Ordering number : ENA0508

SANYO Semiconductors
DATA SHEET

Monolithic Linear IC

LA47202P — Four-Channel BTL Power Amplifier for Car Audio Systems

Overview

The LA47202P is a 4-channel BTL power amplifier IC developed for use in car audio applications. The LA47202P adopts a pure complementary output stage circuit structure with a v-pnp transistor for the high side and an npn transistor for the low side to provide both high output power and high quality sound.
The LA47202P integrates all the functions required for car audio applications on the same chip, including a standby switch, a muting function, and a full complement of protection circuits. It also features a self diagnostics function.

Functions

- High output : P_O max = 47W (typ.) (V_{CC} = 14.4V, f = 1kHz, JEITA max, R_L = 4Ω)
  : P_O max = 29W (typ.) (V_{CC} = 14.4V, f = 1kHz, THD = 10%, R_L = 4Ω)
  : P_O max = 22W (typ.) (V_{CC} = 14.4V, f = 1kHz, THD = 1%, R_L = 4Ω)
- Muting function incorporated (pin 22)
- Built-in standby switch (pin 4)
- Self diagnostics function incorporated (pin 25) :
  Output of both output offset detection, shorting to V_{CC} or ground and load shorting signals
- Electric mirror noise decrease
- Full compliment of protection circuits (shorting to V_{CC}, shorting to ground, load shorting, overvoltage, and thermal protection).
- Improved oscillation stability

Note 1 : Take care to avoid wrong connection. Otherwise, IC or equipment may suffer breakdown, damage, or deterioration.
Note 2 : The protective circuit function is to avoid the abnormal state (wrong connection of the output) temporarily and does not guarantee that IC is not broken.
These protective functions do not operate outside the operation guarantee range, and wrong connection of output may cause breakdown of IC.
Note 3 : External parts, such as the anti-oscillation part, diode to prevent breakdown, may become necessary depending on the set condition. Check their necessity for each set.

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Specifications

Maximum Ratings at Ta = 25°C

Parameter	Symbol	Conditions	Ratings	Unit
Maximum supply voltage	V_{CC} max1	Without signal, t = 1 minute	26	V
	V_{CC} max2	When operating	18	V
Maximum output current	I_O peak	Per channel	4.5	A
Allowable power dissipation	Pd max	With an iInfinitely large heat sink	50	W
Operating temperature	Topr		-40 to +85	°C
Storage temperature	Tstg		-40 to +150	°C
Thermal resistance between junction cases	θj-c		1	°C/W

Note) The relationship between the power dissipation (Pd) and the junction-to-case thermal resistance (θj-c), heat sink thermal resistance (θf) and junction temperature (Tj), case temperature (Tc), and ambient temperature (Ta) is as expressed by the following equation :

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

$= Pd \times \theta j\text{-}c + Tc$, $\quad *Tc = Pd \times \theta f + Ta$

Note that Tj max must be limited with Tstg max (150°C).

