
Subject
OB6220 Demo Board Manual

Board Model: AUOB6220.00 1245

Doc. No.: OB_DOC_DBM_A_622001

Description:

The OB6220 Demo Board consists of a stereo 15W Bridge Tied Load (BTL) output, class-D, audio power amplifier completed with a small number of external components mounted on a printed circuit board. It can be used to directly drive speakers with an external analog audio source as the input. The audio application of 2 channels Bridge Tied Load (BTL) or 1 channel Parallel Bridge Tied Load(PBTL) are presented. The detailed features, block diagram, schematics, BOM, PCB layout, application notes and test data are described.

Key Features:

- Stereo 15W BTL output into 8Ω load at 16V
- Stereo 9.4W BTL output into 8Ω load at 12V
- Mono 30W PBTL output into 4Ω load at 16V
- 90% efficiency(driving 8Ω speakers)

Revision History

Revise Date	Version	Reason/Issue
2013-7-18	00	First Issue
2013-10-15	01	Updated for new IC revision

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1. Features

- Stereo 15W BTL output into 8Ω load at 16V
- Stereo 9.4W BTL output into 8Ω load at 12V
- Mono 30W PBTL output into 4Ω load at 16V
- 6V to 20V single-supply operation
- Can drive stereo speakers as low as 4Ω
- 90% efficiency(driving 8Ω speakers)
- Low quiescent current 10mA
- Four selectable gain settings(20dB,26dB,32dB,36dB)
- Internal oscillator (no external components required)
- External shutdown control function
- Perfect OVP/UVP/OTP/Output Short Circuit protection with recovery
- Speaker protection circuitry includes adjustable power limit and DC detect function
- Fault report function of input DC detect protection and output short circuit protection
- Minimize pop noise
- Eliminates the need of external heat sink
- Space-saving surface mount 28-Pin TSSOP/PP high power package
- Meet EN55022-ClassB EMC standard

2. Demo Board Specifications

Symbol	Item	Specification
Vcc	Supply Voltage range	6V to 20 V
Icc	Supply current	3A max
Po	Continuous output power per channel: 8 Ω, VCC = 12 V, THD+N = 10%,BTL	9.4 W
	Continuous output power per channel: 8 Ω, VCC = 16 V, THD+N = 10%,BTL	15 W
	Continuous output power per channel: 4 Ω, VCC = 16 V, THD+N = 10%,PBTL	30W
Rl	Minimum load impedance	4 Ω
Vin	Input amplitude range	0~2Vrms

