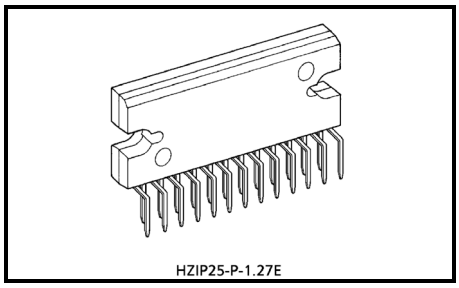
TOSHIBA Bipolar Linear Integrated Circuit Silicon Monolithic

TA8252HQ

Max Power 37W BTL × 4ch Audio Power IC

The TA8252HQ is 4ch BTL audio power amplifier for car audio application.
This IC can generate more high power: P_{OUT} MAX = 37W as it is included the pure complementary PNP and NPN transistor output stage.
It is designed low distortion ratio for 4ch BTL audio power amplifier,built−in stand−by function, muting function,clip detector,and diagnosis circuit.
Additionally, the AUX.amplifier is built−in, it can make the beep signal etc.output to 2 channnels (out 1 and 4).It contains various kind of protectors for car audio use.

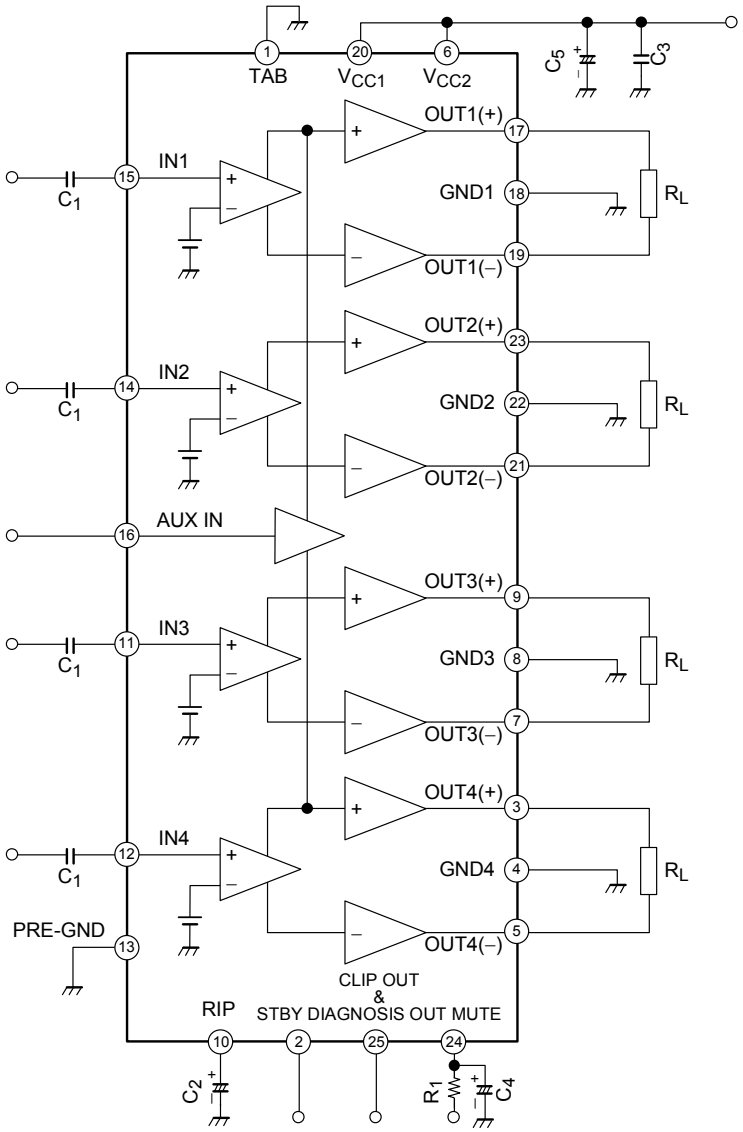


Weight: 9.8g (typ.)

