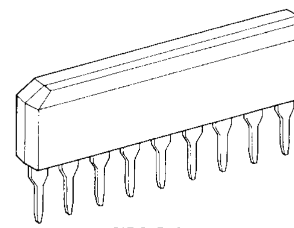
TOSHIBA Bipolar Linear Integrated Circuit Silicon Monolithic

TA7368PG,TA7368FG

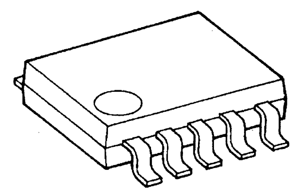
Audio Power Amplifier

TA7368PG



SIP9-P-2.54A

TA7368FG



SSOP10-P-225-1.00

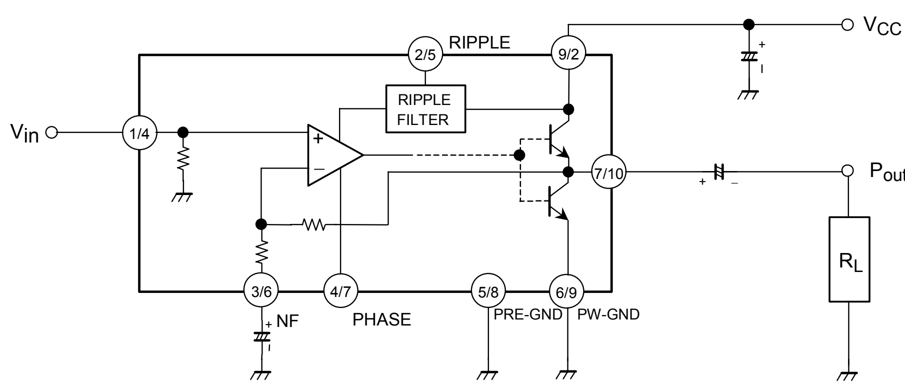
Weight
SIP9−P−2.54A : 0.92g (typ.)
SSOP10−P−225−1.00 : 0.09g (typ.)

The TA7368PG and TA7368FG are suitable for the audio power amplifier of portable cassette tape recorder and radio.

Features

- Very few external parts (only three capacitors)
- Low quiescent current: I_{CCQ} = 6.6mA (typ.) (V_{CC} = 6V)
- Output power
  - TA7368PG
    : P_{out} = 720mW (typ.) (V_{CC} = 6V, R_L = 4Ω, THD = 10%)
  - TA7368PG / FG
    : P_{out} = 450mW (typ.) (V_{CC} = 6V, R_L = 8Ω, THD = 10%)
- Voltage gain: G_V = 40dB (typ.)
- Operating supply voltage range: V_{CC} = 2~10V (Ta = 25°C)

Block Diagram



(/) : TA7368PG / TA7368FG

Precaution For Use And Application

(/) : TA7368PG / TA7368FG

1. Input stage
   The input stage of power amplifier (equivalent circuit) is comprised of a PNP differential pair (Q_2 and Q_3) preceded by a PNP emitter follower (Q_1) which allows DC referencing of the source signal to ground. This eliminated the need for an input coupling capacitor. However, in case the brush noise of volume becomes a problem, provide serially a coupling capacitor to the input side.

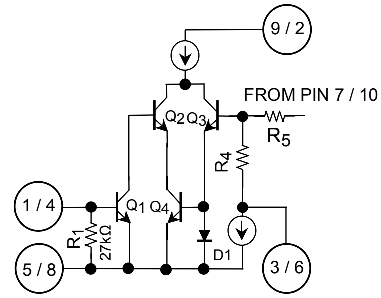


Fig.1

2. Adjustment of voltage gain
   The voltage gain is fixed at $G_V \fallingdotseq 40dB$ by the resistors (R_4 and R_5) in IC, however, its reduction is possible through adding R_f as shown in Figure 2. In this case, the voltage gain is obtained by the following equation.

$$G_V = 20\ell og \frac{R_5 + R_4 + R_f}{R_4 + R_f}$$

   It is recommended to use this IC with the voltage gain of G_V = 28dB or over.

