

TOSHIBA Bipolar Linear Integrated Circuit Silicon Monolithic

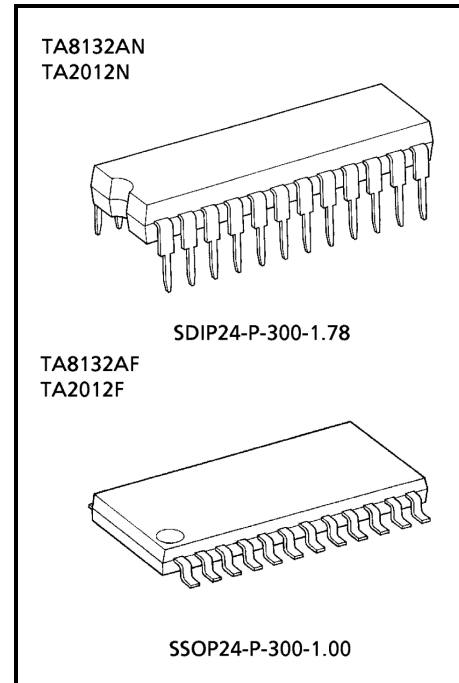
TA8132AN,TA8132AF,TA2012N,TA2012F

3V AM / FM IF + MPX
(For Digital Tuning System)

TA8132AN, TA8132AF and TA2012N, TA2012F are the AM / FM IF+ST DET system ICs, which are designed for DTS radios. These are included many functions and these can be used for digital tuning system with IF counter.

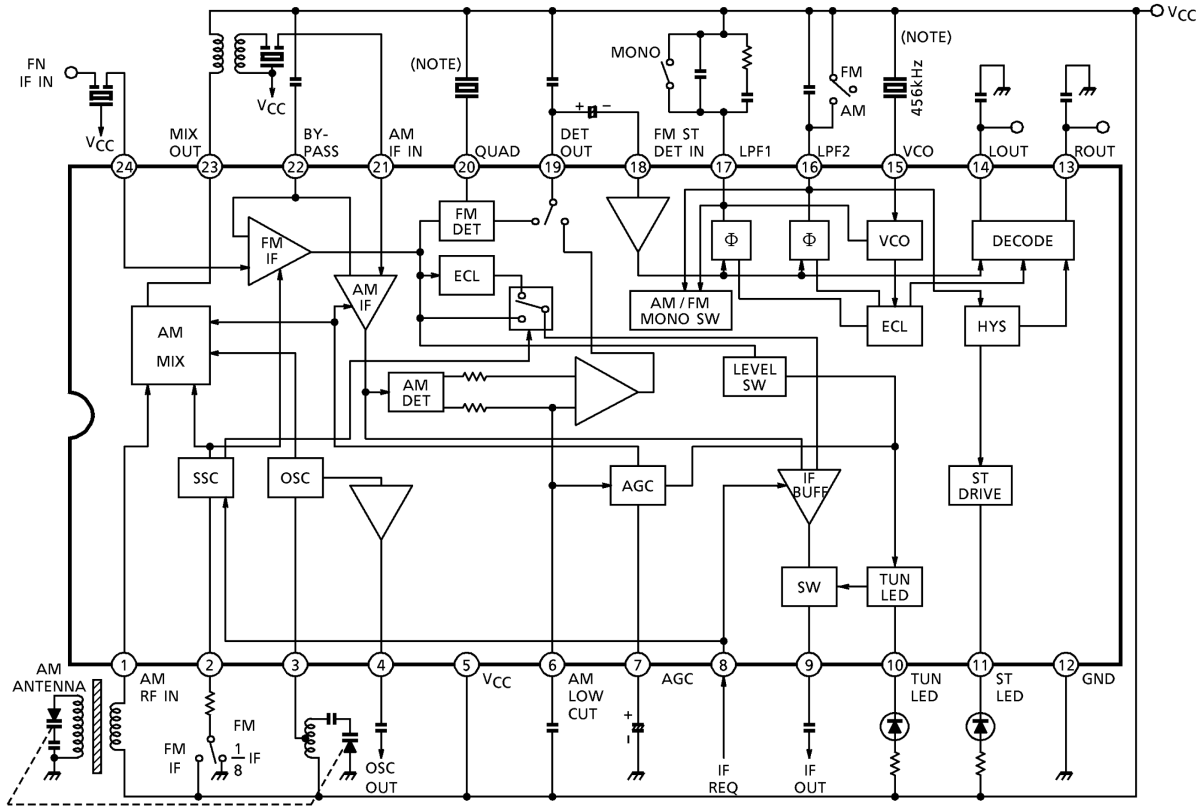
Features

- Built-in AM / FM IF and FM stereo PLL multiplex decoder.
- Suitable for combination with digital tuning system which is included IF counter.
 - One terminal type AM / FM IF count output (auto stop signal) for IF counter of digital tuning system.
 - FM: 10.7MHz or 1.3375MHz (1 / 8 dividing)
changeable by external switch
 - AM: 450kHz
 - Built-in mute circuit for IF count output. It is controlled by the IF request signal from digital tuning system,
 - Pin(8) level: High → come out
Low → non output
 - Adjustable for IF count output sensitivity by external resistance of pin(2).
- For adopting ceramic discriminator and ceramic resonator, it is not necessary to adjust the FM quad detector circuit and FM ST DET VCO circuit.
- S curve characteristics of FM detection output in TA8132AN, TA8132AF and TA2012N, TA2012F are reverse to each other.
 - TA8132AN, TA8132AF: Reverse characteristic.
 - TA2012N, TA2012F: Normal characteristic.
- Built-in one terminal type AM low cut circuit.
- TA2053F is reverse pin type of TA2012F.
- Operating supply voltage range (Ta = 25°C)
VCC (opr.) = 1.8~8.0V



Weight
SDIP24-P-300-1.78: 1.2g (typ.)
SSOP24-P-300-1.00 : 0.31g (typ.)

