

TI Designs: TIDA-00223

Digital Audio I2S over Coax Class D Amplifier



System Description

This design is an I²S/TDM-based, low-cost, easy-to-install/use and rugged alternative to fiber optics/analog copper wire for connecting an automotive (sound) control panel to an output stage/power amplifier. Supporting I²S as well as TDM, it is capable of transmitting digital audio signals for up to 16 independent channels of speakers with each channel output 80W at 4Ω. It also supports bidirectional communication with the control panel (I²C), and room for additional functions (GPIO) over a single Coax cable. Furthermore, the TIDA-00223 reference design enables fast implementation with power supply included, and it has all the protection, diagnostics requirements of modern cars.

Featured Applications

- Front Seat Infotainment Systems
- Rear Seat Entertainment Systems
- Car Audio

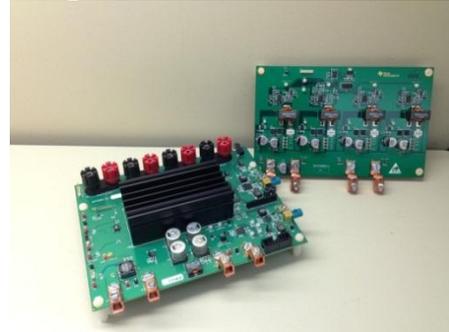
Design Resources

- Block Diagram and Schematic
- Test Data
- Gerber Files
- Design Files
- Bill of Materials
- Wiki Page

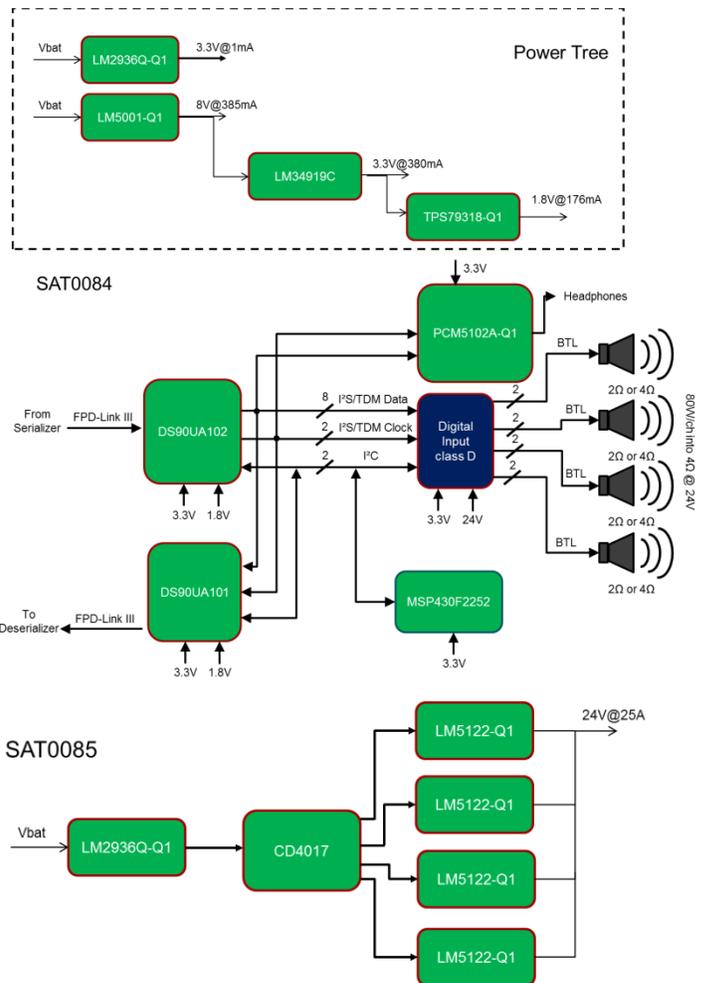
Design Features

- Wide input voltage range: off Battery 6V to 40V power supply
- The design consists of two boards: SAT0084 (FPD-LINK III and audio amplifier) and SAT0085 (600W power solution)
- Audio Serializer/Deserializer support I²S and TDM audio for up to 16 audio channels with very low **15** μs latency
- Audio plus bidirectional I²C and GPIO control over a single low cost, low weight Coax cable, eliminating the need for a local microcontroller
- Power over Coax to run distributed microphone

Design Photo



Block Diagram



Jump start system design and speed time to market

Comprehensive designs include schematics or block diagrams, BOMs, design files and test reports by experts with deep system and product knowledge. Designs span TI's portfolio of analog, embedded processor and connectivity products and supports a board range of applications including industrial, automotive, medical, consumer, and more. To explore the designs, go to <http://www.ti.com/tidesigns>

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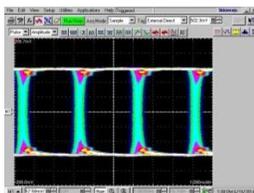


Associated Part Numbers

<u>Part Number</u>	<u>Part Description</u>	<u>EVM Link</u>
DS90UA101-Q1	Automotive Multi-Channel Digital Audio Serializer	EVM
DS90UA102-Q1	Multi-Channel Digital Audio Deserializer	EVM
LM5122-Q1	Wide Vin Synchronous Boost Controller with Multiphase Capability	EVM
PCM5102A-Q1	112dB DAC with 32b, 384kHz PCM	EVM
LM5001-Q1	Wide Vin Buck Switch Mode Regulator	EVM
LM34919C-Q1	Wide Vin Buck Switch Mode Regulator	EVM
TPS79318-Q1	Low Dropout Linear Regulator	EVM
LM2936-Q1	Ultra-Low Quiescent Current Low Dropout Linear Regulator	EVM

Design Considerations and Test Data:

- In the SAT0084 reference board:
 - LDO LM2936-Q1 with off-battery capability allows the MCU to put the system in a low power state and minimize the quiescent current consumption from the automotive battery.
 - First stage SEPIC converter LM5001-Q1 was selected based on its wide VIN range to accommodate off Battery 6V to 40V, 1A output current capability, and 95uA typical quiescent current in shutdown mode.
 - In the second stage, 3.3V and 1.8V are generated to power the FPD-LINK, audio amp and DAC (PCM5102A-Q1) devices.
 - MSP430 on the roadmap for automotive qualification was chosen with the ability to implement I2C capability.
 - 32bit DAC (PCM5102A-Q1) with I2S input are being selected to drive the headphone with excellent linearity.
 - Four speakers with each channel 80W are being supplied by the class-D amplifier
- In the SAT0085 reference board:
 - LDO LM2936-Q1 with off-battery capability and low quiescent current consumption from the automotive battery.
 - CD4017B on the roadmap for automotive qualification was chosen to do the multi-phase for four LM5122-Q1 to deliver 600W
 - LM5122-Q1 boost controller was selected based on its wide VIN range, can do multiphase to increase the output current delivery to boost the output voltage to 24V to drive the class-D amplifier on the SAT0084 board.
- Below is a graph to show the eye diagram captured while I2S audio was playing. From the diagram, it is evident that the eye is clear which increases the ability of recovering data error-free at the receiving end.



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