PCM510xEVM-U

The PCM510x family of ICs are advanced segment, high-performance, hardware-programmable stereo digital-to-analog converters (DACs). These devices employ internal line drivers together with an internal PLL and BCLK reference, so that a serial clock signal (SCK) can be derived. The advanced segment architecture enables excellent dynamic performance and improved tolerance to clock jitter, and the 2.1-V_{RMS} ground-centered outputs eliminate the need for output dc blocking capacitors. The PCM510xEVM-U is designed to support the PCM5100, PCM5101, and PCM5102 DACs. The PCM510xEVM-U also employs the TAS1020B USB controller and the SRC4392 asynchronous sample rate converter.

This user's guide describes the operation of the PCM510xEVM-U and the Texas Instruments CodecControl software. CodecControl provides a graphical user interface for supported TI audio codecs. The software is compatible with Microsoft® Windows® XP, Vista, and Windows 7.

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1 Introduction

CodecControl software is intended to facilitate user evaluation of TI audio codecs. It includes a wide range of features, depending on the specific codec capabilities. The PCM510xEVM-U works together with the CodecControl software. It connects to a PC via an available USB port and enumerates as a USB-class audio device. Once configured with the CodecControl software, the EVM acts as a sound card that can play back audio from the PC, depending on how the device is set up.

For a more detailed description of the PCM510x product line, refer to the product data sheet available from the Texas Instruments web site at http://www.ti.com/.

Throughout this document, the abbreviation *EVM* and the term *evaluation module* are synonymous with the PCM510xEVM-U. Unless otherwise noted, all references to the PCM510x indicate complete functionality of all three related devices (PCM5100, PCM5101, and PCM5102).

1.1 Information About Cautions and Warnings

This document contains caution statements.

CAUTION

This is an example of a caution statement. A caution statement describes a situation that could potentially damage your software or equipment.

The information in a caution or a warning is provided for your protection. Please read each caution and warning carefully.

1.2 Related Documentation from Texas Instruments

The following document provides information regarding Texas Instruments integrated circuits used in the assembly of the PCM510xEVM-U. These documents are available from the TI web site. The last character of the literature number corresponds to the document revision that is current at the time of the writing of this document. Newer revisions may be available from the TI web site at http://www.ti.com/.

Data Sheet	Literature Number
PCM510x	SLAS766
TAS1020B	SLES025A
SRC4392	SBFS029C

1.3 Applications Questions

If you have questions regarding either the use of this evaluation module or other Texas Instruments evaluation modules, post a question in the Audio Converters forum at http://e2e.ti.com. Include in the subject heading the product in which you are interested.

1.4 FCC Warning

This equipment is intended for use in a laboratory test environment only. It generates, uses, and can radiate radio frequency energy and has not been tested for compliance with the limits of computing devices pursuant to subpart J of part 15 of FCC rules, which are designed to provide reasonable protection against radio frequency interference. Operation of this equipment in other environments may cause interference with radio communications, in which case the user at his own expense is required to take whatever measures may be required to correct this interference.

2 PCM510xEVM-U

2.1 Electrostatic Discharge Warning

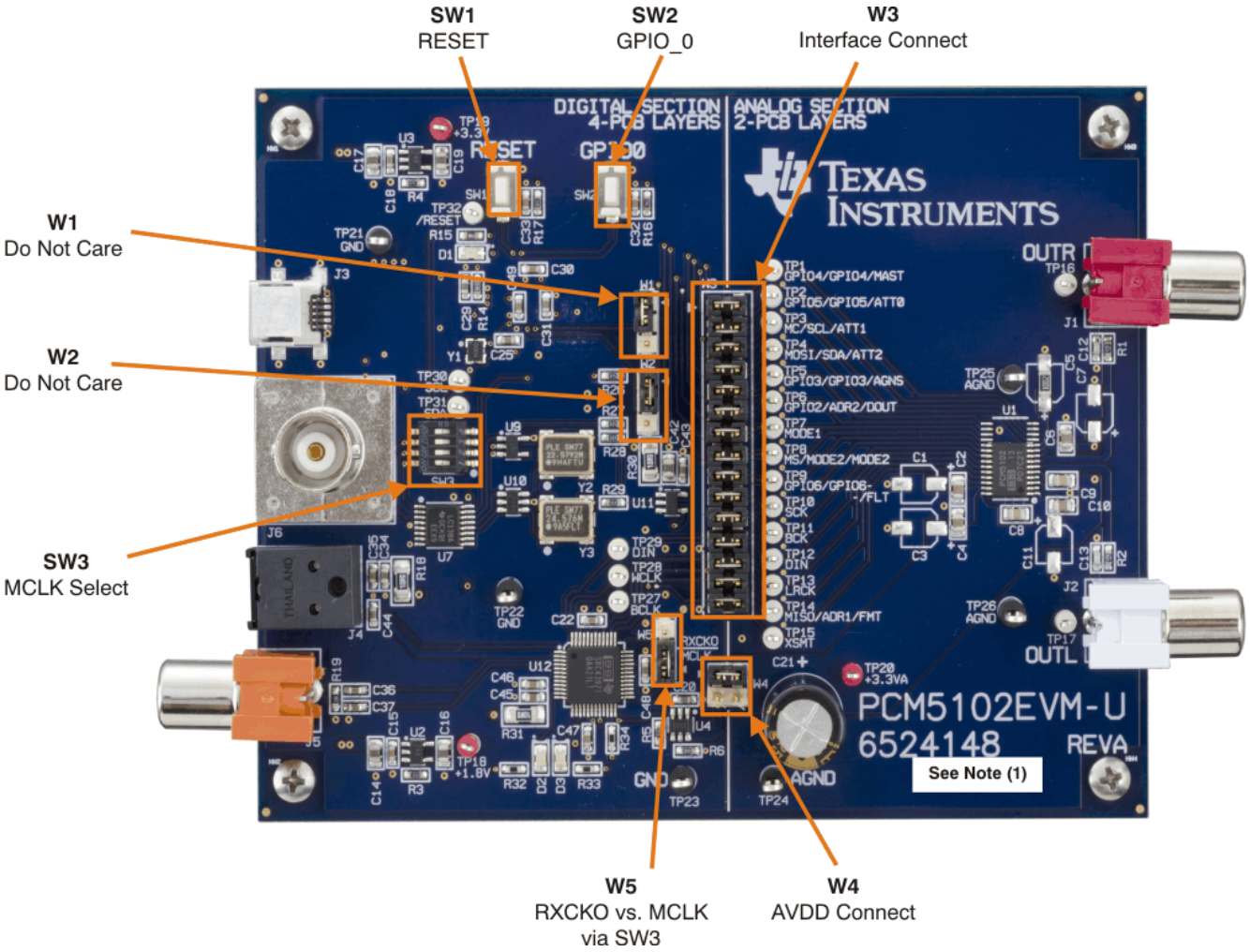
Many of the components on the PCM510xEVM-U are susceptible to damage by electrostatic discharge (ESD). Customers are advised to observe proper ESD handling precautions when unpacking and handling the EVM, including the use of a grounded wrist strap at an approved ESD workstation.

CAUTION

Failure to observe ESD handling procedures may result in damage to EVM components.

2.2 Overview

The PCM510xEVM-U is an easy to use, USB-interface, multi-functional system allowing for digital optical/SPDIF, line or external I²S™ input with varying options for clock sources and clock frequencies. Along with onboard sample rate conversion, this architecture allows for versatile use and testing of the PCM510x family of parts. Figure 1 shows the PCM510xEVM-U with the jumper and switch locations noted.



