

# TA7792P, TA7792F

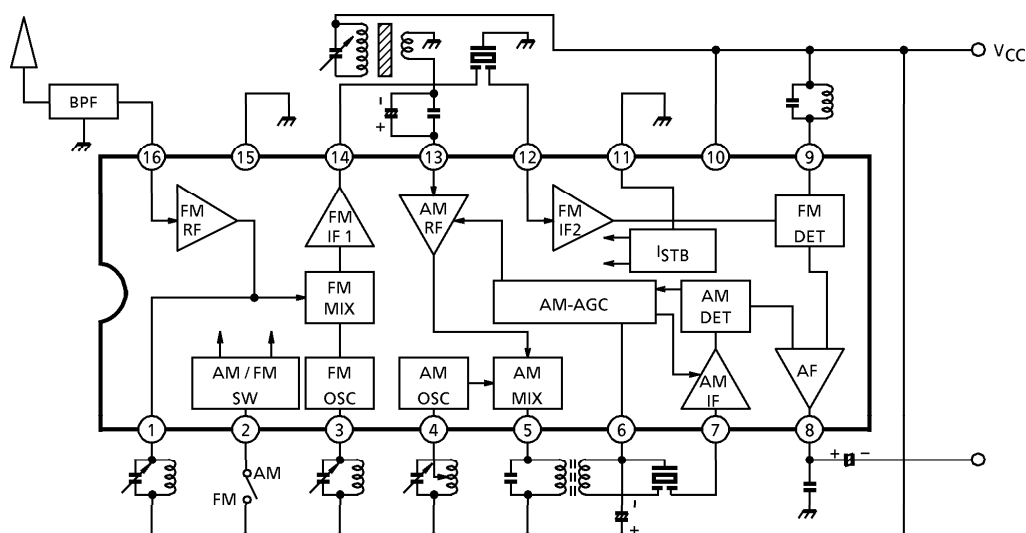
## AM / FM 1 CHIP TUNER SYSTEM IC (1.5V USE)

The TA7792P, TA7792F are AM / FM 1 chip tuner system (FM FRONT END + AM / FM IF) ICs, which are designed for low voltage operation (1.5V, 3.0V). Those are especially suitable for stereo headphone radio and radio cassette recorder equipments. These item can realize the low power dissipation and few external parts.

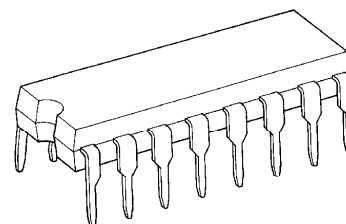
### FEATURES

- AM detector coil-less
- FM mixer coil-less
- Switchover between AM / FM mode is possible with one-make switch.
- Operating supply voltage range  
 $V_{CC}(\text{opr}) = 0.95 \sim 5V$  ( $T_a = 25^\circ C$ )
- Excellent low supply current ( $V_{CC} = 1.5V$ ,  $T_a = 25^\circ C$ )  
 $I_{CC}(\text{AM}) = 1.2\text{mA}$  (Typ.)  
 $I_{CC}(\text{FM}) = 4.0\text{mA}$  (Typ.)

### BLOCK DIAGRAM

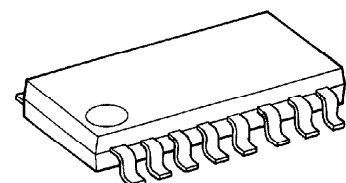


TA7792P



DIP16-P-300-2.54A

TA7792F



SSOP16-P-225-1.00A

Weight  
 DIP16-P-300-2.54A : 1.00g (Typ.)  
 SSOP16-P-225-1.00A : 0.14g (Typ.)

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.

## APPLICATION NOTE

## &lt;FM SECTION&gt;

## ● RF amplifier (See Fig.1)

This stage is composed of the emitter-grounded and cascade connection amplifier.

The input impedance of pin⑮ is about  $260\Omega$ , which is determined by  $D_1$ .

## ● Mixer amplifier (See Fig.2)

The amplified RF signal is transformed into IF signal by the mixer circuit which is composed of a differential amplifier.

The amplified IF signal is appeared through the emitter follower circuit at pin⑭. The output impedance of pin⑭ is about  $300\Omega$ , due to match the impedance of the ceramic filter.

