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HD400-0.1 Amplifier Specifications and Guide

Rev. 1.06
May 31, 2011

PCBs:
10-00007-09D1 (AMP board)
10-00007-10D1 (PSU board)

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1. Introduction

Audera Acoustics Inc. has developed a patented novel ClassHD® switching amplifier and power supply combination that offers improved Signal to Noise Ratio (SNR), distortion, idle consumption, electromagnetic interference (EMI), switching losses, filter losses, filter cost, circuit complexity, power supply requirements, and ultimately cost.

2. Features and Benefits

Traditional switching amplifier designs treat amplifier and power supply building blocks as separate entities and fail to consider how these blocks could interact with each other, ultimately to the detriment of the overall system. By integrating the power supply and amplifier to work together, instead of operating as stand-alone systems, ClassHD® offers significant improvements in switching amplifier performance.

- Audera patented ClassHD switching amplifier with tracking switch-mode power supply technology offers the following benefits:
 - Reduced idle power
 - Reduced EMI
 - High System Efficiency at light or heavy loads, resulting in smaller overall system size as compared to Class D
- Standby power < 0.5W (energy star and EU compliant)
- Idle power < 10W (reduces greenhouse gas emissions)
- 300W RMS output at 1% THD output power
- 700W peak integrated ClassHD tracking power supply
- Onboard auxiliary power supply for powering DSP, op-amps, etc. on feature board
- Low-cost implementation

3. Applications

Audera's ClassHD® switching amplifier and power supply combination is a perfect fit for applications where cost, efficiency and size are the main considerations, but the system performance cannot be compromised.

The HD400 0.1 amplifier system consists of a tracking power supply and a single 300W at 1% THD amplifier channel for subwoofer applications. This is a great fit for the subwoofer in high quality home theatre systems.

4. Electrical specifications

	Value	Comments/Notes
General		
Technology	ClassHD	
Application	Subwoofer	
Configuration	1x300W	<1% THD+N
System FTC power rating	~200W	5 minutes continuous
Low Frequency Channel		
Output Stage	Discrete MOS	
FTC Power @ 10% THD	NA	
Power into 4 ohms 1% THD	300W	
Maximum voltage swing	40V rms	
Recommended Load	4 ohms	
Minimum Load	3.5 ohms	Minimum passband impedance
Usable frequency range	10Hz-1kHz	-1 dB. Apply HPF and LPF filters externally to shape and limit the frequency response as desired.
THD+N @ 100 W, 30 Hz	0.02%	
SNR dBr max output	90 dBrA	A-weighted
Gain	29 dB	
Pre-amp		
Bi-quads	None	
Compressor	Optional	Optional AGC, activated by amplifier overtemperature.
Input impedance	5.5k ohms	
Drive Level for rated power	1.25Vrms	Balanced source. 625mV per line.
Maximum input drive level	1.9Vrms	
Output supply rails		
Auxiliary Power supply	5V, 500mA	For DSP, microcontroller, wireless receiver, etc. Option to remain active or disabled in standby mode.
Standby power supply	5V, 100mA	Supply active in standby mode. Reduce consumption to 5mA to meet 0.5W standby.
Opamp Power supplies	+/- 10V, 20mA	For opamps only. Supply disabled in standby mode.
Protection		
Over Temperature protection	Yes	On power supply. Rolls back peak power output until thermal equilibrium is reached.
Over Current / Short Circuit protection	Yes	On amplifier. Detects high output current and shuts down amplifier. Not recommended to repetitively test as this is a stressful condition and damage to the amplifier mosfets can occur.
DC Output Protection	Yes	On amplifier

AC Input		
Input fuse rating	220-240V: T2.5AH250V 100-120V: T4AH250V	Time lag, high breaking capacity. Recommend Conquer UDA series.
Standby power consumption	<0.5W	.
Idle power consumption	<10W	
AC Input voltage (rated power)	120V* or 240V**	*120V operation requires shorting of jumper W1 and 4A time lag fuse. **240V operation requires removal of jumper W1 and use of 2.5A time lag fuse.
AC Input voltage (operating)	Nameplate: 100-120V OR 220-240V. Tolerance: 90-134V OR 200-264V	100-120V operation requires shorting of jumper W1 and 4A time lag, high breaking capacity fuse. 220-240V operation requires removal of jumper W1 and use of 2.5A time lag, high breaking capacity fuse.
Agency performance		
Meets EMC requirement	IEC/EN 61000 EN-55013 FCC part 15-B	As designed.
Class I insulation (with ground)	Yes	Class 1 with Class 2 construction. All insulation is double or reinforced. Secondary side is not connected to earth ground.
Meets Safety requirements	IEC/EN/UL 60065	
Meets Energy Star	Yes	

