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LA4708N

Monolithic Linear IC

20W 2-channel BTL AF Power Amplifier for Car Stereo

Overview

The LA4708N is a BTL two-channel power IC for car audio developed in pursuit of excellent sound quality. Low-region frequency characteristics have been improved through the use of a new NF capacitor-less circuit, and crosstalk which causes “muddy” sound has been reduced by improving both circuit and pattern layout. As a result, the LA4708N provides powerful bass and clear treble. In addition, the LA4708N features on-chip protectors and standby switch.

Features

- High power : supports total output of 30W + 30W ($V_{CC} = 13.2V$, THD = 30%, $R_L = 4\Omega$)
- Supports $R_L = 2\Omega$ ($P_O = 30W$ when $V_{CC} = 13.2V$, THD = 10%)
- Designed for excellent sound quality ($f_L < 10Hz$, $f_H = 130kHz$)
- NF capacitor-less
- Any on time settable by external capacitor
- Less pop noise
- Standby switch circuit on chip (microprocessor supported)
- Various protectors on chip (output-to-ground short/output-to- V_{CC} short/load short/overvoltage/thermal shutdown circuit)

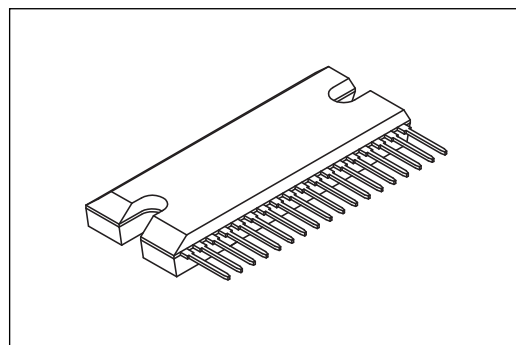
Specifications

Maximum Ratings at $T_a = 25^\circ C$

Parameter	Symbol	Conditions	Ratings	Unit
Maximum supply voltage	$V_{CC} \text{ max 1}$	No signal, $t = 60s$	24	V
	$V_{CC} \text{ max 2}$		16	V
Surge supply voltage	$V_{CC} \text{ surge}$	$t \leq 0.2s$, single giant pulse	50	V
Maximum output current	$I_O \text{ peak}$	Per channel	4.5	A
Allowable power dissipation	$P_d \text{ max}$	Arbitrarily large heat sink	37.5	W
Operating temperature	T_{opr}		-35 to +85	$^\circ C$
Storage temperature	T_{stg}		-40 to +150	$^\circ C$

* Set V_{CC} , R_L in a range that does not exceed $P_d \text{ max} = 37.5W$

Stresses exceeding those listed in the Maximum Ratings table may damage the device. If any of these limits are exceeded, device functionality should not be assumed, damage may occur and reliability may be affected.



SIP18H

ORDERING INFORMATION

See detailed ordering and shipping information on page 9 of this data sheet.

LA4708N

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

Parameter	Symbol	Conditions	Ratings	Unit
Recommended supply voltage	V_{CC}		13.2	V
Operating voltage range	$V_{CC\text{ op}}$	Range where P_d max is not exceeded	9 to 16	V
Recommended load resistance	R_L		4	Ω
Recommended load resistance range	$R_{L\text{ op}}$		2 to 4	Ω

Functional operation above the stresses listed in the Recommended Operating Ranges is not implied. Extended exposure to stresses beyond the Recommended Operating Ranges limits may affect device reliability.

Electrical Characteristics at $T_a = 25^\circ\text{C}$, $V_{CC} = 13.2\text{V}$, $R_L = 4\Omega$, $f = 1\text{kHz}$, $R_g = 600\Omega$

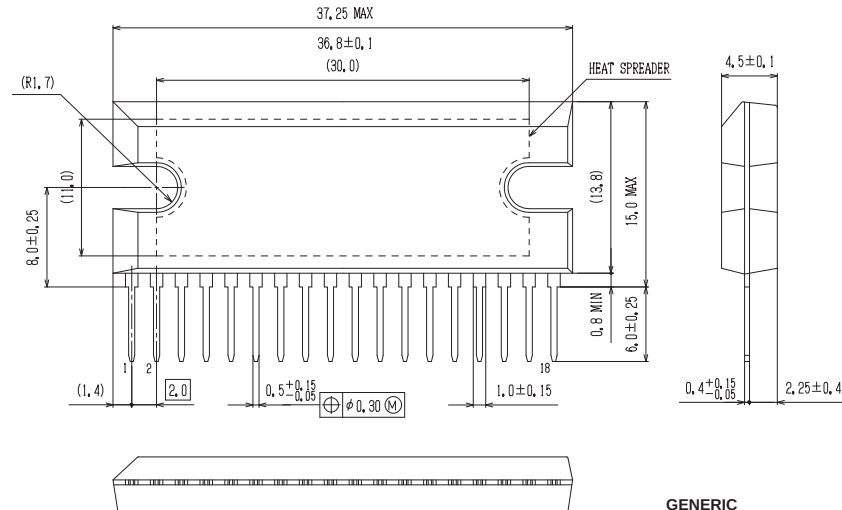
Parameter	Symbol	Conditions	min	typ	max	Unit
Quiescent current	I_{CCO}		70	150	250	mA
Standby current	I_{st}			10	60	μA
Voltage gain	VG		38	40	42	dB
Total harmonic distortion	THD	$P_O = 2\text{W}$		0.07	0.4	%
Output power	P_{O1}	THD = 10%	16	20		W
	P_{O2}	THD = 10%, $V_{CC} = 14.4\text{V}$		24		W
	P_{O3}	THD = 10%, $R_L = 2\Omega$		30		W
Output offset voltage	$V_{N\text{ offset}}$	$R_g = 0$	-300		+300	mV
Output noise voltage	V_{NO}	$R_g = 0$, B.P.F. = 20Hz to 20kHz		0.1	0.5	mVrms
Ripple rejection ratio	SVRR	$R_g = 0$, $f_R = 100\text{Hz}$, $V_R = 0\text{dBm}$	40	50		dB
Channel separation	CHsep	$R_g = 10\text{k}\Omega$, $V_O = 0\text{dBm}$	50	60		dB
Input resistance	r_i		21	30	39	$\text{k}\Omega$
Standby pin applied voltage	V_{st}	Amp on, applied through $10\text{k}\Omega$	2.5		V_{CC}	V

