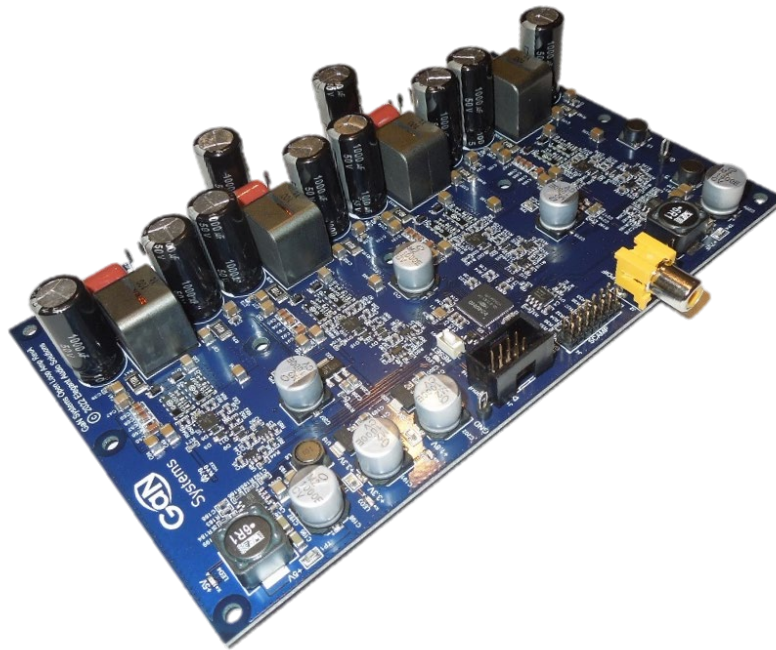


GS-EVM-AUD-AMPOL1-GS

Turnkey Open Loop Digital Class-D Amplifier Module

50W per Channel x 4 into 8Ω

Technical Manual



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

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.

Contents

1	GS-EVM-AUD-AMPOL1-GS Description.....	5
1.1	Introduction	5
1.2	Purpose.....	5
1.3	Features	5
1.4	Benefits	6
2	Technical Specifications of GS-EVM-AUD-AMPOL1-GS	7
2.1	Recommended Operating Conditions.....	7
2.2	Absolute Maximum Ratings	7
3	PCB Layout and Module Connections	7
4	Compatible SMPS: GS-EVB-AUD-SMPS2-GS.....	8
4.1	Description.....	8
4.2	Features and Benefits.....	8
5	Ordering Information.....	9

List of Figures

Figure 1 GS-EVM-AUD-AMPOL1-GS Evaluation Module	6
Figure 2 PCB Layout and Module Connections	7
Figure 3 Gen2 GaN Switched-Mode Power Supply Evaluation Board GS-EVB-AUD-SMPS2-GS.....	8

List of Tables

Table 1 P/N and Description.....	9
----------------------------------	---

1 GS-EVM-AUD-AMPOL1-GS Description

1.1 Introduction

This technical manual highlights the features and benefits of a turnkey open loop Digital Class-D Amplifier Module GS-EVM-AUD-AMPOL1-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-AMPOL1-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-AMPOL1-GS is designed as two independent half-bridge outputs, for use in both stereo and single-channel applications. The GaN open loop approach provides an ideal switching form for Class D amplifiers. The high performance of switching signals delivers a dual feedback loop that provides better performance than a single loop / closed filter. The Module includes a fully programmable DSP with Open-Loop output stage topology and is designed with best-practices EMI considerations, and for compliance with FCC, UL, CSA, and CE requirements.

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
- 50W / Channel x 4 Half-Bridge ground referenced output topology into 8Ω
- 200W / Channel x 2 BTL “Bridge-Tied Load” ground referenced output topology into 8Ω
- Digital integrated I²S “Inter-IC Sound” Audio Input
- Digital integrated S/PDIF “Sony/Philips Digital Interconnect Format” Coaxial Audio Input
- Frequency response of +/- 0.2dB (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 114dB
- THD+N “THD + Noise” less than 0.01% 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 integrated non-intrusive Over-Voltage and Under-Voltage protection
- Guarded handling of complex and low impedance loads
- 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.