5. Mechanical specifications

Mechanical		
Physical dimensions L x W x H mm	Amplifier board 134 x 91 x 45 mm PSU board 150 x 102 x 47 mm	
Weight	PSU: 450g AMP: 225g	

6. Mechanical drawings

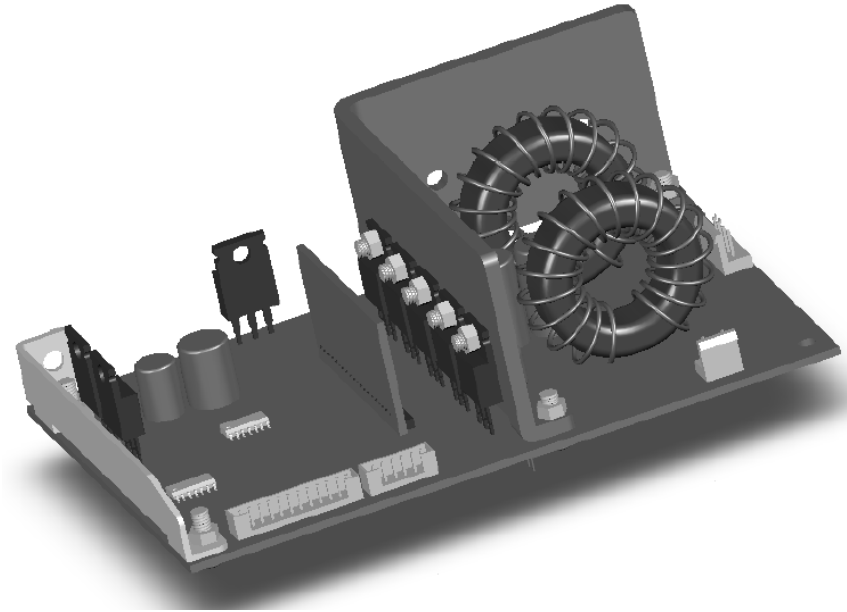


Fig. 1: Amplifier board

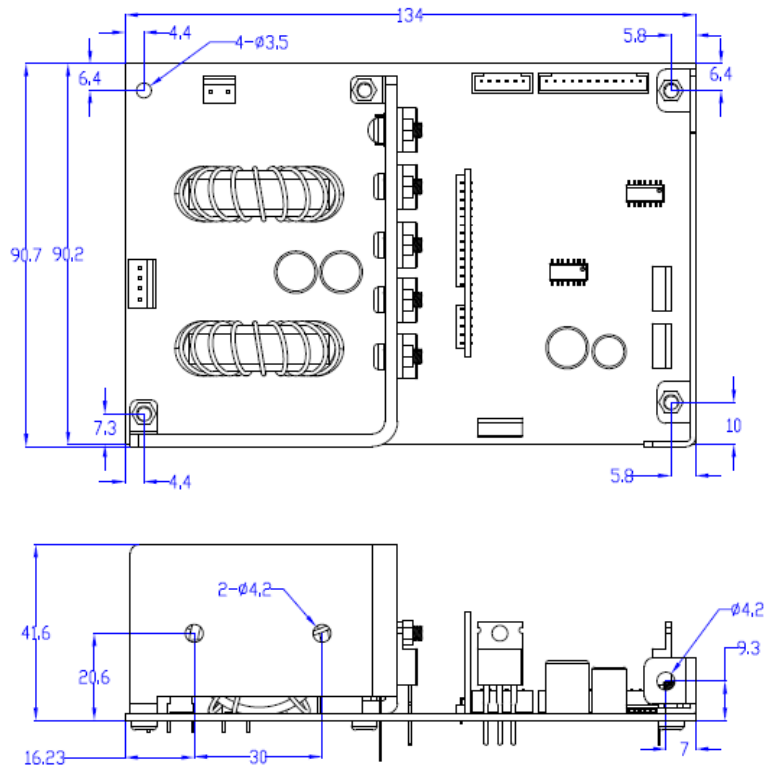


Fig. 2: Amplifier board assembly drawing

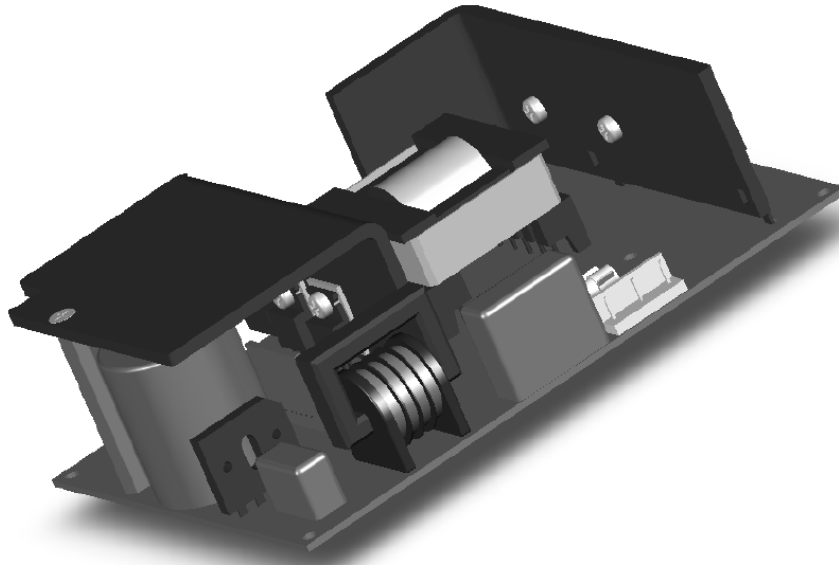


Fig. 3: Power supply board

