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 USB will provide I^2C control and power to the EVM. However, this EVM does not support I2S USB audio streaming from the host computer.

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	SLAS859A
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.

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2 PCM510xEVM-U

2.1 Electrostatic Discharge Warning

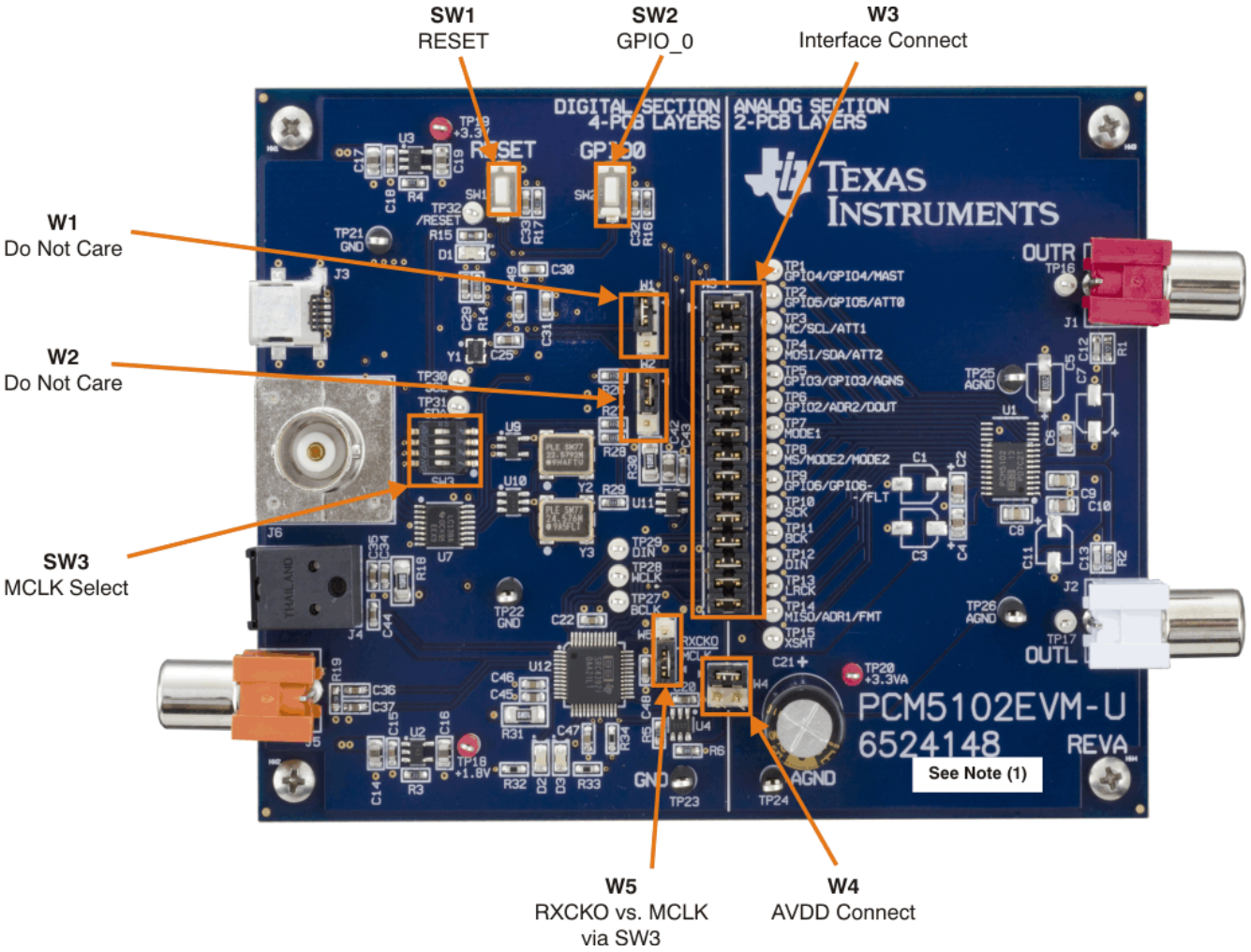
Many of the components on the PCM510xEVM-U are susceptible to damage by electrostatic discharge (ESD). Customers are advised to observe proper ESD handling precautions when unpacking and handling the EVM, including the use of a grounded wrist strap at an approved ESD workstation.

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 I^2S 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

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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

EVM Block Diagram

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

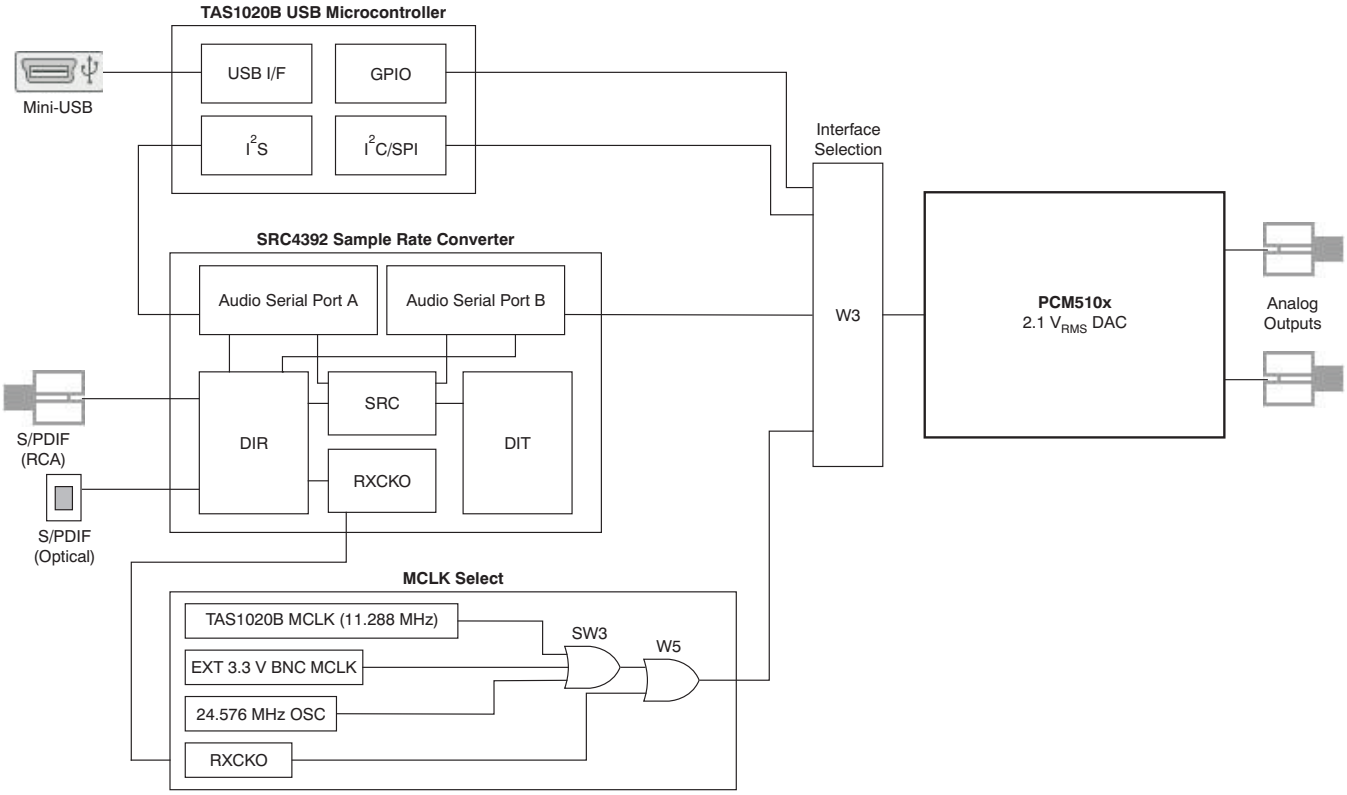


Figure 2. PCM510xEVM-U Block Diagram

Jumpers, Connectors, Test Points, Switches

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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
J4	Optical S/PDIF Input

