

TOSHIBA BIPOLAR LINEAR INTEGRATED CIRCUIT SILICON MONOLITHIC

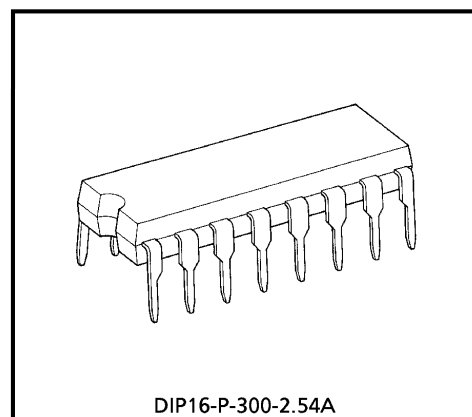
TA7628P, TA7628HP

AMPLIFIER SYSTEM FOR CASSETTE TAPE RECORDER

TA7628P and TA7628HP are Pre + Power amplifier system designed for cassette tape recorder.

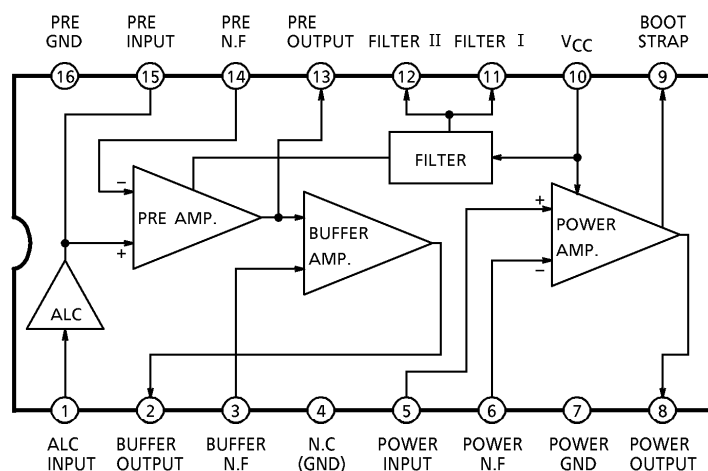
FEATURES

- Recording Playback for Pre Amplifier
- Buffer Amplifier (Recording Amplifier)
- Power Amplifier
- ALC Detector Circuit
- Muting Circuit
- Maximum Output Power ($V_{CC} = 6V, f = 1kHz, THD = 10\%$)
 - : $P_{out} = 0.6W$ (Typ.) ($R_L = 8\Omega$) : TA7628P
 - : $P_{out} = 0.96W$ (Typ.) ($R_L = 4\Omega$) : TA7628HP
- Low Distortion and Wide Dynamic Range
- Without Turn-on "POP" for Muting Circuit
- Operating Supply Voltage Range
 - : $V_{CC} (opr) = 3.5 \sim 9V$ ($T_a = 25^\circ C$)



DIP16-P-300-2.54A
Weight : 1.00g (Typ.)

BLOCK DIAGRAM



961001EBA2

● TOSHIBA is continually working to improve the quality and the reliability of its products. Nevertheless, semiconductor devices in general can malfunction or fail due to their inherent electrical sensitivity and vulnerability to physical stress. It is the responsibility of the buyer, when utilizing TOSHIBA products, to observe standards of safety, and to avoid situations in which a malfunction or failure of a TOSHIBA product could cause loss of human life, bodily injury or damage to property. In developing your designs, please ensure that TOSHIBA products are used within specified operating ranges as set forth in the most recent products specifications. Also, please keep in mind the precautions and conditions set forth in the TOSHIBA Semiconductor Reliability Handbook.

SWITCH OVER

| TEST ITEM | SW ₁ | SW ₂ | SW ₃ | SW ₄ | SW ₅ | SW ₆ |
|-------------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|
| G _{vo1} | 1 | 1 | ON | OFF | OFF | OFF |
| G _{v1} | 1 | 1 | OFF | OFF | OFF | OFF |
| V _{out1} | 1 | 1 | OFF | OFF | OFF | OFF |
| G _{v2} | 1 | 3 | OFF | OFF | OFF | OFF |
| V _{out2} | 1 | 3 | OFF | OFF | OFF | OFF |
| V _{no2} | 1 | 3 | OFF | OFF | ON | OFF |
| ALC | 1 | 2 | OFF | OFF | OFF | OFF |
| G _{vo3} | 2 | 1 | OFF | ON | OFF | OFF |
| G _{v3} | 2 | 1 | OFF | OFF | OFF | OFF |
| P _{out} | 2 | 1 | OFF | OFF | OFF | OFF |
| V _{no3} | 2 | 1 | OFF | OFF | OFF | ON |

961001EBA2'

- The products described in this document are subject to foreign exchange and foreign trade control laws.
- The information contained herein is presented only as a guide for the applications of our products. No responsibility is assumed by TOSHIBA CORPORATION for any infringements of intellectual property or other rights of the third parties which may result from its use. No license is granted by implication or otherwise under any intellectual property or other rights of TOSHIBA CORPORATION or others.
- The information contained herein is subject to change without notice.

PRECAUTION FOR USE

1. Precaution of GND line

The GND points of input side GND and N.F side GND in each amplifier must be arranged at the preamplifier side. (Fig.1)
The input side GND point and the N.F side GND point must be arranged near each other to have no impedance.