Product parametric performance is indicated in the Electrical Characteristics for the listed test conditions, unless otherwise noted. Product performance may not be indicated by the Electrical Characteristics if operated under different conditions.

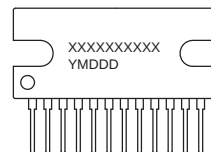
Package Dimensions

unit : mm

SIP18 36.8x13.8 / SIP18H
CASE 127AS
ISSUE A

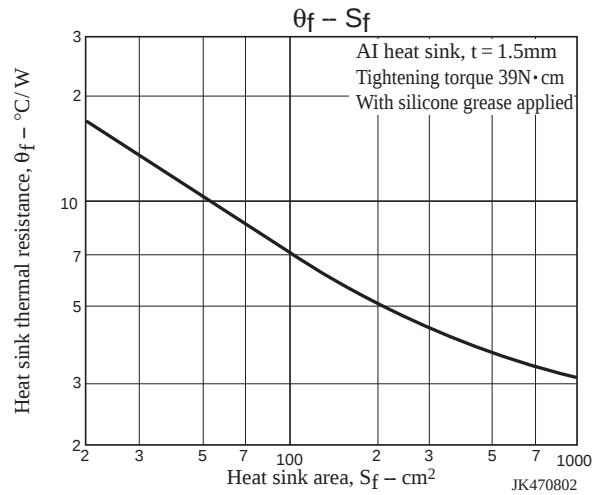
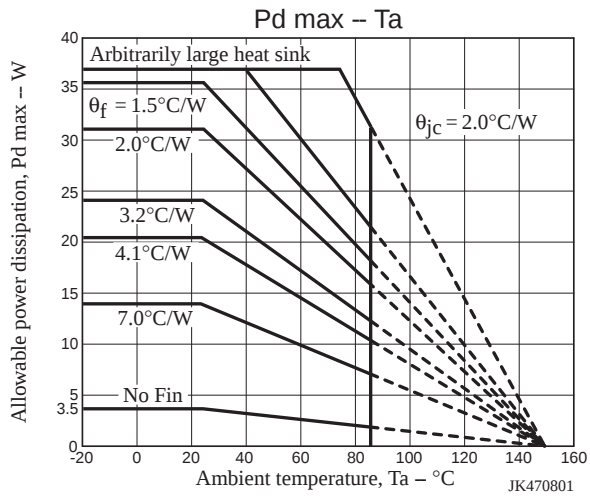