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

Connectors/Switch/Jumper/Test Point	Description
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

2.3 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

2.3.1 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.

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2.4 Use Cases

2.4.1 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 optical, SPDIF, and coaxial 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 2.4.2 is just one example script that adjusts the SRC4392 registers accordingly, as well as set proper jumper configurations.

2.4.2 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
```


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```
#----- 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.

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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 optical, SPDIF, and coaxial 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.

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

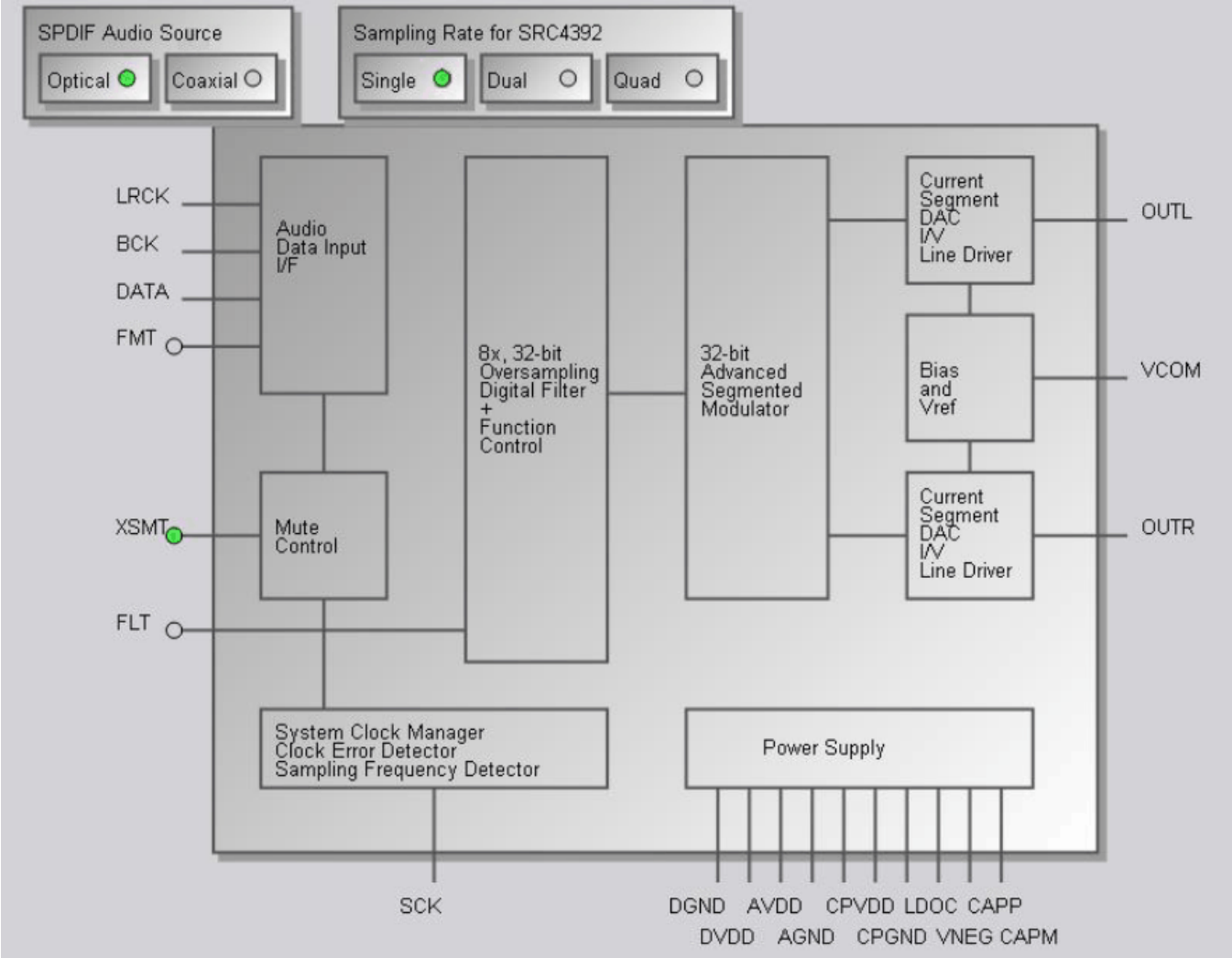


Figure 3. EVM Software Window

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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.

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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.

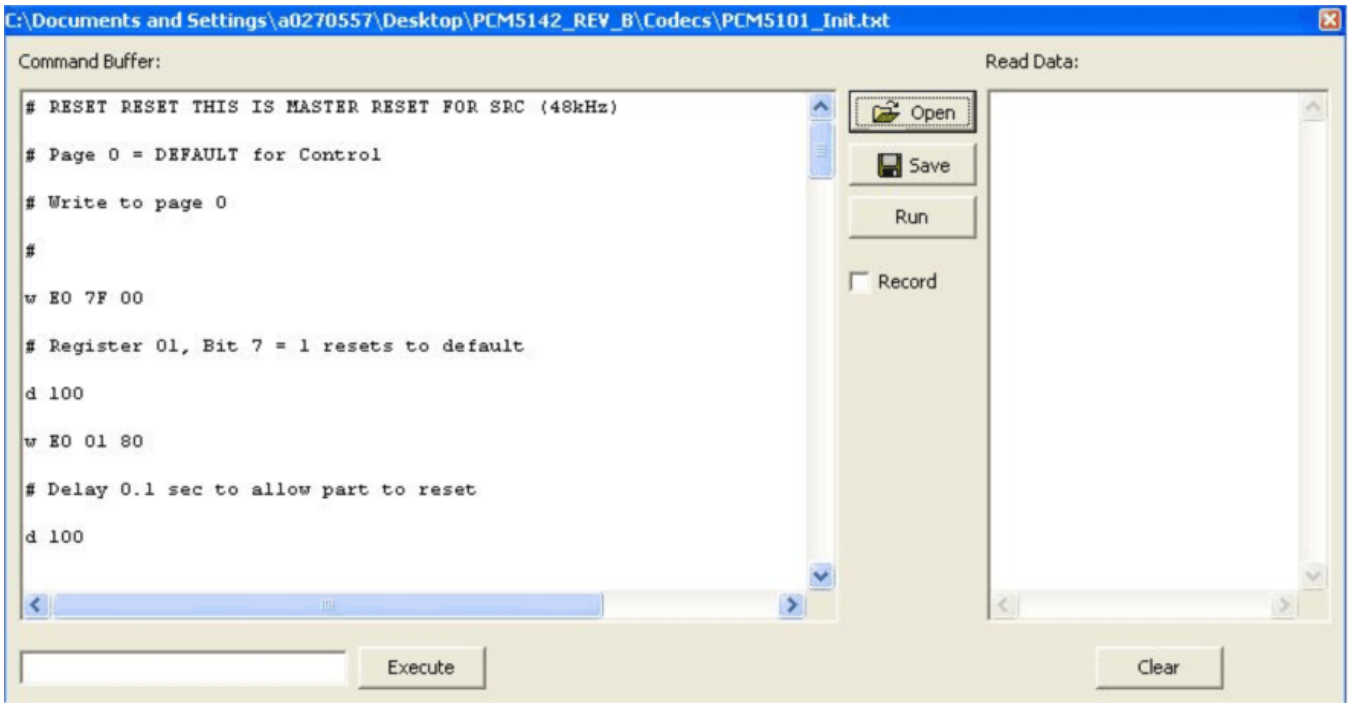


Figure 4. Command Dialog

- 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.

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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.

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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 I^2C 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>

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4 PCM510xEVM-U

4.1 PCM510xEVM-U Schematics

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

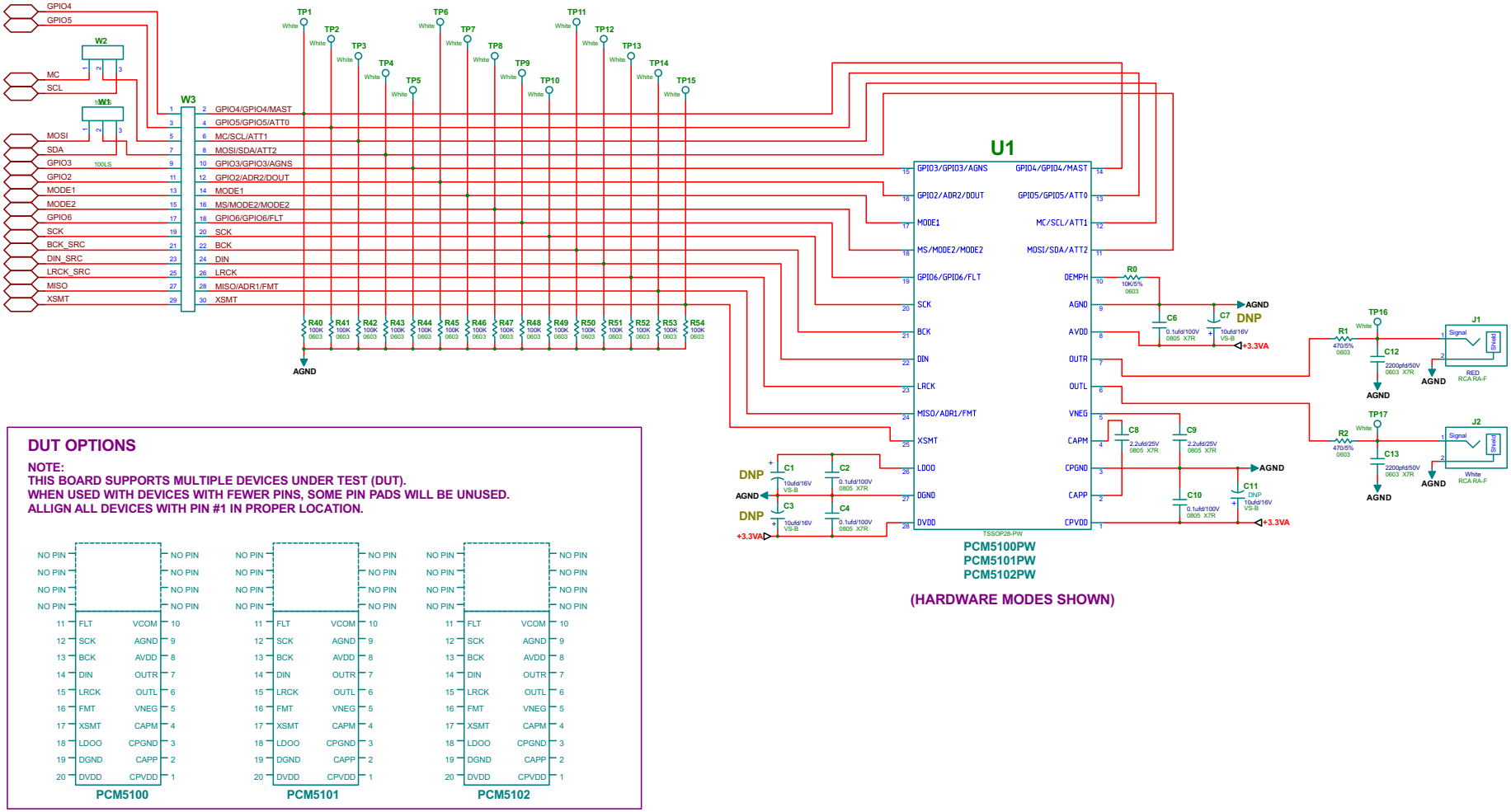


Figure 5. PCM510xEVM-U Schematic

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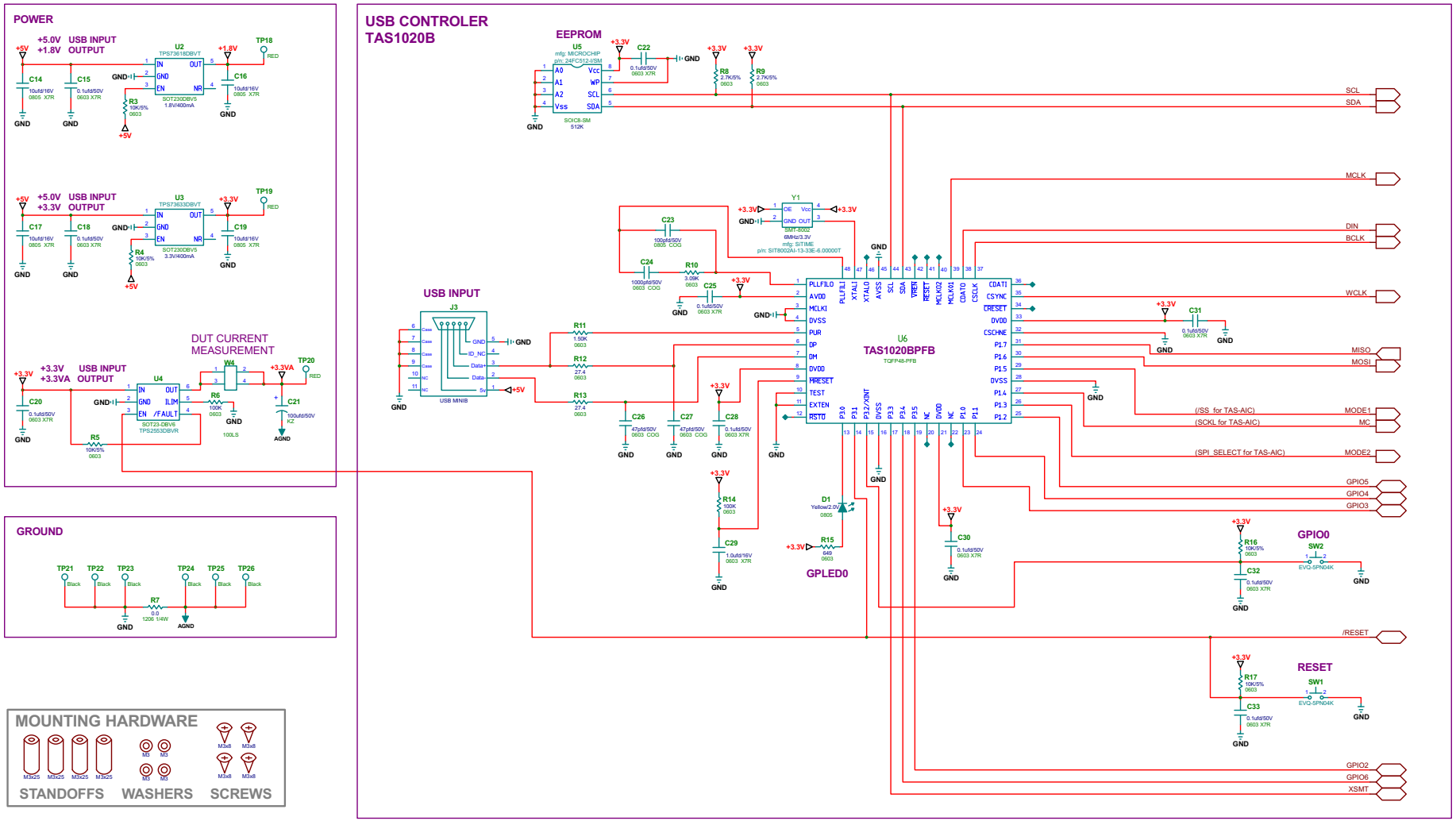


Figure 6. PCM510xEVM-U Power and USB Controller

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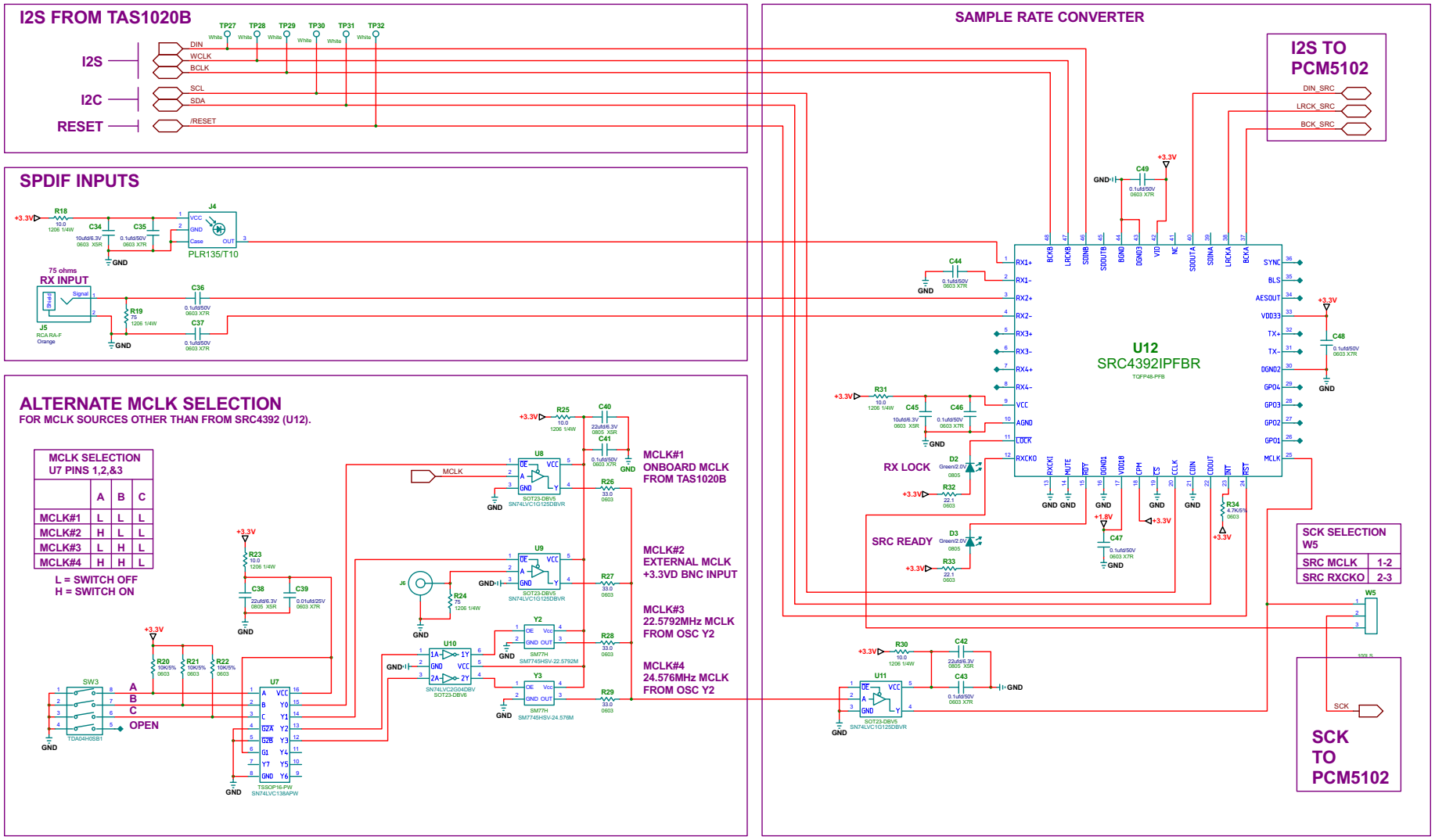


Figure 7. PCM510xEVM-U Digital I/O and Source

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4.2 PCM510xEVM-U Printed-Circuit Board (PCB) Layouts

Figure 9 through Figure 13 illustrate the PCM510xEVM-U PCB layouts.

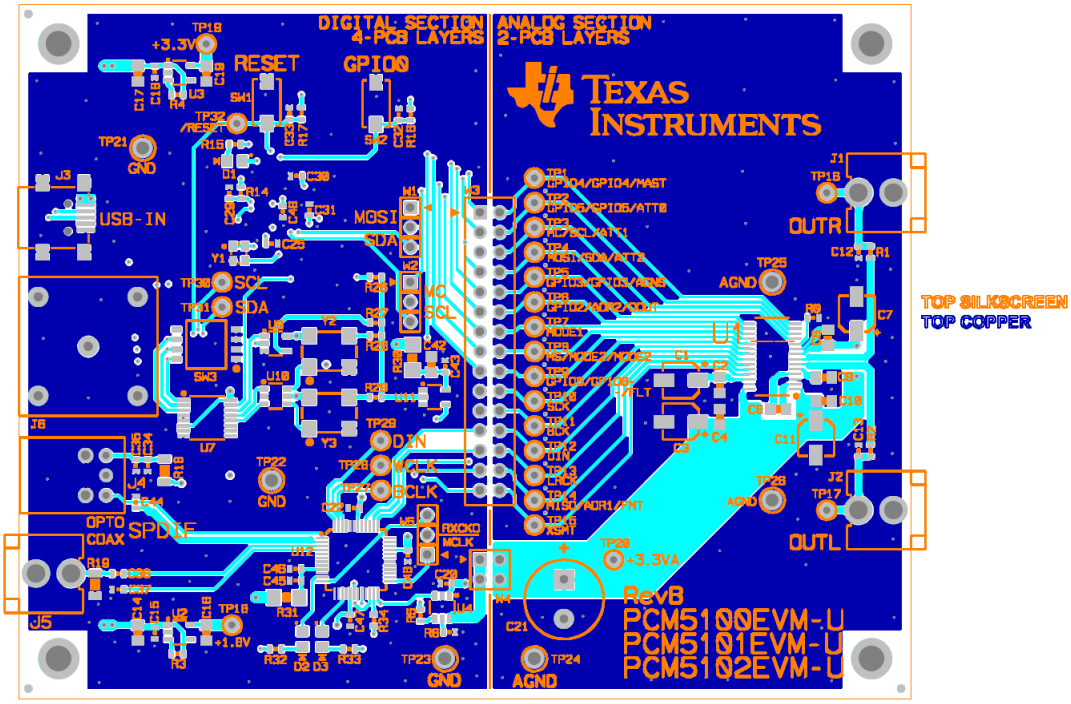


Figure 8. PCM5102EVM-U Revision B Top Composite

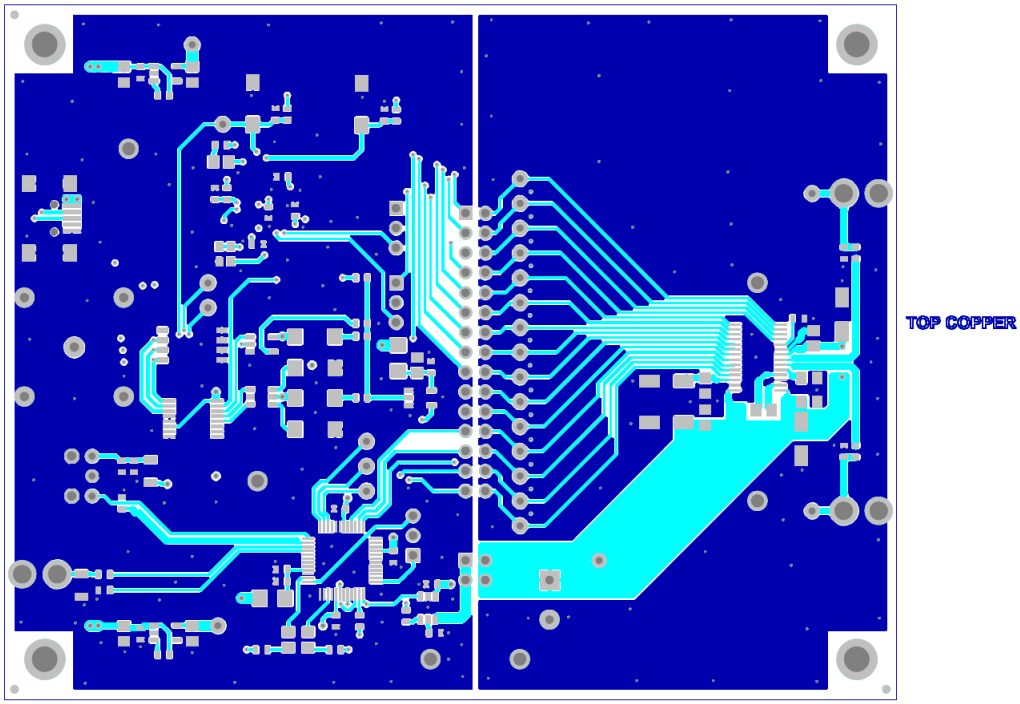


Figure 9. PCM5102EVM-U Revision B Top Copper