Recommended Operating Ranges at Ta = 25°C

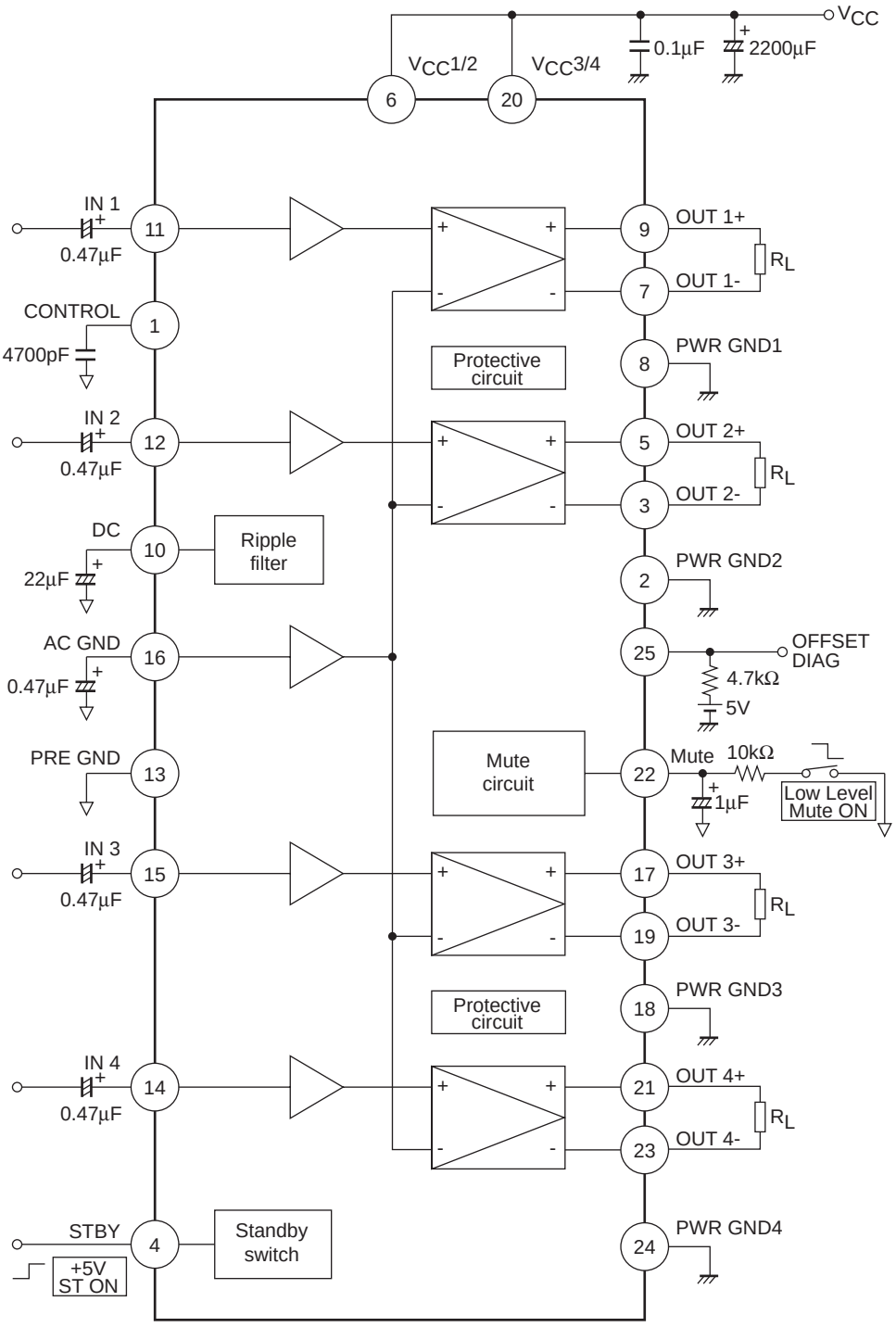
Parameter	Symbol	Conditions	Ratings	Unit
Recommended supply voltage	V_{CC}		14.4	V
Recommended load resistance	R_L		4	Ω
Operating supply voltage range	V_{CC} op	Range not exceeeding Pd max	9 to 16	V

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

Parameter	Symbol	Conditions	Ratings			Unit
			min	typ	max	
Quiescent current	I_{CCO}	R_L = ∞, Rg = 0		200	400	mA
Standby current	Ist	Vst = 0V			10	μA
Voltage gain	VG	V_O = 0dBm	25	26	27	dB
Voltage gain difference	ΔVG		-1		+1	dB
Output power	P_O	THD = 10%	24	29		W
	P_O max1	V_{CC} = 13.7V, JEITA max		42		W
	P_O max2	JEITA max		47		W
Output offset voltage	Vnoffset	Rg = 0	-150		+150	mV
Total harmonic distortion	THD	P_O = 4W		0.05	0.3	%
Channel separation	CHsep	V_O = 0dBm, Rg = 10kΩ	55	65		dB
Ripple rejection ratio	SVRR	Rg = 0, fr = 100Hz, V_{CC}R = 0dBm	45	60		dB
Output noise voltage	V_{NO}	Rg = 0, BPF = 20Hz to 20kHz		100	200	μVrms
Input resistance	Ri			50		kΩ
Mute attenuation	Matt	V_O = 20dBm, mute : on	65	80		dB

* 0dBm = 0.775Vrms

Block Diagram



The components and constant values in the test circuit are used for confirmation of characteristics and do not guarantee that the application equipment will be free from malfunction or trouble.

