Ordering number: ENN8306A

SANYO Semiconductors
DATA SHEET

Monolithic Linear IC

LA47510 — BTL (50W×4) Power IC for Car Stereo Systems

Overview

The LA47510 is a BTL 4-channel (50W×4) power IC for car stereo. The output stage uses a pure complementary format with a V-PNP transistor on the upper side and a NPN transistor on the lower side, making it possible to obtain high power output and excellent sound quality.

This IC incorporates various functions (standby switch, mute function, full complement of protection circuits) needed for car audio, and also has a self-check (output offset detection) function.

Functions & Features

- 50W×4 maximum output (at VCC=14.4V, RL=4Ω)
- Very low external component count
- Onchip offset detector
- Onchip offset detector shutoff switch
- Mute function
- Standby switch
- Full compliment of protection circuits (including shorting to the power supply, shorting to ground, load short-circuit, overvoltage, thermal protection)

Caution 1: Never make wrong connection. A wrong connection would cause fatal damage or performance degradation to the IC or equipment.

Caution 2: The protective circuit functions are provided to temporarily avoid abnormal states such as incorrect output connections, and do not guarantee that IC destruction will not occur.
These protective functions do not operate outside of the operation guarantee range. If the outputs are connected incorrectly, IC destruction may occur when used outside of the operation guarantee range.

Specifications

Maximum Ratings at Ta=25°C

Parameter	Symbol	Test Conditions	Ratings	unit
Maximum supply voltage	V_{CC} max1	No signal, t=1 minute	26	V
	V_{CC} max2	With signal	18	V
Maximum output current	I_O peak	Per channel	4.5	A
Maximum power dissipation	Pd max	With infinite heat sink (note)	50	W
Operating ambient temperature	Topg		-40 to +85	°C
Storage ambient temperature	Tstg		-40 to +150	°C
Junction-to-case thermal resistance	θj-c		1	°C/W

Note: Power consumption (Pd), junction-to-case thermal resistance (θj-c), heat sink thermal resistance (θf), junction temperature (Tj), case temperature (Tc) and ambient temperature (Ta) have the relationship shown in the following equation.

$Tj=Pd(\theta j\text{-}c + \theta f) + Ta$

$=Pd\times\theta j\text{-}c + Tc$, $*Tc=Pd\times\theta f + Ta$ However, Tj max is limited by Tstg max (150°C)

Recommended Operation Conditions at Ta=25°C

Parameter	Symbol	Test Conditions	Ratings	unit
Supply voltage	V_{CC}		14.4	V
Load resistance	R_L		4	Ω
Operating supply voltage range	V_{CC} op	Pdmax shall not be exceeded.	9 to 18	V

Electrical Characteristics at Ta=25°C, V_{CC}=14.4V, f=1kHz, R_L=4Ω, Rg=600Ω

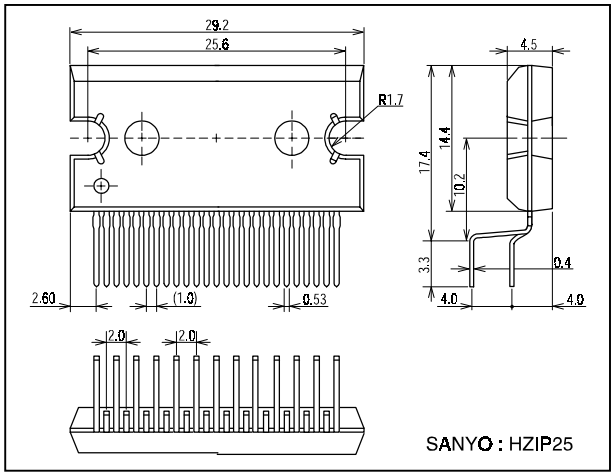
Parameter	Symbol	Test Conditions	min	typ	max	unit
Quiescent current	I_{CCO}	$R_L=\infty$, Rg=0		200	400	mA
Standby current	Ist	Vst=0V			10	μA
Output offset voltage	Vn offset	Rg=0	-100		+100	mV
Voltage gain	VG	Vo=0dBm	25	26	27	dB
Voltage gain difference	ΔVG		-1		+1	dB
Output power	P_O1	THD=10%	24	29		W
	P_O max1	V_{CC}=13.7V, Vin=5Vrms		43		W
	P_O max2	Vin=5Vrms		48		W
Total harmonic distortion	THD	Po=4W		0.05	0.3	%
Channel separation	CHsep	Vo=0dBm, Rg=10kΩ	55	65		dB
Ripple rejection ratio	SVRR	fr=100Hz, Vccr=0dBm, Rg=0 B.P.F=20Hz to 20kHz	45	55		dB
Output noise voltage	V_{NO}	Rg=0, B.P.F=20Hz to 20kHz		150	250	μVrms
Mute attenuation	Ma	Vo=20dBm	70	90		dB
Output middle point voltage	Vn	Rg=0		2.65		V