Block Diagram



(Note)

We recommend

Ceramic resonator: CSB456F18

Ceramic discriminator: CDA10.7MG18 (MURATA MFG CO., LTD)

Explanation Of Terminals

| Pin No. | Item | Internal Circuit | DC Voltage (V) (at no Signal) | |
|---------|---|------------------|----------------------------------|-----|
| | | | AM | FM |
| 1 | AM RF IN | | 3.0 | 3.0 |
| 2 | <ul style="list-style-type: none"> • IF count output sensitivity adjust terminal • FM IF divider control terminal | | — | — |
| 3 | AM OSC | | 3.0 | 3.0 |
| 4 | AM OSC OUT | | 2.7 | 3.0 |
| 5 | V _{CC} | — | 3.0 | 3.0 |
| 6 | AM LOW CUT | | 2.3 | 2.3 |

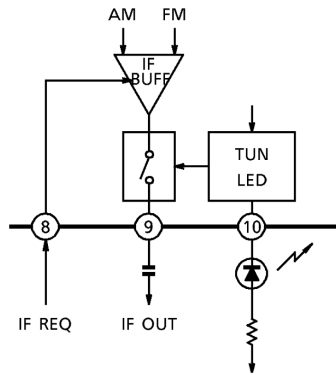
| Pin No. | Item | Internal Circuit | DC Voltage (V) (at no Signal) | |
|----------|----------------------|------------------|----------------------------------|------|
| | | | AM | FM |
| 7 | AGC | | 0.25 | 0.35 |
| 8 | IF OUT SW | | — | — |
| 9 | IF OUT | | 3.0 | 3.0 |
| 10 | TUN LED (tuning LED) | | — | — |
| 11 | ST LED (stereo LED) | | — | — |
| 12 | GND | — | 0 | 0 |
| 13 14 | R-OUT L-OUT | | 1.0 | 1.0 |

| Pin No. | Item | Internal Circuit | DC Voltage (V) (at no Signal) | |
|---------|--|------------------|----------------------------------|------------------------|
| | | | AM | FM |
| 15 | VCO | | 2.5 | 2.5 (VCO stop mode) |
| 16 | LPF2 • LPF terminal for synchronous detector • Bias terminal for AM / FM switch circuit $V_{16} = V_{CC} \rightarrow \text{AM}$ $V_{16} = \text{open} \rightarrow \text{FM}$ | | 3.0 | 2.2 |
| 17 | LPF1 • LPF Terminal for phase detector • VCO stop terminal $V_{17} = V_{CC} \rightarrow \text{VCO stop}$ | | 2.7 | 2.2 |
| 18 | FM ST DET IN | | 0.7 | 0.7 |
| 19 | DET OUT | | 1.1 | 1.1 |

| Pin No. | Item | Internal Circuit | DC Voltage (V) (at no Signal) | |
|---------|-------------------------------------|------------------|----------------------------------|-----|
| | | | AM | FM |
| 20 | QUAD (FM QUAD. Detector) | | 2.4 | 2.1 |
| 21 | AM IF IN | | 3.0 | 3.0 |
| 22 | BY-PASS By-pass for AM/FM IF AMP | | 2.3 | 2.8 |
| 23 | AM MIX OUT | | 3.0 | 3.0 |
| 24 | FM IF IN | | 3.0 | 3.0 |

Application Note

1. How to control the IF count output signal (pin(9) output)



| | | TUN LED | |
|----------------|---|------------|------------|
| | | ON | OFF |
| V ₈ | H | Come out | Non output |
| | L | Non output | Non output |

- Whether or not there is the IF count output signal (pin(9) output) is determined by the and of the pin(8) control voltage: V₈ and tuning LED on / off switching.

In the condition of

V₈: High (active high, V_{TH} = 0.8V (typ.))

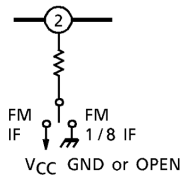
TUN LED: ON (V_{in} ≥ V_L+2dB_μV EMF (typ.))

the IF count output signal comes out from the pin(9).

In the case of the tuning LED function is not needed, it doesn't matter the pin(10) is opened.

- The output impedance of pin(9) is 1.5kΩ (typ.) (cf.P.4)
It is possible to reduce the IF count output signal level to add the resistance between the pin(9) and the V_{CC} line.
- The signal waveform is the rectangular wave, and the level is 500mV_{p-p} (typ.)

2. How to control the divider of FM IF



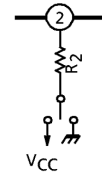
Switch

V_{CC}: 10.7MHz output

GND or OPEN: 1.3375MHz output (1 / 8 dividing)

3. How to adjust the IF count output sensitivity

- The IF count output sensitivity (search sensitivity)
Can be adjusted by varying the IF AMP gain for FM and varying the MIXER gain for AM.
This setting is made by changing the value of external resistance R₂ which is connected to pin(2).
- However, this is only possible at the auto-tuning mode. (external voltage supplied to pin(8) is at high level.)
The original gain returns while receiving a broadcast station (supplied voltage to pin(8) is at low level.)

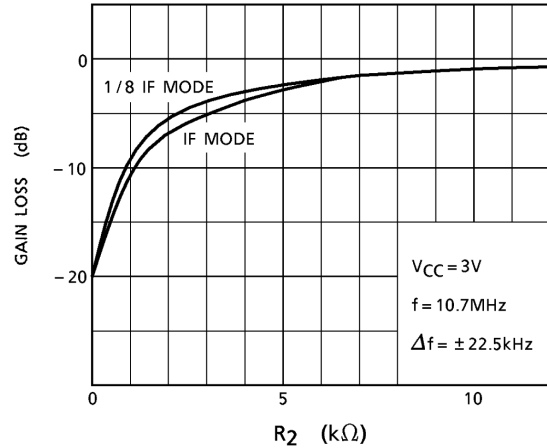


- The gain loss of FM IF AMP

| | | R ₂ | |
|------|-------------------------|----------------|-------------|
| | | 0Ω | 10KΩ (Note) |
| Mode | IF (10.7MHz) | -20dB | -1dB |
| | 1 / 8 IF (1.3375MHz) | -20dB | -1dB |

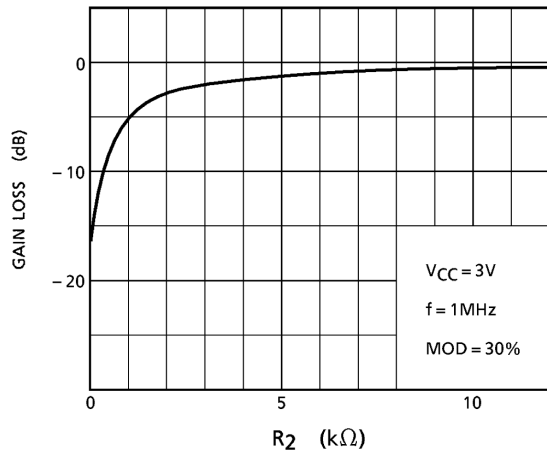
(Note)

- In the condition of the 1 / 8 IF mode, it is possible to set up R₂ = ∞ (OPEN).
- In the condition of IF mode, it is necessary to set up the value of R₂ under 10kΩ. When the R₂ is over 10kΩ it is feared that the mode is change to the 1 / 8 IF mode.