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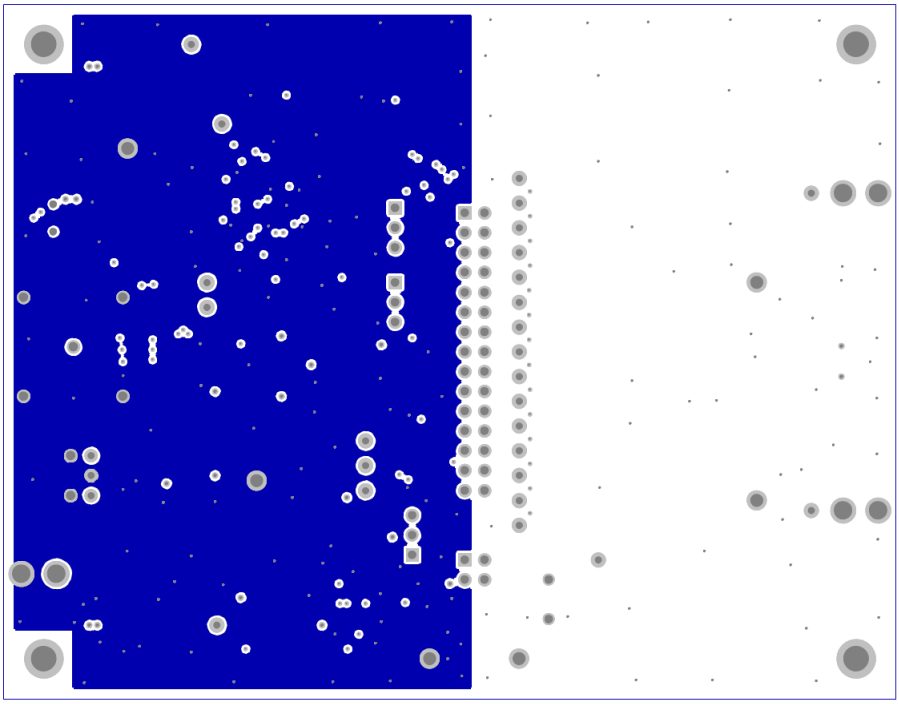


Figure 10. PCM5102EVM-U Revision B Copper Layer 2

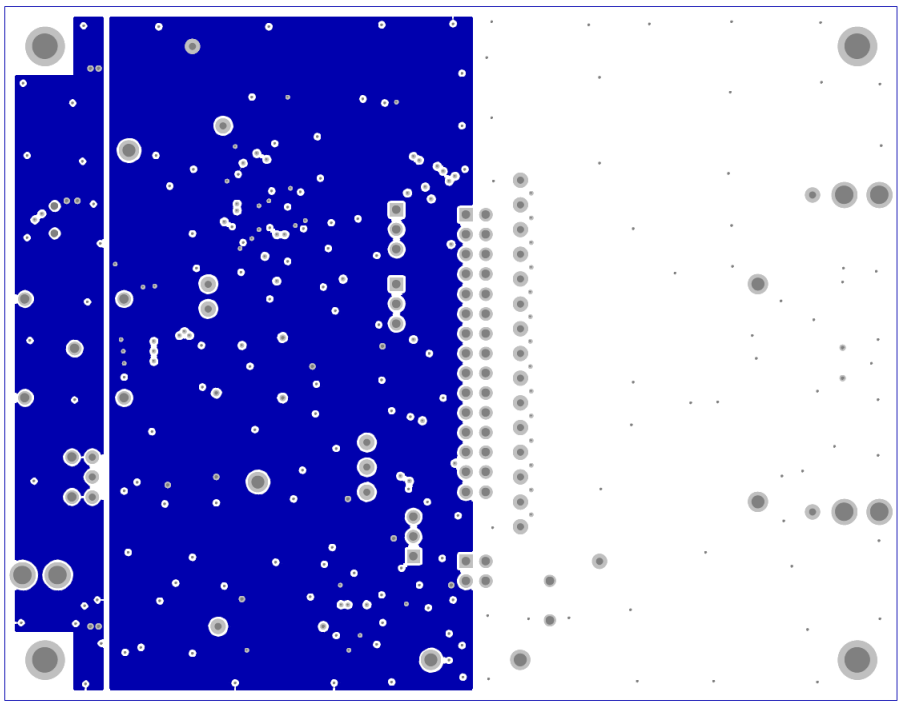


Figure 11. PCM5102EVM-U Revision B Copper Layer 3

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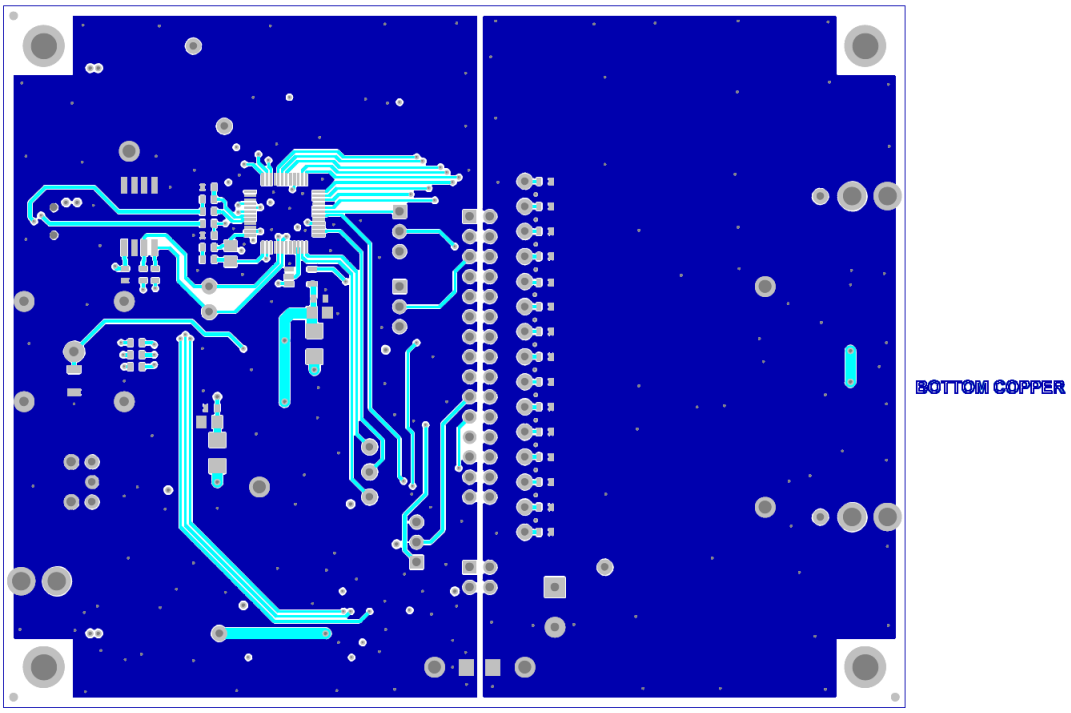


Figure 12. PCM5102EVM-U Revision B Bottom Copper

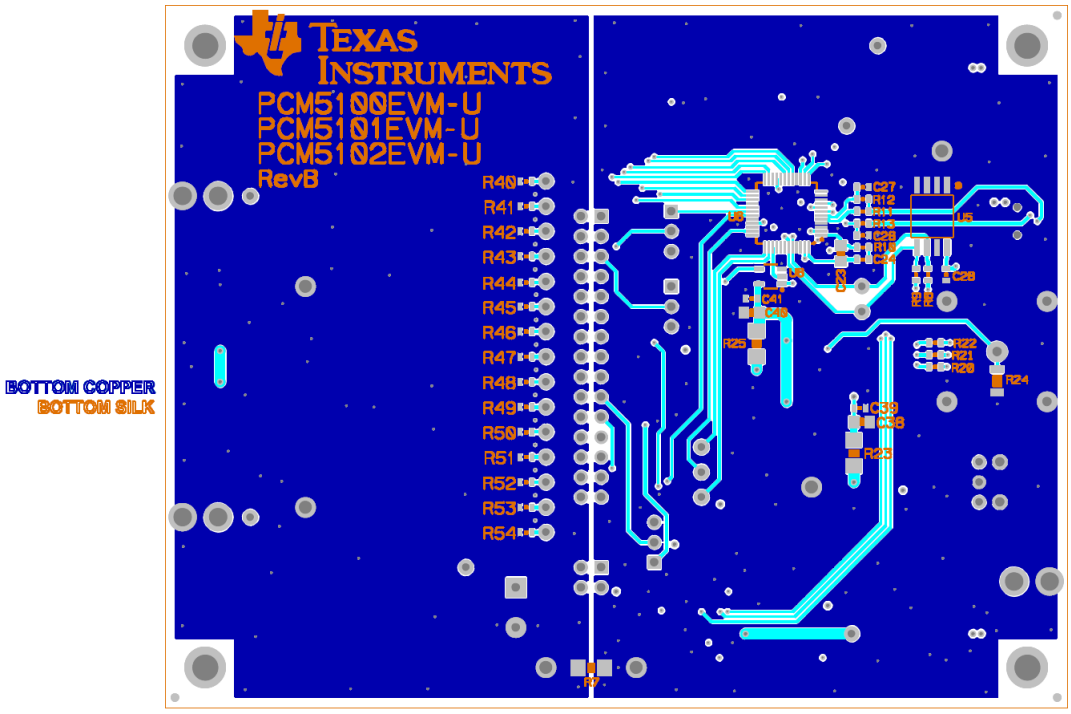


Figure 13. PCM5102EVM-U Revision B Bottom Composite

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4.3 PCM510xEVM-U Bill of Materials

Table 3 is the BOM for the PCM510xEVM-U.

Table 3. PCM5102xEVM-U Bill of Materials Rev C(1)(2)(3)

Item	MFG Part Number	MFG	QTY	Ref Designators	Description
1	PCM5102APW	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.

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Table 3. PCM5102xEVM-U Bill of Materials Rev C[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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Revision History

Changes from B Revision (June 2014) to C Revision **Page**

- Changed last sentence in the first paragraph of the *Introduction*. 2
- Changed link to PCM510x data sheet. 2
- Changed first paragraph in *Scripts and Setup* section. 7
- Deleted second paragraph in *Scripts and Setup* section. 7
- Deleted *USB Playback* section. 7
- Changed last sentence in the first paragraph of the *CodecControl Software* section. 9
- Deleted **NOTE:** in the *Control Software* section. 9
- Added *PCM510xEVM-U Printed-Circuit Board (PCB) Layouts* section. 17
- Changed title of the BOM to *PCM5102xEVM-U Bill of Materials Rev C*. 20
- Changed PCM5102PW to PCM5102APW the the first row of the BOM. 20

NOTE: Page numbers for previous revisions may differ from page numbers in the current version.

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1. *Delivery:* TI delivers TI evaluation boards, kits, or modules, including any accompanying demonstration software, components, or documentation (collectively, an “EVM” or “EVMs”) to the User (“User”) in accordance with the terms and conditions set forth herein. Acceptance of the EVM is expressly subject to the following terms and conditions.

   1.1 EVMs are intended solely for product or software developers for use in a research and development setting to facilitate feasibility evaluation, experimentation, or scientific analysis of TI semiconductors products. EVMs have no direct function and are not finished products. EVMs shall not be directly or indirectly assembled as a part or subassembly in any finished product. For clarification, any software or software tools provided with the EVM (“Software”) shall not be subject to the terms and conditions set forth herein but rather shall be subject to the applicable terms and conditions that accompany such Software