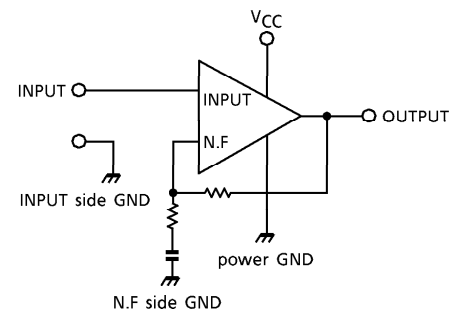


Fig.1

2. About radiation

- 1) The capacitance between the output and GND in preamplifier, buffer amplifier and power amplifier must be arranged near to this IC. The radiation loop must be as small as possible.
- 2) The voltage gain of high frequency in each amplifier must be reduced to reduce the noise with high frequency component. (In the application circuit, the feed back capacitor is used)
A 1000pF or same order capacitor must be connected from the input terminal of preamplifier and power amplifier to GND to prevent the interference of radiation.
- 3) It is better for this IC to separate adequately from the antenna in the radio cassette tape recorder applications.
- 4) The electrolytic capacitance $100\mu\text{F}\sim 220\mu\text{F}$ between V_{CC} and GND must be arranged near to this IC.

3. To prevent the oscillation

- 1) The output terminal of preamplifier must be terminated to GND by the capacitance more than 5600pF.
(The recommended value : $C = 0.01\mu\text{F}$)
- 2) The output terminal of buffer amplifier must be terminated to GND by the capacitance more than $0.01\mu\text{F}$.
(The recommended value : $C = 0.01\mu\text{F}$)
- 3) The output terminal of power amplifier must be terminated to GND by the good temperature characteristic capacitance of $1\sim 2.2\mu\text{F}$. The bootstrap terminal must be terminated to GND with the capacitance more than $0.47\mu\text{F}$.

4. Precaution of preamplifier

- 1) It is better that the coupling capacitor between the volume and the output of preamplifier is small.
Recommended value : $C = 0.47\mu\text{F}$
- 2) In recording mode, the signal source resistance must be more than $1\text{k}\Omega$ for ALC (Automatic Level Control) operation. When this resistance is small, the ALC range becomes narrow.

5. Buffer amplifier

When the output signal is clipped in the buffer amplifier, this signal returns to preamplifier and influences to make THD bad.

To prevent this, in playback mode, the buffer amplifier is recommended to be cut-off by terminating the output terminal to GND directly or by terminating the feedback terminal to GND through 330Ω or less than this shown in Fig.2.

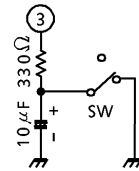


Fig.2

6. Power amplifier

1) In case of the battery use ($V_{CC} \leq 6V$), this IC is happen to oscillate (blocking oscillation) when the impedance of power supply is high. In this case, it is recommended to insert the resistance R_A of $500\Omega \sim 1k\Omega$ between ⑩pin and ⑫pin (V_{CC} - Filter II). By this method, this IC becomes very stable. But the output DC voltage is not center by the influence of R_A . Then the output wave shape is not symmetrical clipping wave and the maximum output voltage is reduced. So we recommend to insert the other resistance R_B between ⑥pin and ⑧pin for compensating the output DC voltage.

2) When you use this IC at the supply voltage of more than 6V, it is better to insert the resistance R_B for compensating output DC voltage. (Fig.3)

$$\text{The recommended value : } \begin{cases} R_B = 220k\Omega \text{ at } V_{CC} = 7.5V \\ R_B = 150k\Omega \text{ at } V_{CC} = 9V \end{cases}$$

3) The output coupling capacitance and bootstrap capacitance is better to be large because of getting the maximum output power.

4) On the PC board, the interval between V_{CC} and GND is better to be large.

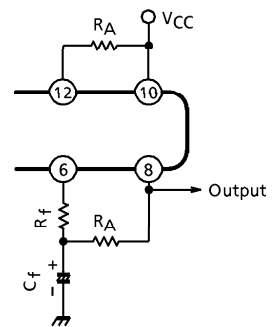


Fig.3

MAXIMUM RATINGS ($T_a = 25^\circ C$)

| CHARACTERISTIC | | SYMBOL | RATING | UNIT |
|-----------------------|----------|--------------|----------|------------|
| Supply Voltage | TA7628P | V_{CC} | 9 | V |
| | TA7628HP | | 12 | |
| Output Current | TA7628P | I_O (peak) | 0.56 | A |
| | TA7628HP | | 1.5 | |
| Power Dissipation | TA7628P | P_D (Note) | 750 | mW |
| | TA7628HP | | 1200 | |
| Operating Temperature | | T_{opr} | - 20~75 | $^\circ C$ |
| Storage Temperature | | T_{stg} | - 55~150 | $^\circ C$ |

(Note) Derated above $T_a = 25^\circ C$ in the proportion, $6.0mW / ^\circ C$ for TA7628P, $9.6mW / ^\circ C$ for TA7628HP.