GENERIC MARKING DIAGRAM*

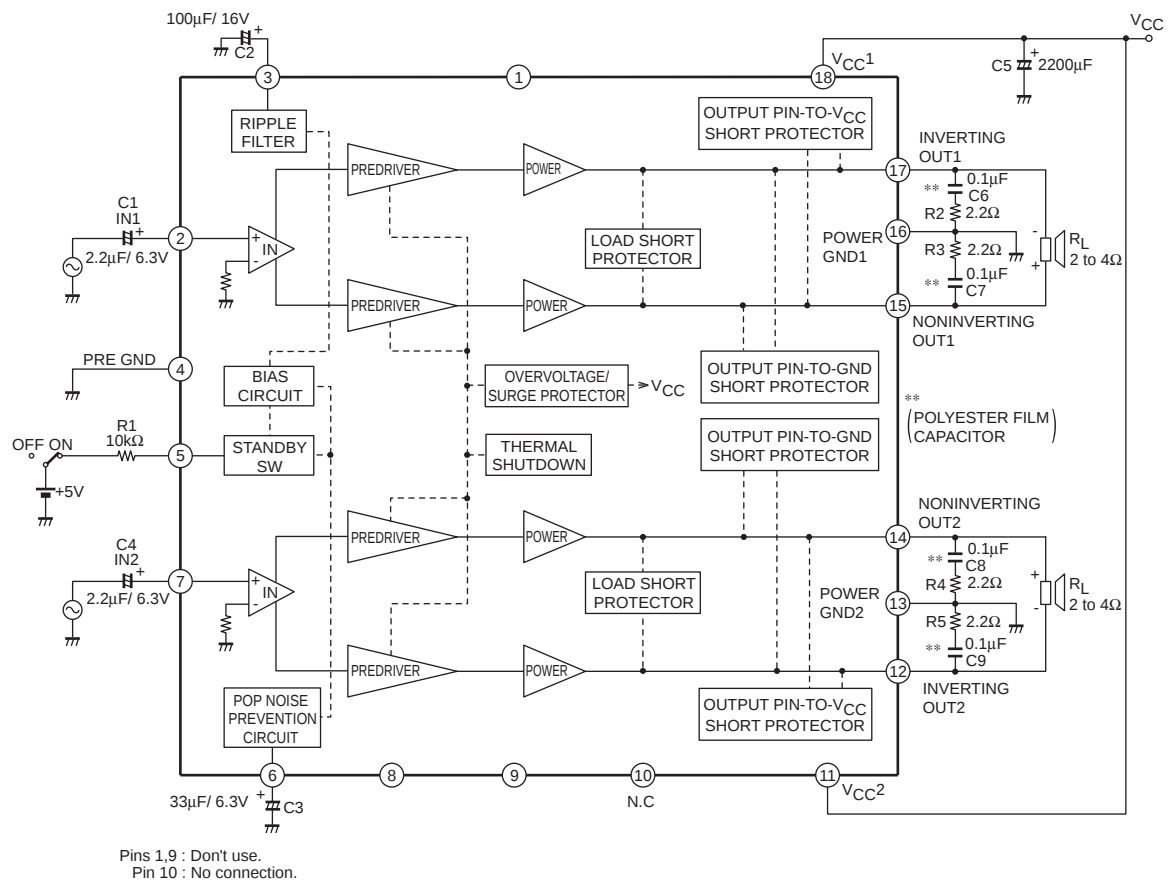


XXXXXX = Specific Device Code
Y = Year
M = Month
DDD = Additional Traceability Data

*This information is generic. Please refer to device data sheet for actual part marking.
Pb-Free indicator, "G" or microdot "■", may or may not be present.



Block Diagram



Each Pin Voltage

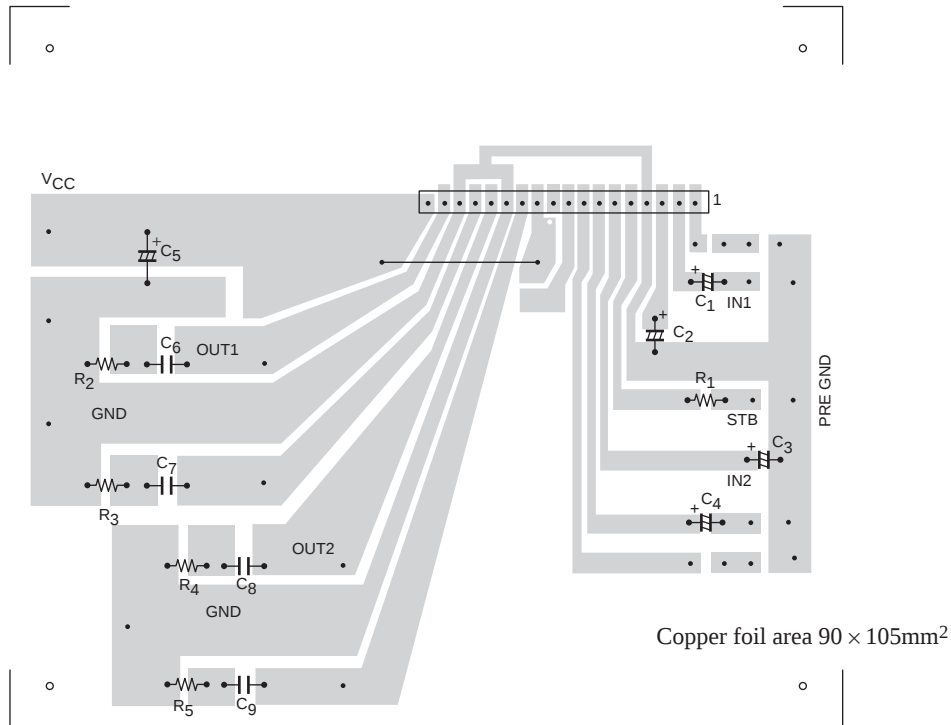
$$V_{CC} = 13.2V, 5V \text{ applied through STBY} = 10k\Omega, R_L = 4\Omega, R_g = 0$$

Pin No.	1	2	3	4	5	6
Name		IN1	DC	Pre-GND	STBY	ON TIME
Pin voltage (V)	0.29	1.58	6.55	0	3.2	2.28

Pin No.	7	8	9	10	11	12
Name	IN2	POP	-	N.C	V _{CC} ²	–OUT 2
Pin voltage (V)	1.58	2.08	0.29	0	13.2	6.5