   1.2 EVMs are not intended for consumer or household use. EVMs may not be sold, sublicensed, leased, rented, loaned, assigned, or otherwise distributed for commercial purposes by Users, in whole or in part, or used in any finished product or production system.

2 *Limited Warranty and Related Remedies/Disclaimers*:

   2.1 These terms and conditions do not apply to Software. The warranty, if any, for Software is covered in the applicable Software License Agreement.

   2.2 TI warrants that the TI EVM will conform to TI's published specifications for ninety (90) days after the date TI delivers such EVM to User. Notwithstanding the foregoing, TI shall not be liable for any defects that are caused by neglect, misuse or mistreatment by an entity other than TI, including improper installation or testing, or for any EVMs that have been altered or modified in any way by an entity other than TI. Moreover, TI shall not be liable for any defects that result from User's design, specifications or instructions for such EVMs. Testing and other quality control techniques are used to the extent TI deems necessary or as mandated by government requirements. TI does not test all parameters of each EVM.

   2.3 If any EVM fails to conform to the warranty set forth above, TI's sole liability shall be at its option to repair or replace such EVM, or credit User's account for such EVM. TI's liability under this warranty shall be limited to EVMs that are returned during the warranty period to the address designated by TI and that are determined by TI not to conform to such warranty. If TI elects to repair or replace such EVM, TI shall have a reasonable time to repair such EVM or provide replacements. Repaired EVMs shall be warranted for the remainder of the original warranty period. Replaced EVMs shall be warranted for a new full ninety (90) day warranty period.

3 *Regulatory Notices:*

   3.1 *United States*

      3.1.1 *Notice applicable to EVMs not FCC-Approved:*

      This kit is designed to allow product developers to evaluate electronic components, circuitry, or software associated with the kit to determine whether to incorporate such items in a finished product and software developers to write software applications for use with the end product. This kit is not a finished product and when assembled may not be resold or otherwise marketed unless all required FCC equipment authorizations are first obtained. Operation is