3. Application Reference

3.1 Demo Board Block Diagram

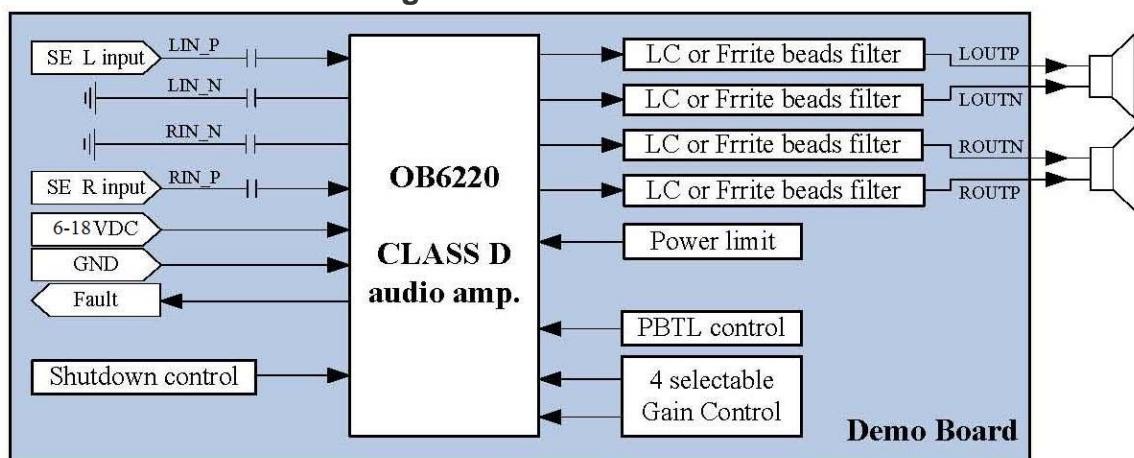


Fig. 1 Stereo Class-D Amplifier with BTL Output and Single-Ended Inputs

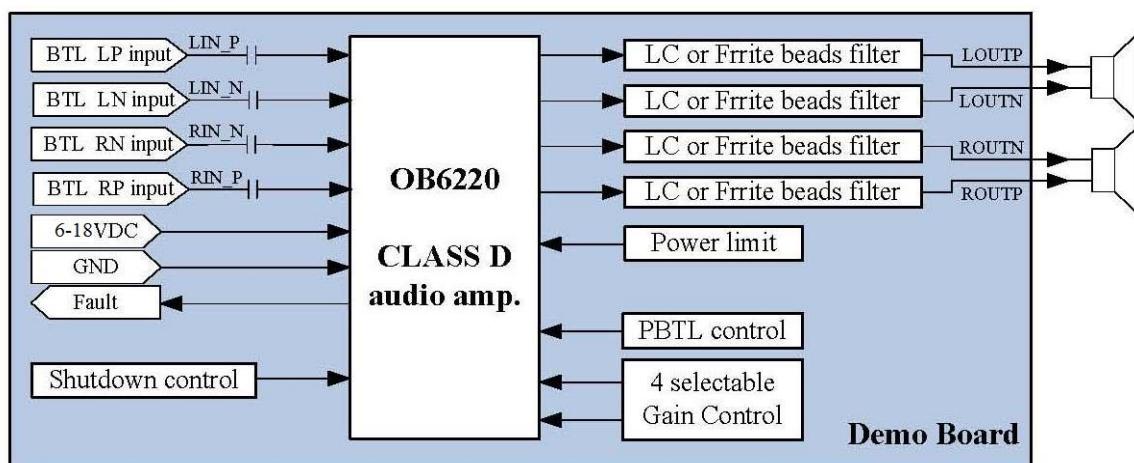


Fig. 2 Stereo Class-D Amplifier with BTL Output and Differential Inputs

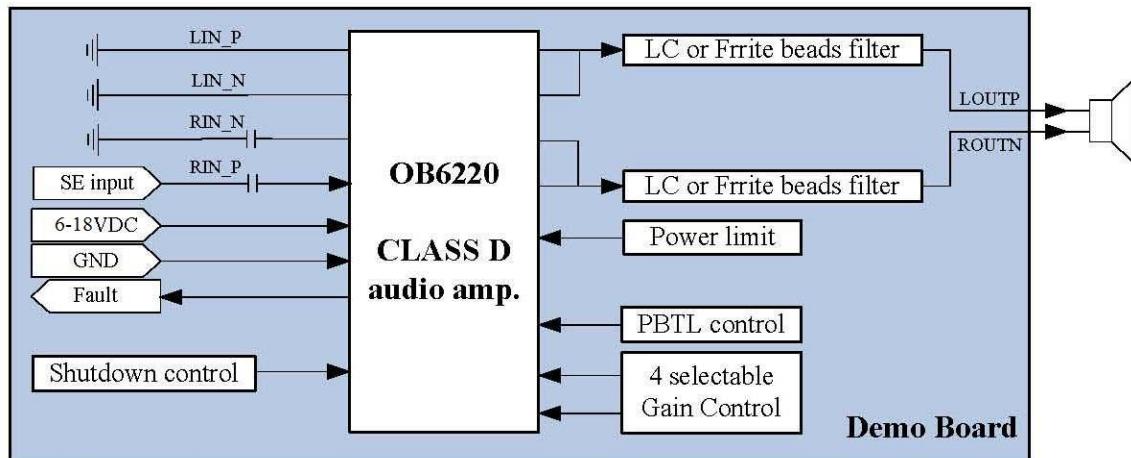


Fig. 3 Mono Class-D Amplifier with PBTL Output and Single-Ended Input

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 (6 – 20VDC)
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
LOUTP		O	Positive audio output for left channel
LOUTN		O	Negative audio output for left channel
ROUTP		O	Positive audio output for right channel
ROUTN		O	Negative audio output for right channel
_FAULT		O	Report short circuit or dc detect fault status as a low state
SW1	_SD	-	Shutdown control switch
J1	PB	-	PBTL/BTL output mode switch
J2	PL	-	Power limit/non power limit mode switch
J3	G0	-	Gain select least-significant bit
J4	G1	-	Gain select most-significant bit
J6	F	-	Auto-recovery/non auto-recovery mode switch of short circuit faults

