

Subject
OB6228 Demo Board Manual

Board Model: AUOB6228-20 1640
Doc. No.: OB_DOC_DBM_A_622800

Description:

The OB6228 Demo Board consists of dual channels 15W Bridge Tied Load(BTL)output, fixed 26dB gain, class-D, with dual channels 40mW earphone driver, audio power amplifier that completed with a small number of external components mounted on a printed circuit board. It can be used to directly drive speakers or earphone with an external analog audio source as the input. The audio application of dual channels single ended and differential inputs are presented. For the application that short traces and wires from output pins to speaker, a simple ferrite beads filter to replace LC filter can be selected. The detailed features, block diagram, schematics, BOM, PCB layout, application notes and test data are described.

Key Features:

- Dual channels 15.5W BTL speaker output into 8Ω load at 15Vcc
- Dual channels 10W BTL speaker output into 8Ω load at 12Vcc
- Dual channels 40mW earphone output into 16Ω load
- 87% efficiency(driving 8Ω load@12Vcc)
- Speaker/earphone mode switch by earphone jack detector
- Excellent EMC performance, output ferrite beads filter can be used to replace LC filter

Revision History

Revise Date	Version	Reason/Issue
2017-3-9	00	First Issue

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1. Features

- Dual channels 15.5W BTL speaker output into 8Ω load at 15Vcc
- Dual channels 10W BTL speaker output into 8Ω load at 12Vcc
- Dual channels 40mW BTL earphone output into 16Ω load
- Speaker/earphone mode switch by earphone jack detector
- 7V to 15V single power supply operation
- Can drive stereo speakers as low as 4Ω
- 87% efficiency(driving 8Ω load@12Vcc)
- Up to 96dB SNR in speaker mode
- Low quiescent current 13mA
- Fixed 26dB speaker gain and 6dB earphone gain (no external components required)
- Internal oscillator (no external components required)
- External shutdown control function
- Perfect OVP/UVP/OTP/Output Short Circuit protection with recovery
- Speaker and earphone protection circuitry includes DC detect function
- Minimized pop noise
- Eliminates the need of external heat sink
- Space-saving surface mount 20-Pin TSSOP/PP high power package
- Excellent EMC performance, Meet EN55022-ClassB EMC standard

2. Demo Board Specifications

Symbol	Item	Specification
Vcc	Supply Voltage range	7V to 15V
Icc	Supply current	3A max
Po(speaker)	Continuous output power per channel: 8Ω, VCC = 12 V, THD+N = 10%,BTL	10W
	Continuous output power per channel: 8Ω, VCC = 15 V, THD+N = 10%,BTL	15.5W
Po(earphone)	Continuous output power per channel: 16Ω, VCC = 12 V, THD+N = 1%	40mW
RI(speaker)	Minimum speaker load impedance	4Ω
RI(earphone)	Minimum earphone load impedance	16Ω
Vin	Input amplitude range	0~2Vrms

