



LA47536 — Monolithic Linear IC Four-Channel 45 W BTL Car Audio Power Amplifier

Overview

The LA47536 is a 4-channel BTL power amplifier IC developed for use in car audio systems. The output stage features a pure complimentary structure that uses V-pnp transistors on the high side and npn transistors on the low side to provide high power and superb audio quality.

The LA47536 includes almost all the functions required for car audio use, including a standby switch, a muting function, and each protection circuit. It also provides a self-diagnosis function (output offset detection).

Functions and Features

- Voltage gain: 32 dB
- High output power
 - Pomax(1) = 45 W (typical)
(At $V_{CC} = 14.4$ V, $f = 1$ kHz, $V_i = 2.5$ Vrms, $R_L = 4$ Ω)
 - Pomax(2) = 40 W (typical)
(At $V_{CC} = 13.7$ V, $f = 1$ kHz, $V_i = 2.5$ Vrms, $R_L = 4$ Ω)
 - Po = 28 W (typical)
(At $V_{CC} = 14.4$ V, $f = 1$ kHz, THD = 10%, $R_L = 4$ Ω)
- Muting function (pin 22)
- Standby switch (pin 4)
- Built-in various protection circuits
 - Output pin-to- V_{CC} short
 - Output pin-to-GND short
 - Load short
 - Over voltage
 - Thermal shut down
- Self-diagnosis function that detects the output offset (pin 25)
- Output offset detection on/off switch (pin 1)

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Specifications

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

Parameter	Symbol	Conditions	Ratings	Unit
Maximum supply voltage	$V_{CC \text{ max1}}$	No signal, $t = 1$ minute	26	V
	$V_{CC \text{ max2}}$	With an input signal applied	18	V
Maximum output current	$I_{O \text{ peak}}$	Per channel	4.5/ch	A
Allowable power dissipation	$P_d \text{ max}$	Assuming an infinite heat sink	50	W
Operating temperature	T_{opr}		-40 to +85	$^\circ\text{C}$
Storage temperature	T_{stg}		-40 to +150	$^\circ\text{C}$
Junction to case thermal resistance	θ_{j-c}		1	$^\circ\text{C/W}$

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

Parameter	Symbol	Conditions	Ratings	Unit
Recommended supply voltage	V_{CC}		14.4	V
Recommended load resistance	$R_{L \text{ op}}$		4	Ω
Operating supply voltage range	$V_{CC \text{ op}}$	The range where $P_d \text{ max}$ is not exceeded	9 to 18	V

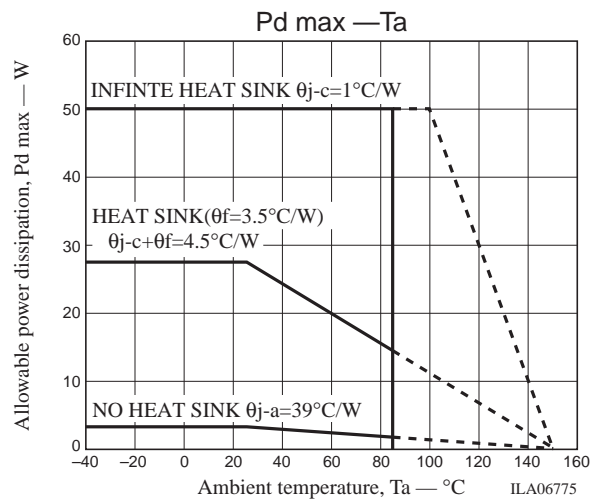
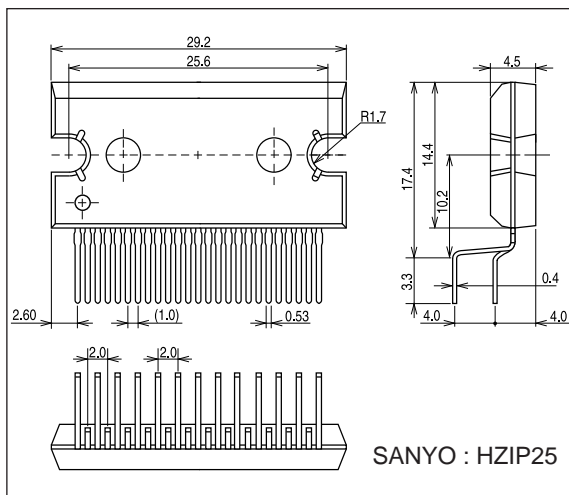
Electrical Characteristics at $T_a = 25^\circ\text{C}$, $V_{CC} = 14.4 \text{ V}$, $R_L = 4 \Omega$, $f = 1 \text{ kHz}$, $R_g = 600 \Omega$

