TOSHIBA INTEGRATED CIRCUIT TECHNICAL DATA

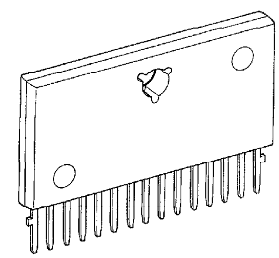
TOSHIBA BIPOLAR LINEAR INTEGRATED CIRCUIT

TA8238K

SILICON MONOLITHIC

7.3W × 2CH AUDIO POWER IC

The TA8238K is dual audio power amplifier for consumer application.
It contains various kind of protectors and the function of stand-by switch.



HSIP15-P-A

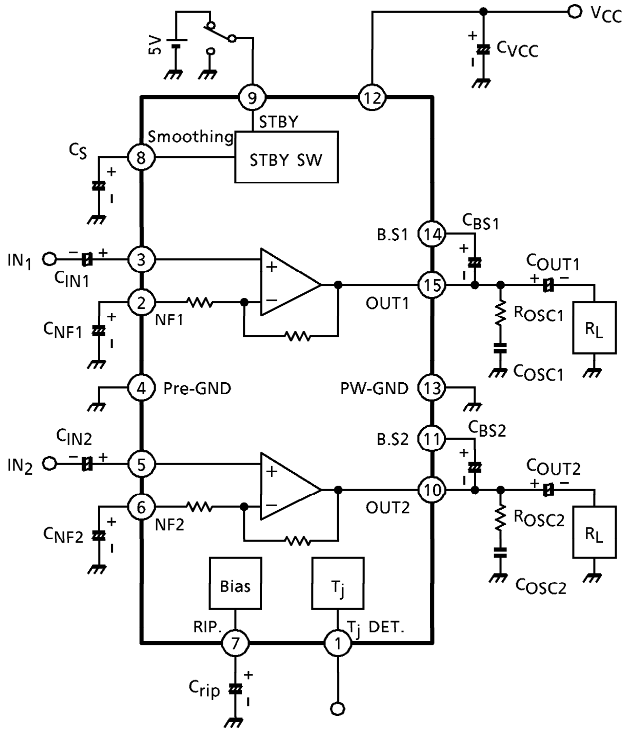
Weight : 3.9g (Typ.)

FEATURES

- Output Power
  - : $P_{OUT\,(1)} = 7.3W$ (Typ.)
    ($V_{CC} = 13.2V$, $f = 1kHz$, $THD = 10\%$, $R_L = 2\Omega$)
  - : $P_{OUT\,(2)} = 6.4W$ (Typ.)
    ($V_{CC} = 14.4V$, $f = 1kHz$, $THD = 10\%$, $R_L = 4\Omega$)
  - : $P_{OUT\,(3)} = 5.3W$ (Typ.)
    ($V_{CC} = 13.2V$, $f = 1kHz$, $THD = 10\%$, $R_L = 4\Omega$)
- Total Harmonic Distortion
  - : $THD = 0.1\%$ (Typ.)
    ($V_{CC} = 13.2V$, $f = 1kHz$, $P_{out} = 1W$, $R_L = 4\Omega$)
- Built In Stand-By Switch Function
  - : $I\ STBY = 1\mu A$ (Typ.)
    (With Pin⑨ set at High, power is turned ON.)
- Built In Junction Temperature Detection Function
  (Pin① : 10mV / °C)
- Built In Various Protection Circuits
  - : Over Voltage, Thermal Shut Down
    Out to GND, Out to V_{CC}
- Operating Supply Voltage
  - : $V_{CC\,(opr.)} = 6\sim18V$

BLOCK DIAGRAM

($G_V = 52dB$)



CAUTION AND APPLICATION METHOD

(Description is made only on the single channel.)

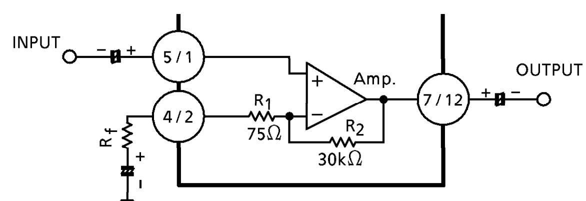
1. Voltage Gain Adjustment

   The closed loop voltage gain (G_V) is determined by R_1, R_2 and R_f.