Description of Operation

1. Standby switch function (pin 4)
   The pin 4 threshold voltage is set to about 3 VBE.
   The amplifier is turned ON at the application voltage of 3.0V or more and OFF at 0.5V or less.

2. Muting function (pin 22)
   When pin 22 is set to the ground potential, the LA47202P goes to the muted state. This supports implementation of an audio muting function.
   The muting function is turned on when a level of 1V or lower is applied through a 10kΩ resistor, and the function is turned off when this pin is open.
   The muting time constant can be set with an external RC circuit.

3. Self diagnostics function (pin 25)

   This function detects abnormal IC states, and outputs a signal from pin 25. Applications can prevent damage to speakers and other problems by using a microcontroller to detect the pin 25 signal and control the standby switch accordingly.
   (1) Output short-circuit to V_{CC}/ground : Pin 25 becomes LOW.
   (2) Load short-circuit : Pin 25 repeats HIGH and LOW states according to the output signal.
   (3) Output offset abnormality : Pin 25 goes low if the OUT pin (V_N) voltage becomes lower than the detection level. Problems that can cause an output offset abnormality include input capacitor leakage and half shorts between the input pins and adjacent circuit components.

   Note that pin 25 is the NPN open collector output (active low). Keep pin 25 open-connection when not using.

4. CONTROL pin (pin 1)
   The protective circuit response speed is adjusted by the pin 1 capacitor.
   By adjusting the response speed of the protective circuit, abnormal sound generated when the protective circuit operates at input of the large signal can be prevented.
   When the capacitance value increases, abnormal sound is more difficult to be generated, but the response speed of the protective circuit becomes lower. The capacitance value must be limited to maximum 0.01μF. The recommended value is 4700pF.
   Check the optimum value for each set.
   As this is designed so that the protective circuit is activated when pin 1 has the GND potential, the protective circuit becomes normally active when the capacitor is short-circuited.

5. AC GND pin (pin 16)
   Be sure to use the pin 16 capacitor with the capacity the same as that of the input capacitor and connect it to PREGND the same as that of the input capacitor.

6. Sound quality (low frequencies)
   The frequency characteristics in low frequency range may be improved by varying the capacitance of input capacitor. Note that this may cause influence on the shock noise, carry out confirmation with each set before varying the capacitance value.

7. Impulse noise related systems
   While the LA47202P does include an impulse noise prevention circuit, we recommend using the muting function together with this circuit.
   - When the amplifier is ON, turn ON the muting function simultaneously with power ON. When the output DC potential has stabilized, turn OFF the muting function.
   - When turning OFF the amplifier, first turn ON the muting function, then turn OFF power supply.

8. 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 1200pF. (Conditions : Our recommended board, R_L = 4Ω)

(2) Board layout

- Provide the V_{CC} capacitor of 0.1μF 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 2200μF V_{CC} capacitor.

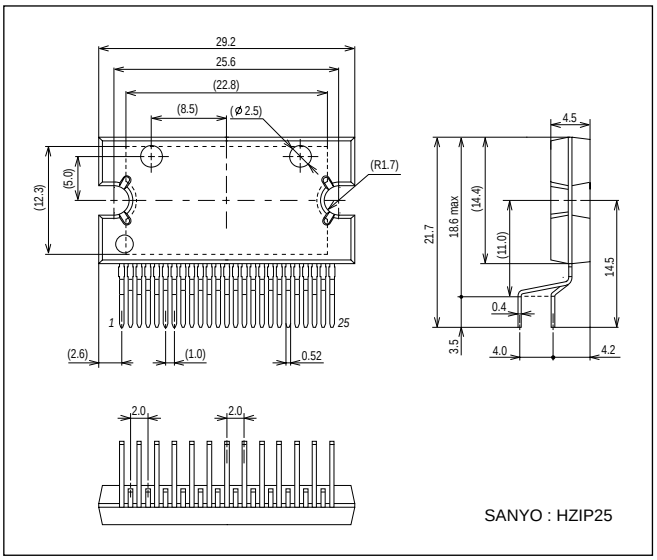
In case of occurrence of parasitic oscillation, any one of following parts may be added as a countermeasure.
Note that the optimum capacitance must be checked for each set in the mounted state.

