

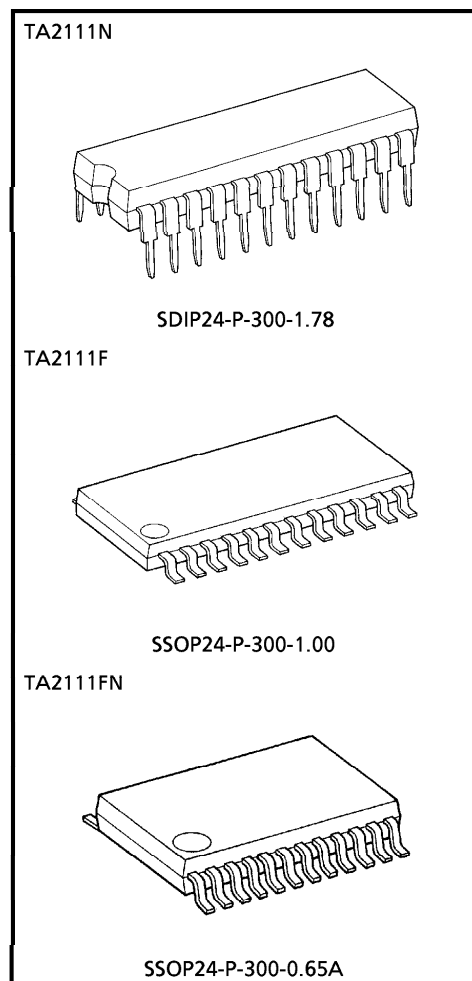
TOSHIBA BIPOLAR LINEAR INTEGRATED CIRCUIT SILICON MONOLITHIC

TA2111N, TA2111F, TA2111FN**3V AM / FM 1 CHIP TUNER IC**

TA2111N/F/FN are AM/FM 1 chip tuner ICs, which are designed for portable Radios and 3V Head phone Radios. FM Local Oscillation Voltage is set up low relativity, for NEW FCC.

FEATURES

- For NEW FCC.
- AM Detector Coil, FM IFT, IF Coupling Condenser are not needed.
- For adopting Ceramic Discriminator, it is not necessary to adjust the FM Quad Detector Circuit.
- Built-in FM MPX VCO circuit.
- Built-in varactor diode for AFC.
- Built-in AM Low cut circuit.
- Low supply current. ($V_{CC} = 3V$, $T_a = 25^\circ C$)
 - I_{CCq} (FM) = 9.0mA (Typ.)
 - I_{CCq} (AM) = 5.0mA (Typ.)
- Operating Supply voltage range : $V_{CC} = 1.8 \sim 7V$ ($T_a = 25^\circ C$)
 - (*) Handle with care to prevent devices from deteriorations by static electricity.

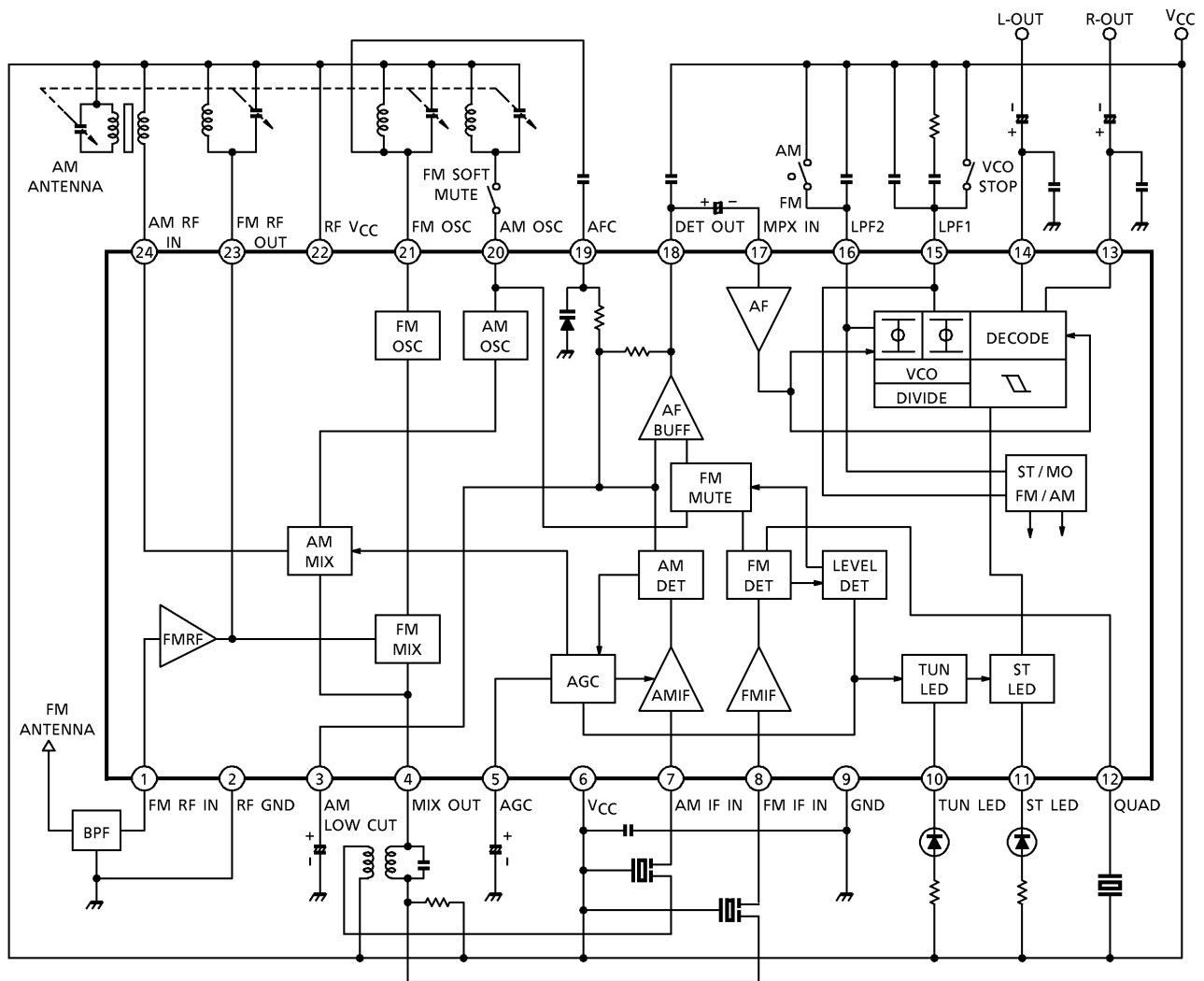
**Weight**

SDIP24-P-300-1.78 : 1.2g (Typ.)
 SSOP24-P-300-1.00 : 0.31g (Typ.)
 SSOP24-P-300-0.65A : 0.14g (Typ.)

