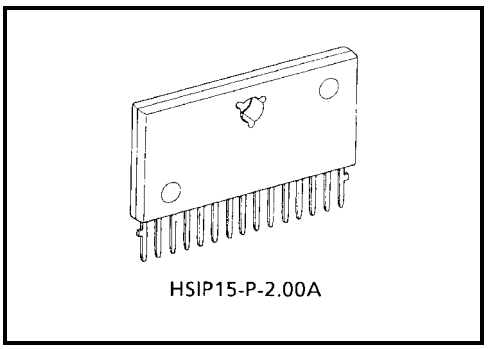
TOSHIBA Bipolar Linear Integrated Circuit Silicon Monolithic

TA8223K

Low Frequency Power Amplifier

TA8223K is an audio power IC with built-in two channels developed for portable radio cassette tape recorder with power ON/OFF switch. Thermal shut down protection circuit is built in.

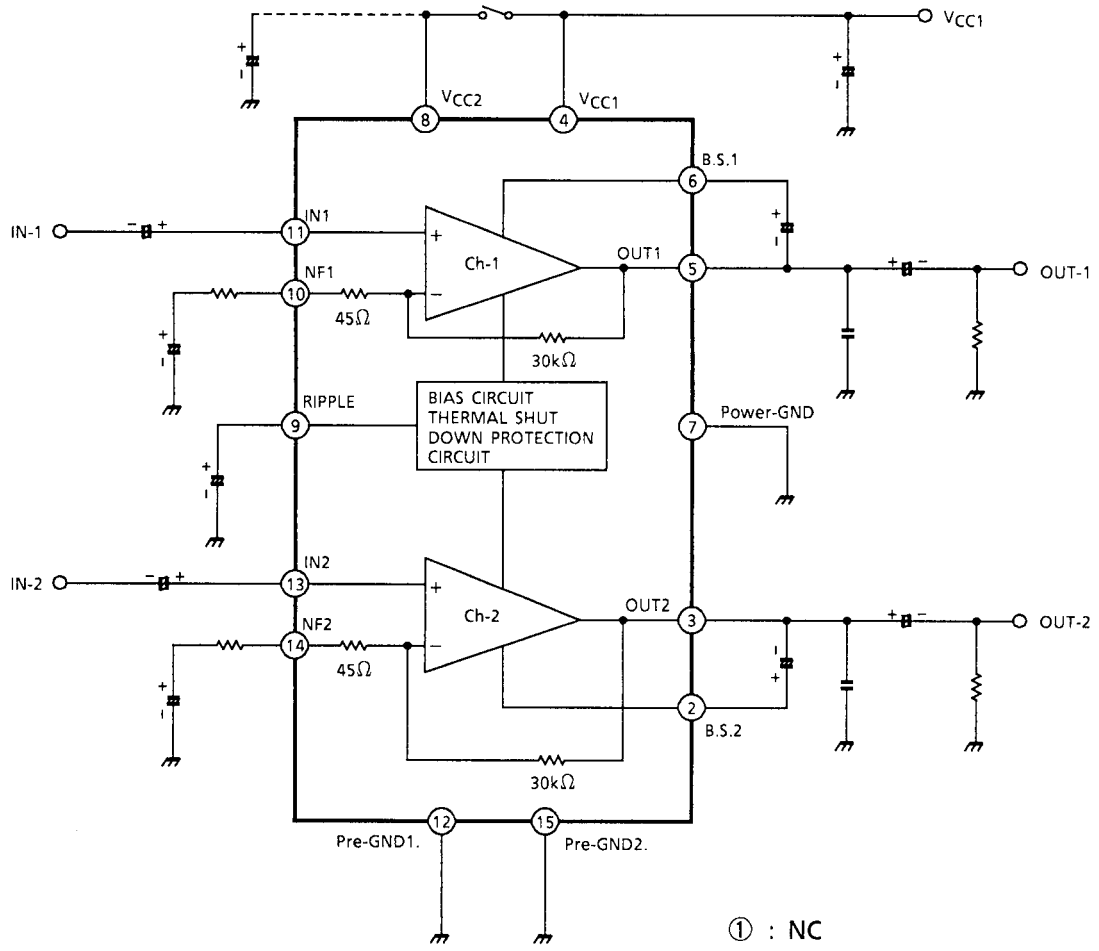


Weight: 3.9 g (typ.)

Features

- High power
  : $P_{out\ (1)}$ = 6.5 W (typ.)
  (V_{CC} = 15 V, R_L = 4 Ω, f = 1 kHz, THD = 10%)
  $P_{out\ (2)}$ = 7.3 W (typ.)
  (V_{CC} = 15 V, R_L = 3 Ω, f = 1 kHz, THD = 10%)
- Low popping noise at power ON
- Small quiescent current
  : I_{CCQ} = 29 mA (typ.) (V_{CC} = 15 V, V_{in} = 0)
- Soft clip
- Built-in thermal shut down protection circuit
- Operation supply voltage range: $V_{CC\ (opr)}$ = 6~18 V (Ta = 25°C)

Block Diagram



Application Information and Application Method

1. Adjustment of voltage gain

The voltage gain G_V is obtained as follows by R1, R2 and R_f in Figure 1.

$$G_V = 20 \log \frac{R_f + R1 + R2}{R_f + R1}$$

When R_f = 0 Ω G_V = 56.5dB (typ.)
When R_f = 120 Ω G_V = 45dB (typ.)