Features

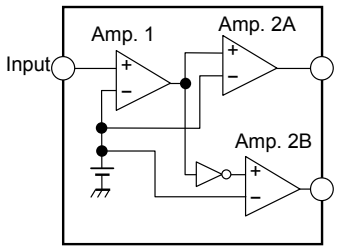
- High power
  : P_{OUT} MAX (1) = 37W (typ.)
  (V_{CC} = 14.4V, f = 1kHz, EIAJ max., R_L = 4Ω)
  : P_{OUT} MAX (2) = 35W (typ.)
  (V_{CC} = 13.7V, f = 1kHz, EIAJ max., R_L = 4Ω)
  : P_{OUT} (1) = 24W (typ.)
  (V_{CC} = 14.4V, f = 1kHz, THD = 10%, R_L = 4Ω)
  : P_{OUT} (2) = 21W (typ.)
  (V_{CC} = 13.2V, f = 1kHz, THD = 10%, R_L = 4Ω)
- Built−in clip detector & diagnosis circuit.(pin(25))
- Low distortion ratio: THD = 0.02% (typ.)
  (V_{CC} = 13.2V, f = 1kHz, P_{OUT} = 5W, R_L = 4Ω)
- Low noise: V_{NO} = 0.10mV_{rms} (typ.)
  (V_{CC} = 13.2V, R_g = 0Ω, G_V = 26dB, BW = 20~20kHz)
- Built−in stand−by switch function (pin(2))
- Built−in multing function (pin(24))
- Built−in AUX. amplifier from single input (pin(16)) to 2 channels output; out1 and 4
- Built−in various protection circuit
  : Thermal shut down, Over voltage, Out to GND, Out to V_{CC}, Out to Out short.
- Operating supply voltage: $V_{CC\ (opr)}$ = 9~18V

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.

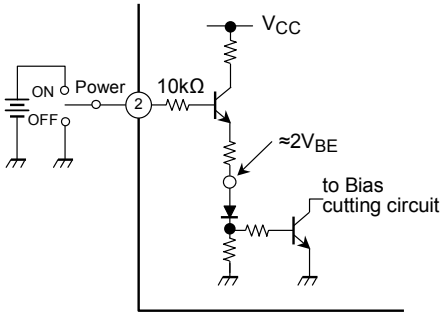


(Fig.1) Block diagram

The voltage gain of amp.1: G_{V1} = 0dB
The voltage gain of amp.2A, B: G_{V2} = 20dB
The voltage gain of BTL connection: $G_{V\ (BTL)}$ = 6dB
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(2))
   By means of controlling pin(2) (stand–by terminal) to high and low, the power supply can be set to on and off.
   The threshold voltage of pin(2) is set at about $3V_{BE}$ (typ.), and the power supply current is about 2μA (typ.) at the stand–by state.

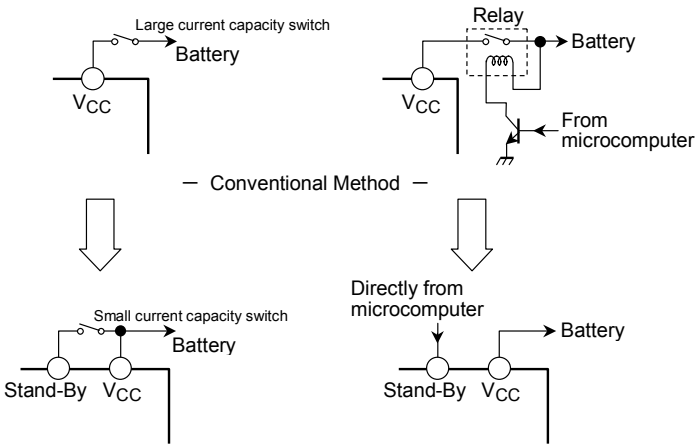


(Fig.2) With pin(2) set to High,
Power is turned ON

Control voltage of pin(2): $V_{(SB)}$

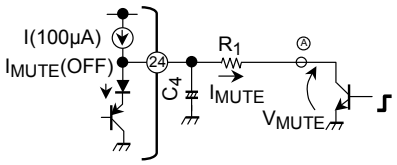
Stand–by	Power	$V_{(SB)}$ (V)
On	Off	0~1.5
Off	On	3~6

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

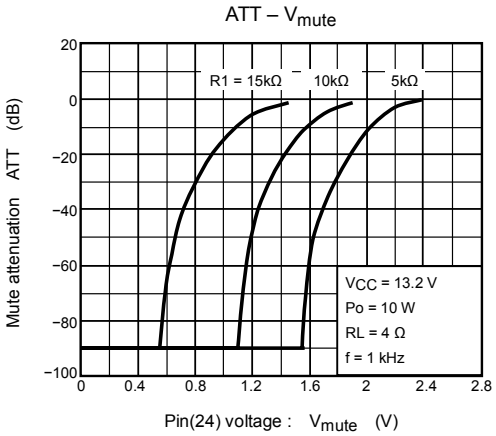


— Stand–by switch method —
(Fig.3)

3. Multing function (pin(24))
   By means of controlling pin(24) less than 0.5V, 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; R_1 must be set up less than 15kΩ, we recommend 10kΩ.
   The muting function have to be controlled by a transistor, FET and μ–COM port which has
   I_{MUTE} > 250μA ability.
   Terminal (24) must not be pulled up and it shall be controlled by open / low.



