
HA13151, HA13152

14 W × 4-Channel BTL Power IC

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ADE-207-116
1st. Edition

Description

The HA13151/HA13152 are high output and low distortion 4 ch BTL power IC designed for digital car audio.

At 13.2 V to 4 Ω load, this power IC provides output power 14 W with 10% distortion.

Functions

- 4 ch BTL power amplifiers
- Built-in standby circuit
- Built-in muting circuit
- Built-in protection circuit (surge, T.S.D, and ASO)

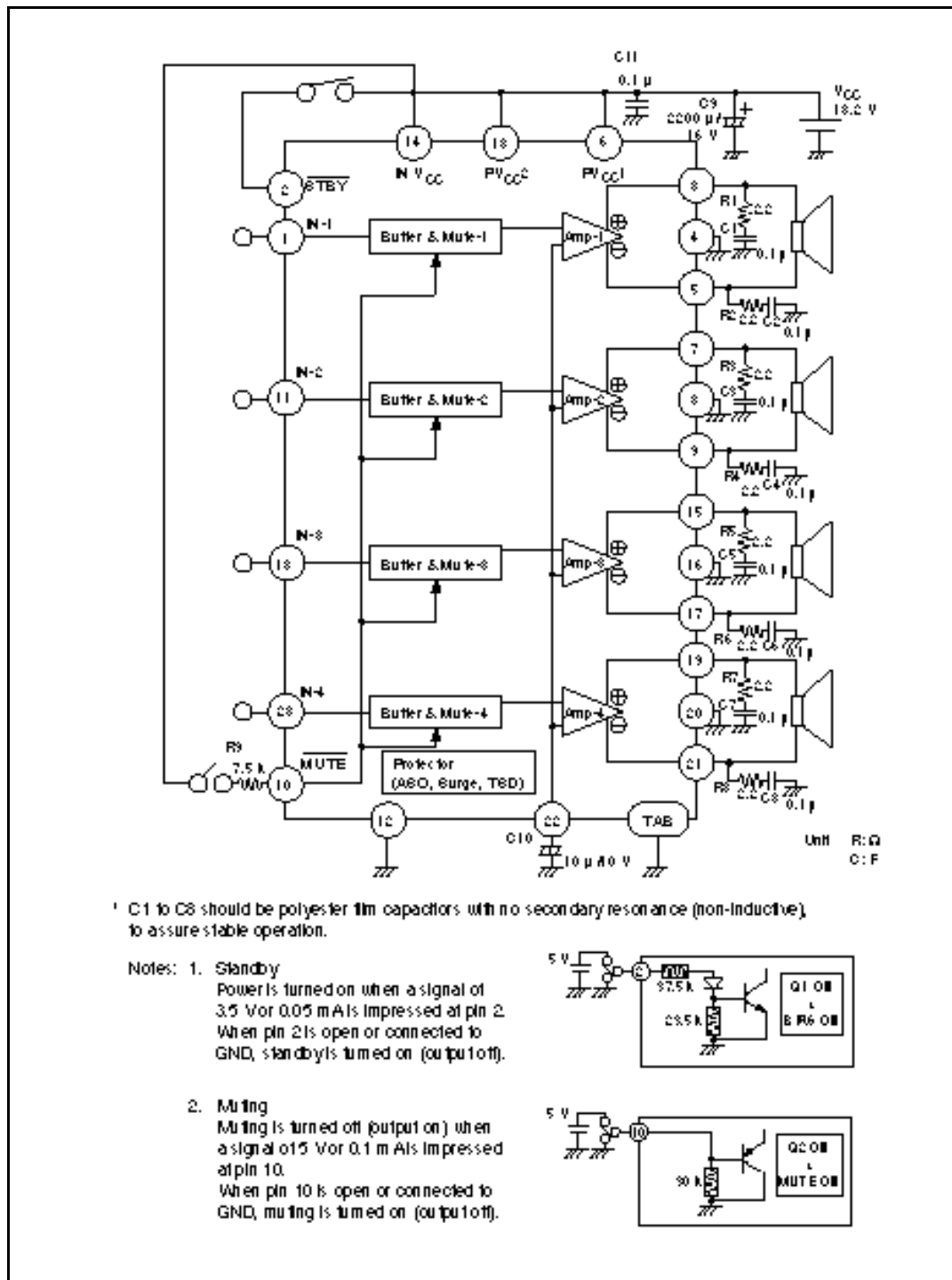
Features

- Few external parts lead to compact set-area possibility
- Popping noise minimized
- Low output noise
- Built-in high reliability protection circuit



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Block Diagram



Absolute Maximum Ratings (Ta = 25°C)

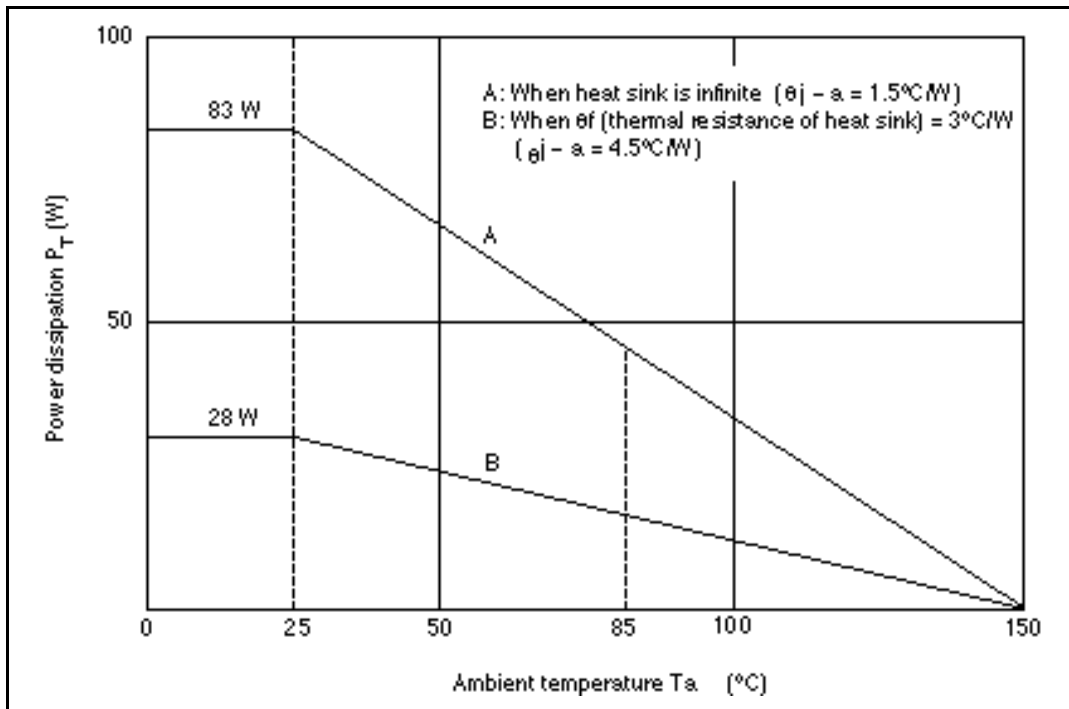
Item	Symbol	Rating	Unit	Remarks
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Operating supply voltage	V_{CC}	18	V
Supply voltage when no signal* ¹	V_{CC} (DC)	26	V
Peak supply voltage* ²	V_{CC} (PEAK)	50	V
Output current* ³	I_o (PEAK)	3	A
Power dissipation* ⁴	P_T	83	W
Junction temperature	T_j	150	°C
Operating temperature	T_{opr}	-30 to +85	°C
Storage temperature	T_{stg}	-55 to +125	°C