(1) The silkscreen label shown on the board may be different to indicate a specific device. Otherwise, the EVM is identical to the one shown here.

Figure 1. PCM510xEVM-U

It should be noted that the PCM510xEVM-U is divided into two sections. The left half contains the digital and USB interface, sample rate conversion, optical/SPDIF and RCA digital inputs, clock circuitry, and reset logic. The right half contains the PCM510x device and the analog circuitry accompanying it. Note that this half of the PCM510xEVM-U is the portion required on a potential customer application. The left half is intended to emulate a wide variety of testing options and scenarios for the PCM510x device.

It should also be noted that the digital interface section, or left half of the PCM510xEVM-U, is a four-layer design. However, the PCM510x device and analog circuitry, or right half of the EVM board, consists only of two layers.

For the analog circuitry surrounding the PCM510x device, certain components can be removed at the cost of higher performance. This configurability may allow for optimal ratio between board space and performance. Components such as C1, C3, C7, and C11 can all be removed for additional board space.

The PCM510xEVM-U features:

- USB Interface
- Analog output
- TX output (J5)
- Optical/SPDIF input
- I^2S input
- Hardware- and software-programmable options
- Digital audio interface test points
- Control interface test points

2.3 EVM Block Diagram

Figure 2 shows the block diagram for the PCM510xEVM-U.

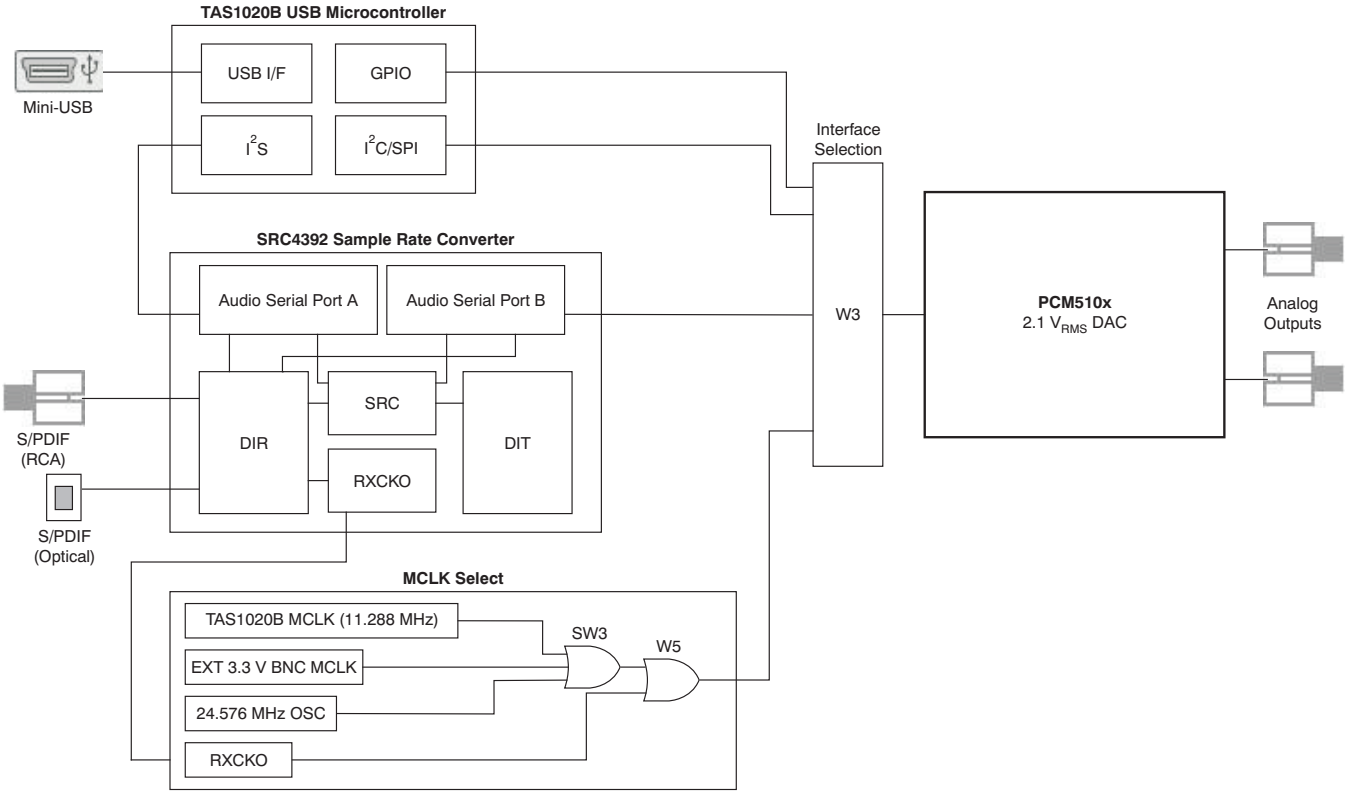


Figure 2. PCM510xEVM-U Block Diagram

2.4 Jumpers, Connectors, Test Points, Switches

Table 1 summarizes the connectors, test points, jumpers, and switches on the PCM510xEVM-U.

Table 1. PCM510xEVM-U Headers, Test Points, Jumpers, and Switches

Connectors/Switch/Jumper/Test Point	Description
Headers	
W1	I^2C/SPI Selection. Shunt Pins 1-2 for SPI, 2-3 for I^2C Control Mode (do not care for PCM510x)
W2	I^2C/SPI Selection. Shunt Pins 1-2 for SPI, 2-3 for I^2C Control Mode (do not care for PCM510x)
W3	Interface Connection. Shunt respective headers to send digital signals to PCM510x.
W4	AVDD Power. Shunt pins 1-2 or 3-4 for AVDD.
W5	MCLK/RXCKO Select
Test Points	
TP1	GPIO4/GPIO4/MAST (do not care for PCM510x)
TP2	GPIO5/GPIO5/ATT0 (do not care for PCM510x)
TP3	MC/SCL/ATT1 (do not care for PCM510x)
TP4	MOSI/SDA/ATT2 (do not care for PCM510x)
TP5	GPIO3/GPIO3/AGNS (do not care for PCM510x)
TP6	GPIO2/ADR2/DOUT (do not care for PCM510x)
TP7	MODE1 (do not care for PCM510x)
TP8	MS/MODE2/MODE2 (do not care for PCM510x)
TP9	FLT
TP10	SCK
TP11	BCK
TP12	DIN
TP13	LRCK
TP14	FMT
TP15	XSMT
TP16	PCM510x Analog Output (R)
TP17	PCM510x Analog Output (L)
TP18	1.8 V
TP19	3.3 V
TP20	3.3 VA
TP21	GND
TP22	GND
TP23	GND
TP24	AGND
TP25	AGND
TP26	AGND
TP27	BCLK (TAS1020B)
TP28	WCLK (TAS1020B)
TP29	DIN (TAS1020B)
TP30	SCL (TAS1020B)
TP31	SDA(TAS1020B)
TP32	$\overline{\text{RESET}}$
Jumpers	
J1	PCM510x RCA Analog Output (R)
J2	PCM510x RCA Analog Output (L)
J3	Mini-USB Connection

Table 1. PCM510xEVM-U Headers, Test Points, Jumpers, and Switches (continued)

Connectors/Switch/Jumper/Test Point	Description
J4	Optical S/PDIF Input
J5	Coaxial S/PDIF Input
J6	BNC External MCLK Input
Switches	
SW1	EVM Reset
SW2	Select EVM Application
SW3	MCLK Select
LEDs	
D2	RX Lock
D3	SRC Ready

2.5 Clock Circuitry

SW3 allows for MCLK selection from multiple sources. The PCM510xEVM-U contains an external BNC jack, J6, as well as one programmed oscillator that provides a clock frequency of 24.576 MHz. The TAS1020B also provides a MCLK output; by default, this clock is used as the master clock for the PCM510xEVM-U. Depending on the application requirements, the SRC4392 is also able to derive a received clock output (RCKO) output based on the input clock frequency, and this derived clock output can be used as the MCLK input for the PCM510x as well. This option is enabled by setting a shunt in position 1-2 (RXCKO) on the 3-pin jumper W5. If W5 has a shunt in position 2-3, then setting SW3 determines which MCLK source is used, as summarized in Table 2.

