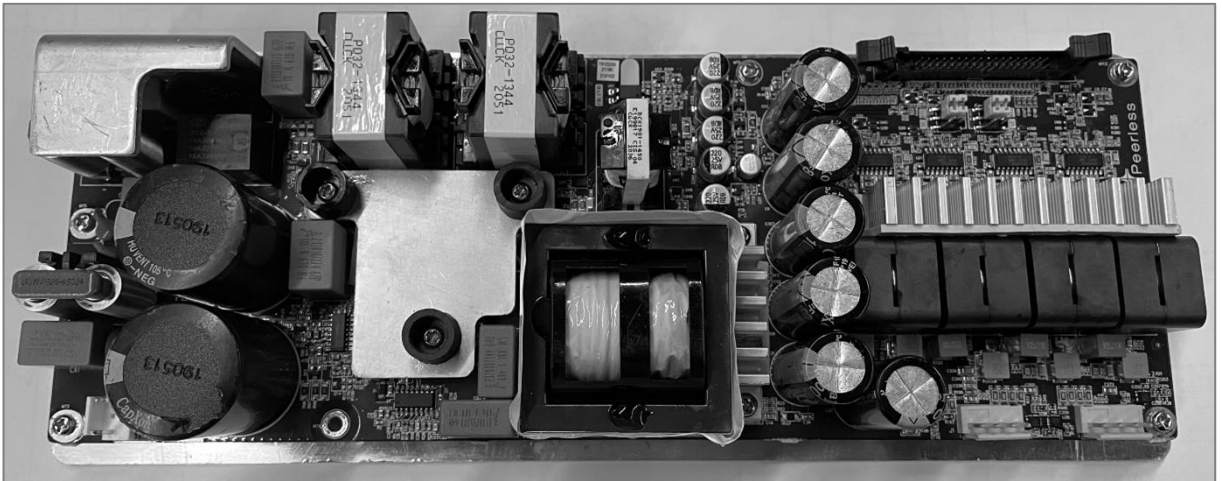




LCPF1200
Datasheet



Document Change History:

Revision	Release Date	Change Description	Updated by
1.0	17-Dec-20	First public release	Development Team
1.1	28-Jan-21	Self-generate noise figures reduced	AG

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1 Overview

1.1 Purpose

This document provides the technical specifications and description of use of the LCPF1200 power supply and audio amplifier module.

1.2 Features and Description

1.2.1 Description

The LCPF1200 module is a discrete class D amplifier with an integrated universal mains power supply with PFC pre-regulator and LLC main supply.

The amplifier is designed to be integrated onto a plate type amplifier module, as typically used in loudspeaker or subwoofer systems, or into rack mounted amplifiers.

The LCPF1200 module has a ribbon cable header for the DSP/MCU interface and is designed with DSP integration in mind, for example some thermal protection is expected to be done in the DSP using limiters. Additionally, voltage and current monitoring is provided for load characterization and advanced DSP control over the acoustic system.

The built-in auxiliary power supply provides up to 10 W of power to supply a typical professional DSP front end.

1.2.2 Features

- 1200 W total rated audio output power with +/- 60 V (120 V) rail
- Universal Mains Regulated Power Supply with Interleaved 2-Phase PFC
- Three independent discrete class D amplifier channels with flexible channel configuration, and jumper for SE or BTL operation:
 - 2 x 1000 W BTL channels into 4 Ω
 - 1 x 1000 W BTL channel into 4 Ω + 2 x 500 W SE channels into 2 Ω
 - 4 x 500 W SE channels into 2 Ω
- Auxiliary power supply to power-up external Input / Controller DSP FE "Front End"
- Controller provides up to 10 W total on +/-15 V (main) and a +3.3 V (standby) power outputs
- ErP and Energy Star compliant standby consumption of <0.5 W (where 3.3 V is an always on output and +/-15 V are power switched outputs) simplifies DSP front-end low power standby circuit design
- >80% total system efficiency at 50% output power
- Multiple readouts (current, voltage, temperature, fault)
- Verified for Safety and EMC compliance

1.3 Applications

Medium and larger sized touring loudspeakers, medium and larger PA loudspeakers, larger fixed installation loudspeakers (conference facilities, bars, etc.), larger studio monitors and home subwoofers, other self-powered loudspeakers. Bass, guitar and keyboard amplifiers and mid-power rack amplifiers.

1.4 Module Size and Mounting

Size (LWH, metric): 295 x 109 x 58 mm

Size (LWH, approximate imperial to the nearest 1/8"): 11 5/8" x 4 1/4" x 2 1/4"

Subject to system verification, additional space around the amplifier module should be left for cooling (100 mm) and safety clearance (10 mm).

There are six mounting holes (see Figure 1: LCPF1200 Mechanical Drawing) and they should all be used when mounting the amplifier module. They have an M3 thread and the screw can protrude 6 mm into the metal plate. The torque setting should be 0.58 ±0.05Nm.