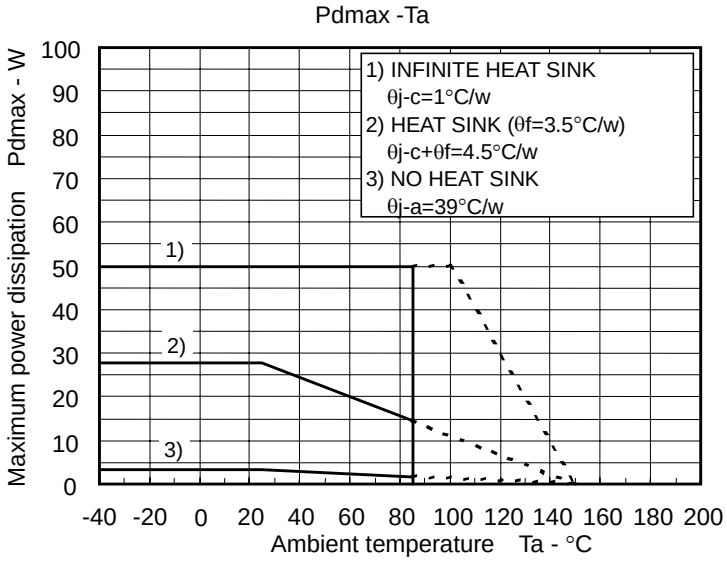
*0dBm=0.775Vrms

Package Dimensions

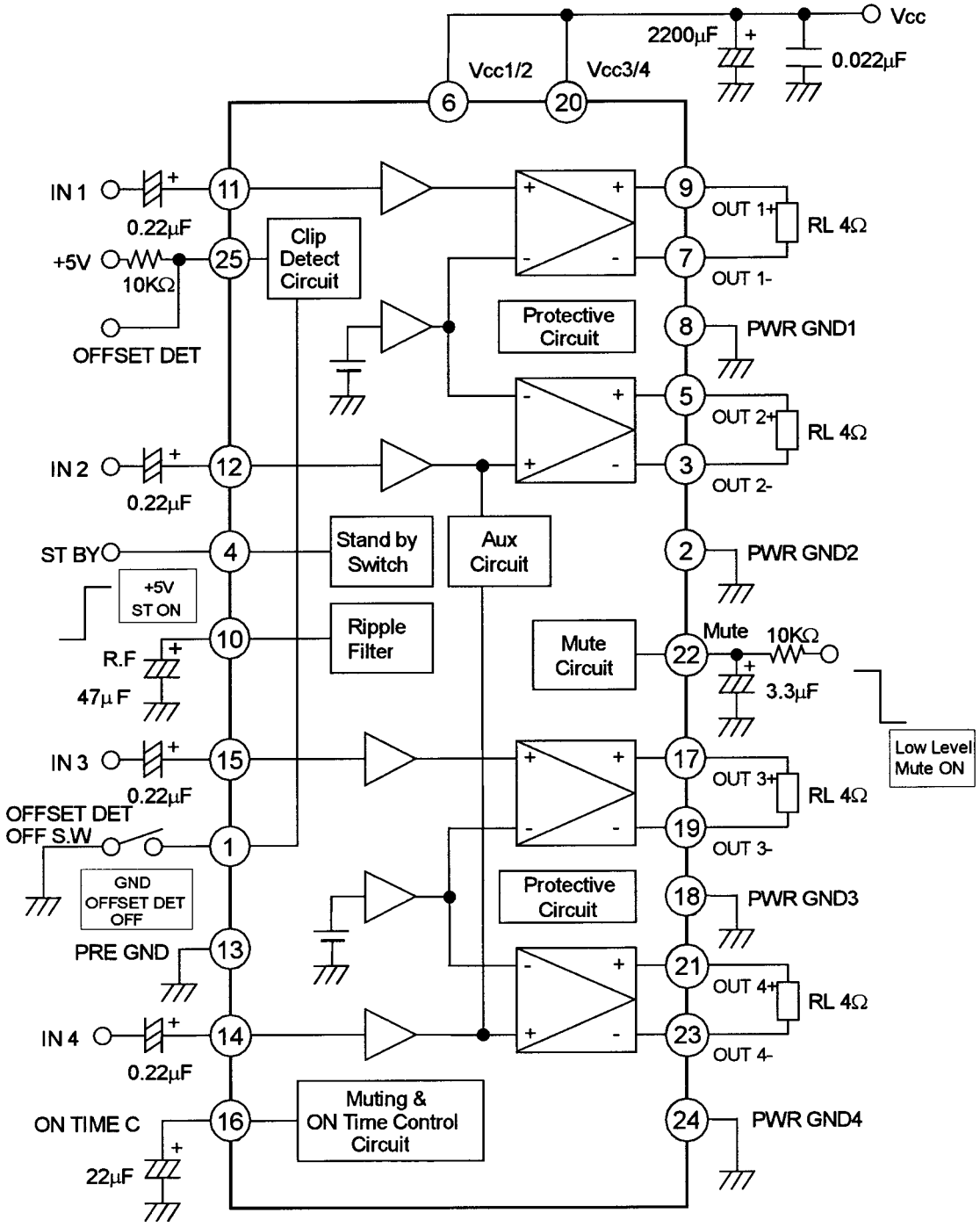
Unit: mm

3236





Block and Test Circuit Diagram



Note: The components and constant values within the test circuit are used to confirm the characteristics, and are not guarantees that incorrect operation or other trouble will not occur in applied equipment.

Description of Operation

1. Standby switch function (pin 4)

The Pin 4 threshold voltage is set to 2 VBE, and the amplifier turns on when Vst = 2.0 V or higher, and off when Vst = 0.7 V or lower. In addition, Pin 4 requires an operating current of 40 μA or more.

Note: Do not ground the output with the Pin 4 voltage at approximately 1.4 V. In addition, do not give the Pin 4 voltage a time constant.

2. Mute function

Mute mode is established and the audio can be muted by connecting Pin 22 to GND through 10 kΩ.

The mute time constant is determined by the external capacitor and resistor constants. The recommended external constants are C = 3.3 μF, R = 10 kΩ.

3. Self-check function (loudspeaker burnout prevention)

Pin 25 is used to check, during normal operation, for any abnormality in the offset level of the amplifier and generates a signal when an abnormal level is detected. Speaker burnout can be prevented by detecting this Pin 25 signal with a microcontroller or other device and controlling the standby power supply, etc. (Output offset errors are thought to be caused by the leak current of the input capacitor, etc.)

In addition, the Pin 25 signal can be turned off by setting Pin 1 to the GND potential.

4. Oscillation stability

Parasitic oscillation may be induced depending on the board layout.