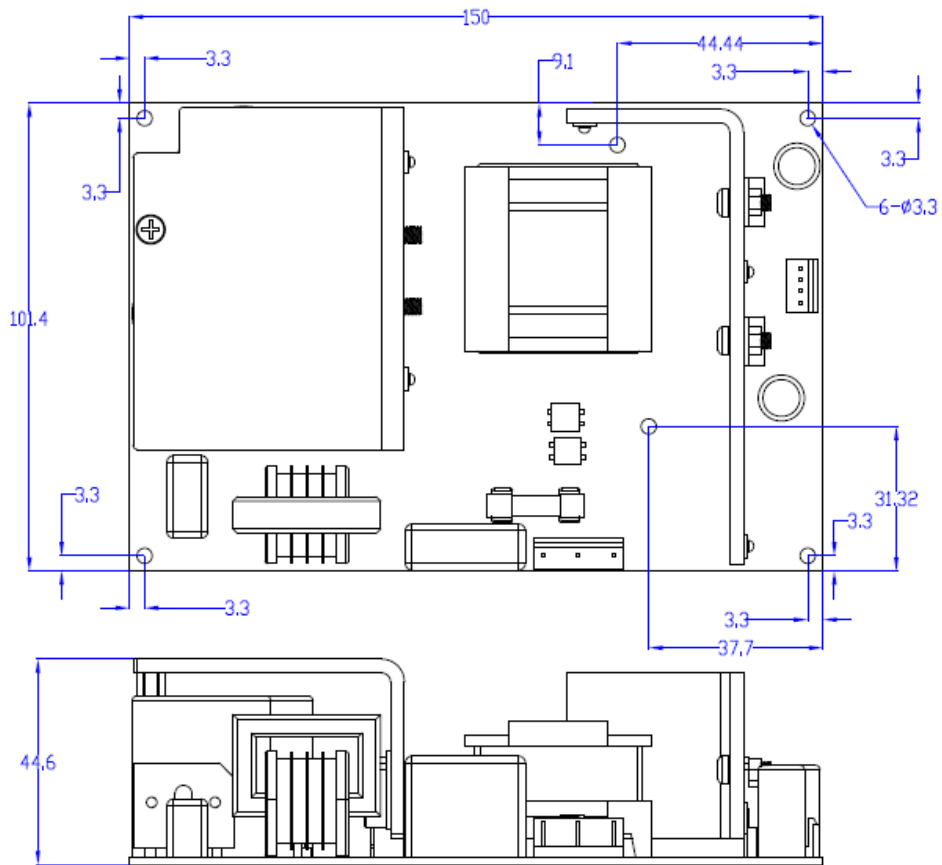


Fig. 4: Power supply board assembly drawing

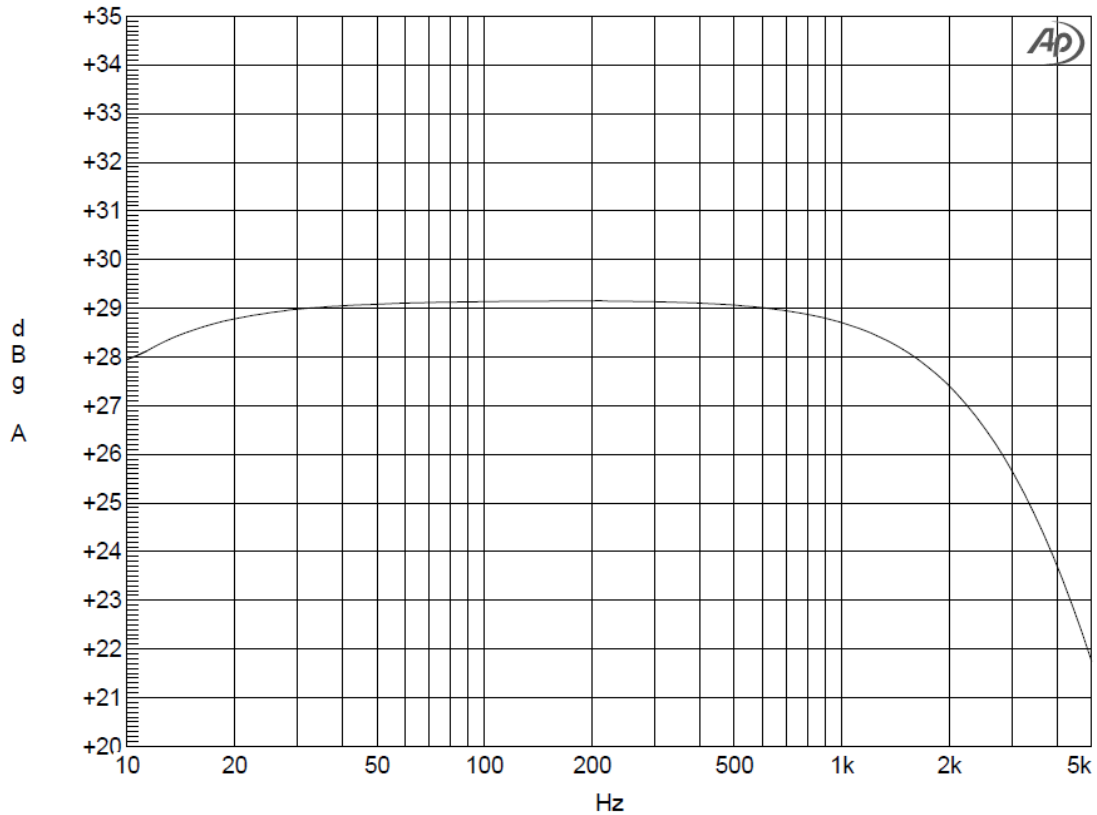
7. Performance Measurements

7.1. Frequency Response

Audio Precision