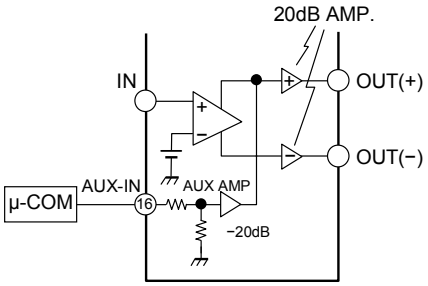
(Fig.4) Muting function



(Fig.5) Mute attenuation–V_{mute} (V)

4.AUX. input (pin(16))

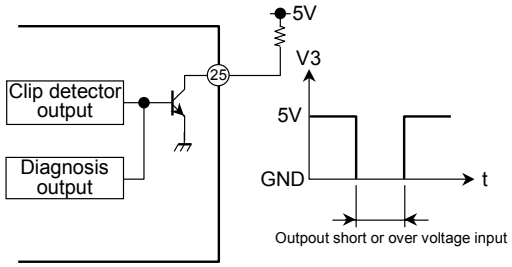
The pin(16) is for input terminal of AUX. amplifier.
The total gain is 0dB by using of AUX. amplifier.
Therfore, the μ–COM can directly drive the AUX. amplifier.
Beep sound or voice synthesizer signal can be input to pin(16) directly.



(Fig.6) AUX input

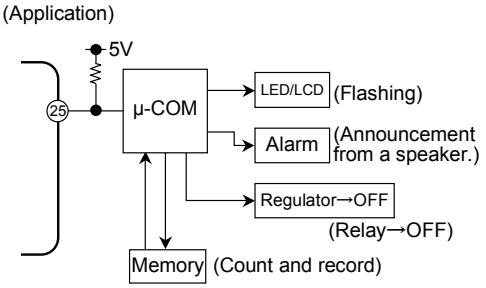
5. Diagnosis output (pin(25))

The diagnosis output terminal of pin(25) has open collector output structure on clip as shown in Fig.7.
In unusual case that output terminal of power amp. is condition of output to V_{CC} or output to GND short and over voltage input mode, 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)

(Fig.7)

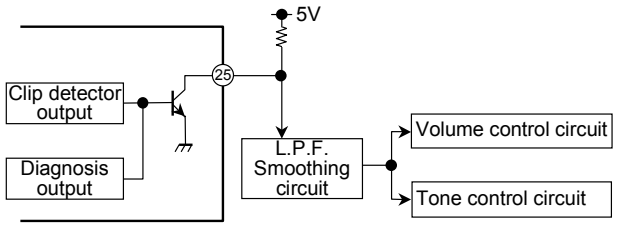


(Fig.8)

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 Fig.9.
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 Fig.9.
In case of being unused this function, use this IC as open connection on pin(25).

(Application)



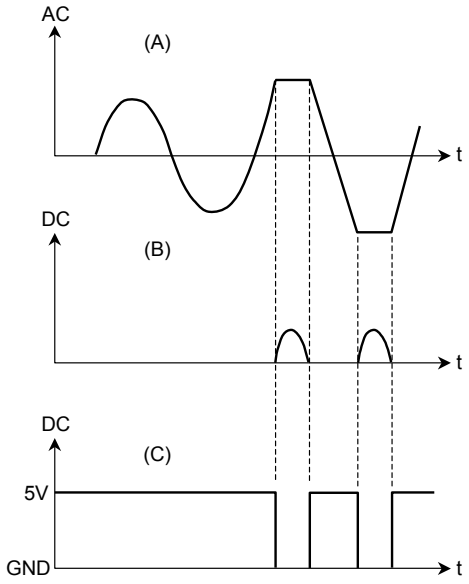
Pin ㉕ : Open collector output (active low)

(Fig.9)

(A) Output (AC wave form)

(B) Clip detector circuit (internal)

(C) Clip DET. terminal (pin ㉕)



7. Cross talk

The cross talk characteristics of the IC is not good between out1 and 2, out3 and 4.
So we recommend to use by below method.

Out1, 2	L–ch (or R–ch)
Out3, 4	R–ch (or L–ch)

And, please refer to below table in case of applying the AUX. in because it is out to out1 and 4.

ex) In case of the signal from AUX. in to front speakers.