subject to the condition that this product not cause harmful interference to licensed radio stations and that this product accept harmful interference. Unless the assembled kit is designed to operate under part 15, part 18 or part 95 of this chapter, the operator of the kit must operate under the authority of an FCC license holder or must secure an experimental authorization under part 5 of this chapter.

      3.1.2 *For EVMs annotated as FCC – FEDERAL COMMUNICATIONS COMMISSION Part 15 Compliant:*

      CAUTION

      This device complies with part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) This device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

      Changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

      FCC Interference Statement for Class A EVM devices

      NOTE: This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.

FCC Interference Statement for Class B EVM devices

NOTE: This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- *Reorient or relocate the receiving antenna.*
- *Increase the separation between the equipment and receiver.*
- *Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.*
- *Consult the dealer or an experienced radio/TV technician for help.*

3.2 *Canada*

3.2.1 *For EVMs issued with an Industry Canada Certificate of Conformance to RSS-210*

Concerning EVMs Including Radio Transmitters:

This device complies with Industry Canada license-exempt RSS standard(s). Operation is subject to the following two conditions: (1) this device may not cause interference, and (2) this device must accept any interference, including interference that may cause undesired operation of the device.

Concernant les EVMs avec appareils radio:

Le présent appareil est conforme aux CNR d'Industrie Canada applicables aux appareils radio exempts de licence. L'exploitation est autorisée aux deux conditions suivantes: (1) l'appareil ne doit pas produire de brouillage, et (2) l'utilisateur de l'appareil doit accepter tout brouillage radioélectrique subi, même si le brouillage est susceptible d'en compromettre le fonctionnement.

Concerning EVMs Including Detachable Antennas:

Under Industry Canada regulations, this radio transmitter may only operate using an antenna of a type and maximum (or lesser) gain approved for the transmitter by Industry Canada. To reduce potential radio interference to other users, the antenna type and its gain should be so chosen that the equivalent isotropically radiated power (e.i.r.p.) is not more than that necessary for successful communication. This radio transmitter has been approved by Industry Canada to operate with the antenna types listed in the user guide with the maximum permissible gain and required antenna impedance for each antenna type indicated. Antenna types not included in this list, having a gain greater than the maximum gain indicated for that type, are strictly prohibited for use with this device.