Countermeasures against oscillation can be taken by adding the following parts.

Note that the following are only examples for reference, and that the optimum capacitance values must be confirmed in the mounted condition for each set.

- Connect a Mylar capacitor (0.033 μF) between the BTL outputs.
- Connect a capacitor and a resistor (0.1 μF and 2.2 Ω in series) between each output and GND.

5. Sound quality (low frequencies)

The frequency response in the low frequency range can be improved by varying the capacitance value of the input capacitor. The recommended value is 2.22 μF or less.

6. Shock noise

This IC incorporates a shock noise canceling circuit, and the shock noise canceling performance can be further improved by using together with the mute function.

- When turning on the amplifier, turn the power supply and the mute function on at the same time. Then turn the mute function off after the output current potential has stabilized.
- When turning off the amplifier, first turn the mute function off and then turn the power supply off.

7. Using the pin 25 function and the pin 1 off function

(1) Offset detection function (Pin 25)

Output offsets can be detected by directly monitoring the pin potential in the condition with 5 V applied through a 10 kΩ resistor. When an offset is detected, the Pin 25 potential falls from 5 V to 0 V.

* The voltage level at pin 25 swings up and down in synchronization with the output signal when the LA47510 is in the normal operating state.

(2) Offset detection function OFF switch (Pin 1)

The offset detection function (Pin 25) can be turned off by connecting Pin 1 to GND. Leave Pin 1 open during normal operation.

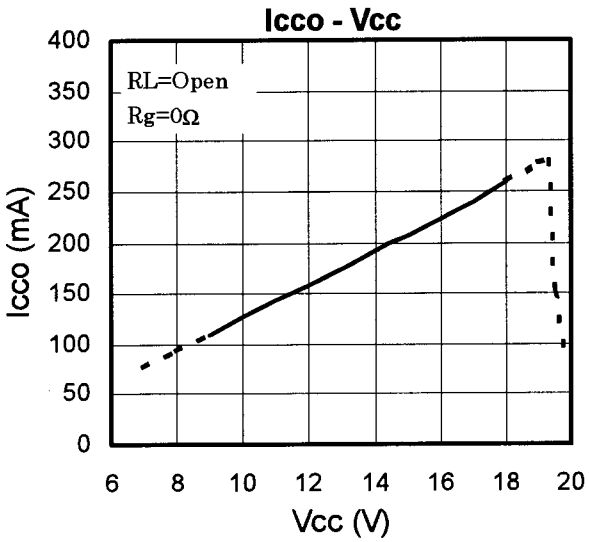
8. Electric mirror noise suppression measures