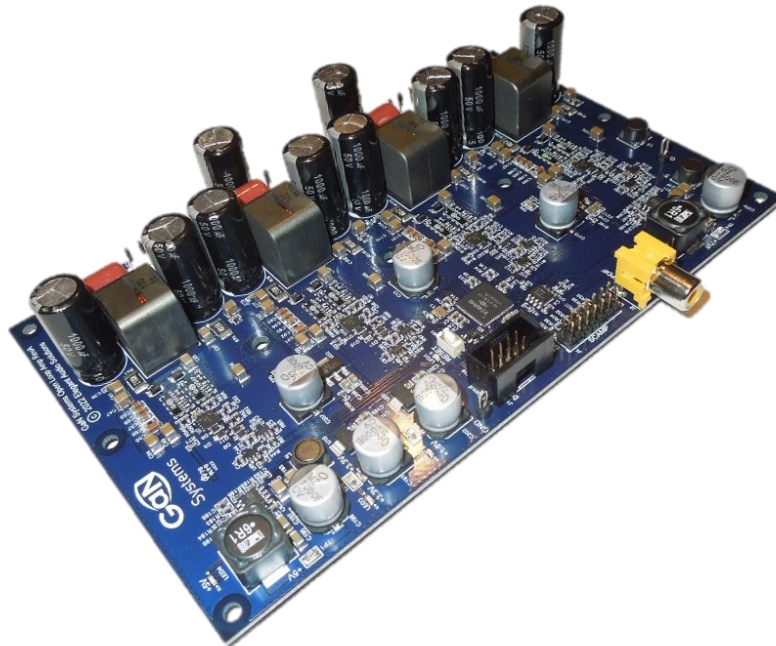


Figure 1 GS-EVM-AUD-AMPOL1-GS Evaluation Module

2 Technical Specifications of GS-EVM-AUD-AMPOL1-GS

2.1 Recommended Operating Conditions

Parameter	Min.	Typ.	Max.	Unit	Notes
Power Supply Voltage	+/-20	-	+/-32	V	Undervoltage @+/-18V
Load Impedance	2	8	-	Ω	
Effective Power Supply Capacitance	1000	-	-	μF	Per rail, per amp. module

2.2 Absolute Maximum Ratings

Parameter	Rating	Unit	Notes
Power Supply Voltage	+/-32	V	Over-Voltage shut down
Peak Output Current	16	A	Max. Current limit @18A
Ambient Temperature	25	$^{\circ}\text{C}$	Normal Operation Without Heat Sink
Heat Sink Temperature	90	$^{\circ}\text{C}$	Heat Sink might be required