## (Note)

The spurious characteristic is determined by the characteristic of the ceramic filter (10.7MHz), because the mixer coil is dispensable. It is possible to improve the spurious characteristic that the two ceramic filters of different characteristics are connected in series.

## ● IF limiter amplifier (See Fig.3)

The IF limiter amplifier is composed of six emitter-grounded amplifiers and a differential amplifier. The basis composition of the emitter-grounded amplifiers is shown as Fig.3.

## ● Detector circuit

This stage is composed of the quadrature detector circuit, which has double balanced.

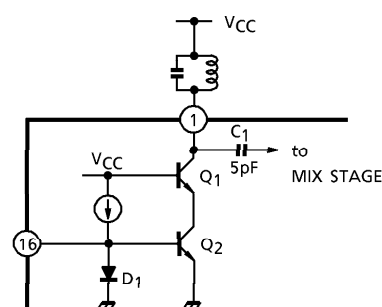


Fig.1

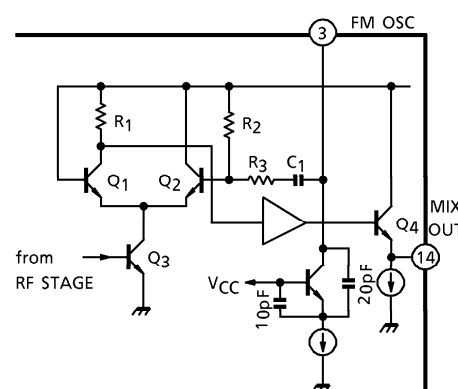


Fig.2

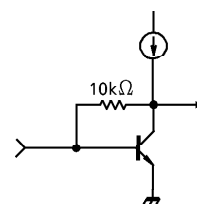


Fig.3

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.

## &lt;AM SECTION&gt;

- RF amplifier (See Fig.4)

This stage is composed of emitter-grounded amplifier, the input impedance of which has about  $7.3k\Omega$ . It is necessary to connect as Fig.4, because the condenser,  $C_1$  is available to the audio by-pass of the RF-AGC, the noise of low frequency.

- Mixer circuit

The amplified RF signal is transformed into IF signal by the mixer circuit, which is composed of a differential amplifier.

- IF amplifier

This stage is composed of four emitter-grounded amplifiers and the two differential amplifiers. The input impedance is rather high, because it is changed by the amplitude of input signal (AGC level). So the input terminal of the IF amplifier must be matched with the impedance of ceramic filter.

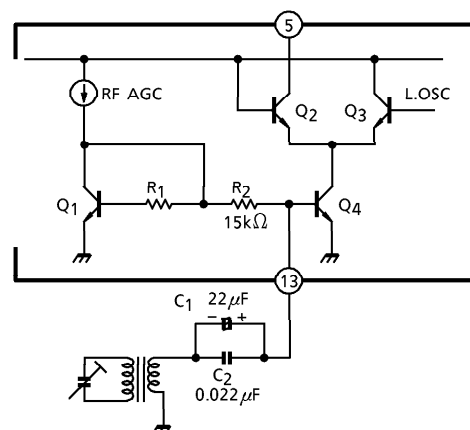


Fig.4

## &lt;COMMON SECTION&gt;

- AM / FM mode switchover

Switchover between AM / FM mode is possible with one-make switch. In case of the opened, this IC has AM mode.

Another in case that the terminal is connected to  $V_{CC}$  directly, that has FM mode.

And the terminal of pin② is  $V_{CC}$  terminal of FM FRONT END section, too.

- Output circuit (See Fig.5)

Both of the AM / FM detector signal is appeared through the pin⑧.

Those output are chosen by the mode switchover. At the same time, the output impedance is changed as follow at AM / FM mode, due to cut the AM carrier signal and pass the FM composite signal smoothly, with only one condenser.

$$R_{out}(AM) = 8k\Omega \text{ (Typ.)}$$

$$R_{out}(FM) = 1.4k\Omega \text{ (Typ.)}$$

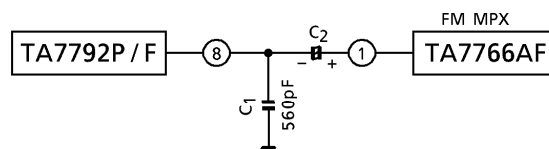


Fig.5

## MAXIMUM RATINGS (Ta = 25°C)

| CHARACTERISTIC        |         | SYMBOL                | RATING  | UNIT |
|-----------------------|---------|-----------------------|---------|------|
| Supply Voltage        |         | V <sub>CC</sub>       | 5       | V    |
| Power Dissipation     | TA7792P | P <sub>D</sub> (Note) | 750     | mW   |
|                       | TA7792F |                       | 350     |      |
| Operating Temperature |         | T <sub>opr</sub>      | −25~75  | °C   |
| Storage Temperature   |         | T <sub>stg</sub>      | −55~150 | °C   |

(Note) Derated above Ta = 25°C in the proportion of 6mW/°C for TA7792P, and of 2.8mW/°C for TA7792F.