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BLOCK DIAGRAM



EXPLANATION OF TERMINALS

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

| PIN No. | CHARACTERISTIC | INTERNAL CIRCUIT | TERMINAL VOLTAGE (Typ.) (V) | |
|---------|--|------------------|-----------------------------|-----|
| | | | AM | FM |
| 1 | FM-RF IN | | 0 | 0.8 |
| 2 | RF GND (GND for FM RF, FM OSC stage) | — | 0 | 0 |
| 3 | AM LOW CUT | | 1.0 | 0.8 |
| 4 | MIX OUT | | 3.0 | 2.9 |
| 5 | AGC (AM AGC) | | 0 | 0 |
| 6 | V_{CC} (V_{CC} for AM, FM IF, FM MPX stage) | — | 3.0 | 3.0 |

| PIN No. | CHARACTERISTIC | INTERNAL CIRCUIT | TERMINAL VOLTAGE (Typ.) (V) | |
|---------|---------------------------------------|------------------|-----------------------------|-----|
| | | | AM | FM |
| 7 | AM IF IN | | 2.3 | 2.6 |
| 8 | FM IF IN | | 3.0 | 3.0 |
| 9 | GND (GND for AM, FM IF, FM MPX stage) | — | 0 | 0 |
| 10 | TUN LED (Tuning LED) | | — | — |
| 11 | ST LED (Stereo LED) | | — | — |
| 12 | QUAD (FM QUAD. Detector) | | 2.5 | 2.2 |

| PIN No. | CHARACTERISTIC | INTERNAL CIRCUIT | TERMINAL VOLTAGE (Typ.) (V) | |
|----------|---|------------------|-----------------------------|-----|
| | | | AM | FM |
| 13 14 | R-OUT (R-ch Output) L-OUT (L-ch Output) | | 1.2 | 1.2 |
| 15 | LPF1 <ul style="list-style-type: none"> ● LPF terminal for synchronous Detector ● VCO stop terminal V15 = V_{CC} → VCO STOP | | 2.3 | 2.3 |
| 16 | LPF2 <ul style="list-style-type: none"> ● LPF terminal for phase Detector ● Bias terminal for AM / FM SW circuit V16 = V_{CC} → AM V16 = OPEN → FM | | 3 | 2.2 |
| 17 | MPX IN | | 0.7 | 0.7 |

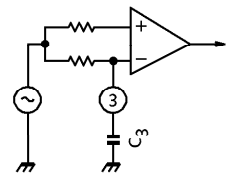
| PIN No. | CHARACTERISTIC | INTERNAL CIRCUIT | TERMINAL VOLTAGE (Typ.) (V) | |
|---------|-------------------------------|--|-----------------------------|-----|
| | | | AM | FM |
| 18 | DET OUT | <p>⑥ LOW→FM, HIGH→AM ⑧ LOW→AM, HIGH→FM</p> | 1.0 | 0.9 |
| 19 | AFC | cf. pin ③ | — | — |
| 20 | AM OSC | | 3.0 | 3.0 |
| 21 | FM OSC | | 3.0 | 3.0 |
| 22 | RF VCC (VCC for FM OSC stage) | — | 3.0 | 3.0 |
| 23 | FM RF OUT | cf. pin ① | 3.0 | 3.0 |

| PIN No. | CHARACTERISTIC | INTERNAL CIRCUIT | TERMINAL VOLTAGE (Typ.) (V) | |
|---------|----------------|------------------|-----------------------------|-----|
| | | | AM | FM |
| 24 | AM RF IN | | 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 : C₃ by-passes this component.
- The cut-off frequency f_L is determined by the internal resistance 10kΩ (Typ.) and the external capacitor C₃ as following ;

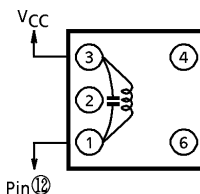
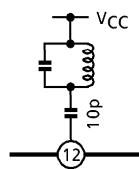


$$f_L = \frac{1}{2 \times \pi \times 10 \times 10^3 \times C_3} \text{ (Hz)}$$

- In the case of the AM Low-Cut function is not needed, set up the value of C₃ over 1μF. In the condition of C₃ ≥ 1μF, the frequency characteristic has flat response at the low frequency.
- In FM mode, C₃ is a Capacitor for AFC Low-Pass filter circuit.

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} (lim.) falls a little.



| TEST FREQUENCY | C ₀ (pF) | Q ₀ | TURNS | | | | WIRE (mm φ) | REFERENCE |
|----------------|---------------------|----------------|-------|-----|-----|-----|-------------|----------------------------------|
| | | | 1-2 | 2-3 | 1-3 | 4-6 | | |
| 10.7MHz | 51 | 45 | — | — | 30 | — | 0.12 UEW | TOKO Co., Ltd. 600BEAS-10018Z |

MAXIMUM RATINGS (Ta = 25°C)

| CHARACTERISTIC | | SYMBOL | RATING | UNIT |
|-----------------------|----------|--------------------------|----------|------|
| Supply Voltage | | V _{CC} | 8 | V |
| LED Current | | I _{LED} | 10 | mA |
| LED Voltage | | V _{LED} | 8 | V |
| Power Dissipation | TA2111N | P _D (Note) | 1200 | mW |
| | TA2111F | | 400 | |
| | TA2111FN | | 500 | |
| Operating Temperature | | T _{opr} | - 25~75 | °C |
| Storage Temperature | | T _{stg} | - 55~150 | °C |

(Note) Derated above Ta = 25°C in the proportion of 9.6mW/°C for TA2111N, of 3.2mW/°C for TA2111F and of 4mW/°C for TA2111FN.

