



SANYO Semiconductors

# DATA SHEET

## LV47002P — Monolithic Linear IC For Car Audio Systems 4-Channel BTL Power Amplifier

### Overview

The LV47002P is the IC for 4-channel BTL power amplifier that is developed for car audio system.

Pch DMOS in the upper side of the output stage and Nch DMOS in the lower side of the output stage are complimentary. High power and high quality sound are realized by that.

This IC incorporate various functions (standby switch, muting function, and various protection circuit) necessary for car audio system. Also, it has a self-diagnosis function.

### Functions

- High output :  $P_O$  max = 48W (typical) ( $V_{CC} = 15.2V$ ,  $f = 1kHz$ , JEITA max,  $R_L = 4\Omega$ )  
:  $P_O$  max = 28W (typical) ( $V_{CC} = 14.4V$ ,  $f = 1kHz$ , THD = 10%,  $R_L = 4\Omega$ )  
:  $P_O$  max = 21W (typical) ( $V_{CC} = 14.4V$ ,  $f = 1kHz$ , THD = 1%,  $R_L = 4\Omega$ )
- Built-in muting function (pin 22)
- Built-in Standby switch (pin 4)
- Built-in Self-diagnosis function (pin 25) :  
Signal output in case of output offset detection, shorting to  $V_{CC}$ , shorting to ground, and load shorting.
- Electric mirror noise decrease
- Built-in various protection circuit (shorting to ground, shorting to  $V_{CC}$ , load shorting, over voltage and thermal shut down)
- No external anti-oscillation part necessary.

Note 1 : Please do not mistake connection.

A wrong connection may produce destruction, deterioration and damage for the IC or equipment.

Note 2 : The protective circuit function is provided to temporarily avoid abnormal state such as incorrect output connection.

But, there is no guarantee that the IC is not destroyed by the accident.

The protective function do not operate of the operation guarantee range. If the outputs are connected incorrectly, IC destruction may occur when used outside of the operation guarantee range.

Note 3 : External parts, such as the anti-oscillation part, may become necessary depending on the set condition. Check their necessity for each set.

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SANYO Semiconductor Co., Ltd.

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# LV47002P

## Specifications

### Maximum Ratings at $T_a = 25^\circ\text{C}$

Parameter	Symbol	Conditions	Ratings	Unit
Maximum supply voltage	$V_{CC\ max1}$	No signal, $t = 1$ minute	26	V
	$V_{CC\ max2}$	During operations	18	V
Maximum output current	$I_O\ peak$	Per channel	4.5/ch	A
Allowable power dissipation	$P_d\ max$	With an infinity heat sink	50	W
Operating temperature	$T_{opr}$		-40 to +85	$^\circ\text{C}$
Storage temperature	$T_{stg}$		-40 to +150	$^\circ\text{C}$
Thermal resistance between the junction and case	$\theta_{j-c}$		1	$^\circ\text{C/W}$

### Recommended Operating Ranges at $T_a = 25^\circ\text{C}$

Parameter	Symbol	Conditions	Ratings	Unit
Recommended supply voltage	$V_{CC}$		14.4	V
Recommended load resistance	$R_L\ op$		4	$\Omega$
Operating supply voltage range	$V_{CC\ op}$	A range not exceeding $P_{dmax}$	9 to 16	V

### Electrical Characteristics at $T_a = 25^\circ\text{C}$ , $V_{CC} = 14.4\text{V}$ , $R_L = 4\Omega$ , $f = 1\text{kHz}$ , $R_g = 600\Omega$