3. Application Reference

3.1 Demo Board Block Diagram

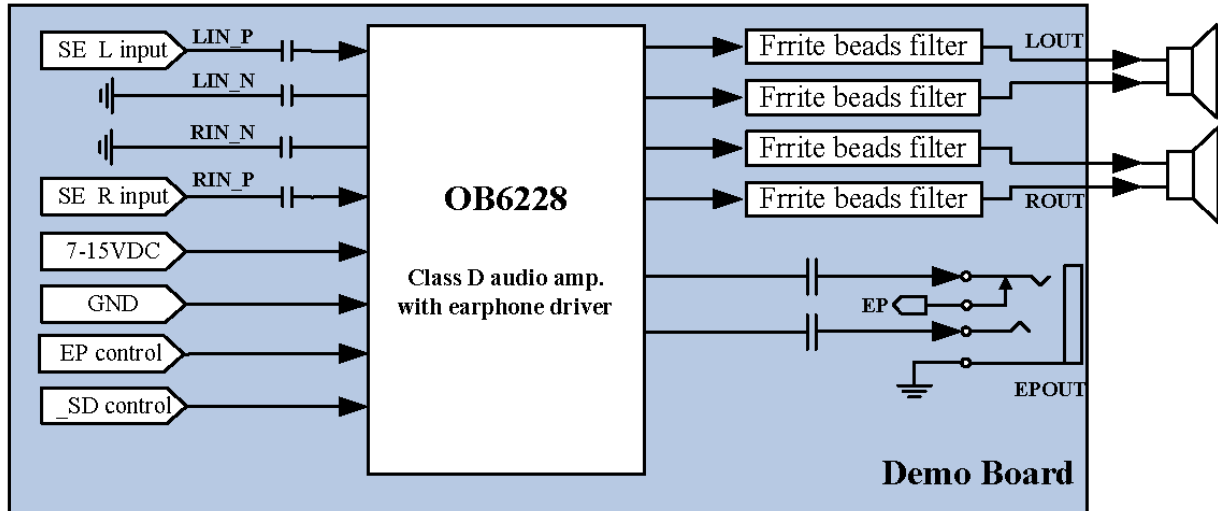


Fig. 1 Dual channels Earphone Output/BTL Speaker Output with Single-Ended Input

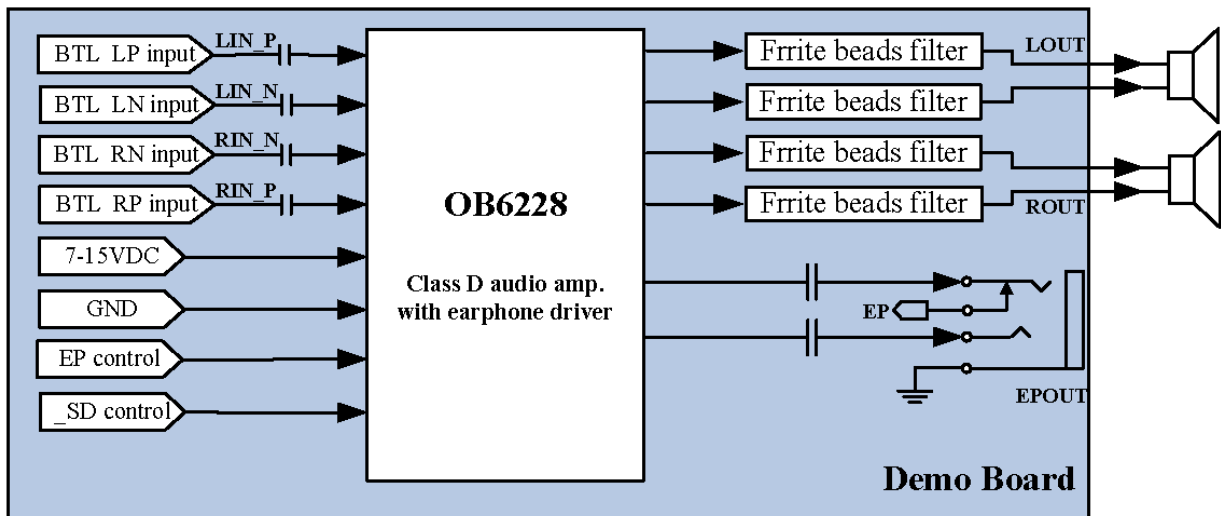


Fig. 2 Dual channels Earphone Output/BTL Speaker Output with BTL Input

3.2 Terminal & Switch & Jack

3.2.1 Terminal & Switch & Jack Assignment

Table 1. Terminal & Switch & Jack Assignment

Reference Number	I/O	Description
VCC	P	Power Supply (7–15VDC)
GND	P	Power Supply ground
LIN	I	Positive and Negative audio input for left channel
RIN	I	Positive and Negative audio input for right channel
LOUT	O	Speaker output for left channel
ROUT	O	Speaker output for right channel
EPOUT	O	Earphone output for left&right channels (type 3.5")
J--_SD	-	Shutdown control switch

* About the Terminal&Switch&Jack's position on demo board, please refer to the 3.5 PCB layout 's view.

