

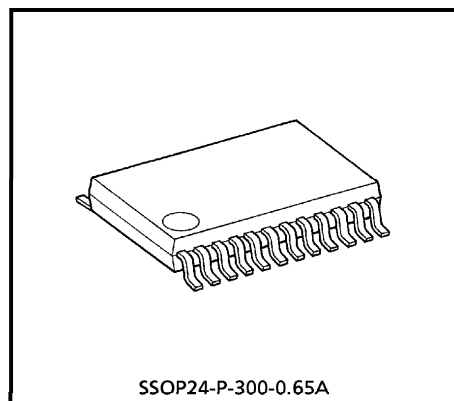
# TA31188FNG

## FILTERLESS IF DETECTOR IC FOR CT1 CORDLESS TELEPHONE

This IF IC is of channel selection filter in itself for cordless telephone and that realized to be able to eliminate the external parts extremely due to including external discriminator.

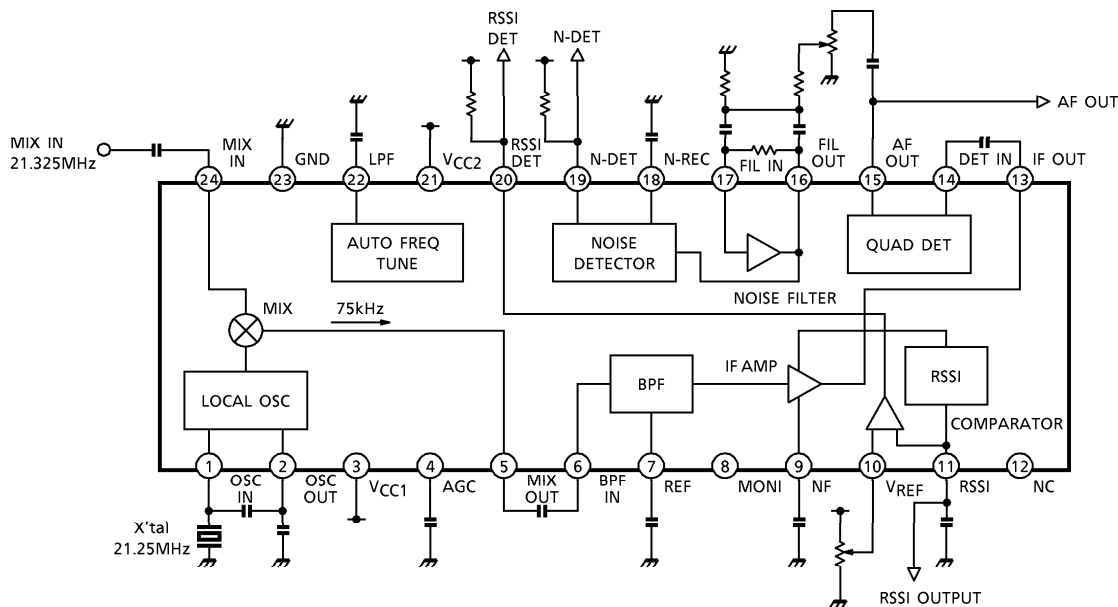
### FEATURES

- Low voltage operation :  $V_{CC} = 1.8V \sim 5.5V$
- High sensitivity : 12dB sensitivity 16dB $\mu$ VEMF (50 $\Omega$  Input)
- Built-in noise detector circuit
- RSSI function
- Small package : SSOP24 pin (0.65mm pitch)



Weight : 0.14g (Typ.)