Notes: 1. Tolerance within 30 seconds
 2. Tolerance in surge pulse waveform
 3. Value per 1 channel
 4. Value when attached on the infinite heat sink plate at $T_a = 25^\circ\text{C}$.
 The derating curve is as shown in the graph below.



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

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Item	Symbol	Min	Typ	Max	Unit	Test Conditions
Quiescent current	I_{Q1}	—	270	—	mA	$V_{in} = 0$
Output offset voltage	V_Q	−300	0	+300	mV	
Gain	G_V	30.5	32	33.5	dB	
Gain difference between channels	G_V	−1.5	0	+1.5	dB	
Rated output power	P_o	—	14	—	W	$V_{CC} = 13.2 \text{ V}$ THD = 10%, $R_L = 4 \text{ } \Omega$
Max output power	P_{omax}	—	22	—	W	$V_{CC} = 13.7 \text{ V}$ THD = Max, $R_L = 4 \text{ } \Omega$
Total harmonic distortion	T.H.D.	—	0.05	—	%	$P_o = 3 \text{ W}$
Output noise voltage	WBN	—	0.15	—	mVrms	$R_g = 0$ BW = 20 to 20 kHz
Ripple rejection	SVR	—	55	—	dB	$R_g = 600 \text{ } \Omega$, $f = 120 \text{ Hz}$
Channel cross talk	C.T.	—	70	—	dB	$R_g = 600 \text{ } \Omega$ $V_{out} = 0 \text{ dBm}$
Input impedance	R_{in}	—	25	—	k	
Standby current	I_{Q2}	—	—	200	μA	
Standby control voltage (high)	V_{STH}	3.5	—	V_{CC}	V	
Standby control voltage (low)	V_{STL}	0	—	1.5	V	
Muting control voltage (high)	V_{MH}	3.5	—	V_{CC}	V	
Muting control voltage (low)	V_{ML}	0	—	1.5	V	
Muting attenuation	ATTM	—	70	—	dB	$V_{out} = 0 \text{ dBm}$

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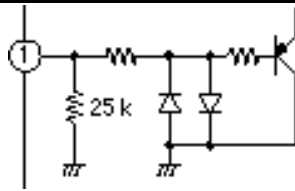
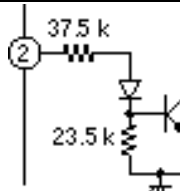
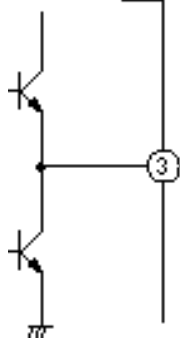
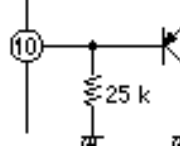
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Item	Symbol	Min	Typ	Max	Unit	Test Conditions
Quiescent current	I_{Q1}	—	270	—	mA	$V_{in} = 0$
Output offset voltage	V_Q	−300	0	+300	mV	
Gain	G_V	38.5	40	41.5	dB	
Gain difference between channels	G_V	−1.5	0	+1.5	dB	
Rated output power	P_o	—	14	—	W	$V_{CC} = 13.2\text{ V}$ THD = 10%, $R_L = 4$
Max output power	P_{omax}	—	22	—	W	$V_{CC} = 13.7\text{ V}$ THD = Max, $R_L = 4$
Total harmonic distortion	T.H.D.	—	0.05	—	%	$P_o = 3\%$
Output noise voltage	WBN	—	0.25	—	mVrms	$R_g = 0$ BW = 20 to 20 kHz
Ripple rejection	SVR	—	45	—	dB	$R_g = 600$, $f = 120\text{ Hz}$
Channel cross talk	C.T.	—	60	—	dB	$R_g = 600$ $V_{out} = 0\text{ dBm}$
Input impedance	R_{in}	—	25	—	k	
Standby current	I_{Q2}	—	—	200	μA	
Standby control voltage (high)	V_{STH}	3.5	—	V_{CC}	V	
Standby control voltage (low)	V_{STL}	0	—	1.5	V	
Muting control voltage (high)	V_{MH}	3.5	—	V_{CC}	V	
Muting control voltage (low)	V_{ML}	0	—	1.5	V	
Muting attenuation	ATTM	—	60	—	dB	$V_{out} = 0\text{ dBm}$

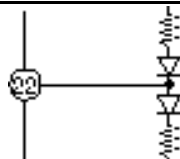
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Pin Explanation

Pin No.	Symbol	Functions	Input Impedance	DC Voltage	Equivalence Circuit
1	IN1	CH1 INPUT	25 k (Typ)	0 V	
11	IN2	CH2 INPUT			
13	IN3	CH3 INPUT			
23	IN4	CH4 INPUT			
2	STBY	Standby control	90 k (at Trs. cutoff)	—	
3	OUT1 +	CH1 OUTPUT	—	$V_{CC}/2$	
5	OUT1 -				
7	OUT2 +	CH2 OUTPUT			
9	OUT2 -				
15	OUT3 +	CH3 OUTPUT			
17	OUT3 -				
19	OUT4 +	CH4 OUTPUT			
21	OUT4 -				
10	MUTE	Muting control	25 k (Typ)	—	

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Pin Explanation (cont)

Pin No.	Symbol	Functions	Input Impedance	DC Voltage	Equivalence Circuit
22	RIPPLE	Bias stability	—	$V_{cc}/2$	
6	PV_{cc1}	Power of output stage	—	V_{cc}	—
18	PV_{cc2}				
14	INV_{cc}	Power of input stage	—	V_{cc}	—
4	CH1 GND	CH1 power GND	—	—	—
8	CH2 GND	CH2 power GND			
16	CH3 GND	CH3 power GND			
20	CH4 GND	CH4 power GND			
12	IN GND	Input signal GND	—	—	—

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Point of Application Board Design

1. Notes on Application Board's Pattern Design
 - For increasing stability, the connected line of V_{CC} and OUTGND is better to be made wider and lower impedance.
 - For increasing stability, it is better to place the capacitor between V_{CC} and GND ($0.1\ \mu\text{F}$) close to IC.
 - For increasing stability, it is better to place C1 to C8 and R1 to R8, which are for stopping oscillation, close to IC.
 - It is better to place the grounding of resistor (R_g), between input line and ground, close to INGND (Pin 12) because if OUTGND is connected to the line between R_g and INGND, THD will become worse due to current from OUTGND.

