GS-EVM-AUD-AMPCL1-GS

Turnkey Closed Loop Analog Class-D Amplifier Module

200W per Channel x 2 into 8Ω

Technical Manual

Visit www.gansystems.com for the latest version of this technical manual.

Please refer to the Evaluation Board/Kit Important Notice on page #11

DANGER

DO NOT TOUCH THE BOARD WHEN IT IS ENERGIZED AND ALLOW ALL COMPONENTS TO DISCHARGE COMPLETELY PRIOR HANDLING THE BOARD.

HIGH VOLTAGE CAN BE EXPOSED ON THE BOARD WHEN IT IS CONNECTED TO POWER SOURCE. EVEN BRIEF CONTACT DURING OPERATION MAY RESULT IN SEVERE INJURY OR DEATH.

Please sure that appropriate safety procedures are followed. This evaluation kit is designed for **engineering evaluation in a controlled lab environment and should be handled by qualified personnel ONLY**. Never leave the board operating unattended.

WARNING

Some components can be hot during and after operation. **There is NO built-in electrical or thermal protection on this evaluation kit**. The operating voltage, current, and component temperature should be monitored closely during operation to prevent device damage.

CAUTION

This product contains parts that are susceptible to damage by electrostatic discharge (ESD). Always follow ESD prevention procedures when handling the product.

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1 GS-EVM-AUD-AMPCL1-GS Description

1.1 Introduction

This technical manual highlights the features and benefits of a turnkey closed loop Analog Class-D Amplifier Module GS-EVM-AUD-AMPCL1-GS. This self-contained 200 watt-per-channel Class-D amplifier module reference design is for manufacturers of powered loudspeakers and stand-alone stereo and multi-channel amplifiers. GaN Systems GS-EVM-AUD-AMPCL1-GS is developed around the enhancement mode GaN-on-silicon power transistors and the next-generation driver technology. These two next-generation technologies are combined with highest quality output filters for best audio quality and sound. GS-EVM-AUD-AMPCL1-GS is designed without a heat sink under normal operating conditions. Thermal protection is provided for worst-case thermal environments, with high efficiency that reduces heat and system size.

1.2 Purpose

The purpose of this evaluation module is to provide a complete comprehensive GaN high-performance Class-D Amplifier solution with high efficiency, reduced heat, reduced system size and weight due to the absence of heat sink, graceful protection, auto recovery, and easy integration with switched-mode power supplies solution. This comprehensive solution from GaN Systems, along with other GaN Systems released Audio reference designs, enables audio systems designers across markets to mix and match designs and maximize performance for their specific industries.

1.3 Features

- Complete Stand-alone Class-D Audio Amplifier Module
- 200W / Channel x 2 into 8Ω
- 300W / Channel x2 into 4Ω
- Dual Half-Bridge or BTL "Bridge Tied Load" topology for ground-referenced output
- Analog integrated I²S "Inter-IC Sound" Audio Input
- Analog integrated S/PDIF "Sony/Philips Digital Interconnect Format" and Auxiliary Audio Inputs
- Frequency response of +/- 0.5dB (8Ω, 20Hz to 20KHz)
- +/- 32V_{DC} Power Supply requirement
- Fully programmable and integrated DSP solution with DAE-3HT
- SNR "Signal to Noise Ratio" & DR "Dynamic Range" higher than 108dB
- THD+N "THD + Noise" less than 0.006% at (8Ω, 1W, 20Hz to 20KHz)
- No heat sink required
- Efficiency higher than 96%
- Complete integrated non-intrusive short circuit protection, thermal protection, and Over-Current protection
- Complete integrate non-intrusive Over-Voltage and Under-Voltage protection
- Post-Filter, Dual closed-loop system for speaker load independence, without reduced gain
- Compatible with GaN Systems SMPS GS-EVB-AUD-SMPS2-GS
- Output stages with 100V Enhancement Mode GaN Transistors GS61008P

1.4 Benefits

- High-performance Class-D Audio Amplifier reference design
- Enables smaller and more efficient Class-D audio systems
- Superior sounding and very high audio quality
- Closest audio signal to the sound source
- Reduction in system size and weight
- Reduction in heat flow
- Safe and stable design with graceful protection features against harmful failures
- Reliable design with Auto recovery features
- Optimization for cost
- Easy attachment to Chassis with 8mm stand-offs and mounting screws
- Compatible with GaN Systems complete LLC design + PFC SMPS that provides 20% volume shrink and 5% BoM cost reduction.
- The properties of GaN allow for high current, high voltage breakdown and high switching frequency. GaNPX small packaging of GS61008P enables low inductance & low thermal resistance and provides very high efficiency power switching.