### BLOCK DIAGRAM



: The TA31188FNG is Pb-Free Package

**PIN FUNCTION** (The values of resistor and capacitor are typ.)

| PIN No. | PIN NAME         | FUNCTION  | INTERNAL EQUIVALENT CIRCUIT |
|---------|------------------|---|-----------------------------|
| 1       | OSC IN           | LOCAL OSC input/output terminals.<br>Colpitts oscillator is formed by internal emitter follower and external crystal.<br>And external local signal injection is possible from pin 1 or pin 2. |                             |
| 2       | OSC OUT          |   |                             |
| 3       | V <sub>CC1</sub> | Power supply terminal.  | —                           |
| 4       | AGC              | AGC terminal for MIX conversion gain.<br>This terminal connects capacitor to GND.   |                             |
| 5       | MIX OUT          | MIX Output terminal.<br>Output impedance is around 1.1kΩ.   |                             |
| 6       | BPF IN           | Internal BPF input terminal.  |                             |
| 7       | REF              | Internal BPF decoupling terminal for DC bias.<br>This terminal connects capacitor to GND.   |                             |
| 8       | MONI             | Use at open as this terminal connects to internal circuit.  | —                           |

| PIN No. | PIN NAME | FUNCTION  | INTERNAL EQUIVALENT CIRCUIT |
|---------|----------|---|-----------------------------|
| 9       | NF       | IF AMP decoupling terminal for DC bias.<br>This terminal connects capacitor to GND.   |                             |
| 10      | VREF     | Reference power supply terminal.  |                             |
| 11      | RSSI     | This terminal outputs DC level according to input signal level to IF AMP.<br>Dynamic range is around 80dB.  |                             |
| 12      | NC       | Open terminal.  | —                           |
| 13      | IF OUT   | Output terminal of IF AMP.  |                             |
| 14      | DET IN   | QUAD DET input terminal.  |                             |
| 15      | AF OUT   | Demodulated output terminal.<br>Output impedance is around 1.1kΩ.   |                             |
| 16      | FIL OUT  | FIL AMP input/output terminal.<br>Compose the BPF by putting the external capacitance and Resistance and this terminal connects to rectifire circuit internally by internal decoupling capacitance. |                             |
| 17      | FIL IN   |   |                             |

| PIN No. | PIN NAME | FUNCTION   | INTERNAL EQUIVALENT CIRCUIT |
|---------|----------|--|-----------------------------|
| 18      | N-REC    | Rectify to direct current by external capacitance after amplifying the FIL AMP output to around 20dB.  |                             |
| 19      | N-DET    | Operating as comparator of N-REC terminal output voltage, and doing the judgement of NOISE DET. Hysteresis width is around 100mV and this terminal is from open collector.                                       |                             |
| 20      | RSSI DET | This terminal outputs the result of comparator between VREF terminal input voltage and RSSI terminal output voltage. If VREF is less than RSSI, then RSSI DET is set to "L". This output is from open collector. |                             |
| 21      | VCC2     | Power supply terminal for AUTO FREQ TUNE block.  | —                           |
| 22      | LPF      | Decoupling terminal of the circuit, that tuning the internal BPF f <sub>0</sub> automatically. This terminal connects capacitor to GND.  |                             |
| 23      | GND      | GND terminal.  | —                           |
| 24      | MIX IN   | 1st IF signal input terminal.  |                             |

## DESCRIPTION

## 1. BPF (band pass filter)

1st IF from MIX input terminal is converted to 2nd IF 75kHz by mixing 2nd MIX and LOCAL OSC 21.250MHz to be input to BPF.

This BPF is of high Q with center frequency  $f_0 = 75\text{kHz}$ ,  $-6\text{dB}$  band width  $\text{BW} = 19\text{kHz}$  and attenuation  $63\text{dB}$  and these factors are cause of selectivity characteristics and demodulation output distortion characteristics.

This IC is of automatic frequency tuning system that stabilize the center frequency  $f_0$  drift of internal BPF for 2nd IF by temprature and parameter tolerance and this function is executed by control circuit with internal clock as reference frequency from LOCAL OSC. Clock frequency signal source should be required high accuracy for 2nd local frequency as the signal source of referency clock 21.250MHz, because selectivity characteristics and demodulation output distortion characteristics depend on clock frequency.

