

TOSHIBA BIPOLAR LINEAR INTEGRATED CIRCUIT SILICON MONOLITHIC

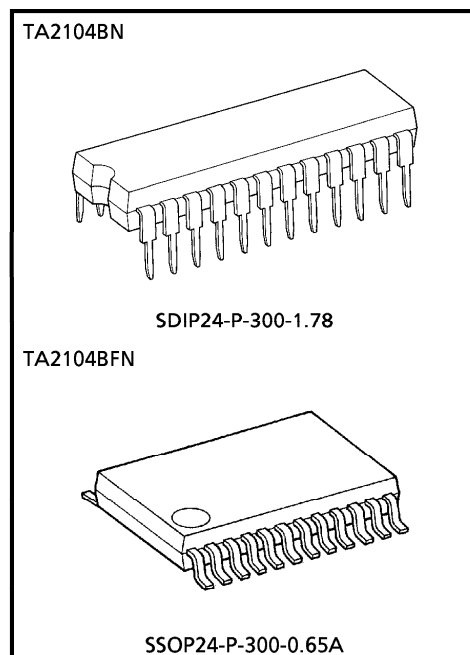
**TA2104BN, TA2104BFN****3 V AM / FM 1 CHIP TUNER IC****(for Digital Tuning System)**

TA2104BN, TA2104BFN are AM/FM 1 chip tuner ICs, which are designed for portable Radios and 3 V Head phone Radios.

This is suitable for Digital Tuning System Applications. FM Local Oscillation Voltage is set up low relatively, for NEW FCC.

**FUNCTIONS**

- For NEW FCC.
- Suitable for combination with Digital Tuning System which is included IF Counter.
- One terminal type AM/FM IF count output for IF counter of Digital Tuning System.
  - FM : 1.3375 MHz (1/8 dividing)
  - AM : 450 kHz
- Built-in Mute Circuit for IF count output.
- For adopting ceramic Discriminator, it is not necessary to adjust the FM Quad Detector Circuit.
- Built-in FM MPX VCO circuit.
- Built-in one terminal type AM/FM Local Oscillator Buffer Output for Digital Tuning System Applications.
- Built-in AM Low cut circuit.
- Low supply current. ( $V_{CC} = 3\text{ V}$ ,  $T_a = 25^\circ\text{C}$ )
  - $I_{CCQ}(\text{FM}) = 11\text{ mA (Typ.)}$
  - $I_{CCQ}(\text{AM}) = 7\text{ mA (Typ.)}$
- Operating Supply voltage range :  $V_{CC} = 1.8\sim 7\text{ V}$  ( $T_a = 25^\circ\text{C}$ )



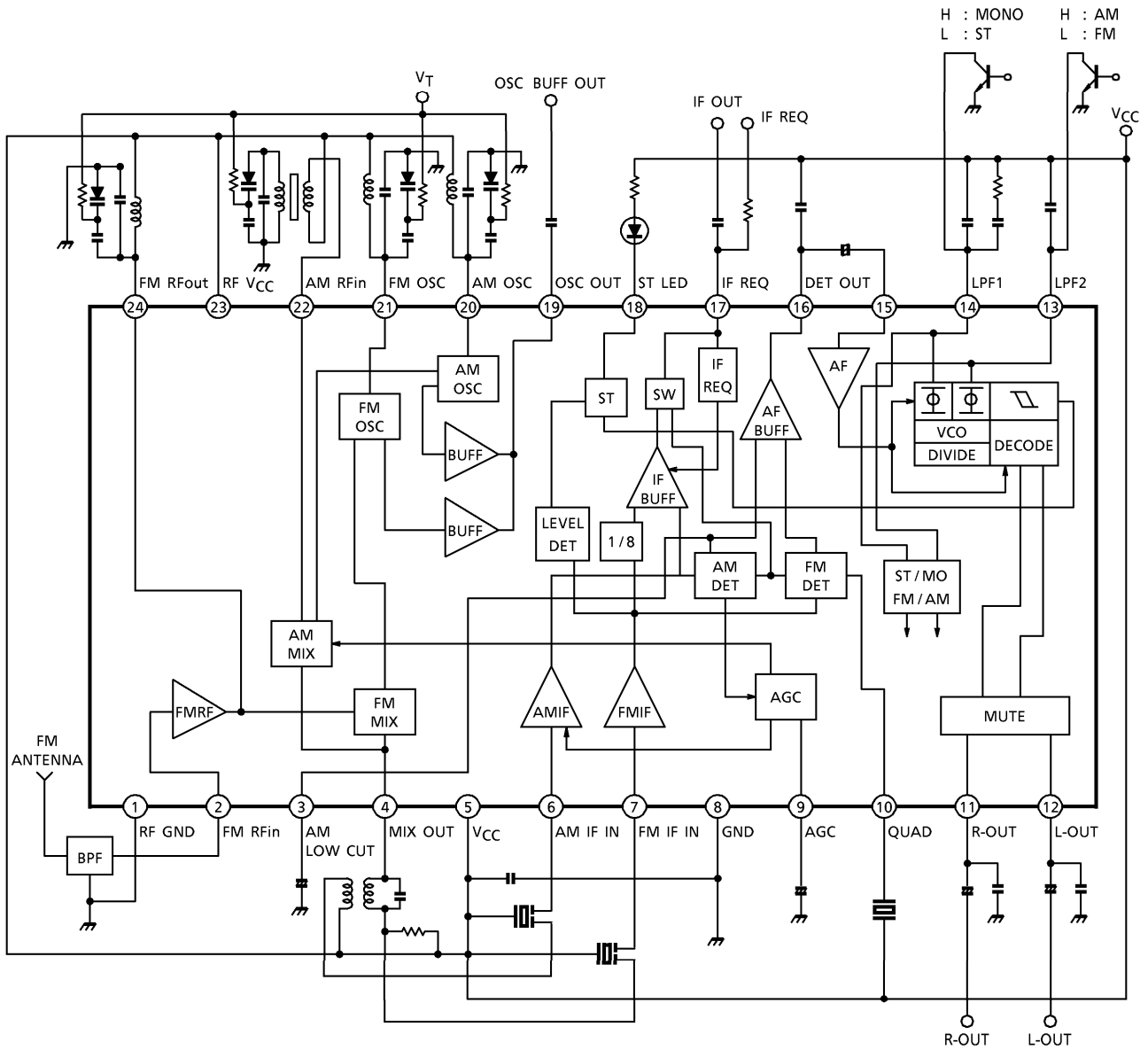
Weight  
 SDIP24-P-300-1.78 : 1.2 g (Typ.)  
 SSOP24-P-300-0.65A : 0.14 g (Typ.)