3 PCB Layout and Module Connections

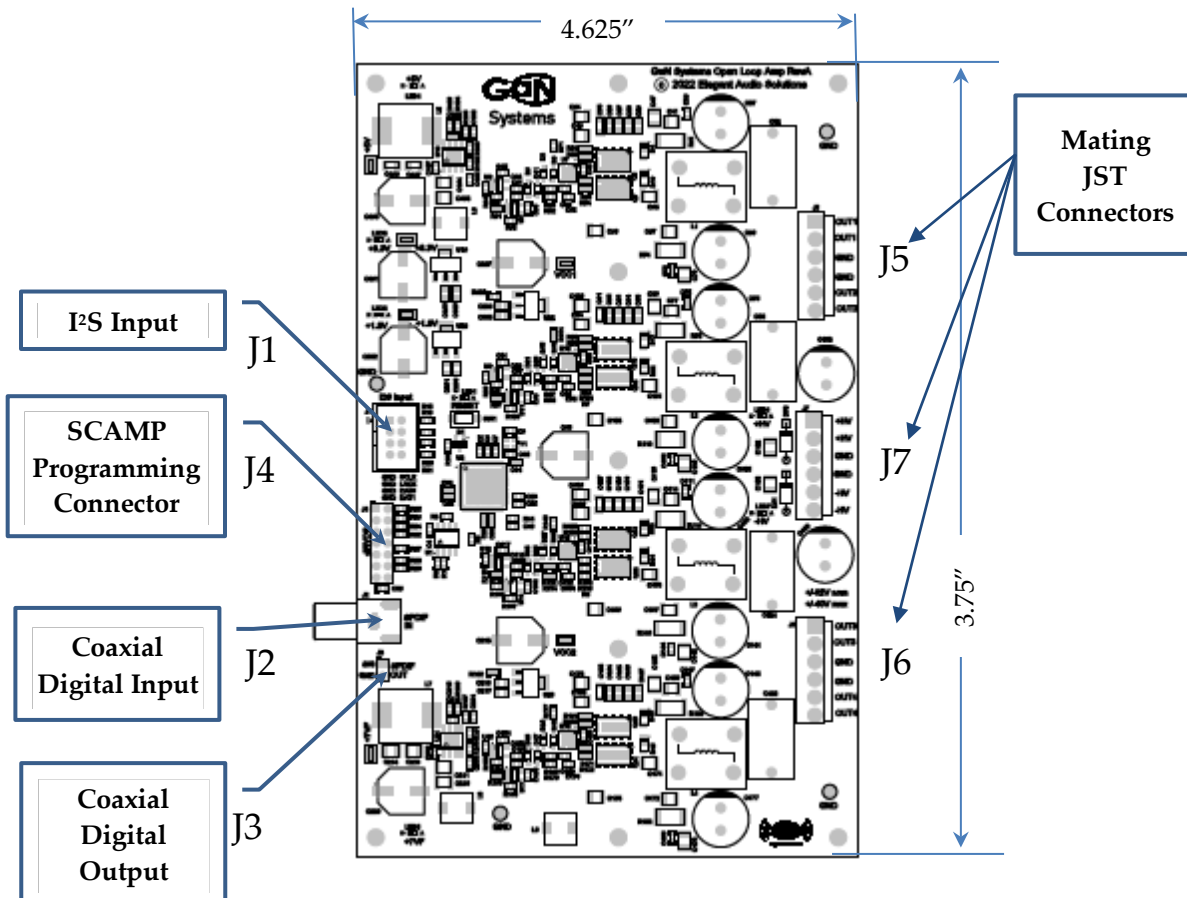


Figure 2 PCB Layout and Module Connections

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 Digital 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

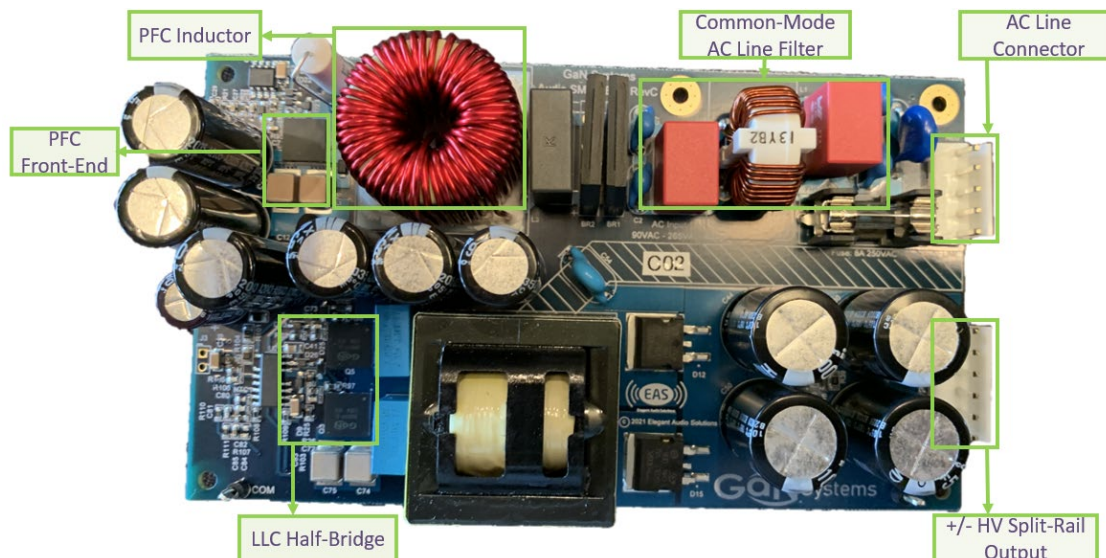


Figure 3 Gen2 GaN Switched-Mode Power Supply Evaluation Board GS-EVB-AUD-SMPS2-GS