Parameter	Symbol	Conditions	Ratings			Unit
			min	typ	max	
Quiescent current	I_{CCO}	$R_L = \infty$, $R_g = 0$		200	400	mA
Standby current	I_{st}	$V_{st} = 0$			10	μA
Output offset	$V_N \text{ offset}$	$R_g = 0$	-150		+150	mV
Voltage gain	V_G	$V_O = 0 \text{ dBm}$	31	32	33	dB
Voltage gain difference	ΔV_G		-1		+1	dB
Output power	P_{O1}	THD = 10%	23	28		W
	$P_{O \text{ max1}}$	$V_{CC} = 13.7 \text{ V}$, $V_{IN} = 2.5 \text{ Vrms}$		40		W
	$P_{O \text{ max2}}$	$V_{IN} = 2.5 \text{ Vrms}$		45		W
Total harmonic distortion	THD	$P_O = 4 \text{ W}$		0.1	0.4	%
Channel separation	CHsep	$V_O = 0 \text{ dBm}$, $R_g = 10 \text{ k}\Omega$	50	60		dB
Ripple rejection ratio	SVRR	$R_g = 0$, $f_r = 100 \text{ Hz}$, $V_{ccr} = 0 \text{ dBm}$, 20 Hz to 20 kHz	40	45		dB
Output noise voltage	V_{NO}	$R_g = 0$, 20 Hz to 20 kHz		300	450	μVrms
Muting attenuation	M_a	$V_O = 20 \text{ dBm}$	70	90		dB
Output center point potential	V_N	$R_g = 0$		2.65		V

Package Dimensions

unit : mm

3236



Functional Description

1. Standby Switch Function (pin 4)

The pin 4 threshold voltage is set to be $2 V_{BE}$. When V_{st} is 2.0V or higher, the amplifier will be on, and when V_{st} is 0.7V or lower, the amplifier will be off. Note that pin 4 requires an operating current of at least 40 μ A.

2. Muting Function

The IC is set to the muted state by setting pin 22 to the ground potential. In this state, the audio output is muted. The time constant with which the muting function operates is set by an external RC circuit, and this time constant influences the pop noise that occurs when the amplifier is turned on or off.

The muting on and off times due to the recommended external component values ($R=10k\Omega$, $C=3.3\mu F$) are as follows.

Muting on time: 50ms

Muting off time: 20ms

3. Self-Diagnosis Function (Speaker burnout prevention)

During steady state operation, the LA47536 detects, internally, whether or not an abnormal amplifier output offset has occurred, and outputs this signal from pin 25. Applications can prevent speaker burnout and other problems by having the system microcontroller detect this pin 25 output signal and control either the standby state or the power supply. (An abnormal output offset may be caused by, for example, input capacitor leakage current.)

The pin 25 signal is turned off by setting pin 1 to the ground potential.

4. Oscillator Stability

In some cases, parasitic oscillations may be induced by the PCB layout. This oscillation can be eliminated by adding the components listed below. Note that the optimal capacitor value must be verified by testing in the actual mounted state in the end product.

- Connect a capacitor and resistor (0.1 μ F and 2.2 Ω) in series between each output pin and ground.