(\* ) Handle with care to prevent devices from deteriorations by static electricity.

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BLOCK DIAGRAM

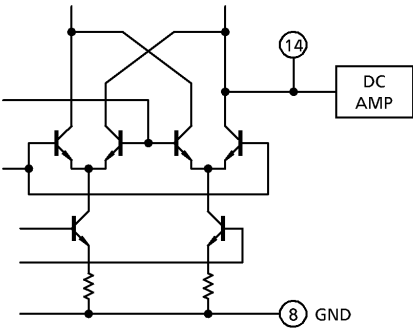
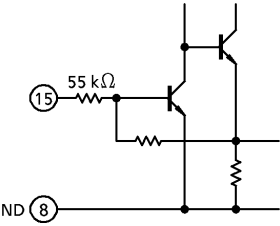
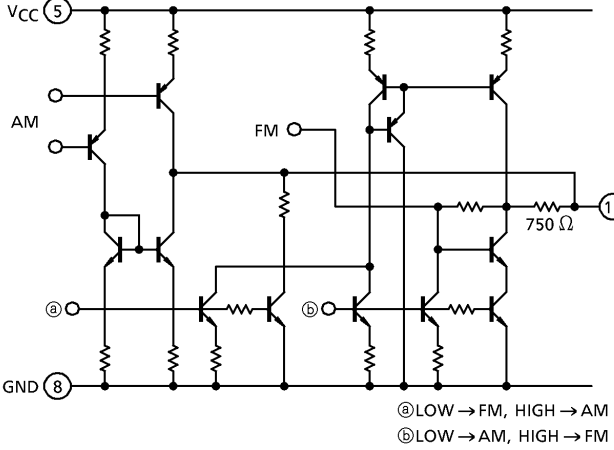
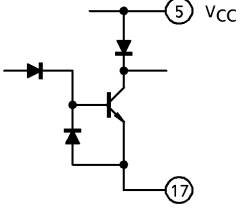
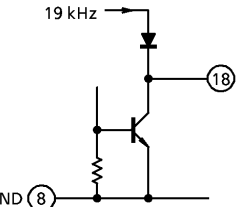


**EXPLANATION OF TERMINALS**

(Terminal Voltage : Typical terminal voltage at no signal with test circuit,  $V_{CC} = 3\text{ V}$ ,  $T_a = 25^\circ\text{C}$ )

| PIN No. | CHARACTERISTIC                                   | INTERNAL CIRCUIT | TERMINAL VOLTAGE (Typ.) (V) |     |
|---------|--|------------------|-----------------------------|-----|
|         |  |                  | AM                          | FM  |
| 1       | RF GND<br>(GND for FM OSC stage)                 | —                | 0                           | 0   |
| 2       | FM-RFin  |                  | 0                           | 0.8 |
| 3       | AM LOW CUT                                       |                  | 1.0                         | —   |
| 4       | MIX OUT  |                  | 3.0                         | 3.0 |
| 5       | $V_{CC}$ ( $V_{CC}$ for AM, FM IF, FM MPX stage) | —                | 3.0                         | 3.0 |
| 6       | AM IF IN   |                  | 2.3                         | 2.5 |
| 7       | FM IF IN   |                  | 3.0                         | 3.0 |

| PIN No.  | CHARACTERISTIC  | INTERNAL CIRCUIT | TERMINAL VOLTAGE (Typ.) (V) |     |
|----------|---|------------------|-----------------------------|-----|
|          |   |                  | AM                          | FM  |
| 8        | GND (GND for AM, FM IF, FM MPX stage)   | —                | 0                           | 0   |
| 9        | AGC   |                  | 0                           | 0   |
| 10       | QUAD  |                  | 2.5                         | 2.2 |
| 11<br>12 | R-OUT<br>L-OUT  |                  | 1.2                         | 1.2 |
| 13       | <p>LPF2</p> <ul style="list-style-type: none"> <li>● LPF terminal for phase Detector.</li> <li>● Bias terminal AM / FM SW circuit.</li> </ul> <p>V<sub>13</sub> = GND → AM<br/>V<sub>13</sub> = OPEN → FM</p> |                  | 0                           | 2.2 |

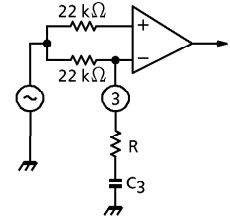
| PIN No. | CHARACTERISTIC   | INTERNAL CIRCUIT   | TERMINAL VOLTAGE (Typ.) (V) |     |
|---------|--|--|-----------------------------|-----|
|         |  |  | AM                          | FM  |
| 14      | LPF1<br>● LPF terminal for Synchronous Detector.<br>● V <sub>CO</sub> Stop terminal.<br>V <sub>14</sub> = GND → V <sub>CO</sub> STOP |    | 0.7                         | 2.4 |
| 15      | MPX IN   |    | 0.7                         | 0.7 |
| 16      | DET OUT  |  | 1.0                         | 0.9 |
| 17      | IF REQ   |   | —                           | —   |
| 18      | ST LED   |   | —                           | —   |

| PIN No. | CHARACTERISTIC                   | INTERNAL CIRCUIT | TERMINAL VOLTAGE (Typ.) (V) |     |
|---------|----------------------------------|------------------|-----------------------------|-----|
|         |                                  |                  | AM                          | FM  |
| 19      | OSC OUT                          |                  | 2.8                         | 2.7 |
| 20      | AM OSC                           |                  | 3.0                         | 3.0 |
| 21      | FM OSC                           |                  | 3.0                         | 3.0 |
| 22      | AM RFin                          |                  | 3.0                         | 3.0 |
| 23      | RF VCC<br>(VCC for FM OSC stage) | —                | 3.0                         | 3.0 |
| 24      | FM RFout                         | Cf. pin ①        | 3.0                         | 3.0 |

**APPLICATION NOTE**

**1. AM Low-Cut Circuit**

- The AM Low-Cut action is carried out by the bypass of the high frequency component of the positive-feedback signal at the AF AMP stage. The external capacitor :  $C_3$  by-pass this component.
- The cut-off frequency  $f_L$  is determined by the internal resistance  $22\text{ k}\Omega$  (Typ.) and the external capacitor  $C_3$  as following ;

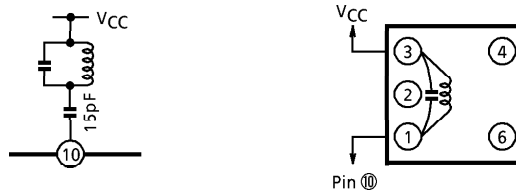


$$f_L = \frac{1}{2 \times \pi \times 22 \times 10^3 \times C_3} \text{ (Hz)}$$

- In the case of the AM Low-Cut function is not needed, set up the value of  $C_3$  over  $1\ \mu\text{F}$ . In the condition of  $C_3 \geq 1\ \mu\text{F}$ , the frequency characteristic has flat response at the low frequency.
- It is possible to reduce the recovered output level at AM mode, by additional resistance between the pin ③ and GND line.

