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# HA13159

37 W × 4-Channel BTL Power IC

# HITACHI

ADE-207-264A (Z)

2nd Edition  
Jul. 1999

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## Description

The HA13159 is four-channel BTL amplifier IC designed for car audio, featuring high output and low distortion, and applicable to digital audio equipment. It provides 37 W output per channel, with a 13.7 V power supply and at Max distortion.

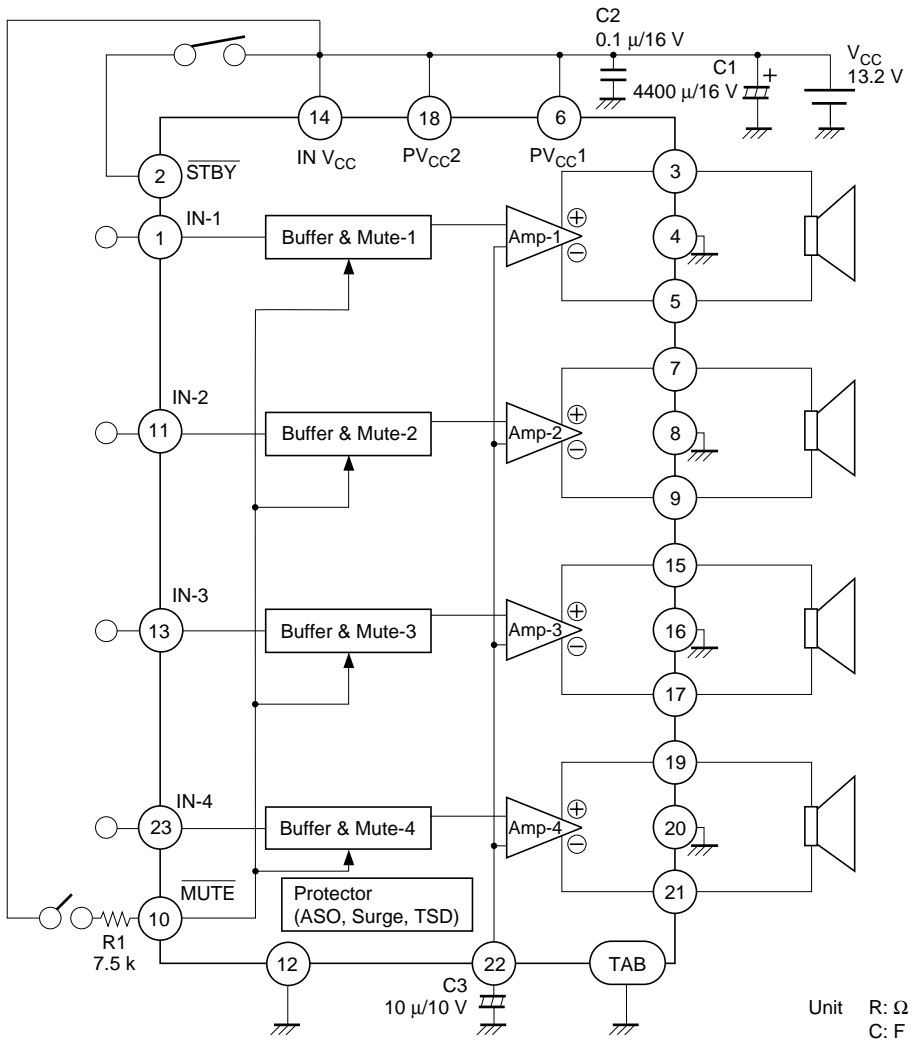
## Functions

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

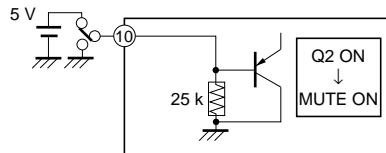
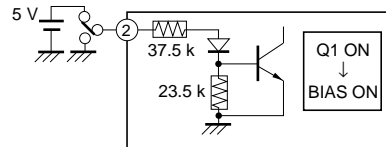
## Features

- Low power dissipation
- Soft thermal limiter
- Requires few external parts (C:3, R:1)
- Popping noise minimized
- Low output noise
- Built-in high reliability protection circuit
- Pin to pin with HA13153A/HA13154A/HA13155/HA13157/HA13158/HA13158A

## Block Diagram



- Notes:
- Standby**  
Power is turned on when a signal of 3.5 V or 0.05 mA is impressed at pin 2. When pin 2 is open or connected to GND, standby is turned on (output off).
  - Muting**  
Muting is turned off (output on) when a signal of 3.5 V or 0.2 mA is impressed at pin 10. When pin 10 is open or connected to GND, muting is turned on (output off).
  - TAB** (header of IC) connected to GND.