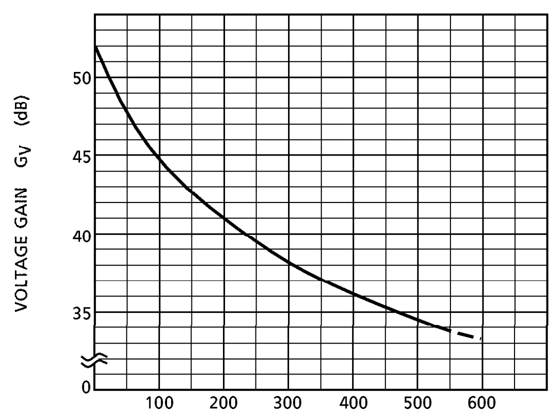
$$G_V = 20\ell og \frac{R_f + R_1 + R_2}{R_f + R_1} \text{ (dB)}$$

   When $R_f = 0$, $G_V = 52dB$ (Typ.) is given.

   The voltage gain is reduced when R_f is increased. (Fig.2)
   With the voltage gain reduced, since the oscillation stability is reduced, refer to the items 3.



(Fig.1)



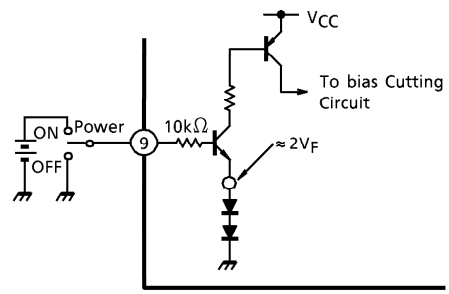
(Fig.2)

2. Stand-by SW Function

By means of controlling pin⑨ (Stand-by terminal) to High and Low, the power supply can be set to ON and OFF. The threshold voltage of pin⑨ is set at 2.1V ($3V_{BE}$), and the Power Supply current is about 1μA (Typ.) at the stand-by state.

Control Voltage pin⑨ : V (SB)

Stand-By	Power	$V_{(SB)}$ (V)
ON	OFF	0~2
OFF	ON	3~V_{CC}

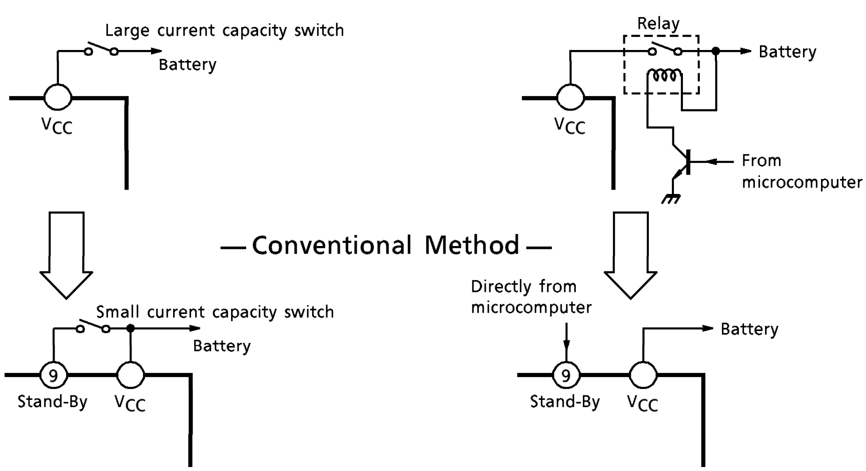


(Fig.3)With Pin⑨ Set to High, Power is Turned ON.

Advantage of Stand-by SW

(1) Since V_{CC} can directly be controlled to ON, 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.



— Standby Switch Method —

3. Preventive Measure Against Oscillation

C_{OSC} : For preventing the oscillation, it is advisable to use C_{OSC}, the condenser of polyester film having small characteristic fluctuation of the temperature and the frequency.
The resistance R to be series applied to C_{OSC} is effective for phase correction of high frequency, and improves the oscillation allowance.