## ELECTRICAL CHARACTERISTICS

Unless otherwise specified, Ta = 25°C, V<sub>CC</sub> = 1.5V

FM : V<sub>in</sub> = 60dB $\mu$ V EMF, f = 83MHz, f<sub>m</sub> = 1kHz,  $\Delta f$  =  $\pm 22.5$ kHz

AM : V<sub>in</sub> = 60dB $\mu$ V EMF, f = 1MHz, f<sub>m</sub> = 1kHz, MOD = 30%

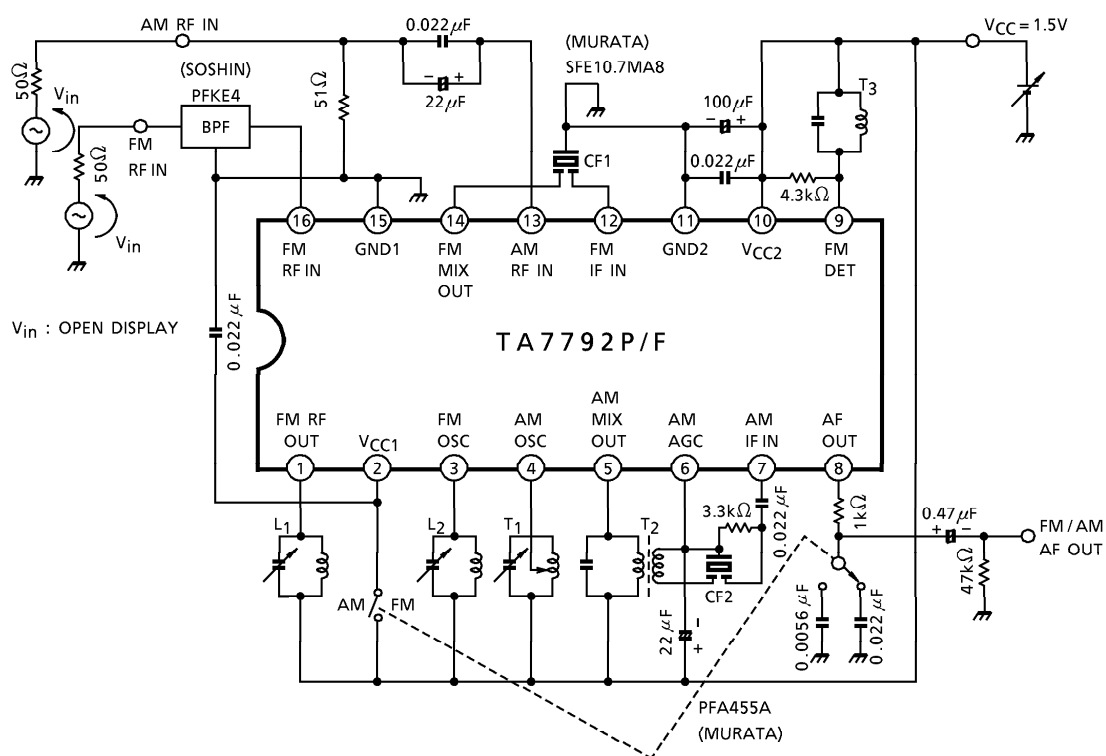
| CHARACTERISTIC         |                                | SYMBOL                 | TEST CIR-CUIT | TEST CONDITION                      | MIN. | TYP. | MAX. | UNIT              |
|------------------------|--------------------------------|------------------------|---------------|-------------------------------------|------|------|------|-------------------|
| Supply Current         |                                | I <sub>CC</sub> (FM)   | 1             | V <sub>in</sub> = 0                 | —    | 4.0  | 5.2  | mA                |
|                        |                                | I <sub>CC</sub> (AM)   | 1             | V <sub>in</sub> = 0                 | —    | 1.2  | 1.8  |                   |
| FM                     | Input Limiting Voltage         | V <sub>in</sub> (lim)  | 1             | −3dB limiting                       | —    | 10   | 16   | dB $\mu$ V EMF    |
|                        | Total Harmonic Distortion      | THD (FM)               | 1             |                                     | —    | 0.25 | —    | %                 |
|                        | Signal To Noise Ratio          | S/N (FM)               | 1             |                                     | —    | 62   | —    | dB                |
|                        | Quiescent Sensitivity          | Q <sub>S</sub>         | 1             | S/N = 30dB                          | —    | 12   | —    | dB $\mu$ V EMF    |
|                        | AM Rejection Ratio             | AMR                    | 1             | MOD = 30%                           | —    | 30   | —    | dB                |
|                        | Oscillator Voltage             | V <sub>osc</sub>       | 2             | f = 60MHz                           | 53   | 90   | 135  | mV <sub>rms</sub> |
|                        | Oscillator Stop Supply Voltage | V <sub>stop</sub> (FM) | 1             | V <sub>in</sub> < −20dB $\mu$ V EMF | —    | 0.85 | 0.95 | V                 |
|                        | Recovered Output Voltage       | V <sub>OD</sub> (FM)   | 1             |                                     | 28   | 45   | 68   | mV <sub>rms</sub> |
| AM                     | Voltage Gain                   | G <sub>V</sub>         | 1             | V <sub>in</sub> = 30dB $\mu$ V EMF  | 14   | 25   | 50   | mV <sub>rms</sub> |
|                        | Recovered Output Voltage       | V <sub>OD</sub> (AM)   | 1             |                                     | 25   | 40   | 60   | mV <sub>rms</sub> |
|                        | Total Harmonic Distortion      | THD (AM)               | 1             |                                     | —    | 1.5  | —    | %                 |
|                        | Signal To Noise Ratio          | S/N (AM)               | 1             |                                     | —    | 40   | —    | dB                |
|                        | Oscillator Stop Supply Voltage | V <sub>stop</sub> (AM) | 1             | V <sub>in</sub> < −20dB $\mu$ V EMF | —    | 0.85 | 0.95 | V                 |
| Output Resistance Pin® |                                | FM R <sub>O</sub> (FM) | 1             | f = 1kHz                            | —    | 1.4  | —    | k $\Omega$        |
|                        |                                | AM R <sub>O</sub> (AM) | 1             | f = 1kHz                            | —    | 8    | —    |                   |