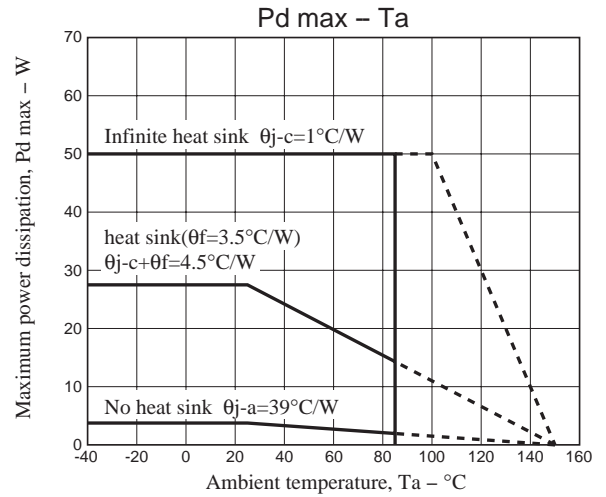
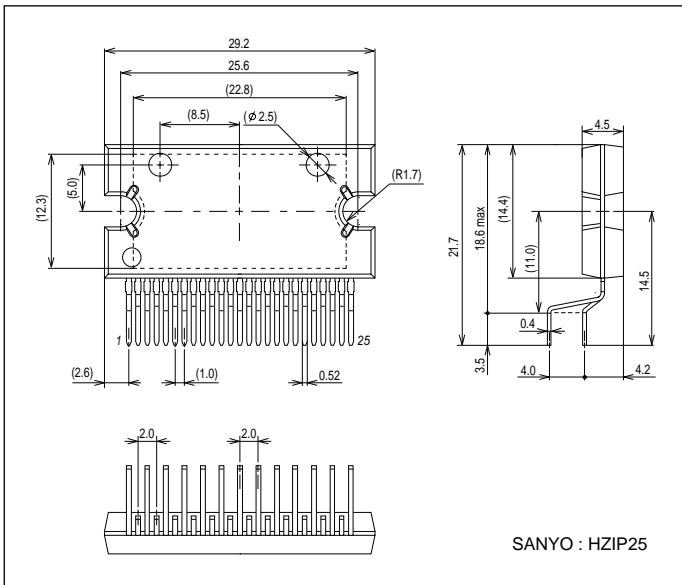
Parameter	Symbol	Conditions	Ratings			Unit
			min	typ	max	
Quiescent current	$I_{CCO}$	$R_L = \infty$ , $R_g = 0\Omega$		200	400	mA
Standby current	$I_{st}$	$V_{st} = 0\text{V}$			10	$\mu\text{A}$
Voltage gain	VG	$V_O = 0\text{dBm}$	25	26	27	dB
Voltage gain difference	$\Delta\text{VG}$		-1		+1	dB
Output power	$P_O$	THD = 10%	23	28		W
	$P_O\ max1$	JEITA max		43		W
	$P_O\ max2$	$V_{CC} = 15.2$ , JEITA max		48		W
Output offset voltage	$V_n\ offset$	$R_g = 0\Omega$	-100		+100	mV
Total harmonic distortion	THD	$P_O = 4\text{W}$		0.03	0.2	%
Channel separation	CHsep	$V_O = 0\text{dBm}$ , $R_g = 10\text{k}\Omega$	55	65		dB
Ripple rejection ratio	SVRR	$R_g = 0\Omega$ , $f_r = 100\text{Hz}$ , $V_{CCR} = 0\text{dBm}$	45	65		dB
Output noise voltage	$V_{NO}$	$R_g = 0\Omega$ , B.P.F. = 20Hz to 20kHz		80	200	$\mu\text{Vrms}$
Input resistance	$R_i$		40	50	65	$\text{k}\Omega$
Mute attenuation	Matt	$V_O = 20\text{dBm}$ , mute : on	75	90		dB
Standby pin control voltage	$V_{stby\ H}$	Amp : on	2.5		$V_{CC}$	V
	$V_{stby\ L}$	Amp : off	0.0		0.5	V
Mute pin control voltage	$V_{mute\ H}$	Mute : off	Open			-
	$V_{mute\ L}$	Mute : on	0.0		1.5	V
<b>Output offset detection</b>						
Detection threshold voltage	$V_{osdet}$		$\pm 1.2$	$\pm 1.8$	$\pm 2.4$	V

