PCM3070EVM-K Evaluation Module

This user's guide describes the characteristics, operation, and use of the PCM3070EVM-K. This evaluation module (EVM) features a complete stereo audio codec with several inputs and outputs, extensive audio routing, mixing, and effects capabilities. A complete circuit description, schematic diagram, and bill of materials are also included.

Contents

1 EVM Overview 3
2 EVM Description and Basics 3
3 PCM3070EVM-K Setup and Installation 7
4 PCM3070 Control Software 11
5 Related Documents 19
Appendix A EVM Connector Descriptions 20
Appendix B PCM3070EVM Schematic 24
Appendix C PCM3070EVM Bill of Materials 27
Appendix D USB-MODEVM Schematic 29
Appendix E USB-MODEVM Bill of Materials 32
Appendix F USB-MODEVM Protocol 34

List of Figures

1 PCM3070EVM-K Block Diagram 4
2 Initial Screen of PCM3070EVM-K Software 9
3 Compatibility Tab 10
4 Playback Script Tab 12
5 Playback Panel 13
6 Audio Recording Panel 14
7 DRC Information Tab 15
8 Program Codec Pop-Up Window 15
9 Audio Inputs Panel 16
10 Status Flags Panel 17
11 Register Tables Panel 18
12 Command-line Interface Panel 19
13 PCM3070EVM Schematic, Sheet 1 24
14 PCM3070EVM Schematic, Sheet 2 25
15 PCM3070EVM Schematic, Sheet 3 26
16 USB-MODEVM Interface Board, Sheet 1 29
17 USB-MODEVM Interface Board, Sheet 2 30
18 USB-MODEVM Interface Board, Sheet 3 31

List of Tables

1 USB-MODEVM SW2 Settings 5

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2 List of Jumpers and Switches 5
3 Analog Interface Pinout 20
4 Alternate Analog Connectors 21
5 Digital Interface Pinout 22
6 Power Supply Pinout 23
7 PCM3070EVM Bill of Materials 27
8 USB-MODEVM Bill of Materials 32

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1 EVM Overview

1.1 Features

- Full-featured evaluation board for the PCM3070 stereo audio codec
- USB connection to personal computer (PC) provides power, control, and streaming audio data for easy evaluation
- Onboard microphone for ADC evaluation
- Connection points for external control and digital audio signals for quick connection to other circuits/input devices

The PCM3070EVM-K is a complete evaluation kit, which includes a universal serial bus (USB)-based motherboard and evaluation software for use with a personal computer running the Microsoft Windows® operating system (Windows Win2000 or Windows XP).

1.2 Introduction

The PCM3070EVM is in the Texas Instruments (TI) modular EVM form factor, which allows direct evaluation of the device performance and operating characteristics and eases software development and system prototyping.

The PCM3070EVM-K is a complete evaluation/demonstration kit, which includes a USB-based motherboard called the USB-MODEVM Interface board and evaluation software for use with a PC running the Microsoft Windows operating systems.

The PCM3070EVM-K is operational with one USB cable connection to a PC. The USB connection provides power, control, and streaming audio data to the EVM for reduced setup and configuration. The EVM also allows external control signals, audio data, and power for advanced operation, which allows prototyping and connection to the rest of the development or system evaluation.

2 EVM Description and Basics

This section provides information on the analog input and output, digital control, power, and general connection of the PCM3070EVM-K .

2.1 PCM3070EVM-K Block Diagram

The PCM3070EVM-K consists of two separate circuit boards, the USB-MODEVM and the PCM3070EVM. The USB-MODEVM is built around the TAS1020B streaming audio USB controller with an 8051-based core. The motherboard features two positions for modular EVMs, or one double-wide serial modular EVM can be installed. The PCM3070EVM is one of the double-wide modular EVMs that is designed to work with the USB-MODEVM.

The simple diagram of Figure 1 shows how the PCM3070EVM is connected to the USB-MODEVM. The USB-MODEVM Interface board is intended to be used in USB mode, where control of the installed EVM is accomplished using the onboard USB controller device. Provision is made, however, for driving all the data buses (I^2C™, SPI™, I^2S, etc.) externally. The source of these signals is controlled by SW2 on the USB-MODEVM. See Table 1 for details on the switch settings.

The USB-MODEVM has two EVM positions that allow for the connection of two small evaluation modules or one larger evaluation module. The PCM3070EVM is designed to fit over both of the smaller evaluation module slots as shown in Figure 1

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2.1.1 USB-MODEVM Interface Board

The diagram of Figure 1 shows only the basic features of the USB-MODEVM Interface board.

Because the PCM3070EVM is a double-wide modular EVM, it is installed with connections to both EVM positions, which connects the PCM3070 digital control interface to the I^2C port realized using the TAS1020B, as well as the TAS1020B digital audio interface.

In the factory configuration, the board is ready to be used with the USB-MODEVM. To view all the functions and configuration options available on the USB-MODEVM board, see the USB-MODEVM Interface Board schematic in Appendix F.

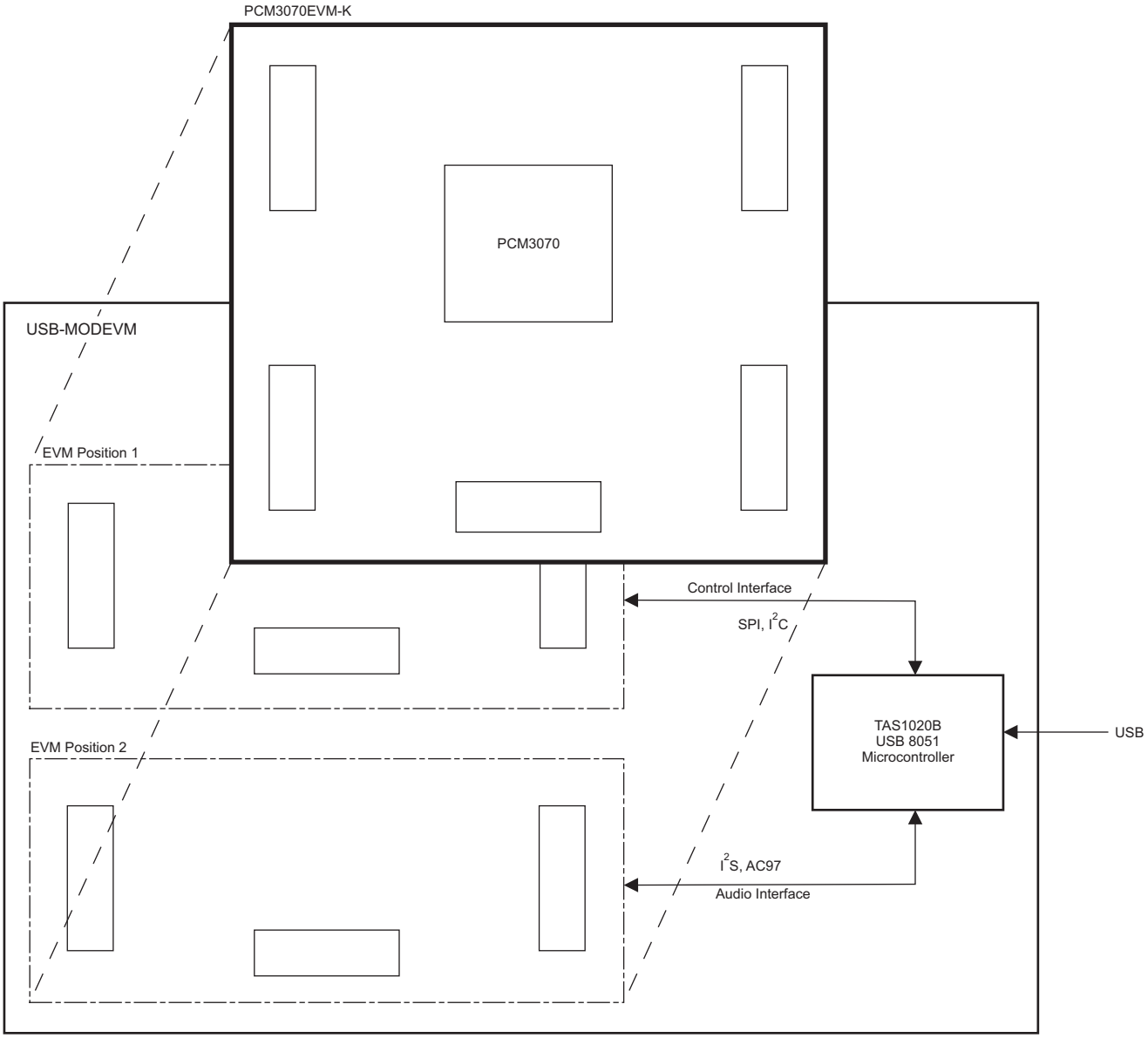


Figure 1. PCM3070EVM-K Block Diagram

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2.2 Default Configuration and Connections

2.2.1 USB-MODEVM

Table 1 provides a list of the SW2 settings on the USB-MODEVM. For use with the PCM3070EVM, SW-2 positions 1, 3, 4, 5, 6, and 7 must be set to ON, whereas SW-2.2 and SW-2.8 must be set to OFF. If the PCM3070EVM is to be used with an external audio interface, SW2.4 and SW2.5 also need to be set to OFF and such interface must be connected as explained in Section 2.4

Table 1. USB-MODEVM SW2 Settings

SW-2 Switch Number	Label	Switch Description
1	A0	USB-MODEVM EEPROM I^{2}C Address A0 ON: A0 = 0 OFF: A0 = 1
2	A1	USB-MODEVM EEPROM I^{2}C Address A1 ON: A1 = 0 OFF: A1 = 1
3	A2	USB-MODEVM EEPROM I^{2}C Address A2 ON: A2 = 0 OFF: A2 = 1
4	USB I^{2}S	I^{2}S Bus Source Selection ON: I^{2}S Bus connects to TAS1020 OFF: I^{2}S Bus connects to USB-MODEVM J14
5	USB MCK	I^{2}S Bus MCLK Source Selection ON: MCLK connects to TAS1020 OFF: MCLK connects to USB-MODEVM J14
6	USB SPI	SPI Bus Source Selection ON: SPI Bus connects to TAS1020 OFF: SPI Bus connects to USB-MODEVM J15
7	USB RST	RST Source Selection ON: EVM Reset Signal comes from TAS1020 OFF: EVM Reset Signal comes from USB-MODEVM J15
8	EXT MCK	External MCLK Selection ON: MCLK Signal is provided from USB-MODEVM J10 OFF: MCLK Signal comes from either selection of SW2-5

2.2.2 PCM3070 Jumper Locations

Table 2 provides a list of jumpers found on the EVM and their factory default conditions.

Table 2. List of Jumpers and Switches

Jumper	Default Position	Jumper Description
W1	Removed	Connects an external microphone bias.
W2	Removed	Onboard microphone connect (-).
W3	Removed	Onboard microphone connect (+).
W4	Removed	Connects bias resistor to IN3_R.
W5	Removed	Connects bias resistor to IN3_L.
W6	Removed	Provides means to change effective resistance to 1 kΩ for differential microphone.
W7	Installed	Connects IN3_R to J5/microphone.
W8	Removed	Connects IN3_R to GND or 1-kΩ pulldown.
W9	Removed	Connects 16-Ω load to HPL
W10	Removed	Connects 16-Ω load to HPR
W11	Removed	DC-couples HPL to its output. Use when driving differentially.
W12	Removed	DC-couples HPR to its output. Use when driving differentially.
W13	Installed	Selects the onboard EEPROM as the TAS1020B firmware source.

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Table 2. List of Jumpers and Switches (continued)

Jumper	Default Position	Jumper Description
W14	Installed	Connects SCLK for USB SPI.
W15	Installed	Connects $\overline{\text{RESET}}$ for USB RESET.
W16	Installed	Provides a means to measure IOVDD current.
W17	Installed	Provides a means to measure DVDD current.
W18	Installed	Provides a means to measure LDO in/HPVDD current.
W19	Installed	Provides a means to measure AVDD current.
W20	2-3	Selects LDOin/HPVDD +5-V regulator source.
W21	Installed	Connects IOVDD from the header block to the rest of the circuit.
W22	Removed	DC-couples IN2_L. Use when evaluating DC measurement feature for this pin.
W23	Removed	DC-couples IN2_R. Use when evaluating DC measurement feature for this pin.
SW1	I2C	When set to I2C, the I2C signals from P12/J12 are connected to the codec and SPI_SELECT is set low. When set to SPI, the SPI signals from P12/J12 are connected to the codec and SPI_SELECT is pulled to IOVDD.
SW2	LOW	When set to LOW, AVDD and DVDD are connected to +1.8 VA and +1.8 VD, respectively, and LDO_SELECT is set low. When set to HI, AVDD, and DVDD are disconnected from other supplies and LDO_SELECT is pulled to IOVDD.

