Ordering number : ENN8178

SANYO Semiconductors
DATA SHEET

Monolithic Linear IC

LA4632 — 10 W Two-Channel BTL AF Power Amplifier for Audio Applications

Overview

The LA4632 is a pin compatible version of the LA4631 (5 W × two channel single ended type) BTL power amplifier IC. The LA4632's pin compatibility makes it possible to share a common printed circuit board among a series of end products differentiated by power rank. Note that the LA4631 has a pin 13, and that it is necessary to provide a hole for this pin if the same printed circuit board is to be shared. Also, some of the external components used differ. The LA4632 provides a full complement of built-in protection circuits, including protection against shorting to the power supply, shorting to ground, load shorting, and excessive temperatures.

Functions and Applications

- Two-channel BTL power amplifier for audio applications

Absolute Maximum Ratings at Ta = 25°C

Parameter	Symbol	Conditions	Rated value	Unit
Maximum supply voltage	V_{CC} max	With no input signal	24	V
Maximum output current	I_O peak	Per channel	2.5	A
Allowable power dissipation	Pd max	With an infinitely large heat sink	25	W
Maximum junction temperature	Tj max		150	°C
Operating temperature	Topr		–20 to +75	°C
Storage temperature	Tstg		–40 to +150	°C

Operating Characteristics at Ta = 25°C

Parameter	Symbol	Conditions	Rated value	Unit
Recommended supply voltage	V_{CC}		13	V
Recommended load resistance range	R_L op		4 to 8	Ω
Allowable operating supply voltage range *1	V_{CC} op	When RL = 8 Ω	5.5 to 20	V
		When RL = 6 Ω	5.5 to 17	V
		When RL = 4 Ω	5.5 to 13	V

Caution: V_{CC}, R_L, and the output level must be set for the size of the heat sink used so that the Pd max range is not exceeded.

*1. When both channels are operating such that $I_O$peak = 1.0 A per channel is exceeded.
If the IC is operated such that $I_O$peak = 1.0 A per channel is not exceeded, the IC can be used in the range 5.5 to 20 V (in the ranges where Pd max is not exceeded) with a load of R_L = 4 to 8 Ω.

SANYO Electric Co.,Ltd. Semiconductor Company
TOKYO OFFICE Tokyo Bldg., 1-10, 1 Chome, Ueno, Taito-ku, TOKYO, 110-8534 JAPAN

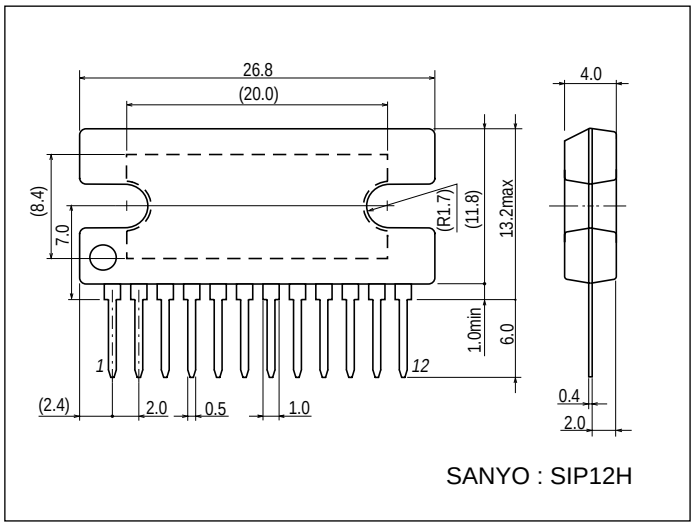
Operating Characteristics at Ta = 25 °C, V_{CC} = 13 V, R_L = 6 Ω, f = 1kHz, Rg = 600 Ω