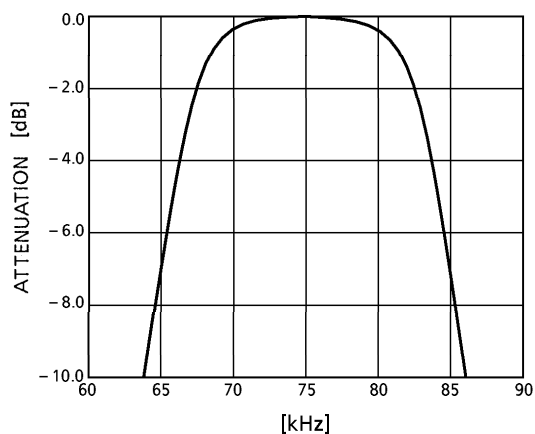


Fig.1 BPF characteristics

## 2. LOCAL OSC external injection method

Inputting from pin1 as shown in Fig.2, add resistor R21 to pin2 and set the input signal so that signal level at pin1 is  $95\sim 105\text{dB}\mu\text{V}$ . A built-in BUFFER amp minimizes leakage from MIX.

Inputting from pin2 as shown in Fig.3, set the injection level at pin2 between  $95\text{dB}\mu\text{V}$  and  $105\text{dB}\mu\text{V}$ .

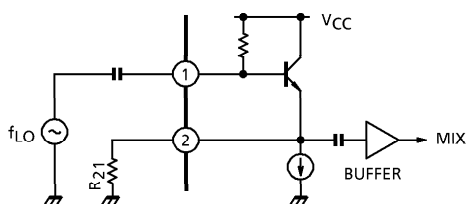


Fig.2

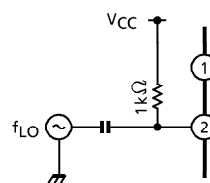


Fig.3

3. NOISE FILTER AMP

NOISE FILTER AMP can construct BPF as Fig.4. Setting constants follow as below equation (1)~(3).

$$(1) f_0 = \frac{1}{2\pi \sqrt{R_1 (R_2 // R_3) C^2}}$$

$$(2) G_V = R_1 / 2R_2$$

$$(3) Q^2 = \frac{R_3}{4 (R_2 // R_3)}$$

at  $R_2 \gg R_p$

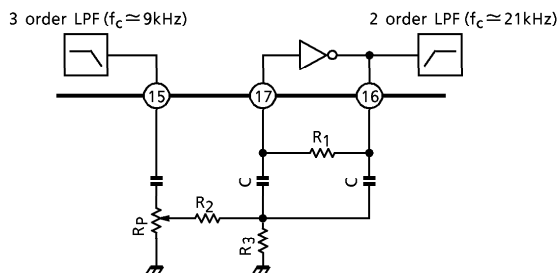


Fig.4

In case of the setting level of NOISE DET being low, NOISE DET may operate incorrectly in the cause of carrier leak components of IF frequency 75kHz.

In this case get the NOISE DET filter set to LPF to be able to eliminate carrier leak components.

$$(1) f_0 = \frac{1}{2\pi R \sqrt{C_1 C_2}}$$

$$(2) G_V = \frac{1}{2\omega C_2 R_4}$$

$$(3) Q^2 = \frac{C_1}{4C_2}$$

at  $R_4 \gg R$ ,  $\omega = 2\pi f$

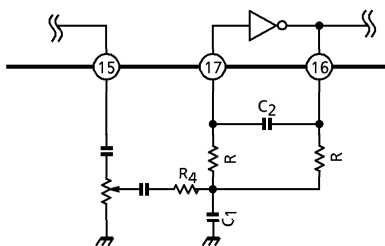


Fig.5

4. Noise detection rise time

The rise time is a proportion of time constant 7.5ms of the smoothing capacitor  $C_{181} = 0.1\mu F$  of the noise rectifier and internal resistor  $75k\Omega$ . Although decreasing the capacitance of  $C_{181}$  can shorten the rise time, note that the NOISE DET output fluctuation may increase. This should be taken into account before use.

5. RSSI COMPARATOR

The result of RSSI COMPARATOR is output to RSSI DET (20pin) by comparing RSSI terminal output voltage with  $V_{REF}$  terminal input voltage.

