IS31AP2110 20W Stereo Class-D Audio Amplifier with Power Limit And Dynamic Temperature Control

DESCRIPTION

The IS31AP2110 is a high efficiency stereo class-D audio amplifier with adjustable power limit function and dynamic temperature control. The evaluation board operates from a single 8~26V supply voltage and can deliver 20W/CH into an 8Ω loudspeaker without the need for an external heat sink.

It supports parallel BTL mode to deliver 40W into a 4Ω loudspeaker with 0.11% THD+N. The adjustable power limit function allows the user to set a voltage rail lower than half of 3.3V to limit the amount of current through the speaker.

FEATURES

- Single supply voltage
  - 8V ~ 26V board operation
  - Built-in 3.3V LDO
- 87% efficient Class-D operation eliminates need for heat sink
- Board Selectable settings
  - Four user selectable gain settings
  - PBTL or BTL mode
  - Auto recovery mode
  - Adjustable power limit function for speaker protection (requires potentiometer VR1)
- IS31AP2110 IC features
  - Short-Circuit protection with auto recovery option
  - Under-voltage detection
  - Over-voltage protection
  - Pop noise and click noise reduction
  - Over temperature protection with auto recovery
  - Dynamic temperature control prevents chip from over heating

QUICK START

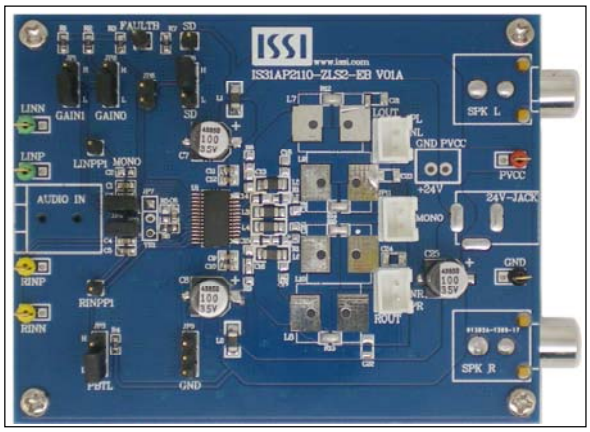


Figure 1: Photo of IS31AP2110Evaluation Board

RECOMMENDED EQUIPMENT

- 8~26V, 3A power supply
- Audio source with 3.5mm mini plug
- Pair of speakers (4Ω or 8Ω) with RCA-type plugs

ABSOLUTE MAXIMUM RATINGS

- ≤ 26V power supply
- ≥ 4Ω and ≤ 8Ω speaker

Caution: Do not exceed the conditions listed above; otherwise the board will be damaged.

PROCEDURE

The IS31AP2110 demo board is fully assembled and tested. Follow the steps listed below to verify board operation.

Caution: Do not turn on the power supply until all connections are completed.

1) With JP3 = L, connect a pair of 4Ω (or 8Ω) speakers to the SPKR RCA Jack (ROUT connector) and SPKL RCA Jack (LOUT connector).
2) Connect the power supply ground to the GND terminal and positive to the VCC terminal or connect a power jack to CON2.
3) If the audio is stereo, connect audio source to the audio connector (3.5mm) and close jumpers JP4 and JP5, default is closed.
4) If the audio source is differential, connect the audio source to LINP/LINN terminals (left channel) and RINP/RINN terminals (right channel). JP4 and JP5 jumpers should be open.
5) Turn on the power supply.
6) Turn on the audio source.

PERFORMANCE DESCRIPTION

There are five configuration jumpers to enable the following IC functions:

1) **JP8** - Enable/disable the IC. Jumper is closed to H is enable, closed to L to disable. When **JP8** is closed to H and **JP6** is closed, the short-circuit auto recovery function is enabled.
2) **JP3** – Enable/disable PBTL (MONO) Mode. Jumper **J3** closed to L is BTL Mode. Jumper **J3** closed to H is PBTL Mode. If PBTL jumper is set to H (PBTL mode), the Left outputs (OUTPL and OUTNL) as well as the Right outputs (OUTPR and OUTNR) are synchronized and in phase. This allows the connection of OUTPL to OUTNL and OUTPR to OUTNR.
3) **JP1 and JP2** – Output Gain Selection. Four gain levels can be selected based on the table below.