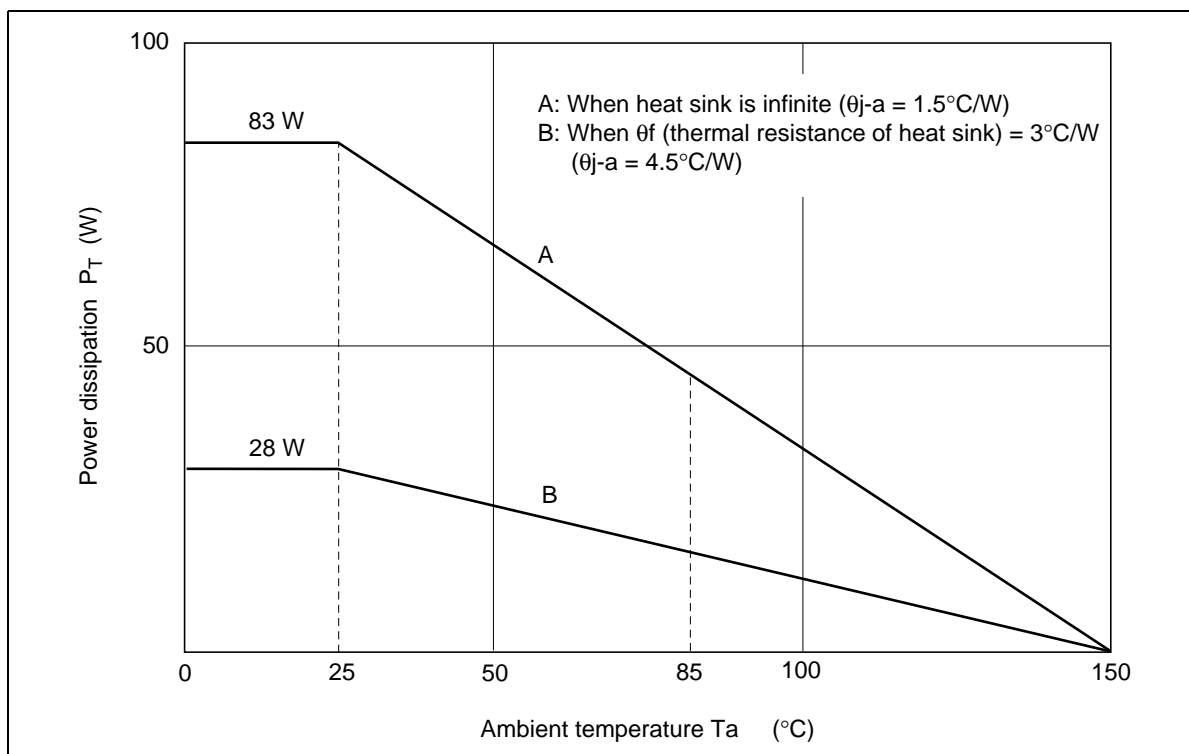


Unit R: Ω  
C: F

**Absolute Maximum Ratings**

Item	Symbol	Rating	Unit
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)	4	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

- Note:
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  $T_a = 25\text{ °C}$ .  
The derating curve is as shown in the graph below.



# HA13159

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

Item	Symbol	Min	Typ	Max	Unit	Test Conditions
Quiescent current	$I_{Q1}$	—	220	—	mA	$V_{in} = 0$
Output offset voltage	$\Delta V_Q$	-180	0	+180	mV	
Gain	$G_V$	30.5	32	33.5	dB	
Gain difference between channels	$\Delta G_V$	-1.0	0	+1.0	dB	
Rated output power	$P_O$	—	22	—	W	$V_{CC} = 13.2\text{ V}$ , THD = 10%, $R_L = 4\ \Omega$
Max output power	$P_{OMAX}$	—	37	—	W	$V_{CC} = 13.7\text{ V}$ , $R_L = 4\ \Omega$
Total harmonic distortion	T.H.D.	—	0.03	—	%	$P_o = 3\text{ W}$
Output noise voltage	WBN	—	0.15	—	mVrms	$R_g = 0\ \Omega$ , BW = 20 to 20 kHz
Ripple rejection	SVR	—	55	—	dB	$f = 120\text{ Hz}$
Channel cross talk	C.T.	—	70	—	dB	$V_{out} = 0\text{ dBm}$
Input impedance	$R_{in}$	—	25	—	k $\Omega$	
Standby current	$I_{O2}$	—	—	10	$\mu\text{A}$	
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	$V_{out} = 0\text{ dBm}$