- The gain loss of AM MIXER

| R ₂ | |
|----------------|------|
| 0Ω | 10KΩ |
| -16dB | -1dB |

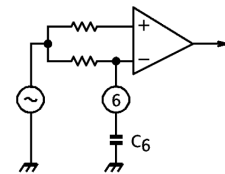


4. AM low-cut circuit

- 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: C₆ by-passes this component.
- The cut-off frequency f_L is determine by the internal resistance 22kΩ (typ.) and the external capacitor C₆ as following;

$$f_L = \frac{1}{2 \times \pi \times 22 \times 10^3 \times C_6} \text{ (Hz)}$$

- In the case of the AM low-cut function is not needed, set up the value of C₆ over 0.47μF. In the condition of C₆ ≥ 0.47μF, the frequency characteristic has flat response at the low frequency.

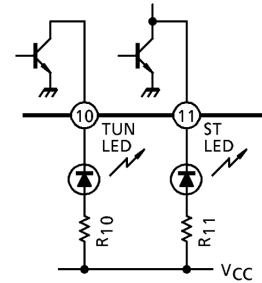


5. AM local oscillator buffer output

- The output impedance of AM local oscillator buffer output pin (pin(4)) is 750Ω (typ.) (cf.P.3)
- It is possible to reduce the output level to add the resistance between the pin(4) and VCC line. The signal waveform is the rectangular wave, and the level is $500mV_{p-p}$ ($f_{OSC} = 1.45MHz$, typ.)
- The higher local oscillation frequency (f_{OSC}) to be, the lower buff output level to be owing to the load capacity. So, in the case that it is connected to other circuits, take care of the input capacity of these circuits and stray capacity of wire.

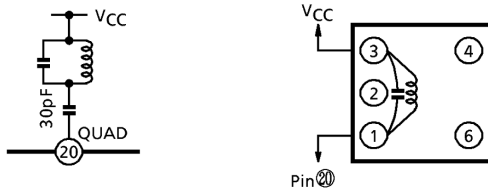
6. Tuning LED driver and stereo LED driver

- The tuning LED driver and stereo LED driver don't have current limit resistance shown in the right figure. So, it is necessary to add the current limit resistance: R10, R11.
- Set up the values of R10, R11 to keep the drive currents ID10, ID11 under 10mA.



7.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_o (pF) | Q_o | Turns | | | | Wire (mm ϕ) | REF |
|----------------|------------|-------|-------|-----|-----|-----|-------------------|---|
| | | | 1-2 | 2-3 | 1-3 | 4-6 | | |
| 10.7MHz | 100 | 100 | — | — | 12 | — | 0.12 UEW | SUMIDA ELECTRIC CO., LTD 2153-4095-189 or equivalent |

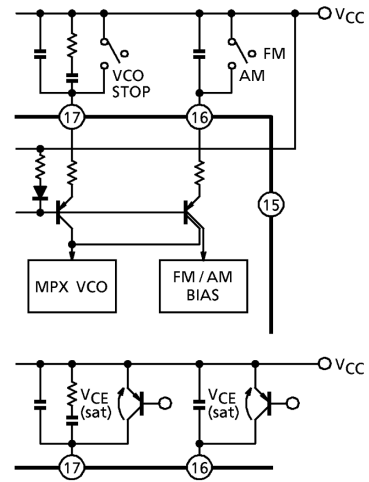
8. FM / AM switch and forced monaural switch

FM / AM switch over and stere / forced monaural switch over are done by internal PNP transistors ON / OFF which are connected to pin(16) and pin (17) respectively.

The threshold voltages of these PNP transistors are $V_{th} = V_{CC}$, and for switching, we recommend to use mechanical switch.
(Direct short to V_{CC} line.)

In the case of the electrical switch over by transistor, set up V_{CE} (saturation voltage between collector and emitter) 50mV or less, otherwise there are some cases that it does not become the AM mode and force monaural mode.

When these external switches are ON, the currents which flow into pin(16) and pin(17) are 100 μ A and 20 μ A respectively. (Typical value at $V_{CC} = 3V$)



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 | TA8132AN | 1200 | mW |
| | TA8132AF | 400 | |
| Operating Temperature | T_{opr} | -25~75 | °C |
| Storage temperature | T_{stg} | -55~150 | °C |

(Note): Derated above 25°C in the proportion of 9.6mW / °C for TA8132AN, TA2012N and of 3.2mW / °C for TA8132AF, TA2012F.

Electrical characteristics

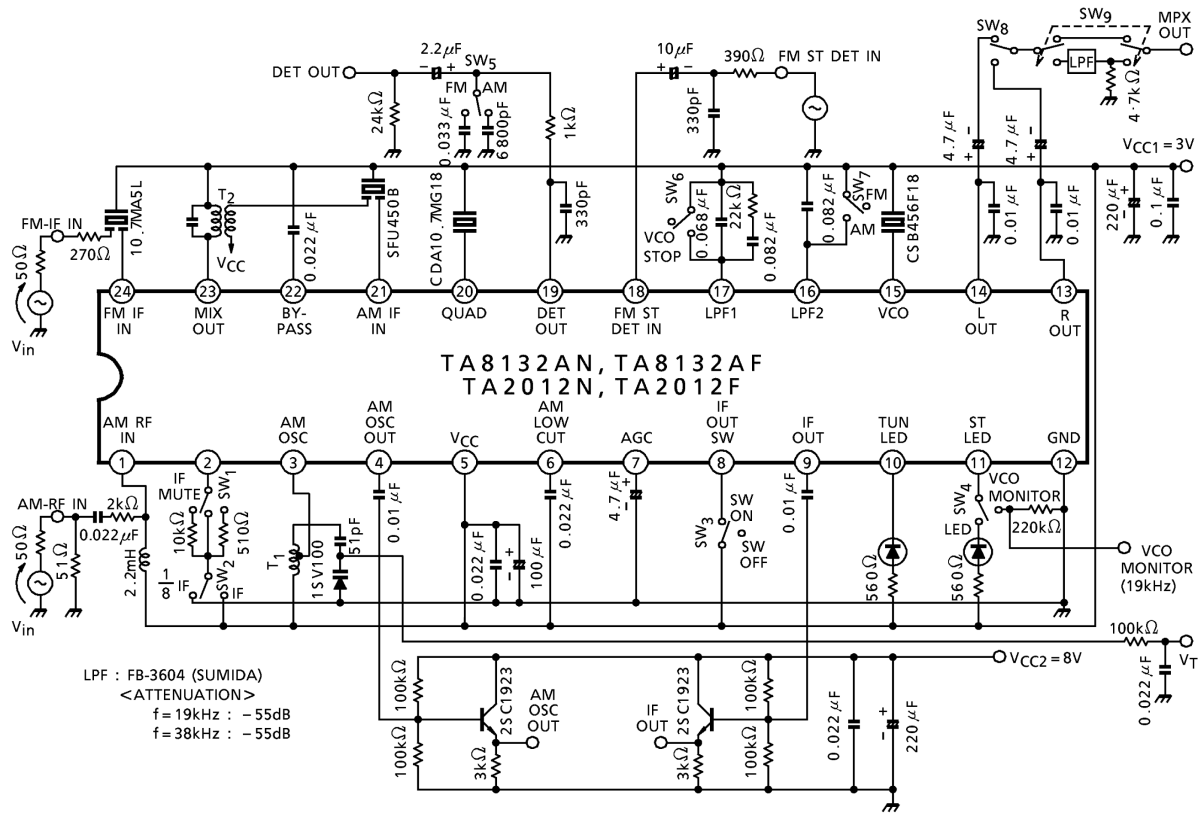
Unless Otherwise Specified, $T_a = 25^\circ\text{C}$, $V_{CC1} = 3\text{V}$, $SW_1 \rightarrow 10\text{k}\Omega$, $SW_3 \rightarrow \text{OFF}$
 FM IF: $f = 10.7\text{MHz}$, $\Delta f = \pm 22.5\text{kHz}$, $f_m = 1\text{kHz}$
 AM: $f = 1\text{MHz}$, $\text{MOD} = 30\%$, $f_m = 1\text{kHz}$
 MPX: $f_m = 1\text{kHz}$

