HARRIS SEMICONDUCTOR

HIP25MMREF

Half Bridge Outputs Multimedia 2 x 25W Audio Amplifier

December 1996

Features

- Typical Operation . . . . . $12V_{DC}$ to $36V_{DC}$
- Power Output (4Ω Load, $32V_{DC}$ Supply) . . . . 25W RMS
- 40Hz to 13kHz Bandwidth . . . . . (±3dB)
- Typical THD+N = 0.55% (5W RMS)
- High Efficiency, Half Bridge Output (Typical 80% at 20W RMS)
- Pop-Free Start-Up
- Bridgeable Outputs for Higher Output Power
- Input Gain 29dB

Applications

- Computer Audio Systems
- Mini-Systems
- Portable Audio Systems
- Monitors

Ordering Information

Contact Harris licensing agents, Continental Far East or International Operations. See contact information provided in this document.

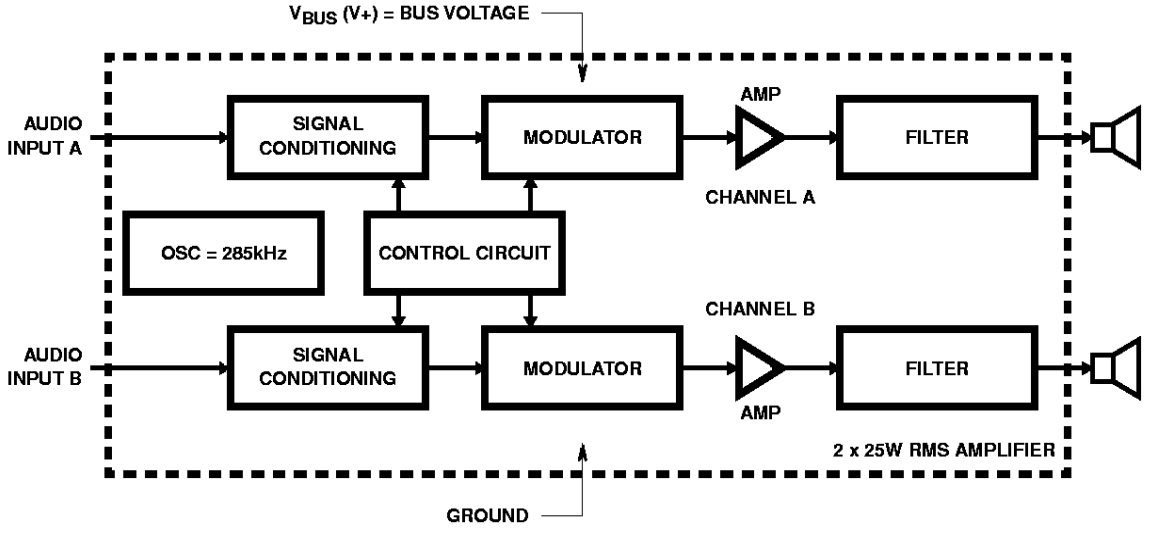
Description

coolaudio™ The HIP25MMREF Reference Design is a dual channel audio amplifier utilizing Class-D topology with half bridge outputs. The typical 25W RMS per channel power output is achieved through the use of 4Ω impedance speakers and $28V_{DC}$ to $32V_{DC}$. The output drive is controlled by Harris' HIP2100 Half Bridge Driver for high efficiency Class-D operation. The design is part of Harris' CoolAudio program that enables Customers to achieve a minimum time-to-market for audio end products. The amplifier has been designed to run continuously at rated power with no droop in output level.

This design is offered to Customers after execution of a Licensing Agreement. At this time, Harris will provide a documentation package containing: 1) Circuit Description, 2) Schematics, 3) Test and Manufacturing Information, 4) A Bill of Material with all vendor and vendor part numbers, 5) Harris' Engineering Support Contacts, 6) One Sample Amplifier board.