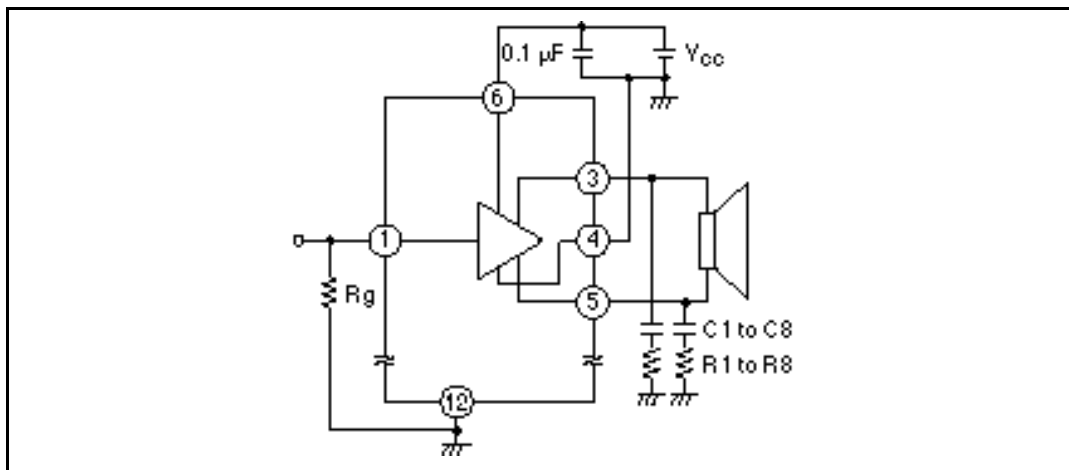


Figure 1 Notes on Application Board's Pattern Design

2. How to Reduce the Popping Noise by Muting Circuit

At normal operating circuit, Muting circuit operates at high speed under 1 μs .

In case popping noise becomes a problem, it is possible to reduce the popping noise by connecting capacitor, which determines the switching time constant, between pin 10 and GND. (Following figure 2)

We recommend value of capacitor greater than 1 μF .

Also transitional popping noise can be reduced sharply by muting before V_{CC} and Standby are ON/OFF.

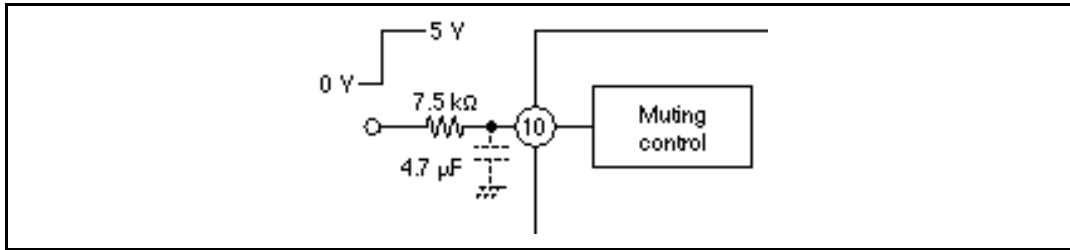


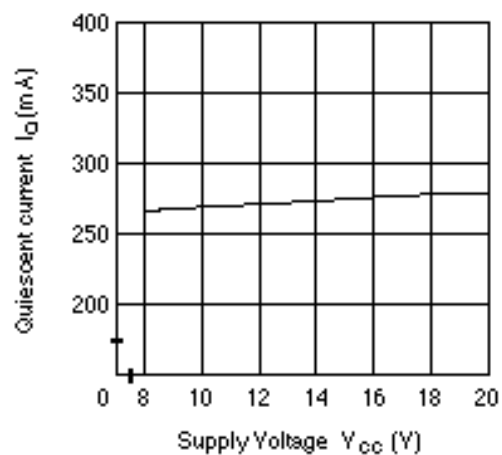
Figure 2 How to use Muting Circuit

Table 1 Muting ON/OFF Time

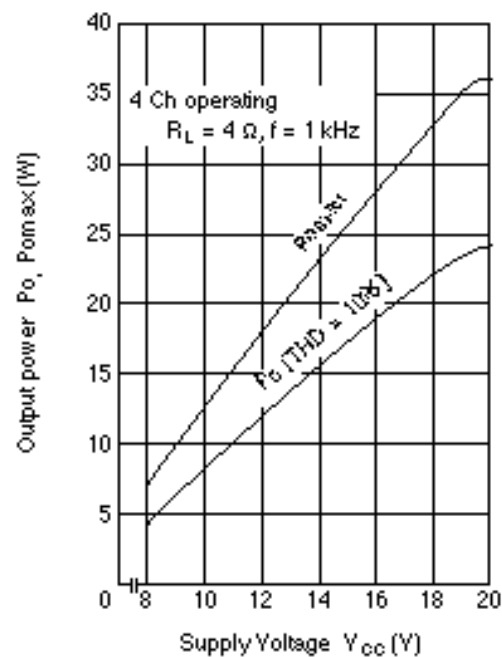
C (μF)	ON Time	OFF Time
nothing	under 1 μs	under 1 μs
0.47	2 ms	2 ms
4.7	19 ms	19 ms

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Quiescent Current vs. Supply Voltage (HA13151)

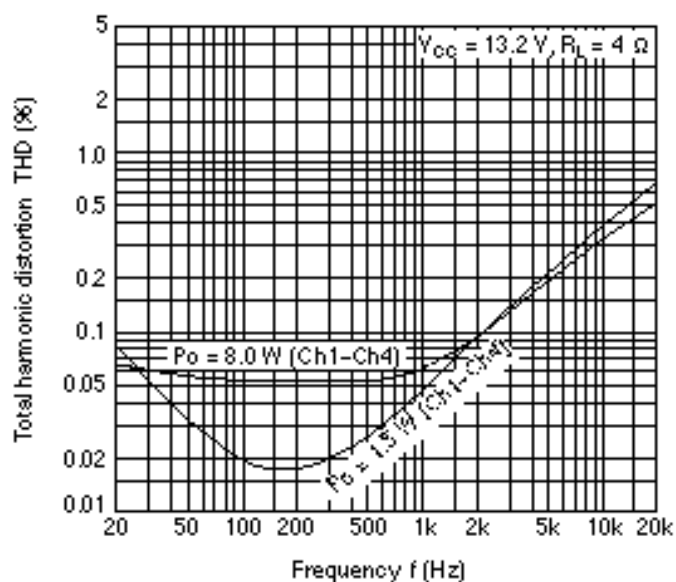


Output Power vs. Supply Voltage (HA13151)