(1) Voltage gain to be used (G_V Setting)
(2) Capacity value of condenser
(3) Kind of condenser
(4) Layout of printed board

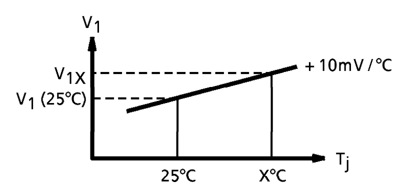
In case of its use with the voltage gain G_V reduced or with the feedback amount increased, care must be taken because the phase-inversion is caused by the high frequency resulting in making the oscillation liable generated.

4. Junction Temperature Detecting pin①

Using temperature characteristic of a band gap circuit and in proportion to junction temperature, pin① DC voltage : V_2 rises at about +10mV / °C temperature characteristic. So, the relation between V_2 at $T_j = 25°C$ and V_{2x} at $T_j = x°C$ is decided by the following expression :

$$T\ (x°C) = \frac{V_{2x} - V_2\ (25°C)}{10mV / °C} + 25\ (°C)$$

In deciding a heat sink size, a junction temperature can be easily made clear by measuring voltage at this pin while a backside temperature of IC was so far measured using a thermocouple type thermometer.

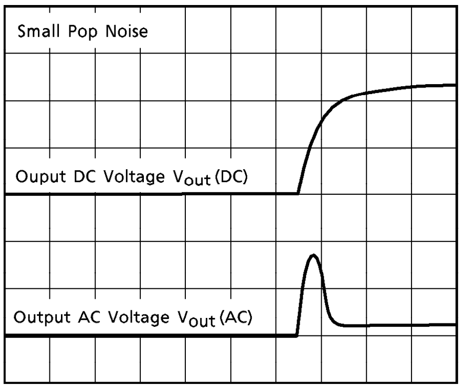


(Fig.4)

5. Pop Noise

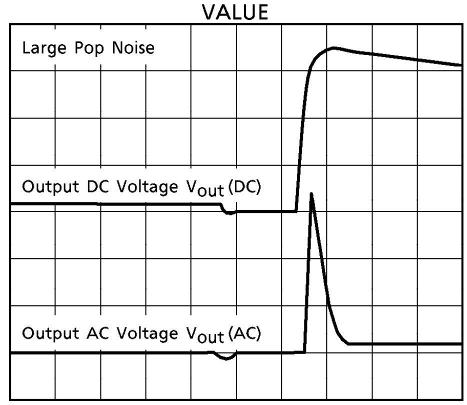
The pop noise is reduced by the time constant τ of pin⑧ : smoothing.
Therefore, we recommend $C_S = 100\mu F$, which is between pin⑧ and GND, because the pop noise will become worse by using the smaller capacity of C_S.

$C_S = 100\mu F$: RECOMMENDED VALUE



OUTPUT DC VOLTAGE 2V / DIV, 20ms / DIV
OUTPUT AC VOLTAGE 1V / DIV, 20ms / DIV

$C_S = 10\mu F$: LESS THAN RECOMMENDED VALUE



OUTPUT DC VOLTAGE 2V / DIV, 20ms / DIV
OUTPUT AC VOLTAGE 1V / DIV, 20ms / DIV

MAXIMUM RATINGS (Ta = 25°C)

