

TAS278X_Mono Speaker Characterization

Setup of Mono Speaker Characterization

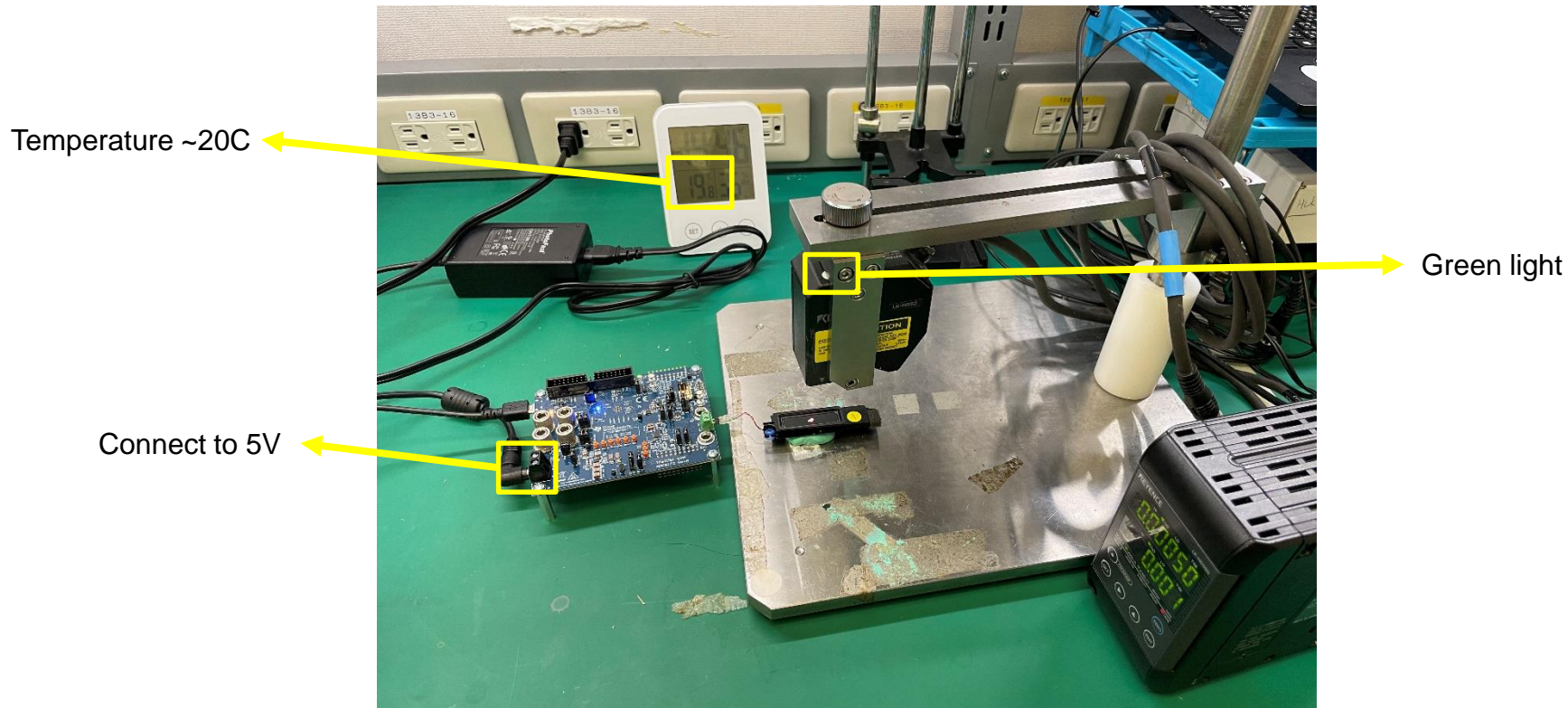
Software

- TAS2781_v3.0.1-alpha50 or newer

Hardware

- TAS2781 Mono EVM
- 5V adapter
- LK laser meter(Optional)

Hardware Setup



Flow

1. Go to Audio Processing set parameters
 - a) Set Re value to 4 ohm(Default is 6.7ohm)
 - b) Set Sd
2. Connect
3. Go to Audio Processing to load algorithm
4. Go to Char page and start Char

Choose speaker config – Mono => Start

The screenshot displays the PurePath™ Console interface for the TAS2781/83 device. The window title is "PurePath™ Console -TAS2781/83". The breadcrumb navigation shows "App Center > TAS2781/83 Home (Mono)". The top right corner includes "I2c Address" and a dropdown menu set to "Mono". A red "START" button with a right-pointing arrow is visible in the top right.

The main content area features a welcome message: "Welcome! Select **speaker configuration** and start tuning". Below this, there is a "Number Of Amplifiers" dropdown menu set to "1". Two configuration options are presented:

- Mono:** A diagram shows a TAS2781/83 chip connected to a single speaker icon. Below the diagram, it states "One device drives one speaker".
- 1 Amp Dual Membrane:** A diagram shows a TAS2781/83 chip connected to a dual membrane speaker icon. Below the diagram, it states "One device drives one dual membrane speaker".

A link at the bottom right of the configuration area reads "Continue Previous Session (Dual Mono)". The bottom status bar shows "TAS2781/83 - offline", a "Connect" button, "iPC", and the "TEXAS INSTRUMENTS" logo.