\* 0dBm = 0.775Vrms

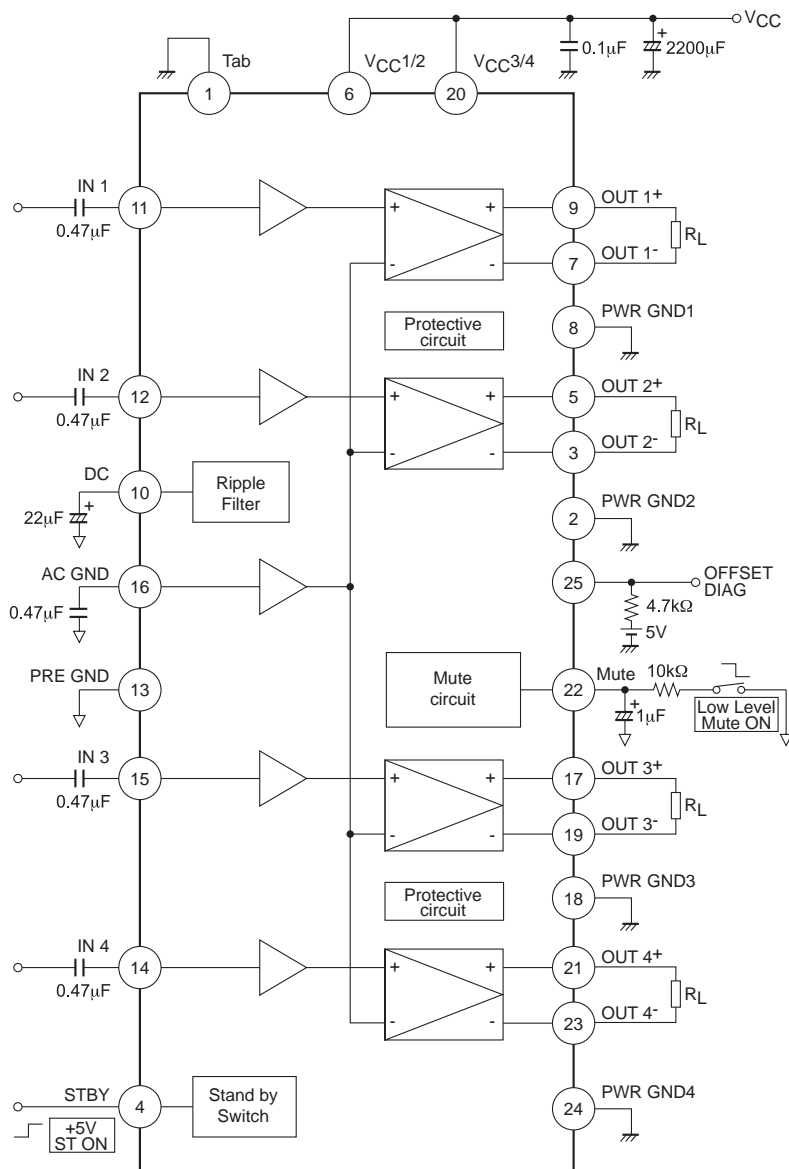
# LV47002P

## Package Dimensions

unit : mm (typ)  
3236A



## Block Diagram



# LV47002P

## External Components

Part Name	Recommended Value	Purpose	Remarks
C1 to C5	0.47 $\mu$ F	Cuts DC voltage	The larger the constant value, the lower the cut-off frequency The values of C1 to C5 must be the same
C6	22 $\mu$ F	Reduces ripples Reduces pop noise	The larger the constant value, the longer the amplifier ON/OFF time
C7	2200 $\mu$ F	Ripple filter	Eliminating power supply ripples
C8	0.1 $\mu$ F	Improves oscillation stability	Reducing high-frequency noise
C9	1 $\mu$ F	Reduces pop noise	The larger the constant value, the longer the mute ON/OFF time
R1	10k $\Omega$	Reduces pop noise	The larger the constant value, the longer the mute ON/OFF time
R2	4.7k $\Omega$	Pull-up resistor	

\* The components and constant values within the test circuit are used for confirmation of characteristics and are not guarantees that incorrect or trouble will not occur in application equipment.

## Description of Operation

### 1. Standby switch function (pin 4)

Threshold voltage of the pin 4 is set by about  $2V_{BE}$ .

The amplifier is turned on by the applied voltage of 2.5V or more. Also, the amplifier is turned off by the applied voltage of 0.5V or less.

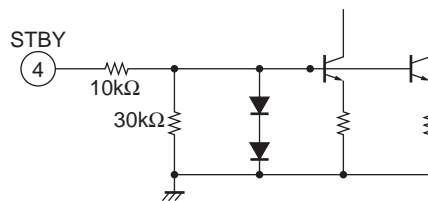


Fig1 Standby equivalent circuit

### 2. Muting function (pin 22)

The muted state is obtained by setting pin 22 to the ground potential, enabling audio muting.

The muting function is turned on by the applied voltage of 1V or less to the resistance of 10k $\Omega$ . And the muting function is turn off when this pin opens.

Also, the time constant of the muting function is determined by external capacitor and resistor constants.

It is concerned with a pop noise in amplifier ON/OFF and mute ON/OFF. After enough examination, please set it.

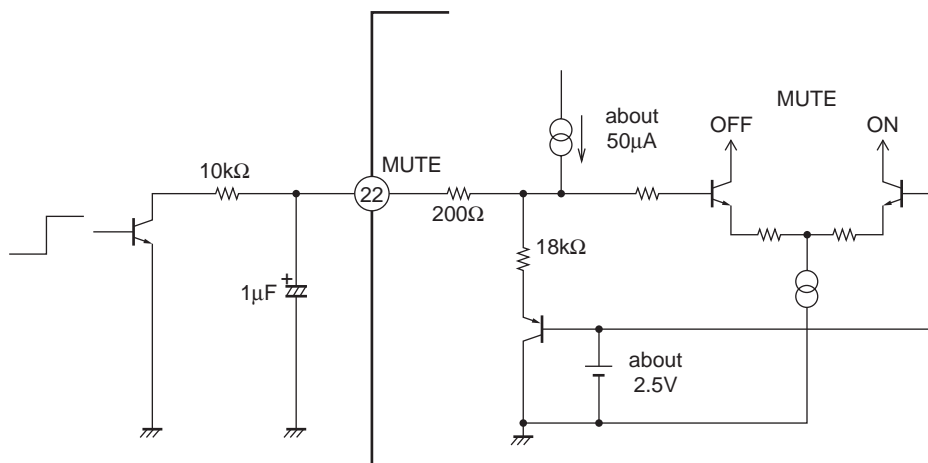


Fig2 Mute equivalent circuit

### 3. ACGND pin (pin 16)

The capacitor of the pin 16 must use the same capacitance value as the input capacitor.

Also, connect to the same PREGND as the input capacitor.

## LV47002P

### 4. Self-diagnostics function (pin 25)

By detecting the unusual state of the IC, the signal is output to the pin 25.

Also, by controlling the standby switch after the signal of the pin 25 is detected by the microcomputer, the burnout of the speaker can be prevented.