Parameter	Symbol	Conditions	Ratings			Unit
			min	typ	max	
Quiescent current drain	I_{CCO}	Rg = 0, no signal	40	70	150	mA
Standby current	Ist			0	10	μA
Voltage gain	VG	V_O= 0 dBm	33	35	37	dB
Total harmonic distortion	THD	P_O = 1 W		0.06	0.2	%
Output power	P_O	THD = 10 %	8.5	10		W
Output offset voltage	V_N offset	Rg = 0	–300		+300	mV
Output noise voltage	V_{NO}	Rg = 0, BPF = 20 Hz to 20 kHz		0.14	0.3	mVrms
Supply voltage rejection ratio	SVRR	Rg = 0, f_R = 100Hz, VR = 0 dBm	50	60		dB
Channel separation	CH sep	Rg = 10 kΩ, V_O = 0 dBm	50	60		dB
Input resistance	Ri		14	20	26	kΩ
Standby pin applied voltage	VST	The pin 5 voltage such that the amplifier is on	2.5		10	V
Mute pin applied voltage	VM	The pin 6 voltage such that muting is applied	1.7		3	V
Muting attenuation	ATTM	V_O = 1 Vrms, BPF = 20 Hz to 20 kHz	80	90		dB

Package Dimensions

unit : mm

3049B



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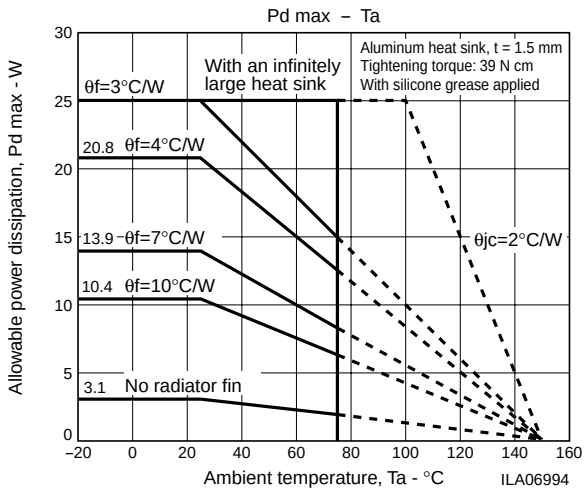
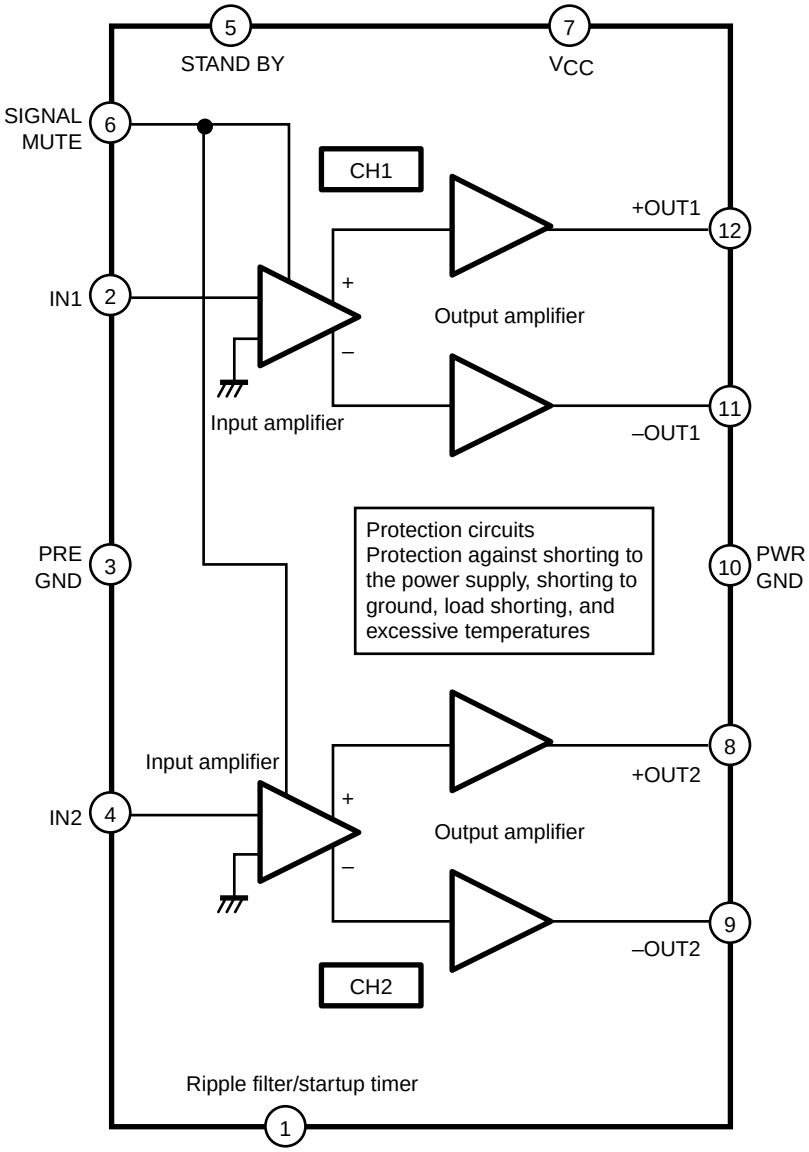
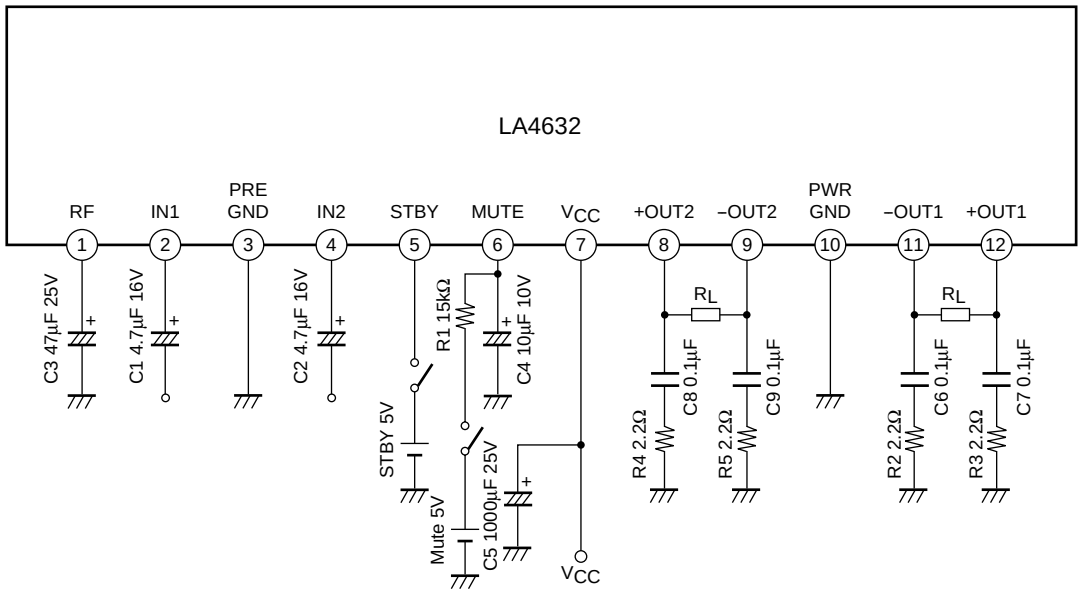