Go to Tuning and Audio Processing

PurePath™ Console -TAS2781/83

App Center > TAS2781/83 Home (1 Amp Dual Membrane)

I2c Address 1 Amp Dual Membrane

Tuning and Audio Processing
Tune Smart Amp and voice your speaker

Equalizer (Bandwidth) Equalizer (Gain)
Frequency Frequency
Gain 2000 Hz Gain 2000 Hz
Bandwidth 100 Hz Bandwidth 100 Hz

Characterization
Measure your speaker

Device Control
Device Control for TAS2781

Direct I2C
Write or read specific registers using command line

Register Map
Register map for TAS2781

End System Integration
Insystem Tuning or Creating bin for end-system integration

System Checks
Perform system diagnostics

Documentation
Audio Enhancement, Speaker Protection and Audio Processing, User Guide and Y-Bridge Documentations

Digital input smart amp with integrated speaker protection, advanced EQ evaluation module.

TAS2781/83 - offline

PC V

TEXAS INSTRUMENTS

Select configuration 3

PurePath™ Console -TAS2781/83

App Center > TAS2781/83 Home (1 Amp Dual Membrane) > Audio processing ?

Common Features : Speaker Protection, Volume, VBAT Power Limiter, Biquads (10) and Dynamic Range Compression (3-Band)

Select Audio Mode

Feature	Configuration 1	Configuration 2	Configuration 3
	Select	Select	Select
DEQ	×	×	✓
PBE	✓	✓	×
External classH	✓	×	×
Rattle Noise Suppressor	×	✓	✓

TAS2781/83 - offline PC V TEXAS INSTRUMENTS

1.Go to Audio Processing chose characterization Data

PurePath™ Console -TAS2781/83

Tuning Snapshots Audio Player

App Center > TAS2781/83 Home (Mono) > Audio processing

Import

Characterization Data

Warning: You are using the default data!

Speaker Type : closed

Re : 6.00 Ohm

Fs : 891 Hz

Flex Cable Re : 0.0 Ohm

[Edit](#)

Smart Amp

On

Tune Smart Amp, Excursion Protection and Thermal Protection

Equalizer

Off

Cascaded Biquadratic filters for audio equalization.

DRC 3-Band

Off

Three Band Three Curve Dynamic range compression

VBAT Power Limiter

Power Limiter and Advanced Battery Guard

Rattle Noise Suppressor

Off

Suppresses the speaker rattle noise

TDM

Configure TDM receiver and transmitter settings

DEQ

Off

Dynamic EQ

Successfully updated coefficients

TAS2781/83 - offline Connect PC V TEXAS INSTRUMENTS

1. Set parameters(Re/Sd)

The screenshot displays the PurePath™ Console interface for a TAS2781/83 device. The main window is titled "PurePath™ Console - TAS2781/83" and shows a navigation path: "App Center > TAS2781/83 Home (Mono) > Audio processing > Characterization".

The central part of the interface features a graph titled "SPL Response". The y-axis is labeled "Gain (dB)" and ranges from -50 to 30. The x-axis is labeled "Frequency (Hz)" and ranges from 200 to 3k. A blue line represents the speaker response, showing a gain that increases from approximately -40 dB at 200 Hz to a peak of about 5 dB at 1000 Hz, then slightly decreases. The graph has tabs for "Speaker Response", "Modeled", and "Measured". A button above the graph says "Click delete icon to load Default Char data".

Below the graph are four parameter panels:

- Driver:** Contains input fields for R_e (8 Ohm), S_d (0.960 cm²), and Flex Cable R_e (0 Ohm). The R_e and S_d fields are highlighted with a red box.
- Driver Model - Thiele Small:** Contains fields for F_s (891 Hz), Q_{ts} (2.27), V_{as} (0.000620 liter), Q_{ms} (4.59), Q_{es} (4.50), and a checkbox for "Flex Cable R_e Before Sense".
- Temperature:** Contains fields for Temperature Coefficient (0.00390 K⁻¹), Integral Gain 1 (0.0100 K/W), Integral Gain 2 (0.0160 K/W), Proportional Gain (0.0720 K/W), and Integral Cutoff (74.0 %).
- SOA - Limits:** Contains fields for Excursion Limit (Critical) (0.320 mm), Excursion Limit (Nominal) (0.280 mm), Thermal Limit (80.0 °C), and Actual Thermal Limit (75 °C).

At the bottom of the interface, there is a status bar showing "TAS2781/83 - offline", a "Connect" button, "IPC" and "V" buttons, and the Texas Instruments logo.

2. Connect

The screenshot displays the PurePath™ Console interface for device TAS2781/83. The main content area is titled "Audio processing" and contains eight configuration panels:

- Characterization Data:** Shows speaker parameters: Speaker Type (closed), Re (6.70 Ohm), Fs (891 Hz), and Flex Cable Re (0.0 Ohm). A warning message states "Warning: You are using the default data!". An "Edit" link is present below the parameters.
- Smart Amp:** Toggles "On" and includes a description: "Tune Smart Amp, Excursion Protection and Thermal Protection".
- Equalizer:** Toggles "Off" and includes a description: "Cascaded Biquadratic filters for audio equalization".
- DRC 3-Band:** Toggles "Off" and includes a description: "Three Band Three Curve Dynamic range compression".
- VBAT Power Limiter:** Includes a description: "Power Limiter and Advanced Battery Guard".
- Rattle Noise Suppressor:** Toggles "Off" and includes a description: "Suppresses the speaker rattle noise".
- TDM:** Includes a description: "Configure TDM receiver and transmitter settings".
- DEQ:** Toggles "Off" and includes a description: "Dynamic EQ".

At the bottom of the interface, the status bar shows "TAS2781/83 - offline" and a "Connect" button, which is highlighted with a red box. Other elements include "Tuning Snapshots", "Audio Player", and "Import" buttons at the top, and "PC" and "V" buttons at the bottom.