ELECTRICAL CHARACTERISTICS (TA7628P) (Unless otherwise specified, $V_{CC} = 6V$, $f = 1kHz$, $T_a = 25^\circ C$)
TOTAL

| CHARACTERISTIC | SYMBOL | TEST CIR-CUIT | TEST CONDITION | MIN. | TYP. | MAX. | UNIT |
|-------------------|--------------|---------------|-----------------|------|------|------|------|
| Quiescent Current | $I_{CCQ(1)}$ | — | $V_{CC} = 3.5V$ | 7 | — | — | mA |
| Quiescent Current | $I_{CCQ(2)}$ | — | $V_{CC} = 6V$ | 9 | — | 36 | mA |

PRE AMP.

| CHARACTERISTIC | SYMBOL | TEST CIR-CUIT | TEST CONDITION | MIN. | TYP. | MAX. | UNIT |
|--------------------------------|------------|---------------|----------------|------|------|------|---------------|
| Open Loop Voltage Gain | G_{vo1} | — | — | 55 | 70 | — | dB |
| Closed Loop Voltage Gain | G_{v1} | — | — | — | 40 | — | dB |
| Maximum Output Voltage | V_{out1} | — | THD = 1% | — | 0.7 | — | V_{rms} |
| Input Resistance | R_{IN1} | — | — | 24 | 30 | — | $k\Omega$ |
| Equivalent Input Noise Voltage | V_{ni} | — | $R_g = 0$ | — | 1.4 | 2.5 | μV_{rms} |

PRE AMP. + BUFFER AMP.

| CHARACTERISTIC | SYMBOL | TEST CIR-CUIT | TEST CONDITION | MIN. | TYP. | MAX. | UNIT |
|--------------------------|------------|---------------|--|------|------|------|------------|
| Closed Loop Voltage Gain | G_{v2} | — | Pre amp. $G_v = 40dB$ Buffer amp. $G_v = 20dB$ | — | 60 | — | dB |
| Maximum Output Voltage | V_{out2} | — | THD = 3% | 1.5 | 1.7 | — | V_{rms} |
| Output Noise Voltage | V_{no2} | — | $R_g = 0$, $G_{v2} = 60dB$ | — | 1.2 | 2.5 | mV_{rms} |
| ALC Effect | ALC1 | — | $V_{in} = 0.775mV_{rms} (-60dBm)$ $\sim 0.0775V_{rms} (-20dBm)$ | — | 2 | — | dB |
| ALC Range | ALC2 | — | Range of THD $\leq 1\%$ | — | 60 | — | dB |

POWER AMP.

| CHARACTERISTIC | SYMBOL | TEST CIR-CUIT | TEST CONDITION | MIN. | TYP. | MAX. | UNIT |
|--------------------------|-----------|---------------|-----------------------------|------|------|------|------------|
| Open Loop Voltage Gain | G_{vo3} | — | — | 60 | 70 | — | dB |
| Closed Loop Voltage Gain | G_{v3} | — | — | — | 40 | — | dB |
| Output Power | P_{out} | — | $R_L = 8\Omega$, THD = 10% | 0.5 | 0.6 | — | W |
| Output Noise Voltage | V_{no3} | — | $R_g = 0$, $G_v = 40dB$ | — | 0.3 | 1.0 | mV_{rms} |

ELECTRICAL CHARACTERISTICS (TA7628HP) (Unless otherwise specified, $V_{CC} = 6V$, $f = 1kHz$, $T_a = 25^\circ C$)

TOTAL

| CHARACTERISTIC | SYMBOL | TEST CIR-CUIT | TEST CONDITION | MIN. | TYP. | MAX. | UNIT |
|-------------------|--------------|---------------|-----------------|------|------|------|------|
| Quiescent Current | $I_{CCQ(1)}$ | — | $V_{CC} = 3.5V$ | 7.5 | — | — | mA |
| Quiescent Current | $I_{CCQ(2)}$ | — | $V_{CC} = 6V$ | 11 | — | 35 | mA |

PRE AMP.

| CHARACTERISTIC | SYMBOL | TEST CIR-CUIT | TEST CONDITION | MIN. | TYP. | MAX. | UNIT |
|--------------------------------|------------|---------------|----------------|------|------|------|---------------|
| Open Loop Voltage Gain | G_{vo1} | — | — | 55 | 70 | — | dB |
| Closed Loop Voltage Gain | G_{v1} | — | — | — | 40 | — | dB |
| Maximum Output Voltage | V_{out1} | — | THD = 1% | — | 0.7 | — | V_{rms} |
| Input Resistance | R_{IN1} | — | — | — | 30 | — | $k\Omega$ |
| Equivalent Input Noise Voltage | V_{ni} | — | $R_g = 0$ | — | 1.4 | 2.5 | μV_{rms} |