Frequency Response

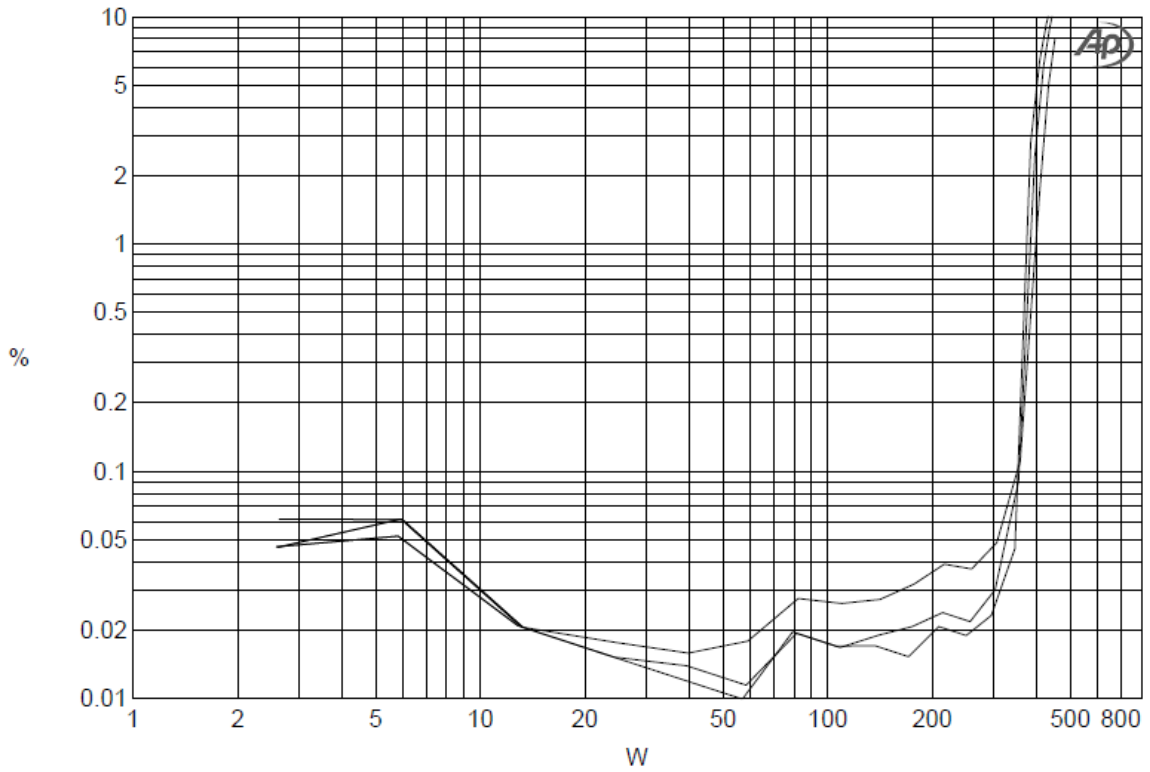
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Mains Supply : 230 VAC | Load : 4 Ohm resistive | Meas. BW : <10 - 40 kHz AES17 |
10W Output