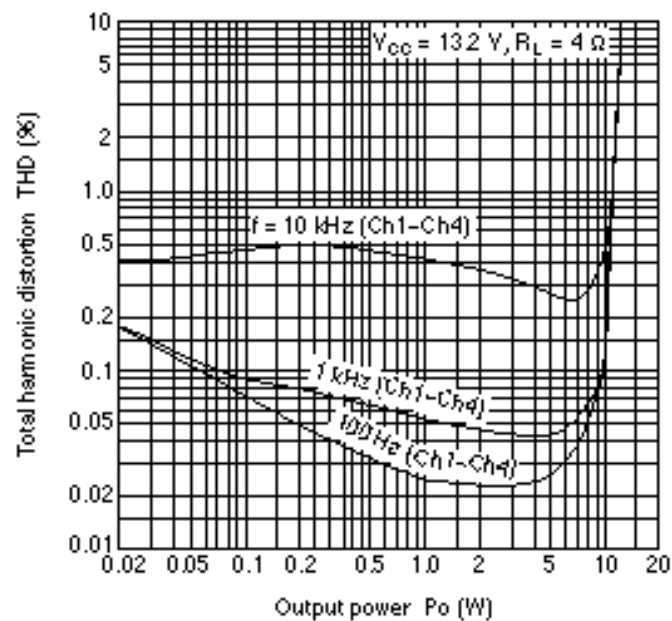


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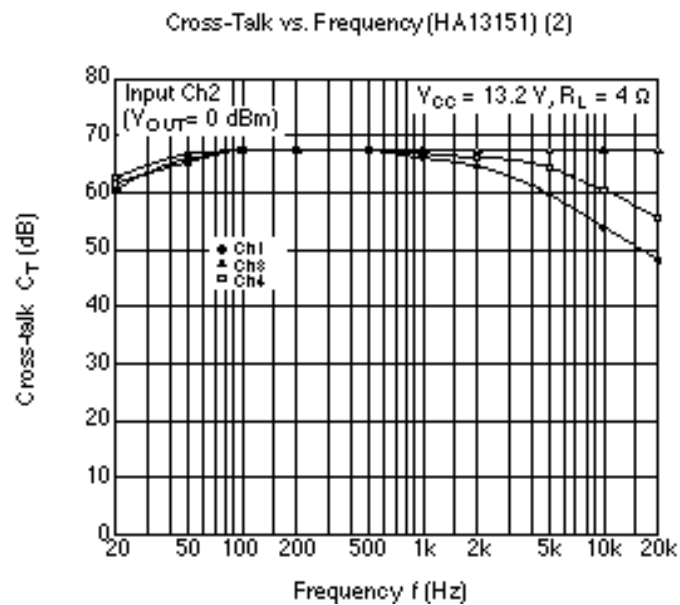
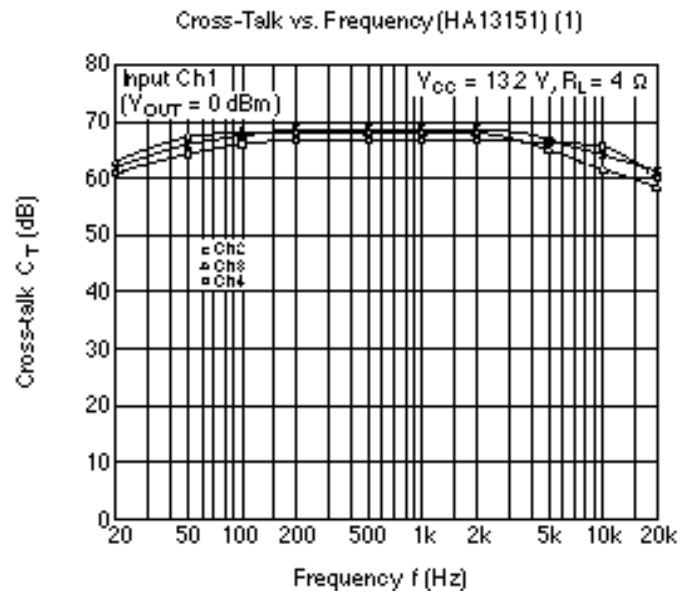
Total Harmonic Distortion vs. Frequency (HA13151)



Total Harmonic Distortion vs. Output Power (HA13151)

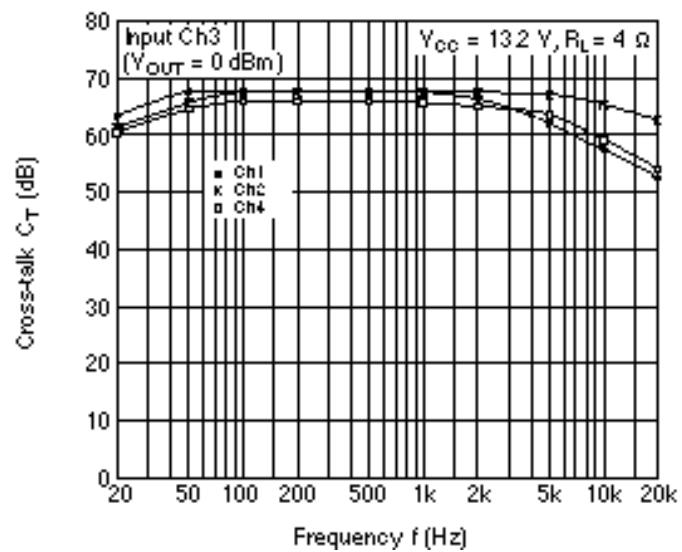


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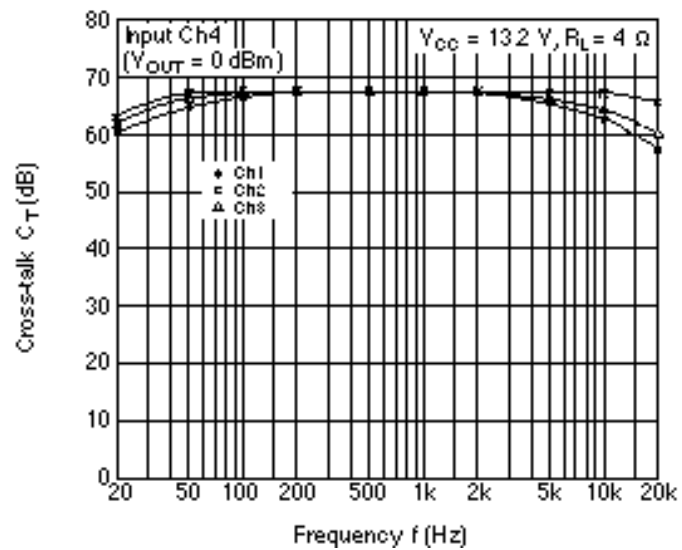