Pin No.	13	14	15	16	17	18
Name	PWR-GND 2	+OUT 2	+OUT 1	PWR-GND 1	–OUT 1	V _{CC} ¹
Pin voltage (V)	0	6.5	6.5	0	6.5	13.2

Sample Print Pattern



Description of External Components

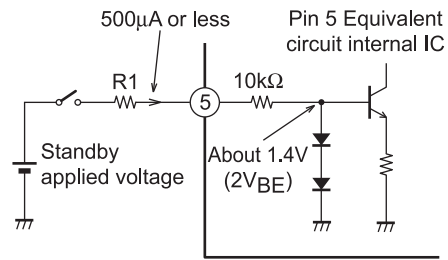
C1, C4	Input capacitors	2.2 μF is recommended. f_L can be varied by C1, C4 capacitances to adjust the bass range.
C2	Decoupling capacitor (ripple filter)	
C3	Amplifier on time setting capacitor	Approximately 0.8 second for 33 μF . Since the on time is proportional to this capacitance, it can be set as desired by varying this capacitance. (Refer to the characteristics curve.)
C5	Power supply capacitor	
C6, C7, C8, C9	Oscillation blocking capacitors	Use polyester film capacitors (Mylar capacitors) with good temperature characteristics. (R2, R3, R4, and R5 used jointly.) Since stability may be affected slightly by the pattern layout, etc., 0.1 μF or more is recommended.
R1	Standby switch current limiting resistor	10k Ω is recommended (when the applied voltage for the standby switch is 2.5V to 13.2V). This resistor cannot be removed.

Features of IC Inside and Usage Notes

Standby function

- Pin 5 is the standby switch pin. The amplifier is turned on by applying approximately 2.5V or more to this pin through an external resistor (R1).
- If voltage in excess of 13.2V is to be applied to the standby switch, calculate the value of R1 using the following formula so that the current flowing into pin 5 is 500μA or less:

$$R1 = \frac{\text{Applied voltage} - 1.4V}{500\mu A} - 10k\Omega$$



Mute function

- Pin 6 is the connector for the capacitor that determines the on time in order to prevent pop noise. By grounding this pin, the amplifier can implement mute operation. In this case, the recovery time depends on C3.