Table 2. SW3 Clock Selection

Setting	A	B	C
Onboard MCLK from TAS1020B	Low	Low	Low
External MCLK 3.3-V BNC Input	High	Low	Low
24.576-MHz MCLK from PLL Y3	High	High	High

2.5.1 MCLK Source Matching

The SRC4392 is equipped with two audio serial data ports, each of which generates BCLK and LRCLK signals. When the SRC4392 receives an S/PDIF input, it automatically derives the MCLK of the input, which is sent to the RXCKO pin. Dividers are used to send the generated BLCK and LRCLK from the audio ports (if they are in master mode). For certain use cases, the SRC4392 is set up so that these ports are used. When routing through the audio serial ports on the SRC4392, it is important to use RXCKO as the master clock source for the PCM510x. In order to ensure proper operation, the master clock source must be synchronized to the bit and word clock supplied to the PCM510x. Therefore, the master clock source for the PCM510x must also be replicated from the digital input source, which is why RXCKO must be chosen. If the master clock source for the PCM510x is the onboard MCLK from the TAS1020B USB controller, for example, then there is potential for synchronization mismatch between the master clock supplied to the PCM510x and the bit and word clocks being supplied to the PCM510x. For use cases routing through the SRC4392 audio serial ports, look to jumper W5 for selecting RXCKO as the master clock source, as opposed to one of the options chosen by adjusting SW3. The SRC4392 product data sheet has additional routing information.

The PCM510x devices contain an internal PLL and BCLK reference, so that the MCLK can be generated internally. When using external I^2S input directly into the W3 jumper, a MCLK can be derived form the BCLK input. Refer to the PCM510x product data sheet for more details.

2.6 Use Cases

2.6.1 Scripts and Setup

While the PCM510x is only hardware programmable, the CodecControl software is still necessary to properly configure the PCM510xEVM-U for different use cases, such as USB playback or optical/SPDIF input to the PCM510x. Most of the I/O routing and clock frequency selection on the PCM510x evaluation module is performed by the SRC4392. Section 2.6.2 and Section 2.6.3 are two example scripts that adjust the SRC4392 registers accordingly, as well as set proper jumper configurations.

There are several use cases for which the PCM510xEVM-U can be used. Depending on whether it is USB playback, or optical/SPDIF input, for example, there may need to be changes made in the scripts and jumper configuration to accommodate these cases. Likewise, the shunts on header W3 may need to be installed accordingly. Section 2.6.2 and Section 2.6.3 are some example use cases for the PCM5101 for USB playback and optical/SPDIF input, respectively.

2.6.2 USB Playback

```
# The following script is used for playback via USB
# RESET RESET THIS IS MASTER RESET FOR SRC (48kHz)
# Page 0 = DEFAULT for Control
# Write to page 0
w E0 7F 00
# Register 01, Bit 7 = 1 resets to default
d 100
w E0 01 80
# Delay 0.1 sec to allow part to reset
d 100
# Register 01, Bit 7 = 0 for normal operation
w E0 01 00
d 100
# w E0 7F 00
# Register 01, Bit 7 = 1 resets to default

#----- Setup Port A ------#

# 24bit I2S, Master mode, DIR source, at mute
# Divide by 256, MCLK input source
# Unmute Port A Output
# power on port A and B
w E0 01 38
# set up port A as master, 24 bit I2S sourced from port B
w E0 03 19
# select  MCLK as source at 256fs
w E0 04 01
# port B slave, 24 bit I2S
w E0 05 01

#----- Setup DIR ------#

#DIR Config 1
# Input source: RX2 - S/PDIF RCA (default)
#w E0 0D 01
# Input source: RX4 - S/PDIF optical, RX_MUX = RX1
w E0 0D 08
#DIR Config 2 - default
w E0 0E 01

#----- Setup DIT -----#

# DIT COnfig 1
# Port A data in, DIv 256
w E0 07 80
# DIT Config 2
# Default is to output to RCA
```

```
# Comment out RCA and uncomment Optical for optical outputs
#Output to RCA
# TX - ON, TX MUTE - ON, Optical disabled
#w E0 08 06
# TX Mute - OFF
#w E0 08 04
#Output to Optical
# TX - OFF, TX MUTE - ON, optical disabled
w E0 08 03
# TX MUTE - OFF
w E0 08 01


#----- PLL Configuration -----#

# Set P=2, J=8, D=0
w E0 0F 22
w E0 10 1B
w E0 11 A3
# GPIO1 Config
# GPIO1 = RCVR non-audio data
w E0 1B 06
# GPIO2 Config
# GPIO2 = RCVR non-valid data
w E0 1C 07
# Power Status
# Disable RCVR (/PDRX) and Port B(/PDPB) power down and enable All Function power down
#w E0 01 14
#w E0 03 29
```

2.6.3 Optical/SPDIF Input via J4 (48 kHz, RXCKO Master Clock)

```
# RESET RESET THIS IS MASTER RESET FOR SRC
# SW3 (2-7) turned on, rest turned off
# Page 0 = DEFAULT for Control
# Write to page 0
w E0 7F 00
# Register 01, Bit 7 = 1 resets to default
d 100
w E0 01 80
# Delay 0.1 sec to allow part to reset
d 100
# Register 01, Bit 7 = 0 for normal operation

w E0 01 00
d 100
# w E0 7F 00
# Register 01, Bit 7 = 1 resets to default

#----- Setup Port A ------#

# 24bit I2S, Master mode, DIR source, at mute
# Divide by 256, MCLK input source
w E0 03 69
w E0 04 0B

#----- Setup DIR ------#

#DIR Config 1
# Input source: RX2 - S/PDIF RCA (default)
#w E0 0D 01
# Input source: RX4 - S/PDIF optical, RX_MUX = RX1
w E0 0D 08
#DIR Config 2 - default
w E0 0E 01
```

```
#----- Setup DIT -----#

# DIT COnfig 1
# Port A data in, DIv 256
w E0 07 80
# DIT Config 2
# Default is to output to RCA
# Commment out RCA and uncomment Optical for optical outputs
#Output to RCA
# TX - ON, TX MUTE - ON, Optical disabled
#w E0 08 06
# TX Mute - OFF
#w E0 08 04
#Output to Optical
# TX - OFF, TX MUTE - ON, optical disabled
w E0 08 03
# TX MUTE - OFF
w E0 08 01


#----- PLL Configuration -----#

# Set P=2, J=8, D=0
w E0 0F 22
w E0 10 1B
w E0 11 A3

# GPIO1 Config
# GPIO1 = RCVR non-audio data
w E0 1B 06
# GPIO2 Config
# GPIO2 = RCVR non-valid data
w E0 1C 07

# Power Status
# Disable RCVR (/PDRX) and Port B(/PDPB) power down and enable All Function power down
#w E0 01 14

# Unmute Port A Output
w E0 03 29

# Disable All Function power down (all blocks set by local control)
w E0 01 3F
```

NOTE: For characteristic performance graphs, refer to the PCM510x data sheet.

