

Product Bulletin

# TAS5414 & TAS5424 4-Channel Digital Audio Amplifiers for Automotive

*Low EMI, high power efficiency*

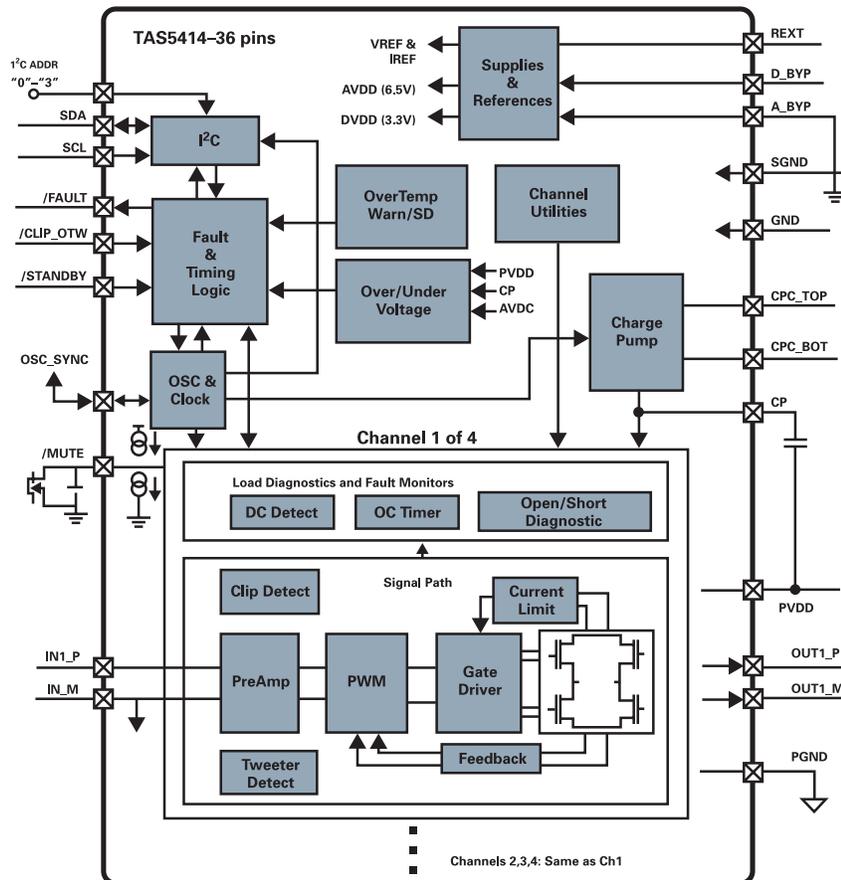
The first two devices from the TAS54x4 family of products specifically designed for automotive audio systems are the four-channel single-ended input TAS5414 and four-channel TAS5424 with differential inputs providing better immunity to board noise. These two digital amplifiers are among the first devices to combine the high power efficiency of Class D amps with new breakthroughs in low electromagnetic interference (EMI). The EMI performance of

the TAS54x4 amplifiers meets the tough standards of the automotive industry, including CISPR-25 qualifications. The architecture of the TAS54x4 was designed especially for superior EMI performance including a new patented gate drive technology.

In addition to its low EMI and high power efficiency, the TAS5414 is highly integrated, supporting four audio channels in one device as well as a complete automotive diagnostic suite that

**Key Features**

- Breakthrough in low EMI and power efficiency for Class D amplifiers
- Designed specifically for automotive audio applications
- Highly integrated with four audio channels and diagnostics on-chip
- Saves space and reduces weight with compact thermal management
- Integration eliminates discrete components, lowering heat dissipation
- Excellent audio performance for car radios, stereos, CD players, portable MP3 players and others audio sub-systems
- Meets or exceeds automotive requirements including CISPR-25 and AEC Q100



provides operational monitoring to reduce total system cost. The high efficiency and level of integration reduces size requirements enabling flexible positioning of external amplifiers or driving high channel count systems directly from the in dash head unit.

Backed by exhaustive simulation, analysis and stress testing in addition to an architecture developed from the ground up for the exacting standards of the automotive industry, the TAS5414 meets the high quality standards required by automobile manufacturers.

**Shattering EMI barriers**

Until the TAS54x4, Class D amplifiers produced significant levels of EMI which, despite the power efficiency of such devices, restricted the use of Class D amps in automotive applications. Because it was designed from the

ground up for EMI performance, the TAS54x4 shatters this barrier by achieving automotive EMI levels. The TAS54x4 is able to reduce EMI by optimizing power switching events. Additionally, a sophisticated feedback loop has been implemented to ensure high fidelity audio performance.

The lower EMI emissions of the TAS54x4 reduces overall system costs by eliminating the need for expensive shielding or other measures that are typically employed to prevent EMI from interfering with control system buses or radio reception in vehicles.

### ***The Power Efficiency of Class D Amplifiers***

The excellent power efficiency and consequent low heat dissipation of Class D amplifiers is well documented. Unlike Class AB amps that offer 40 to 50 percent efficiency typically and 25 percent efficiency in some instances, the Class D TAS54x4 amps offers more than 90 percent efficiency at normal radio listening levels. This results in significantly less heat generated compared to Class AB amps.