2.3 Analog Signal Connections

2.3.1 Analog Inputs

The analog input sources can be applied directly to terminal blocks J2, J3, and J4 or input jacks J1 and J5. The connection details can be found in Appendix A.

2.3.2 Analog Output

The analog outputs are available from terminal blocks J6 and J8 or output jacks J7, J9, and J10. Note that J10 is provided for signal-to-noise ratio (SNR) measurements only. The connection details can be found in Appendix A.

2.4 Digital Signal Connections

The digital inputs and outputs of the EVM can be monitored through P12 and P22. If external signals need to be connected to the EVM, digital inputs must be connected via J14 and J15 on the USB-MODEVM and the SW2 switch must be changed accordingly (see Section 2.2.1). The connector details are available in Section A.2.

2.5 Power Connections

The PCM3070EVM can be powered independently when being used in stand-alone operation or by the USB-MODEVM when it is plugged onto the motherboard.

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2.5.1 Stand-Alone Operation

When used as a stand-alone EVM, power is applied to P23/J23 directly; make sure to reference the supplies to the appropriate grounds on that connector.

CAUTION

Verify that all power supplies are within the safe operating limits shown on the PCM3070 data sheet before applying power to the EVM.

P23/J23 provides connection to the common power bus for the PCM3070EVM. Power is supplied on the pins listed in Table 6.

The PCM3070EVM-K motherboard (the USB-MODEVM Interface board) supplies power to P23/J23 of the PCM3070EVM. Power for the motherboard is supplied either through its USB connection or via terminal blocks on that board.

2.5.2 USB-MODEVM Operation

The USB-MODEVM Interface board can be powered from several different sources:

- USB
- 6-Vdc to 10-Vdc ac/dc external wall supply (not included)
- Laboratory power supply

When powered from the USB connection, JMP6 must have a shunt from pins 1–2 (this is the default factory configuration). When powered from 6-Vdc to 10-Vdc power supply, either through the J8 terminal block or J9 barrel jack, JMP6 must have a shunt installed on pins 2–3. If power is applied in any of these ways, onboard regulators generate the required supply voltages, and no further power supplies are necessary.

If laboratory supplies are used to provide the individual voltages required by the USB-MODEVM Interface, JMP6 must have no shunt installed. Voltages are then applied to J2 (+5VA), J3 (+5VD), J4 (+1.8VD), and J5 (+3.3VD). The +1.8VD and +3.3VD can also be generated on the board by the onboard regulators from the +5VD supply; to enable this configuration, the switches on SW1 need to be set to enable the regulators by placing them in the ON position (lower position, looking at the board with text reading right-side up). If +1.8VD and +3.3VD are supplied externally, disable the onboard regulators by placing SW1 switches in the OFF position.

Each power supply voltage has an LED (D1-D7) that illuminates when the power supplies are active.

3 PCM3070EVM-K Setup and Installation

The following section provides information on using the PCM3070EVM-K, including setup, program installation, and program usage.

NOTE: If using the EVM in stand-alone mode, the software must be installed per the following instructions, but the hardware configuration may be different.

3.1 Software Installation

1. Download the latest version of the PCM3070 Control Software (CS) located in the http://focus.ti.com/docs/toolsw/folders/print/pcm3070evm-k.html.
2. Open the self-extracting installation file.
3. Extract the software to a known folder.
4. Install the EVM software by double-clicking the **Setup** executable, and follow the directions. The user may be prompted to restart their computer.

This installs all the PCM3070EVM-K software and required drivers onto the PC.

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3.2 EVM Connections

1. Ensure that the PCM3070EVM is installed on the USB-MODEVM Interface board, aligning J11, J12, J21, J22, and J23 with the corresponding connectors on the USB-MODEVM.
2. Verify that the jumpers and switches are in their default conditions.
3. Attach a USB cable from the PC to the USB-MODEVM Interface board. The default configuration provides power, control signals, and streaming audio via the USB interface from the PC. On the USB-MODEVM, LEDs D3, D4, D5, and D7 illuminate to indicate that the USB is supplying power.
4. For the first connection, the PC recognizes new hardware and begins an initialization process. The user may be prompted to identify the location of the drivers or allow the PC to automatically search for them. Allow the automatic detection option.
5. Once the PC confirms that the hardware is operational, D2 on the USB-MODEVM illuminates to indicate that the firmware has been loaded and the EVM is ready for use. If D2 does not illuminate, verify that the EEPROM jumper and switch settings conform to Table 1 and Table 2.

After the PCM3070EVM-K software installation (described in Section 3.2) is complete, evaluation and development with the PCM3070 can begin.

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The PCM3070EVM-K software can now be launched. The user sees an initial screen that looks similar to Figure 2.

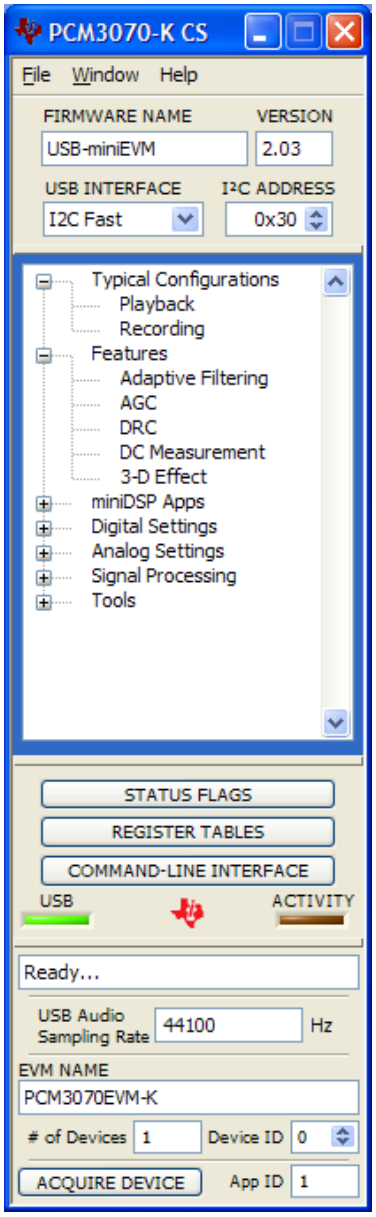


Figure 2. Initial Screen of PCM3070EVM-K Software

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If running the software in Windows Vista or Windows 7, right-click the PCM3070EVM-K CS shortcut and select *Properties*. Configure the *Compatibility* tab as shown in Figure 3

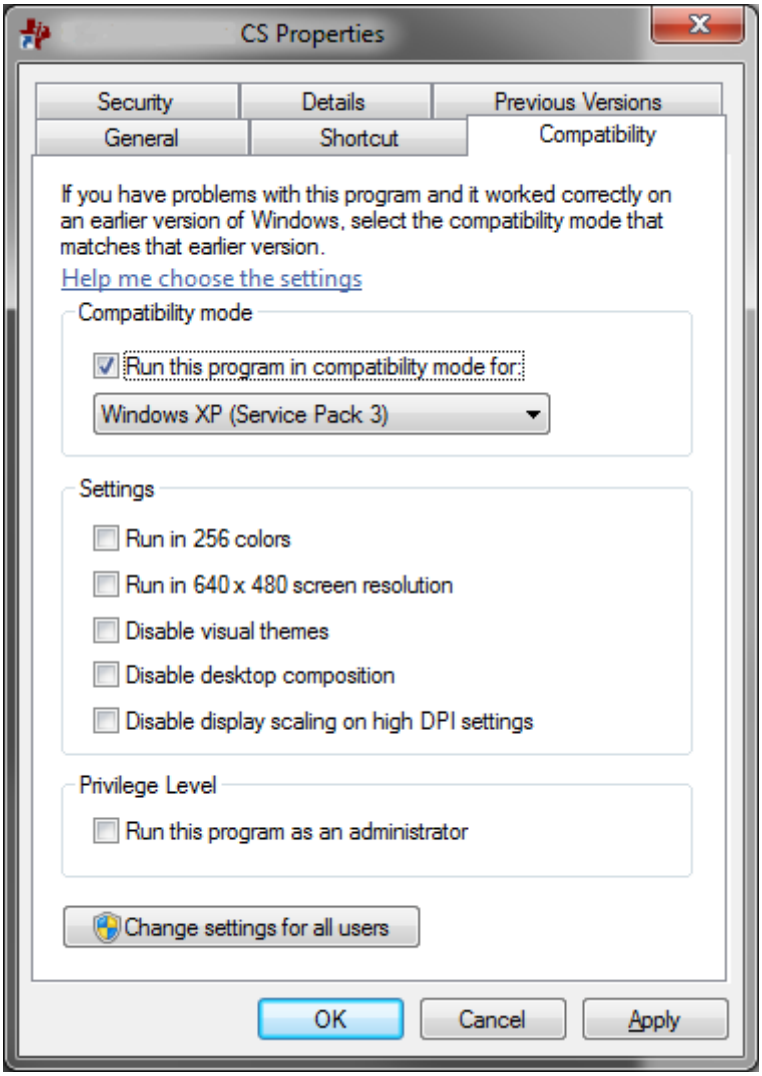


Figure 3. Compatibility Tab

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4 PCM3070 Control Software

The PCM3070 Control Software (CS) is an intuitive, easy-to-use, powerful tool to learn, evaluate, and control the PCM3070. This tool was specifically designed to make learning the PCM3070 software easy. The following sections describe the operation of this software.

4.1 Main Panel Window

The Main Panel window, shown in Figure 2, provides easy access to all the features of the PCM3070-K CS. The Firmware Name and Version boxes provide information about the firmware loaded into the EVM's EEPROM.

The USB-MODEVM Interface drop-down menu allows the user to select which communication protocol the TAS1020B USB Controller uses to communicate with the PCM3070 or to toggle the TAS1020B GPIO pins. The PCM3070 supports I^2C Standard, I^2C Fast, and 8-bit register SPI. The USB-MODEVM Interface selection is global to all panels, including the Command-Line Interface. To communicate to the PCM3070 using SPI, SW1 must be switched towards SPI and W14 must be set to 1-2 on the PCM3070EVM.

The Panel Selection Tree provides access to typical configurations, features, and other panels that allow the user to control the PCM3070. The tree is divided into several categories which contain items that pop up panels. A panel can be opened by double-clicking any item inside a category in the Panel Selection Tree.

Below the Panel Selection Tree are three buttons that pop up the following:

- Status Flags - Allows the user to monitor the PCM3070 status flags.
- Register Tables - A tool to monitor register pages.
- Command-Line Interface - A tool to execute/generate scripts and monitor register activity.

The USB LED indicates if the EVM kit is recognized by the software and the ACTIVITY LED illuminates every time a command request is sent.

The dialog box at the bottom of the Main Panel provides feedback of the current status of the software.

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4.1.1 Typical Configurations

This category can help users to quickly become familiar with the PCM3070. Each of the panels that can be accessed through this menu have controls relevant to the selected configuration; a tab shows the script that will be loaded for that particular configuration. Each script includes a brief description of the selected configuration, as shown in Figure 4.

