

PORTABLE CONSUMER CODEC LOW-POWER, HIGH-FIDELITY INTEGRATED CODEC

TSCS42xx

DESCRIPTION

The TSCS42xx is a low-power, high-fidelity integrated CODEC with 32 bit stereo playback stereo record functionality. In addition to a high-fidelity low-power CODEC, the device integrates the true cap-less headphone amplifier.

The digital audio data ports work in both master or slave modes and supports all common Linear PCM delivery formats (I2S / LJ / RJ / TDM) as well as direct Bluetooth[®] PCM mode.

Beyond high-fidelity for portable systems, the device offers an enriched “audio presence” through built-in audio output processing DSP engine (AOP) which is easily tunable by the designer using the Windows[®]-based Tempo ASC GUI.

APPLICATIONS

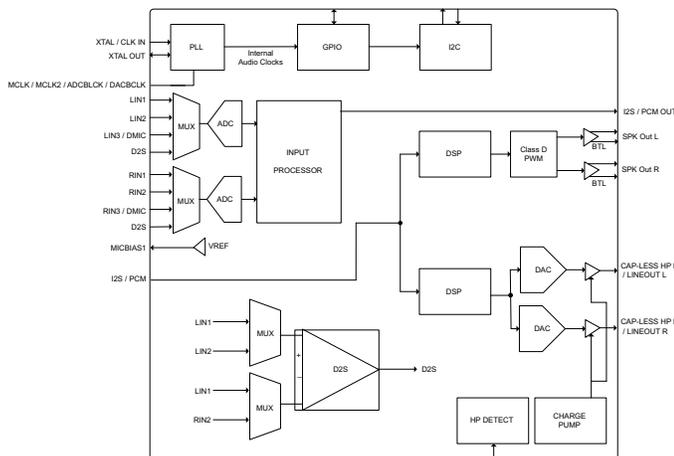
- **Bluetooth / Wi-Fi Speakers**
- **Portable Navigation Devices**
- **Portable Gaming Devices**
- **Personal Media Players**
- **Multimedia Handsets**
- **Tablets**

PART NUMBERS

TSCS42A1X1NLGXyyX	Analog Microphone
TSCS42A2X1NDGXyyX	Analog Microphone
TSCS42D1X1NLGXyyX	Digital Microphone

yy = silicon revision, contact TSI for current part number.

BLOCK DIAGRAM



FEATURES

- **High-Fidelity CODEC**
 - Stereo 32-bit DACs with 124dB SNR
 - Stereo 32-bit ADCs with 90dB SNR
 - Supports Sample Rates from 8kHz up to 96kHz
- **Audio Output Processing DSP Engine**
 - 3D Stereo Enhancement
 - 12-band Parametric Equalizers available per channel
 - Wideband Dynamic Range Compressor
 - Pro-Style Multi-band Compressor / Limiter / Expander
 - Psychoacoustic Bass Enhancement
 - Compressed Audio High-Frequency Restoration
- **DDX™ Digital Speaker Driver**
 - 3W/channel 4Ω (1.5W/channel 8Ω)
 - TSI DDX™ Class-D technology achieves low EMI and >90% efficiency
 - Spread spectrum support for reduced EMI
 - Constant Output power mode
 - Anti-Pop circuitry
 - Filterless architecture reduces BOM cost
- **On-chip True Capless Headphone Driver**
 - 35mW output power (16Ω), < 1% THD+N
 - 29mW output power (32Ω), < 1% THD+N
 - Charge-pump allows true ground centered outputs
 - Headphone detection logic
- **Microphone / Line-In Interface**
 - Analog microphone or line-in inputs
 - Automatic level control
 - 1 stereo DMIC
- **Low-Power with Integrated Power Management**
 - 1.7V CODEC supports 1Vrms
 - Very low standby and no-signal power consumption
 - 1.8V digital / 1.7V analog supply for low power
- **2-wire (I²C compatible) control interface**
- **I²S data interface**
 - Supports Bluetooth mode
 - Left-Justified, Right-Justified and PCM Audio Interfaces
- **Package**
 - 48-Lead 7x7mm QFN

TSCS42xx

Portable Consumer CODEC

AUDIO OUTPUTS

The TSCS42xx provides multiple outputs for analog sound. Audio outputs include:

- A stereo 3W/channel (4W) or a 1.5W/channel (8W) filterless DDX™ Class-D amplifier. This amplifier is capable of driving the speakers typically found in portable equipment, providing high-efficiency all while maintaining excellent sound quality.
- A line-out / capless stereo headphone port with ground referenced outputs, is capable of driving headphones without requiring any external DC blocking capacitors.
- Constant output power mode maintains output volume even with a dropping battery supply voltage.

Each endpoint features independent volume controls, including a soft-mute capability which can slowly ramp up or down the volume changes to avoid unwanted audio artifacts.

The TSCS42xx output signal paths consist of digital filters, DACs and output drivers. The digital filters and DACs are enabled when the TSCS42xx is in 'playback only' or 'record and playback' mode. The output drivers can be enabled or disabled independently under register control.

The digital filter and audio processing block processes the data to provide volume control and numerous sound enhancement algorithms. Two high performance sigma-delta audio DACs convert the digital data into analog.

The digital audio data is then converted to oversampled bit streams using digital interpolation filters, which then enters the sigma-delta DACs, and become converted to high-quality analog audio signals.

To enhance the sound available from small, low-power speakers typically found in portable devices, the TSCS42xx provides numerous audio enhancement capabilities to help maximize the capabilities of the drivers and enclosure. The TSCS42xx features 24 independently programmable bands of parametric equalization using a variety of available filter types, allowing the system designer to provide an advanced system equalizer to accommodate the specific speakers and enclosure design. A multiband compressor / limiter features programmable attack and release thresholds, enabling the system designer to attenuate loud noise excursions to avoid speaker artifacts, thus allowing the underlying content to be played at a louder volume without distortion. For compressed audio sources, a multiband expander is available to help restore the dynamic range of the original content. A stereo depth "3D" enhancement algorithm allows common left/right content (e.g. dialog) to be attenuated separately from other content, providing a perceived depth separation between background and foreground audio. Psychoacoustic bass enhancement and high-frequency restoration enhancement algorithms help achieve a sound that is rich, full tone with incredible detail even from originally compressed content, using speakers that have a limited frequency response, especially at the low-end.



<https://www.temposemi.com>

8627 N. MoPac Expwy, Suite 130

Austin, Texas 78759

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