TOSHIBA Bipolar Linear Integrated Circuit Silicon Monolithic

TA8276H

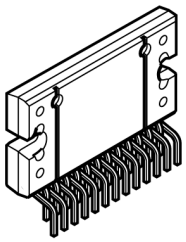
Max Power 35 W BTL × 4 ch Audio Power IC

The TA8276H is 4 ch BTL audio power amplifier for car audio application.

This IC can generate more high power: $P_{OUT}MAX$ = 35 W as it is included the pure complementary PNP and NPN transistor output stage.

It is designed low distortion ratio for 4 ch BTL audio power amplifier, built-in stand-by function, muting function, output clipping detection and diagnosis circuit which can detect output to V_{CC}/GND short and over voltage input mode.

Additionally, the AUX amplifier and various kind of protector for car audio use are built-in.



HZIP25-P-1.00F

Weight: 7.7 g (typ.)

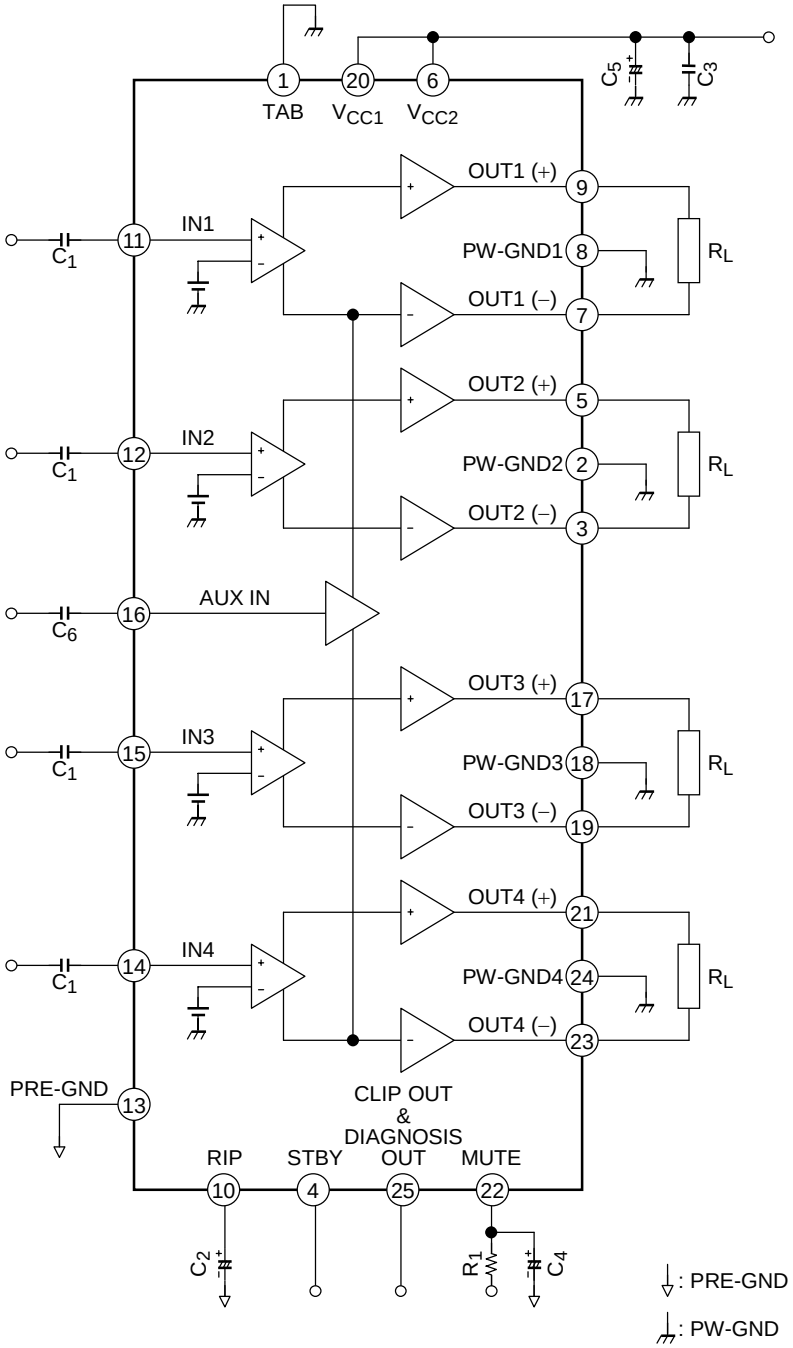
Features

- High power: $P_{OUT}MAX$ (1) = 35 W (typ.)
  (V_{CC} = 14.4 V, f = 1 kHz, JEITA max, R_L = 4 Ω)
  : $P_{OUT}MAX$ (2) = 31 W (typ.)
  (V_{CC} = 13.7 V, f = 1 kHz, JEITA max, R_L = 4 Ω)
  : P_{OUT} (1) = 23 W (typ.)
  (V_{CC} = 14.4 V, f = 1 kHz, THD = 10%, R_L = 4 Ω)
  : P_{OUT} (2) = 20 W (typ.)
  (V_{CC} = 13.2 V, f = 1 kHz, THD = 10%, R_L = 4 Ω)
- Built-in output clipping detection and diagnosis circuit (pin 25)
- Low distortion ratio: THD = 0.02% (typ.)
  (V_{CC} = 13.2 V, f = 1 kHz, P_{OUT} = 5 W, R_L = 4 Ω)
- Low noise: V_{NO} = 0.10 mVrms (typ.)