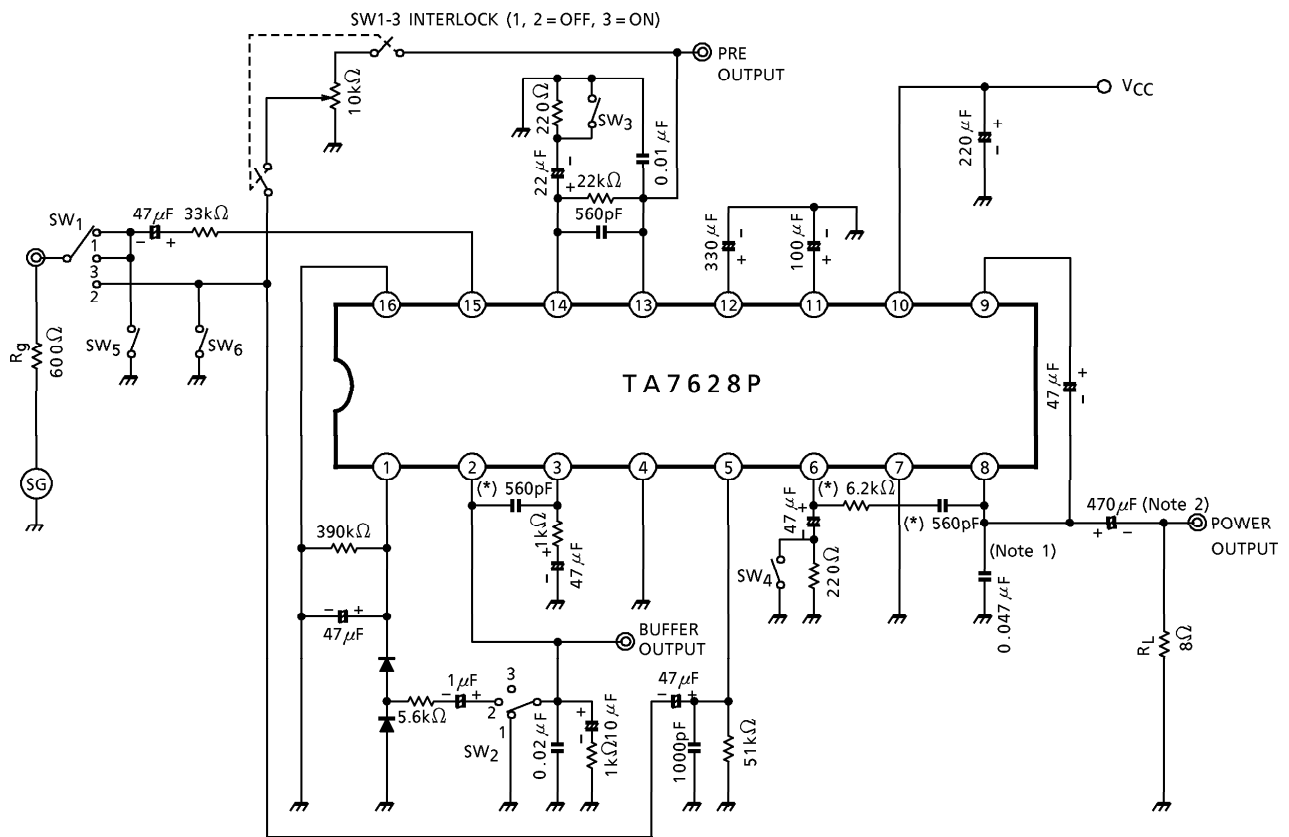
PRE AMP. + BUFFER AMP.

| CHARACTERISTIC | SYMBOL | TEST CIR-CUIT | TEST CONDITION | MIN. | TYP. | MAX. | UNIT |
|--------------------------|------------|---------------|--|------|------|------|------------|
| Closed Loop Voltage Gain | G_{v2} | — | Pre amp. $G_v = 40dB$ Buffer amp. $G_v = 20dB$ | — | 60 | — | dB |
| Maximum Output Voltage | V_{out2} | — | THD = 3% | 1.5 | 1.7 | — | V_{rms} |
| Output Noise Voltage | V_{no2} | — | $R_g = 0$, $G_{v2} = 60dB$ | — | 1.2 | 2.5 | mV_{rms} |
| ALC Effect | ALC1 | — | $V_{in} = 0.775mV_{rms}$ (- 60dBm) $\sim 0.0775V_{rms}$ (- 20dBm) | — | 2 | — | dB |
| ALC Range | ALC2 | — | Range of THD $\leq 1\%$ | — | 60 | — | dB |

POWER AMP.

| CHARACTERISTIC | SYMBOL | TEST CIR-CUIT | TEST CONDITION | MIN. | TYP. | MAX. | UNIT |
|--------------------------|-----------|---------------|--|------|------|------|------------|
| Open Loop Voltage Gain | G_{vo3} | — | — | 60 | 70 | — | dB |
| Closed Loop Voltage Gain | G_{v3} | — | — | — | 40 | — | dB |
| Output Power | P_{out} | — | $R_L = 4\Omega$, THD = 10% $V_{CC} = 9V$, $R_L = 8\Omega$, THD = 10% | 0.8 | 0.96 | — | W |
| Output Noise Voltage | V_{no3} | — | $R_g = 0$, $G_v = 40dB$ | — | 0.3 | 1.0 | mV_{rms} |

