C0G ceramic capacitors (0402) TDK C1005C0G1H101J |
| C8, C9, C10, C14, C15 | 5 | 1.0µF ±20%, 10V X7R ceramic capacitors (0603) TDK C1608X7R1A105M |

| DESIGNATION | QTY | DESCRIPTION |
|---------------|-----|---|
| C11, C12, C13 | 3 | 220µF ±20%, 10V tantalum capacitors (Y-case) AVX TPSY227M010R0200 Sprague 592D227X0010V2T |
| C16 | 1 | 1.0µF ±10%, 10V tantalum capacitor (R-case) AVX TAJR105K010 |
| C17, C18 | 2 | 100µF ±10%, 6.3V tantalum capacitors (W-case) AVX TAJW107K006 |
| R1-R6 | 6 | 15kΩ ±1% resistors (0402) |
| R7, R8, R9 | 3 | 10kΩ ±5% resistors (0402) |
| R11-R14 | 4 | 100kΩ ±5% resistors (0402) |
| R15 | 1 | 680kΩ ±5% resistor (0402) |
| R16, R17 | 0 | Not installed, resistors (0402) |

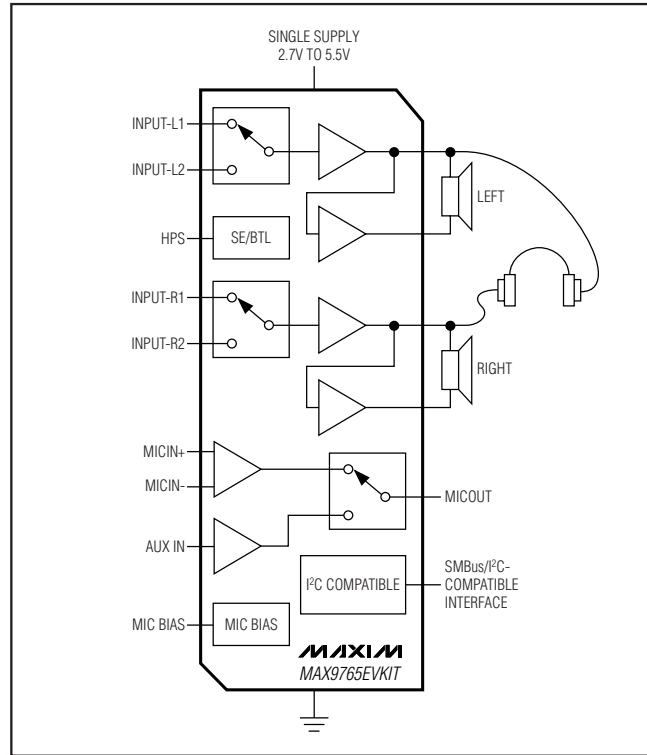


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Component Lists (continued)

| DESIGNATION | QTY | DESCRIPTION |
|-------------|-----|--|
| R18 | 1 | 2kΩ ±1% resistor (0402) |
| R19 | 0 | Not installed, resistor (0402) |
| R20 | 1 | 47kΩ ±5% resistor (0402) |
| J1, J3 | 2 | Phono jacks (white) |
| J2, J4 | 2 | Phono jacks (red) |
| J5 | 1 | Switched stereo headphone jack (3.5mm dia) |
| J6 | 1 | 2 x 10 right-angle female receptacle |
| J7 | 1 | Phono jack (black) |
| J8 | 1 | Nonswitched stereo headphone jack (3.5mm dia) |
| JU1 | 1 | 2-pin header |
| JU2 | 1 | 3-pin header |
| JU3 | 1 | Jumper (2 x 4-pin header) |
| TB1, TB2 | 2 | 2-circuit terminal blocks |
| U1 | 1 | MAX9765ETJ (32-pin thin QFN) |
| — | 3 | Shunts |
| — | 1 | PCB: MAX9765 Evaluation Kit |
| — | 1 | Software disk (CD-ROM), MAX9765 evaluation kit |

Functional Diagram



Component Suppliers

| SUPPLIER | PHONE | FAX | WEBSITE |
|-----------|--------------|--------------|-----------------------|
| AVX Corp. | 843-946-0238 | 843-626-3123 | www.avxcorp.com |
| Sprague | 402-563-6866 | 402-563-6296 | www.vishay.com |
| TDK Corp. | 847-803-6100 | 847-390-4405 | www.component.tdk.com |

Note: Indicate that you are using the MAX9765 when contacting these component suppliers.

Quick Start

Recommended Equipment

- The MAX9765 EV system
 - MAX9765 EV kit
 - Maxim CMAXQUSB interface board (USB cable included)
- A user-supplied Windows 98SE/2000/XP PC with a spare USB port
- DC power supply capable of supplying any voltage between 2.7V and 5.5V at 1A
- One pair of headphones (16Ω or greater)

- Two stereo audio sources (to demonstrate the input mux feature)
- One pair of speakers (4Ω or greater)
- Two microphones (to demonstrate the mic amp 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 98SE/2000/XP operating system.

