Application Report

TAS2563 Quick Start Guide

Jin Gao

Abstract

This document provides a starting guide on the steps required to go from speaker selection to end system integration with TAS2563 (6.1-W Boosted Class-D Audio Amplifier With Integrated DSP And IV Sense)

Table of Contents

Trademarks

All other trademarks are the property of their respective owners.

1 EVMs and LB2 Setup Checklist

The hardware setup and the accessories listed below are for speaker characterization and to get started with TAS2563. Some of the accessories required for characterization are included in the Learning Board 2 bundle; however, additional testing equipment may be acquired separately if needed. Note that TAS2563EVM is a daughter card which requires a PPC3-EVM-MB to communicate with Learning Board 2 and PPC3 Software.

Devices Required:

1. TAS2563 EVM (Daughter Card)
2. Learning Board 2 (LB2)
3. PPC3-EVM-MB (Required for TAS2563 EVM Daughter Card)

*Please visit www.TI.com for EVM orders

Accessories required for characterization via USB

- ☐ TS Mic. connection adapter (Included in LB2)
- ☐ Single channel RCA cable (Included in LB2)
- ☐ 34-pin Ribbon cable (Included in LB2)
- ☐ LC Filter/Accessory board (Included in LB2)
- ☐ RCA to 3.5 mm TRRS adapter (Included in LB2)
- ☐ Measurement MIC (Included in LB2)
- ☐ Micro-USB cable (Not included)
- ☐ Power Supply (4.5V – 26V, 25W) (Not included)
- ☐ Test Speaker[1] (Not included)
- ☐ Measurement laser (Not included)

*Additional accessories may be included in LB2 Bundle

Jumper settings (Mono/Stereo)

- For jumpers and PC audio output configurations, please refer to
  – PPC3-EVM-MB User Guide
  – TAS2563EVM User Guide
  – Learning board 2 User Guide

EVMs and LB2 Setup (internal boost)

1. Align and stack *TAS2563EVM* on *PPC3-EVM-MB* accordingly to the pins and header slots
2. Connect *PPC3-EVM-MB* to *LB2* with a 34-pin ribbon cable via LEARNING BOARD 2 slot on *PPC3-EVM-MB* and J21 on *LB2*
3. Connect the input (J5) *of LC filter* to the OUT1 of *TAS2563EVM*
4. Connect the output of the *LC filter* (J6) to the AMP IN (J12) of *LB2*
5. Connect the *TS MIC adapter* to J1 of LB2
6. Connect the RCA cable to the *TS MIC adapter* and to the *RCA to 3.5 mm TRRS adapter* with the measurement microphone
7. Attach the test speaker to AMP_OUT(J14) of LB2
8. Connect the *power supply* to VBAT (J11 or J12) of *PPC3-EVM-MB*
9. Connect the micro-USB from J2 of *PPC3-EVM-MB* to PC

[1] Test speaker used in this document: ASE03008MR-LW150-R

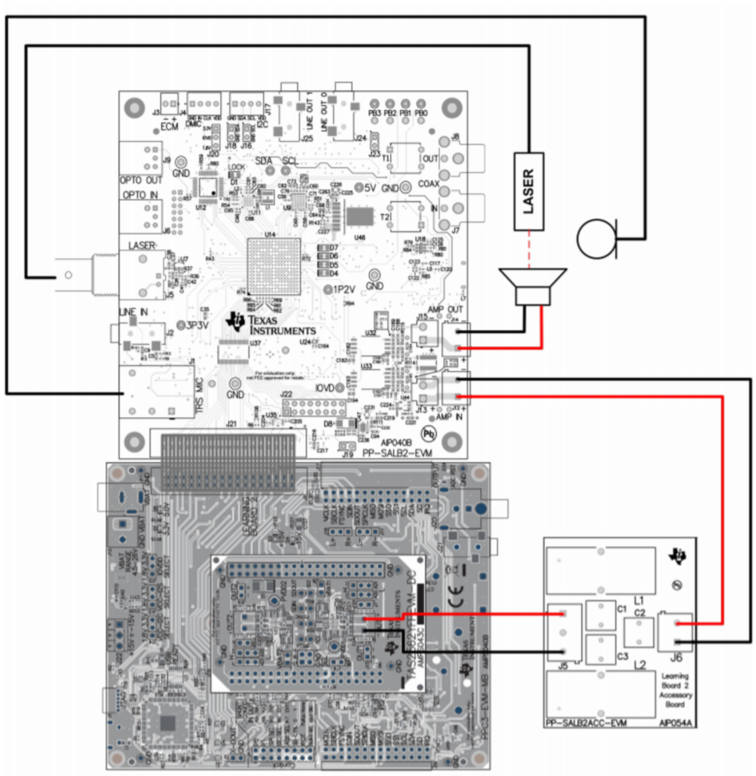

Figure 1-1. Wiring Diagram

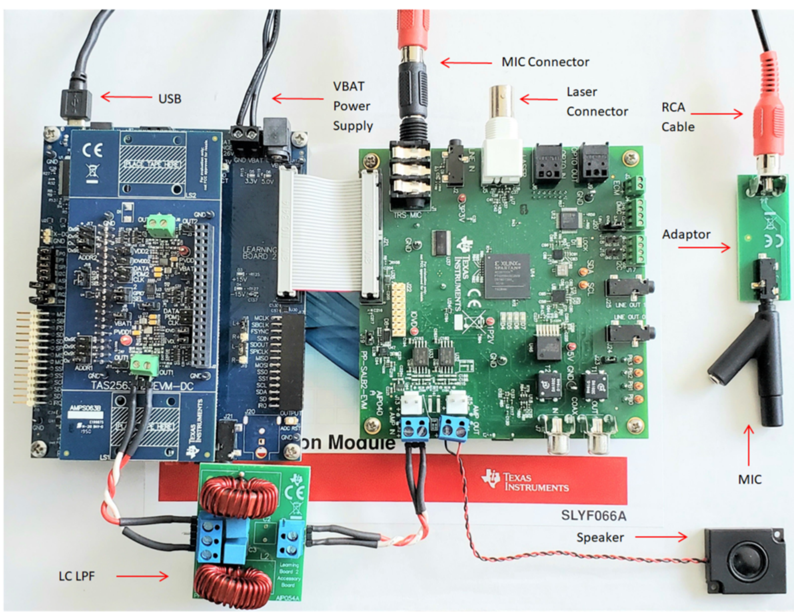

Figure 1-2. Hardware Setup

Note

Verify the direction of the low pass filter that is shown in Figure 1-2.

---

2 Introduction

Smart Amps from Texas Instruments™ build upon the classic Class-D audio amplifier by adding the ability to real-time monitor the temperature and excursion of the speaker. Typical amplifiers do not have this capability and revert to attenuating the entire audio signal to ensure reliability. This attenuation will result in lower sound pressure level (SPL) and overall audio quality. Smart Amp uses the real-time temperature and excursion data from the Current and Voltage Sense (IV Sense) feature to update the speaker model in real-time. This is controlled by an algorithm running in the DSP inside the device. This feedback allows the device to monitor the health of the speaker and optimize the sound quality to enable greater audio performance.

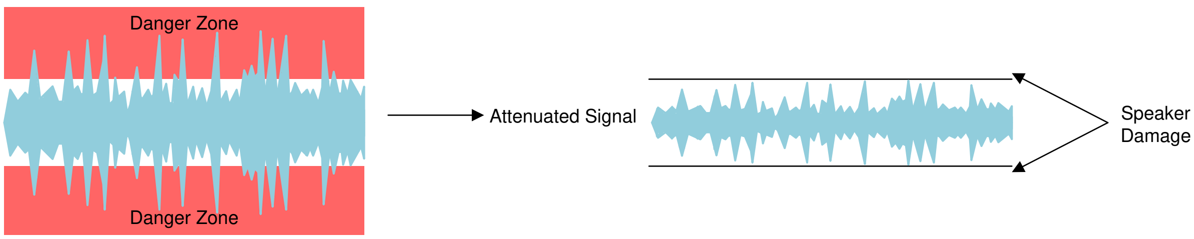

Figure 2-1. Conventional Audio Amplifier Output

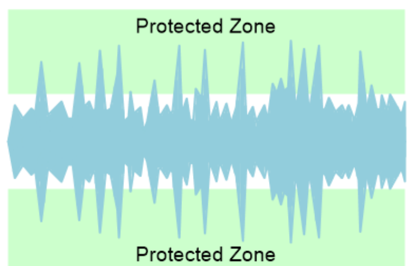

Figure 2-2. Smart Amp Protected Output

TAS2563 Smart Amp features:

- Smart Amp algorithm with enhanced speaker protections for better audio outputs
- Continuous speaker modeling and constantly optimized output power and audio peaks for maximum sound and reliability (More Info)
- Preserved audio peaks for improved audio clarity
- BOP and Limiter function for tunable power consumption with reference to battery voltage (More Info)
- Supports 12 Steps Class-H controller for internal boosting (More Info)
- High Accuracy IV sense for real time output monitoring and excursion protection (More Info)
- Noise Gate to minimize idle audio noise (More Info)
- PDM MIC input (More Info)
- Flexible digital interface with I2S/TDM (More Info)
- Spread spectrum low EMI mode (More Info)
- Device supply and temperature monitoring through I2S (More Info)
- Ultrasound (96 kHz) support with Smart Amp

3 Speaker Selection

One of the first steps in an audio design is to decide which speaker to use. There are many different parameters to look at when making this decision: output power, SPL, size, cost, and more. TI's Smart Amp products work with a wide variety of speakers on the market, and it is important to confirm the following items to ensure highest audio quality:

- Nominal speaker impedance: 3.2 to 8 Ω
- Resonant frequency: 200 to 1400 Hz

If the speaker follows the above guidelines, it will allow for the highest quality of TI audio at the maximum sound pressure level

4 Speaker Parameters

It is important to know where to obtain the speaker parameters and to ensure their accuracy when starting an audio design. For Smart Amp devices, these parameters affect how the algorithm protects the speaker. Figure 4-1 lists where to find the most important speaker parameters. Some of the parameters can be found during speaker characterization, but it is always best to request these details directly from your speaker vendor or obtain from the speaker's data sheet.

Figure 4-1. Smart Amp Speaker Parameters

Key Parameter	Obtained From Speaker Vendor/Datasheet	Obtained from Speaker Characterization
X_{max} (mm)	Yes	No
T_{max} (°C)	Yes	No
Temperature Coefficient (K^{-1})	Yes	No
Sd (cm^2)	Yes	No
BL	Yes	No
Re (Ω)	Yes	Yes
F0 (Hz)	Yes	Yes
Tolerances of Re	Yes	No
Impedance transfer function	Yes	Yes
Excursion transfer function	Yes	Yes

This is a sample speaker datasheet. Parameters such as X_{max}, T_{max}, impedance, power rating, and resonant frequency can commonly be found on the datashhet. Certain parameters such as temperature coefficient (K^{-1}), BL factor, etc. may only be available through direct request from the manufacturer.

Specifications

Parameters	Values	Units
Rated Power Handling	1	Watts
Max Power Handling	1.2	Watts
Impedance @ 2 kHz	6 ± 15%	Ohms
Sensitivity (SPL @ 2.45V/10cm) At 2 kHz in 1cc enclosure	93 ± 3	dB
Resonant Frequency (free air / in 1.5cc enclosure)	550±10% / 750±10%	Hz
Frequency Range (-10 dB, without DSM)	650 ~ 20,000	Hz
Xmax (where BL product drops by 20%)	0.3	mm
Tmax (max voice coil temperature)	90	°C
Vdrx (based on Xmax set to 0.3mm)	3.65	V

Figure 4-2. Example Speaker Datasheet Capture

5 Implemetation Flowchart

This flowchart severs as a reference for typical audio device implementation process. Typical end product applcation of TAS2563 are: smart phones, personal electronics, portable speakers, smart speakers, etc. It is recommended to begin with schematic review in the early phase of implementation to get familiarze with system and hardware requirements.

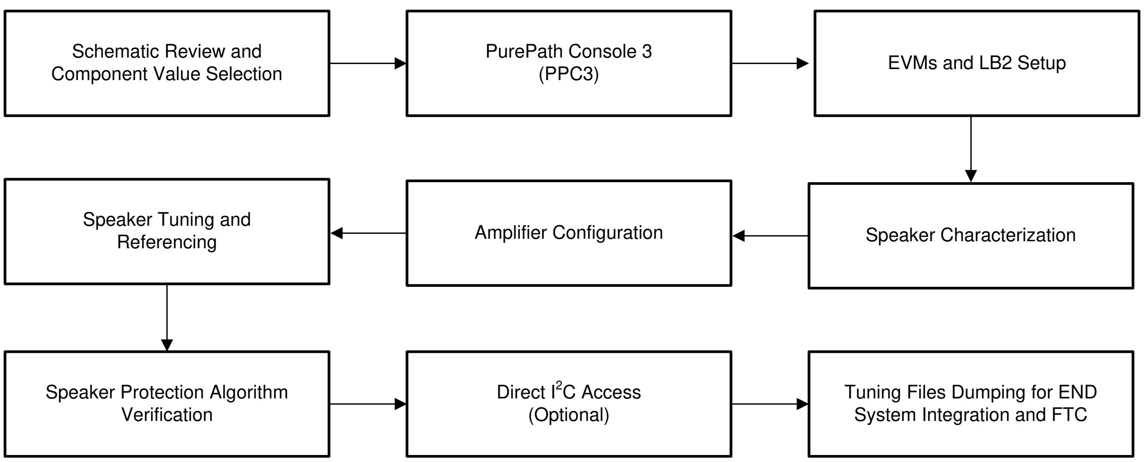

Figure 5-1. Implementation Flow Chart

6 Schematic Review

The following section will provide the typical application of the TAS2563 Smart Amp device along with design tradeoffs to consider when planning the schematic of a Smart Amp product in an audio design. This is the first step of flow chart, and it is recommended to be designed in parallel with other steps.

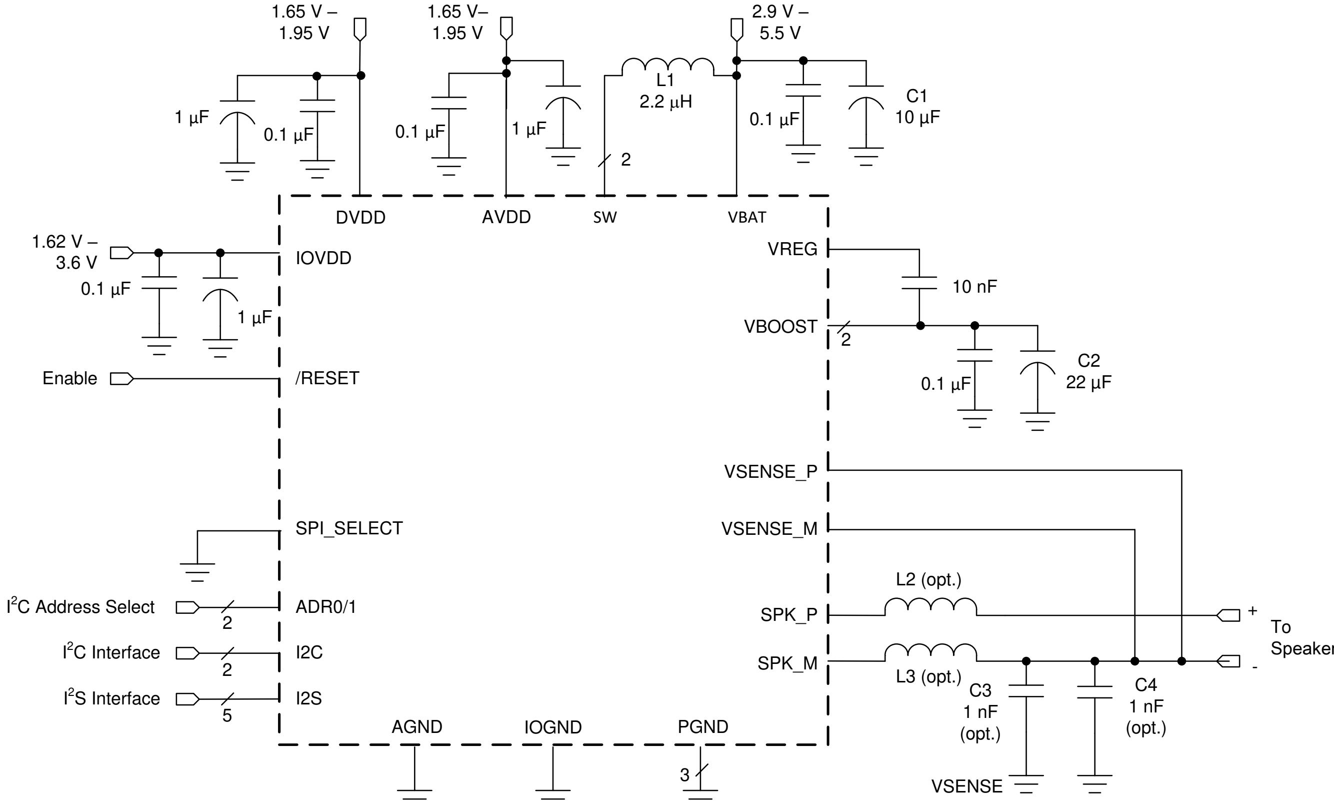

Figure 6-1. Typical Applicaiton Schematic

Table 6-1. Recommended External Components

COMPONENT	DESCIPTION	SPECIFICATION	MIN	TYP	MAX	UNIT
L1	Boost Converter Inductor	Inductance, 20% Tolerance	0.47	1		µH
		Saturation Current		4.5		A
L2, L3	EMI Filter Inductors (optional). These are not recommended as it degrades THD +N performance. TAS2563 is a filter-less Class-D and does not require these bead inductors.	Impedance at 100 MHz		120		Ω
		DC Resistance			.095	Ω
		DC Current			2	A
		Size		0402		EIA
C1	Boost Converter Input Capacitor(	Capacitance, 20% Tolerance	10			µF