- (1) Shorting to  $V_{CC}$ /Shorting to ground : The pin 25 becomes the low level.
- (2) Load shorting : The pin 25 is alternated between the low level and the high level according to the output signal.
- (3) Output offset detection : when the output offset voltage exceeds the detection threshold voltage, the pin 25 becomes the low level.

\* Note: The output offset abnormality is thought of as the leakage current of the input capacitor.

In addition, the pin 25 has become the NPN open collector output (active low).

The pin 25 must be left open when this function is not used.

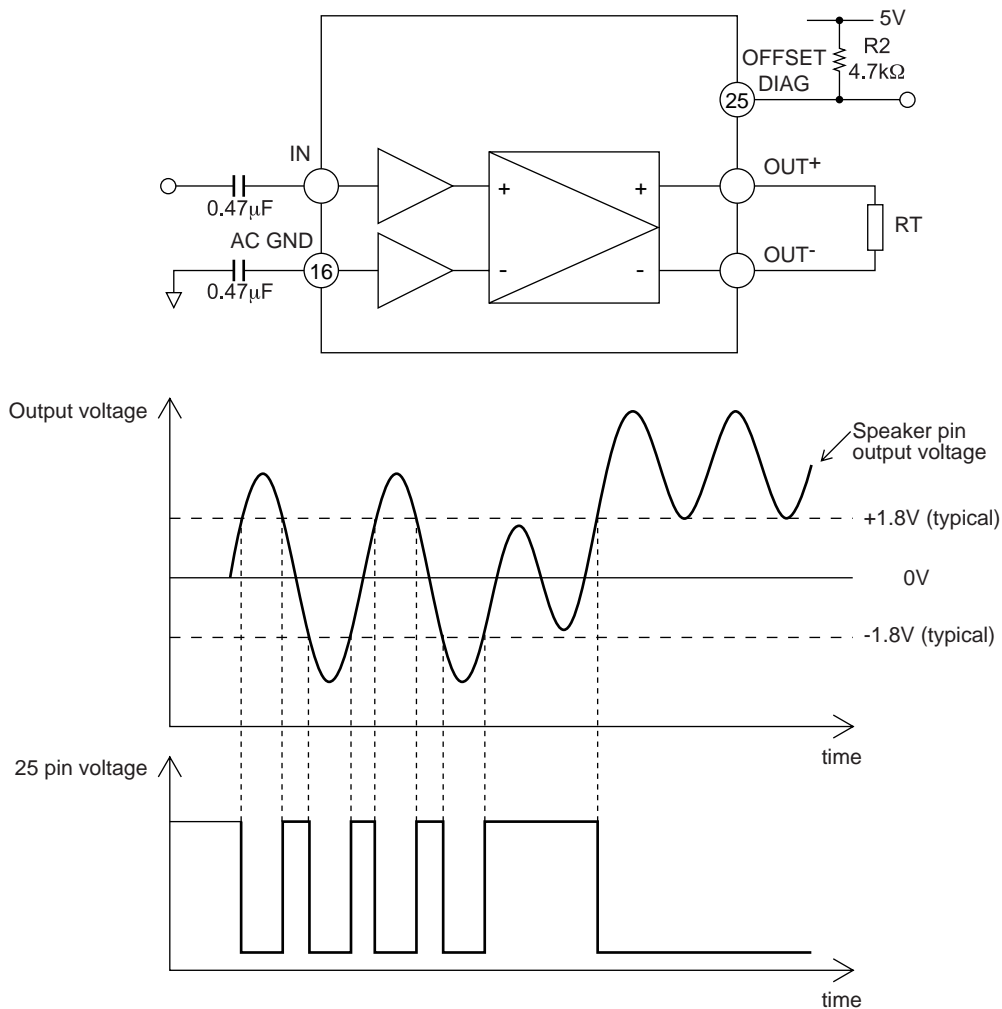


Fig3 Self-diagnosis Function Diagram

### 5. Sound quality (low frequencies)

By varying the value of input capacitor, low-frequency characteristic can be improved.

However, it is concerned the shock noise. Please confirm in each set when the capacitance value varies.

### 6. Pop noise

For pop noise prevention, it is recommended to use the muting function at the same time.

- Please turn on the muting function simultaneously with power supply on when the amplifier is turned on. Next, turn off the muting function after the output DC potential stabilization.
- When the amplifier is turn off, turn off the power supply after turning on the muting function.

### 7. Oscillation stability

Pay due attention on the following points because parasitic oscillation may occur due to effects of the capacity load, board layout, etc.