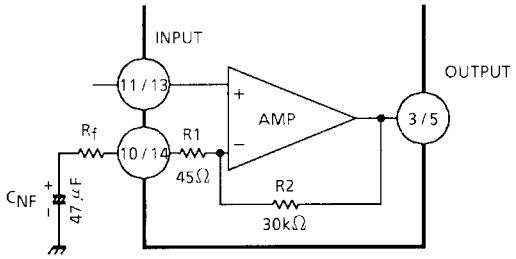


Figure 1

By increasing R_f, reduction of G_V is possible. However, since the feedback increase is liable to produce oscillation, it is recommended to use this at 40dB or over.

2. Thermal shut-down circuit

The thermal shut-down circuit is built in for the purpose of preventing the destruction of IC due to the abnormal temperature rise when the heat radiation is insufficient.
The operation temperature is set at radiation Fin temperature 175°C (typ.).
At this temperature or over the bias is interrupted to prevent the destruction of IC.

3. Input stage

The input circuit of this IC is as shown in Figure 2.
PNP Tr: Q1 is provided in the input circuit so as to make its usage possible without the input coupling capacitor.
However, at pin11 and 13, max 60 mV offset voltage is produced.
Application after checking volume slide noise is recommended.
For cutting the volume slide noise, insert the input capacitor: C_{IN} in series to interrupt the DC component.

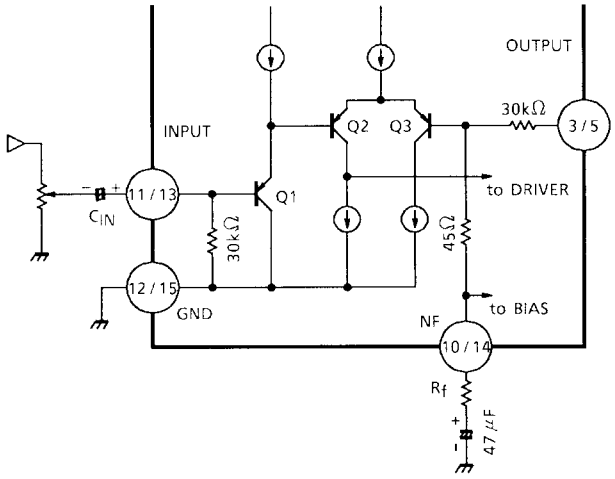


Figure 2

4. Oscillation preventive measures (Note 1)

For oscillation preventive capacitor C6 and C7 between the output terminal and GND, it is recommended to use polyester film capacitor having good characteristics for temperature and for high frequency.
Since the characteristics of the ceramic capacitor is liable to be influenced by the temperature, use this capacitor after the temperature test to check the oscillation allowance.
In addition, as the position of the electrolytic capacitor has a remarkable influence on the oscillation, connect C10 to V_{CC} at the nearest possible position from power GND.
At using this application with the voltage gain reduced, oscillation is liable to be produced. Apply the capacitor after checking enough for its capacity, type and mounting position.

Note 1: As the oscillation allowance varies according to the printed pattern layout, the standard printed board of TOSHIBA is recommended to be referred to design it.

5. Power ON/OFF switch

There is power ON/OFF switch at pin 8. However, output power is changed by pin 8 supply voltage when pin 4 supply voltage is not same pin 8 supply voltage, after referring to attached data, select pin 8 supply voltage.

6. Input voltage

When the excessive signal is input, turning-up is produced in the clip waveform. The turning-up point is V_{in} = 300 mVrms (typ.) : V_{CC} = 15 V, R_L = 4 Ω, f = 1 kHz: Enough care must be taken for this phenomenon.

Maximum Ratings (Ta = 25°C)

Characteristics	Symbol	Rating	Unit
Supply voltage	V_{CC}	25	V
Output current (peak/CH)	$I_{O\ (peak)}$	4	A
Power dissipation	P_D (Note 2)	15.0	W
Operating temperature	T_{opr}	−20~75	°C
Storage temperature	T_{stg}	−55~150	°C

Note 2: Derated above Ta = 25°C in the proportion of 120 mW/°C.