Table 6-1. Recommended External Components (continued)

COMPONENT	DESCIPTION	SPECIFICATION	MIN	TYP	MAX	UNIT
C2	Boost Converter Output Capacitor	Type	X5R			
		Capacitance, 20% Tolerance	10		47	µF
		Rated Voltage	16			V
		Capacitance at 11.5 V derating	3.3			µF
C3, C4	EMI Filter Capacitors (optional, must use L2, L3 if C3, C4 used)	Capacitance		1		nF
C5	VDD Decoupling Capacitor	Capacitance	4.7			µF
C6	DREG Decoupling Capacitor	Capacitance	1			µF
C7	GREG Fly Capacitor	Capacitance	100			nF

7 Design Trade-offs

- When selecting components, be aware of the under-rated values of capacitors and inductors and provide headroom for the desired voltage ratings.
  - Capacitors
    - Use capacitors with voltage rating of at least 2x the maximum DC voltage applied to the capacitor. Capacitance may change sharply depending on the applied voltage.
    - Review the temperature dependent characteristics for the capacitor. The capacitance may change with temperature changes.
  - Inductors
    - Verify the inductor rated saturation current meets design specifications.
    - Review the DC current bias dependent characteristics of the inductor. The inductance may change sharply depending on the applied current.
    - Review the frequency dependent characteristics of the inductor. The inductance may change sharply depending on the operating frequency.
- Ferrite bead filter
  - Pay close attention to the set resonance frequency of the filter.
  - Refer to Filter-Free™ Class-D Audio Amplifiers for more information on this filter.
- Removing decoupling capacitors
  - Removal can cause noise on the supply.
  - Removal can lead to transients that affect THD+N performance of the device.
  - Removal can lead to shutting down the device if transients dip too low and as a result trigger UVLO.
- Boost converter – The capacitor and inductor must be within data sheet guidelines to maintain a stable output voltage.
  - Derating of the capacitor and inductor at bias conditions is critical.
- Plan ahead for contingencies on nodes that may be require additional filtering. For example, where EMI filters may be needed on amplifier outputs.
- It is recommended to have the schematic reviewed by a local TI resource, or by reaching out on the TI E2E™ Community

8 Layout Review

To properly utilize TAS2563 in audio application, it is critical to design the layout and the schematic accordingly to the guidelines. For detailed layout guidelines for TAS2563 and best practices, please refer to PCB Layout Guidelines and TAS2563 Schematic and Layout Guidelines.

9 PPC3

PurePath™ Console 3 is a highly integrated and easy-to-use audio development suit with user-friendly graphical user interface (GUI) designed by Texas Instruments specifically for evaluation, configuration and debug process associated with audio product development. It provides various features such as characterization, audio processing and tuning, direct register map reading, I2C communication, audio I/O configuration, system configuration, end system integration and etc.

Along with PPC3, device-specific plug-ins must be downloaded in PPC3 to interface with the device.

To download PPC3, please submit a request form from the TI website .

Plug-ins can be requested in the same PPC3 request form. For details on step-by step request and installation guide, please refer to Requesting Access to Audio Software.

Figure 9-1. PurePath Console 3

10 Playback Jumper Setting

Before speaker characterization, please ensure the EVMs and the Learning Board 2 are set as default described in Figure 10-1 and verify the jumper settings are configured for characterization. The following table can be used for default jumper setting reference.

Table 10-1. TAS2563EVM Default Jumper Setting

Jumper	Setting	Description
J3	Remove	Output 2 Sense
J11	Remove	Output 1 Sense
J16	Insert	EEPROM Write Protect
J18	I2C	Control Select
J17	0x9A	Ch 2 Address Select
J4	Insert	VDD 2
J5	Insert	IOVDD 2
J1	Insert	VBAT 2
J9 - Data	Remove	PDM Data 2
J9 - CLK	Remove	PDM Clock 2
J8 - 2	Insert	GPIO Select 2
J19	0x98	Ch 1 Address Select
J12	Insert	VDD 1
J13	Insert	IOVDD 1
J10	Insert	VBAT 1
J15 - Data	Remove	PDM Data 1
J15 - CLK	Remove	PDM Clock 1
J8 -1	Insert	GPIO Select 1

TAS2563 EVM supports both mono and dual mono/stereo playback. For each mode, configure the jumpers accordingly. Minor adjustment is *required* for characterization.

Since only one speaker can be characterized at a time, both mono and stereo speaker characterization process have jumper setting similar to that of Mono Playback. After characterization, reconfigure the jumper setting to utilize stereo playback. Otherwise, for mono playback no jumper change is needed.

Mono Playback Setup

1. Connect the speaker to J14 on TAS2563EVM
   a. (For characterization only) LC Filter is attached to J14 on TAS2563 EVM instead, and the speaker is attached to the AMP_OUT (J15) of LB2 as shown in Figure 1-2.
2. Remove jumper J1, J4, and J5 on TAS2563EVM
3. Set jumper at J19 to desired I^2C address on TAS2563EVM
4. Configure PPC3-EVM-MB as described in TAS2563EVM User Guide
   - USB control for I^2C
   - USB control for I^2S
   - 3.3 V I^2C
   - 3.3 V I^2S
   - 1.8 V IOVDD
5. Connect a 5 V supply to connector J12 or J11 on PPC3-EVM-MB
6. Connect a Micro USB cable from PC to PPC3-EVM-MB
7. Set PC default playback device as described in TAS2563EVM User Guide

Stereo Playback Setup

1. Connect a speaker to both J14 and J6 on the TAS2563EVM
2. Set the jumpers at J19 and J17 to unique I^2C addresses on TAS2563EVM
3. Configure PPC3-EVM-MB as described in TAS2563EVM User Guide
   - USB control for I^2C
   - USB control for I^2S
   - 3.3 V I^2C
   - 3.3 V I^2S
   - 1.8 V IOVDD
4. Connect a 5 V supply to connector J12 or J11 on PPC3-EVM-MB
5. Connect a Micro USB cable from PC to PPC3-EVM-MB
6. Set PC default playback device as described in TAS2563EVM User Guide

11 Speaker Characterization Overview

With integrated DSP, TAS2563 has the ability to monitor temperare and excursion limits in real-time for protected and optimized speaker output. To accuratly model the thermal and excursion reponse of the speaker, it is necessary to characterize the speaker in use during the development process in PPC3.

This section marks the second step of the a typical implemtation workflow as described in Figure 5-1. Please refer to the Characterization Applicaiton Report for a complete walk-through of the characterization Process.

Note

Mono playback jumper setting is also applicable to both Mono and Stereo speaker characterization; However, for speaker characterization the test speaker is replaced with a low pass filter and it is connected J14 of LB2 as shown in Figure 1-2 **.**

12 Amplifier Configuration

TAS2563 offers a wide range advance configurations to suit various audio system requirements. Some of the most used features include, but not limited to, Brown-Out Protection, Limiter, Boost control, and Thermal Foldback. Especially with TAS2563's integrated DSP, these functions can be easily and finely adjusted in PPC3. For detailed explanation of each configuration and its functions, please refer to other application report listed on the TAS2563 Product Page, TAS2563 Datasheet, and the TAS2563 Device Feature Overview. Please note that in order to initialize the EVMs after every power on/off, the EVM requires reload of the tuning files by simply selecting "Tuning and Audio Processing" panel of the Device Home Page as shown in Figure 13-2.

The features that are available to be configured for TAS2563 in the "Device Control" are listed in the following table:

Device Configurations	Reference Document
Limiter	More Info, Datasheet
Brown-Out Protection	More Info, Datasheet
Playback	Datasheet
PCM & TDM	Datasheet PCM, Datasheet TDM
Faults Retry	Datasheet
IRQZ	Datasheet
Idle Channel Detection	Datasheet
Thermal Foldback	More Info, Datasheet
Channel Gain Control	More Info

Amplifier configuration page can be found under “Device Control” in the PPC3 device home page shown in Figure 12-1.