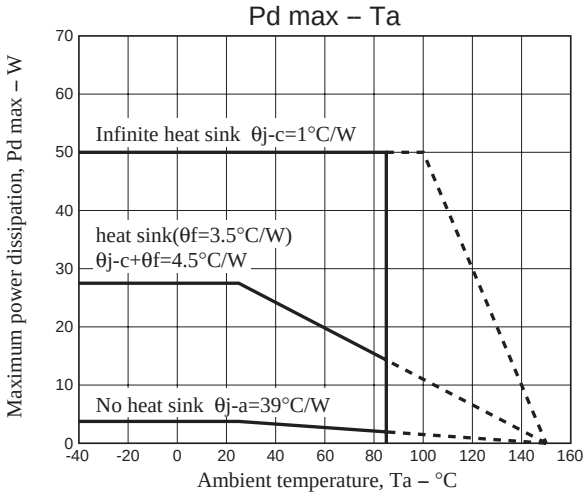
- Series connection of CR (0.1μF and 2.2Ω) between BTL outputs
- Series connection of CR (0.1μF and 2.2Ω) between each output pin and GND.

Package Dimensions

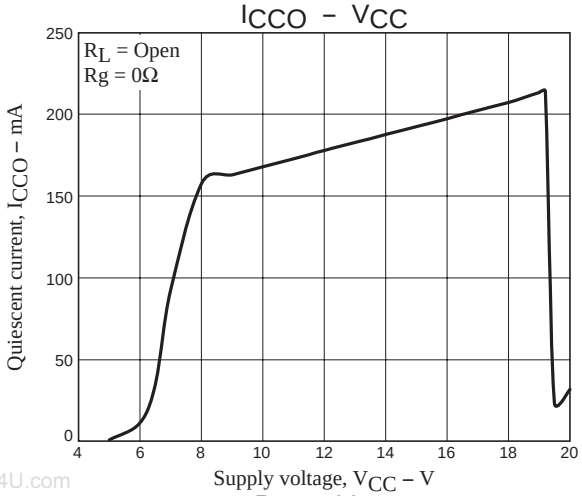
unit : mm (typ)