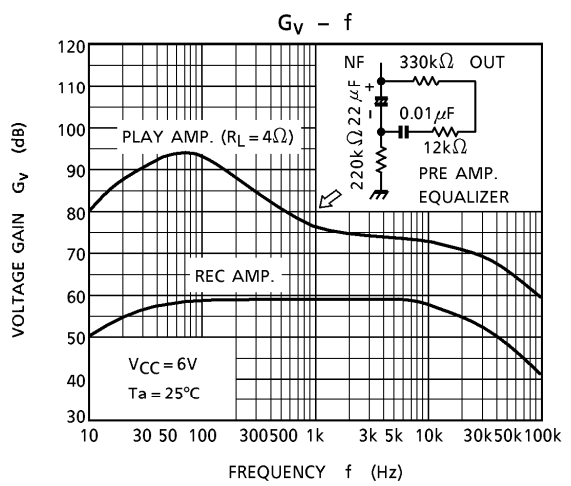
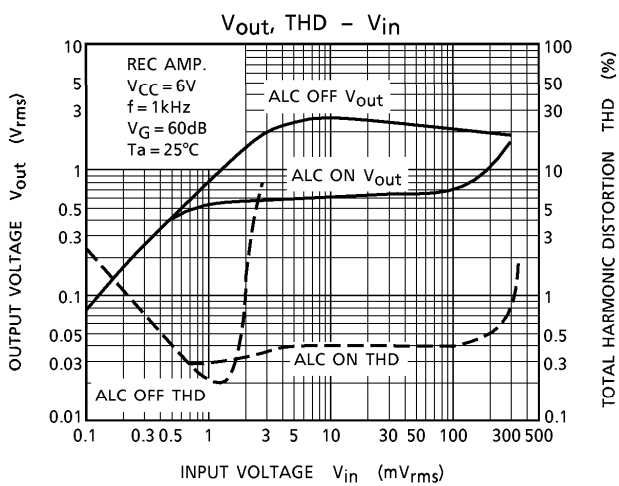
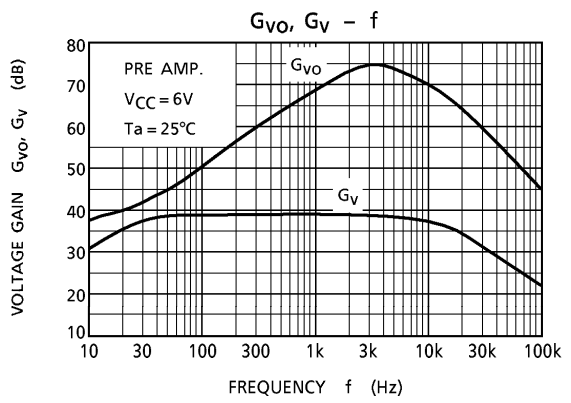
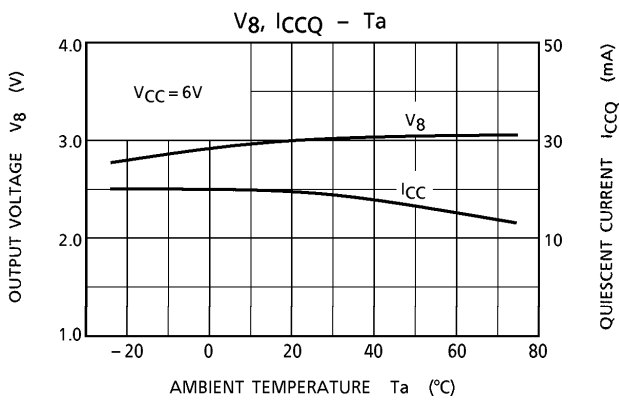
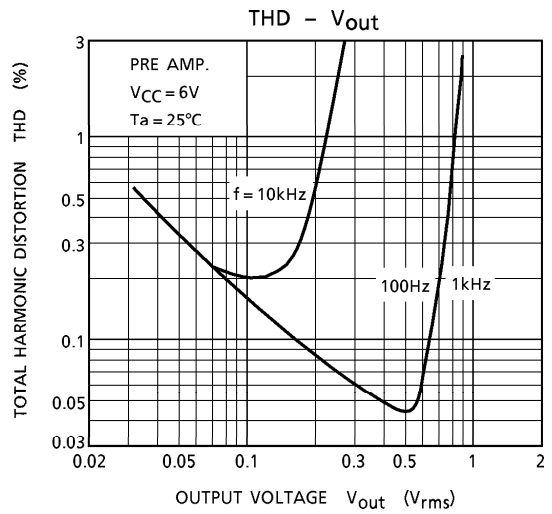
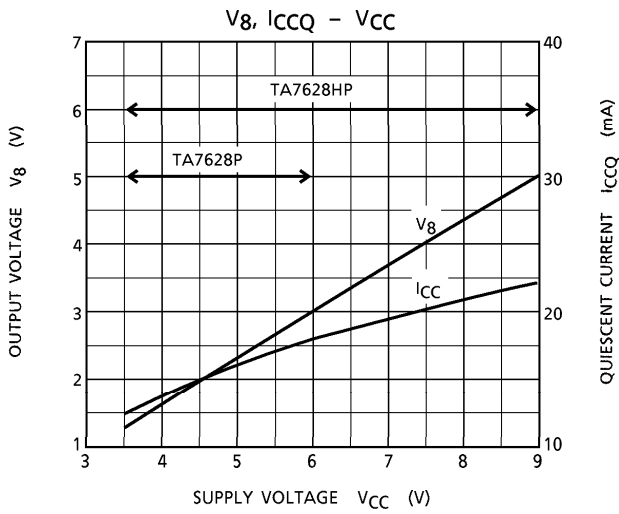
TEST CIRCUIT

