EVM User's Guide: TAC5412Q14B4EVM-K TAC5311Q14B4EVM-K TAA5412Q14B4EVM-K EVM

TAx5x1x-Q1 Family Evaluation Module

Description

The TAx5x1xQ14B4EVM-K evaluation module (EVM) allows the user to test the capabilities of Texas Instruments' TAC5412-Q1 a stereo high-performance Codec, TAC5311-Q1 a mono Codec or TAA5412 a stereo high-performance ADC. The evaluation module is paired with the AC-MB, a flexible motherboard which provides power, control and digital audio data to the evaluation module.

Get Started

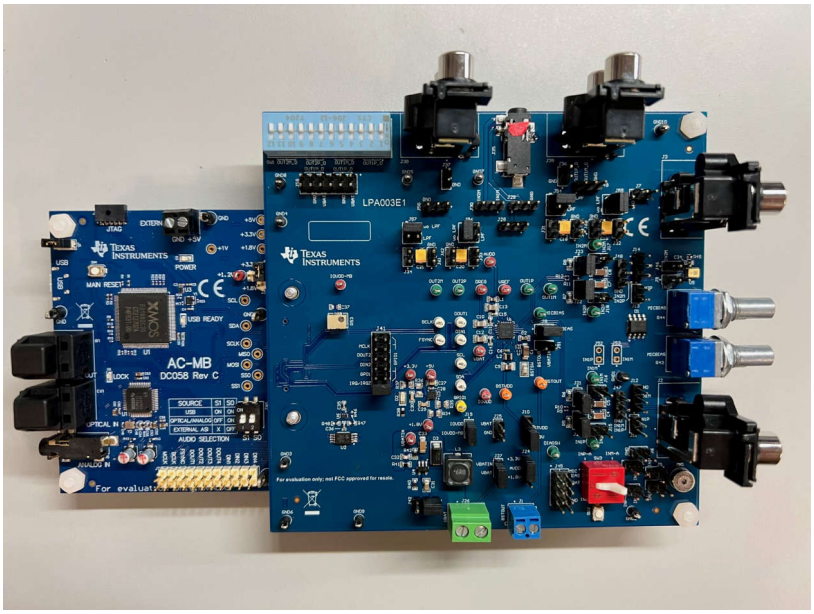
1. Order the EVM from TAx5x1x product folder.
2. Download the latest TAx5x1x data sheet.
3. Request access and download PPC3 GUI from TAx5x1x product folder.

Features

- Complete evaluation kit for the TAC5412-Q1, a stereo high-performance Codec, TAC5311-Q1 a mono Codec or TAA5412 a stereo high-performance ADC
- On-board microphones provided for voice recording testing
- Direct access to digital audio signals and control interface for simple end-system integration
- USB connection to PC provides power, control, and streaming audio data for easy evaluation
- On-board diagnostic scenarios for analog audio input

Applications

- Emergency call- e-call
- Telematics control unit
- Automotive active noise cancellation
- Automotive head units



1 Evaluation Module Overview

1.1 Introduction

This user's guide describes the functionality of TAC5412Q14B4EVM-K, TAC5311Q14B4EVM-K and TAA5412Q14B4EVM-K EVM evaluation kit.

The TAx5x1xQ14B4EVM is an evaluation module (EVM) designed to demonstrate the performance and functionality of the TAx5x1xQ1 family of devices. This family includes the devices shown in Table 1-1 with differences in performance and function noted.

Table 1-1. TAx5x1x-Q1 Family

Device	ADC DR (dB)	DAC DR (dB)	Feature
TAC5412-Q1	110	120	Stereo CODEC
TAC5411-Q1	110	120	Mono CODEC
TAC5312-Q1	102	106	Stereo CODEC
TAC5311-Q1	102	106	Mono CODEC
TAA5412-Q1	110	NA	Stereo ADC

1.2 Kit Contents

- TAC5412-Q1, TAC5311-Q1 or TAA5412-Q1 device
- TAx5x1XQ14B4 EVM/daughterboard
- AC-MB Controller/motherboard

1.3 Specification

The TAx5x1xQ14B4EVM evaluation module (EVM) paired with the AC-MB, a flexible motherboard which provides power, control and digital audio data to the evaluation module allows user to record and playback audio signal. The configuration for the TAC5412-Q1, TAC5311-Q1 or TAA5412-Q1 device is done through the PurePath Console 3 (PPC3) GUI.

1.4 Device Information

- TAC5412-Q1: a low power, high performance, Stereo Audio Codec with integrated programmable boost, micbias and diagnostics.
- TAC5411-Q1: a low power, high performance, Mono Audio Codec with integrated programmable boost, micbias and diagnostics.
- TAC5312-Q1: a low power Stereo Audio Codec with integrated programmable boost, micbias and diagnostics.
- TAC5311-Q1: a low power Mono Audio Codec with integrated programmable boost, micbias and diagnostics.
- TAA5412: a low power high performance Stereo Audio ADC with integrated programmable boost, micbias and diagnostics.

2 Hardware

2.1 Hardware Overview

The evaluation kit consists of the TAx5x1xQ14B4EVM daughterboard and the AC-MB controller board. The controller board is used to provide power, control, and digital audio signals to the evaluation module. The daughterboard contains the TAx5x1x-Q1 device and the input output connections. Depending on the selected device, some components are not populated in the EVM.

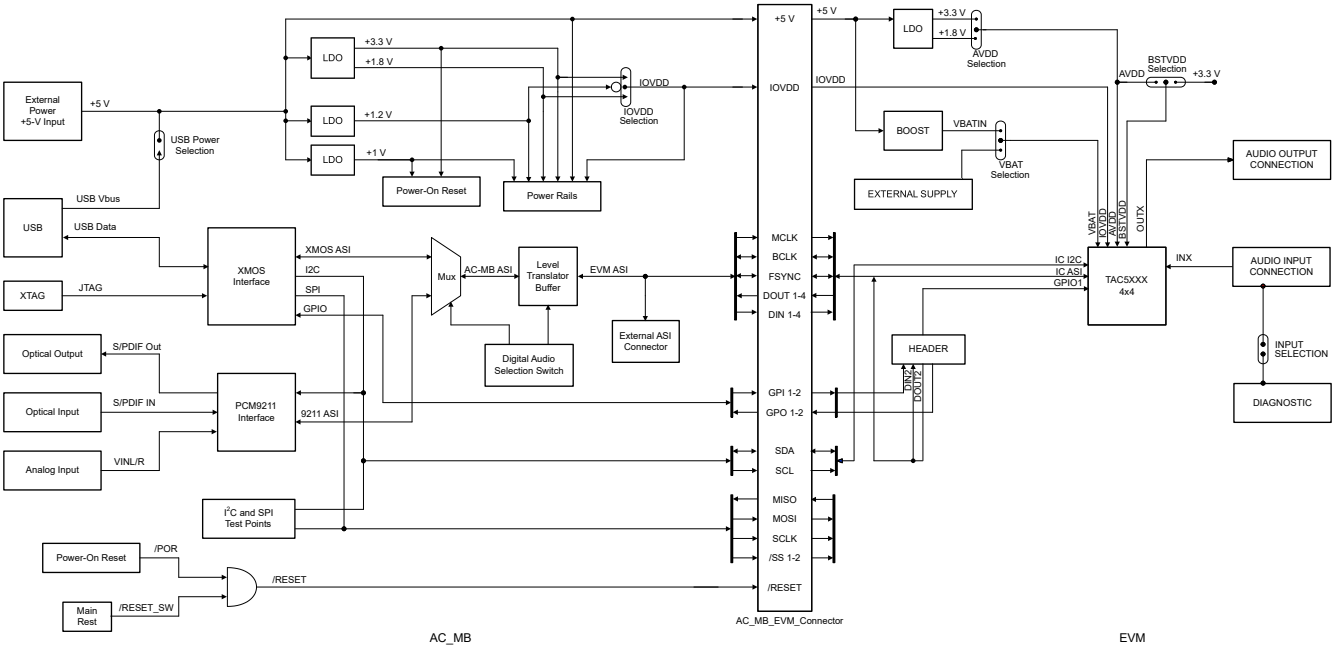


Figure 2-1. TAx5x1xQ1 EVM Block Diagram

2.2 AC-MB Settings

2.2.1 Audio Serial Interface Settings

The AC-MB provides the digital audio signals to the evaluation module from the universal serial bus (USB), optical jack, stereo audio jack, and external audio serial interface (ASI) header. Figure 2-2 shows a block diagram of the ASI routing on the AC-MB.

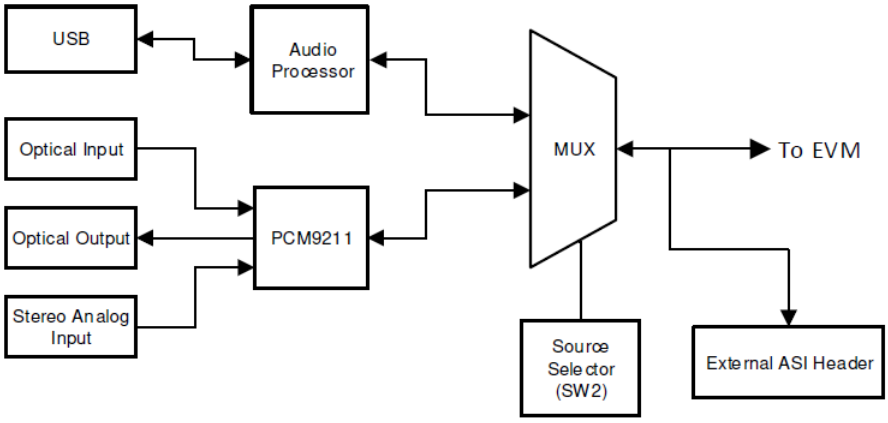


Figure 2-2. AC-MB Audio Interface Block Diagram

Switch SW2 on the AC-MB selects the audio serial bus that interfaces with the PCM6xx0EVM. Next to switch SW2, the AC-MB has a quick reference table to identify the audio serial interface source options and switch settings. The AC-MB acts as the controller for the audio serial interface, with three different modes of operation: USB, optical or analog, or external ASI.

The serial interface clocks and data are provided from the USB interface. The sampling rate and format are determined by the USB audio class driver on the operating system. The default settings for the USB audio interface are 32-bit frame size, 48-kHz sampling rate, BCLK and FSYNC ratio is 256, and the format is time division multiplexing (TDM).

2.2.1.1 USB Mode

The AC-MB is detected by the OS as an audio device with the name TI USB Audio UAC2.0. Figure 2-3 shows the AC-MB audio setting for the USB mode of operation.

Figure 2-3. AC-MB USB Audio Setting

2.2.1.2 Optical or Auxiliary Analog Audio Input Mode

Serial interface signals are provided from the PCM9211 digital transceiver, which is capable of sending digital data to the EVM from an analog input or optical input. Meanwhile, the data from the EVM can be streamed through the optical output.

Figure 2-4 shows the AC-MB audio setting for the optical and analog mode of operation.

Figure 2-4. AC-MB Optical or Auxiliary Analog Audio Input Setting

The optical output of the AC-MB streams the data captured on the EVM with the format determined by the input source used. When there is an optical input connected, the LOCK LED must be ON, and the PCM9211 streams the audio serial interface clocks with the format determined by the optical input frame. The digital data from the optical input is streamed to the evaluation module. If the optical input is not connected, then the PCM9211 captures the input signal provided through the analog input, and streams the signal to the evaluation module. This feature can be useful when a digital input digital-to-analog converter (DAC) is connected to the AC-MB, providing an analog input for quick evaluation. In auxiliary analog audio mode, the audio serial interface format is fixed to a 24-bit, 48-kHz, I2S mode.

2.2.1.3 External Audio Interface Mode

In this mode, the audio serial interface clocks for the evaluation board are provided through connector J7 from an external source. This architecture allows an external system to be used for communication with the evaluation board, such as a different host processor or test equipment (Audio Precision™). The clocks generated from the USB interface and PCM9211 are isolated with this setting. Figure 2-5 shows the AC-MB audio setting for the external mode of operation.

Figure 2-5. AC-MB External Audio Interface Setting

Figure 2-6 shows how to connect the external audio interface. Odd numbered pins are signal carrying, and even numbered pins are connected to ground.

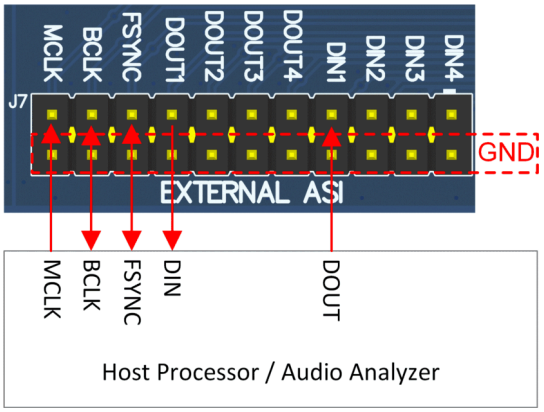


Figure 2-6. AC-MB Connection with External Audio Serial Interface

2.2.2 AC-MB Power Supply

The complete EVM system is powered from a single 5-V power supply. However, the motherboard has different low-dropout regulators (LDOs) integrated that provide the required power supplies to the different blocks of the board. Figure 2-7 shows a block diagram depicting the power structure of the AC-MB.

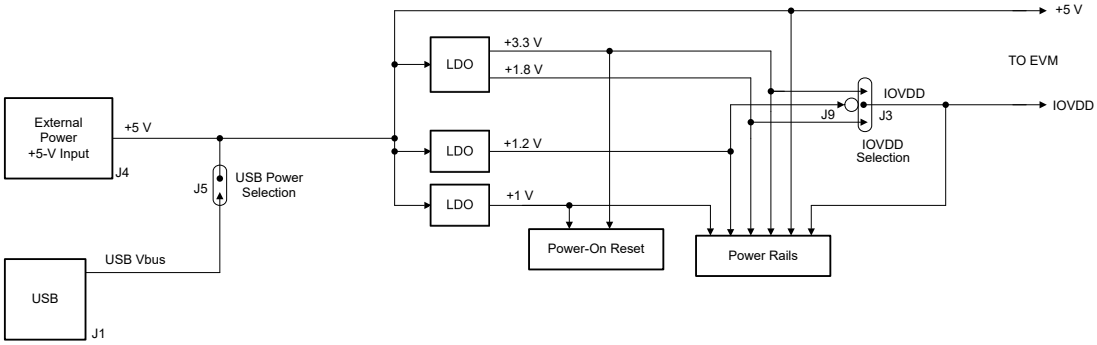


Figure 2-7. Power-Supply Distribution of the AC-MB

The AC-MB can be powered from the host computer by using the USB 5-V power supply (VBUS) by shorting header J5, USB POWER. Additionally, the AC-MB can be powered from an external power supply connected to terminal J4, EXTERNAL POWER. Header J5 must be open for external supply operation. The IOVDD voltage

for the digital signals that is provided to the evaluation module is generated on the motherboard from the main power supply (USB or external).

The voltage levels available are 1.2 V, 1.8 V, and 3.3 V and can be selected via the J9 and J3 IOVDD header. For 1.2-V operation, short pin 1 of header J9 and pin 2 of header J3; for 1.8-V operation, short pins 2 and 3 of header J3; for 3.3-V operation, short pins 1 and 2 of header J3. The green POWER LED (D3) turns ON when the motherboard is fully powered and the power supplies from the onboard LDOs are correct. The USB READY LED indicates a successful USB communication between the AC-MB and the host computer.

2.3 TAx5x1xQ1EVM-K Hardware Settings

2.3.1 TAx5412-Q1 EVM Input Hardware Settings

The TAx5412-Q1 evaluation module has several input configuration options. The EVM allows the user to evaluate the device across multiple operation modes. The different operation modes are highlighted in this section.

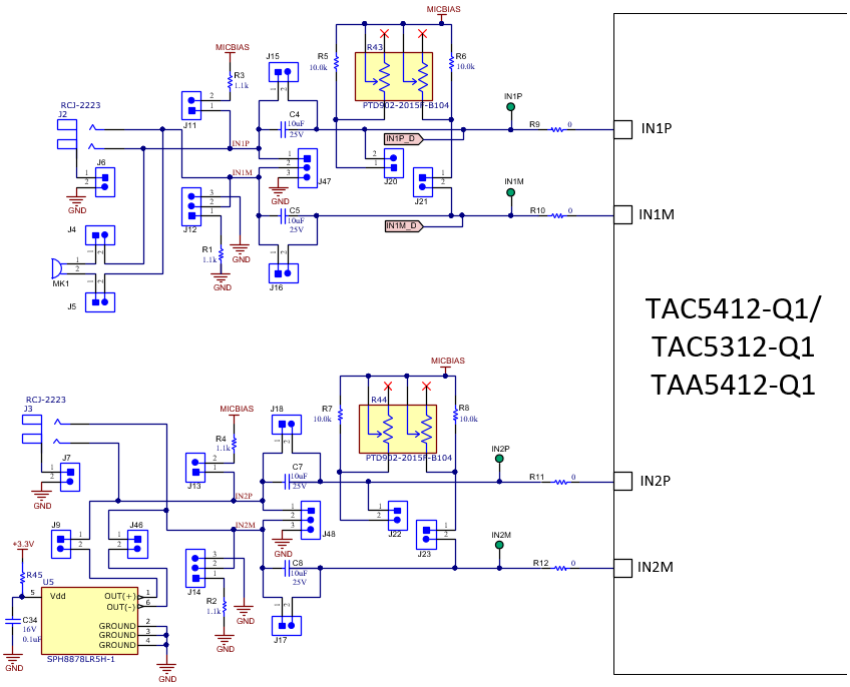


Figure 2-8. TAC5412Q1/TAC5312Q1/TAA5412Q1 EVM Input Architecture for Channel 1 and 2

The IN1 and IN2 input architecture allows these two channels to be quickly configured to support any of the supported operation modes. The INxP and INxM pins of the TAx5412-Q1 can optionally connect to onboard microphones for quick evaluation of a microphone in AC- or DC-coupled modes. Jumper configuration details can be found in Figure 2-9.

For TAC5x11-Q1 evaluation module, The DIN1P and DIN1M can be connected to IN1P and IN1M respectively through jumper J52 and J53 as shown in Figure 2-8. Only IN1 Input Terminal is applicable in this evaluation module from the configuration table.

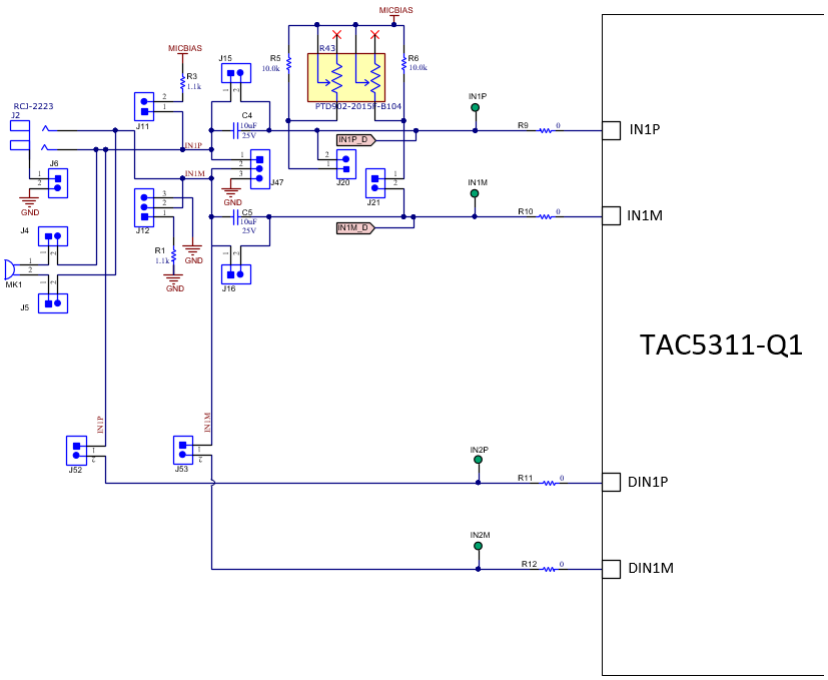


Figure 2-9. TAC5311-Q1 EVM Input Architecture for Channel 1 and DIN1P/M

Table 2-1. Input Jumper Configuration

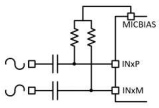
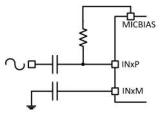
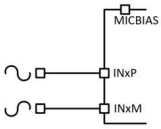
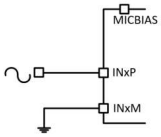
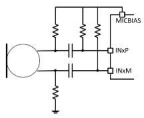
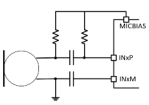
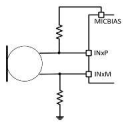
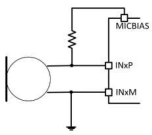
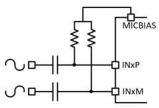
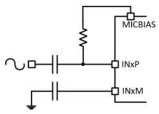
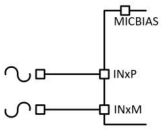
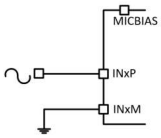
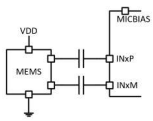
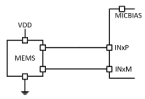
Input Terminal	Input Mode	Installed Jumpers	Uninstalled Jumpers	Input Swing	Topology	Register
IN1	LINE-IN Differential, AC-coupled	J8, J20, J21	J4, J5, J6, J11, J12, J15, J16	10 V_{RMS}		B0_P0_R80, B0_P1_R115
	LINE-IN Single-ended, AC-coupled	J6, J8, J12 (2-3), J20, J21	J4, J5, J11, J15, J16	5 V_{RMS}		B0_P0_R80, B0_P1_R115
	LINE-IN Differential, DC-coupled	J15, J16	J4, J5, J6, J11, J12, J20, J21, J8 (DUT MICBIAS is not used)	10 V_{RMS}		B0_P0_R80
	LINE-IN Single-ended, DC-coupled	J6, J12 (2-3), J15, J16	J4, J5, J11, J20, J21, J8 (DUT MICBIAS is not used)	5 V_{RMS}		B0_P0_R80
	On-board Electret Condenser Microphone (ECM) Differential, AC-coupled	J4, J5, J8, J11, J12 (1-2), J20, J21	J6, J15, J16	Refer to Microphone data sheet		B0_P0_R80, B0_P1_R115
	On-board Electret Condenser Microphone (ECM) Single-ended, AC-coupled	J4, J5, J8, J11, J12 (2-3), J20	J6, J15, J16, J21	Refer to Microphone data sheet		B0_P0_R80, B0_P1_R115

Table 2-1. Input Jumper Configuration (continued)

Input Terminal	Input Mode	Installed Jumpers	Uninstalled Jumpers	Input Swing	Topology	Register
	On-board Electret Condenser Microphone (ECM) Differential, DC-coupled	J4, J5, J8, J11, J12 (1-2), J15, J16	J6, J20, J21	Refer to Microphone data sheet		B0_P0_R80, B0_P1_R115
	On-board Electret Condenser Microphone (ECM) Single-ended, DC-coupled	J4, J5, J8, J11, J12 (2-3), J15, J16	J6, J20, J21	Refer to Microphone data sheet		B0_P0_R80, B0_P1_R115
IN2	LINE-IN Differential, AC-coupled	J8, J22, J23	J7, J9, J13, J14, J17, J18, J46	10 V_{RMS}		B0_P0_R85, B0_P1_R115
	LINE-IN Single-ended, AC-coupled	J7, J8, J14 (2-3), J22, J23	J9, J13, J17, J18, J46	5 V_{RMS}		B0_P0_R85, B0_P1_R115
	LINE-IN Differential, DC-coupled	J17, J18	J7, J9, J13, J14, J22, J23, J46, J8 (DUT MICBIAS is not used)	10 V_{RMS}		B0_P0_R85
	LINE-IN Single-ended, DC-coupled	J7, J14 (2-3), J17, J18	J9, J13, J22, J23, J46, J8 (DUT MICBIAS is not used)	5 V_{RMS}		B0_P0_R85
	On-board Analog MEMS microphone, AC-coupled	J8, J9, J22, J23, J46	J7, J13, J14, J17, J18	Refer to Microphone data sheet		B0_P0_R85, B0_P1_R115
	On-board Analog MEMS microphone, DC-coupled	J9, J17, J18, J46	J7, J13, J14, J22, J23, J8 (DUT MICBIAS is not used)	Refer to Microphone data sheet		B0_P0_R85, B0_P1_R115

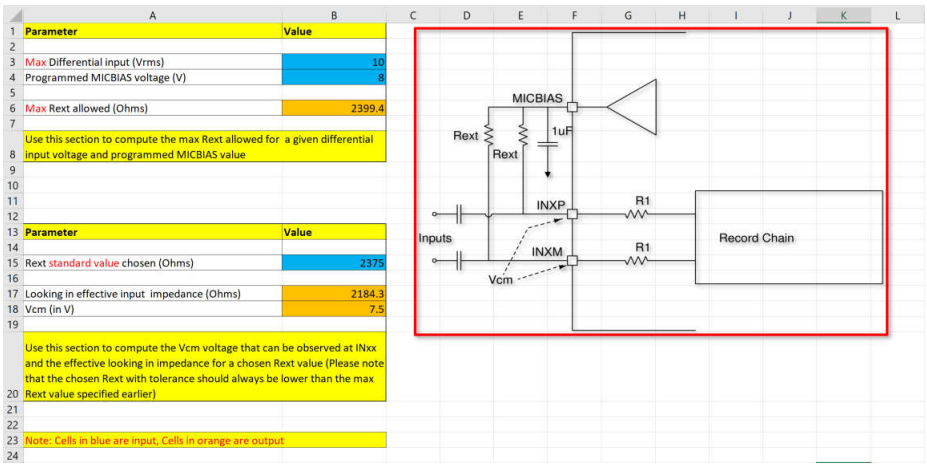
2.3.1.1 Line Inputs

For the line input configuration shown in Figure 2-10, the TAx5x1x-Q1 captures the audio signal provided through RCA terminals J2 (IN1), J3 (IN2) or header J47 or J48. The RCA white connector is connected to the INxP and RCA red connector is connected to the INxM. Depending on differential or single-ended configuration, populate J6 or J7 jumper as described in Table 2-1 accordingly. The input accepted in this mode is a differential 10-VRMS full-scale audio signal. If a single-ended source is used, the 5-VRMS signal is supported. The gang potentiometer R43 and R44 provide the input bias resistors for this AC-Coupled input mode depending on the desired input swing and impedance.

Using the TAx5x1x-Q1 AC-Coupled external resistor calculator, enter the maximum input level and the desired MICBIAS voltage to determine the resistance required to achieve full input swing as shown in Figure 2-10.

From the calculator example below, the maximum resistance allowed is 2399.4 Ohm and the closest standard resistance is 2375 Ohm. Based on this standard value resistance, the effective impedance looking into the device is about 2184 Ohm. This effective input impedance forms a high pass filter with the external capacitor. The Vcm is the common voltage for the respective MICBIAS and Input Swing. One can adjust the R50 and

R51 potentiometer to get the common mode voltage (Vcm). By default, the EVM Vcm is set to 7.3V with 8 V MICBIAS.



Parameter	Value
Max Differential input (Vrms)	10
Programmed MICBIAS voltage (V)	8
Max Rext allowed (Ohms)	2399.4
Use this section to compute the max Rext allowed for a given differential input voltage and programmed MICBIAS value	

Parameter	Value
Rext standard value chosen (Ohms)	2375
Looking in effective input impedance (Ohms)	2184.3
Vcm (in V)	7.5
Use this section to compute the Vcm voltage that can be observed at INxx and the effective looking in impedance for a chosen Rext value (Please note that the chosen Rext with tolerance should always be lower than the max Rext value specified earlier)	
Note: Cells in blue are input, Cells in orange are output	

Figure 2-10. AC-Coupled External Resistor Calculator

2.3.1.2 On-board Microphone Input

For the on-board microphone input configuration shown in Figure 2-8, the TAx5x1x-Q1 records the audio captured from MK1 (ECM) or U5 (Analog MEMS) microphones. For U5, the audio port is located at the bottom of the board. Electret Microphone (MK1) is connected to IN1P/M and MICBIAS is used to power the on-board microphone, so header J8 must be installed. The MEMS microphone (U5) can be configured as a single-ended or differential input and connected to IN2P/M. There must not be any connections to J2 or J3 while the on-board microphone is used to preserve the performance of the microphone. There is a possibility that gain adjustment is needed in the device depending on the microphone sensitivity.

2.3.2 TAC541x-Q1 EVM Output Hardware Settings

The TAx541x-Q1 evaluation module has several output configuration options and offers flexibility to allow the user to evaluate the device with different load conditions and configurations. The different configurations are highlighted in this section.

The EVM analog audio output port provides option for AC/DC-Coupled and filter or filter-less paths for easy evaluation. By default the filter conponents are not populated.

Switch SW1 allows users to select respective loads for each output pair for 16 Ohm, 604 Ohm or 10K Ohm if needed. These resistors are for quick evaluation and can be bypassed for actual load. SW1 and the output RCA connectors are located on the top left hand side shown in Figure 2-11.