Out1	Front	L–ch (or R–ch)	AUX. out
Out2	Rear		—
Out3	Rear	R–ch (or L–ch)	—
Out4	Front		AUX. out

Absolute Maximum Rating (Ta = 25°C)

Characteristic	Symbol	Rating	Unit
Peak supply voltage (0.2s)	$V_{CC\ (surge)}$	50	V
DC supply voltage	$V_{CC\ (DC)}$	25	V
Operating supply voltage	$V_{CC\ (opr)}$	18	V
Output current (peak)	$I_{O\ (peak)}$	9	A
Power dissipation	P_D (*)	250	W
Operating temperature	T_{opr}	−40~85	°C
Storage temperature	T_{stg}	−55~150	°C

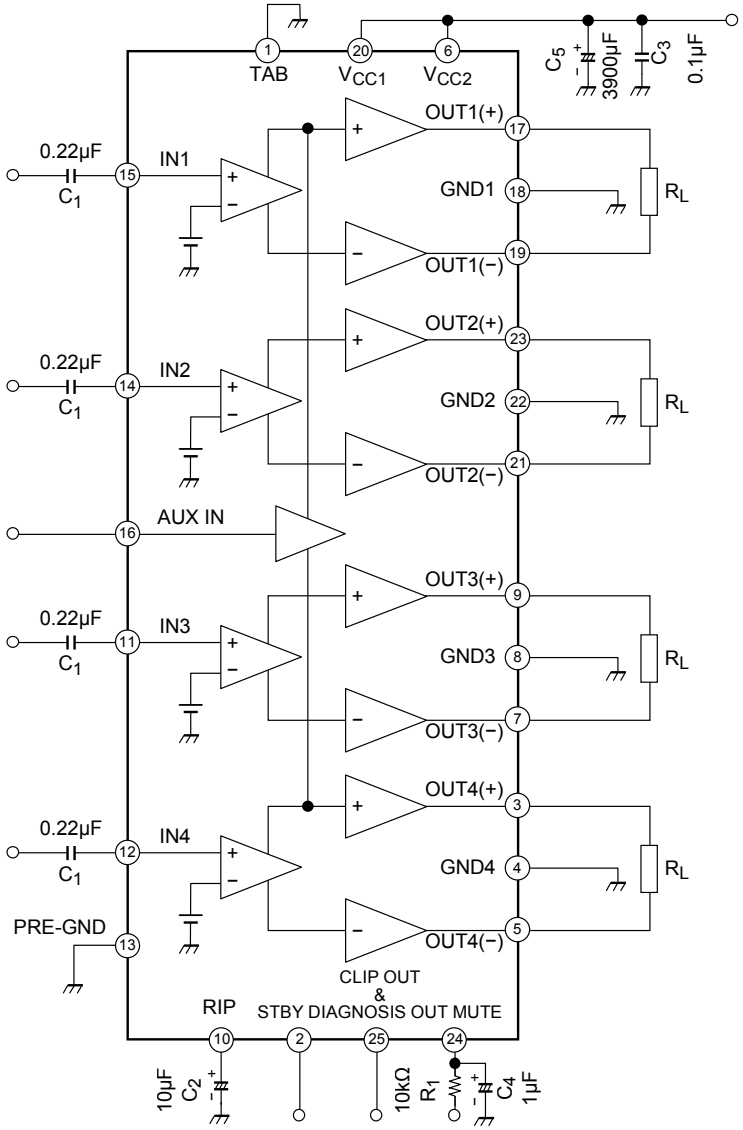
(*): Package thermal resistance θ_{j-T} = 0.5°C / W (typ.)
(Ta = 25°C, with infinite heat sink)

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

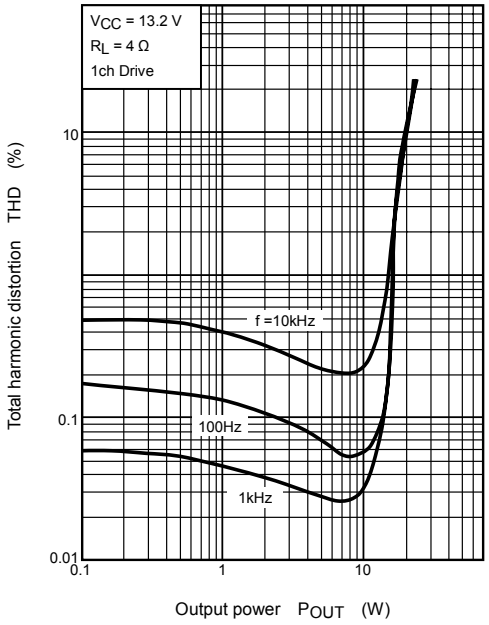
Characteristic	Symbol	Test Cir−cuit	Condition	Min.	Typ.	Max.	Unit
Quiescent current	I_{CCQ}	—	V_{IN} = 0	—	200	400	mA
Output power	P_{OUT} MAX (1)	—	V_{CC} = 14.4V, max power	—	37	—	W
	P_{OUT} MAX (2)	—	V_{CC} = 13.7V, max power	—	35	—	
	P_{OUT} (1)	—	V_{CC} = 14.4V, THD = 10%	—	24	—	
	P_{OUT} (2)	—	THD = 10%	19	21	—	
Total harmonic distortion	THD	—	P_{OUT} = 3W	—	0.02	0.2	%
Voltage gain	G_V	—	V_{OUT} = 0.775V_{rms} (0dBm)	24	26	28	dB
Voltage gain ratio	ΔG_V	—	V_{OUT} = 0.775V_{rms} (0dBm)	−1.0	0	1.0	dB
Output noise voltage	$V_{NO\ (1)}$	—	R_g = 0Ω, DIN45405	—	0.12	—	mV_{rms}
	$V_{NO\ (2)}$		R_g = 0Ω, BW = 20Hz~20kHz	—	0.10	0.35	mV_{rms}
Ripple rejection ratio	R.R.	—	f_{rip} = 100Hz, R_g = 620Ω V_{rip} = 0.775V_{rms} (0dBm)	40	50	—	dB
Cross talk	C.T.	—	R_g = 620Ω, V_{OUT} = 0.775V_{rms} (0dBm)	—	65	—	dB
Output offset voltage	V_{OFFSET}	—	—	−100	0	+100	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	—	6.0	V
	V_{SB} L	—	Power: Off	0	—	1.5	
Mute control voltage (*)	V_M H	—	Mute: Off	Open			V
	V_M L	—	Mute: On, R_1 = 10kΩ	0	—	0.5	
Mute attenuation	ATT M	—	Mute: On V_{OUT} = 7.75V_{rms} (20dBm) at mute: Off.	80	90	—	dB