※ V<sub>in</sub> : Open Display

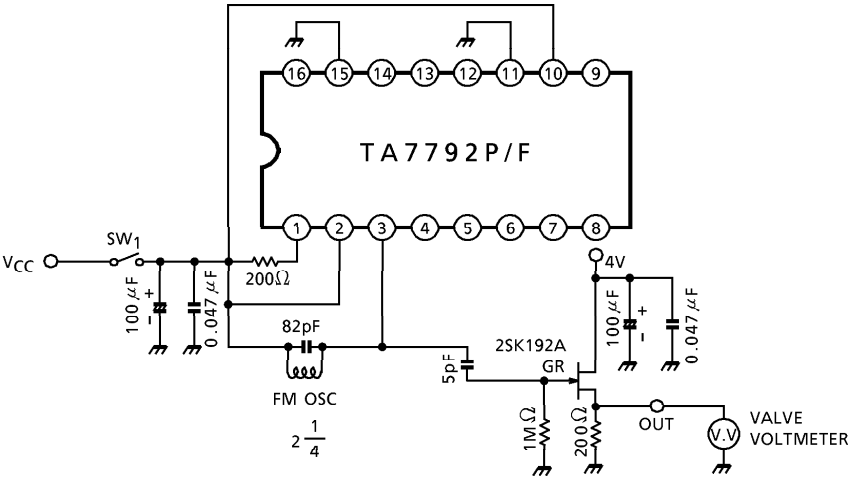
**TERMINAL VOLTAGE** : Terminal voltage at no signal with test circuit ( $V_{CC} = 1.5V$ ,  $T_a = 25^\circ C$ )