* 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 Setting

Table 2. Gain select setting

Gain	G1(J4)	G0(J3)
20dB	ON	ON
26dB	ON	OFF
32dB	OFF	ON
36dB	OFF	OFF

Table 3. shutdown setting

State	Switch
shutdown	_SD (@SW1)
operation	ON OFF

Table 4. BTL and PBTL setting

Mode	Jumper
BTL	PB(J1)
PBTL	ON OFF

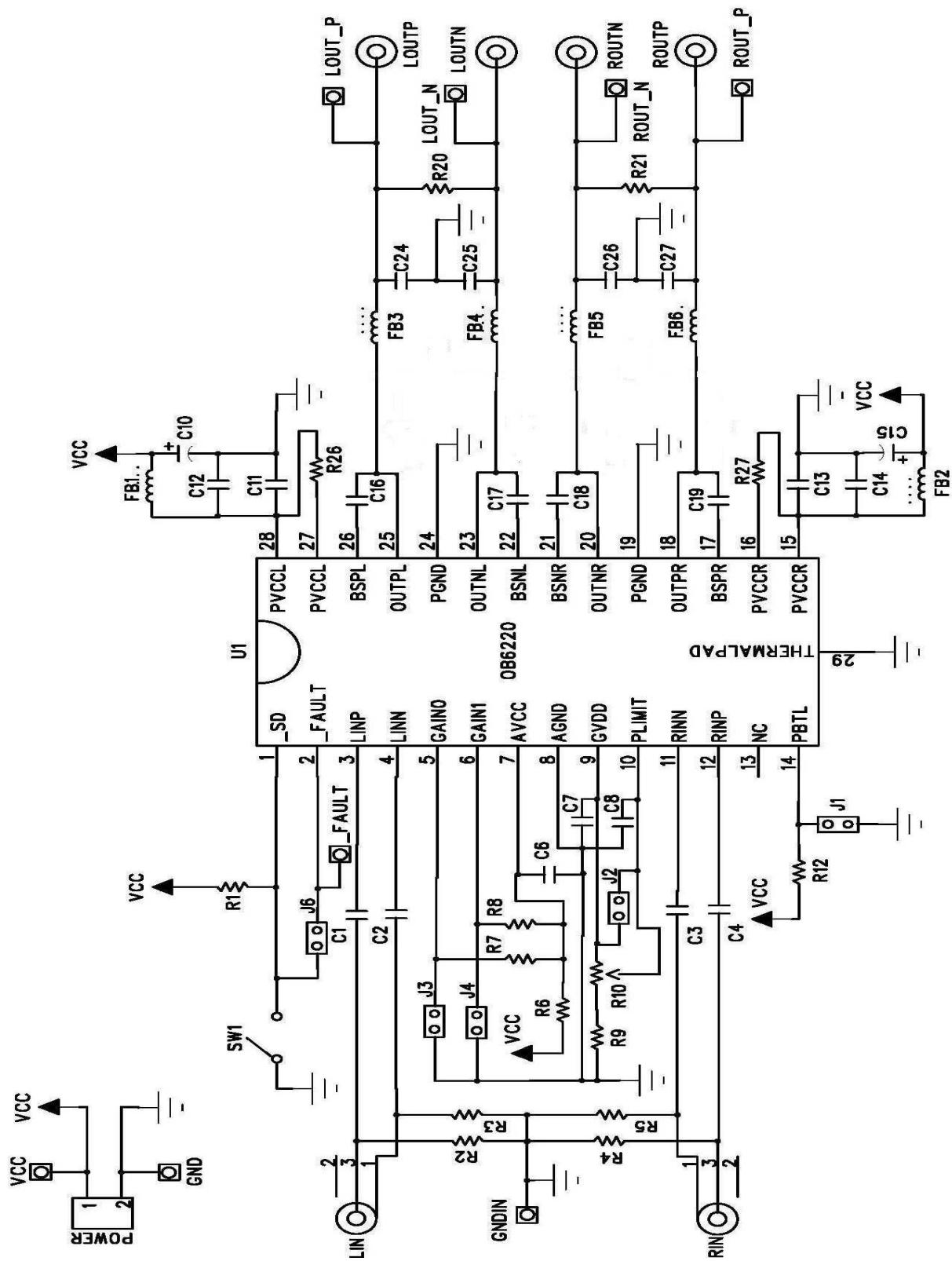
Table 5. power limit setting

Mode	Jumper
non power limit	PL(J2)
power limit	ON OFF

Table 6. Output Short Circuit auto-recovery /non auto-recovery setting

Mode	Jumper
auto-recovery	ON
non auto-recovery	F(J6) OFF

3.3 Schematic



3.4 Operation

3.4.1 Quick Start List for Stand-Alone Operation

Follow these steps to use the OB6220 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 AVCC&PVCC, and can be used to pull up the logic pins for shutdown control, fault report, gain and the PBTL. GVDD is an internally generated supply for the output FETs and is also used to power the PLIMIT voltage divider circuit on demo board.

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 6V to 20V to the POWER connector with taking care to observe marked polarity.