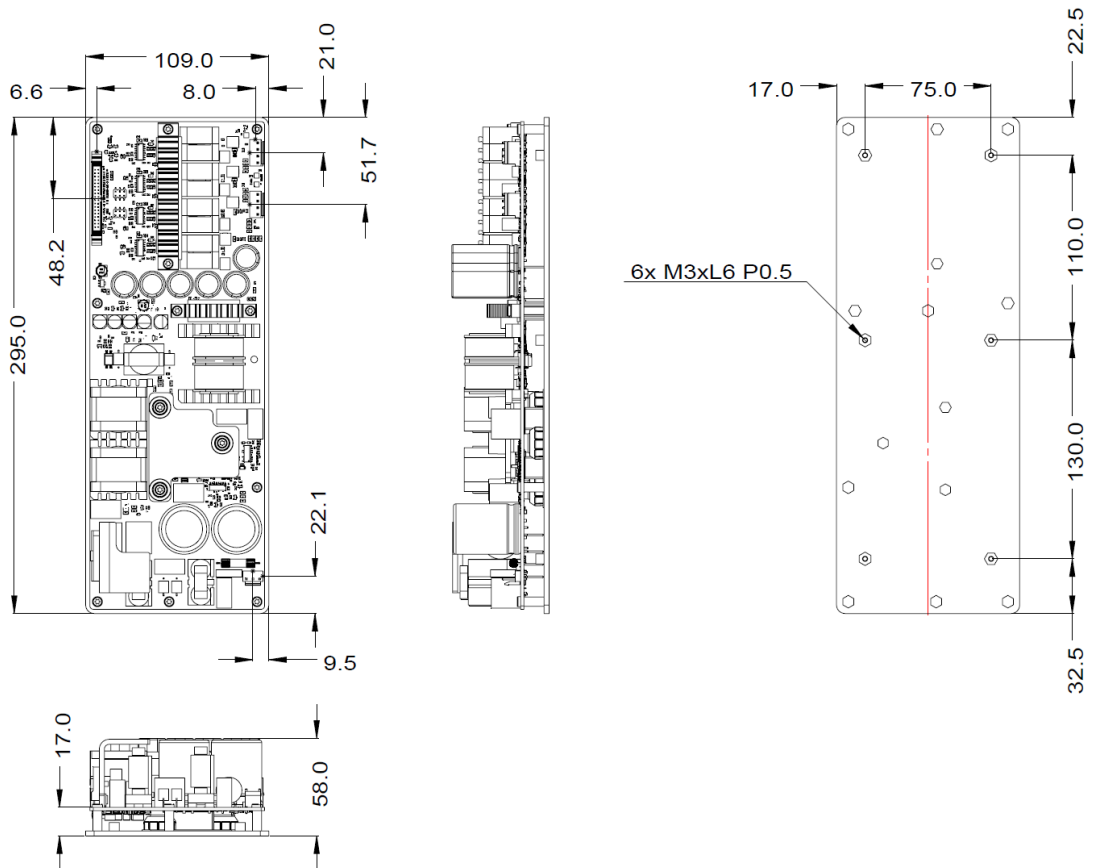


Figure 1: LCPF1200 Mechanical Drawing

1.5 Block Diagram

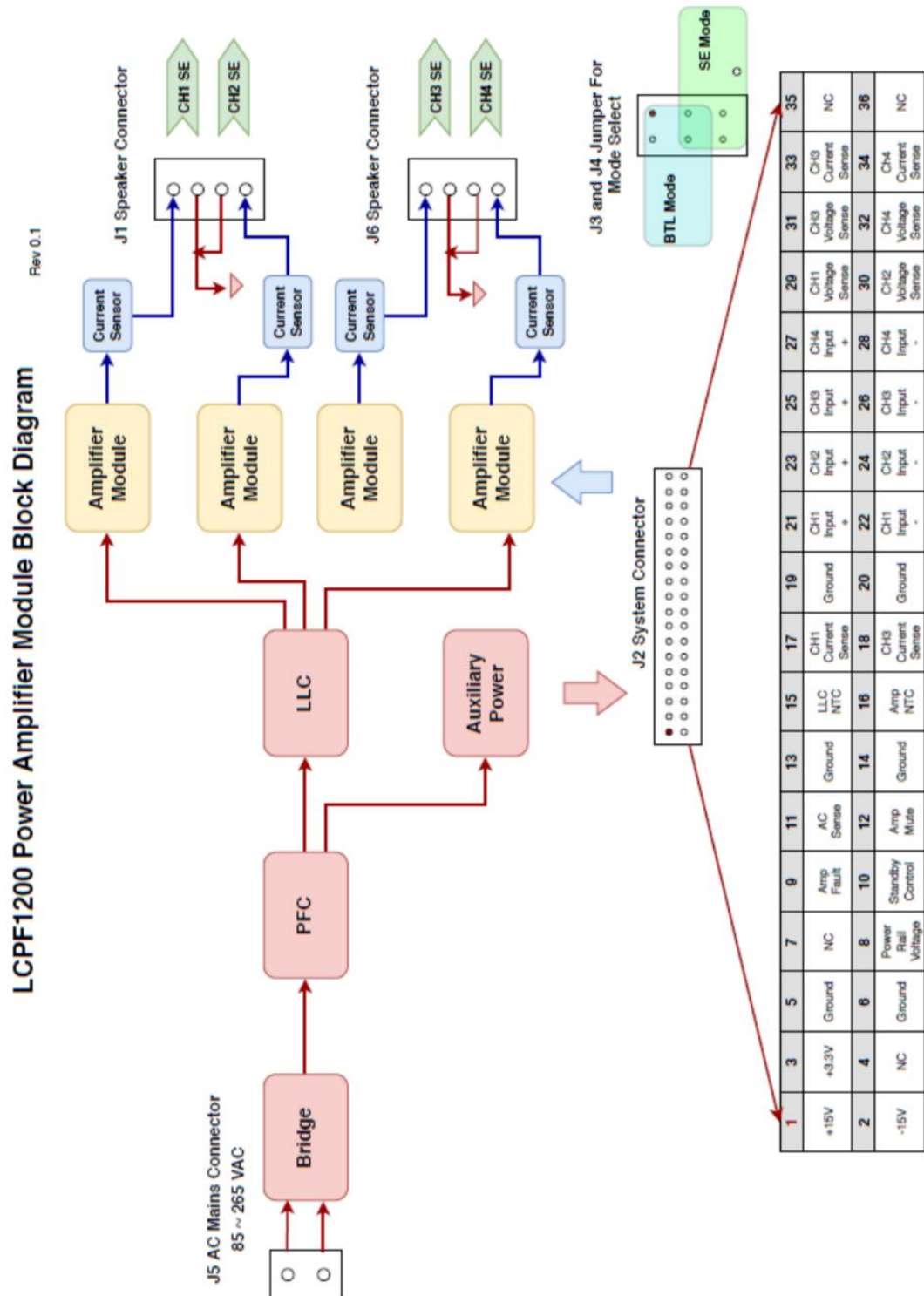


Figure 2: LCPF1200 Block Diagram Connectivity

2 Connectivity

2.1 Connector Locations

Pin 1 of the connector is shown on the picture below and is also clearly marked on the PCB.

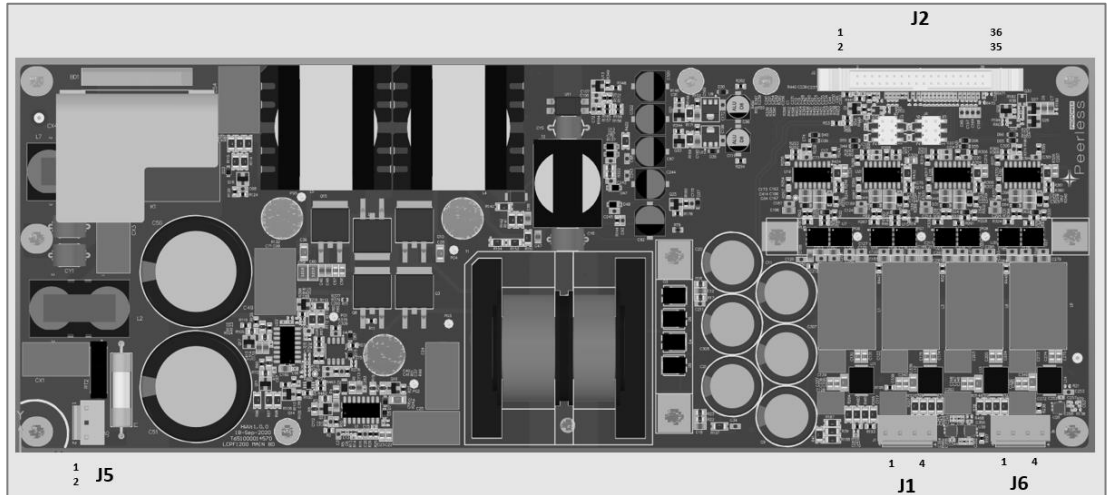


Figure 3: LCPF1200 Connector Overview

2.2 J1: Speaker Connector (CH1 output, CH2 output)

Connector Type: JST VHR Series, 4-pin, 1-row, pitch = 3.96 mm

Mating connector: JST VHR Series, 4-pin, 1-row, pitch = 3.96 mm

Pin	Function	Description	Type
1	Ch1+	Ch1 Output	Speaker output
2	Ch1-	GND	Ground
3	Ch2-	GND	Ground
4	Ch2+	Ch2 Output	Speaker output

Table 1: Speaker Connector J1

In BTL mode, use pins 1 and 4.

2.3 J6: Speaker Connector (CH3 output and CH4 output)

Connector Type: JST VHR Series, 4-pin, 1-row, pitch = 3.96 mm

Mating connector: JST VHR Series, 4-pin, 1-row, pitch = 3.96 mm

Pin	Function	Description	Type
1	Ch3+	Ch3 Output	Speaker output
2	Ch3-	GND	Ground
3	Ch4-	GND	Ground
4	Ch4+	Ch4 Output	Speaker output

Table 2: Speaker Connector J4

In BTL mode, use pins 1 and 4.