| Characteristic | | Symbol | Test Circuit | Test Condition | Min. | Typ. | Max. | Unit | |
|-----------------------------|---------------------------|--------------------------|-------------------|---|---|--------|--------|-------------------------|-------------------|
| Supply current | | I_{CC} (FM) | 1 | FM mode, $V_{in} = 0$ | — | 11.0 | 14.0 | mA | |
| | | I_{CC} (AM) | 1 | AM mode, $V_{in} = 0$ | — | 10.5 | 13.5 | | |
| FM IF | Input limiting voltage | V_{in} (lim.) | 1 | -3dB limiting point | 41 | 46 | 51 | dB μV EMF | |
| | Recovered output voltage | V_{OD} | 1 | $V_{in} = 80\text{dB}\mu\text{V}$ EMF | 50 | 75 | 100 | mV _{rms} | |
| | Signal to noise ratio | S / N | 1 | $V_{in} = 80\text{dB}\mu\text{V}$ EMF | — | 65 | — | dB | |
| | Total harmonic distortion | THD | 1 | $V_{in} = 80\text{dB}\mu\text{V}$ EMF | — | 0.2 | — | % | |
| | AM rejection ratio | AMR | 1 | $V_{in} = 80\text{dB}\mu\text{V}$ EMF | — | 38 | — | dB | |
| | LED on sensitivity | V_L | 1 | $I_L = 1\text{mA}$ | 48 | 53 | 58 | dB μV EMF | |
| | IF count output frequency | IF | f_{IF} (FM) | 1 | $V_{in} = 80\text{dB}\mu\text{V}$ EMF, $SW_2 \rightarrow V_{CC}$, $SW_3 \rightarrow \text{ON}$ | — | 10.7 | — | MHz |
| | | 1 / 8 IF | $f_{1/8 IF}$ (FM) | 1 | $V_{in} = 80\text{dB}\mu\text{V}$ EMF, $SW_2 \rightarrow \text{GND}$, $SW_3 \rightarrow \text{ON}$ | 1.3374 | 1.3375 | 1.3376 | |
| | IF count output voltage | IF | V_{IF} (FM) | 1 | $V_{in} = 61\text{dB}\mu\text{V}$ EMF, $SW_2 \rightarrow V_{CC}$, $SW_3 \rightarrow \text{ON}$ | 350 | 500 | — | mV _{p-p} |
| | | 1 / 8 IF | $V_{1/8 IF}$ (FM) | 1 | $V_{in} = 61\text{dB}\mu\text{V}$ EMF, $SW_2 \rightarrow \text{GND}$, $SW_3 \rightarrow \text{ON}$ | 350 | 500 | — | |
| IF count output sensitivity | | $I_{F\text{sens.}}$ (FM) | 1 | $SW_1 \rightarrow 0$, $SW_2 \rightarrow \text{GND}$, $SW_3 \rightarrow \text{ON}$ | — | 76 | — | dB μV EMF | |
| | | | | $SW_1 \rightarrow 510\Omega$, $SW_2 \rightarrow \text{GND}$, $SW_3 \rightarrow \text{ON}$ | — | 68 | — | | |
| | | | | $SW_1 \rightarrow 0$, $SW_2 \rightarrow V_{CC}$, $SW_3 \rightarrow \text{ON}$ | — | 77 | — | | |
| | | | | $SW_1 \rightarrow 510\Omega$, $SW_2 \rightarrow V_{CC}$, $SW_3 \rightarrow \text{ON}$ | — | 69 | — | | |

| Characteristic | | Symbol | Test Circuit | Test Condition | Min. | Typ. | Max. | Unit |
|-----------------------------|--------------------------------|----------------|---|---|------|------|----------------------------|----------------------------|
| AM | Gain | G_V | 1 | $V_{in} = 26\text{dB}\mu\text{V EMF}$ | 28 | 57 | 85 | mV_{rms} |
| | Recovered output voltage | V_{OD} | 1 | $V_{in} = 60\text{dB}\mu\text{V EMF}$ | 50 | 75 | 100 | |
| | Signal to noise ratio | S / N | 1 | $V_{in} = 60\text{dB}\mu\text{V EMF}$ | — | 41 | — | dB |
| | Total harmonic distortion | THD | 1 | $V_{in} = 60\text{dB}\mu\text{V EMF}$ | — | 1.0 | — | % |
| | LED on sensitivity | V_L | 1 | $I_L = 1\text{mA}$ | 21 | 26 | 31 | $\text{dB}\mu\text{V EMF}$ |
| | Local OSC buff. output voltage | $V_{OSC (AM)}$ | 1 | $f_{OSC} = 1.45\text{MHz}$ | 350 | 500 | — | $\text{mV}_{\text{p-p}}$ |
| | | | 2 | $f_{OSC} = 27\text{MHz}$ | — | 500 | — | |
| | IF count output voltage | $V_{IF (AM)}$ | 1 | $V_{in} = 39\text{dB}\mu\text{V EMF}, SW_3 \rightarrow \text{ON}$ | 350 | 500 | — | $\text{mV}_{\text{p-p}}$ |
| IF count output sensitivity | $IF_{\text{sens. (AM)}}$ | 1 | $SW_1 \rightarrow 0, SW_2 \rightarrow \text{GND}, SW_3 \rightarrow \text{ON}$ | — | 49 | — | $\text{dB}\mu\text{V EMF}$ | |
| | | | $SW_1 \rightarrow 510\Omega, SW_2 \rightarrow \text{GND}, SW_3 \rightarrow \text{ON}$ | — | 42 | — | | |
| | | | $SW_1 \rightarrow 0, SW_2 \rightarrow V_{CC}, SW_3 \rightarrow \text{on}$ | — | 49 | — | | |
| | | | $SW_1 \rightarrow 510\Omega, SW_2 \rightarrow V_{CC}, SW_3 \rightarrow \text{ON}$ | — | 42 | — | | |
| Pin(19) output resistance | R_{19} | 1 | FM mode | — | 0.6 | — | $\text{k}\Omega$ | |
| | | | AM mode | — | 12 | — | | |