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Procedure

The MAX9765 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 the Maxim website (www.maxim-ic.com/evkit-software) to download the most recent version of the EV kit software, 9765Rxx.ZIP.
- 2) Install the MAX9765 evaluation software on your computer by running the INSTALL.EXE program. The program files are copied and icons are created in the Windows **Start** menu.
- 3) On the CMAXQUSB board, ensure that the shunt of JU1 is in the 3.3V position.
- 4) Carefully connect the boards by aligning the 20-pin connector of the MAX9765 EV kit with the 20-pin header of the CMAXQUSB interface board. Gently press them together. Do not turn on the power until all connections are made.
- 5) Connect the 2.7V to 5.5V power supply to the pads labeled VDD and GND on the MAX9765 EV kit board.
- 6) Adjust the 2.7V to 5.5V power supply to 3.0V.
- 7) Ensure that both stereo audio sources are turned off.
- 8) Connect the first stereo audio source to the input jacks labeled J1 and J2.
- 9) Connect the second stereo audio source to the input jacks labeled J3 and J4.
- 10) Plug the headphones into the 3.5mm headphone jack labeled J5.
- 11) Connect the speakers to the terminal blocks labeled TB1 and TB2.
- 12) Connect a differential microphone to the pads marked MICIN+ and MICIN- and/or connect a single-ended microphone to the 3.5mm jack labeled J8.
- 13) Ensure that a shunt is installed on jumper JU1.
- 14) Ensure that shunts are installed across pins 1-2 of jumpers JU2 and JU3.
- 15) Connect the USB cable from the PC to the CMAXQUSB board. **A Building Driver Database** window pops up in addition to a **New Hardware Found** message. If you do not see a window that is similar to the one described above after 30 seconds, remove the USB cable from the CMAXQUSB interface board and reconnect it again. Administrator privileges are required to install the USB device driver on Windows 98SE/2000/XP. Refer to the TROUBLESHOOTING_USB.PDF document included with the software if you have any problems during this step.
- 16) 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\MAX9765** (default installation directory) using the **Browse** button.
- 17) Turn on the DC power supply.
- 18) Enable the stereo audio sources.
- 19) Start the MAX9765 program by opening its icon in the **Start** menu.
- 20) Observe as the program automatically detects the address of the MAX9765 and starts the main program.
- 21) The MAX9765 features can be controlled using the provided software. The *Detailed Description of Software* section outlines how to use these functions.

Detailed Description of Software

User-Interface Panel

The MAX9765 EV kit software provides an easy user interface (Figure 1) to control and read back the programmable features of this device. Each of the buttons and control sliders correspond to bits in the command and configuration bytes. By clicking on them, the correct I²C/SMBus write operation is generated to update the internal registers of the MAX9765. The **Interface** box indicates the current **Device Address**, the **Register Address**, and the **Data Sent/Received** for the last read/write operation. This data is used to confirm proper device operation.

Note: Words in boldface are user-selectable features in the software.

Signal Input Selection

The MAX9765 EV kit can route one of two independent stereo signals to the speakers or headphones. The input signal is selected by choosing the desired option in the **Signal Input Selection** box. Choosing **Signal Input #1** routes the signal from input jacks J1 and J2. Choosing **Signal Input #2** routes the signal from input jacks J3 and J4.

Microphone Control

The MAX9765 EV kit is capable of amplifying both a single-ended microphone and a differential microphone. Selecting the **Differential Mode (internal)** option located in the **Microphone Input Selection** box evaluates a differential microphone connected to the MICIN+ and MICIN- pads. Selecting the **Single-Ended Mode (external)** option evaluates a single-ended microphone connected to the AUXIN and MICBIAS