3 CodecControl Software

This section explains how to use the CodecControl software together with the PCM510x device. While the PCM510x is only hardware-programmable, the CodecControl software is required to properly configure the PCM510xEVM-U for different use cases, such as USB playback or optical/SPDIF input to the device.

3.1 Control Software

The CodecControl software exposes most of the features of a supported TI audio codec EVM through an intuitive graphical user interface.

NOTE: Before a PC running Windows can use the TI audio converter EVM as a sound card, the EVM must be properly configured (sampling rate, audio routing, internal amplifier settings, etc.) with the CodecControl software. This configuration occurs automatically once an EVM is detected by the CodecControl software.

Figure 3 illustrates the CodecControl software with the PCM510xEVM-U window as an example of the CodecControl software in operation.

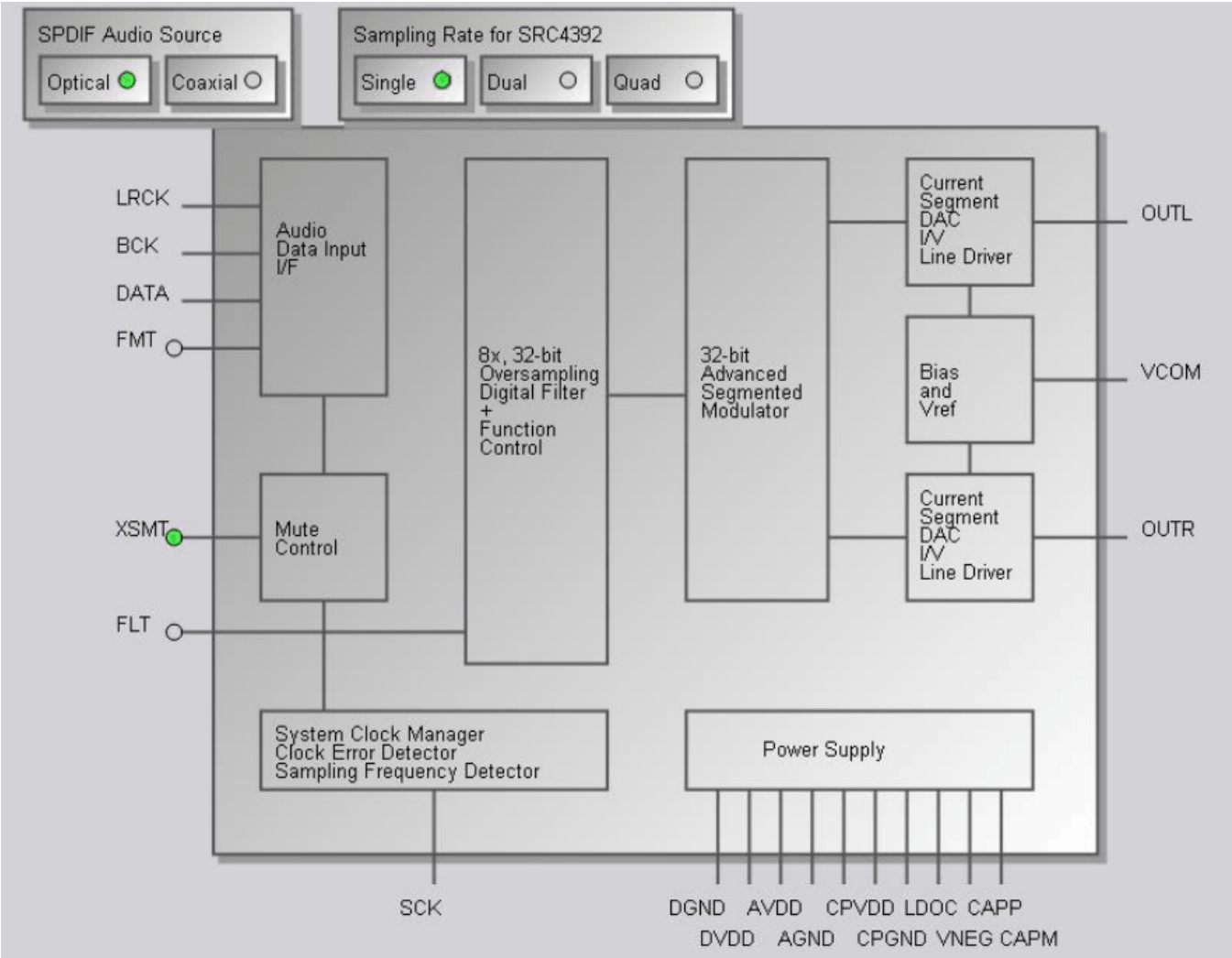


Figure 3. EVM Software Window

3.2 Installation

Download the CodecControl software from the PCM510xEVM-U audio codec product folder and launch the program. The file is a self-extracting archive that is downloaded in a compressed format.

The default target folder is:

C:\Program Files\Texas Instruments\CodecControl

Click the **Unzip** button to complete the installation. The CodecControl software is now available in the target folder. The name of the executable is *CodecControl.exe*.

To launch the CodecControl software, navigate to the target folder and double-click the CodecControl.exe file.

3.3 Concepts

The CodecControl software presents a block diagram view of a supported TI audio codec EVM, such as that shown in Figure 3.

The block diagram consists of active objects that respond to user input (for example, switches or amplifiers with variable gain that show a volume control when a user clicks on the component with a mouse).

NOTE: **Active Objects:** Each active object changes color to red if the cursor is placed over the object. Clicking the object triggers its function.

Some active objects are linked to control register(s) of the particular TI audio codec. The CodecControl software updates the appropriate register(s) whenever an active object is triggered. If a register that is linked to an active object is changed through other components (for example, the script interpreter or the register inspector), the active object changes its state accordingly.

The CodecControl software automatically detects a supported TI audio codec EVM once it is connected to an available USB port of the PC.

If no TI audio codec EVM is connected to the PC, the control software also supports an EVM simulation mode, where it is possible to retrieve script commands based on user input within the block diagram.

Simulation mode is only available if no TI audio codec EVM is attached to the PC. Choose *File->New EVM simulation…* and select an EVM from the list of supported TI audio codec EVMs.

3.4 Dialogs and Active Objects

The CodecControl software contains several dialog windows that provide access to additional features. Most dialogs are linked to active objects and are opened by clicking on the active object.

Several dialogs are not linked to active objects and are opened instead using the View menu.

3.4.1 Initialization Script Dialog

The CodecControl software executes an initialization script when a supported TI audio codec is detected.

To show or edit the initialization script, choose *View->Init Script…* from the main window menu bar.

Click the **Run** button to run the script again.

3.4.2 Command Dialog

Open the command dialog (*View->Command…*) to write, edit, load, save, and run command scripts. Command scripts are text files that contain commands to communicate with the TI audio codec. The syntax is described in Section 3.5. The command dialog is shown in Figure 4.