How to reduce pop noise

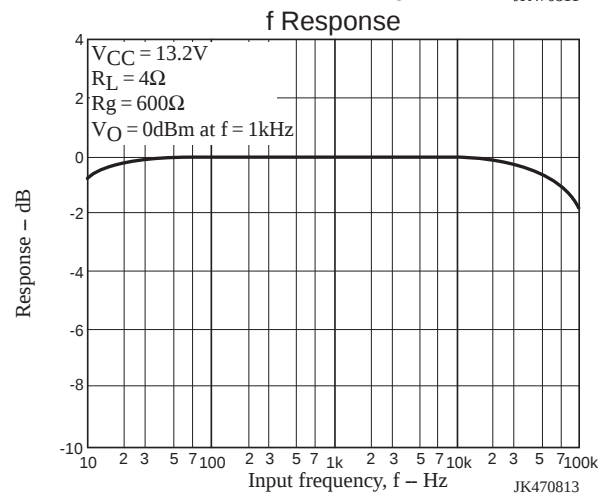
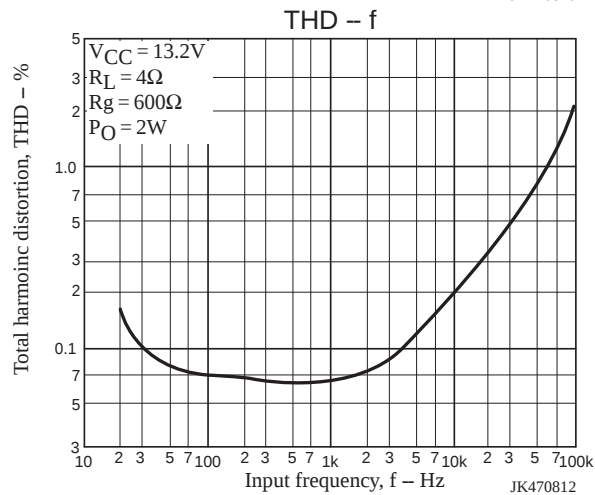
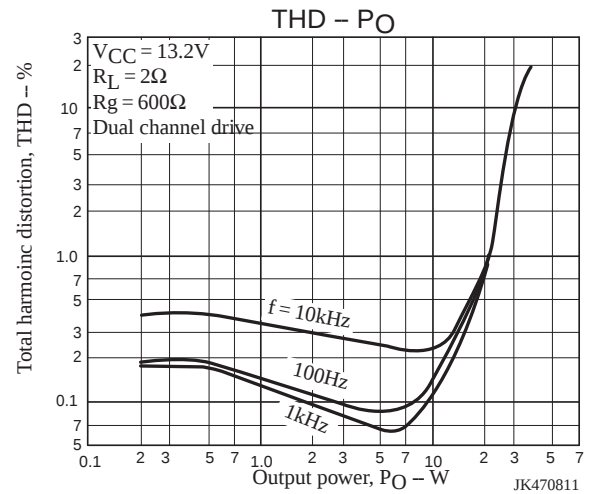
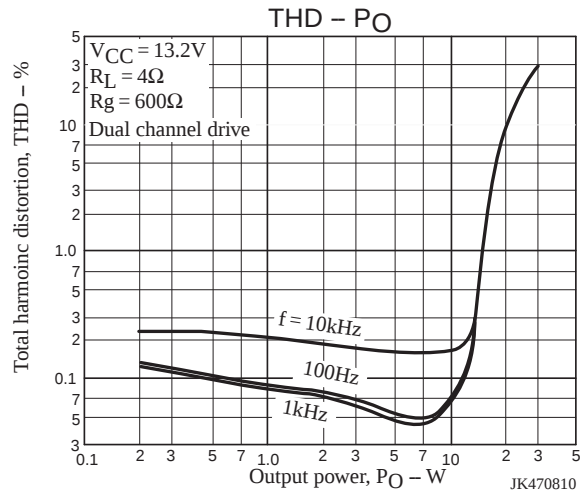
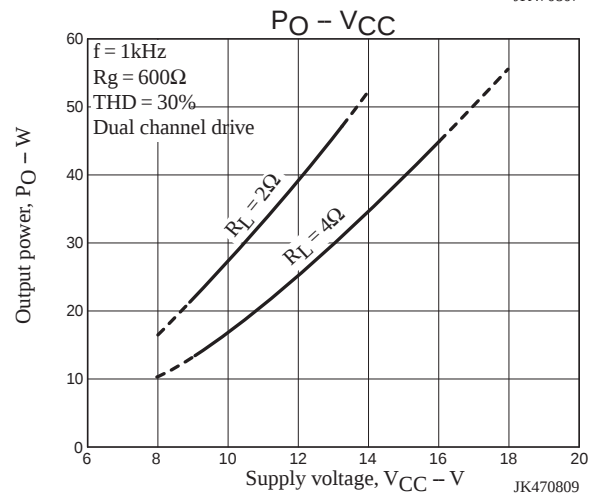
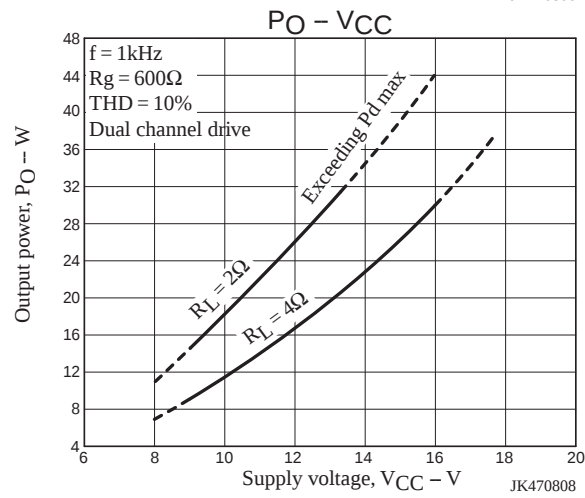
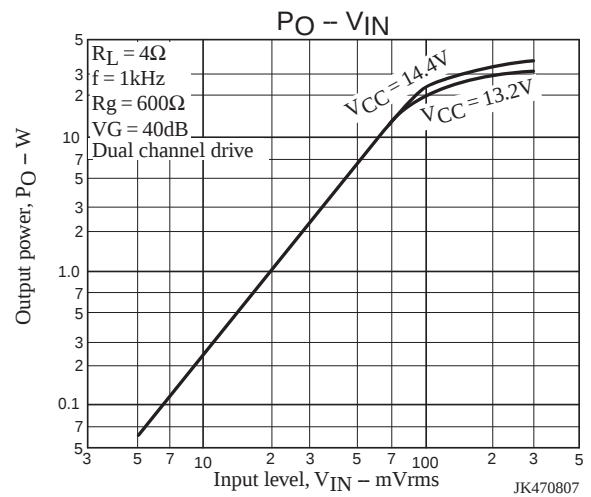
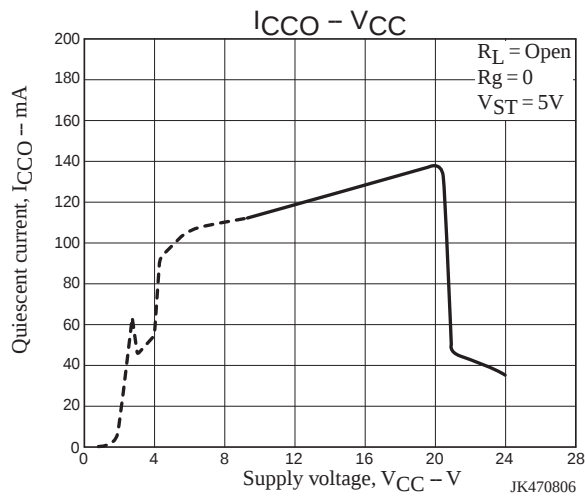
- Although the LA4708N reduces pop noise, an electrolytic capacitor of between 0.47 and 2.2μF can be connected between pin 8 and the pre-GND to further reduce pop noise that occurs when power supply is turned on/off (standby switch on/off). The larger the capacitance, the lower the frequency of pop noise, and it is barely audible, but sound residue of the sound signal is liable to linger when power is turned off. Pin 8 is the bias pin for the output amplifier and normally is left open.