2.4 J2: System Connector

Connector Type: IDC connector, 36-Pin, pitch = 2.0 mm

Mating connector: IDC cable, 36-Pin, pitch = 2.0 mm

Pin	Function	Description	Type
1	+15V	Power supply +15 V, 250 mA	Power
2	-15V	Power supply -15 V, 250 mA	Power
3	+3V3	Power supply +3.3 V, 500 mA	Power
4	NC	Reserved for future use	-
5	GND	Power Ground (same as signal ground)	Ground
6	GND	Power Ground (same as signal ground)	Ground
7	NC	Reserved for future use	-
8	POWER RAIL VOLT	Power rail good detection, logic output high when power rail is > 80% of nominal value: 3.3 V is normal, fault is 0 V.	Logic output
9	FAULT AMP MCU	Amplifier fault detection pin: 3.3 V is normal, fault is 0 V.	Logic output
10	STBY	High (3.3 to 5 V) enables the amplifier. Low (0 to 0.7 V) disables the amplifier.	Logic input
11	AC SENSE	Pulse train (0 and +3.3 V) correlated to 2x AC mains frequency; missing pulse detects loss of AC mains for system safe shutdown.	Logic output
12	AMP MUTE	High (3.3 to 5 V) is unmuted. Low (0 to 0.7 V) is muted.	Logic input
13	GND	Signal Ground (same as power ground)	Ground
14	GND	Signal Ground (same as power ground)	Ground
15	NTC1	NTC is connected from this pin to ground. System to provide appropriate pull up.	Resistance output
16	AMP NTC	NTC is connected from this pin to ground. System to provide appropriate pull up.	Resistance output
17	CH2 C SENSE	CH2 current monitoring output, 0-3 V	Analog output
18	CH1 C SENSE	CH1 current monitoring output, 0-3 V	Analog output
19	GND	Signal Ground (same as power ground)	Ground
20	GND	Signal Ground (same as power ground)	Ground
21	CH1 IN +	CH1 Analog non-inverting input	Audio input
22	CH1 IN -	CH1 Analog inverting input	Audio input
23	CH2 IN +	CH2 Analog non-inverting input	Audio input
24	CH2 IN -	CH2 Analog inverting input	Audio input
25	CH3 IN +	CH3 Analog non-inverting input	Audio input
26	CH3 IN -	CH3 Analog inverting input	Audio input
27	CH4 IN +	CH4 Analog non-inverting input	Audio input
28	CH4 IN -	CH4 Analog inverting input	Audio input
29	CH1 V SENSE	CH2 amplifier output voltage sense, 2.2 V p-p	Analog output
30	CH2 V SENSE	CH2 amplifier output voltage sense, 2.2 V p-p	Analog output
31	CH3 V SENSE	CH3 amplifier output voltage sense, 2.2 V p-p	Analog output
32	CH4 V SENSE	CH4 amplifier output voltage sense, 2.2 V p-p	Analog output
33	CH3 C SENSE	CH3 current sensing output, 0-3V	Analog output
34	CH4 C SENSE	CH4 current sensing output, 0-3V	Analog output
35	NC	No connection	-
36	NC	No connection	-

Table 3: System Connector

2.5 J5: AC Mains Connector

Connector Type: JST VHR Series, 3-pin, 1-row, pitch = 3.96 mm

Mating connector: JST VHR Series, 3-pin, 1-row, pitch = 3.96 mm

Pin	Function	Description	Type
1	Live	AC Live	AC mains input
2	NC	No connection	
3	Neutral	AC Neutral	AC mains input

Table 4: AC Mains Connector

2.6 J3 and J4 Jumper Connector

For channels 1 and 2 or 3 and 4, position the jumpers as shown below to select 4 x SE or 2 x BTL (factory default) or 1 x BTL + 2 x SE. Check the mode before connecting a load to the amplifier outputs.

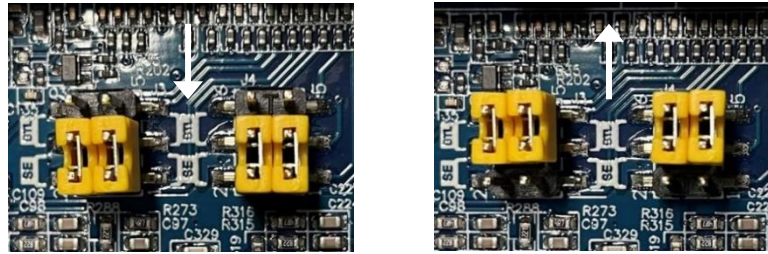


Figure 4: SE-mode (left) and BTL-mode (right) selection connector

3 Protection Features

3.1 Under-voltage protection (UVP)

The amplifier module has a built-in under-voltage protection. It monitors whether the line voltage drops below the specified low operational AC voltage range, typically the main supply will shut down below 80 Vac, however the standby SMPS may continue to operate with a line voltage as low as 60 Vac. In this intermediate case the system may see an amplifier fault condition.

3.2 Amplifier DC Protection (DCP)

The amplifier module has a built-in dc detection circuit. If a dc-voltage is detected at the one of the amplifier outputs, the module mutes the amplifier to protect the loudspeaker. Additionally, the FAULT AMP MCU pin goes low so the MCU can indicate the fault.

3.3 Over-current Protection (OCP)

The amplifier module features over-current protection to protect the power MOSFETs during abnormal load conditions. It starts a sequence of events when it detects an over-current condition during either the high-side or low-side turn-on of a pulse. As soon as either the high-side or low-side current sensing block detects an over-current, then the amplifier is shut down until the output current is back to normal.

3.4 Thermal Protection (OTP)

The amplifier module has a built-in thermal protection to prevent the module from suffering thermal runaway. If the primary transformer $>100\text{ }^{\circ}\text{C}$ and the primary MOSFET $>90\text{ }^{\circ}\text{C}$, the built-in thermal protection circuit switches off the power supply rails, after some cooling the unit can restart. The cool down time depends on the ambient temperature and attached heatsinking.

3.5 Electrostatic discharge (ESD)

Whilst the amplifier module is well protected against ESD, appropriate ESD handling precautions should still be taken. The warranty does not cover ESD damaged to products due to improper handling.

4 Specifications

4.1 Environmental Conditions

Parameter	Test Conditions	Min	Typical	Max	Unit
Weight			1420		g
Storage temperature		-20		+60	°C
Storage humidity	(40 °C, non-condensing)			90	% RH
Operating temperature				+45	°C
Operating humidity	(non-condensing)			90	% RH
Operating altitude				2000	m

Table 5: Environmental Conditions

4.2 Mechanical Stress Testing

Parameter	Test Conditions	Quantity
Shake test (unpacked)	Random vibration with total spectral content 3.78 Grms	4 hours per axis on 3 axes
Shock test (unpacked)	60 cm onto a hard surface	1 shock on each of 3 axes
Drop test (packed)	60 cm onto a hard surface	2 drops on flat sides, 2 on edges and 2 on corners

Table 6: Mechanical Stress Testing

4.3 Environmental Stress Testing

Parameter	Test Conditions	Time
Reliability aging	1/8 rated power on all channels with 9dB crest factor IEC noise, 4 Ω load	12 days
Power test	33% rated power on all channels with 9dB crest factor IEC noise, 4 Ω load	100 hours
Power cycling test	EIA noise on all channels, 4 Ω load, 2 mins/cycle	1000 cycles
Thermal profile test	25°C, 1/8 rated power on all channels with 9dB crest factor IEC noise, 4 Ω load	180 min
Temperature test	23 °C to 0 °C in 30 min, 0 °C for 4 hours, 0 °C to +45 °C in hour, 45 °C for 4 hours, 45 °C to 23 °C in 30 mins. 33% rated power on all channels with 9dB crest factor IEC noise, 4 Ω load.	1 cycle
High temperature /humidity test	45 °C and 90% RH for 4 hours with 30 min ramp up and down time to ambient conditions. 33% rated power on all channels with 9dB crest factor IEC noise, 4 Ω load.	5 hours