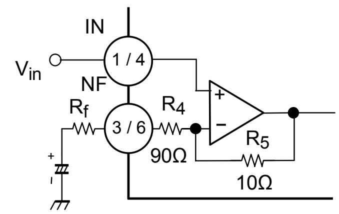


Fig.2

3. Ripple rejection ratio
   Adding C_{RIP}, to ripple terminal 2 as shown in Figure 3, the ripple rejection ratio is improved from −25dB typ. to −45dB typ.

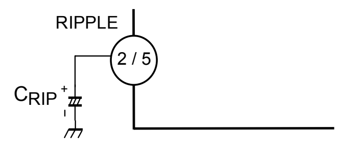


Fig.3

4. Power dissipation
   Care should be taken to use this IC below maximum power dissipation. Because it may over absolute maximum rating depending on operating condition.
   - TA7368PG P_D = 900mW (Ta = 25°C)
   - TA7368FG P_D = 400mW (Ta = 25°C)

5. Phase–compensation
   Small temperature coefficient and excellent frequency characteristic is needed by capacitors below.
   - Oscillation preventing capacitors for power amplifier output
   - Bypass capacitor for ripple filter
   - Capacitor between V_{CC} and GND

Absolute Maximum Ratings (Ta = 25°C)

Characteristic		Symbol	Rating	Unit
Supply voltage		V_{CC}	14	V
Power dissipation	TA7368PG	P_D (Note)	900	mW
	TA7368FG		400	
Operating temperature		T_{opr}	−25∼75	°C
Storage temperature		T_{stg}	−55∼150	°C

(Note) Derated above Ta = 25°C in the proportion of 7.2mW / °C for TA7368PG and of 3.2mW / °C for TA7368FG.

Electrical Characteristics For TA7368PG

(Unless otherwise specified, V_{CC} = 6V, f = 1kHz, R_g = 600Ω, R_L = 4Ω, Ta = 25°C)

Characteristic	Symbol	Test Circuit	Test Condition	Min.	Typ.	Max.	Unit
Quiescent current	I_{CCQ}	—	V_{CC} = 3V, V_{in} = 0	—	5.5	—	mA
			V_{CC} = 6V, V_{in} = 0	—	6.6	15	
			V_{CC} = 9V, V_{in} = 0	—	7.5	18	
Output power	P_{out}	—	V_{CC} = 3V ,R_L = 4Ω, THD = 10%	—	120	—	mW
			V_{CC} = 6V, R_L = 4Ω, THD = 10%	500	720	—	
			V_{CC} = 6V, R_L = 8Ω, THD = 10%	300	450	—	
			V_{CC} = 9V, R_L = 8Ω, THD = 10%	800	1100	—	
			V_{CC} = 9V, R_L = 16Ω, THD = 10%	450	610	—	
Total harmonic distortion	THD	—	P_{out} = 100mW	—	0.3	1.0	%
Voltage gain	G_V	—	V_{in} = 0.5mV_{rms}	37	40	43	dB
Output noise voltage	V_{no}	—	R_g = 10kΩ, BPF = 20Hz~20kHz	—	0.2	0.5	mV_{rms}
Ripple rejection ratio	RR	—	f_r = 100Hz, V_r = 0.3V_{rms} Without C_{RIP}	—	25	—	dB
Input resistance	R_{IN}	—	—	—	27	—	kΩ

Terminal Voltage For TA7368PG

Typical Terminal Voltage at no Signal With Test Circuit. (V_{CC} = 6V, Ta = 25°C) [Unit: V]

Terminal no.	1	2	3	4	5	6	7	8	9
DC voltage (V)	0	2.40	0.62	0.64	0	0	2.61	NC	6.0

Electrical Characteristic For TA7368FG

(unless otherwise specified, V_{CC} = 6V, f = 1kHz, R_g = 600Ω, R_L = 8Ω, Ta = 25°C)