3236A

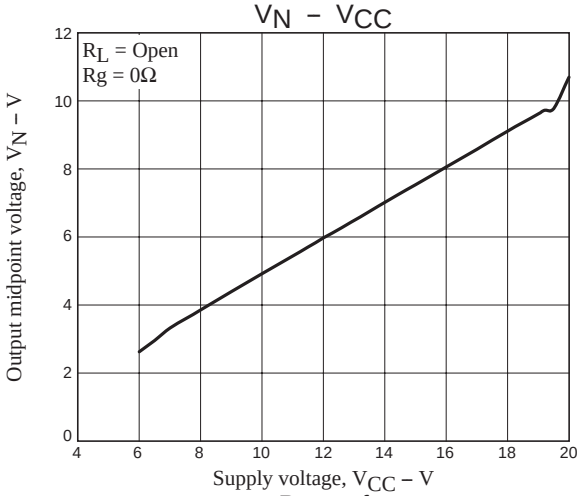




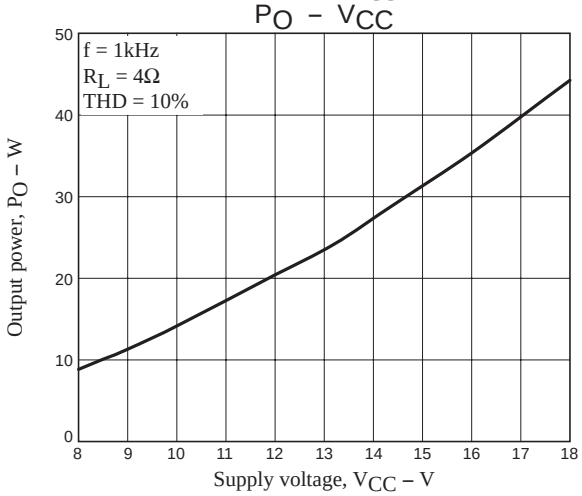
I_{CCO} – V_{CC}



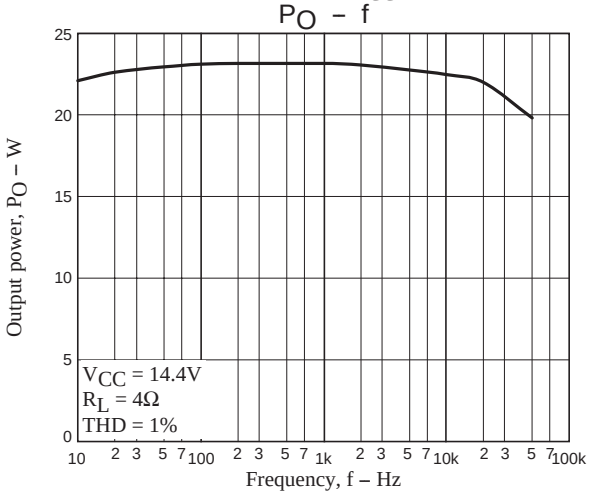
V_N – V_{CC}



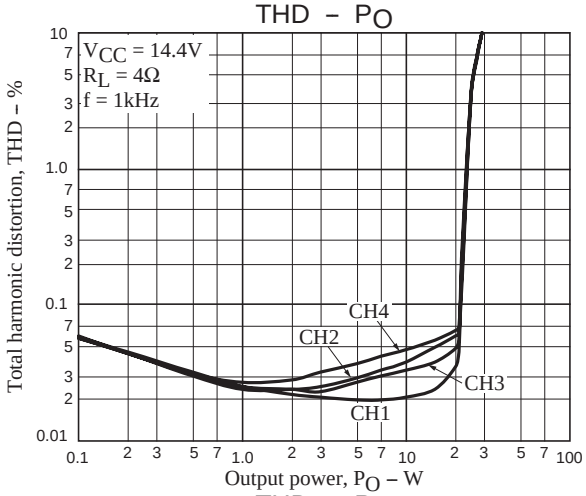
P_O – V_{CC}



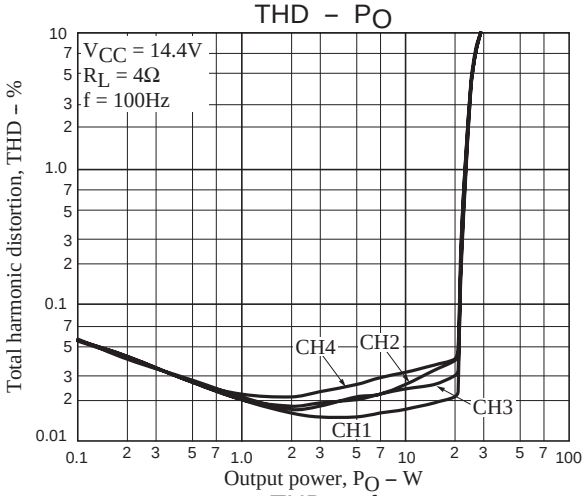