Pin Explanation

Pin No.	Symbol	Functions	Input Impedance	DC Voltage	Equivalence Circuit
1	IN1	CH1 INPUT	25 kΩ (Typ)	0 V	
11	IN2	CH2 INPUT			
13	IN3	CH3 INPUT			
23	IN4	CH4 INPUT			
2	STBY	Standby control	90 kΩ (at Trs. cutoff)	—	
3	OUT1 (+)	CH1 OUTPUT	—	V <sub>cc</sub> /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 kΩ (Typ)	—	
22	RIPPLE	Bias stability	—	V <sub>cc</sub> /2	

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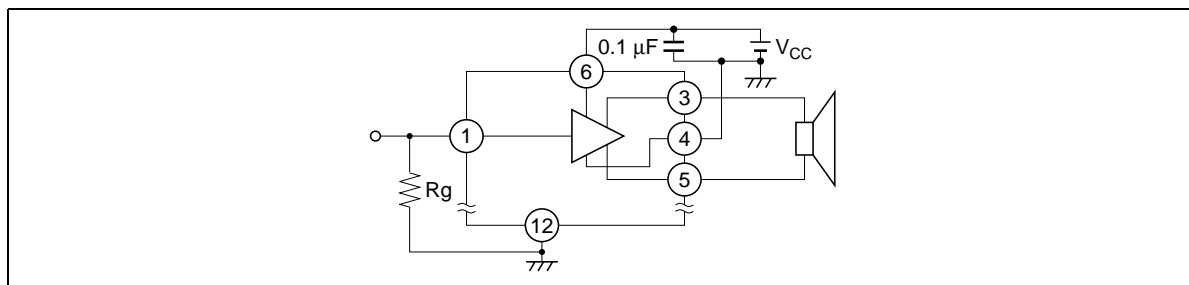
## Pin Explanation (cont)

Pin No.	Symbol	Functions	Input Impedance	DC Voltage	Equivalence Circuit
6	PV <sub>cc1</sub>	Power of output stage	—	V <sub>cc</sub>	—
18	PV <sub>cc2</sub>				
14	INV <sub>cc</sub>	Power of input stage	—	V <sub>cc</sub>	—
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	—	—	—

## 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.
- 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**

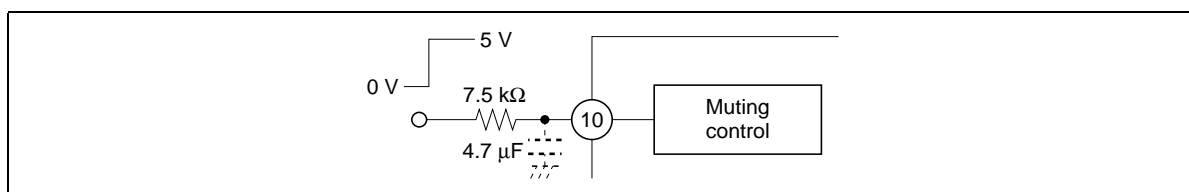
### 2. How to Reduce the Popping Noise by Muting Circuit

At normal operating circuit, Muting circuit operates at high speed under  $1 \mu\text{s}$ .

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  $1 \mu\text{F}$ .