Characteristic	Symbol	Test Circuit	Test Condition	Min.	Typ.	Max.	Unit
Quiescent current	I_{CCQ}	—	V_{CC} = 3V, V_{in} = 0	—	5.5	—	mA
			V_{CC} = 6V, V_{in} = 0	—	6.6	15	
			V_{CC} = 9V, V_{in} = 0	—	7.5	18	
Output power	P_{out}	—	V_{CC} = 3V, R_L = 4Ω, THD = 10%	—	120	—	mW
			V_{CC} = 6V, R_L = 8Ω, THD = 10%	300	450	—	
			V_{CC} = 9V, R_L = 16Ω, THD = 10%	450	610	—	
Total harmonic distortion	THD	—	P_{out} = 100mW	—	0.3	1.0	%
Voltage gain	G_V	—	V_{in} = 0.5mV_{rms}	37	40	43	dB
Output noise voltage	V_{no}	—	R_g = 10kΩ, BPF = 20Hz~20kHz	—	0.2	0.5	mV_{rms}
Ripple rejection ratio	RR	—	f_r = 100Hz, V_r = 0.3V_{rms}, Without C_{RIP}	—	25	—	dB
Input resistance	R_{IN}	—	—	—	27	—	kΩ

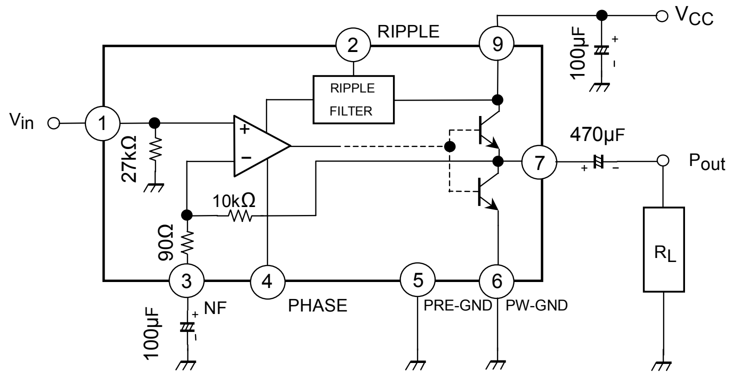
Terminal Voltage For TA7368FG

Typical Terminal Voltage at no Signal with Test Circuit. (V_{CC} = 6V, Ta = 25°C) [Unit: V]

Terminal no.	1	2	3	4	5	6	7	8	9	10
DC voltage (V)	NC	6.0	NC	0	2.40	0.62	0.64	0	0	2.61