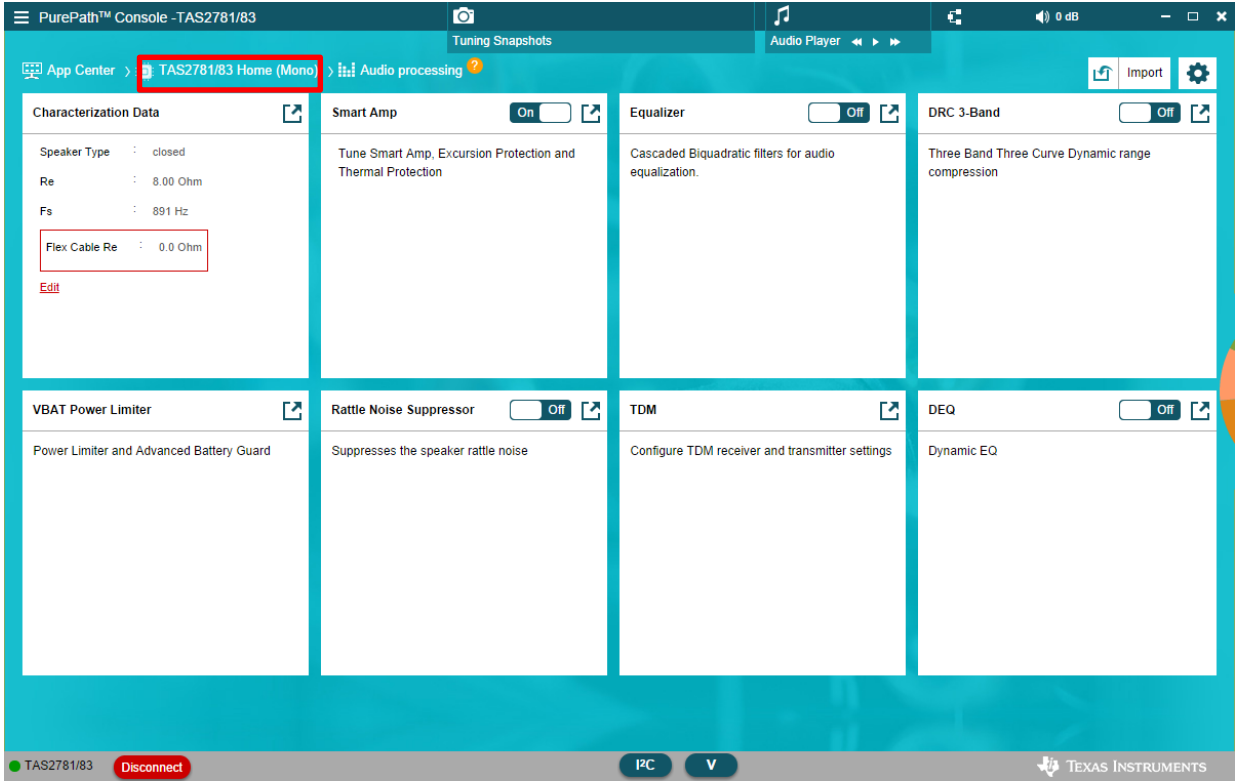
3. Go to Audio Processing to load algorithm

The screenshot shows the PurePath™ Console interface for TAS2781/83. The interface is divided into several sections:

- Class-D Amplifier:** A large image of a DJ mixer with the text "Class-D Amplifier" and "5.7W Class-D Smart Amp system on chip with built-in real-time DSP. Low noise DAC with Class-D amplifier."
- Characterization:** "Measure your speaker" with a speaker icon and musical notes.
- Tuning and Audio Processing:** This tile is highlighted with a red box. It contains a sub-interface with two columns of controls: "Equalizer (Bandwidth)" and "Gain" on the left, and "Equalizer (Bandwidth)" and "Gain" on the right. The text "Customize filter types and settings for the selected hybrid flow" is to the right of these controls.
- Device Control:** "Device Control for TAS2781" with a photo of the device.
- Direct I2C:** "Write or read specific registers using command line" with a circuit board icon.
- Register Map:** "Register map for TAS2781" with a photo of a register map document.
- End System Integration:** "Insystem Tuning or Creating bin for end-system integration" with a diagram of a system.
- System Checks:** "Perform system diagnostics" with a photo of a pen and papers.
- Documentation:** "Audio Enhancement, Speaker Protection and Audio Processing, User Guide and Y-Bridge Documentations" with a photo of documents.

At the bottom of the interface, there is a status bar with "TAS2781/83", a "Disconnect" button, "I2C" and "V" buttons, and the "TEXAS INSTRUMENTS" logo.

Back to home page



4. Go to Char page and start Char

PurePath™ Console -TAS2781/83

App Center > TAS2781/83 Home (Mono)

I2c Address Mono

Class-D Amplifier

5.7W Class-D Smart Amp system on chip with built-in real-time DSP.
Low noise DAC with Class-D amplifier.