Hysteresis range is around 30mV. When  $V_{RSSI} > V_{REF}$ , RSSI DET is "L" level.

Reference voltage  $V_{REF}$  can be set by the external resistance  $R_{101}$ .

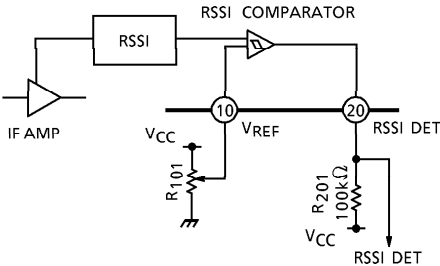


Fig.6

## MAXIMUM RATINGS (Ta = 25°C)

| CHARACTERISTIC        | SYMBOL           | RATING       | UNIT |
|-----------------------|------------------|--------------|------|
| Supply Voltage        | V <sub>CC</sub>  | 7            | V    |
| Power Dissipation     | P <sub>D</sub>   | 780          | mW   |
| Operating Temperature | T <sub>opr</sub> | - 20 ~ + 70  | °C   |
| Storage Temperature   | T <sub>stg</sub> | - 55 ~ + 150 | °C   |

ELECTRICAL CHARACTERISTICS (Unless otherwise specified V<sub>CC</sub> = 3.0V, f<sub>IN</sub> = 21.325MHz, Δf = ± 3kHz, f<sub>MOD</sub> = 1kHz, Ta = 25°C)