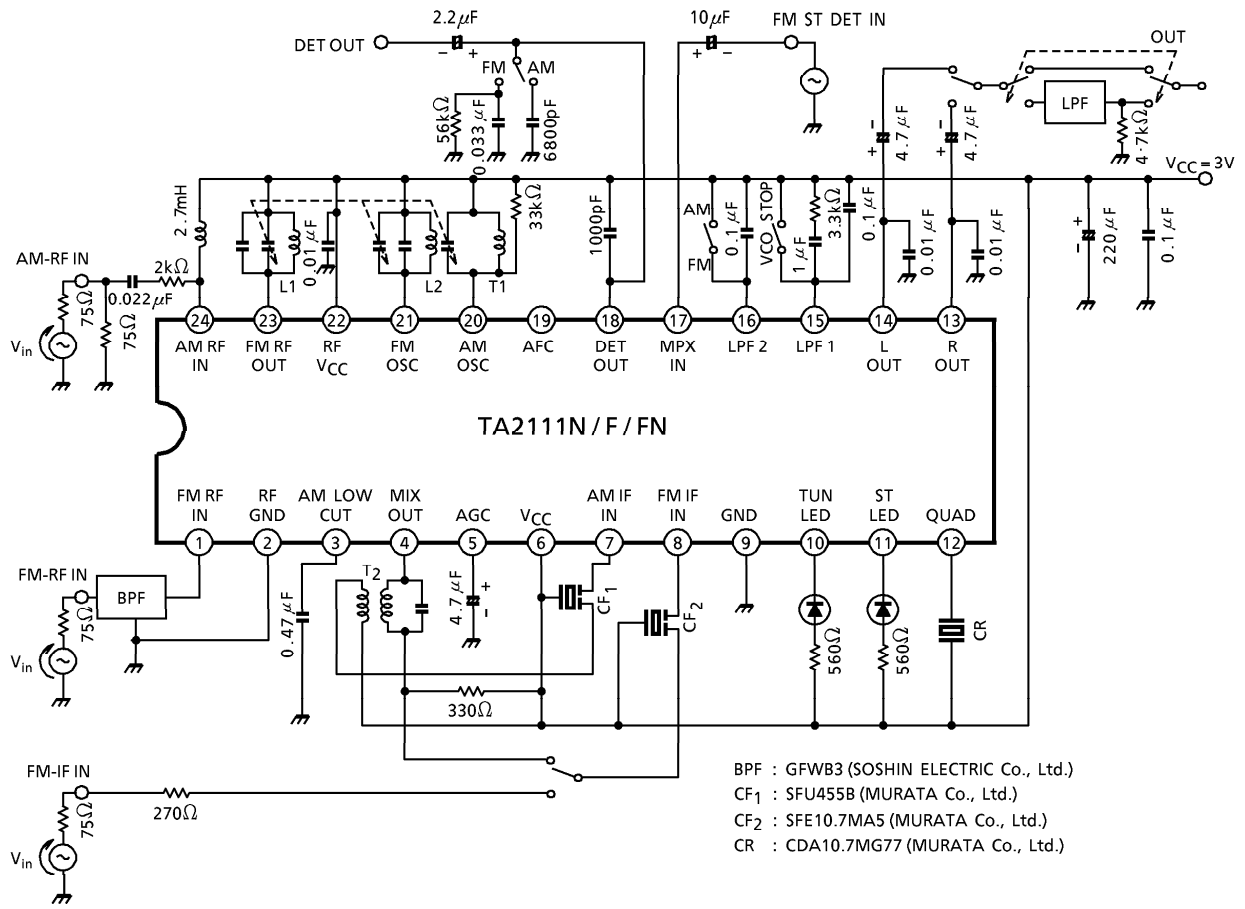
ELECTRICAL CHARACTERISTICS

Unless otherwise specified, Ta = 25°C, V_{CC} = 3V, F/E : f = 98MHz, f_m = 1kHz
 FM IF : f = 10.7MHz, Δf = ± 22.5kHz, f_m = 1kHz
 AM : f = 1MHz, MOD = 30%, f_m = 1kHz
 MPX : f_m = 1kHz

