PCM5122/42EVM-U

The PCM5122/42 families of ICs are advanced segment, high-performance, software-programmable stereo digital-to-analog converters (DACs). The PCM512x family employs fixed-function audio processing, while the PCM514x family employs miniDSP audio processing. 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 an improved tolerance to clock jitter, and the 2.1-V_{RMS} ground-centered outputs eliminate the need for output dc blocking capacitors. The PCM5122/42EVM-U is designed to support the PCM5121, PCM5122, PCM5141 and PCM5142 DACs. The PCM5122/42EVM-U also employs the TAS1020B USB controller and the SRC4392 asynchronous sample rate converter.

This User's Guide describes the operation of the PCM5122/42EVM-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 PCM5122/42EVM-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 PCM512x and PCM514x 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 PCM5122/42EVM-U. Unless otherwise noted, all references to the PCM5122/42 indicate complete functionality of all four related devices (PCM5121, PCM5122, PCM5141 and PCM5142).

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 TI's integrated circuits used in the assembly of the PCM5122/42EVM-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 are available from the TI web site at http://www.ti.com/.

Data Sheet	Literature Number
PCM5122/42	SLAS759
TAS1020B	SLES025A
SRC4392	SBFS029C

1.3   Applications Questions

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

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.

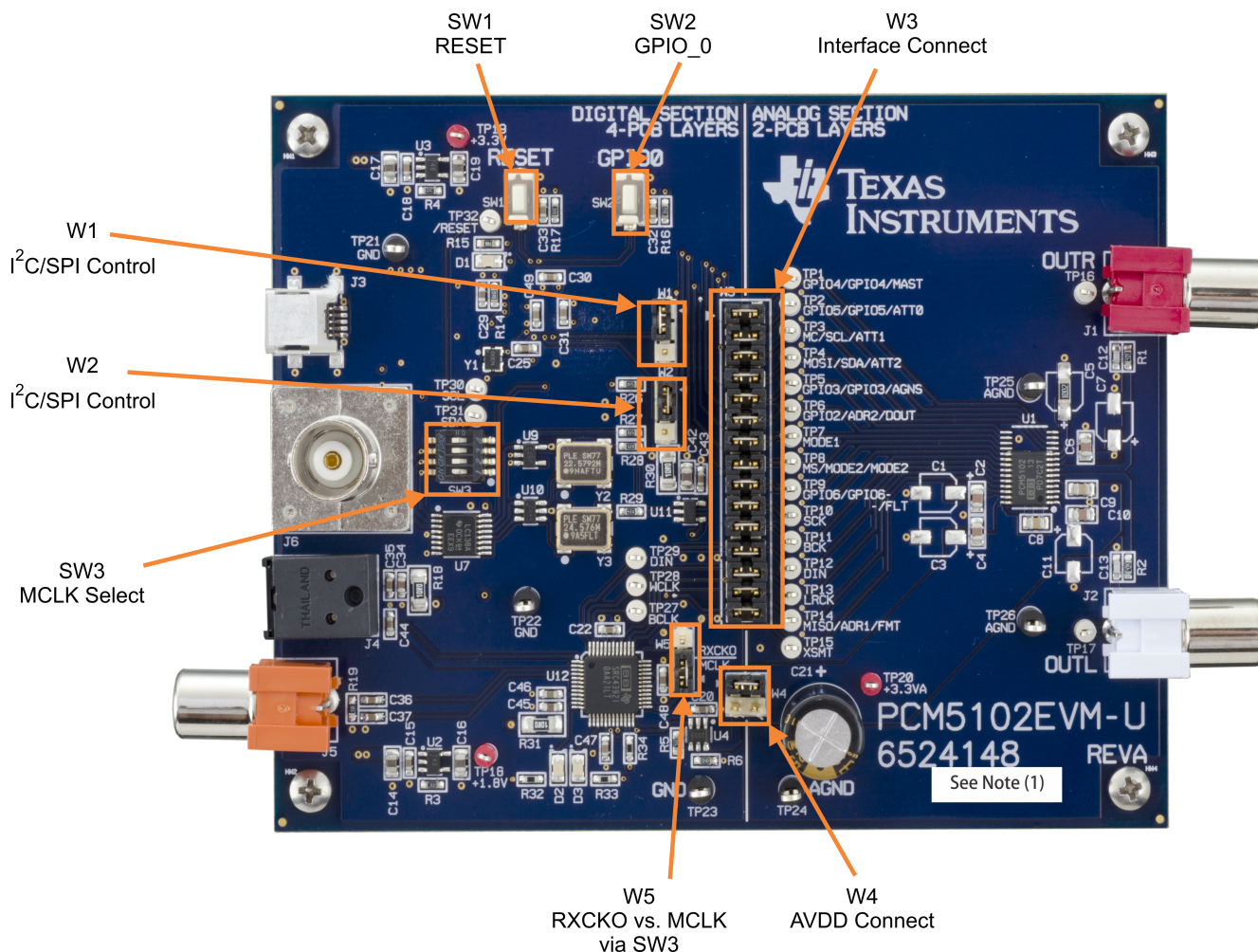## 2 PCM5122/42EVM-U

2.1 Electrostatic Discharge Warning

Many of the components on the PCM5122/42EVM-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 PCM5122/42EVM-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 PCM5122/42 family of parts. Figure 1 shows the PCM5122/42EVM-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. PCM5122/42EVM-U

The PCM5122/42EVM-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 PCM5122/42 device and the analog circuitry accompanying it. Note that this half of the PCM5122/42EVM-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 PCM5122/42 device.

The digital interface section, or left half of the PCM5122/42EVM-U, is a four-layer design. However, the PCM5122/42 device and analog circuitry, or right half of the EVM board, consists only of two layers.