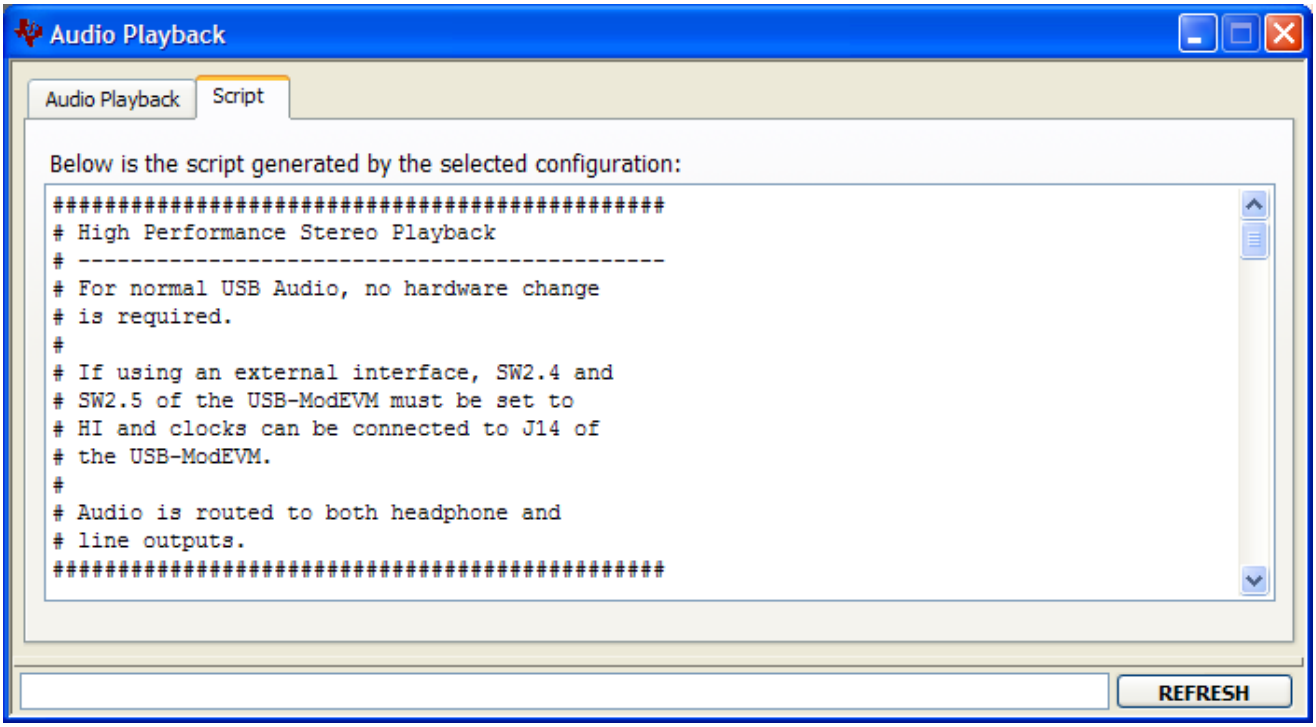


Figure 4. Playback Script Tab

4.1.1.1 Playback

The Playback panel (shown in Figure 5) has the following configurations:

- High Performance Stereo Playback - this configuration programs the PCM3070 for low-noise, high-performance stereo playback through both line and headphone outputs.
- Direct Analog Bypass - this configuration routes IN1_L/IN1_R to HPL/HPR.
- PGA Analog Bypass - this configuration routes IN1_L/IN1_R to the analog input amplifier (Mic PGA) which is then routed to both the line and headphone amplifiers.

The analog inputs and outputs used for these configurations can be accessed as follows:

1. IN1_L / IN1_R - Jack J1 or terminal block J2.
2. Line outputs - Jack J7 or terminal block J6.
3. Headphone outputs - Jack J9 or terminal block J8.

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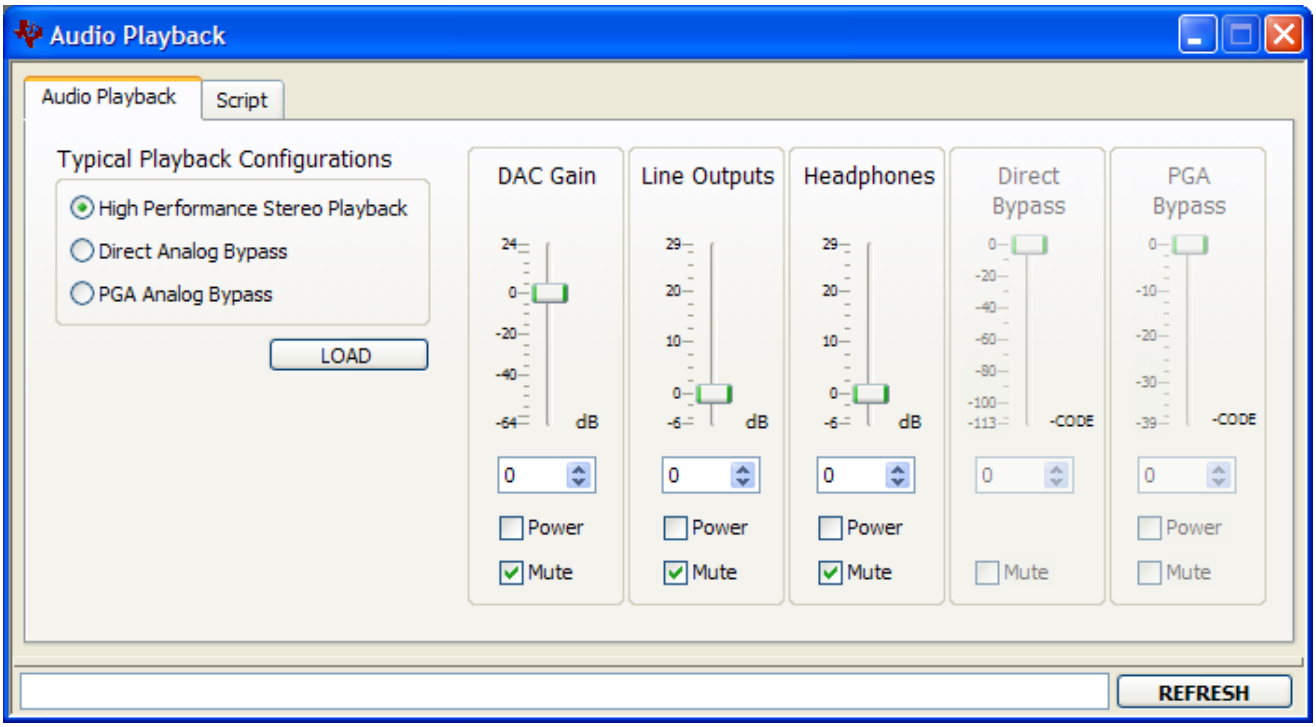


Figure 5. Playback Panel

4.1.1.2 Audio Recording

The Audio Recording panel (shown in Figure 6) has the following configurations:

- High Performance Stereo Recording - this configuration programs the PCM3070 for low-noise, high-performance stereo recording. IN1_L and IN1_R are routed in a single-ended fashion.

  The analog inputs used for these configurations can be accessed as follows:

  1. IN1_L / IN1_R - Jack J1 or terminal block J2.

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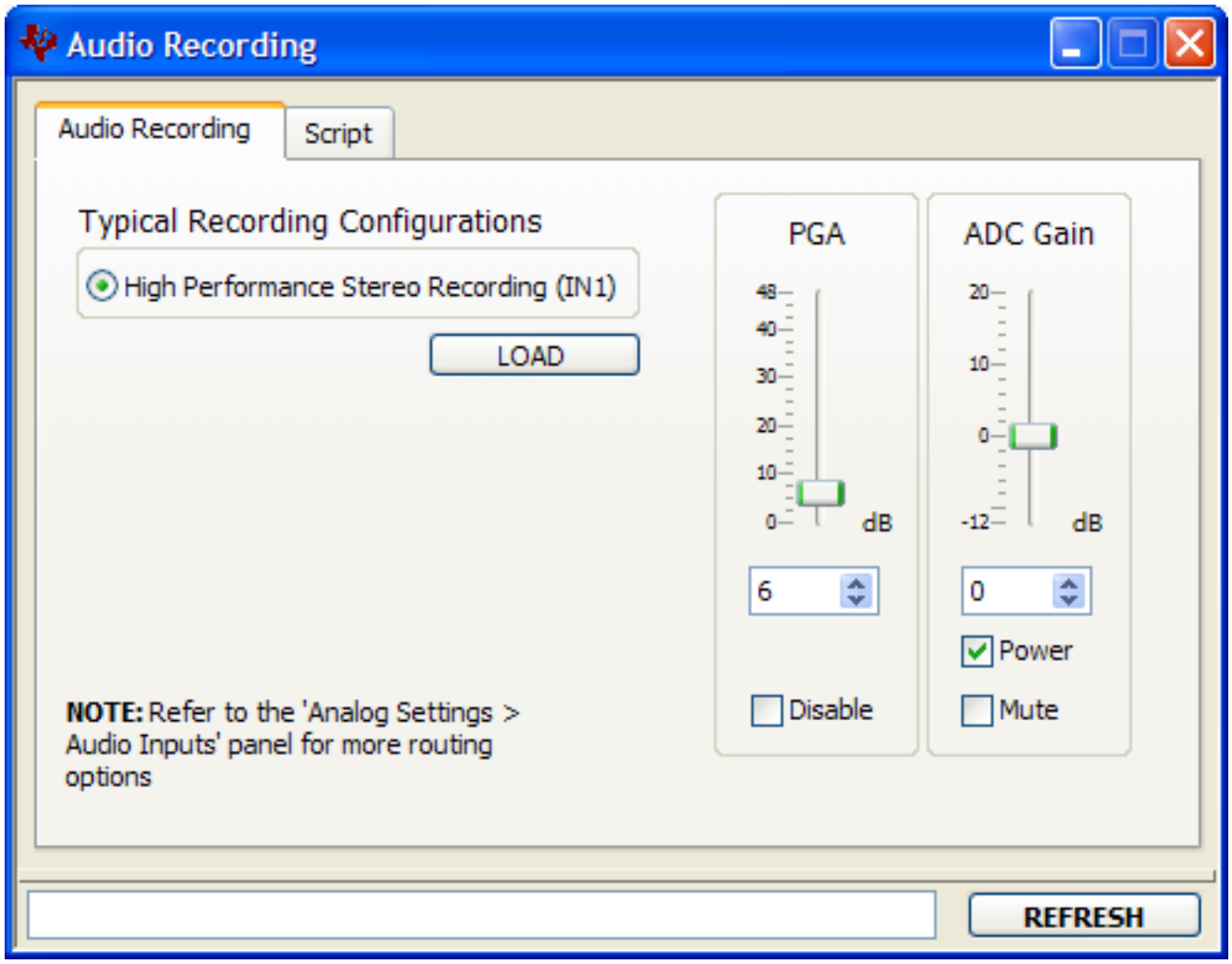


Figure 6. Audio Recording Panel

4.1.2 Features

The **Features** category allows the user to evaluate various features of the PCM3070. Each of the **Features** panels include an **Information** tab that explains the feature and provides hardware setup information for easy evaluation, as seen in Figure 7.

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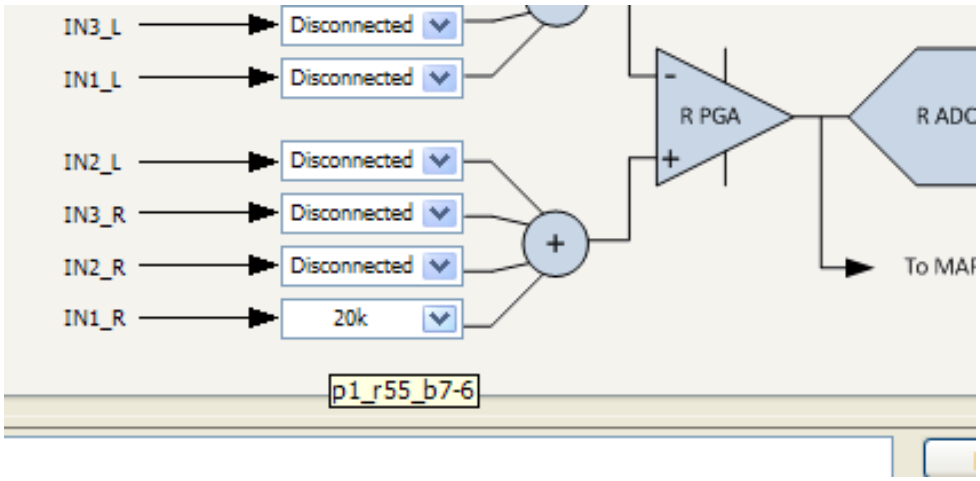


Figure 7. DRC Information Tab

Any item in the **Features** category can be accessed by a double-click. As soon as a **Features** panel opens, a pop-up message appears asking to program the codec for that feature (see Figure 8). A command script is sent to the codec if the **OK** button is clicked. This script programs all registers necessary to evaluate the feature. This can be bypassed by clicking the **Cancel** button.

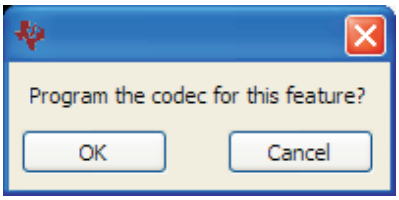


Figure 8. Program Codec Pop-Up Window

The script corresponding to each feature can be accessed at the Installation Directory\DATA\EVM folder. Also, each script can be manually customized and loaded as the feature's start-up script as long as the file name remains the same.