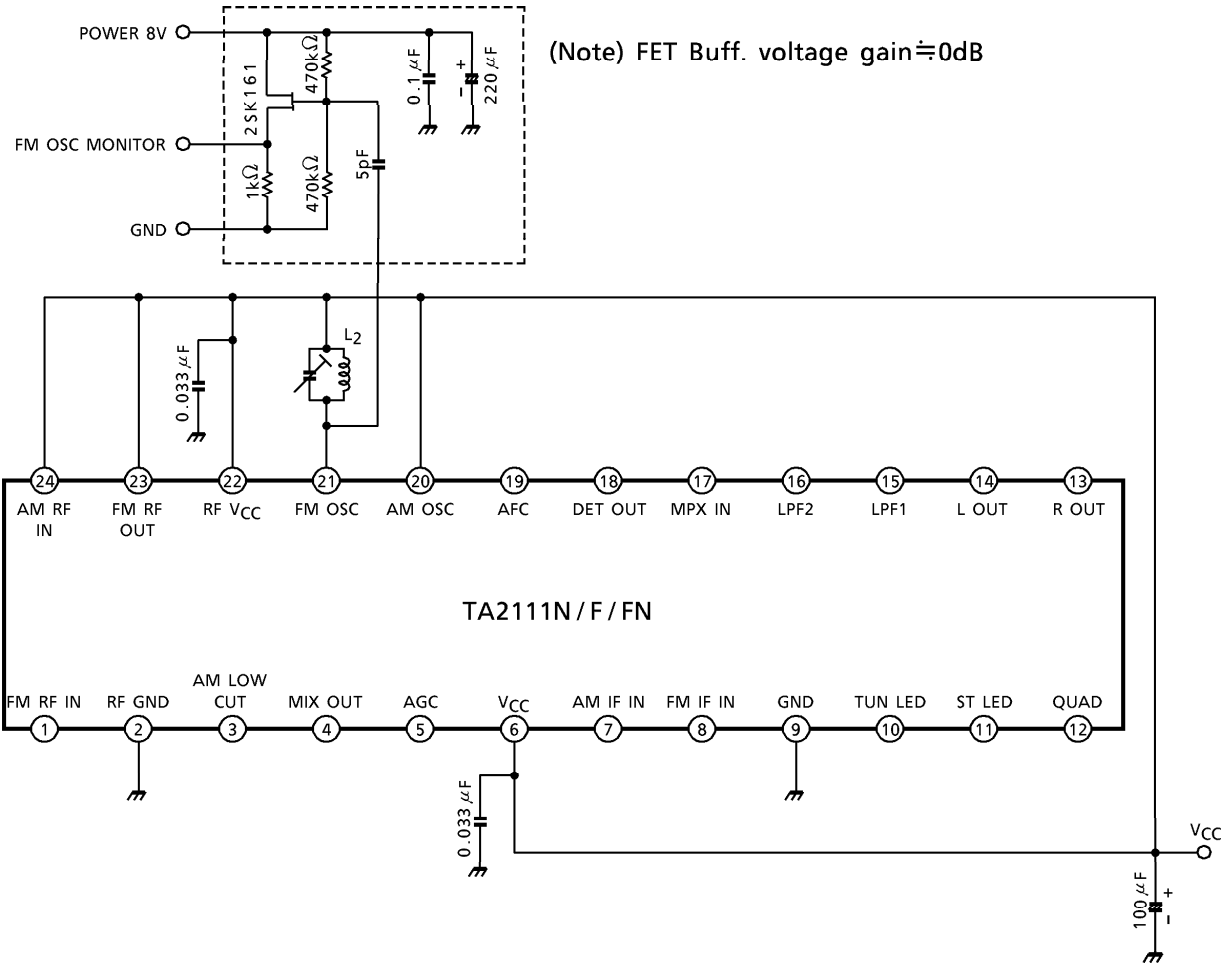
| CHARACTERISTIC | | SYMBOL | TEST CIRCUIT | TEST CONDITION | MIN. | TYP. | MAX. | UNIT |
|--------------------------|---------------------------|--------------------------|--------------|---|------|------|------|-----------------------|
| Supply Current | | I _{CC} (FM) | 1 | V _{in} = 0, FM mode | — | 9 | 12.5 | mA |
| | | I _{CC} (AM) | 1 | V _{in} = 0, AM mode | — | 5 | 7.5 | |
| F/E | Input Limiting Voltage | V _{in} (lim) | 1 | - 3dB limiting | — | 7 | — | dB _μ V EMF |
| | Local OSC Voltage | V _{OSC} | 2 | f _{OSC} = 108.7MHz | — | 105 | — | mV _{rms} |
| FM IF | Input Limiting Voltage | V _{in} (lim) IF | 1 | - 3dB limiting | 35 | 40 | 45 | dB _μ V EMF |
| | Recovered Output Voltage | V _{OD} | 1 | V _{in} = 80dB _μ V EMF | 60 | 75 | 90 | mV _{rms} |
| | Signal To Noise Ratio | S/N | 1 | V _{in} = 80dB _μ V EMF | — | 65 | — | dB |
| | Total Harmonic Distortion | THD | 1 | V _{in} = 80dB _μ V EMF | — | 0.2 | — | % |
| | AM Rejection Ration | AMR | 1 | V _{in} = 80dB _μ V EMF | — | 50 | — | dB |
| | LED On Sensitivity | V _L | 1 | I _L = 1mA | 40 | 45 | 50 | dB _μ V EMF |
| | Soft Mute Attenuation | MUTE | 1 | V _{in} = 0 | — | 20 | — | dB |
| AM | Gain | G _V | 1 | V _{in} = 25dB _μ V EMF | 18 | 35 | 70 | mV _{rms} |
| | Recovered Output Voltage | V _{OD} | 1 | V _{in} = 60dB _μ V EMF | 50 | 70 | 90 | mV _{rms} |
| | Signal To Noise Ratio | S/N | 1 | V _{in} = 60dB _μ V EMF | — | 41 | — | dB |
| | Total Harmonic Distortion | THD | 1 | V _{in} = 60dB _μ V EMF | — | 0.7 | — | % |
| | LED On Sensitivity | V _L | 1 | I _L = 1mA | 23 | 28 | 33 | dB _μ V EMF |
| Pin 18 Output Resistance | R ₁₈ | — | FM mode | — | 0.75 | — | kΩ | |
| | | | AM mode | — | 15.5 | — | | |

| CHARACTERISTIC | | SYMBOL | TEST CIRCUIT | TEST CONDITION | MIN. | TYP. | MAX. | UNIT | |
|----------------|-------------------------------------|------------------------------|----------------------|---|---|--------------------|------------------|-------------------|-------------------|
| MPX | Input Resistance | R _{IN} | — | — | — | 55 | — | kΩ | |
| | Output Resistance | R _{OUT} | — | — | — | 5 | — | kΩ | |
| | Max. Composite Signal Input Voltage | V _{in} MAX (STEREO) | 1 | L + R = 90%, P = 10%, f _m = 1kHz, THD = 3% | — | 700 | — | mV _{rms} | |
| | Separation | Sep | 1 | L + R = 180mV _{rms} , P = 20mV _{rms} | f _m = 100Hz — f _m = 1kHz 35 f _m = 10kHz — | 45 — 45 — | — — — — | dB | |
| | Total Harmonic Distortion | Monaural | THD (MONAURAL) | 1 | V _{in} = 200mV _{rms} | — | 0.3 | — | % |
| | | Stereo | THD (STEREO) | 1 | L + R = 180mV _{rms} , P = 20mV _{rms} | — | 0.3 | — | |
| | Voltage Gain | G _V | 1 | V _{in} = 200mV _{rms} | - 2.5 | - 1 | 0.5 | dB | |
| | Channel Balance | C.B. | 1 | V _{in} = 200mV _{rms} | - 1.5 | 0 | 1.5 | dB | |
| | Stereo LED Sensitivity | ON | V _L (ON) | 1 | Pilot Input | — | 8 | 12 | mV _{rms} |
| | | OFF | V _L (OFF) | 1 | | 3 | 6 | — | |
| | Stereo LED Hysteresis | V _H | 1 | To LED turn off from LED turn on | — | 2 | — | mV _{rms} | |
| | Capture Range | C.R. | 1 | P = 20mV _{rms} | — | ± 8 | — | % | |
| | Signal To Noise Ratio | S/N | 1 | — | — | 80 | — | dB | |

TEST CIRCUIT 1



TEST CIRCUIT 2

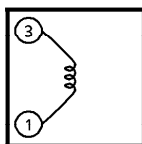


COIL DATA

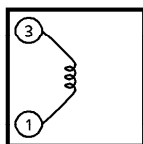
| COIL No. | TEST FREQ. | L (μH) | Co (pF) | Q _o | TURNS | | | | | WIRE (mmφ) | REFERENCE |
|-----------------------|------------|--------|---------|----------------|-------|-----|-----|------------------|-----|------------|-------------------|
| | | | | | 1-2 | 2-3 | 1-3 | 1-4 | 4-6 | | |
| L ₁ FM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

Ⓣ : TOKO Co., Ltd.