For the analog circuitry surrounding the PCM5122/42 device, certain components can be removed at the cost of higher performance. This configurability allows 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 PCM5122/42EVM-U features:

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

2.3 EVM Block Diagram
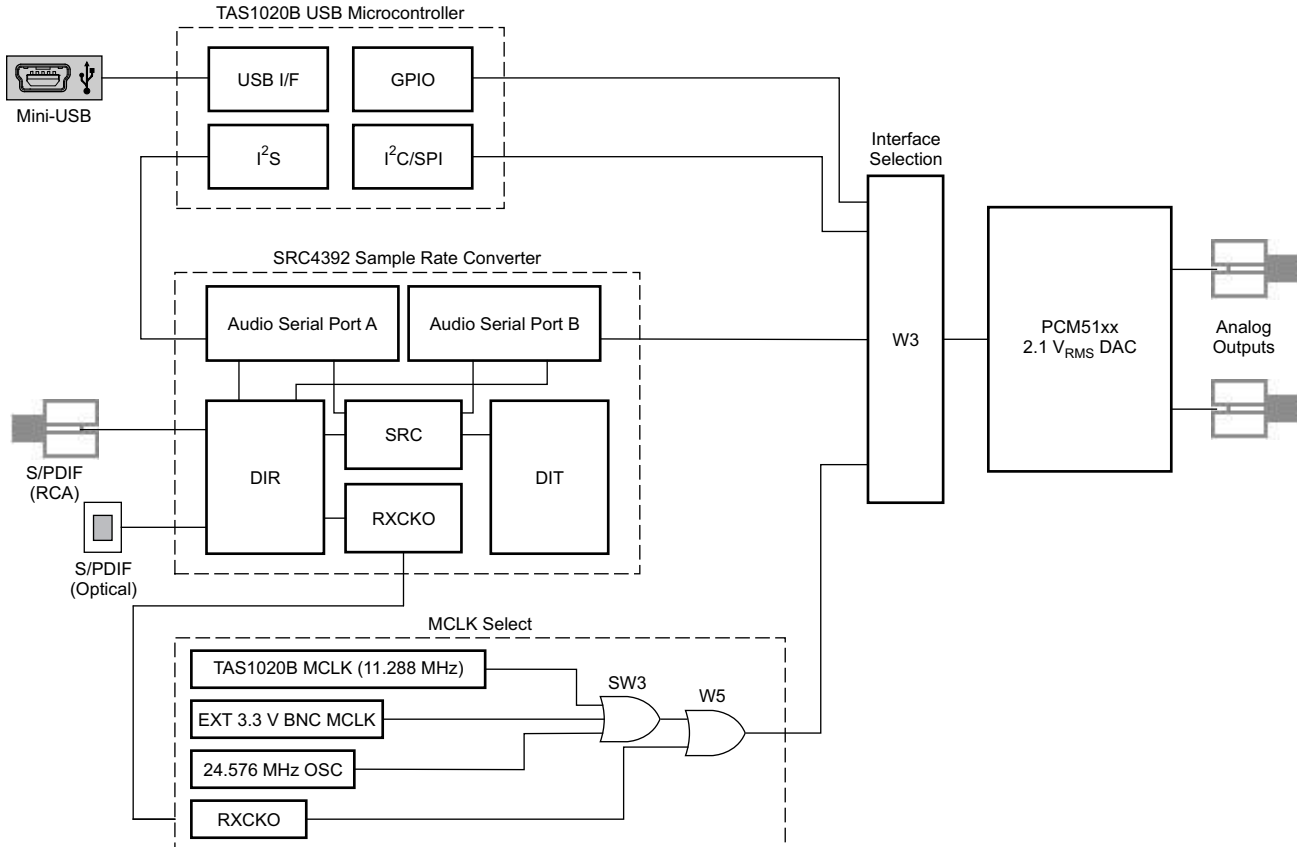
Figure 2 shows the block diagram for the PCM5122/42EVM-U.

Figure 2. PCM5122/42EVM-U Block Diagram

2.4 Jumpers, Connectors, Test Points, Switches

Table 1 summarizes the connectors, test points, jumpers, and switches on the PCM5122/42EVM-U.

Table 1. PCM5122/42EVM-U Headers, Test Points, Jumpers, and Switches

Connectors/Switch/Jumper/Test Point	Description
Headers	
W1	I^{2}C/SPI Selection. Shunt pins 1-2 for SPI, 2-3 for I^{2}C control mode
W2	I^{2}C/SPI Selection. Shunt pins 1-2 for SPI, 2-3 for I^{2}C control mode
W3	Interface Connection. Shunt respective headers to send digital signals to PCM5122/42.
W4	AVDD power. Shunt pins 1-2 or 3-4 for AVDD.
W5	MCLK/RXCKO select
Test Points	
TP1	GPIO4/GPIO4/MAST
TP2	GPIO5/GPIO5/ATT0
TP3	MC/SCL/ATT1
TP4	MOSI/SDA/ATT2
TP5	GPIO3/GPIO3/AGNS
TP6	GPIO2/ADR2/DOUT
TP7	MODE1
TP8	MS/MODE2/MODE2
TP9	FLT
TP10	SCK
TP11	BCK
TP12	DIN
TP13	LRCK
TP14	FMT
TP15	XSMT
TP16	PCM5122/42 analog output (R)
TP17	PCM5122/42 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	PCM5122/42 RCA analog output (R)
J2	PCM5122/42 RCA analog output (L)
J3	Mini-USB connection
J4	Optical S/PDIF input

Table 1. PCM5122/42EVM-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

2.5 Clock Circuitry

SW3 allows for MCLK selection from multiple sources. The PCM5122/42EVM-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 PCM5122/42EVM-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 PCM5122/42 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 PCM5122/42. In order to ensure proper operation, the master clock source must be synchronized to the bit and word clock supplied to the PCM5122/42. Therefore, the master clock source for the PCM5122/42 must also be replicated from the digital input source, which is why RXCKO must be chosen. If the master clock source for the PCM5122/42 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 PCM5122/42 and the bit and word clocks being supplied to the PCM5122/42. 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 PCM5122/42 devices contain an internal PLL and BCLK reference, so that the MCLK can be generated internally. When using external I^{2}S input directly into the W3 jumper, a MCLK can be derived form the BCLK input. Refer to the PCM5122/42 product data sheet for more details.

