International
IOR Rectifier

REFERENCE DESIGN

IRAUDAMP15

35W/4Ω x 2 Channel Class D Audio Power Amplifier Using the IR4311

By
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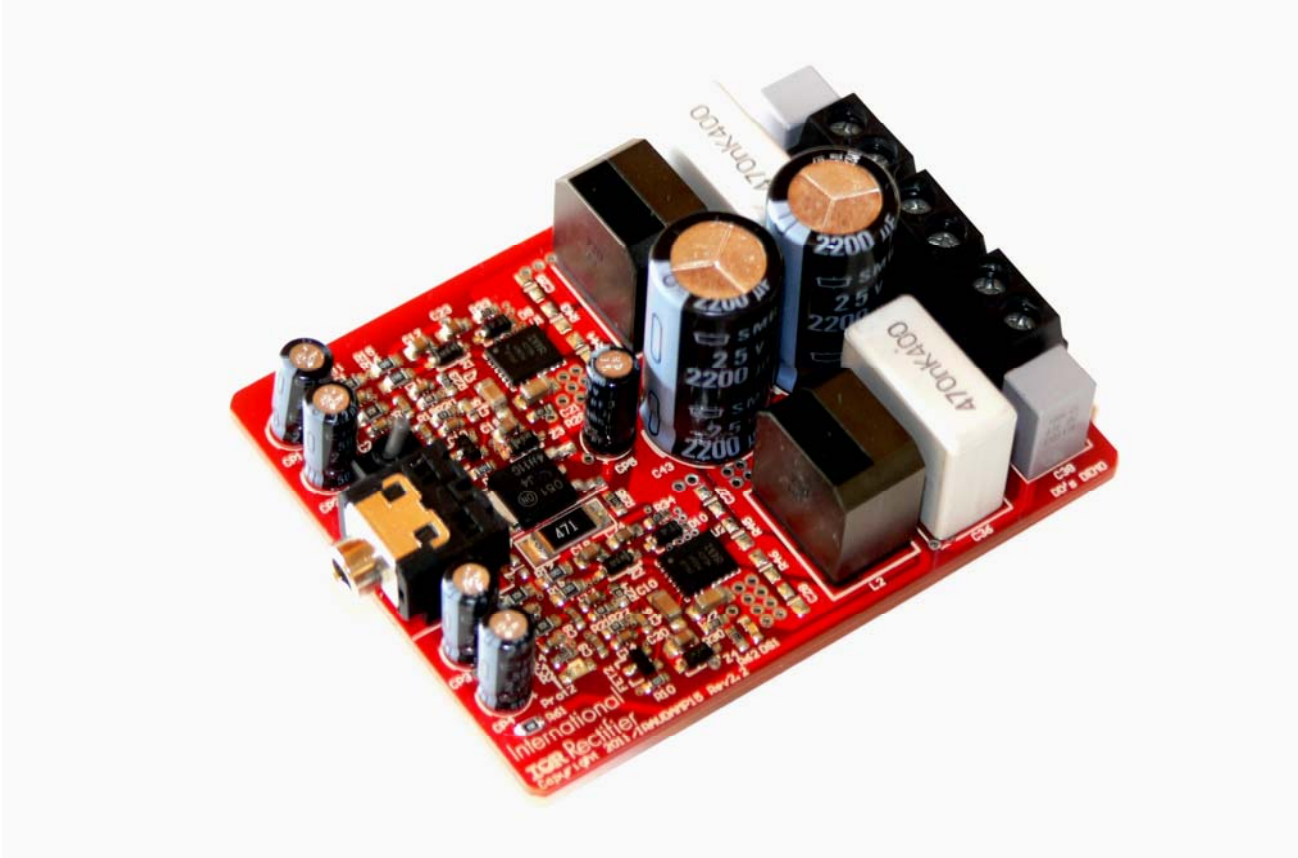

CAUTION:

International Rectifier suggests the following guidelines for safe operation and handling of IRAUDAMP15 Demo board;

- **Always wear safety glasses whenever operating Demo Board**
- **Avoid physical contact with exposed metal surfaces when operating Demo Board**
- **Turn off Demo Board when placing or removing measurement probes**

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Introduction

The IRAUDAMP15 reference design is a two-channel, 35W/ch half-bridge Class D audio power amplifier with single power supply. This reference design demonstrates how to use the IR4311 IC with single power supply, implement protection circuits, and design an optimum PCB layout using PowIRaudio integrated Class D IC. This reference design does not require additional heatsink or fan cooling for normal operation (one-eighth of continuous rated power).The reference design provides all the required housekeeping power supplies for ease of use. The two-channel design is scalable for power and the number of channels.