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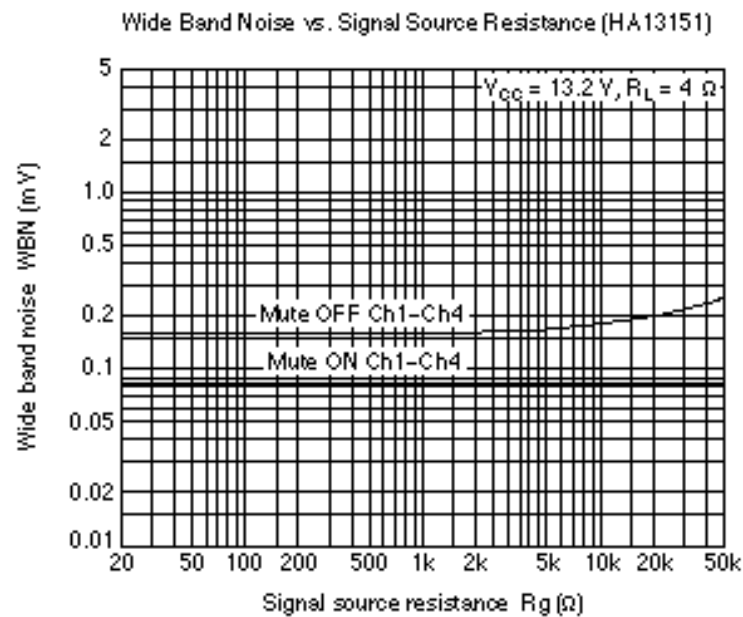
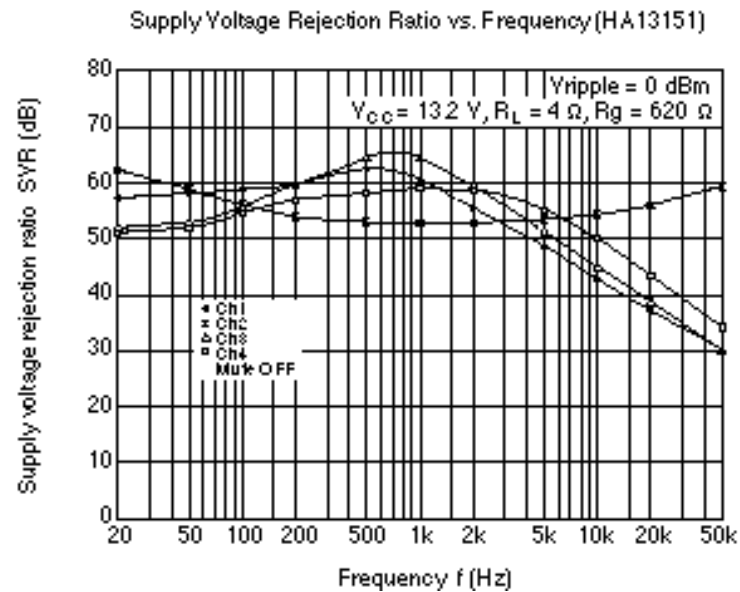
Cross-Talk vs. Frequency(HA13151) (3)



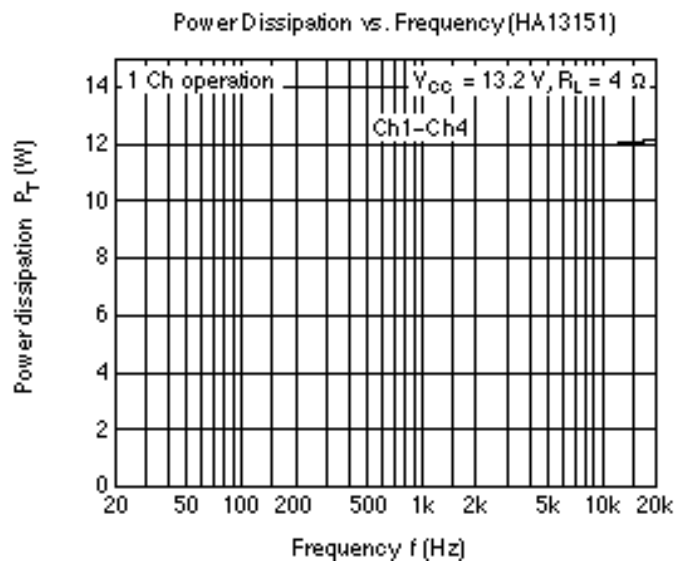
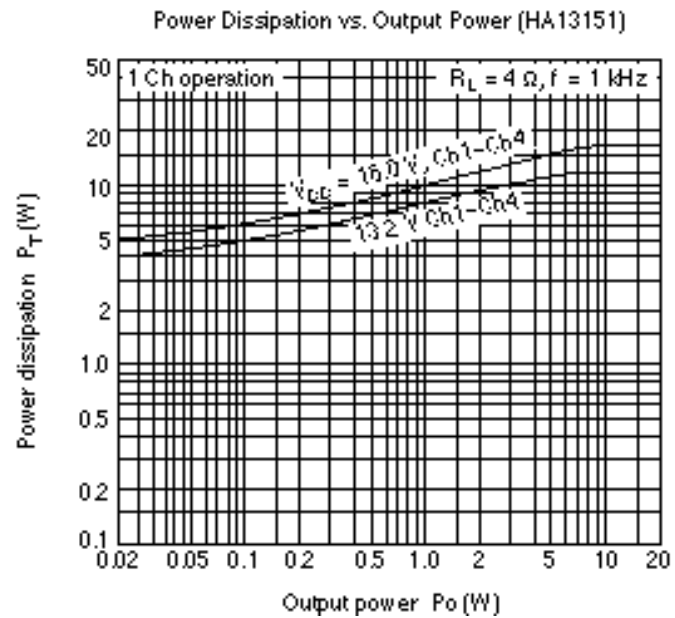
Cross-Talk vs. Frequency(HA13151) (4)



