FEATURES

USB connectivity to host PC
External connectivity to DSP/MCU for digital audio signals (available through general-purpose 2.54 mm pitch connector)
4 audio jacks: stereo line input, mono microphone input, stereo line output, and stereo headphone output
Multiple test points across the board for monitoring signals
Master/slave mode selectivity

GENERAL DESCRIPTION

The SSM2603 is a low power, high quality stereo audio codec for portable digital audio applications with one set of stereo programmable gain amplifier (PGA) line inputs and one monaural microphone input. The board can operate as a master or slave and supports various clock frequencies. The SSM2603 software-programmable stereo output options provide many application possibilities because the device can be used as a headphone driver or as a speaker driver. Its volume control functions provide a large range of gain control of the audio signal. Included in this data sheet is a detailed setup and user guide for the SSM2603 evaluation board hardware and software. Read the Evaluation Board Quick Setup section to ensure that proper communication is established from the host PC to the SSM2603 evaluation board.

This data sheet describes how to configure and use the SSM2603 evaluation board. It is recommended that the SSM2603 evaluation board data sheet be read in conjunction with the SSM2603 data sheet, which provides more detailed information about the specifications, internal block diagrams, and application guidance for the codec IC.

EVALUATION BOARD DESCRIPTION

The SSM2603 evaluation board carries a complete application circuit for the SSM2603. The board features a USB connection to a host PC. This serves as the power supply, digital audio data, and control/status data link, making it a plug-and-play USB audio device that can communicate with the software under the Microsoft® Windows® operating system. The board also has a general-purpose 2.54 mm pitch connector to connect to an external DSP/MCU for digital audio signals.

Figure 1 shows the top view of the PCB. Figure 2 shows the bottom view of the board. The complete schematic of the board is illustrated in Figure 23 to Figure 28. Figure 29 and Figure 30 show the top layer layout and the bottom layer layout, respectively, of the PCB. The bill of materials is shown in Table 1.
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REVISION HISTORY

4/09—Revision 0: Initial Version
EVALUATION BOARD HARDWARE
HARDWARE DESCRIPTION
The SSM2603 evaluation board can be divided into several segments: the microcontroller unit (MCU) with USB interface, power supplies, analog input/output circuitry, the SSM2603 device, and the digital audio interface and bidirectional digital buffer.

**MCU with USB Interface**
The on-board microcontroller (MCU) with USB interface is located on the top left portion of the evaluation board.

- The MCU has two functions: transmitting the SSM2603 registers control word between the host PC and the SSM2603 I2C port and transmitting digital audio data between the host PC and the SSM2603 digital audio interface.
- Use SW1 to reset the MCU.
- When the MCU is working correctly, LED D4 is blinking.
- J8 is a mini Type B USB connector.

**Power Supplies**
The power supplies are located on the top center portion of the board. The entire board is powered through the USB connector. There are three on-board low dropouts (LDOs) deriving 3.3 V from the USB 5 V supply. LED D1, LED D2, and LED D3 indicate power supply status.

- The output from LDO U4 provides the voltage for the digital supply, DBVDD, and the MCU. The LDO output is fixed at 3.3 V.
- The output from LDO U3 provides the voltage for the digital supply, DCVDD. By default, the LDO output is set to 3.3 V. If a voltage other than 3.3 V is needed for DCVDD, the user must remove Resistor R8 and apply the desired external voltage to the power supply pads, AVDD and AGND, on the top center portion of the board.

**Analog Input/Output Circuitry**
The right portion of the SSM2603 board includes analog input and output circuitry for SSM2603. From top to bottom, these are:

- Stereo line input jack
- Mono microphone input jack
- Stereo line output jack
- Stereo headphone output jack
**SSM2603 Device**

The SSM2603 device is located in the center of the SSM2603 evaluation board.

![Figure 6. SSM2603 Device](image)

**Digital Audio Interface and Bidirectional Digital Buffer**

On the bottom left of the evaluation board are the general-purpose digital audio interface, J1, and the bidirectional digital buffer for digital audio signals.

J1 is for connecting the SSM2603 digital audio interface signals to/from the external DSP or MCU. One column of J1 is DGND and the other column is marked with the name of the digital audio signal (BCLK, DACLRG, DACDAT, ADCDAT, ADCLRC, MCLK, and CLKOUT). These signals are routed to the corresponding SSM2603 digital audio interface signals through the digital buffer. The buffer is bidirectional. Its direction is controlled in the software.

![Figure 7. General-Purpose Digital Audio Interface and Buffer](image)
EVALUATION BOARD QUICK SETUP

Follow these five steps to quickly set up the evaluation board:

1. Make sure Jumper JP1 is applied.
2. Connect the board to the host PC with a mini Type B USB cable. The Windows system reports that new hardware has been found if it is the first time the board is connected. The PC installs drivers for the new hardware automatically. When installation is complete, SSM2602/03/04 Eval Board appears on the status bar of the Speaker control panel.
3. Install the SSM2603 evaluation board control software from SSM2603 Eval Board.msi.
4. From the Start menu, select Programs, then ADI, then SSM2603 Eval Board, and then SSM2603.exe to run the control software. If the USB cable is not connected or Jumper JP1 is not applied before running the software, an error message box appears. Close the software, check the hardware connectivity, and rerun the software until the message box no longer appears.
5. When installation is complete, the software GUI appears. Click the DAC button to play music files in media player. You should be able to hear the music from the headphone or from the active speaker connected to the headphone output jack of the evaluation board. Note that only music files with a 48 kHz or 44.1 kHz sample rate are supported in this mode.
GUI FUNCTIONAL BLOCKS

The software GUI is logically split into menu items, command buttons, and the register control panel. The menu is for setting up the software and hardware working mode. The command buttons are for register access. The register control panel is for viewing and modifying each register.