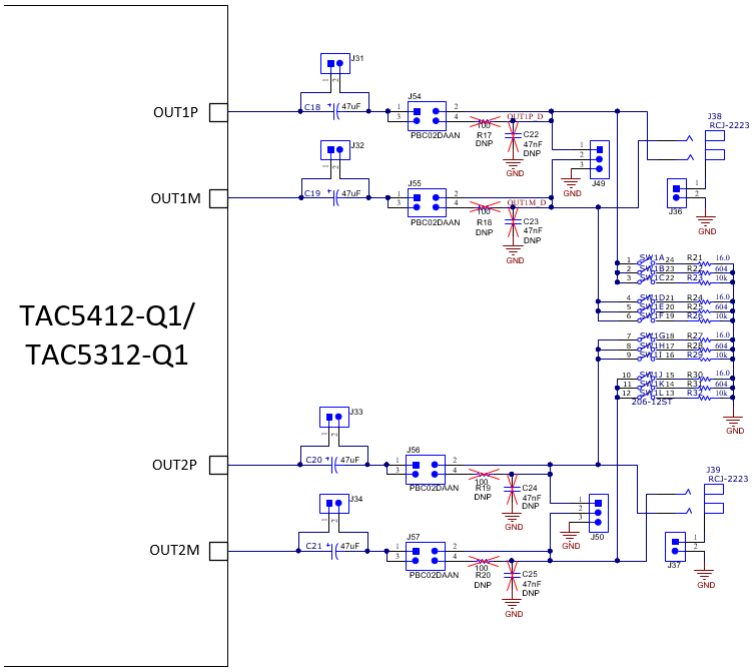


Figure 2-11. TAC5412-Q1/TAC5312-Q1 EVM Output Architecture for Channel 1 and 2

OUT1 and OUT2 audio output pins have connection options with external load or the on-board load selections. A pair of RCA connectors, white from OUTP and red from OUTM, allow users to connect to external device as differential or single ended. Jumper header J36 or J37 must be populated if single-ended is desired or removed otherwise for differential configuration.

Table 2-2. SW1 Pin

SW1 pin	Load Configuration	Resistor Rating	Output Module Register Setting
1, 4, 7, 10	16 Ω	0.5 W	B0_P0_R101
2, 5, 8, 11	604 Ω	0.125 W	B0_P0_R101
3, 6, 9, 12	10 kΩ	0.4 W	B0_P0_R101

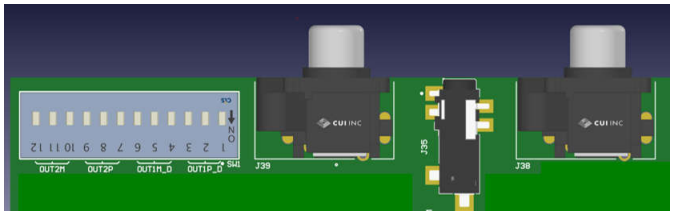


Figure 2-12. TAC5412-Q1 Analog Output Connections

For TAC5x11-Q1, OUT2 components are not populated.

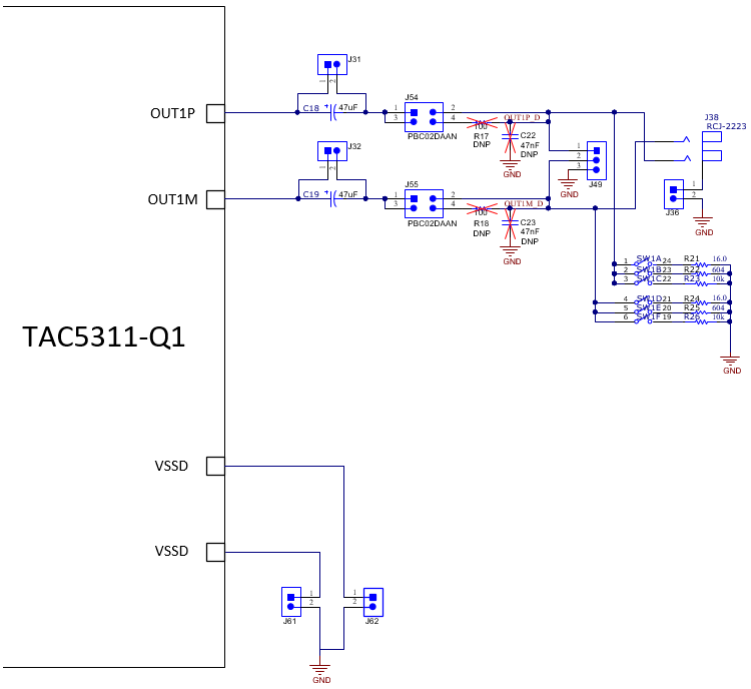


Figure 2-13. TAC5311-Q1 EVM Output Architecture for Channel 1

2.4 Diagnostics Hardware Setup

The diagnostics test circuitry, as shown in Figure 2-14, is not connected to any channel by default. To test IN1P and IN1M diagnostic, configure the inputs as DC coupled and populate jumper headers on J43 and J44.

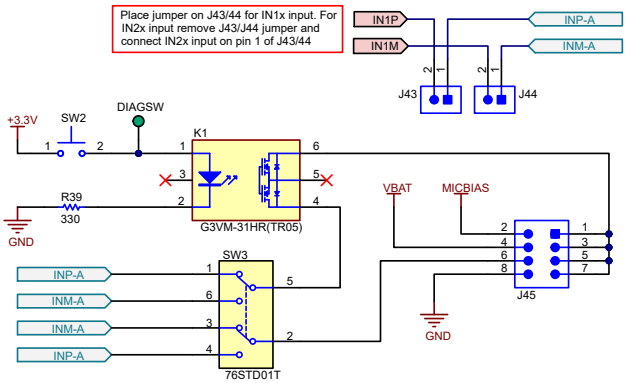


Figure 2-14. TAx5x1x-Q1 EVM Diagnostic Circuitry

The diagnostic test selection is done by populating one jumper at any one time on J45 header either for input to MICBIAS short, input to VBAT short, input to input short or input to ground short. Once the connection is established, press SW2 to initiate the test, the fault detection can then be verified through the device register. The bidirectional arrow indicates moving the switch to left for IN1P test and to the right for IN1M test.

TI's recommended settings for this diagnostics test circuit are discussed in this section. The following figures below are based on newer EVM revision which has IN1P and IN1M connected by default through J43 and J44.

2.4.1 Short to MICBIAS Setup

Figure 2-15 shows a short to the MICBIAS test. If using a single-ended input for the test channel, only connect INxP.

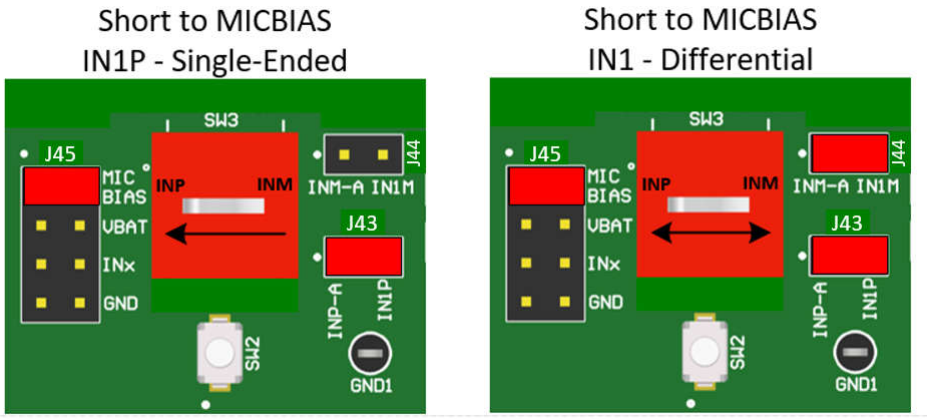


Figure 2-15. Short to MICBIAS Diagnostic Test Setup

2.4.2 Short to VBAT Setup

A short to VBAT tests shown in figure below requires an external voltage source connected to VBAT via J26 or on-board VBAT via J27. If on-board VBAT is used, populate jumper on J42 pin 1-2 to enable the U4 switch regulator.

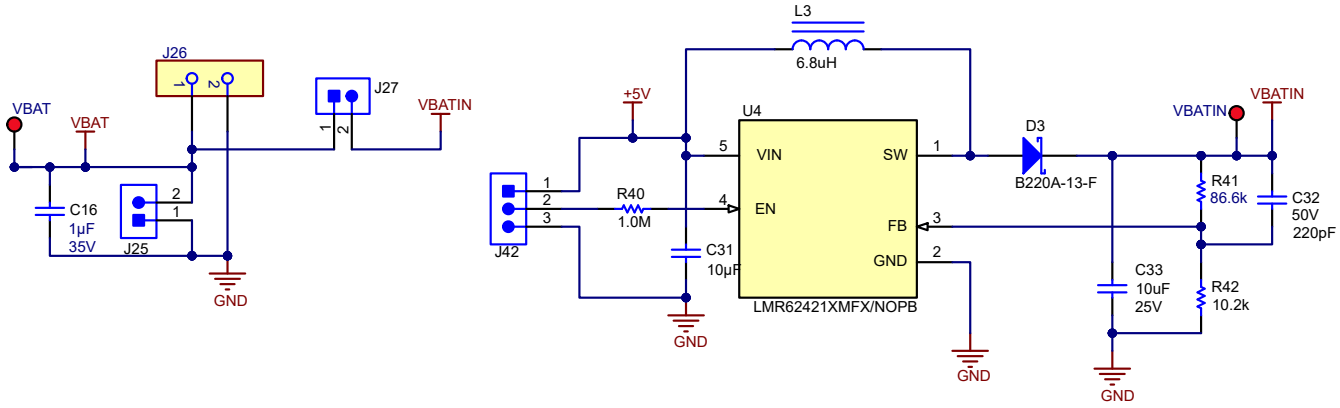


Figure 2-16. VBAT Connection

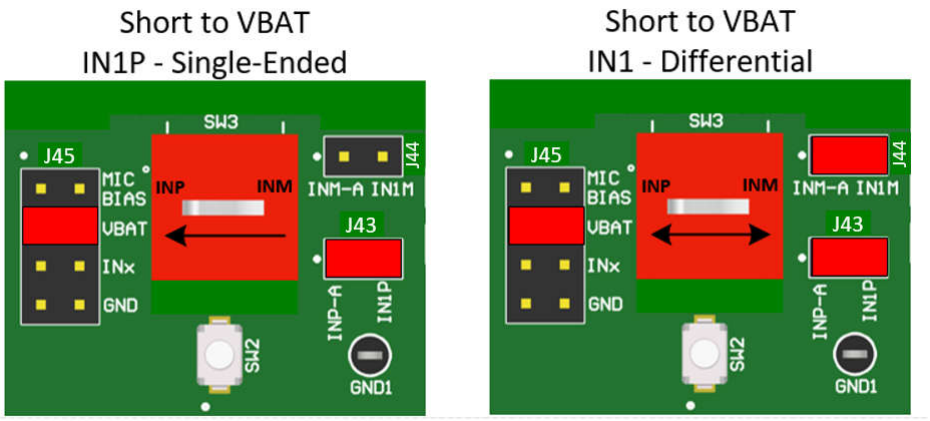


Figure 2-17. Short to VBAT Diagnostic Test Setup

2.4.3 Shorted Input Pins Setup

Shorted input diagnostic testing can be performed for differential inputs only.

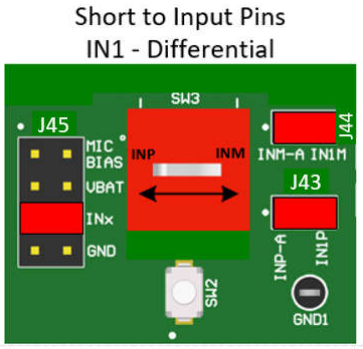


Figure 2-18. Short to Input Diagnostic Test Setup

2.4.4 Short to GND Setup

Figure 2-19 shows the short to ground testing for the inputs.

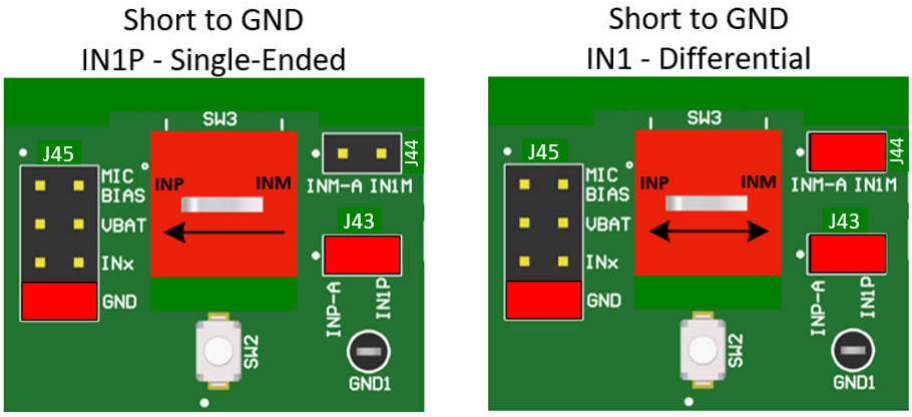


Figure 2-19. Short to Ground Diagnostic Test Setup

2.5 GPIO1 Hardware Configurations

GPIO1 has many configuration options through J41 header, but only one setting is allowed at a time. GPIO1 can be configured for general purpose input output and Audio Serial Interface can be configured as either MCLK, DIN or DOUT in controller or target mode. This is shown in the figure below.

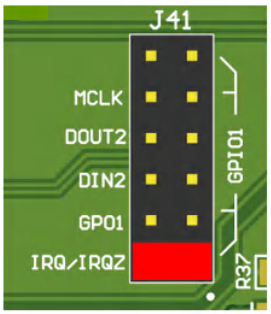


Figure 2-20. GPIO1 Configuration

3 Software

3.1 Software Description

Texas Instruments' PurePath™ console 3 (PPC3) graphical development suite is a program that serves as a platform for many of TI's audio products. PPC3 is designed to simplify the evaluation, configuration, and debug process associated with the development of audio products.

3.2 PurePath Console 3 Installation

The TAx5x1x-Q1 EVM GUI is an application that installs into the PPC3 framework. PPC3 must be installed prior to downloading the TAx5x1x-Q1 EVM GUI. Request access for PPC3 through PUREPATHCONSOLE. If the PPC3 is already installed, then proceed to TAx5x1x-Q1 EVM GUI. Figure 3-1 shows the setup directory for the PPC3 installation.

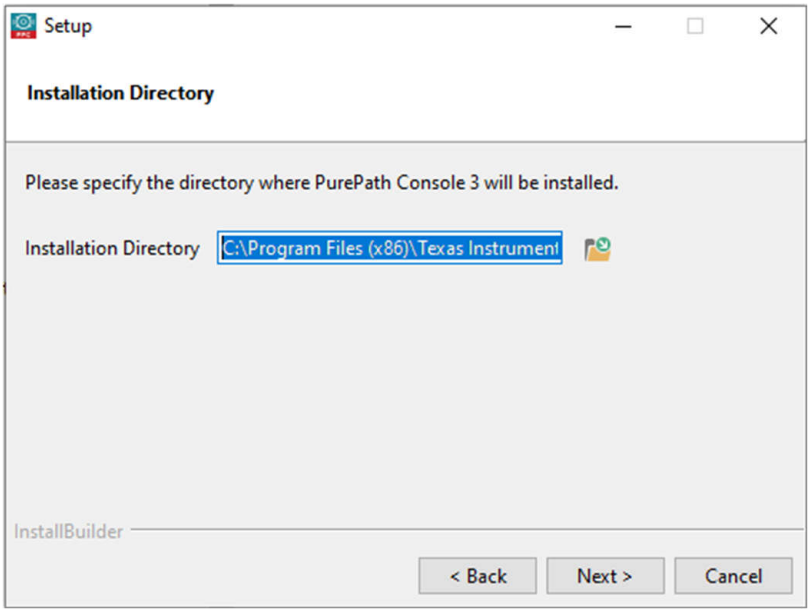


Figure 3-1. PurePath Console 3 Installation

Open the PPC3 installer and follow the instructions in the setup wizard.

3.2.1 USB Audio Setup

Note: When using the USB audio interface, the Texas Instruments USB audio device control panel, shown in Figure 3-2, opens with the input setting configured for 8 channel, 32 bits. For USB audio, 32-bit mode must be used on the EVM as well.

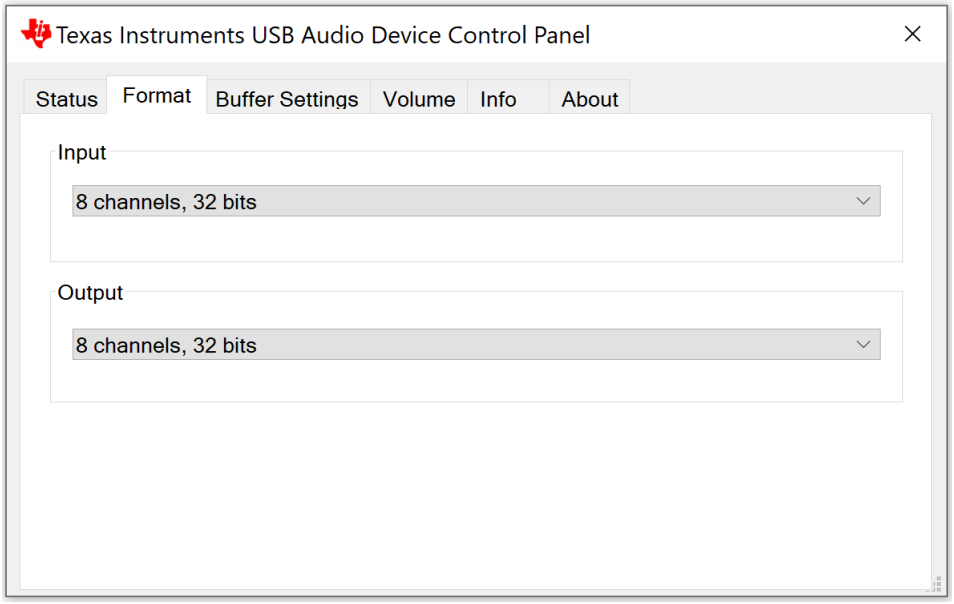


Figure 3-2. Texas Instruments USB Audio Device Control Panel

3.3 TAx5x1x-Q1 EVM GUI

Open the PPC3 application in the directory chosen for the GUI installation in Section 3.2. Figure 3-3 shows the resulting app center window. Click on the TAC5x1x-Q1 app tile.

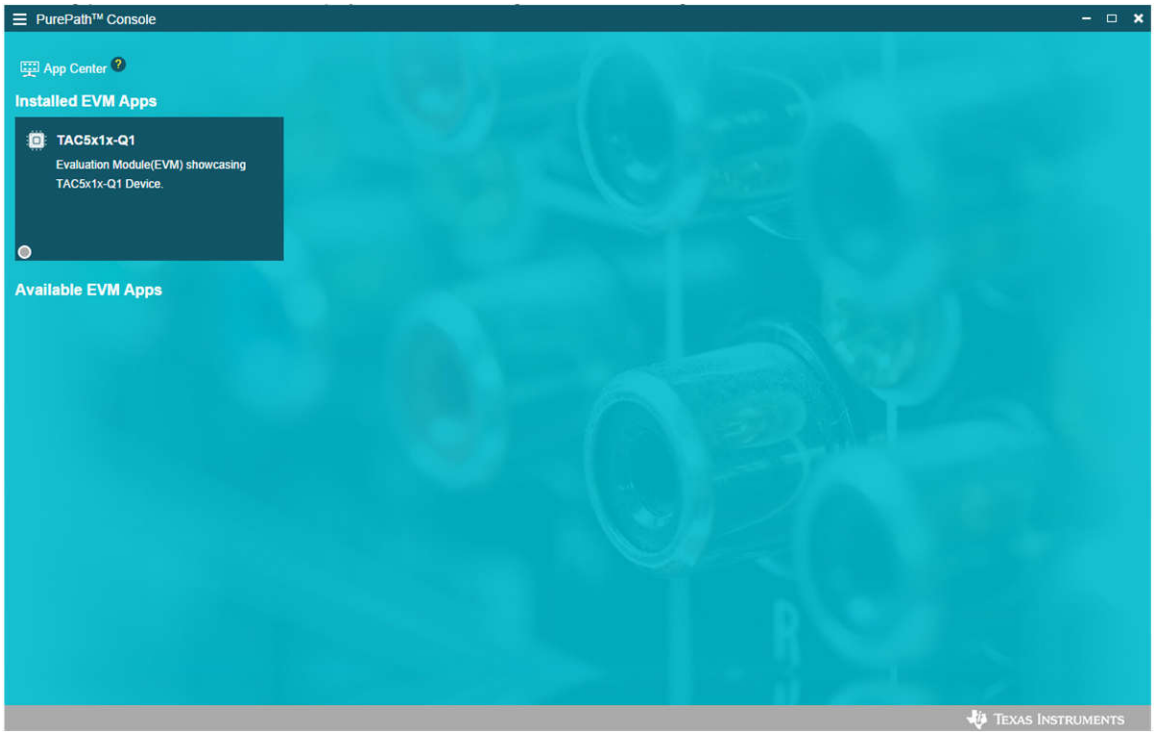


Figure 3-3. PurePath Console 3 App Center

The TAC5x1x-Q1 GUI is designed to work with up to four devices at any time. Select the device(for example, *TAA5412-Q1* as shown in the Figure 3-4). There can be other device variants in the pull-down menu. The subsequent PPC3 Software sections below are based on this device example. Choose the 1 device radio button and click New.

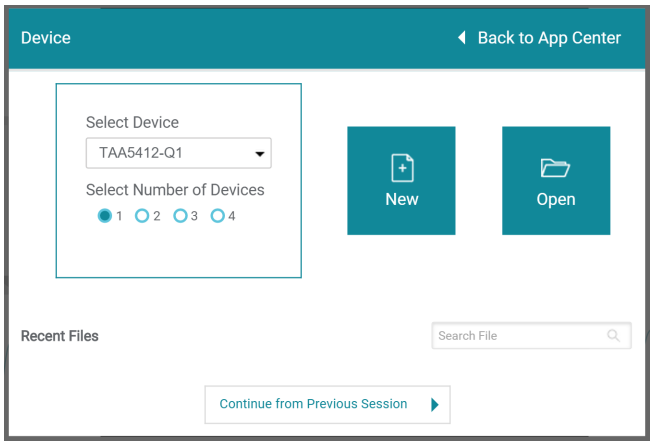


Figure 3-4. Select Device Configuration

The GUI opens to the default Device Config tab as shown below.

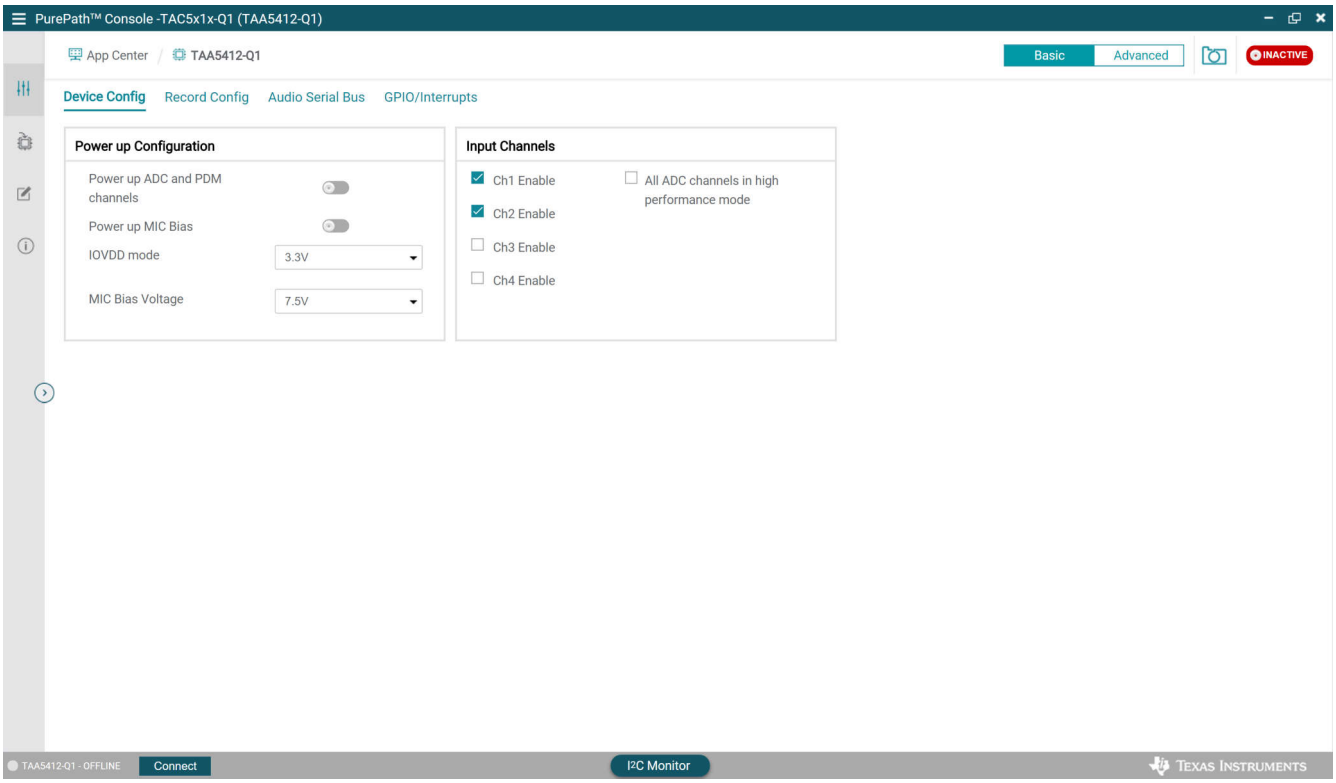


Figure 3-5. Device Config Tab

Before changing any parameters, check the lower left corner of the PPC3 window, as shown in Figure 3-6, to verify that the EVM is connected. If no EVM is detected, the text reads TAA5412-Q1 - OFFLINE. If the EVM is detected but does not connect automatically, a *Connect* button is shown. Clicking this button connects the hardware.

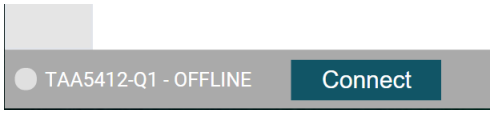


Figure 3-6. Hardware Connect Button

When the hardware is connected, the *Connect* button changes to *Disconnect*, and the device is ready to be configured. Choose to either update GUI with device values or overwrite device with GUI values; either selection works for initial setup.

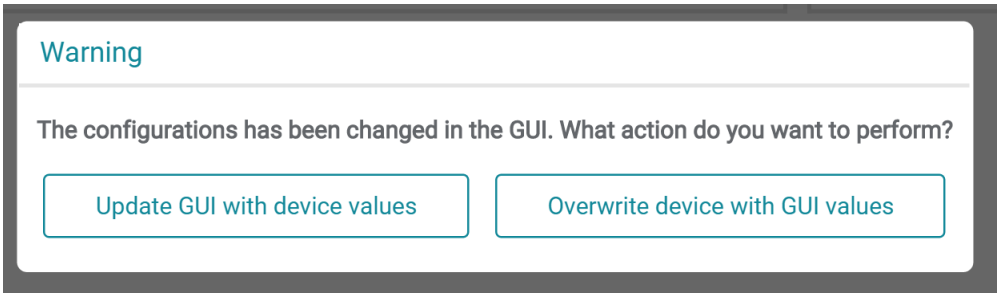


Figure 3-7. Update GUI-Device

To activate the GUI, hit the *INACTIVE* red button to change to *ACTIVE* green button, the GUI is now in operation. The user can configure the device, and then activate the PPC3. Once the device is activated, some controls are grayed out until the *ACTIVE* button is deactivated.

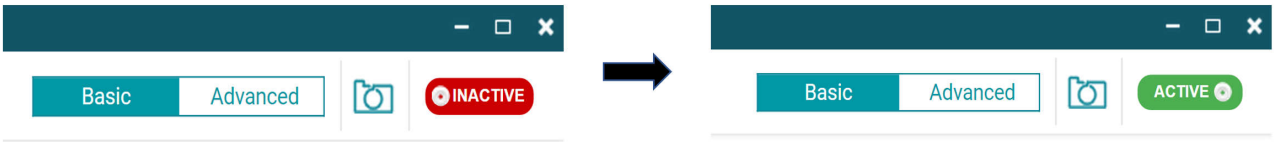


Figure 3-8. Activate GUI

3.3.1 Software Overview

The TAx5x1x-Q1 EVM control software allows for the configuration of the TAx5x1x-Q1 EVM-PDK. The application is organized into three main views: Configuration, End System Integration, and Register Map. These views are detailed in this section. Some controls in these tabs are grayed out when the tabs are not applicable to the selected device variant.

3.3.2 Configuration View

The configuration view, shown in Figure 3-9, contains all of the tools used to configure and program the TAx5x1x-Q1 EVM. This view has tabs for each of the device configuration and is described in this section.