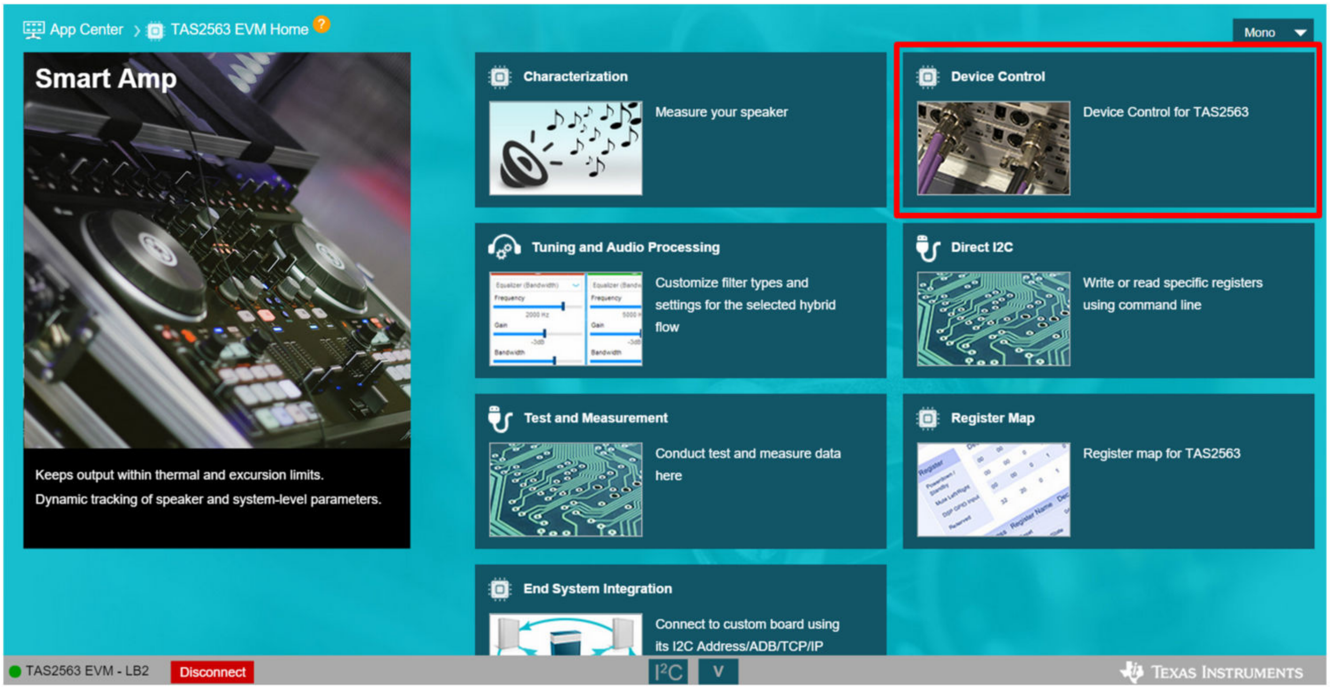

Figure 12-1. PPC3 Device Home (Need to replace to LIT image)

13 Audio Processing and Speaker Tuning

Application specific speaker tuning is a very important step to optimize the sound quality and SPL of a speaker. An example of this may be to have the highest quality sound for voice in a video doorbell or the highest quality of music playback in a portable speaker. TI's Smart Amp products allow custom speaker tuning all within the PPC3 Software GUI. PPC3 offers several easy to use tuning tools such as 5-bands equalizer, Dynamic EQ, Smart Amp Protection, and Dynamic Range Compression to mention a few.

This section will present an overview of the tuning page UI. For more information on the tuning process, please refer to the Smart Amp Tuning Guide, and TAS2563 Tuning Guide. Note that the Smart Amp Tuning Guide is applicable to all PPC3 supported Smart-Amp devices with integrated DSP, and it is not device-specific; therefore, there may be some discrepancies between the guide and TAS2563 Tuning and Audio Processing page.

To begin tuning the amplifier and the characterized speaker, please remove the Learning Board 2 and the LC filter as shown below. Only TAS2563 and PPC3-EVM-MB will be used for tuning.

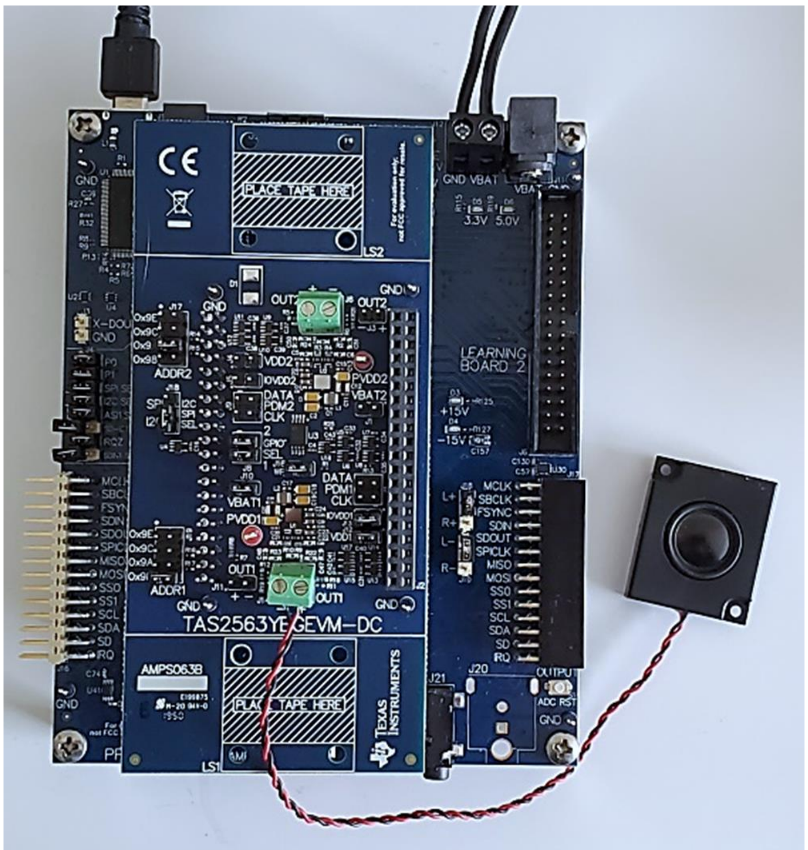

Figure 13-1. Mono Tuning Setup

Note

For Stereo tuning, please attached the second speaker to J6 of TAS2563 after completing speaker characterization for both speakers.

Select “Tuning and Audio Processing” panel of the Device Home Page (Shown in Figure 13-2).