1. (V_{CC} = 13.2 V, R_g = 0 Ω, G_V = 26 dB, BW = 20 Hz~20 kHz)

- Built-in stand-by switch (pin 4)
- Built-in muting function (pin 22)
- Built-in AUX amplifier from single input to 2 channels output (pin 16)
- Built-in various protection circuit
  : Thermal shut down, over voltage, out to GND, out to V_{CC}, out to out short, speaker burned
- Operating supply voltage: $V_{CC\ (opr)}$ = 9~18 V

Block Diagram



Caution and Application Method

(Description is made only on the single channel.)

1. Voltage Gain Adjustment

This IC has no NF (negative feedback) terminals. Therefore, the voltage gain can't adjusted, but it makes the device a space and total costs saver.

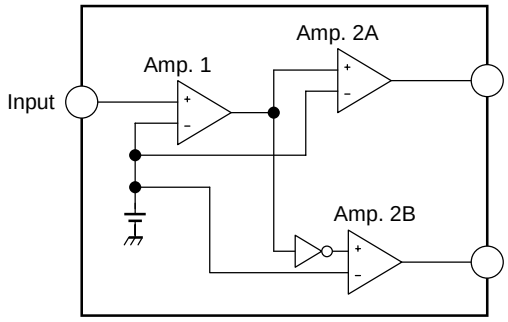


Figure 1 Block Diagram

The voltage gain of Amp.1: G_{V1} = 0 dB
The voltage gain of Amp.2A, B: G_{V2} = 20 dB
The voltage gain of BLT Connection: $G_{V\ (BTL)}$ = 6 dB
Therefore, the total voltage gain is decided by expression below.
$G_V = G_{V1} + G_{V2} + G_{V\ (BTL)} = 0 + 20 + 6 = 26$ dB

2. Stand-by SW Function (pin 4)

By means of controlling pin 4 (stand-by terminal) to high and low, the power supply can be set to ON and OFF. The threshold voltage of pin 4 is set at about $3V_{BE}$ (typ.), and the power supply current is about 2 μA (typ.) at the stand-by state.

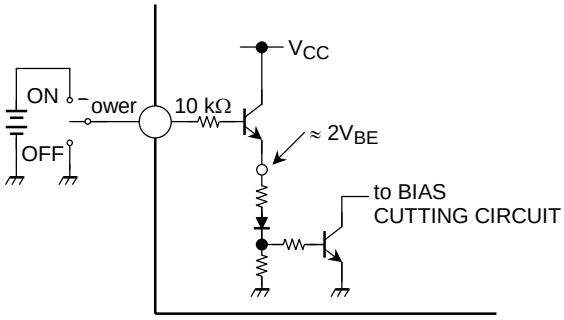


Figure 2 With pin 4 set to High, Power is turned ON

Control Voltage of pin 4: V_{SB}

Stand-by	Power	V_{SB} (V)
ON	OFF	0~1.5
OFF	ON	3~V_{CC}

Adjustage of Stand-by SW

(1) Since V_{CC} can directly be controlled to ON or OFF by the microcomputer, the switching relay can be omitted.
(2) Since the control current is microscopic, the switching relay of small current capacity is satisfactory for switching

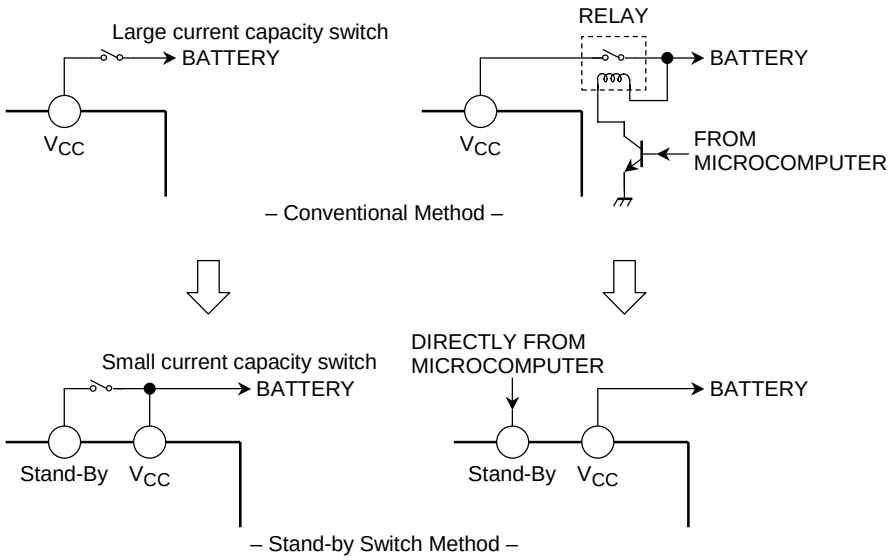
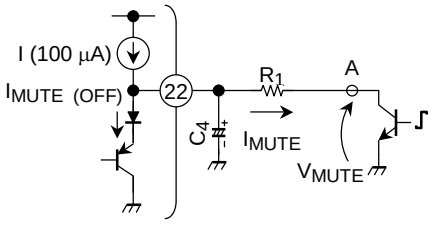


Figure 3

3. Muting Function (pin 22)

By means of controlling pin 22 less than 0.5 V, it can make the audio muting condition.
The muting time constant is decided by R_1 and C_4 and these parts is related the pop noise at power ON/OFF.
The series resistance; R1 must be set up less than 10 kΩ to get enough muting attenuation.
The muting function have to be controlled by a transistor, FET and μ-COM port which has I_{MUTE} > 250 μA ability.
Pin 22 terminal voltage has the temperature characteristics of 4.6 V (low temperature) to 3.2 V (high temperature).
Therefore, it is need to design with attention as using the microcontroller of which operating voltage is less than 5 V.
Terminal 22 may not be pulled up and shall be controlled by OPEN/LOW.
When it is obliged to do, it must be pulled up via diode, because it has to defend flowing reverse current to internal circuit of pin 22.