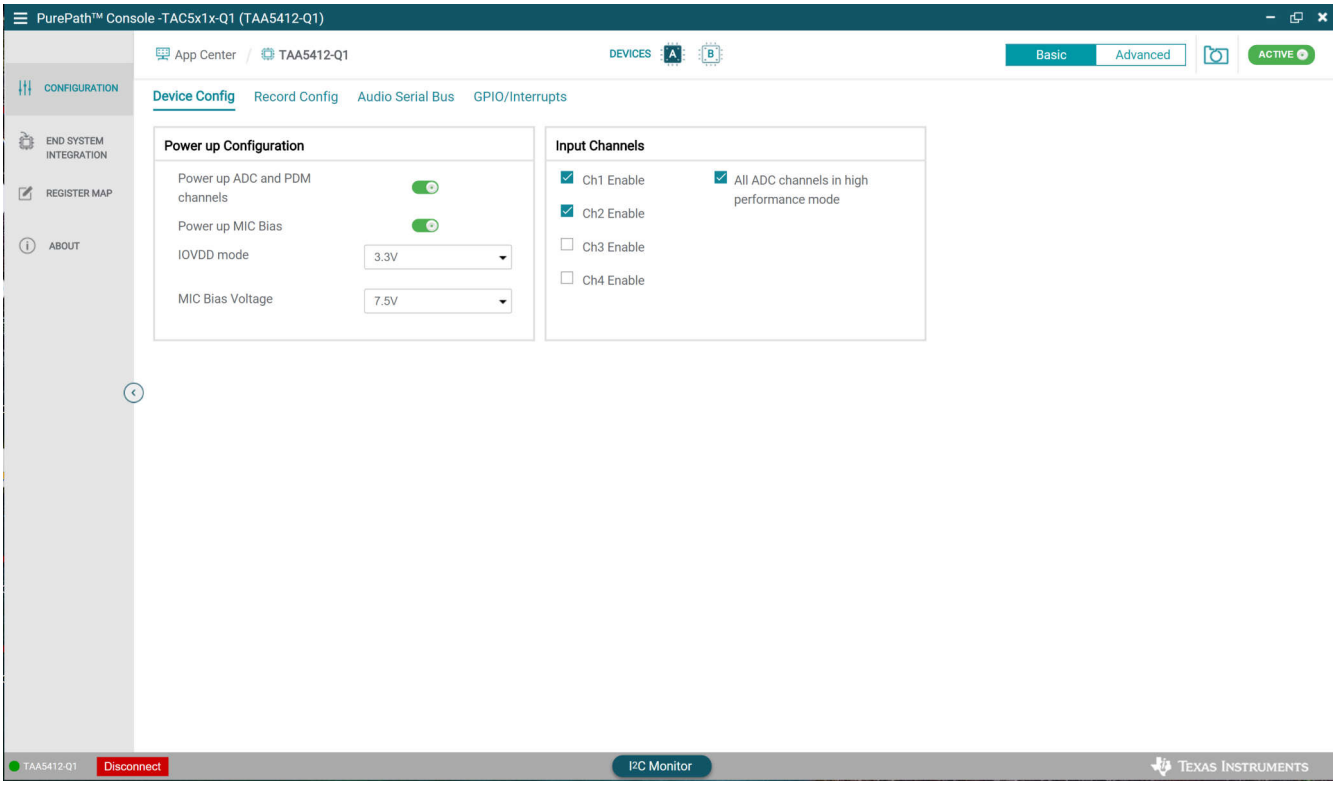


Figure 3-9. Configuration View

3.3.2.1 Device Config Tab

The Device Config tab contains the controls for powering up/enabling the analog blocks, the different channel selection and the associated IO and MIC Bias level. Input channel 3 and channel 4 are associated with the PDM input channels.

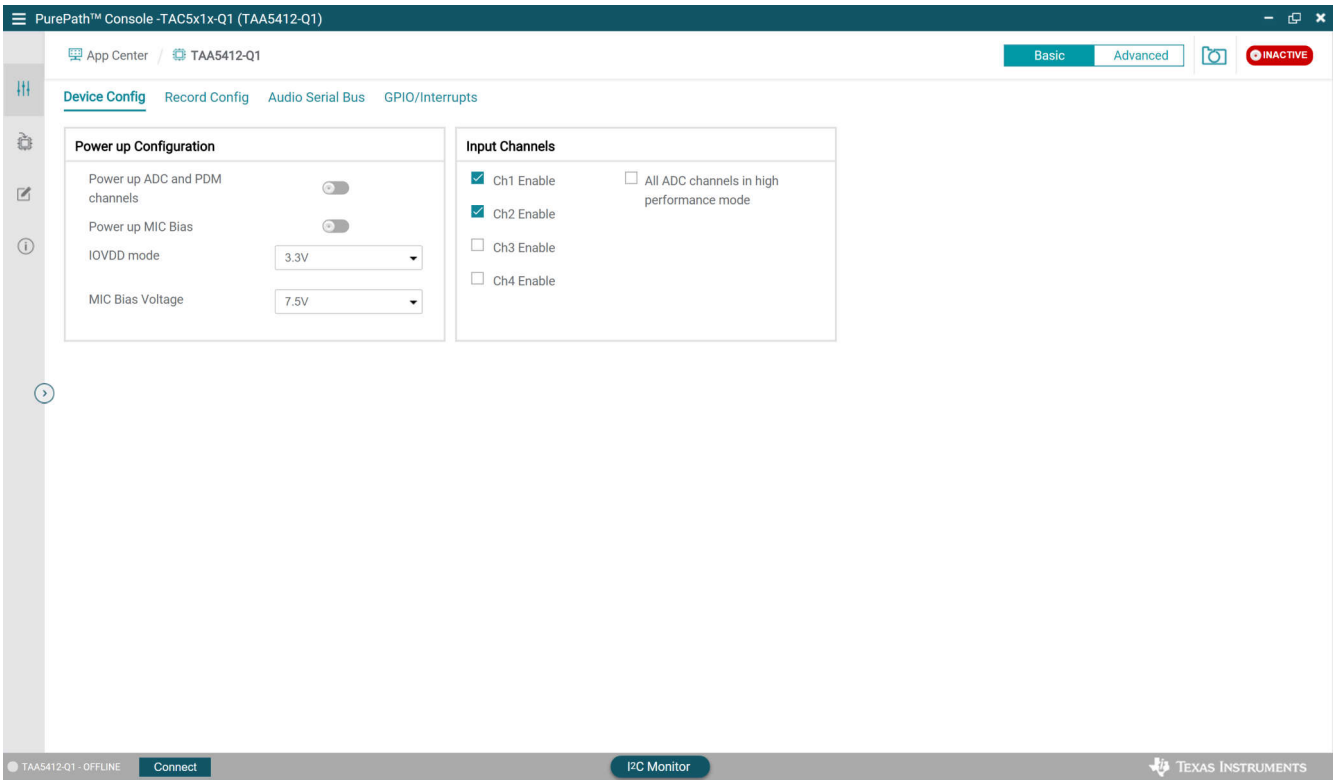


Figure 3-10. Device Config Tab

3.3.2.2 Record Config Tab

The Record Config tab contains the controls for the analog inputs and the associated input channels and the levels. Channel 3 and channel 4 are associated with Digital Microphone inputs. For PDM input, several PDM clock selections are available with the associated data and clock triggering in this record config tab.

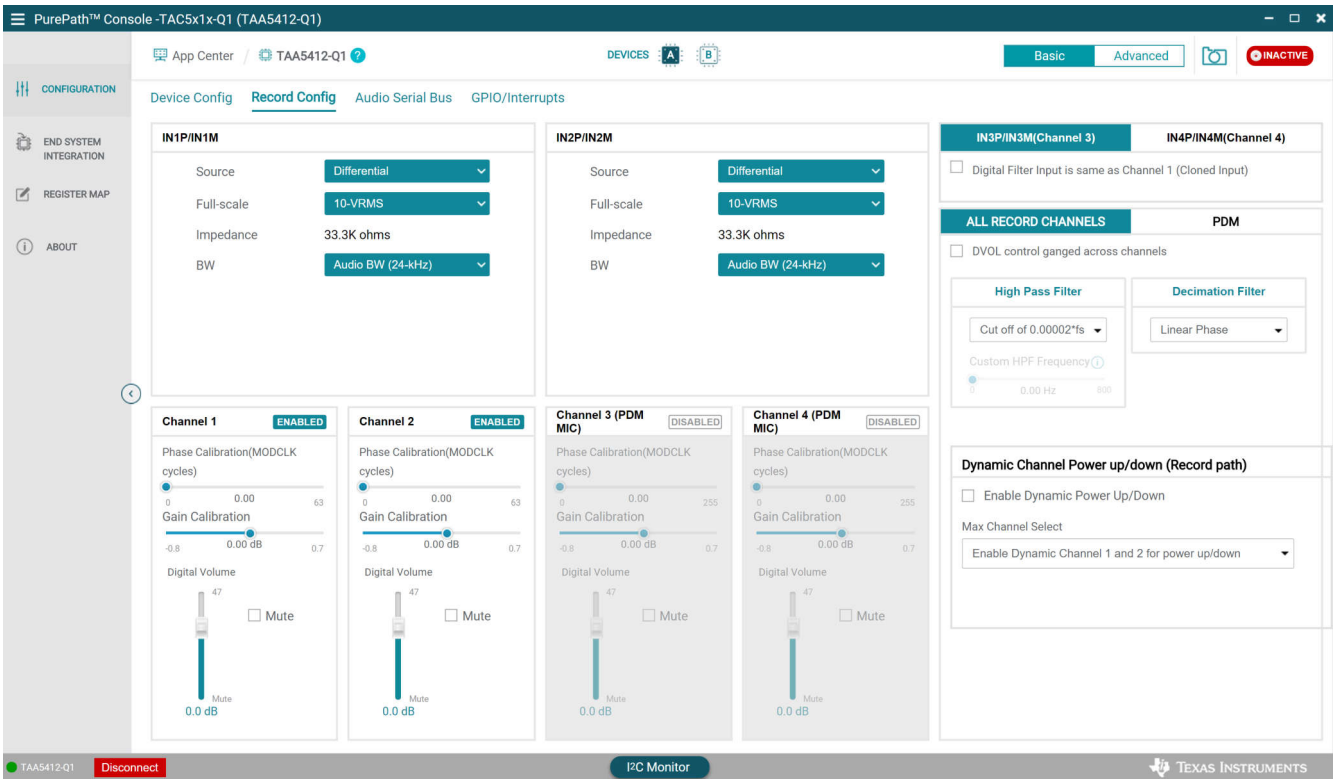


Figure 3-11. Record Config Tab

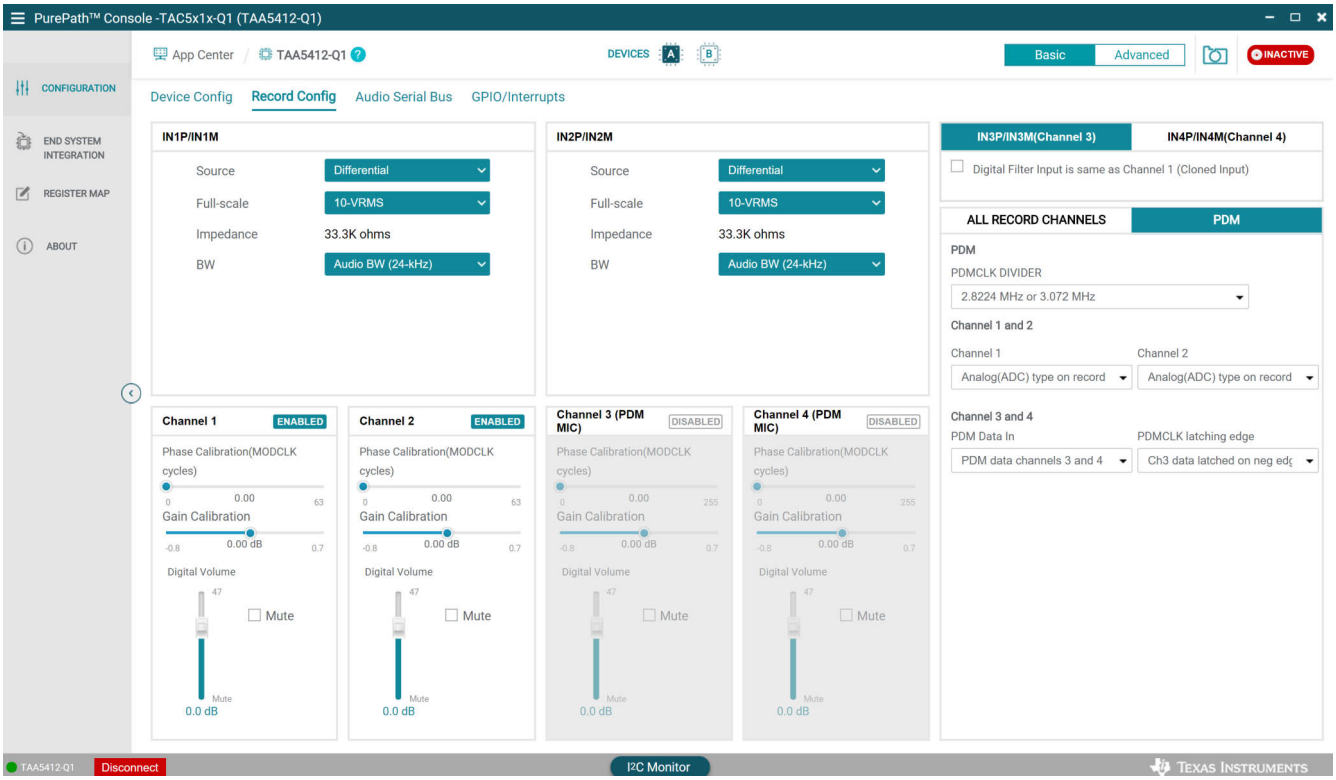


Figure 3-12. PDM Record Config Tab

3.3.2.3 Playback Config Tab

This tab provides control to the analog output configurations with the associated drive selections.

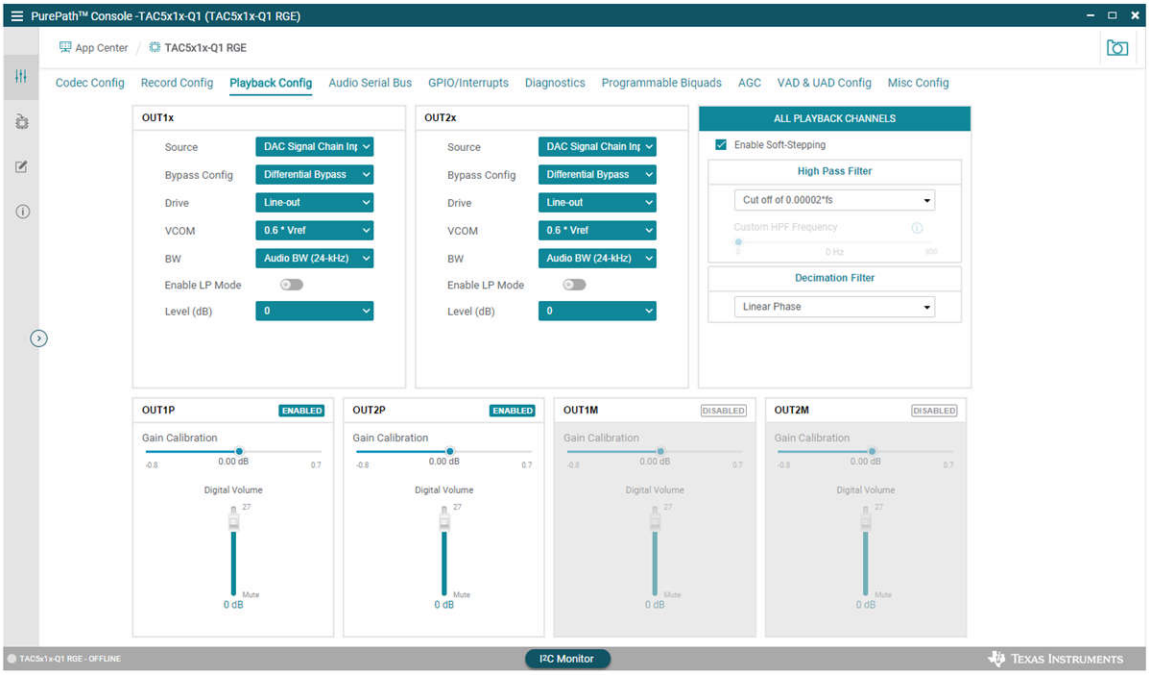


Figure 3-13. Playback Config Tab

3.3.2.4 Audio Serial Bus Tab

The TAx5x1x-Q1 family of devices feature a very flexible audio serial bus. Allowing these devices to function seamlessly with a wide range of DSPs, SoCs, or other audio devices. The audio serial bus tab provides controls to configure the EVM to the required format, mode and the different supported MCLK frequencies.

Besides the primary audio serial bus, the devices support a secondary audio serial bus when needed to interface with an external controller/device with the same flexibility.

3.3.2.4.1 Configuring Primary Audio Serial Bus

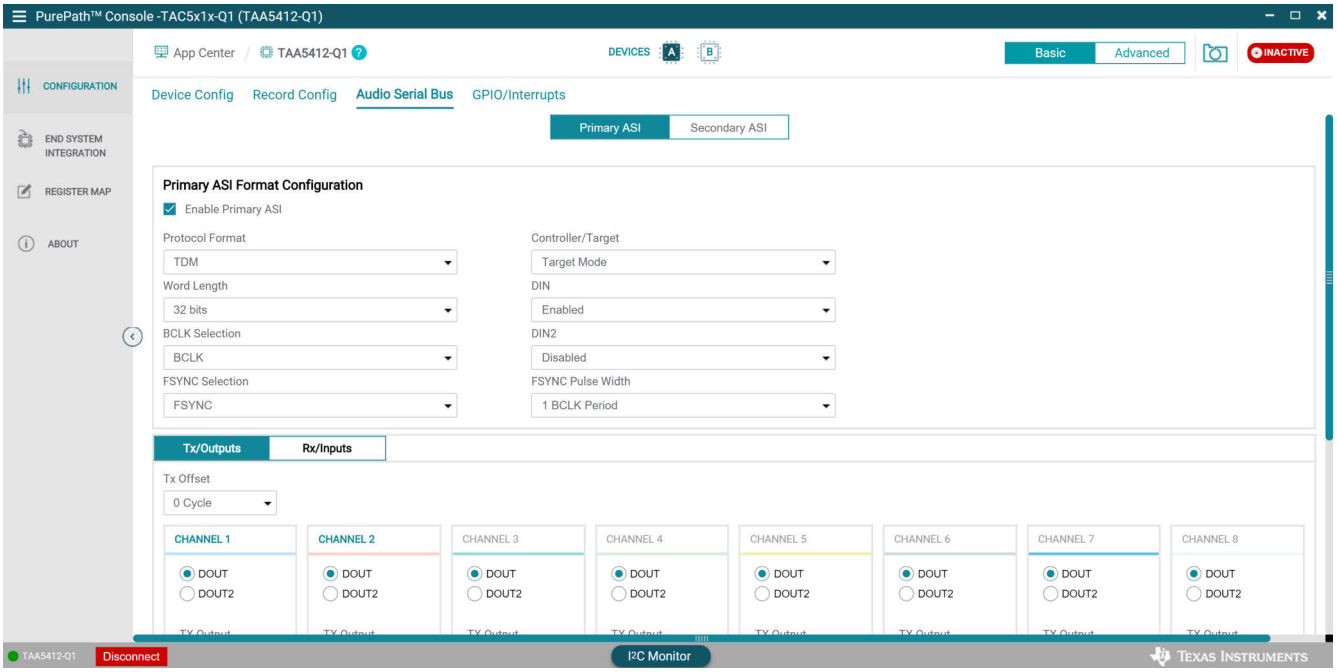


Figure 3-14. Primary Audio Serial Bus Page 1

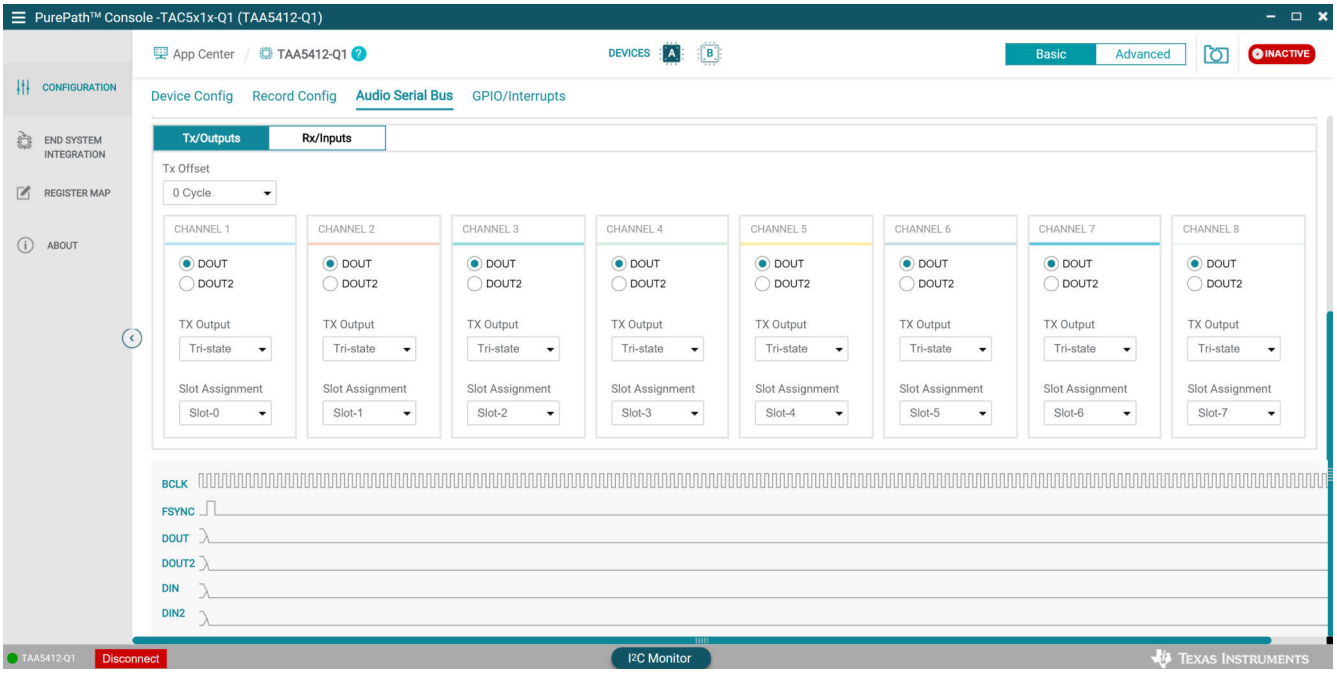


Figure 3-15. Primary Audio Serial Bus TX - Page 2

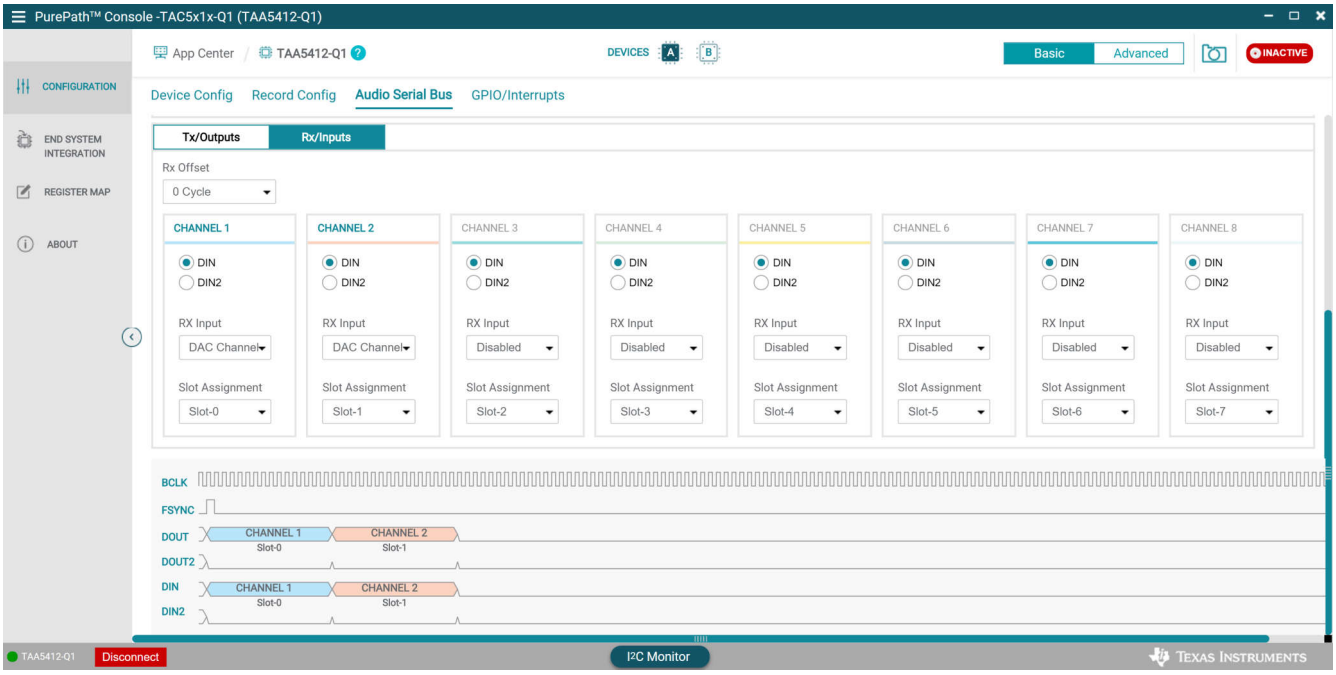


Figure 3-16. Primary Audio Serial Bus RX - Page 3

3.3.2.4.2 Configuring Secondary Audio Serial Bus

A similar audio serial bus setting to the Primary interface is available under the Secondary ASI tab when a second audio serial bus is needed.