Table 7: Environmental Stress Testing

4.4 AC Mains Supply Specification

Electrical Characteristics @ 25°C (unless otherwise specified)

Parameter	Test Conditions	Min	Typical	Max	Unit
Operating voltage range	47Hz – 63 Hz	85		265	V _{ACrms}
Performance voltage range	47Hz – 63 Hz	100		265	V _{ACrms}
Mains frequency		47		63	Hz
Switching frequency (LLC)			85		kHz
Standby power consumption	STBY pin is high, 230Vac		0.28	0.35	W
Idle power consumption			3		W
In-rush current		30		60	A
On-board hardwired fuse			12		A
Power supply discharge time	No load		1.2	2	s
Rated thermal power mounted to a plate	200 x 350 x 3 mm Aluminum plate		400		W
System efficiency @2x4 Ω at rated power BTL	230 Vac 120 Vac		81 80		%
Power factor (rated power)			0.95		PF
Thermal shutdown		85	90	100	°C

Table 8: AC Mains Parameters

4.5 Rated Audio Power vs Load Impedance and Configuration

Amplifier module was mounted with its metal plate onto a metal plate.

Configuration	Load	Power (1%)	Power (no clip)	V (peak)	V (RMS)
SE	2	700*	675*	52.0	38.0
SE	3	519	490	54.2	38.3
SE	4	420	371	54.4	38.5
SE	6	250	249	54.7	38.7
SE	8	199	188	54.8	38.8
BTL	4	1400*	1350*	104.0	73.0
BTL	6	1000	943	106.4	75.2
BTL	8	764	721	107.4	75.9

* Shall be DSP-limited to less than rated value within 100 ms

Table 9: Audio Power vs. Load and Configuration

4.6 Thermal Power Dissipation

Mains Voltage	Output vs. Max Power	Thermal Power Dissipation
120 Vac	0%	20 W
	12.5%	50 W
	33%	100 W
230 Vac	0%	20 W
	12.5%	50 W
	33%	100 W

Table 10: Thermal Power Dissipation

4.7 Audio Performance

Room Temperature = 25 °C, f = 1 kHz, RL = 4 Ω, 230 V/50 Hz AC mains supply, test set = Audio Precision (unless otherwise specified)

Parameter	Test Conditions	Min	Typical	Max	Unit
Rated total power for all channels	THD+N <1%, duration 10 s		1200		W
Long term thermally limited total power	THD+N <1%, continuous		400		W
Peak power, single channel (BTL)	Duration 1 ms		2700		W
Rated power, single channel (BTL)	THD+N <1%, duration 1s		1200		W
Peak power, single channel (SE)	Duration 1 ms		800		W
Rated power, single channel (SE)	THD+N <1%, duration 1 s,		350		W
Maximum output voltage			120		Vp
Maximum output current	Output inductor and OCP limited			30	Ap
Power bandwidth			>30		kHz
THD+N	Power output 10 W		0.002	0.003	%
Self-generated output noise, SE	20 – 20k Hz, unweighted		65	70	µV
	20 – 20k Hz, A-weighted		35	45	µV
Channel separation	SE at 10 W		83		dB
	BTL at 10 W		95		dB
Dynamic range	Unweighted		117		dB
	A-weighted		120		dB
Voltage gain	BTL mode		27		dB
	SE mode		21		dB
Input sensitivity	Power output 600 W @ 4 ohm		2.1		V
Common-mode rejection ratio			60		dB
Frequency response	Fin 20 – 20k Hz		±2		dB
Input impedance signal line			26		kΩ
Input level limit	Fin 20 – 20k Hz			10	Vp
Output impedance (SE)			20		mΩ
Damping factor (SE)			200		-
Amplifier PWM frequency		320		400	kHz

Table 11: General Audio Parameters

4.8 Auxiliary Power Supply Specification

Electrical Characteristics @ 25°C (unless otherwise specified)

Parameter	Test Conditions	Min	Typical	Max	Unit
+15 V rail	Module On	14.5	15	15.5	V
-15 V rail	Module On	-14.5	-15	-15.5	V
+15 V rail full load current rating	Module On			300	mA
- 15 V rail full load current rating	Module On			300	mA
Ripple and Noise on 15 V Rail	Full load			50	mVpp
Ripple and Noise on -15 V Rail	Full load			50	mVpp
+3.3 V rail	Module On	3.25	3.3	3.35	V
+3.3 V rail full load current rating	Module On			500	mA
Ripple and noise on +3.3 V rail	Full load			50 mV	mVpp
Maximum total output power external	Combination of +/-15 V and 3 V outputs available			10	W

Table 12: Auxiliary Power Supply Parameters

4.9 Audio Precision Detailed Measurement Report Graphs

4.9.1 Frequency Response

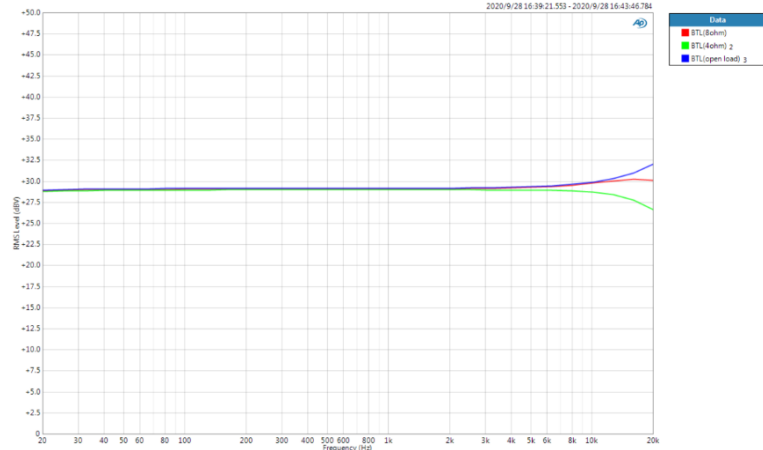


Figure 5: Frequency response 4 Ω (Green), 8 Ω (Red), open load (Blue)