For more information, see us on the web, home page http://www.semi.harris.com. For technical assistance, call Central Applications at 1-800-442-7747, or email us at centapp@harris.com.

Reference Design Block Diagram



CoolAudio™, is a trademark of Harris Corporation.

CAUTION: These devices are sensitive to electrostatic discharge. Users should follow proper IC Handling Procedures.

File Number **4271**

Absolute Maximum Ratings

Supply Voltage, V_{BUS} (Note 1) . . . . . -0.3V to 36V
All Other Pin Voltages (Note 1) . . . . . V_{GND} -0.3V to V_{BUS} +0.3V
OUT1, OUT2 Slew Rate 20V/ns

Operating Conditions

Supply Voltage, V_{BUS} (Relative to GND) . . . . . +32V
Voltage on V_{SS} 0V
Temperature Range . . . . . -40°C to 60°C

CAUTION: Stresses above those listed in "Absolute Maximum Ratings" may cause permanent damage to the device. This is a stress only rating and operation of the device at these or any other conditions above those indicated in the operational sections of this specification is not implied.

NOTES:

1. All voltages are relative to V_{GND}, unless otherwise specified.
2. θ_{JA} is measured with the component mounted on an evaluation PC board in free air.

Electrical Specifications

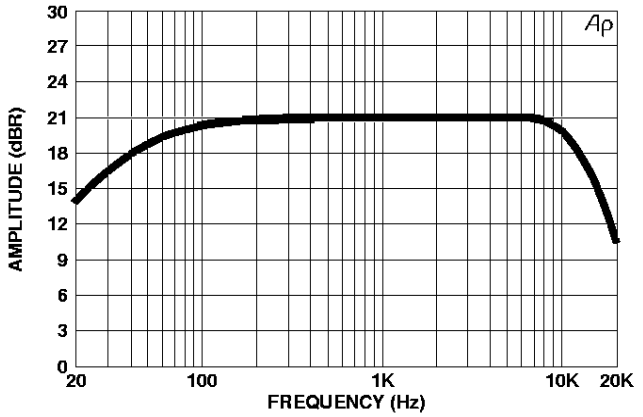
V_{BUS} = 32V, R_{LOAD} = 3.65Ω, V_{COM} = 0V

PARAMETER	SYMBOL	TEST CONDITIONS	T_A = 25°C TYP	UNITS
SUPPLY MEASUREMENTS				
V_{BUS} Quiescent Current	I_{BUSQ}	Audio In = 0V, Remote = V_{BUS} = 14.4V	75	mA
PSRR (V_{OUT1}-V_{OUT2})/(V_{BUS2_1} - V_{BUS2_2})	P_{SRR}	V_{BUS} = 30V ±10% At 20W (1kHz)	3	mV/V
Supply Voltage, Minimum Operating	$V_{BUSMINO}$	P_{OUT} = 0W	11.3	V
OUTPUT MEASUREMENTS				
Maximum Output Power at 30V	P_{MAX}	V_{BUS} = 36V	32	W
Efficiency	$PMAX_{EFF}$	V_{BUS} = 32V, P_{OUT} = 5W	60	%
	$PMAX_{EFF}$	V_{BUS} = 32V, P_{OUT} = 15W	76	%
	$PMAX_{EFF}$	V_{BUS} = 32V, P_{OUT} = 25W	83	%
PERFORMANCE MEASUREMENTS				
Total Harmonic Distortion + Noise	THD+N	P_{OUT} = 10W	<1.3	%
SNR	V_{SNR}	Relative to Full Scale Output	-50	dB
PSSR (ΔV_{OUT} / ΔV_{BAT})	P_{SSR}	V_{BUS} = ±1V	3	mV/V
ADDITIONAL MEASUREMENTS				
Cutoff Frequency	F_{UPPER}		13,000	Hz
PWM Frequency	F_{PWM}		285	kHz
Input Impedance	R_{IN}	R_{IN} Gain 29dB	10	KΩ