2.6 Use Cases

2.6.1 PurePath Studios

The PCM512x and PCM514x are software programmable, and can be programmed using either CodecControl software or PurePath Studio. For more information on enabling the audio processing capabilities of the PCM512x with Pure Path, see the document below. This application note provides a great starting point regarding the usage of PurePath with PCM512x and PCM514x devices. Note that while the PCM512x employs fixed function audio processing, the PCM514x has full miniDSP processing, enabling configurable process flows.

- *PCM5122 with PurePath Application Note* (SLAA541)

2.6.2 Scripts and Setup

Most of the I/O routing and clock frequency selection on the PCM5122/42 evaluation module is performed by the SRC4392. Section 2.6.3 and Section 2.6.4 are two example scripts that adjust the SRC4392 registers accordingly, as well as set the proper jumper configurations.

There are several use cases where the PCM5122/42EVM-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 2.6.3 and Section 2.6.4 are some example use cases for the PCM5101 for USB playback and optical/SPDIF input, respectively.

2.6.3 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
```

2.6.4   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 PCM5122/42 data sheet.

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3 CodecControl Software

This section explains how to use the CodecControl software together with the PCM5122/42 device. For characteristic performance graphs, refer to the PCM5122/42 data sheet.

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 PCM5122/42EVM-U window as an example of the CodecControl software in operation.
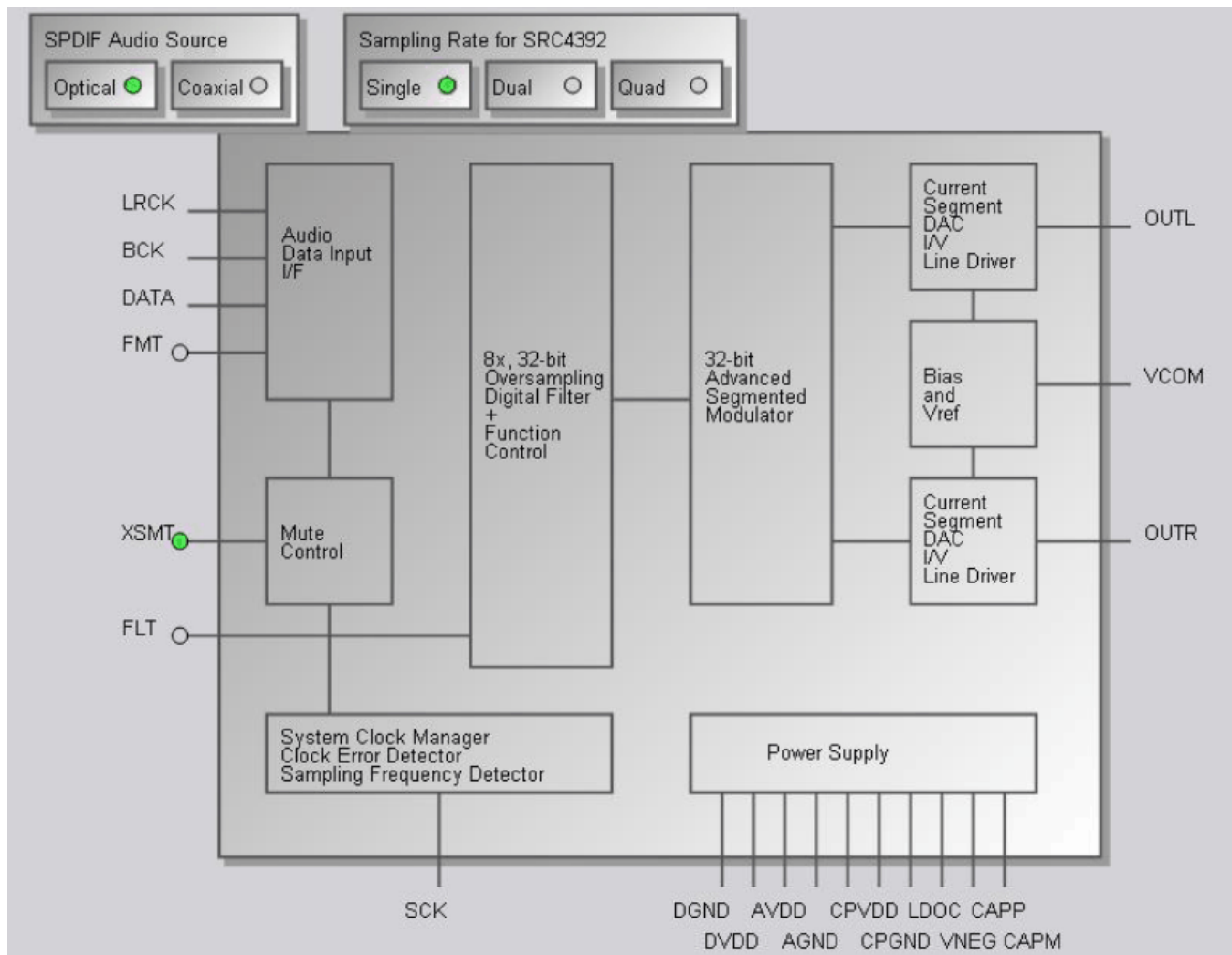
Figure 3. EVM Software Window

3.2   Installation

Download the CodecControl software from the PCM5122/42EVM-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.
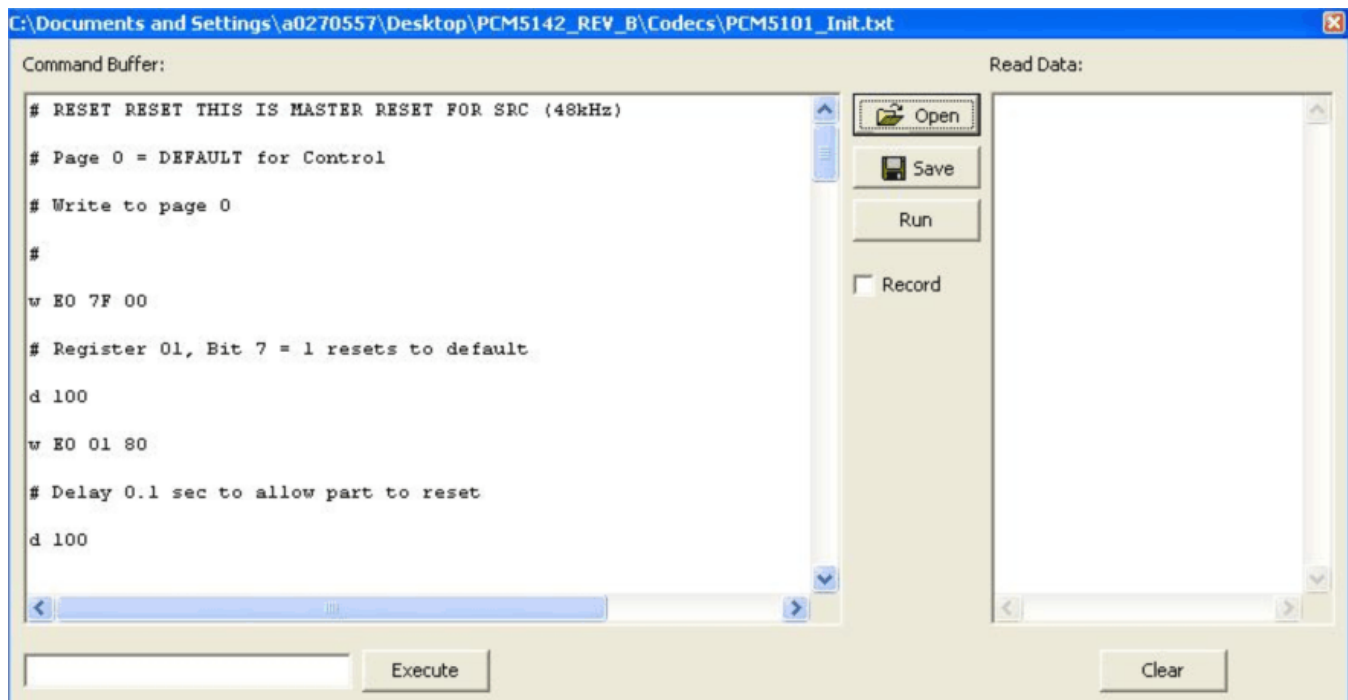

Figure 4. Command Dialog

- The primary area of the command dialog is the command buffer (editable text) which contains the command script. Clicking the **Run** button runs the command script.
- 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. Clicking the **Refresh** button triggers reading the content of one page.

- 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. Change a single writable bit by clicking on the bit and it flips.

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: This feature is not used for the PCM5122/42, which are hardware programmable only.

3.4.4 Firmware Update

TI may publish new firmware for TI audio codec EVMs. Program the new firmware to a TI audio codec EVM by choosing *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
l	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 that is read from in hexadecimal format.
    <length> is the number of bytes that are read from <register> in auto-increment mode.
    The result is 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 that is written to in hexadecimal format.
    <data…> is a sequence of bytes that are 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 is 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^{2}C™ or spi for SPI.

Command: **b**[optional comment]

[optional comment] is a string of characters. The command interpreter shows a modal dialog with the optional comment. Script execution resumes 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 that is read from in hexadecimal format.