4.1.3 miniDSP Applications

The PCM3070 features two miniDSP cores, one for the ADC and another for the DAC.

Currently, the PCM3070-K CS has two DAC miniDSP applications: Equalizers and Spectrum Analyzer. Visit the PCM3070EVM-K product folder for updates and availability on new miniDSP applications.

See the miniDSP section in the data sheet (SLAS549) for information on how to develop custom miniDSP algorithms.

4.1.4 Control Categories

The **Digital Settings**, **Analog Settings**, and **Signal Processing** categories provide control of many registers and other features of the PCM3070 . These categories are intended for the advanced user. Hovering the mouse cursor on top of a control displays a tip strip that contains page, register, and bit information. As an example, hovering on top of IN1_R of the Audio Inputs panel, as shown in Figure 9 displays p1_r55_b7-6 which means that this control writes to Page 1/Register 55/Bits D7 to D6.

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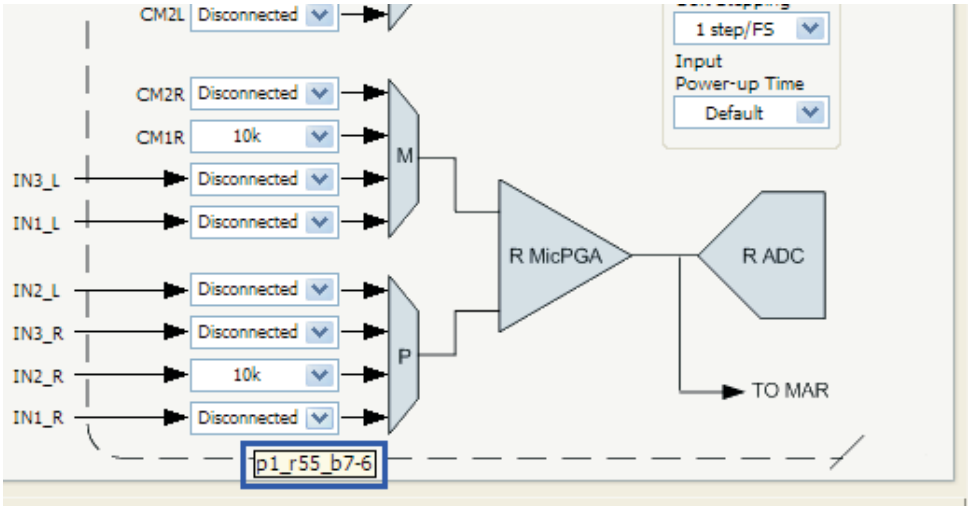


Figure 9. Audio Inputs Panel

Before changing a control, see the data sheet to ensure that a particular control is compatible with the current state of the codec. As an example, some controls in the **Analog Setup** panel must be modified in a particular order as described in the data sheet. Other controls must only be modified with a specific hardware setup, such as powering up the AVDD LDO.

All controls update their status with respect to the register contents in the following conditions:

- A panel is opened.
- The **Execute Command Buffer** button in the **Command-Line Interface** is pressed.
- The **Refresh** button at the bottom right of a panel is pressed.

4.2 Status Flags Panel

The PCM3070 status flags can monitored in the **Status Flags** panel (Figure 10) which is located below the **Panel Selection Tree** . Pressing the **POLL** button continuously reads all the registers relevant to each flag and updates those flags accordingly. The rate at which the registers are read can be modified by changing the value in the **Polling Interval** numeric control. Note that a smaller interval reduces responsiveness of other controls, especially volume sliders, due to bandwidth limitations. By default, the polling interval is 200 ms and can be set to a minimum of 20 ms.

The **Sticky Flags** tab contains indicators whose corresponding register contents clear every time a read is performed to that register. To read all the sticky flags, click the **Read Sticky Flags** button.

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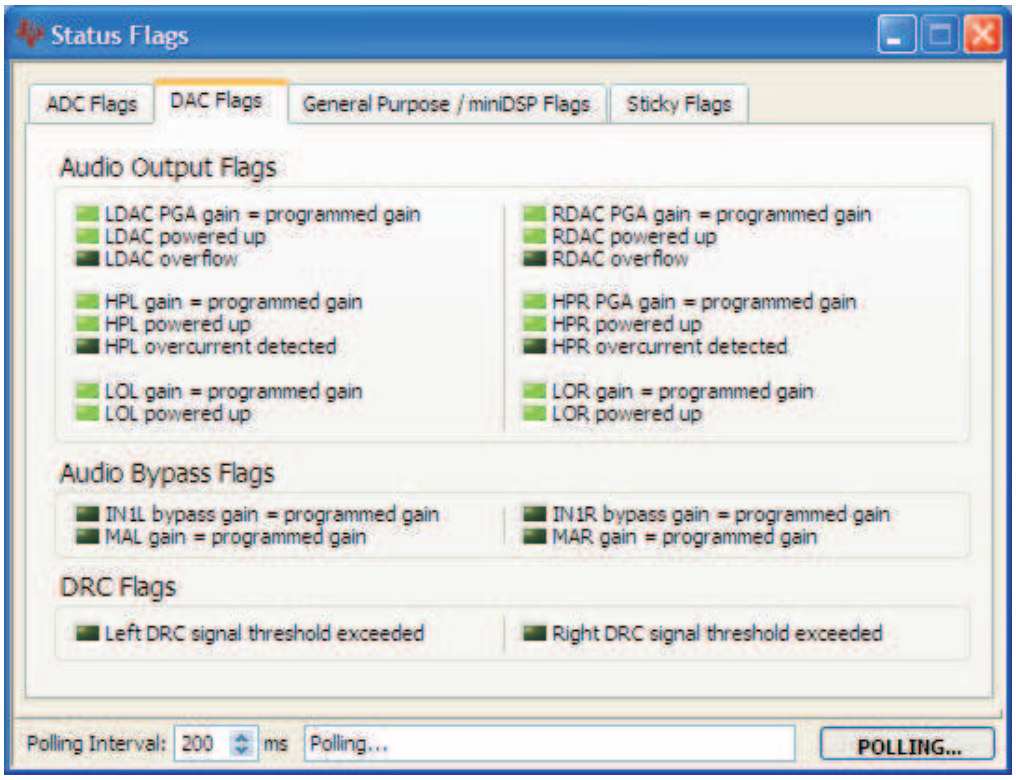


Figure 10. Status Flags Panel

4.3 Register Tables Panel

The contents of configuration and coefficient pages of the PCM3070 can be accessed through the **Register Tables** panel (Figure 11).

The **Page Number** control changes to the page to be displayed in the register table. The register table contains page information such as the register name, reset value, current value, and a bitmap of the current value. The contents of the selected page can be exported into a spreadsheet by clicking the **Dump to Spreadsheet** button.

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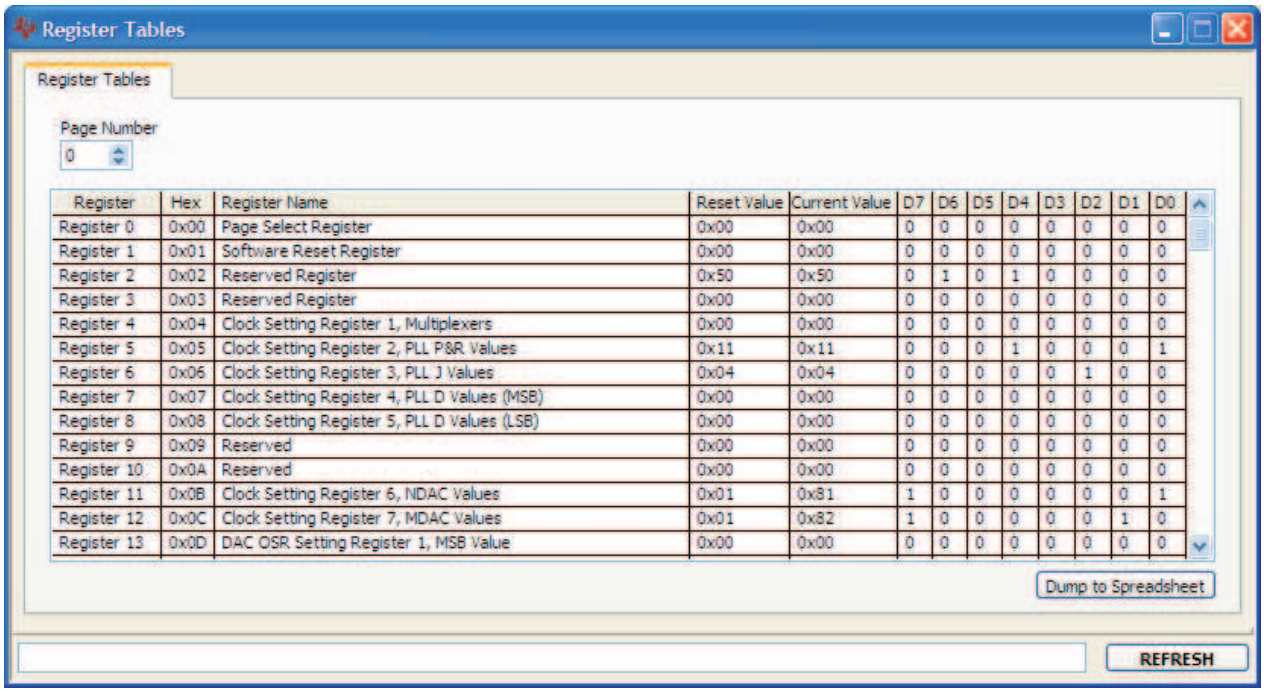


Figure 11. Register Tables Panel

4.4 Command-Line Interface Panel

The **Command-Line Interface** panel provides a means to communicate with the PCM3070 using a simple scripting language (described in Section F.1). The TAS1020B USB Controller (located on the USB-MODEVM motherboard) handles all communication between the PC and the PCM3070.

A script is loaded into the command buffer, either by loading a script file using the **File** menu or by pasting text from the clipboard using the Ctrl-V key combination (Figure 12).

When the command buffer is executed, the return data packets which result from each individual command are displayed in the **Command History** control. This control is an array (with a maximum size of 100 elements) that contains information about each command as well as status. The **Interface** box displays the interface used for a particular command in the **Command History** array. The Command box displays the type of command executed (i.e., write, read) for a particular interface. The Flag Retries box displays the number of read iterations performed by a **Wait for Flag** command (see Section F.1 for details). The **Register Data** array displays the register number and data bytes that correspond to a particular command.

The **Information** tab provides additional information related to the **Command History** as well as additional settings. The **Syntax** and **Examples** tabs provide useful information related to the scripting language.

The **File** menu provides some options for working with scripts. The first option, *Open Script File...*, loads a command file script into the command buffer. This script can then be executed by pressing the **Execute Command Buffer** button. The contents of the **Command Buffer** can be saved using the *Save Script File...* option.

Both the **Command Buffer** and **Command History** can be cleared by clicking their corresponding **Clear** buttons.