Concernant les EVMs avec antennes détachables

Conformément à la réglementation d'Industrie Canada, le présent émetteur radio peut fonctionner avec une antenne d'un type et d'un gain maximal (ou inférieur) approuvé pour l'émetteur par Industrie Canada. Dans le but de réduire les risques de brouillage radioélectrique à l'intention des autres utilisateurs, il faut choisir le type d'antenne et son gain de sorte que la puissance isotrope rayonnée équivalente (p.i.r.e.) ne dépasse pas l'intensité nécessaire à l'établissement d'une communication satisfaisante. Le présent émetteur radio a été approuvé par Industrie Canada pour fonctionner avec les types d'antenne énumérés dans le manuel d'usage et ayant un gain admissible maximal et l'impédance requise pour chaque type d'antenne. Les types d'antenne non inclus dans cette liste, ou dont le gain est supérieur au gain maximal indiqué, sont strictement interdits pour l'exploitation de l'émetteur

3.3 *Japan*

3.3.1 *Notice for EVMs delivered in Japan:* Please see http://www.tij.co.jp/lsds/ti_ja/general/eStore/notice_01.page 日本国内に輸入される評価用キット、ボードについては、次のところをご覧ください。
http://www.tij.co.jp/lsds/ti_ja/general/eStore/notice_01.page

3.3.2 *Notice for Users of EVMs Considered "Radio Frequency Products" in Japan:* EVMs entering Japan are NOT certified by TI as conforming to Technical Regulations of Radio Law of Japan.

If User uses EVMs in Japan, User is required by Radio Law of Japan to follow the instructions below with respect to EVMs:

1. Use EVMs in a shielded room or any other test facility as defined in the notification #173 issued by Ministry of Internal Affairs and Communications on March 28, 2006, based on Sub-section 1.1 of Article 6 of the Ministry's Rule for Enforcement of Radio Law of Japan,
2. Use EVMs only after User obtains the license of Test Radio Station as provided in Radio Law of Japan with respect to EVMs, or
3. Use of EVMs only after User obtains the Technical Regulations Conformity Certification as provided in Radio Law of Japan with respect to EVMs. Also, do not transfer EVMs, unless User gives the same notice above to the transferee. Please note that if User does not follow the instructions above, User will be subject to penalties of Radio Law of Japan.

【無線電波を送信する製品の開発キットをお使いになる際の注意事項】

本開発キットは技術基準適合証明を受けておりません。