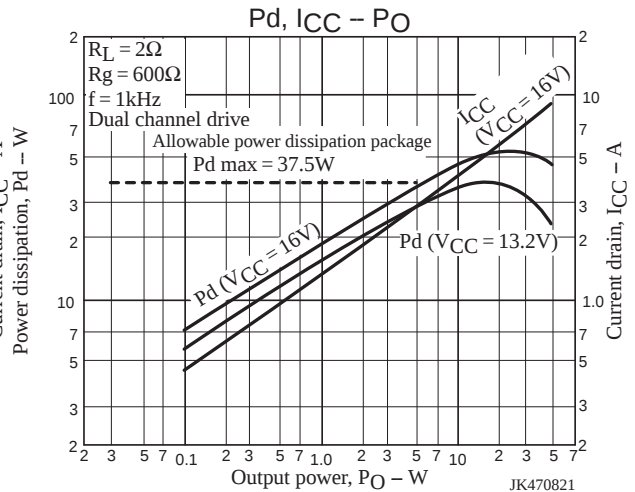
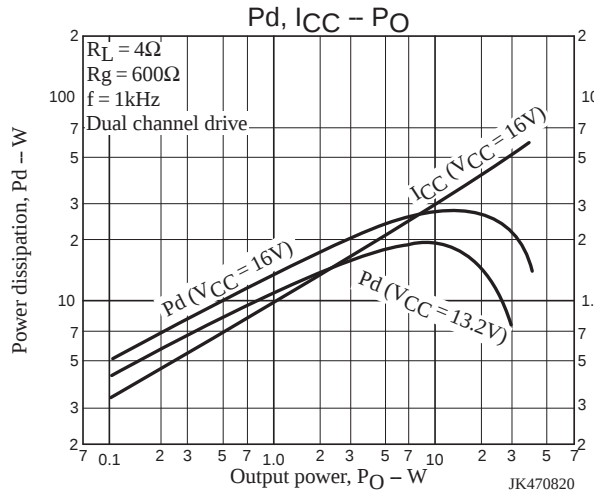
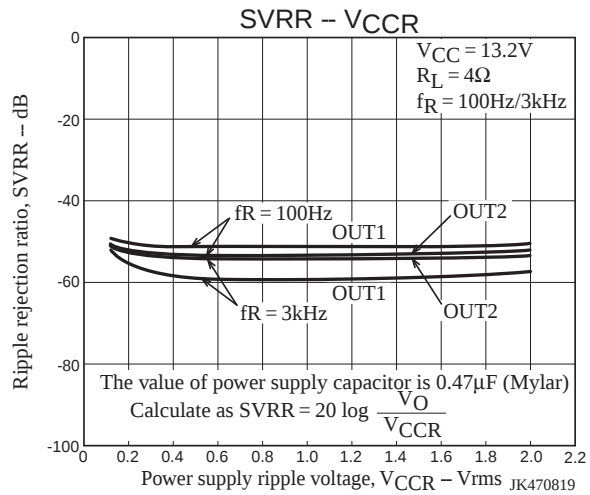
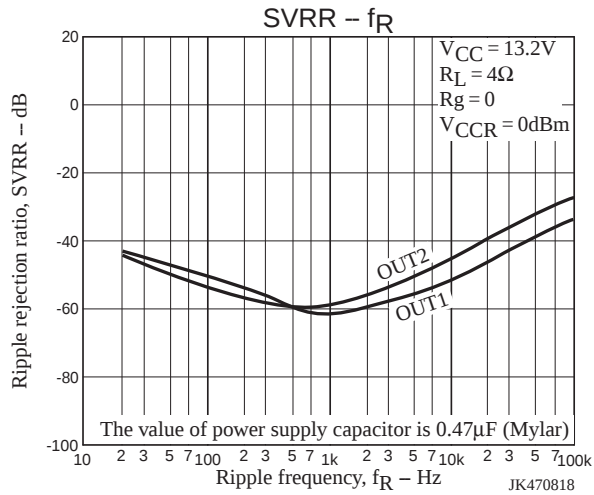
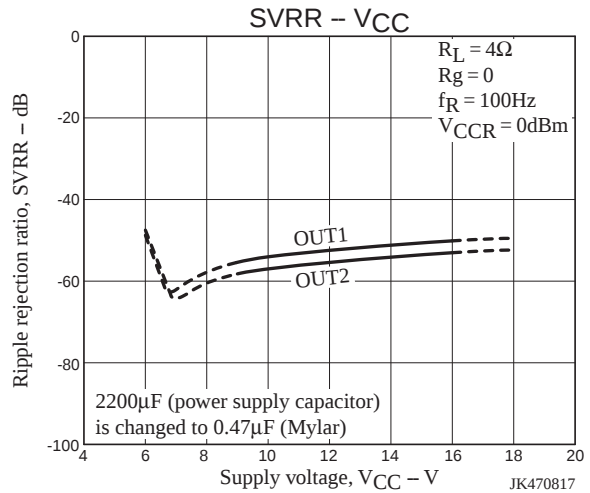
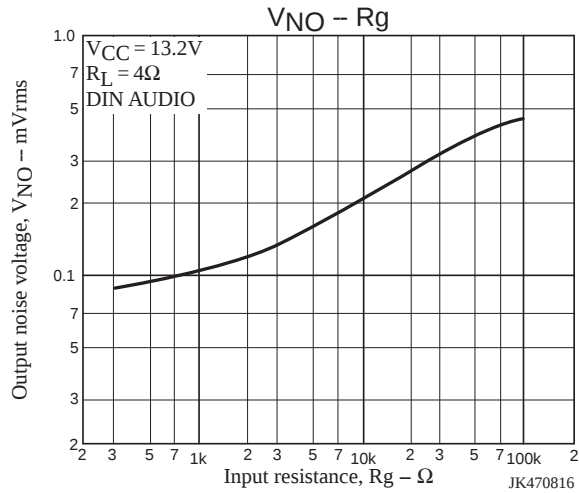
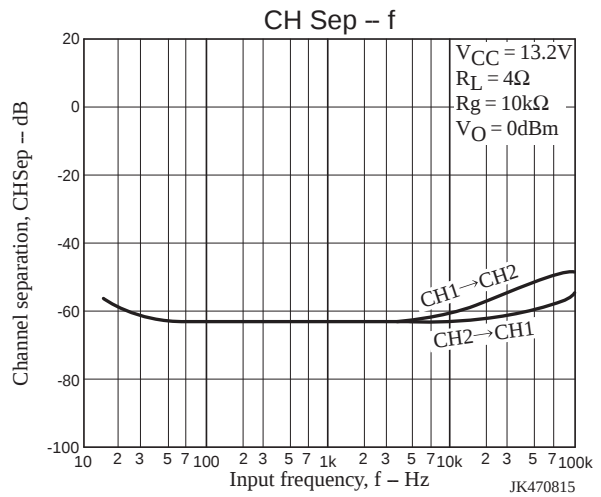
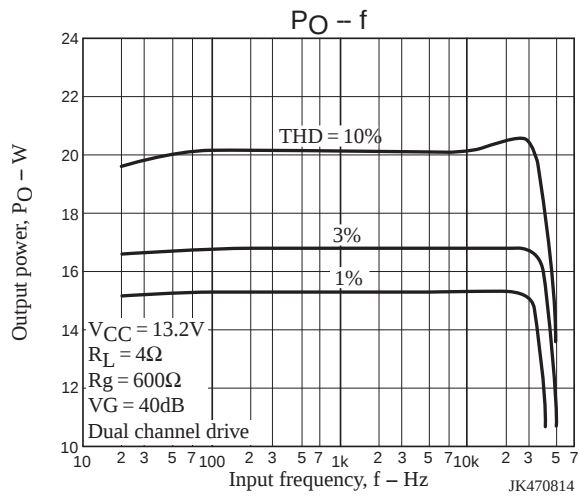
Protectors