<Recommended Application>



<Application for pulled up>

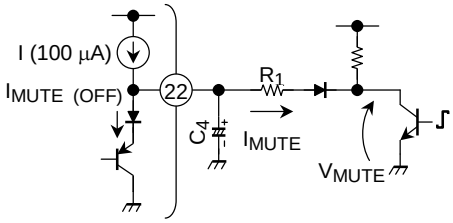


Figure 4 Muting Function

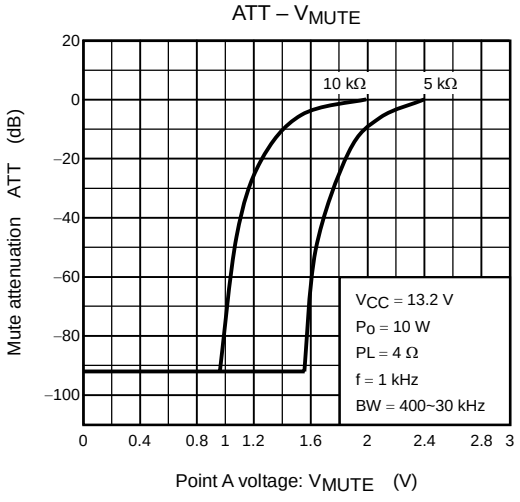


Figure 5 Mute Attenuation – V_{MUTE} (V)

4. AUX Input (pin 16)

The pin 16 is for input terminal of AUX amplifier.

The total gain is 0 dB by using of AUX amplifier.

Therefore, the μ-COM can directly drive the AUX amplifier.

BEEP sound or voice synthesizer signal can be input to pin 16 directly.

When AUX function is not used, this pin must be connected to PRE-GND (pin 13) via a capacitor.

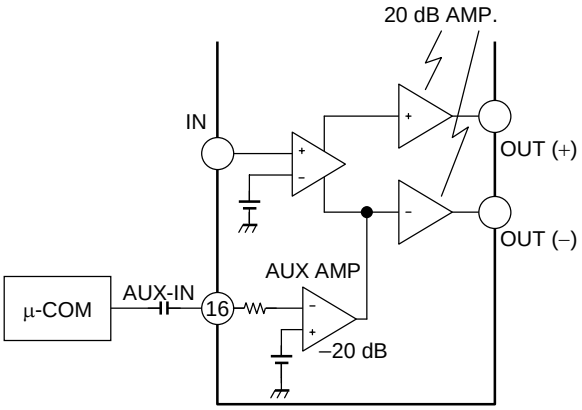
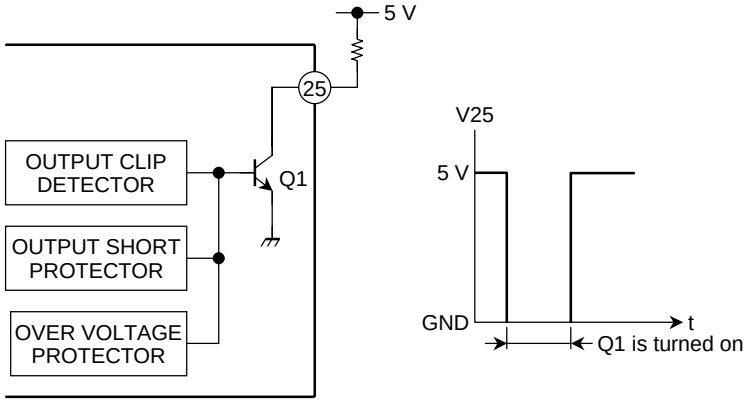


Figure 6 AUX Input

5. Diagnosis Output (pin 25)

This diagnosis output terminal of pin 25 has open collector output structure on chip as shown in Figure 7. In case diagnosis circuit that detect unusual case is operated, NPN Tr. (Q1) is turned on.
It is possible to protect all the system of apparatus as well as power IC protection.

In case of being unused this function, use this IC as open-connection on pin 25.



pin 25: Open collector output (active low)

Figure 7 Self Diagnosis Output

5.1 In Case of Shorting Output to V_{CC}/GND or Over Voltage Power Supplied

NPN Tr. (Q1) is turned on.

Threshold of over voltage protection: V_{CC} = 22 V (typ.)

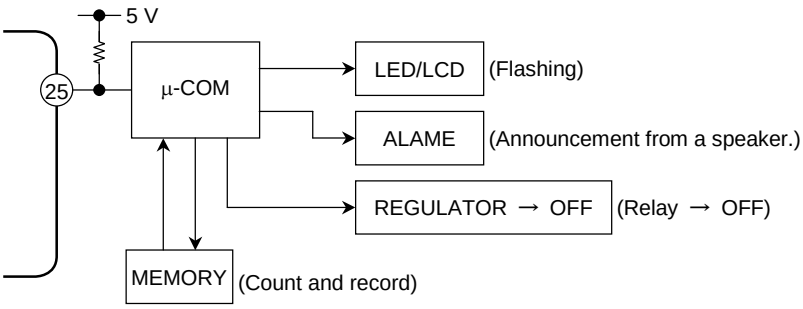


Figure 8 Application 1

5.2 In Case of Shorting Output to Output

NPN Tr. (Q1) is turned on and off in response to the input signal voltage.

5.3 Prevention of speaker burning accident (In Case of Rare Short Circuit of Speaker)

When the direct current resistance between OUT + and OUT – terminal becomes 1 Ω or less and output current over 4 A flows, this IC makes a protection circuit operate and suppresses the current into a speaker.

This system makes the burning accident of the speaker prevent as below mechanism.