3.4.3 Audio Inputs and Outputs

1. For BTL configuration, connect analog audio source to jacks LIN and RIN using standard RCA plugs, either differential or single-ended.
For PBTL configuration, connect a single input to the RIN RCA plug, either differential or single-ended,
For each of the configuration, short the audio input to GND that are not in being used by R2,R3,R4,R5 on demo board.
2. For BTL configuration, connect a speaker across terminals LOUTP and LOUTN, connect another speaker across terminals ROUTP and ROUTN.
For PBTL configuration, connect a single speaker from one of the left output jacks to one of the right output jacks. Also make sure to connect the LOUTP&LOUTN together and the ROUTP&ROUTN together by R20 and R21 on demo board.

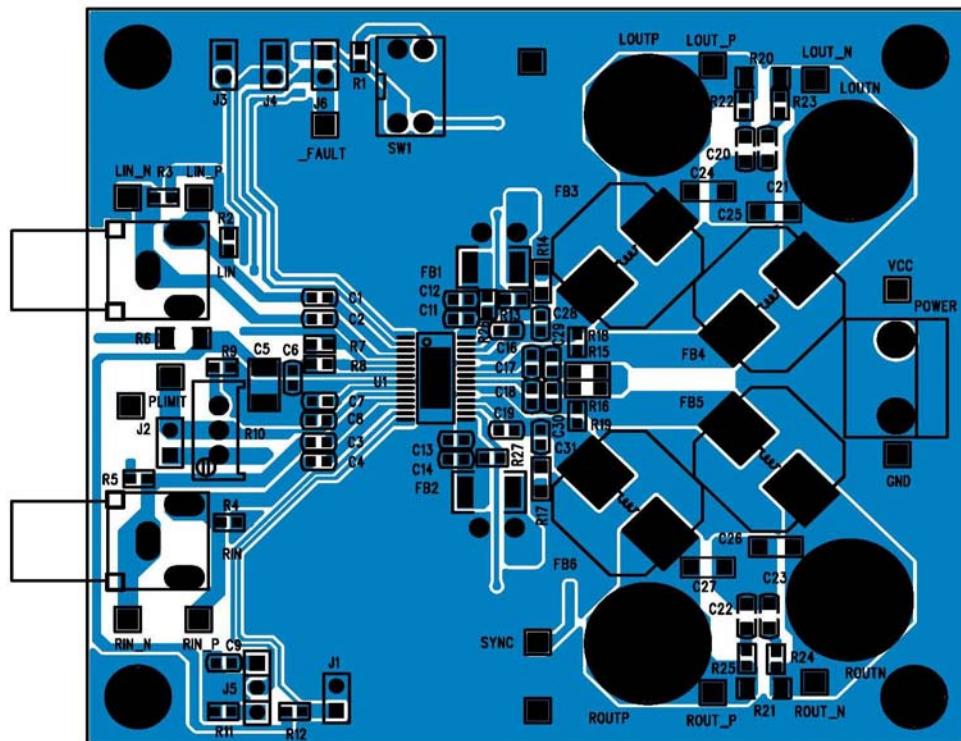
3.4.4 Control Inputs

1. Ensure the jumper and switch are set correctly depending on the desired **3.2.2 Switch and Jumper Setting**, include Gain0,Gain1,PBTL,SD,Power limit mode setting.

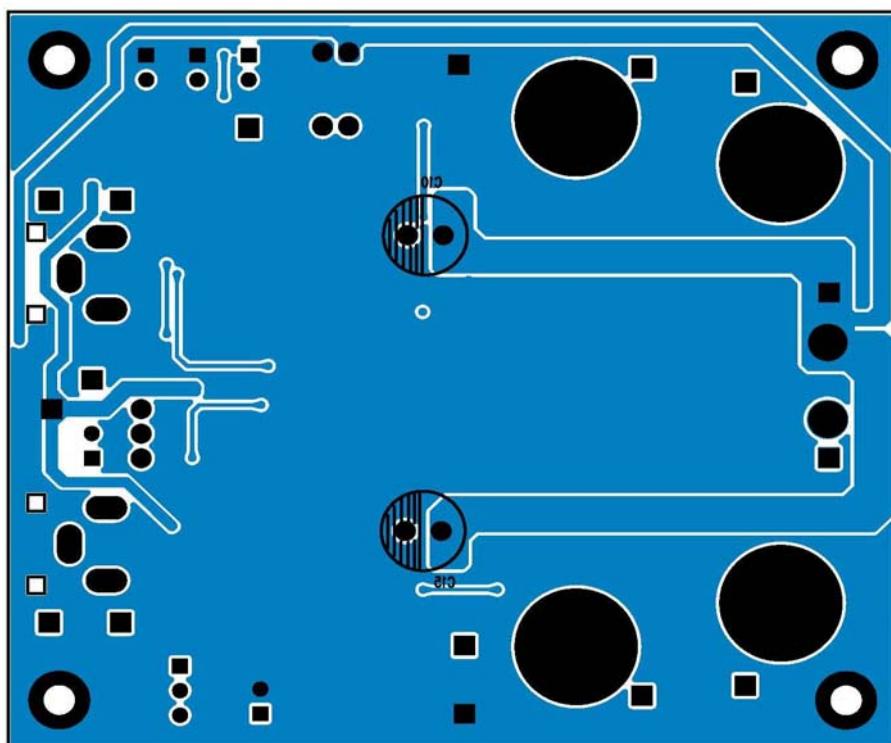
3.4.5 Power Up

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!