Block Diagram



Application Circuit Example/Test Circuit Diagram



Top view

- Caution
  Although the LA4632 is basically pin compatible with the LA4631, there are certain differences in the external components and the way the devices are used.

External Components and Usage Notes

C1, C2: These are input coupling capacitors; we recommend a value of 4.7 µF or lower. A zero bias type circuit is used for the LA4632 input circuits, and the input pin potential is close to zero volts. Therefore the polarity must be considered in conjunction with the DC potential of the circuit connected to the LA4632 front end. If there is a large potential difference between the plus and minus sides of the input capacitors, the stabilization time when power is first applied can be reduced by reducing the value of the input capacitors, as long as that reduction does not compromise the low-band characteristics.

C3: This capacitor is used both as a ripple filter and to set the amplifier's startup time. A value of 47 µF is recommended. With this value, the startup time (the time from the point power is first applied until the point an output is generated) will be about 0.6 to 0.7 seconds. (See note 1.)

C4, R1: This RC circuit is used for mute smoothing. C4 is required even if the muting function is not used. (See note 2.)

C5: Power supply capacitor

C6 to C9, R2 to R5: These components form oscillation prevention RC circuits. We recommend using polyester film capacitors (Mylar capacitors) with excellent thermal characteristics for C6 through C9. (R2 to R5 are 2.2 Ω 1/4 W resistors.)