<The guess mechanism of a burning accident of the speaker>

Abnormal output offset voltage (voltage between OUT + and OUT –) over 4 V is made by the external circuit failure.(Note 1)

↓

The speaker impedance becomes 1 Ω or less as it is in a rare short circuit condition.

↓

The current more than 4 A flows into the speaker and the speaker is burned.

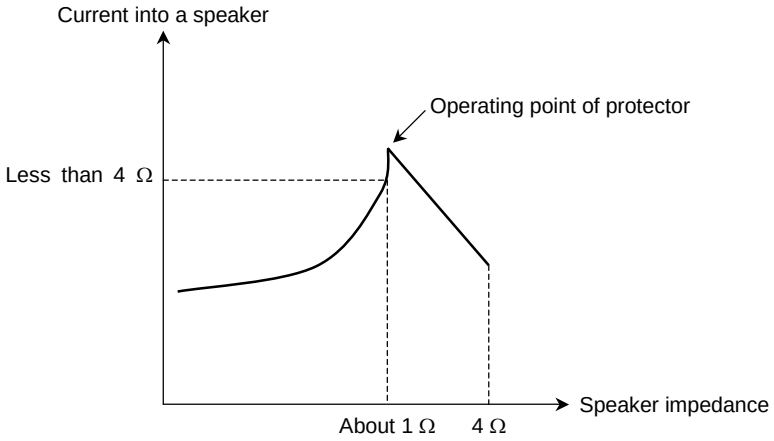


Figure 9

Note 1: It is appeared by biased input DC voltage
(for example, large leakage of the input capacitor, short-circuit between copper patterns of PCB.)

5.4 Applications

When output terminals short-circuit to V_{CC} or GND, the voltage of 25pin is fixed to "L".

And when shorting OUT + to OUT –, "L" and "H" are switched according to an input signal.

Therefore, it is possible to judge how the power IC condition is if a micro-controller detects the 25pin voltage that is smoothed out with LPF.

It is recommend that the threshold voltage (Vth) is set up as higher as possible because output level of LPF is changed according to an input signal.
(for example, Vth is set up to 4 V if 25pin is pulled up to 5 V line.)

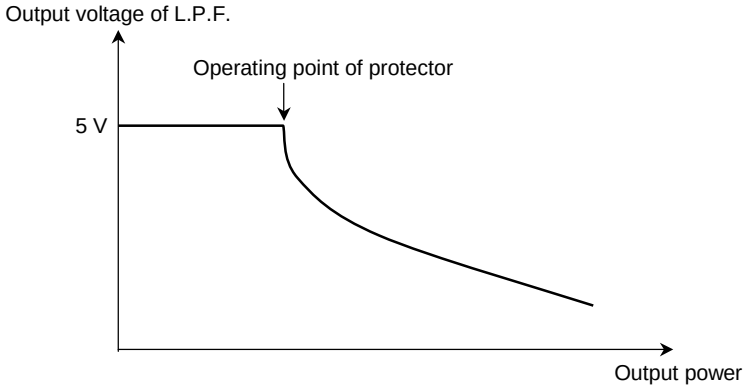


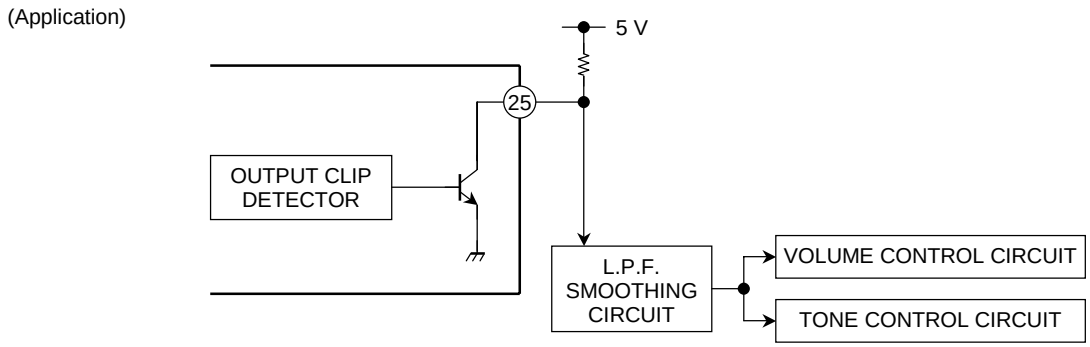
Figure 10

6. Output Clip Detection Function (pin 25)

The output clip detection terminal of pin 25 has the open collector output structure on chip as shown in Figure 11. In case that the output waveform is clipping, the clip detection circuit is operated and NPN Tr. is turned on.

It is possible to improve the audio quality with controlling the volume, tone control circuit through L.P.F. smoothing circuit as shown in Figure 11.

In case of being unused this function, use this IC as open connection on pin 25.



pin 25: Open collector output (active low)