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

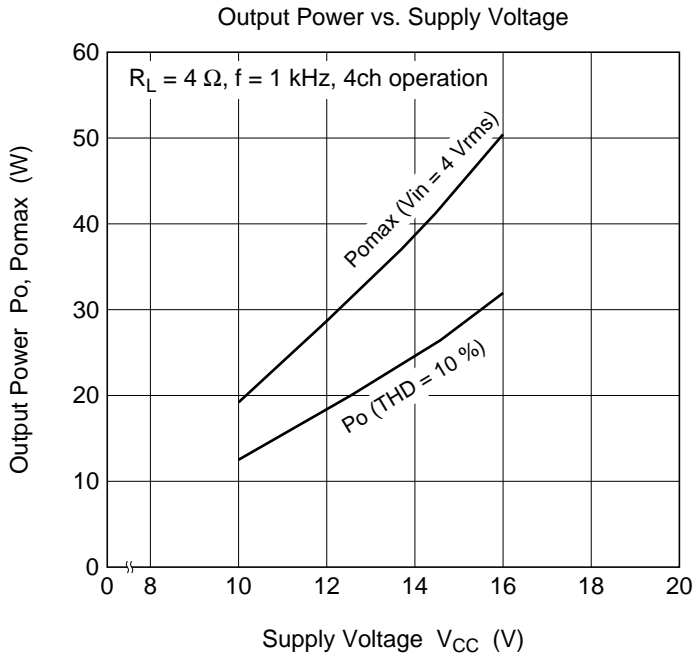
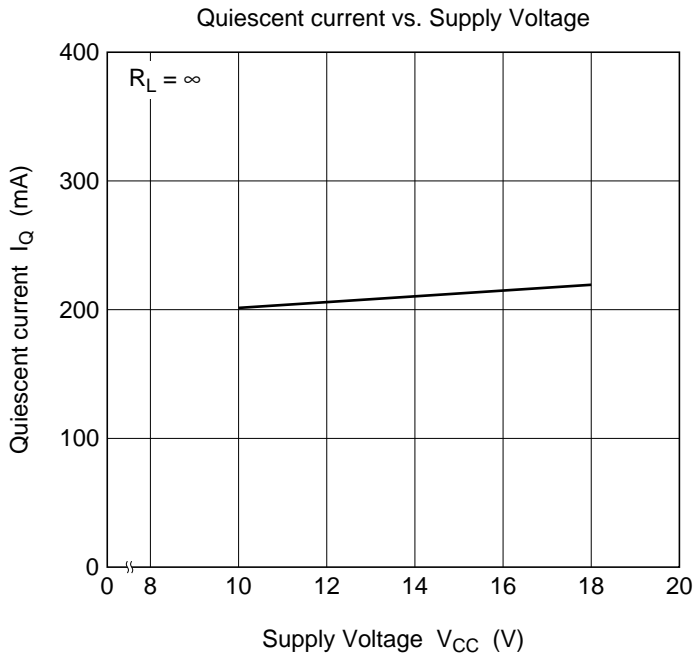


**Figure 2 How to use Muting Circuit**

**Table 1 Muting ON/OFF Time**

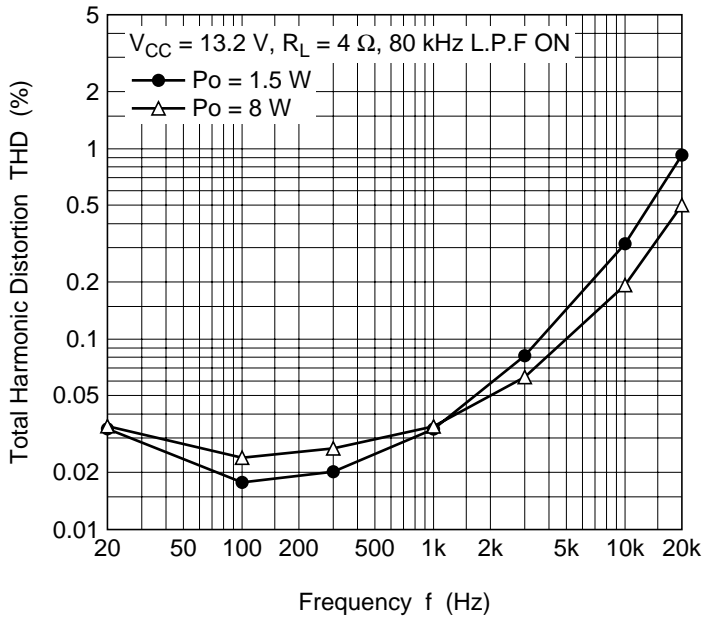
C ( $\mu\text{F}$ )	ON Time	OFF Time
nothing	under $1 \mu\text{s}$	under $1 \mu\text{s}$
0.47	2 ms	2 ms
4.7	19 ms	19 ms