P_O – f



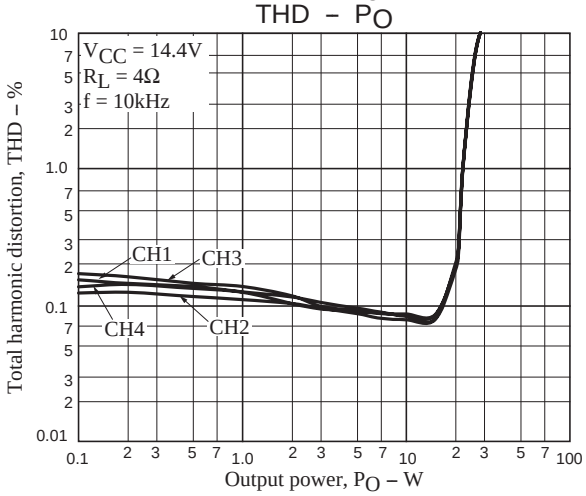
THD – P_O



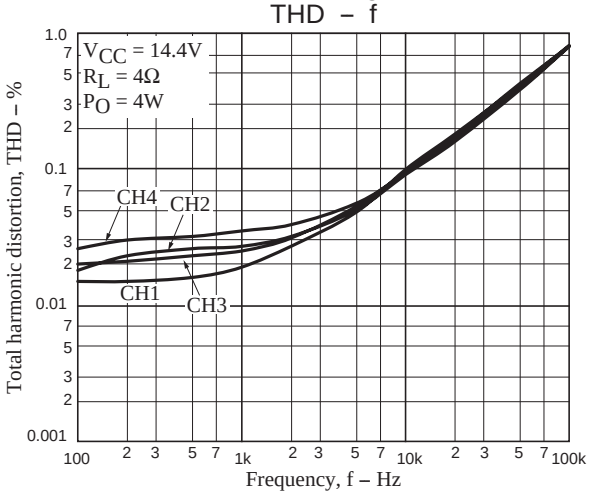
THD – P_O



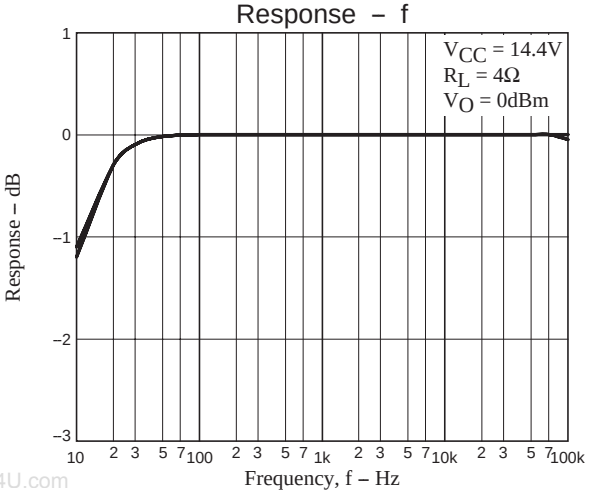
THD – P_O



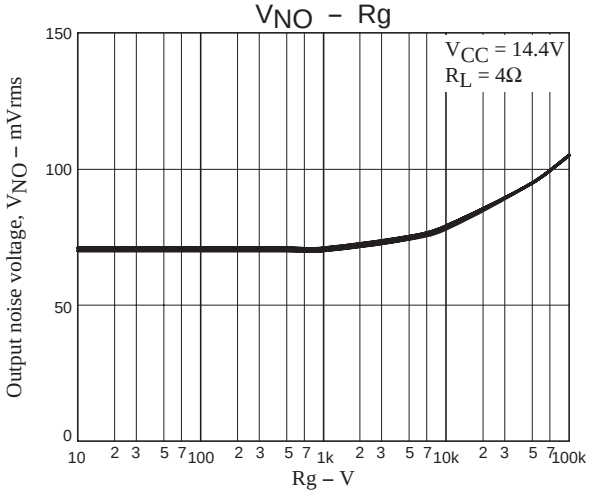
THD – f



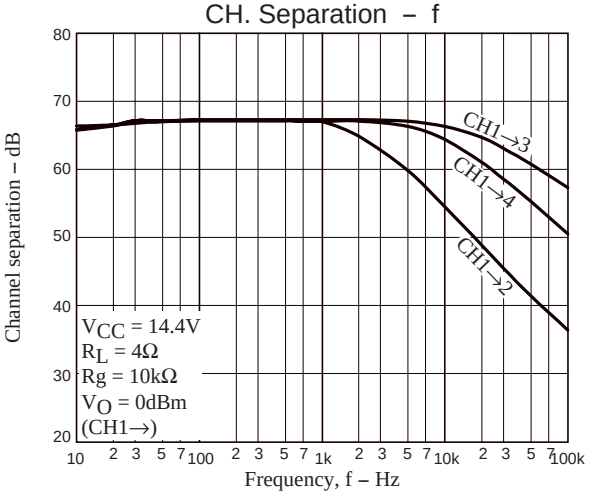