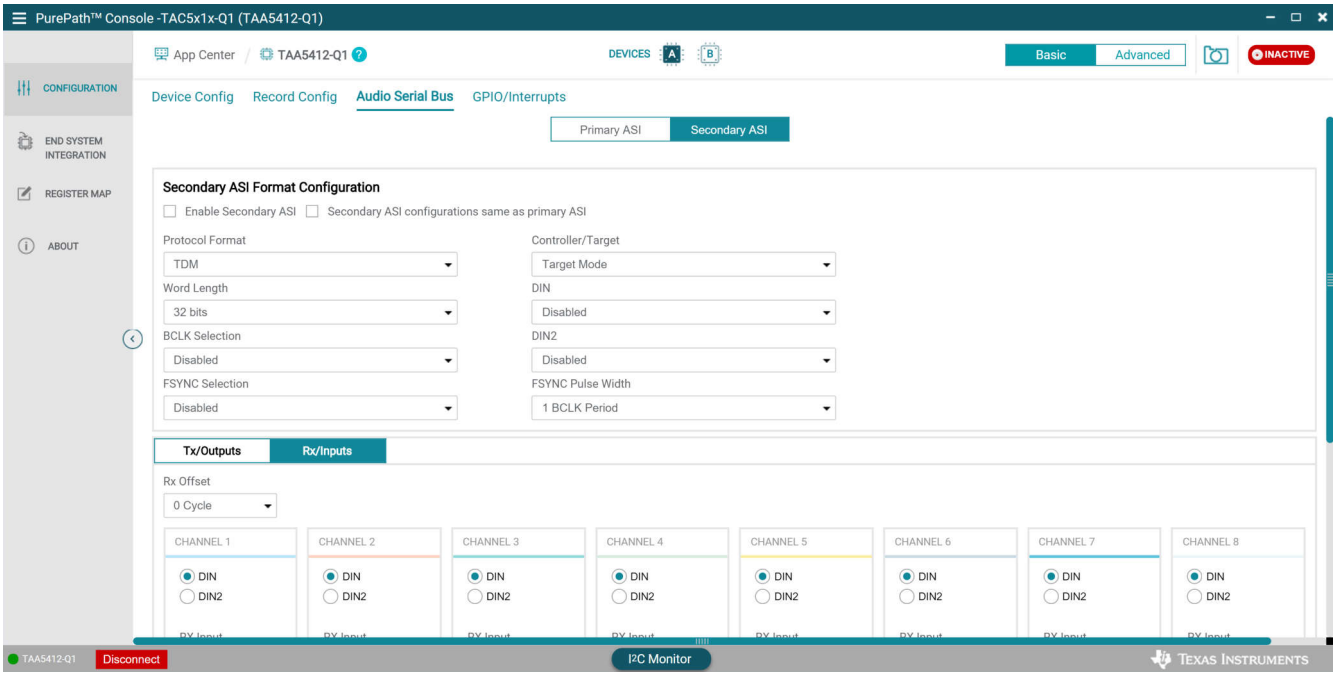


Figure 3-17. Secondary Audio Serial Bus Page 1

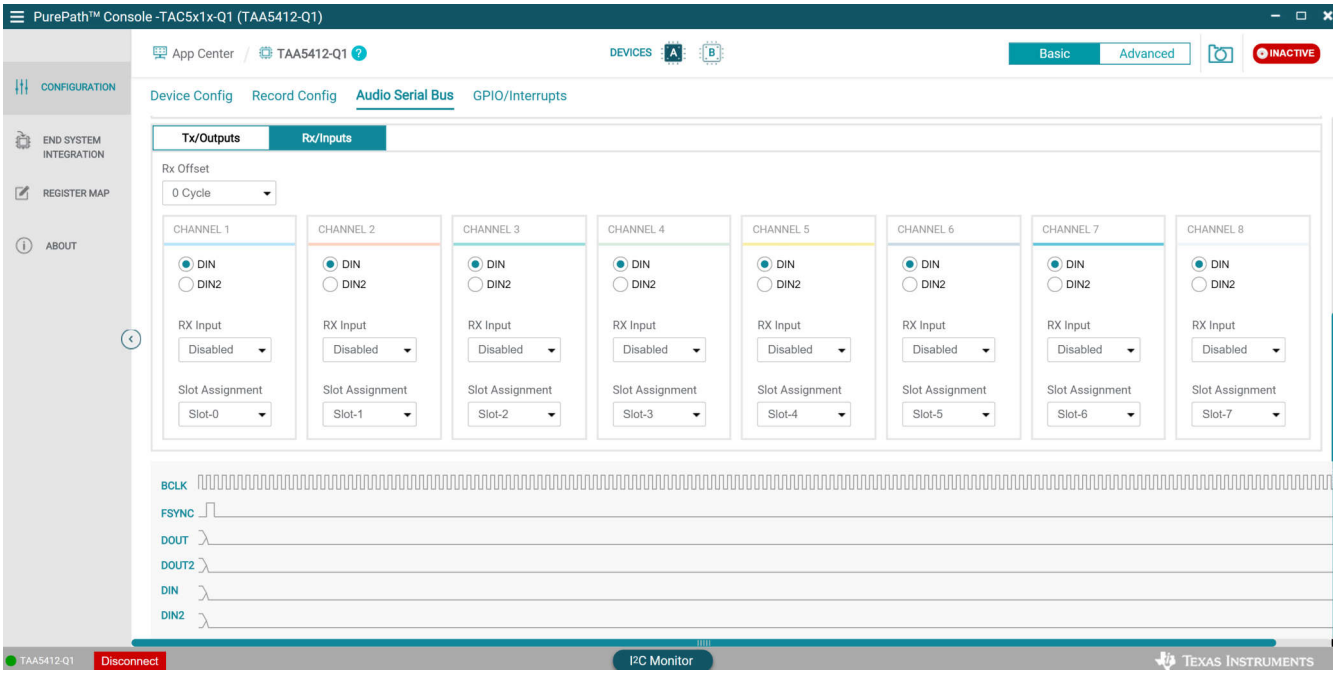


Figure 3-18. Secondary Audio Serial Bus TX - Page 2

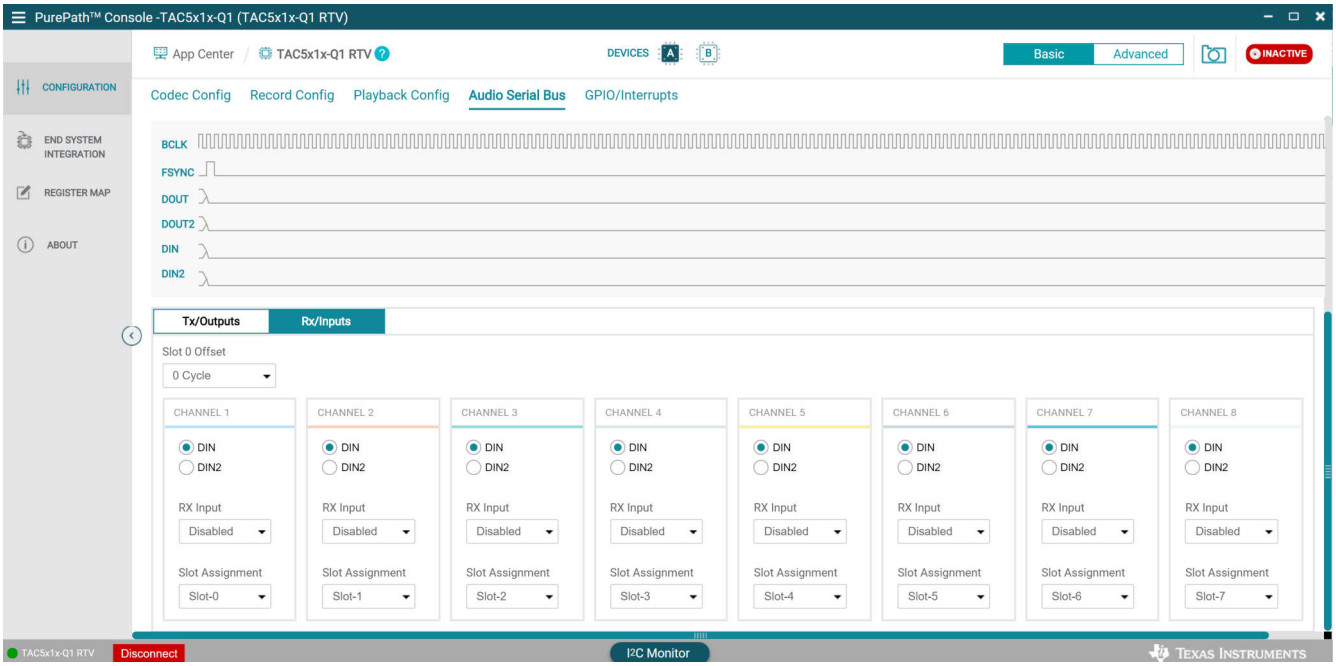


Figure 3-19. Secondary Audio Serial Bus RX - Page 3

3.3.2.4.3 Example Configuring I2S Interface

The TAx5x1x-Q1 features a highly flexible audio serial bus that can be configured to implement a wide range of data formats. The default format is TDM, however the GUI can be used to change the data format to I2S/LJ. This section shows a configuration example for a 2-channel I2S output to a USB audio at 16 bits and 48 kHz.

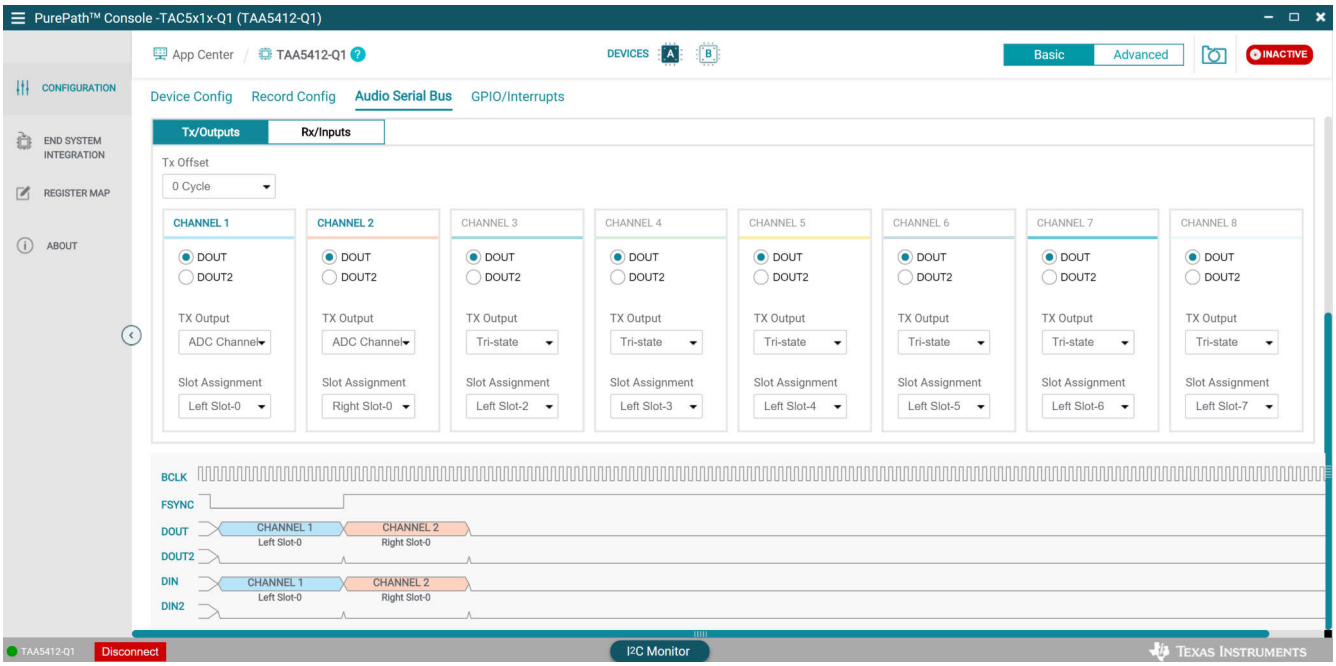


Figure 3-20. Configuring I2S Example

3.3.2.5 GPIO/Interrupts Tab

As shown in the figure below, the GPIO function and interrupt behavior can be configured in this tab. There is 1 General Purpose Input Output (GPIO1) in the TAx5x1x-Q1 devices. These general purpose input/output drivers also provide several multiplexing functions, and the selection can also be configured in this tab..

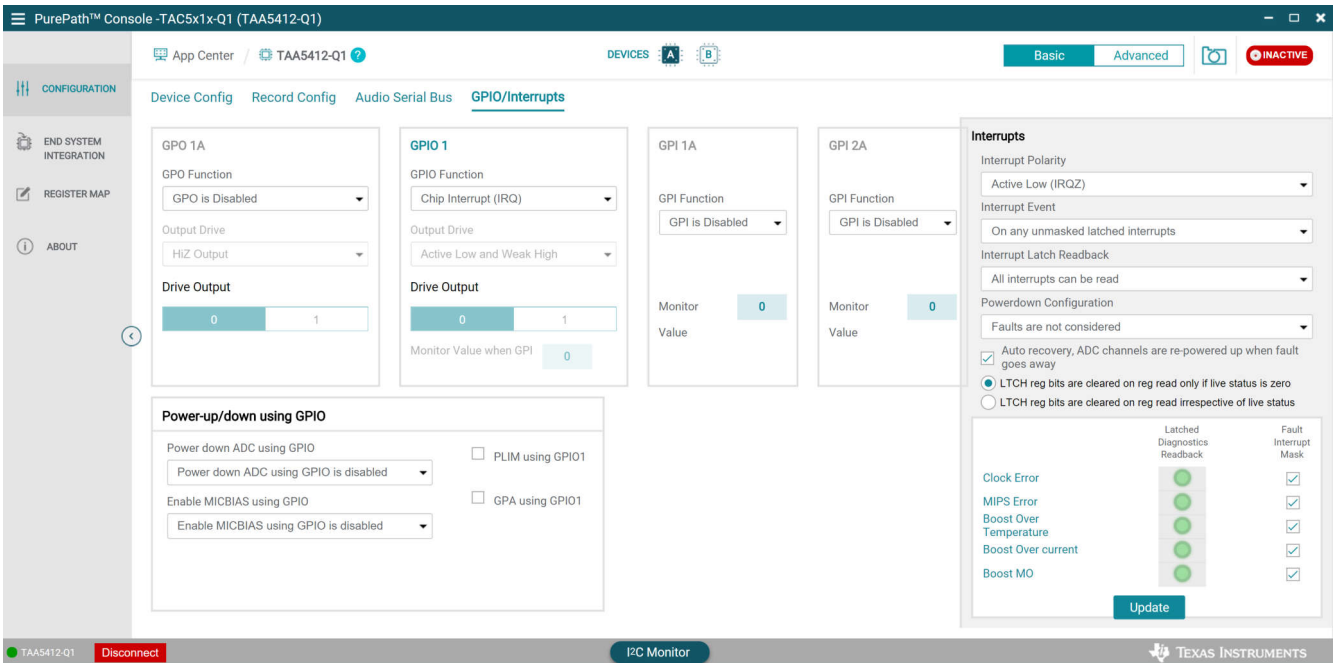


Figure 3-21. GPIO/Interrupts Tab

3.3.2.6 Advanced Tabs

The following tabs are available in the Advanced feature. Click the Advance tab and a selection of other features are displayed, select the feature to bring up the panel. Some of these features are not available in some device variants.

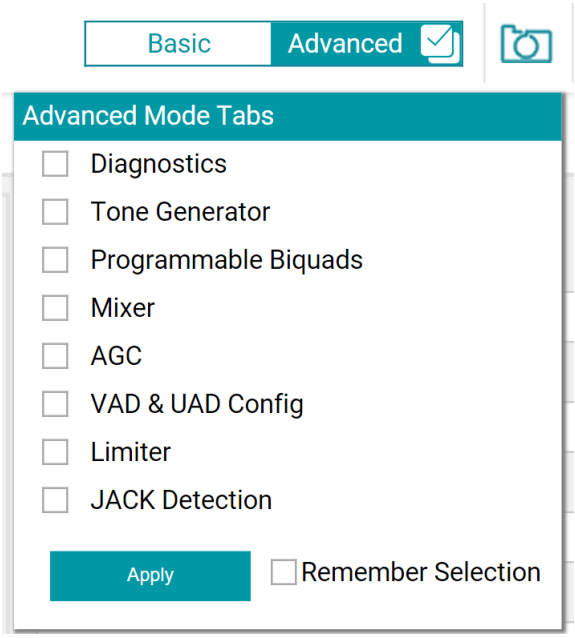


Figure 3-22. Advanced Feature

3.3.2.6.1 Diagnostic Tab

The diagnostics tab allows for the configuration and monitoring of the integrated diagnostics features of the TAx5x1x-Q1 devices. The latched fault status window also includes controls for mask interrupt. When a mask is enabled any masked faults are displayed, however these masks do not trigger an interrupt.

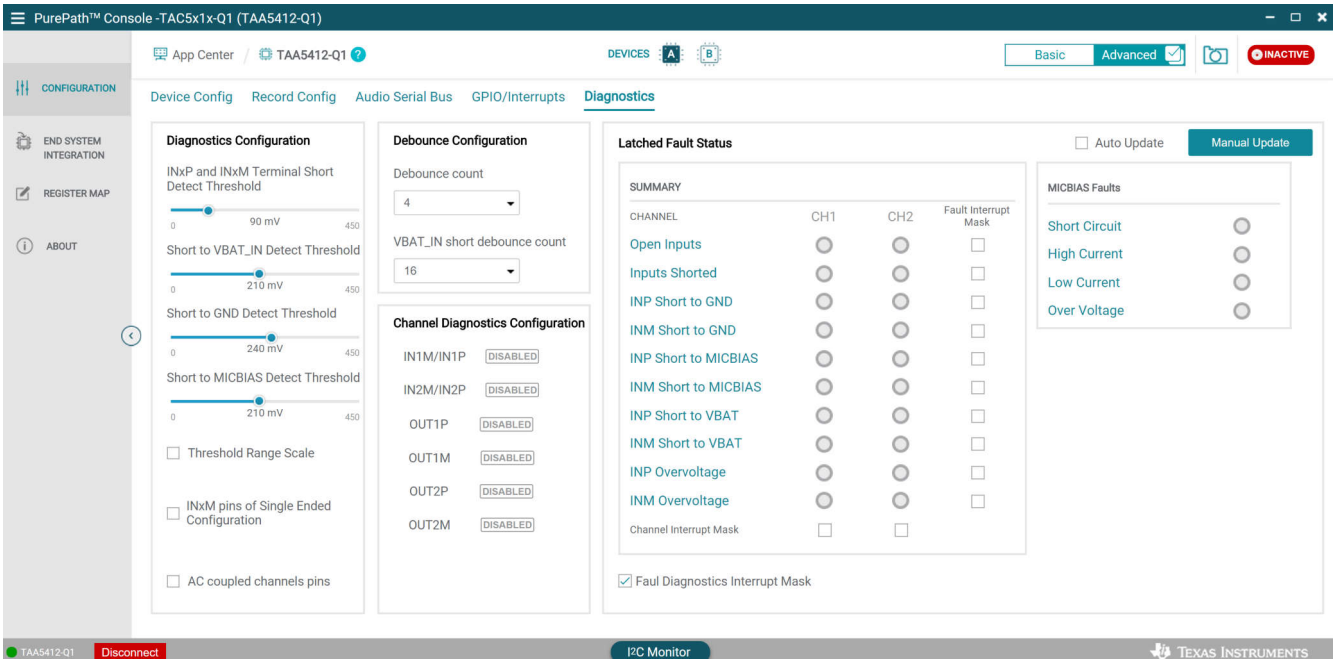


Figure 3-23. Diagnostic Tab

3.3.2.6.2 Programmable Biquads Tab

Configuration of the biquad filters is made easy with the GUI in the programmable biquads tab. Biquad coefficients can be generated using the filter designers within PPC3, or coefficients from an external filter design tool can be manually entered. Each biquad can be configured individually and then the gain and phase responses can be shown for individual channels or for all channels. Note PPC3 uses the detected sampling rate from the audio serial bus tab to determine the biquad coefficients. The TAx5x1x-Q1 device must be receiving the desired sampling rate when the audio serial bus tab is opened, and the clock monitor must be updated by clicking on the Read button. If no EVM is connected, PPC3 assumes an fS of 48 kHz for all biquad calculations.

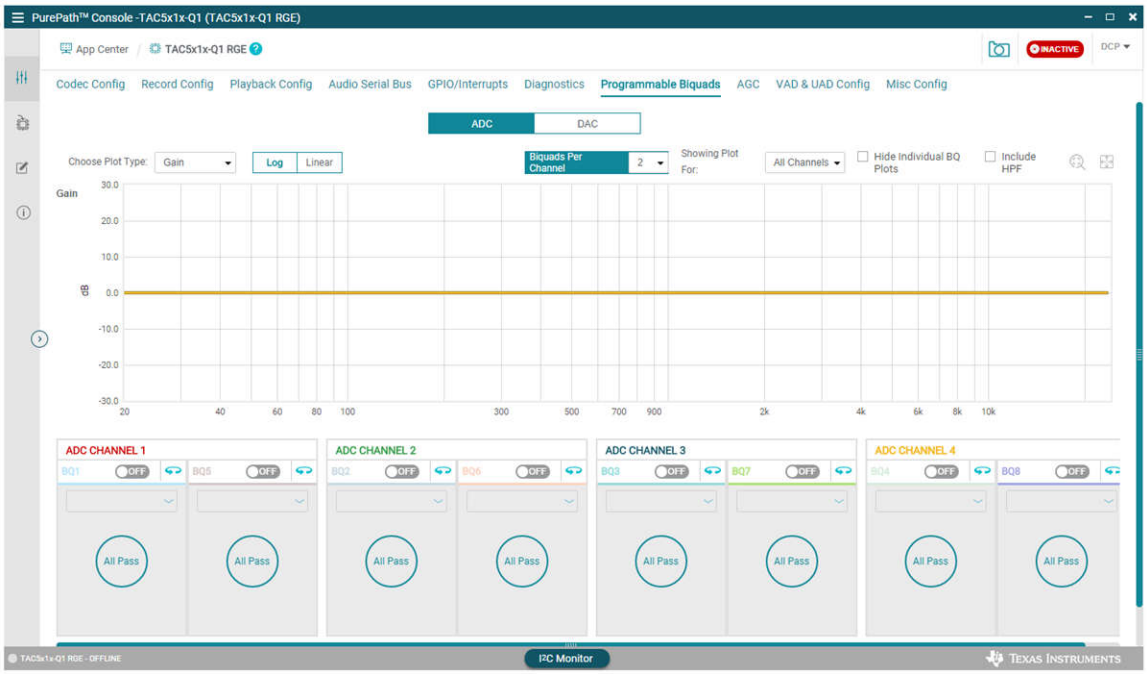


Figure 3-24. Programmable ADC Biquads Tab

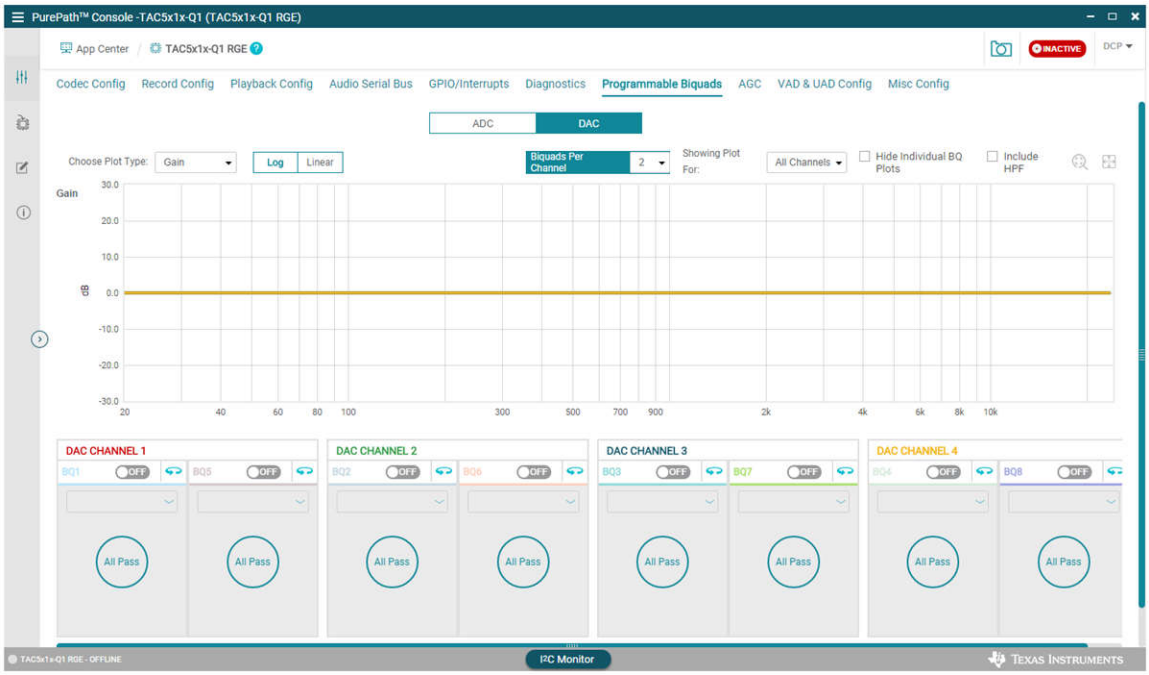


Figure 3-25. Programmable DAC Biquads Tab

3.3.2.6.3 Automatic Gain Control (AGC) Tab

The AGC parameters are global and can be configured in the AGC tab. Each channel must have the AGC enabled in the audio config tab for the AGC configuration to become active. These software controls are grayed out and inactive while the device is in active mode.

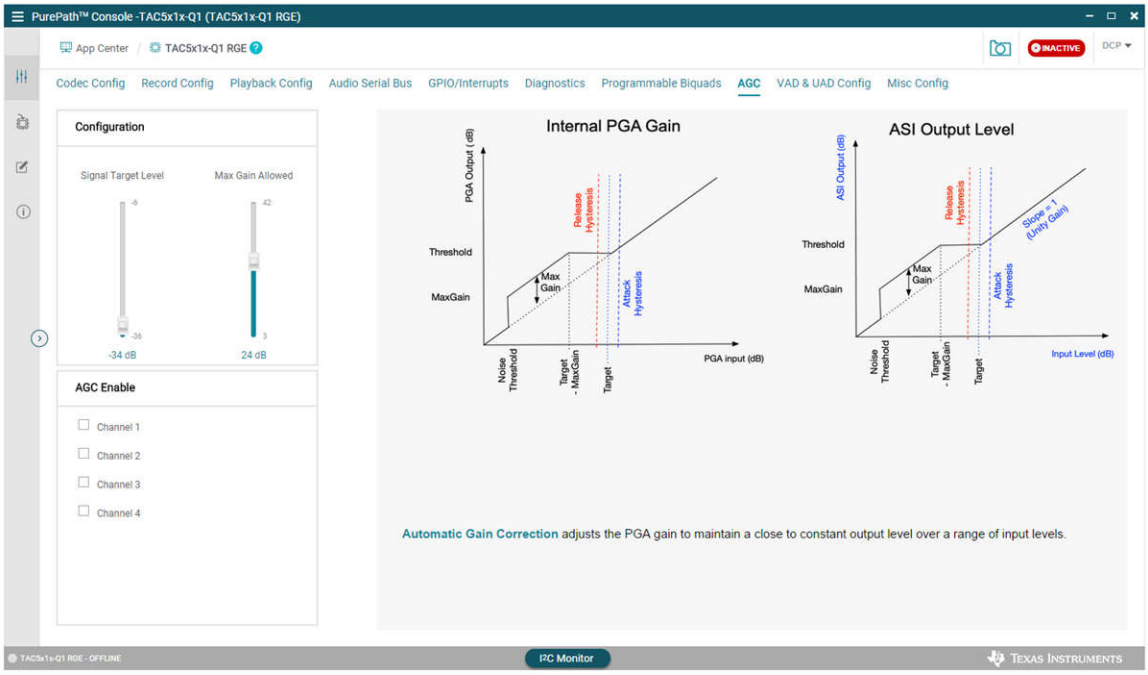


Figure 3-26. Automatic Gain Control (AGC) Tab

3.3.2.6.4 Voice/Ultrasonic Auto Detection (VAD/UAD) Tab

The TAx5x1x-Q1 devices support Voice Detection and Ultrasonic Detection; settings are available in this tab.

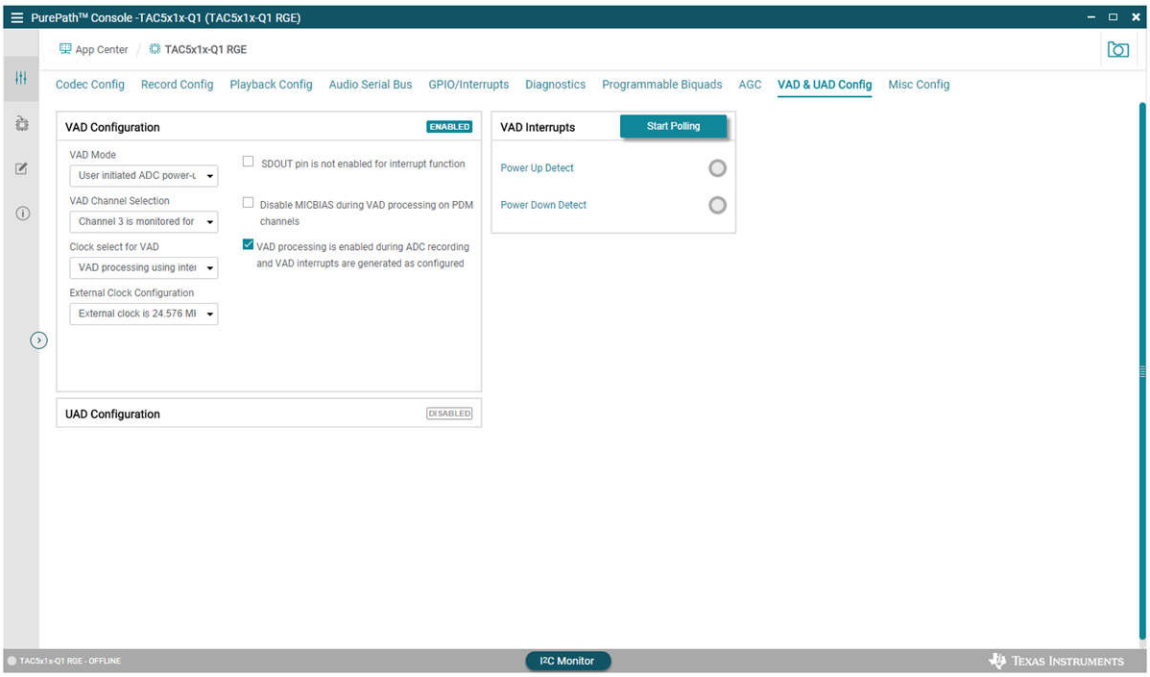


Figure 3-27. Voice/Ultrasonic Auto Detection

3.3.2.6.5 Mixer Tab

The TAx5x1x-Q1 devices support several mixing feature; settings are available in this tab.