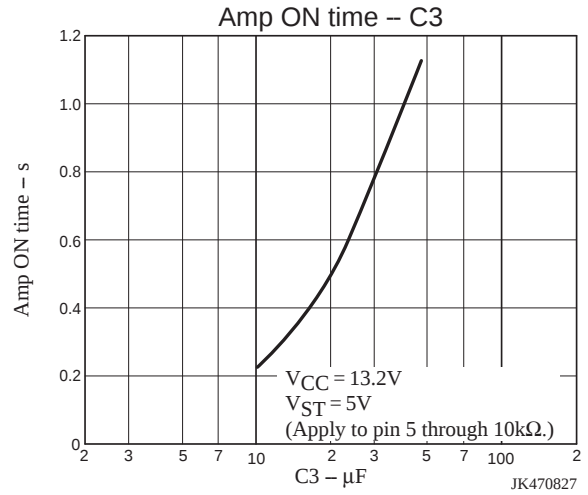
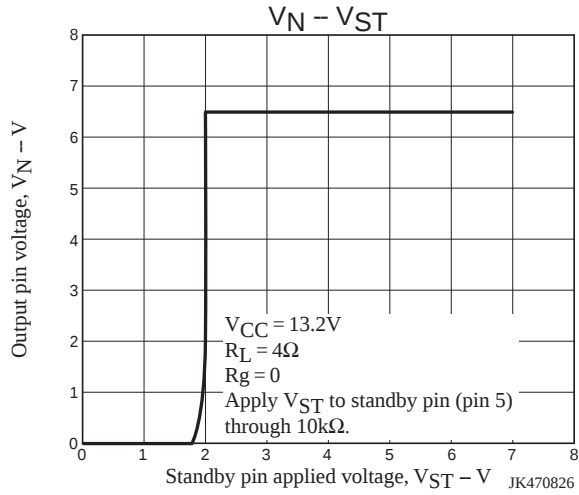
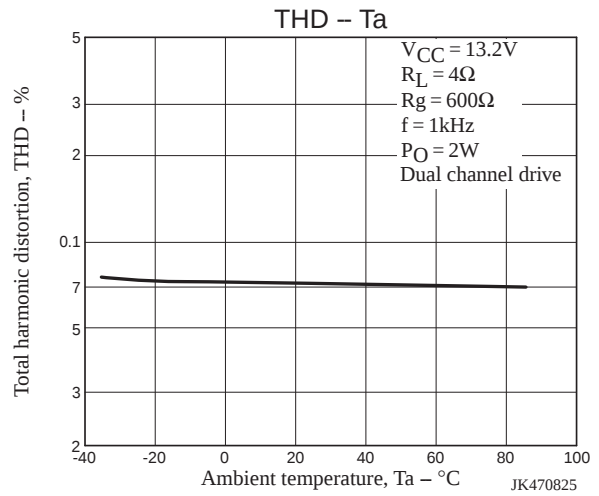
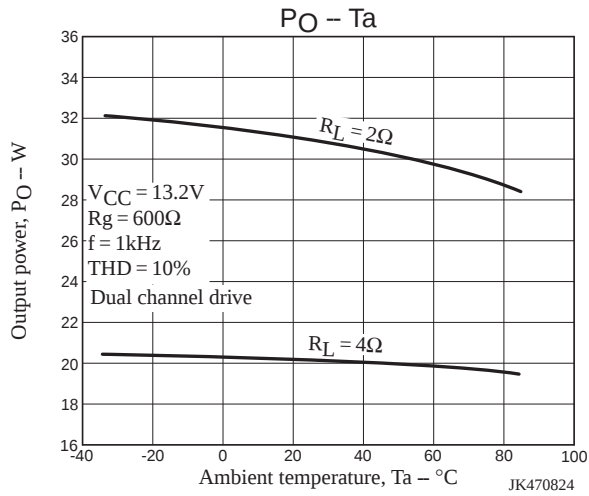
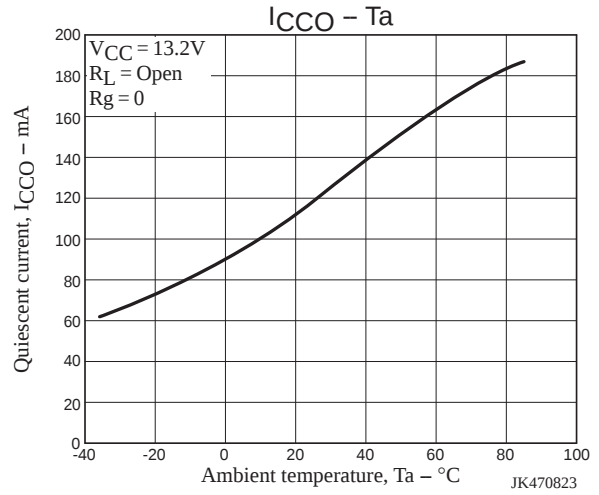
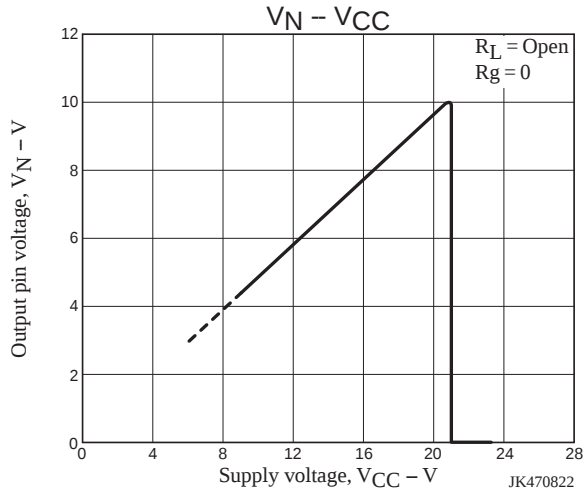
- In an output-to-ground and output-to-V_{CC} short protector system configuration, if a DC resistor is connected between amplifier output pin and GND, the protector may operate, causing the amplifier not to start operating. Therefore, as a general rule, no DC resistor should be connected between amplifier output pin and GND.
- In order to prevent damage or degradation which may be caused by abnormally heated IC, the LA4708N has a thermal shutdown protector. Accordingly, if the IC junction temperature (T_j) climbs to around 170 to 180°C due to inadequate heat dissipation, the thermal shutdown protector will operate to control the output gradually into attenuation.
- Also be fully careful of handling other protectors built in the LA4708N.

Miscellaneous

- Since pins 1 and 9, which are unused, are connected internally, they must be left open.
- Pin 10 is an NC pin (no internal connection).







ORDERING INFORMATION

Device	Package	Shipping (Qty / Packing)
LA4708N-E	SIP18H (Pb-Free)	15 / Fan-Fold

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