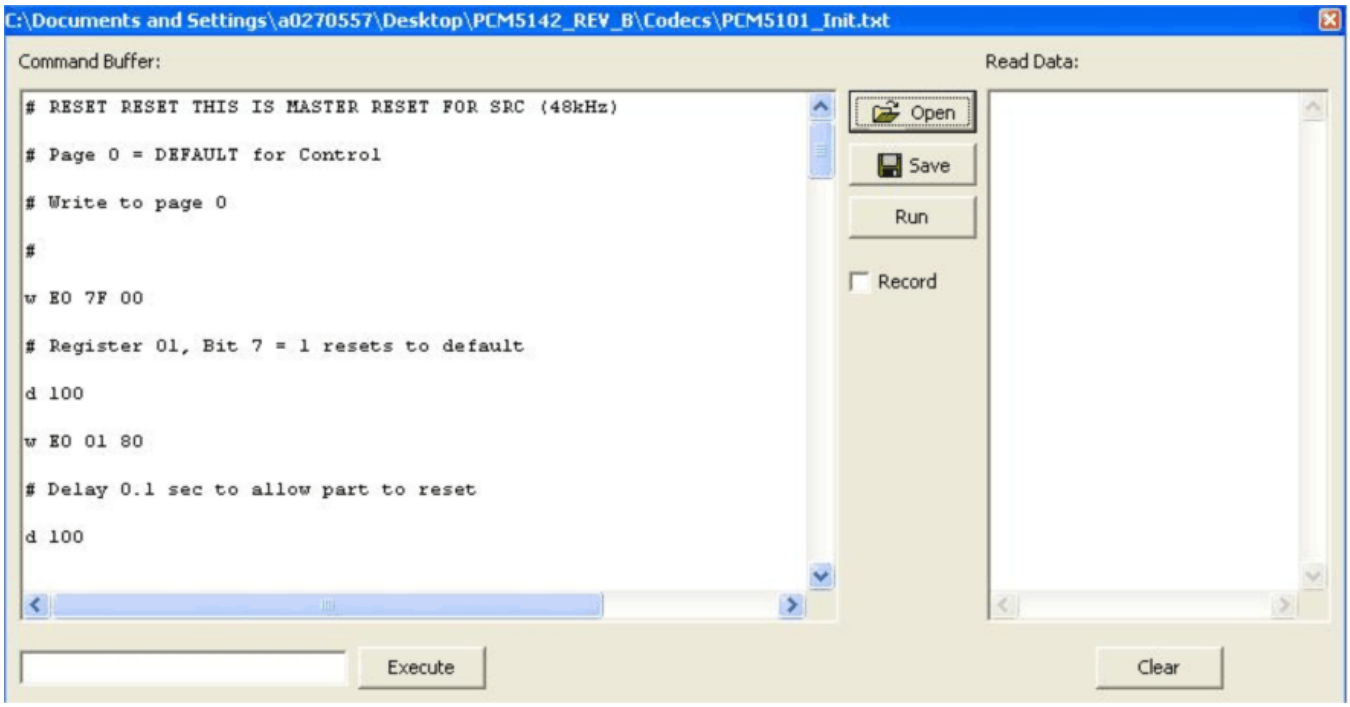


Figure 4. Command Dialog

- The primary area of the command dialog is the command buffer (editable text) which contains the command script. To run the command script, click the **Run** button
- The smaller, read-only text area on the right side of the command dialog displays control data read from the TI audio codec. The **Clear** button clears the Read Data field.
- The one-line text edit field on the left bottom allows single command execution.
- The *Record* check box enables recording of commands generated by the control software.

3.4.3 Register Inspector

The register inspector dialog (*View->Register Inspector…*) gives access to all registers of the TI audio codec. The register inspector displays the content of the connected TI audio codec device registers. To trigger reading the content of one page, click the **Refresh** button.

- The *addr* column shows the address of the registers in decimal notation.
- The *description* column contains a description for each register. If the register has no function assigned, it is declared *Reserved*.
- The data columns show the data of each register (one byte). The first data column uses decimal notation, and the second uses hexadecimal notation. It is possible to change the register value by clicking into one of the data fields and typing the new value (either decimal or hexadecimal).
- The numbered columns show the register content in binary notation. Read/write bits are shown solid black or red; read-only bits are gray or dark red. Red numbers represent bits that recently changed. To change a single writable bit, click on the bit and it will flip.

The coefficients may be used for a specific customer filter implementation. The format is compatible with the TI audio codec that was detected by the CodecControl software.

NOTE: For the PCM510x, which are hardware programmable only, this feature is not used.

3.4.4 Firmware Update

TI may publish new firmware for TI audio codec EVMs. To program the new firmware to a TI audio codec EVM, choose *File->Update Firmware…* and select the new firmware file.

The update process takes a few seconds (there is no progress bar) and is completed once the update firmware dialog disappears. The EVM must be disconnected and reconnected to finish the firmware update process.

3.5 Script Syntax

A script is a text file that contains data to send to a device.

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:

r	Read from the serial control bus
w	Write to the serial control bus
>	Extend repeated write commands
#	Comment
I	Set interface bus to use
b	Break
d	Delay
f	Wait for Flag

Command: **r** <address> <register> <length>

<address> is the device address in hexadecimal format. For example, *30* for device address 0x30.

<register> is the register in hexadecimal format that will be read from.

<length> is the number of bytes that will be read from <register> in auto-increment mode.

The result will be displayed in the right-side output window of the command interpreter dialog.

Command: **w** <address> <register> <data ...>

<address> is the device address in hexadecimal format. For example, *30* for device address 0x30.

<register> is the register in hexadecimal format that will be written to.

<data…> is a sequence of bytes that will be written to the <register> in auto-increment mode. Each byte is in hexadecimal format.

Command: **>** <data ...>

This command continues a write sequence in a new line.

<data…> is a sequence of bytes that will be written in auto-increment mode. Each byte is in hexadecimal format.

Command: # [optional comment]

This command indicates a comment.

Command: **I**<interface>

<interface> is i2c for I²C™ or spi for SPI

Command: **b**[optional comment]

[optional comment] is a string of characters. The command interpreter will show a modal dialog with the optional comment. Script execution will resume once the dialog is closed.

Command: **d**<time>

This command suspends script execution by at least <time> milliseconds.

Command: **f** <address> <register> <mask> [optional timeout]

This commands suspends script execution until the value read from <address> <register> matches <mask>

<address> is the device address in hexadecimal format. For example, *30* for device address 0x30.

<register> is the register in hexadecimal format that will be read from.

<mask> is a 8-bit binary format mask that is compared with the data from the device. Each bit can be 0, 1, or X.

For example: <mask> = 010XX01X tests, if the data from the device has D7 = 0, D6 = 1, D5 = 0, D4 = don't care, D3 = don't care, D2 = 0, D1 = 1, D0 = don't care.

[optional timeout] specifies how long (milliseconds) the command interpreter will poll the device if the data do not match the <mask>

4 PCM510xEVM-U

4.1 PCM510xEVM-U Schematics

Figure 5 through Figure 7 show the schematics for the PCM5122EVM-U.