Fig. 5: Frequency Response

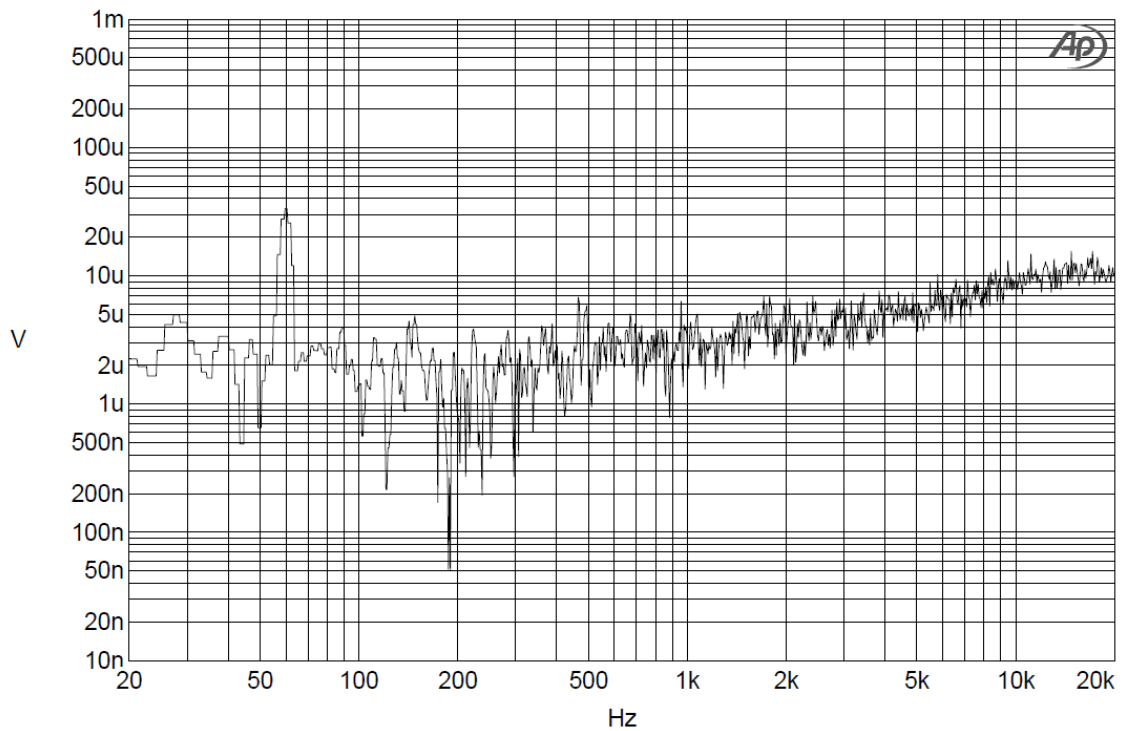
7.2. THD + Noise vs. Output Power



AC Mains : 230 VAC | Load : 4 Ohms | Meas. BW = 22 Hz - 22 kHz |
 Upper trace: 100Hz, Middle trace: 50Hz, Lower trace: 30Hz

Fig. 6: THD+n vs Power

7.3. Residual Output Noise



AC Mains : 230 VAC | Load : 4 ohm resistive | Inputs terminated at AP | Noise voltage 1.3mV rms A-weighted | SNR 90dB

Fig. 7: Output Noise

7.4. Maximum Continuous Output Power

(As determined by maximum continuous operating temperature rating of limiting electronic components.) :

Test Conditions :

1. Ambient Air Temperature : 25 deg. C
2. AC Mains Voltage : 230 VAC
3. UUT in free-air (not enclosed) .
4. Heat generated by load resistors does not raise temperature of UUT.

CONTINUOUS SINE WAVE

Load Resistance (Ohms)	Max. Continuous Output Power (Watts)	Corresponding Output Voltage (V rms)
4	169	26

Note : The HD400-0.1 is not designed to produce continuous sine waves of greater than 200 Watts for periods longer than 10 seconds. Do not operate it in this manner.

8. Operating Procedure

CAUTION : POTENTIALLY LETHAL VOLTAGES EXIST ON THIS EVAL BOARD WITH AC MAINS POWER APPLIED. IMPROPER OR UNSAFE HANDLING OF THIS BOARD MAY RESULT IN SERIOUS INJURY OR DEATH.

8.1. Load Connection

- Connect a resistive or speaker load via the 2-pin connector J2 on the amp board. The load impedance must meet the minimum 3.5 ohms in the passband as specified in Table 1.
- Load power rating should be capable of handling the dynamic and continuous output power produced by the amplifier.

8.2. Input Connection and Grounding

- Connect a balanced audio source to J11. Refer to Fig. 8 for details.
- (Unbalanced input can be accommodated with a few resistor changes – please ask Audera for details)
- Signal grounds: Short the AGND and AGND-SIG together on the featureboard (preferable for lowest noise, THD), OR insert shorting jumper onto AMP J12 (second choice). Do not operate the amplifier unless one of these two methods is complete.
- Caution : Disconnect UUT from AC Power when inserting or removing RCA input connectors .