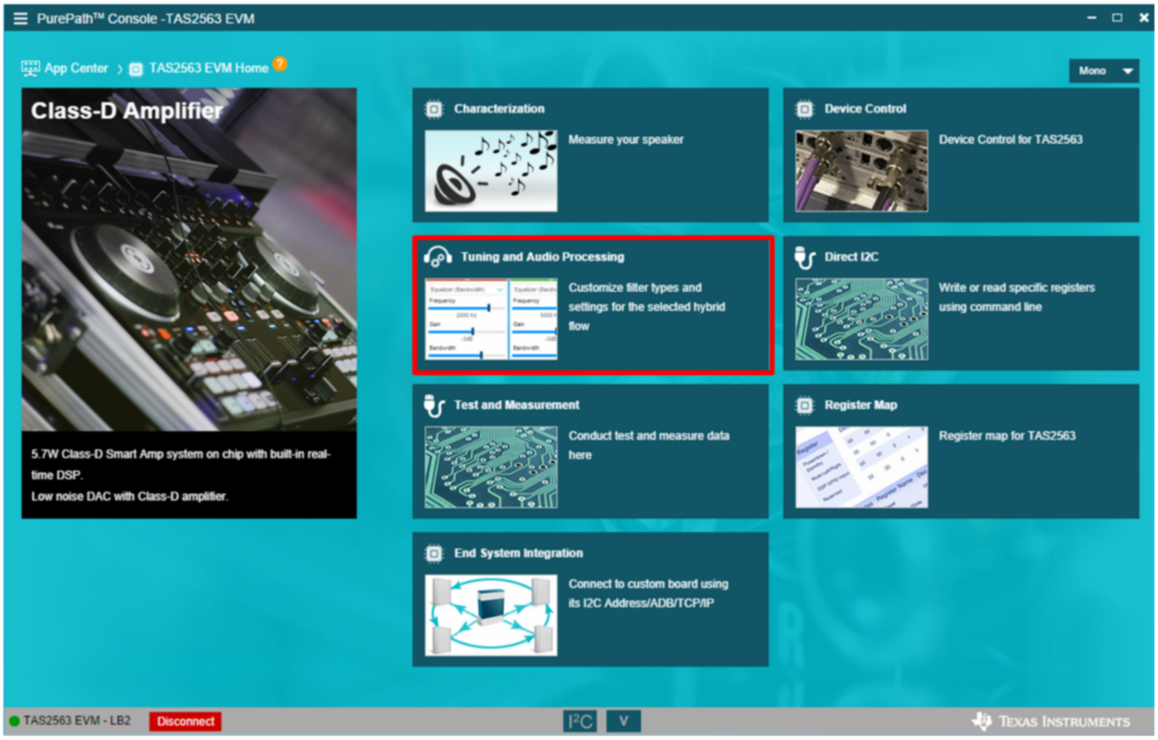

Figure 13-2. Device Home

Tuning Page UI

It is important to get familiar with GUI to improve the overall tuning experience. All of the tuning tools and features can be found within the Tuning and Audio Processing page. Please refer to Smart Amp Tuning Guide for detailed instructions on each tuning parameters. Please note each marking on Figure 13-3: Audio Processing Page as each may be important during the tuning process.

1. Speaker parameters extracted from the characterization data
2. A Snapshot tools that allows user to save an instance of the tuning page
3. Audio player that can import multiple music files for audio referencing during tuning
4. Digital input gain
5. Import tuning file and reset/reload tuning profile
6. Open Characterization Result page
7. Open GUI Demo
8. Open Smart Amp page
9. Open Equalizer page
10. Open DRC page
11. Switch/sync tuning between speaker A and speaker B, (ONLY applicable in Dual Mono/stereo mode)
12. Open DEQ

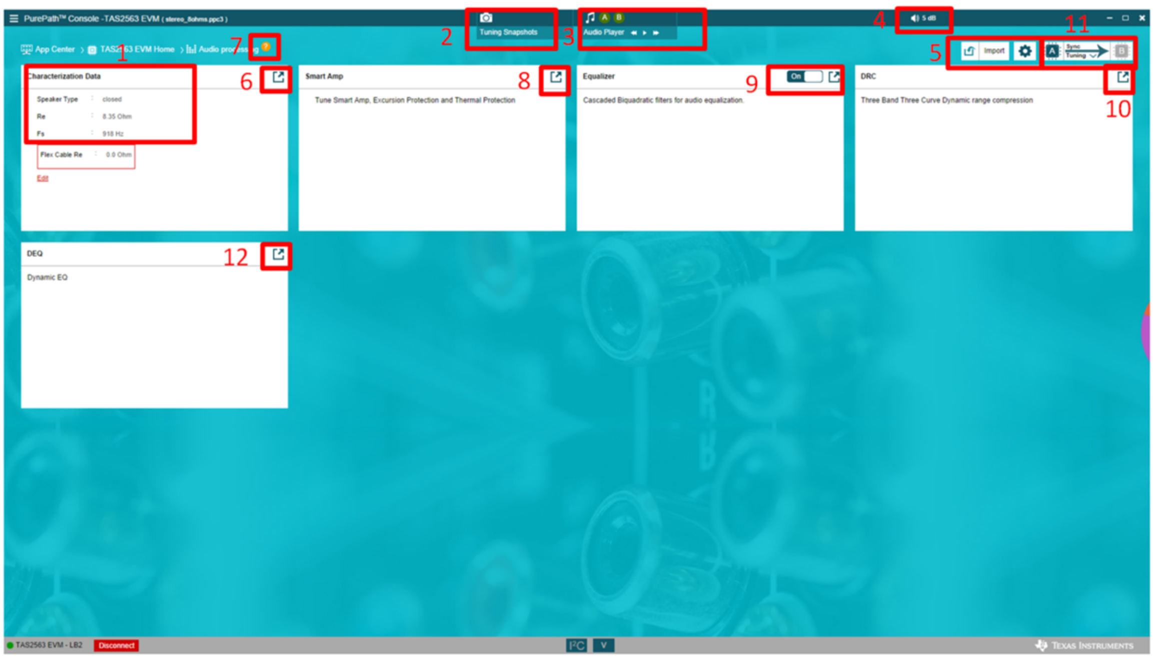

Figure 13-3. Audio Processing and Tuning Page UI

14 Speaker Protection Verification

Once the device has been tuned and configured correctly, it is important to verify the settings by actually listen to some music and voice tracks. During this verification process, user can examine the estimated excursions and temperatures, measure the excursion with a laser, compare the estimated and measured result to verify the accuracy of the estimation algorithm, visualize audio waveforms, and listen to any negative or unexpected artifacts that may occur from incorrect tuning.

Select the verification icon at the bottom of the Device Home page to access Verification window.

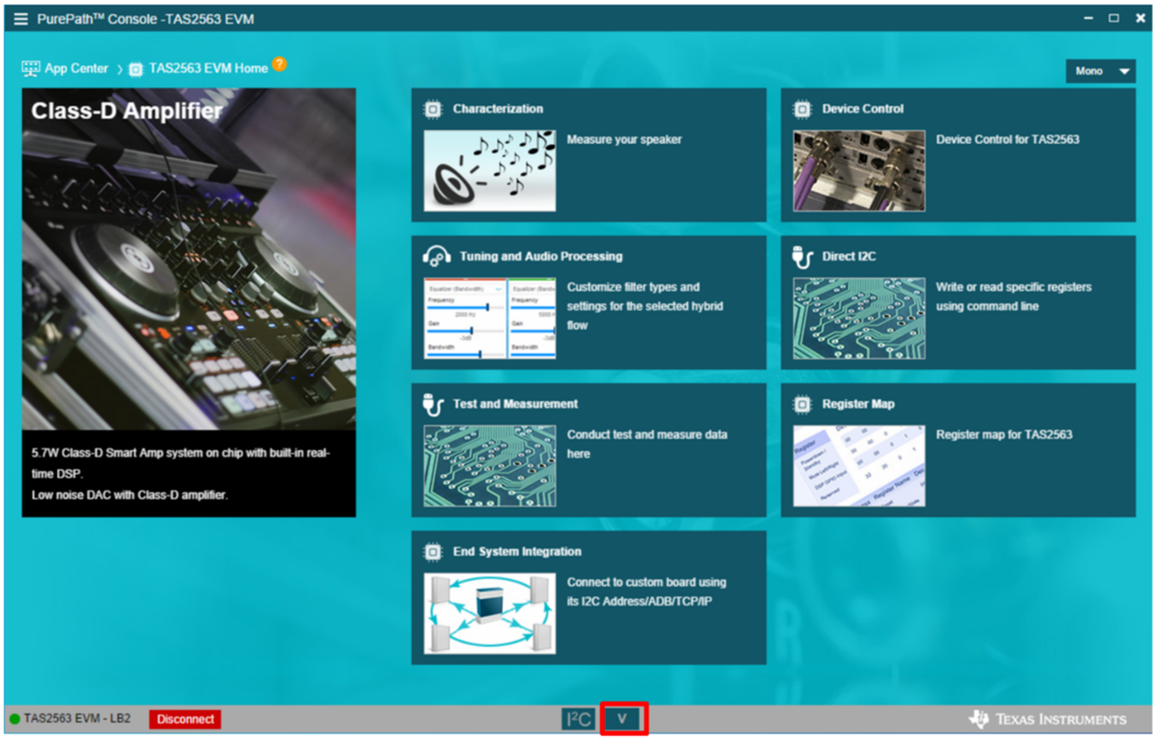

Figure 14-1. Device Home

To begin the verification processes, select “Start” on top of the Verification window and play the testing soundtracks either in any multimedia player or in PPC3 Audio Player. Please ensure that the speaker protection is working properly by determine if the temperature and the excursion is within the limit and compare the measured and estimated data. Note, in order to initialize the EVMs after every power on/power off, the EVM requires reload of the tuning files by simply selecting “Tuning and Audio Processing” panel of the Device Home

Page as shown in Figure 13-2. To measure the actual excursion, a measurement laser is required. Please refer to Figure 1-1 for laser setup and visit E2E community to ask if your laser is compatible.