| PIN No.<br>PIN NAME |                  | SYMBOL         | TYP. |     | UNIT | PIN No.<br>PIN NAME |                  | SYMBOL          | TYP. |     | UNIT |
|---------------------|------------------|----------------|------|-----|------|---------------------|------------------|-----------------|------|-----|------|
|                     |                  |                | AM   | FM  |      |                     |                  |                 | AM   | FM  |      |
| 1                   | FM RF OUT        | V <sub>1</sub> | —    | 1.5 | V    | 9                   | FM DET           | V <sub>9</sub>  | 1.5  | 1.5 | V    |
| 2                   | V <sub>CC1</sub> | V <sub>2</sub> | —    | 1.5 | V    | 10                  | V <sub>CC2</sub> | V <sub>10</sub> | 1.5  | 1.5 | V    |
| 3                   | FM OSC           | V <sub>3</sub> | —    | 1.5 | V    | 11                  | GND2             | V <sub>11</sub> | 0    | 0   | V    |
| 4                   | AM OSC           | V <sub>4</sub> | 1.5  | 1.5 | V    | 12                  | FM IF IN         | V <sub>12</sub> | —    | 0.7 | V    |
| 5                   | AM MIX OUT       | V <sub>5</sub> | 1.5  | 1.5 | V    | 13                  | AM RF IN         | V <sub>13</sub> | 0.7  | —   | V    |
| 6                   | AM AGC           | V <sub>6</sub> | 0.8  | —   | V    | 14                  | FM MIX OUT       | V <sub>14</sub> | —    | 0.8 | V    |
| 7                   | AM IF IN         | V <sub>7</sub> | 1.4  | 1.5 | V    | 15                  | GND1             | V <sub>15</sub> | 0    | 0   | V    |
| 8                   | AF OUT           | V <sub>8</sub> | 0.6  | 0.6 | V    | 16                  | FM RF IN         | V <sub>16</sub> | —    | 0.7 | V    |

## TEST CIRCUIT 1



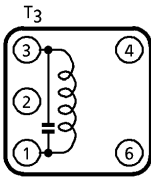
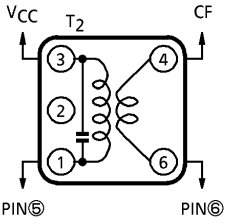
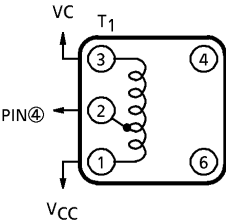
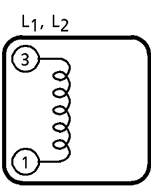
TEST CIRCUIT 2