Applications

- Docking station audio systems
- PC audio systems
- Musical instruments
- Karaoke amplifiers
- Game consoles
- Powered speaker systems
- Car audio amplifiers

Features

Output Power:	35W x 2 channels (4Ω load)
Multiple Protection Features:	Over-current protection (OCP), high side and low side Over-voltage protection (OVP), Under-voltage protection (UVP), high side and low side Over-temperature protection (OTP)
PWM Modulator:	Self-oscillating half-bridge topology

Specifications

General Test Conditions (unless otherwise noted)		Notes / Conditions
Supply Voltages	18-31V*	
Load Impedance	2-4Ω	Resistive load
Self-Oscillating Frequency	400kHz	No input signal, Adjustable
Gain Setting	21.4dB	1Vrms input yields rated power

Electrical Data	Typical	Notes / Conditions
IR Devices Used	IR4311 PowIRaudio integrated Class D IC	
Modulator	Self-oscillating, second order sigma-delta modulation, analog input	
Power Supply Range	18-31V*	Single power supply;
Output Power CH1-2: (1% THD+N)	26W	1kHz
Output Power CH1-2: (10% THD+N)	35W	1kHz
Rated Load Impedance	2-4Ω	Resistive load
Idling Supply Current	90mA	No input signal
Total Idle Power Consumption	2.8W	No input signal
Distortion	0.02%	THD+N @ 5W, 4Ω
Residual Noise	230μV	IHF-A weighted, AES-17 filter
Channel Efficiency	96%	Single-channel driven, 35W, Class D stage