Electrical Characteristics

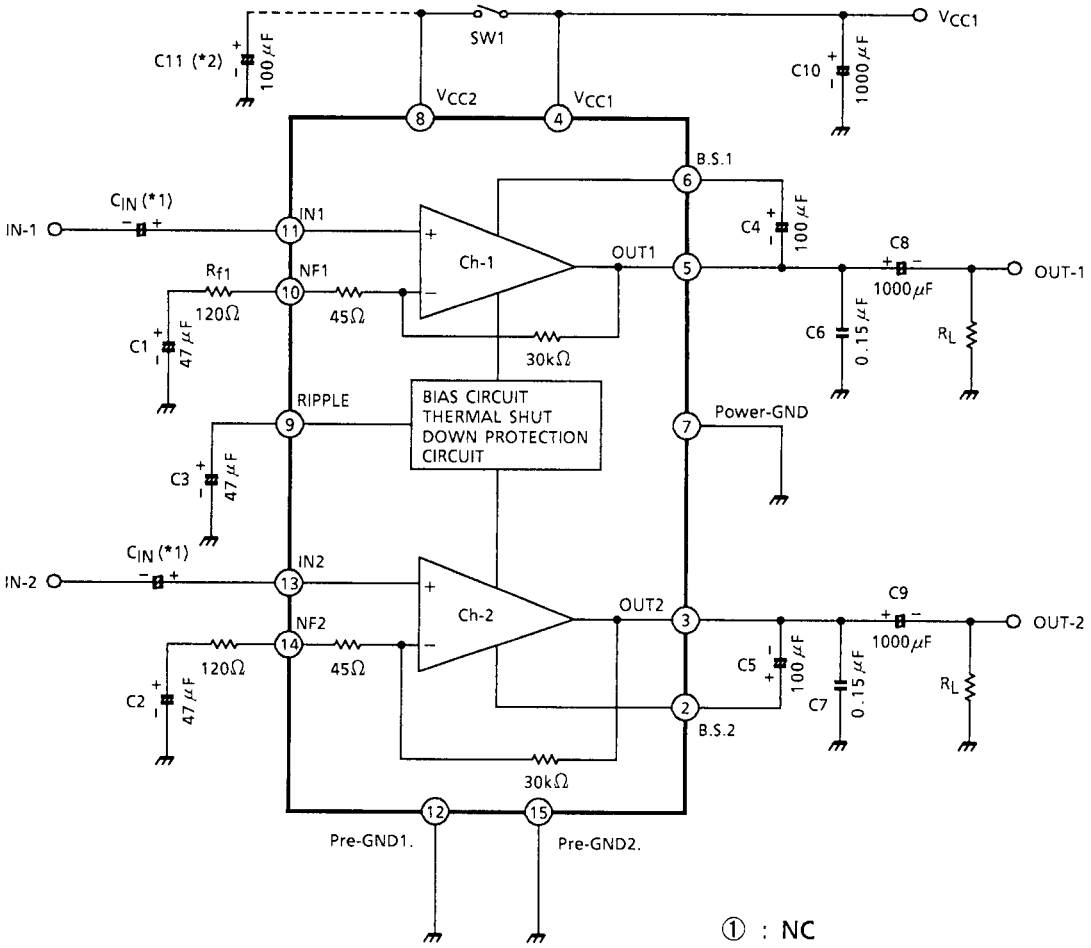
(unless otherwise specified, V_{CC} = 15 V, R_L = 4 Ω, R_g = 600 Ω, f = 1 kHz, Ta = 25°C, R_f = 120 Ω)

Characteristics	Symbol	Test Circuit	Test Condition	Min	Typ.	Max	Unit
Quiescent current	I_{CCQ}	—	V_{in} = 0	—	29	60	mA
Output power	$P_{out\ (1)}$	—	THD = 10%	5.0	6.5	—	W
	$P_{out\ (2)}$	—	THD = 10%, V_{CC} = 15 V, R_L = 3 Ω	—	7.3	—	
Total harmonic distortion	THD	—	P_{out} = 1 W	—	0.15	1.0	%
Voltage gain	$G_{v\ (1)}$	—	R_f = 120 Ω, V_{OUT} = 0.775 Vrms (0dBm)	43	45	47	dB
	$G_{v\ (2)}$	—	R_f = 0, V_{OUT} = 0.775 Vrms (0dBm)	—	56.5	—	
Input resistance	R_{IN}	—		—	30	—	kΩ
Output noise voltage	V_{no}	—	R_g = 10 kΩ, BW = 20 Hz~20 kHz	—	0.35	0.70	mVrms
Ripple rejection ratio	R.R.	—	R_g = 600 Ω, f_{ripple} = 100 Hz	−45	−55	—	dB
Cross talk	C.T.	—	R_g = 600 Ω, amp1↔2, f = 1 kHz, V_{OUT} = 0.775 Vrms (0dBm)	—	−55	—	dB
Input offset voltage	V_{13}, V_{11}	—	—	—	20	60	mV
Stand-by current	I_{OFF}	—	SW1 → OFF	—	1	—	μA

TYP. DC Voltage of Each Terminal (V_{CC} = 15 V, Ta = 25°C)

Terminal No.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
DC Voltage (V)	N.C	14.7	7.9	15	7.9	14.7	0	15	8.0	0.6	0.02	0	0.02	0.6	0

