TOSHIBA Bi-CMOS Digital Integrated Circuit Silicon Monolithic

TENTATIVE TB2922HQ

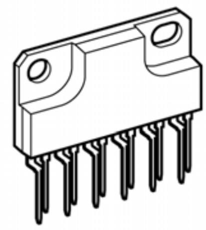
Dual Audio Power Amplifier

The TB2922HQ is 2ch BTL audio amplifier for TV or home audio applications.

It includes and the pure complementary P-ch and N-ch DMOS output stage.

The package is CPP (Compact Power Package).

It is built-in standby function, muting function various kinds of protectors.



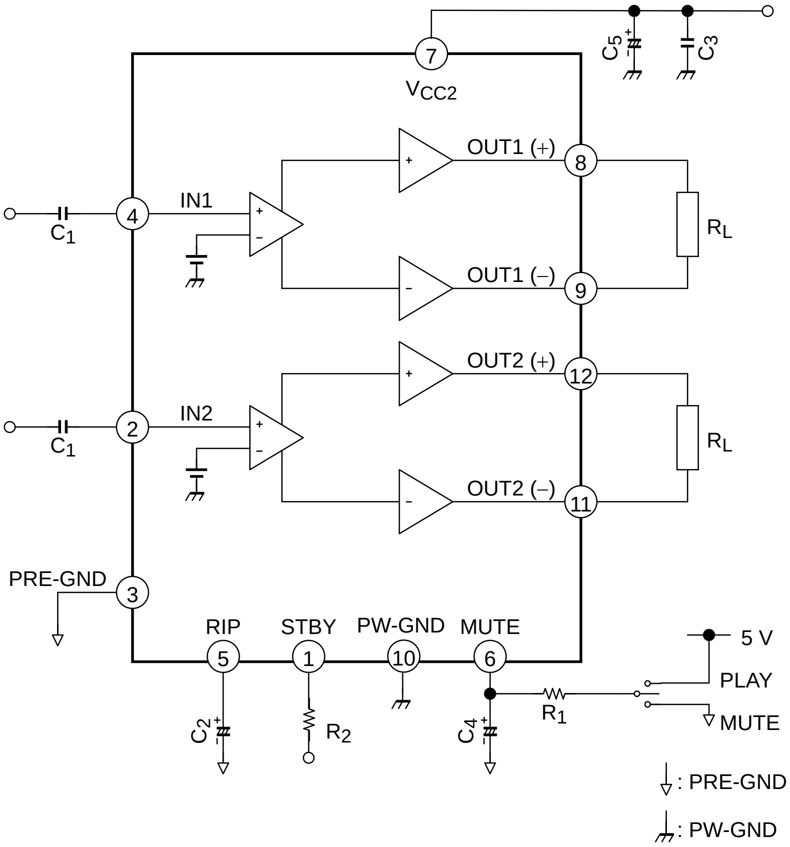
HZIP12-P-1.78B

Weight: 4.04 g (typ.)

Features

- High power output
  - : P_{OUT} (1)= 23 W (typ)
    (V_{CC} = 18V, R_L = 8 Ω, f = 1 kHz, THD = 10%)
  - : P_{OUT} (2)= 39W (typ)
    (V_{CC} = 16V, R_L = 4 Ω, f = 1 kHz, THD = 10%)
  - : P_{OUT} (3)= 46W (typ)
    (V_{CC} = 26V, R_L = 8 Ω, f = 1 kHz, THD = 10%)
  - : P_{OUT}MAX (1)= 72W (typ)
    (V_{CC} = 26V, R_L = 8 Ω, f = 1 kHz, Max Power)
- Low distortion ratio : THD=0.02% (typ)
- Low noise : V_{no} = 0.16 μVrms (typ)
  (V_{CC} = 18V, R_L = 8 Ω, R_g = 0 Ω, BW = 20 Hz~20 kHz)
- Low outside parts
- Built-in standby switch function (pin 1)
- Built-in muting function (pin 6)
- Built-in various protection circuits:
  Thermal shut down, overvoltage, out to GND, out to V_{CC}, out to out short speaker burned
- Operating supply voltage
  : V_{CC} (opr) = 9 to 26 V (R_L = 8 Ω)
  : V_{CC} (opr) = 9 to 18 V (R_L = 4 Ω)

Block Diagram



Note1: Some of the functional blocks, circuits, or constants in the block diagram may be omitted or simplified for explanatory purpose.