<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 polls the device if the data do not match the <mask>.

4   PCM5122/42EVM-U Schematic

Figure 5 shows the schematic for the PCM5122/42EVM-U.
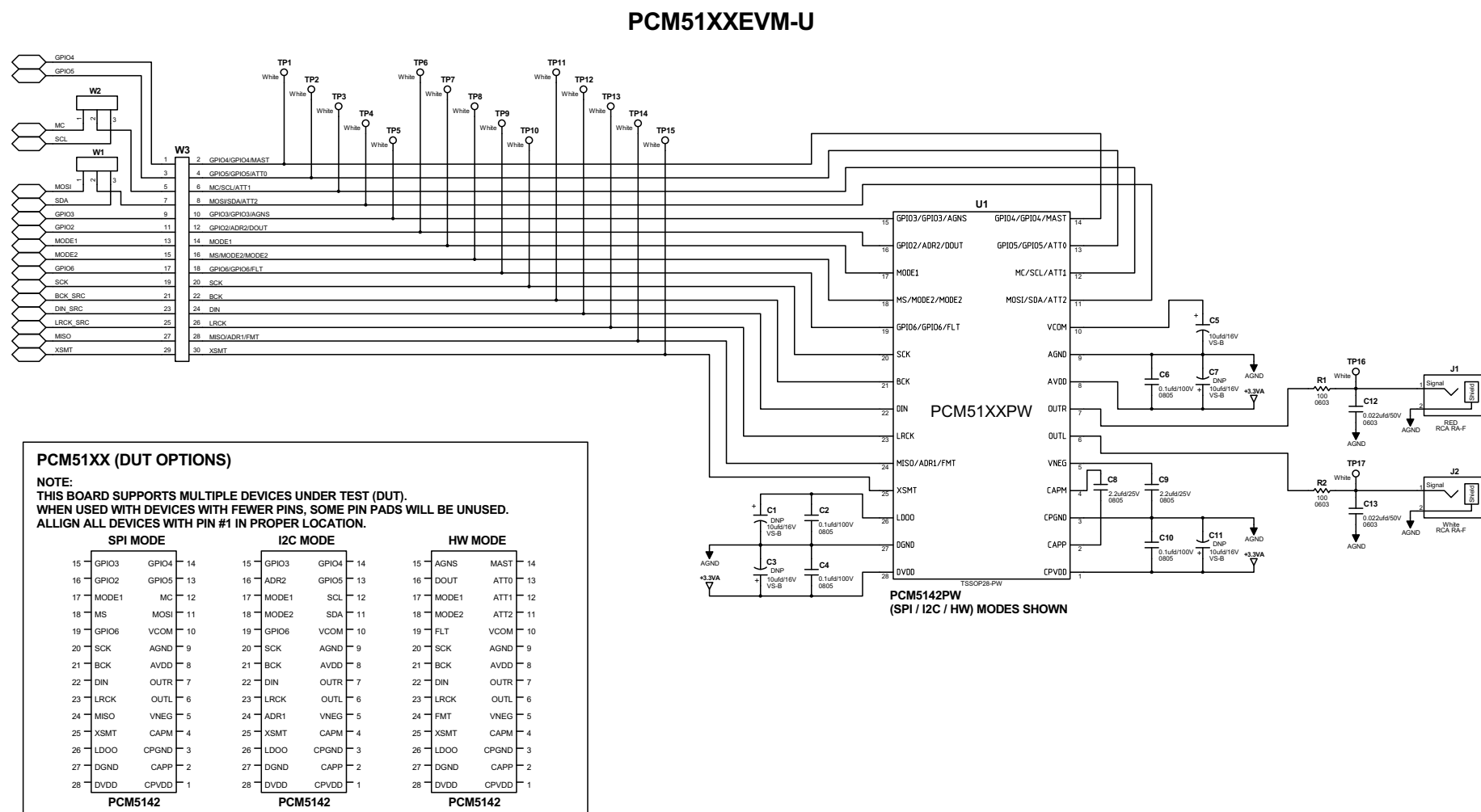
Figure 5. Schematic

5 Bill of Materials

Table 3 lists the bill of materials (BOM).

Table 3. PCM5122/42EVM-U Bill of Materials

KS PART #	CUST. PART #	QTY	VALUE	DESIGNATORS	PKG/CASE	T.COEFF/ PWR	TOL	VOLT RATED	DESC.	DIST.	DIST P/N	MFR.	MFR. PART #
11360	C 2	2	2200 pF	C12, C13	0603	C0G	5	50 V	Capacitors	Digi-Key	490-1459-2-ND	Venkel	C0603COG500-222JNE
11301	C 2/C 10/	20	0.1 µF	C15, C18, C20, C22, C25, C28, C30, C31, C32, C33, C35, C36, C37, C41, C43, C44, C46, C47, C48, C49	0603	X7R	10	50 V	Capacitors	Digi-Key	490-1519-2-ND	Venkel	C0603X7R500-104KNE
11068	C 1/C 10	1	1.0 µF	C29	0603	X7R	10	16 V	Capacitors	Digi-Key	587-1241-2-ND	TDK Corporation	C1608X7R1C105K
11823	C 3	1	10000 pF	C39	0603	X7R	5	50 V	Capacitors	Digi-Key	399-1092-2-ND	Kemet	C0603C103J5RACTU
11300	C 2	1	1000 pF	C24	0603	C0G	5	50 V	Capacitors	Digi-Key	490-4768-2-ND	Venkel	C0603COG500-102JNE
11208	C 1/C 12	2	10 µF	C34, C45	0603	X5R	20	6.3 V	Capacitors	Digi-Key	445-4112-2-ND	Panasonic	ECJ-1VB0J106M
11535	C 3	2	47 pF	C26, C27	0603	C0G	5	50 V	Capacitors	Digi-Key	445-1277-2-ND	Venkel	C0603COG500-470JNE
11953	D 1	4	0.1 µF	C2, C4, C6, C10	0805	X7R	10	100 V	Capacitors	Digi-Key	445-1418-2-ND	Venkel	C2012X7R2A104K
13777	D 3	1	100 pF	C23	0805	C0G (NP0)	5	50 V	Capacitors	Digi-Key	PCC101CGTR-ND	Panasonic	ECJ-2VC1H101J
11013	D 6	4	10 µF	C14, C16, C17, C19	0805	X5R	10	16 V	Capacitors	Digi-Key	587-1295-1-ND	Taiyo Yuden	EMK212BJ106KG-T
11118	D 1/D 7	2	2.2 µF	C8, C9	0805	X7R	10	25 V	Capacitors	Digi-Key	490-4787-2-ND	Venkel	C0805X7R250-225KNE
12360	D 2	3	22 µF	C38, C40, C42	0805	X5R	20	6.3 V	Capacitors	Digi-Key	445-1422-2-ND	Kemet	C0805C226M9PACTU
20626		1	100 µF	C21	P5 D10 H16	85°C	20	25 V	Capacitors			Nichicon	UKZ1E101MPM
12689	P 4	1	10.0 kΩ	C5	1206	1/4W	1	150 V	Resistors	Venkel	CR1206-4W-49R9FT	Venkel	CR1206-4W-49R9FT
11493	P 2	1	0.0 (zero Ω)	R7	1206	1/8W	±5%	250 V	Resistors	Digi-Key	P0.0ETR-ND	Venkel	CR1206-8W-000T
11464	N 5	1	1.50 kΩ	R11	0603	1/10W	1	150 V	Resistors	Digi-Key	311-1.50KHRTR-ND	Venkel	CR0603-10W-1501FT
12011	P 2	5	10 Ω	R18, R23, R25, R30, R31	1206	1/4W	1	150 V	Resistors	Digi-Key	P10.0FTR-ND	Venkel	CR1206-8W-10R0FT
12012	N 9 / N 38	8	10.0 kΩ	R3, R4, R5, R16, R17, R20, R21, R22	0603	1/10W	1		Resistors	Digi-Key	311-10.0KHRTR-ND	Venkel	CR0603-10W-1002FT
11528	N 5	2	470 Ω	R1, R2	0603	1/10W	1	150 V	Resistors	Digi-Key	311-470HRTR-ND	Yageo	RC0603FR-07470RL
11127	N1/N38	2	100 kΩ	R6, R14	0603	1/16W	1		Resistors	Digi-Key	311-100KHRTR-ND	Venkel	CR0603-16W-1003FT
11541	N 6	2	2.70 kΩ	R8, R9	0603	1/16W	1	150 V	Resistors	Digi-Key	311-2.70KHRTR-ND	Venkel	CR0603-16W-2701FT
12693	N 16	2	22.1 Ω	R32, R33	0603	1/10W	1	75 V	Resistors	Digi-Key	P22.1HTR-ND	Venkel	CR0603-10W-22R1FT
16884	N 31	2	27.4 Ω	R12, R13	0603	1/16W	1		Resistors	Digi-Key	P27.4HTR-ND	Panasonic - ECG	ERJ-3EKF27R4V
11542	N 6	1	3.09 kΩ	R10	0603	1/16W	1	150 V	Resistors	TTI	RC0603FR-073K09L	Venkel	CR0603-16W-3091FT
11468	N 5	4	33.2 Ω	R26, R27, R28, R29	0603	1/10W	1	50 V	Resistors	Digi-Key	311-33.2HRTR-ND	Venkel	CR0603-10W-33R2FT
15084	N 26/N 42	1	4.70 kΩ	R34	0603	1/10W	1		Resistors	Digi-Key	P4.70KHTR-ND	Panasonic - ECG	ERJ-3EKF4701V
11022	N 1	1	649 Ω	R15	0603	1/10W	1		Resistors	Digi-Key	311-649HRTR-ND	Yageo America	RC0603FR-07649RL

Table 3. PCM5122/42EVM-U Bill of Materials (continued)