Figure 11

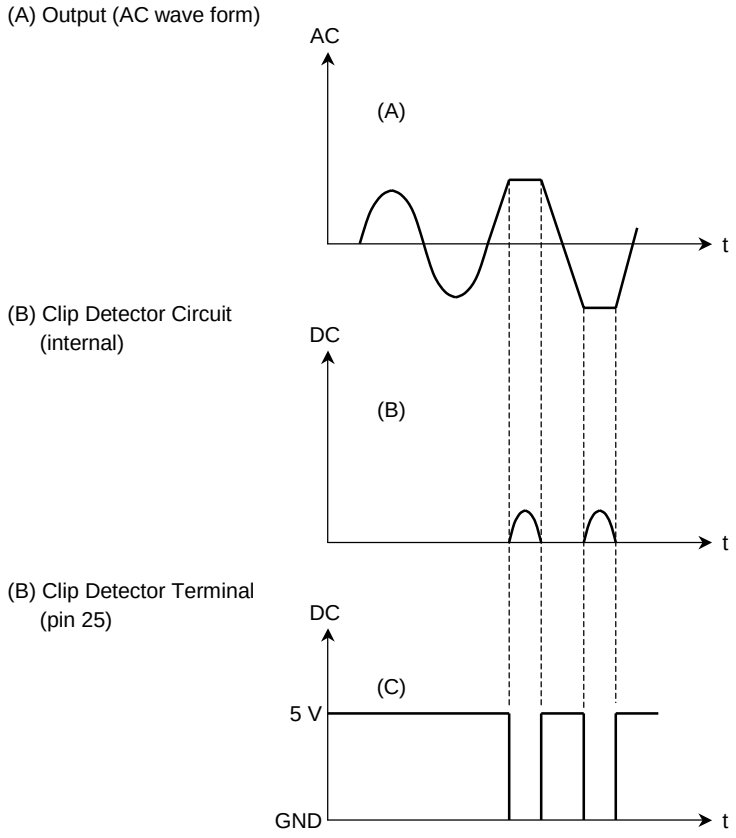


Figure 12 Clip Detection

Maximum Ratings (Ta = 25°C)

Characteristics	Symbol	Rating	Unit
Peak supply voltage (0.2 s)	$V_{CC\ (surge)}$	50	V
DC supply voltage	$V_{CC\ (DC)}$	25	V
Operation supply voltage	$V_{CC\ (opr)}$	18	V
Output current (peak)	$I_{O\ (peak)}$	9	A
Power dissipation	P_D (Note 1)	125	W
Operation temperature	T_{opr}	−40~85	°C
Storage temperature	T_{stg}	−55~150	°C

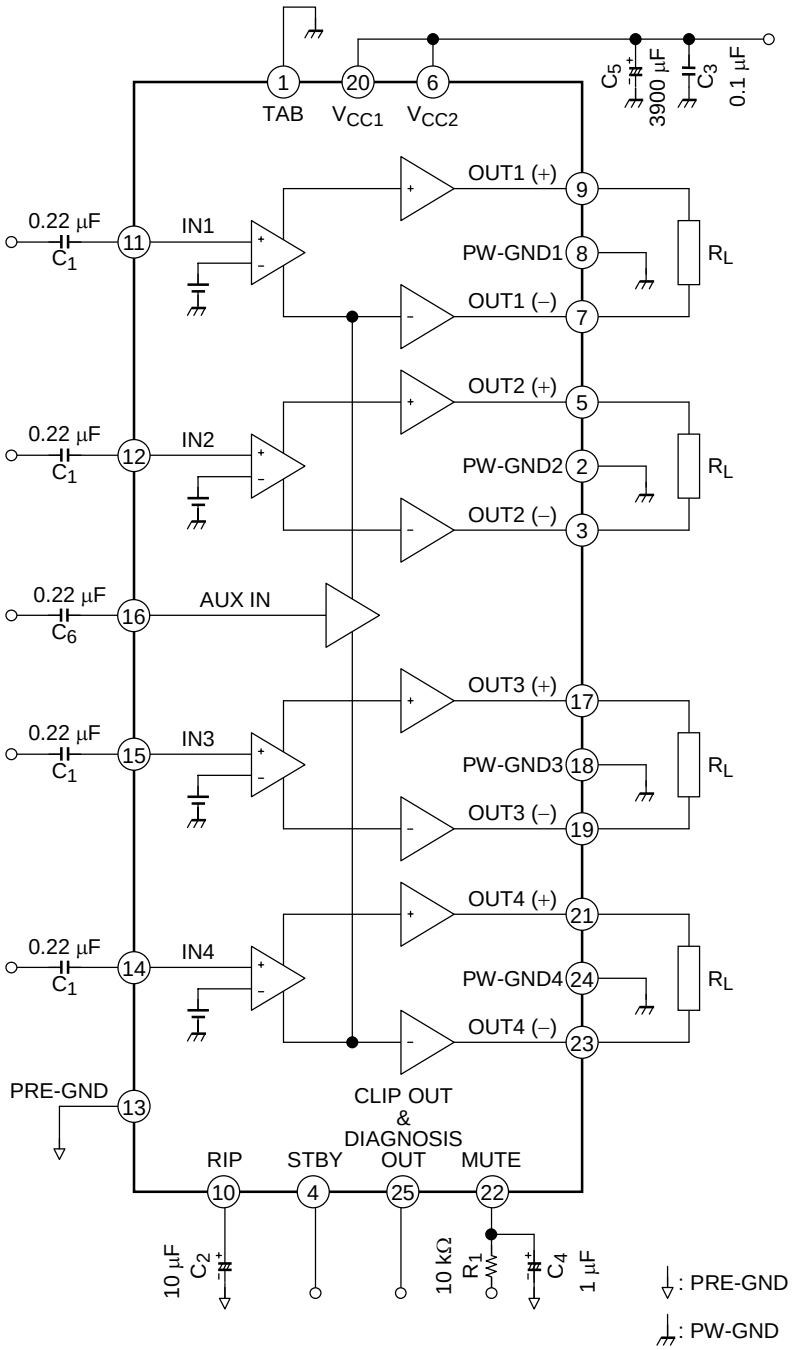
Note 1: Package thermal resistance θj-T = 1°C/W (typ.)
(Ta = 25°C, with infinite heat sink)

Electrical Characteristics
(unless otherwise specified, V_{CC} = 13.2 V, f = 1 kHz, R_L = 4 Ω, Ta = 25°C)