MAX9765 Evaluation System/Evaluation Kit

Evaluates: MAX9765

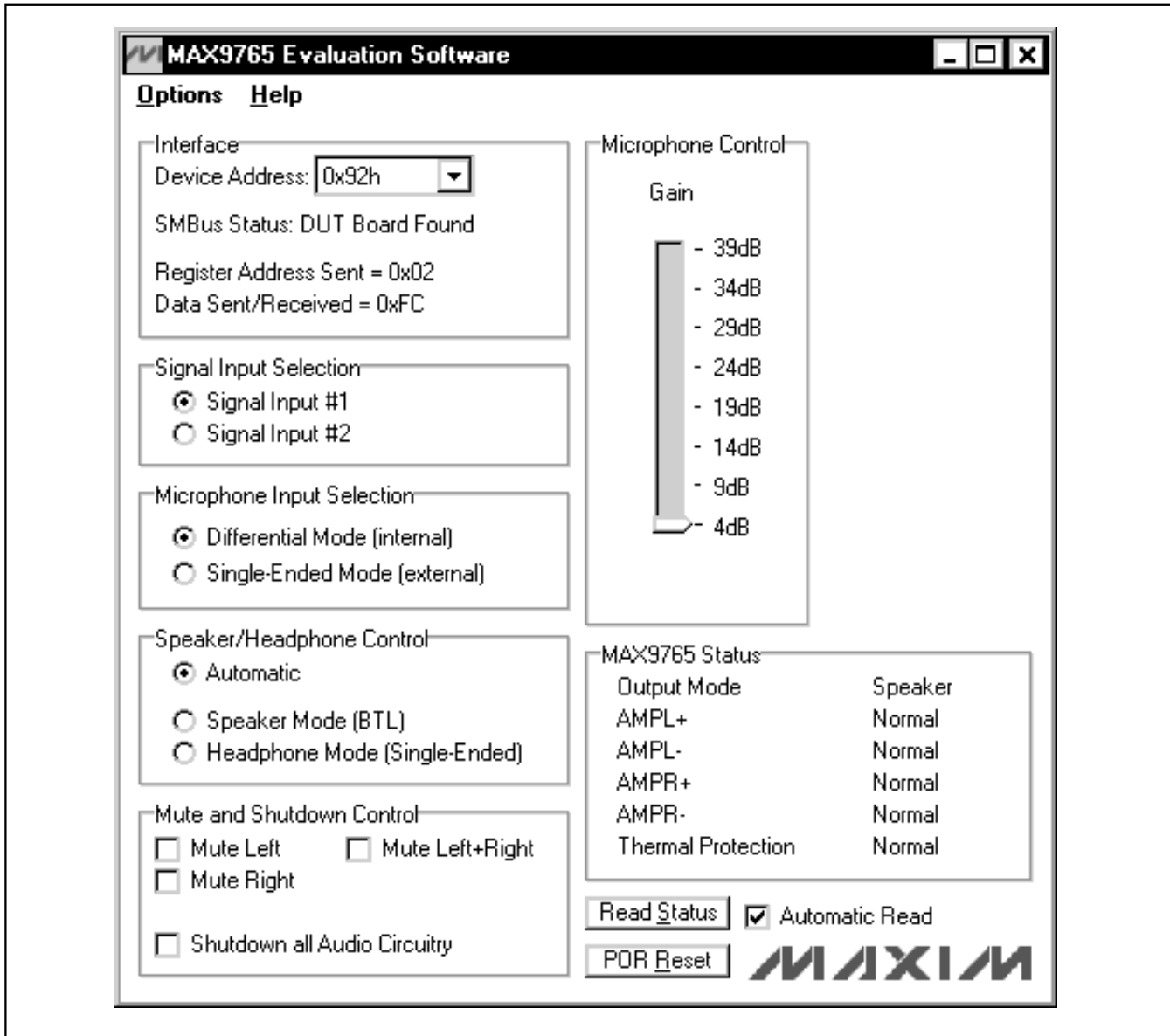


Figure 1. MAX9765 EV Kit Software Main Window

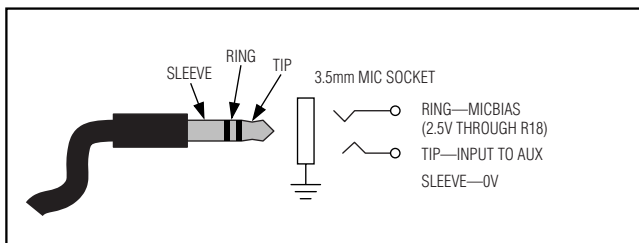


Figure 2. Notebook PC Microphone Connection Diagram

pads or through microphone jack J8. Microphone jack J8 conforms to a standard notebook PC (Figure 2).

The MAX9765 EV kit software also controls the microphone amplifier gain through the 2-wire interface.

The microphone amplifier gain can be adjusted by the **Gain** slider in the **Microphone Control** box.

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Speaker/Headphone Control

Selecting the desired option in the **Speaker/Headphone Control** box allows the MAX9765 EV kit to operate in one of three independent modes. The **Automatic** mode (default) detects the insertion of the headphones in jack J5. The speaker outputs are disabled if the headphones are present, and enabled if the headphones are absent. Selecting the **Speaker Mode (BTL)** provides drive to the speakers and headphones (if both are present). Selecting the **Headphone Mode (Single-Ended)** provides drive to the headphones only.

MAX9765 Status

The program continually polls the device for new status data and updates the MAX9765 status window. To disable continuous polling of data, uncheck the **Automatic Read** checkbox.

Software Mute and Shutdown Control

Selecting the desired option in the **Mute and Shutdown Control** box allows the MAX9765 EV kit to disable the left, right, or both output channels. Checking the **Mute**

Left option mutes the left channel. Checking the **Mute Right** option mutes the right channel. Checking the **Mute Left+Right** option mutes both channels.

Checking the **Shutdown all Audio Circuitry** places the MAX9765 into a low-power software shutdown mode. In this mode, all the I²C registers are still active.

Simple SMBus Commands

There are two methods for communicating with the MAX9765: through the normal user-interface panel or through the SMBus commands available by selecting the **Two Wire Interface Diagnostics** item from the Interface pulldown menu. A display pops up that allows the SMBus protocols, such as Read Byte and Write Byte, to be executed. To stop normal user-interface execution so that it does not override the manually set values, turn off the update timer by unchecking the **Automatic Read** checkbox.

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 3 for an example of this tool.