**2. FM Detection Circuit**

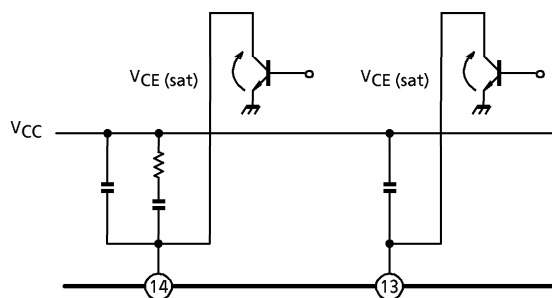
For the FM detection circuit, detection coil is able to use instead of ceramic discriminator. Recommended circuit and recommended coil are as follows. (In this case, please take care that  $V_{in}(\text{lim.})$  falls a little.)



| TEST FREQUENCY | $C_o$ (pF) | $Q_o$ | TURNS |     |     |     | WIRE (mm $\phi$ ) | REFERENCE                        |
|----------------|------------|-------|-------|-----|-----|-----|-------------------|----------------------------------|
|                |            |       | 1-2   | 2-3 | 1-3 | 4-6 |                   |                                  |
| 10.7 MHz       | 51         | 45    | —     | —   | 30  | —   | 0.08 UEW          | TOKO Co., Ltd.<br>600BEAS-10018Z |

**3. FM/AM switch and forced monaural switch.**

- FM/AM switchover and stereo/forced monaural switchover are done by pin ⑬ and pin ⑭.
- FM/AM switch (pin ⑬)
  - (  $V_{13}$  : Low (Active Low,  $V_{th} = 0.2\text{ V}$  (Typ.),  $I_{th} 30\ \mu\text{A}$  (Typ.)  $\rightarrow$  AM )
  - (  $V_{13}$  : OPEN  $\rightarrow$  FM )
- Stereo/forced monaural switch (pin ⑭)
  - (  $V_{14}$  : Low (Active Low,  $V_{th} = 0.2\text{ V}$  (Typ.),  $I_{th} 30\ \mu\text{A}$  (Typ.)  $\rightarrow$  Forced Monaural )
  - (  $V_{14}$  : OPEN  $\rightarrow$  Stereo )



## MAXIMUM RATINGS (Ta = 25°C)

| CHARACTERISTIC        |           | SYMBOL                   | RATING   | UNIT |
|-----------------------|-----------|--------------------------|----------|------|
| Supply Voltage        |           | V <sub>CC</sub>          | 8        | V    |
| LED Current           |           | I <sub>LED</sub>         | 10       | mA   |
| LED Voltage           |           | V <sub>LED</sub>         | 8        | V    |
| Power Dissipation     | TA2104BN  | P <sub>D</sub><br>(Note) | 1200     | mW   |
|                       | TA2104BFN |                          | 500      |      |
| 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 9.6 mW/°C for TA2104BN of 4 mW/°C for TA2104BFN.



**ELECTRICAL CHARACTERISTICS**

Unless otherwise specified,  $T_a = 25^\circ\text{C}$ ,  $V_{CC} = 3\text{ V}$ , F/E :  $f = 98\text{ MHz}$ ,  $f_m = 1\text{ kHz}$   
 FM IF :  $f = 10.7\text{ MHz}$ ,  $\Delta f = \pm 75\text{ kHz}$ ,  $f_m = 1\text{ kHz}$   
 AM :  $f = 1\text{ MHz}$ ,  $\text{MOD} = 30\%$ ,  $f_m = 1\text{ kHz}$   
 MPX :  $f_m = 1\text{ kHz}$