5. Audio Quality (Low band)

The frequency characteristics in the low frequencies can be improved by making the capacitance of the input capacitors variable.

The recommended capacitance is 2.2 μ F and smaller.

6. Protection Circuits

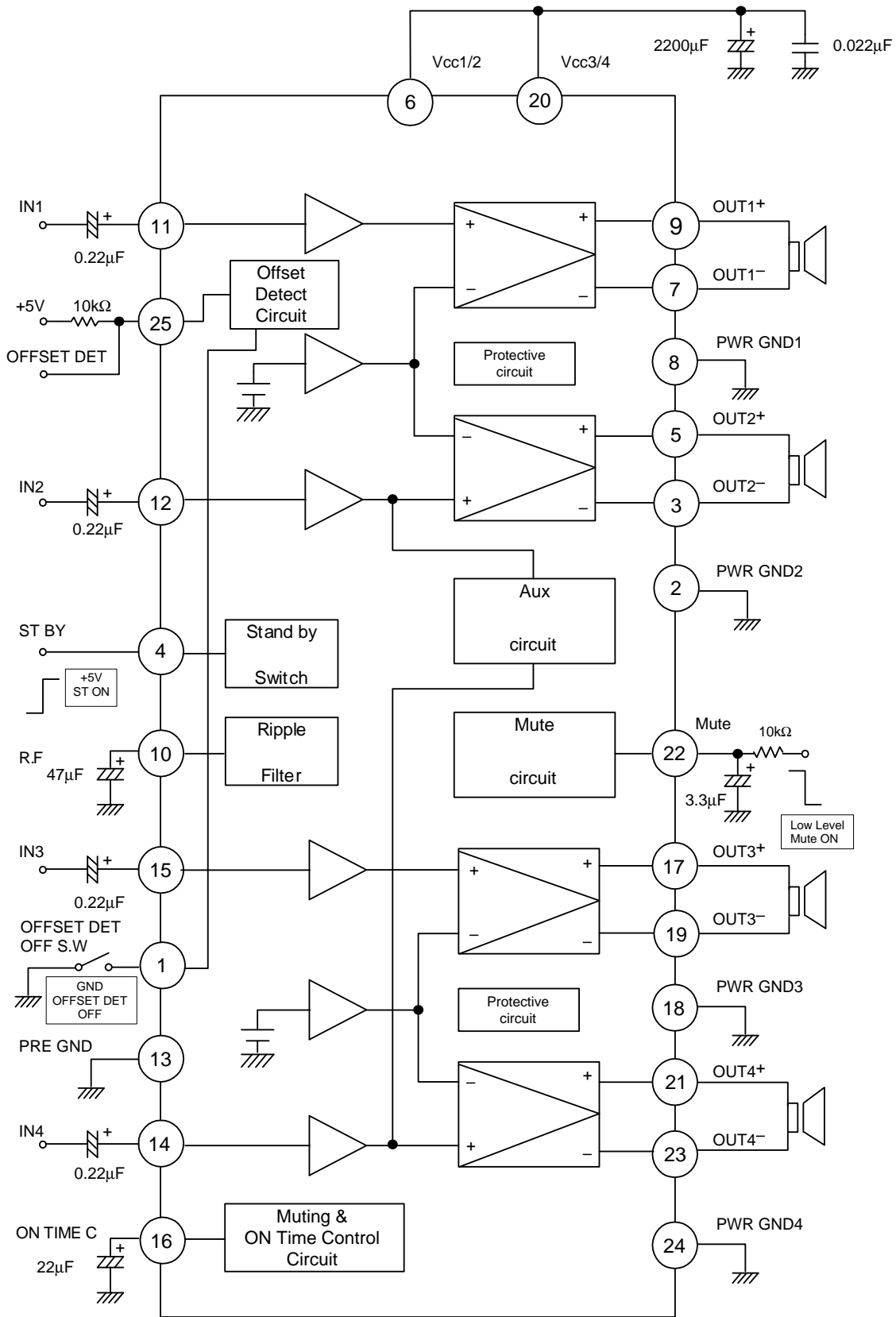
Do not ground the outputs with the STBY voltage at around 1.4V. Also, do not turn the IC off in the grounded state with a time constant provided for the STBY voltage.