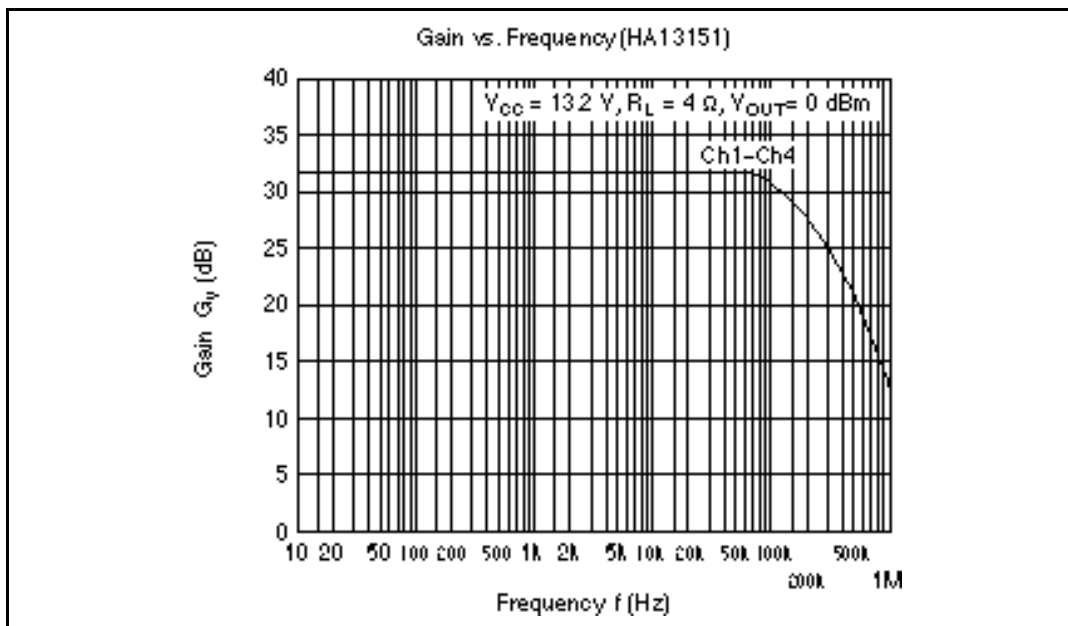
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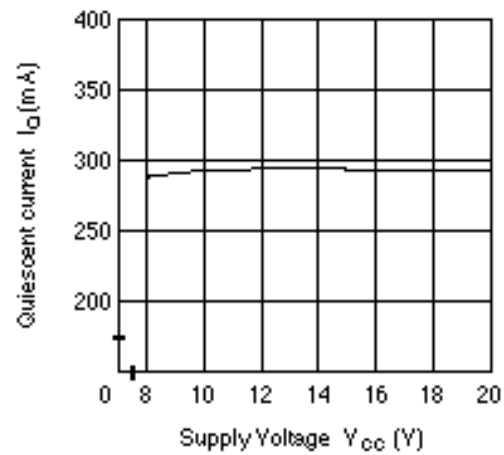


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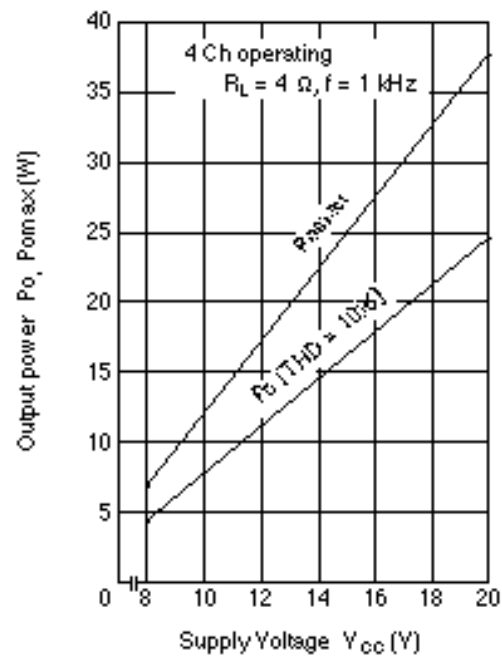


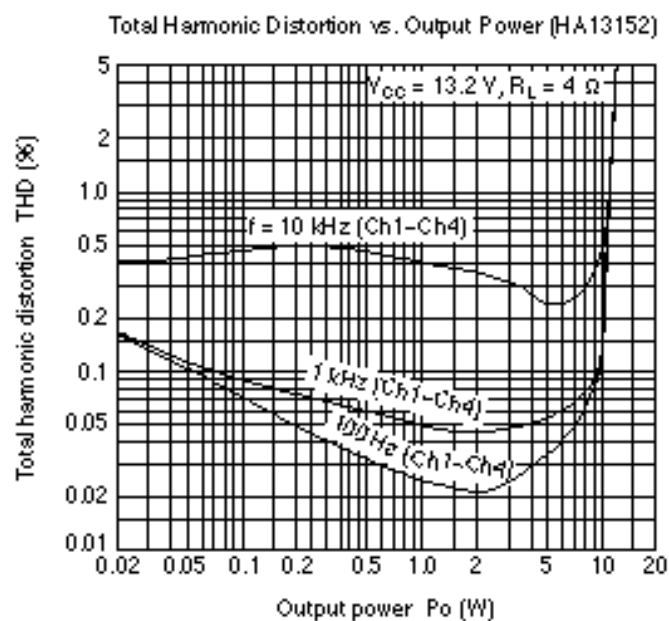
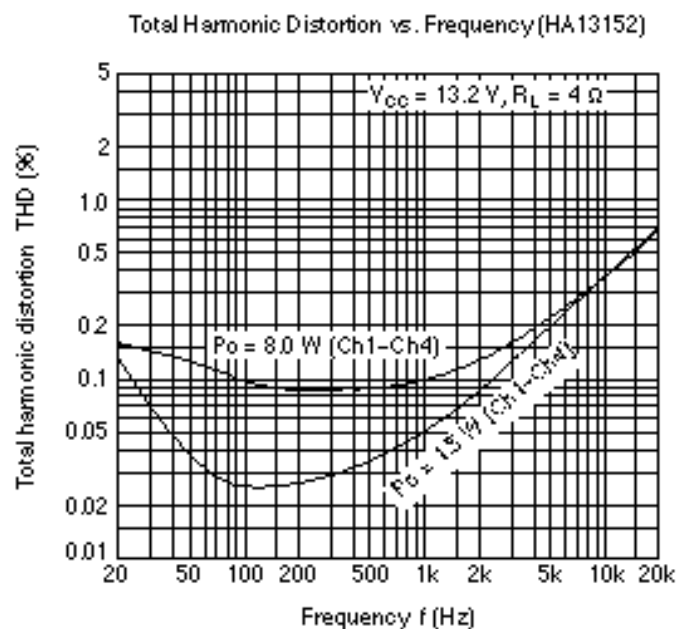
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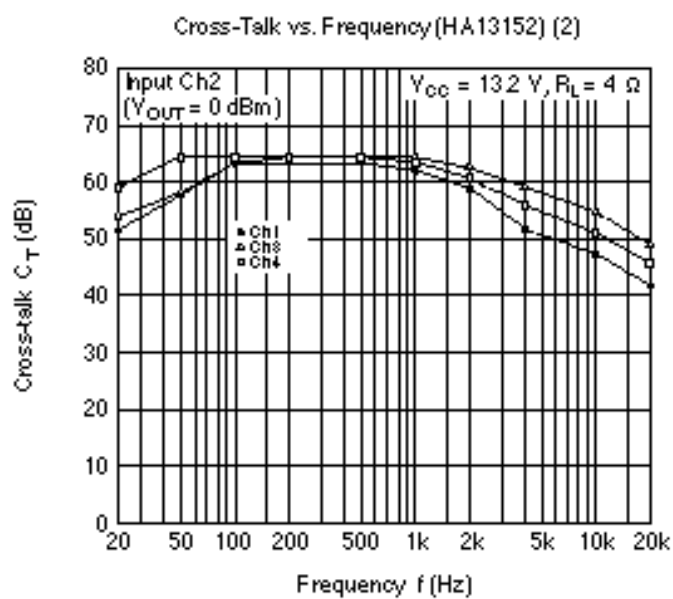
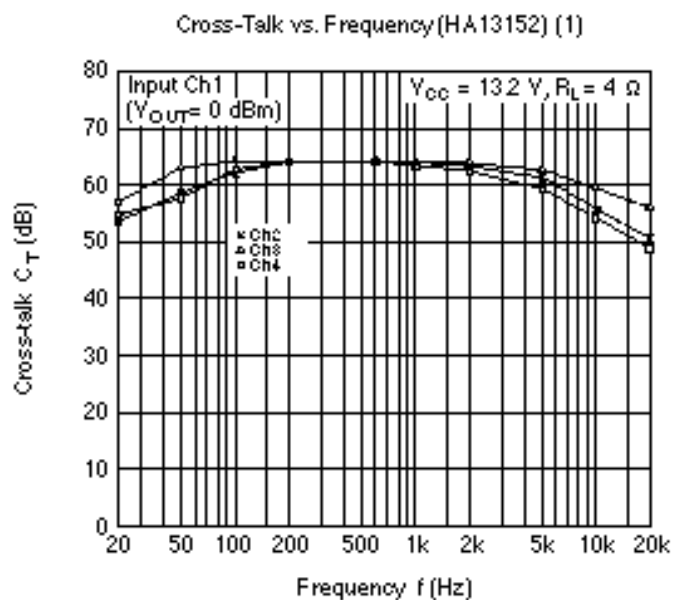
Quiescent Current vs. Supply Voltage (HA13152)