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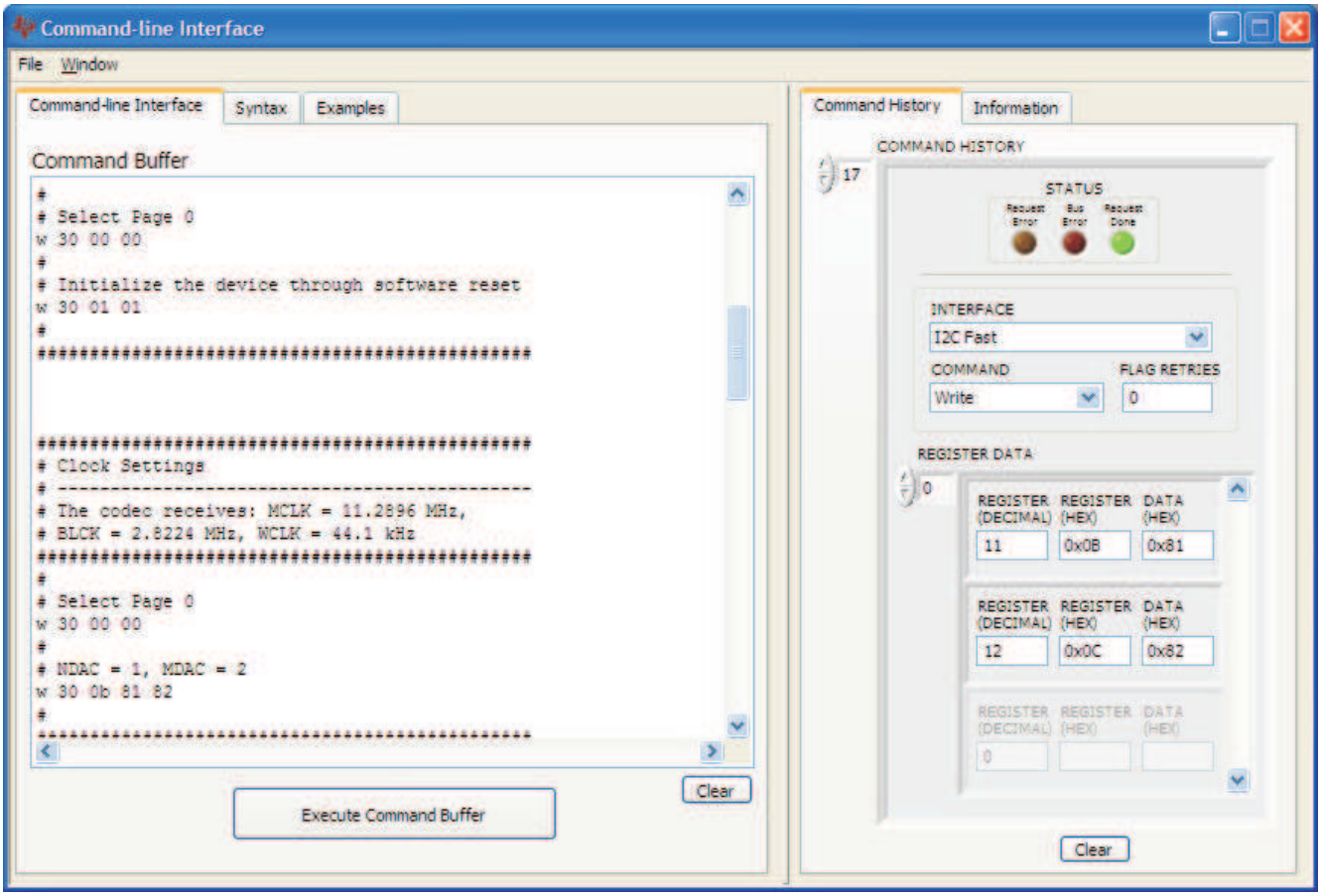


Figure 12. Command-line Interface Panel

5 Related Documents

The following related documents are available through the Texas Instruments Web site at www.ti.com.

EVM-Compatible Device Data Sheets

Device	Literature Number
PCM3070	SLAS724
TAS1020B	SLES025
REG1117-3.3	SBVS001
TPS767D318	SLVS209
SN74LVC125A	SCAS290
SN74LVC1G125	SCES223
SN74LVC1G07	SCES296

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Appendix A EVM Connector Descriptions

This appendix contains the connection details for each of the main connectors on the EVM.

A.1 Analog Interface Connectors

A.1.1 Analog Dual-Row Socket Details, J11 and J21

The PCM3070EVM has two analog dual-row sockets located at the bottom of the board. These sockets provide support to the EVM and connect the analog ground plane of the EVM to the USB-MODEVM analog ground. Consult Samtec at www.samtec.com or call 1-800-SAMTEC-9 for a variety of mating connector options. Table 3 summarizes the analog interface pinout for the PCM3070EVM.

Table 3. Analog Interface Pinout

PIN NUMBER	SIGNAL	DESCRIPTION
J11.1	NC	Not Connected
J11.2	NC	Not Connected
J11.3	NC	Not Connected
J11.4	NC	Not Connected
J11.5	NC	Not Connected
J11.6	NC	Not Connected
J11.7	NC	Not Connected
J11.8	NC	Not Connected
J11.9	AGND	Analog Ground
J11.10	NC	Not Connected
J11.11	AGND	Analog Ground
J11.12	NC	Not Connected
J11.13	AGND	Analog Ground
J11.14	NC	Not Connected
J11.15	NC	Not Connected
J11.16	NC	Not Connected
J11.17	AGND	Analog Ground
J11.18	NC	Not Connected
J11.19	AGND	Analog Ground
J11.20	NC	Not Connected
J21.1	NC	Not Connected
J21.2	NC	Not Connected
J21.3	NC	Not Connected
J21.4	NC	Not Connected
J21.5	NC	Not Connected
J21.6	NC	Not Connected
J21.7	NC	Not Connected
J21.8	NC	Not Connected
J21.9	AGND	Analog Ground
J21.10	NC	Not Connected
J21.11	AGND	Analog Ground
J21.12	NC	Not Connected
J21.13	AGND	Analog Ground
J21.14	NC	Not Connected
J21.15	NC	Not Connected
J21.16	NC	Not Connected
J21.17	AGND	Analog Ground
J21.18	NC	Not Connected
J21.19	AGND	Analog Ground

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Table 3. Analog Interface Pinout (continued)

PIN NUMBER	SIGNAL	DESCRIPTION
J21.20	NC	Not Connected

A.1.2 Analog Screw Terminal and Audio Jack Details, J1 to J10

The analog inputs and outputs can be accessed through screw terminals or audio jacks.

Table 4 summarizes the screw terminals and audio jacks available on the PCM3070EVM.

Table 4. Alternate Analog Connectors

DESIGNATOR	PIN 1	PIN 2	PIN 3	PIN 4	PIN 5
J1 (IN1)	AGND	IN1_L	IN1_R	NC	NC
J2 (IN1)	IN1_L	AGND	IN1_R		
J3 (IN2)	IN2_L	AGND	IN2_R		
J4 (EXT MIC IN)	IN3_L	AGND	IN3_R / NC		
J5 (MIC INPUT)	AGND	IN3_L	IN3_R / NC	IN3_L	IN3_R / NC
J6 (LINE OUT)	LOL	AGND	LOR		
J7 (LINE OUT)	AGND	LOL	LOR	NC	NC
J8 (HEADPHONE)	HPL	AGND	HPR		
J9 (HEADPHONE OUTPUT)	AGND	HPL	HPR	NC	NC
J10 (HEADPHONE TEST ONLY)	AGND	HPL	HPR	NC	NC

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A.2 Digital Interface Connectors, P12/J12 and P22/J22

The PCM3070EVM is designed to easily interface with multiple control platforms. Samtec part numbers SSW-110-22-F-D-VS-K and TSM-110-01-T-DV-P provide a convenient 10-pin, dual-row header/socket combination at P12/J12 and P22/J22. These headers/sockets provide access to the digital control and serial data pins of the device. Consult Samtec at www.samtec.com or call 1-800- SAMTEC-9 for a variety of mating connector options. Table 5 summarizes the digital interface pinout for the PCM3070EVM.

Table 5. Digital Interface Pinout

PIN NUMBER	SIGNAL	DESCRIPTION
P12.1/J12.1	NC	Not Connected
P12.2/J12.2	NC	Not Connected
P12.3/J12.3	SCLK	SPI Serial Clock
P12.4/J12.4	DGND	Digital Ground
P12.5/J12.5	NC	Not Connected
P12.6/J12.6	NC	Not Connected
P12.7/J12.7	/SS	SPI Chip Select
P12.8/J12.8	NC	Not Connected
P12.9/J12.9	NC	Not Connected
P12.10/J12.10	DGND	Digital Ground
P12.11/J12.11	MOSI	SPI MOSI Slave Serial Data Input
P12.12/J12.12	NC	Not Connected
P12.13/J12.13	MISO	SPI MISO Slave Serial Data Output
P12.14/J12.14	$\overline{\text{RESET}}$	TAS1020B Reset
P12.15/J12.15	NC	Not Connected
P12.16/J12.16	SCL	I^2C Serial Clock
P12.17/J12.17	NC	Not Connected
P12.18/J12.18	DGND	Digital Ground
P12.19/J12.19	NC	Not Connected
P12.20/J12.20	SDA	I^2C Serial Data Input/Output
P22.1/J22.1	NC	Not Connected
P22.2/J22.2	NC	Not Connected
P22.3/J22.3	BCLK	Audio Serial Data Bus Bit Clock (Input/Output)
P22.4/J22.4	DGND	Digital Ground
P22.5/J22.5	NC	Not Connected
P22.6/J22.6	NC	Not Connected
P22.7/J22.7	WCLK	Audio Serial Data Bus Word Clock (Input/Output)
P22.8/J22.8	NC	Not Connected
P22.9/J22.9	NC	Not Connected
P22.10/J22.10	DGND	Digital Ground
P22.11/J22.11	DIN	Audio Serial Data Bus Data Input (Input)
P22.12/J22.12	NC	Not Connected
P22.13/J22.13	DOUT	Audio Serial Data Bus Data Output (Output)
P22.14/J22.14	NC	Not Connected
P22.15/J22.15	NC	Not Connected
P22.16/J22.16	NC	Not Connected
P22.17/J22.17	MCLK	Master Clock Input
P22.18/J22.18	DGND	Digital Ground
P22.19/J22.19	NC	Not Connected
P22.20/J22.20	NC	Not Connected

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Note that P22/J22 comprises the signals needed for an I²S™ serial digital audio interface; the control interface (I²C™ and $\overline{\text{RESET}}$) signals are routed to P12/J12.

A.3 Power Supply Connector Pin Header, P23/J23

P23/J23 provides connection to the common power bus for the PCM3070EVM. Power is supplied on the pins listed in Table 6.

Table 6. Power Supply Pinout

SIGNAL	PIN NUMBER		SIGNAL
NC	P23.1/J23.1	P23.2/J23.2	NC
+5VA	P23.3/J23.3	P23.4/J23.4	NC
DGND	P23.5/J23.5	P23.6/J23.6	AGND
+1.8VD	P23.7/J23.7	P23.8/J23.8	NC
+3.3VD	P23.9/J23.9	P23.10/J23.10	+5VD

The PCM3070EVM-K motherboard (the USB-MODEVM Interface board) supplies power to P23/J23 of the PCM3070EVM. Power for the motherboard is supplied either through its USB connection or via terminal blocks on that board.

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Appendix B PCM3070EVM Schematic

The schematic diagram for the PCM3070EVM is provided as a reference.