Evaluates: MAX9765

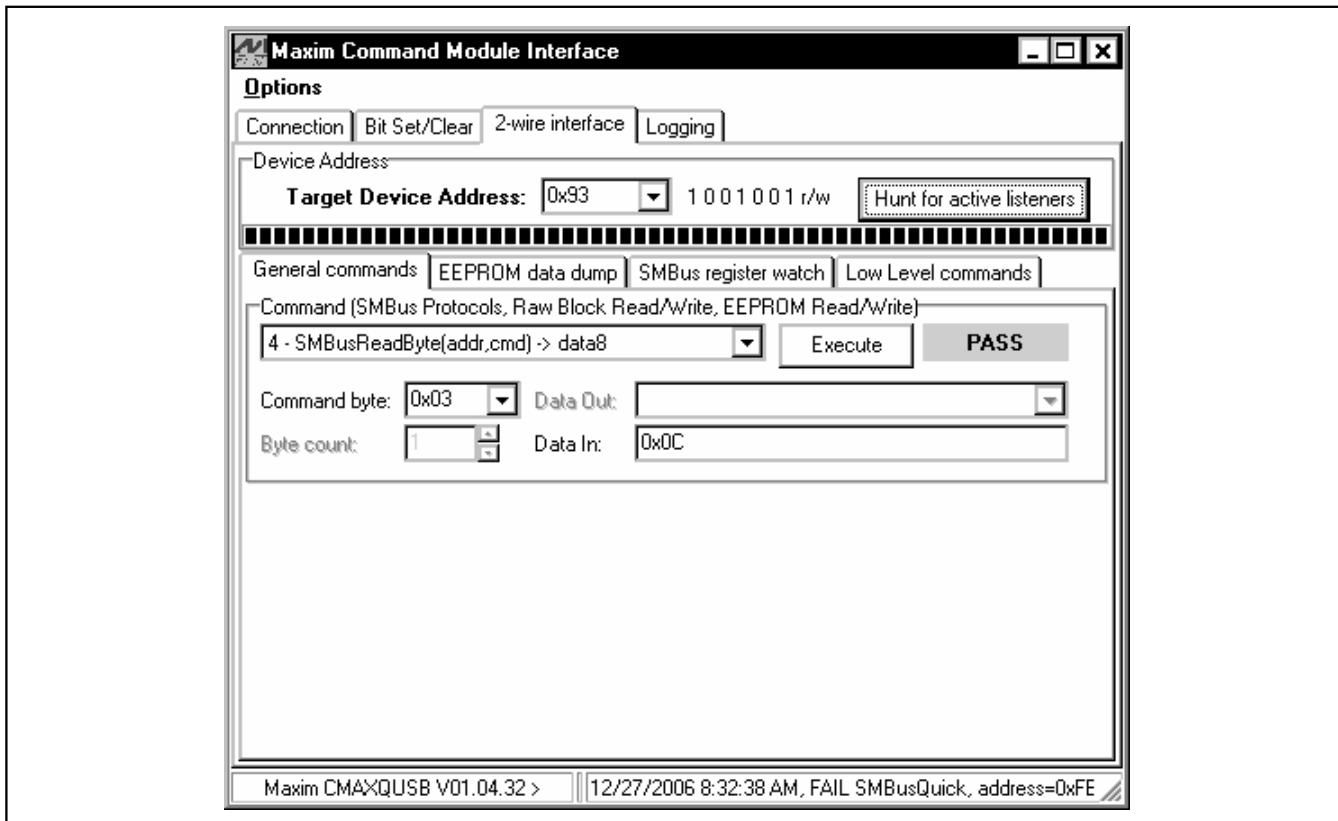


Figure 3. Simple SMBusReadByte Operation Using the Included 2-Wire Interface Diagnostics. (In this example, the software is reading data (0x0C) to Device Address 0x93, Register Address 0x03. The above data sequence detects the MAX9765 in speaker mode.)

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Note: In places where the slave address asks for an 8-bit value, it must be the 7-bit slave address of the MAX9765 as determined by the ADD pin with the last bit set to 1 for a read operation and zero for a write. Refer to the MAX9765 data sheet for a complete list of registers and functions.

Detailed Description of Hardware

The MAX9765 EV kit is a stereo, single-supply speaker/headphone/microphone amplifier. The MAX9765 EV kit is designed to be driven by any stereo audio source.

The input impedance is 15k Ω . The MAX9765 EV kit is shipped with components selected to produce a unity gain and can be powered with a 2.7V to 5.5V supply. A bandpass filter is implemented on the MAX9765 EV kit. The -3dB corner frequencies are approximately 16Hz and 106kHz and are dependent on components R1–R6, C1–C6.

Multiple input and output jacks facilitate easy connections to the board. Connect the speakers to terminal blocks TB1 and TB2. Connect the two stereo input sources through jacks J1–J4. Connect the headphones through J5. Connect the microphone to the MICIN+/MICIN- pads or through the input jack (J8). The amplified microphone output appears on the pad labeled OUT or on J7.

MAX9765 Address Selection

There are four possible I²C/SMBus addresses (refer to the MAX9765 data sheet for details). Jumper JU1 sets the MAX9765 slave address. The default address is 1001 001Y (ADD = VCC). See Table 1 for a complete list of addresses.

Note: The first 7 bits shown are the address. Y (bit 0) is the SMBus read/write bit. This bit is a 1 for a read operation and a zero for a write.

Hardware Shutdown Control

Jumper JU2 controls the hardware shutdown function of the MAX9765 EV kit. This shuts down the MAX9765 I²C/SMBus interface and resets all the registers to their power-on defaults (see Table 2 for shutdown shunt positions).

Table 1. Shunt Settings for SMBus Address

| JUMPER | SHUNT POSITION | MAX9765 ADDRESS PIN | MAX9765 ADDRESS | |
|--------|----------------|---------------------|-----------------|-------------|
| | | | BINARY | HEXADECIMAL |
| JU3 | 1–2* | V _{DD} | 1001 001Y | 0x92h |
| JU3 | 3–4 | SCL | 1001 011Y | 0x96h |
| JU3 | 5–6 | SDA | 1001 010Y | 0x94h |
| JU3 | 7–8 | SGND | 1001 000Y | 0x90h |

*Default configuration.