4.9.2 Total Harmonic Distortion + Noise

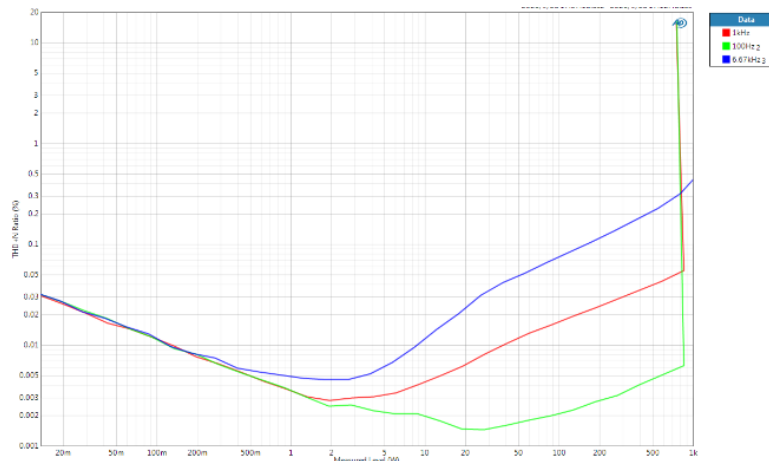


Figure 6: THD + Noise (4 Ω load), 100 Hz, 1 kHz and 6.67 kHz

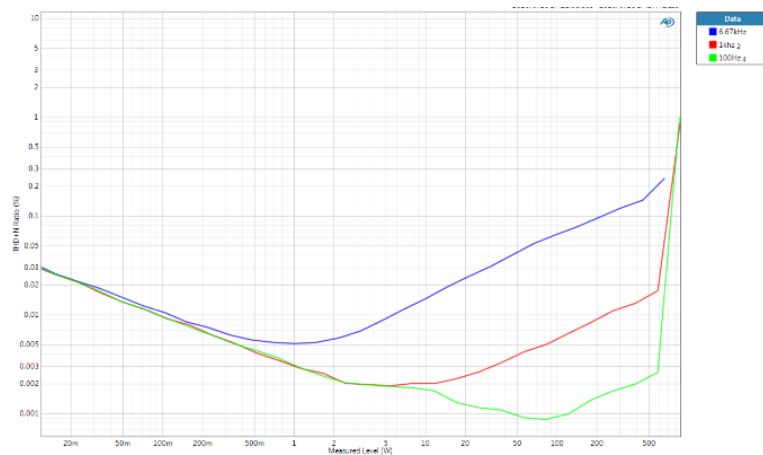


Figure 7: THD + Noise (8 Ω load), 100Hz, 1 kHz, 6.67 kHz

4.9.3 Idle Noise Spectrum

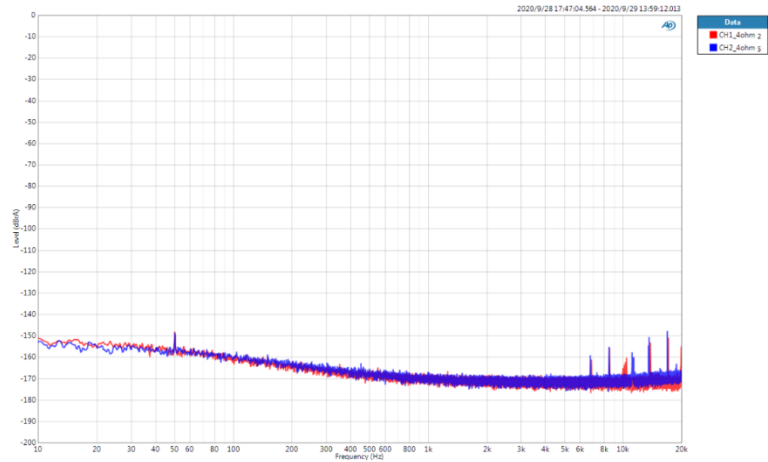


Figure 8: FFT idle noise (0 dB = rated power), CH1 (Red), CH2 (Blue)

4.9.4 Intermodulation Distortion (CCIF)

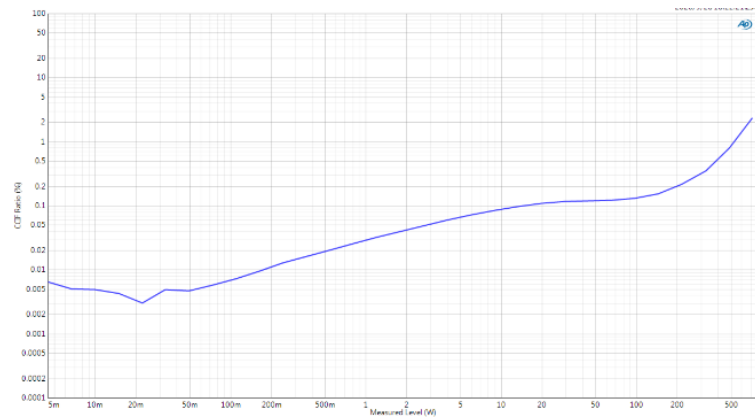


Figure 9: CCIF vs Power (4 Ω load)

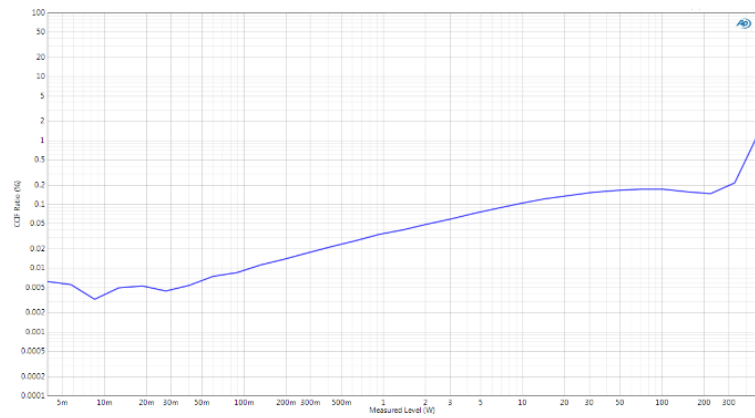


Figure 10: CCIF vs Power (8 Ω load)

4.9.5 Intermodulation Distortion (TIM)

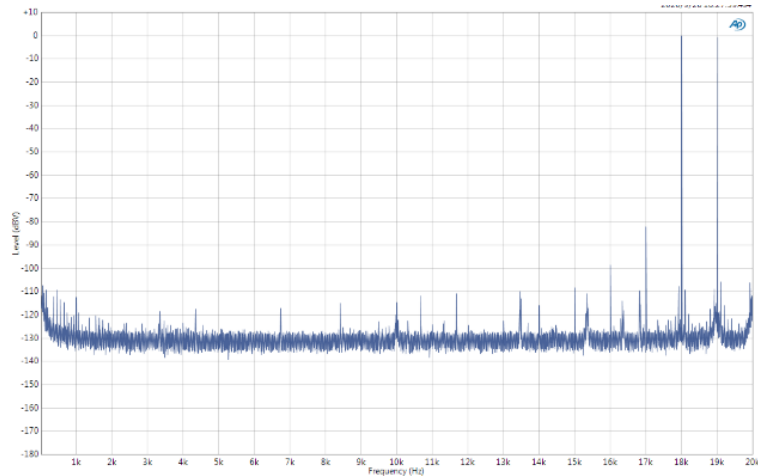


Figure 11: Dual tone intermodulation spectrum

4.9.6 Crosstalk (SE)

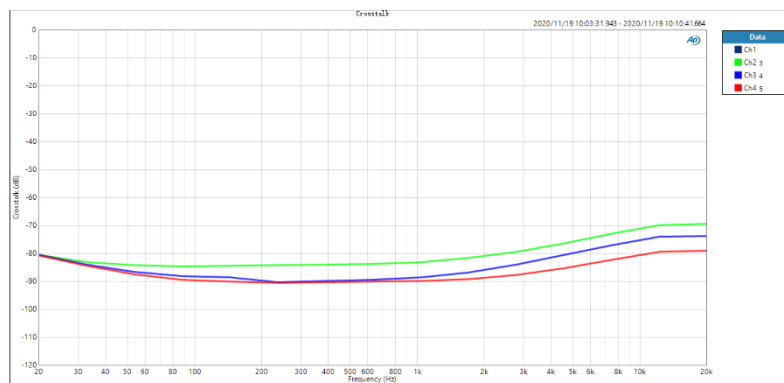


Figure 12 Crosstalk

5 Control and Read Out Pin Specification

5.1 Control Pin Descriptions

5.1.1 STBY

Power consumption is minimized as the +/-60 V and +15/-15 V supply rails are switched off. The PFC function is also disabled to further reduce power. Providing a switched +/-15V simplifies system design, as typically this would need to be managed and implemented in the DSP. The only active power rail is the 3.3 V standby output (maximum 0.5 W at 150 mA is available). It is expected that the MCU detects the presence or not of a signal and puts the amplifier module into standby as needed using this pin.