## Characteristic Curves

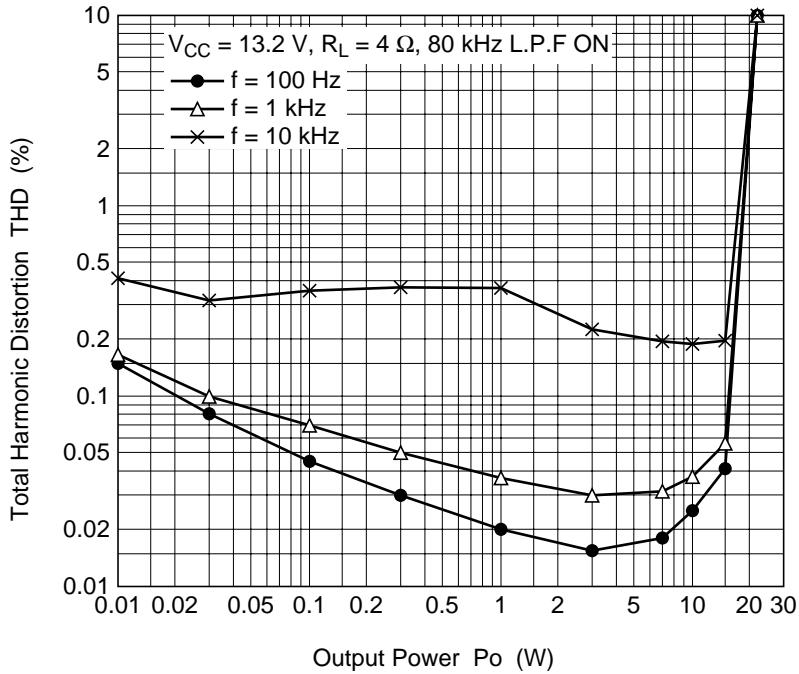


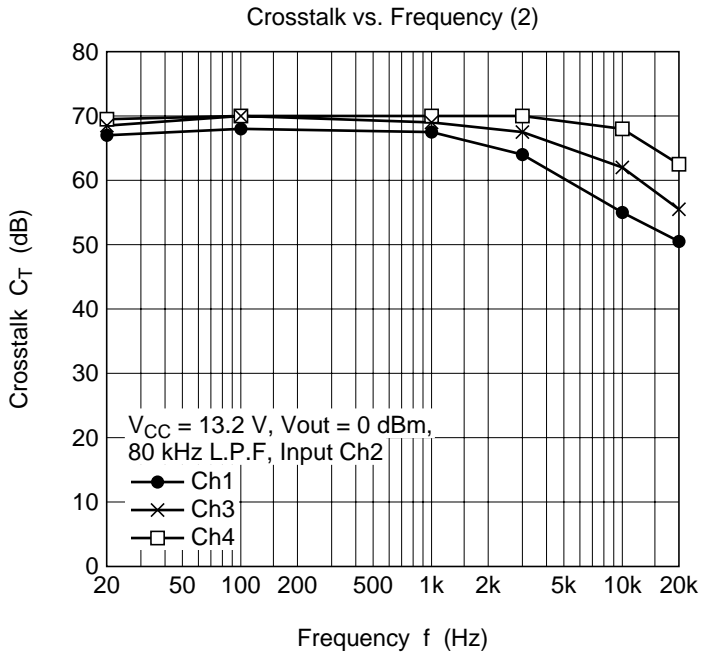
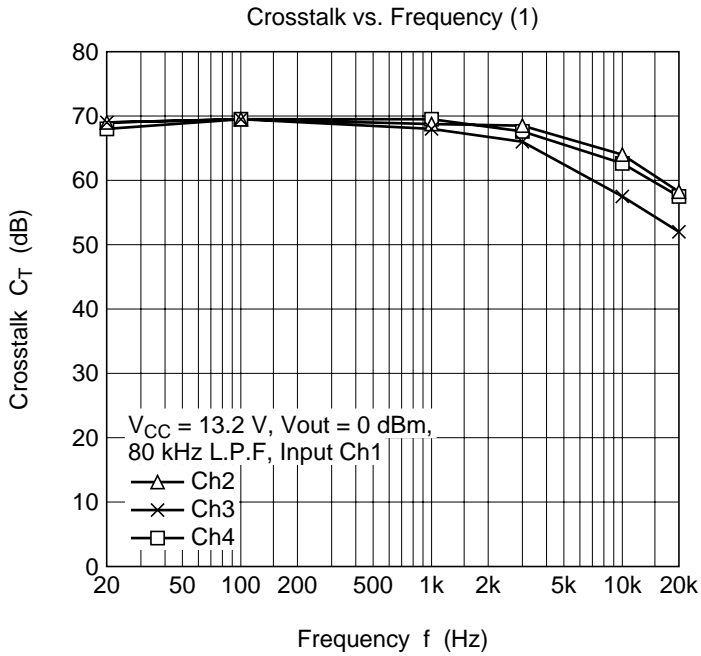