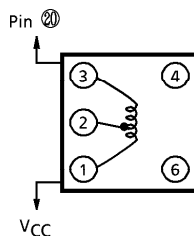
L₁ : FM RF



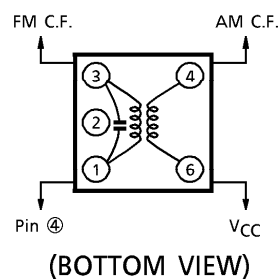
L₂ : FM OSC



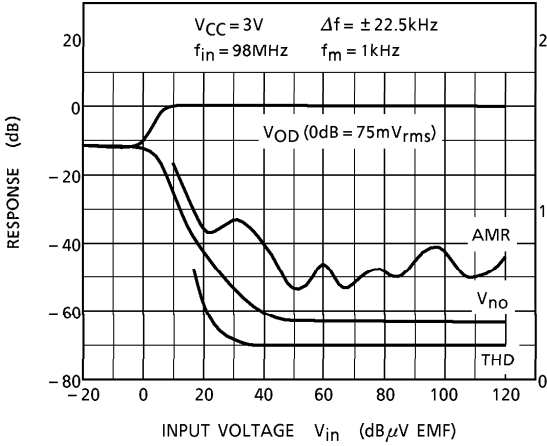
T₁ : AM OSC



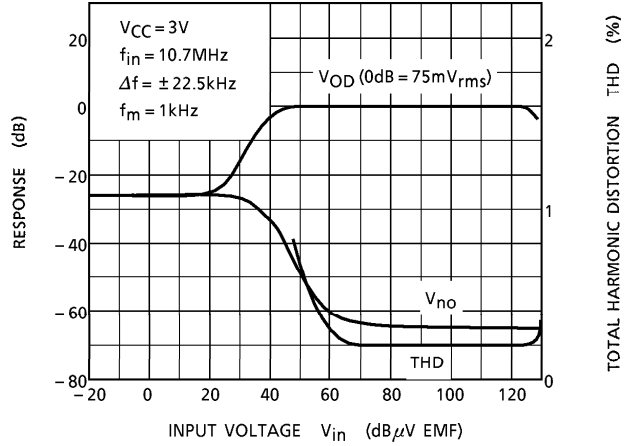
T₂ : AM IFT



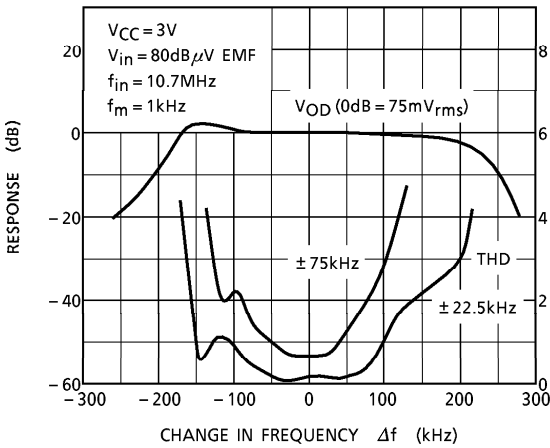
FM (F / E + IF)
VOD, V_{no}, THD, AMR - V_{in}