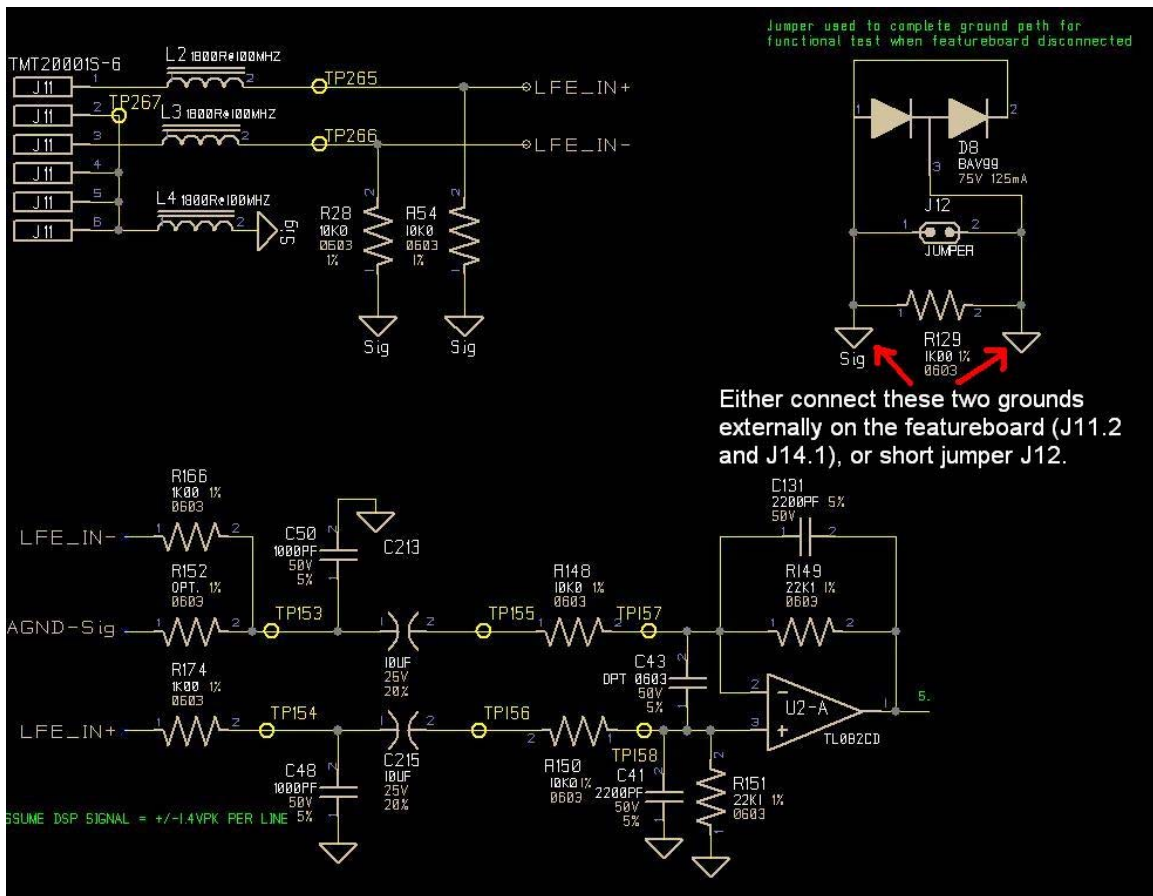


Fig. 8: Amplifier Input and Grounding Schematic

8.3. GPIO Connection

- NOTE: TO ENABLE THE AMPLIFIER, USER MUST PULL BOTH THE J14 ON-STANDBY PIN AND THE MUTE PIN “LOW” (CONNECT TO AGND). IF THESE PINS ARE LEFT FLOATING, THE AMPLIFIER WILL NOT TURN ON.
- The GPIO header J14 on the amp board offers the following connectivity:
 - Power supply outputs to power external circuitry:
 - +/-10V, +/-20mA for Op amps, etc.
 - +5V, 500mA for DSP, wireless receiver, etc.
 - +5V, 100mA for standby circuitry such as microcontroller, auto-detect, etc.
 - Control inputs to amplifier:
 - ON-STANDBY: control amplifier mode
 - MUTE: control amplifier mode
 - DSP_TRACK: (optional) for advanced tracking algorithms
 - Monitoring signals from amplifier:
 - CLIP: toggles state when amplifier detects it is clipping
 - FAULT: toggles state when amplifier detects an internal fault
 - THERMAL: analog output proportional to amplifier temperature

The GPIO header detailed description is below:

AMP to Featureboard “FB” GPIO Header (AMP: J14)

12-pin 2mm male shrouded header.