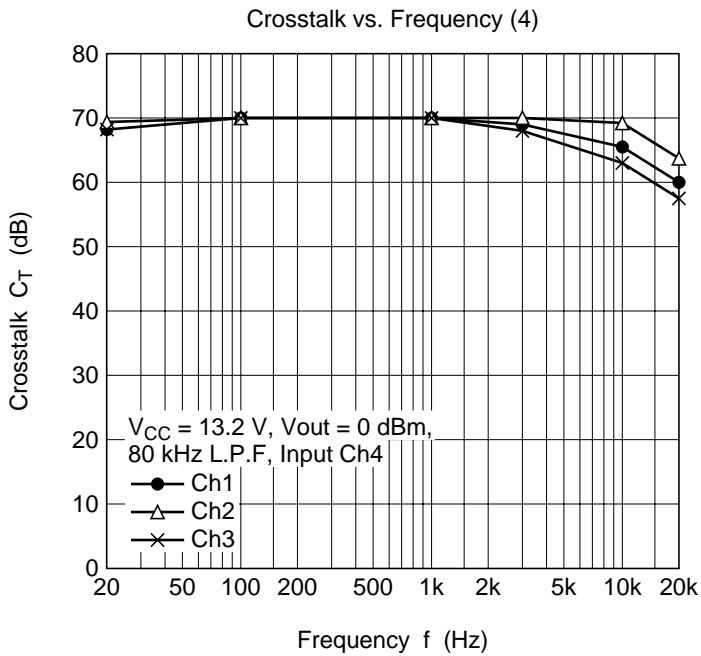
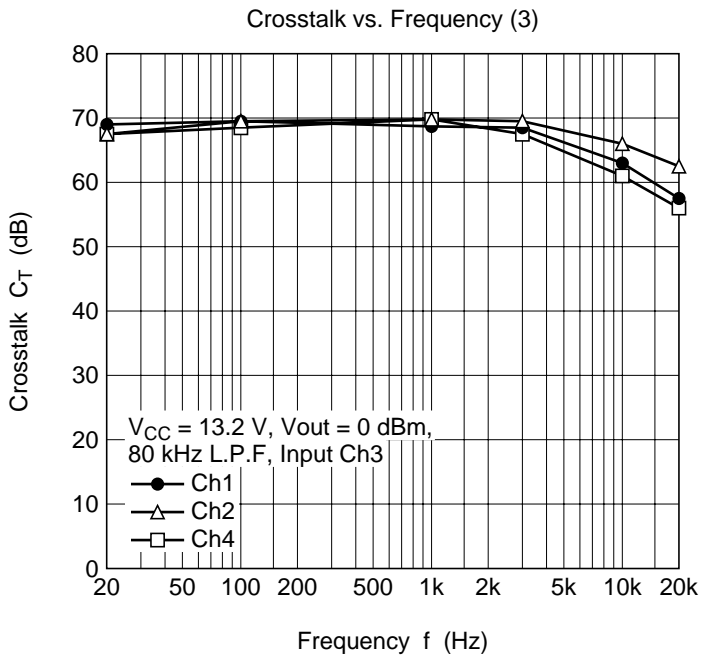
Total Harmonic Distortion vs. Frequency