Reference Board Connector Assignment

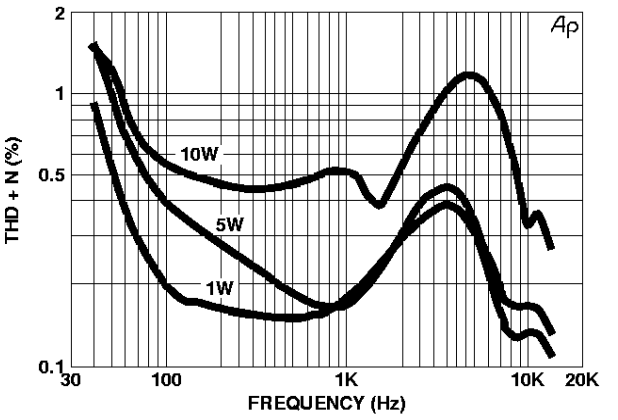
SYMBOL	DESCRIPTION
INPUT A	Audio Input Channel A
INPUT B	Audio Input Channel B
V_{BUS}	The amplifier output stage power source. Connect through a fuse directly to the battery
OUT+A	The + polarity high power output Channel A
OUT+B	The + polarity high power output Channel B
COM	The ground return for the amplifier

Typical Performance Curves



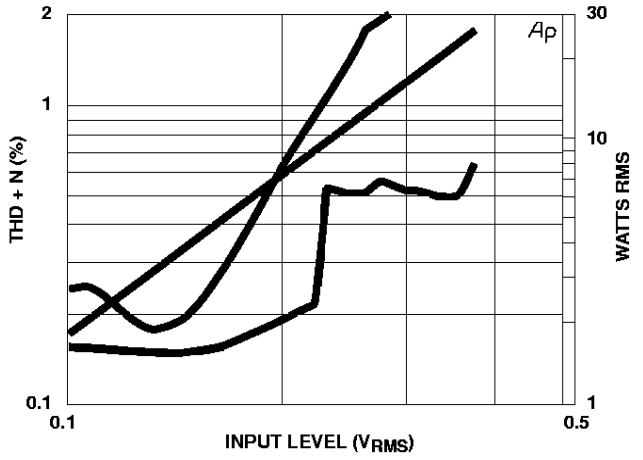
NOTE: The above curve shows the frequency response from 40Hz to 13kHz at approximately 20W output power.

FIGURE 1. FREQUENCY RESPONSE



NOTE: The above curves are THD+N% vs Frequency at constant output power for powers of 1W, 5W, and 10W using $32V_{DC}$ into a 4Ω load.

FIGURE 2. THD+N (%) vs FREQUENCY (HZ)



NOTE: The left ordinate is THD+Noise%. The right hand ordinate is the output power (not counting the output filter dissipation) and the abscissa is the input signal in V_{RMS}. The straight diagonal line indicates the output power as a function of input voltage, whereas the curvy line indicates the THD+N% as a function of input voltage. The distortion plus noise can also be determined as a function of output power. All data is for an input frequency of 1000Hz and 32V.

FIGURE 3. THD+N (%) AND POWER LEVEL (W_{RMS}) vs INPUT AMPLITUDE (V_{RMS})