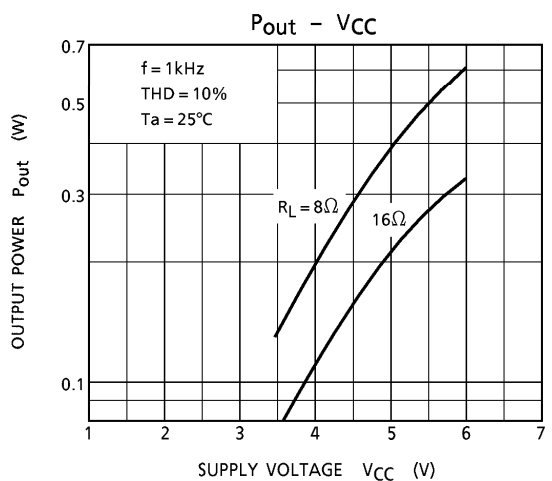
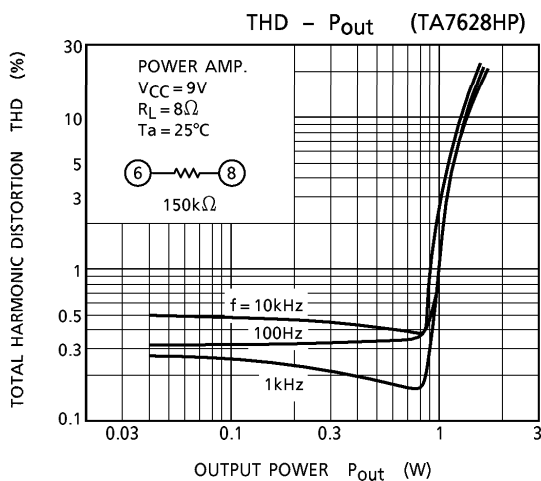
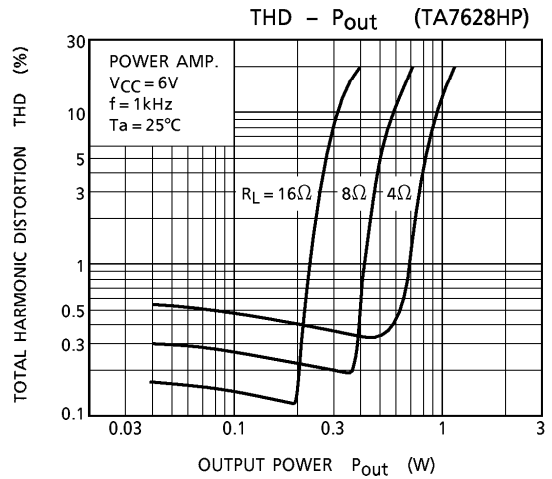
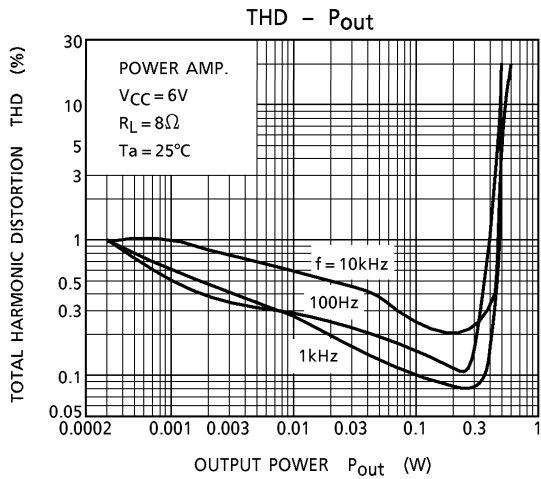
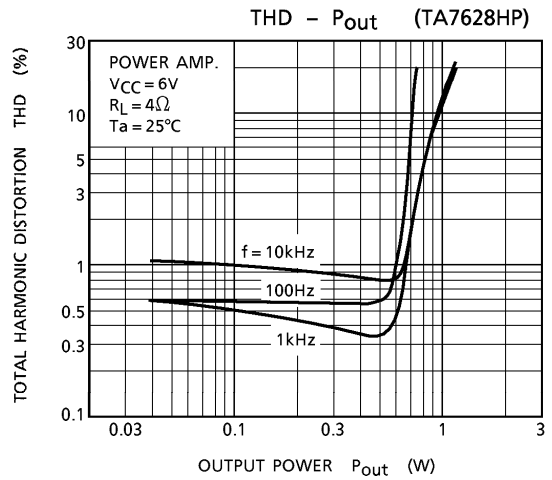
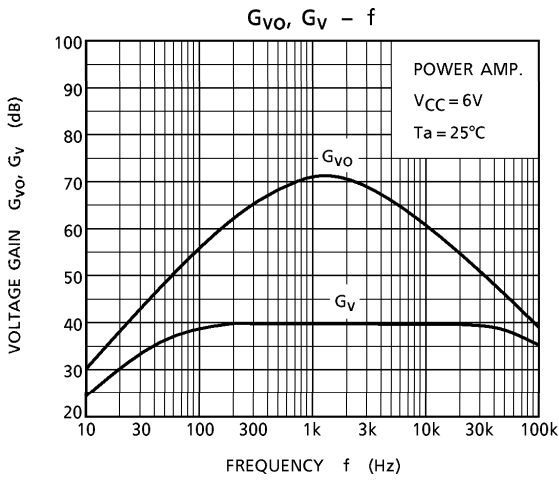