3.2.2 Switch & Jumper & Jack Setting

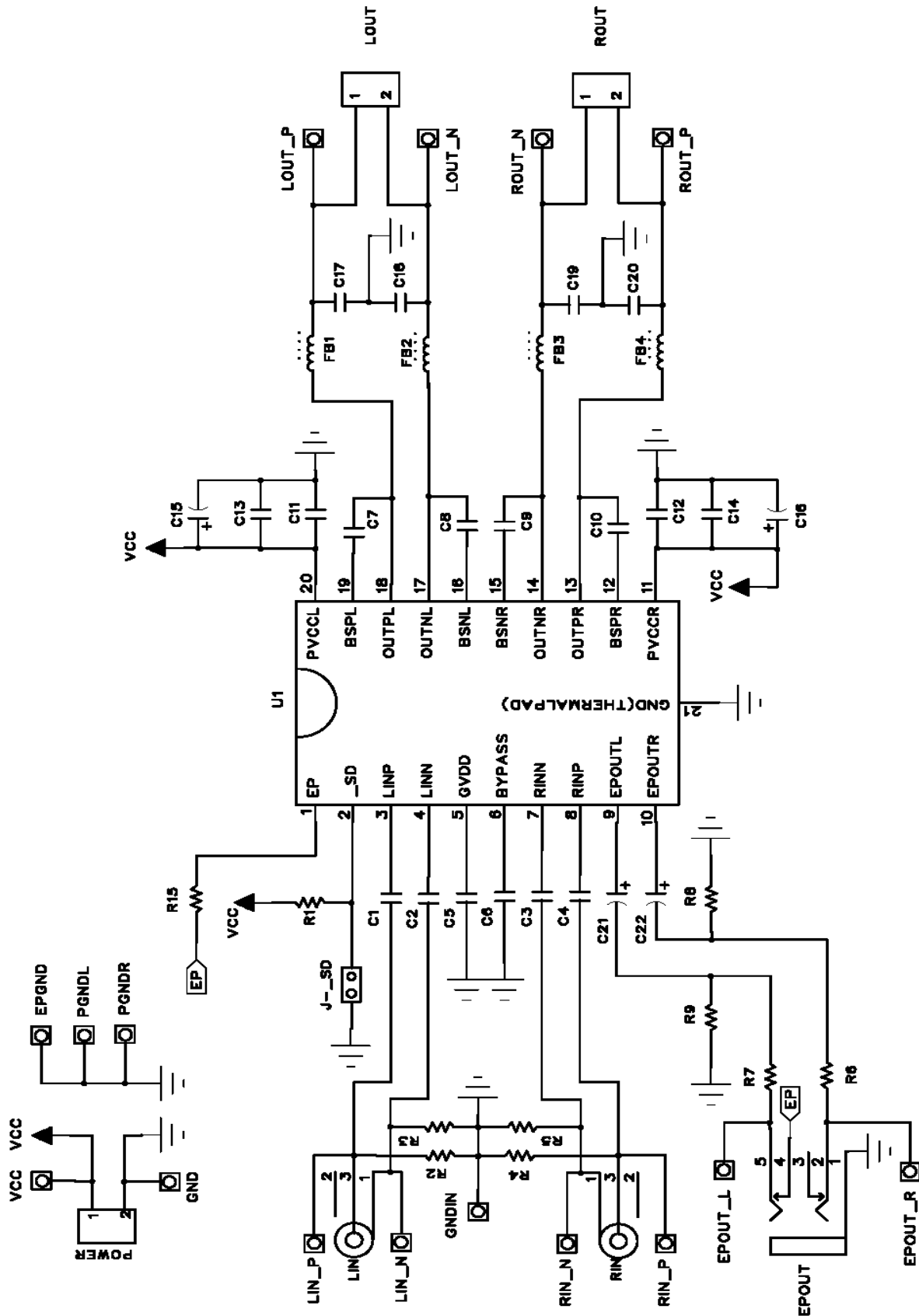
Table 2. shutdown setting

State	Jumper	
shutdown	J--_SD	ON
operation		OFF

Table 3. Earphone Jack setting

State	Earphone Jack
Earphone mode	Earphone plugged-in
Speaker mode	Earphone not plugged-in

3.3 Schematic



3.4 Operation

3.4.1 Quick Start List for Stand-Alone Operation

Follow these steps to use the OB6228UP demo board stand-alone or when connecting it into existing circuits or equipments. Connections to the demo board can be made by using plugs for the power supply and output connections. The audio inputs accept standard RCA plugs. A single power supply is required to power up the demo board. The Vcc supply can also be used to power all the PVCC, and can be used to pull up the logic pins for shutdown control. GVDD is an internally generated supply for the output FETs. BYPASS provide common mode voltage for internal analog reference.