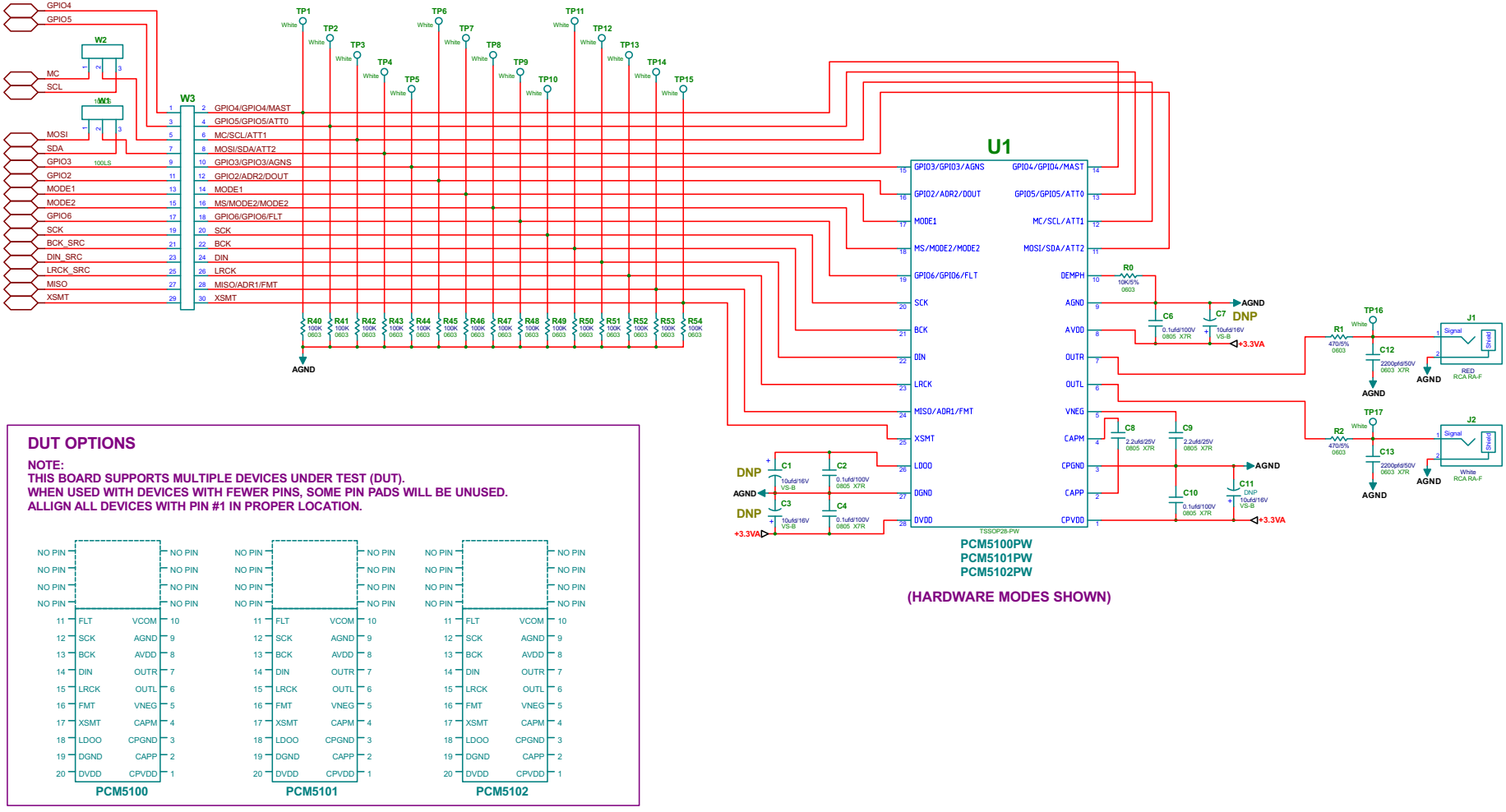


Figure 5. PCM510xEVM-U Schematic

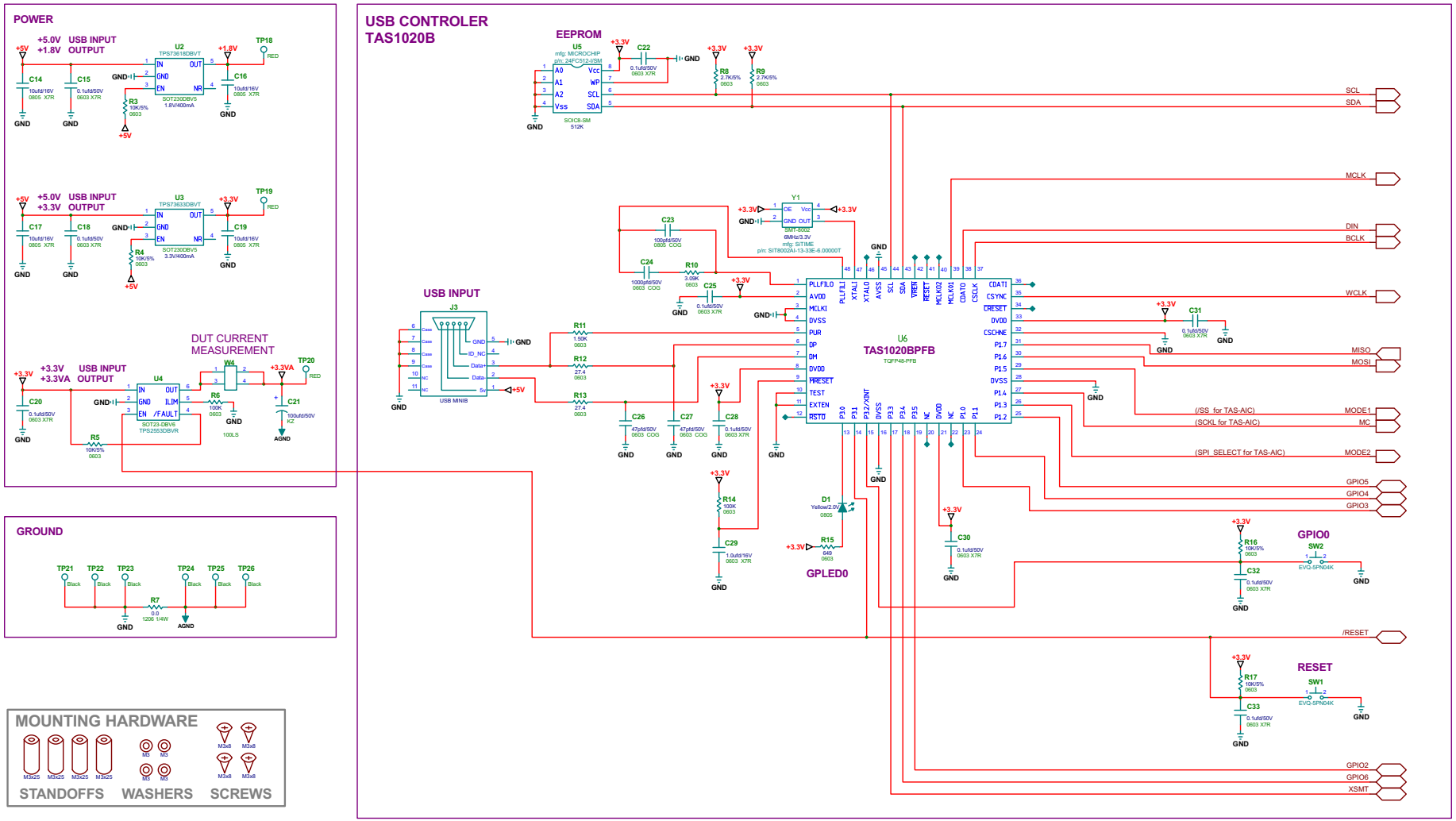


Figure 6. PCM510xEVM-U Power and USB Controller

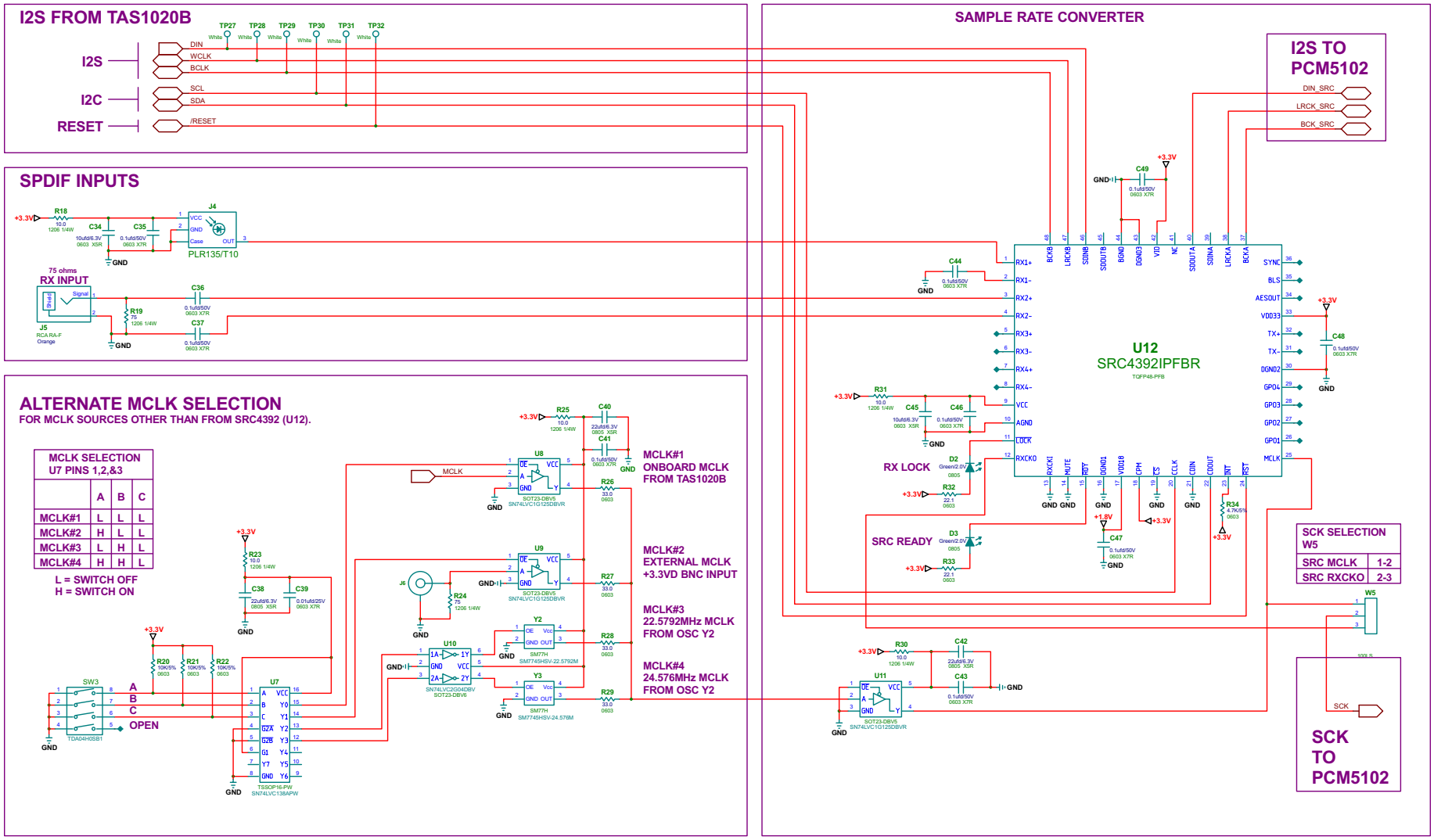


Figure 7. PCM510xEVM-U Digital I/O and Source

4.2 PCM510xEVM-U Bill of Materials

Table 3 is the BOM for the PCM510xEVM-U.

Table 3. PCM510xEVM-U Bill of Materials[1][2][3]

Item	MFG Part Number	MFG	QTY	Ref Designators	Description
1	PCM5102PW	TEXAS INSTRUMENTS	1	U1	24-BIT 384KHz AUDIO STEREO DAC w/MINI DSP TSSOP20-PW ROHS
2	TPS73618DBVT	TEXAS INSTRUMENTS	1	U2	VOLT REG 1.8V 400MA LDO CAP FREE NMOS SOT23-DBV5 ROHS
3	TPS73633DBVT	TEXAS INSTRUMENTS	1	U3	VOLT REG 3.3V 400MA LDO CAP FREE NMOS SOT23-DBV5 ROHS
4	TPS2553DBV	TEXAS INSTRUMENTS	1	U4	Adj.,Active High,Pwr-Dist Switch,SOT23-DBV6,ROHS
5	TAS1020BPFB	TEXAS INSTRUMENTS	1	U6	USB STREAMING CONTROLLER TQFP48-PFB ROHS
6	SN74LVC138APWR	TEXAS INSTRUMENTS	1	U7	3-LINE TO 8-LINE DECODER/DEMULTIPLEXER TSSOP16-PW ROHS
7	SN74LVC1G125DBVR	TEXAS INSTRUMENTS	3	U8, U9, U11	SINGLE BUS BUFFER GATE WITH 3-STATE OUTPUT SOT23-DBV5 ROHS
8	SN74LVC2G04DBVR	TEXAS INSTRUMENTS	1	U10	DUAL INVERTER GATE SOT23-DBV6 ROHS
9	SRC4392IPFBR	BURR-BROWN	1	U12	2 CHAN,ASYNC,SAMPLE RATE CONV W/DIG AUDIO REC/XMTR ROHS
10	24FC512-I/SM	MICROCHIP	1	U5	512K (64Kx8) I2C SERIAL EEPROM SOIC8-SM ROHS
11	PLR135/T10	EVERLIGHT ELECTRONICS	1	J4	PHOTOLINK FIBER OPTIC RECEIVER 2.4-5.5V 15MB PCB-RA SHUTTER ROHS
12	SML-LXT0805YW-TR	LUMEX OPTO	1	D1	LED, YELLOW 2.0V SMD0805 ROHS
13	SML-LXT0805GW-TR	LUMEX OPTO	2	D2, D3	LED, GREEN 2.0V SMD0805 ROHS