The SSM2603 supports the I2C standard for the register control interface. This is selected under the Mode menu. For I2C mode, you can select between two device addresses in the I2C mode submenu.

There are two available digital audio interfaces for the SSM2603 on-board. One is the USB MCU. This is used to play back music on the host PC and transmit to the SSM2603 DAC, or to record music with the SSM2603 ADC and transmit to the host PC through a USB connection. The other digital audio interface is the general-purpose connector, J1. This is used to connect to your DSP or MCU. Only one interface can communicate with the SSM2603 at one time, and this is selected under the Control menu (see Figure 12).

The Import and Export utilities are for reading/writing the SSM2603 registers in batch mode. The file import utility reads the register setting from a .txt file and then writes to the SSM2603 internal registers. The file export utility reads the SSM2603 internal registers back and then writes to a .txt file.

The .txt file used for SSM2603 register configuration contains multiple lines and each line is for one register. The first word of a line is a 7-bit register address entry, which is in two-digit hexadecimal format. The second word of a line is a 9-bit register value entry, which is in three-digit hexadecimal format. When using the import utility, use the export utility first to generate the software .txt file as a template and then add, remove, or modify the register entries in the template file.

After setting the registers in the SSM2603 GUI window, the control software (see Figure 10), and clicking the Set button, the settings are configured to the corresponding SSM2603 registers. If the Set button is not clicked, the SSM2603 registers are not configured.

The I2C is a read and write protocol, so in I2C mode, when the Get button is clicked, the SSM2603 registers are read back and reflected in the SSM2603 GUI window.

The Reset button corresponds to SSM2603 Register R15. When it is clicked, all SSM2603 registers are set to the power-on reset value.

There are three short-cut buttons: DAC, ADC, and Bypass. These are used to quickly set the panel for the DAC path, the ADC path, and the analog line-in to analog line-out loopback path, respectively.

The SSM2603 GUI window is logically split into several different functional blocks. Each functional block represents the underlying internal register of the SSM2603 that corresponds to the block.

Power Management Control

This section controls SSM2603 Register R6. If an option is checked, the power for that corresponding module is turned off; otherwise, the power is turned on for that part. For example, selecting POWER OFF shuts down the chip.


**Line Input Control**

This section controls SSM2603 Register R0 and Register R1 for the left and right line input channel, respectively. Note that the **Right channel follows left** option and the **Left channel follows right** option are mutually exclusive.

![Line Input Control Section](image)

**Headphone Output Control**

This section controls SSM2603 Register R2 and Register R3 for the left and right headphone output channel, respectively. Note that the **Right channel follows left** option and **Left channel follows right** option are mutually exclusive.

![Headphone Output Control Section](image)

**Digital Audio Interface Control**

This section controls SSM2603 Register R7 and D[2:1] of Register R5. Specifically, the **Active/Inactive** option corresponds to R9.

![Digital Audio Interface Control Section](image)

**Sample Rate Control**

This section controls SSM2603 Register R8.

![Sample Rate Control Section](image)

**Analog and Digital Audio Path Control**

This section controls SSM2603 Register R4 and Register R5 for the analog and digital audio path, respectively. **MIC Input** corresponds to D[8:6] and D[1:0] of R4. **Audio Mixer** corresponds to D[5:3] of R4. **DAC & ADC** corresponds to D[4:3] and D0 of R5 and D2 of R4.

![Analog and Digital Audio Path Control Section](image)

**ALC Control**

This section controls SSM2603 Register R16 and Register R17.

![ALC Control Section](image)

**Noise Gate Control**

This section controls SSM2603 Register R18.

![Noise Gate Control Section](image)
Figure 23. Schematic of SSM2603 Evaluation Board, SSM2603 Chip

Figure 24. Schematic of SSM2603 Evaluation Board, Power Supply
Figure 25. Schematic of SSM2603 Evaluation Board, Digital Buffer

Figure 26. Schematic of SSM2603 Evaluation Board, Analog Output
Figure 27. Schematic of SSM2603 Evaluation Board, Analog Input

Figure 28. Schematic of SSM2603 Evaluation Board, USB MCU
Figure 29. Layout of SSM2603 Evaluation Board, Top Layer

Figure 30. Layout of SSM2603 Evaluation Board, Bottom Layer
## ORDERING INFORMATION

### BILL OF MATERIALS

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<th>Manufacturer</th>
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1 | U9 | TAS1020B, QFP48-20-355 | TI | TAS1020B |
1 | U10 | ADM1818, SOT-23 | Analog Devices | ADM1818 |
1 | Y1 | 6 MHz, Osc2-190-430x175 | ECS | ECS-60-32-4X |

**ORDERING GUIDE**

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<td>Evaluation Board</td>
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¹ Z = RoHS Compliant Part.

**ESD CAUTION**

ESD (electrostatic discharge) sensitive device. Charged devices and circuit boards can discharge without detection. Although this product features patented or proprietary protection circuitry, damage may occur on devices subjected to high energy ESD. Therefore, proper ESD precautions should be taken to avoid performance degradation or loss of functionality.