3.4.2 Power Supply

1. Ensure that the external power source is set to OFF.
2. Connect an external regulated power supply adjusted from 7V to 15V to the POWER connector with taking care to observe marked polarity.

3.4.3 Audio Inputs and Outputs

1. Connect analog audio source to jacks LIN and RIN using standard RCA plugs, either differential or single-ended. Short the audio input to GND that are not in being used by R2,R3,R4,R5 on demo board.
2. Connect a speaker across terminal LOUT (or terminals LOUT_P and LOUT_N), connect another speaker across terminal ROUT (or terminals ROUT_P and ROUT_N).

3.4.4 Control Inputs

1. Ensure the jumper are set correctly depending on the desired 3.2.2 Switch & Jumper Setting, include J-_{SD} state setting.

3.4.5 Power Up

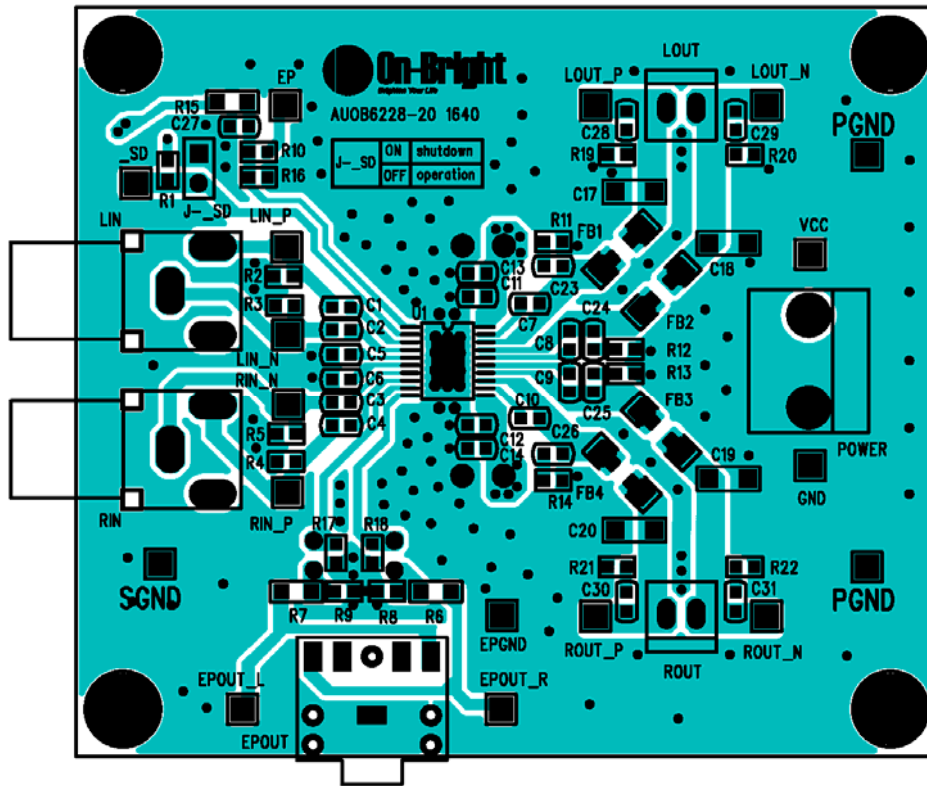
1. Verify correct voltage and input polarity, and turn the external power supply ON. The demo board begins operation
2. Adjust the audio source for the correct volume and enjoy!