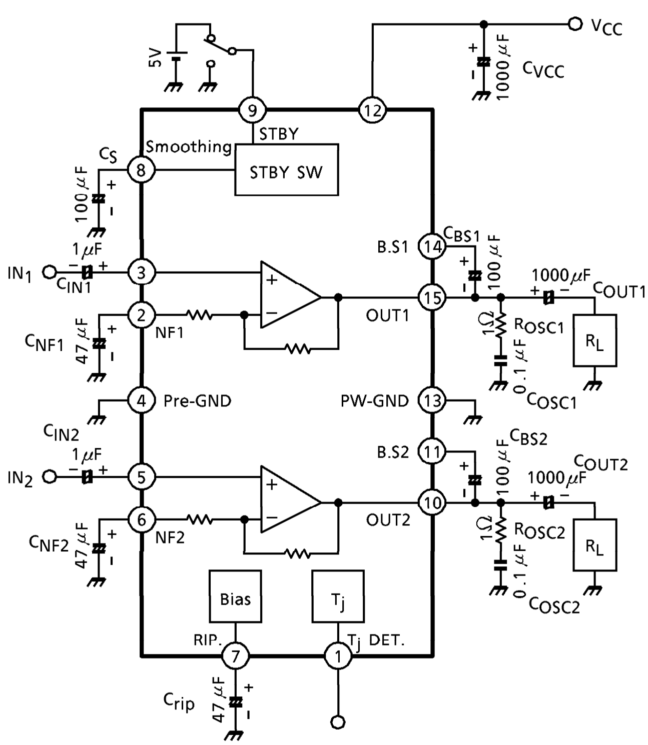
CHARACTERISTIC	SYMBOL	RATING	UNIT
Peak Supply Voltage (0.2s)	$V_{CC\,(surge)}$	50	V
DC Supply Voltage	$V_{CC\,(DC)}$	20	V
Operating Supply Voltage	$V_{CC\,(opr)}$	18	V
Output Current (peak)	$I_{O\,(peak)}$	4.5	A
Power Dissipation	P_D	15	W
Operating Temperature	T_{opr}	−30~85	°C
Storage Temperature	T_{stg}	−55~150	°C

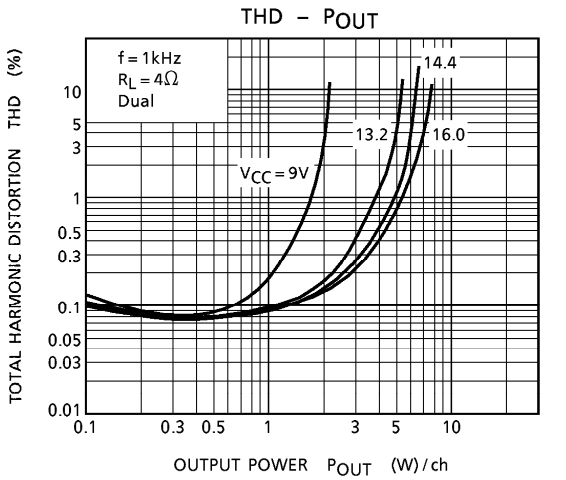
ELECTRICAL CHARACTERISTICS
(Unless otherwise specified, $V_{CC}=13.2V$, $f=1kHz$, $R_g=600\Omega$, $R_L=4\Omega$, $Ta=25°C$)

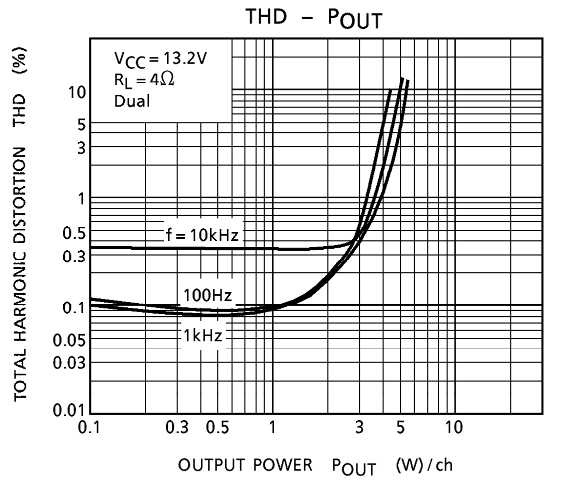
CHARACTERISTIC	SYMBOL	TEST CIR-CUIT	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Quiescent Current	I_{ccq}	—	$V_{in}=0$	—	60	150	mA
Output Power	$P_{out\,(1)}$	—	THD = 10%, $R_L=2\Omega$	—	7.3	—	W
	$P_{out\,(2)}$	—	$V_{CC}=14.4V$, THD = 10%	—	6.4	—	W
	$P_{out\,(3)}$	—	THD = 10%	4.8	5.3	—	W
Total Harmonic Distortion	THD	—	$P_{out}=1W$	—	0.1	0.5	%
Voltage Gain	G_V	—	$V_{out}=0.775V_{rms}$ (0dBm)	50	52	54	dB
Voltage Gain Ratio	ΔG_V	—	$V_{out}=0.775V_{rms}$ (0dBm)	− 1	0	1	dB
Output Noise Voltage	V_{NO}	—	$R_g=0\Omega$, BW = 20Hz~20kHz	—	0.2	0.7	mV_{rms}
Ripple Rejection Ratio	R.R.	—	$f_{ripple}=100Hz$, $V_{out}=0.775V_{rms}$ (0dBm), $R_g=600\Omega$	40	57	—	dB
Cross Talk	C.T.	—	$R_g=600\Omega$, $V_{out}=0.775V_{rms}$ (0dBm)	—	65	—	dB
Input Resistance	R_{IN}	—	—	—	30	—	kΩ
Stand-By Current	I_{STBY}	—	Pin⑨ : GND	—	1	10	μA