7. Pop Noise

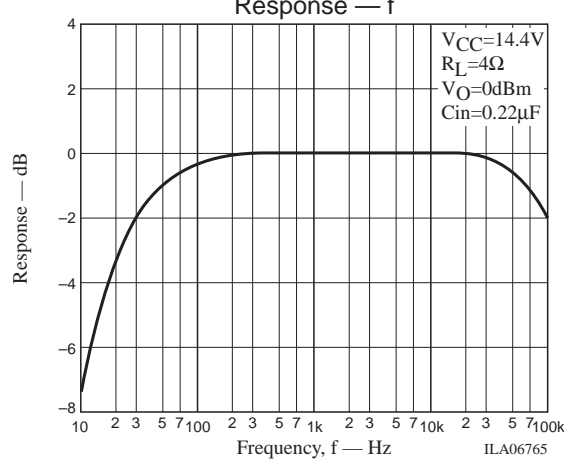
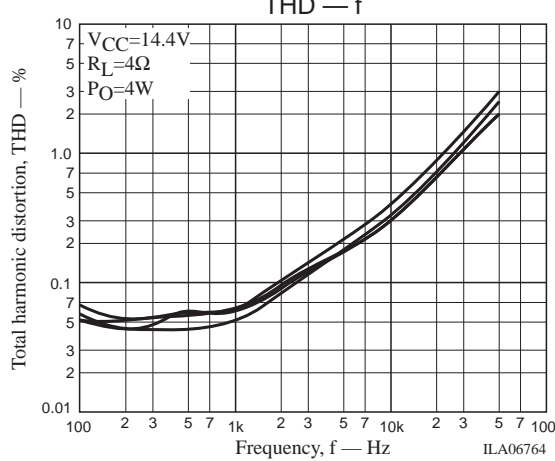
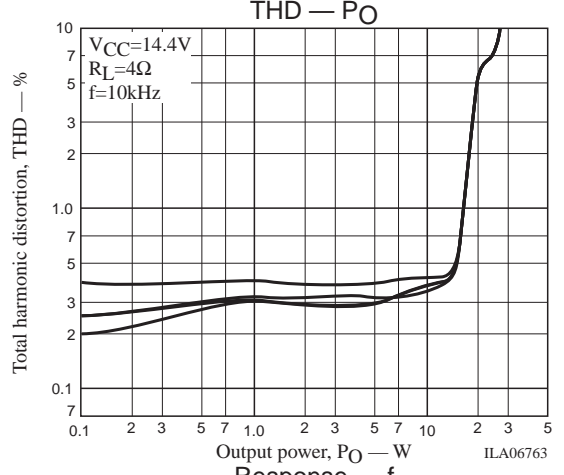
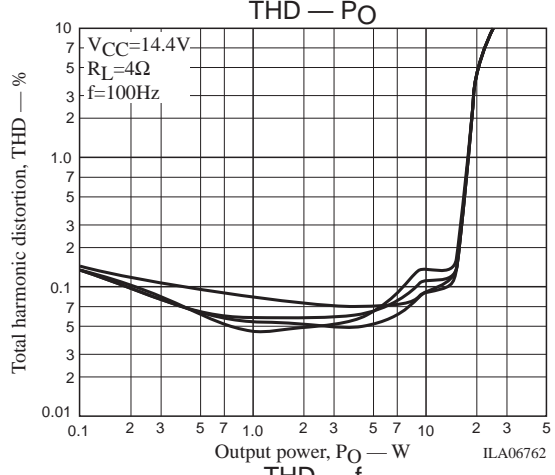
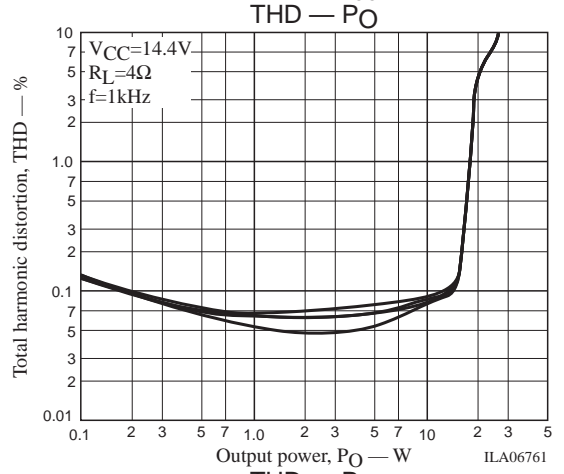
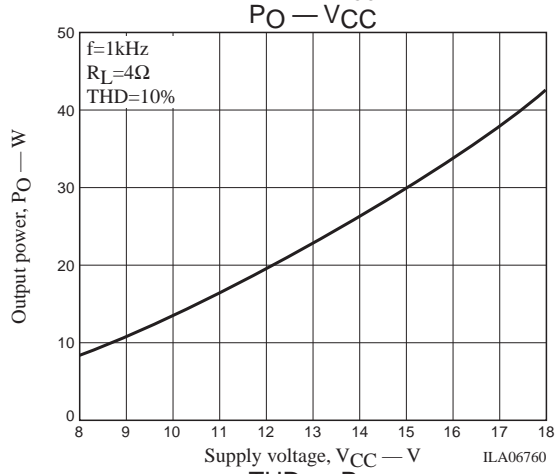