3.4.6 Speaker/Earphone Mode Switch

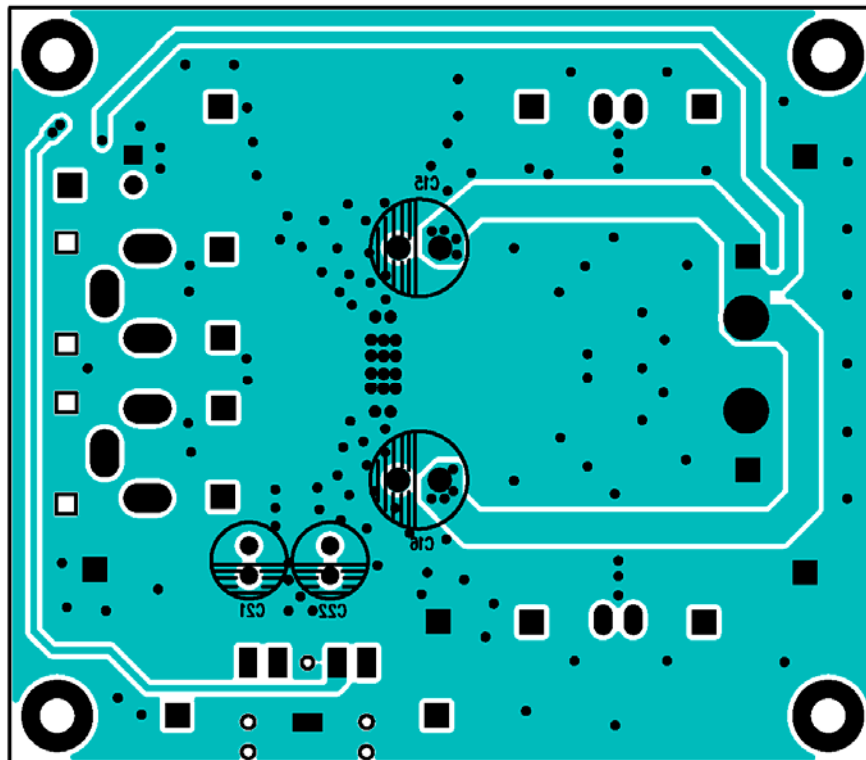
1. Plug 3.5" stereo earphone into the earphone jack on board, switch the speaker output to earphone output.
2. Pull out the earphone, back to speaker output.

3.5 PCB layout

TOP Side View



Bottom Side View



3.6 Bill of Material

Item	Qty.	Ref.No.	Description	Size
ICs:				
1.	1	U1	Class D audio amplifier IC,OB6228UP	TSSOP20
PCB:				
2.	1	PCB	OB6228UP EVM PCB, double layers, AUOB6228-20 1640	73*63.5*1.6mm
Resistor:				
3.	1	R1	Resistor,chip,100kohm,1/10W,5%	0603
4.	3	R3,R5,R10	Resistor,chip,0ohm,1/10W,5%	0603
5.	3	R6,R7,R15	Resistor,chip,0ohm,1/4W,5%	0805
6.	2	R8,R9	Resistor,chip,1kohm,1/10W,5%	0603
Capacitor:				
7.	6	C1,C2,C3,C4,C5,C6	Capacitor,ceramic,1uF,±10%,X5R,16V	0603
8.	4	C7,C8,C9,C10	Capacitor,ceramic,0.22uF,±10%,X5R,25V	0603
9.	2	C11,C12	Capacitor,ceramic,0.001uF,±10%,COG,25V	0603
10.	2	C13,C14	Capacitor,ceramic,0.1uF,±10%,COG,25V	0603
11.	2	C15,C16	Capacitor,electrolytic,100uF,25V,105°C	Φ6*7mm
12.	4	C17,C18,C19,C20	Capacitor,ceramic,1nF,±5%,X7R,25V	1206
13.	2	C21,C22	Capacitor,electrolytic,100uF,16V,105°C	Φ6*7mm
Ferrite beads:				
14.	4	FB1,FB2,FB3,FB4	Ferrite beads, SMD, 60ohm@100MHz, 6A Wurth, 742792410	1806
Others:				
15.	1	POWER	Power Connector,2pin,7.9mm,Male	
16.	2	LOUT,ROUT	Connector,2pin,2.54mm,Male	
17.	1	LIN	Phono Jack, PC mount, switched, red	
18.	1	RIN	Phono Jack, PC mount, switched, white	
19.	1	J-_SD	Jumper,2pin	
20.	1	EPOUT	Earphone Jack, dual channels,3.5"	

* All others unlisted components are no assembled.