Pin	Function	Comments
1	AGND	AGND (Power Ground) for all GPIO signals.
2	+10V	Op amp + supply, driven by AMP. Supplies up to 20mA to FB. Shuts down in standby mode.
3	-10V	Op amp – supply, driven by AMP. Supplies up to 20mA to FB. Shuts down in standby mode.
4	+5Vstby	5V Standby supply, driven by AMP. Supplies up to 100mA. Always “ON” in Standby mode. Use this for autodetect, microcontrollers, or other low power functions that are always powered. In standby mode, reduce consumption to <5mA to meet 0.5W standby.
5	+5Vdsp	5V Power supply, driven by AMP, for the FB DSP, wireless receiver, LEDs, etc. Supplies up to 500mA. Shuts down in standby mode (option: keep active in standby mode)
6	AGND	AGND (Analog and Power Ground) for all GPIO signals.
7	CLIP	Voltage clip. Driven by AMP. Floating is normal, pulled low = clip detected. AMP has open collector NPN transistor to AGND. Add pullup resistor on FB to 3.3V or 5V.
8	ON-STANDBY	Controls amplifier mode. Driven by FB. Floating is STANDBY, Low is ON. Amplifier has 4k75 pullup to +5V stby. Use open collector NPN transistor on FB to pull low / float this line.
9	THERMAL	Analog output 3.3V or less, inversely proportional to AMP temperature. Uses NTC voltage divider from AMP. Use an ADC on the featureboard to read this signal. Activate temperature-based DSP compressors on FB if temperature too high (THERMAL voltage too low).
10	FAULT	Fault: Driven by AMP. Floating is normal, pulled low = fault detected. AMP has open collector NPN transistor to AGND. Use pullup resistor on FB to 3.3V or 5V. AMP NPN pulls this pin momentarily low if overcurrent or DC fault is detected. Amp still takes independent action to protect itself. Featureboard can also take action e.g. activate indicator LED, or trigger compressors, or go to mute mode, or go to standby mode.
11	MUTE	Controls amplifier mode. Driven by FB. Floating is MUTE, pulled low = UNMUTE. AMP has 22k pullup to +5Vstby. Use open collector NPN transistor on FB to pull low/float this line.
12	DSP_TRACK	(optional) time-advanced signal from DSP for advanced tracking algorithm

8.4. AP / Audio analyzer / Oscilloscope Connection

- Caution: It is recommended that only one scope ground clip is used and that it be connected to the J11 pin 6 header on the amplifier (AGND-SIG). This will prevent the possibility of a short circuit caused through multiple scope grounds.
- Caution : Some audio sources (including PCs) are ground-referenced, and placing a grounded oscilloscope ground clip anywhere other than AGND-SIG could short-circuit the amplifier circuitry.
- **NOTE : Amplifier outputs are BRIDGED and therefore neither output terminal is connected to system ground (both output terminals have potentials relative to input ground).** Do not connect ground clips to any amplifier output terminal.
- Audio analyzer inputs should be configured and connected as “Balanced”. Make sure the audio analyzer probes are not shorting any amplifier output to earth ground, AGND, or AGND-SIG.

8.5. AC Power Mains Connection

- Set the doubler W1 according to the input voltage.
 - For 220-240V, remove W1.
 - For 100-120V, insert W1.
- Connect an un-powered 3-wire AC mains cord to PSU connector J1. Pin 1 is “neutral”, pin 2 is “line” (hot), pin 3 is “earth ground”.
- Once energized, potentially lethal voltages are present on the board and necessary precautions must be taken.

- It is recommended to use an AC isolation transformer as an overall additional margin of safety to reduce potential shock hazards from accidentally touching live elements on the primary side.

8.6. Recommended Safety Guidelines

- Use an isolation transformer for the AC mains supply to reduce the possibility of shock hazard.
- Wear safety glasses whenever the sample is energized.
- Avoid personal contact with the sample whenever AC power is applied.

8.7. Warnings and Operating Restrictions

- Please call Audera Acoustics if there are further questions regarding setup, testing, etc at +1 (905) 859-8015.
- Do not short circuit the output terminals.
- The sample is not intended for short circuit, elevated temperature, overdrive, ESD, EMC, or any abusive testing – electrical or mechanical. It is only provided for listening evaluation of acoustic performance as would be incurred during normal playback of musical signals into speaker or resistive loads as detailed in this guide.
- Disconnect the HD400-0.1 from AC power mains when placing or removing measurement probes/leads and when inserting or removing RCA input plugs.
- Please be mindful that oscilloscope probe ground clips can short components and/or terminals on the board. This may cause damage.