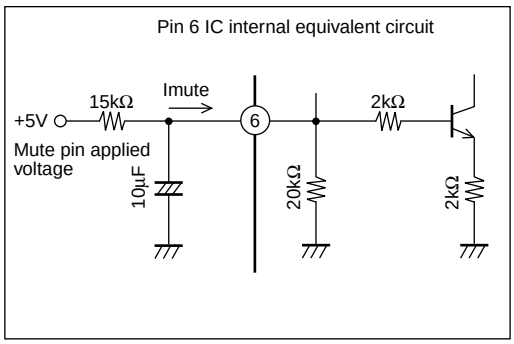
*1. Startup time

The LA4632 features a built-in startup circuit that can be adjusted somewhat by changing the value of the capacitor connected to pin 1. (With the recommended value of 47 µF, the time is about 0.6 to 0.7 seconds (a time that changes somewhat with V_{CC}). That time can be extended to about 0.8 to 0.9 seconds by inserting a capacitor with a value of 10 µF in parallel.) Since using a capacitor with a value smaller than the recommended value may reduce the SVRR between ground and the output, we cannot recommend using a smaller value.

*2. Signal muting function

The signal muting function is turned on by connecting the recommended RC circuit (10 µF, 15 kΩ) to pin 6 and applying a voltage of +5 V to the mute pin. This circuit implements a muting function with extremely low impulse noise.

This RC circuit is used to smooth the attack and recovery times, and since the 10 µF capacitor also has the function of smoothing after the startup time, it is required even if the signal muting function is not used.

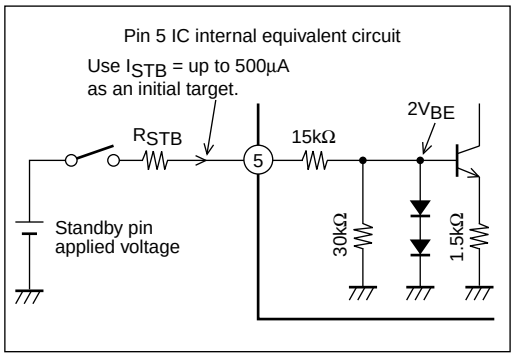


When an voltage of +5 V is applied to the mute pin through the external 15 kΩ resistor, the pin 6 voltage becomes about 1.85 V. (The muting function activation level in the specifications is 1.7 V minimum.) The pin 6 influx current (Imute) at this time will be roughly 210 μA.

Although it is possible to change the mute pin applied voltage or the values of the mute pin external components, if the pin 6 voltage (and pin 6 influx current) is too high, or if the pin 6 external component time constant is too short, the amplitude of impulse noise in the system may rise. This phenomenon must be taken into account when designing this circuit.

Other items

Standby function



The IC's pin 5 is a standby pin. The amplifier is turned on when the voltage applied to this pin is about 2 V or higher. (The value in the specifications is 2.5 V minimum.) If a voltage of +5 V is directly applied to the standby pin, the pin 5 influx current will be about 230 μA.

$$I_{STB} = \frac{5\ V - 2\ V_{BE}\ (\text{about } 1.55\ V)}{15\ k\Omega} = 230\ \mu A$$

If a voltage that exceeds the upper limit voltage given in the specifications (10 V) is applied as the standby pin voltage, calculate a value for an external resistor R_{STB} from the following formula so that the pin 5 influx current does not increase excessively (use a value of under about 500 μA as the initial target value).

$$R_{STB} = \frac{\text{Applied voltage} - 2V_{BE}\ (\text{about } 1.55\ V)}{I_{STB}\ (\text{Under } 500\ \mu A)} - 15\ k\Omega$$

Usage Notes

Notes on the Maximum Ratings

If this IC is used in the vicinity of the maximum ratings, even the slightest fluctuations in the operating conditions could cause those ratings to be exceeded, making the destruction of the device possible. Applications must be designed with adequate margins in the supply voltage and other parameters so that the devices is always used in ranges that do not exceed the maximum ratings.

Notes on Protection Circuits

While the LA4632 provides a full complement of built-in protection circuits, care is required in their use. In particular, be careful not to inadvertently short IC pins to each other.