* All components should be ordered as Lead-Free

3.7 EMC Report

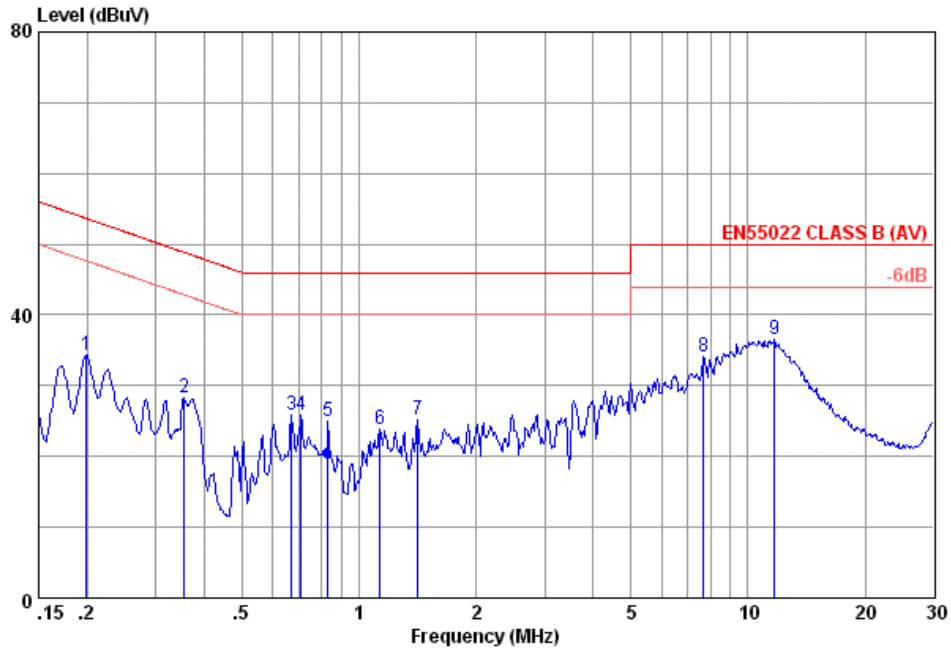
The demo board passed EMC requirement with more than 6dB margin

All following EMC test used OB6228UP + OB2273 demo boards.

3.7.1 Conducted Emission Test

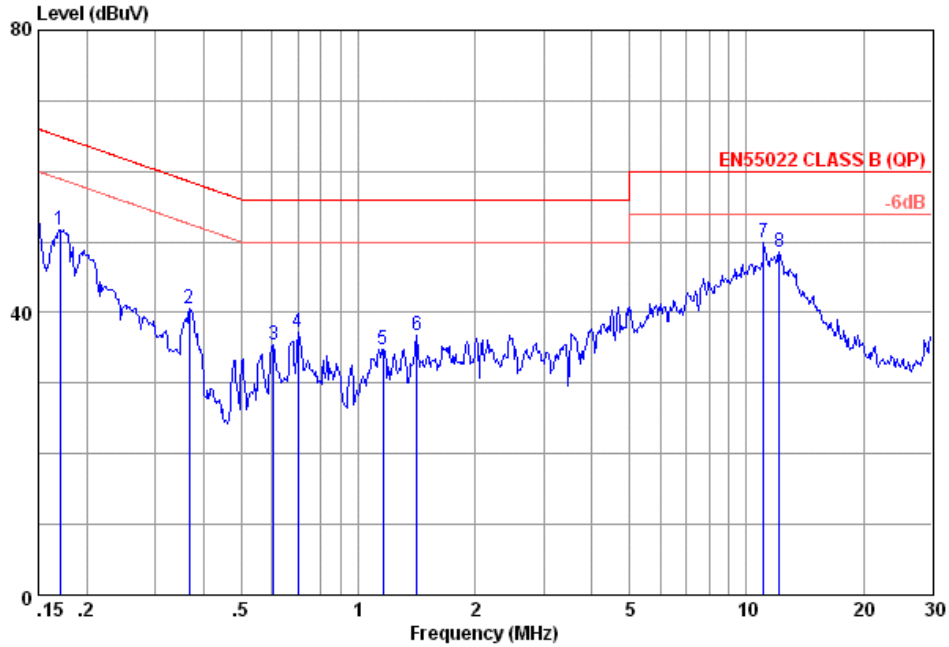
EN55022 CLASS B report @ 12Vcc8ohm, stereo 10W, ferrite beads filters
power line length=1m, input line length=1m, speaker cable length=80cm