Table 2. Shutdown Selection

| JUMPER | SHUNT POSITION | DESCRIPTION |
|--------|----------------|-------------------|
| JU2 | 1–2* | MAX9765 enabled |
| JU2 | 2–3 | MAX9765 shut down |

*Default configuration.

Table 3. Manual Headphone Sense Control

| JUMPER | SHUNT POSITION | DESCRIPTION |
|--------|----------------|--|
| JU1 | Installed* | MAX9765 EV kit headphone sense controlled by the insertion of headphones |
| JU1 | Not installed | MAX9765 EV kit headphone sense switch forced open |

*Default configuration.

Manual Headphone Sense Control

Removing the shunt from jumper JU1 simulates a pair of headphones being inserted into the headphone jack by forcing the HPS pin to a logic high. Connect the load to the LEFT, RIGHT, and GND pads located by headphone jack J5 (see Table 3 for jumper settings).

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Evaluates: MAX9765

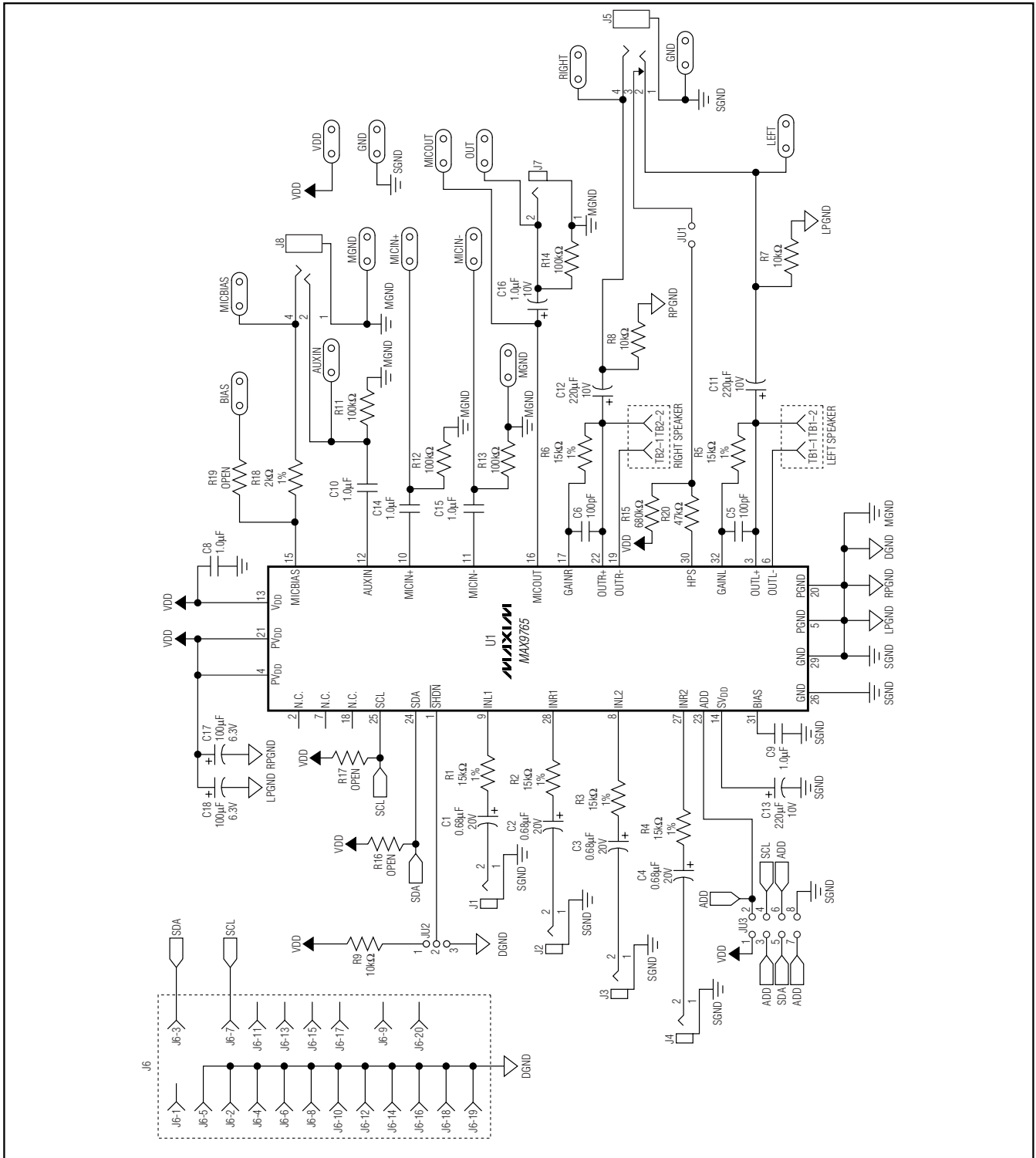


Figure 4. MAX9765 EV Kit Schematic

MAX9765 Evaluation System/Evaluation Kit

Evaluates: MAX9765

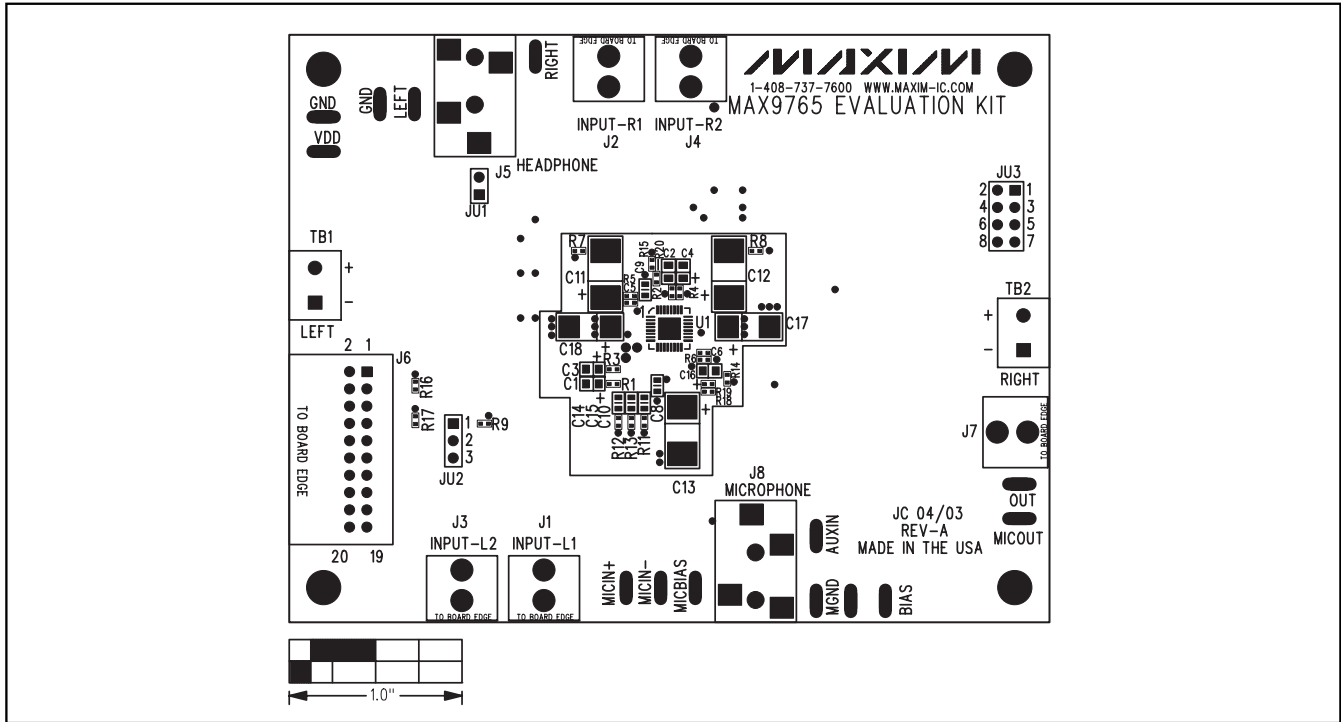


Figure 5. MAX9765 EV Kit Component Placement Guide—Component Side

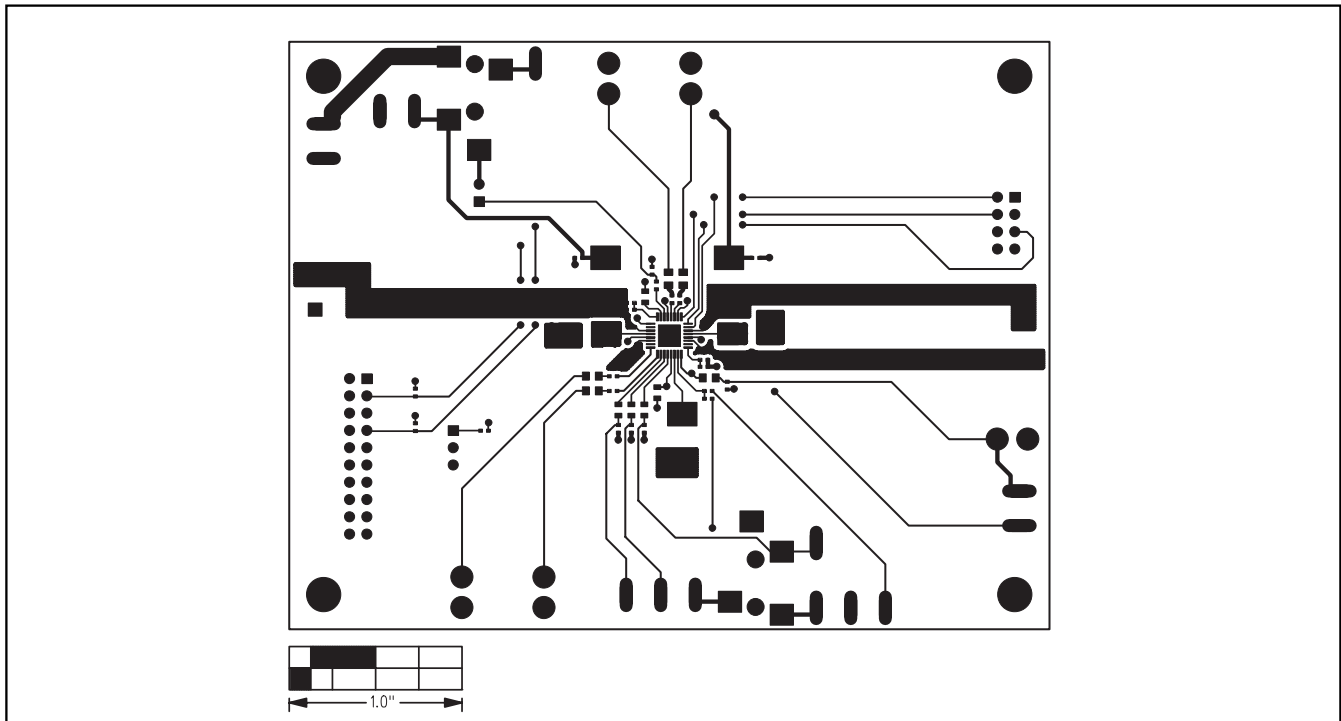


Figure 6. MAX9765 EV Kit PCB Layout—Component Side

MAX9765 Evaluation System/Evaluation Kit

Evaluates: MAX9765

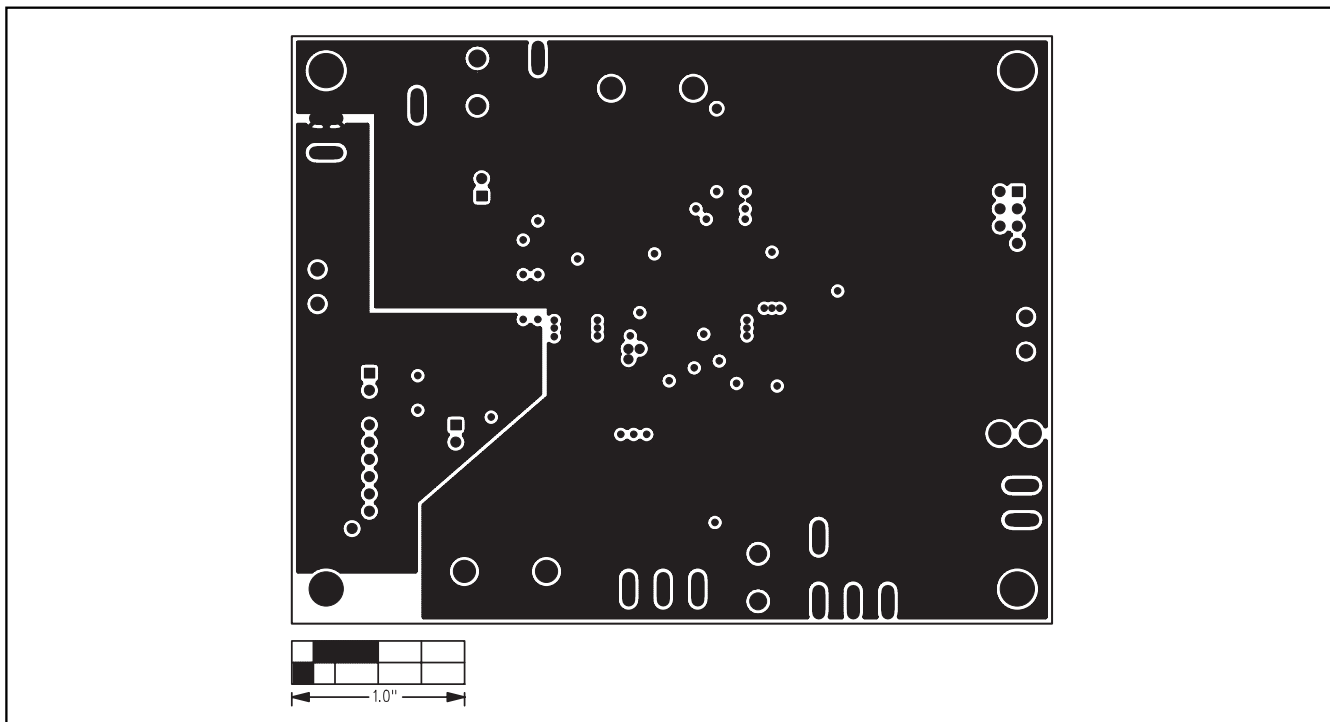