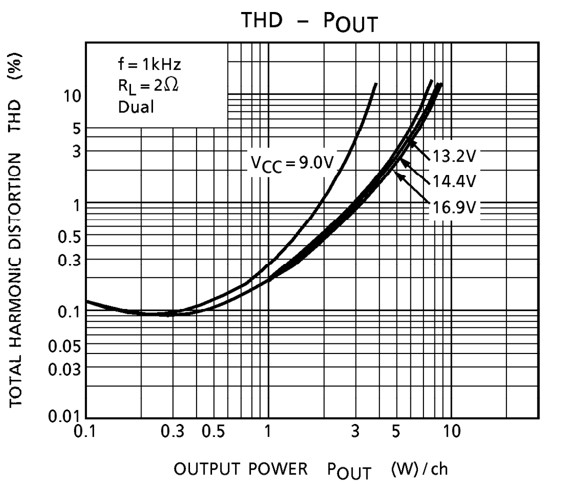
TEST CIRCUIT

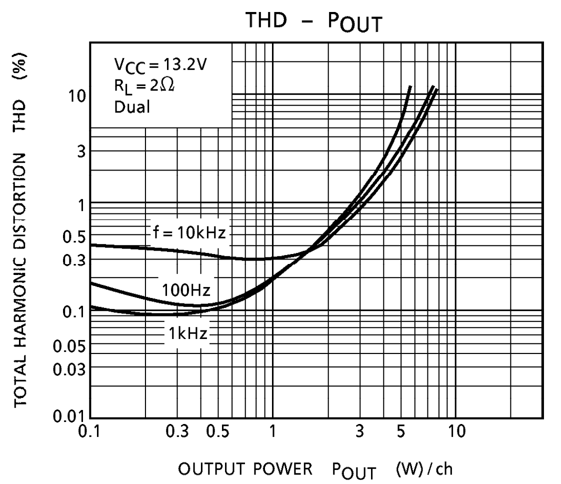
($G_V=52dB$)