*Power Supply Voltage Range	18~27V	27~37V
*R25~R28	220Ω	470Ω

Connection Setup

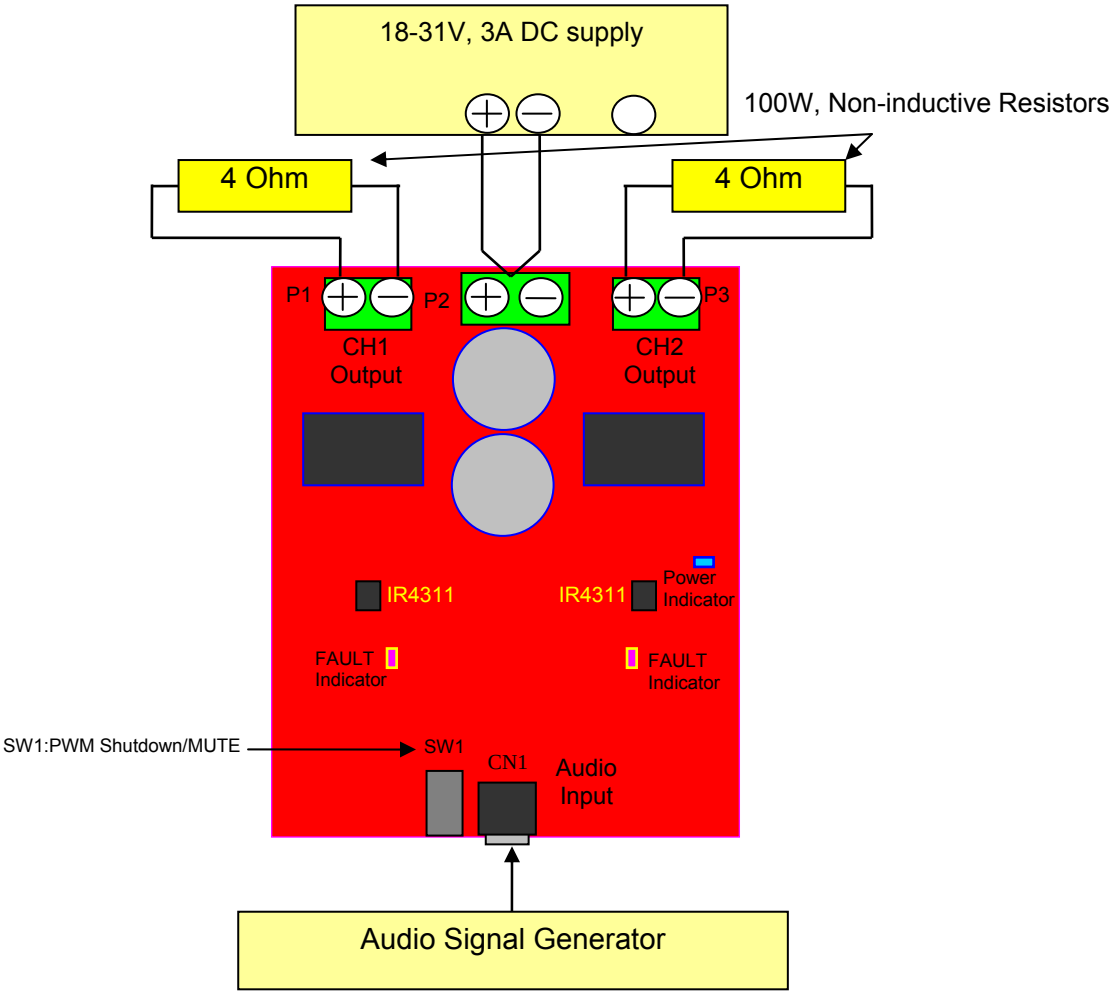


Fig 1 Typical Test Setup

Connector Description

Audio IN	CN1	Analog input for CH1 and CH2
POWER	P2	Single supply
CH1 OUT	P1	Output for CH1
CH2 OUT	P3	Output for CH2

Test Procedures

Test Setup:

1. Connect 4Ω, 100W load to both output connectors, P1 and P3 and audio analyzer (Ap).
2. Connect Audio Signal Generator to CN1 for CH1 and CH2 respectively (Ap).
3. Connect a single power supply to P2 pre-adjusted to 18-31V as shown on Figure above
4. Turn on the power supply.
5. Turn on SW1 (right side).
6. Blue LED (Normal) stays turning on after RED LED extinguished.
7. With an Oscilloscope, monitor switching waveform at VS of CH1 and CH2.
8. Quiescent current for the power supply should be 70mA ±10mA at 31V.

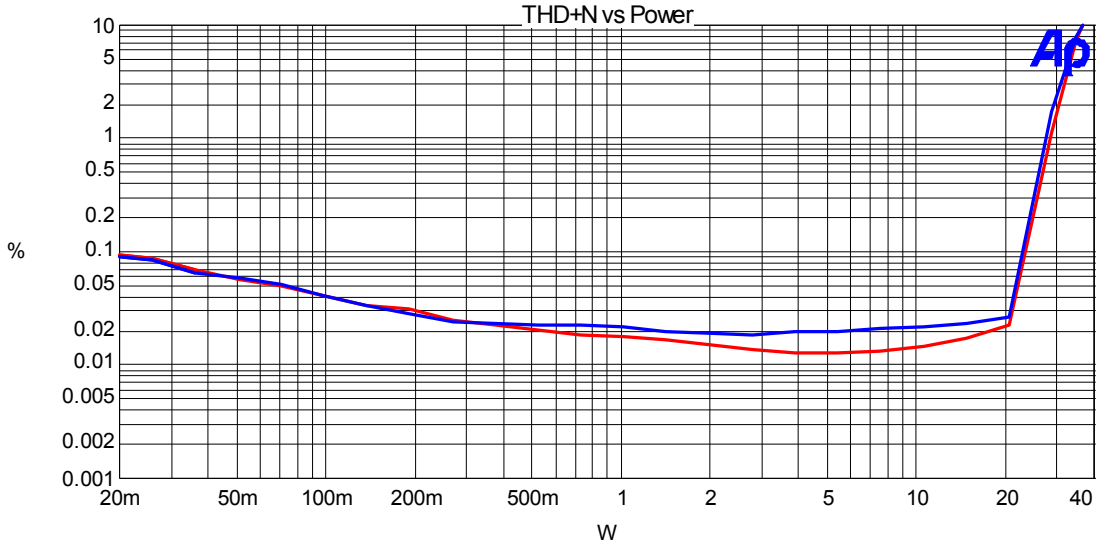
Functionality Audio Tests:

9. Sweep the audio signal voltage from 15 mV_{RMS} to 1.5 V_{RMS}.
10. Monitor the output signals at P1/P3 with an oscilloscope. The waveform must be a non distorted sinusoidal signal with input sinusoidal signal below 1Vrms.

Performance and Test Graphs

Power vs THD+N (without heatsink)

Test Conditions:
VBus = 31V
Input Signal=1 kHz
Load Impedance = 4 ohms

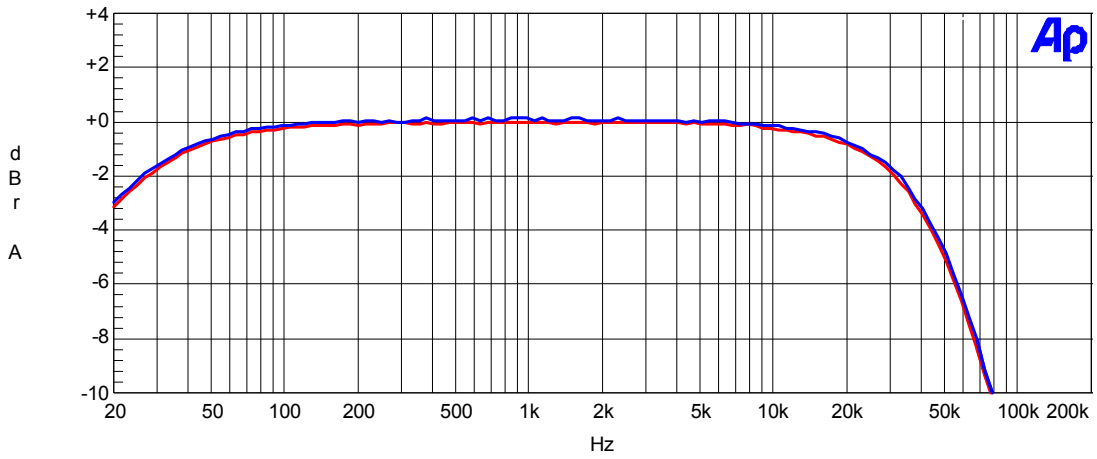


Sweep	Trace	Color	Line Style	Thick	Data	Axis	Comment
1	1	Red	Solid	2	Anlr.THD+N Ratio	Left	Ch1 4ohms 31V
1	3	Blue	Solid	2	Anlr.THD+N Ratio	Left	Ch2 4ohms 31V