14	SIT8002AI-13-33E-6.00000T	SITIME	1	Y1	OSCILLATOR SMT 6MHz 3.3V OUT-ENABLE ROHS
15	SM7745HSV-22.5792M	PLETRONICS	1	Y2	OSCILLATOR SMT 3.3V SM77H SERIES 22.5792MHz ROHS
16	SM7745HSV-24.576M	PLETRONICS	1	Y3	OSCILLATOR SMT 3.3V SM77H SERIES 24.576MHz ROHS
17	EEE1CA100SR	PANASONIC	0	C1, C3, C7, C11	CAP SMD ELECT 10ufd 16V 20% VS-B ROHS
18	C2012X7R2A104K	TDK	4	C2, C4, C6, C10	CAP SMD0805 CERM 0.1UFD 100V 10% X7R ROHS
19	GCM21BR71E225KA73L	MURATA	2	C8, C9	CAP SMD0805 CERM 2.2UFD 25V 10% X7R ROHS
20	GRM188R71H222KA01D	MURATA	2	C12, C13	CAP SMD0603 CERM 2200PFD 50V 10% X7R ROHS
21	GRM21BR61C106KE15L	MURATA	4	C14, C16, C17, C19	CAP SMD0805 CERM 10UFD 16V 10% X5R ROHS
22	C1608X7R1H104K	TDK	20	C15, C18, C20, C22, C25, C28, C30, C31, C32, C33, C35, C36, C37, C41, C43, C44, C46, C47, C48, C49	CAP SMD0603 CERM 0.1UFD 50V 10% X7R ROHS
23	UKZ1E101MPM	NICHICON	1	C21	CAP ALUM ELEC KZ RADIAL 100UFD 50V 20% ROHS
24	GRM2165C1H101JA01D	MURATA	1	C23	CAP SMD0805 CERM 100PFD 50V 5% C0G ROHS
25	C1608C0G1H102J	TDK CORP.	1	C24	CAP SMD0603 CERM 1000PFD 50V 5% COG ROHS
26	GRM1885C1H470JA01D	MURATA	2	C26, C27	CAP SMD0603 CERM 47PFD 50V 5% COG ROHS
27	C1608X7R1C105K	TDK	1	C29	CAP SMD0603 CERM 1.0UFD 16V 10% X7R ROHS
28	GRM188R60J106ME47D	MURATA	2	C34, C45	CAP SMD0603 CERM 10UFD 6.3V 20% X5R ROHS
29	C2012X5R0J226M	TDK	3	C38, C40, C42	CAP SMD0805 CERM 22UFD 6.3V 20% X5R ROHS
30	06031C103JAT2A	AVX	1	C39	CAP SMD0603 CERM 0.01UFD 25V 5% X7R ROHS
31	ERJ-3GEYJ103V	PANASONIC	9	R0, R3, R4, R5, R16, R17, R20, R21, R22	RESISTOR SMD0603 10K 5% 1/10W ROHS
32	ERJ-3GEYJ471V	PANASONIC	2	R1, R2	RESISTOR SMD0603 470 OHMS 5% 1/10W ROHS