JP1=L JP2=L	JP1=L JP2=H	JP1=H JP2=L	JP1=H JP2=H
20dB	26dB	32dB	36dB

4) Power limit adjustment: add a potentiometer (100K) VR1 from PLIMIT pin to ground to adjust the output voltage limit. The voltage Vplimit sets a limit on the output peak-to-peak voltage. The maximum BTL output voltage of the gain control amplifier is limit to 2*(1.55v-Vplimit), The Class-D BTL output voltage on loudspeaker is amplified by 9.95 of 2*(1.55V-Vplimit),

For normal BTL operation (Stereo) and PBTL (Mono) operation:

$$P_{OUT} = \left[2 \times \left|V_P\right| \times 9.95\right]^2 \div \left(2 \times R_L\right)$$

for unclipped power (1)

Where:

- VP is the peak voltage of gain control amplifier output

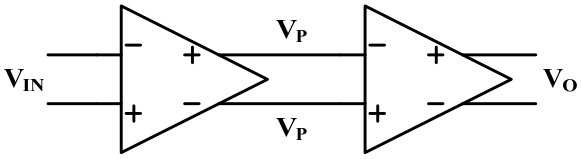
if (VIN×Gv /2) < (1.55V－VPLIM), then VP = (VIN×Gv /2).

if (VIN×Gv/2) > (1.55V－VPLIM), then VP = (1.55V－VPLIM).

- VIN is the input peak voltage.

- Gv is the gain of gain control amplifier, the four gain levels are 1V/V, 2V/V, 4V/V, 6.34V/V, corresponding to 20dB, 26dB, 32dB, 36dB overall gain.

-Vplimit>1.55V or Vplimit=GND are all without power limit feature.



Gain Control Amplifier Gain = 1, 2, 4, 6.34V/V **Class-D Amplifier Gain = 9.95V/V**

5) Please refer to the IS31AP2110 datasheet for additional device information.

Jumper Setting Table

Jumper	Options	Setting (note: Jumper on "H" for logic 1, on "L" for logic 0)
JP1 (GAIN1), JP2 (GAIN0)	Select between four amplifier gain levels	JP1 – JP2 0 - 0 : 20dB Gain 0 - 1 : 26dB Gain 1 - 0 : 32dB Gain 1 - 1 : 36dB Gain
JP3 (PBTL)	Enable/Disable PBTL	0 - BTL mode 1 - PBTL mode (Parallel BTL)
JP4 (LINN) JP5 (RINN)	Single ended audio input	Insert header to ground unused negative audio line input
JP6	Auto-Recovery enable	Insert header to enable auto-recovery of short circuit faults
JP8	Audio amp shutdown	H (1) – outputs enabled L (0) – outputs Hi-Z

ORDERING INFORMATION

Part No.	Temperature Range	Package
IS31AP2110-ZLS2-EB	-40°C to +85°C (Industrial)	TSSOP-28, Lead-free

Table 1: Ordering Information

For pricing, delivery, and ordering information, please contacts ISSI's analog marketing team at analog@issi.com or (408) 969-6600.