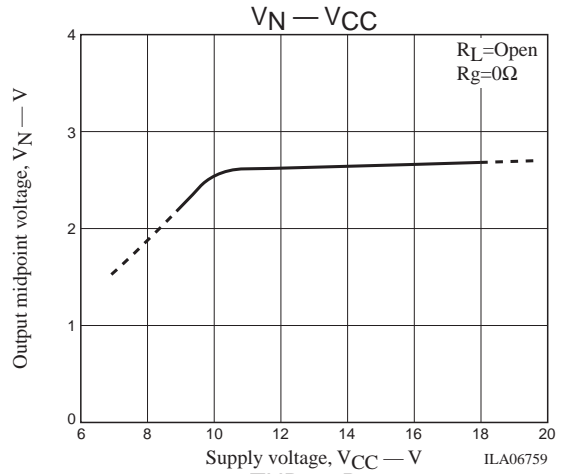
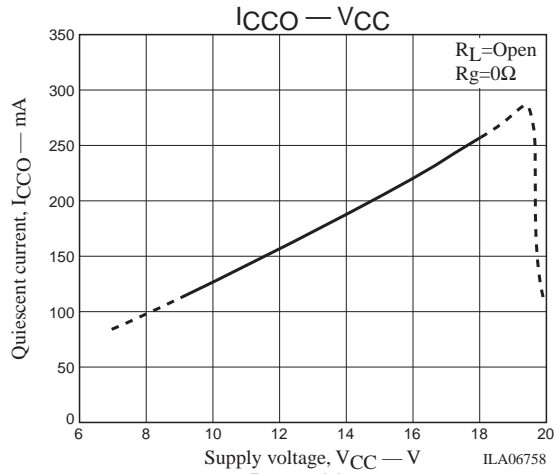
Although the LA47536 includes a pop noise prevention circuit, pop noise can be reduced even further by using the muting function as well.