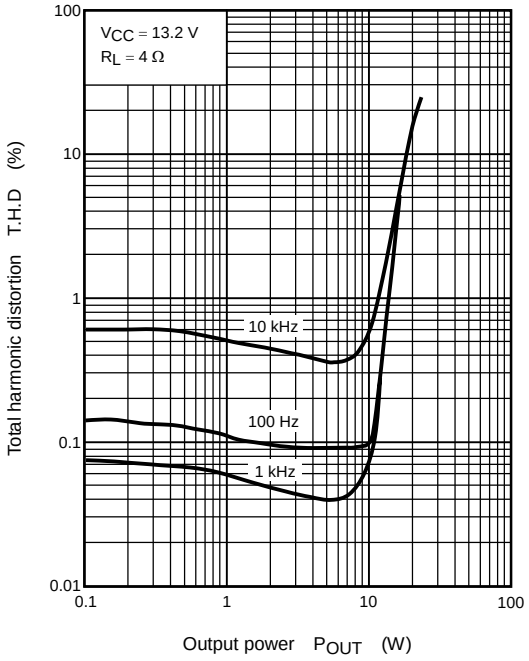
Characteristics	Symbol	Test Circuit	Test Condition	Min	Typ.	Max	Unit
Quiescent current	I_{CCQ}	—	V_{IN} = 0	—	200	400	mA
Output power	P_{OUT} MAX (1)	—	V_{CC} = 14.4 V, max Power	—	35	—	W
	P_{OUT} MAX (2)	—	V_{CC} = 13.7 V, max Power	—	31	—	
	P_{OUT} (1)	—	V_{CC} = 14.4 V, THD = 10%	—	23	—	
	P_{OUT} (2)	—	THD = 10%	17	20	—	
Total harmonic distortion	THD	—	P_{OUT} = 5 W	—	0.02	0.2	%
Voltage gain	G_V	—	V_{OUT} = 0.775 V_{rms} (0 dBm)	24	26	28	dB
Voltage gain ratio	ΔG_V	—	V_{OUT} = 0.775 V_{rms} (0 dBm)	−1.0	0	1.0	
Output noise voltage	V_{NO} (1)	—	Rg = 0 Ω, DIN45405	—	0.12	—	mV_{rms}
	V_{NO} (2)	—	Rg = 0 Ω, BW = 20 Hz~20 kHz	—	0.10	0.35	
Ripple rejection ratio	R.R.	—	f_{rip} = 100 Hz, Rg = 620 Ω V_{rip} = 0.775 V_{rms} (0 dBm)	40	50	—	dB
Cross talk	C.T.	—	Rg = 620 Ω V_{OUT} = 0.775 V_{rms} (0 dBm)	—	65	—	dB
Output offset voltage	V_{OFFSET}	—	—	−150	0	150	mV
Input resistance	R_{IN}	—	—	—	90	—	kΩ
Stand-by current	I_{SB}	—	Stand-by condition	—	2	10	μA
Stand-by control voltage	V_{SB} H	—	Power: ON	3.0	—	V_{CC}	V
	V_{SB} L	—	Power: OFF	0	—	1.5	
Mute control voltage (Note 2)	V_M H	—	Mute: OFF	Open			—
	V_M L	—	Mute: ON, R_1 = 10 kΩ	0	—	0.5	V
Mute attenuation	ATT M	—	Mute: ON, V_{OUT} = 7.75 Vrms (20 dBm) at Mute: OFF.	80	90	—	dB

Note 2: Muting function have to be controlled by open and low logic, which logic is a transistor, FET and μ-COM port of I_{MUTE} > 250 μA ability.
This means than the mute control terminal : pin 22 must not be pulled-up.