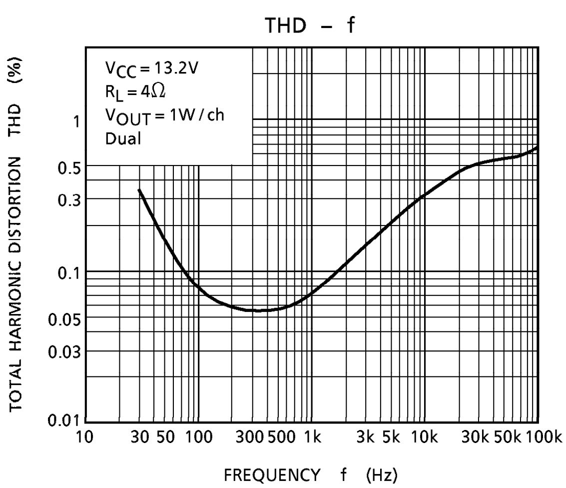


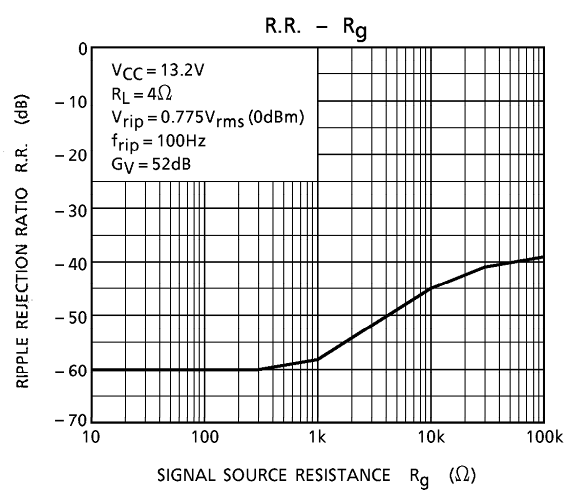

THD – POUT
f = 1kHz
RL = 4Ω
Dual
VCC = 9V
13.2
14.4
16.0
TOTAL HARMONIC DISTORTION THD (%)
OUTPUT POWER POUT (W) / ch

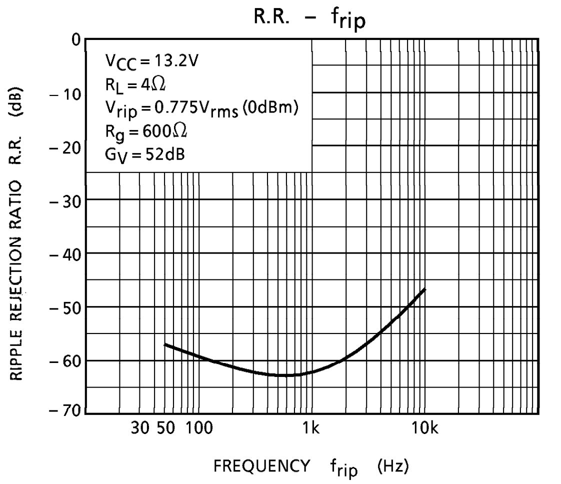

THD – POUT
VCC = 13.2V
RL = 4Ω
Dual
f = 10kHz
100Hz
1kHz
TOTAL HARMONIC DISTORTION THD (%)
OUTPUT POWER POUT (W) / ch

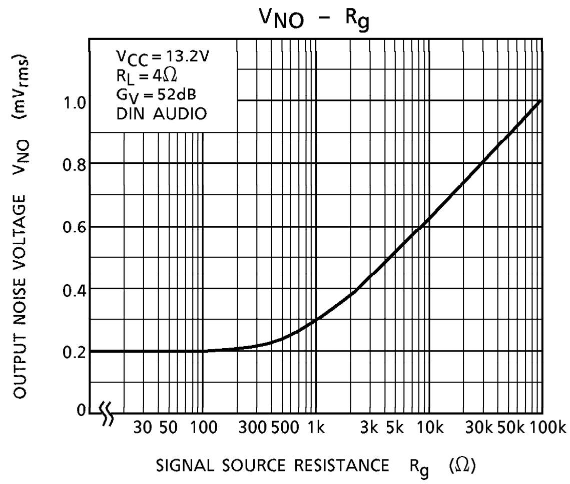

THD – POUT
f = 1kHz
RL = 2Ω
Dual
VCC = 9.0V
13.2V
14.4V
16.9V
TOTAL HARMONIC DISTORTION THD (%)
OUTPUT POWER POUT (W) / ch