AV curve



	Freq	Level	Read	Cable	LISN	Limit	Over		
	MHz	dBuV	Level	Loss	Factor	Factor	Line	Limit	
			dBuV	dB	dB	dB	dBuV	dB	
1	0.198631	34.32	34.17	0.04	0.11	0.15	53.67	-19.35	Average
2	0.355762	28.22	28.05	0.05	0.12	0.17	48.83	-20.61	Average
3	0.671866	25.89	25.69	0.06	0.14	0.20	46.00	-20.11	Average
4	0.708424	25.94	25.74	0.06	0.14	0.20	46.00	-20.06	Average
5	0.830470	25.07	24.87	0.06	0.14	0.20	46.00	-20.93	Average
6	1.129233	23.94	23.70	0.08	0.16	0.24	46.00	-22.06	Average
7	1.418169	25.20	24.94	0.09	0.17	0.26	46.00	-20.80	Average
8	7.686994	34.17	33.67	0.18	0.32	0.50	50.00	-15.83	Average
9	11.682560	36.55	35.92	0.23	0.40	0.63	50.00	-13.45	Average

QP curve



	Freq	Level	Read	Cable	LISN	Limit	Over		
	MHz	dBuV	Level	Loss	Factor	Factor	Line	Limit	
			dBuV	dB	dB	dB	dBuV	dB	
1	0.170340	51.77	51.62	0.04	0.11	0.15	64.94	-13.17	Peak
2	0.367253	40.59	40.42	0.05	0.12	0.17	58.56	-17.97	Peak
3	0.604313	35.39	35.19	0.06	0.14	0.20	56.00	-20.61	Peak
4	0.700956	37.13	36.93	0.06	0.14	0.20	56.00	-18.87	Peak
5	1.159548	34.72	34.48	0.08	0.16	0.24	56.00	-21.28	Peak
6	1.418169	36.80	36.54	0.09	0.17	0.26	56.00	-19.20	Peak
7	11.079690	49.89	49.29	0.22	0.38	0.60	60.00	-10.11	Peak
8	12.123980	48.63	47.98	0.23	0.42	0.65	60.00	-11.37	Peak

3.8 Protection Report

3.8.1 Protection Test – OVP,UVP,OTP

Test Condition: Ta=25°C, PVCC =12V, Rload=8Ω (unless otherwise noted)

Items		Specification	Result
OVP	Over voltage threshold	over 16.8V then protection, no broken	16.8V
	Over voltage recovery threshold	return to 16V then recover, no broken	16V
UVP	Under voltage threshold	under 5.5V then protection, no broken	5.5V
	Under voltage recovery threshold	return to 6V then recover, no broken	6V
OTP	Over temperature protection	170°C±15 °C then protection, no broken	170°C
	Over temperature protection hysteresis	reduced 40°C then recover, no broken	40°C

3.8.2 Protection Test – Output Short Circuit Protection

3.8.2.1 Output Short Circuit Protection – output pin short to Vcc

Test Condition: Ta=25°C, PVCC =12V, Rload=8Ω, audio input floating (unless otherwise noted)

Vcc	Items	Specification	Result
8V	pin OUTPL short to PVCC	OCP triggered, auto-recovery triggered, no broken	PASS
	pin OUTNL short to PVCC	OCP triggered, auto-recovery triggered, no broken	PASS
	pin OUTPR short to PVCC	OCP triggered, auto-recovery triggered, no broken	PASS
	pin OUTNR short to PVCC	OCP triggered, auto-recovery triggered, no broken	PASS
12V	pin OUTPL short to PVCC	OCP triggered, auto-recovery triggered, no broken	PASS
	pin OUTNL short to PVCC	OCP triggered, auto-recovery triggered, no broken	PASS
	pin OUTPR short to PVCC	OCP triggered, auto-recovery triggered, no broken	PASS
	pin OUTNR short to PVCC	OCP triggered, auto-recovery triggered, no broken	PASS
15V	pin OUTPL short to PVCC	OCP triggered, auto-recovery triggered, no broken	PASS
	pin OUTNL short to PVCC	OCP triggered, auto-recovery triggered, no broken	PASS
	pin OUTPR short to PVCC	OCP triggered, auto-recovery triggered, no broken	PASS
	pin OUTNR short to PVCC	OCP triggered, auto-recovery triggered, no broken	PASS