3.5 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,OB6220	TSSOP28
PCB:				
2.	1	PCB	OB6220 EVM PCB, double layers, AUOB6220.00 1245	87*76*1.6mm
Resistor:				
3.	2	R26,R27	Resistor,chip,0ohm,1/10W,5%	0603
4.	2	FB1,FB2	Resistor,chip,0ohm,1/2W,5%	1812
5.	1	R6	Resistor,chip,10ohm,1/4W,1%	1206
6.	1	R9	Resistor,chip,5.1kohm,1/10W,1%	0603
7.	1	R12	Resistor,chip,10kohm,1/10W,5%	0603
8.	3	R1,R7,R8	Resistor,chip,100kohm,1/10W,5%	0603
9.	1	R10	VARISTOR,100kohm	
Capacitor:				
10.	2	C11,C13	Capacitor,ceramic,0.001uF,±10%,COG,35V	0603
11.	2	C12,C14	Capacitor,ceramic,0.1uF,±10%,COG,35V	0603
12.	4	C16,C17,C18,C19	Capacitor,ceramic,0.22uF,±10%,X5R,16V	0603
13.	4	C24,C25,C26,C27	Capacitor,ceramic,0.68uF,±5%,X7R,35V	1206
14.	6	C1,C2,C3,C4,C7,C8	Capacitor,ceramic,1uF,±10%,X5R,16V	0603
15.	1	C6	Capacitor,ceramic,1uF,±10%,X5R,35V	0603
16.	2	C10,C15	Capacitor,electrolytic,100uF,35V,105°C	Φ7*11mm
Inductor:				
17.	4	FB3,FB4,FB5,FB6	Inductor,SMD,22uH,ferrite material	10.4*10.4*4.8mm
Others:				
18.	1	POWER	Power Connector,2pin,7.9mm	
19.	2	LOUTN, ROUTN	Banana Jack, red	
20.	2	LOUTP, ROUTP	Banana Jack, black	
21.	1	LIN	Phono Jack, PC mount, switched, red	
22.	1	RIN	Phono Jack, PC mount, switched, white	
23.	1	SW1	DIP Switch,2 channels	
24.	5	J1,J2,J3,J4,J6	Head,2pin male, straight	
25.	5		Jumper,2pin	
26.	1	_FAULT	Test Point Connector,red,1.32mm	

* All others unlisted components are no assembled.