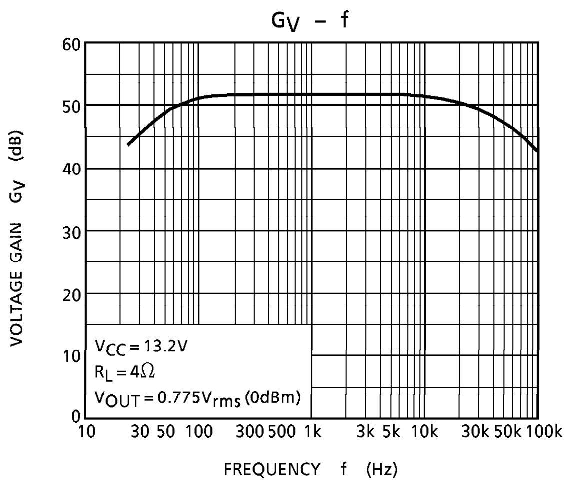

THD – POUT
VCC = 13.2V
RL = 2Ω
Dual
f = 10kHz
100Hz
1kHz
TOTAL HARMONIC DISTORTION THD (%)
OUTPUT POWER POUT (W) / ch

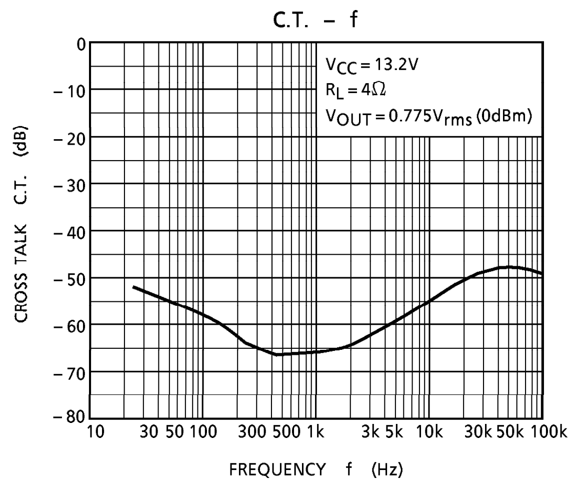

THD – f
VCC = 13.2V
RL = 4Ω
VOUT = 1W / ch
Dual
TOTAL HARMONIC DISTORTION THD (%)
FREQUENCY f (Hz)

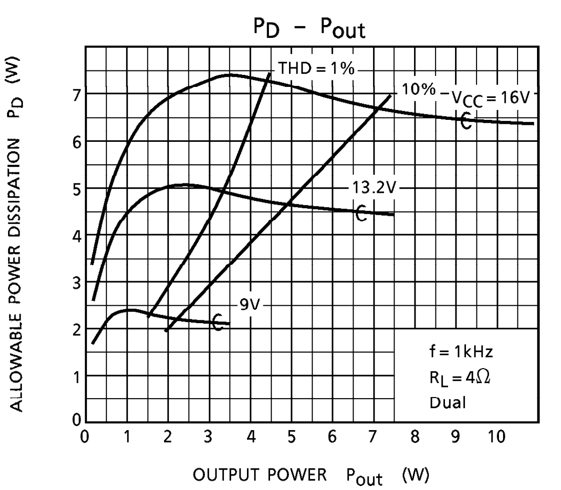

R.R. – Rg
VCC = 13.2V
RL = 4Ω
Vrip = 0.775Vrms (0dBm)
frip = 100Hz
GV = 52dB
RIPPLE REJECTION RATIO R.R. (dB)
SIGNAL SOURCE RESISTANCE Rg (Ω)

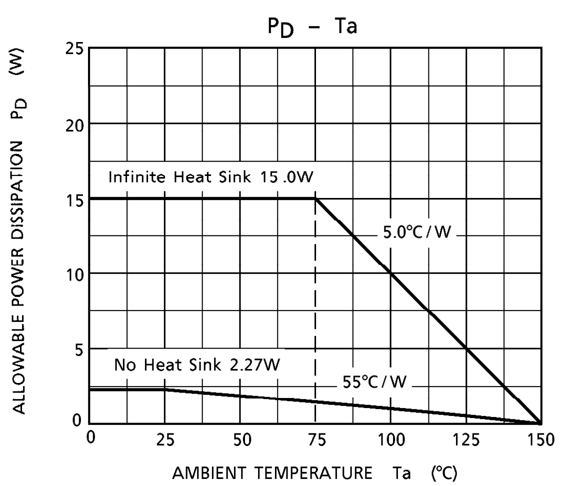

R.R. – frip
VCC = 13.2V
RL = 4Ω
Vrip = 0.775Vrms (0dBm)
Rg = 600Ω
GV = 52dB
RIPPLE REJECTION RATIO R.R. (dB)
FREQUENCY frip (Hz)


VNO – Rg
VCC = 13.2V
RL = 4Ω
GV = 52dB
DIN AUDIO
OUTPUT NOISE VOLTAGE VNO (mVrms)
SIGNAL SOURCE RESISTANCE Rg (Ω)