| Characteristic | | Symbol | Test Circuit | Test Condition | Min. | Typ. | Max. | Unit | |
|-----------------------|-------------------------------------|------------------------|-------------------------------------|---|---|------|-------------------|-------------------|-------------------|
| MPX | Input resistance | R_{IN} | 1 | — | — | 25 | — | k Ω | |
| | Output resistance | R_{OUT} | 1 | — | — | 5 | — | | |
| | Max. composite signal input voltage | $V_{in\ MAX}$ (stereo) | 1 | L + R = 90%, P = 10% THD = 3%, SW _g →LPF: ON | — | 350 | — | mV _{rms} | |
| | Separation | Sep | — | L + R = 135mV _{rms} P = 15mV _{rms} , SW _g →LPF: ON | $f_m = 100kHz$ | — | 42 | — | dB |
| | | | | | $f_m = 1kHz$ | 35 | 42 | — | |
| | | | | | $f_m = 10kHz$ | — | 42 | — | |
| | Total harmonic distortion | Monaural | THD (monaural) | 1 | $V_{in} = 150\ mV_{rms}$ (mono) | — | 0.2 | — | % |
| | | Stereo | THD (stereo) | | L + R = 135mV _{rms} , P = 15mV _{rms} SW _g →LPF: ON | — | 0.2 | — | |
| | Voltage gain | G_V (MPX) | 1 | $V_{in} = 150mV_{rms}$ (mono) | -5 | -3 | -1 | dB | |
| | Channel balance | C.B. | 1 | $V_{in} = 150mV_{rms}$ (mono) | -2 | 0 | 2 | dB | |
| | Stereo LED sensitivity | ON | V_L (ON) | 1 | Pilot input | — | 8 | 15 | mV _{rms} |
| | | OFF | V_L (OFF) | | | 2 | 6 | — | |
| Stereo LED hysteresis | V_H | 1 | To LED turn off from LED turn on | — | 2 | — | mV _{rms} | | |
| Capture range | C.R. | 1 | P = 15mV _{rms} | — | ±1.3 | — | % | | |
| Signal to noise ratio | S / N | 1 | $V_{in} = 150mV_{rms}$ (mono) | — | 78 | — | dB | | |

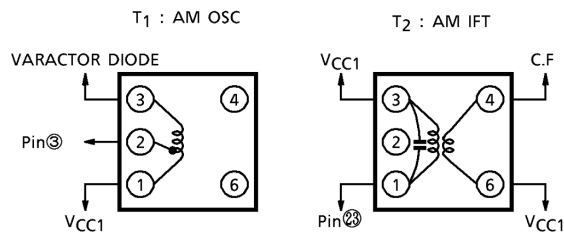
Test Circuit 1



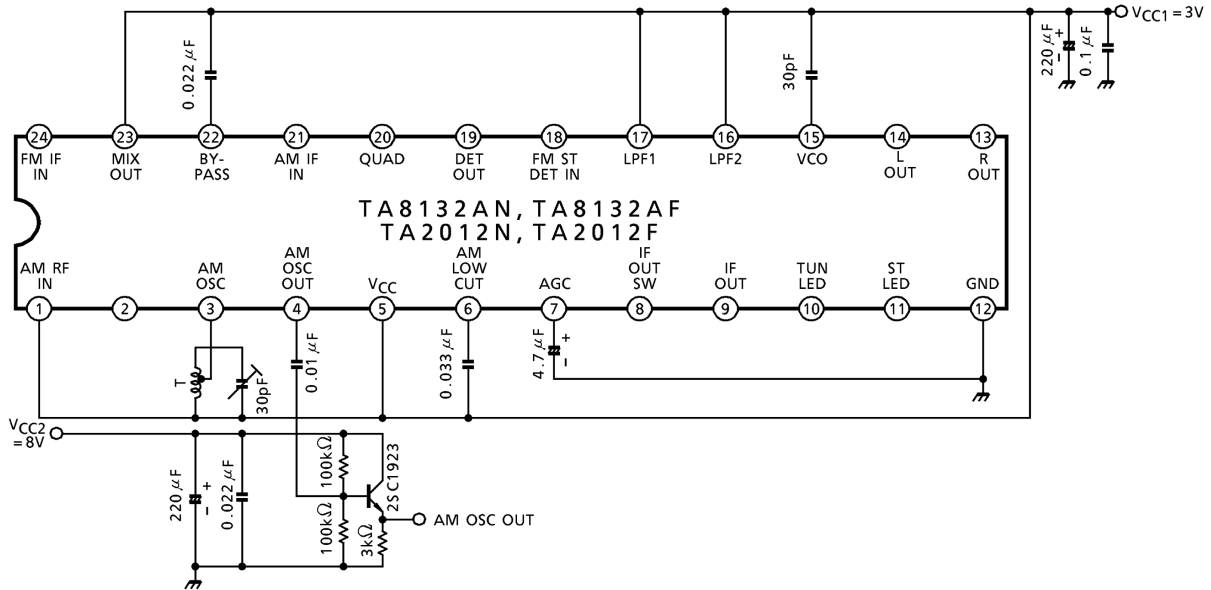
Coil Data (test circuit 1)

| Coil No. | f | L (μH) | C ₀ (pF) | Q ₀ | Turn | | | | Wire (mm) | RED. (Coil No.) |
|-----------------------|--------|--------|---------------------|----------------|------|-----|-----|-----|-----------|-------------------|
| | | | | | 1-2 | 2-3 | 1-3 | 4-6 | | |
| T ₁ AM OSC | 796kHz | 288 | — | 115 | 13 | 73 | — | — | 0.08 UEW | 4147-1356-038 (S) |
| T ₂ AM IFT | 455kHz | — | 180 | 120 | — | — | 180 | 15 | 0.06 UEW | 2150-2162-165 (S) |

(S): SUMIDA ELECTRIC Co., Ltd.