(1) These assemblies are ESD sensitive, observe ESD precautions.
(2) These assemblies must be clean and free from flux and all contaminants. Use of no-clean flux is not acceptable.
(3) These assemblies must comply with workmanship standards IPC-A-610 Class 2.

Table 3. PCM510xEVM-U Bill of Materials[1][2][3] (continued)

Item	MFG Part Number	MFG	QTY	Ref Designators	Description
33	ERJ-3EKF1003V	PANASONIC	17	R6, R14, R40, R41, R42, R43, R44, R45, R46, R47, R48, R49, R50, R51, R52, R53, R54	RESISTOR SMD0603 100K OHM 1% THICK FILM 1/10W ROHS
34	ERJ-8GEY0R00V	PANASONIC	1	R7	RESISTOR SMD1206 0.0 OHM 5% 1/4W ROHS
35	ERJ-3GEYJ272V	PANASONIC	2	R8, R9	RESISTOR SMD0603 2.7K OHMS 5% 1/10W ROHS
36	ERJ-3EKF3091V	PANASONIC	1	R10	RESISTOR SMD0603 3.09K OHM 1% THICK FILM 1/10W ROHS
37	ERJ-3EKF1501V	PANASONIC	1	R11	RESISTOR SMD0603 1.50K OHM 1% THICK FILM 1/10W ROHS
38	ERJ-3EKF27R4V	PANASONIC	2	R12, R13	RESISTOR SMD0603 27.4 OHMS 1% 1/10W ROHS
39	RC0603FR-07649RL	YAGEO	1	R15	RESISTOR SMD0603 THICK FILM 649 OHMS 1% 1/10W ROHS
40	ERJ-8ENF10R0	PANASONIC	5	R18, R23, R25, R30, R31	RESISTOR SMT1206 10.0 OHM 1% 1/4W ROHS
41	MCR18EZPF75R0	ROHM SEMICONDUCTOR	2	R19, R24	RESISTOR SMD1206 75 OHMs 1% 1/4W ROHS
42	ERJ-3EKF33R0V	PANASONIC	4	R26, R27, R28, R29	RESISTOR SMD0603 33.0 OHMS 1% 1/10W ROHS
43	CRCW060322R1FKEA	VISHAY	2	R32, R33	RESISTOR SMD0603 22.1 OHMS 1% 1/10W ROHS
44	ERJ-3GEYJ472V	PANASONIC	1	R34	RESISTOR SMD0603 4.7K OHMS 5% 1/10W ROHS
45	RCJ-042	CUI STACK	1	J1	RCA JACK THRU RA-FEMALE RED ROHS
46	RCJ-043	CUI STACK	1	J2	RCA JACK THRU RA-FEMALE WHITE ROHS
47	UX60-MB-5ST	HIROSE	1	J3	JACK USB MINIB SMT-RA 5PIN ROHS
48	RCJ-047	CUI STACK	1	J5	RCA JACK THRU RA-FEMALE ORANGE ROHS
49	5227699-2	TYCO ELECTRONICS	1	J6	JACK BNC SQUARE 50 OHMS ROHS
50	PBC03SAAN	SULLINS	3	W1, W2, W5	HEADER THRU MALE 3 PIN 100LS 120 TAIL GOLD ROHS
51	PBC15DAAN	SULLINS	1	W3	HEADER THRU MALE 2X15 100LS 120 TAIL GOLD ROHS
52	PBC02DAAN	SULLINS	1	W4	HEADER THRU MALE 2X2 PIN 100LS 120 TAIL GOLD ROHS
53	5002	KEYSTONE ELECTRONICS	23	TP1, TP2, TP3, TP4, TP5, TP6, TP7, TP8, TP9, TP10, TP11, TP12, TP13, TP14, TP15, TP16, TP17, TP27, TP28, TP29, TP30, TP31, TP32	PC TESTPOINT, WHITE, ROHS
54	5000	KEYSTONE ELECTRONICS	3	TP18, TP19, TP20	PC TESTPOINT, RED, ROHS
55	5011	KEYSTONE ELECTRONICS	6	TP21, TP22, TP23, TP24, TP25, TP26	PC TESTPOINT BLACK 063 HOLE ROHS
56	EVQ-5PN04K	PANASONIC	2	SW1, SW2	SWITCH MOM 240G SMD 6x3.5MM ROHS
57	TDA04H0SB1	CK COMPONENTS	1	SW3	SWITCH SMT DIP8 4POS ROHS
58	95947A018	MCMASTER-CARR	4	STANDOFFS	STANDOFF M3x25mm 4.5mm DIA HEX ALUM F-F ROHS
59	92148A150	MCMASTER-CARR	4	STANDOFF WASHERS	WASHER SPLIT-LOCK M3 6.2mm OD 0.7mm THICK STAINLESS STEEL ROHS
60	92000A118	MCMASTER-CARR	4	STANDOFF SCREWS	SCREW M3x8 PHILIPS PANHEAD STAINLESS STEEL ROHS
61	969102-0000-DA	3M	4	W1(2-3), W2(2-3), W4(1-2), W5(1-2)	SHUNT BLACK AU FLASH 0.100LS OPEN TOP ROHS
62	969102-0000-DA	3M	12	W3: 1-2, 3-4, 5-6, 7-8, 9-10, 15-16, 17-18, 19-20, 21-22, 23-24, 25-26, 29-30	SHUNT BLACK AU FLASH 0.100LS OPEN TOP ROHS
		TOTAL	186		
X1	DO NOT POPULATE		4	C1, C3, C7, C11	

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