Figure 7. MAX9765 EV Kit PCB Layout—Inner Layer 2

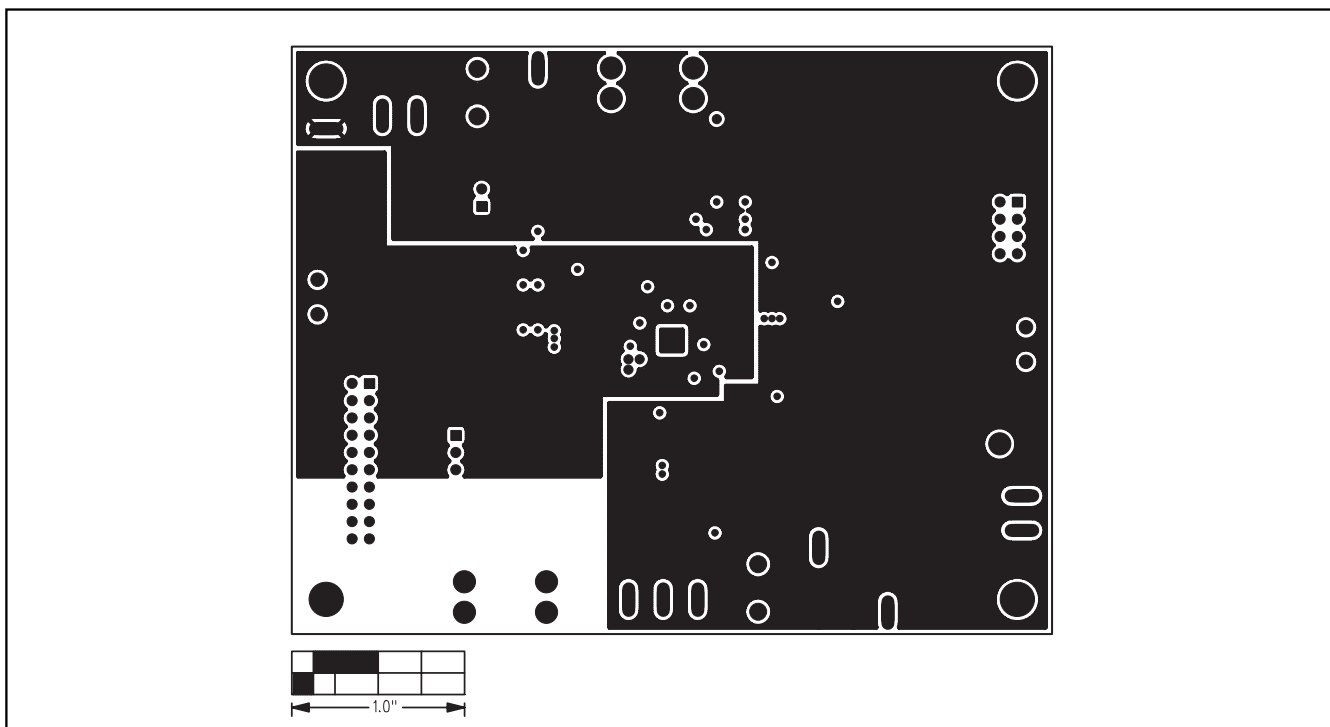


Figure 8. MAX9765 EV Kit PCB Layout—Inner Layer 3

MAX9765 Evaluation System/Evaluation Kit

Evaluates: MAX9765

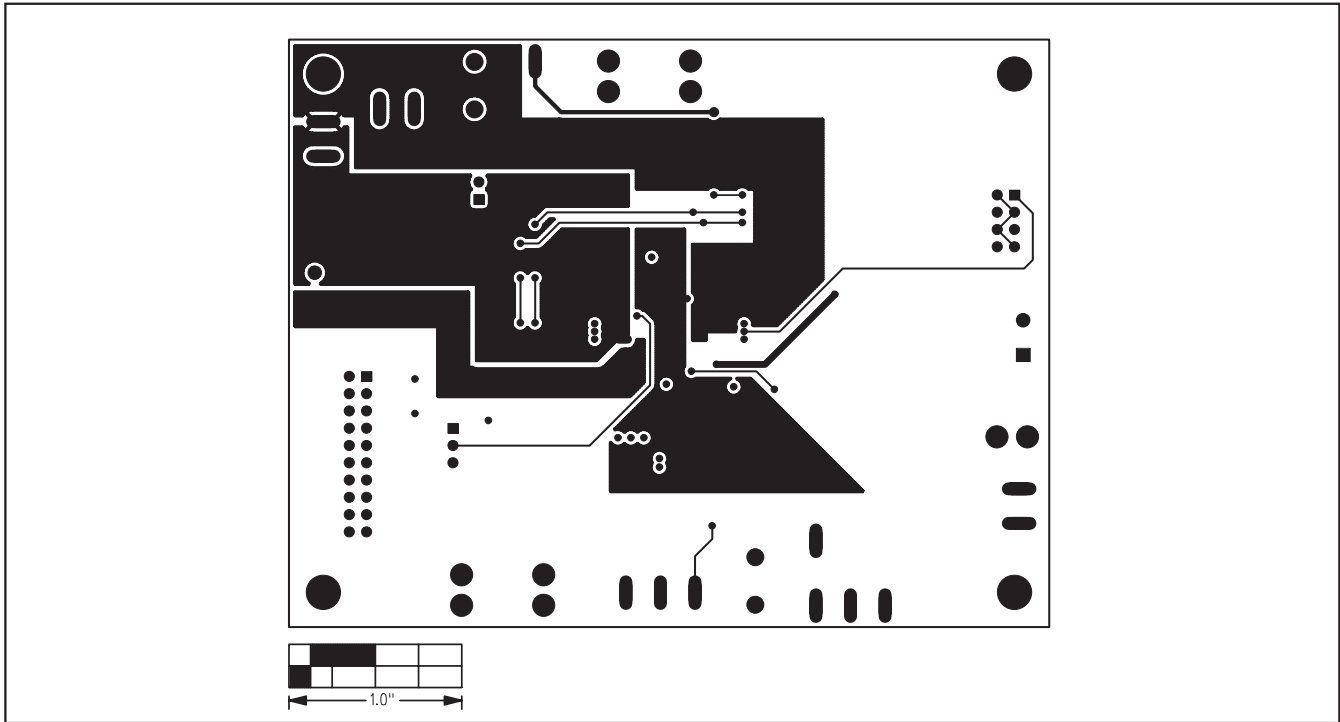


Figure 9. MAX9765 EV Kit PCB Layout—Solder Side

Revision History

Pages changed at Rev 1: 1, 2, 3, 5, 6, 8, 9, 10

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