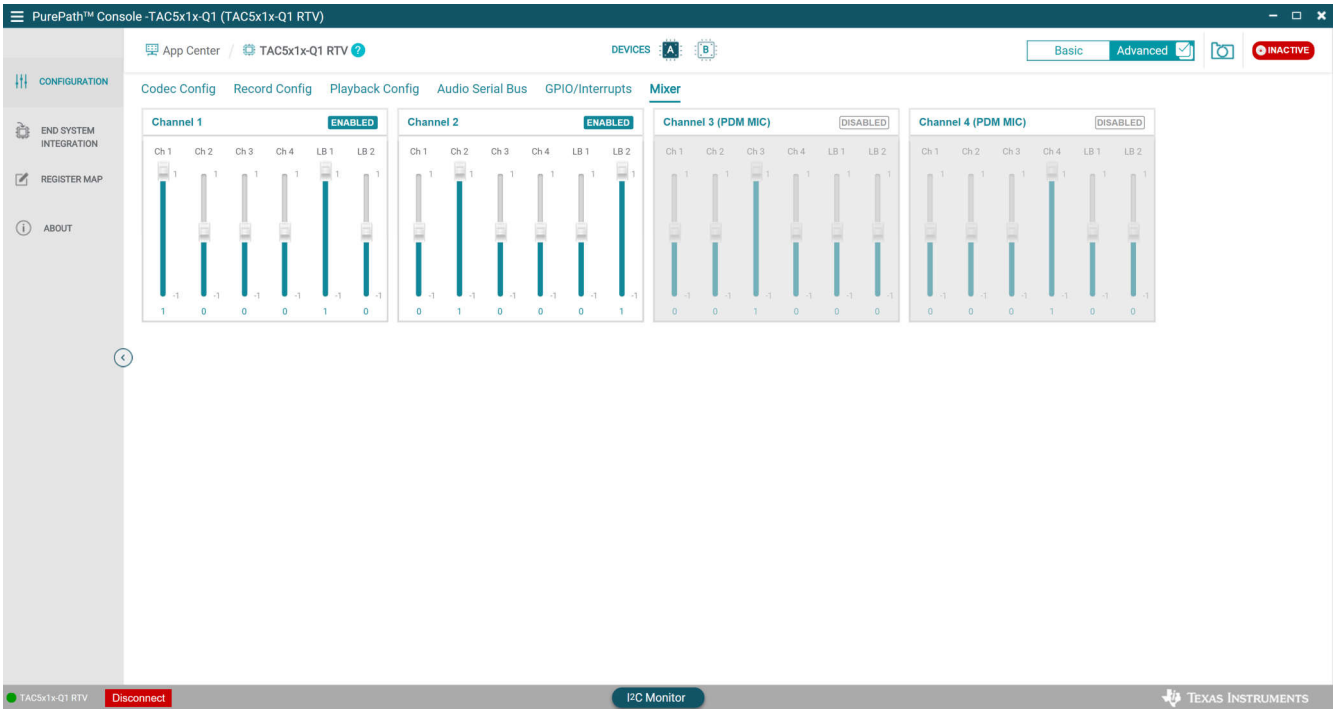


Figure 3-28. Mixer Tab

3.3.2.6.6 Tone Generation Tab

The TAx5x1x-Q1 devices support beep and chirp generation; settings are available in this tab.

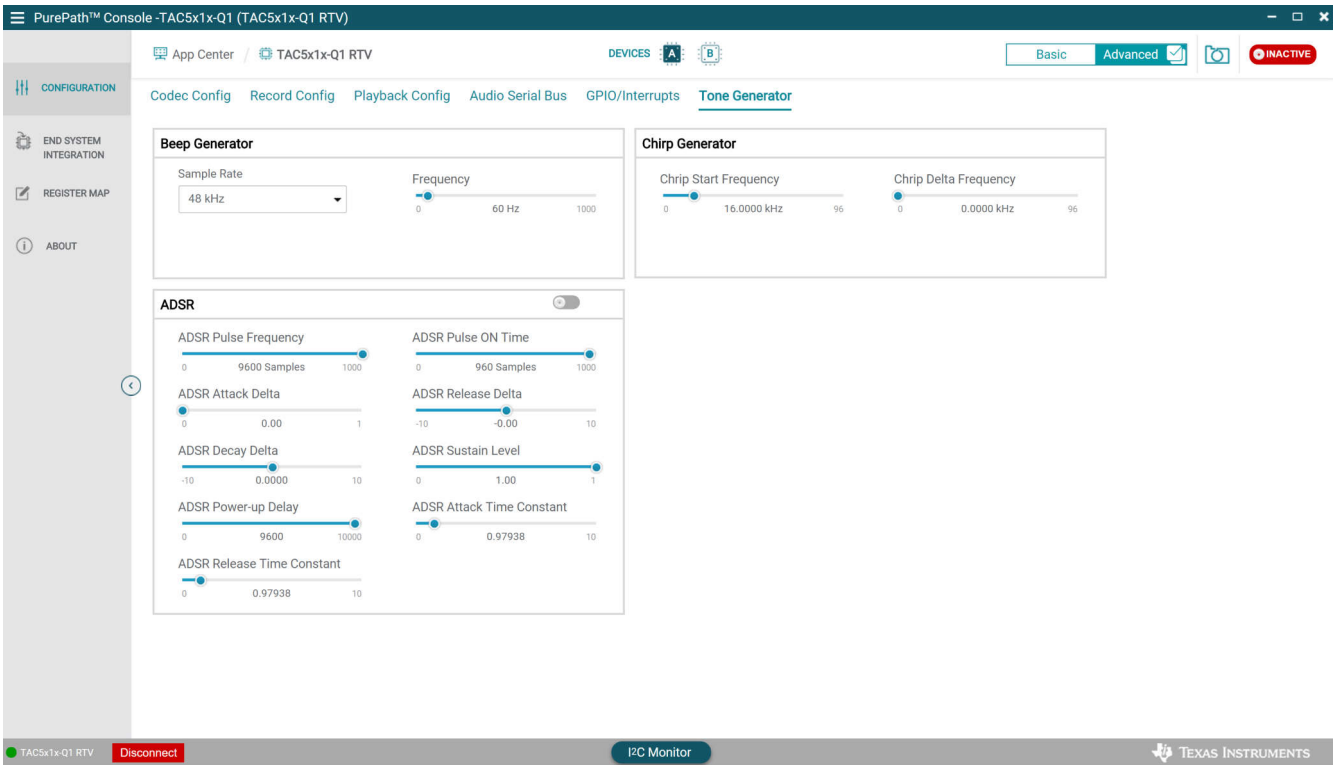


Figure 3-29. Tone Generation

3.3.2.6.7 Limiter Tab

Various device's limiter like brown out, temperature are available in this tab.

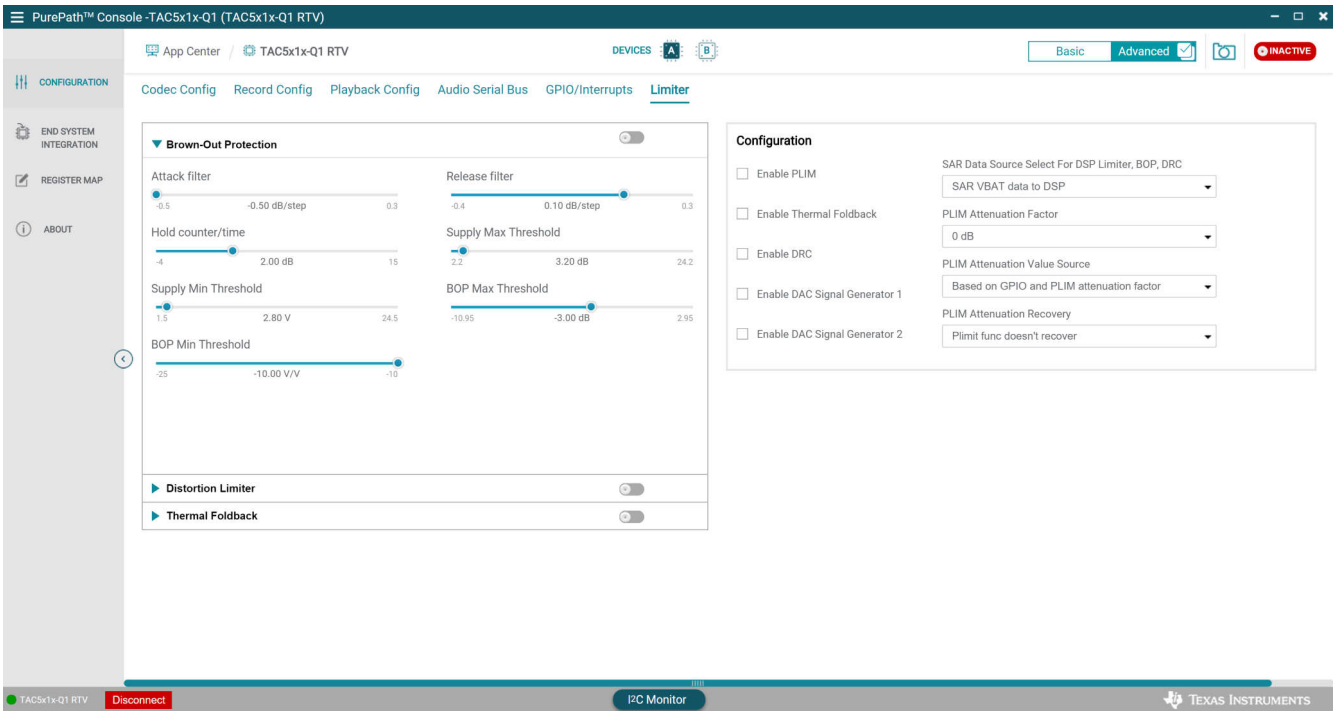


Figure 3-30. Limiter Tab

3.3.2.7 End System Integration View

The End System Integration view provides methods for exporting the current configuration to a header (.h) or .cfg file. The header file can be used for quick integration with a simple microcontroller.

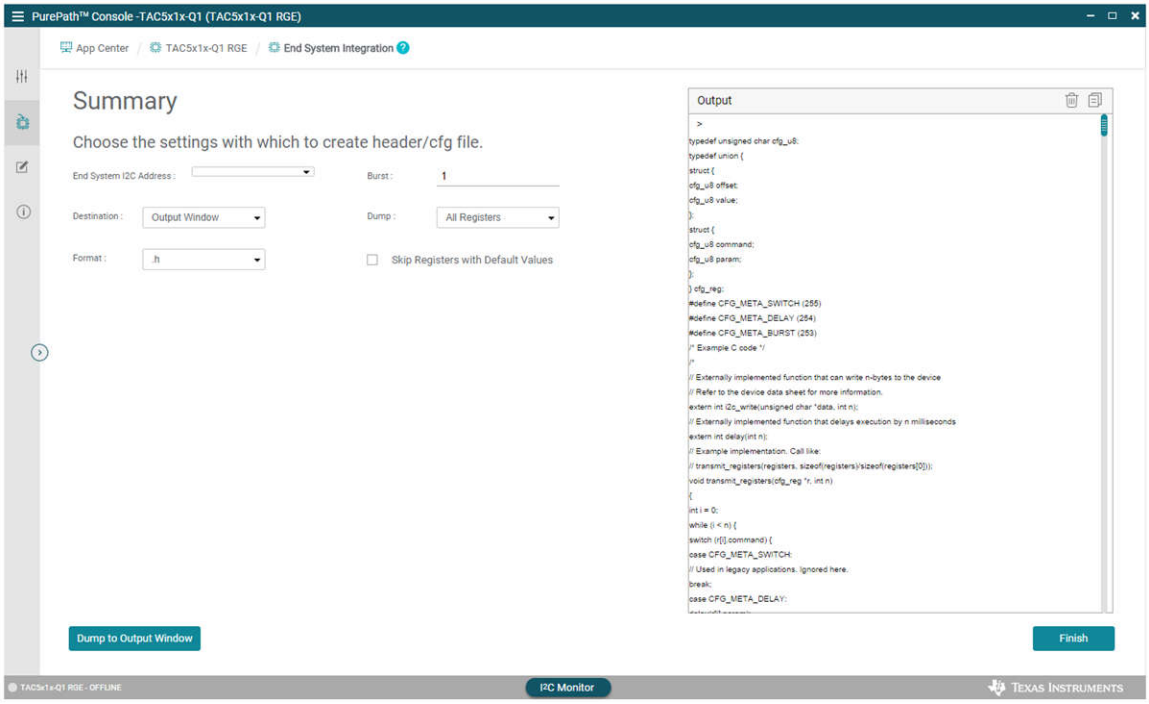


Figure 3-31. End System Configuration

3.3.2.8 Register Map View

The register map view provides a view of page 0, page 1 and page 3 of the register map.

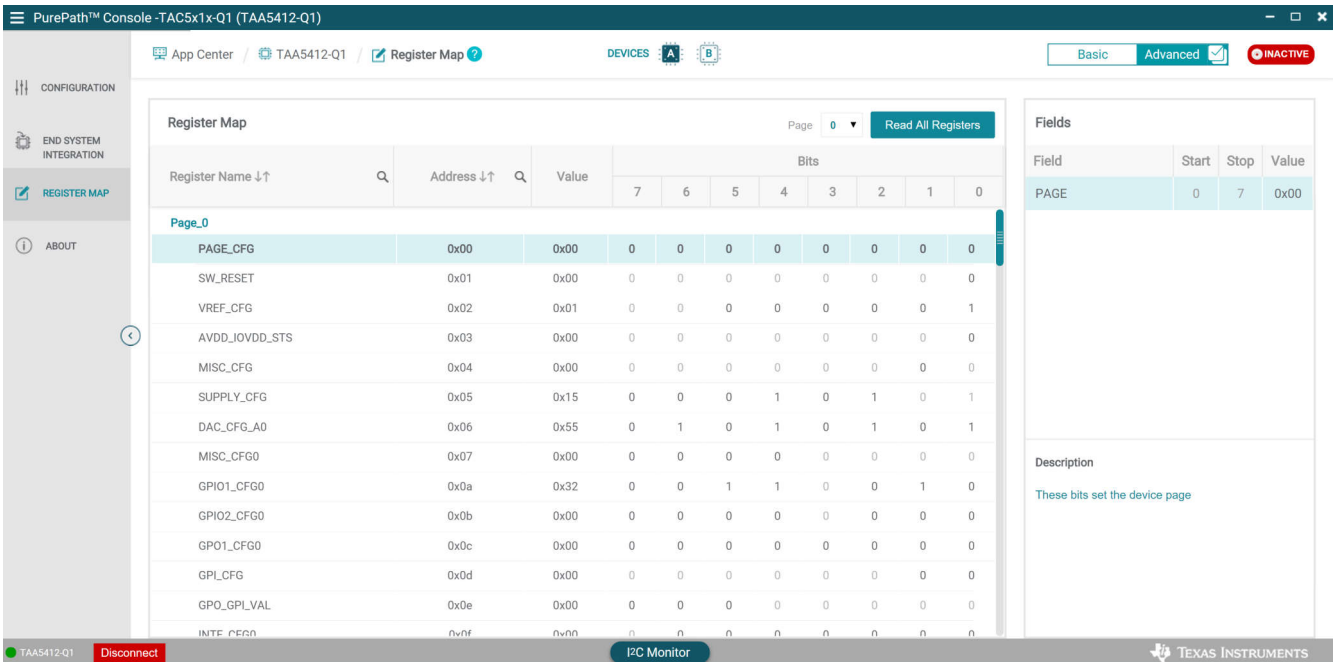


Figure 3-32. Register Map View

3.3.2.9 I2C Monitor View

The I2C Monitor tab allows user to load existing device configuration file or direct I2C transaction to configure the device registers. To access this window panel, click on the I2C Monitor button at the bottom of the GUI and the I2C monitor window opens as shown in the figure below. Click on the I/O button to access input/output panel.

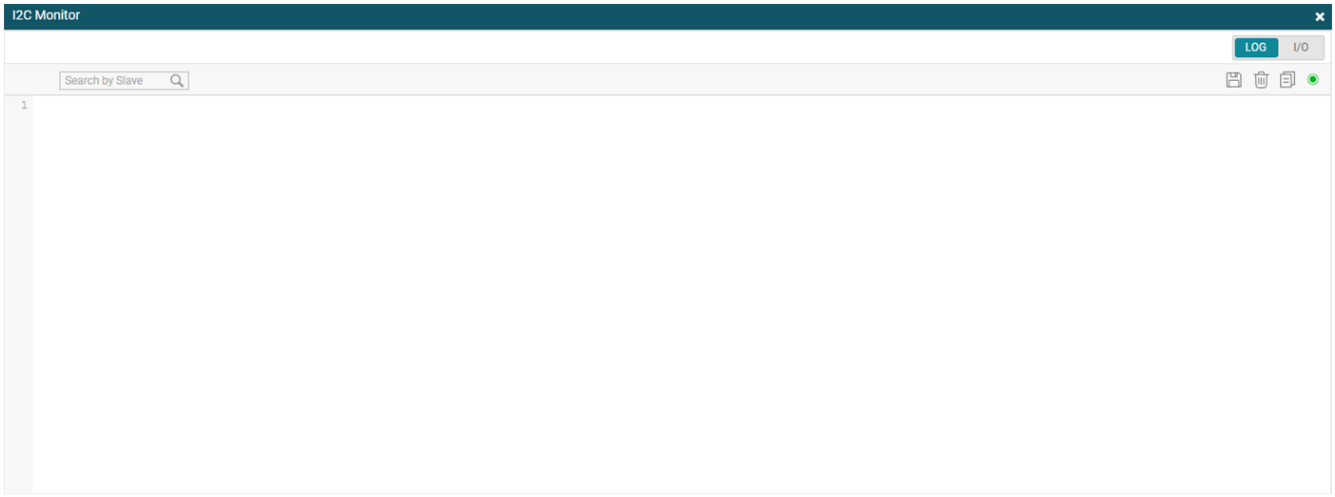


Figure 3-33. I2C Monitor Window

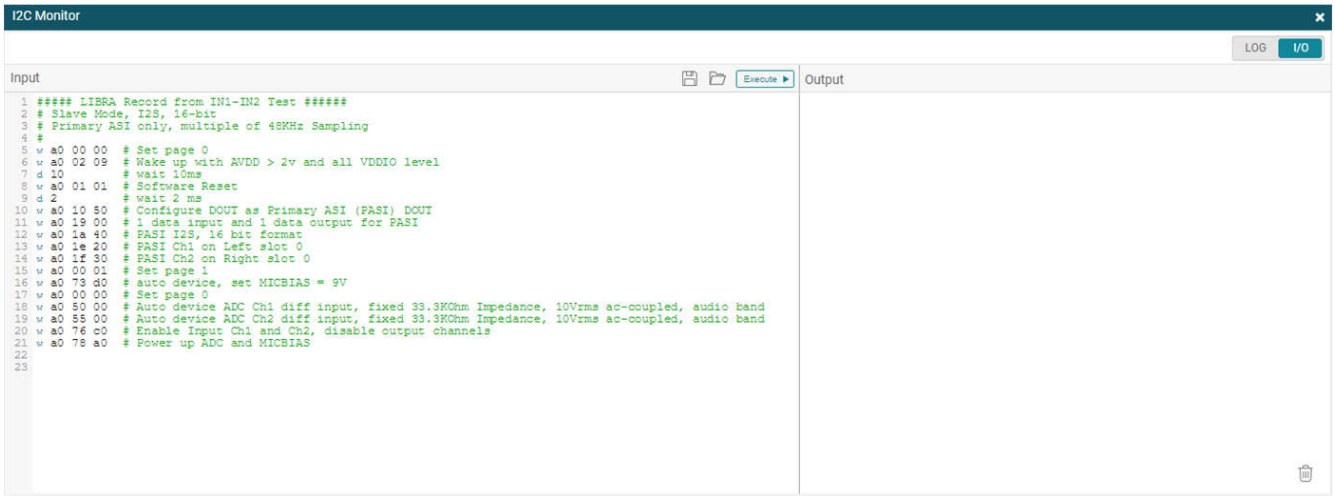


Figure 3-34. I2C Monitor I/O Window

3.4 Configuration Examples

The following are several examples to configure the device into the respective paths. The user can copy the settings below and paste into the I2C Monitor window.

- Target mode differential AC-couple recording with PASI.

This configuration is for differential audio recording (ADC) with a 48 kHz sampling rate, TDM format, and 32-bit depth.

```
##### Record AC-Couple Differential IN1-IN2 path ######
# Target Mode, TDM, 32 bit
# Primary ASI only, multiple of 48 kHz Sampling

w a0 00 00        # Set page 0
w a0 01 01        # Software Reset
w a0 02 09        # Wake up with AVDD > 2v and all VDDIO level
w a0 10 50        # Configure DOUT as Primary ASI (PASI) DOUT
w a0 19 00        # 1 data input and 1 data output for PASI
w a0 1a 30        # PASI TDM, 32-bit format
w a0 1e 20        # PASI Ch1 on slot 0
w a0 1f 21        # PASI Ch2 on slot 1
w a0 00 01        # Set page 1
w a0 73 D0        # auto device, set MICBIAS = 9V
w a0 00 00        # Set page 0
w a0 50 00        # Auto device ADC Ch1 diff input, fixed 33.3KOhm, 10Vrms ac-coupled, audio band
w a0 55 00        # Auto device ADC Ch2 diff input, fixed 33.3KOhm, 10Vrms ac-coupled, audio band
w a0 76 c0        # Enable Input Ch1 and Ch2, disable output channels
w a0 78 a0        # Power up ADC and MICBIAS
```

- Target mode single-ended AC-couple recording with PASI.

This configuration is for single-ended audio recording (ADC) with a 48 kHz sampling rate, I2S format, and 32-bit depth.

```
##### Record AC-Couple Single-Ended IN1-IN2 path ######
# Target Mode, I2S, 32 bit
# Primary ASI only, multiple of 48KHz Sampling

w a0 00 00        # Set page 0
w a0 01 01        # Software Reset
w a0 02 09        # Wake up with AVDD > 2v and all VDDIO level
w a0 10 50        # Configure DOUT as Primary ASI (PASI) DOUT
w a0 19 00        # 1 data input and 1 data output for PASI
w a0 1a 70        # PASI I2S, 32-bit format
w a0 1e 20        # PASI Ch1 on Left slot 0
w a0 1f 30        # PASI Ch2 on Right slot 0
w a0 00 01        # Set page 1
w a0 73 d0        # auto device, set MICBIAS = 9V
w a0 00 00        # Set page 0
w a0 50 40        # Auto device ADC Ch1 SE input, fixed 33.3KOhm, ac-coupled, audio band
w a0 55 40        # Auto device ADC Ch2 SE input, fixed 33.3KOhm, ac-coupled, audio band
w a0 76 c0        # Enable Input Ch1 and Ch2, disable output channels
w a0 78 a0        # Power up ADC and MICBIAS
```

- Controller mode differential AC-couple recording with PASI.

This configuration is for differential audio recording (ADC) with 48 kHz sampling rate, I2S format and 32-bit depth, and MCLK of 12.288 MHz.

```
##### Record AC-Couple Differential IN1-IN2 path ######
# Controller Mode, I2S, 32-bit, GPIO1 = CCLK from BCLK2 @ 12.288 MHz
# Primary ASI only, multiple of 48 kHz Sampling

w a0 00 00        # Set page 0
w a0 01 01        # Software Reset
w a0 02 09        # Wake up with AVDD > 2v and all VDDIO level
w a0 0a 10        # configure GPIO1 as input
w a0 0f 20        # Set GPIO1=CCLK
w a0 10 50        # Configure DOUT as Primary ASI (PASI) DOUT
w a0 19 00        # 1 data input and 1 data output for PASI
w a0 1a 70        # PASI I2S, 32-bit format
w a0 1e 20        # PASI Ch1 on Left slot 0
w a0 1f 30        # PASI Ch2 on Right slot 0
w a0 32 50        # PASI Fs=48KHz with auto clock configuration
w a0 34 48        # PLL always enabled with fractional allowed and from fixed clk frequency
w a0 37 30        # Use MCLK=12.288 MHz, PASI in controller mode
w a0 38 80        # Use internal BCLK for FSYNC generation in controller mode
w a0 39 40        # Set controller mode BCLK/FSYNC ratio to 64 = h40
w a0 00 01        # Set page 1
w a0 73 d0        # auto device, set MICBIAS = 9V
w a0 00 00        # Set page 0
w a0 50 00        # Auto device ADC Ch1 diff input, fixed 33.3KOhm, 10Vrms ac-coupled, audio band
w a0 55 00        # Auto device ADC Ch2 diff input, fixed 33.3KOhm, 10Vrms ac-coupled, audio band
w a0 76 c0        # Enable Input Ch1 and Ch2, disable output channels
w a0 78 a0        # Power up ADC and MICBIAS
```

- Target mode differential DC-couple recording with PASI.

This configuration is for differential audio recording (ADC) with a 48 kHz sampling rate, I2S format, and 32-bit depth.

```
##### Record DC-Couple IN1-IN2 path ######
# Target Mode, I2S, 32 bit
# Primary ASI only, multiple of 48 kHz Sampling
#
w a0 00 00    # Set page 0
w a0 01 01    # Software Reset
w a0 02 09    # Wake up with AVDD > 2v and all VDDIO level
w a0 10 50    # Configure DOUT as Primary ASI (PASI) DOUT
w a0 19 00    # 1 data input and 1 data output for PASI
w a0 1a 70    # PASI I2S, 32-bit format
w a0 1e 20    # PASI Ch1 on Left slot 0
w a0 1f 30    # PASI Ch2 on Right slot 0
w a0 00 01    # Set page 1
w a0 73 d0    # auto device, set MICBIAS = 9V
w a0 00 00    # Set page 0
w a0 50 04    # Auto device ADC Ch1 DIFF input, fixed 33.3KOhm, ac/dc-coupled, audio band
w a0 55 04    # Auto device ADC Ch2 DIFF input, fixed 33.3KOhm, ac/dc-coupled, audio band
w a0 76 c0    # Enable Input Ch1 and Ch2, disable output channels
w a0 78 a0    # Power up ADC and MICBIAS
```

- Target mode playback to differential LINEOUT with PASI.

This configuration is for differential audio playback (DAC) with a 48 kHz sampling rate, TDM format, and 32-bit depth.

```
##### Playback Differential LINEOUT Path ######
# Target Mode, TDM, 32 bit
# Primary ASI only, multiple of 48 kHz Sampling
#
w a0 00 00    # Set page 0
w a0 01 01    # Software Reset
w a0 02 09    # Wake up with AVDD > 2v and all VDDIO level
w a0 11 80    # Enable PASI DIN
w a0 19 00    # 1 data inputs and 1 data outputs for PASI
w a0 1a 30    # PASI TDM, 32-bit format
w a0 28 20    # PASI DIN Ch1 on TDM slot 0
w a0 29 21    # PASI DIN Ch2 on TDM slot 1
w a0 64 20    # Configure OUT1P/M as differential from DAC1
w a0 65 20    # Configure OUT1P LINEOUT 0dB audio band
w a0 66 20    # Configure OUT1M LINEOUT 0dB 2Vrms Differential
w a0 6b 20    # Configure OUT2P/M as differential from DAC2
w a0 6c 20    # Configure OUT2P LINEOUT 0dB audio band
w a0 6d 20    # Configure OUT2M LINEOUT 0dB 2Vrms Differential
w a0 76 0c    # Disable all input channels and enable output channel 1 and 2
w a0 78 40    # Power up all DAC channel
```

- Target mode playback to single-ended LINEOUT with PASI.

This configuration is for single-ended mono audio playback (DAC) with a 48 kHz sampling rate, TDM format, and 32-bit depth.

```
##### Playback Single-Ended Mono LINEOUT Path ######
# Target Mode, TDM, 32 bit
# Primary ASI only, multiple of 48 kHz Sampling
#
w a0 00 00    # Set page 0
w a0 01 01    # Software Reset
w a0 02 09    # Wake up with AVDD > 2v and all VDDIO level
w a0 11 80    # Enable PASI DIN
w a0 19 00    # 1 data inputs and 1 data outputs for PASI
w a0 1a 30    # PASI TDM, 32-bit format
w a0 28 20    # PASI DIN Ch1 on TDM slot 0
w a0 29 21    # PASI DIN Ch2 on TDM slot 1
w a0 64 28    # Configure OUT1P as mono single-ended from DAC1
w a0 65 20    # Configure OUT1P LINEOUT 0dB audio band
w a0 66 20    # Configure 2Vrms Differential
w a0 6b 28    # Configure OUT2P as mono single-ended from DAC2
w a0 6c 20    # Configure OUT2P LINEOUT 0dB audio band
w a0 6d 20    # Configure 2Vrms Differential
w a0 76 0c    # Disable all input channels and enable output channel 1 and 2
w a0 78 40    # Power up all DAC channel
```

- Target mode playback to differential headphones with PASI.