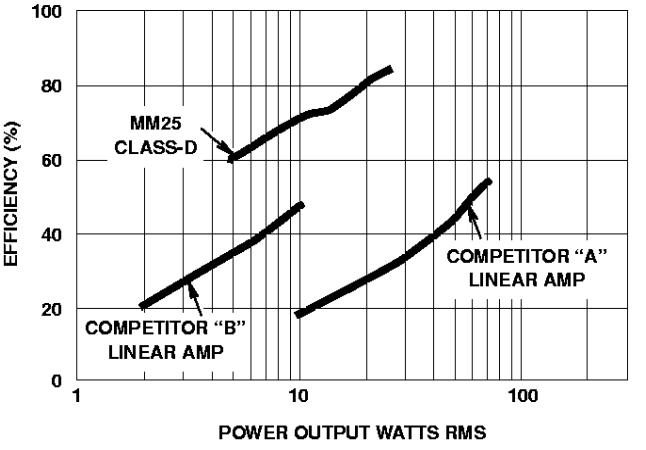


FIGURE 4. POWER EFFICIENCY COMPARISON

Reference Board Physical Layout

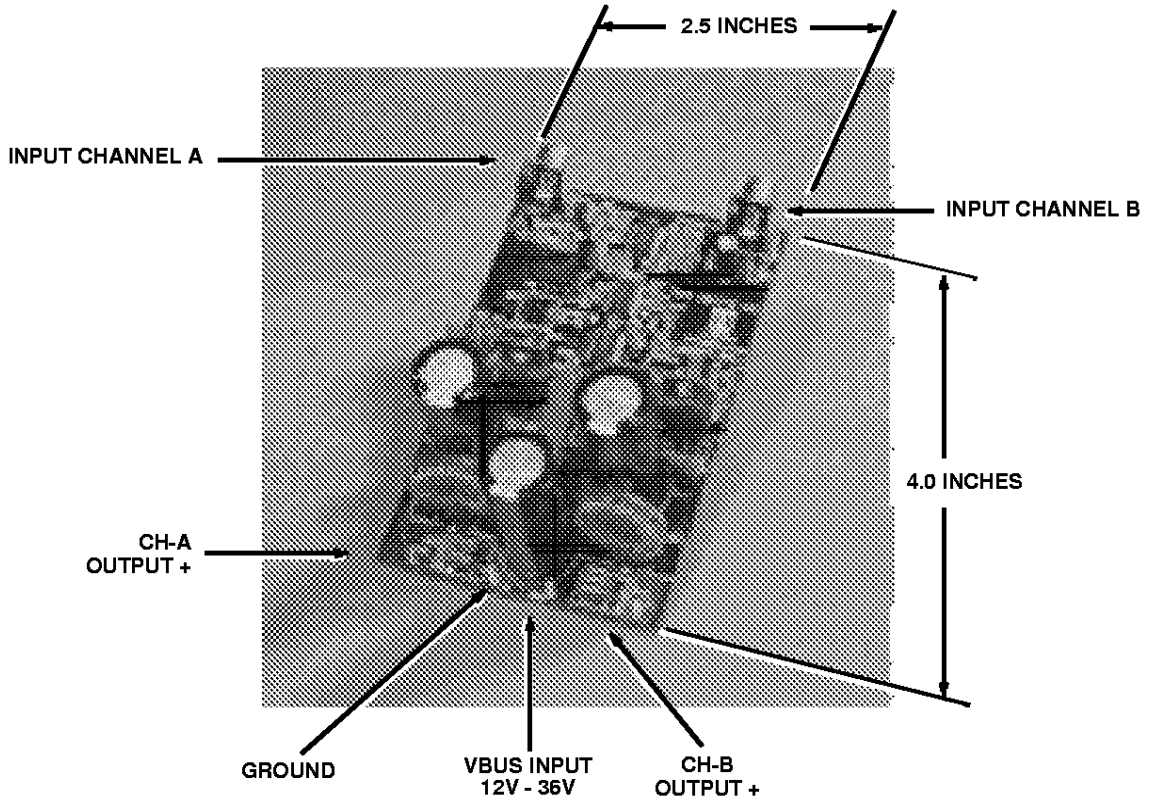


FIGURE 5. MULTIMEDIA AMPLIFIER 2 X 25W RMS

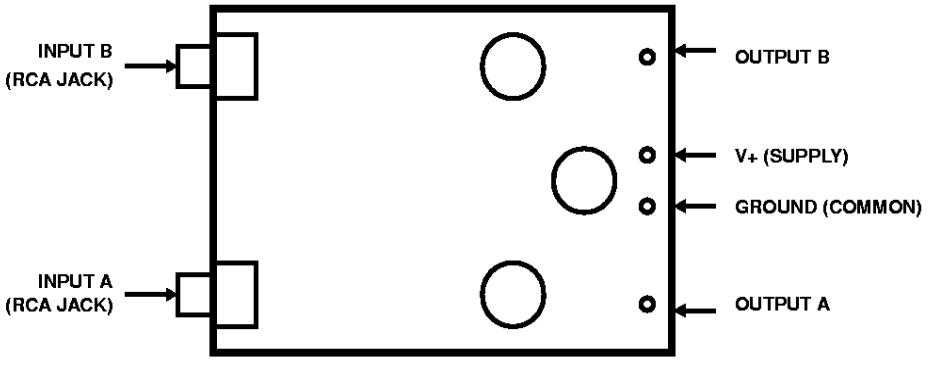


FIGURE 6. AMPLIFIER BOARD CONNECTIONS

Evaluation Test Procedure

HIP25MMREF Multimedia Stereo Amplifier

Equipment

Test equipment required for proper evaluation of the 25W x 2 Amplifier are as follows:

Regulated DC Power Supply with clean output and capable of supplying a constant 32VDC at 3A minimum continuously. For power supplies capable of higher currents than specified, an output current limit set at 2.5A is recommended. For power supplies which do not read the current limit set point directly, the position of the set point control corresponding to the appropriate current levels should be determined prior to starting the test and marked on the power supply control panel.

Audio Precision System 1 Analyzer or equivalent, capable of providing clean audio input signals controllable in amplitude from 0mV to 500mV and frequencies from 15Hz to 20,000Hz. The system should also be capable of analyzing the output of the amplifier, providing vital operating characteristics of the amplifier including: Output Power, Frequency Response, Total Harmonic Distortion, Inter-Modulation Distortion and Noise.

Speakers or Resistive Loads capable of handling a minimum of 25W of audio power and having a characteristic impedance of 4Ω.

Procedure

1. Prior to making connections to the amplifier board, set up the power supply for and output voltage of 32V and set the current limit at 0mA.
2. Make board connections to test, loads/speakers and power supply equipment as indicated in Figure 6.