KS PART #	CUST. PART #	QTY	VALUE	DESIGNATORS	PKG/CASE	T.COEFF/ PWR	TOL	VOLT RATED	DESC.	DIST.	DIST P/N	MFR.	MFR. PART #
11470		2	75 Ω	R19, R24	0603	1/10W	1	150 V	Resistors	Digi-Key	RMCF0603FT75R0TR-ND	Venkel	CR0603-10W-75R0FT
11522		2	LED - Green Diffused	D2, D3	0805			2 V	Optoelectronics	Digi-Key	67-1553-2-ND	Lumex Opto/Components Inc	SML-LXT0805GW-TR
12333		1	LED - Yellow	D1	0805			2.1 V	Optoelectronics	Digi-Key	67-1554-1-ND	Lumex Opto/Components Inc	SML-LXT0805YW-TR
21439		1	SN74LVC 138APW	U7	16-TSSOP	24 mA		1.65 V ~ 3.6 V	Integrated Circuits			Texas Instruments	SN74LVC138APW
19081		1	PCM5142 PW	U1	20-TSSOP				Integrated Circuits			Texas Instruments	PCM5142PW
21420		1	SRC4392I pFBR	U12	48-TQFP				Integrated Circuits			Texas Instruments	SRC4392I pFBR
11992		1	TAS1020 B pFB	U6	48-TQFP			3 V ~ 3.6 V	Integrated Circuits	Texas Instruments	TAS1020B pFB	Texas Instruments	TAS1020B pFB
11104		1	24FC512-I/SM	U5	8-SOIC				Integrated Circuits	Digi-Key	24FC512-I/SM-ND	Microchip	24FC512-I/SM
13752		3	SN74LVC 1G125DB V	U8, U9, U11	SOT-23-5	32 mA		1.65 V ~ 5.5 V	Integrated Circuits	Digi-Key	296-11603-1-ND	Texas Instruments	SN74LVC1G125DBV
16878		1	TPS7361 8DBVT	U2	SOT-23-5	400 mA		1.8 V	Integrated Circuits	Texas Instruments	TPS73618DBVT	Texas Instruments	TPS73618DBVT
17696		1	TPS7363 3DBVT	U3	SOT-23-5	400 mA		3.3 V	Integrated Circuits	Texas Instruments	TPS73633DBVT	Texas Instruments	TPS73633DBVT
19633		1	SN74LVC 2G04DBV	U10	SOT-23-6	-40°C ~ 85°C	3232	1.65 V ~ 5.5 V	Integrated Circuits	Texas Instruments	SN74LVC2G04DBVR	Texas Instruments	SN74LVC2G04DBV
19685		1	TPS2553 DBV	U4	SOT-23-6			Adj	Integrated Circuits	Texas Instruments	TPS2553DBVT	Texas Instruments	TPS2553DBV
14742		1	6 MHz	Y1	4-SMD 2.5 mm × 2 mm	15 pF	50	3.3 V	Crystals	Mouser	788-8002AI133E-6.0T	SiTime	SIT8002AI-13-33E-6.00000T
14380		1	22.5792 MHz	Y2	SMT	50 ppm		3.3 V	Crystals	Gscs	SM7745HSV-22.5792M	Pletronics	SM7745HSV-22.5792M
14381		1	24.576 MHz	Y3	SMT	50 ppm		3.3 V	Crystals	Channel Comp	SM7745HSV-24.576M	Pletronics	SM7745HSV-24.576M
15375		1	TORX147 PL(F,T)	J4					Fiber Optics	Arrow Electronics	TORX147PLF,T	Toshiba	TORX147PL(F,T)
11516		1	4 SPST	SW3	4 pos	0.025 A		24 VDC	Switches	Digi-Key	CKN9065-ND	ITT Cannon - C K	TDA04H0SB1R
13776		2	PB SPST- NO Off- Mom	SW1, SW2	6.00 mm × 3.50 mm	0.05 A	160	12 VDC	Switches	Digi-Key	P13597SCT-ND	Panasonic	EVQ-PNF04M
12926		3	Test Loop - Red	TP18, TP19, TP20	0.040				Test Equipment	Heilind Electronics	5000	Keystone Electronic	5000

Table 3. PCM5122/42EVM-U Bill of Materials (continued)

KS PART #	CUST. PART #	QTY	VALUE	DESIGNATORS	PKG/CASE	T.COEFF/ PWR	TOL	VOLT RATED	DESC.	DIST.	DIST P/N	MFR.	MFR. PART #
11048		23	Test Loop - White	TP1, TP2, TP3, TP4, TP5, TP6, TP7, TP8, TP9, TP10, TP11, TP12, TP13, TP14, TP15, TP16, TP17, TP27, TP28, TP29, TP30, TP31, TP32	0.040				Test Equipment	Heilind Electronics	5002	Keystone Electronics	5002
14797		6	Test Loop - Black	TP21, TP22, TP23, TP24, TP25, TP26	0.063 - Long Loop				Test Equipment	Heilind Electronics	5011	Keystone Electronics	5011
11087		3	1 × 3	W1, W2, W5	0.1 in	High Temp			Connectors	Samtec	HTSW-150-07-G-S	Samtec	HTSW-150-07-G-S
11088		1	2 × 15	W3	0.1 × 0.1 in	High Temp			Connectors	Samtec	HTSW-150-07-G-D	Samtec	HTSW-150-07-G-D
11088		1	2 × 2	W4	0.1 ×0.1 in	High Temp			Connectors	Samtec	HTSW-150-07-G-D	Samtec	HTSW-150-07-G-D
11758		1	5227699-2	J6	BNC - 50 Ω				Connectors	Future Electronics	5227699-2	Tyco Electronics/Amp	5227699-2