This configuration is for differential audio playback (DAC) with a 48 kHz sampling rate, I2S format, and 32-bit depth.

```
##### Playback Differential Headphone Path ######
# Target Mode, I2S, 32-bit
# Primary ASI only, multiple of 48 kHz Sampling
# Playback through Stereo OUT1P and OUT2P for Headphone
#
w a0 00 00    # Set page 0
w a0 01 01    # Software Reset
w a0 02 09    # Wake up with AVDD > 2v and all VDDIO level
w a0 11 80    # Enable PASI DIN
w a0 19 00    # 1 data input and 1 data output for PASI
w a0 1a 70    # PASI I2S, 32 bit format
w a0 28 20    # PASI DIN Ch1 on Left slot 0
w a0 29 30    # PASI DIN Ch2 on Right slot 0
w a0 64 20    # Configure OUT1P/M as differential from DAC1
w a0 65 60    # Configure OUT1P as Headphone 0dB audio band
w a0 66 60    # Configure OUT1M as Headphone 0dB audio band
w a0 6b 20    # Configure OUT2P/M as differential from DAC2
w a0 6c 60    # Configure OUT2P as Headphone 0dB audio band
w a0 6d 60    # Configure OUT2M as Headphone 0dB audio band
w a0 76 0c    # Enable output channel 1 and 2 and disable all input channels
w a0 78 40    # Power up DAC channel
```

- Target mode playback to mono single-ended headphones with PASI

This configuration is for mono single-ended audio playback (DAC) with a 48 kHz sampling rate, I2S format, and 32-bit depth.

```
##### Playback Single-Ended Headphone Path ######
# Target Mode, I2S, 32 bit
# Primary ASI only, multiple of 48 kHz Sampling
# Playback through mono OUT1P and OUT2P for Headphone
#
w a0 00 00    # Set page 0
w a0 01 01    # Software Reset
w a0 02 09    # Wake up with AVDD > 2v and all VDDIO level
w a0 11 80    # Enable PASI DIN
w a0 19 00    # 1 data input and 1 data output for PASI
w a0 1a 70    # PASI I2S, 32-bit format
w a0 28 20    # PASI DIN Ch1 on Left slot 0
w a0 29 30    # PASI DIN Ch2 on Right slot 0
w a0 64 28    # Configure OUT1P as mono single-ended from DAC1
w a0 65 60    # Configure OUT1P as Headphone 0dB audio band
w a0 66 60    # Configure 2Vrms Differential
w a0 6b 28    # Configure OUT2P as mono single-ended from DAC2
w a0 6c 60    # Configure OUT2P as Headphone 0dB audio band
w a0 6d 60    # Configure 2Vrms Differential
w a0 76 0c    # Enable output channel 1 and 2 and disable all input channels
w a0 78 40    # Power up DAC channel
```

- Diagnostic setting

This configuration enables input diagnostic testing; users read the fault detection status from B0_P1_R54 for Ch 1 and B0_P1_R55 for Ch 2.

```
##### Diagnostic Setting ######
#
w a0 00 00    # Set page 0
w a0 01 01    # Software Reset
w a0 02 09    # Wake up with AVDD > 2v and all VDDIO level
w a0 50 08    # Device set to DC mode
w a0 00 01    # Set page 1
w a0 73 d0    # Set MICBIAS = 9 V
w a0 46 80    # Enable IN1P and IN1M Scan for diagnostic
w a0 47 00    # Input terminal short and VBAT_In short threshold 0mV
w a0 48 12    # short to GND and to MICBIAS threshold 60mV
w a0 4a b0    # 16 counts for debounce to filter out false fault detection
w a0 4b 40    # Enable moving average with 0.5 weightage
w a0 00 00    # Set page 0
w a0 76 c0    # Enable ADC channel 1 and channel 2
w a0 78 a0    # Power up ADC and MICBIAS
```

3.5 System Overview

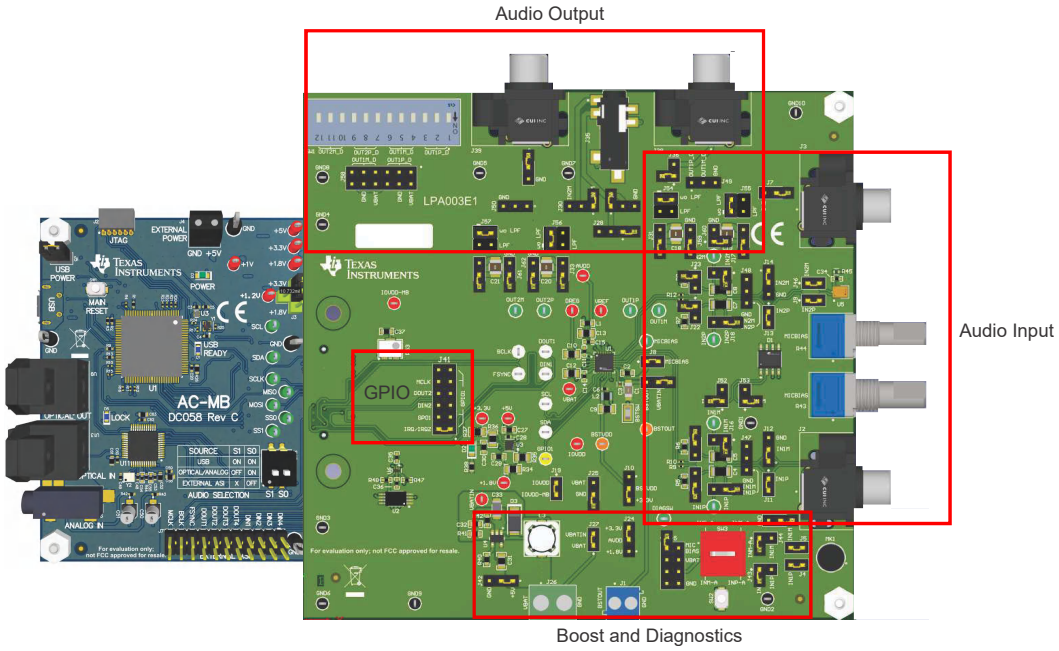


Figure 3-35. System Overview

4 Hardware Design Files

This section provides the schematics, layout example and bill of materials (BOM) for each TAx541x-Q1 EVM variant.

4.1 Schematics

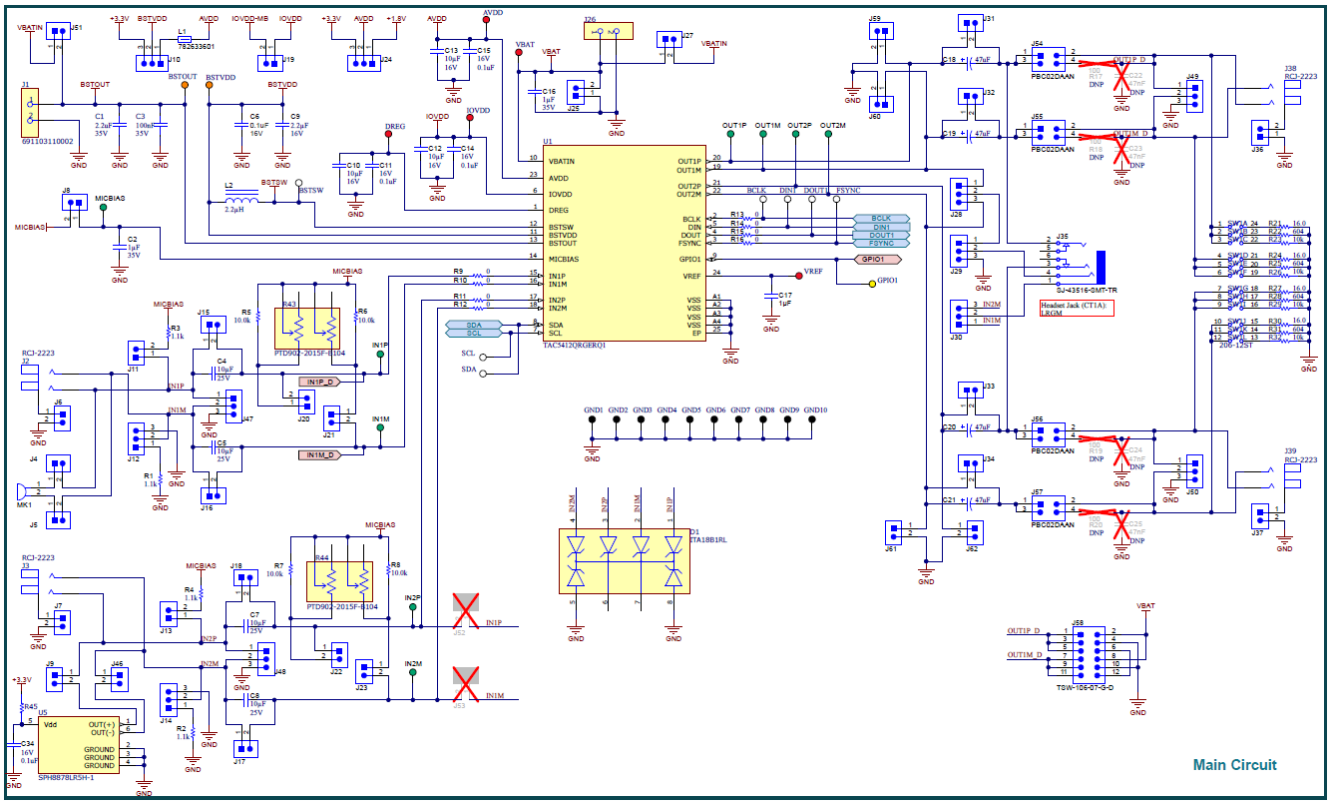


Figure 4-1. TAC5412-Q1 EVM Main DUT Schematic

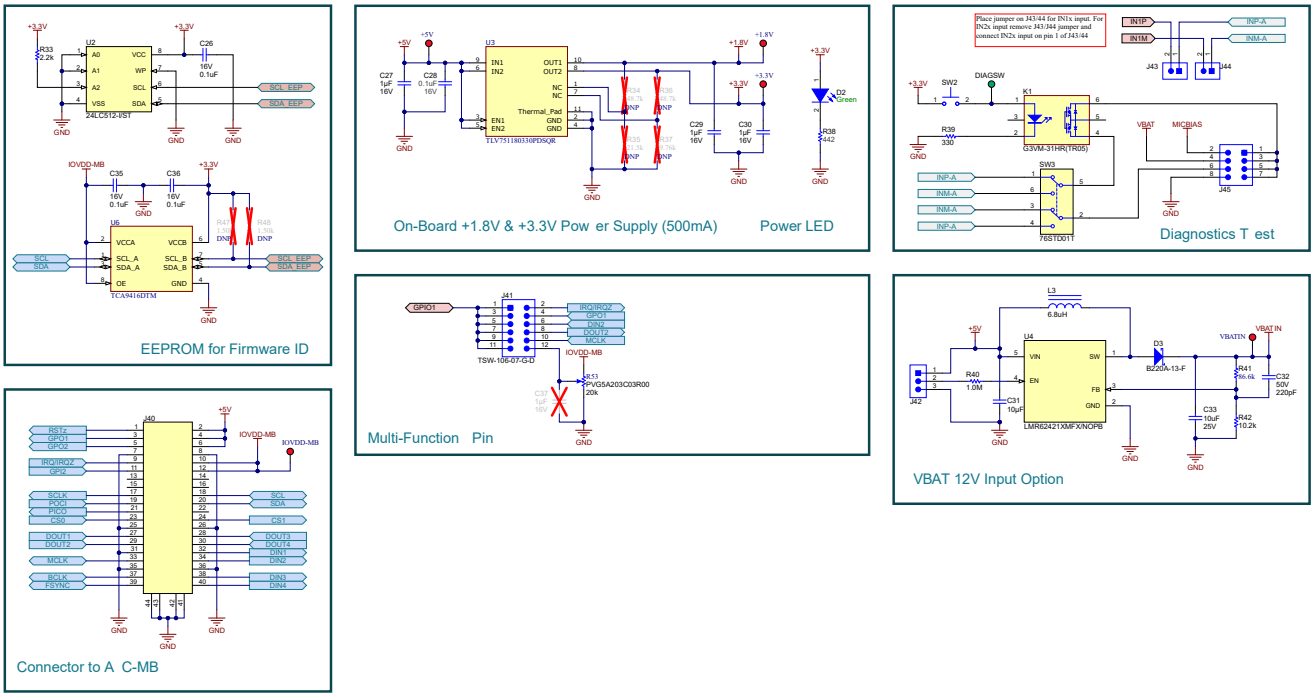


Figure 4-2. TAC5412-Q1 EVM Connectors and Supporting Circuitry Schematic

TAC5311-Q1 EVM Schematic

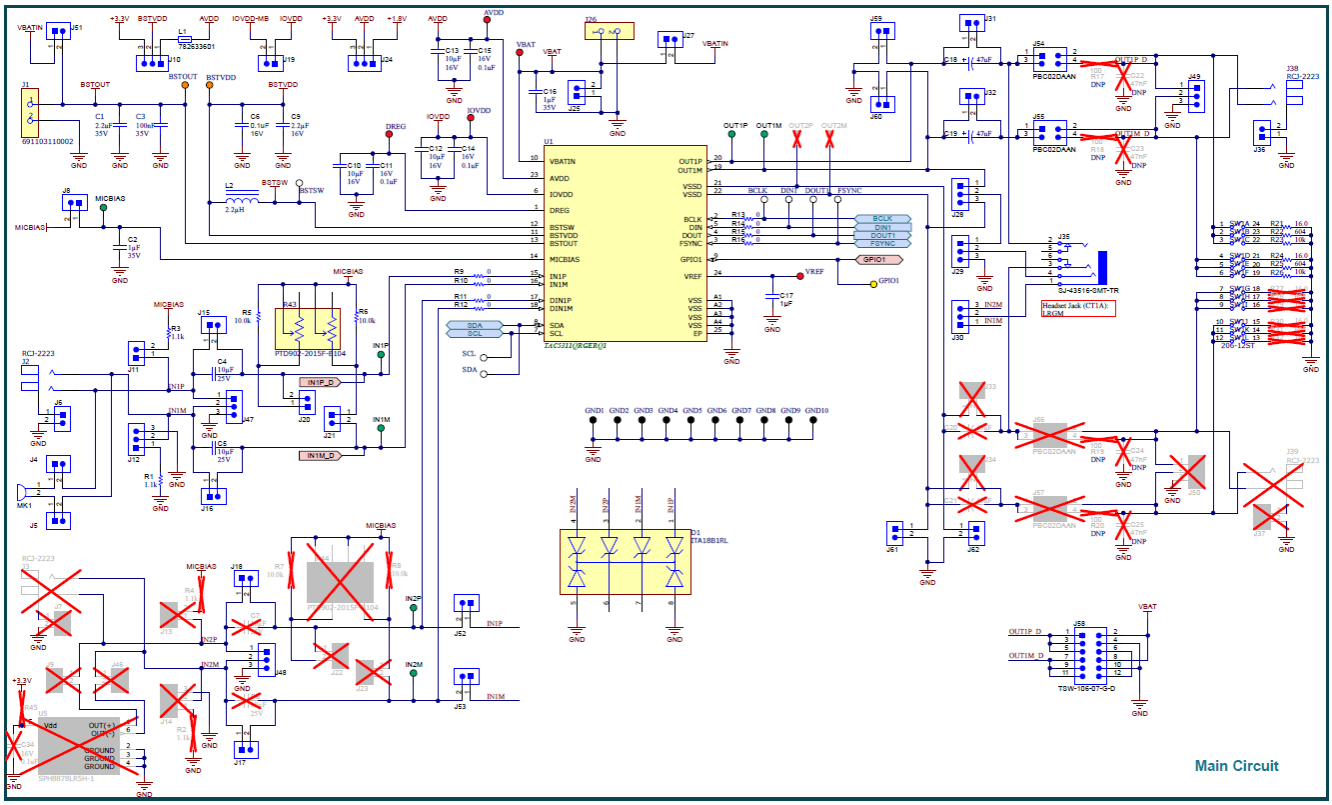


Figure 4-3. TAC5311-Q1 EVM Main DUT Schematic

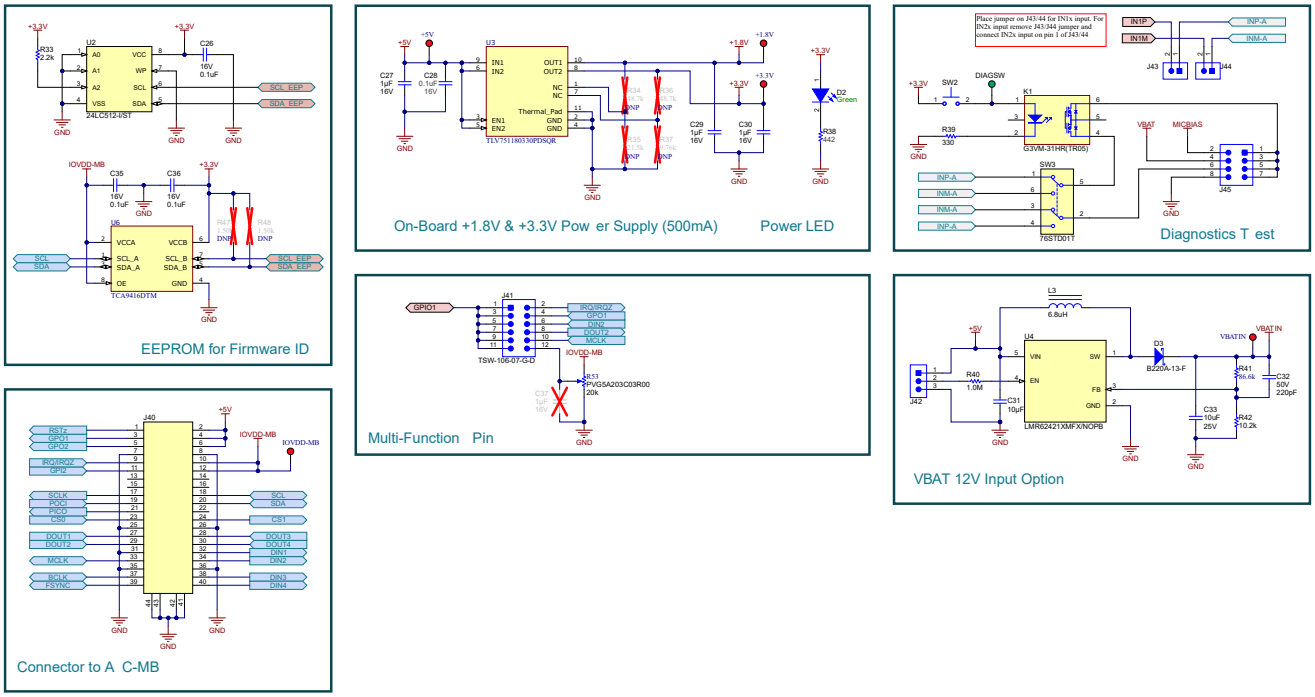


Figure 4-4. TAC5311-Q1 EVM Connectors and Supporting Circuitry Schematic

TAA5412-Q1 EVM Schematic

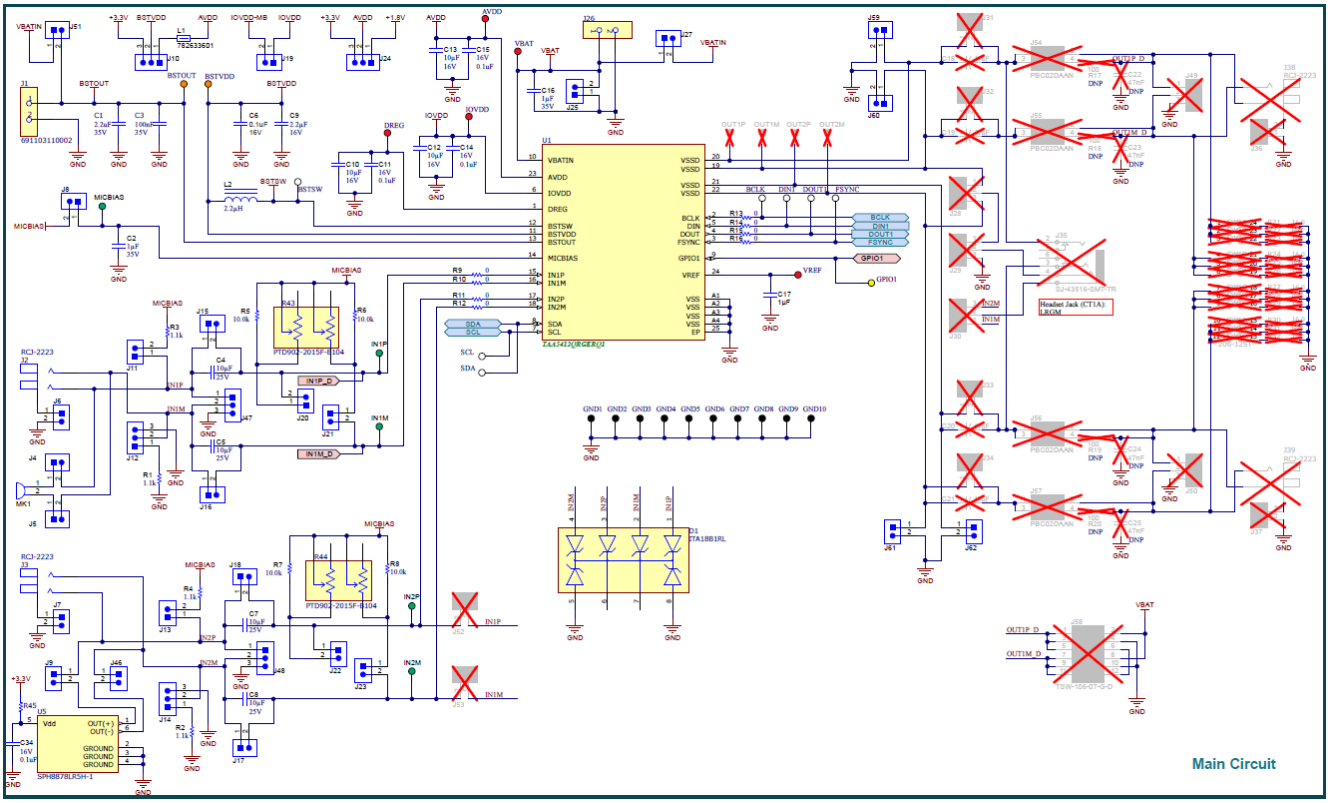


Figure 4-5. TAA5412-Q1 EVM Main DUT Schematic

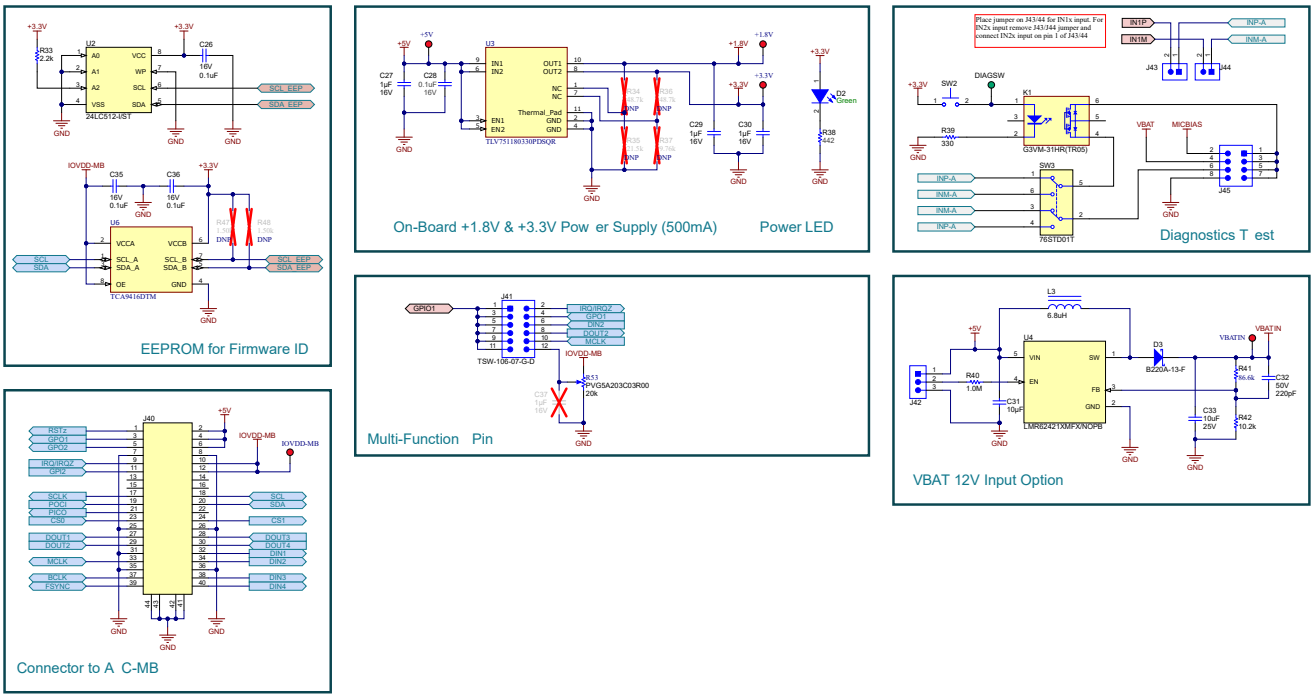


Figure 4-6. TAA5412-Q1 EVM Connectors and Supporting Circuitry Schematic

4.2 PCB Layouts

TAx5x1x-Q1 EVM Board Layout

The board layout consists of the top and bottom silkscreen, the top and bottom layer routings, the power planes, the 2 inner layout routings and the ground planes. The layout applies to TAC5412-Q1, TAC5311-Q1 and TAA5411-Q1 EVM.