(*): Muting function have to be controlled by open and low logic, which logic is a transistor, FET and μ−COM port of I_{MUTE} > 250μA ability.
This means that the mute control terminal: Pin(24) must not be pulled−up.

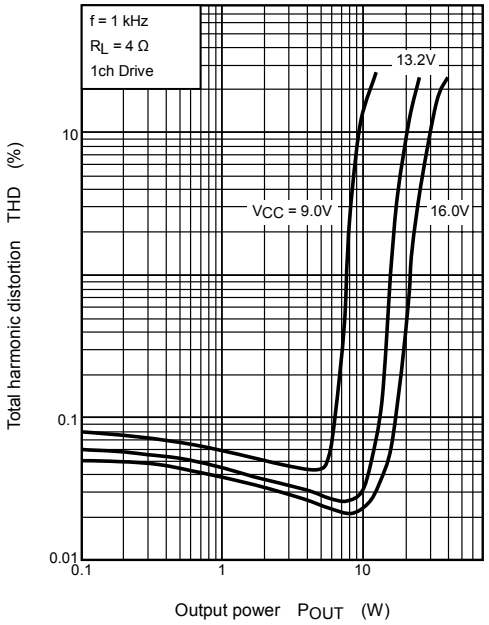
Test Circuit



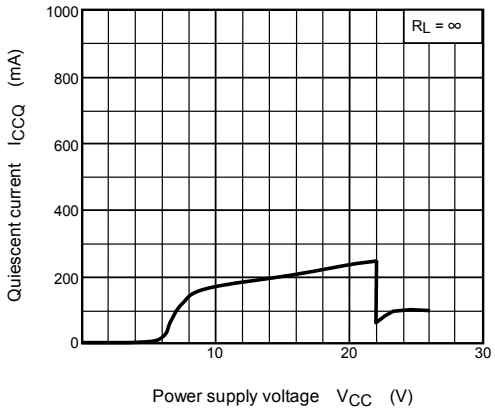
THD – P_{OUT}



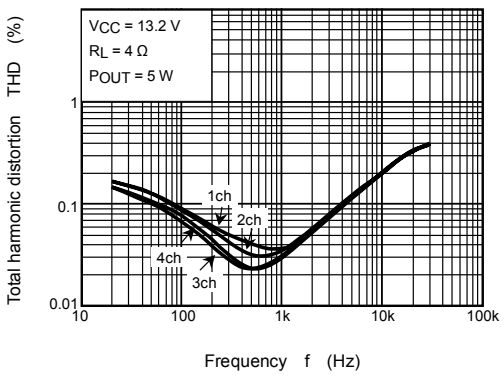
THD – P_{OUT}