#### (1) Capacity load

When the capacitor is to be inserted between each output pin and GND so as to prevent electric mirror noise, select the capacitance of maximum 1500pF. (Conditions : Our recommended board,  $R_L = 4\Omega$ )

#### (2) Board layout

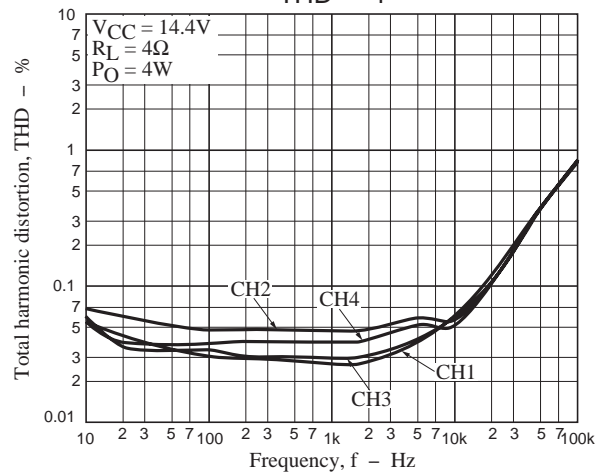
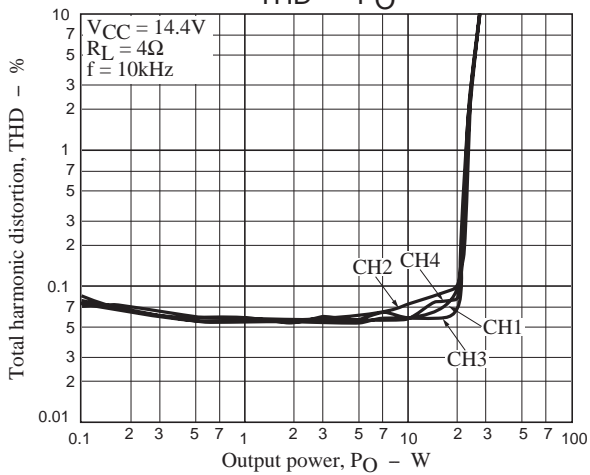
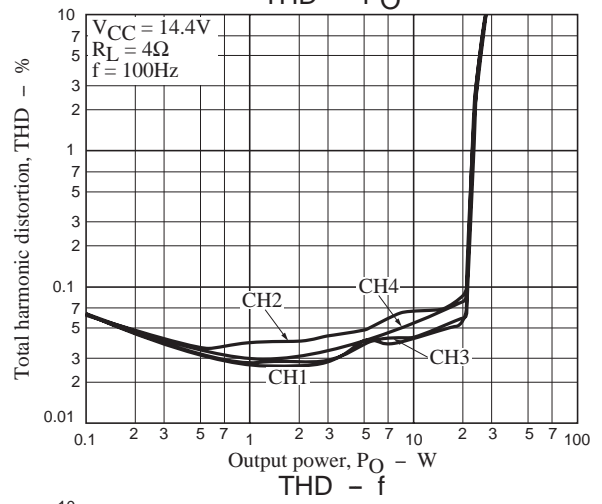
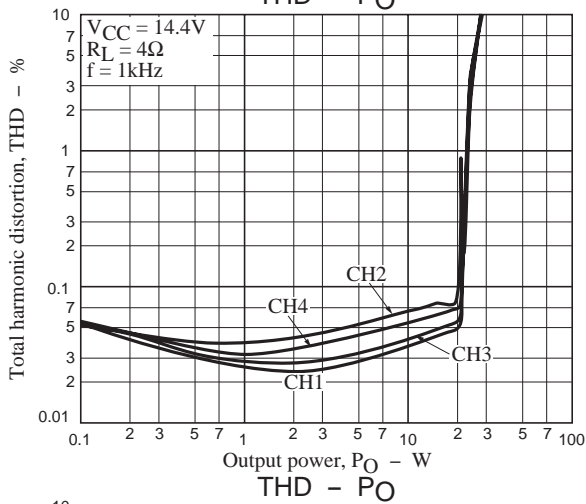