Fig 2

Frequency Response

Test Conditions:
VBus = 31V
Set Output = 1V
Load Impedance = 4 ohms

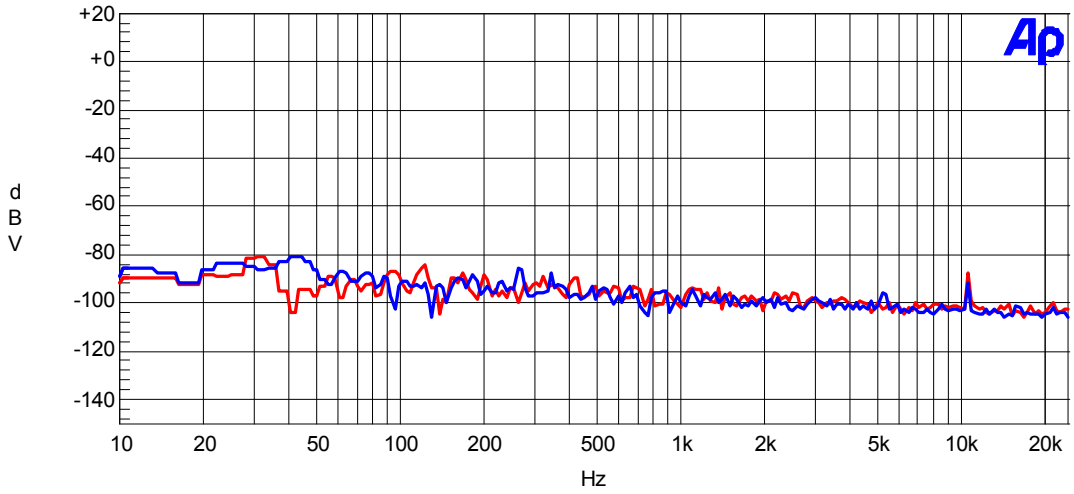


Sweep	Trace	Color	Line Style	Thick	Data	Axis	Comment
1	1	Red	Solid	2	Anlr.Level A	Left	Ch1 4ohm SP 25V
1	2	Blue	Solid	2	Anlr.Level B	Left	Ch2 4ohm SP 25V

Fig 3

Noise Floor

Test Conditions:
VBus = 31V
Load Impedance = 4 ohms
No Input Signal



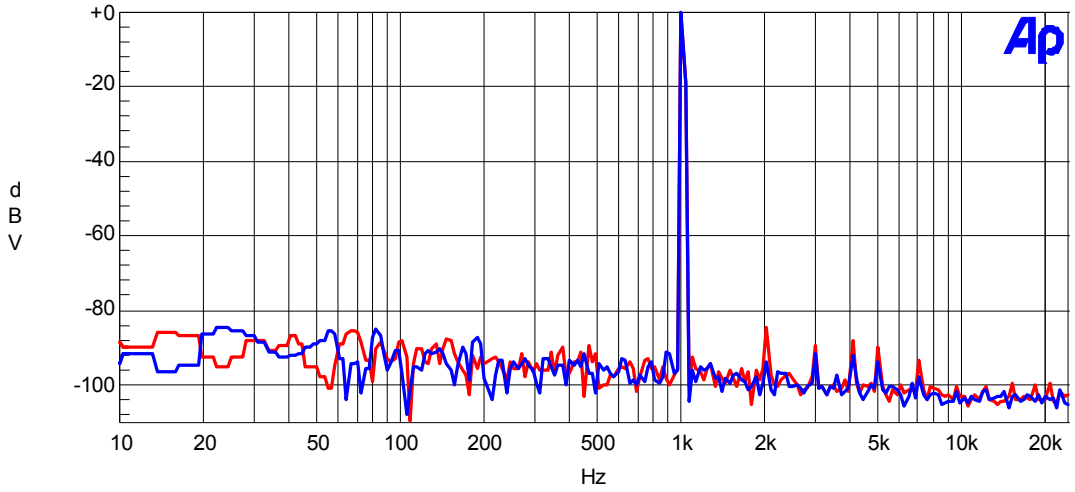
Sweep	Trace	Color	Line Style	Thick	Data	Axis	Comment
1	1	Red	Solid	2	Fft.Ch.1 Ampl	Left	Ch1
1	2	Blue	Solid	2	Fft.Ch.2 Ampl	Left	Ch2

Fig 4

Noise Floor with 1Vrms Output

Test Conditions:

VBus = 31V
Output = 1Vrms @ 1 KHz
Load Impedance = 4 ohms



Sweep	Trace	Color	Line Style	Thick	Data	Axis	Comment
1	1	Red	Solid	2	Fft.Ch.1 Ampl	Left	Ch1 4ohm
1	2	Blue	Solid	2	Fft.Ch.2 Ampl	Left	Ch1 4ohm