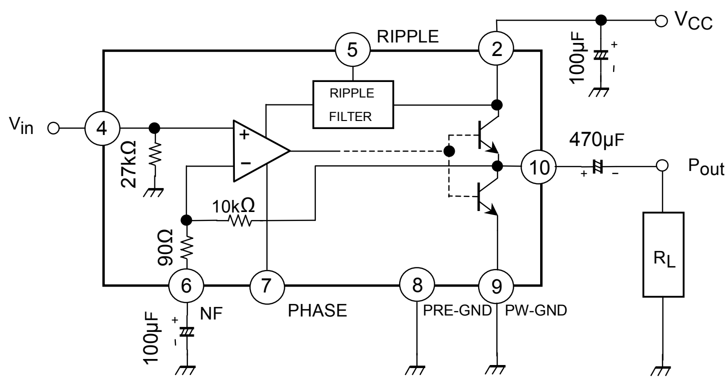
Test Circuit

TA7368PG

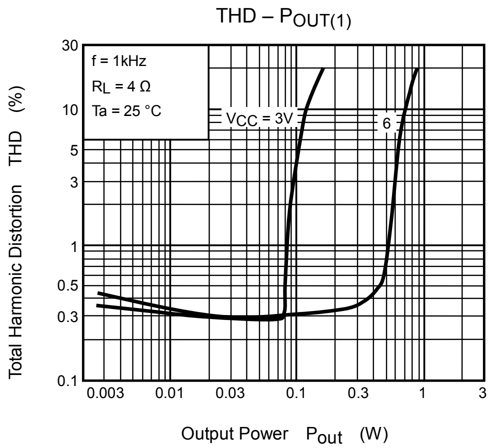


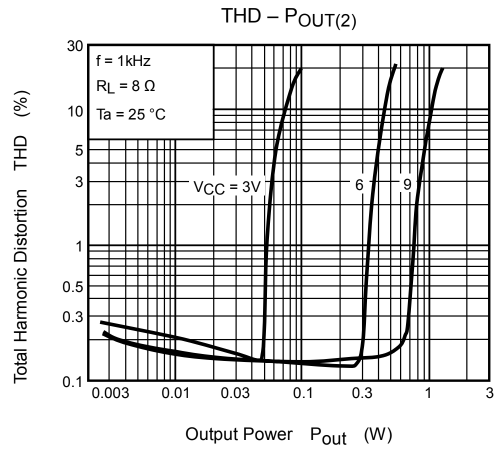
※ Pin(8): Non-connection

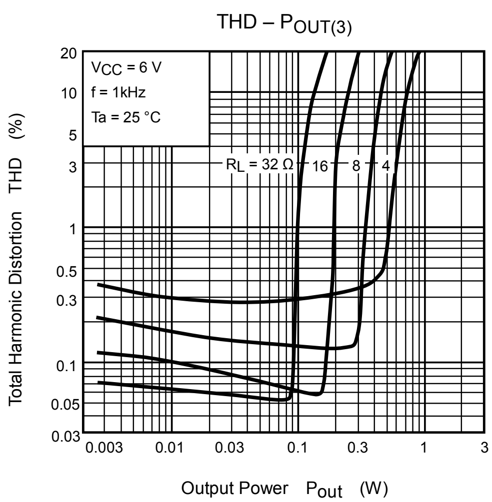
TA7368FG

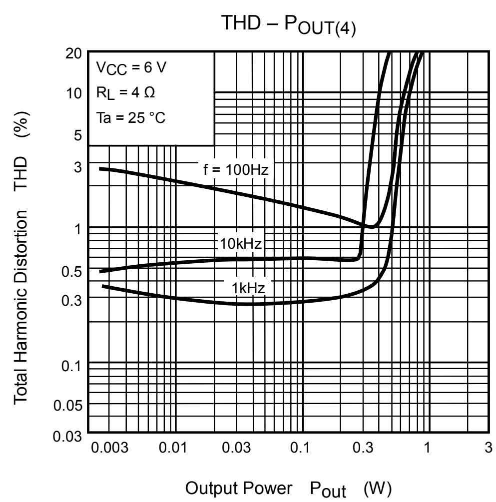


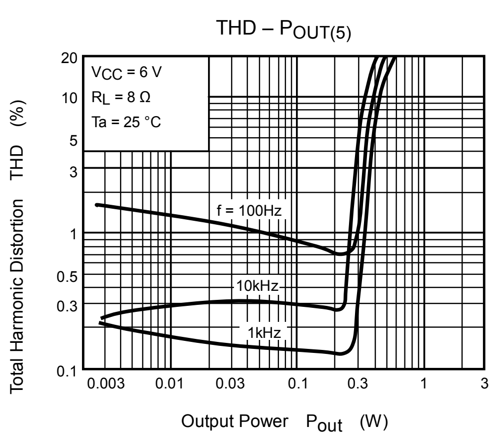
※ Pin(1), (3): Non-connection

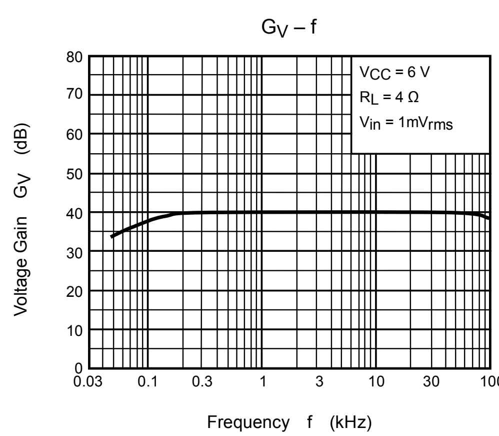

THD – $P_{OUT(1)}$
f = 1kHz
R_L = 4 Ω
Ta = 25 °C
V_{CC} = 3V
6
Total Harmonic Distortion THD (%)
Output Power P_{out} (W)


THD – $P_{OUT(2)}$
f = 1kHz
R_L = 8 Ω
Ta = 25 °C
V_{CC} = 3V
6
9
Total Harmonic Distortion THD (%)