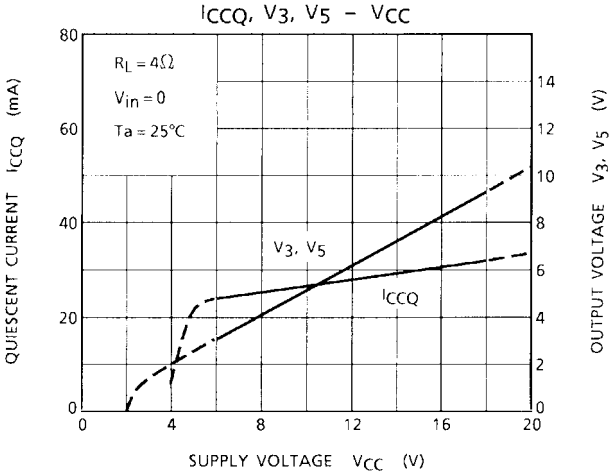
Test Circuit



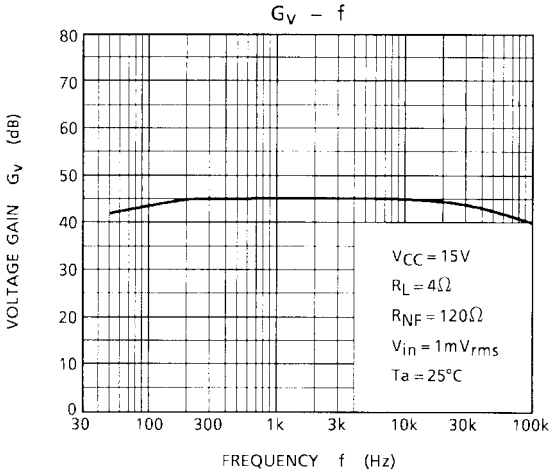
*1: This IC can be used without coupling capacitor (C_{IN}). If volume slide noise occurred by input offset voltage is undesirable, it needs to use the capacitor (C_{IN}).

*2: The condenser between the pin 8 and the GND (C11) is for reducing POP noise when the power ON/OFF switch (SW1) is set to ON/OFF.