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2. 実験局の免許を取得後ご使用いただく。
3. 技術基準適合証明を取得後ご使用いただく。

なお、本製品は、上記の「ご使用にあたっての注意」を譲渡先、移転先に通知しない限り、譲渡、移転できないものとします。

上記を遵守頂けない場合は、電波法の罰則が適用される可能性があることをご留意ください。

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東京都新宿区西新宿６丁目２４番１号

西新宿三井ビル

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4 *EVM Use Restrictions and Warnings:*

4.1 EVMS ARE NOT FOR USE IN FUNCTIONAL SAFETY AND/OR SAFETY CRITICAL EVALUATIONS, INCLUDING BUT NOT LIMITED TO EVALUATIONS OF LIFE SUPPORT APPLICATIONS.

4.2 User must read and apply the user guide and other available documentation provided by TI regarding the EVM prior to handling or using the EVM, including without limitation any warning or restriction notices. The notices contain important safety information related to, for example, temperatures and voltages.

4.3 *Safety-Related Warnings and Restrictions:*

4.3.1 User shall operate the EVM within TI's recommended specifications and environmental considerations stated in the user guide, other available documentation provided by TI, and any other applicable requirements and employ reasonable and customary safeguards. Exceeding the specified performance ratings and specifications (including but not limited to input and output voltage, current, power, and environmental ranges) for the EVM may cause personal injury or death, or property damage. If there are questions concerning performance ratings and specifications, User should contact a TI field representative prior to connecting interface electronics including input power and intended loads. Any loads applied outside of the specified output range may also result in unintended and/or inaccurate operation and/or possible permanent damage to the EVM and/or interface electronics. Please consult the EVM user guide prior to connecting any load to the EVM output. If there is uncertainty as to the load specification, please contact a TI field representative. During normal operation, even with the inputs and outputs kept within the specified allowable ranges, some circuit components may have elevated case temperatures. These components include but are not limited to linear regulators, switching transistors, pass transistors, current sense resistors, and heat sinks, which can be identified using the information in the associated documentation. When working with the EVM, please be aware that the EVM may become very warm.