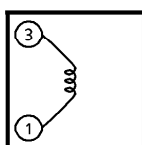
| CHARACTERISTIC              |                                 | SYMBOL                                  | TEST CIRCUIT | TEST CONDITION   | MIN.   | TYP.   | MAX.                       | UNIT                       |
|-----------------------------|---------------------------------|---|--------------|--|--------|--------|----------------------------|----------------------------|
| Supply Current              |                                 | $I_{CC}(\text{FM})$                     | —            | $V_{in} = 0$ , FM mode                                 | —      | 11     | 14.5                       | mA                         |
|                             |                                 | $I_{CC}(\text{AM})$                     | —            | $V_{in} = 0$ , AM mode                                 | —      | 7      | 9.5                        |                            |
| F/E                         | Input Limiting Voltage          | $V_{in}(\text{lim})$                    | —            | $V_{in} = 60\text{ dB}\mu\text{V}$ EMF, -3 dB limiting | —      | 12     | —                          | $\text{dB}\mu\text{V}$ EMF |
|                             | Local OSC Buffer Output Voltage | $V_{\text{OSC}}(\text{buff})\text{ FM}$ | —            | $f_{\text{OSC}} = 108.7\text{ MHz}$                    | 23     | 35     | —                          | $\text{mV}_{\text{rms}}$   |
| FM IF                       | Input Limiting Voltage          | $V_{in}(\text{lim})\text{ IF}$          | —            | $V_{in} = 80\text{ dB}\mu\text{V}$ EMF, -3 dB limiting | 37     | 42     | 47                         | $\text{dB}\mu\text{V}$ EMF |
|                             | Recovered Output Voltage        | $V_{\text{OD}}$                         | —            | $V_{in} = 80\text{ dB}\mu\text{V}$ EMF                 | 200    | 250    | 300                        | $\text{mV}_{\text{rms}}$   |
|                             | Signal To Noise Ratio           | S/N                                     | —            | $V_{in} = 80\text{ dB}\mu\text{V}$ EMF                 | —      | 75     | —                          | dB                         |
|                             | Total Harmonic Distortion       | THD                                     | —            | $V_{in} = 80\text{ dB}\mu\text{V}$ EMF                 | —      | 0.3    | —                          | %                          |
|                             | AM Rejection Ration             | AMR                                     | —            | $V_{in} = 80\text{ dB}\mu\text{V}$ EMF                 | —      | 60     | —                          | dB                         |
|                             | IF Count Output Frequency       | $f_{\text{IF}}(\text{FM})$              | —            | $V_{in} = 80\text{ dB}\mu\text{V}$ EMF, SW7 : ON       | 1.3373 | 1.3375 | 1.3377                     | MHz                        |
|                             | IF Count Output Voltage         | $V_{\text{IF}}(\text{FM})$              | —            | $V_{in} = 80\text{ dB}\mu\text{V}$ EMF, SW7 : ON       | 200    | 250    | —                          | $\text{mV}_{\text{p-p}}$   |
| IF Count Output Sensitivity | IF sens (FM)                    | —                                       | SW7 : ON     | 41   | 46     | 51     | $\text{dB}\mu\text{V}$ EMF |                            |
| AM                          | Gain                            | $G_V$                                   | —            | $V_{in} = 27\text{ dB}\mu\text{V}$ EMF                 | 20     | 38     | 70                         | $\text{mV}_{\text{rms}}$   |
|                             | Recovered Output Voltage        | $V_{\text{OD}}$                         | —            | $V_{in} = 60\text{ dB}\mu\text{V}$ EMF                 | 60     | 85     | 108                        | $\text{mV}_{\text{rms}}$   |
|                             | Signal To Noise Ratio           | S/N                                     | —            | $V_{in} = 60\text{ dB}\mu\text{V}$ EMF                 | —      | 41     | —                          | dB                         |
|                             | Total Harmonic Distortion       | THD                                     | —            | $V_{in} = 60\text{ dB}\mu\text{V}$ EMF                 | —      | 0.7    | —                          | %                          |
|                             | Local OSC Buffer Output Voltage | $V_{\text{OSC}}(\text{buff})\text{ AM}$ | —            | $f_{\text{OSC}} = 1.45\text{ MHz}$                     | 44     | 66     | —                          | $\text{mV}_{\text{rms}}$   |
|                             | IF Count Output Voltage         | $V_{\text{IF}}(\text{AM})$              | —            | $V_{in} = 60\text{ dB}\mu\text{V}$ EMF, SW7 : ON       | 200    | 250    | —                          | $\text{mV}_{\text{p-p}}$   |
|                             | IF Count Output Sensitivity     | IF sens (AM)                            | —            | SW7 : ON   | 38     | 43     | 48                         | $\text{dB}\mu\text{V}$ EMF |
| PIN ⑰ Output Resistance     |                                 | $R_{17}$                                | —            | FM mode  | —      | 0.75   | —                          | k $\Omega$                 |
|                             |                                 |   |              | AM mode  | —      | 15.5   | —                          |                            |

| CHARACTERISTIC     |                                     | SYMBOL                       | TEST CIRCUIT         | TEST CONDITION  | MIN.   | TYP.         | MAX.          | UNIT              |                   |
|--------------------|-------------------------------------|------------------------------|----------------------|---|--|--------------|---------------|-------------------|-------------------|
| MPX                | Input Resistance                    | R <sub>IN</sub>              | —                    | —   | —  | 55           | —             | kΩ                |                   |
|                    | Output Resistance                   | R <sub>OUT</sub>             | —                    | —   | —  | 5            | —             | kΩ                |                   |
|                    | Max. Composite Signal Input Voltage | V <sub>in</sub> MAX (Stereo) | —                    | L + R = 90%, P = 10%,<br>SW3 : LPF ON<br>f <sub>m</sub> = 1 kHz, THD = 3%     | —  | 700          | —             | mV <sub>rms</sub> |                   |
|                    | Separation                          | Sep.                         | —                    | L + R = 180 mV <sub>rms</sub> ,<br>P = 20 mV <sub>rms</sub> ,<br>SW3 : LPF ON | f <sub>m</sub> = 100 Hz<br>f <sub>m</sub> = 1 kHz<br>f <sub>m</sub> = 10 kHz | —<br>35<br>— | 45<br>45<br>— | —<br>—<br>—       | dB                |
|                    | Total Harmonic Distortion           | Monaural                     | THD (Monaural)       | —   | V <sub>in</sub> = 200 mV <sub>rms</sub>                                      | —            | 0.3           | —                 | %                 |
|                    |                                     | Stereo                       | THD (Stereo)         | —   | L + R = 180 mV <sub>rms</sub> ,<br>P = 20 mV <sub>rms</sub> , SW3 : LPF ON   | —            | 0.3           | —                 |                   |
|                    | Voltage Gain                        |                              | G <sub>V</sub>       | —   | V <sub>in</sub> = 200 mV <sub>rms</sub>                                      | -2.7         | -1.2          | 0.2               | dB                |
|                    | Channel Balance                     |                              | C.B.                 | —   | V <sub>in</sub> = 200 mV <sub>rms</sub>                                      | -1.5         | 0             | 1.5               | dB                |
|                    | Stereo LED Sensitivity              | ON                           | V <sub>L</sub> (ON)  | —   | Pilot Input (19 kHz)   | —            | 10            | 14                | mV <sub>rms</sub> |
|                    |                                     | OFF                          | V <sub>L</sub> (OFF) | —   |  | 5            | 8             | —                 |                   |
|                    | Stereo LED Hysteresis               |                              | V <sub>H</sub>       | —   | To LED turn off from LED turn on   | —            | 2             | —                 | mV <sub>rms</sub> |
|                    | Capture Range                       |                              | C.R.                 | —   | P = 15 mV <sub>rms</sub>   | —            | ±8            | —                 | %                 |
| Signal Noise Ratio |                                     | S/N                          | —                    | V <sub>in</sub> = 200 mV <sub>rms</sub>                                       | —  | 80           | —             | dB                |                   |
| Muting Attenuation |                                     | MUTE                         | —                    | V <sub>in</sub> = 200 mV <sub>rms</sub>                                       | —  | 80           | —             | dB                |                   |