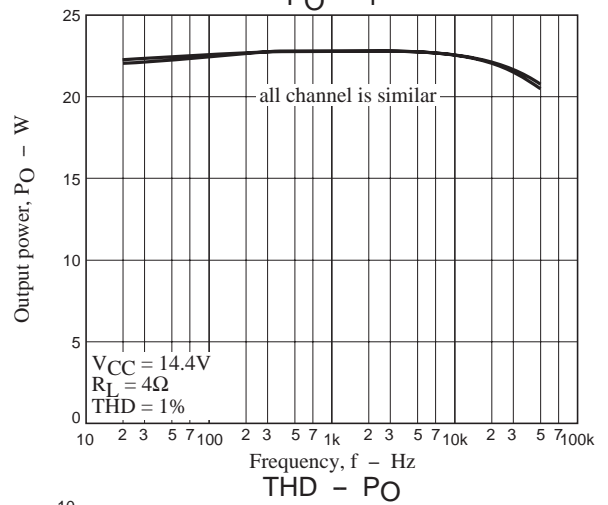
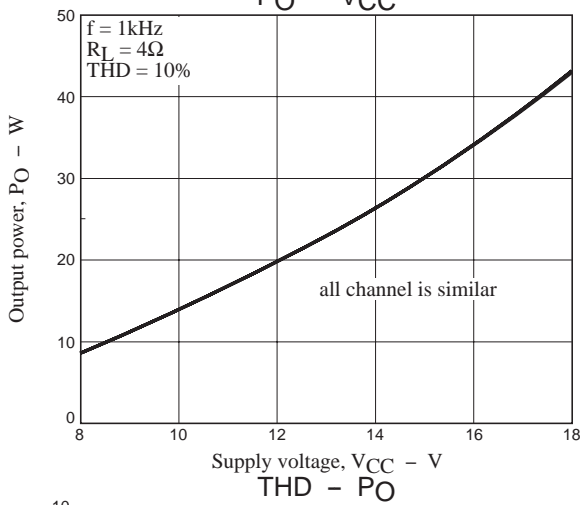
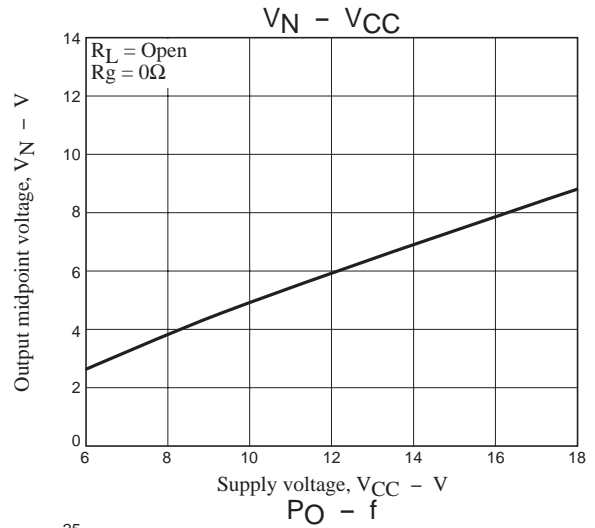
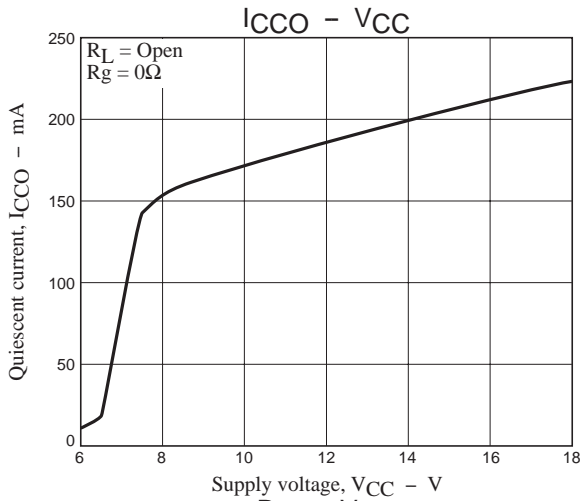
- Provide the  $V_{CC}$  capacitor of  $0.1\mu\text{F}$  in the position nearest to IC.
- PREGND must be independently wired and connected to the GND point that is as stable as possible, such as the minus pin of the  $2200\mu\text{F}$   $V_{CC}$  capacitor.