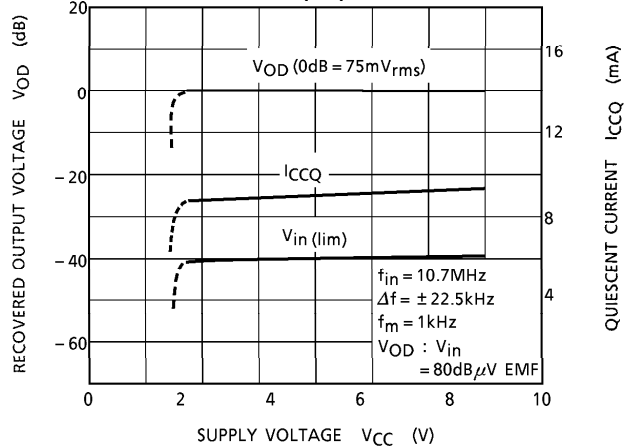
FM (IF)
VOD, V_{no}, THD - V_{in}



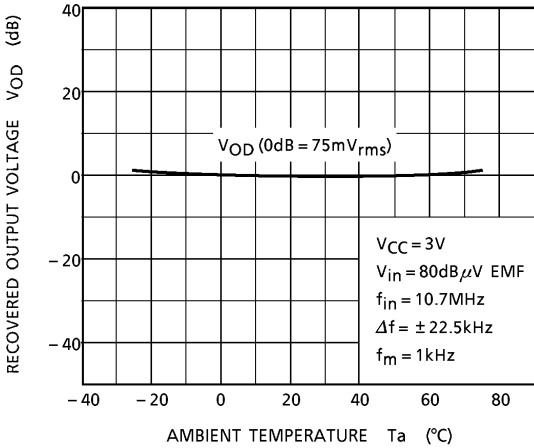
FM (IF)
VOD, THD - Δf



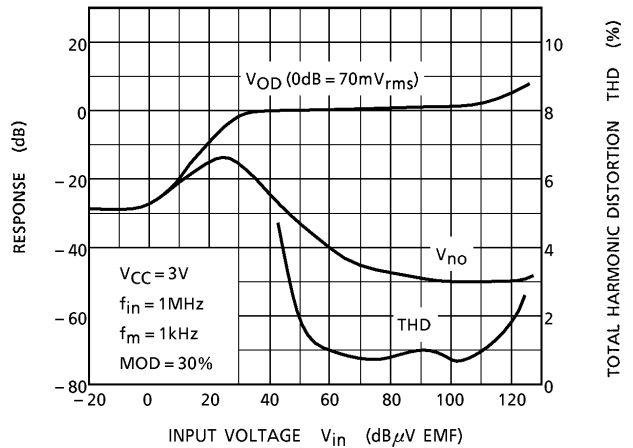
FM (IF)
VOD, V_{in}(lim) - V_{CC}

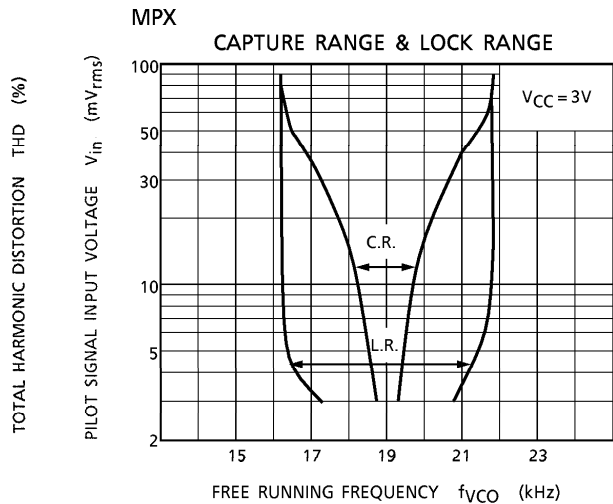
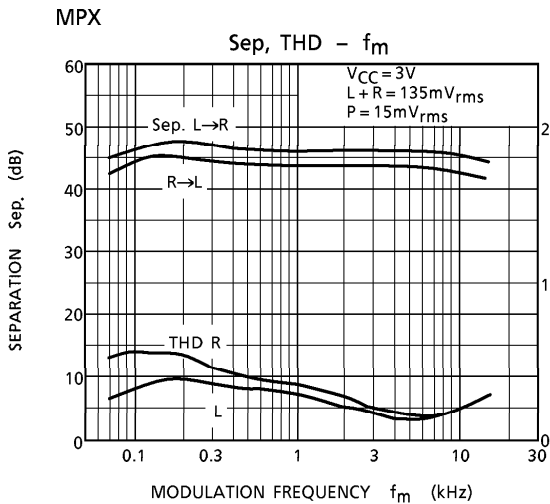
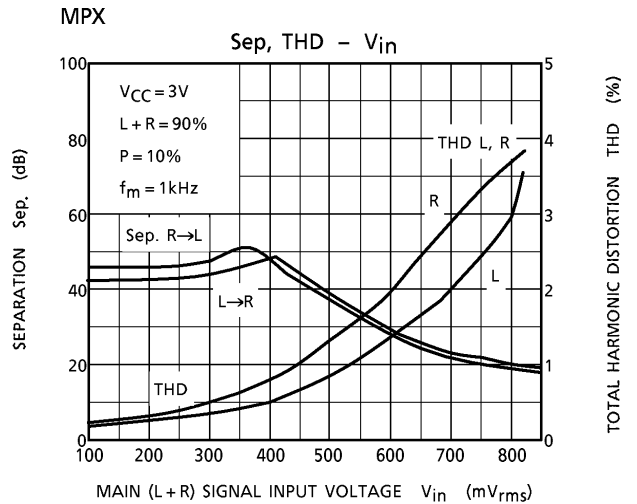
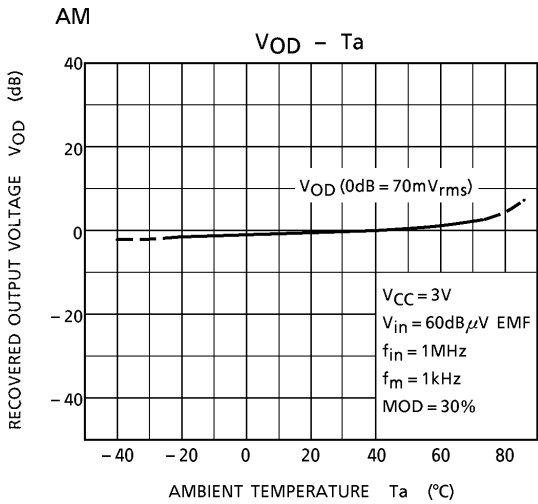
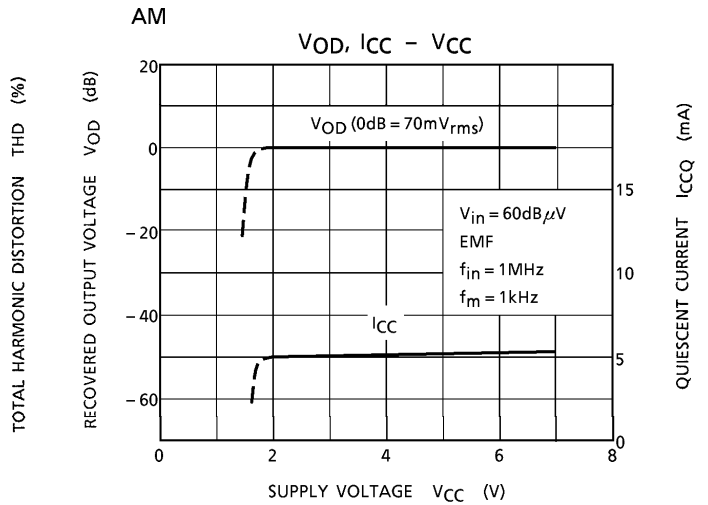
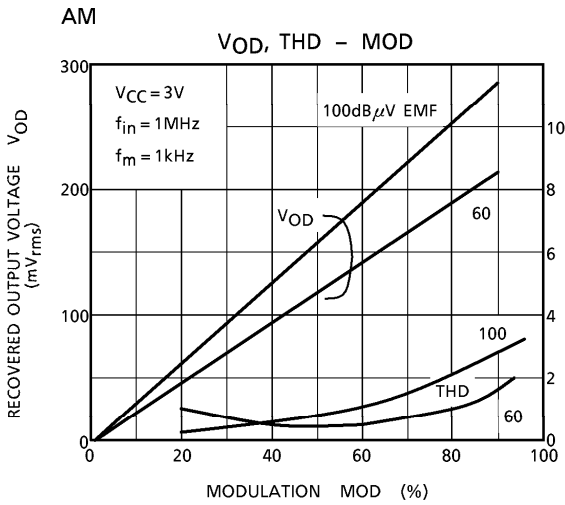