- Characterization**
Measure your speaker
- Tuning and Audio Processing**
Tune Smart Amp and voice your speaker
- Register Map**
Register map for TAS2781
- Documentation**
Audio Enhancement, Speaker Protection and Audio Processing, User Guide and Y-Bridge Documentations
- Device Control**
Device Control for TAS2781
- Direct I2C**
Write or read specific registers using command line
- End System Integration**
Insystem Tuning or Creating bin for end-system integration

TAS2781/83 Disconnect I2C V TEXAS INSTRUMENTS

Preparation => Refer to the link to make sure the PC sound setting

The screenshot displays the PurePath™ Console interface for the TAS2781/83 device. The breadcrumb navigation shows: App Center > TAS2781/83 Home (Mono) > Characterization. A progress bar at the top contains several steps: Preparation (highlighted with a red box), Speaker Selection, Re Calibration, SOA, Thermal Char, IV Measurement, Model Fit, and Determine BI. The main content area is titled "Connect Speaker to EVM" and includes the instruction: "Now connect the speaker A to 2781 EVM as shown below." Below this, a note states: "Note: Please ensure that PC Sound settings are configured as per the setup guide: [\(click here to open the setup guide\)](#)" (the link is highlighted with a red box). A diagram shows a grey box labeled "TAS2781" with a USB cable on the left and a speaker labeled "A" on the right. The speaker is connected to a blue audio jack. Navigation buttons "Prev" and "Next" (highlighted with a red box) are located at the bottom left and right of the main content area, respectively. The bottom status bar shows "TAS2781/83", a "Disconnect" button, "PC" and "V" buttons, and the "TEXAS INSTRUMENTS" logo.

Hardware check

PurePath™ Console -TAS2781/83

App Center > TAS2781/83 Home (Mono) > Characterization ?

Preparation Speaker Selection Re Calibration SOA Thermal Char IV Measurement Model Fit Determine BI

Hardware Checks

We will begin by checking if the 2781 EVM is correctly configured and if the algo is running successfully in the PC

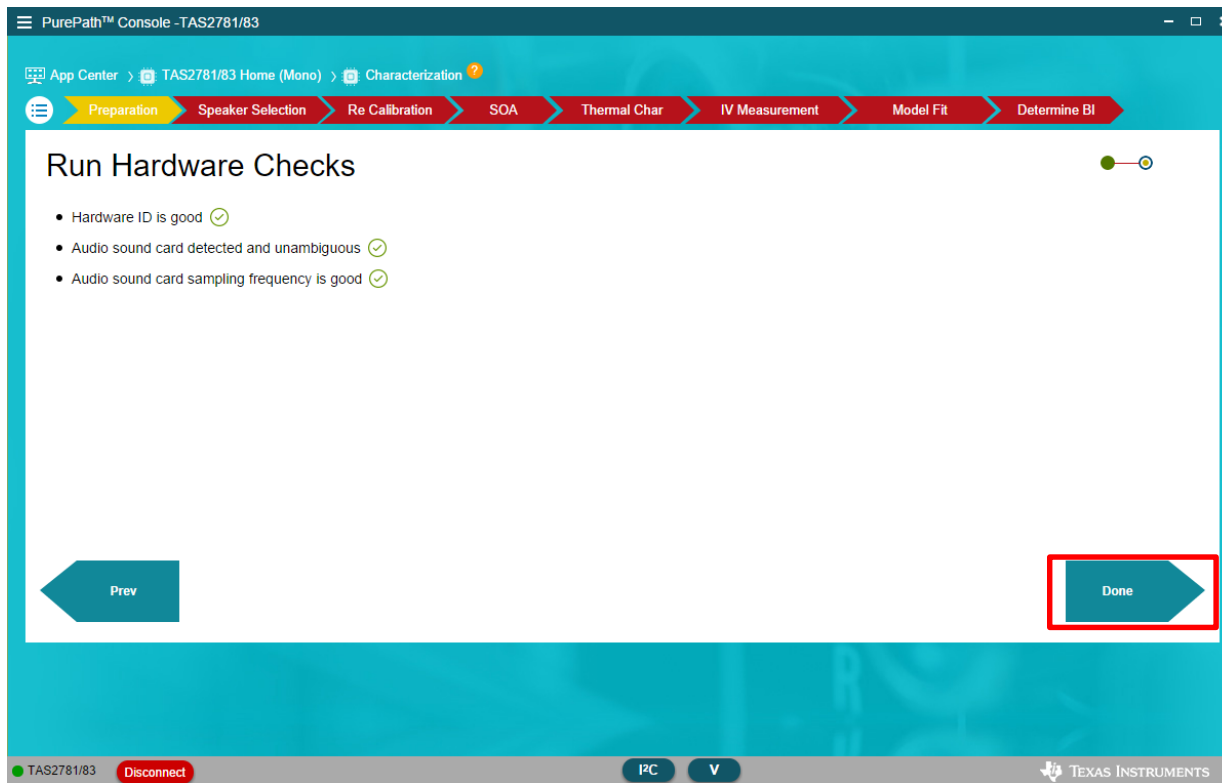
If you are confident that there are no setup issues, you may skip these checks.

Skip Checks

Prev Start Checks

TAS2781/83 Disconnect PC V TEXAS INSTRUMENTS

Hardware check => All green light => Done



PurePath™ Console -TAS2781/83

App Center > TAS2781/83 Home (Mono) > Characterization ?