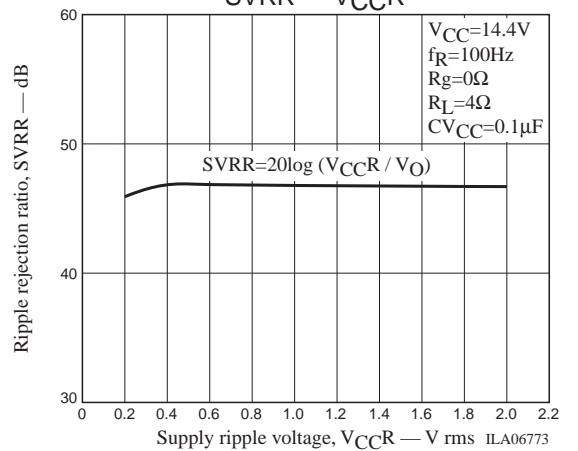
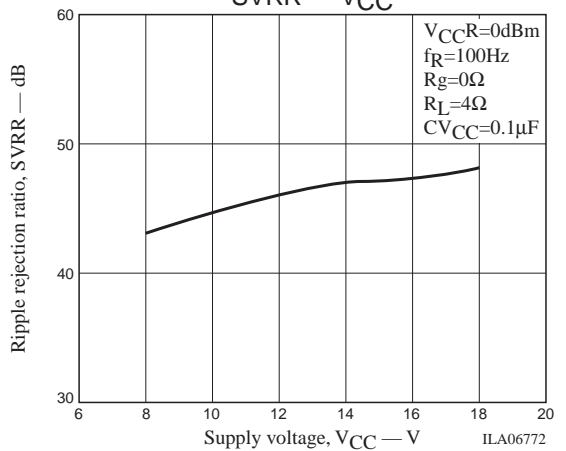
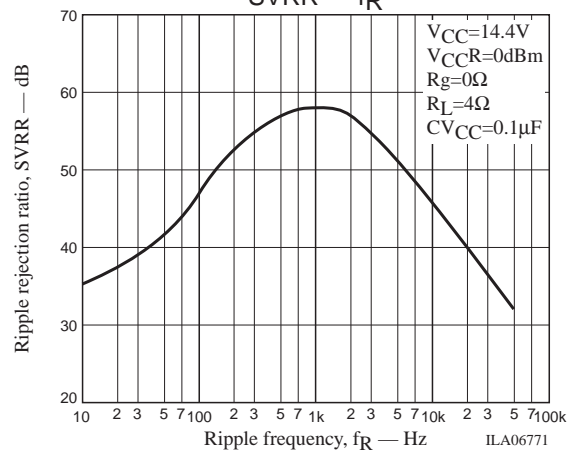
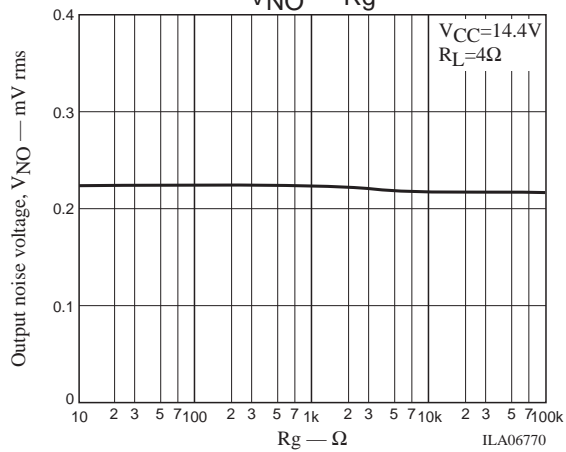
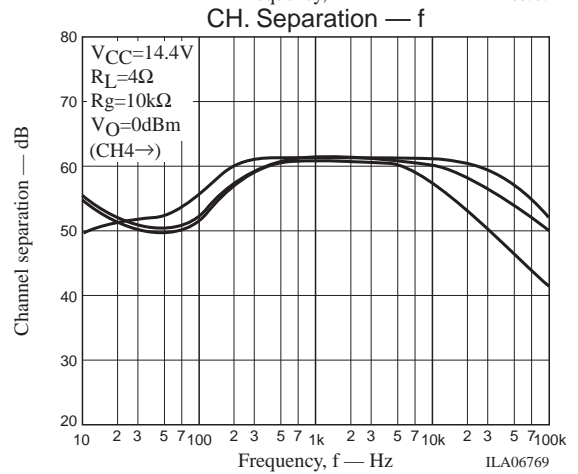
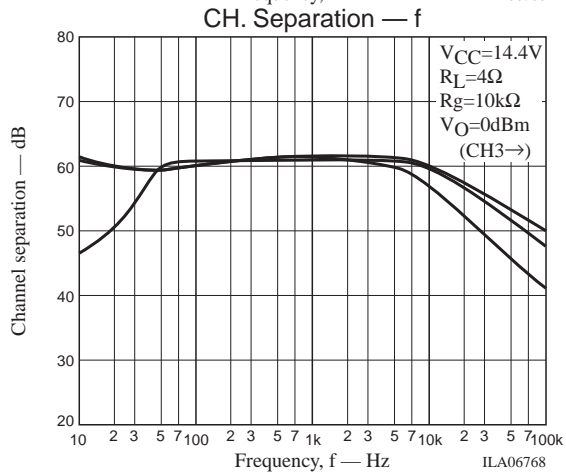
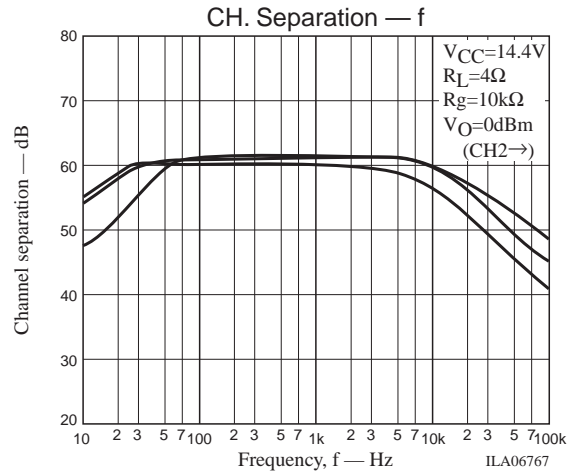
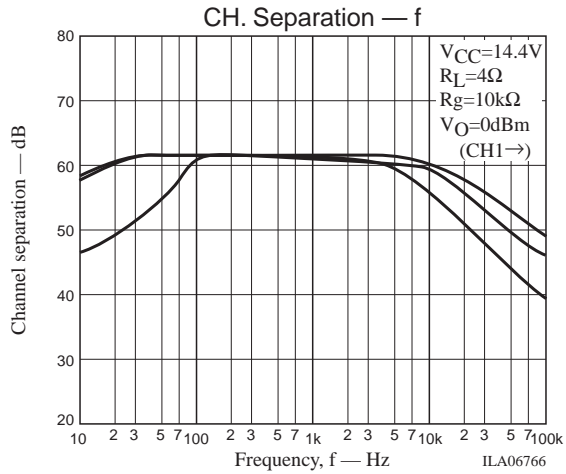
- Activate the muting function at the same time as power is applied. Then, after the output DC potential has stabilized, turn off the muting function.
- When turning the amplifier off, first turn on the muting function and then turn off the power supply. These two methods are effective at minimizing pop noise.

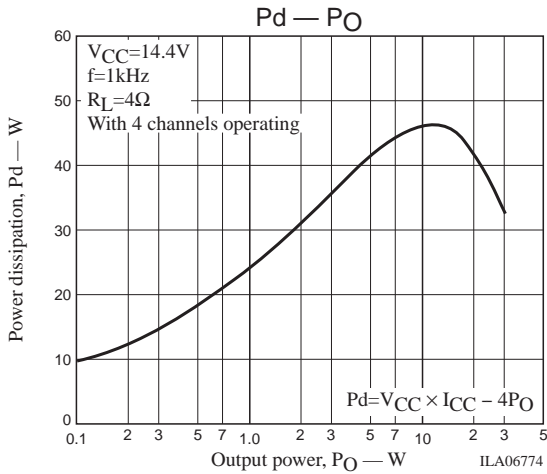
Block and Application Diagram



* Package: HZIP25







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