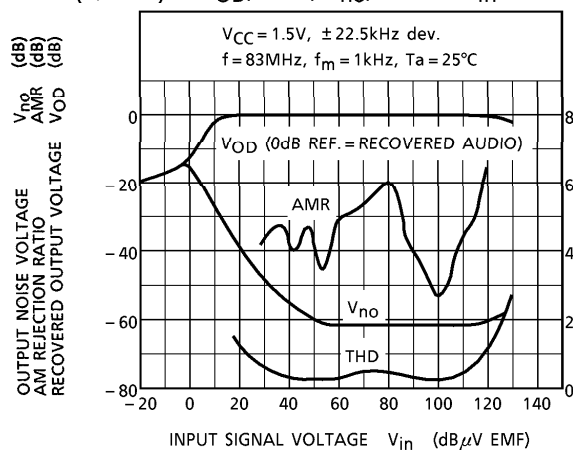
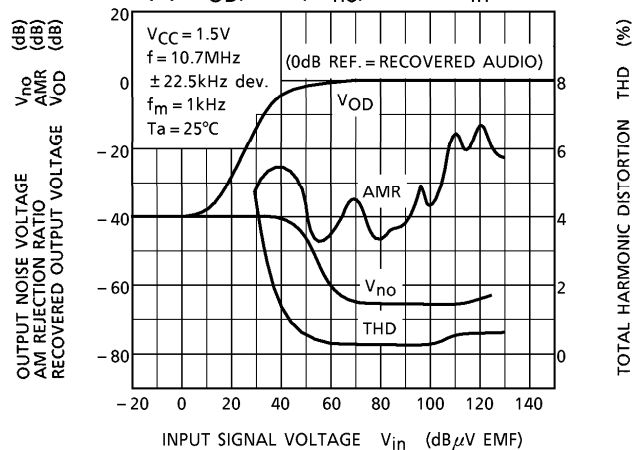
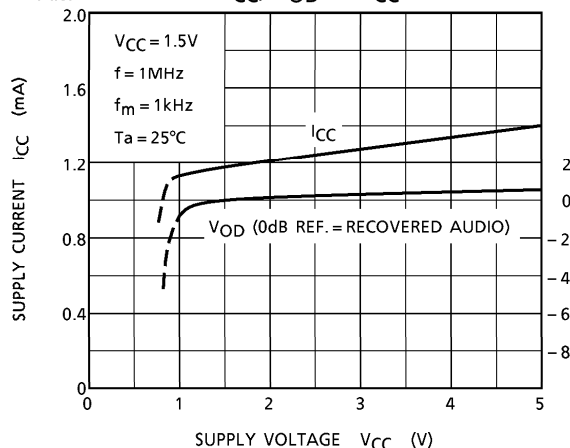
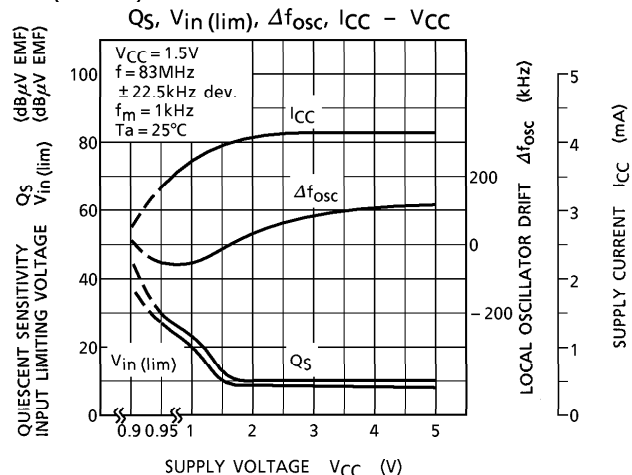
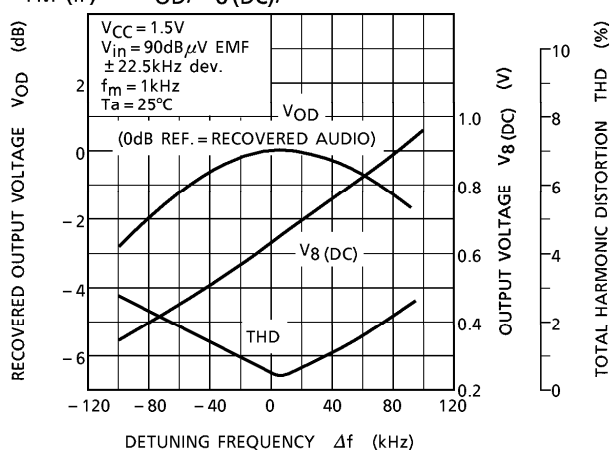
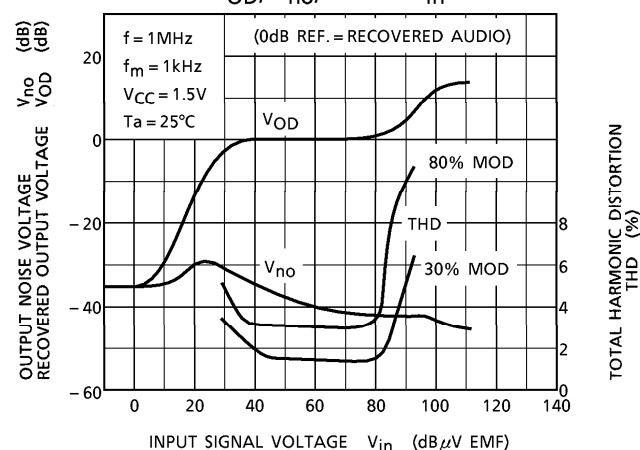
COIL DATA (Test circuit)

Ⓢ : SUMIDA ELECTRIC Co., Ltd.