Output Power vs. Supply Voltage (HA13152)

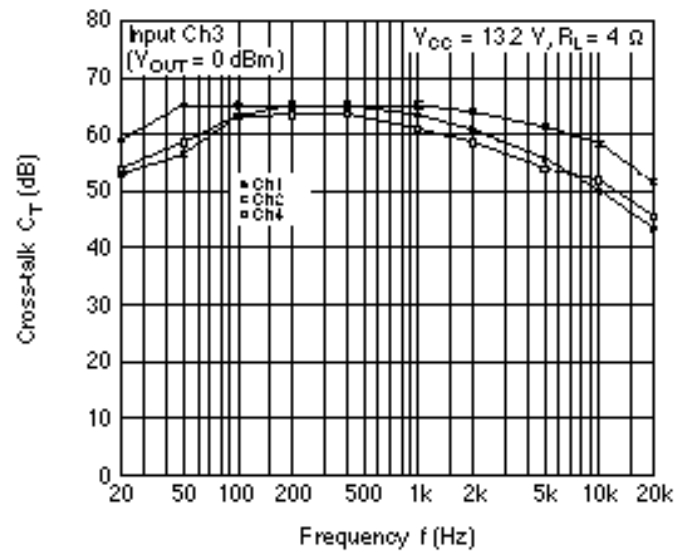




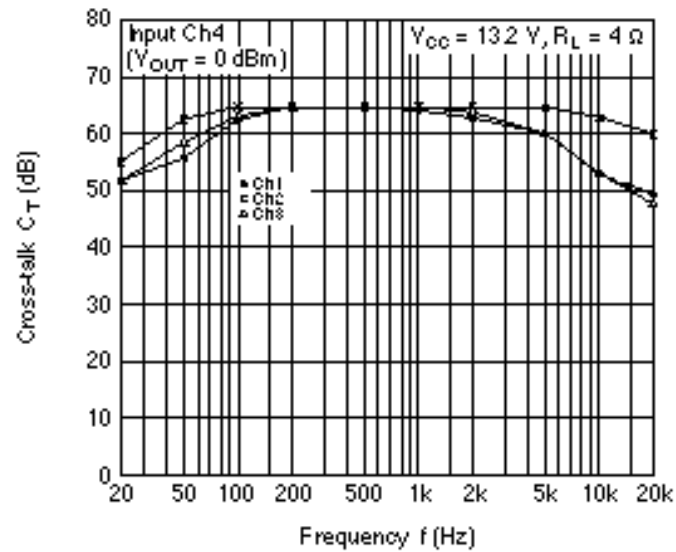


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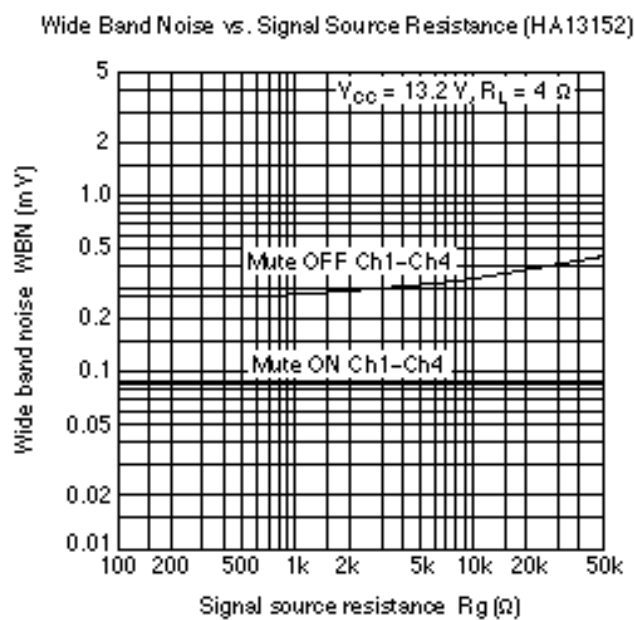
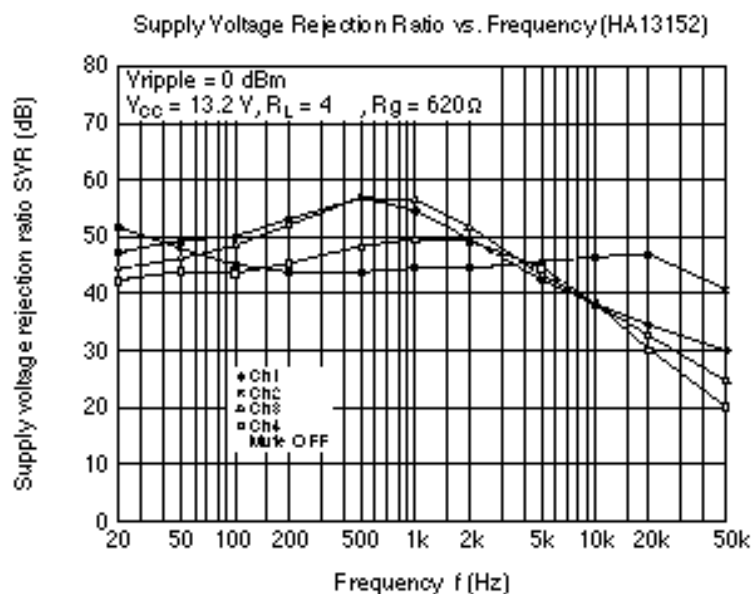
Cross-Talk vs. Frequency (HA13152) (3)