Preparation > Speaker Selection > Re Calibration > SOA > Thermal Char > IV Measurement > Model Fit > Determine BI

Run Hardware Checks

- Hardware ID is good ✓
- Audio sound card detected and unambiguous ✓
- Audio sound card sampling frequency is good ✓

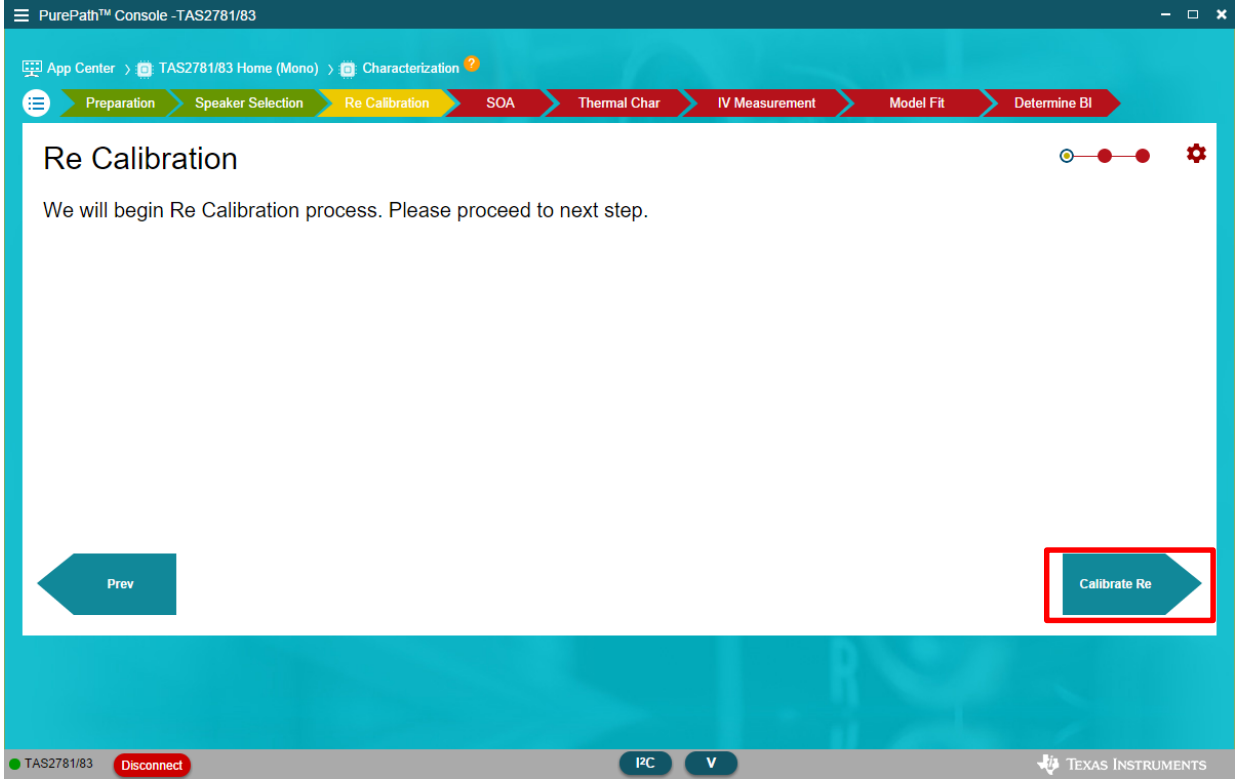
Prev Done

TAS2781/83 Disconnect PC V TEXAS INSTRUMENTS

Choose speaker type

The screenshot shows the PurePath™ Console software interface. The title bar reads "PurePath™ Console - TAS2781/83". The breadcrumb navigation is "App Center > TAS2781/83 Home (Mono) > Characterization". A progress bar at the top contains the following steps: Preparation, Speaker Selection (highlighted in yellow), Re Calibration, SOA, Thermal Char, IV Measurement, Model Fit, and Determine BI. The main content area is titled "Choose your Speaker Type" and contains the text: "We are now ready to begin IV Measurements. We'll play some test patterns and measure current and voltage to determine speaker impedance vs frequency. Before we begin, please identify the speaker system you are using." Below the text is a diagram of a "Microspeaker(Single Driver Closed Box)" with a red border. The diagram shows a speaker cone and two terminals labeled "+" and "-". A "Prev" button is located at the bottom left of the content area. The bottom status bar shows "TAS2781/83", a "Disconnect" button, "PC" and "V" indicators, and the "TEXAS INSTRUMENTS" logo.

Re calibration



Re calibration

The screenshot displays the PurePath™ Console interface for device TAS2781/83. The breadcrumb navigation shows: App Center > TAS2781/83 Home (Mono) > Characterization. A progress bar at the top indicates the current step is 'Re Calibration', with previous steps (Preparation, Speaker Selection) in green and subsequent steps (SOA, Thermal Char, IV Measurement, Model Fit, Determine BI) in red. The main content area is titled 'Re Calibration' and displays the text 'Calibrated Re Value is 8.18 ohms'. At the bottom of the main area, there are three buttons: 'Re-run Re Calib' (left-pointing arrow), 'Abort' (red square), and 'Accept' (right-pointing arrow, highlighted with a red border). A status bar at the bottom shows 'TAS2781/83' with a 'Disconnect' button, 'PC' and 'V' indicators, and the 'TEXAS INSTRUMENTS' logo. A small notification box in the bottom right corner reads 'Resetting to GUI values'.

SOA setting

PurePath™ Console - TAS2781/83

App Center > TAS2781/83 Home (Mono) > Characterization ?

Preparation > Speaker Selection > Re Calibration > **SOA** > Thermal Char > IV Measurement > Model Fit > Determine BI

Safe Operating Area

Before you can begin using the Smart Amp algorithm, you need to specify the safe operating area (SOA) of the speaker for both excursion and thermal limits.