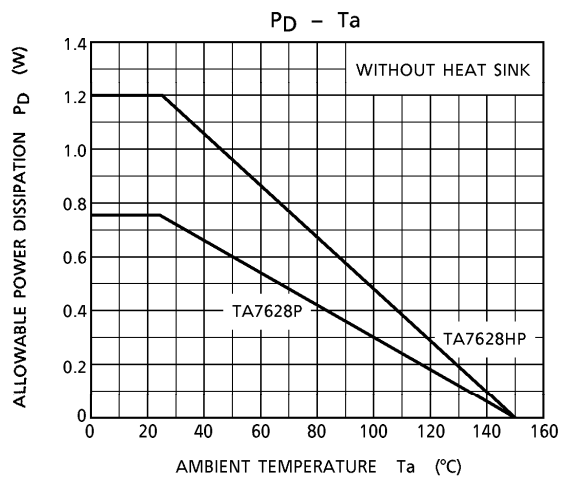
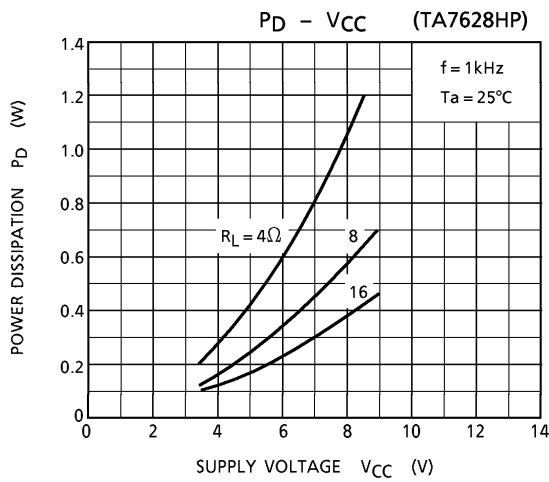
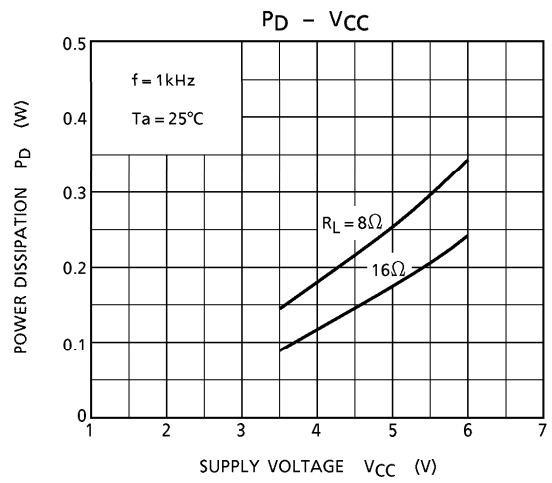
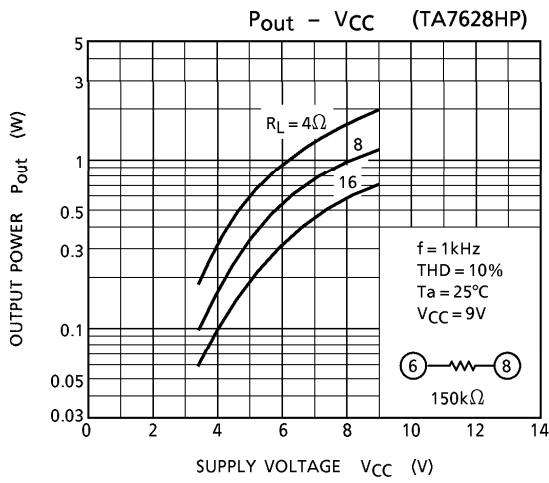
(*) Use in measuring the output noise voltage.