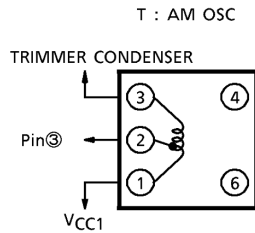
Test Circuit 2

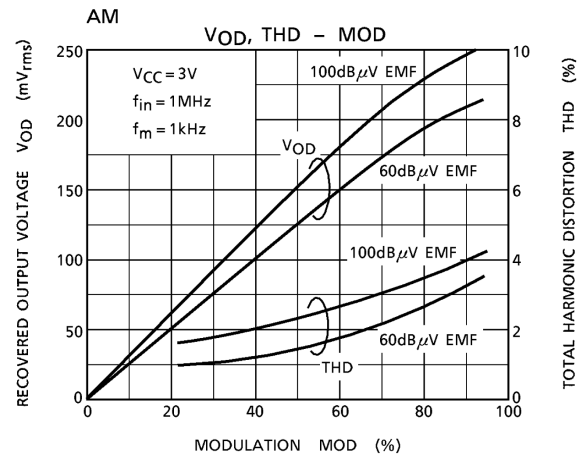
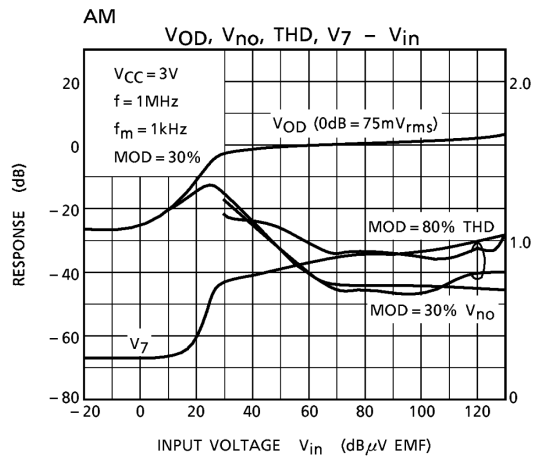
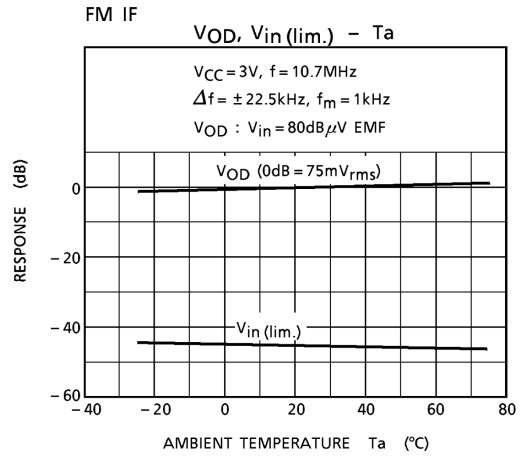
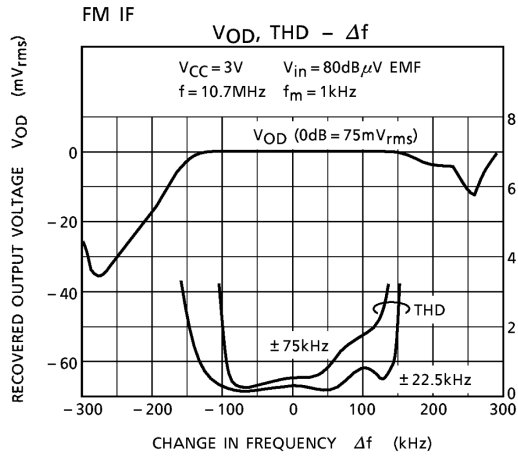
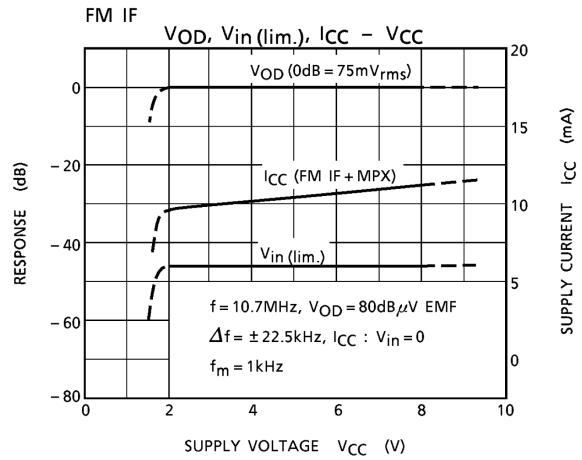
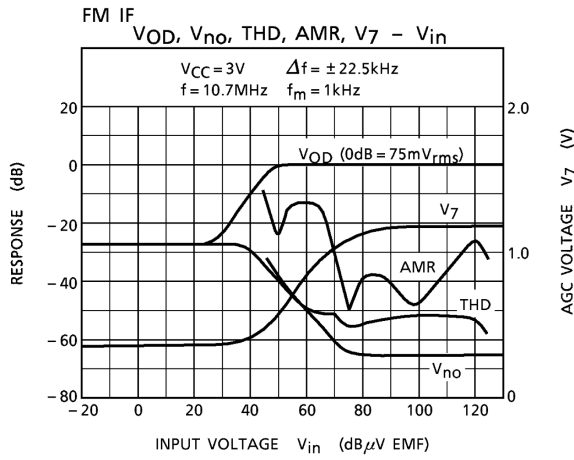