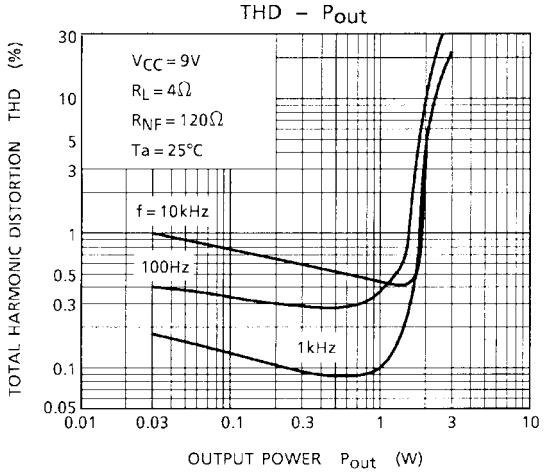
I_{CCQ}, V_3, V_5 – V_{CC}



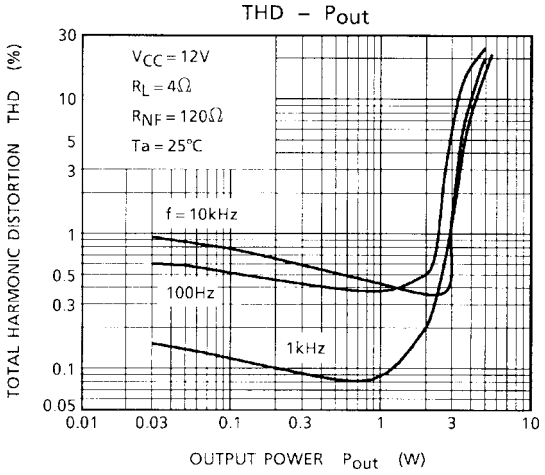
G_V – f



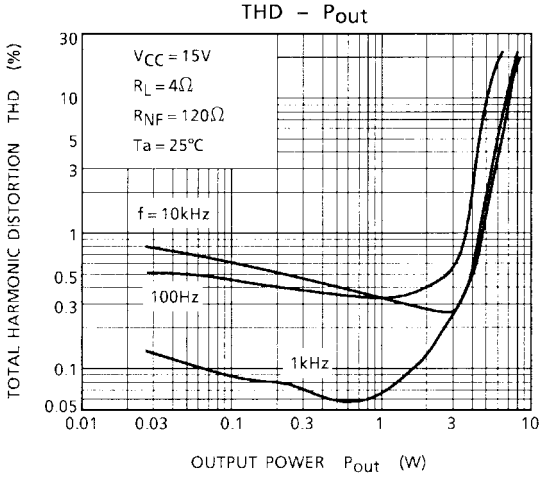
THD – P_{out}



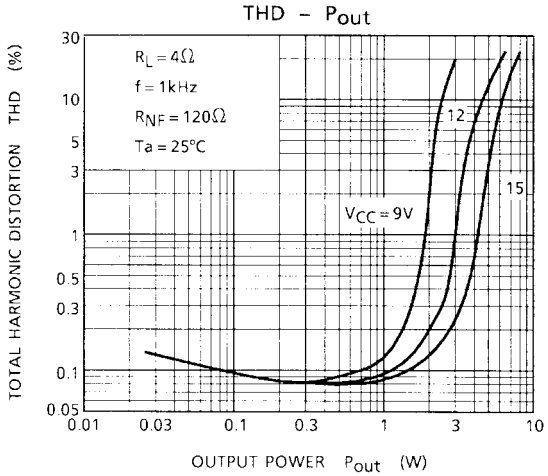
THD – P_{out}



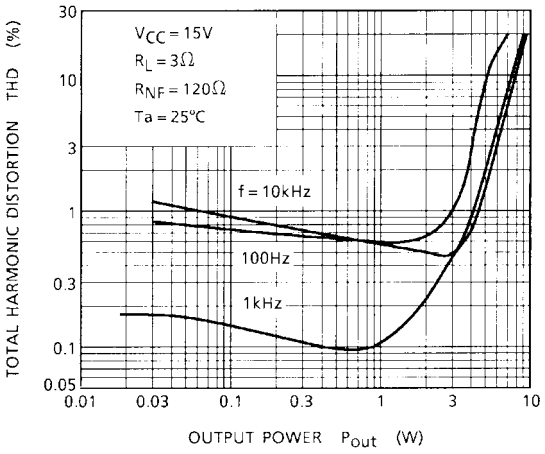
THD – P_{out}



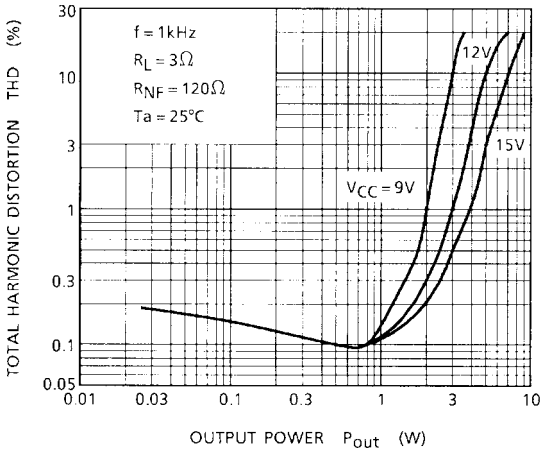
THD – P_{out}



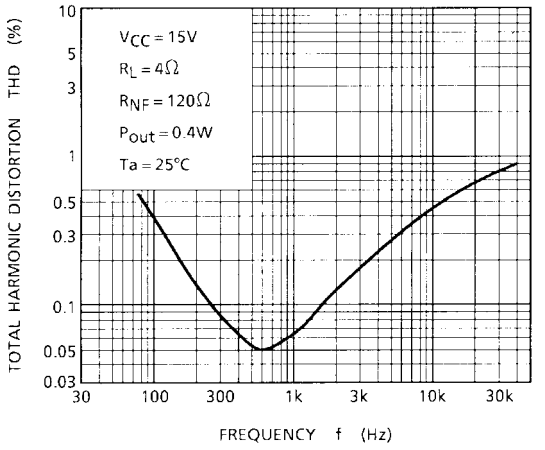
THD – P_{out}



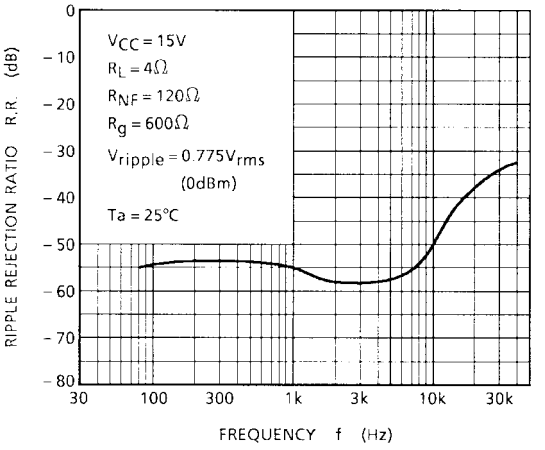