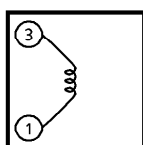
**COIL DATA**

| COIL No.              | TEST FREQ | L (μH) | Co (pF) | Q <sub>o</sub> | TURNS |     |                 |     |     | WIRE (mmφ) | REFERENCE                      |
|-----------------------|-----------|--------|---------|----------------|-------|-----|-----------------|-----|-----|------------|--------------------------------|
|                       |           |        |         |                | 1-2   | 2-3 | 1-3             | 1-4 | 4-6 |            |                                |
| L <sub>1</sub> FM RF  | 100 MHz   |        |         | 79             |       |     | 2 $\frac{1}{2}$ |     |     | 0.16UEW    | TOKO Co., Ltd.<br>666SNF-305NK |
| L <sub>2</sub> FM OSC | 100 MHz   |        |         | 76             |       |     | 2               |     |     | 0.16UEW    | TOKO Co., Ltd.<br>666SNF-306NK |
| T <sub>1</sub> AM OSC | 796 kHz   | 268    | —       | 65             | 19    | 95  |                 |     |     | 0.05UEW    | TOKO Co., Ltd.<br>5PNR-5146Y   |
| T <sub>2</sub> AM IFT | 455 kHz   | —      | 470     | 60             |       |     | 109             |     | 7   | 0.05UEW    | TOKO Co., Ltd.<br>5PNR-5147X   |

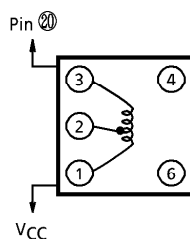
L<sub>1</sub> : FM RF



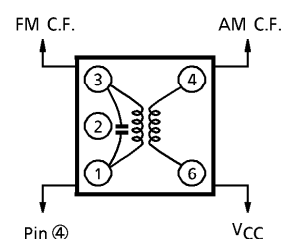
L<sub>2</sub> : FM OSC



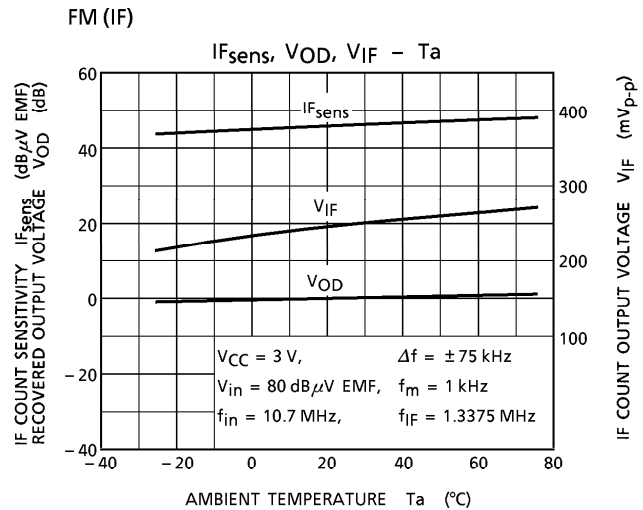
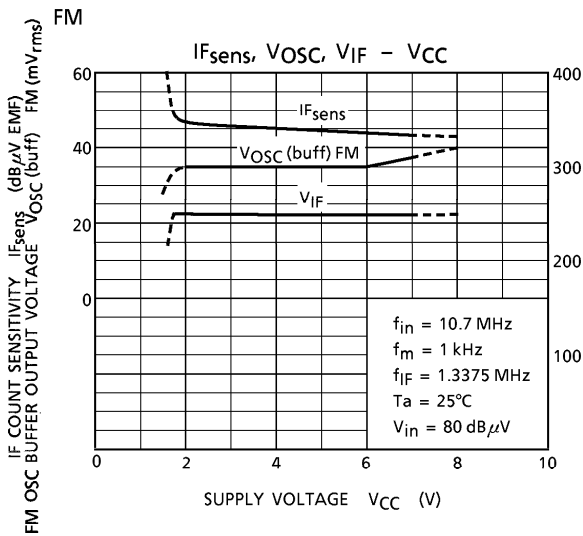
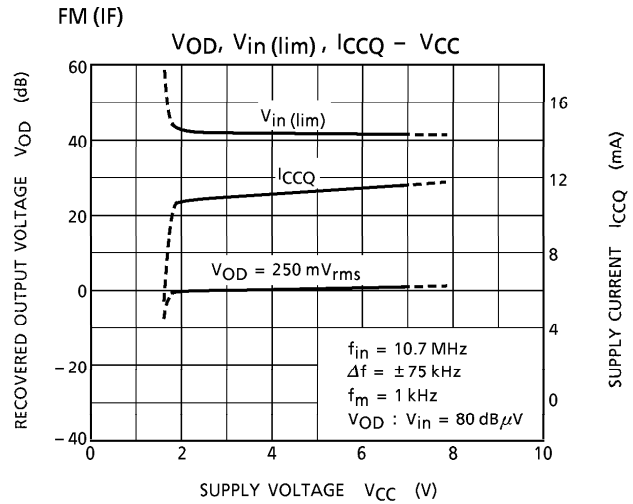
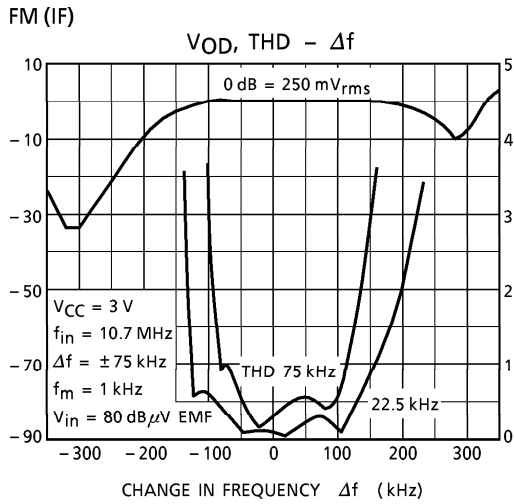
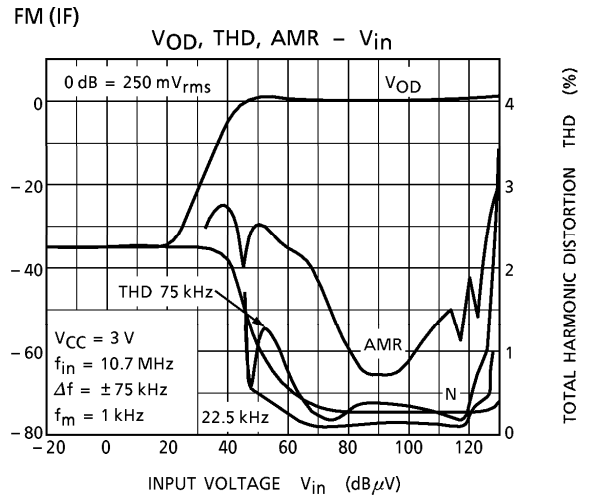
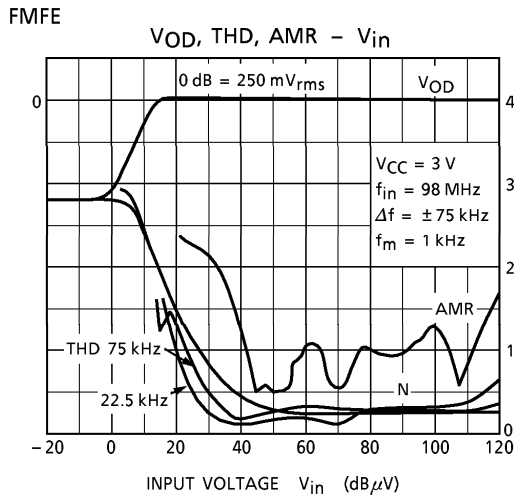
T<sub>1</sub> : AM OSC