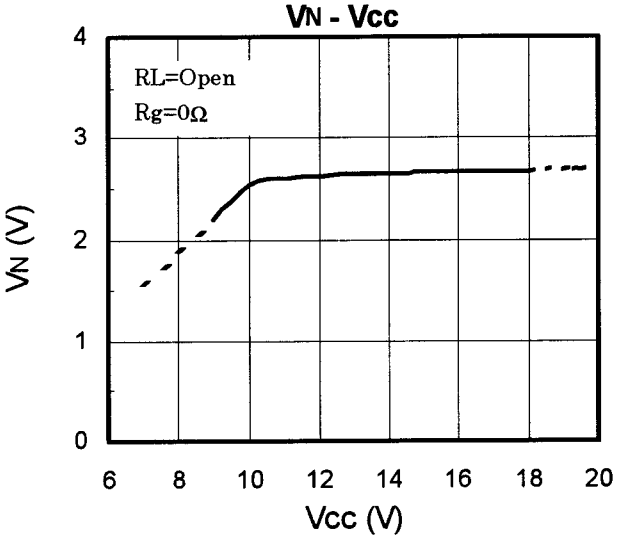
Electric mirror noise can be reduced by inserting a bypass capacitor between the output and GND.

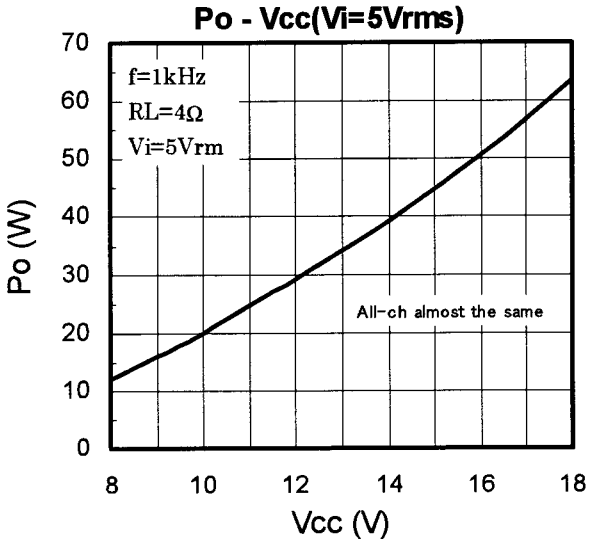
For reference, the standard value is approximately 470 pF and the maximum value is approximately 2200 pF.

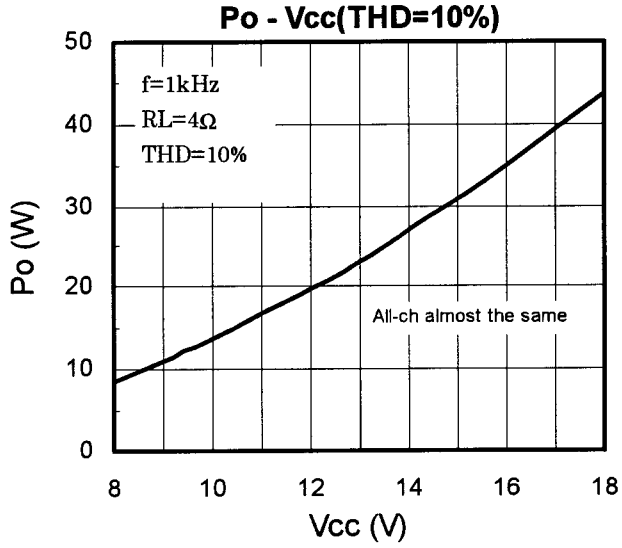
However, note that inserting a bypass capacitor will cause the oscillation stability to worsen, so thorough investigation of anti-oscillation measures should be made in the set condition before use.