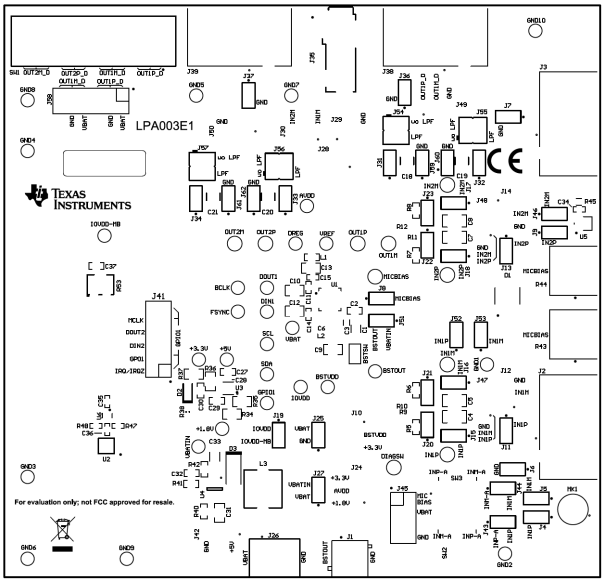


Figure 4-7. TAx5x1x-Q1 EVM Top Silkscreen

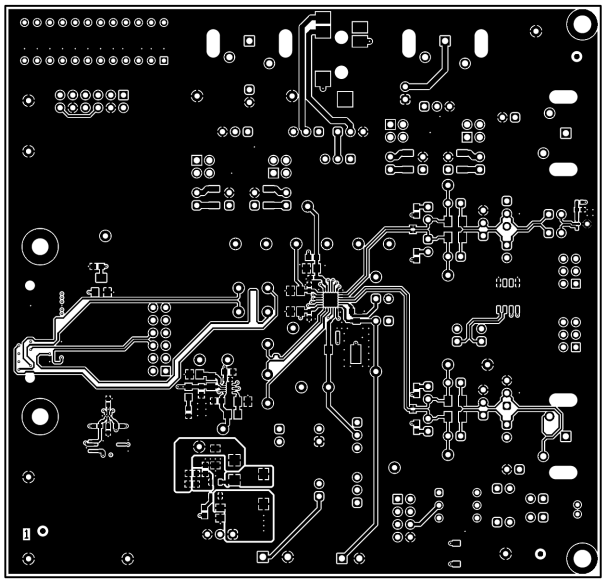


Figure 4-8. TAx5x1x-Q1 EVM Top Layer

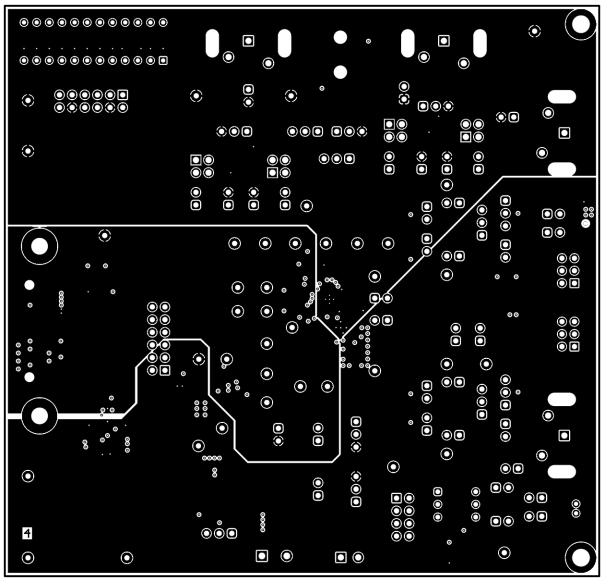


Figure 4-9. TAx5x1x-Q1 EVM Power Layer 1

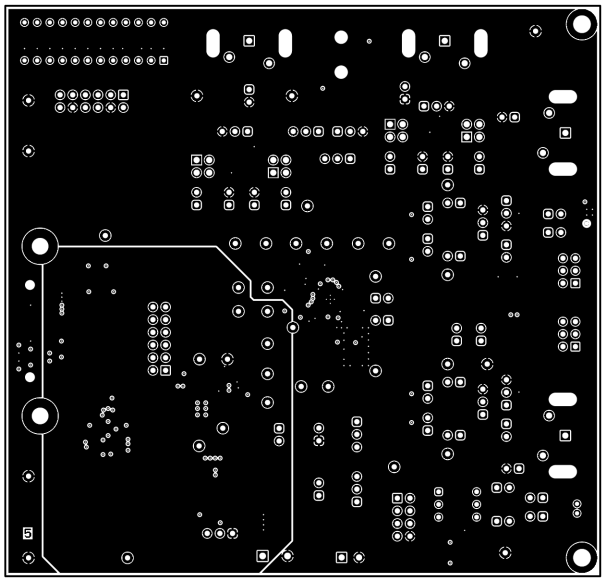


Figure 4-10. TAx5x1x-Q1 EVM Power Layer 2

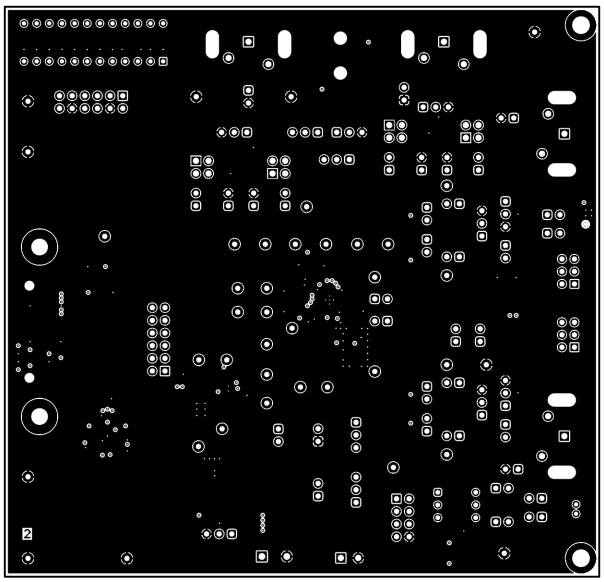


Figure 4-11. TAx5x1x-Q1 EVM Ground Layer 1

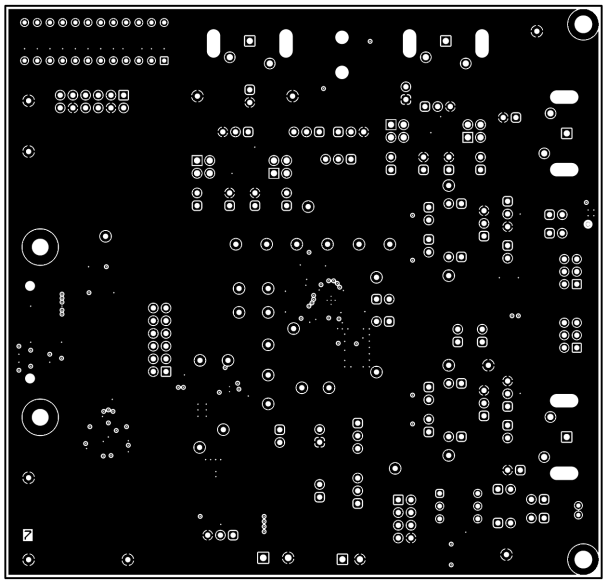


Figure 4-12. TAx5x1x-Q1 EVM Ground Layer 2

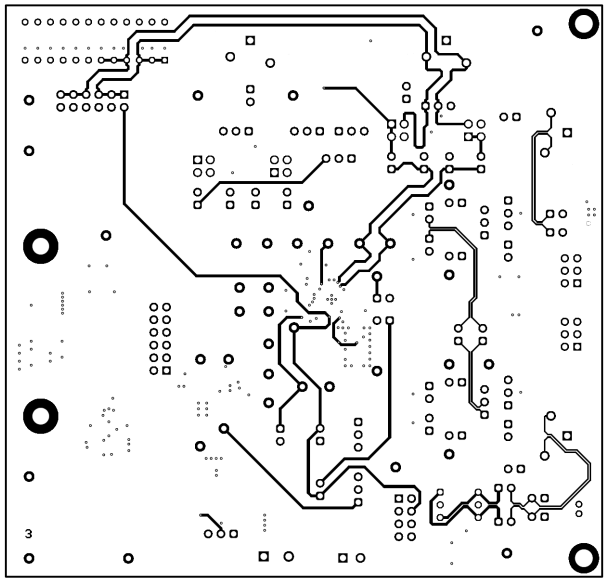


Figure 4-13. TAx5x1x-Q1 EVM Signal Layer 1

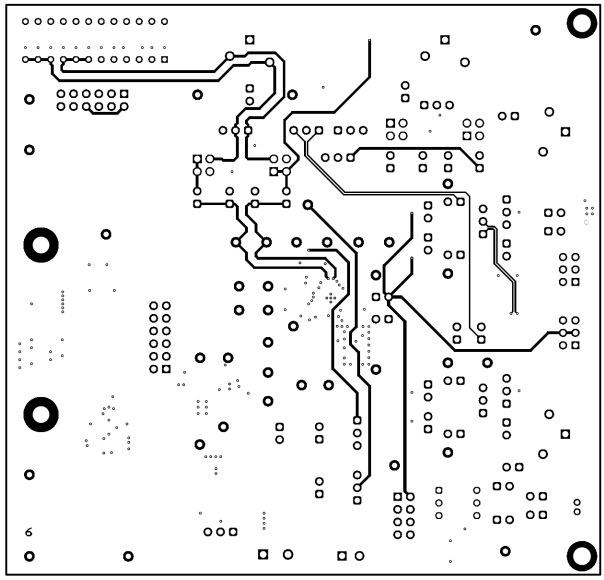


Figure 4-14. TAx5x1x-Q1 EVM Signal Layer 2

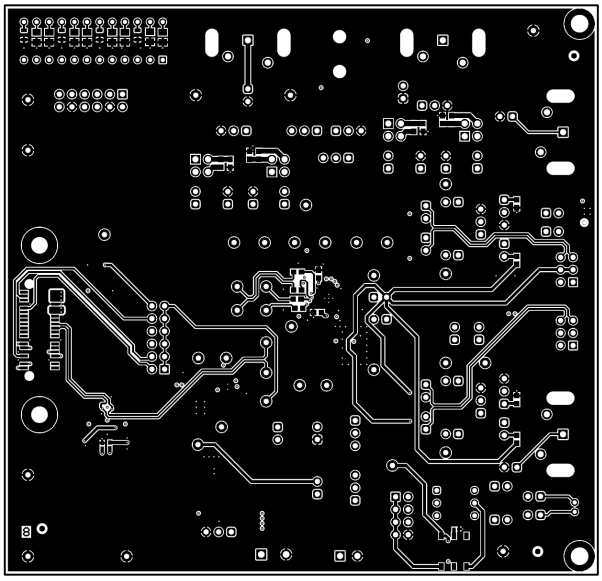


Figure 4-15. TAx5x1x-Q1 EVM Bottom Layer

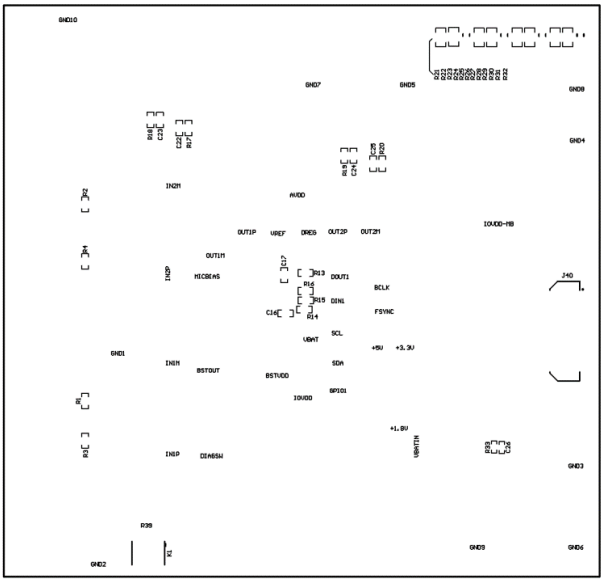


Figure 4-16. TAx5x1x-Q1 EVM Bottom Silkscreen

4.3 Bill of Materials (BOM)

4.3.1 TAC5412-Q1 EVM Bill of Materials

Designator	Qty	Value	Description	Package Reference	Part Number	Manufacturer	Alternate PartNumber	Alternate Manufacturer
!PCB	1		Printed Circuit Board		LPA003	Any		
+1.8V, +3.3V, +5V, AVDD, DREG, IOVDD, IOVDD-MB, VBAT, VBATIN, VREF	10		Test Point, Miniature, Red, TH	Red Miniature Testpoint	5000	Keystone Electronics		
BCLK, DIN1, DOUT1, FSYNC, SCL, SDA	6		Test Point, Miniature, White, TH	White Miniature Testpoint	5002	Keystone Electronics		
BSTOUT, BSTVDD	2		Test Point, Miniature, Orange, TH	Orange Miniature Testpoint	5003	Keystone Electronics		
BSTSW	1		Test Point, Miniature, SMT	Testpoint_Keystone_Miniature	5015	Keystone Electronics		
C1	1	2.2µF	Capacitor Ceramic 2.2uF 35 V X7R 10% 1206 T/R	1206	C3216X7R1V225K160AE	TDK		
C2, C16	2	1uF	CAP, CERM, 1 uF, 35 V, +/- 10%, X7R, 0603	0603	C1608X7R1V105K080AC	TDK		
C3	1	100 nF	Cap Ceramic 100 nF 35 V X7R 10% Pad SMD 0402 +125°C Automotive T/R	0402	CGA2B3X7R1V104K050BB	TDK Corporation		
C4, C5, C7, C8	4	10uF	CAP, CERM, 10 µF, 25 V,+/- 5%, X7R, AEC-Q200 Grade 1, 1206	1206	C1206C106J3RACAUTO	Kemet		
C6, C11, C14, C15, C26, C28, C34, C35, C36	9	0.1uF	CAP, CERM, 0.1 uF, 16 V, +/- 10%, X7R, 0402	0402	8.85012E+11	Wurth Elektronik		
C9	1	2.2uF	CAP, CERM, 2.2 uF, 16 V, +/- 10%, X7R, 0805	0805	C2012X7R1C225K125AB	TDK		
C10, C12, C13	3	10uF	CAP, CERM, 10 µF, 16 V,+/- 10%, X7R, 0805	0805	EMK212BB7106KG-T	Taiyo Yuden		
C17, C27, C29, C30	4	1uF	CAP, CERM, 1 uF, 16 V, +/- 10%, X7R, 0603	0603	8.85012E+11	Wurth Elektronik		
C18, C19, C20, C21	4	47uF	CAP, TA, 47 uF, 10 V, +/- 10%, 0.5 ohm, SMD	3528-21	TPSB476K010R0500	AVX		
C31	1	10uF	CAP, CERM, 10 µF, V,+/- 10%, X7R, 0805	0805	GRM21BR71A106KA73L	MuRata		

Designator	Qty	Value	Description	Package Reference	Part Number	Manufacturer	Alternate PartNumber	Alternate Manufacturer
C32	1	220 pF	CAP, CERM, 220 pF, 50 V, +/- 5%, C0G/NP0, 0603	0603	C0603C221J5GACTU	Kemet		
C33	1	10uF	CAP, CERM, 10 uF, 25 V, +/- 10%, X7R, 1206	1206	GRM31CR71E106KA12L	MuRata		
D1	1		28 V Clamp 25 A (8/20µs) Ipp Tvs Diode Surface Mount 8-SOIC	SOIC8	ITA18B1RL	STMicroelectronics		
D2	1	Green	LED, Green, SMD	LED_0805	LTST-C170KGKT	Lite-On		
D3	1	20 V	Diode, Schottky, 20 V, 2 A, SMA	SMA	B220A-13-F	Diodes Inc.		
DIAGSW, IN1M, IN1P, IN2M, IN2P, MICBIAS, OUT1M, OUT1P, OUT2M, OUT2P	10		Test Point, Miniature, Green, TH	Green Miniature Testpoint	5116	Keystone		
GND1, GND2, GND3, GND4, GND5, GND6, GND7, GND8, GND9, GND10	10		Test Point, Miniature, Black, TH	Black Miniature Testpoint	5001	Keystone Electronics		
GPIO1	1		Test Point, Miniature, Yellow, TH	Yellow Miniature Testpoint	5004	Keystone Electronics		
H1, H2	2		Small nylon hex nut, 0.10 thick with a 0.250 outside diameter and a 4-40 threading	Hex Nut,4-40 Thread, 250" Head Dia	9605	Keystone		
H3, H4	2		HEX STANDOFF 4-40 NYLON 3/4"	HEX STANDOFF 4-40 NYLON 3/4"	4804	Keystone		
J1	1			CONN_TERM_POS2	6.91103E+11	Wurth		
J2, J3, J38, J39	4		3.20mm ID, 9.00mm OD (RCA) Phono (RCA) Jack Mono Connector Solder	CONN_RCA_DUAL	RCJ-2223	CUI Devices		

Designator	Qty	Value	Description	Package Reference	Part Number	Manufacturer	Alternate PartNumber	Alternate Manufacturer
J4, J5, J6, J7, J8, J9, J11, J13, J15, J16, J17, J18, J19, J20, J21, J22, J23, J25, J27, J31, J32, J33, J34, J36, J37, J43, J44, J46, J51, J59, J60, J61, J62	33		Header, 100mil, 2x1, Gold, TH	2x1 Header	TSW-102-07-G-S	Samtec		
J10, J12, J14, J24, J28, J29, J30, J42, J47, J48, J49, J50	12		Header, 100mil, 3x1, Gold, TH	3x1 Header	TSW-103-07-G-S	Samtec		
J26	1		TERM BLK 2POS SIDE ENTRY 5 MM PCB	HDR2	6.91138E+11	Würth Elektronik		
J35	1		AUDIO JACK 3.5mm 4COND, SMT	AUDIO JACK 3.5mm 4COND, SMT	SJ-43516-SMT-TR	CUI Inc.		
J40	1		Connector, Header, High Speed, 20 pairs, SMT	QTE-020-01-X-D-A	QTE-020-01-L-D-A	Samtec		
J41, J58	2		Header, 100mil, 6x2, Gold, TH	6x2 Header	TSW-106-07-G-D	Samtec		
J45	1		Header, 100mil, 4x2, Gold, TH	4x2 Header	TSW-104-07-G-D	Samtec		
J54, J55, J56, J57	4		Header, 2.54mm, 2x2, Gold, TH	Header, 2.54mm, 2x2, TH	PBC02DAAN	Sullins Connector Solutions		
K1	1		Relay, SPST-NO (1 Form A), 4 A, SMD	6.3x4.4mm	G3VM-31HR(TR05)	Omron Electronic Components		
L1	1	600 ohm	Ferrite Bead, 600 ohm @ 100 MHz, 1 A, 0603	0603	782633601	Wurth Elektronik		
L2	1	2.2uH	Inductor, Shielded, Metal Composite, 2.2 µH, 2.2 A, 0.1 ohm, SMD	2x1.6mm	LPWI201610H2R2T	Littelfuse		
L3	1	6.8uH	Inductor, Shielded Drum Core, Ferrite, 6.8 uH, 2.91 A, 0.033 ohm, SMD	SMD	7447779006	Wurth Elektronik		

Designator	Qty	Value	Description	Package Reference	Part Number	Manufacturer	Alternate PartNumber	Alternate Manufacturer
LBL1	1		Thermal Transfer Printable Labels, 0.650" W x 0.200" H - 10,000 per roll	PCB Label 0.650 x 0.200 inch	THT-14-423-10	Brady		
MK1	1		Microphone, Condenser, Analog, Omnidirectional, -42DB, TH	6 mm DIA	POM-2242P-C33-R	PUI Audio		
R1, R2, R3, R4	4	1.1k	RES, 1.1 k, 5%, 0.1 W, AEC-Q200 Grade 0, 0603	0603	CRCW06031K10JNEA	Vishay-Dale		
R5, R6, R7, R8	4	10.0k	RES, 10.0 k, 1%, 0.1 W, AEC-Q200 Grade 0, 0603	0603	RMCF0603FT10K0	Stackpole Electronics Inc		
R9, R10, R11, R12	4	0	RES, 0, 5%, 0.05 W, 0201	0201	CRCW020100 00Z0ED	Vishay-Dale		
R13, R14, R15, R16	4	0	RES, 0, 0%, 0.25 W, AEC-Q200 Grade 0, 0603	0603	PMR03EZPJ000	Rohm		
R21, R24, R27, R30	4	16	RES, 16.0, 1%, 0.5 W, 0805	0805	ERJ-P06F16R0V	Panasonic		
R22, R25, R28, R31	4	604	RES, 604, 1%, 0.125 W, AEC-Q200 Grade 0, 0805	0805	CRCW0805604RFKEA	Vishay-Dale		
R23, R26, R29, R32	4		RES SMD 10K OHM 5% 0.4W 0805	0805	ESR10EZPJ103	Rohm Semiconductor		
R33	1	2.2k	RES, 2.2 k, 5%, 0.063 W, AEC-Q200 Grade 0, 0402	0402	CRCW04022K20JNED	Vishay-Dale		
R38	1	442	RES, 442, 1%, 0.1 W, AEC-Q200 Grade 0, 0603	0603	CRCW0603442RFKEA	Vishay-Dale		
R39	1	330	RES, 330, 5%, 0.063 W, AEC-Q200 Grade 0, 0402	0402	CRCW0402330RJNED	Vishay-Dale		
R40	1	1.0Meg	RES, 1.0 M, 5%, 0.1 W, AEC-Q200 Grade 0, 0603	0603	CRCW06031M00JNEA	Vishay-Dale		
R41	1	86.6k	RES, 86.6 k, 1%, 0.1 W, AEC-Q200 Grade 0, 0603	0603	CRCW060386K6FKEA	Vishay-Dale		
R42	1	10.2k	RES, 10.2 k, 1%, 0.1 W, AEC-Q200 Grade 0, 0603	0603	CRCW060310K2FKEA	Vishay-Dale		
R43, R44	2	100 kΩ	Res POT Carbon Element 100kOhm 20% 1/20W/1/40W PC Pins Thru-Hole	PTH_POT_9MM50_24MM65	PTD902-2015F-B104	Bourns		

Designator	Qty	Value	Description	Package Reference	Part Number	Manufacturer	Alternate PartNumber	Alternate Manufacturer
R45	1	10k	10k ±5% 0.063W, 1/16W Chip Resistor 0402 (1005 Metric) Moisture Resistant Thick Film	0402	RC0402JR-1310KL	Yageo		
R53	1	20k	Trimmer Potentiometer, 20 k ohm, 0.25 W, SMD	Trimmer, 4.8,3.9x5.1mm	PVG5A203C03R00	Bourns		
SH1, SH2, SH3, SH4, SH5, SH6, SH7, SH8, SH9, SH10, SH11, SH12, SH13, SH14, SH15, SH16, SH17, SH18, SH19, SH20, SH21, SH22, SH23, SH24, SH25, SH28, SH29, SH30, SH31, SH32, SH33, SH34, SH35, SH36, SH37, SH38, SH39, SH40, SH41, SH42, SH43, SH44, SH45, SH46, SH47, SH48, SH49	47	1x2	Shunt, 100mil, Gold plated, Black	Shunt	SNT-100-BK-G	Samtec	969102-0000-DA	3M
SW1	1		Dip Switch SPST 12 Position Through Hole Slide (Standard) Actuator 50 mA 24VDC	DIP24	206-12ST	CTS		
SW2	1		Switch, Tactile, SPST-NO, 0.05A, 12 V, SMT	Switch, 4.4x2x2.9 mm	TL1015AF160QG	E-Switch		

Designator	Qty	Value	Description	Package Reference	Part Number	Manufacturer	Alternate PartNumber	Alternate Manufacturer
SW3	1		Switch, DPDT, 0.15 A, 30 VDC, TH	9.65x9.65mm	76STD01T	Grayhill		
U1	1		Libra SW Controlled High Voltage Stereo	VQFN24	TAC5412QRGERQ1	Texas Instruments		
U2	1		EEPROM, 512KBIT, 400 KHZ, 8TSSOP	TSSOP-8	24LC512-I/ST	Microchip		
U3	1		500-mA, low-IQ, high-PSRR, dual-channel low-dropout (LDO) voltage regulator 10-WSON -40 to 125	WSON10	TLV751180330PDSQR	Texas Instruments		
U4	1		SIMPLE SWITCHER 2.7V to 5.5V, 2.1A Step-Up Regulator in SOT-23, DBV0005A (SOT-23-5)	DBV0005A	LMR62421XMFX/NOPB	Texas Instruments	LMR62421XMFE/NOPB	Texas Instruments
U5	1		Approx. 7 Hz - 36 kHz Analog Microphone MEMS (Silicon). Approx. 2.3 V - 3.6 V Omnidirectional (-44dB ±0.5dB SPL) Solder Pads	LGA	SPH8878LR5H-1	Knowles	SPH1878LR5H-C	Knowles
U6	1		TCA9416DTM X2SON8	X2SON8	TCA9416DTM	Texas Instruments		
C22, C23, C24, C25	0	0.047uF	CAP, CERM, 0.047 uF, 50 V, +/- 10%, X7R, 0603	0603	C1608X7R1H473K080AA	TDK		
C37	0	1uF	CAP, CERM, 1 uF, 16 V, +/- 10%, X7R, 0603	0603	8.85012E+11	Wurth Elektronik		
FID1, FID2, FID3, FID4, FID5, FID6	0		Fiducial mark. There is nothing to buy or mount.	N/A	N/A	N/A		
J52, J53	0		Header, 100mil, 2x1, Gold, TH	2x1 Header	TSW-102-07-G-S	Samtec		
R17, R18, R19, R20	0	100	RES, 100, 1%, 0.1 W, 0603	0603	RC0603FR-07100RL	Yageo		
R34, R36	0	48.7k	RES, 48.7 k, 1%, 0.125 W, AEC-Q200 Grade 0, 0805	0805	CRCW080548K7FKEA	Vishay-Dale		
R35	0	21.5k	RES, 21.5 k, 1%, 0.125 W, AEC-Q200 Grade 0, 0805	0805	CRCW080521K5FKEA	Vishay-Dale		
R37	0	9.76k	RES, 9.76 k, 1%, 0.125 W, AEC-Q200 Grade 0, 0805	0805	CRCW08059K76FKEA	Vishay-Dale		
R47, R48	0	1.50k	RES, 1.50 k, 1%, 0.063 W, AEC-Q200 Grade 0, 0402	0402	RMCF0402FT1K50	Stackpole Electronics Inc		

Designator	Qty	Value	Description	Package Reference	Part Number	Manufacturer	Alternate PartNumber	Alternate Manufacturer
SH26, SH27	0	1x2	Shunt, 100mil, Gold plated, Black	Shunt	SNT-100-BK-G	Samtec	969102-0000-DA	3M

4.3.2 TAC5311-Q1 EVM Bill of Materials

Table 4-1. Bill of Materials

Designator	Qty	Value	Description	Package Reference	Part Number	Manufacturer	Alternate PartNumber	Alternate Manufacturer
!PCB	1		Printed Circuit Board		LPA003	Any		
+1.8V, +3.3V, +5V, AVDD, DREG, IOVDD, IOVDD-MB, VBAT, VBATIN, VREF	10		Test Point, Miniature, Red, TH	Red Miniature Testpoint	5000	Keystone Electronics		
BCLK, DIN1, DOUT1, FSYNC, SCL, SDA	6		Test Point, Miniature, White, TH	White Miniature Testpoint	5002	Keystone Electronics		
BSTOUT, BSTVDD	2		Test Point, Miniature, Orange, TH	Orange Miniature Testpoint	5003	Keystone Electronics		
BSTSW	1		Test Point, Miniature, SMT	Testpoint_Keystone_Miniature	5015	Keystone Electronics		
C1	1	2.2µF	Capacitor Ceramic 2.2uF 35 V X7R 10% 1206 T/R	1206	C3216X7R1V225K160AE	TDK		
C2, C16	2	1uF	CAP, CERM, 1 uF, 35 V, +/- 10%, X7R, 0603	0603	C1608X7R1V105K080AC	TDK		
C3	1	100 nF	Cap Ceramic 100 nF 35 V X7R 10% Pad SMD 0402 +125°C Automotive T/R	0402	CGA2B3X7R1V104K050BB	TDK Corporation		
C4, C5	2	10uF	CAP, CERM, 10 µF, 25 V,+/- 5%, X7R, AEC-Q200 Grade 1, 1206	1206	C1206C106J3RACAUTO	Kemet		
C6, C11, C14, C15, C26, C28, C35, C36	8	0.1uF	CAP, CERM, 0.1 uF, 16 V, +/- 10%, X7R, 0402	0402	8.85012E+11	Wurth Elektronik		
C9	1	2.2uF	CAP, CERM, 2.2 uF, 16 V, +/- 10%, X7R, 0805	0805	C2012X7R1C225K125AB	TDK		
C10, C12, C13	3	10uF	CAP, CERM, 10 µF, 16 V,+/- 10%, X7R, 0805	0805	EMK212BB7106KG-T	Taiyo Yuden		
C17, C27, C29, C30	4	1uF	CAP, CERM, 1 uF, 16 V, +/- 10%, X7R, 0603	0603	8.85012E+11	Wurth Elektronik		
C18, C19	2	47uF	CAP, TA, 47 uF, 10 V, +/- 10%, 0.5 ohm, SMD	3528-21	TPSB476K010R0500	AVX		

Table 4-1. Bill of Materials (continued)

Designator	Qty	Value	Description	Package Reference	Part Number	Manufacturer	Alternate PartNumber	Alternate Manufacturer
C31	1	10uF	CAP, CERM, 10 µF, V,+/- 10%, X7R, 0805	0805	GRM21BR71A106KA73L	MuRata		
C32	1	220 pF	CAP, CERM, 220 pF, 50 V, +/- 5%, C0G/NP0, 0603	0603	C0603C221J5GACTU	Kemet		
C33	1	10uF	CAP, CERM, 10 uF, 25 V, +/- 10%, X7R, 1206	1206	GRM31CR71E106KA12L	MuRata		
D1	1		28 V Clamp 25 A (8/20µs) Ipp Tvs Diode Surface Mount 8-SOIC	SOIC8	ITA18B1RL	STMicroelectronics		
D2	1	Green	LED, Green, SMD	LED_0805	LTST-C170KGKT	Lite-On		
D3	1	20 V	Diode, Schottky, 20 V, 2 A, SMA	SMA	B220A-13-F	Diodes Inc.		
DIAGSW, IN1M, IN1P, IN2M, IN2P, MICBIAS, OUT1M, OUT1P	8		Test Point, Miniature, Green, TH	Green Miniature Testpoint	5116	Keystone		
GND1, GND2, GND3, GND4, GND5, GND6, GND7, GND8, GND9, GND10	10		Test Point, Miniature, Black, TH	Black Miniature Testpoint	5001	Keystone Electronics		
GPIO1	1		Test Point, Miniature, Yellow, TH	Yellow Miniature Testpoint	5004	Keystone Electronics		
H1, H2	2		Small nylon hex nut, 0.10 thick with a 0.250 outside diameter and a 4-40 threading	Hex Nut,4-40 Thread, 250" Head Dia	9605	Keystone		
H3, H4	2		HEX STANDOFF 4-40 NYLON 3/4"	HEX STANDOFF 4-40 NYLON 3/4"	4804	Keystone		
J1	1			CONN_TERM_POS2	6.91103E+11	Wurth		
J2, J38	2		3.20mm ID, 9.00mm OD (RCA) Phono (RCA) Jack Mono Connector Solder	CONN_RCA_DUAL	RCJ-2223	CUI Devices		

Table 4-1. Bill of Materials (continued)

Designator	Qty	Value	Description	Package Reference	Part Number	Manufacturer	Alternate PartNumber	Alternate Manufacturer
J4, J5, J6, J8, J11, J15, J16, J17, J18, J19, J20, J21, J25, J27, J31, J32, J36, J43, J44, J51, J52, J53, J59, J60, J61, J62	26		Header, 100mil, 2x1, Gold, TH	2x1 Header	TSW-102-07-G-S	Samtec		
J10, J12, J24, J28, J29, J30, J42, J47, J48, J49	10		Header, 100mil, 3x1, Gold, TH	3x1 Header	TSW-103-07-G-S	Samtec		
J26	1		TERM BLK 2POS SIDE ENTRY 5 MM PCB	HDR2	6.91138E+11	Würth Elektronik		
J35	1		AUDIO JACK 3.5mm 4COND, SMT	AUDIO JACK 3.5mm 4COND, SMT	SJ-43516-SMT-TR	CUI Inc.		
J40	1		Connector, Header, High Speed, 20 pairs, SMT	QTE-020-01-X-D-A	QTE-020-01-L-D-A	Samtec		
J41, J58	2		Header, 100mil, 6x2, Gold, TH	6x2 Header	TSW-106-07-G-D	Samtec		
J45	1		Header, 100mil, 4x2, Gold, TH	4x2 Header	TSW-104-07-G-D	Samtec		
J54, J55	2		Header, 2.54mm, 2x2, Gold, TH	Header, 2.54mm, 2x2, TH	PBC02DAAN	Sullins Connector Solutions		
K1	1		Relay, SPST-NO (1 Form A), 4 A, SMD	6.3x4.4mm	G3VM-31HR(TR05)	Omron Electronic Components		
L1	1	600 ohm	Ferrite Bead, 600 ohm @ 100 MHz, 1 A, 0603	0603	782633601	Wurth Elektronik		
L2	1	2.2uH	Inductor, Shielded, Metal Composite, 2.2 µH, 2.2 A, 0.1 ohm, SMD	2x1.6mm	LPWI201610H2R2T	Littelfuse		
L3	1	6.8uH	Inductor, Shielded Drum Core, Ferrite, 6.8 uH, 2.91 A, 0.033 ohm, SMD	SMD	7447779006	Wurth Elektronik		