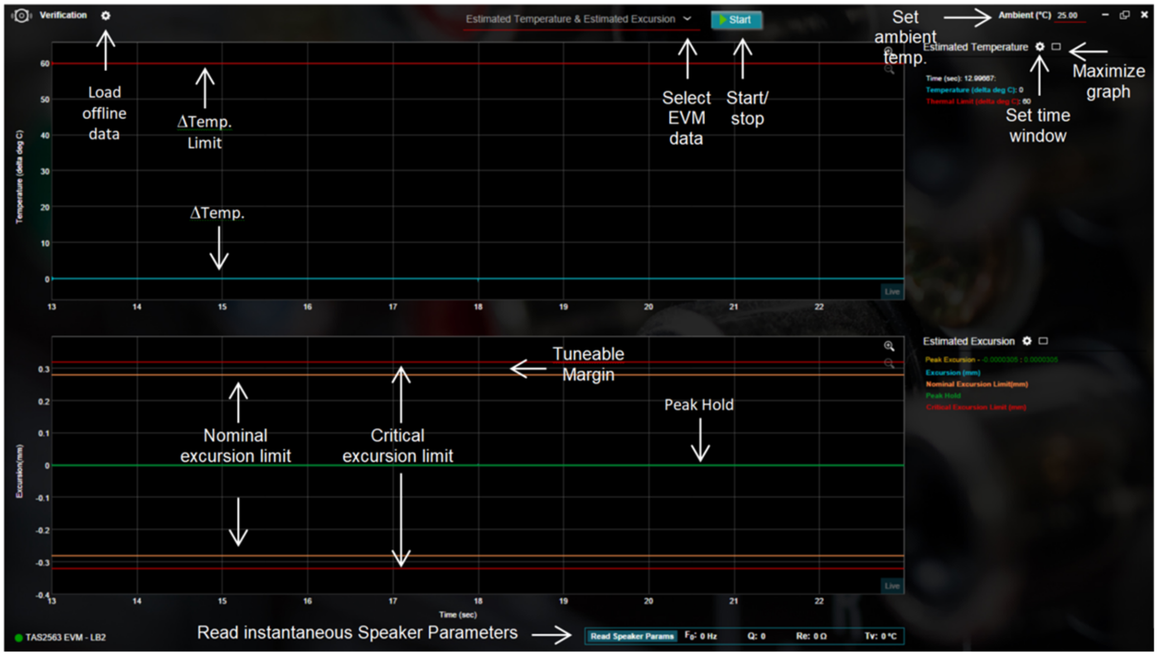

Figure 14-2. Verification Page

The waveform captures shown below are some of the examples of proper excursion protection. It is important to test the amplifier with varying degrees of volume amount different genres to observe near limit response. Piano, bass, drums, and voice are varieties of sound that serve as good test parameters for worst-case excursion and distortion. Waveforms shown in Figure 14-3 are and Figure 14-4 are examples of functioning excursion algorithm.

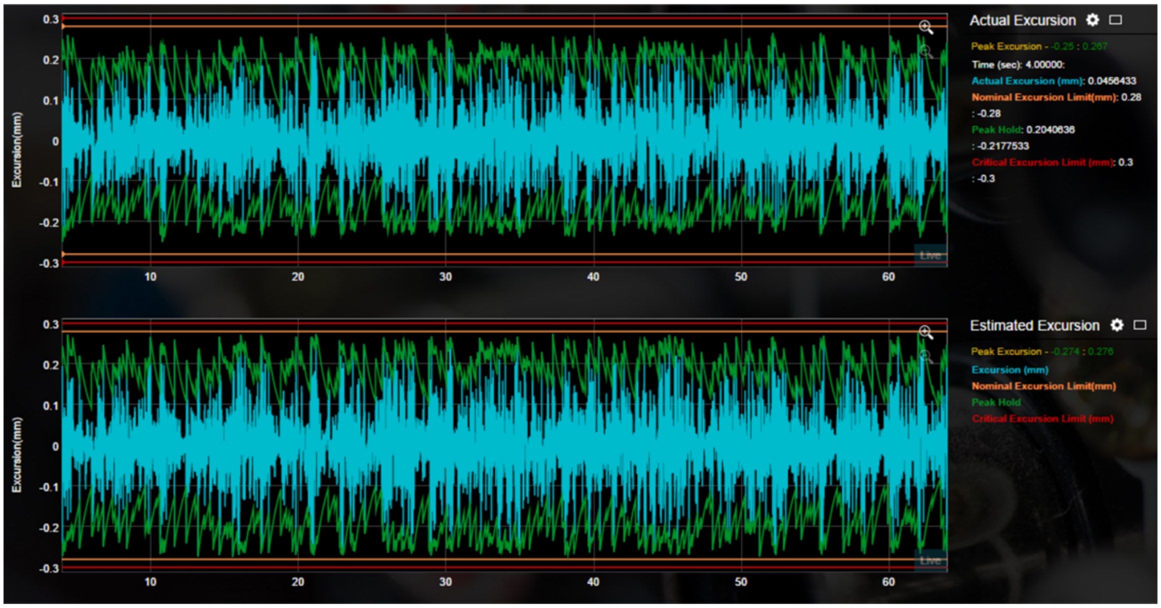

Figure 14-3. Excrusion Protection with X_{max} = 0.3 mm

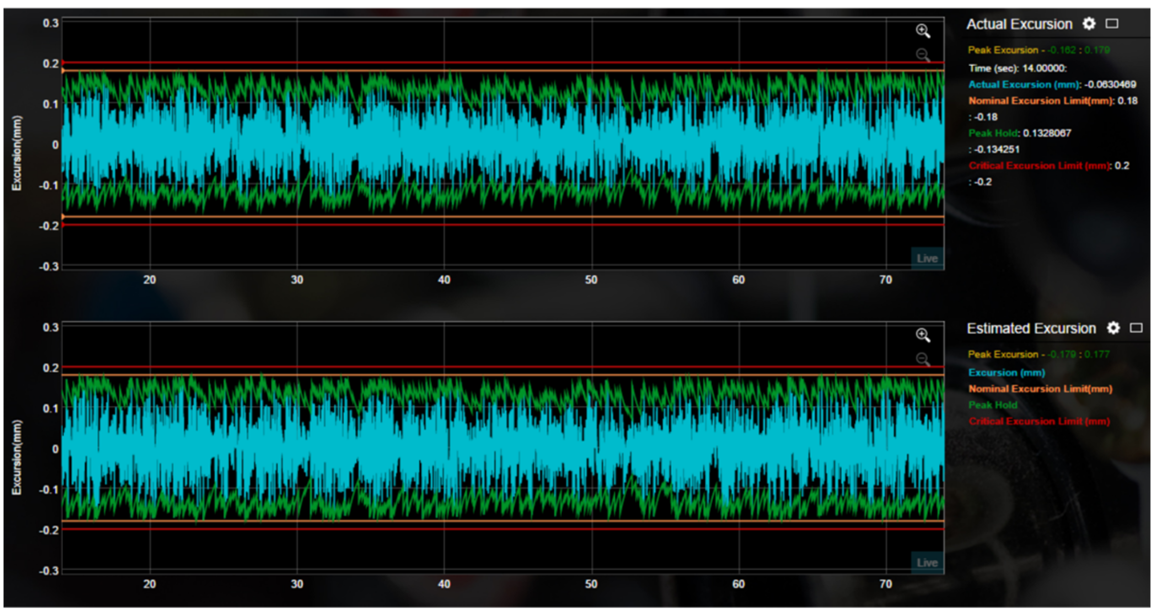

Figure 14-4. Excrusion Protection with X_{max} = 0.2 mm

Waveforms Figure 14-5 and Figure 14-6 are the examples of the properly functioning thermal protection algorithms. Each testing has a different thermal limit, 85 °C, and 55 °C. As the speaker heats up, the estimated change in temperature (Blue line) approaches near the nominal thermal limit.