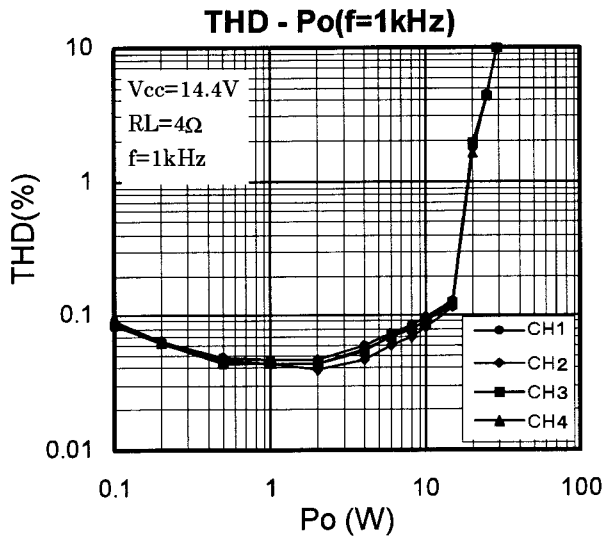
Characteristics Charts

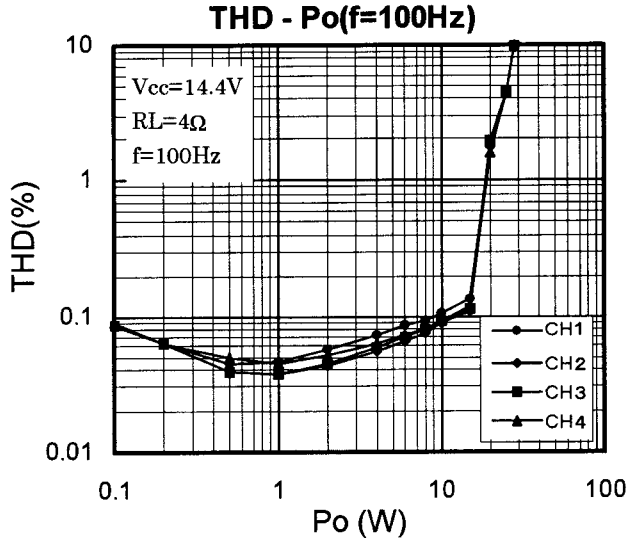


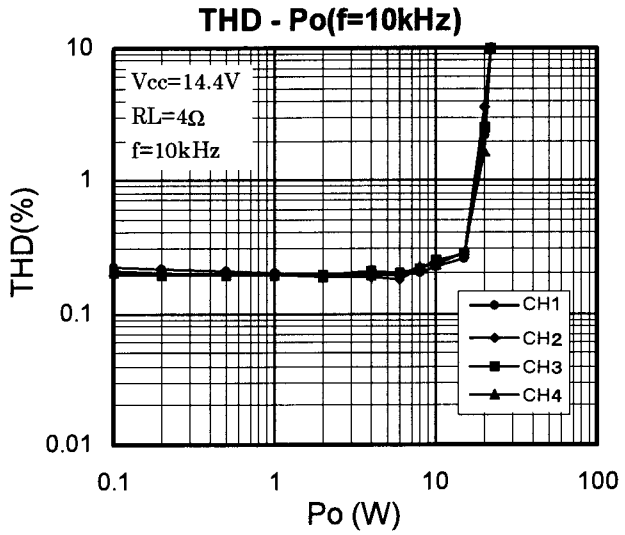


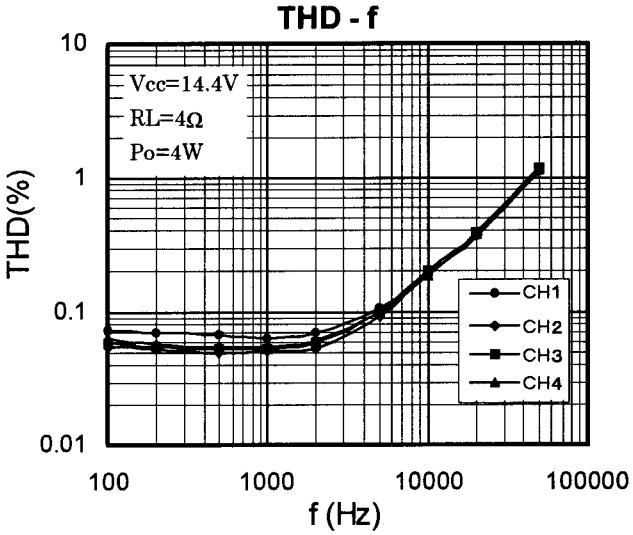


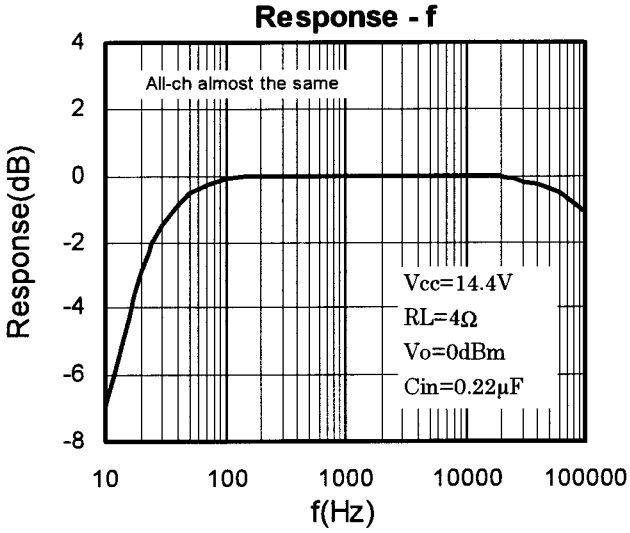


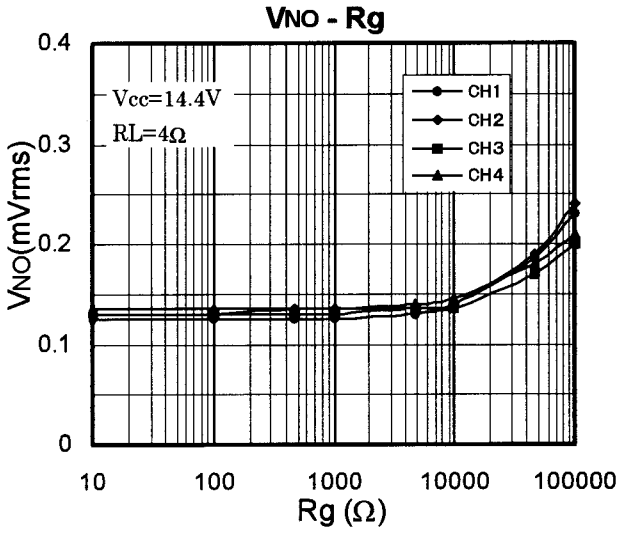