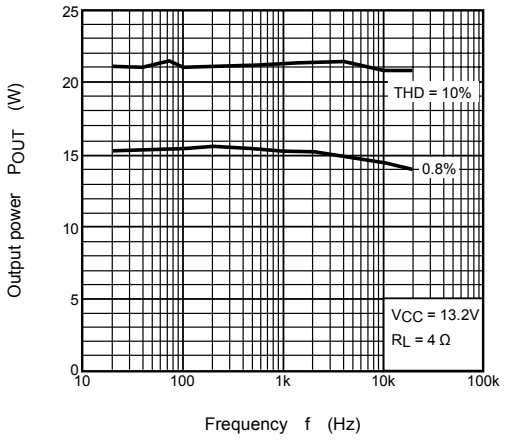
I_{CCQ} – V_{CC}



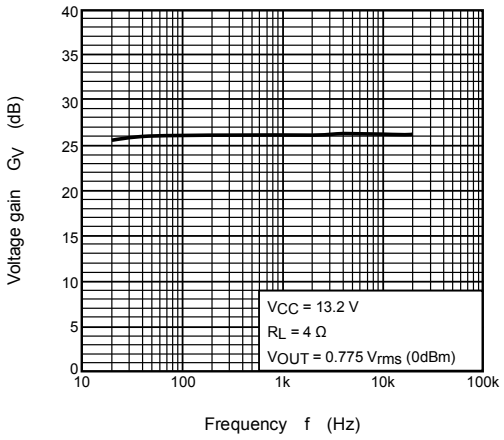
THD – f



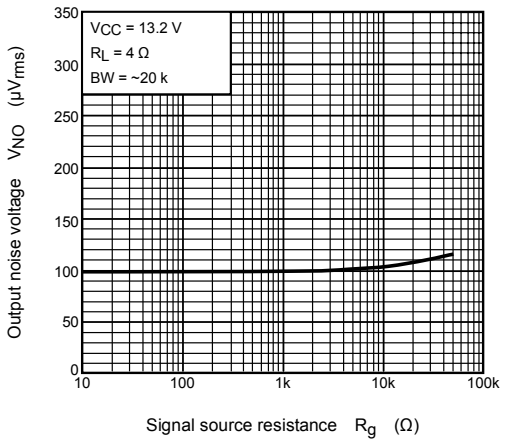
P_{OUT} – f



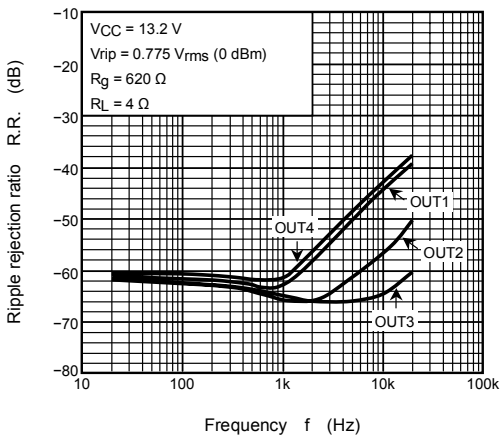
G_V – f



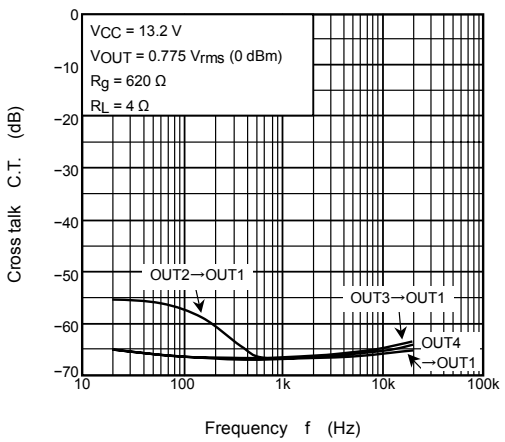
V_{NO} – R_g



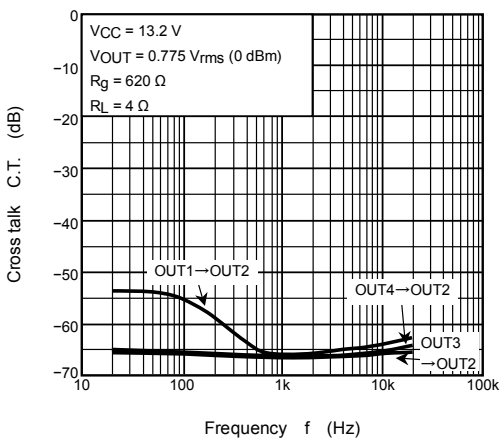
R.R. – f



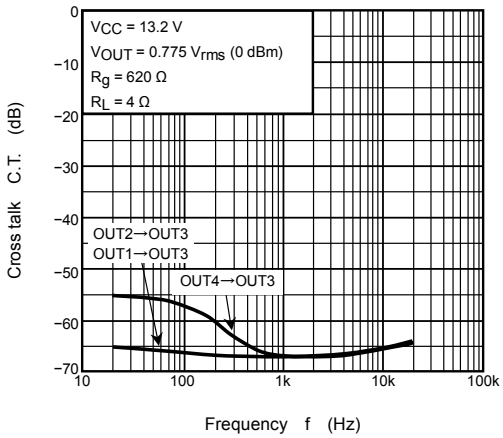
C.T. – f (OUT1)