Fig 5

Efficiency

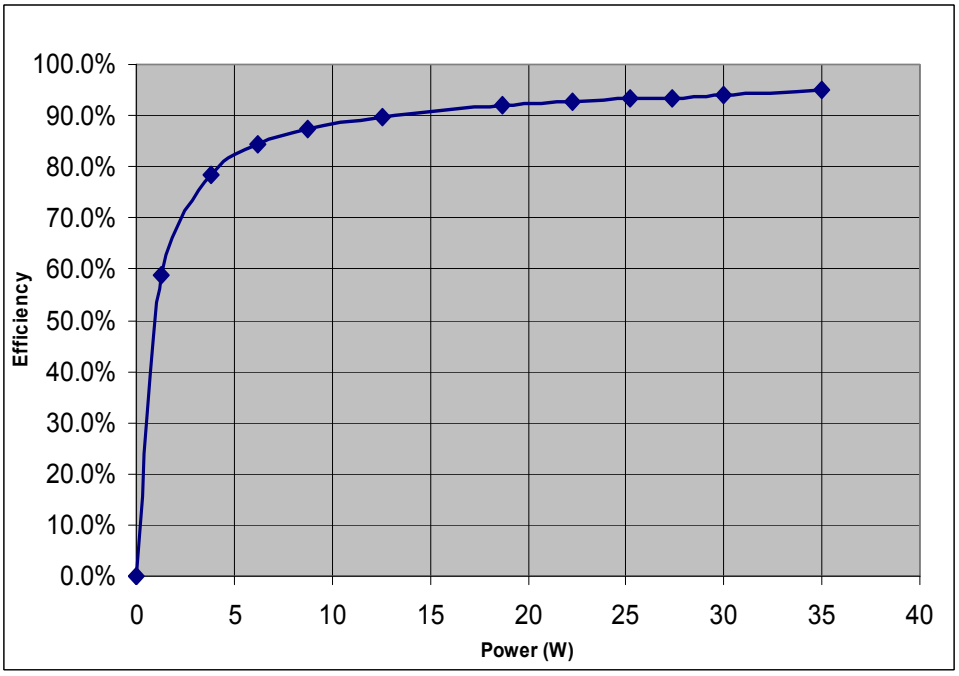


Fig 6

Thermal Information:

1/8 Po Thermal Test

Conditions:

- Tamb=25°C natural convection cooling
- Both Channel Driven 1/8Po continuous 30mins
- Temperature measured by infrared camera

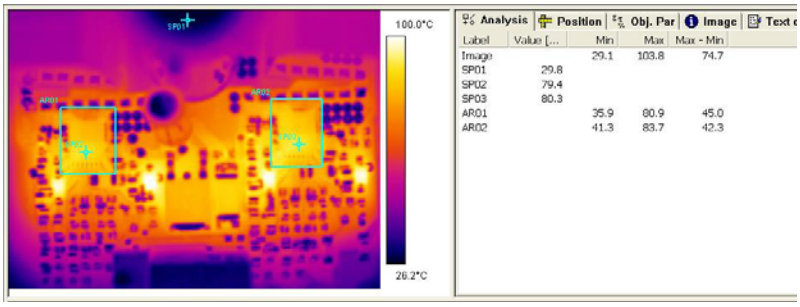


Fig 7 IRAUDAMP15 (Vbus=31V)