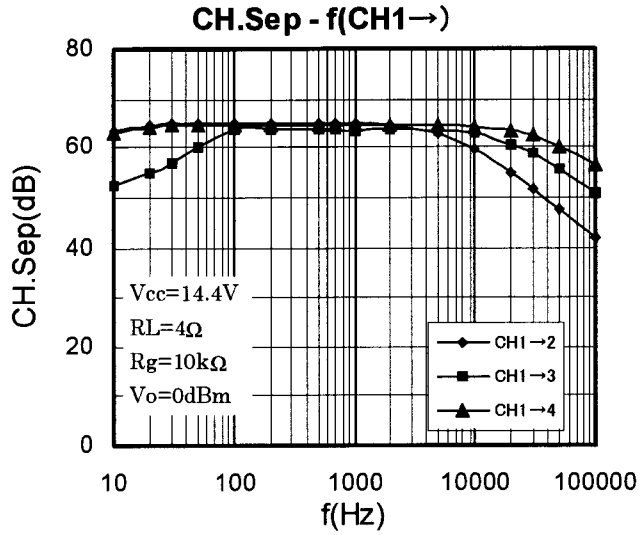


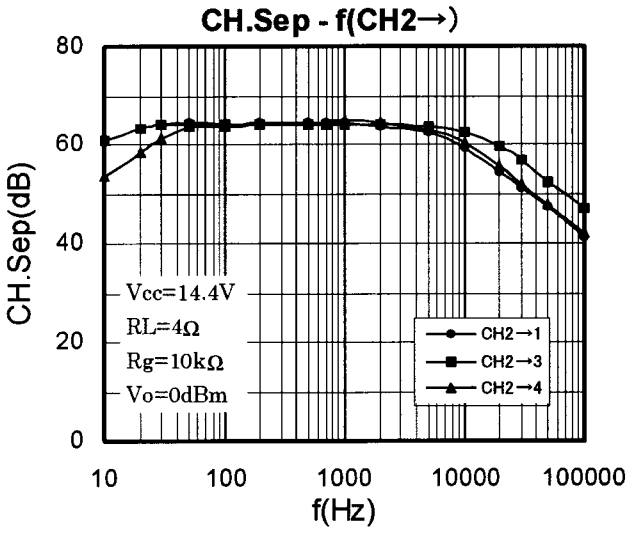

THD - Po(f=10kHz)
Vcc=14.4V
RL=4Ω
f=10kHz
THD(%)
Po (W)
CH1
CH2
CH3
CH4

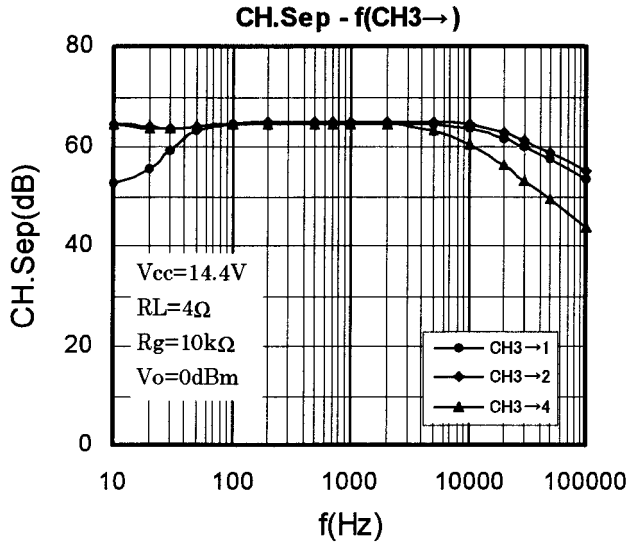

THD - f
Vcc=14.4V
RL=4Ω
Po=4W
THD(%)
f (Hz)
CH1
CH2
CH3
CH4

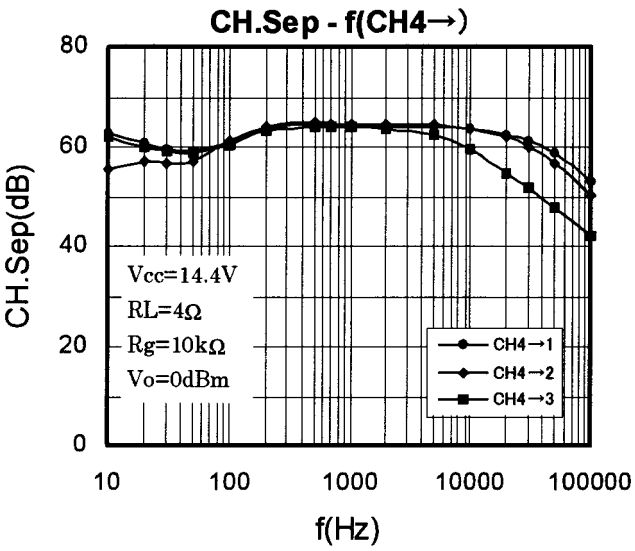

Response - f