[Notes on the short to power, short to ground, and load shorting protection circuit]

- This protection circuit operates when an abnormal short such as a short to power (a short between an output and V_{CC}), a short to ground (a short between an output and ground), or a load short (a short between the output ± sides) occurs. Although this circuit may not operate when the V_{CC} voltage is under about 9 V, the thermal protection circuit is thought adequate to protect the IC in that case.
- This protection circuit is the type that continues to operate while the above listed short state continues and recovers automatically as soon as the abnormality is resolved. However, there are cases where, depending on the operating conditions, the protection circuit locks and the protection operation continues. In these cases, the protection circuit can be cleared by switching to standby mode or cutting and reapplying power.
- Note that if the output is shorted to power in the state where the IC is in the standby state (amplifier operation is turned off) and V_{CC} is over about 20 V, an offset may occur between the plus and minus outputs. If a load is connected in this state, current may flow in through the load and the IC may be destroyed.
- In the following usage conditions, a symptom in which the output audio is cut off at high outputs due to protection circuit operation. Depending on the end product specifications, it may be necessary to check for this phenomenon.
- Situations where both channels are operating in a manner that the I_OPeak per channel exceeds 1 A at low RL (high loads) and high V_{CC} (The higher the chip temperature the easier it is for this phenomenon to occur.)
  The "Allowable operating supply voltage range (V_{CC} op)" item in the operating conditions specifications provides specific target operating conditions so that the above phenomenon will not occur under severe usage conditions (high temperatures, high outputs. (See the different V_{CC} op ranges for different R_L values.)

[Thermal Protection Circuit]

- The LA4632 includes an on-chip thermal protection circuit to prevent degradation or destruction of the IC due to abnormal heating. If this IC's junction temperature (Tj) rises above 160°C due to and insufficient heat sink or other reason, the thermal protection circuit will operate and gradually reduce the output signal level. This protection function clears automatically as the temperature falls.

Notes on Printed Circuit Boards

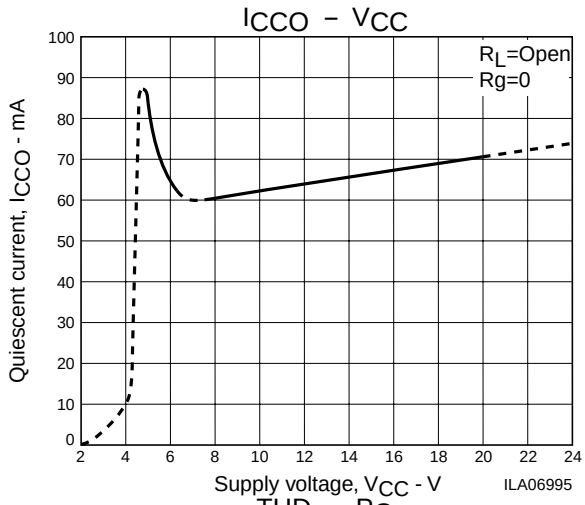
When designing the printed circuit board pattern, keep the inputs and V_{CC}, and the inputs and the outputs, away from each other. (This is to prevent increased distortion, oscillation, and other problems.)

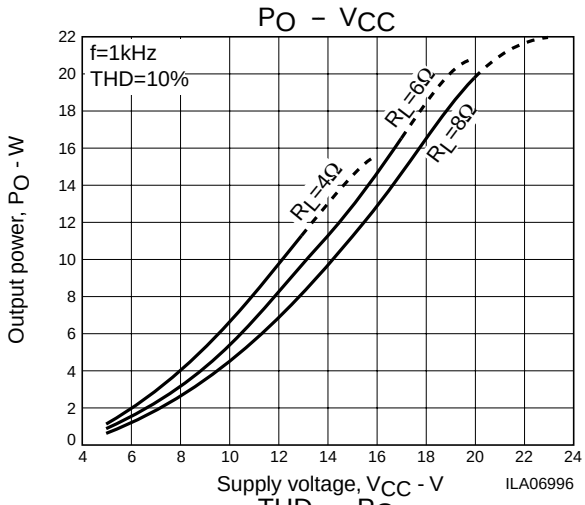
Notes on Heat Sink Attachment

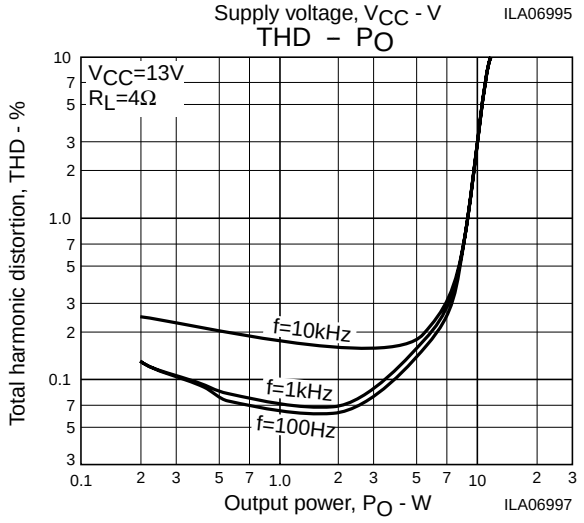
Foreign matter such as metal chips must not be trapped between the IC's heat sink and the externally attached heat sink. If a grease is used between the IC and the external heat sink, be sure to apply the grease evenly to the whole contact surface.