Logic: High = Active, Low = Disabled.

5.1.2 AMP MUTE

The amplifier output is disabled when the amplifier module is muted. There is approximately a 200 ms switch-on mute when this control pin is changed from low-to-high to prevent startup popping noises and allow power supply rails to stabilize. Conversely, when this control pin is changed from high-to-low, muting is near instantaneous to quickly mute the speaker outputs.

Logic: Low = Active, High = Disabled.

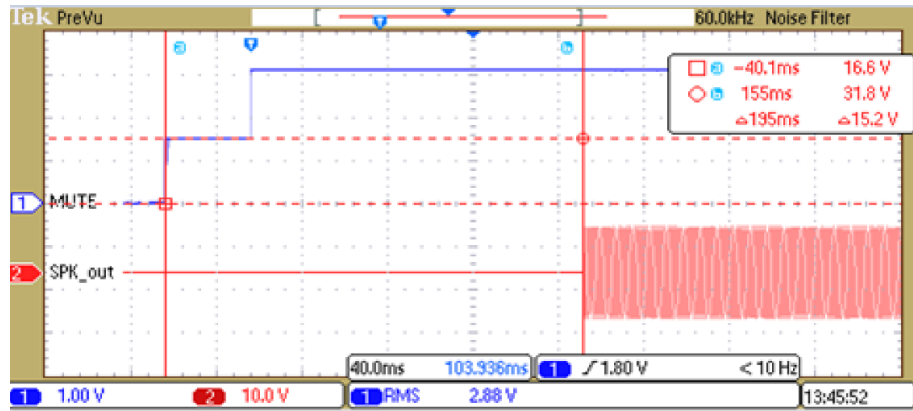


Figure 13: Mute Release timing

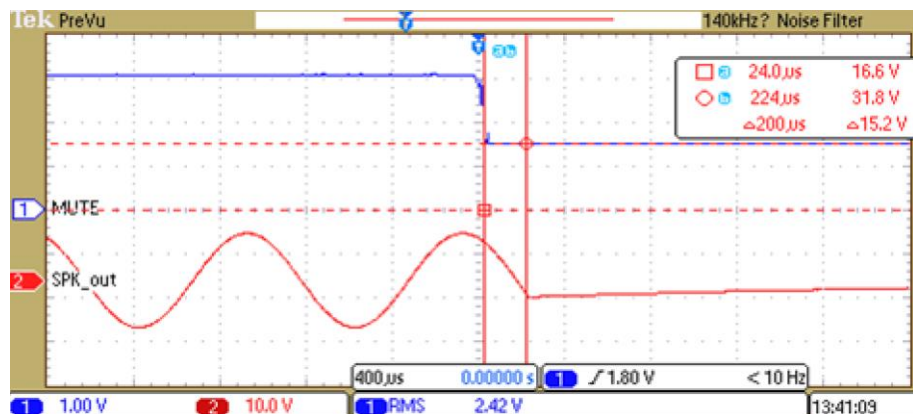


Figure 14: Mute Active Timing

5.2 Read Out Pin Descriptions

5.2.1 Power Rail Volt

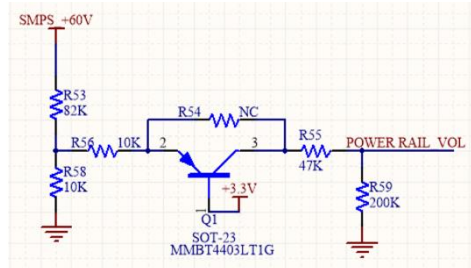


Figure 15 : Power Rail Voltage Detection Circuit

This is a logic output pin for monitoring the voltage of the amplifier power rail (positive side only). It indicates if the amplifier rail is >80% of the nominal value and can be useful for detecting if the system is overloaded or there is excessive rail droop caused by low mains voltage or overload.

5.2.2 Fault Amp MCU

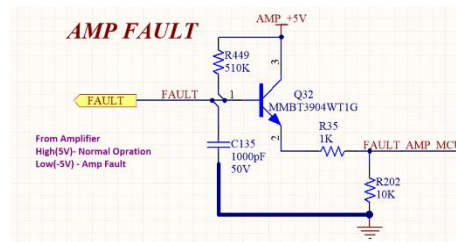


Figure 16 : AMP Fault Control Circuit

This is a logic output pin that goes low if the amplifier experiences a fault, if the over-current protection is active, if the DC offset protection is active, or if the amplifier is muted. Normal operating is shown by a high level.

5.2.3 AC Sense

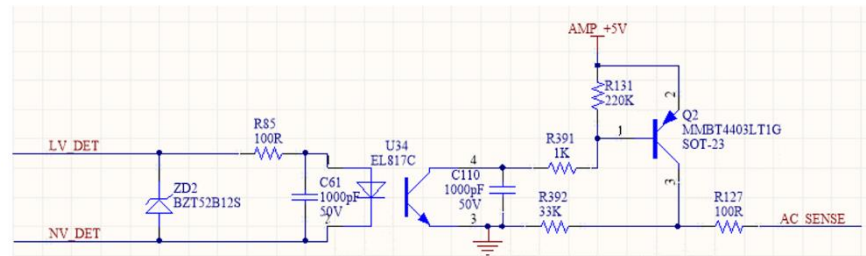


Figure 17 : AC Line Detection Circuit

This is a logic output pin for monitoring the AC mains status. It is a pulse train (0 - 3.3 V) correlated to twice the AC mains frequency; a missing pulse indicates a loss of AC mains so that the system can be safely shutdown. Together with a timer, this signal can be used by the system MCU; if no pulse is detected for at least 3 mains cycle periods, the MCU can assume that AC power has been disconnected. Then the AMP MUTE pin should be used to mute the amplifier. With careful system design there is also time to save the system state in preparation for imminent shutdown.

5.2.4 NTC1

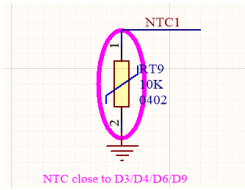


Figure 18 : NTC1 Circuit

This is a resistance analog output to indicate the temperature of an NTC located in the power supply section that is used for the system to monitor temperature – see Figure 22 and Table 14.

5.2.5 MP_NTC

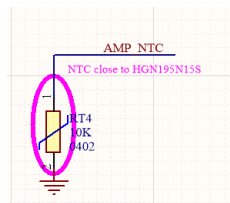


Figure 19 : AMP NTC Circuit

This is a resistance analog output to indicate the temperature of an NTC located near the amplifier heatsink that is used for the system to monitor temperature – see Figure 22 and Table 14.