* All components should be ordered as Lead-Free

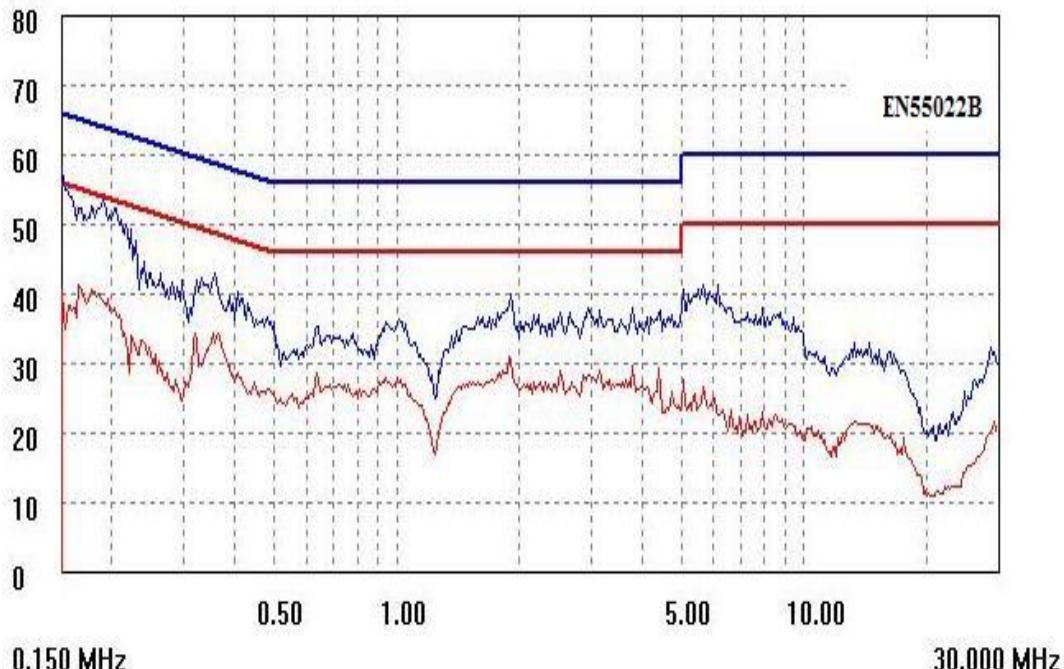
3.7 EMC Report

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

All following EMC test used OB6220 + OB2273 demo boards.

3.7.1 Conducted Emission Test

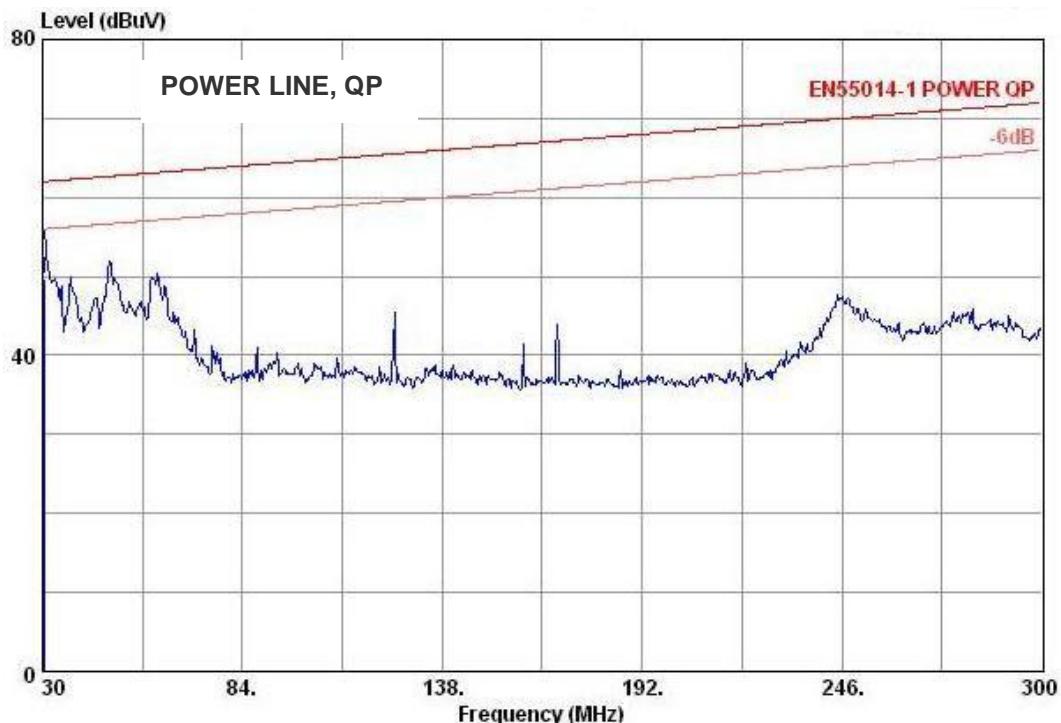
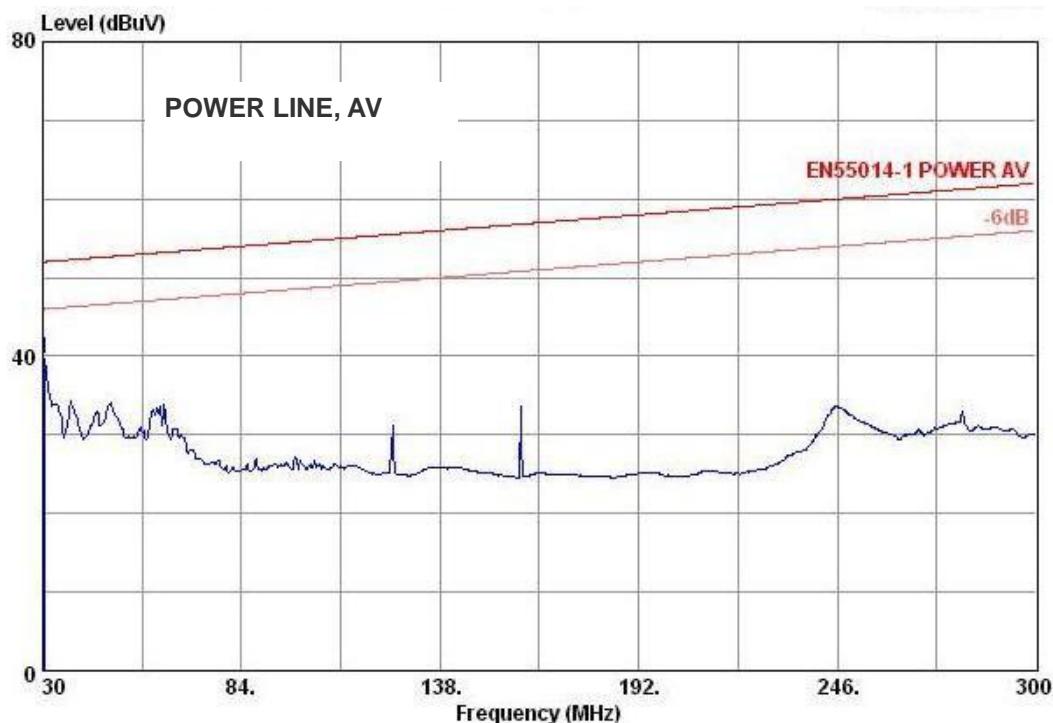
EN55022 CLASS B report @ 12Vcc8ohm, stereo 8W,
power line length=50cm, input line length=1m, speaker cable length=50cm