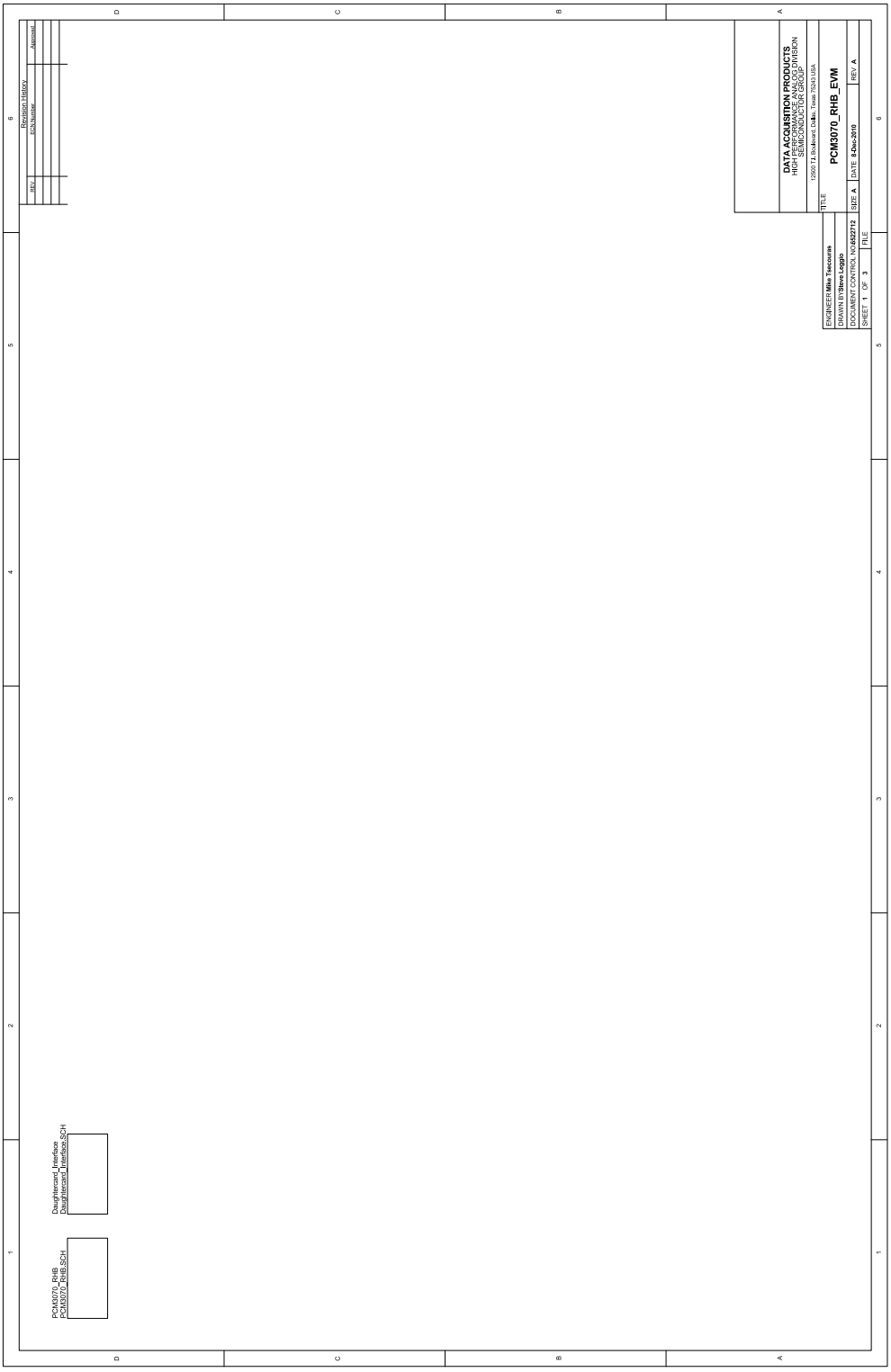


Figure 13. PCM3070EVM Schematic, Sheet 1

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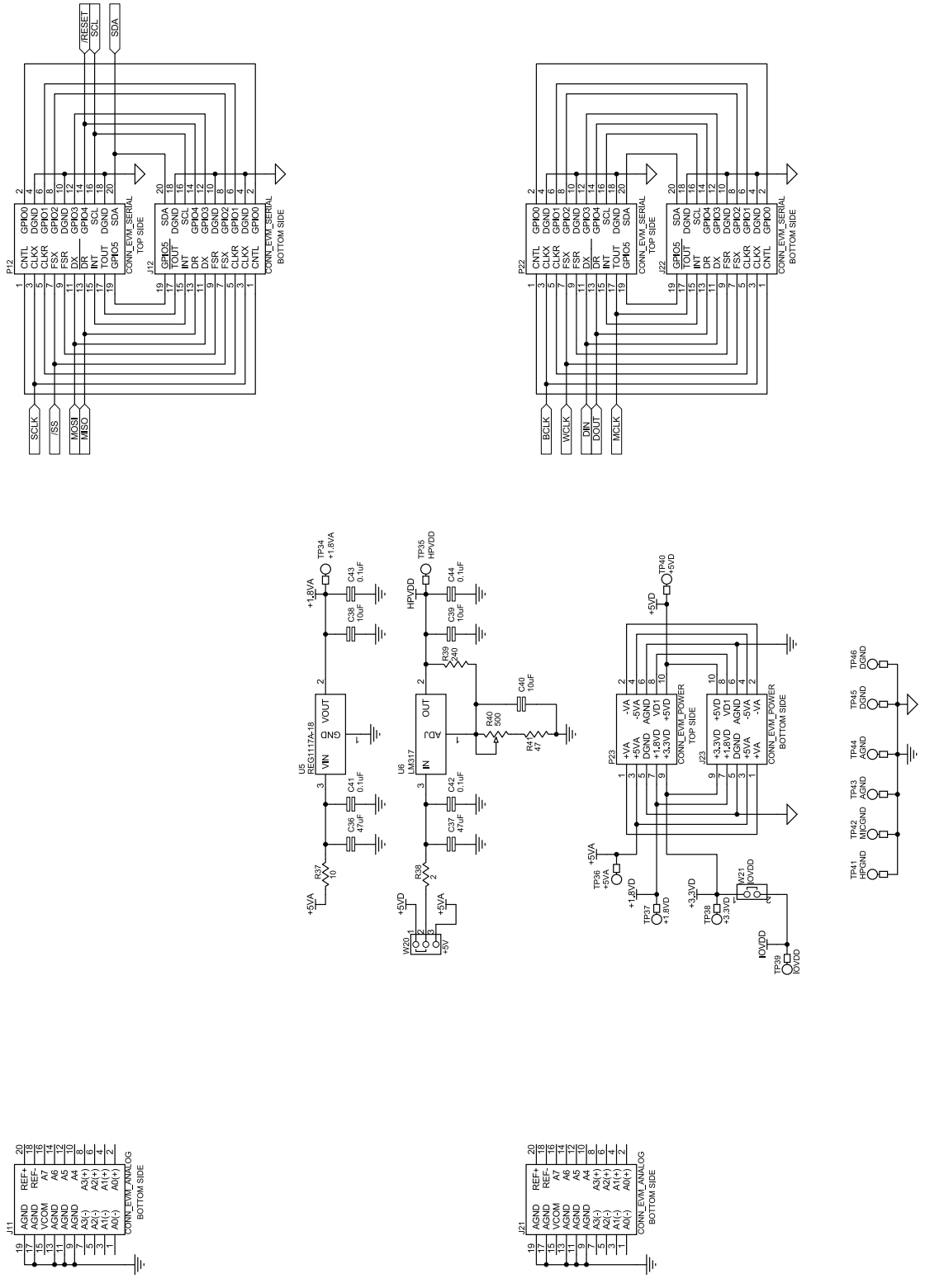


Figure 14. PCM3070EVM Schematic, Sheet 2

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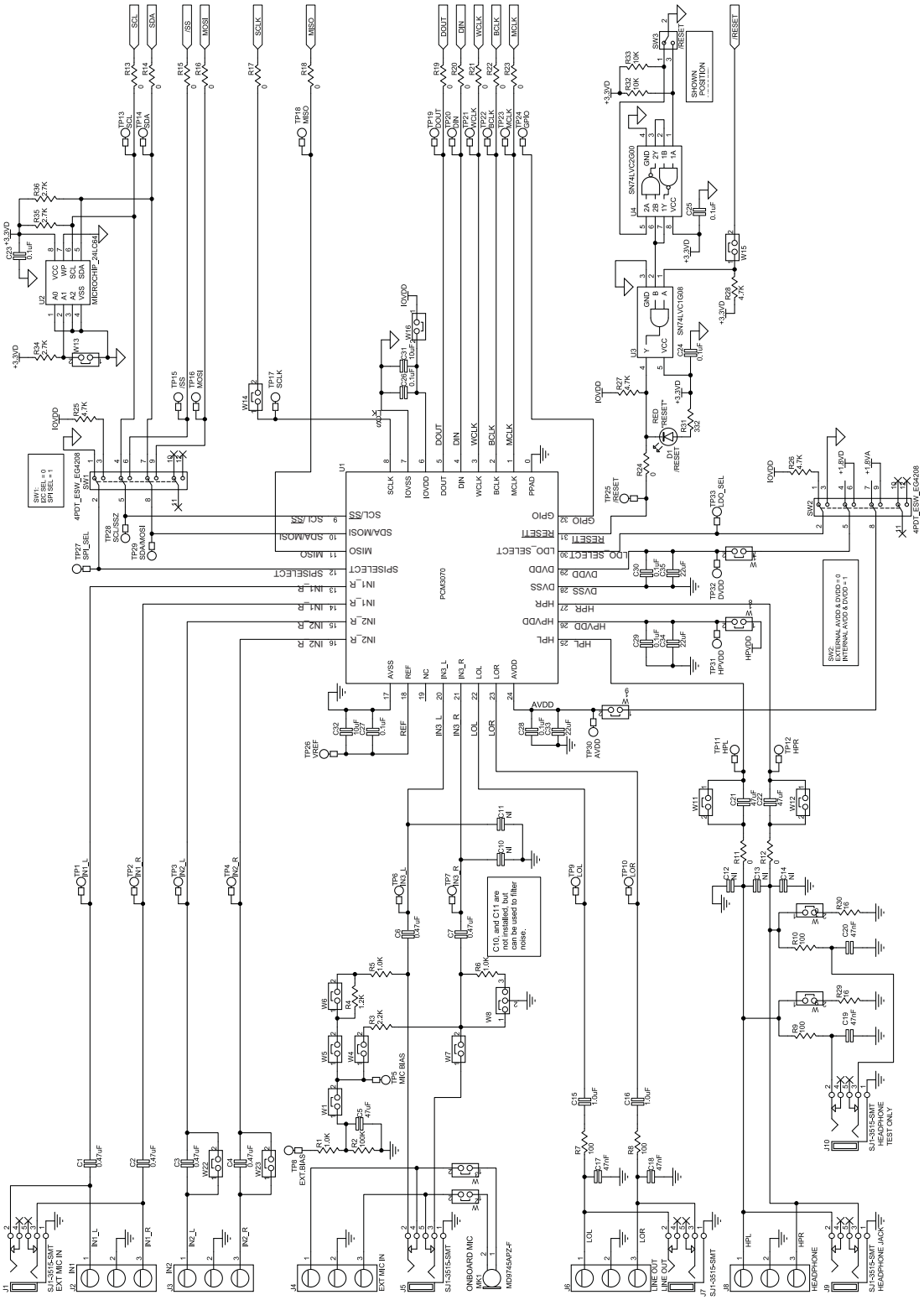


Figure 15. PCM3070EVM Schematic, Sheet 3

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Appendix C PCM3070EVM Bill of Materials

The complete bill of materials for the PCM3070EVM is provided as a reference.

Table 7. PCM3070EVM Bill of Materials

PCB					
Qty	**Value**	**Ref Des**	**Description**	**Vendor**	**Part Number**
1		N/A	PCM3070_RHB_EVM_RevA (PCB)	Texas Instruments	
RESISTORS					
Qty	**Value**	**Ref Des**	**Description**	**Vendor**	**Part Number**
2	0	R11, R12	RES ZERO OHM 1/4W 5% 1206 S.D.	Panasonic	EJ-8GEY0R00V
12	0	R13, R14, R15, R16, R17, R18, R19, R20, R21, R22, R23, R24	RES ZERO OHM 1/10W 5% 0603 S.D.	Panasonic	EJ-3GEY0R00V
1	2	R38	RESISTOR 2.0 OHM 1/4W 5% 1206	Panasonic	EJ-8GEYJ2R0V
1	10	R37	RES 10 OHM 1/4W 5% 1206 S.D.	Panasonic	EJ-8GEYJ100V
2	16	R29, R30	RES 16 OHM 1W 5% 2512 S.D.	Panasonic	EJ-1TYJ160U
1	47	R41	RES 47 OHM 1/10W 5% 0603 S.D.	Panasonic	EJ-3GEYJ470V
4	100	R7, R8, R9, R10	RES 100 OHM 1/10W 1% 0603 S.D.	Panasonic	EJ-3EKF1000V
1	240	R39	RES 240 OHM 1/10W 5% 0603 S.D.	Panasonic	EJ-3GEYJ241V
1	332	R31	RES 332 OHM 1/10W 1% 0603 SMD	Panasonic	ERJ-3EKF3320V
1	500	R40	TRIMPOT 500 OHM 4MM TOP ADJ SMD	Bourns Inc.	3214W-1-501E
3	1.0K	R1, R5, R6	RES 1.00K OHM 1/10W 1% 0603 SMD	Panasonic	ERJ-3EKF1001V
1	1.2K	R4	RES 1.20K OHM 1/10W 1% 0603 SMD	Panasonic	ERJ-3EKF1201V
1	2.2K	R3	RES 2.2K OHM 1/10W 5% 0603 SMD	Panasonic	ERJ-3GEYJ222V
3	2.7K	R34, R35, R36	RES 2.7K OHM 1/10W 5% 0603 SMD	Panasonic	ERJ-3GEYJ272V
4	4.7K	R25, R26, R27, R28	RES 4.7K OHM 1/10W 5% 0603 SMD	Panasonic	ERJ-3GEYJ472V
2	10K	R32, R33	RES 10K OHM 1/10W 5% 0603 SMD	Panasonic	ERJ-3GEYJ103V
1	100K	R2	RES 100K OHM 1/10W 1% 0603 SMD	Panasonic	ERJ-3EKF1003V
CAPACITORS					
Qty	**Value**	**Ref Des**	**Description**	**Vendor**	**Part Number**
4	47000pF	C17, C18, C19, C20	CAP CER 47000PF 50V X7R 10% 0603	TDK Corporation	C1608X7R1H473 K
5	0.1uF	C26, C27, C28, C29, C30	CAP CER .10UF 6.3V X5R 10% 0402	TDK Corporation	C1005X5R0J104K
3	0.1uF	C23, C24, C25	CAP CER .1UF 25V X7R 0603	TDK Corporation	C1608X7R1E104K
4	0.1uF	C41, C42, C43, C44	CAP .1UF 25V CERAMIC X7R 0805	Panasonic	ECJ-2VB1E104K
6	0.47uF	C1, C2, C3, C4, C6, C7	CAP CER .47UF 10V X5R 10% 0603	Panasonic	C1608X5R1A474K
2	1.0uF	C15, C16	CAP CERAMIC 1UF 10V X5R 0603	Panasonic	ECJ-BVB1A105K
2	10uF	C31, C32	CAP CERAMIC 10UF 6.3V X5R 0603	Panasonic	ECJ-1VB0J106M
3	10uF	C38, C39, C40	CAP CERAMIC 10UF 10V X5R 0805	Panasonic	ECJ-2FB1A106K
3	22uF	C33, C34, C35	CAP CER 22UF 6.3V X5R 20% 0805	TDK Corporation	C2012X5R0J226M
5	47uF	C5, C21, C22, C36, C37	CAP CER 47UF 10V X5R 1210	Murata	GRM32ER61A476 KE20L
2	no value - not installed	C10, C11	CAP 0603	N/A	N/A
3	no value - not installed	C12, C13, C14	CAP 1206	N/A	N/A
INTEGRATED CIRCUITS					
Qty	**Value**	**Ref Des**	**Description**	**Vendor**	**Part Number**
1		U1	Audio Codec	Texas Instruments	PCM3070IRHB
1		U2	IC SERIAL EEPROM 64K 2.5V 8-SOIC	MicroChip	24LC64-I/SN
1		U3	Single 2-Input Positive-AND Gate	Texas Instruments	SN74LVC1G08DB VR
1		U4	Dual 2-Input Positive-NAND Gate	Texas Instruments	SN74LVC2G00DC TR