Table 4-1. Bill of Materials (continued)

Designator	Qty	Value	Description	Package Reference	Part Number	Manufacturer	Alternate PartNumber	Alternate Manufacturer
LBL1	1		Thermal Transfer Printable Labels, 0.650" W x 0.200" H - 10,000 per roll	PCB Label 0.650 x 0.200 inch	THT-14-423-10	Brady		
MK1	1		Microphone, Condenser, Analog, Omnidirectional, -42DB, TH	6 mm DIA	POM-2242P-C33-R	PUI Audio		
R1, R3	2	1.1k	RES, 1.1 k, 5%, 0.1 W, AEC-Q200 Grade 0, 0603	0603	CRCW06031K10JNEA	Vishay-Dale		
R5, R6	2	10.0k	RES, 10.0 k, 1%, 0.1 W, AEC-Q200 Grade 0, 0603	0603	RMCF0603FT10K0	Stackpole Electronics Inc		
R9, R10, R11, R12	4	0	RES, 0, 5%, 0.05 W, 0201	0201	CRCW02010000Z0ED	Vishay-Dale		
R13, R14, R15, R16	4	0	RES, 0, 0%, 0.25 W, AEC-Q200 Grade 0, 0603	0603	PMR03EZPJ000	Rohm		
R21, R24	2	16	RES, 16.0, 1%, 0.5 W, 0805	0805	ERJ-P06F16R0V	Panasonic		
R22, R25	2	604	RES, 604, 1%, 0.125 W, AEC-Q200 Grade 0, 0805	0805	CRCW0805604RFKEA	Vishay-Dale		
R23, R26	2		RES SMD 10K OHM 5% 0.4W 0805	0805	ESR10EZPJ103	Rohm Semiconductor		
R33	1	2.2k	RES, 2.2 k, 5%, 0.063 W, AEC-Q200 Grade 0, 0402	0402	CRCW04022K20JNED	Vishay-Dale		
R38	1	442	RES, 442, 1%, 0.1 W, AEC-Q200 Grade 0, 0603	0603	CRCW0603442RFKEA	Vishay-Dale		
R39	1	330	RES, 330, 5%, 0.063 W, AEC-Q200 Grade 0, 0402	0402	CRCW0402330RJNED	Vishay-Dale		
R40	1	1.0Meg	RES, 1.0 M, 5%, 0.1 W, AEC-Q200 Grade 0, 0603	0603	CRCW06031M00JNEA	Vishay-Dale		
R41	1	86.6k	RES, 86.6 k, 1%, 0.1 W, AEC-Q200 Grade 0, 0603	0603	CRCW060386K6FKEA	Vishay-Dale		
R42	1	10.2k	RES, 10.2 k, 1%, 0.1 W, AEC-Q200 Grade 0, 0603	0603	CRCW060310K2FKEA	Vishay-Dale		

Table 4-1. Bill of Materials (continued)

Designator	Qty	Value	Description	Package Reference	Part Number	Manufacturer	Alternate PartNumber	Alternate Manufacturer
R43	1	100 kΩ	Res POT Carbon Element 100kOhm 20% 1/20W/1/40W PC Pins Thru-Hole	PTH_POT_9MM50_24MM65	PTD902-2015F-B104	Bourns		
R53	1	20k	Trimmer Potentiometer, 20 k ohm, 0.25 W, SMD	Trimmer, 4.8,3.9x5.1mm	PVG5A203C03R00	Bourns		
SH1, SH2, SH3, SH4, SH5, SH6, SH7, SH8, SH9, SH10, SH11, SH12, SH13, SH14, SH15, SH16, SH22, SH23, SH26, SH27, SH28, SH29, SH30, SH31, SH32, SH33, SH34, SH35, SH36, SH37, SH43, SH44, SH45, SH46, SH47, SH48, SH49	37	1x2	Shunt, 100mil, Gold plated, Black	Shunt	SNT-100-BK-G	Samtec	969102-0000-DA	3M
SW1	1		Dip Switch SPST 12 Position Through Hole Slide (Standard) Actuator 50 mA 24VDC	DIP24	206-12ST	CTS		
SW2	1		Switch, Tactile, SPST-NO, 0.05A, 12 V, SMT	Switch, 4.4x2x2.9 mm	TL1015AF160QG	E-Switch		
SW3	1		Switch, DPDT, 0.15 A, 30 VDC, TH	9.65x9.65mm	76STD01T	Grayhill		
U1	1		Libra SW Controlled High Voltage Mono	VQFN24	TAC5311QRGERQ1	Texas Instruments		
U2	1		EEPROM, 512KBIT, 400 KHZ, 8TSSOP	TSSOP-8	24LC512-I/ST	Microchip		

Table 4-1. Bill of Materials (continued)

Designator	Qty	Value	Description	Package Reference	Part Number	Manufacturer	Alternate PartNumber	Alternate Manufacturer
U3	1		500-mA, low-IQ, high-PSRR, dual-channel low-dropout (LDO) voltage regulator 10-WSON -40 to 125	WSON10	TLV751180330PDSQR	Texas Instruments		
U4	1		SIMPLE SWITCHER 2.7V to 5.5V, 2.1A Step-Up Regulator in SOT-23, DBV0005A (SOT-23-5)	DBV0005A	LMR62421XMFX/NOPB	Texas Instruments	LMR62421XMFE/NOPB	Texas Instruments
U6	1		TCA9416DTM X2SON8	X2SON8	TCA9416DTM	Texas Instruments		
C7, C8	0	10uF	CAP, CERM, 10 µF, 25 V,+/- 5%, X7R, AEC-Q200 Grade 1, 1206	1206	C1206C106J3RACAUTO	Kemet		
C20, C21	0	47uF	CAP, TA, 47 uF, 10 V, +/- 10%, 0.5 ohm, SMD	3528-21	TPSB476K010R0500	AVX		
C22, C23, C24, C25	0	0.047uF	CAP, CERM, 0.047 uF, 50 V, +/- 10%, X7R, 0603	0603	C1608X7R1H473K080AA	TDK		
C34	0	0.1uF	CAP, CERM, 0.1 uF, 16 V, +/- 10%, X7R, 0402	0402	8.85012E+11	Wurth Elektronik		
C37	0	1uF	CAP, CERM, 1 uF, 16 V, +/- 10%, X7R, 0603	0603	8.85012E+11	Wurth Elektronik		
FID1, FID2, FID3, FID4, FID5, FID6	0		Fiducial mark. There is nothing to buy or mount.	N/A	N/A	N/A		
J3, J39	0		3.20mm ID, 9.00mm OD (RCA) Phono (RCA) Jack Mono Connector Solder	CONN_RCA_DUAL	RCJ-2223	CUI Devices		
J7, J9, J13, J22, J23, J33, J34, J37, J46	0		Header, 100mil, 2x1, Gold, TH	2x1 Header	TSW-102-07-G-S	Samtec		
J14, J50	0		Header, 100mil, 3x1, Gold, TH	3x1 Header	TSW-103-07-G-S	Samtec		
J56, J57	0		Header, 2.54mm, 2x2, Gold, TH	Header, 2.54mm, 2x2, TH	PBC02DAAN	Sullins Connector Solutions		
OUT2M, OUT2P	0		Test Point, Miniature, Green, TH	Green Miniature Testpoint	5116	Keystone		
R2, R4	0	1.1k	RES, 1.1 k, 5%, 0.1 W, AEC-Q200 Grade 0, 0603	0603	CRCW06031K10JNEA	Vishay-Dale		

Table 4-1. Bill of Materials (continued)

Designator	Qty	Value	Description	Package Reference	Part Number	Manufacturer	Alternate PartNumber	Alternate Manufacturer
R7, R8	0	10.0k	RES, 10.0 k, 1%, 0.1 W, AEC-Q200 Grade 0, 0603	0603	RMCF0603FT10K0	Stackpole Electronics Inc		
R17, R18, R19, R20	0	100	RES, 100, 1%, 0.1 W, 0603	0603	RC0603FR-07100RL	Yageo		
R27, R30	0	16	RES, 16.0, 1%, 0.5 W, 0805	0805	ERJ-P06F16R0V	Panasonic		
R28, R31	0	604	RES, 604, 1%, 0.125 W, AEC-Q200 Grade 0, 0805	0805	CRCW0805604RFKEA	Vishay-Dale		
R29, R32	0		RES SMD 10K OHM 5% 0.4W 0805	0805	ESR10EZPJ103	Rohm Semiconductor		
R34, R36	0	48.7k	RES, 48.7 k, 1%, 0.125 W, AEC-Q200 Grade 0, 0805	0805	CRCW080548K7FKEA	Vishay-Dale		
R35	0	21.5k	RES, 21.5 k, 1%, 0.125 W, AEC-Q200 Grade 0, 0805	0805	CRCW080521K5FKEA	Vishay-Dale		
R37	0	9.76k	RES, 9.76 k, 1%, 0.125 W, AEC-Q200 Grade 0, 0805	0805	CRCW08059K76FKEA	Vishay-Dale		
R44	0	100 kΩ	Res POT Carbon Element 100kOhm 20% 1/20W/1/40W PC Pins Thru-Hole	PTH_POT_9MM50_24MM65	PTD902-2015F-B104	Bourns		
R45	0	10k	10k ±5% 0.063W, 1/16W Chip Resistor 0402 (1005 Metric) Moisture Resistant Thick Film	0402	RC0402JR-1310KL	Yageo		
R47, R48	0	1.50k	RES, 1.50 k, 1%, 0.063 W, AEC-Q200 Grade 0, 0402	0402	RMCF0402FT1K50	Stackpole Electronics Inc		
SH17, SH18, SH19, SH20, SH21, SH24, SH25, SH38, SH39, SH40, SH41, SH42	0	1x2	Shunt, 100mil, Gold plated, Black	Shunt	SNT-100-BK-G	Samtec	969102-0000-DA	3M

Table 4-1. Bill of Materials (continued)

Designator	Qty	Value	Description	Package Reference	Part Number	Manufacturer	Alternate PartNumber	Alternate Manufacturer
U5	0		Approx. 7 Hz - 36 kHz Analog Microphone MEMS (Silicon); Approx. 2.3 V - 3.6 V Omnidirectional (-44dB ±0.5dB SPL) Solder Pads	LGA	SPH8878LR5H-1	Knowles		

4.3.3 TAA5412-Q1 EVM Bill of Materials

Table 4-2. Bill of Materials

Designator	Qty	Value	Description	Package Reference	Part Number	Manufacturer	Alternate PartNumber	Alternate Manufacturer
!PCB	1		Printed Circuit Board		LPA003	Any		
+1.8V, +3.3V, +5V, AVDD, DREG, IOVDD, IOVDD-MB, VBAT, VBATIN, VREF	10		Test Point, Miniature, Red, TH	Red Miniature Testpoint	5000	Keystone Electronics		
BCLK, DIN1, DOUT1, FSYNC, SCL, SDA	6		Test Point, Miniature, White, TH	White Miniature Testpoint	5002	Keystone Electronics		
BSTOUT, BSTVDD	2		Test Point, Miniature, Orange, TH	Orange Miniature Testpoint	5003	Keystone Electronics		
BSTSW	1		Test Point, Miniature, SMT	Testpoint_Keystone_Miniature	5015	Keystone Electronics		
C1	1	2.2µF	Capacitor Ceramic 2.2uF 35 V X7R 10% 1206 T/R	1206	C3216X7R1V225K160AE	TDK		
C2, C16	2	1uF	CAP, CERM, 1 uF, 35 V, +/- 10%, X7R, 0603	0603	C1608X7R1V105K080AC	TDK		
C3	1	100 nF	Cap Ceramic 100 nF 35 V X7R 10% Pad SMD 0402 +125°C Automotive T/R	0402	CGA2B3X7R1V104K050BB	TDK Corporation		
C4, C5, C7, C8	4	10uF	CAP, CERM, 10 µF, 25 V,+/- 5%, X7R, AEC-Q200 Grade 1, 1206	1206	C1206C106J3RACAUTO	Kemet		
C6, C11, C14, C15, C26, C28, C34, C35, C36	9	0.1uF	CAP, CERM, 0.1 uF, 16 V, +/- 10%, X7R, 0402	0402	8.85012E+11	Wurth Elektronik		
C9	1	2.2uF	CAP, CERM, 2.2 uF, 16 V, +/- 10%, X7R, 0805	0805	C2012X7R1C225K125AB	TDK		
C10, C12, C13	3	10uF	CAP, CERM, 10 µF, 16 V,+/- 10%, X7R, 0805	0805	EMK212BB7106KG-T	Taiyo Yuden		
C17, C27, C29, C30	4	1uF	CAP, CERM, 1 uF, 16 V, +/- 10%, X7R, 0603	0603	8.85012E+11	Wurth Elektronik		
C31	1	10uF	CAP, CERM, 10 µF, V,+/- 10%, X7R, 0805	0805	GRM21BR71A106KA73L	MuRata		

Table 4-2. Bill of Materials (continued)

Designator	Qty	Value	Description	Package Reference	Part Number	Manufacturer	Alternate PartNumber	Alternate Manufacturer
C32	1	220 pF	CAP, CERM, 220 pF, 50 V, +/- 5%, C0G/NP0, 0603	0603	C0603C221J5GACTU	Kemet		
C33	1	10uF	CAP, CERM, 10 uF, 25 V, +/- 10%, X7R, 1206	1206	GRM31CR71E106KA12L	MuRata		
D1	1		28 V Clamp 25 A (8/20µs) Ipp Tvs Diode Surface Mount 8-SOIC	SOIC8	ITA18B1RL	STMicroelectronics		
D2	1	Green	LED, Green, SMD	LED_0805	LTST-C170KGKT	Lite-On		
D3	1	20 V	Diode, Schottky, 20 V, 2 A, SMA	SMA	B220A-13-F	Diodes Inc.		
DIAGSW, IN1M, IN1P, IN2M, IN2P, MICBIAS	6		Test Point, Miniature, Green, TH	Green Miniature Testpoint	5116	Keystone		
GND1, GND2, GND3, GND4, GND5, GND6, GND7, GND8, GND9, GND10	10		Test Point, Miniature, Black, TH	Black Miniature Testpoint	5001	Keystone Electronics		
GPIO1	1		Test Point, Miniature, Yellow, TH	Yellow Miniature Testpoint	5004	Keystone Electronics		
H1, H2	2		Small nylon hex nut, 0.10 thick with a 0.250 outside diameter and a 4-40 threading	Hex Nut,4-40 Thread, 250" Head Dia	9605	Keystone		
H3, H4	2		HEX STANDOFF 4-40 NYLON 3/4"	HEX STANDOFF 4-40 NYLON 3/4"	4804	Keystone		
J1	1			CONN_TERM_POS2	6.91103E+11	Wurth		
J2, J3	2		3.20mm ID, 9.00mm OD (RCA) Phono (RCA) Jack Mono Connector Solder	CONN_RCA_DUAL	RCJ-2223	CUI Devices		

Table 4-2. Bill of Materials (continued)

Designator	Qty	Value	Description	Package Reference	Part Number	Manufacturer	Alternate PartNumber	Alternate Manufacturer
J4, J5, J6, J7, J8, J9, J11, J13, J15, J16, J17, J18, J19, J20, J21, J22, J23, J25, J27, J43, J44, J46, J51, J59, J60, J61, J62	27		Header, 100mil, 2x1, Gold, TH	2x1 Header	TSW-102-07-G-S	Samtec		
J10, J12, J14, J24, J42, J47, J48	7		Header, 100mil, 3x1, Gold, TH	3x1 Header	TSW-103-07-G-S	Samtec		
J26	1		TERM BLK 2POS SIDE ENTRY 5 MM PCB	HDR2	6.91138E+11	Würth Elektronik		
J40	1		Connector, Header, High Speed, 20 pairs, SMT	QTE-020-01-X-D-A	QTE-020-01-L-D-A	Samtec		
J41	1		Header, 100mil, 6x2, Gold, TH	6x2 Header	TSW-106-07-G-D	Samtec		
J45	1		Header, 100mil, 4x2, Gold, TH	4x2 Header	TSW-104-07-G-D	Samtec		
K1	1		Relay, SPST-NO (1 Form A), 4 A, SMD	6.3x4.4mm	G3VM-31HR(TR05)	Omron Electronic Components		
L1	1	600 ohm	Ferrite Bead, 600 ohm @ 100 MHz, 1 A, 0603	0603	782633601	Wurth Elektronik		
L2	1	2.2uH	Inductor, Shielded, Metal Composite, 2.2 µH, 2.2 A, 0.1 ohm, SMD	2x1.6mm	LPWI201610H2R2T	Littelfuse		
L3	1	6.8uH	Inductor, Shielded Drum Core, Ferrite, 6.8 uH, 2.91 A, 0.033 ohm, SMD	SMD	7447779006	Wurth Elektronik		
LBL1	1		Thermal Transfer Printable Labels, 0.650" W x 0.200" H - 10,000 per roll	PCB Label 0.650 x 0.200 inch	THT-14-423-10	Brady		
MK1	1		Microphone, Condenser, Analog, Omnidirectional, -42DB, TH	6 mm DIA	POM-2242P-C33-R	PUI Audio		

Table 4-2. Bill of Materials (continued)

Designator	Qty	Value	Description	Package Reference	Part Number	Manufacturer	Alternate PartNumber	Alternate Manufacturer
R1, R2, R3, R4	4	1.1k	RES, 1.1 k, 5%, 0.1 W, AEC-Q200 Grade 0, 0603	0603	CRCW06031K10JNEA	Vishay-Dale		
R5, R6, R7, R8	4	10.0k	RES, 10.0 k, 1%, 0.1 W, AEC-Q200 Grade 0, 0603	0603	RMCF0603FT10K0	Stackpole Electronics Inc		
R9, R10, R11, R12	4	0	RES, 0, 5%, 0.05 W, 0201	0201	CRCW020100 00Z0ED	Vishay-Dale		
R13, R14, R15, R16	4	0	RES, 0, 0%, 0.25 W, AEC-Q200 Grade 0, 0603	0603	PMR03EZPJ0 00	Rohm		
R33	1	2.2k	RES, 2.2 k, 5%, 0.063 W, AEC-Q200 Grade 0, 0402	0402	CRCW04022K20JNED	Vishay-Dale		
R38	1	442	RES, 442, 1%, 0.1 W, AEC-Q200 Grade 0, 0603	0603	CRCW060344 2RFKEA	Vishay-Dale		
R39	1	330	RES, 330, 5%, 0.063 W, AEC-Q200 Grade 0, 0402	0402	CRCW040233 0RJNED	Vishay-Dale		
R40	1	1.0Meg	RES, 1.0 M, 5%, 0.1 W, AEC-Q200 Grade 0, 0603	0603	CRCW06031M00JNEA	Vishay-Dale		
R41	1	86.6k	RES, 86.6 k, 1%, 0.1 W, AEC-Q200 Grade 0, 0603	0603	CRCW060386K6FKEA	Vishay-Dale		
R42	1	10.2k	RES, 10.2 k, 1%, 0.1 W, AEC-Q200 Grade 0, 0603	0603	CRCW060310K2FKEA	Vishay-Dale		
R43, R44	2	100 kΩ	Res POT Carbon Element 100kOhm 20% 1/20W/1/40W PC Pins Thru-Hole	PTH_POT_9MM50_24MM65	PTD902-2015F-B104	Bourns		
R45	1	10k	10k ±5% 0.063W, 1/16W Chip Resistor 0402 (1005 Metric) Moisture Resistant Thick Film	0402	RC0402JR-1310KL	Yageo		
R53	1	20k	Trimmer Potentiometer, 20 k ohm, 0.25 W, SMD	Trimmer, 4.8,3.9x5.1mm	PVG5A203C03R00	Bourns		

Table 4-2. Bill of Materials (continued)

Designator	Qty	Value	Description	Package Reference	Part Number	Manufacturer	Alternate PartNumber	Alternate Manufacturer
SH1, SH2, SH3, SH4, SH5, SH6, SH7, SH8, SH9, SH10, SH11, SH12, SH13, SH14, SH15, SH16, SH17, SH18, SH19, SH20, SH21, SH22, SH23, SH24, SH25, SH30, SH31, SH43, SH44, SH45, SH46, SH47, SH48, SH49	34	1x2	Shunt, 100mil, Gold plated, Black	Shunt	SNT-100-BK-G	Samtec	969102-0000-DA	3M
SW2	1		Switch, Tactile, SPST-NO, 0.05A, 12 V, SMT	Switch, 4.4x2x2.9 mm	TL1015AF160QG	E-Switch		
SW3	1		Switch, DPDT, 0.15 A, 30 VDC, TH	9.65x9.65mm	76STD01T	Grayhill		
U1	1		TAA5412QRGERQ1	VQFN24	TAA5412QRGERQ1	Texas Instruments		
U2	1		EEPROM, 512KBIT, 400 KHZ, 8TSSOP	TSSOP-8	24LC512-I/ST	Microchip		
U3	1		500-mA, low-IQ, high-PSRR, dual-channel low-dropout (LDO) voltage regulator 10-WSON -40 to 125	WSON10	TLV751180330PDSQR	Texas Instruments		
U4	1		SIMPLE SWITCHER 2.7V to 5.5V, 2.1A Step-Up Regulator in SOT-23, DBV0005A (SOT-23-5)	DBV0005A	LMR62421XMFX/NOPB	Texas Instruments	LMR62421XMFE/NOPB	Texas Instruments
U5	1		Approx. 7 Hz - 36 kHz Analog Microphone MEMS (Silicon); approx. 2.3 V - 3.6 V Omnidirectional (-44dB ±0.5dB SPL) Solder Pads	LGA	SPH8878LR5H-1	Knowles	SPH1878LR5H-C	Knowles
U6	1		TCA9416DTM X2SON8	X2SON8	TCA9416DTM	Texas Instruments		
C18, C19, C20, C21	0	47uF	CAP, TA, 47 uF, 10 V, +/- 10%, 0.5 ohm, SMD	3528-21	TPSB476K010R0500	AVX		
C22, C23, C24, C25	0	0.047uF	CAP, CERM, 0.047 uF, 50 V, +/- 10%, X7R, 0603	0603	C1608X7R1H473K080AA	TDK		

Table 4-2. Bill of Materials (continued)

Designator	Qty	Value	Description	Package Reference	Part Number	Manufacturer	Alternate PartNumber	Alternate Manufacturer
C37	0	1uF	CAP, CERM, 1 uF, 16 V, +/- 10%, X7R, 0603	0603	8.85012E+11	Wurth Elektronik		
FID1, FID2, FID3, FID4, FID5, FID6	0		Fiducial mark. There is nothing to buy or mount.	N/A	N/A	N/A		
J28, J29, J30, J49, J50	0		Header, 100mil, 3x1, Gold, TH	3x1 Header	TSW-103-07-G-S	Samtec		
J31, J32, J33, J34, J36, J37, J52, J53	0		Header, 100mil, 2x1, Gold, TH	2x1 Header	TSW-102-07-G-S	Samtec		
J35	0		AUDIO JACK 3.5mm 4COND, SMT	AUDIO JACK 3.5mm 4COND, SMT	SJ-43516-SMT-TR	CUI Inc.		
J38, J39	0		3.20mm ID, 9.00mm OD (RCA) Phono (RCA) Jack Mono Connector Solder	CONN_RCA_DUAL	RCJ-2223	CUI Devices		
J54, J55, J56, J57	0		Header, 2.54mm, 2x2, Gold, TH	Header, 2.54mm, 2x2, TH	PBC02DAAN	Sullins Connector Solutions		
J58	0		Header, 100mil, 6x2, Gold, TH	6x2 Header	TSW-106-07-G-D	Samtec		
OUT1M, OUT1P, OUT2M, OUT2P	0		Test Point, Miniature, Green, TH	Green Miniature Testpoint	5116	Keystone		
R17, R18, R19, R20	0	100	RES, 100, 1%, 0.1 W, 0603	0603	RC0603FR-07100RL	Yageo		
R21, R24, R27, R30	0	16	RES, 16.0, 1%, 0.5 W, 0805	0805	ERJ-P06F16R0V	Panasonic		
R22, R25, R28, R31	0	604	RES, 604, 1%, 0.125 W, AEC-Q200 Grade 0, 0805	0805	CRCW0805604RFKEA	Vishay-Dale		
R23, R26, R29, R32	0		RES SMD 10K OHM 5% 0.4W 0805	0805	ESR10EZPJ103	Rohm Semiconductor		
R34, R36	0	48.7k	RES, 48.7 k, 1%, 0.125 W, AEC-Q200 Grade 0, 0805	0805	CRCW080548K7FKEA	Vishay-Dale		
R35	0	21.5k	RES, 21.5 k, 1%, 0.125 W, AEC-Q200 Grade 0, 0805	0805	CRCW080521K5FKEA	Vishay-Dale		
R37	0	9.76k	RES, 9.76 k, 1%, 0.125 W, AEC-Q200 Grade 0, 0805	0805	CRCW08059K76FKEA	Vishay-Dale		

Table 4-2. Bill of Materials (continued)

Designator	Qty	Value	Description	Package Reference	Part Number	Manufacturer	Alternate PartNumber	Alternate Manufacturer
R47, R48	0	1.50k	RES, 1.50 k, 1%, 0.063 W, AEC-Q200 Grade 0, 0402	0402	RMCF0402FT 1K50	Stackpole Electronics Inc		
SH26, SH27, SH28, SH29, SH32, SH33, SH34, SH35, SH36, SH37, SH38, SH39, SH40, SH41, SH42	0	1x2	Shunt, 100mil, Gold plated, Black	Shunt	SNT-100-BK-G	Samtec	969102-0000-DA	3M
SW1	0		Dip Switch SPST 12 Position Through Hole Slide (Standard) Actuator 50 mA 24VDC	DIP24	206-12ST	CTS		

5 Additional Information

5.1 Trademarks

PurePath™ is a trademark of Texas Instruments.
All trademarks are the property of their respective owners.

6 References

Cable Reference

The following are cables that can be used for evaluation with external audio instrument like Audio Precision:

- BNC Male to RCA Male Cable
- RCA Speaker Cable with Banana Plugs

STANDARD TERMS FOR EVALUATION MODULES

1. *Delivery:* TI delivers TI evaluation boards, kits, or modules, including any accompanying demonstration software, components, and/or documentation which may be provided together or separately (collectively, an “EVM” or “EVMs”) to the User (“User”) in accordance with the terms set forth herein. User's acceptance of the EVM is expressly subject to the following terms.

   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 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 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 a nonconforming EVM if (a) the nonconformity was 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, (b) the nonconformity resulted from User's design, specifications or instructions for such EVMs or improper system design, or (c) User has not paid on time. Testing and other quality control techniques are used to the extent TI deems necessary. TI does not test all parameters of each EVM. User's claims against TI under this Section 2 are void if User fails to notify TI of any apparent defects in the EVMs within ten (10) business days after delivery, or of any hidden defects with ten (10) business days after the defect has been detected.

   2.3 TI's sole liability shall be at its option to repair or replace EVMs that fail to conform to the warranty set forth above, 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.

WARNING

Evaluation Kits 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 shall operate the Evaluation Kit within TI’s recommended guidelines and any applicable legal or environmental requirements as well as reasonable and customary safeguards. Failure to set up and/or operate the Evaluation Kit within TI’s recommended guidelines may result in personal injury or death or property damage. Proper set up entails following TI’s instructions for electrical ratings of interface circuits such as input, output and electrical loads.

NOTE:

EXPOSURE TO ELECTROSTATIC DISCHARGE (ESD) MAY CAUSE DEGREDATION OR FAILURE OF THE EVALUATION KIT; TI RECOMMENDS STORAGE OF THE EVALUATION KIT IN A PROTECTIVE ESD BAG.

3 *Regulatory Notices:*

3.1 *United States*

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

FCC NOTICE: 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 or RSS-247*

Concerning EVMs Including Radio Transmitters:

This device complies with Industry Canada license-exempt RSSs. 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。

https://www.ti.com/ja-jp/legal/notice-for-evaluation-kits-delivered-in-japan.html

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

If User uses EVMs in Japan, not certified to Technical Regulations of Radio Law of Japan, User is required to follow the instructions set forth by Radio Law of Japan, which includes, but is not limited to, the instructions below with respect to EVMs (which for the avoidance of doubt are stated strictly for convenience and should be verified by User):

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.

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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。

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。 日本テキサス・インスツルメンツ株式会社

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3.3.3 *Notice for EVMs for Power Line Communication:* Please see http://www.tij.co.jp/lsds/ti_ja/general/eStore/notice_02.page

電力線搬送波通信についての開発キットをお使いになる際の注意事項については、次のところをご覧ください。https://www.ti.com/ja-jp/legal/notice-for-evaluation-kits-for-power-line-communication.html

3.4 *European Union*

3.4.1 *For EVMs subject to EU Directive 2014/30/EU (Electromagnetic Compatibility Directive)*:

This is a class A product intended for use in environments other than domestic environments that are connected to a low-voltage power-supply network that supplies buildings used for domestic purposes. In a domestic environment this product may cause radio interference in which case the user may be required to take adequate measures.

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.

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