The blue curve is QP curve, the red curve is AV curve.

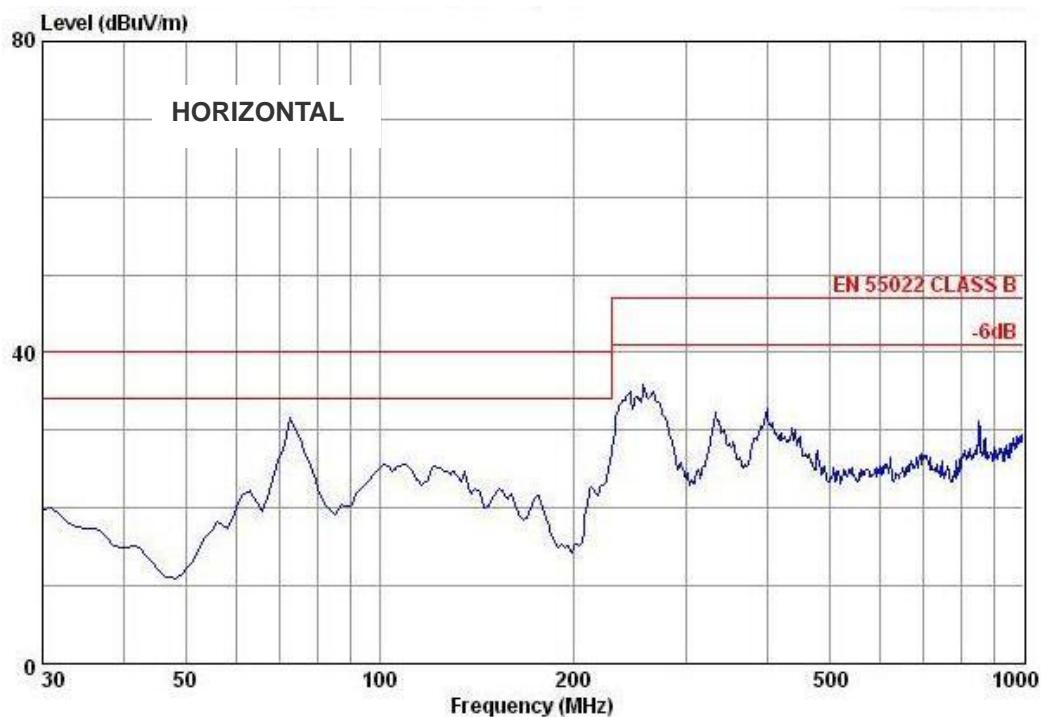
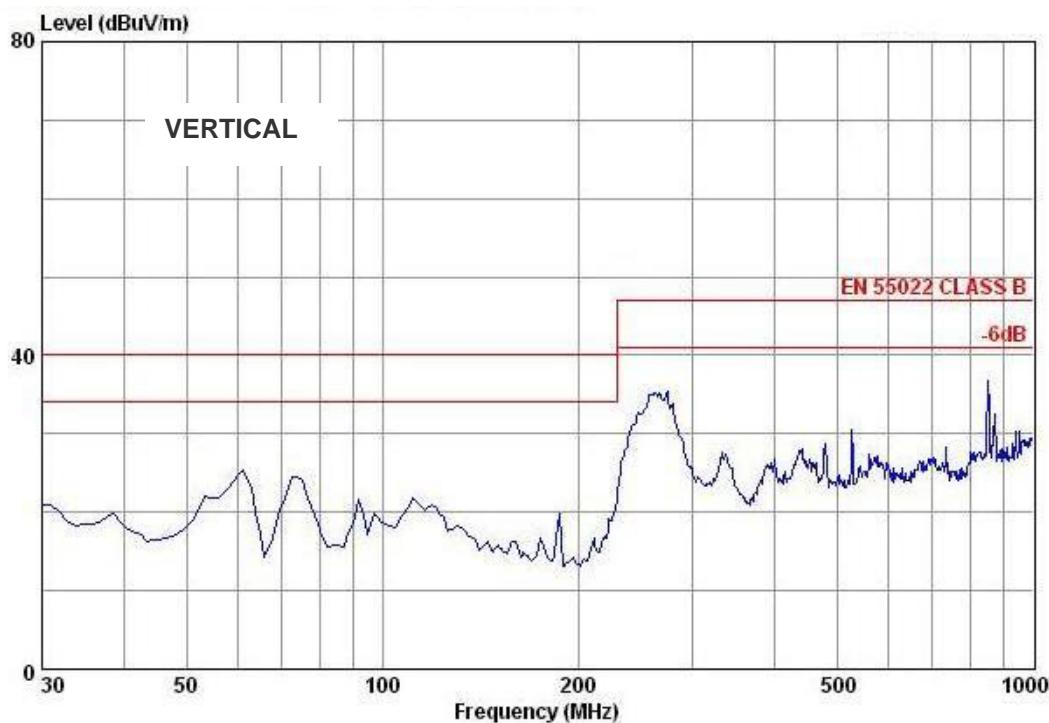
3.7.2 Power Clamp Radiation Test