IR4311's temperature saturated around 85°C within 30minutes

Schematic

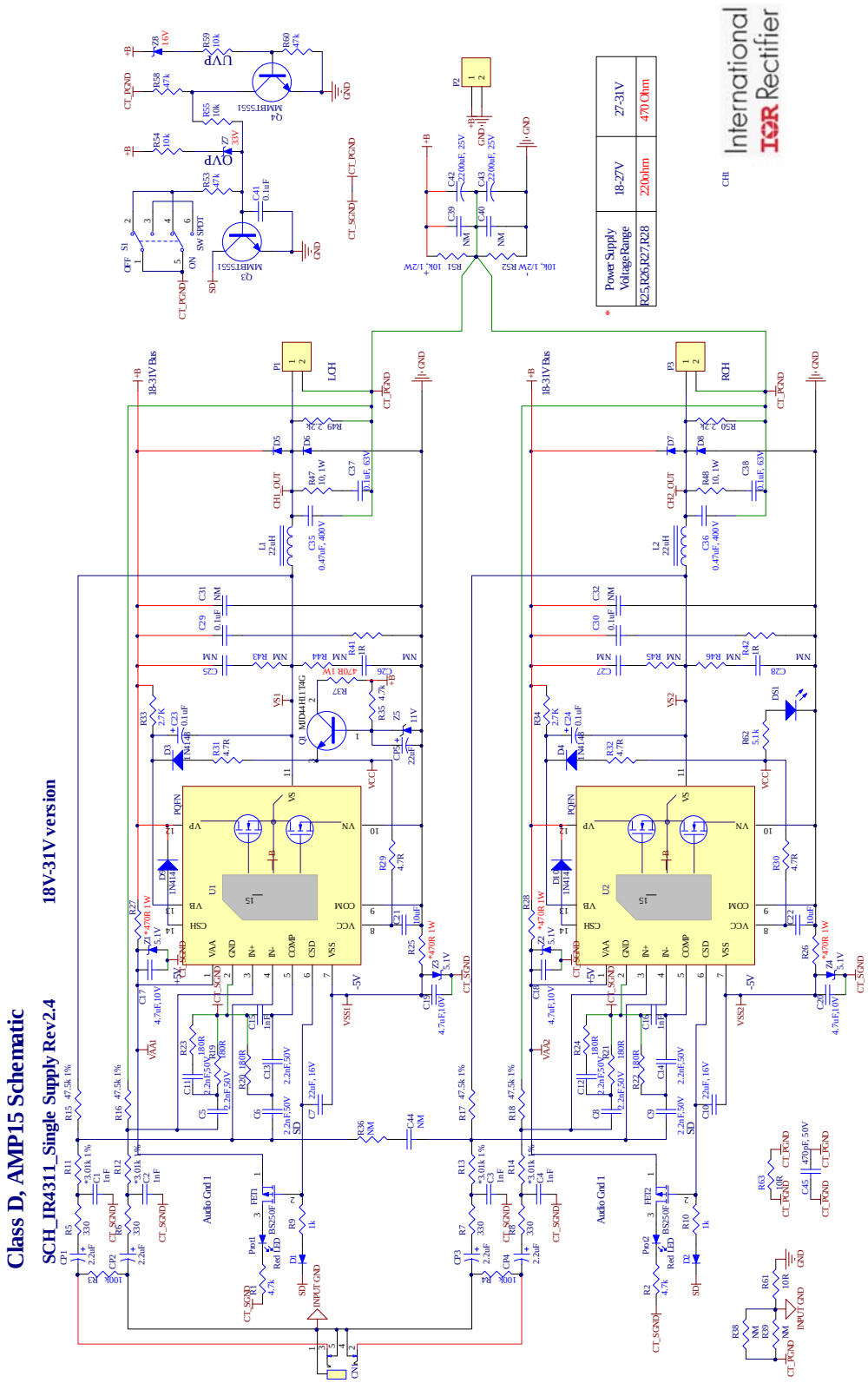


Fig8

PCB Specifications

PCB:

1. Two Layers SMT PCB with through holes
2. 1/16 thickness
3. 2/0 OZ Cu
4. FR4 material
5. 10 mil lines and spaces
6. Solder Mask to be Green enamel EMP110 DBG (CARAPACE) or Enthone Endplate DSR-3241or equivalent.
7. Silk Screen to be white epoxy non conductive per IPC–RB 276 Standard.
8. All exposed copper must finished with TIN-LEAD Sn 60 or 63 for 100u inches thick.
9. Tolerance of PCB size shall be 0.010 –0.000 inches
10. Tolerance of all Holes is -.000 + 0.003”
11. PCB acceptance criteria as defined for class II PCB’S standards.

PCB Layout

Top side:

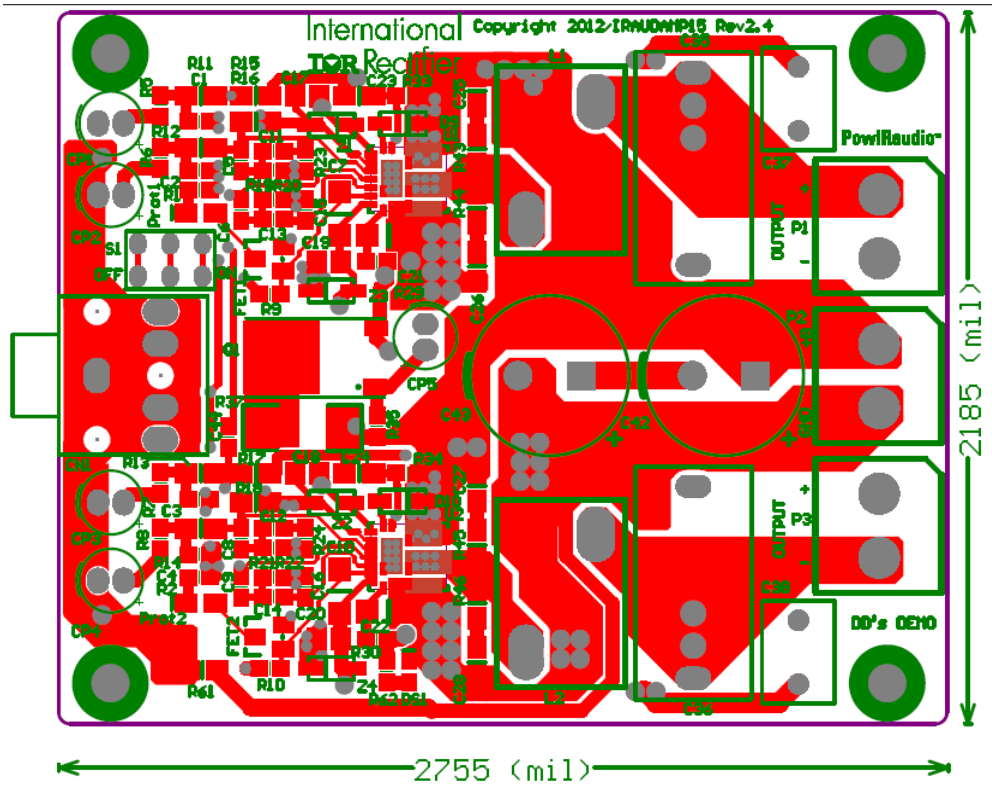


Fig 9

Bottom side:

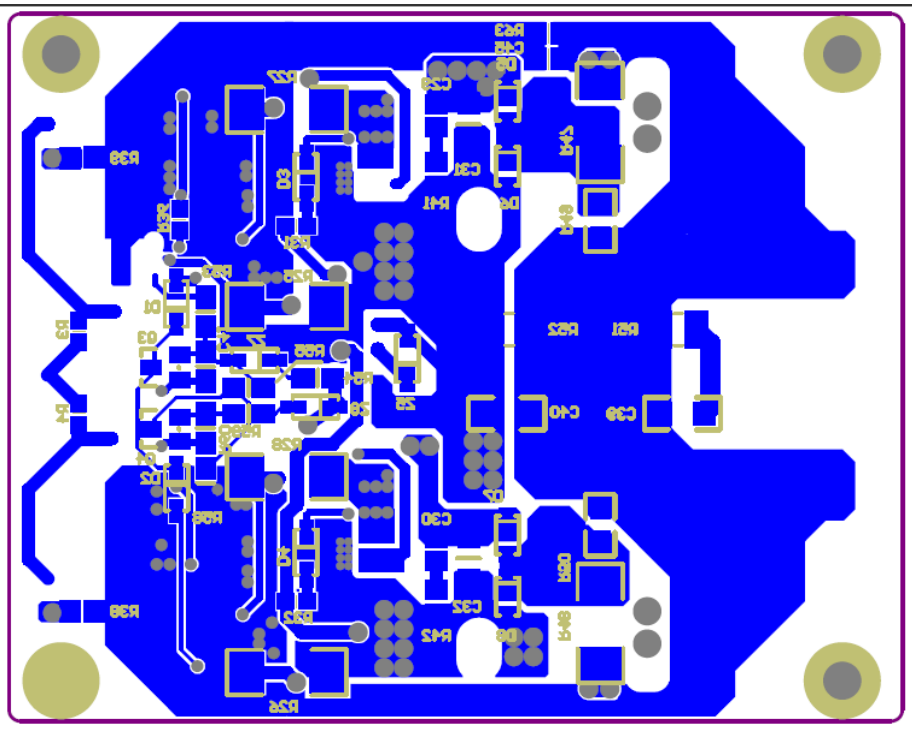


Fig 10

Note: Refer to AN1170 for footprint and board mounting details.

Revision changes descriptions

Revision	Changes description	Date
Rev 1.0	Released	May, 11 2012

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