Figure 1 GS-EVM-AUD-AMPCL1-GS Evaluation Module

2 Technical Specifications of GS-EVM-AUD-AMPCL1-GS

2.1 Recommended Operating Conditions

Parameter	Min.	Typ.	Max.	Unit	Notes
Power Supply Voltage	+/-20	-	+/-32	V	Undervoltage @+/-20V
Load Impedance	2	-	-	Ω	
Source Impedance	-	-	10	kΩ	
Effective Power Supply Capacitance	1000	-	-	μF	Per rail, per amp. module

2.2 Absolute Maximum Ratings

Parameter	Rating	Unit	Notes
Power Supply Voltage	+/-37	V	Over-Voltage shut down
Peak Output Current	20	A	Max. Current limit @18A
Ambient Temperature	25	°C	Normal Operation Without Heat Sink
Heat Sink Temperature	90	°C	Heat Sink might be required

2.3 Performance Data

Power Supply = +/- 32V_{DC} ; Load = 8Ω

Parameter	Min.	Typ.	Max.	Unit	Notes
Output Power	200	-	-	W	THD < 0.03%
Distortion	-	-	0.04	%	THD+N, 1KHz, 200W
Output Noise	108	-	-	dB	Unwanted, 200W/8Ω
Frequency Response	10	-	20k	Hz	+/- 0.5dB
Voltage Gain	+25.5	+26	+26.5	dB	
Current Limit	15	16	18	A	
Power Supply Rejection	+65			dB	Either rail

2.4 Audio Input Characteristics

Parameter	Min.	Typ.	Max.	Unit	Notes
Input Impedance	-	100	-	kΩ	Either input to Ground
Common-Mode Rejection	-	75	-	dB	20Hz to 20kHz