4.3.2 EVMs are intended solely for use by technically qualified, professional electronics experts who are familiar with the dangers and application risks associated with handling electrical mechanical components, systems, and subsystems. User assumes all responsibility and liability for proper and safe handling and use of the EVM by User or its employees, affiliates, contractors or designees. User assumes all responsibility and liability to ensure that any interfaces (electronic and/or mechanical) between the EVM and any human body are designed with suitable isolation and means to safely limit accessible leakage currents to minimize the risk of electrical shock hazard. User assumes all responsibility and liability for any improper or unsafe handling or use of the EVM by User or its employees, affiliates, contractors or designees.

4.4 User assumes all responsibility and liability to determine whether the EVM is subject to any applicable international, federal, state, or local laws and regulations related to User's handling and use of the EVM and, if applicable, User assumes all responsibility and liability for compliance in all respects with such laws and regulations. User assumes all responsibility and liability for proper disposal and recycling of the EVM consistent with all applicable international, federal, state, and local requirements.

5. *Accuracy of Information:* To the extent TI provides information on the availability and function of EVMs, TI attempts to be as accurate as possible. However, TI does not warrant the accuracy of EVM descriptions, EVM availability or other information on its websites as accurate, complete, reliable, current, or error-free.

6. *Disclaimers:*

   6.1 EXCEPT AS SET FORTH ABOVE, EVMS AND ANY WRITTEN DESIGN MATERIALS PROVIDED WITH THE EVM (AND THE DESIGN OF THE EVM ITSELF) ARE PROVIDED "AS IS" AND "WITH ALL FAULTS." TI DISCLAIMS ALL OTHER WARRANTIES, EXPRESS OR IMPLIED, REGARDING SUCH ITEMS, INCLUDING BUT NOT LIMITED TO ANY IMPLIED WARRANTIES OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE OR NON-INFRINGEMENT OF ANY THIRD PARTY PATENTS, COPYRIGHTS, TRADE SECRETS OR OTHER INTELLECTUAL PROPERTY RIGHTS.

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7. *USER'S INDEMNITY OBLIGATIONS AND REPRESENTATIONS.* USER WILL DEFEND, INDEMNIFY AND HOLD TI, ITS LICENSORS AND THEIR REPRESENTATIVES HARMLESS FROM AND AGAINST ANY AND ALL CLAIMS, DAMAGES, LOSSES, EXPENSES, COSTS AND LIABILITIES (COLLECTIVELY, "CLAIMS") ARISING OUT OF OR IN CONNECTION WITH ANY HANDLING OR USE OF THE EVM THAT IS NOT IN ACCORDANCE WITH THESE TERMS AND CONDITIONS. THIS OBLIGATION SHALL APPLY WHETHER CLAIMS ARISE UNDER STATUTE, REGULATION, OR THE LAW OF TORT, CONTRACT OR ANY OTHER LEGAL THEORY, AND EVEN IF THE EVM FAILS TO PERFORM AS DESCRIBED OR EXPECTED.

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