Output Power P_{out} (W)

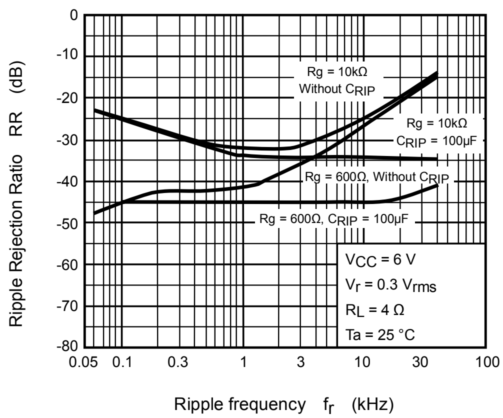

THD – $P_{OUT(3)}$
V_{CC} = 6 V
f = 1kHz
Ta = 25 °C
R_L = 32 Ω
16
8
4
Total Harmonic Distortion THD (%)
Output Power P_{out} (W)


THD – $P_{OUT(4)}$
V_{CC} = 6 V
R_L = 4 Ω
Ta = 25 °C
f = 100Hz
10kHz
1kHz
Total Harmonic Distortion THD (%)
Output Power P_{out} (W)

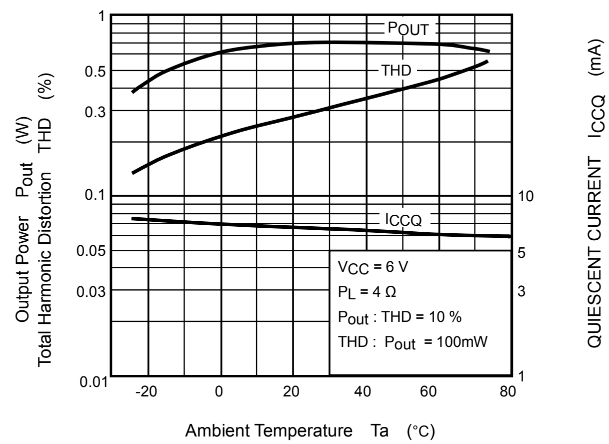

THD – $P_{OUT(5)}$
V_{CC} = 6 V
R_L = 8 Ω
Ta = 25 °C
f = 100Hz
10kHz
1kHz
Total Harmonic Distortion THD (%)
Output Power P_{out} (W)


G_V – f
V_{CC} = 6 V
R_L = 4 Ω
V_{in} = 1mV_{rms}
Voltage Gain G_V (dB)
Frequency f (kHz)