GV – f
VCC = 13.2V
RL = 4Ω
VOUT = 0.775Vrms (0dBm)
VOLTAGE GAIN GV (dB)
FREQUENCY f (Hz)

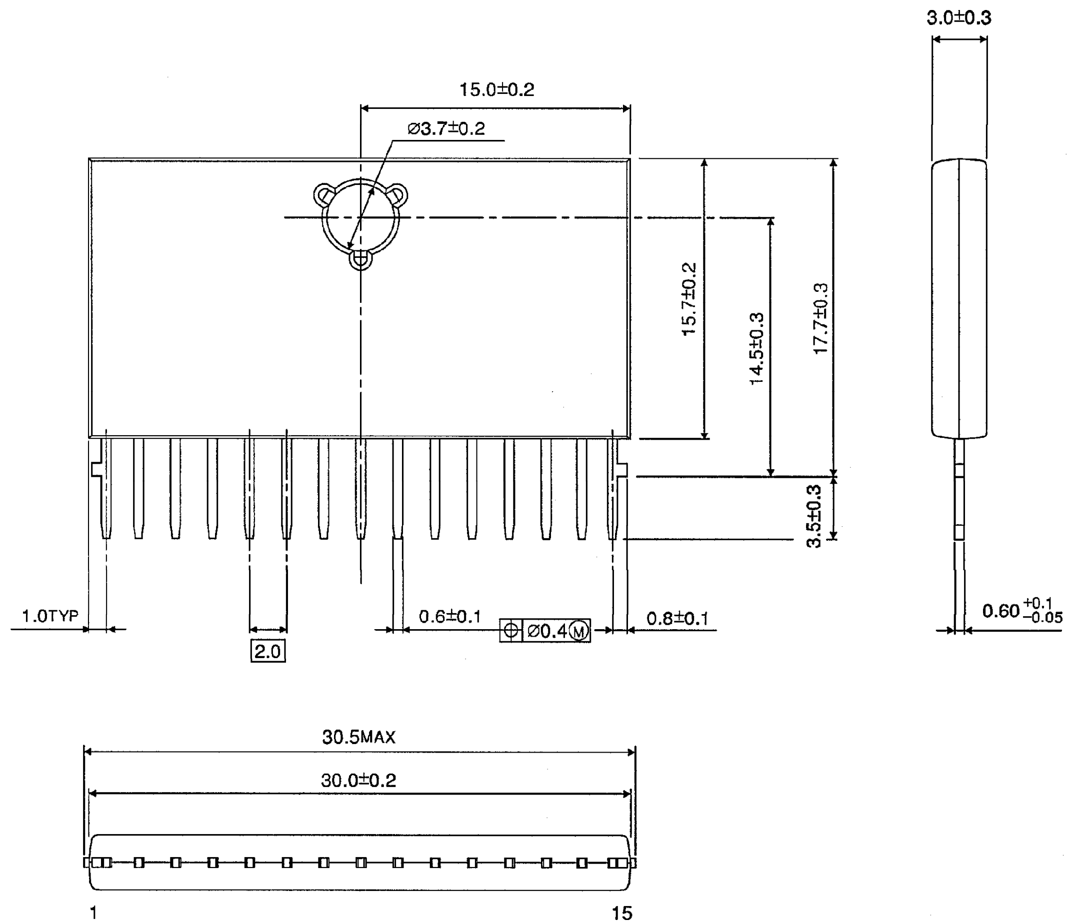

C.T. – f
VCC = 13.2V
RL = 4Ω
VOUT = 0.775Vrms (0dBm)
CROSS TALK C.T. (dB)
FREQUENCY f (Hz)


PD – Pout
THD = 1%
10%
VCC = 16V
13.2V
9V
f = 1kHz
RL = 4Ω
Dual
ALLOWABLE POWER DISSIPATION PD (W)
OUTPUT POWER Pout (W)


PD – Ta
Infinite Heat Sink 15 .0W
5.0°C / W
No Heat Sink 2.27W
55°C / W
ALLOWABLE POWER DISSIPATION PD (W)
AMBIENT TEMPERATURE Ta (°C)

OUTLINE DRAWING
HSIP15-P-A

Unit : mm



Weight : 3.9g (Typ.)