Caution and Application Method (Description is made only on the single channel)

1. Voltage Gain Adjustment

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

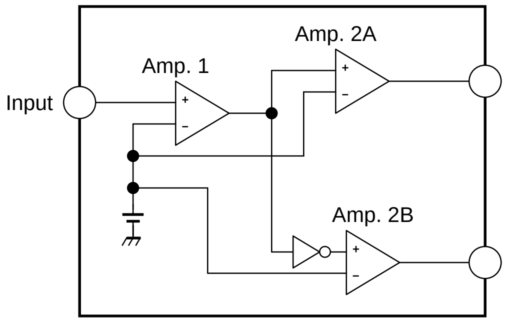


Figure 1 Block Diagram

The voltage gain of amp.1 : $G_{V1} = 8dB$
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.

$G_V = G_{V1} + G_{V2} + G_{V\,(BTL)} = 8 + 20 + 6 = 34dB$

2. Standby SW Function (pin 1)

By means of controlling pin 1 (standby pin) to High and Low, the power supply can be set to ON and OFF. The threshold voltage of pin 1 is set at about 3 V_{BE} (typ.), and the power supply current is about 2 μA (typ.) in the standby state.

Control Voltage of Pin 4: V_{SB}

Stand-by	Power	V_{SB} (V)
ON	OFF	0 to 0.5
OFF	ON	2.5 to 6 V

When changing the time constant of pin 1, check the pop noise.

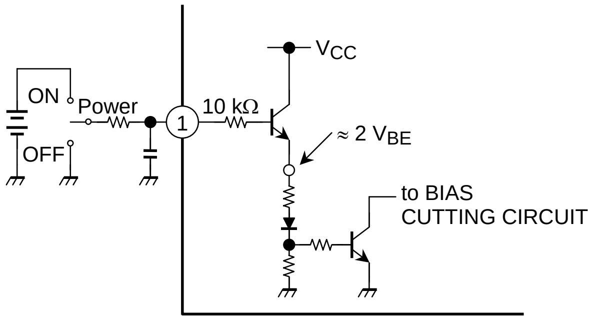


Figure 2 With pin 1 set to High, Power is turned ON

Advantage of Standby 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.

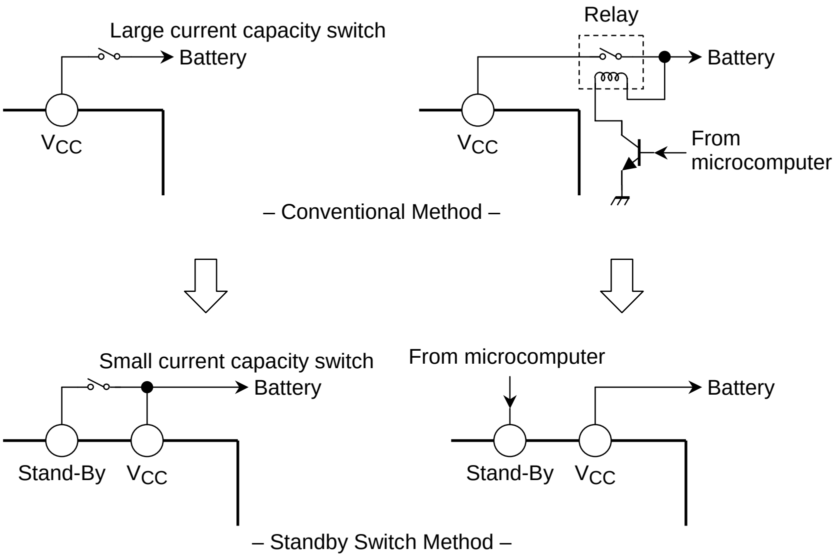


Figure 3

3. Muting Function (pin 6)

Audio muting function is enabled when pin 6 is Low. When the time constant of the muting function is determined by R_1 and C_4, it should take into account the pop noise. The pop noise, which is generated when the power or muting function is turned ON/OFF, will vary according to the time constant. (Refer to Figure4)

The pin 6 is designed to operate off 5 V so that the outside pull-up resistor R_1 is determined on the basic of this value:

ex) When control voltage is changed in to 6 V from 5 V.

$$6\ V/5\ V \times 47\ k = 56\ k$$

Additionally, as the V_{CC} is rapidly falling, the IC internal low voltage muting operates to eliminate the large pop noise basically.

The low voltage muting circuit pull 200 μA current into the IC so that the effect of the internal low voltage muting does not become enough if the R_1 is too small value.

To obtain enough operation of the internal low voltage muting, a series resistor, R_1 at pin 6 should be 47 kΩ or more.

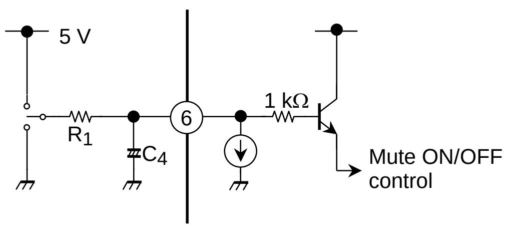


Figure 4 Muting Function

4. Pop Noise Suppression

The pop noise which is generated when the muting function is turned ON/OFF will vary according to the time constant of C4.