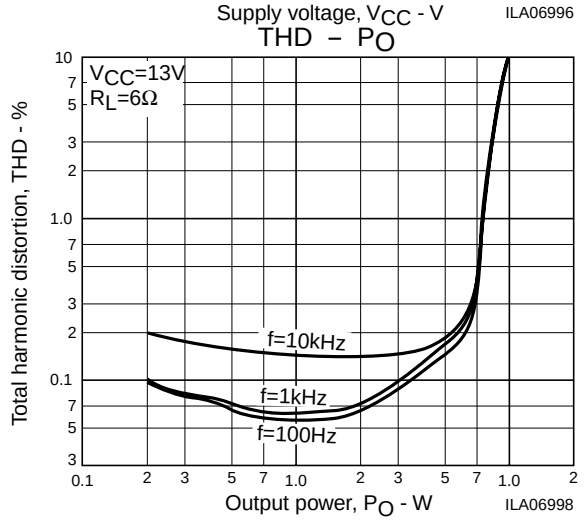
Other Notes

The LA4632 is a BTL power amplifier IC. When connecting test equipment, the test equipment used for the input system and the test equipment used for the output system must not share the same ground.

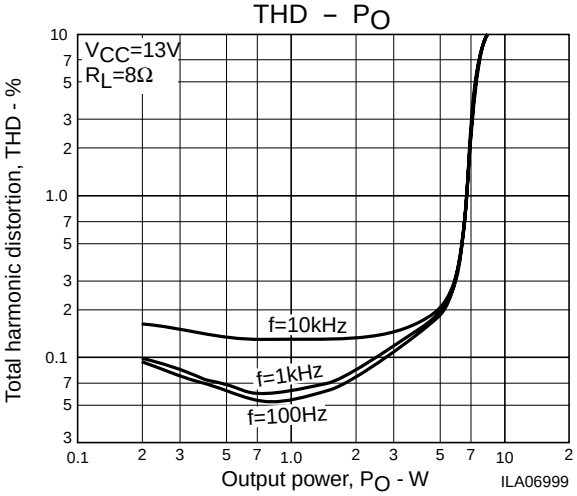




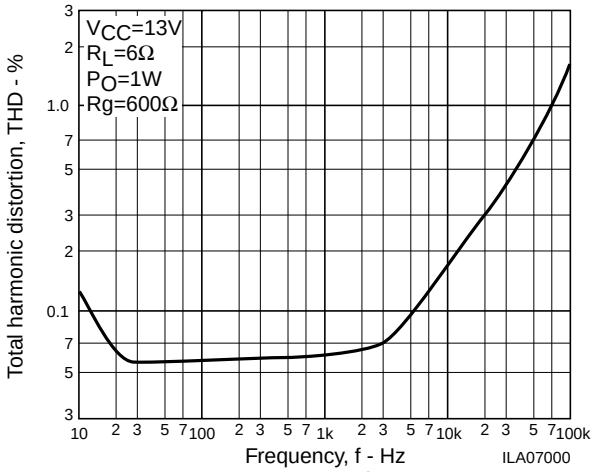