Automotive designers are able to better manage system heat dissipation because of the TAS54x4's power efficiency. Instead of large and heavy heat sinks or fans for thermal management, the TAS54x4 requires only a light and compact heat sink that reduces the space and weight of audio subsystems. And by integrating four audio channels in the

TAS54x4, designers can now implement a new class of cost-effective eight-channel audio systems that are lighter, smaller and more power-efficient than today's high-end systems. In fact, two TAS54x4s, providing eight audio channels, will dissipate less power than a four-channel Class AB implementation.

### ***Placement Flexibility***

In the past, the location of the audio amplifier in a vehicle has often been determined by the amplifier's size, EMI performance, heat dissipation and other aspects. By optimizing these factors, the TAS54x4 gives automotive designers a new level of flexibility with regards to the placement of the amplifier in the vehicle.

As audio system features continue to increase as well as consumer demand for more power automotive designers increasingly must deploy the audio amplification unit in a location removed from the audio system's head unit in the dashboard to eliminate another heat source. But placing the amplifier in the trunk or under a seat, for example, drives up the cost of the audio system by requiring wiring harnesses, added power conditioning, and separate enclosures and mounting brackets. Additional costs are incurred from extra testing procedures and installation labor. Now, with the energy efficiency and highly integrated TAS54x4, designers have the

option of deploying the audio system's amplifier practically anywhere in the vehicle, including in the dashboard with the head unit even on premium systems with lots of features and power. If deployed somewhere other than the dash, the amplifier size provided by the energy efficiency of the TAS5414 can save space and simplify installation of the audio amplifier subsystem in the trunk or under a seat, for example. As an added benefit the TAS54x4 digital amplifiers reduce weight providing better fuel economy.

### ***Automotive Manufacturability***

While designing the TAS54x4 amps, TI focused on the unique and stringent requirements of the automotive manufacturing process. On-chip diagnostics have been integrated into the TAS54x4s so the amplifier can monitor the audio system while the vehicle is being manufactured. For instance, when connected to a diagnostic unit, the TAS54x4 can report whether speakers are properly connected. If a screw were to pass through a speaker wire, the TAS54x4s can alert technicians to the short circuit condition and even which channel is impacted. Additionally the TAS54x4 amplifiers are capable of detecting tweeters in passive cross-over speaker designs.

### ***For more information***

For additional information on the TAS5414 or TAS5424, please visit [www.ti.com/caraudio](http://www.ti.com/caraudio)

<b>TAS54x4 Features</b>	<b>Benefits</b>
<b>Breakthrough gate drive technology</b>	Drastically reduces EMI to meet the requirements of automotive applications
<b>90% power efficiency at normal listening levels, 4</b>	At a normal listening level (3W/Ch) a 4 channel AB amplifier generates ~32Ω of heat compared to less than 3Ω for the TAS54x4 amplifiers, or about 1/10th the heat.
<b>Low heat dissipation</b>	An 8-channel TAS5414AI Class D system dissipates less heat than a 4-channel Class A/B implementation Also a 4 channel TAS54x4 system can drive 2Ω speakers with twice the output power compared to an AB amplifier driving 4Ω speakers while generating less heat.
<b>High power output from a single chip</b>	From 22W per channel continuously into 4 ohm at less than 1% THD+N from a 14.4 V supply up to 90W per channel into 2 ohm at 10% THD+N from a 20V supply
<b>Cost-effective design</b>	Thermal efficiency eliminates heavy and large heat sinks or fans that increase system size, weight and cost
<b>Automotive Design</b>	Patented feedback design provides excellent power supply rejection in the harsh automotive electrical environment. Also protected against load dump events to 50V, reverse battery, and jump starts.
<b>Patented AM interference avoidance</b>	Internal clock oscillator with three selectable switching frequencies ensures the TAS5414 switching does not interfere with AM/FM radio reception
<b>Patented pop and click reduction technology</b>	Soft start and stop with gain ramping
<b>High channel density Typical 105dB signal-to-noise (SNR) ratio</b>	Four digital audio channels on a single chip Excellent SNR eliminates speaker hiss from tweeters
<b>Interfaces</b>	I <sup>2</sup> C provides easy control for system MCU
<b>Low defective parts per million (DPPM)</b>	Extensive defect failure modes effects and analysis (DFMEA), advanced software simulations, voltage level stress testing (VLST), and optional full production burn-in at hot and cold temperatures
<b>On-chip load diagnostic functions</b>	Fast and robust detection of short circuits to power, ground or speaker to speaker, DC input, over voltage, under voltage, and tweeter detection.
<b>Protection and monitoring functions</b>	Protects the audio system against damage or fire hazard
<b>Industrial operating temperature range: -40C to 105C</b>	Provides reliable performance no matter where components are located in the vehicle
<b>Offered with green mold compound and Pb-free packaging</b>	Environmentally friendly packaging
<b>AEC Q100 qualification targeted to be completed by 4Q06</b>	Compliance with automotive quality standards

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