| COIL STAGE            | TEST FREQUENCY | L (μH) | C <sub>0</sub> (pF) | Q <sub>0</sub> | TURN |     |                 |     | WIRE (mm φ) | REFERENCE       |
|-----------------------|----------------|--------|---------------------|----------------|------|-----|-----------------|-----|-------------|-----------------|
|                       |                |        |                     |                | 1-2  | 2-3 | 1-3             | 4-6 |             |                 |
| L <sub>1</sub> FM RF  | 100MHz         | 0.053  | —                   | 100            | —    | —   | 1 $\frac{3}{4}$ | —   | 0.5UEW      | Ⓢ 0258-000-020  |
| L <sub>2</sub> FM OSC | 100MHz         | 0.065  | —                   | 100            | —    | —   | 2 $\frac{1}{4}$ | —   | 0.5UEW      | Ⓢ 0258-000-021  |
| T <sub>1</sub> AM OSC | 796kHz         | 288    | —                   | 115            | 13   | 73  | —               | —   | 0.08UEW     | Ⓢ 4147-1356-038 |
| T <sub>2</sub> AM IFT | 455kHz         | —      | 180                 | 120            | —    | —   | 180             | 15  | 0.06UEW     | Ⓢ 2150-2162-165 |
| T <sub>3</sub> FM DET | 10.7MHz        | —      | 82                  | 110            | —    | —   | 13              | —   | 0.12UEW     | Ⓢ 4152-4095-015 |

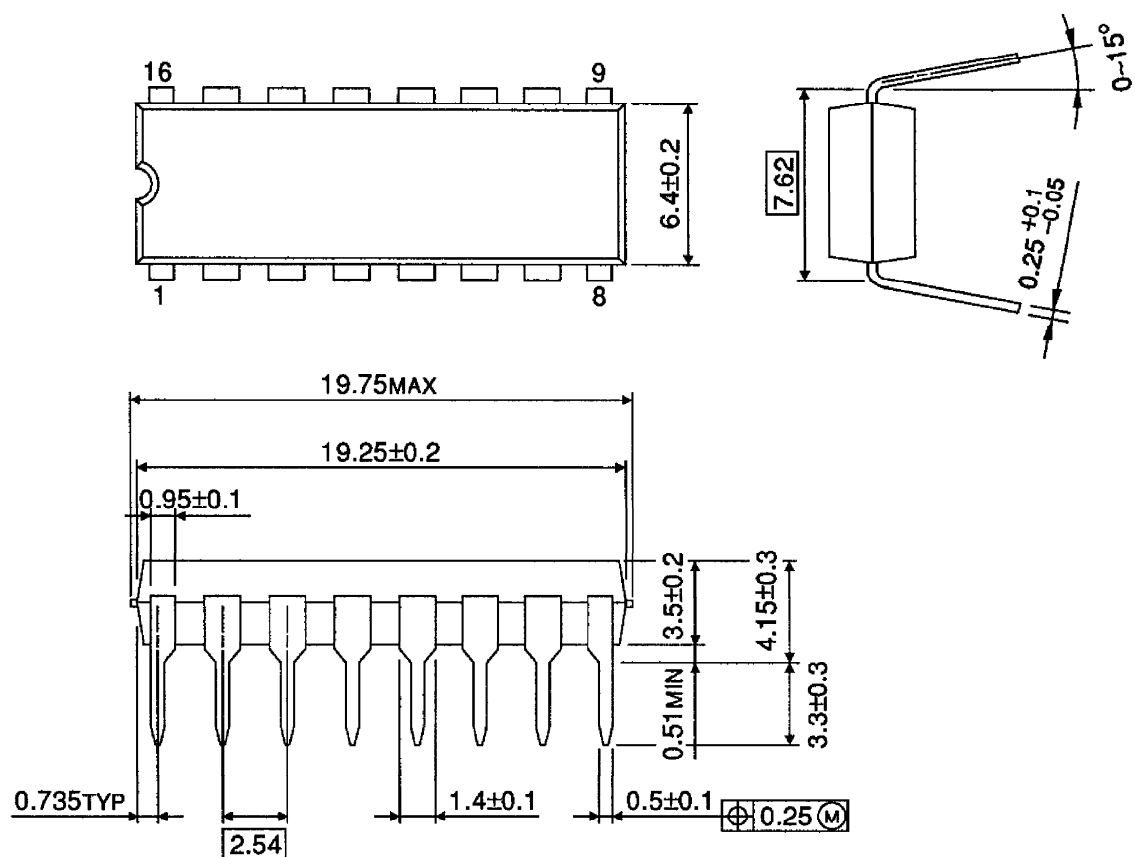


## CHARACTERISTICS CURVES

FM (F/E + IF)  $V_{OD}$ , AMR,  $V_{no}$ , THD -  $V_{in}$ FM (IF)  $V_{OD}$ , AMR,  $V_{no}$ , THD -  $V_{in}$ AM  $I_{CC}$ ,  $V_{OD}$  -  $V_{CC}$ FM (F/E + IF)  $Q_S$ ,  $V_{in}(lim)$ ,  $\Delta f_{osc}$ ,  $I_{CC}$  -  $V_{CC}$ FM (IF)  $V_{OD}$ ,  $V_8(DC)$ , THD -  $\Delta f$ AM  $V_{OD}$ ,  $V_{no}$ , THD -  $V_{in}$ 