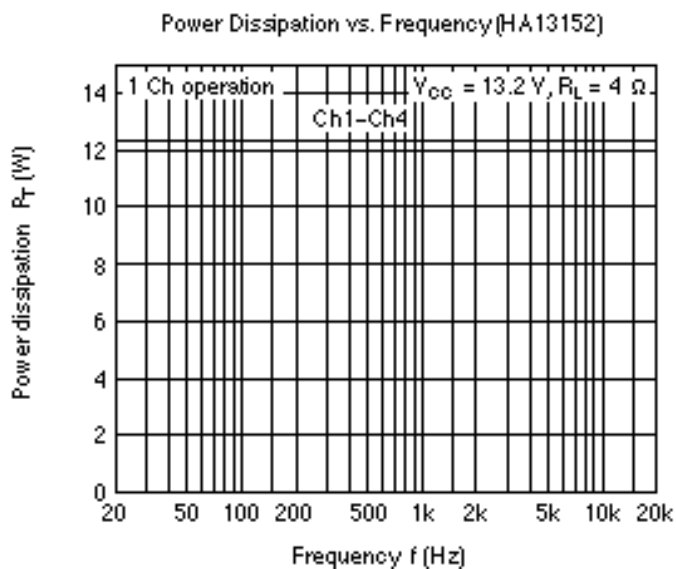
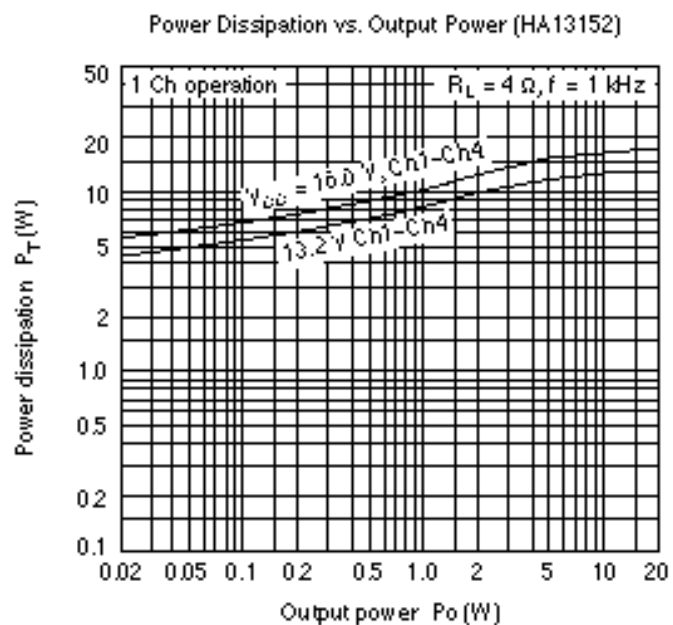
Cross-Talk vs. Frequency (HA13152) (4)



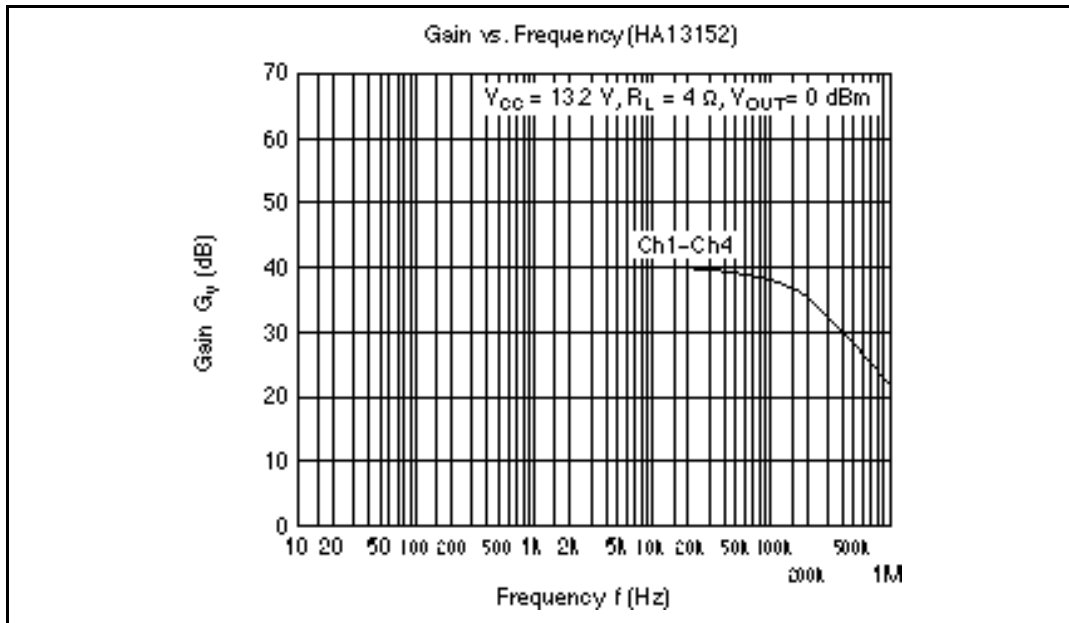
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Hitachi, Ltd.

Semiconductor & IC Div.
Nippon Bldg., 2-5-2, Ohite-machi, Chiyoda-ku, Tokyo 100, Japan
Tel Tokyo (03) 3270-2111
Fax: (03) 3270-5109

For further information write to:

Hitachi America, Ltd.
Semiconductor & IC Div.
2000 Sierra Point Parkway
Briarcliff, CA. 94005-1835
U.S.A.
Tel 415-589-8300
Fax 415-589-4207

Hitachi Europe GmbH
Electronic Components Group
Continental Europe
Dornacher Straße 3
D-85622 Feldkirchen
München
Tel 089-9 24 80-0
Fax 089-9 29 30 00

Hitachi Europe Ltd.
Electronic Components Div.
Northern Europe Headquarters
Whitebrook Park
Lower Cookham Road
Maidenhead
Berkshire SL6 8YA
United Kingdom
Tel 0628-585000
Fax 0628-778322

Hitachi Asia Pte. Ltd.
45 Collyer Quay #20-00
Hitachi Tower
Singapore 0404
Tel 535-2400
Fax 535-1533

Hitachi Asia (Hong Kong) Ltd.
Unit 705, North Tower,
World Finance Centre
Harbour City, Canton Road
Tsim Sha Tsui, Kowloon
Hong Kong
Tel 27359218
Fax 27308074

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