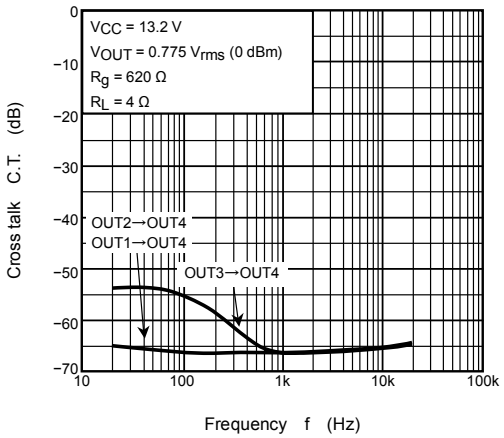
C.T. – f (OUT2)



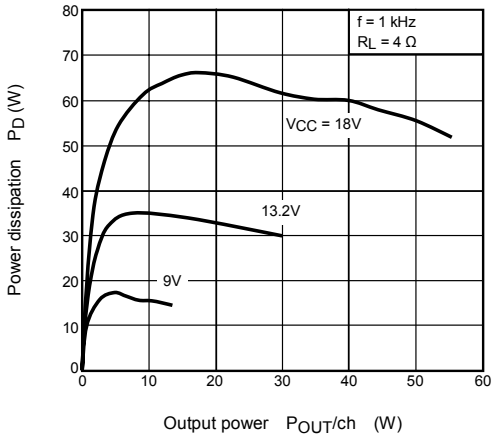
C.T. – f (OUT3)



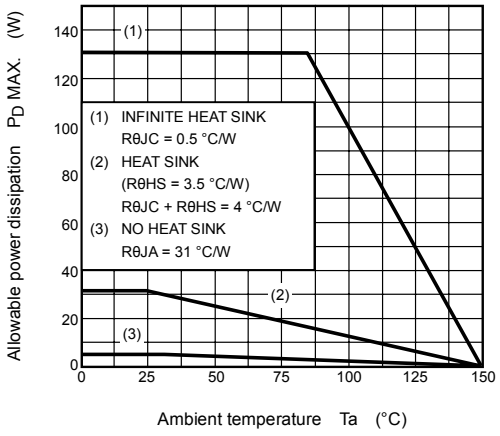
C.T. – f (OUT4)