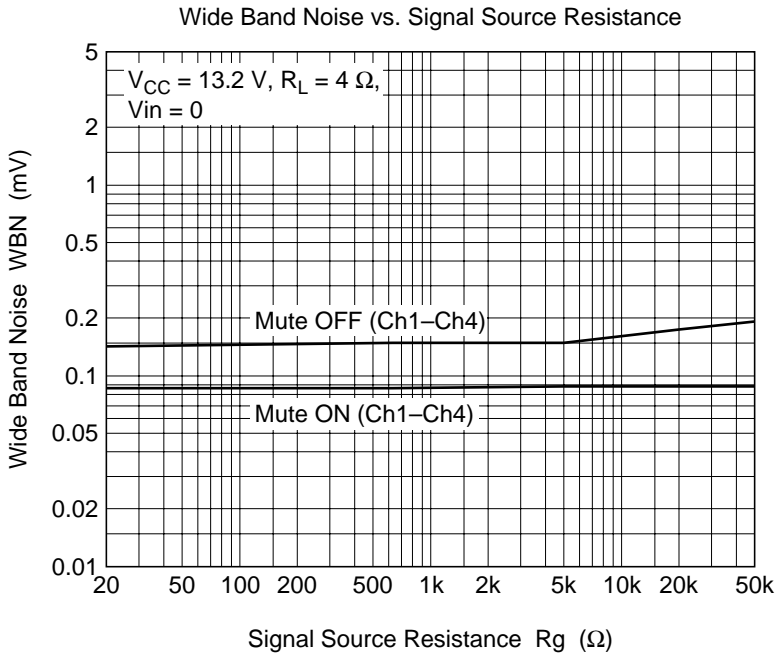
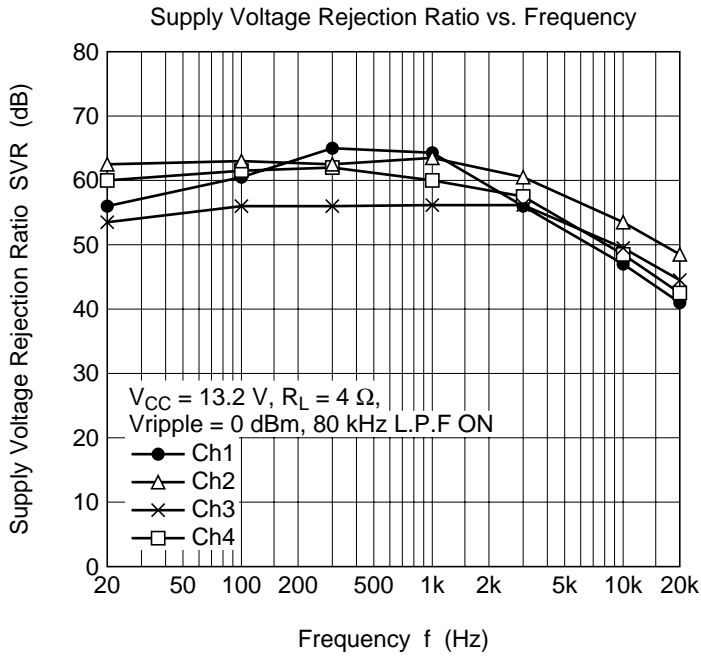


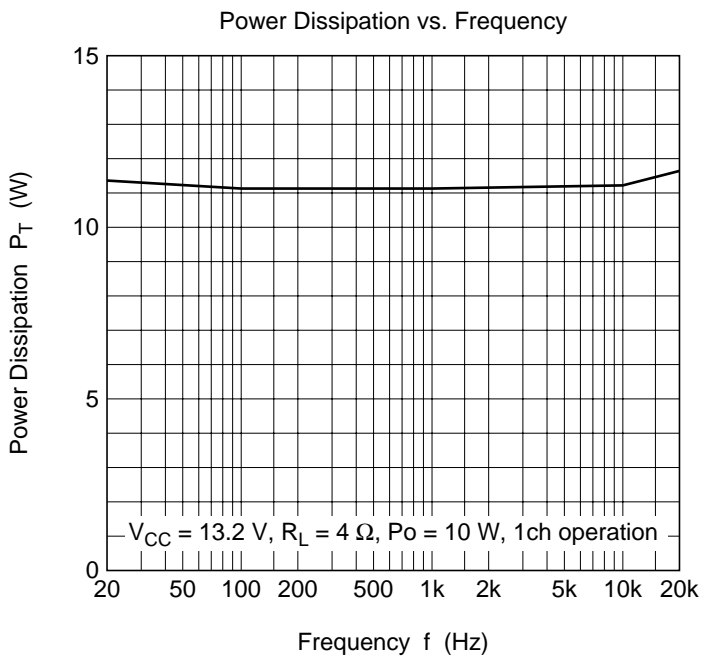
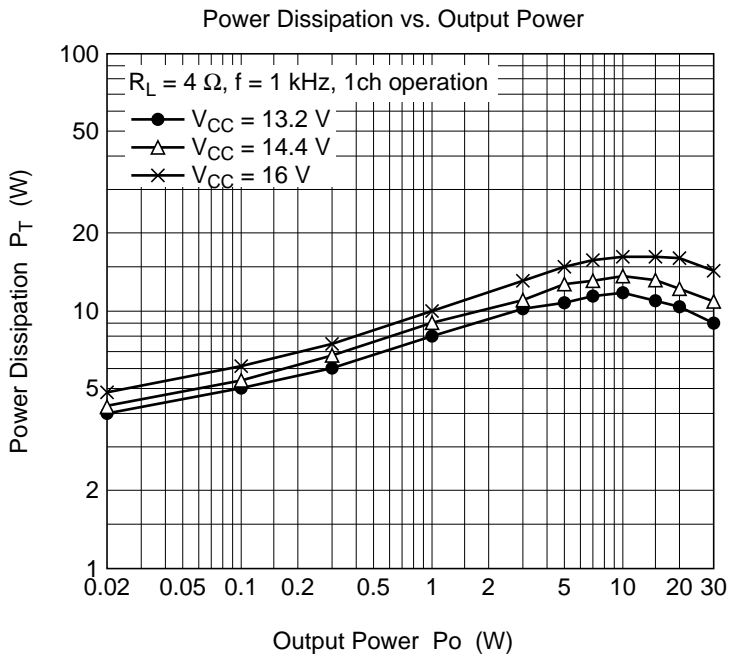
Total Harmonic Distortion vs. Output Power