FM (IF)
VOD - T_a

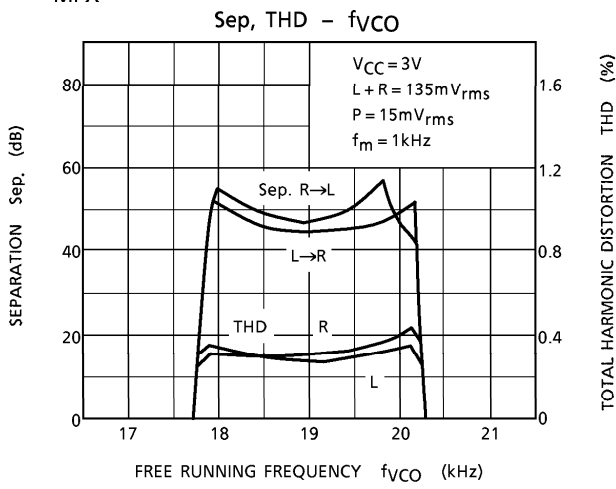


AM
VOD, V_{no}, THD - V_{in}

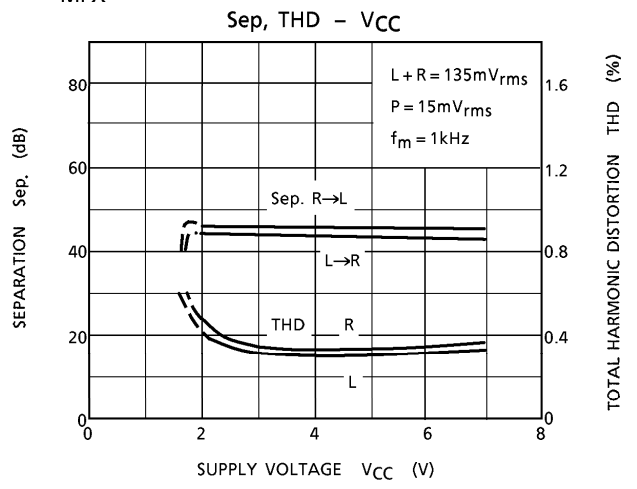




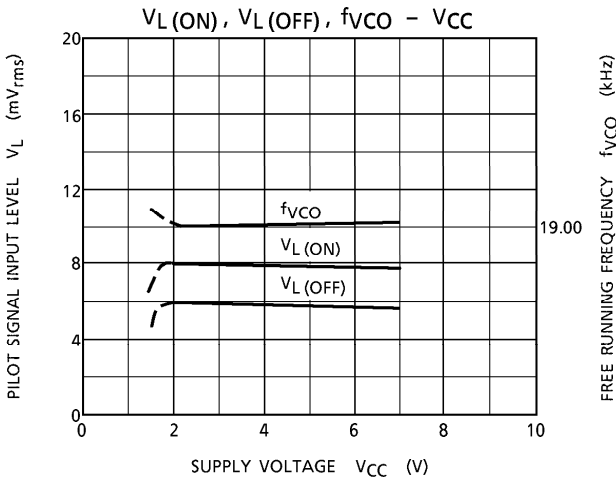
MPX



MPX

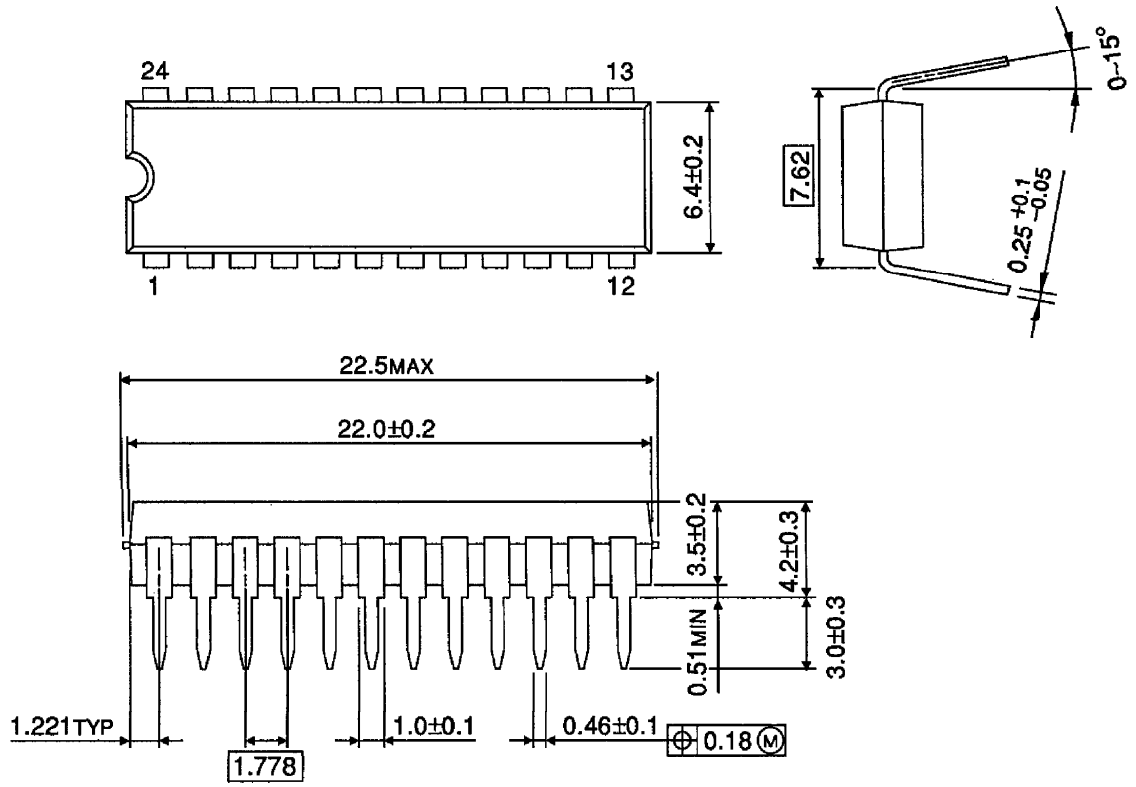


MPX



OUTLINE DRAWING
SDIP24-P-300-1.78

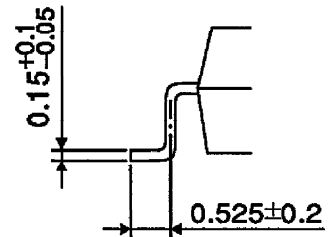