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Table 7. PCM3070EVM Bill of Materials (continued)

1		U5	Single Output LDO, 1.0A, Fixed(1.8V)	Texas Instruments	REG1117A-1.8
1		U6	3-Pin 1.5-A Adjustable Voltage Regulator	Texas Instruments	LM317DCY
MISCELLANEOUS ITEMS					
Qty	**Value**	**Ref Des**	**Description**	**Vendor**	**Part Number**
1		D1	LED THIN 635NM RED DIFF 0805 SMD	Lumex	SML-LXT0805IW-TR
1		MK1	Omnidirectional Microphone Cartridge	Knowles Acoustics	MD9745APZ-F
			or alternate	Knowles Acoustics	MD9745APA-1
2		SW1-SW2	SWITCH SLIDE 4PDT 30V RT ANGLE	E-Switch	EG4208
1		SW3	SWITCH SLIDE SPDT 30V.2A PC MNT	E-Switch	EG1218
5		J2, J3, J4, J6, J8	Screw Terminal Block, 3 Position	On Shore Technology	ED555/3DS
5		J1, J5, J7, J9, J10	3.5mm Audio Jack, T-R-S, SMD	CUI Inc.	SJ1-3515-SMT
			or alternate	KobiConn	161-3335-E
11	not installed	TP26, TP30, TP31, TP32, TP34, TP35, TP36, TP37, TP38, TP39, TP40	TEST POINT PC MINI .040"D RED	Keystone Electronics	5000
29	not installed	TP1, TP2, TP3, TP4, TP5, TP6, TP7, TP8, TP9, TP10, TP11, TP12, TP13, TP14, TP15, TP16, TP17, TP18, TP19, TP20, TP21, TP22, TP23, TP24, TP25, TP27, TP28, TP29, TP33	TEST POINT PC MINI .040"D WHITE	Keystone Electronics	5002
6		TP41, TP42, TP43, TP44, TP45, TP46	TEST POINT PC MULTI PURPOSE BLK	Keystone Electronics	5011
2		P12, P22	20 Pin SMT Plug Header	Samtec	TSM-110-01-L-DV-P
4		J11, J12, J21, J22	20 pin SMT Socket Header	Samtec	SSW-110-22-F-D-VS-K
1		P23	10 Pin SMT Plug Header	Samtec	TSM-105-01-L-DV-P
1		J23	10 pin SMT Socket Header	Samtec	SSW-105-22-F-D-VS-K
14		W2, W3, W4, W5, W6, W7, W9, W10, W11, W12, W13, W15, W22, W23	2 Pin Thru-hole Plug Header (Jumper), 0 .1" spacing	Samtec	TSW-102-07-L-S
5		W16, W17, W18, W19, W21	Bus Wire (18-22 Gauge)		
4		W1, W8, W14, W20	3 Position Jumper , 0 .1" spacing	Samtec	TSW-103-07-L-S
	Installed per test procedure.	Installed per test procedure.	Header Shorting Block	Samtec	SNT-100-BK-T
ATTENTION: All components must be Rhos compliant. Some part numbers may be either leaded or Rhos. Verify that purchased components are Rhos compliant.					

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Appendix D USB-MODEVM Schematic

The schematic diagram for USB-MODEVM Interface Board is provided as a reference.

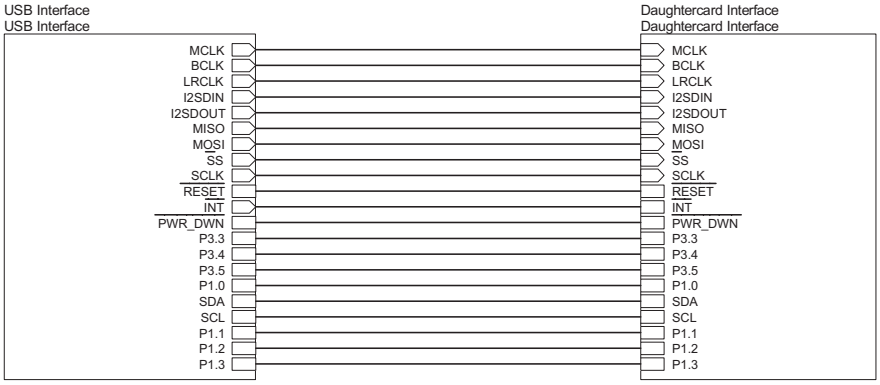


Figure 16. USB-MODEVM Interface Board, Sheet 1

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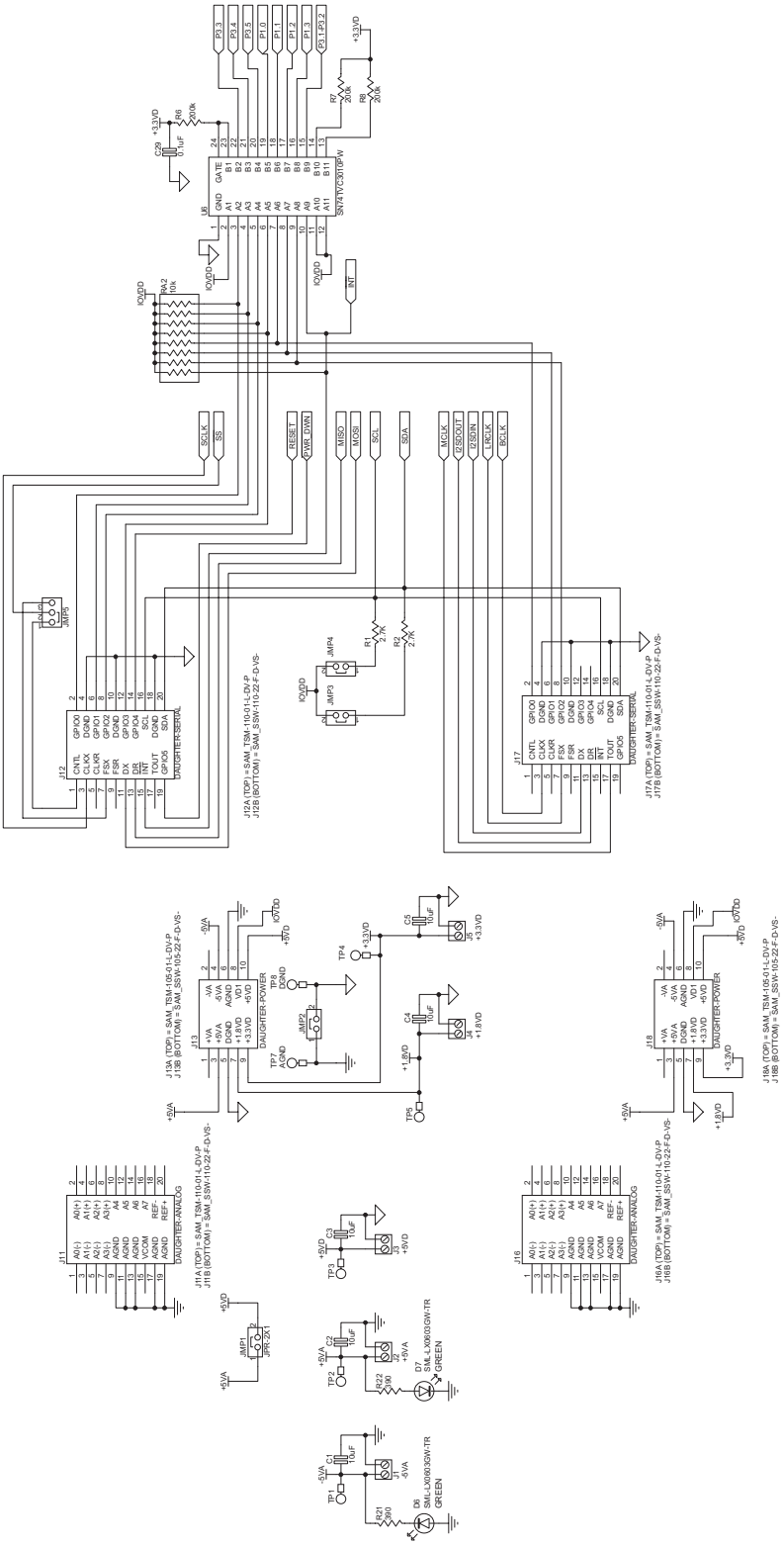