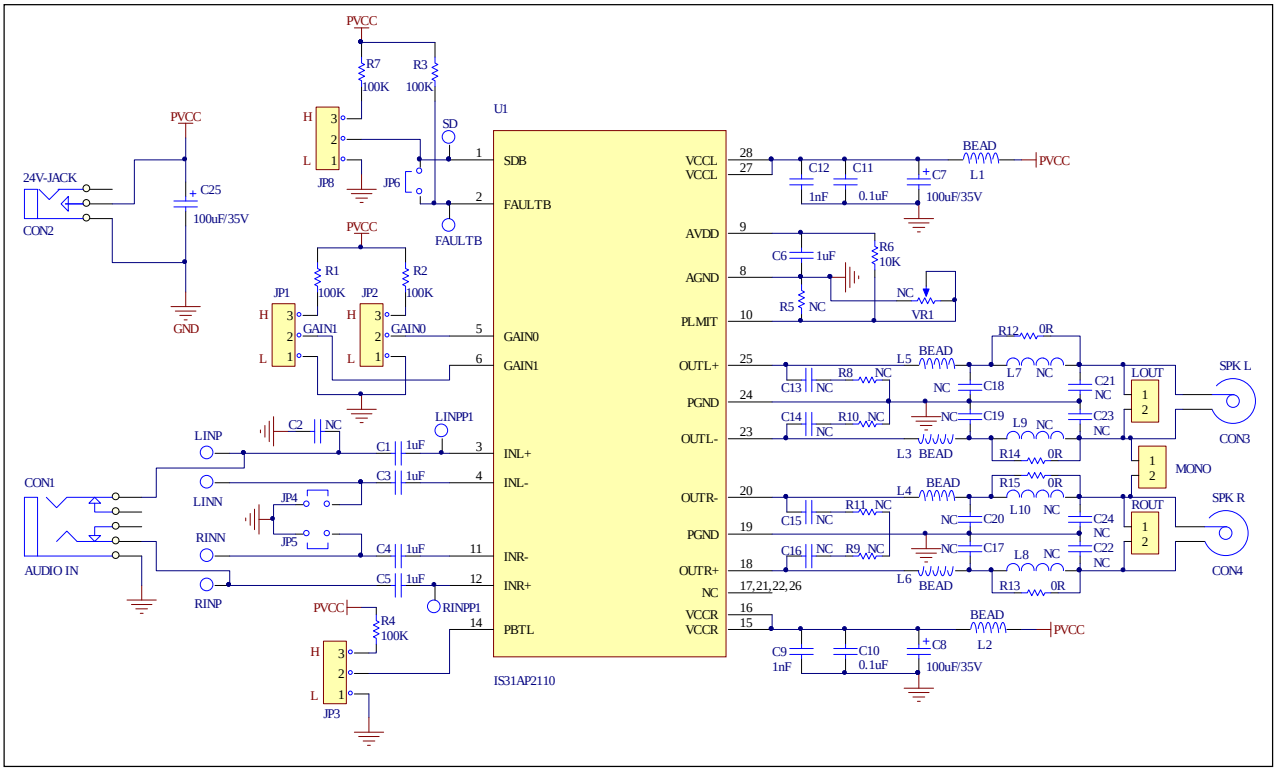


Figure 2: IS31AP2110 Application Schematic

BILL OF MATERIALS

Name	Symbol	Description	Qty	Supplier	Part No.
Audio Amplifier	U1	Class-D Audio Amplifier	1	ISSI	IS31AP2110
Resistors	R1~R3,R7	RES,100K,1/16W,±5%,SMD	4	Yageo	RC0603JR-07100KL
Resistor	R6	RES,10K,1/16W,±5%,SMD	1	Yageo	RC0603JR-0710KL
Resistors	R12~R15	RES,0R,1/10W,±5%,SMD	4	Yageo	RL0805JR-0700KL
Capacitors	C10,C11,	CAP,0.1μF,16V,±20%,SMD	2	Yageo	CX0603MRX7R7BB104
Capacitors	C12,C9	CAP, 1nF,16V,±20%,SMD	2	Yageo	CX0603MKX7R7BB102
Capacitors	C1,C3~C6	CAP, 1μF,16V,±20%,SMD	5	Yageo	CX0603MKX7R7BB105
Capacitors	C7,C8,C25	CAP,100μF,35V,±20%,SMD	3		
Bead	L1~L6	BEAD,80ohm/100MHZ,SMD	6	Yageo	UPB321611T-800Y–S
Connector	CON2	2.5mm DC connector	1		
Connector	CON1	3.5mm min plug	1		
connector	CON3,CON4	RCA –type plugs	2		
Headers	J1,J2,J3,J8	3 pin headers	4		
Headers	J4,J5,J6	2 pin headers	4		
Headers	LOUT,ROUT, MONO	2 pin headers	3		

Table 2: Bill of Materials, refers to Figure 2 above.