All-ch almost the same
Vcc=14.4V
RL=4Ω
Vo=0dBm
Cin=0.22µF
Response(dB)
f(Hz)

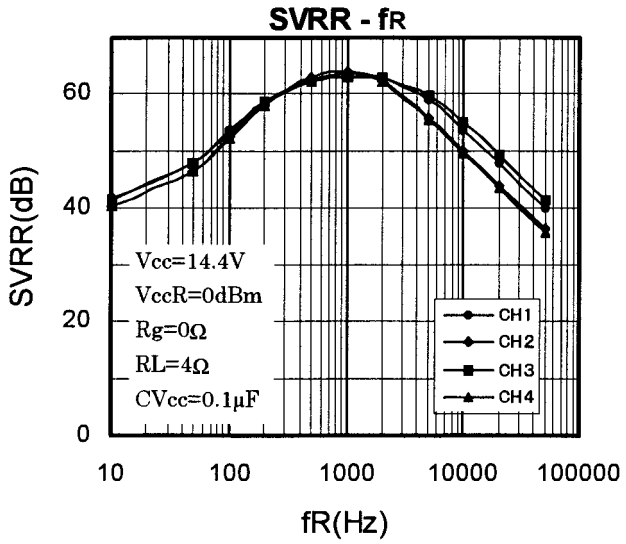

VNO - Rg
Vcc=14.4V
RL=4Ω
VNO(mVrms)
Rg (Ω)
CH1
CH2
CH3
CH4

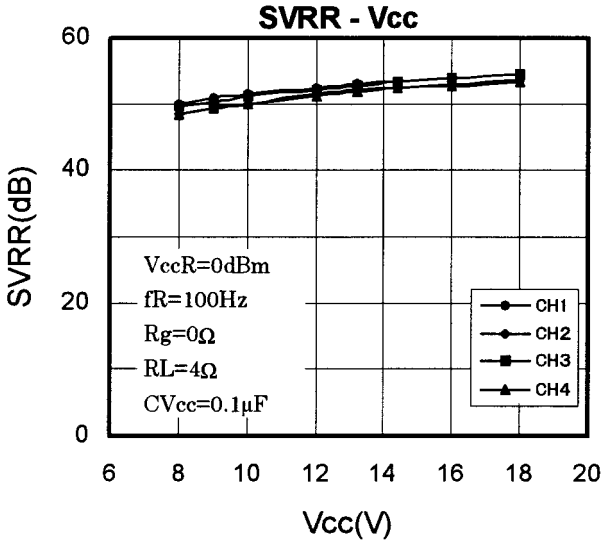

CH.Sep - f(CH1→)
Vcc=14.4V
RL=4Ω
Rg=10kΩ
Vo=0dBm
CH.Sep(dB)
f(Hz)
CH1→2
CH1→3
CH1→4