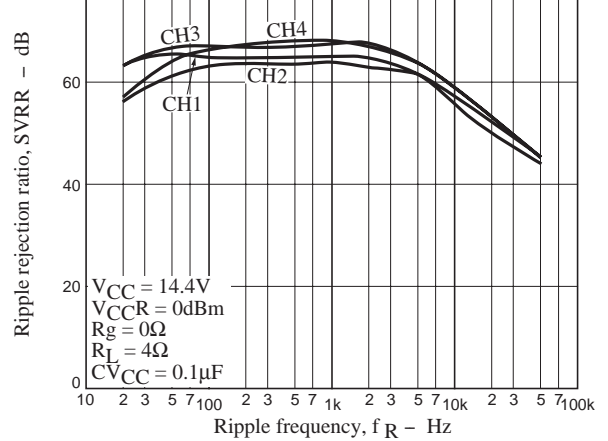
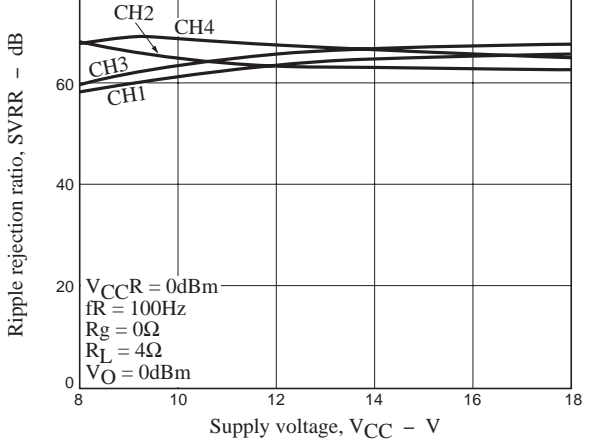
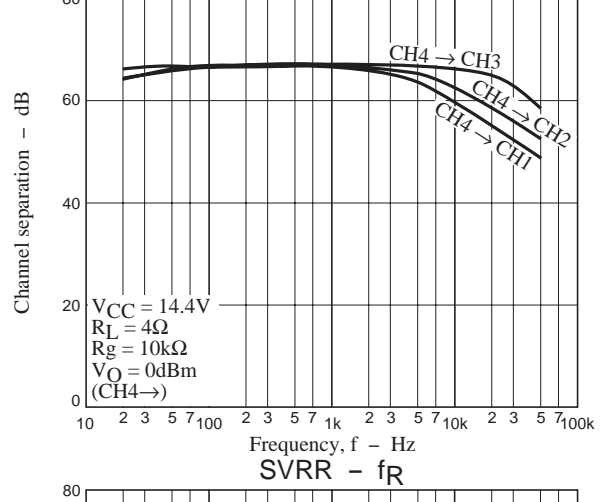
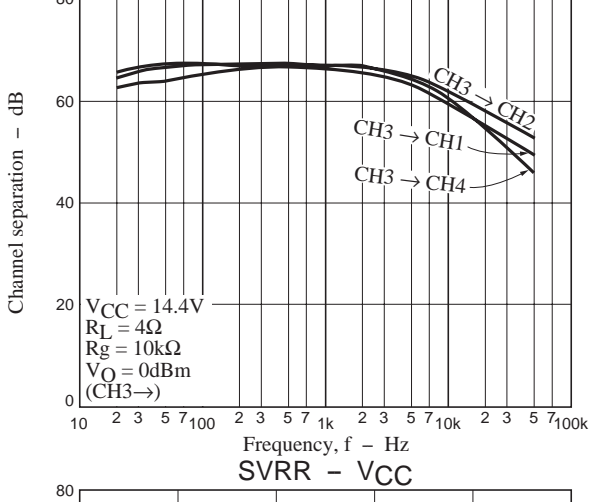
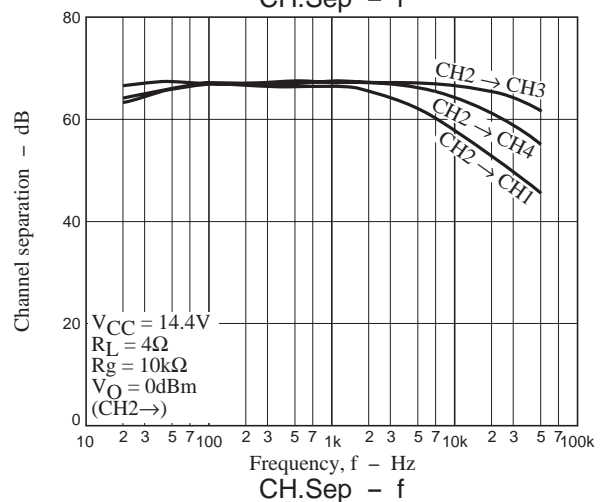
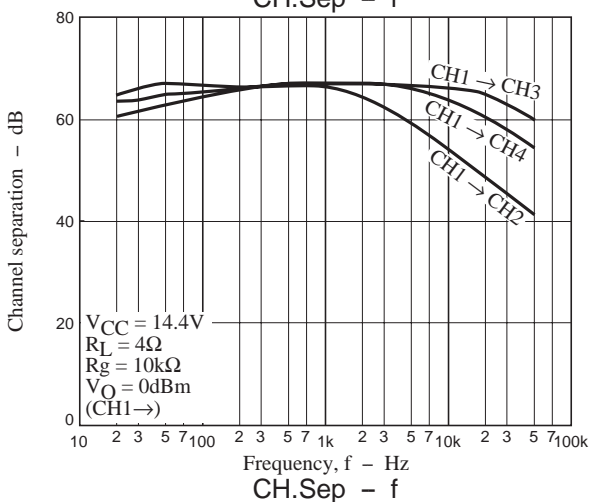
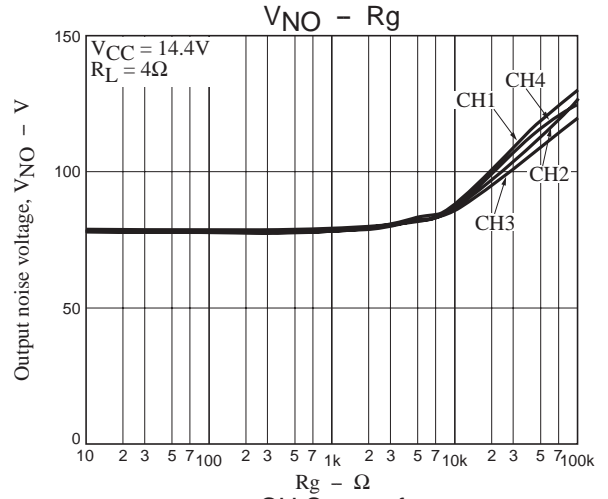
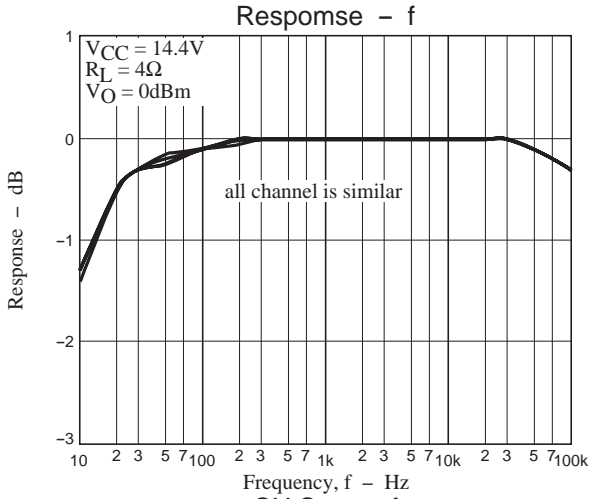
In case of occurrence of parasitic oscillation, any one of following parts may be added as a countermeasure.