19083		1	Phono Jack - Orange	J5	T/H - R/A				Connectors	Digi-Key	CP-1469-ND	CUI Inc	RCJ-047
19085		1	Phono Jack - Red	J1	T/H - R/A				Connectors	Digi-Key	CP-1419-ND	CUI Inc	RCJ-042
19084		1	Phono Jack - White	J2	T/H - R/A				Connectors	Digi-Key	CP-1420-ND	CUI Inc	RCJ-043
14421		1	USB - Mini B type	J3	Type B (SMT)				Connectors	Heilind Electronics	UX60-MB-5ST	Hirose Electric Co Ltd	UX60-MB-5ST
14560		20	Shunt	Note	0.1 in SP				Hardware	Mouser	151-8000-E	Kobiconn	151-8000-E
11082		4	4-40/0.25 in - Screws	Screws	Philips				Hardware	Pencom	4-40X1/4PH-PN-MS-SS	Building Fasteners	PMSSS 440 0025 PH
11080		4	0.5 in	Standoffs	Round Threaded				Hardware	Pencom	RST3/16-440X.5-A	Keystone Electronics	2027
DNI		4	DNI	C1, C3, C7, C11	DNI	DNI	DNI	DNI	Undefined Category	DNI	DNI	DNI	DNI

EVALUATION BOARD/KIT/MODULE (EVM) ADDITIONAL TERMS

Texas Instruments (TI) provides the enclosed Evaluation Board/Kit/Module (EVM) under the following conditions:

The user assumes all responsibility and liability for proper and safe handling of the goods. Further, the user indemnifies TI from all claims arising from the handling or use of the goods.

Should this evaluation board/kit not meet the specifications indicated in the User's Guide, the board/kit may be returned within 30 days from the date of delivery for a full refund. THE FOREGOING LIMITED WARRANTY IS THE EXCLUSIVE WARRANTY MADE BY SELLER TO BUYER AND IS IN LIEU OF ALL OTHER WARRANTIES, EXPRESSED, IMPLIED, OR STATUTORY, INCLUDING ANY WARRANTY OF MERCHANTABILITY OR FITNESS FOR ANY PARTICULAR PURPOSE. EXCEPT TO THE EXTENT OF THE INDEMNITY SET FORTH ABOVE, NEITHER PARTY SHALL BE LIABLE TO THE OTHER FOR ANY INDIRECT, SPECIAL, INCIDENTAL, OR CONSEQUENTIAL DAMAGES.

Please read the User's Guide and, specifically, the Warnings and Restrictions notice in the User's Guide prior to handling the product. This notice contains important safety information about temperatures and voltages. For additional information on TI's environmental and/or safety programs, please visit www.ti.com/esh or contact TI.

No license is granted under any patent right or other intellectual property right of TI covering or relating to any machine, process, or combination in which such TI products or services might be or are used. TI currently deals with a variety of customers for products, and therefore our arrangement with the user is not exclusive. TI assumes no liability for applications assistance, customer product design, software performance, or infringement of patents or services described herein.

REGULATORY COMPLIANCE INFORMATION

As noted in the EVM User's Guide and/or EVM itself, this EVM and/or accompanying hardware may or may not be subject to the Federal Communications Commission (FCC) and Industry Canada (IC) rules.

For EVMs **not** subject to the above rules, this evaluation board/kit/module is intended for use for ENGINEERING DEVELOPMENT, DEMONSTRATION OR EVALUATION PURPOSES ONLY and is not considered by TI to be a finished end product fit for general consumer use. It generates, uses, and can radiate radio frequency energy and has not been tested for compliance with the limits of computing devices pursuant to part 15 of FCC or ICES-003 rules, which are designed to provide reasonable protection against radio frequency interference. Operation of the equipment may cause interference with radio communications, in which case the user at his own expense will be required to take whatever measures may be required to correct this interference.