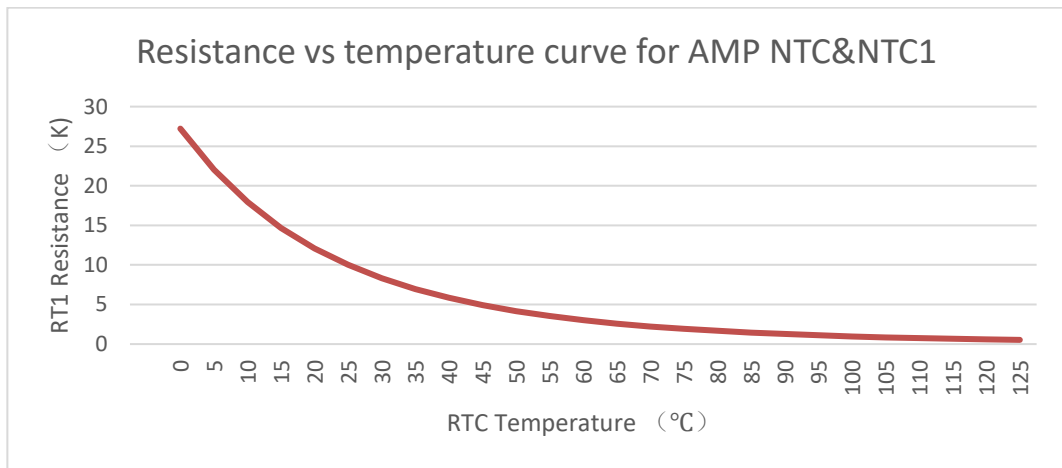


Figure 20: Output pin voltage vs. temperature for NTC1 and AMP_NTC with 2.2 kΩ pullup resistor to 3.3 V

Temperature, °C	Resistance, kΩ	Temperature, °C	Resistance, kΩ	Temperature, °C	Resistance, kΩ
-40	195.652	20	12.081	80	1.669
-35	148.171	25	10.000	85	1.452
-30	113.347	30	8.315	90	1.268
-25	87.559	35	6.948	95	1.110
-20	68.237	40	5.834	100	0.974
-15	53.650	45	4.917	105	0.858
-10	42.506	50	4.161	110	0.758
-5	33.892	55	3.535	115	0.672
0	27.219	60	3.014	120	0.596
5	22.021	65	2.586	125	0.531
10	17.926	70	2.228		
15	14.674	75	1.925		

Table 13: NTC characteristic resistance vs temperature

NTC Application Note: The resistance-to-temperature curve for NTC1 and AMP_NTC is shown in Table. when provided with the recommended 2.2 kΩ pull-up resistor to 3.3 V. It is not recommended to operate the amplifier with a temperature above 90 °C. It is recommended to implement a thermal limiting into the system DSP with the following characteristics:

1. Change RMS limiter threshold by -1 dB / °C when 85 °C is exceeded
2. Change RMS limiter threshold by -2 dB / °C when 90 °C is exceeded
3. Shut off the amplifier if 95 °C is reached because thermal regulation has failed.

5.2.6 C-SENSE

This is an analog output pin which uses an isolated hall current sensor to provide amplifier current monitoring. It has a voltage-to-current sensitivity of 45 mV/A and a maximum range of 0 - 3 V, to represent the -31 A to +31 A output current range, with a DC offset of 1.55V. When connected to a DSP, it is recommended to AC couple the signal to remove the DC offset. How this is done will depend on the ADC input used. The signal is low pass filtered with a 20 kHz RC to reduce noise and the output impedance is approximately 1 kΩ. An example output is shown in Figure 7.

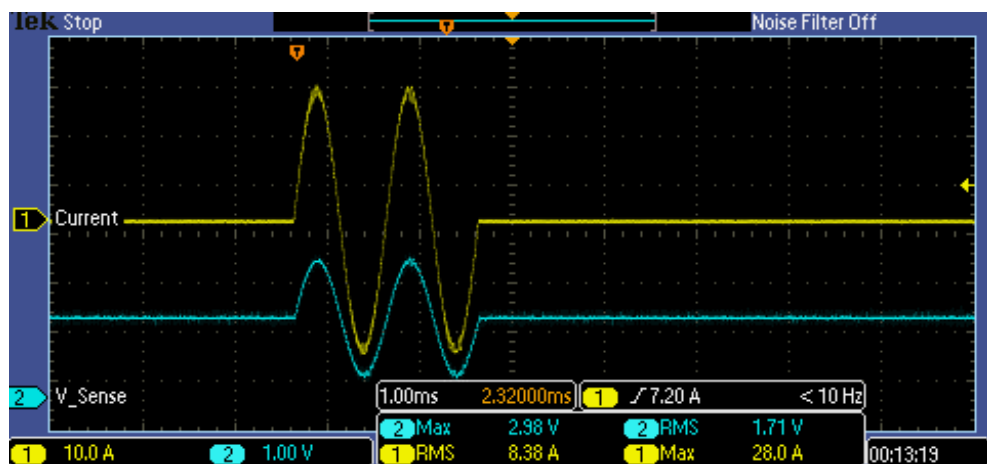


Figure 21: C-sense output voltage vs AMP load current example.

5.2.7 V-Sense

This is an analog output pin presents the amplifier power level to an external device with a 1/28 voltage divider. The output is AC coupled and has a 10 kΩ impedance. Note therefore that if a low impedance ADC is used to sample this signal it may require buffering otherwise it will have a reduced amplitude. The maximum output voltage corresponding to the 60 V rail is 2.14 V peak.

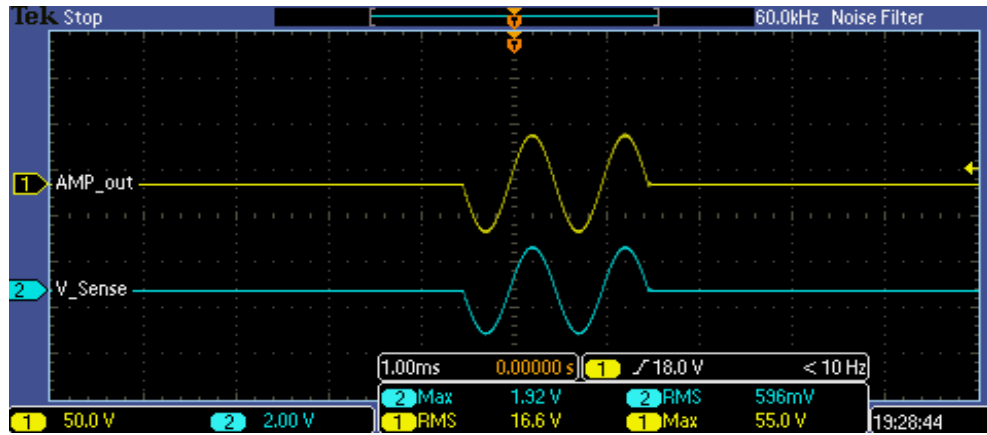


Figure 22: V-sense voltage vs AMP output voltage.

6 Thermal Requirements

At full power, the LCPF can be operated within the range -10 to +45 ° without additional cooling efforts, for example heatsinking or forced-air convection.

From 45 – 55 °C, the amplifier can operate, but, depending on system de-rating or intervention of DSP, thermal management may be needed.

It is recommended that the amplifier is mounted to a 3 mm thick aluminum plate with minimum dimensions of 295 x 110 mm. However, temperature profiling and testing within the system will be needed to verify operation as the thermal environment of each system is different. The plate should be clean and flat, and thermal transfer paste should be used to aid heat dissipation.

Subject to system verification, additional space around the amplifier module should be left for cooling (100 mm) and safety clearance (10 mm).

As noted in the “NTC Application Note” section, the on-board NTC outputs should be used by the system DSP to implement system-level thermal protection to ensure the most reliable operation.

7 Safety



This amplifier module operates at mains voltages and generates high voltages. Hazardous voltages are presented on accessible parts. It must not be possible to touch these parts when the amplifier module is installed into equipment. Never touch any part of the amplifier module while it is connected to the mains. Power up via an isolated current-limited supply when testing. Be aware of high voltages when testing.



Attention: Observe precautions for handling electrostatic sensitive devices. This module uses semiconductors that can be damaged by electrostatic discharge. Damage due to inappropriate handling is not covered by the warranty.