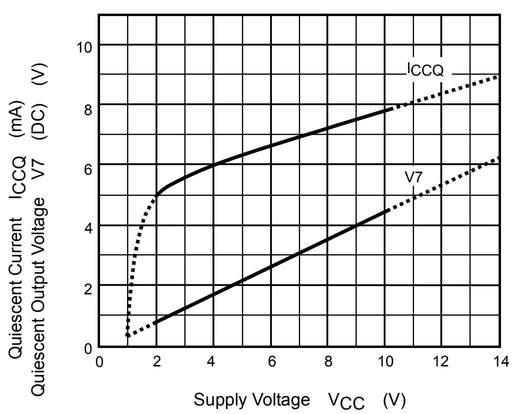
RR – f_r



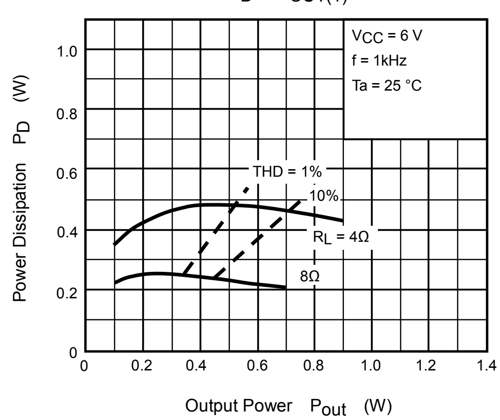
P_{OUT}, THD, I_{CCQ} – Ta



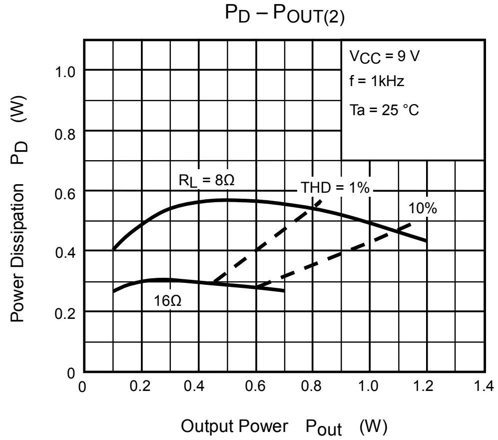
I_{CCQ}, V7 – V_{CC}



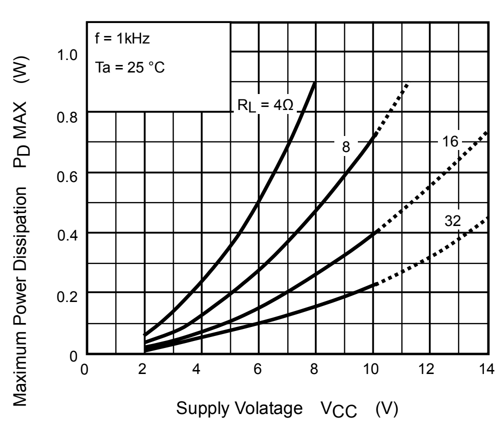
P_D – $P_{OUT(1)}$

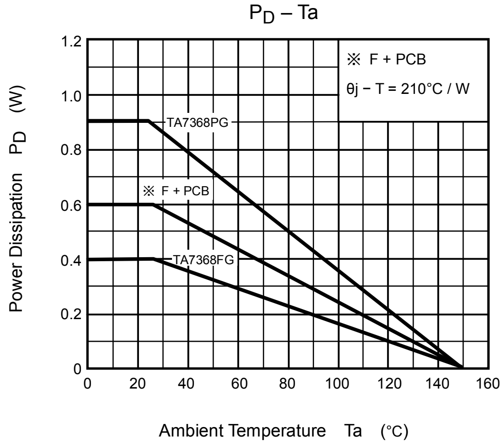


P_D – $P_{OUT(2)}$



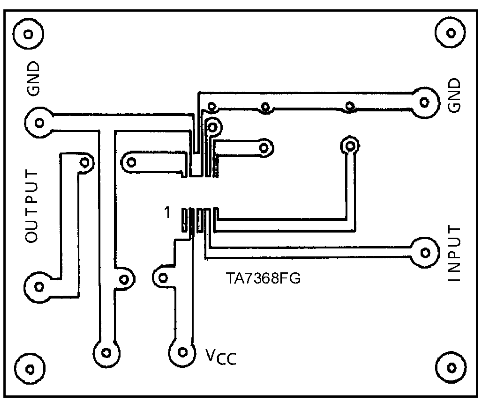
P_D MAX – V_{CC}





※ F+PCB
By being mounted on certain PCB's, flat packages increase the heat dissipating efficiency.
Data shown on the left is resulted from the measurement on the PCB recommended by TOSHIBA.
(θj–T : Thermal resistance)