Excursion Limit (Critical): ⓘ

Thermal Limit: ⓘ

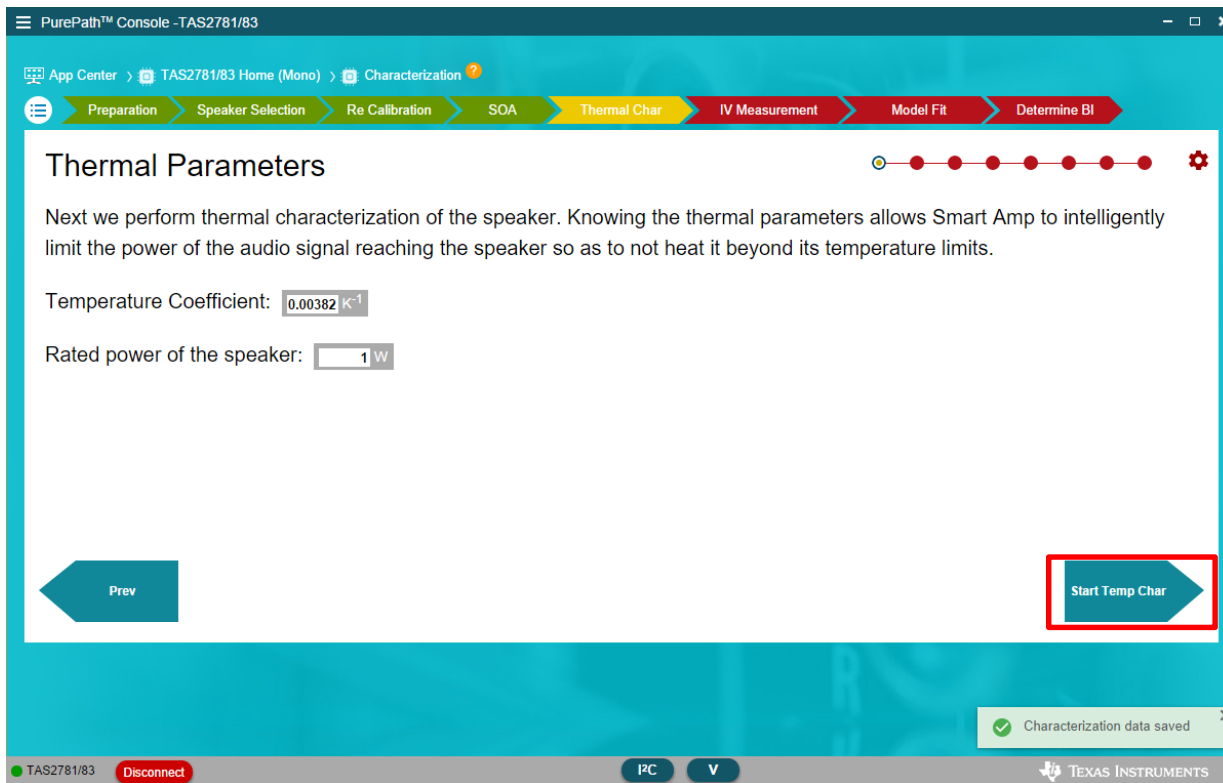
CAUTION: It is extremely critical that System Gain, Excursion Limit and Thermal Limit are set correctly and according to the system specifications. With improper settings Smart Amp can potentially overload the system causing permanent failure.

Prev Accept

Characterization data saved

TAS2781/83 Disconnect PC V TEXAS INSTRUMENTS

Thermal characterization



PurePath™ Console - TAS2781/83

App Center > TAS2781/83 Home (Mono) > Characterization

Preparation > Speaker Selection > Re Calibration > SOA > Thermal Char > IV Measurement > Model Fit > Determine BI

Thermal Parameters

Next we perform thermal characterization of the speaker. Knowing the thermal parameters allows Smart Amp to intelligently limit the power of the audio signal reaching the speaker so as to not heat it beyond its temperature limits.

Temperature Coefficient:

Rated power of the speaker:

Prev Start Temp Char

Characterization data saved

TAS2781/83 Disconnect PC V TEXAS INSTRUMENTS

Thermal characterization

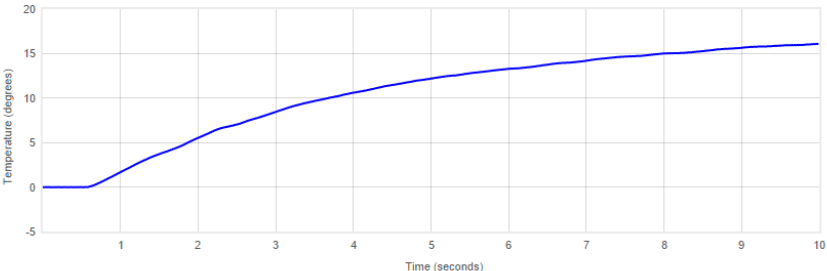
PurePath™ Console - TAS2781/83 (CHAR.ppc3)

App Center > TAS2781/83 Home (Mono) > Characterization

Preparation > Speaker Selection > Re Calibration > SOA > Thermal Char > IV Measurement > Model Fit > Determine BI

Review Kp Char Model

If the plot or the parameters appear incorrect, run the Kp characterization once again. Remember to allow the speaker to cool down, or use a different speaker of the same type.