**EN55014 report @ 12Vcc8ohm, stereo 8W,
power line length=50cm, input line length=1m, speaker cable length=50cm**



3.7.3 Radiation Emission Test

**EN55022 CLASS B report @ 12Vcc8ohm, stereo 8W,
power line length=50cm, input line length=1m, speaker cable length=50cm**



3.8 Protection Report

3.8.1 Protection Test – OVP,UVP,OTP

Test Condition: Ta=25°C, PVCC=AVCC=12V, Rload=8Ω, GAIN=20dB (unless otherwise noted)

Items		Specification	Result
OVP	Over voltage threshold	over 22V then protection, no broken	22V
	Over voltage recovery threshold	return to 21.6V then recover, no broken	21.6V
UVP	Under voltage threshold	under 5.4V then protection, no broken	5.4V
	Under voltage recovery threshold	return to 5.8V then recover, no broken	5.8V
OTP	Over temperature protection	170°C±15 °C then protection, no broken	175°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 power

Test Condition: Ta=25°C, VCC=PVCC=AVCC, Rload=8Ω, GAIN=20dB, 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
20V	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, VCC=PVCC=AVCC, Rload=8Ω, GAIN=20dB, 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
20V	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, VCC=PVCC=AVCC, Rload=8Ω, GAIN=20dB, 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
20V	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

3.8.3 Protection Test – DC Detect Protection

Test Condition: Ta=25°C, PVCC=AVCC=12V, Rload=8Ω, GAIN=20dB, INP&INN=DCV differential input (unless otherwise noted)

parameter	specification		Test Result
	Gain	Vin(differential)	
DC detect threshold	20dB	120mV	120mV
	26dB	60mV	60mV
	32dB	30mV	30mV
	36dB	18mV	18mV
DC detect time	430ms		430ms

3.9 Reliability Report

3.9.1 Abnormal Power On Test

Test Condition: $T_a=25^\circ C$, $PVCC=AVCC=12V$, $R_{load}=8\Omega$, $GAIN=20dB$ (unless otherwise noted)

Items	Specification	Result
22.5Vcc power on	enter into OVP, no broken	PASS
5Vcc power on	enter into UVP, no broken	PASS
power on when air temperature exceeds $190^\circ C$	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 power	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
power on when differential input voltage exceeds the DCD set point (20dB,26dB,32dB,36dB)	enter into DCD protection, no broken	PASS

3.9.2 High Temperature System Burn-in Test

Test Condition:

$T_a=60^\circ C$, $PVCC=AVCC=20V$, $R_{load}=8\Omega^2$, $GAIN=26dB$, music input “异度狂欢”, $Vin=1V_{rms}$, peak output power = $20W^2$, 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:

$T_a= -20^\circ C$, $PVCC=AVCC=18V$, $R_{load}=8\Omega^2$, $GAIN=20dB$, 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:

$T_a=25^\circ C$, $PVCC=AVCC=16V$, $R_{load}=8\Omega^2$, $GAIN=20dB$, $Vin=1kHz$ sinewave, continuously output power = $15W^2$, 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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