THD – P_{out}



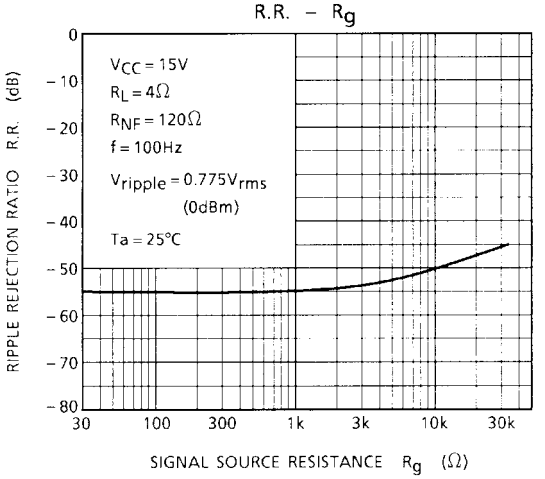
THD – f



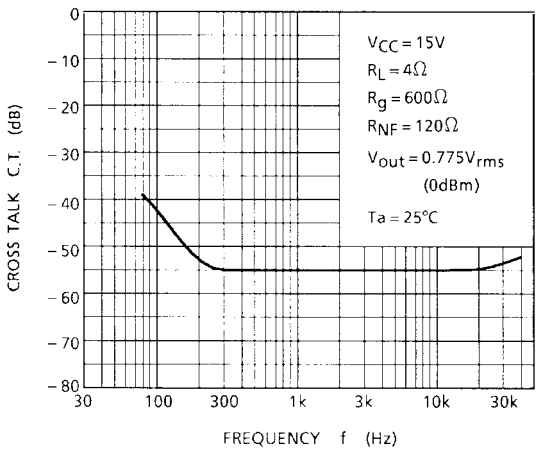
R.R. – f



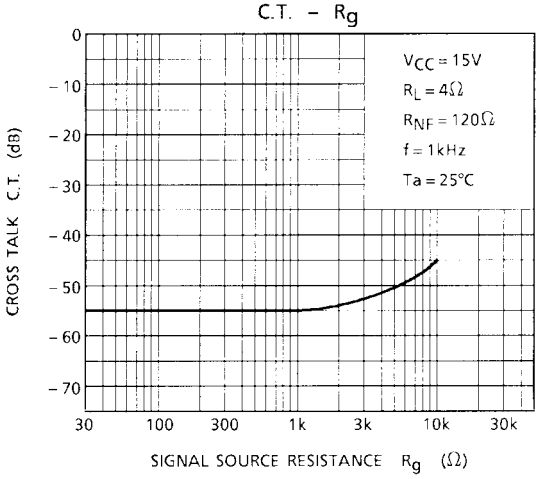
R.R. – R_g



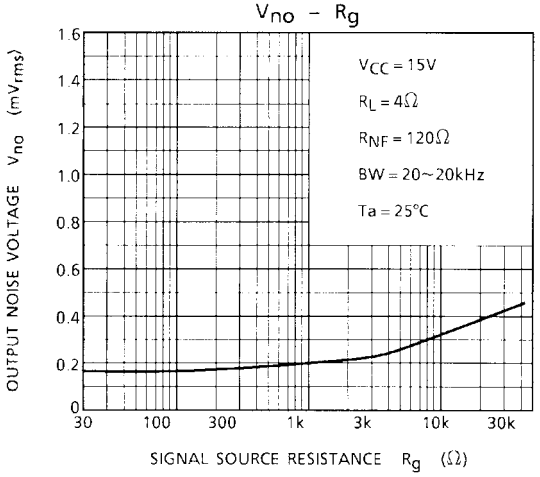
C.T. – f



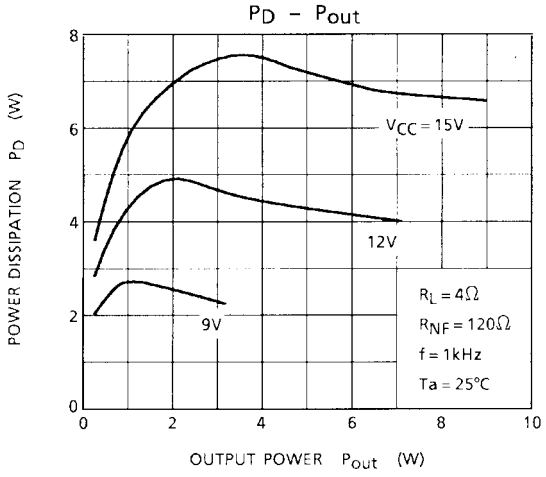
C.T. – R_g



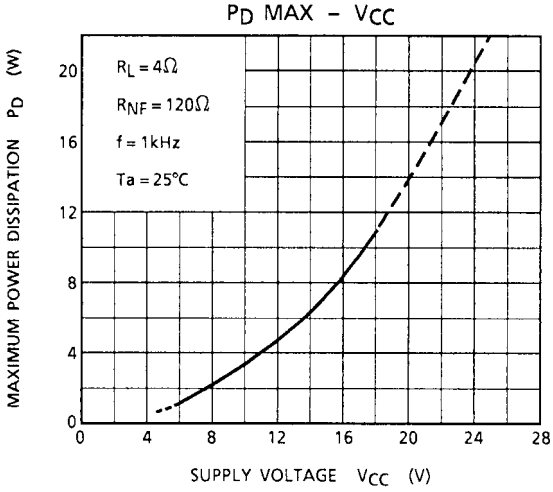
V_{no} – R_g



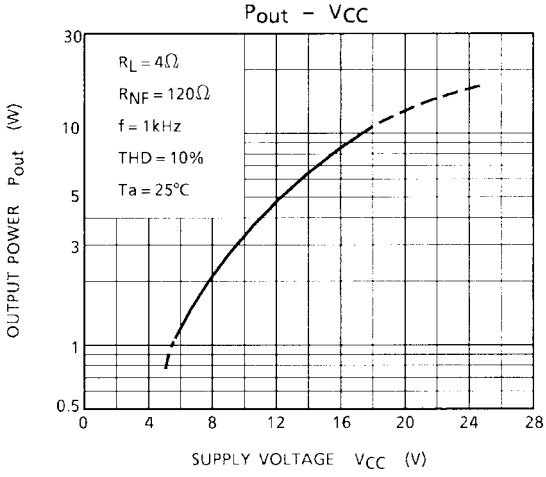
P_D – P_{out}



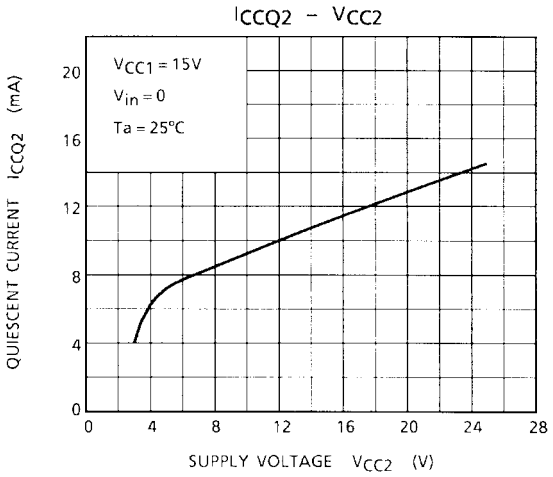