P_D – P_{OUT}

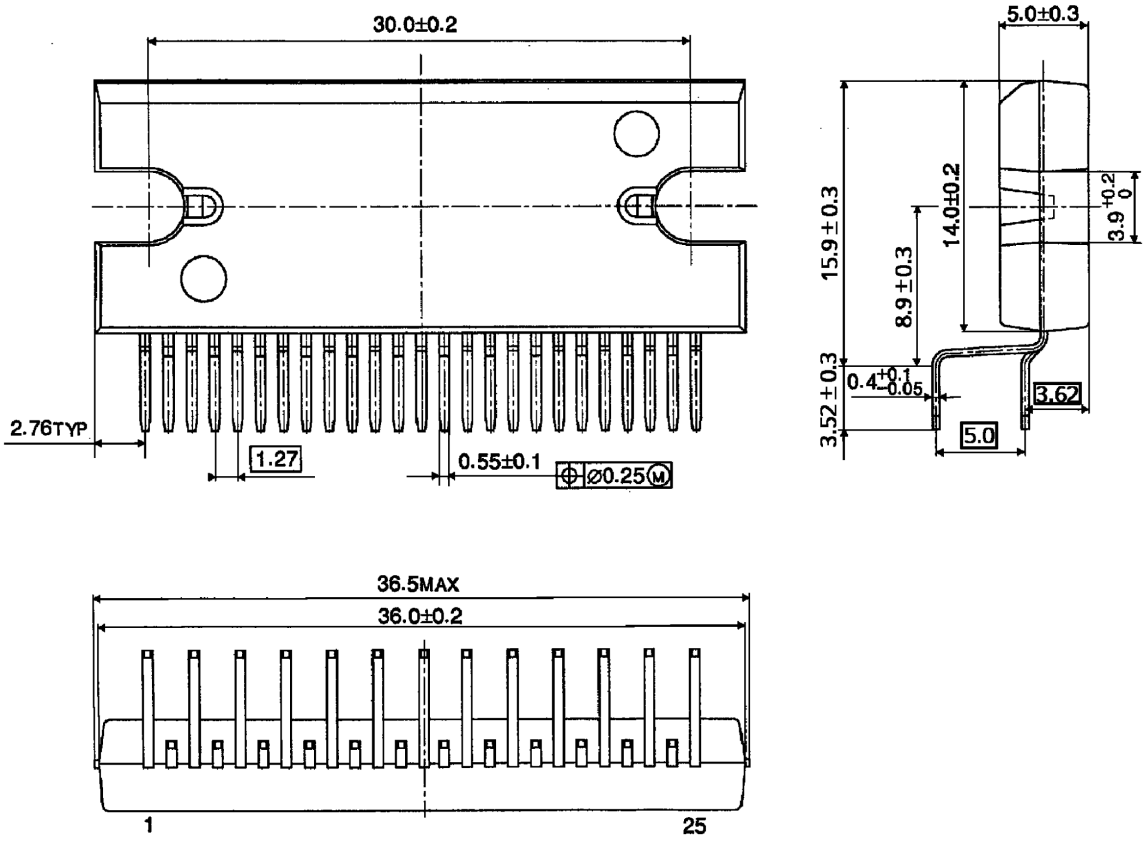


P_D MAX. – Ta



Package Dimensions

HZIP25-P-1.27E UNIT : mm



Weight: 9.8g (typ.)

- Use an appropriate power supply fuse to ensure that a large current does not continuously flow in case of over current and/or IC failure. The IC will fully break down when used under conditions that exceed its absolute maximum ratings, when the wiring is routed improperly or when an abnormal pulse noise occurs from the wiring or load, causing a large current to continuously flow and the breakdown can lead smoke or ignition. To minimize the effects of the flow of a large current in case of breakdown, appropriate settings, such as fuse capacity, fusing time and insertion circuit location, are required.

- If your design includes an inductive load such as a motor coil, incorporate a protection circuit into the design to prevent device malfunction or breakdown caused by the current resulting from the inrush current at power ON or the negative current resulting from the back electromotive force at power OFF. For details on how to connect a protection circuit such as a current limiting resistor or back electromotive force adsorption diode, refer to individual IC datasheets or the IC databook. IC breakdown may cause injury, smoke or ignition.

- Use a stable power supply with ICs with built-in protection functions. If the power supply is unstable, the protection function may not operate, causing IC breakdown. IC breakdown may cause injury, smoke or ignition.

- Carefully select external components (such as inputs and negative feedback capacitors) and load components (such as speakers), for example, power amp and regulator. If there is a large amount of leakage current such as input or negative feedback condenser, the IC output DC voltage will increase. If this output voltage is connected to a speaker with low input withstand voltage, overcurrent or IC failure can cause smoke or ignition. (The over current can cause smoke or ignition from the IC itself.) In particular, please pay attention when using a Bridge Tied Load (BTL) connection type IC that inputs output DC voltage to a speaker directly.

- Over current Protection Circuit
  Over current protection circuits (referred to as current limiter circuits) do not necessarily protect ICs under all circumstances. If the Over current protection circuits operate against the over current, clear the over current status immediately. Depending on the method of use and usage conditions, such as exceeding absolute maximum ratings can cause the over current protection circuit to not operate properly or IC breakdown before operation. In addition, depending on the method of use and usage conditions, if over current continues to flow for a long time after operation, the IC may generate heat resulting in breakdown.

- Thermal Shutdown Circuit
  Thermal shutdown circuits do not necessarily protect ICs under all circumstances. If the Thermal shutdown circuits operate against the over temperature, clear the heat generation status immediately. Depending on the method of use and usage conditions, such as exceeding absolute maximum ratings can cause the thermal shutdown circuit to not operate properly or IC breakdown before operation.

- Heat Radiation Design
  When using an IC with large current flow such as power amp, regulator or driver, please design the device so that heat is appropriately radiated, not to exceed the specified junction temperature (Tj) at any time and condition. These ICs generate heat even during normal use. An inadequate IC heat radiation design can lead to decrease in IC life, deterioration of IC characteristics or IC breakdown. In addition, please design the device taking into considerate the effect of IC heat radiation with peripheral components.

- Installation to Heat Sink
  Please install the power IC to the heat sink not to apply excessive mechanical stress to the IC. Excessive mechanical stress can lead to package cracks, resulting in a reduction in reliability or breakdown of internal IC chip. In addition, depending on the IC, the use of silicon rubber may be prohibited. Check whether the use of silicon rubber is prohibited for the IC you intend to use, or not. For details of power IC heat radiation design and heat sink installation, refer to individual technical datasheets or IC databooks.

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- This product generates heat during normal operation. However, substandard performance or malfunction may cause the product and its peripherals to reach abnormally high temperatures.
  The product is often the final stage (the external output stage) of a circuit. Substandard performance or malfunction of the destination device to which the circuit supplies output may cause damage to the circuit or to the product. 030619_R

About solderability, following conditions were confirmed

- Solderability

  (1) Use of Sn-37Pb solder Bath
  - solder bath temperature = 230°C
  - dipping time = 5 seconds
  - the number of times = once
  - use of R-type flux

  (2) Use of Sn-3.0Ag-0.5Cu solder Bath
  - solder bath temperature = 245°C
  - dipping time = 5 seconds
  - the number of times = once
  - use of R-type flux