General Statement for EVMs including a radio

User Power/Frequency Use Obligations: This radio is intended for development/professional use only in legally allocated frequency and power limits. Any use of radio frequencies and/or power availability of this EVM and its development application(s) must comply with local laws governing radio spectrum allocation and power limits for this evaluation module. It is the user's sole responsibility to only operate this radio in legally acceptable frequency space and within legally mandated power limitations. Any exceptions to this are strictly prohibited and unauthorized by Texas Instruments unless user has obtained appropriate experimental/development licenses from local regulatory authorities, which is responsibility of user including its acceptable authorization.

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

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

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.

For EVMs annotated as IC – INDUSTRY CANADA Compliant

This Class A or B digital apparatus complies with Canadian ICES-003.

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

Concerning EVMs including radio transmitters

This device complies with Industry Canada licence-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.

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.

Cet appareil numérique de la classe A ou B est conforme à la norme NMB-003 du Canada.

Les changements ou les modifications pas expressément approuvés par la partie responsable de la conformité ont pu vider l'autorité de l'utilisateur pour actionner l'équipement.

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.

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.

【Important Notice for Users of this Product in Japan】

This development kit is NOT certified as Confirming to Technical Regulations of Radio Law of Japan

If you use this product in Japan, you are required by Radio Law of Japan to follow the instructions below with respect to this product:

1. Use this product 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 this product only after you obtained the license of Test Radio Station as provided in Radio Law of Japan with respect to this product, or

3. Use of this product only after you obtained the Technical Regulations Conformity Certification as provided in Radio Law of Japan with respect to this product. Also, please do not transfer this product, unless you give the same notice above to the transferee. Please note that if you could not follow the instructions above, you will be subject to penalties of Radio Law of Japan.

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【ご使用にあたっての注】

本開発キットは技術基準適合証明を受けておりません。

本製品のご使用に際しては、電波法遵守のため、以下のいずれかの措置を取っていただく必要がありますのでご注意ください。
1. 電波法施行規則第6条第1項第1号に基づく平成18年3月28日総務省告示第173号で定められた電波暗室等の試験設備でご使用いただく。
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。

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EVALUATION BOARD/KIT/MODULE (EVM)
WARNINGS, RESTRICTIONS AND DISCLAIMERS

For Feasibility Evaluation Only, in Laboratory/Development Environments. Unless otherwise indicated, this EVM is not a finished electrical equipment and not intended for consumer use. It is intended solely for use for preliminary feasibility evaluation in laboratory/development environments by technically qualified electronics experts who are familiar with the dangers and application risks associated with handling electrical mechanical components, systems and subsystems. It should not be used as all or part of a finished end product.