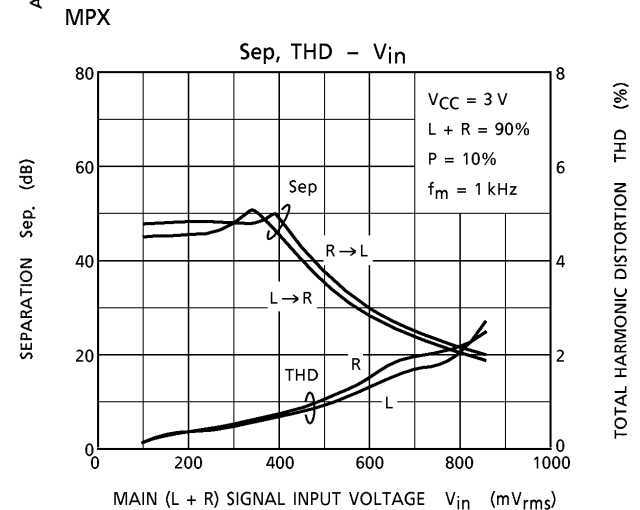
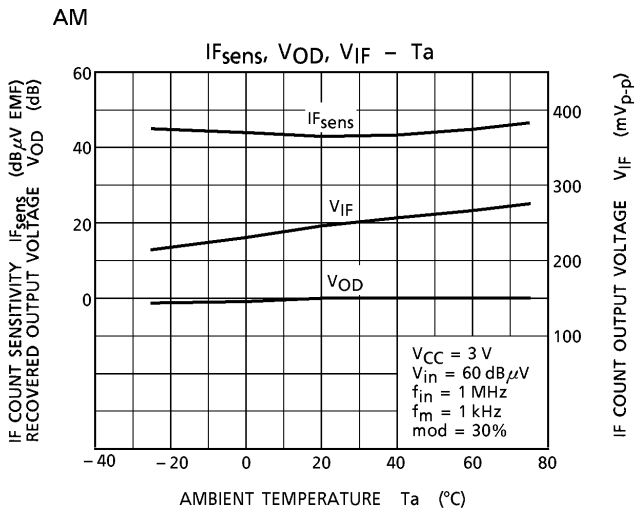
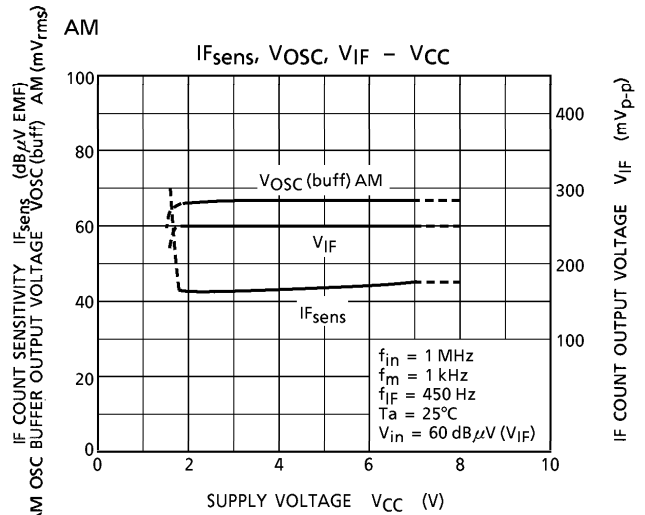
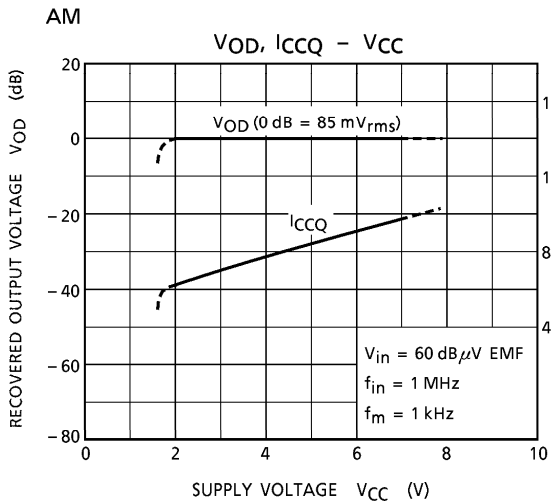
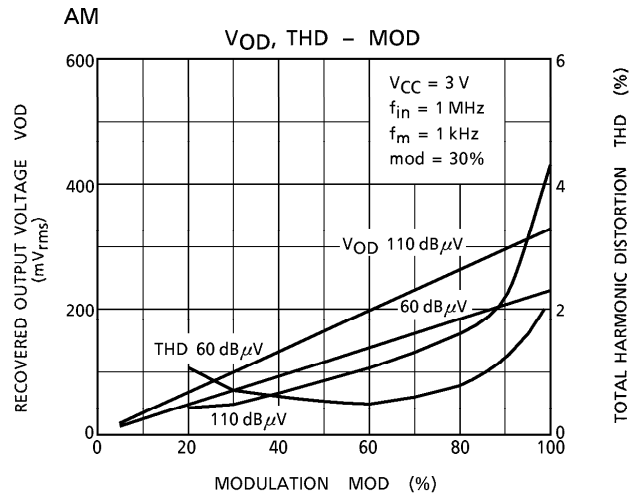
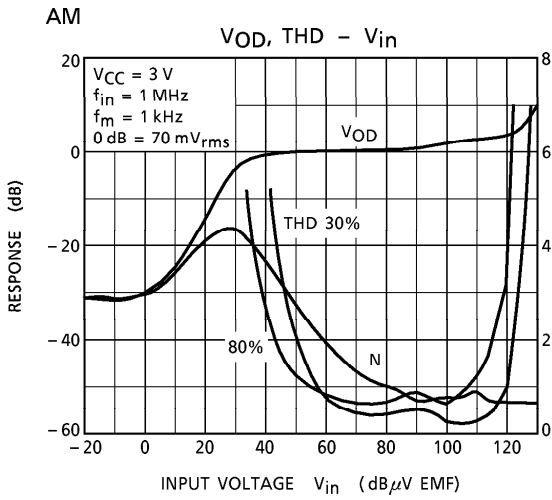