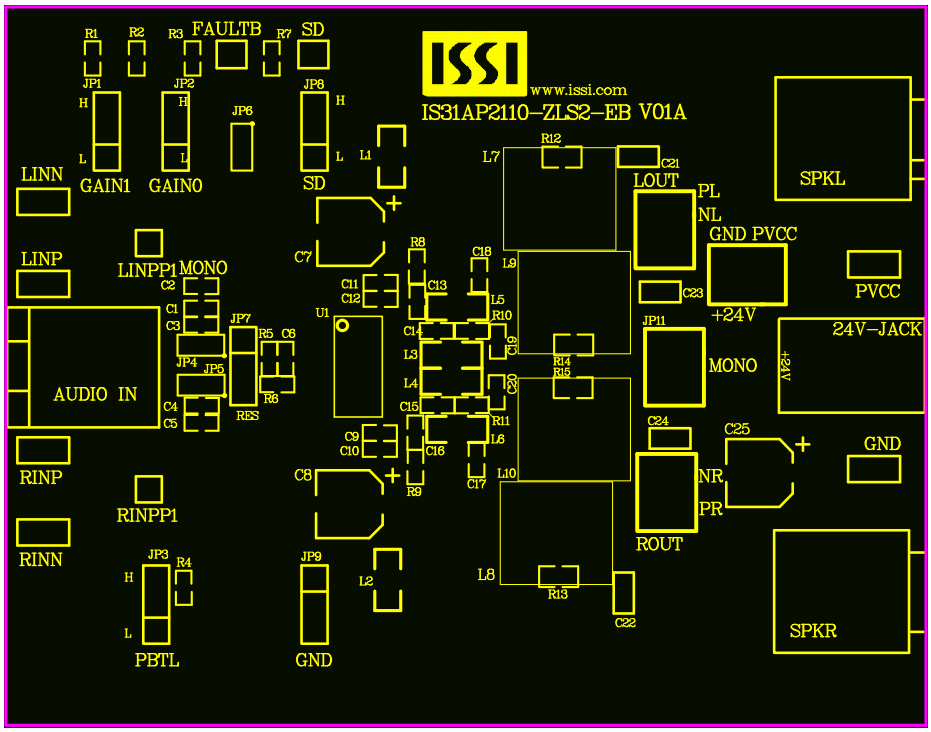


Figure 3: Board Component Placement Guide -Top Layer

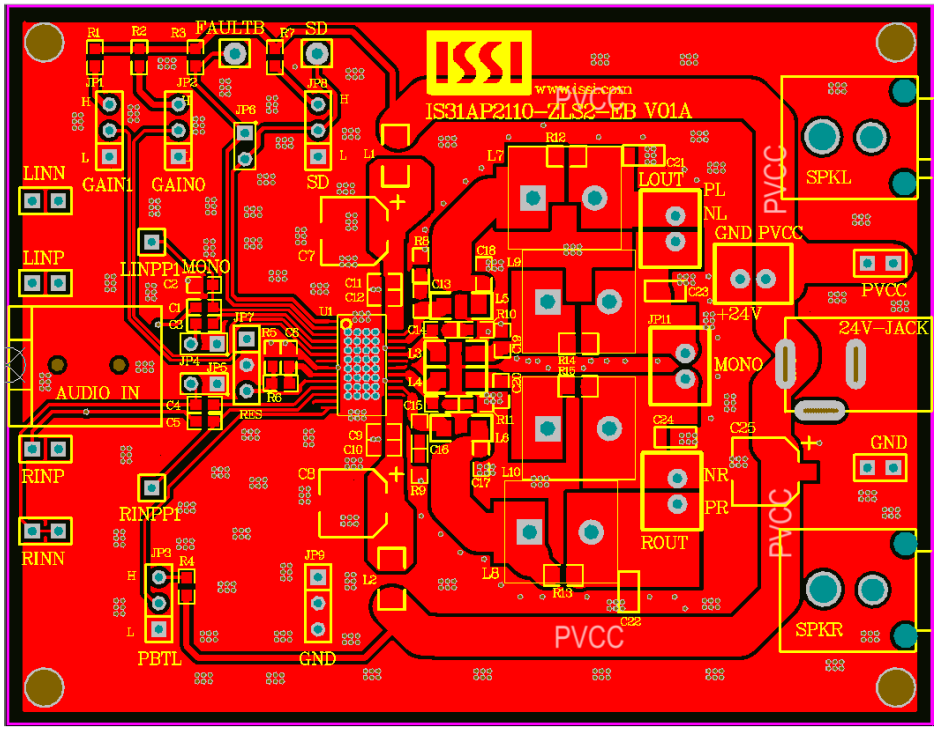


Figure 4: Board PCB Layout- Top Layer