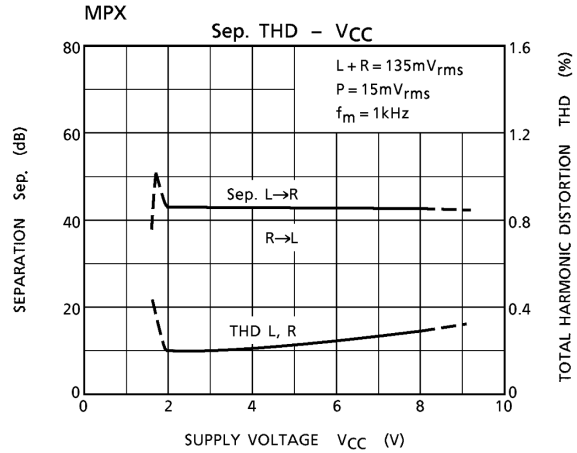
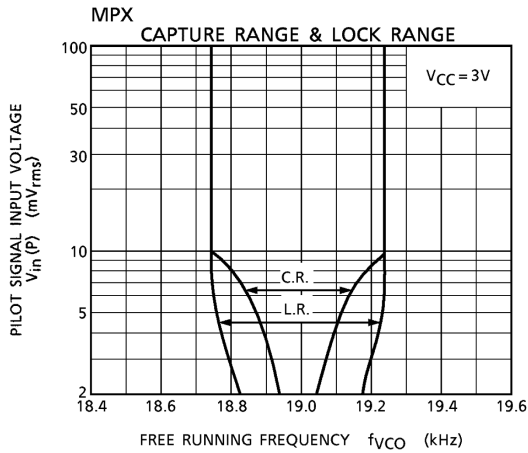
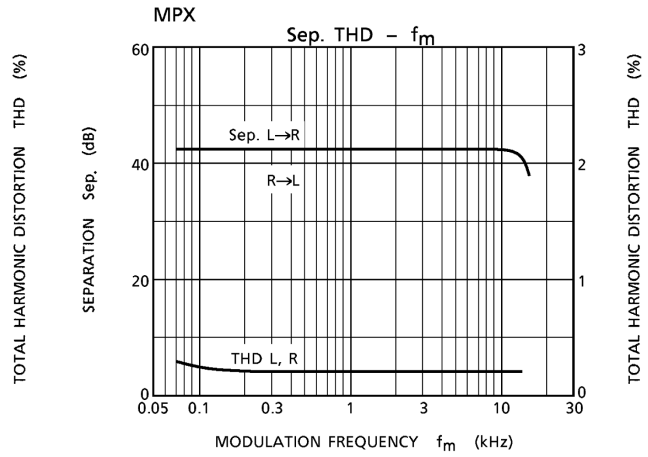
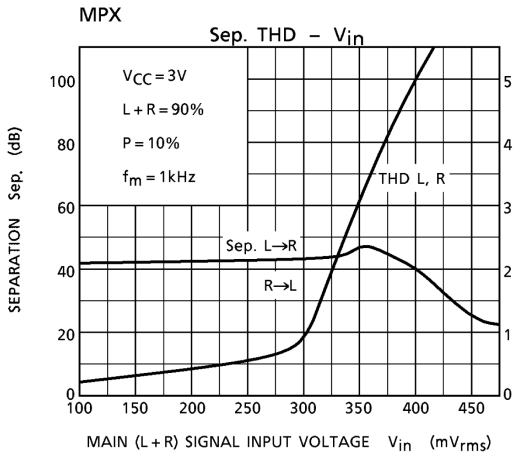
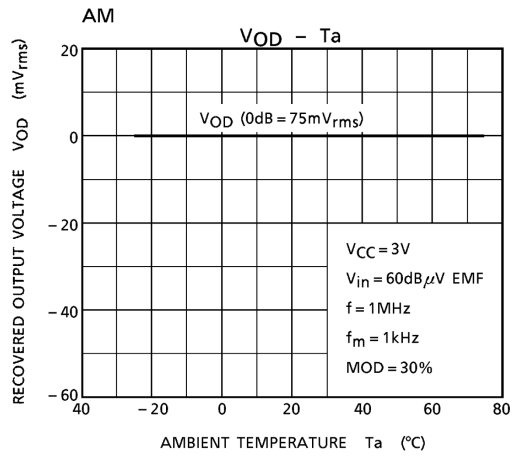
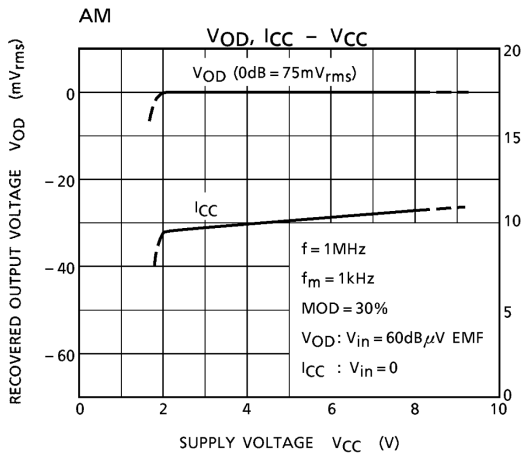
Coil Data (test circuit 2)

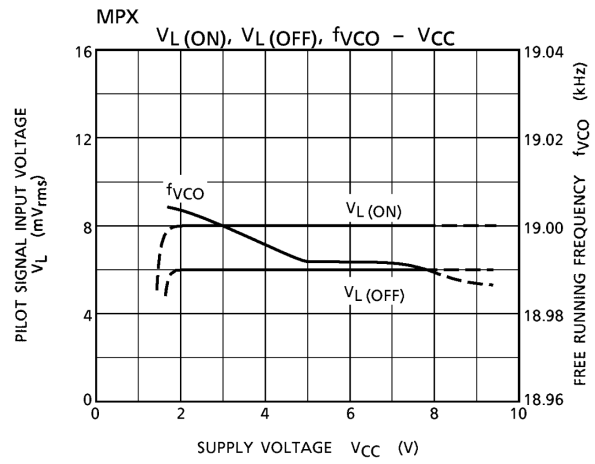
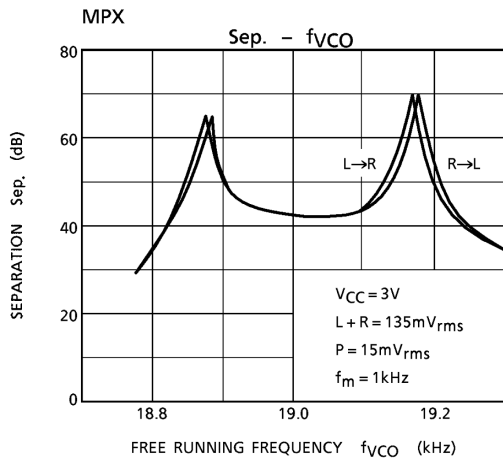
| Coil No. | f | L (μH) | C ₀ (pF) | Q ₀ | Turn | | | | Wire (mm) | REF. (Coil No.) |
|----------|---------|--------|---------------------|----------------|------|-----|-----|-----|-----------|-----------------|
| | | | | | 1-2 | 2-3 | 1-3 | 4-6 | | |
| T AM OSC | 7.96MHz | 1.4 | — | 84 | 1 | 6 | 7 | — | 0.08 UEW | (T) 7PL-1344Y |

(T): TOKO Co., Ltd.