Response – f



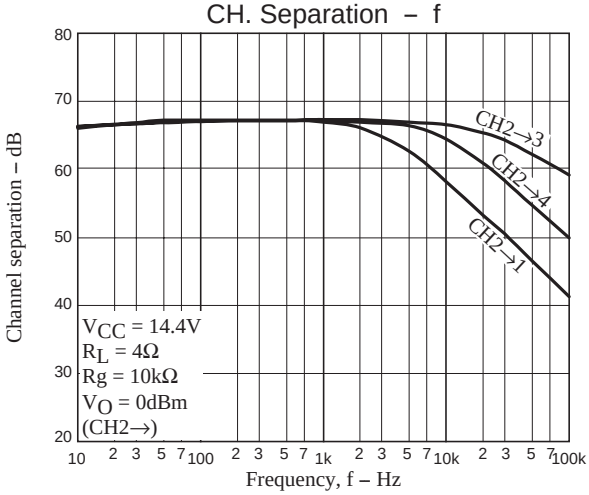
V_{NO} – Rg



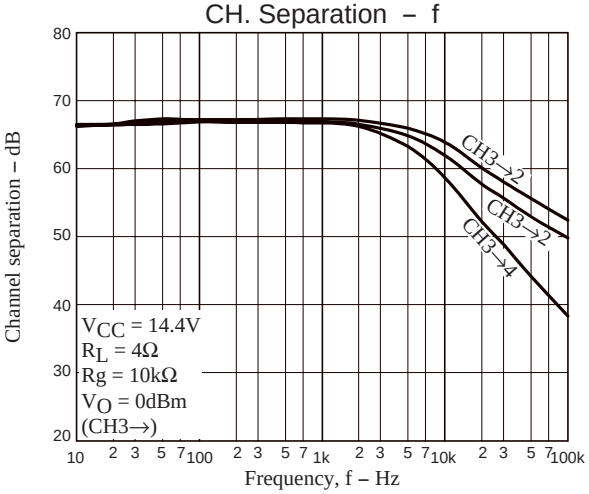
CH. Separation – f



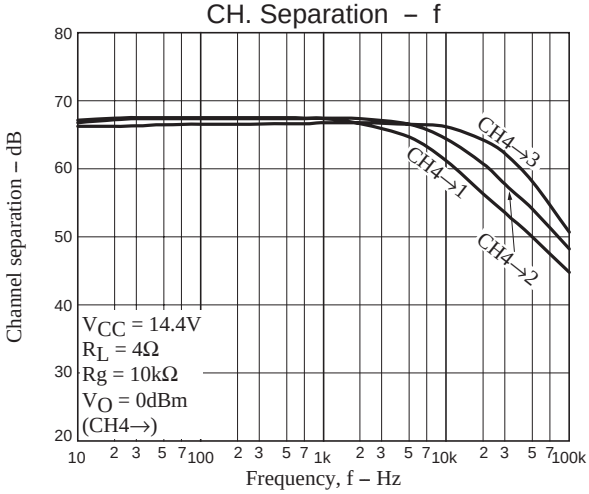
CH. Separation – f



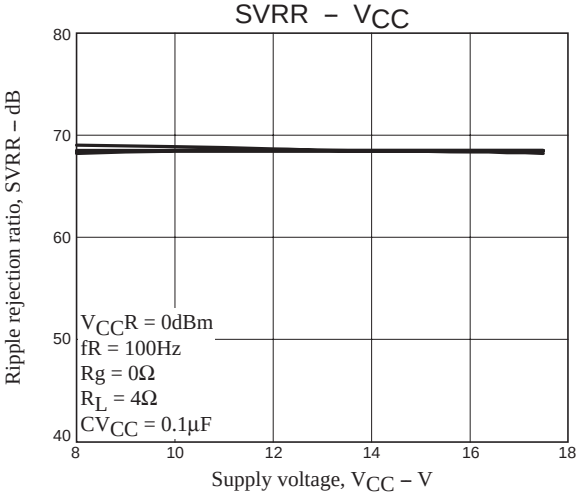
CH. Separation – f