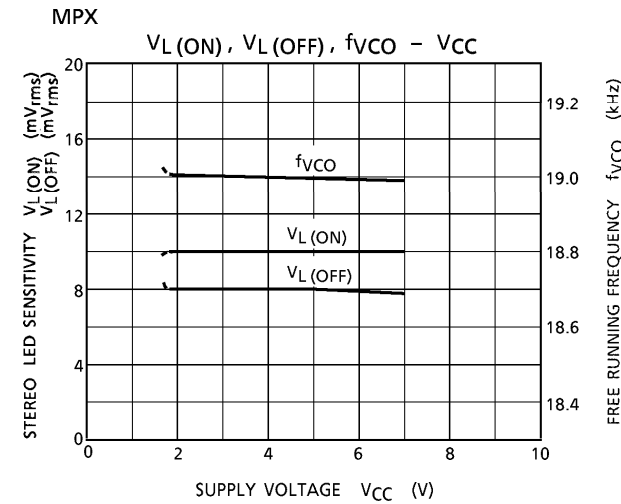
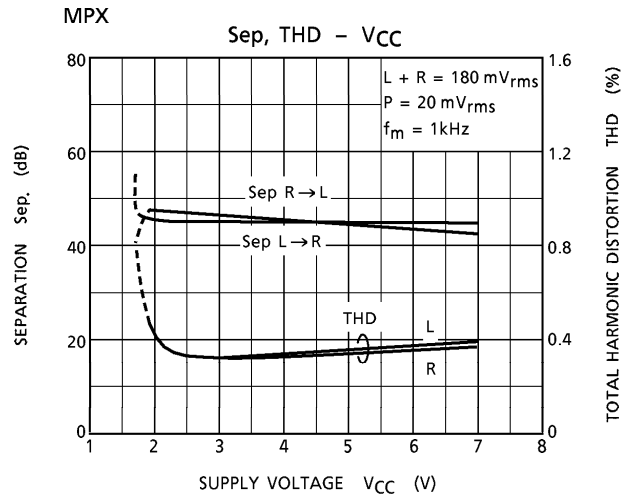
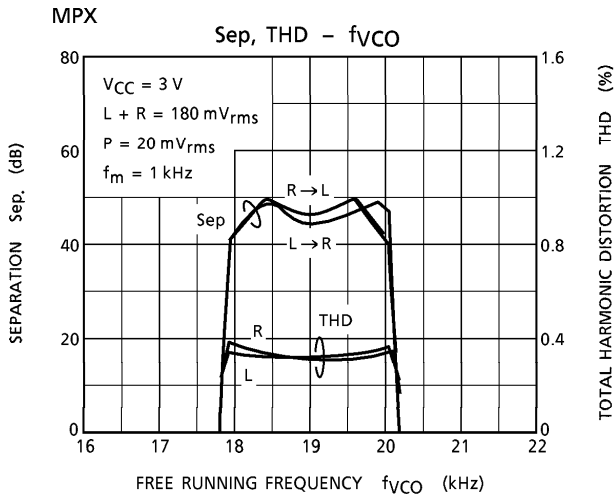
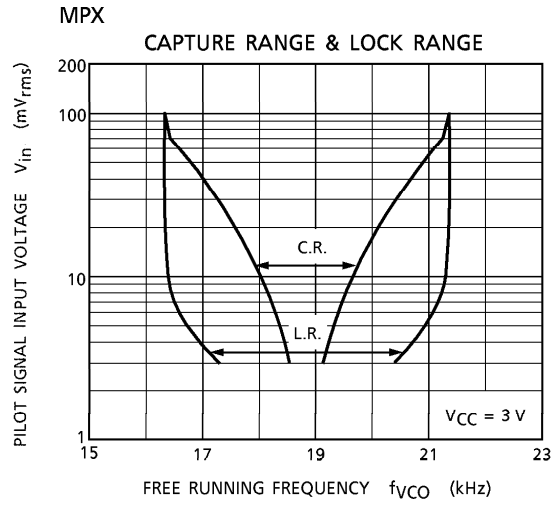
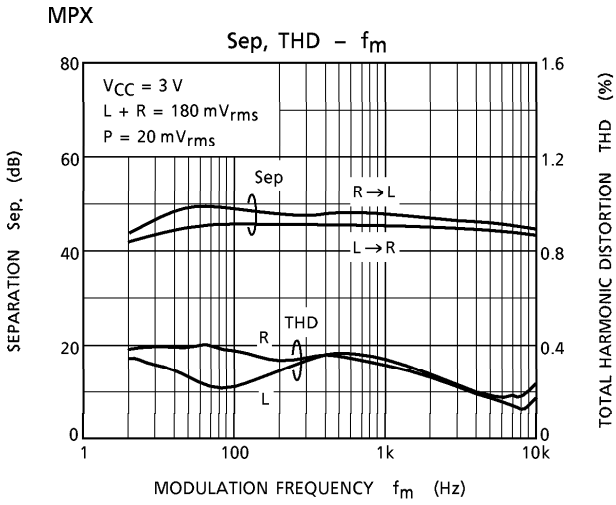
T<sub>2</sub> : AM IFT