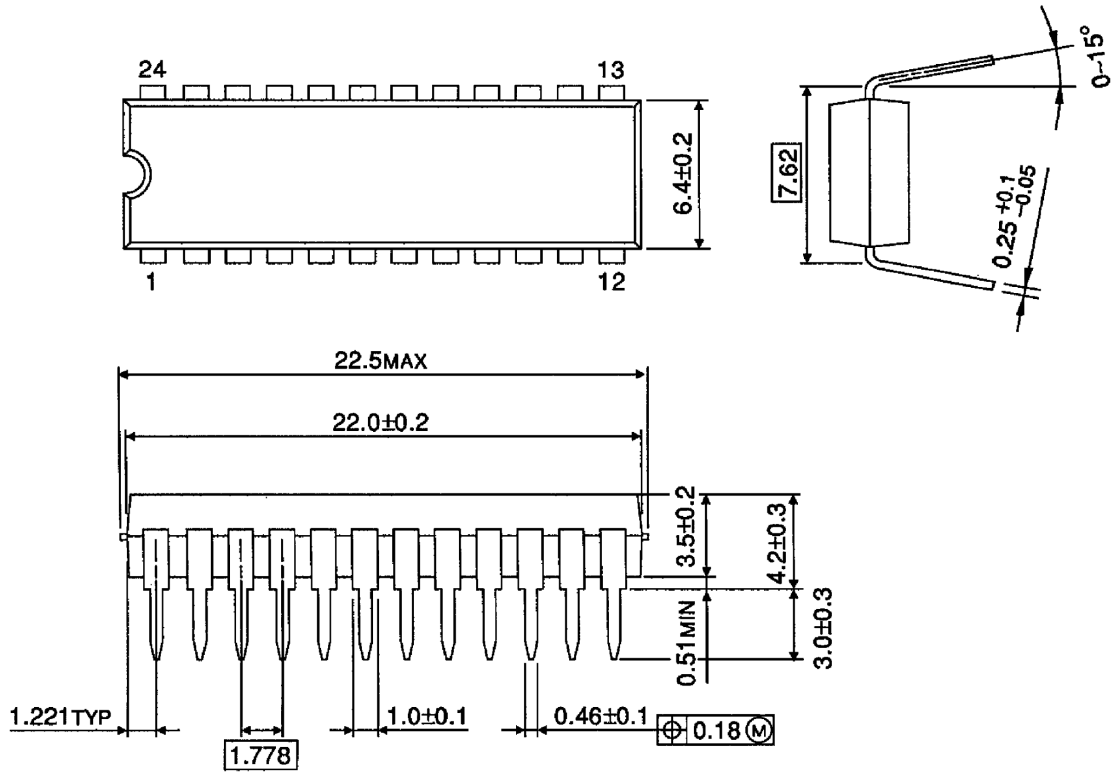




Package Dimensions

SDIP24-P-300-1.78

Unit : mm

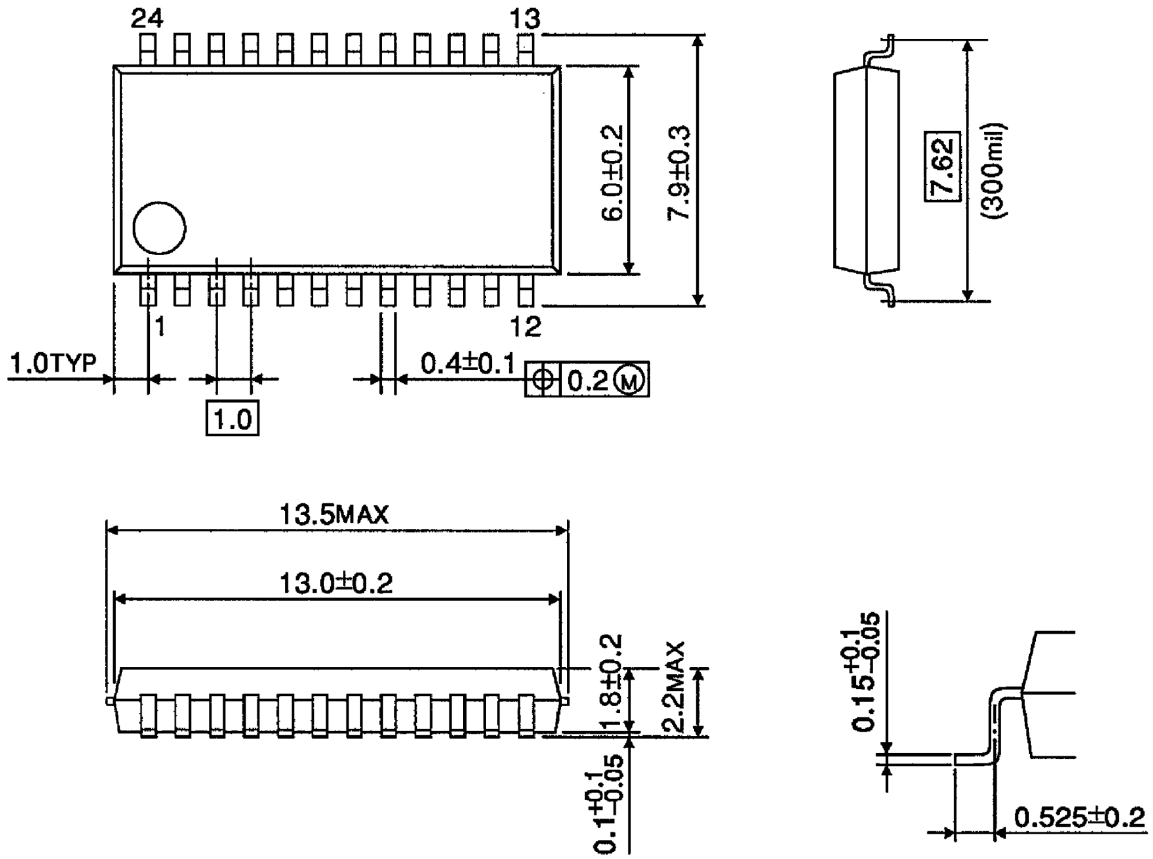


Weight: 1.2g (typ.)

Package Dimensions

SSOP24-P-300-1.00

Unit : mm



Weight: 0.31g (typ.)

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000707EBA

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