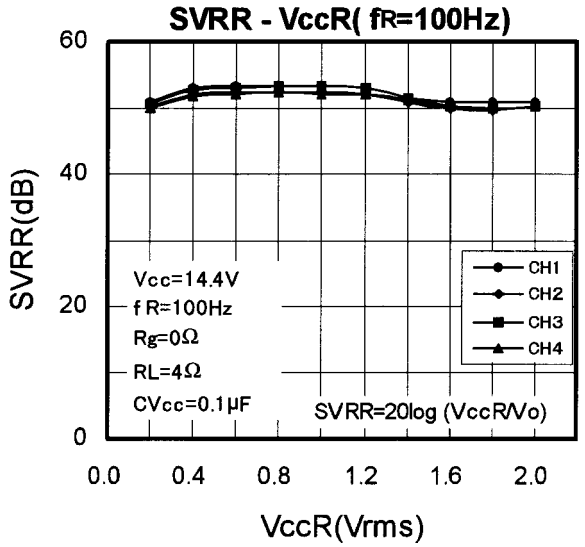

CH.Sep - f(CH2→)
Vcc=14.4V
RL=4Ω
Rg=10kΩ
Vo=0dBm
CH.Sep(dB)
f(Hz)
CH2→1
CH2→3
CH2→4

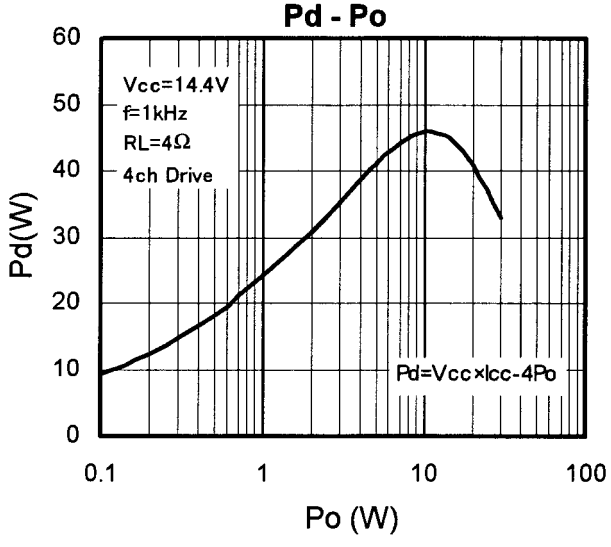

CH.Sep - f(CH3→)
CH.Sep(dB)
80
60
40
20
0
Vcc=14.4V
RL=4Ω
Rg=10kΩ
Vo=0dBm
CH3→1
CH3→2
CH3→4
10
100
1000
10000
100000
f(Hz)


CH.Sep - f(CH4→)
CH.Sep(dB)
80
60
40
20
0
Vcc=14.4V
RL=4Ω
Rg=10kΩ
Vo=0dBm
CH4→1
CH4→2
CH4→3
10
100
1000
10000
100000
f(Hz)


SVRR - fR
SVRR(dB)
60
40
20
0
Vcc=14.4V
VccR=0dBm
Rg=0Ω
RL=4Ω
CVcc=0.1μF
CH1
CH2
CH3
CH4
10
100
1000
10000
100000
fR(Hz)


SVRR - Vcc
SVRR(dB)
60
40
20
0
VccR=0dBm
fR=100Hz
Rg=0Ω
RL=4Ω
CVcc=0.1μF
CH1
CH2
CH3
CH4
6
8
10
12
14
16
18
20
Vcc(V)


SVRR - VccR(fR=100Hz)
SVRR(dB)
60
40
20
0
Vcc=14.4V
f R=100Hz
Rg=0Ω
RL=4Ω
CVcc=0.1μF
SVRR=20log (VccR/Vo)
CH1
CH2
CH3
CH4
0.0
0.4
0.8
1.2
1.6
2.0
VccR(Vrms)


Pd - Po
Pd(W)
60
50
40
30
20
10
0
Vcc=14.4V
f=1kHz
RL=4Ω
4ch Drive
Pd=Vcc×Icc-4Po
0.1
1
10
100
Po (W)