Printed Circuit Board



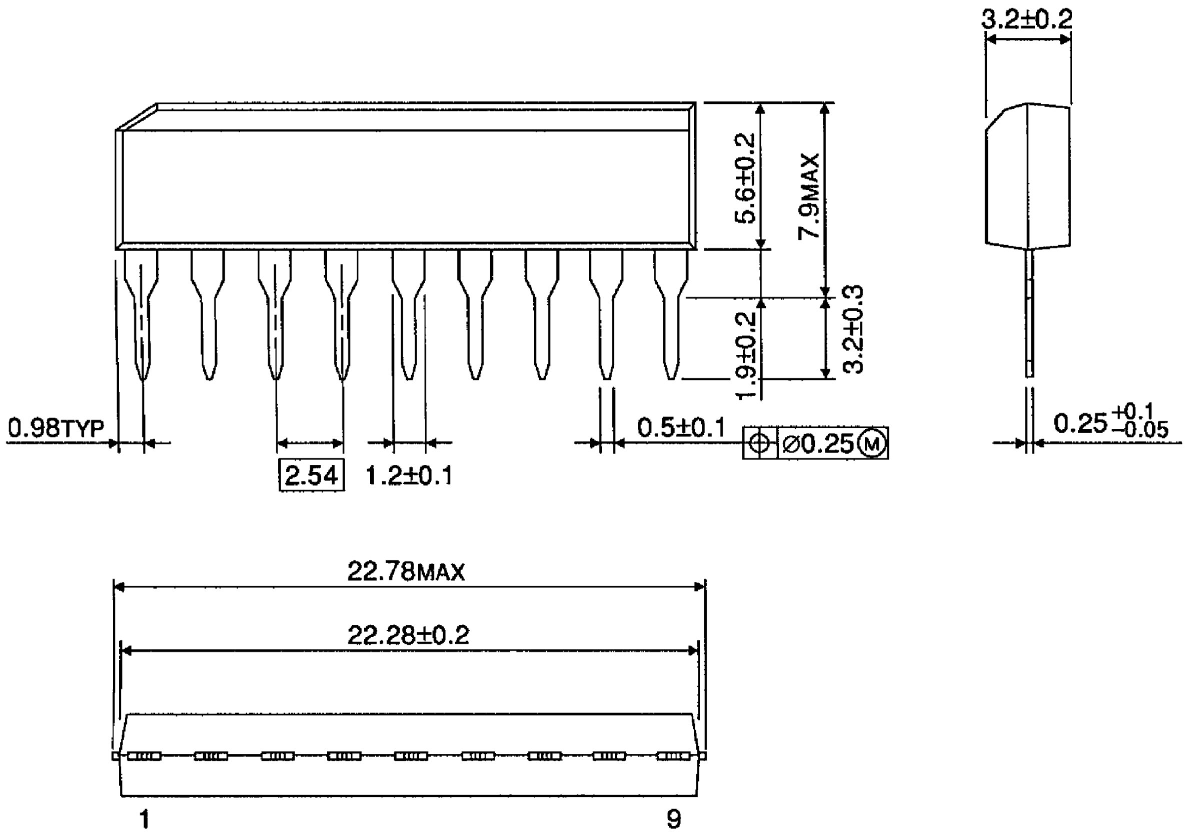
60 × 47.5 (mm)