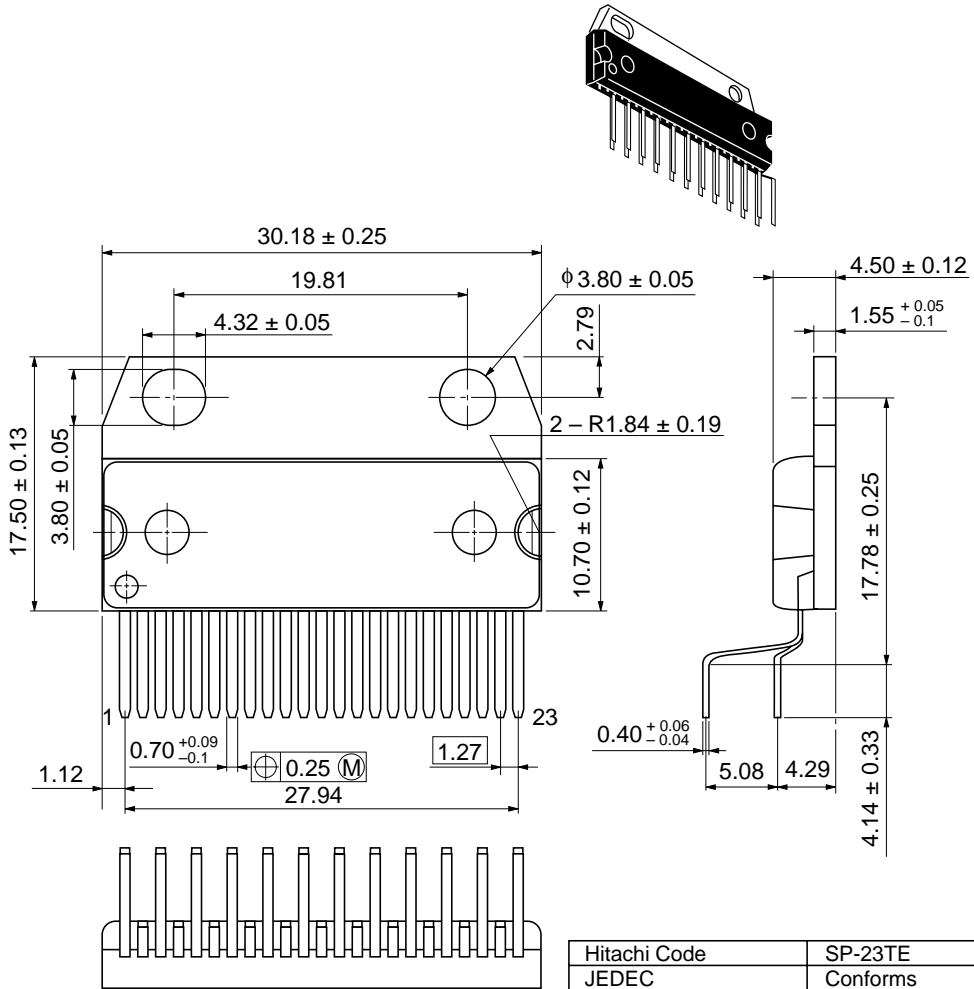




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## Package Dimensions

Unit: mm



Hitachi Code	SP-23TE
JEDEC	Conforms
EIAJ	—
Weight (reference value)	8.5 g

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