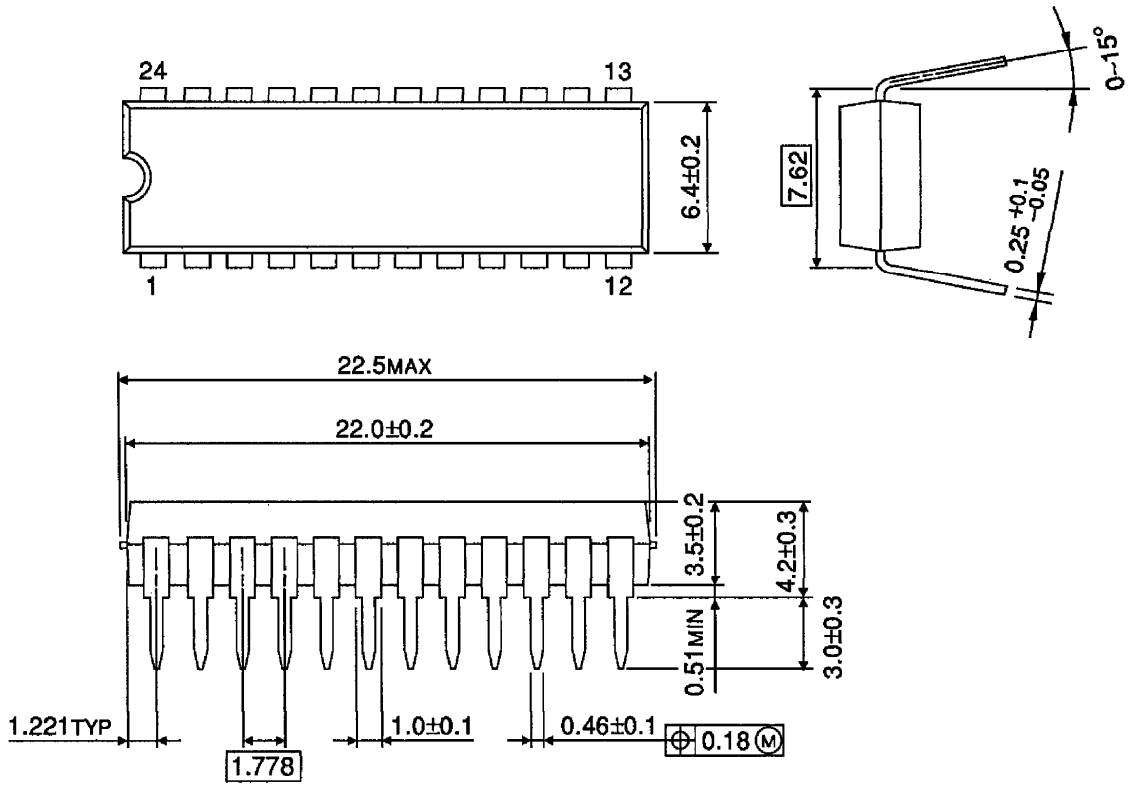






OUTLINE DRAWING  
SDIP24-P-300-1.78

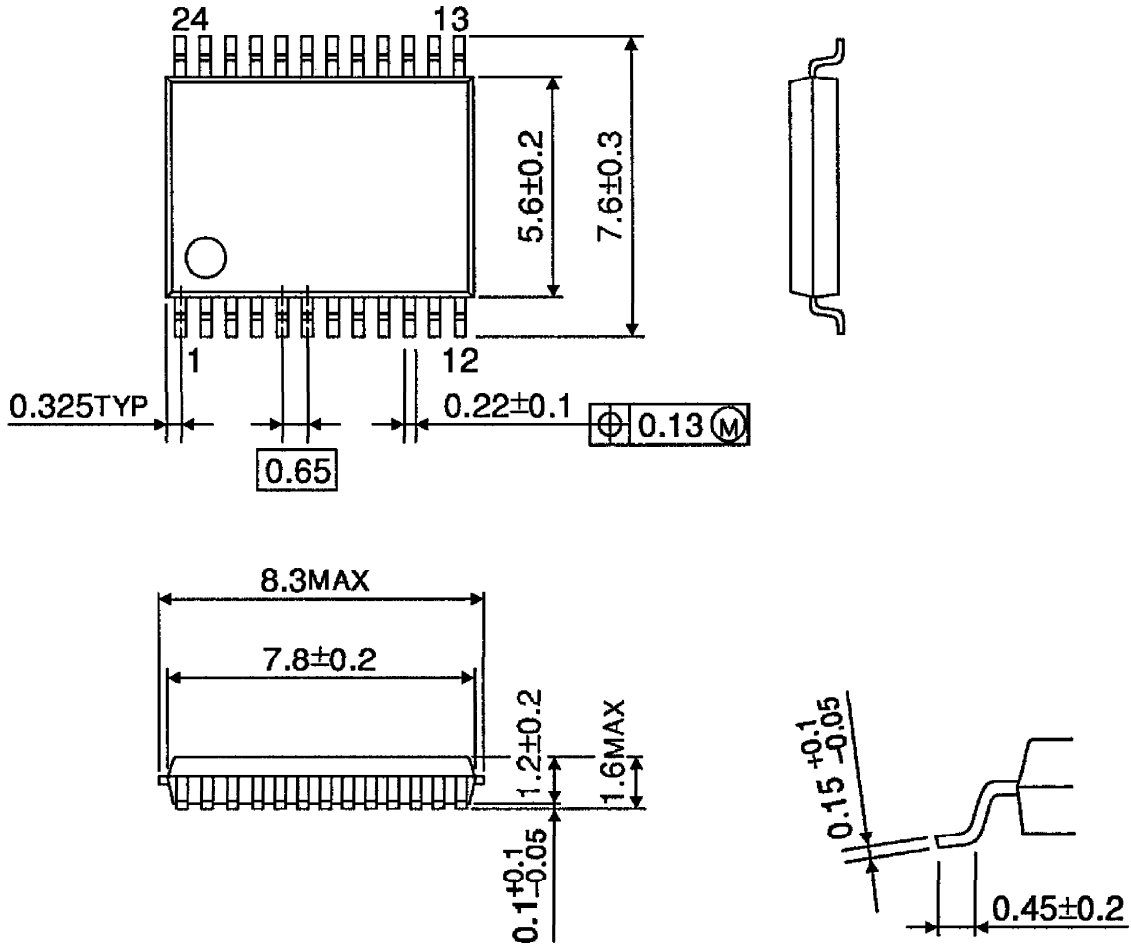
Unit : mm



Weight : 1.2 g (Typ.)

OUTLINE DRAWING  
SSOP24-P-300-0.65A

Unit : mm



Weight : 0.14 g (Typ.)