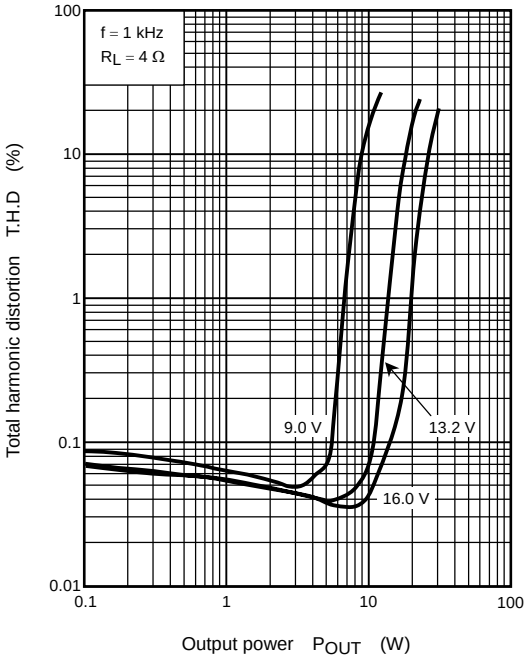
Test Circuit



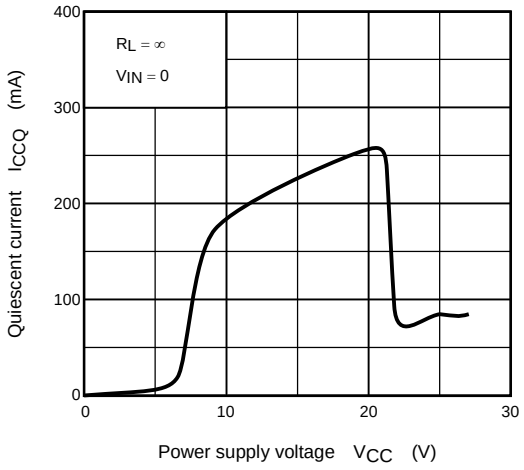
T.H.D – P_{OUT}



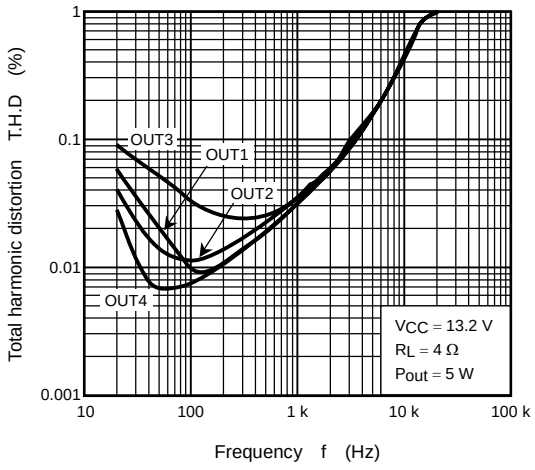
T.H.D – P_{OUT}



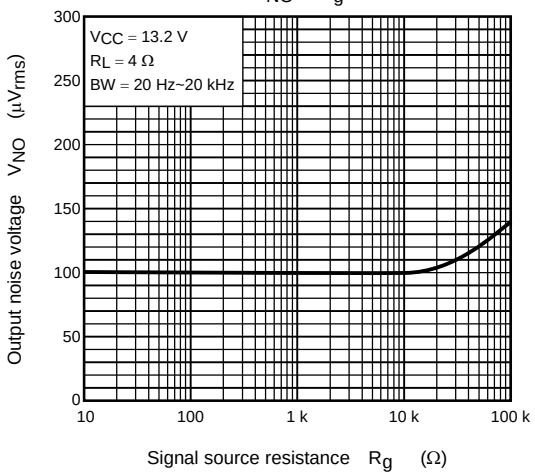
I_{CCQ} – V_{CC}



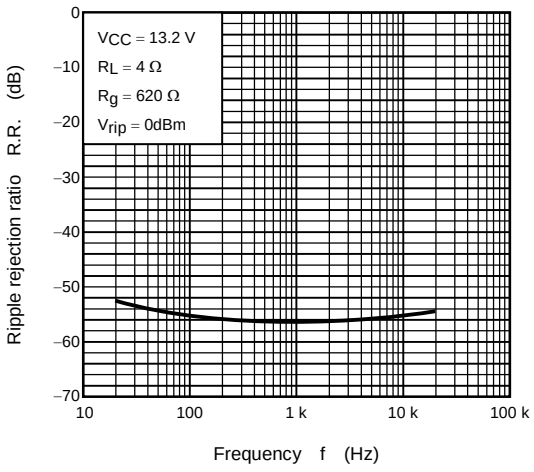
T.H.D – f



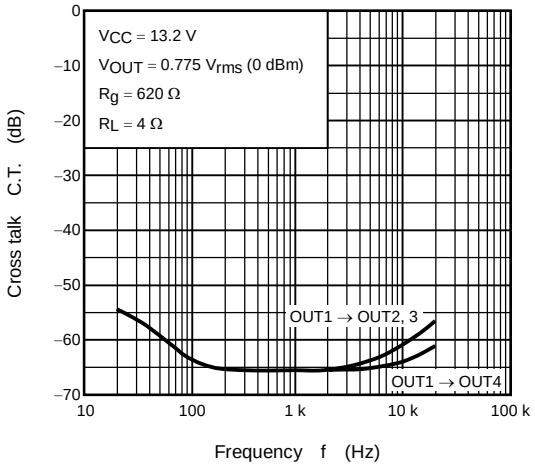
$V_{NO} - R_g$



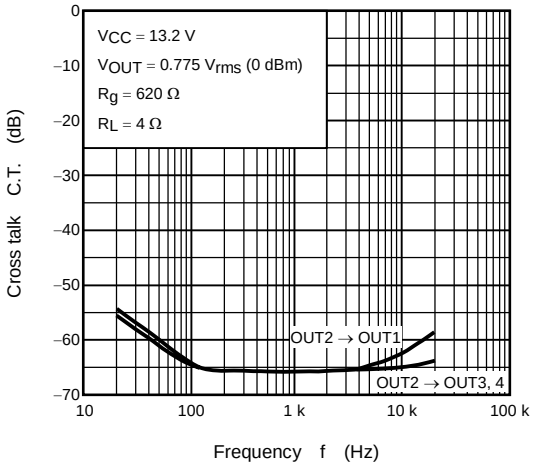
R.R. – f



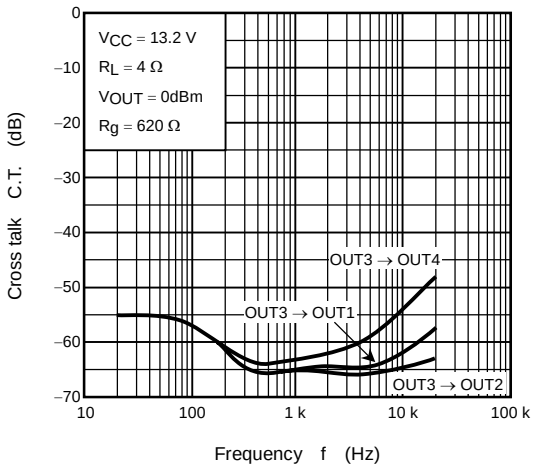
C.T. – f (OUT1)