The graph shows ΔT of 60 °C and ambient temperature of 25 °C

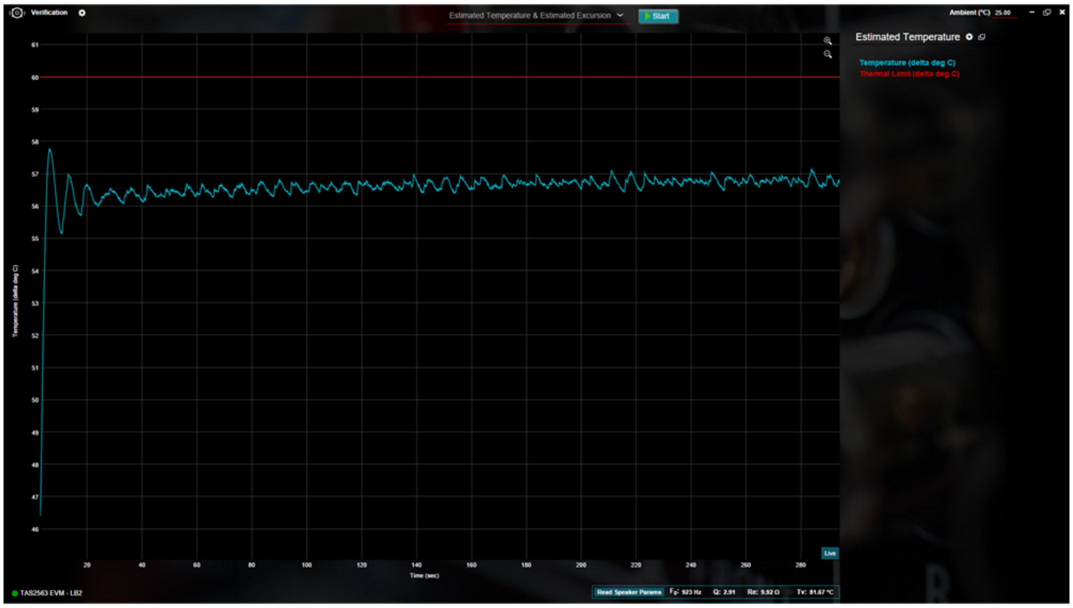

Figure 14-5. Thermal Protection Estimation with T_{max} = 85 °C

The graph shows ΔT of 30 °C and ambient temperature of 25 °C

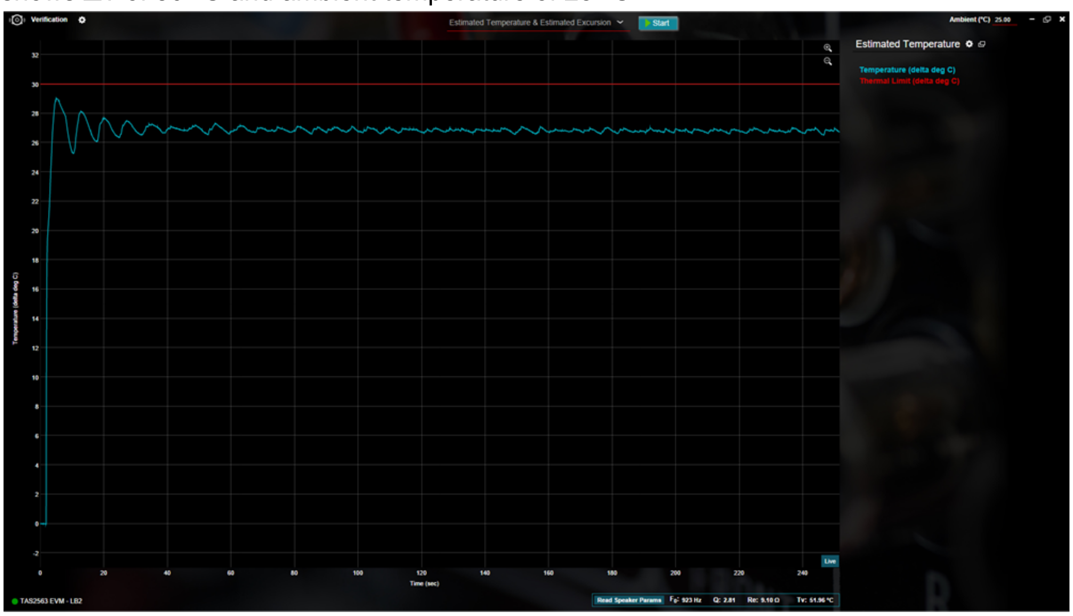

Figure 14-6. Thermal Protection Estimation with T_{max} = 55 °C

15 Direct I²C Access

PPC3 also offers direct I²C command window to communicate specific registers that are not interfaced in the GUI and for users who prefer direct I²C read/write. This section covers the format of I²C commands and a brief walk-through of some of the Direct I²C features.

Select “Direct I²C” panel of the Device Home Page to access I²C command console. I²C record tool can also be accessed in the bottom ribbon of the Device Home Page.

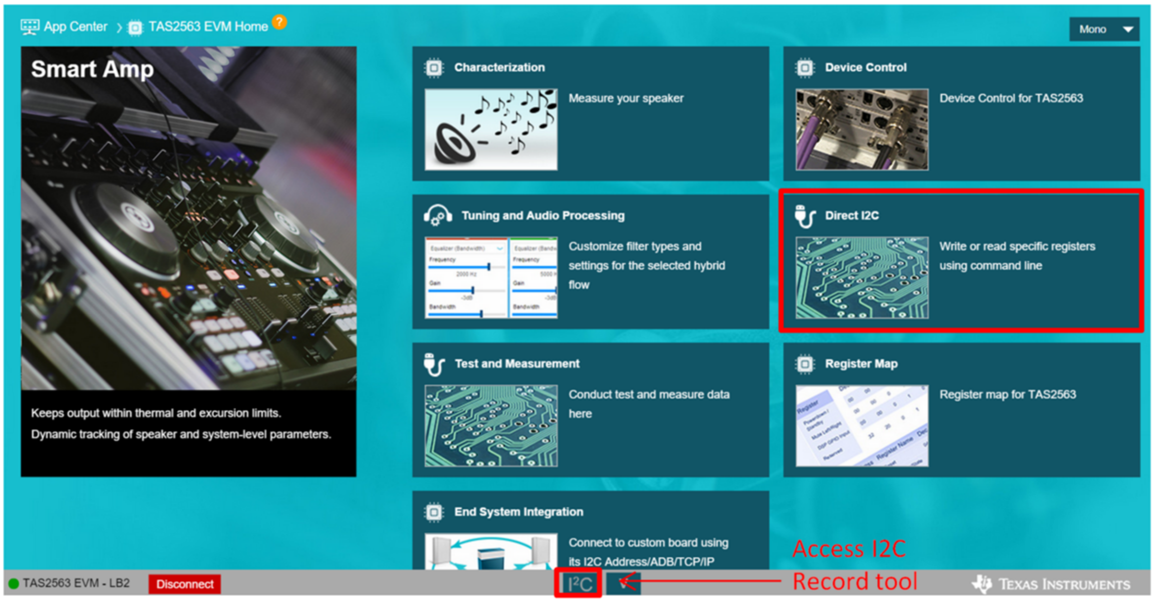

Figure 15-1. Device Home

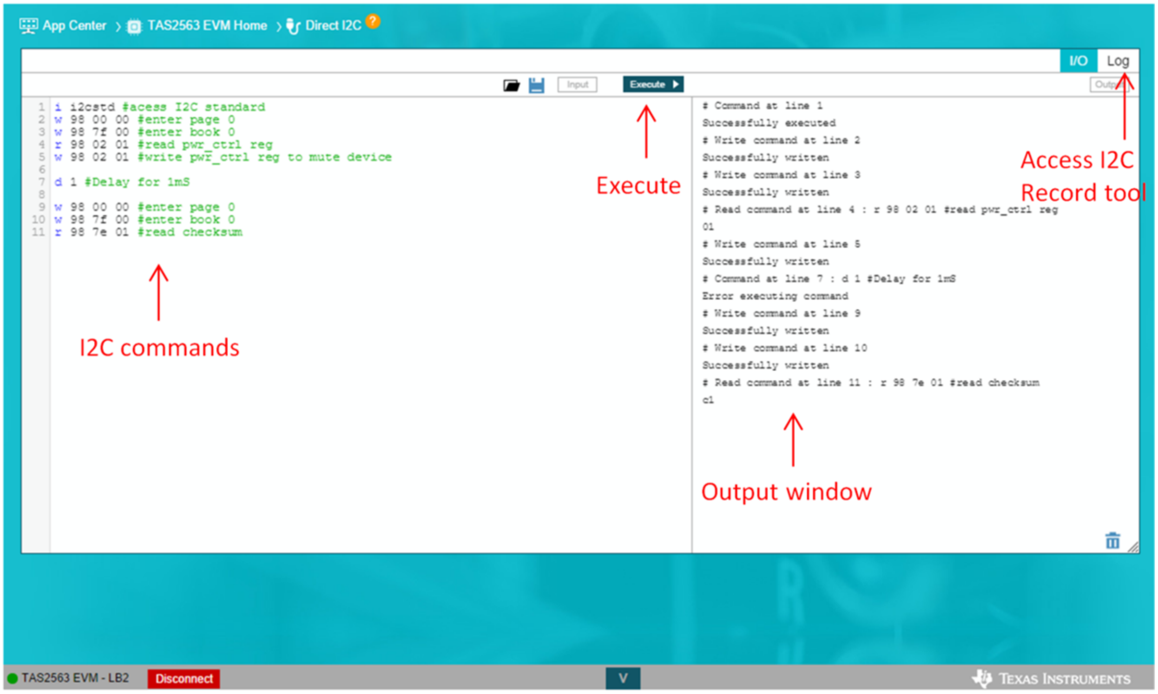

Figure 15-2. Direct I^2C

I^2C Record Tool

PPC3 Direct I^2C also offers a recording feature. To Access I^2C Recording Tool, please refer to Figure 15-1 or through the quick access I^2C window in the device home page. I^2C Recording Tool offers a quick and easy way to translate GUI commands in to I^2C commands for referencing and I^2C implementation.