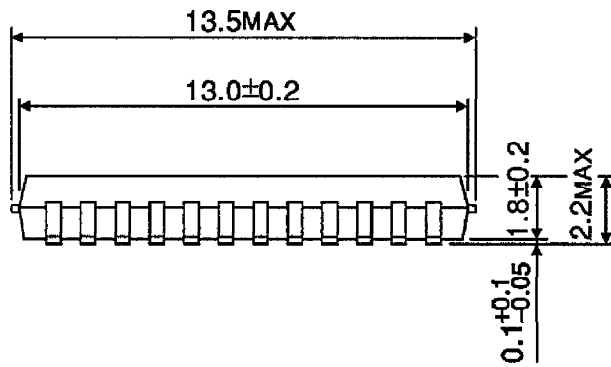
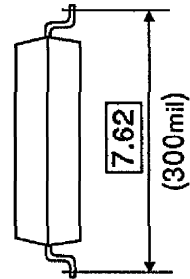
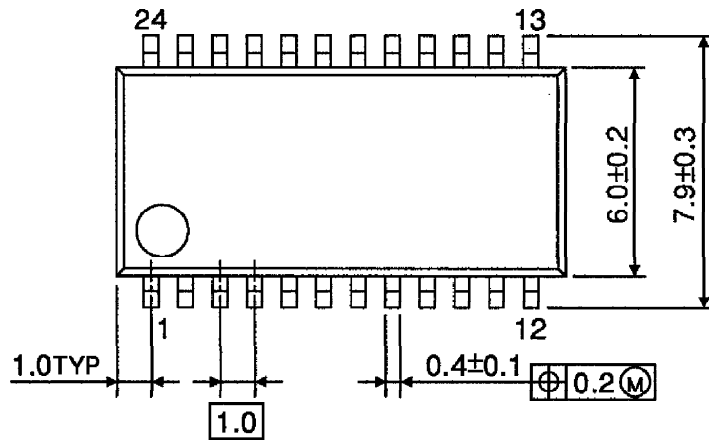
Unit : mm



Weight : 1.2g (Typ.)

OUTLINE DRAWING
SSOP24-P-300-1.00

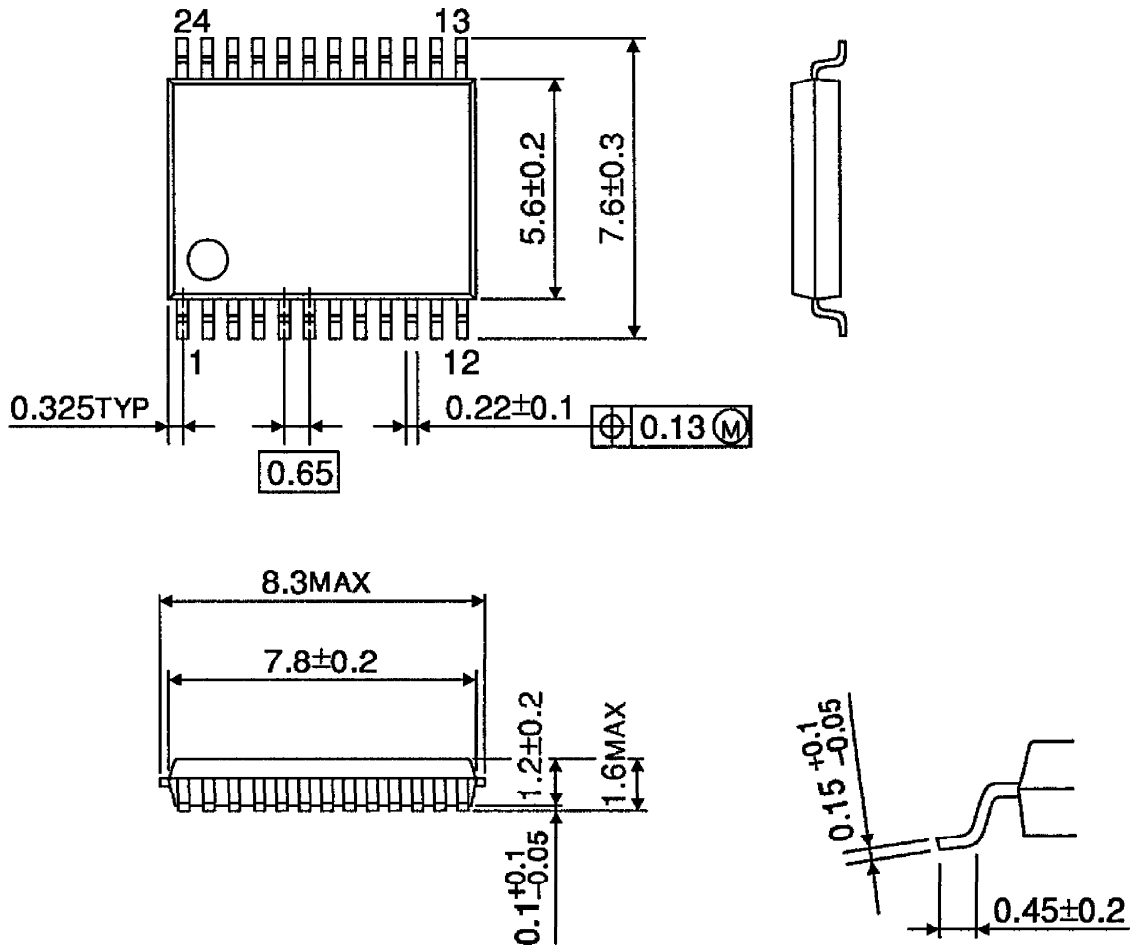
Unit : mm



Weight : 0.31g (Typ.)

OUTLINE DRAWING
SSOP24-P-300-0.65A

Unit : mm



Weight : 0.14g (Typ.)