3 PCB Layout and Module Connections

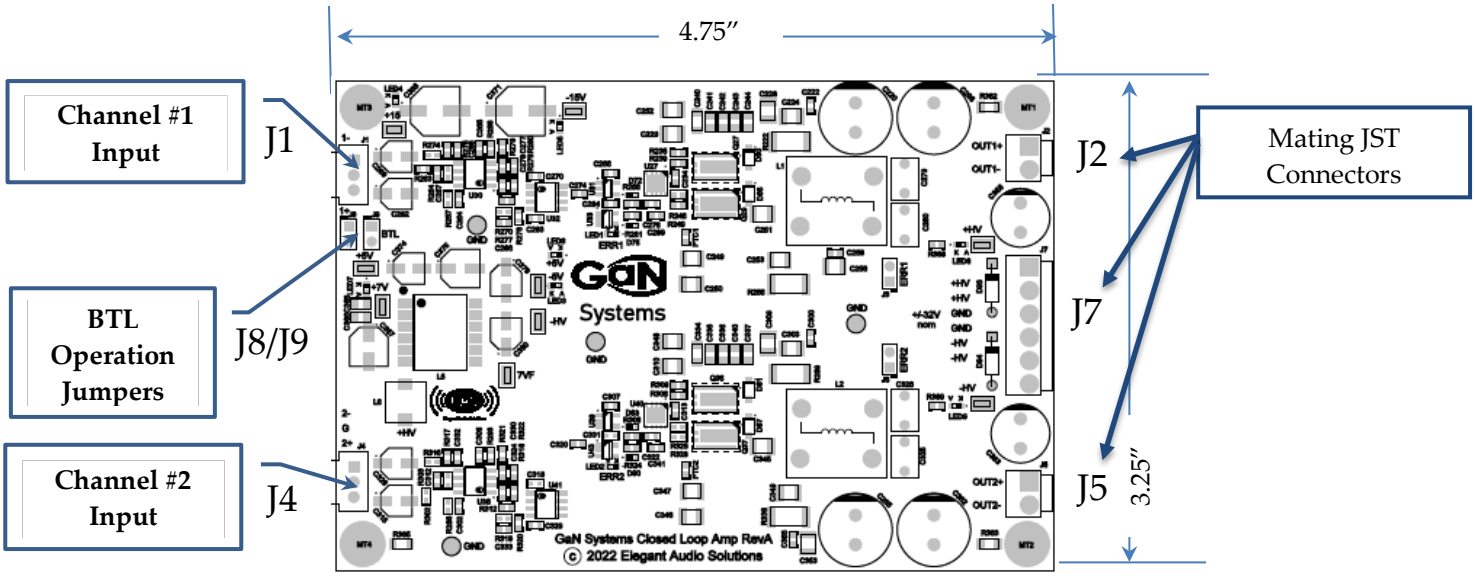

Figure 2 PCB Layout and Module Connections

4 Compatible SMPS: GS-EVB-AUD-SMPS2-GS

4.1 Description

GaN Systems Switched-Mode Power Supply GS-EVB-AUD-SMPS2-GS evaluation board GS-EVB-AUD-SMPS2-GS Evaluation Board | GaN Systems is compatible with GaN Systems Open Loop Analog Class-D Amplifier Module GS-EVM-AUD-AMPOL1-GS. This SMPS provides the basis for a complete LLC Power Supply design, with Power Factor Correction (PFC). Controlled by advanced digital control methods coupled with 650V GaN enhancement mode E-HEMTs, the SMPS includes all required components and subsystems for a complete and compliant high-voltage power supply. Power can be easily scaled by redesigning the magnetic components and providing proper heatsinking and thermal management.

4.2 Features and Benefits

- Universal AC line input voltage (85 V - 264 V)
- +/-32 VDC Regulated Output Voltage
- 400W Continuous Output Power
- More than 90% full load Efficiency
- Fan-less, self-powered (from AC Line Input) design with no external DC supplies required
- Minimal external components due to high level of integration with D2Audio Controller/DSP
- High efficiency across a wide load range is achieved using GaN Systems GaN E-HEMTs and advanced control techniques
- Easily scaled to higher power by redesigning magnetics, proper selection of GaN Systems GaN E-HEMTS, and thermal management
- Next Generation GaN Systems E-HEMTS providing below system improvements
    - 20% Volume Shrink
    - 5% BoM cost reduction

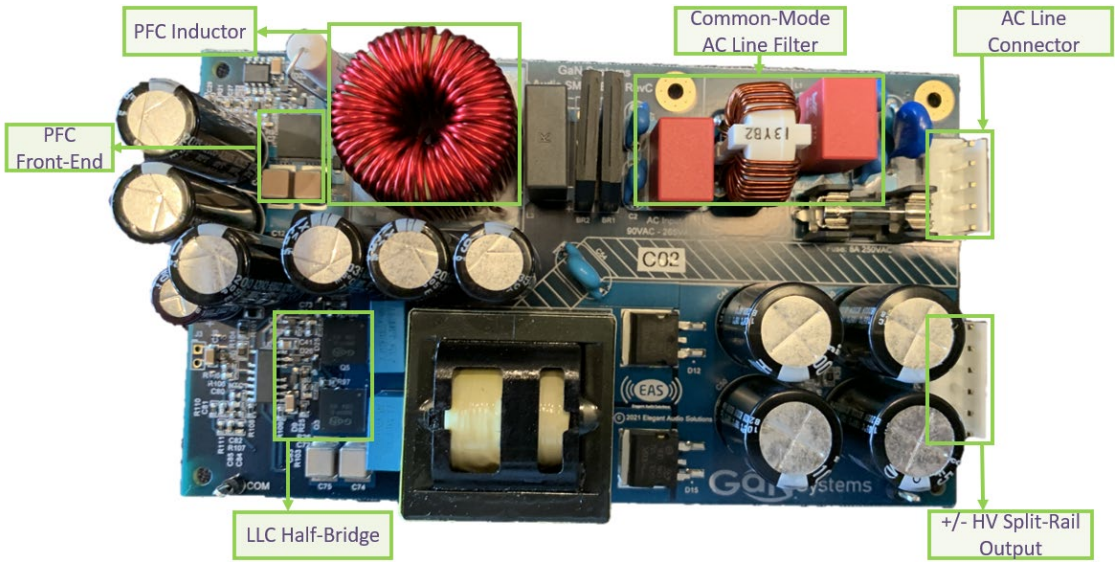

Figure 3 Gen2 GaN Switched-Mode Power Supply Evaluation Board GS-EVB-AUD-SMPS2-GS

5 Ordering Information

The ordering information are listed in Table 1 below:
Where to buy | GaN Systems

Table 1 P/N and Description

PART NUMBER	DESCRIPTION
GS-EVM-AUD-AMPCL1-GS	Amplifier: 200W per Channel x 2 into 8Ω, Turnkey Closed Loop Analog Class-D Amplifier Module
GS-EVB-AUD-SMPS2-GS	Power Source: 400W LLC Switched Mode Power Supply w/PFC
GS61008P	100V, 90A, GaN E-mode, GaNPX® package, Bottom-side cooled
GS-065-011-2-L	650V, 11A, GaN E-mode, 8x8 PDFN, Bottom-side cooled
GS-065-030-2-L	650V, 30A, GaN E-mode, 8x8 PDFN, Bottom-side cooled

Evaluation Board/Kit Important Notice

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