P_D MAX – V_{CC}

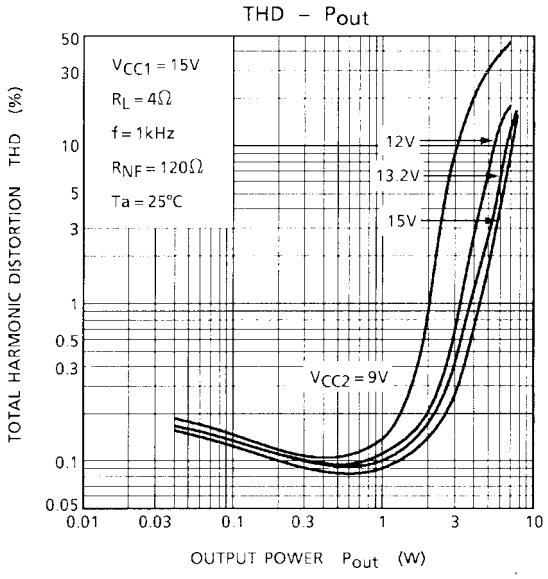


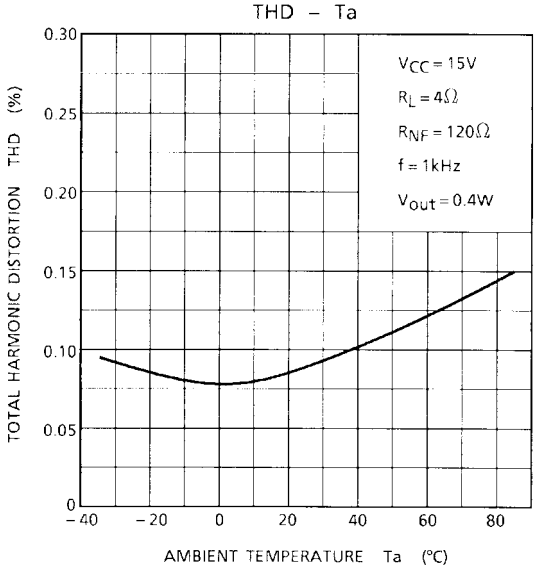
P_{out} – V_{CC}

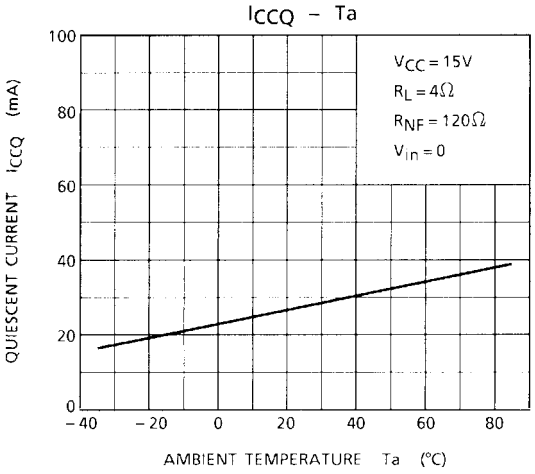


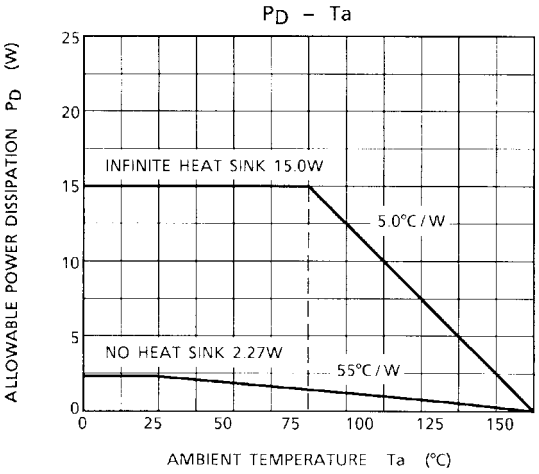
I_{CCQ2} – V_{CC2}




THD – Pout
TOTAL HARMONIC DISTORTION THD (%)
OUTPUT POWER Pout (W)
VCC1 = 15V
RL = 4Ω
f = 1kHz
RNF = 120Ω
Ta = 25°C
12V
13.2V
15V
VCC2 = 9V
50
30
10
5
3
1
0.5
0.3
0.1
0.05
0.01
0.03
0.1
0.3
1
3
10