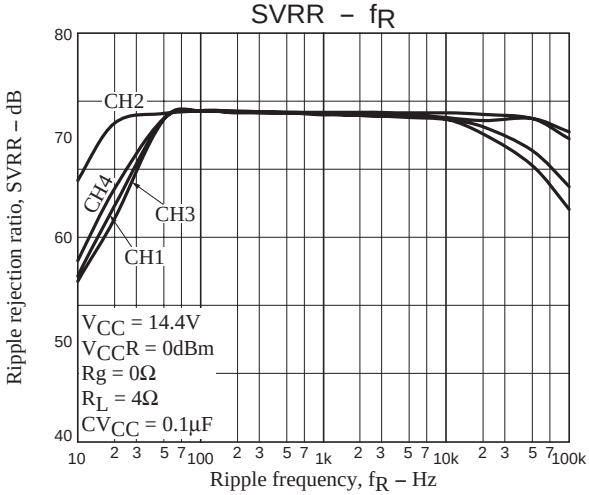
CH. Separation – f

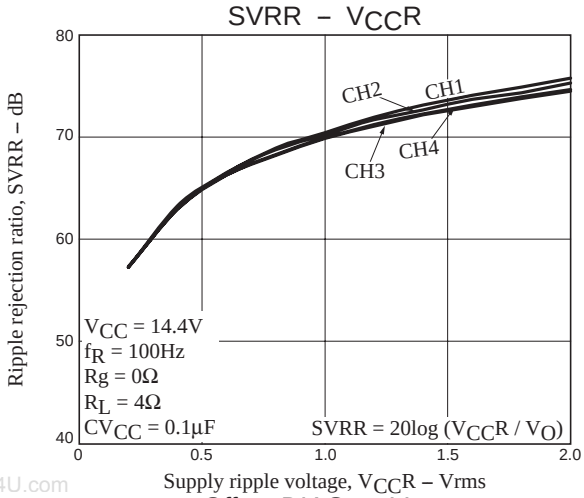


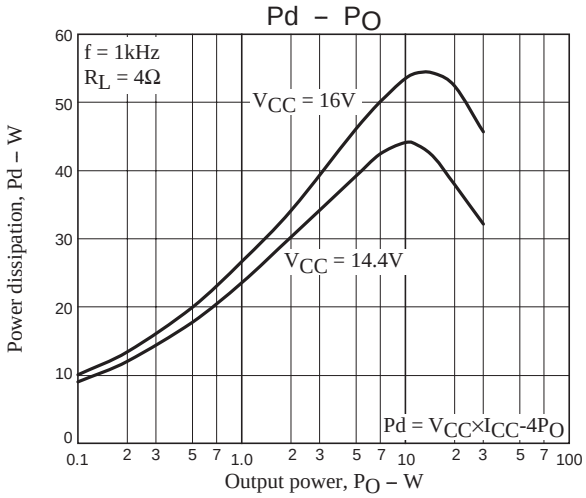
SVRR – V_{CC}

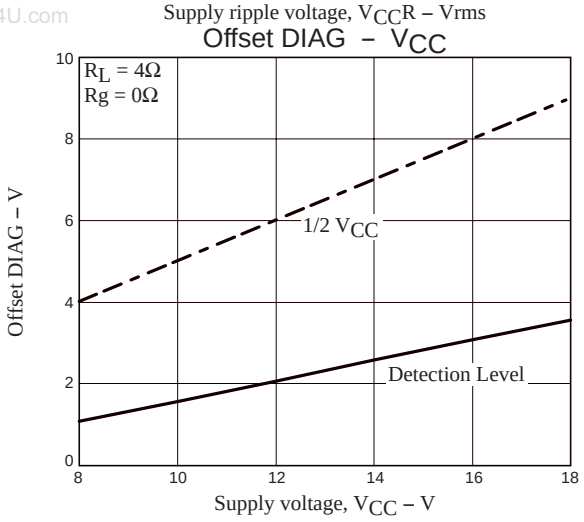


SVRR – f_R









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