**OUTLINE DRAWING**  
DIP16-P-300-2.54A

Unit : mm

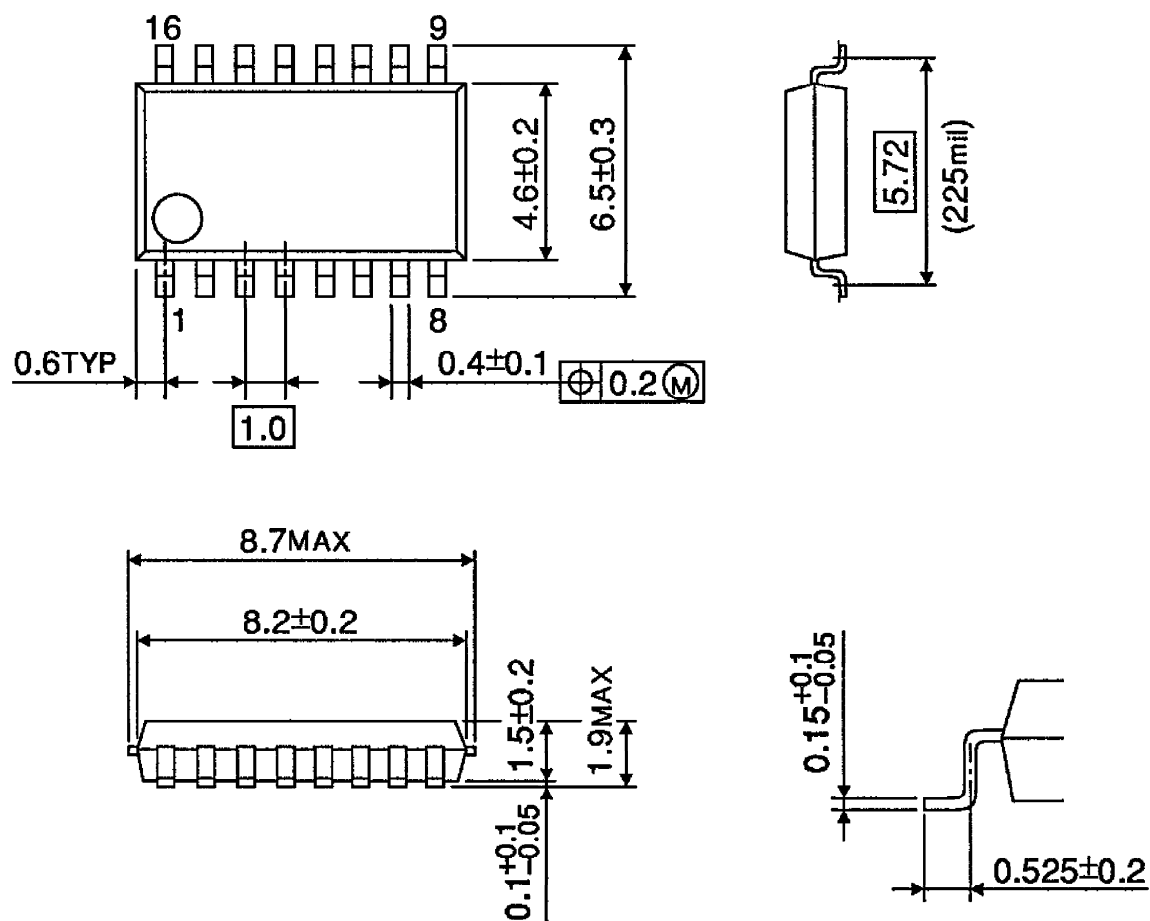


Weight : 1.00g (Typ.)

**OUTLINE DRAWING**

SSOP16-P-225-1.00A

Unit : mm



Weight : 0.14g (Typ.)