For example, if an user would like to quickly generate the I^2C commands to configure the BOP threshold voltage, the user will follow the following steps: select “Record”, select “TAS2563 EVM Home” to return to the Device Home Page, select Device Control panel, adjust the “threshold voltage” in the BOP panel, select “Apply” in the top right position of the window, return to Direct I2C Recording page, and select “Stop” recording. The I^2C commands required to set the BOP threshold will be auto generated in the output window of the record tool as shown in Figure 15-3. If user would like to see specific command that was changed, a simple comparison of two generated I2C translations can easily identify the modified command.

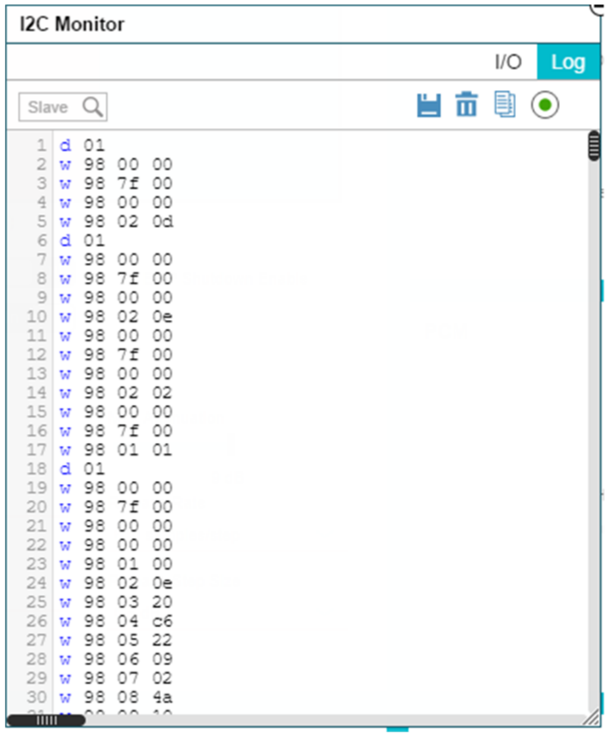

Figure 15-3. I2C Quick Acess Monitor

16 I^2C Command Syntax:

To access all of the registers available to the user, please follow the I2C command format as shown below and refer to the TAS2563 datasheet for register map.

Interface:

```
i [interface]
```

Where 'interface' is i2cstd, i2cfast, spi8, spi16, or gpio.

Register Write:

```
W [I2C Address] [register] [data 1] [data 2]…[data k]
```

Where "W" denotes write command, "I2C Address", "register", and "data" are in hexadecimal format.

Register Read:

```
r [i2c address] [register] [read amount]
```

Where 'i2c address', 'register' and 'read amount' are in hexadecimal format and read amount is less than or equal to 32 (0x20).

Delay:

```
d [delay time]
```

Where "delay time" is the delay time in decimal milliseconds format.

Break Point:

```
b ["string"]
```

Where "string" can be any string of characters to be displayed at a pop-up message

Wait for Flag:

```
f [i2c address] [register] [D7][D6][D5][D4][D3][D2][D1][D0]
```

Where 'i2c address' and 'register' are in hexadecimal format and 'D7' through 'D0' are in binary format with values of 0, 1, or X for don't care.

I^2C Command Example:

```
w 98 00 00 #enter page 0
w 98 7f 00 #enter book 0
r 98 02 01 #read pwr_ctrl reg
w 98 02 01 #write pwr_ctrl reg to mute device
d 1 #Delay for 1mS
w 98 00 00 #enter page 0
w 98 7f 00 #enter book 0
r 98 7e 01 #read checksum
```

17 End System Integration Overview

The last step of the develpment process using PPC3 is the End-System Integration. In End-System Integraion, users can export the tuning file, the characterization data, and the device configuration in to single binary formatted file for the device driver. Users can also assign separate snapshots of tuning configuration for different application (e.g. Doorbell chime and music playback) and set ASI Record Channel for specific data reading or audio out for echo referencing application.

In addition, this process also offers users to define the pass/fail limits of speaker parameters during the calibration step, or Factory Test and Calibration. Since speaker parameters such as Re, Fs, Q factor, and temperature limit may vary from speaker to speaker, it is recommended to calibrate the speaker model to parameter variations to avoid fitting one speaker model to all speakers. This ensures all speakers are modeled accurately to to provide the best optimized performance.

To access the End-System Integration panel, please selcct "End-System Integration" in the PPC3 Device Home page. For detailed steps

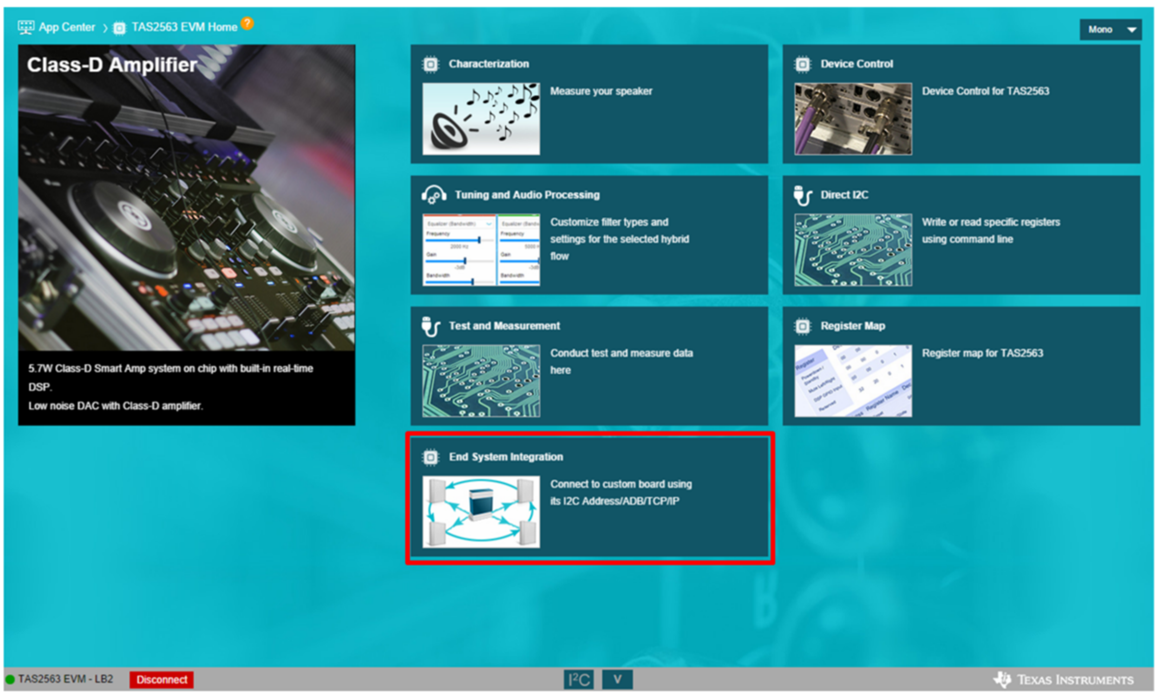

Figure 17-1. End System Integration

18 References

This guide is only intended to offer users a simplified begin-to-end implementaion of TI Smart Amp devices. It serves as a reference for those who are not familiar with TI Smart Amp devices, and it does not include all of the functionalities and features of which PPC3 or TAS2563 provide. For more details regarding the device or the PPC3, please refer to the listed helpful links.

Helpful Links and Trainings:

E2E Forum	https://e2e.ti.com/
TAS2563 Product Page	https://www.ti.com/product/TAS2563
TAS2563 Datasheet	https://www.ti.com/lit/gpn/tas2563
PPC3	https://training.ti.com/ppc3
TI Sample Ordering Page	http://samples.ti.com/
TI Store	https://www.ti.com/store
TAS2563 User's Guide	https://www.ti.com/lit/pdf/slau800
PPC3-EVM-MB User's Guide	https://www.ti.com/lit/pdf/sleu120
Learning Board 2 User's Guide	https://www.ti.com/lit/ug/slou422a/slou422a.pdf