Note that the optimum capacitance must be checked for each set in the mounted state.

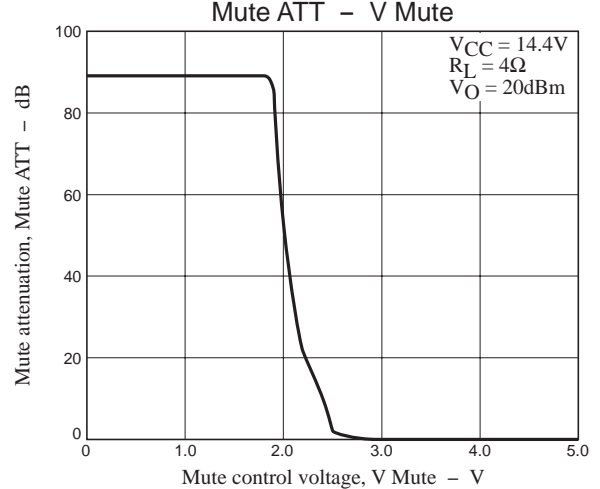
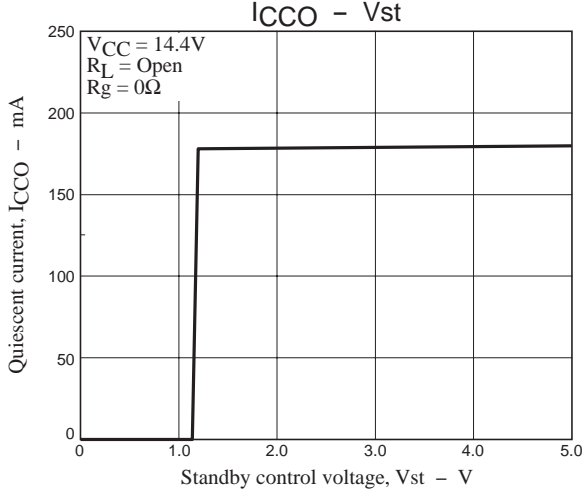
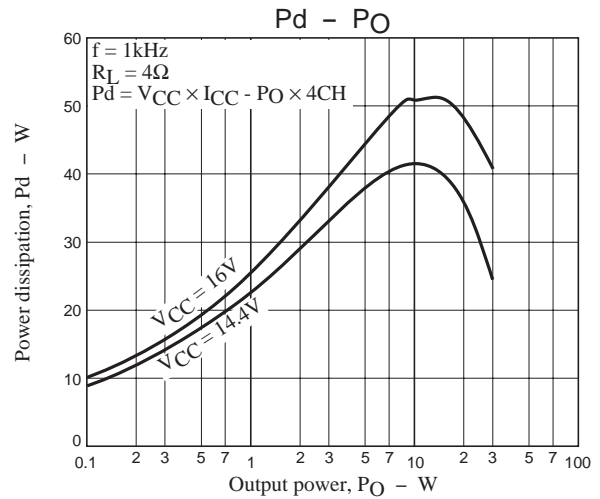
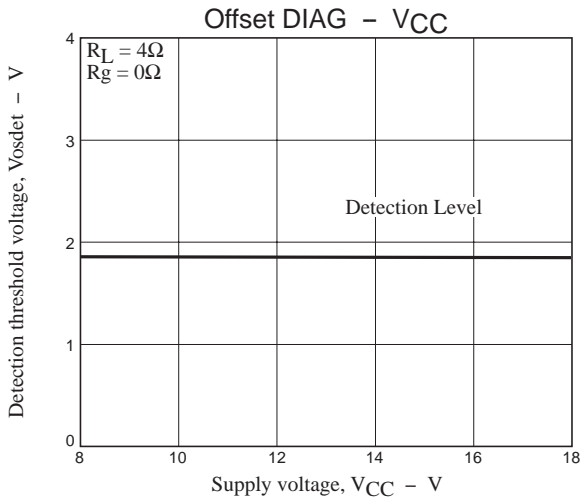
- Series connection of CR ( $0.1\mu\text{F}$  and  $2.2\Omega$ ) between BTL outputs
- Series connection of CR ( $0.1\mu\text{F}$  and  $2.2\Omega$ ) between each output pin and GND.

# LV47002P









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