THD – Ta
TOTAL HARMONIC DISTORTION THD (%)
AMBIENT TEMPERATURE Ta (°C)
VCC = 15V
RL = 4Ω
RNF = 120Ω
f = 1kHz
Vout = 0.4W
0.30
0.25
0.20
0.15
0.10
0.05
0
–40
–20
0
20
40
60
80

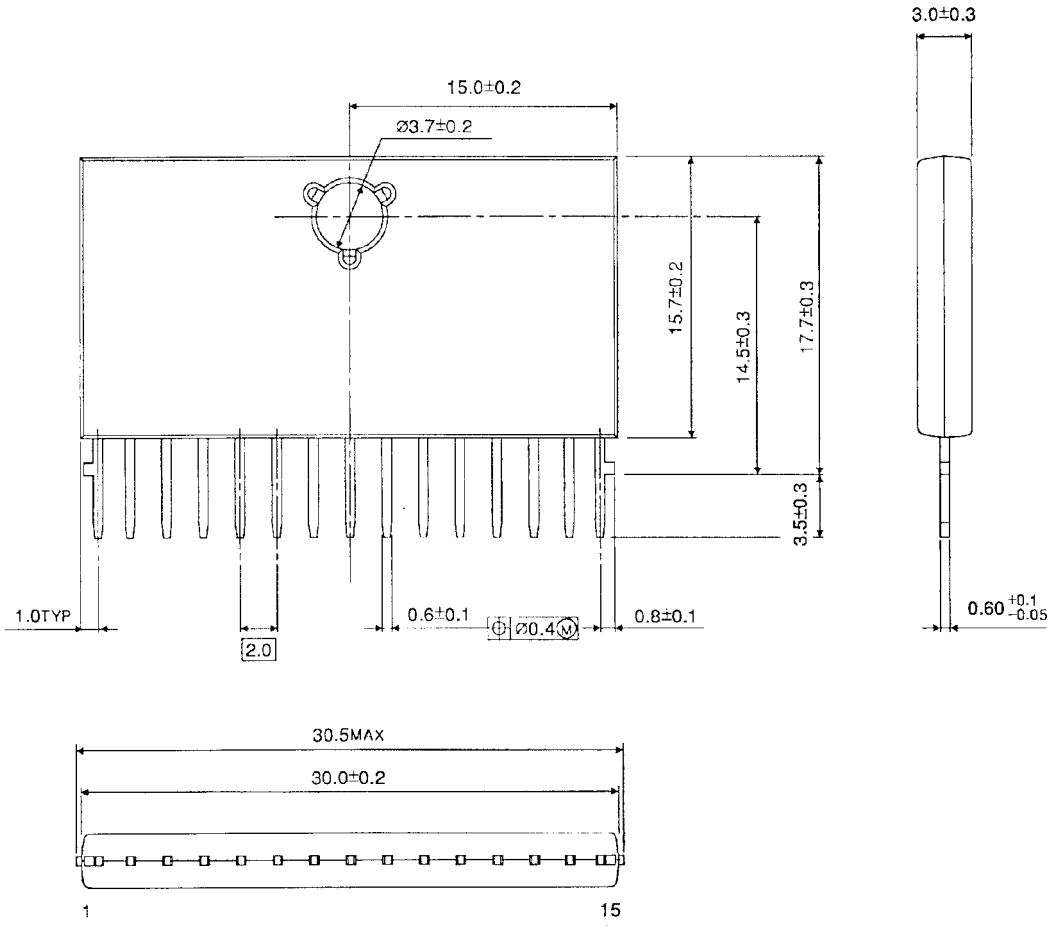

ICCQ – Ta
QUIESCENT CURRENT ICCQ (mA)
AMBIENT TEMPERATURE Ta (°C)
VCC = 15V
RL = 4Ω
RNF = 120Ω
Vin = 0
100
80
60
40
20
0
–40
–20
0
20
40
60
80


PD – Ta
ALLOWABLE POWER DISSIPATION PD (W)
AMBIENT TEMPERATURE Ta (°C)
INFINITE HEAT SINK 15.0W
5.0°C / W
NO HEAT SINK 2.27W
55°C / W
25
20
15
10
5
0
0
25
50
75
100
125
150

Package Dimensions

HSIP15-P-2.00A

Unit : mm



Weight: 3.9 g (typ.)

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