The greater the capacitance, the lower the pop noise. Note that the time from when the mute control signal is applied to C4 to when the muting function is turned ON/OFF will be longer.

5. External Component Constants

Component Name	Recommended Value	Purpose	Effect	
			Lower than recommended value	Higher than recommended value
C1	0.22 μF	To eliminate DC	Cut-off frequency is increased	Cut-off frequency is reduced
C2	10 μF	To reduce ripple	Powering ON/OFF is faster	Powering ON/OFF takes longer
C3	0.1 μF	To provide sufficient oscillation margin	Reduces noise and provides sufficient oscillation margin	
C4	1 μF	To reduce pop noise	High pop noise. Duration until muting function is turned ON/OFF is short	Low pop noise. Duration until muting function is turned ON/OFF is long
C5	3900 μF	Ripple filter	Power supply ripple filtering	

Maximum Ratings (Ta = 25°C)

Characteristics	Symbol	Rating	Unit
DC supply voltage	$V_{CC\ (DC)}$	28	V
Operation supply voltage	$V_{CC\ (opr)}$	26	V
Power dissipation	P_D (Note 2)	62.5	W
Operation temperature	T_{opr}	−40 to 85	°C
Storage temperature	T_{stg}	−55 to 150	°C

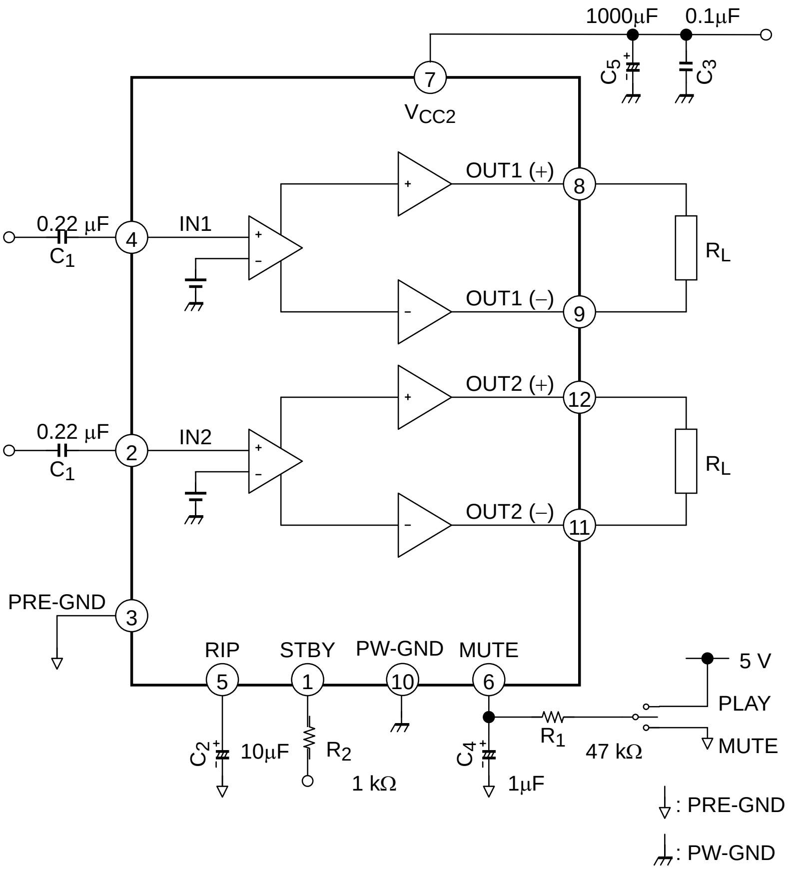
Note 2: Package thermal resistance $\theta_{j\text{-}T}$ = 2°C/W (typ.) (Ta = 25°C, with infinite heat sink)

The absolute maximum ratings of a semiconductor device are a set of specified parameter values, which must not be exceeded during operation, even for an instant. If any of these rating would be exceeded during operation, the device electrical characteristics may be irreparably altered and the reliability and lifetime of the device can no longer be guaranteed. Moreover, these operations with exceeded ratings may cause break down, damage and/or degradation to any other equipment. Applications using the device should be designed such that each maximum rating will never be exceeded in any operating conditions. Before using, creating and/or producing designs, refer to and comply with the precautions and conditions set forth in this documents.