(Note 1) TA7628HP : $0.047\mu\text{F} \rightarrow 0.068\mu\text{F}$

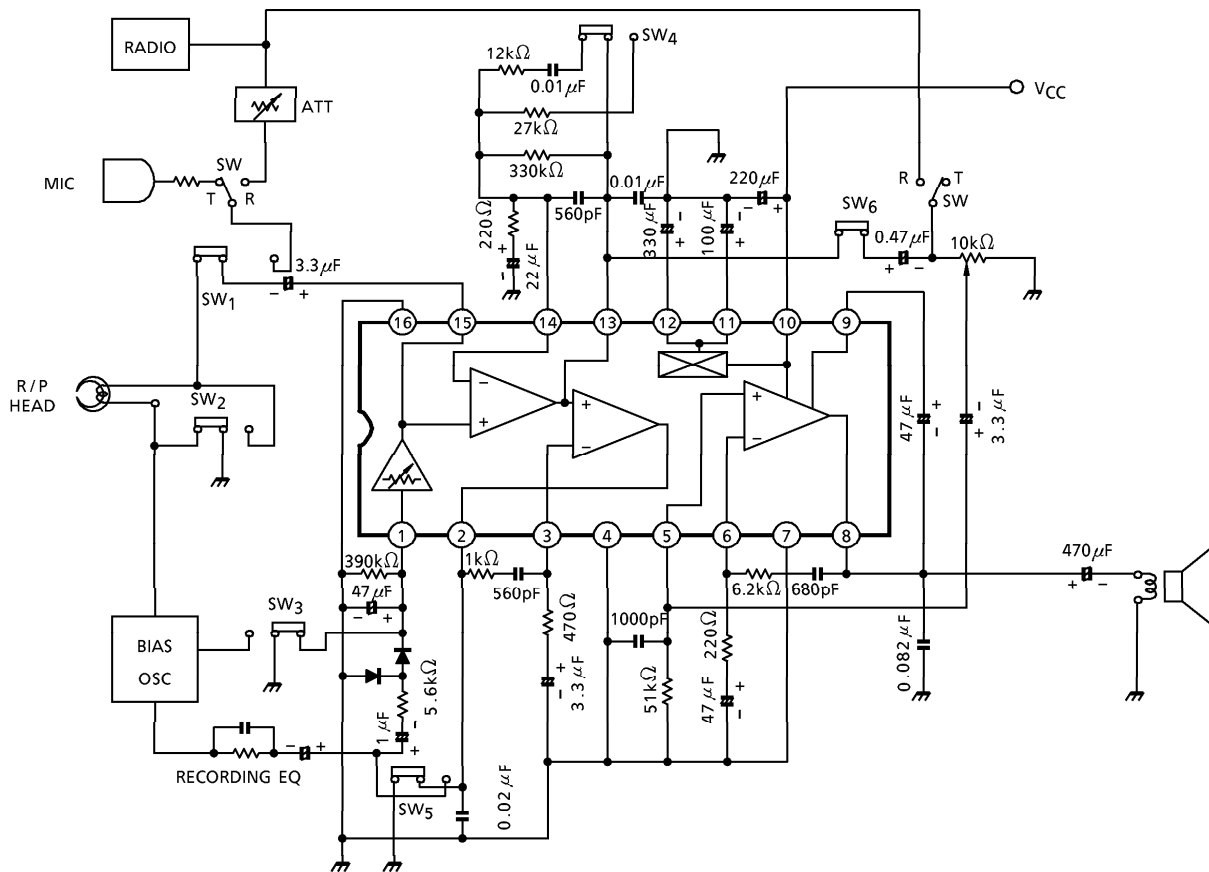
(Note 2) TA7628HP : $470\mu\text{F} \rightarrow 1000\mu\text{F}$







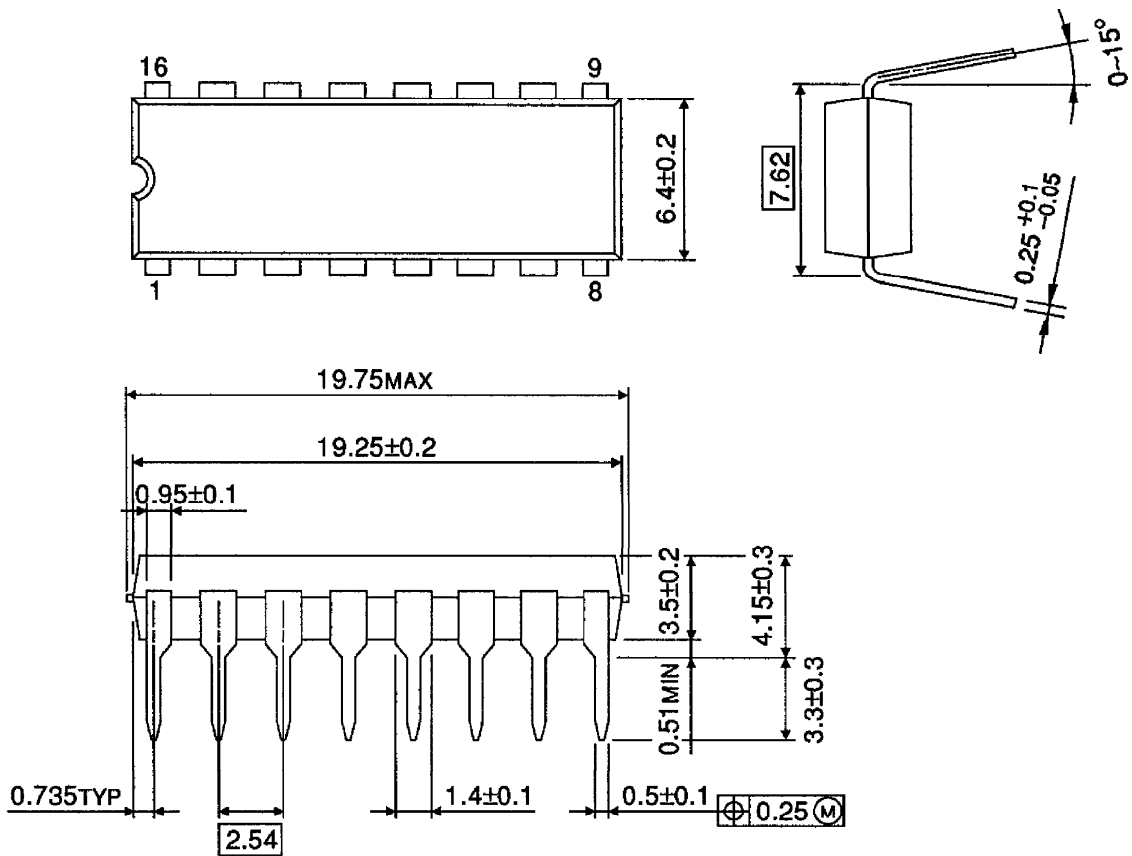
APPLICATION CIRCUIT



SW₁~SW₆ are set for play back.
SW Functions.

OUTLINE DRAWING
DIP16-P-300-2.54A

Unit : mm



Weight : 1.00g (Typ.)