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-AMPOL1-GS	Amplifier: 50W per Channel x 4 into 8Ω, Turnkey Open Loop Digital 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

GaN Systems Inc. (GaN Systems) provide the enclosed product(s) under the following AS IS conditions:

This evaluation board/kit being sold or provided by GaN Systems is intended for ENGINEERING DEVELOPMENT, DEMONSTRATION, and OR EVALUATION PURPOSES ONLY and is not considered by GaN Systems to be a finished end-product fit for general consumer use. As such, the goods being sold or provided are not intended to be complete in terms of required design-, marketing-, and/or manufacturing-related protective considerations, including but not limited to product safety and environmental measures typically found in end products that incorporate such semiconductor components or circuit boards. This evaluation board/kit does not fall within the scope of the European Union directives regarding electromagnetic compatibility, restricted substances (RoHS), recycling (WEEE), FCC, CE, or UL, and therefore may not meet the technical requirements of these directives, or other related regulations.

If this evaluation board/kit does not meet the specifications indicated in the Technical Manual, the board/kit may be returned within 30 days from the date of delivery for a full refund. THE FOREGOING WARRANTY IS THE EXCLUSIVE WARRANTY MADE BY THE SELLER TO THE BUYER AND IS IN LIEU OF ALL OTHER WARRANTIES, EXPRESSED, IMPLIED, OR STATUTORY, INCLUDING ANY WARRANTY OF MERCHANTABILITY OR FITNESS FOR ANY PARTICULAR PURPOSE. EXCEPT TO THE EXTENT OF THIS INDEMNITY, NEITHER PARTY SHALL BE LIABLE TO THE OTHER FOR ANY INDIRECT, SPECIAL, INCIDENTAL, OR CONSEQUENTIAL DAMAGES. The user assumes all responsibility and liability for proper and safe handling of the goods. Further, the user indemnifies GaN Systems from all claims arising from the handling or use of the goods. Due to the open construction of the product, it is the user's responsibility to take all appropriate precautions concerning electrostatic discharge. No License is granted under any patent right or other intellectual property right of GaN Systems whatsoever. GaN Systems assumes liability for applications assistance, customer product design, software performance, or infringement of patents or any other intellectual property rights of any kind. GaN Systems currently services a variety of customers for products around the world, and therefore this transaction is not exclusive. Please read the Technical Manual and, specifically, the Warnings and Restrictions notice in the Technical Manual before handling the product. Persons handling the product(s) must have electronics training and observe good engineering practice standards. This notice contains important safety information about temperatures and voltages. For further safety concerns, please contact GaN Systems' Engineering Team.

GaN Systems Inc.

www.gansystems.com

Important Notice – Unless expressly approved in writing by an authorized representative of GaN Systems, GaN Systems components are not designed, authorized, or warranted for use in lifesaving, life-sustaining, military, aircraft, or space applications, nor in products or systems where failure or malfunction may result in personal injury, death, or property or environmental damage. The information given in this document shall not in any event be regarded as a guarantee of performance. GaN Systems hereby disclaims any or all warranties and liabilities of any kind, including but not limited to warranties of non-infringement of intellectual property rights. All other brand and product names are trademarks or registered trademarks of their respective owners. Information provided herein is intended as a guide only and is subject to change without notice. The information contained herein, or any use of such information does not grant, explicitly, or implicitly, to any party any patent rights, licenses, or any other intellectual property rights. General Sales and Terms Conditions apply.