Figure 17. USB-MODEVM Interface Board, Sheet 2

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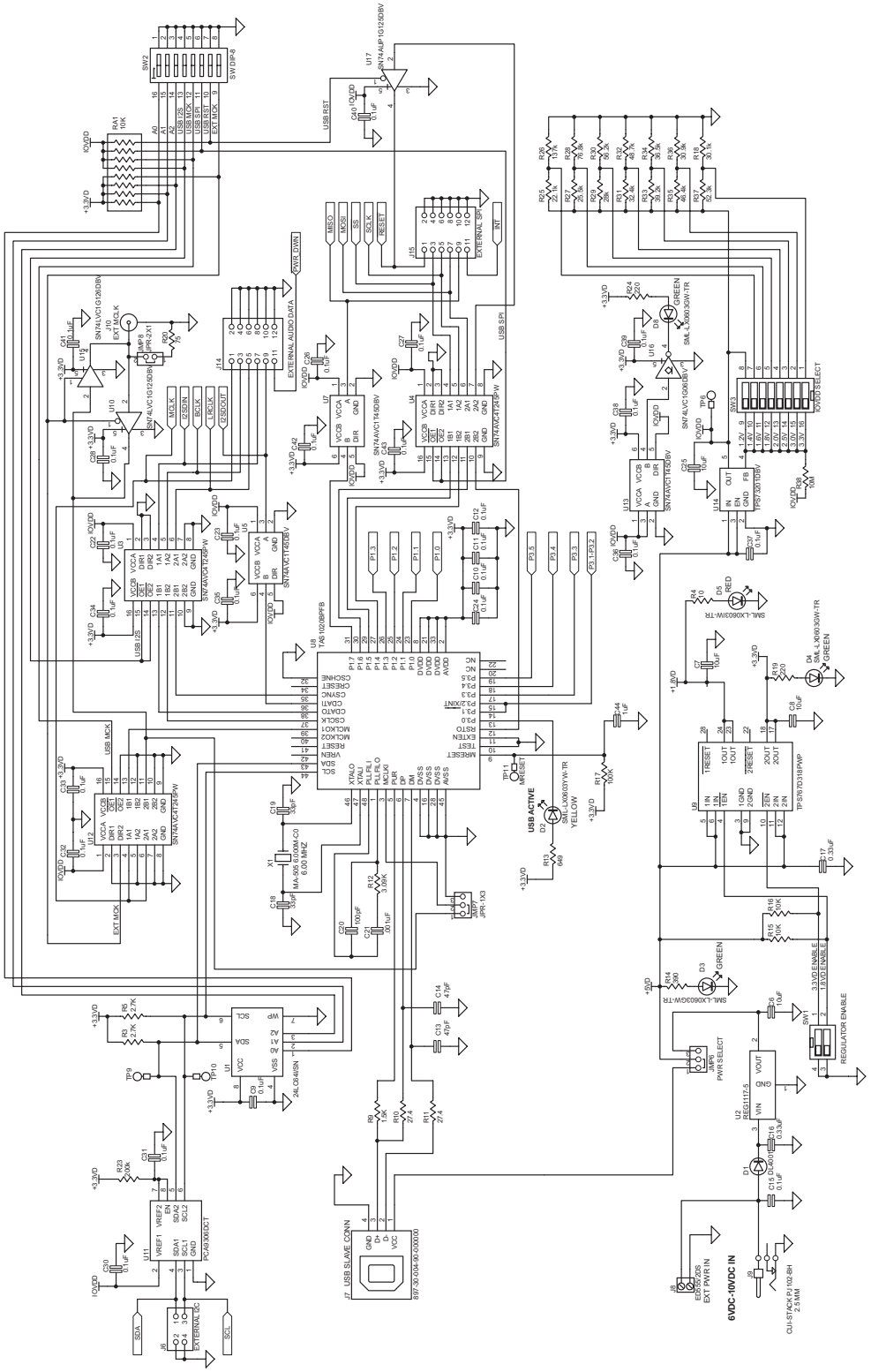


Figure 18. USB-MODEVM Interface Board, Sheet 3

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Appendix E USB-MODEVM Bill of Materials

The complete bill of materials for USB-MODEVM Interface Board is provided as a reference.

Table 8. USB-MODEVM Bill of Materials

Designators	Description	Manufacturer	Mfg. Part Number
R4	10Ω 1/10W 5% Chip Resistor	Panasonic	ERJ-3GEYJ1300V
R10, R11	27.4Ω 1/16W 1% Chip Resistor	Panasonic	ERJ-3EKF27R4V
R20	75Ω 1/4W 1% Chip Resistor	Panasonic	ERJ-14NF75R0U
R19	220Ω 1/10W 5% Chip Resistor	Panasonic	ERJ-3GEYJ221V
R14, R21, R22	390Ω 1/10W 5% Chip Resistor	Panasonic	ERJ-3GEYJ391V
R13	649Ω 1/16W 1% Chip Resistor	Panasonic	ERJ-3EKF6490V
R9	1.5KΩ 1/10W 5% Chip Resistor	Panasonic	ERJ-3GEYJ1352V
R1–R3, R5–R8	2.7KΩ 1/10W 5% Chip Resistor	Panasonic	ERJ-3GEYJ272V
R12	3.09KΩ 1/16W 1% Chip Resistor	Panasonic	ERJ-3EKF3091V
R15, R16	10KΩ 1/10W 5% Chip Resistor	Panasonic	ERJ-3GEYJ1303V
R17, R18	100kΩ 1/10W 5%Chip Resistor	Panasonic	ERJ-3GEYJ1304V
RA1	10KΩ 1/8W Octal Isolated Resistor Array	CTS Corporation	742C163103JTR
C18, C19	33pF 50V Ceramic Chip Capacitor, ±5%, NPO	TDK	C1608C0G1H330J
C13, C14	47pF 50V Ceramic Chip Capacitor, ±5%, NPO	TDK	C1608C0G1H470J
C20	100pF 50V Ceramic Chip Capacitor, ±5%, NPO	TDK	C1608C0G1H101J
C21	1000pF 50V Ceramic Chip Capacitor, ±5%, NPO	TDK	C1608C0G1H102J
C15	0.1µF 16V Ceramic Chip Capacitor, ±10%, X7R	TDK	C1608X7R1C104K
C16, C17	0.33µF 16V Ceramic Chip Capacitor, ±20%, Y5V	TDK	C1608X5R1C334K
C9–C12, C22–C28	1µF 6.3V Ceramic Chip Capacitor, ±10%, X5R	TDK	C1608X5R0J1305K
C1–C8	10µF 6.3V Ceramic Chip Capacitor, ±10%, X5R	TDK	C3216X5R0J1306K
D1	50V, 1A, Diode MELF SMD	Micro Commercial Components	DL4001
D2	Yellow Light Emitting Diode	Lumex	SML-LX0603YW-TR
D3– D7	Green Light Emitting Diode	Lumex	SML-LX0603GW-TR
D5	Red Light Emitting Diode	Lumex	SML-LX0603IW-TR
Q1, Q2	N-Channel MOSFET	Zetex	ZXMN6A07F
X1	6MHz Crystal SMD	Epson	MA-505 6.000M-C0
U8	USB Streaming Controller	Texas Instruments	TAS1020BPFB
U2	5-V LDO Regulator	Texas Instruments	REG1117-5
U9	3.3-V/1.8-V, Dual-Output LDO Regulator	Texas Instruments	TPS767D318PWP
U3, U4	Quad, 3-State Buffers	Texas Instruments	SN74LVC125APW
U5–U7	Single IC Buffer Driver with Open Drain o/p	Texas Instruments	SN74LVC1G07DBVR
U10	Single 3-State Buffer	Texas Instruments	SN74LVC1G125DBVR
U1	64K 2-Wire Serial EEPROM I^2C	Microchip	24LC64I/SN
	USB-MODEVM PCB	Texas Instruments	6463995
TP1–TP6, TP9–TP11	Miniature test point terminal	Keystone Electronics	5000
TP7, TP8	Multipurpose test point terminal	Keystone Electronics	5011
J7	USB Type B Slave Connector Thru-Hole	Mill-Max	897-30-004-90-000000
J13, J2–J5, J8	2-position terminal block	On Shore Technology	ED555/2DS
J9	2.5mm power connector	CUI Stack	PJ-102B
J130	BNC connector, female, PC mount	AMP/Tyco	414305-1
J131A, J132A, J21A, J22A	20-pin SMT plug	Samtec	TSM-110-01-L-DV-P
J131B, J132B, J21B, J22B	20-pin SMT socket	Samtec	SSW-110-22-F-D-VS-K
J133A, J23A	10-pin SMT plug	Samtec	TSM-105-01-L-DV-P
J133B, J23B	10-pin SMT socket	Samtec	SSW-105-22-F-D-VS-K
J6	4-pin double row header (2x2) 0.1"	Samtec	TSW-102-07-L-D
J134, J135	12-pin double row header (2x6) 0.1"	Samtec	TSW-106-07-L-D
JMP1–JMP4	2-position jumper, 0.1" spacing	Samtec	TSW-102-07-L-S

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Table 8. USB-MODEVM Bill of Materials (continued)

Designators	Description	Manufacturer	Mfg. Part Number
JMP8–JMP14	2-position jumper, 0.1" spacing	Samtec	TSW-102-07-L-S
JMP5, JMP6	3-position jumper, 0.1" spacing	Samtec	TSW-103-07-L-S
JMP7	3-position dual row jumper, 0.1" spacing	Samtec	TSW-103-07-L-D
SW1	SMT, half-pitch 2-position switch	C&K Division, ITT	TDA02H0SK1
SW2	SMT, half-pitch 8-position switch	C&K Division, ITT	TDA08H0SK1
	Jumper plug	Samtec	SNT-100-BK-T

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Appendix F USB-MODEVM Protocol

F.1 Writing Scripts

A script is simply a text file that contains data to send to the serial control buses.

Each line in a script file is one command. No provision is made for extending lines beyond one line, except for the **>** command. A line is terminated by a carriage return.

The first character of a line is the command. Commands are:

l Set interface bus to use
r Read from the serial control bus
w Write to the serial control bus
> Extend repeated write commands to lines below a **w**
Comment
b Break
d Delay

f Wait for flag

The first command, **l**, sets the interface to use for the commands to follow. This command must be followed by one of the following parameters:

i2cstd	Standard mode I^2C bus
i2cfast	Fast mode I^2C bus
spi8	SPI bus with 8-bit register addressing
spi16	SPI bus with 16-bit register addressing
gpio	Use the USB-MODEVM GPIO capability

For example, if a fast mode I^2C bus is to be used, the script begins with:

l i2cfast

A double-quoted string of characters following the **b** command can be added to provide information to the user about each breakpoint. When the script is executed, the software's command handler halts as soon as a breakpoint is detected and displays the string of characters within the double quotes.

The Wait for Flag command, **f,** reads a specified register and verifies if the bitmap provided with the command matches the data being read. If the data does not match, the command handler retries for up to 200 times. This feature is useful when switching buffers in parts that support the adaptive filtering mode. The command f syntax follows:

```
f [i2c address] [register] [D7][D6][D5][D4][D3][D2][D1][D0]
where 'i2c address' and 'register' are in hexadecimal format and 'D7' through 'D0' are in binary
format with values of 0, 1 or X for don't care.
```

Anything following a comment command **#** is ignored by the parser, provided that it is on the same line.

The delay command **d** allows the user to specify a time, in milliseconds, that the script pauses before proceeding. **The delay time is entered in decimal format.**

A series of byte values follows either a read or write command. Each byte value is expressed in hexadecimal, and each byte must be separated by a space. Commands are interpreted and sent to the TAS1020B by the program using the protocol described in **Section G1** (**doesn't exist**).

The first byte following an **r** (read) or **w** (write) command is the I^2C slave address of the device (if I^2C is used) or the first data byte to write (if SPI is used—note that SPI interfaces are not standardized on protocols, so the meaning of this byte varies with the device being addressed on the SPI bus). The second byte is the starting register address that data will be written to (again, with I^2C; SPI varies—see **Section G1** (**doesn't exist**) for additional information about what variations may be necessary for a particular SPI mode). Following these two bytes are data, if writing; if reading, the third byte value is the number of bytes to read, (expressed in hexadecimal).

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For example, to write the values 0xAA 0x55 to an I²C device with a slave address of 0x30, starting at a register address of 0x03, the user writes:

```
#example script
I i2cfast
w 30 03 AA 55
r 30 03 02
```

This script begins with a comment, specifies that a fast I²C bus will be used, then writes *0xAA 0x55* to the I²C slave device at address 0x30, writing the values into registers 0x03 and 0x04. The script then reads back two bytes from the same device starting at register address 0x03. Note that the slave device value does not change. It is unnecessary to set the R/$\overline{W}$ bit for I²C devices in the script; the read or write commands does that.

If extensive repeated write commands are sent and commenting is desired for a group of bytes, the **>** command can be used to extend the bytes to other lines that follow. A usage example for the **>** command follows:

```
#example script for '>' command
I i2cfast
# Write AA and BB to registers 3 and 4, respectively
w 30 03 AA BB
# Write CC, DD, EE and FF to registers 5, 6, 7 and 8, respectively
> CC DD EE FF
# Place a commented breakpoint
b "AA BB CC DD EE FF was written, starting at register 3"
# Read back all six registers, starting at register 3
r 30 03 06
```

The following example demonstrates usage of the Wait for Flag command, **f**:

```
#example script for 'wait for flag' command
I i2cfast
# Switch to Page 44
w 30 00 2C
# Switch buffers
w 30 01 05
# Wait for bit D0 to clear. 'x' denotes a don't care.
f 30 01 xxxxxxx0
```

Any text editor can be used to write these scripts; Jedit is an editor that is highly recommended for general usage. For more information, go to: http://www.jedit.org.

Once the script is written, it can be used in the command window by running the program, and then selecting *Open Script File...* from the File menu. Locate the script and open it. The script is then displayed in the command buffer. The user can also edit the script once it is in the buffer and save it by selecting *Save Script File...* from the File menu.

Once the script is in the command buffer, it can be executed by pressing the *Execute Command Buffer* button. If breakpoints are in the script, the script executes to that point, and the user is presented with a dialog box with a button to press to continue executing the script. When ready to proceed, push that button and the script continues.

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