3. With the audio input signal set at 0mV, and the power supply current limits set at 0mA, turn on power supply. Increase the current limit on the supply until the supply set voltage of 32V is reached. Check the amplifier supply current. The supply current with no input signal should be approximately 75mA. After verifying that supply current is normal, increase the current limit setting of the supply to 2.5A.
4. If the amplifier output is connected to resistive loads, 4Ω, 25W resistors, make sure the resistors are placed in a safe position since they will heat up during the evaluation test.
5. Depending on the type of testing to be conducted (Output Power, THD, IMD, etc.) select the menu and control panel settings on the Audio Precision Analyzer to conduct the test. Input frequency should be set between 40Hz and 16000Hz, and input voltage level should be increased in 10mV increments (Max) until desired output power is achieved. At 25W output power into 2 loads, the power supply current should be approaching 2A.
6. Conduct the desired tests in accordance with the Audio Precision test procedures.
7. Power down audio signal input and power supply before disconnecting the amplifier from the test set up.

Expected Test Results

The Harris 25W Multimedia Stereo Amplifier is designed to provide 25W RMS output power into two 4Ω speaker loads with less than 0.6% THD. The THD of the amplifier for normal power levels (~12W) will be well below 0.5%, typically around 0.2%. As the amplifier output power approaches 25W per channel, the output voltage swing approaches the limits of the supply voltage (32V) and the output waveform will begin to clip, resulting in a rapid increase in THD as the amplifier is driven beyond 25W. The amplifier is designed for a voltage gain of 29dB.

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All Harris Semiconductor products are manufactured, assembled and tested under **ISO9000** quality systems certification.

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