Never expose this apparatus to liquids or moisture.

This product has no user-serviceable parts. Do not disassemble.

9 Demo Board Guide

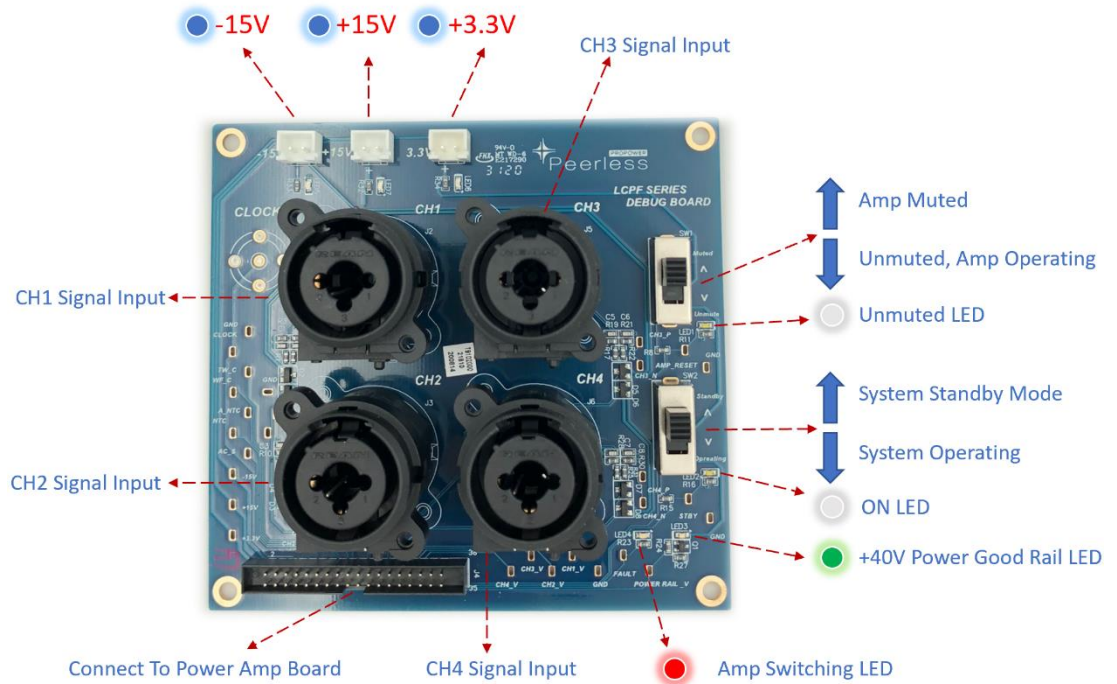


Figure 24: Demo board connectors, LEDs and switches.

Power on Sequence:

1. AC power OFF
2. Reset the switches as shows on the picture, connect to power amplifier board
3. AC power ON: +3.3 V LED lights up
4. Set switch to "Operating": white LED lights up
5. +/-15 V LEDs light up
6. +40 V power rail LED lights up
7. Set switch to "Unmuted": white LED lights up
8. Amp switching LED lights up: amplifier is operational

10 List of abbreviations

SE: Single-ended amplifier

BTL: Bridge-tied-load amplifier

PFC: Power Factor Correction pre-regulation

LLC: Inductor-Inductor-Capacitor power supply

MCU: Micro Controller Unit

EMC: Electro-magnetic compatibility

GND: Power and signal ground

NTC: Temperature sensor with a negative temperature coefficient

11 Compliance Standards

11.1 System Compliance Notes

EMI and Safety verification, and formal testing of the final product should be carried out to secure compliance of the final product and to achieve formal regulatory approval. The module is provided pre-tested to meet the above requirements in a mock-up system however this cannot exactly represent the end use. The system integrator will need to work with Peerless to ensure the amplifier in the product application can pass the regulatory requirements.

EMC will require special attention and collaboration with the system integrator, note that for Class A "professional" products, it may be possible to pass conducted and radiated emission without any system-level shielding of the amplifier module. However, Class B "consumer" products will likely require an EMI shielded enclosure such as a steel case, perforated steel cage, or "aluminum tub" type of enclosure for the amplifier module. Shielding and EMC require attention to how the amplifier module is used in the system application, cable lengths, and proximity of other internal wiring to the amplifier and power supply components. System design should be reviewed with Peerless engineering before design completion.

11.2 Safety Compliance

Pre-testing to the standards listed below has been completed within Peerless' own testing labs. Official certification must be done at the system level.

11.2.1 Core standards

Safety tested according to the following core standards:

- EN 60065:2002 + A1:2006 + A11:2008 + A2:2010 + A12:2011
- EN 62368-1:2014
- CSA C22.2 NO. 62368-1-14:2014
- UL 62368:2014

11.2.2 Country regulations

Evaluated against and complies with the regulations of the following countries:

- 60065 AR, AT, AU, BE, BY, CA, CH, CN, CZ, DE, DK, ES, EU, FI, FR, GB, GR, HU, IE, IT, JP, KR, MY, NL, NO, NZ, PL, PT, RO, SE, SG, SI, SK, UA, US
- 62368-1 CA, DK, FI, DE, IE, IT, NO, SE, GB, US, CENELEC common modifications

11.3 Electro-Magnetic Compliance

11.3.1 ESD Precautions

- The product (the system into which this amplifier module will be installed) shall pass the ESD discharge test by ± 4 kV contact discharge and ± 8 kV air discharge.

11.3.2 EMI Compliance

- EN 55032:2012 with EN 55032:2012 AC 2013
- EN 61000-3-2:2014
- EN 61000-3-3:2013
- FCC part 15 subpart B

11.3.3 Immunity

- EN 55103-2:2009
- EN 55035:2017

11.4 Environmental

- EN 50564 (ErP)
- RoHS 2.0

12 Warrantee

Unless there is a separate purchase/project contract containing negotiated warranty terms, the warranty terms below apply.

TYM warrants that the Products produced by TYM or TYM's subcontractor are free from defects in material, functionality and workmanship. In every case TYM stays liable for the fulfilment of the duties resulting from this Agreement. The warranty is valid for twelve (12) months from the delivery date of such Products ("Warranty Period"). Customer may make any warranty claim in writing within ten (10) days after Customer becomes or ought to aware of the defect and before the expiration of the Warranty Period.

If any defect occurs, Customer shall immediately notify TYM and provide TYM with a detailed description in component level of defect of the Products and the results of already performed analysis in regard to the defect Products. In case of the defect is confirmed by TYM and attributable to TYM and within the Warranty Period, TYM may at its own discretion: (i) replace the defective Products with non-defective Products; (ii) repair; (iii) accept the return of the defective Products for a full refund if such Products cannot be repaired or replaced with non-defective Products; or (iv) reimburse Customer for the reasonable costs incurred in connection with the reasonable corrective action agreed by both Parties.

TYM's warranty shall not apply to the extent arising out of: (i) modifications to the Products that were not authorized by Customer; or (ii) compliance with design(s), requirement(s), instruction(s), or use of part(s) or materials provided by Customer; (iii) the modification of components made by Customer or any third party not authorized by TYM; or (iv) any misuse, neglect, accident, or improper installation or testing by Customer. In any event, TYM shall not be liable for any defects which are caused by or attributable to Customer.



Peerless, c/o Tymphany HK Limited
One Thorndale Drive, Suite 200, San Rafael, California 94903
Tel: +1 415-887-9538
e-mail: sales@tymphany.com
website: www.tymphany.com

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