Your Sole Responsibility and Risk. You acknowledge, represent and agree that:

1. You have unique knowledge concerning Federal, State and local regulatory requirements (including but not limited to Food and Drug Administration regulations, if applicable) which relate to your products and which relate to your use (and/or that of your employees, affiliates, contractors or designees) of the EVM for evaluation, testing and other purposes.

2. You have full and exclusive responsibility to assure the safety and compliance of your products with all such laws and other applicable regulatory requirements, and also to assure the safety of any activities to be conducted by you and/or your employees, affiliates, contractors or designees, using the EVM. Further, you are responsible to assure 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.

3. You will employ reasonable safeguards to ensure that your use of the EVM will not result in any property damage, injury or death, even if the EVM should fail to perform as described or expected.

4. You will take care of proper disposal and recycling of the EVM's electronic components and packing materials.

Certain Instructions. It is important to operate this EVM within TI's recommended specifications and environmental considerations per the user guidelines. Exceeding the specified EVM ratings (including but not limited to input and output voltage, current, power, and environmental ranges) may cause property damage, personal injury or death. If there are questions concerning these ratings please 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 result in unintended and/or inaccurate operation and/or possible permanent damage to the EVM and/or interface electronics. Please consult the EVM User's 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, some circuit components may have case temperatures greater than 60°C as long as the input and output are maintained at a normal ambient operating temperature. These components include but are not limited to linear regulators, switching transistors, pass transistors, and current sense resistors which can be identified using the EVM schematic located in the EVM User's Guide. When placing measurement probes near these devices during normal operation, please be aware that these devices may be very warm to the touch. As with all electronic evaluation tools, only qualified personnel knowledgeable in electronic measurement and diagnostics normally found in development environments should use these EVMs.

Agreement to Defend, Indemnify and Hold Harmless. You agree to 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 use of the EVM that is not in accordance with the terms of the agreement. This obligation shall apply whether Claims arise under law of tort or contract or any other legal theory, and even if the EVM fails to perform as described or expected.

Safety-Critical or Life-Critical Applications. If you intend to evaluate the components for possible use in safety critical applications (such as life support) where a failure of the TI product would reasonably be expected to cause severe personal injury or death, such as devices which are classified as FDA Class III or similar classification, then you must specifically notify TI of such intent and enter into a separate Assurance and Indemnity Agreement.

IMPORTANT NOTICE