Kp Comp
Kp Comp: 0.0811

Change Kp Init Abort Accept

TAS2781/83 Disconnect PC V TEXAS INSTRUMENTS

Thermal characterization

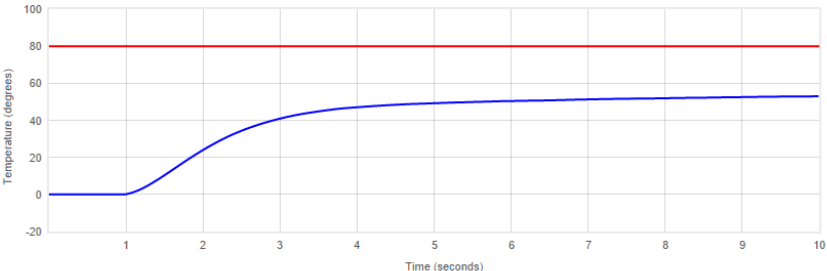
PurePath™ Console - TAS2781/83 (CHAR.ppc3)

App Center > TAS2781/83 Home (Mono) > Characterization

Preparation > Speaker Selection > Re Calibration > SOA > Thermal Char > IV Measurement > Model Fit > Determine BI

Review Thermal Model

If the plot or the parameters appear incorrect, run this step once again. Remember to allow the speaker to cool down, or use a different speaker of the same type.



Thermal Model
Proportional Gain: 0.0811
Integral Gain 1: 0.0113
Integral Gain 2: 0.180
Integral Cutoff: 69.2 %

Record Again Abort Accept

TAS2781/83 Disconnect PC V TEXAS INSTRUMENTS

Power Profile Measurement

The screenshot shows the PurePath™ Console interface for a device named TAS2781/83. The breadcrumb trail is: App Center > TAS2781/83 Home (Mono) > Characterization. A progress bar at the top indicates the current step is 'Power Profile Measurement', with previous steps (Preparation, Speaker Selection, Re Calibration, SOA, Thermal Char) completed and subsequent steps (IV Measurement, Model Fit, Determine BI) pending. The main content area displays the title 'Power Profile Measurement' and a progress indicator with 8 dots, the 6th of which is highlighted. Below the title, a text block states: 'Power Profile of the output will be displayed along with the temperature in the next step. Please note that this step might take upto a minute to complete.' At the bottom of the main area, there are three buttons: 'Prev' (disabled), 'Skip' (disabled), and 'Proceed' (active and highlighted with a red box). A status bar at the bottom shows 'TAS2781/83' with a 'Disconnect' button, 'PC' and 'V' indicators, and the 'TEXAS INSTRUMENTS' logo. A notification in the bottom right corner reads 'Characterization data saved' with a close button.

Power Profile Measurement



IV measurement

The screenshot displays the PurePath™ Console software interface for a characterization process. The window title is "PurePath™ Console -TAS2781/83 (CHAR.ppc3)". The breadcrumb navigation shows "App Center > TAS2781/83 Home (Mono) > Characterization". A progress bar at the top indicates the current step is "IV Measurement", with other steps including "Preparation", "Speaker Selection", "Re Calibration", "SOA", "Thermal Char", "Model Fit", and "Determine BI".

The main content area is titled "IV Measurement" and contains the text: "We will perform IV Measurement by playing chirp tone." Below this text is a diagram of a speaker with two terminals labeled "+" and "-".

At the bottom of the main content area, there are three buttons: "Prev" (left-pointing arrow), "Abort" (red button), and "Start IV Measurement" (right-pointing arrow, highlighted with a red border). A status bar at the bottom right shows a green checkmark and the text "Characterization data saved".

The bottom status bar includes a green dot next to "TAS2781/83", a red "Disconnect" button, "PC" and "V" buttons, and the "TEXAS INSTRUMENTS" logo.

IV measurement

PurePath™ Console - TAS2781/83 (CHAR.ppc3)

App Center > TAS2781/83 Home (Mono) > Characterization

Preparation > Speaker Selection > Re Calibration > SOA > Thermal Char > IV Measurement > Model Fit > Determine BI

Review Speaker Model

If the plot doesn't appear correct, check your speaker connection and re-run IV Measurement. If the chosen speaker model is not correct please re-visit the Speaker Type selection.

Measured Impedance Fitted Impedance Fitted Exc.

Frequency (Hz)	Measured Impedance (Ω)	Fitted Impedance (Ω)	Fitted Exc. (mm/V)
100	10	10	0.18
200	10	10	0.20
300	12	12	0.25
400	28	28	0.28
500	15	15	0.25
700	10	10	0.15
1000	10	10	0.10
2000	10	10	0.05
3000	10	10	0.02

Fit Frequency Start: 100 Hz Fit Frequency End: 3000 Hz

Re-Run IV Measurement Choose Speaker Type Abort Re-Fit Export as CSV Accept

TAS2781/83 Disconnect PC V TEXAS INSTRUMENTS

Determine BL

PurePath™ Console - TAS2781/83 (CHAR.ppc3)

App Center > TAS2781/83 Home (Mono) > Characterization

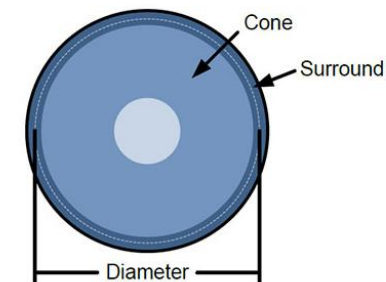
Preparation > Speaker Selection > Re Calibration > SOA > Thermal Char > IV Measurement > Model Fit > Determine BL

Speaker Details

Please provide the following details of the speaker

Enter the diaphragm area or diameter:

Area: (or) Diameter:



Obtaining the Loudspeaker Diameter

Prev Next

TAS2781/83 Disconnect PC V TEXAS INSTRUMENTS

Determine BL

PurePath™ Console - TAS2781/83 (CHAR.ppc3)

App Center > TAS2781/83 Home (Mono) > Characterization

Preparation > Speaker Selection > Re Calibration > SOA > Thermal Char > IV Measurement > Model Fit > Determine BL

Force Factor (BL) and the Speaker Diaphragm

Next we need to determine the Force Factor (BL) of the speaker diaphragm. If you have this data (directly from the speaker manufacturer or by alternate measurements), you may enter it below:

- Manually Enter BL (Known / Guess)
- Laser Method

If you don't know the BL, it can be determined by doing Laser Measurement.