3.8.2.2 Output Short Circuit Protection – output pin short to GND

Test Condition: Ta=25°C, PVCC=12V, Rload=8Ω, audio input floating (unless otherwise noted)

Vcc	Items	Specification	Result
8V	pin OUTPL short to PGND	OCP triggered, auto-recovery triggered, no broken	PASS
	pin OUTNL short to PGND	OCP triggered, auto-recovery triggered, no broken	PASS
	pin OUTPR short to PGND	OCP triggered, auto-recovery triggered, no broken	PASS
	pin OUTNR short to PGND	OCP triggered, auto-recovery triggered, no broken	PASS
12V	pin OUTPL short to PGND	OCP triggered, auto-recovery triggered, no broken	PASS
	pin OUTNL short to PGND	OCP triggered, auto-recovery triggered, no broken	PASS
	pin OUTPR short to PGND	OCP triggered, auto-recovery triggered, no broken	PASS
	pin OUTNR short to PGND	OCP triggered, auto-recovery triggered, no broken	PASS
15V	pin OUTPL short to PGND	OCP triggered, auto-recovery triggered, no broken	PASS
	pin OUTNL short to PGND	OCP triggered, auto-recovery triggered, no broken	PASS
	pin OUTPR short to PGND	OCP triggered, auto-recovery triggered, no broken	PASS
	pin OUTNR short to PGND	OCP triggered, auto-recovery triggered, no broken	PASS

3.8.2.3 Output Short Circuit Protection – output N pin short to P pin

Test Condition: Ta=25°C, PVCC=12V, Rload=8Ω, audio 1kHz1Vpp sinewave differential input (unless otherwise noted)

Vcc	Items	Specification	Result
8V	pin OUTPL short to OUTNL	OCP triggered, auto-recovery triggered, no broken	PASS
	pin OUTPR short to OUTNR	OCP triggered, auto-recovery triggered, no broken	PASS
12V	pin OUTPL short to OUTNL	OCP triggered, auto-recovery triggered, no broken	PASS
	pin OUTPR short to OUTNR	OCP triggered, auto-recovery triggered, no broken	PASS
15V	pin OUTPL short to OUTNL	OCP triggered, auto-recovery triggered, no broken	PASS
	pin OUTPR short to OUTNR	OCP triggered, auto-recovery triggered, no broken	PASS

3.9 Reliability Report

3.9.1 Abnormal Power On Test

Test Condition: Ta=25°C, PVCC=12V, Rload=8Ω (unless otherwise noted)

Items	Specification	Result
18Vcc power on	enter into OVP, no broken	PASS
5Vcc power on	enter into UVP, no broken	PASS
power on when air temperature exceeds 190°C	enter into OTP, no broken	PASS
power on when output short to GND	enter into OCP, no broken	PASS
power on when output short to Vcc	enter into OCP, no broken	PASS
power on when output N short to output P (audio 1kHz1Vpp sinewave differential input)	enter into OCP, no broken	PASS

3.9.2 High Temperature System Burn-in Test

Test Condition:

Ta=60°C, PVCC=15V, Rload=8ohm*2, music input “异度狂欢”, peak output power >25W*2, duration 168hours(7days)

Test Result:

- The devices can operate normally after burn-in;
- All functions and all protections are in normal after burn-in;
- Output pin I-V characteristics are in normal after burn-in.

3.9.3 Low Temperature Cycle Power on-off Test

Test Condition:

Ta= -20°C, PVCC=15V, Rload=8ohm*2, music input “异度狂欢”, peak output power >25W*2, power on-off 3000cycles, cycle time 1min

Test Result:

- The devices can on-off in each cycle;
- The devices can operate normally after test;
- All functions and all protections are in normal after test;
- Output pin I-V characteristics are in normal after test.

3.9.4 Maximum Output Power Burn-in Test

Test Condition:

Ta=25°C, PVCC=15V, Rload=8ohm*2, Vin=1kHz sinewave, continuously output power = 15.5W*2, duration 48hours

Test Result:

- The devices can operate normally after burn-in;
- All functions and all protections are in normal after burn-in;

- Output pin I-V characteristics are in normal after burn-in.

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