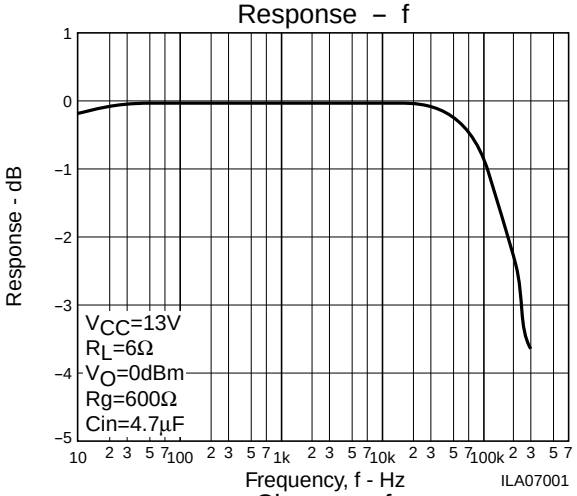
THD – P_O



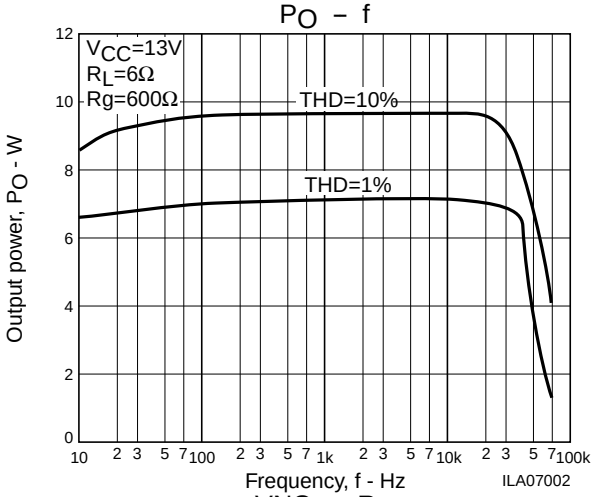
THD – f



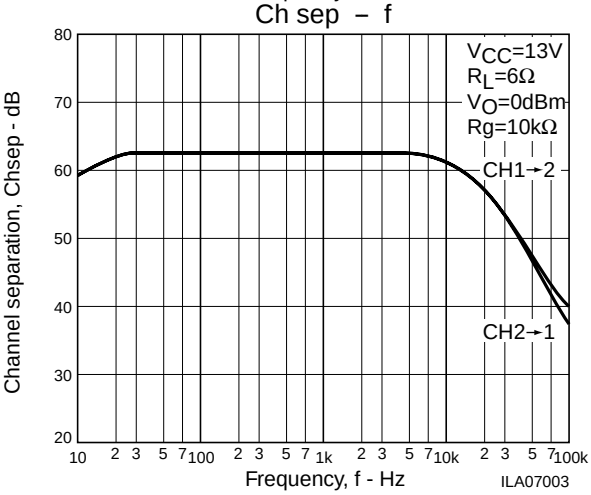
Response – f



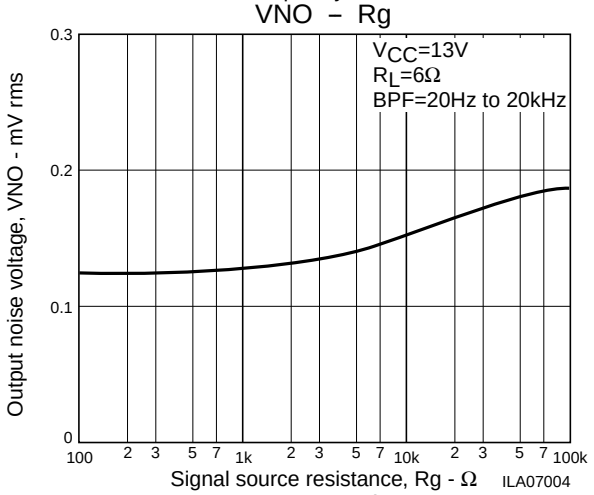
P_O – f



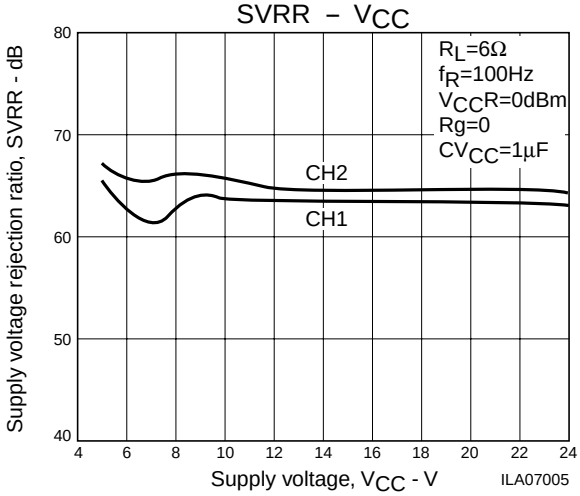
Ch sep – f



VNO – Rg



SVRR – V_{CC}



SVRR – f_R