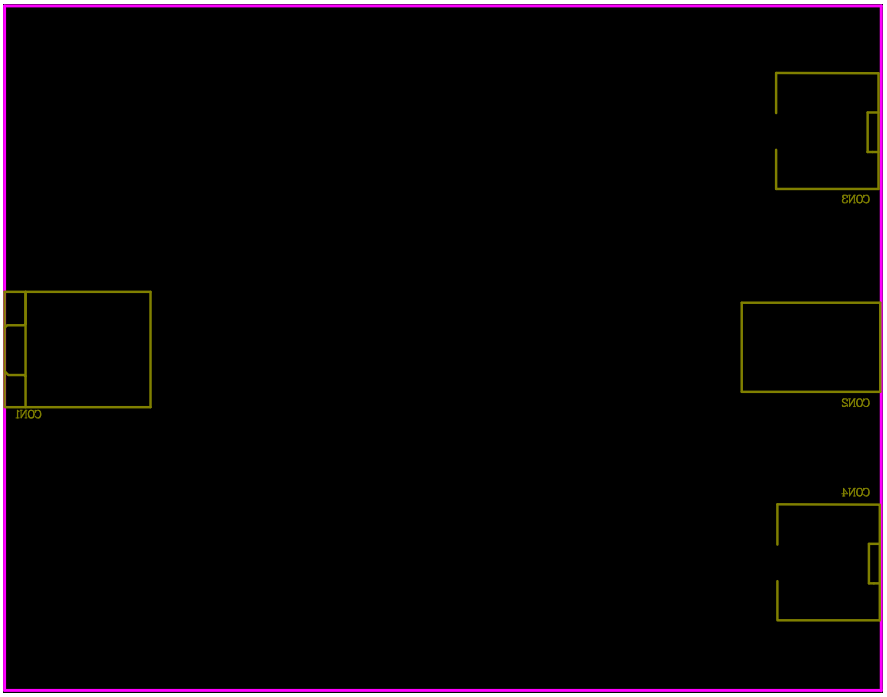


Figure 5: Board Component Placement Guide -Bottom Layer

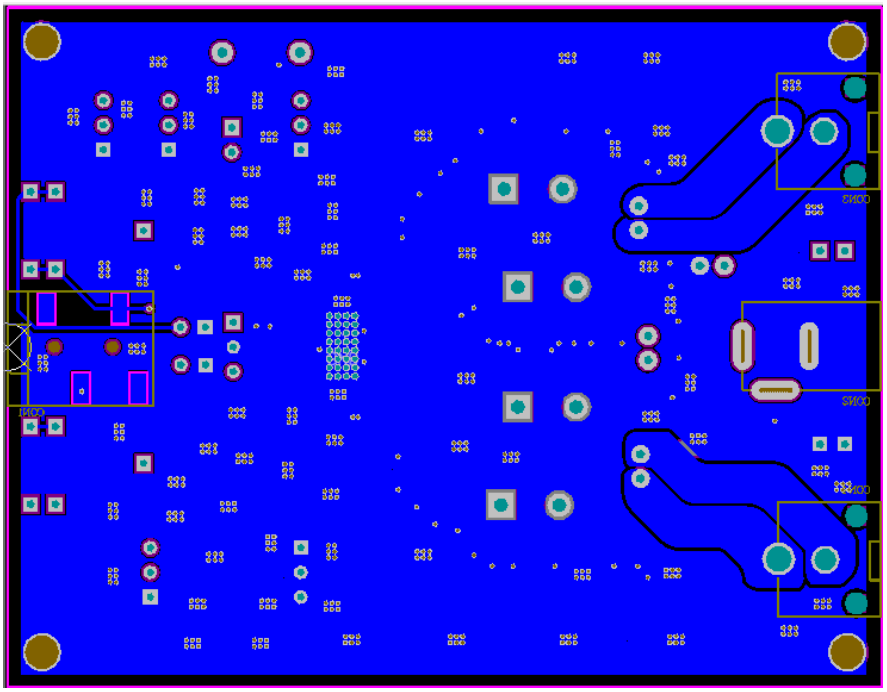


Figure 6: Board PCB Layout-Bottom Layer