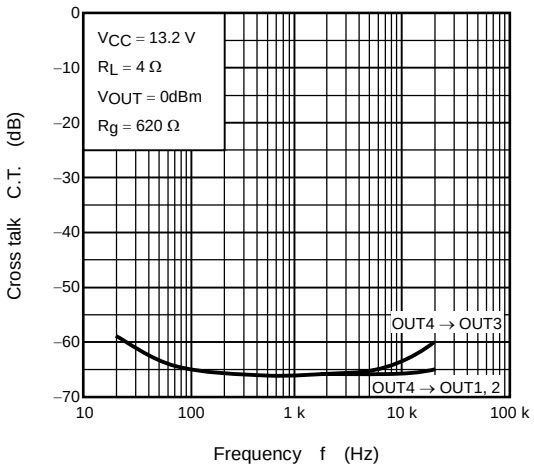
C.T. – f (OUT2)



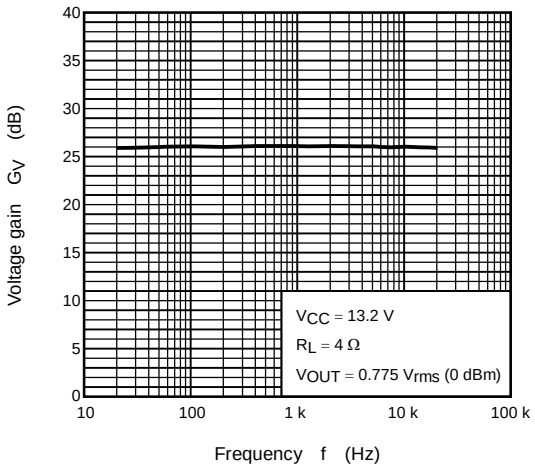
C.T. – f (OUT3)



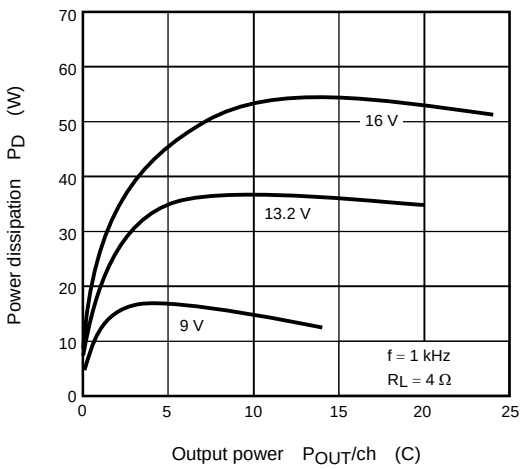
C.T. – f (OUT4)



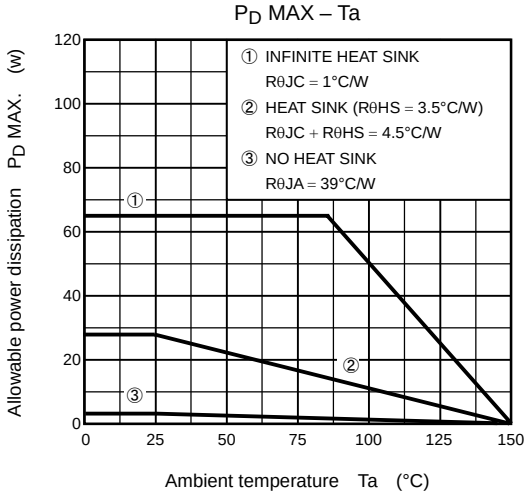
G_V – f



P_D – P_{OUT}

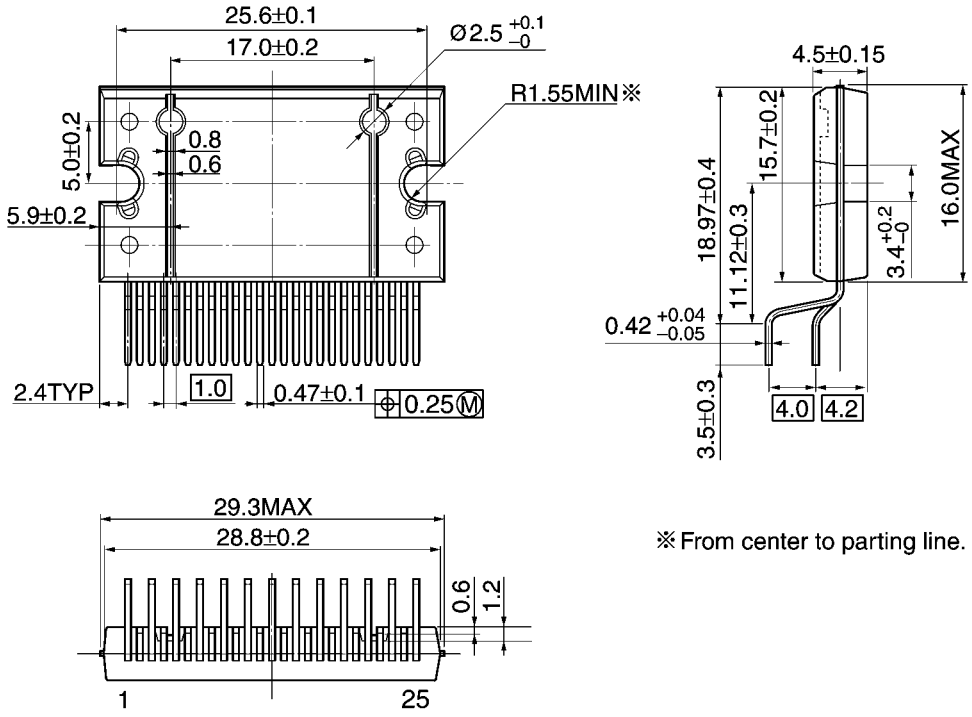


P_D MAX – Ta



Package Dimensions

HZIP25-P-1.00F Unit: mm



※ From center to parting line.

Weight: 7.7 g (typ.)