Electrical Characteristics
(unless otherwise specified, V_{CC} = 18 V, f = 1 kHz, R_L = 8 Ω, Ta = 25°C)

Characteristics	Symbol	Test Circuit	Test Condition	Min	Typ.	Max	Unit
Quiescent current	I_{CCQ}	—	V_{IN} = 0	—	80	150	mA
Output power	P_{OUT} (1)	—	THD = 10%	21	23	—	W
	P_{OUT} (2)	—	THD = 10%, RL=4 Ω	—	39	—	
	P_{OUT} (3)	—	V_{CC} = 26 V, THD = 10%	—	46	—	
	P_{OUT} MAX (1)	—	V_{CC} = 26V, Max POWER	—	72	—	
Total harmonic distortion	THD	—	P_{OUT} = 4 W	—	0.03	0.2	%
Voltage gain	G_V	—	V_{OUT} = 0.775 Vrms	32	34	36	dB
Voltage gain ratio	ΔG_V	—	V_{OUT} = 0.775 Vrms	−1.0	0	1.0	dB
Output noise voltage	V_{NO} (1)	—	Rg = 0 Ω, DIN45405	—	160	—	μVrms
	V_{NO} (2)	—	Rg = 0 Ω, BW = 20 Hz~20 kHz	—	180	250	
Ripple rejection ratio	R.R.	—	f_{rip} = 100 Hz, R_g = 620 Ω V_{rip} = 0.775 Vrms	40	50	—	dB
Cross talk	C.T.	—	R_g = 620 Ω V_{OUT} = 0.775 Vrms	—	60	—	dB
Output offset voltage	V_{OFFSET}	—	—	−250	0	250	mV
Input resistance	R_{IN}	—	—	24	30	36	kΩ
Standby current	I_{SB}	—	Standby condition	—	1	10	μA
Standby control voltage	V_{SB} H	—	POWER: ON	2.5	—	6.0	V
	V_{SB} L	—	POWER: OFF	0	—	0.5	
Mute control voltage	V_M H	—	MUTE: OFF	2.5	—	6.0	V
	V_M L	—	MUTE: ON, R_1 = 47 kΩ	0	—	0.5	
Mute attenuation	ATT M	—	MUTE: ON V_{OUT} = 10 Vrms→Mute: OFF	85	100	—	dB

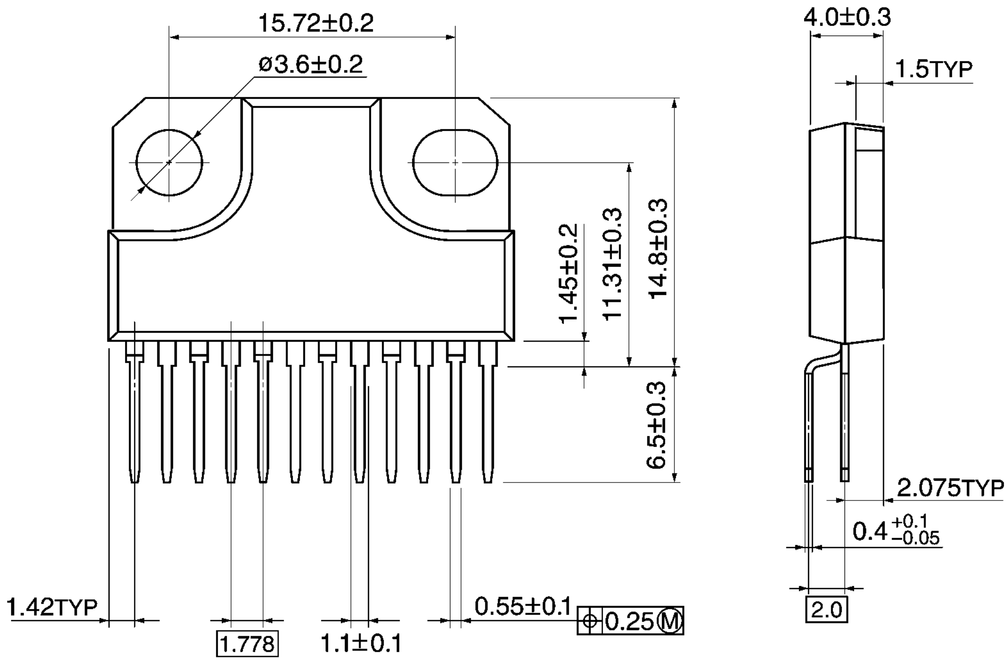
Test Circuit

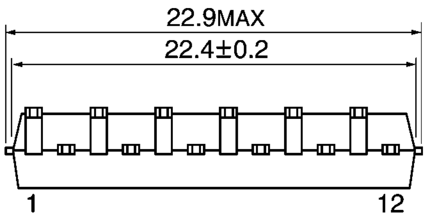


Components in the test circuits are only used to obtain and confirm the device characteristics.
These components and circuits do not warrant to prevent the application equipment from malfunction or failure.

Package Dimensions

HZIP12-P-1.78B Unit: mm





Weight: 4.04 g (typ.)

About solderability, following conditions were confirmed

- Solderability

(1) Use of Sn-63Pb 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

RESTRICTIONS ON PRODUCT USE