Prev Abort Laser Method

TAS2781/83 Disconnect PC V TEXAS INSTRUMENTS

Determine BL

PurePath™ Console -TAS2781/83 (CHAR.ppc3)

App Center > TAS2781/83 Home (Mono) > Characterization ?

Preparation > Speaker Selection > Re Calibration > SOA > Thermal Char > IV Measurement > Model Fit > Determine BL

Check laser setup

Check Laser Setup

- Laser Detected ✓
- Laser Programmed ✓

Read Laser Value

Laser Value : -0.00182

Note: Please proceed if the laser value is less than 0.001

Use LK-Navigator tool and adjust the laser until read value must be less than 0.001

Prev Abort Start Laser Measurement

TAS2781/83 Disconnect PC V TEXAS INSTRUMENTS

Determine BL

PurePath™ Console - TAS2781/83 (CHAR.ppc3)

App Center > TAS2781/83 Home (Mono) > Characterization

Preparation > Speaker Selection > Re Calibration > SOA > Thermal Char > IV Measurement > Model Fit > Determine BI

Review Speaker Model

If the plot doesn't appear correct, check your speaker connection and redo BI Measurement.

Legend: Measured Impedance (blue), Fitted Impedance (red), Measured Exc. (light red), Fitted Exc. (dark red)

Fit Frequency Start: 100 Hz Fit Frequency End: 3000 Hz

Buttons: Redo BI Measurement, Abort, Re-Fit, Accept & Skip Extended BI Msmt, Extended BI

Driver
Re: 8.18 Ohm Sd: 2.60 cm²

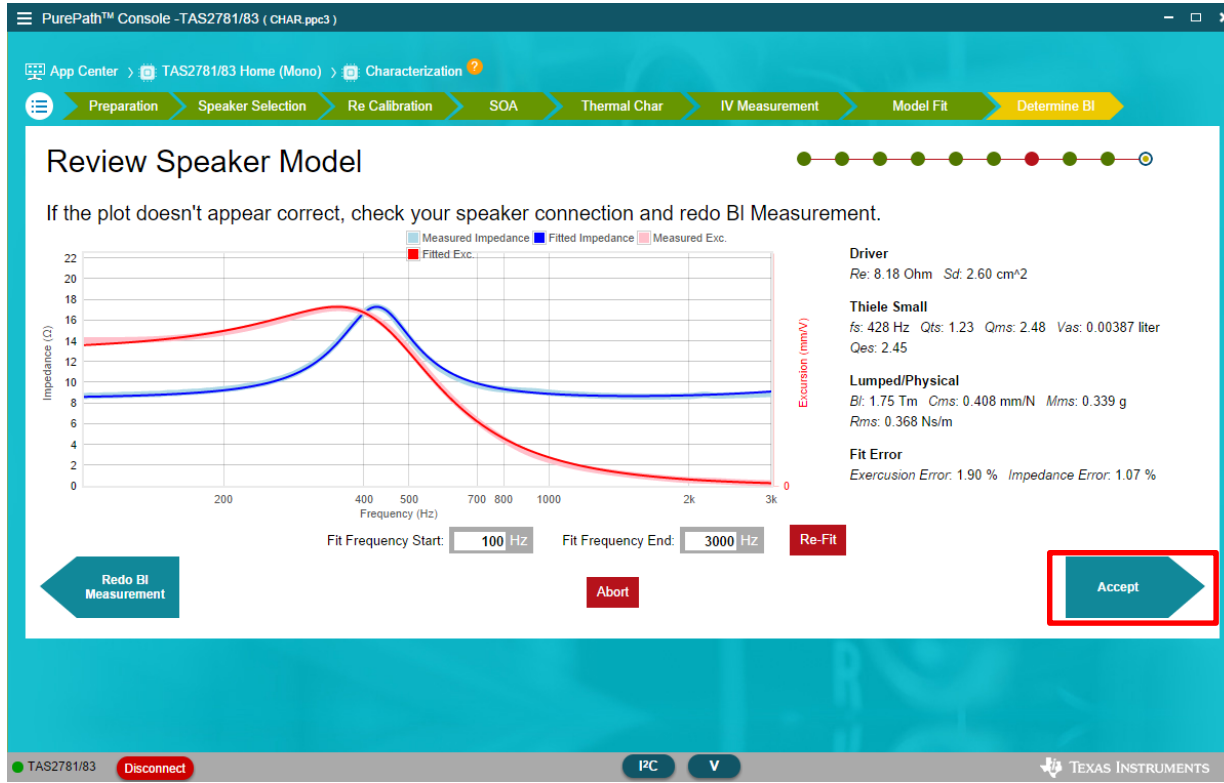
Thiele Small
fs: 402 Hz Qts: 1.57 Qms: 4.50 Vas: 0.00345 liter
Qes: 2.42

Lumped/Physical
Bl: 1.92 Tm Cms: 0.363 mm/N Mms: 0.432 g
Rms: 0.242 Ns/m

Fit Error
Excursion Error: 7.42 % Impedance Error: 5.11 %

TAS2781/83 Disconnect PC V TEXAS INSTRUMENTS

Extend BL => Make excursion closer to Xmax



Done characterization