Material: Phenol resin
Thickness of copper leaf: 35μm
Plate thickness: 1.6mm

Package Dimensions

SIP9-P-2.54A

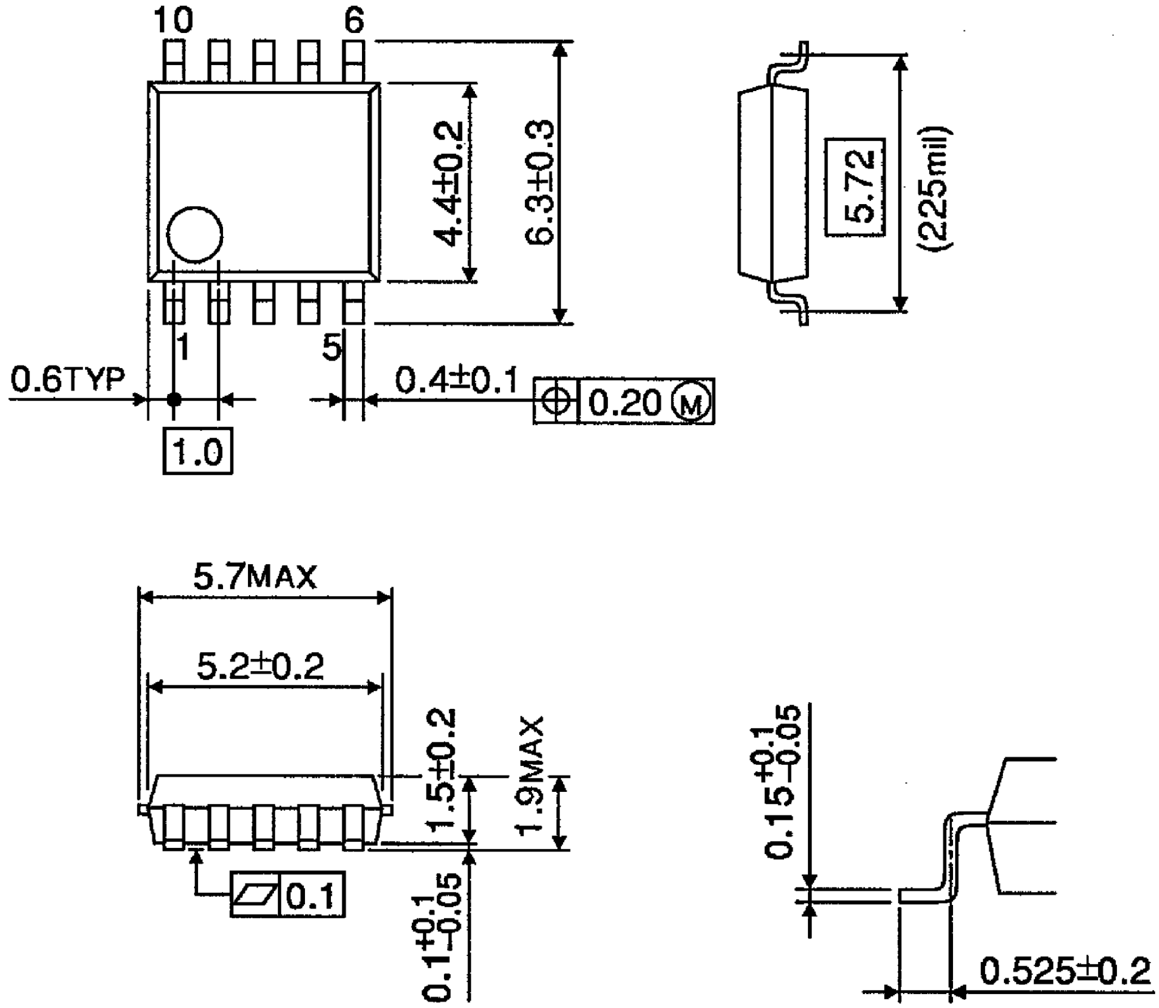
Unit : mm



Weight: 0.92g (typ.)

Package Dimensions

SSOP10-P-225-1.00 Unit : mm



Weight: 0.09g (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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060116EBA

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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