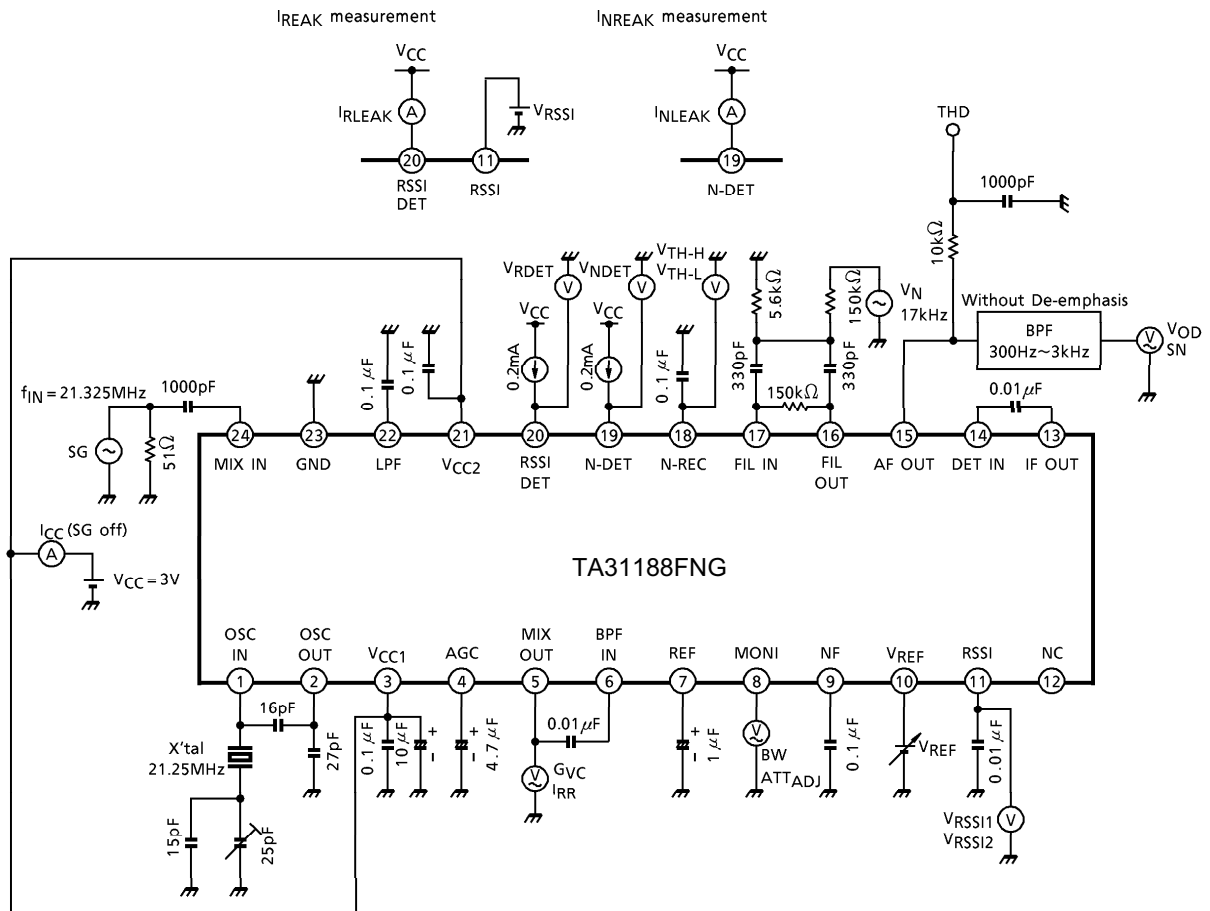
| CHARACTERISTIC                        | SYMBOL          | TEST CIRCUIT | TEST CONDITION  | MIN. | TYP.   | MAX. | UNIT                 |
|---------------------------------------|-----------------|--------------|---|------|--------|------|----------------------|
| Power Supply Voltage                  | V <sub>CC</sub> | —            | —   | 1.8  | 3.0    | 5.5  | V                    |
| Current Consumption                   | I <sub>CC</sub> | 1            | No Signal   | 4.5  | 6.5    | 8.5  | mA                   |
| MIX Operating Frequency               | f <sub>IN</sub> | —            | —   | —    | 21.325 | —    | MHz                  |
| MIX Image Rejection Ratio             | I <sub>RR</sub> | 1            | V <sub>IN</sub> = 70dB <sub>μ</sub> VEMF,<br>Pin4 GND   | 25   | 35     | —    | dB                   |
| MIX Conversion Gain                   | G <sub>VC</sub> | 1            | V <sub>IN</sub> = 60dB <sub>μ</sub> V,<br>Pin4 GND      | 27   | 30     | 33   | dB                   |
| MIX Intercept Point                   | I <sub>p</sub>  | —            | —   | —    | 103    | —    | dB <sub>μ</sub> VEMF |
| MIX Input Impedance                   | R <sub>IN</sub> | —            | —   | —    | 5      | —    | kΩ                   |
|                                       | C <sub>IN</sub> | —            | —   | —    | 3      | —    | pF                   |
| 12dB Sensitivity                      | 12dB SN         | —            | —   | —    | 16     | 20   | dB <sub>μ</sub> VEMF |
| Demodulation Output Level             | V <sub>OD</sub> | 1            | V <sub>IN</sub> = 80dB <sub>μ</sub> VEMF                | 160  | 200    | 240  | mV <sub>rms</sub>    |
| SN Ratio                              | SN              | 1            | V <sub>IN</sub> = 80dB <sub>μ</sub> VEMF                | 47   | 58     | —    | dB                   |
| AM Rejection Ratio                    | AMR             | —            | AM = 30%,<br>V <sub>IN</sub> = 80dB <sub>μ</sub> VEMF   | —    | 38     | —    | dB                   |
| Demodulation Output Distortion        | THD             | 1            | V <sub>IN</sub> = 80dB <sub>μ</sub> VEMF                | —    | - 38   | - 32 | dB                   |
| Demodulation Output Cut-off Frequency | f <sub>C</sub>  | 1            | - 3dB   | 3.4  | 5.5    | —    | kHz                  |
| Pass Band Width                       | BW              | —            | - 6dB   | —    | 19     | —    | kHz                  |
| Rejection Level at Adjacent Channel   | ATTADJ          | 1            | f <sub>SEP</sub> = ± 25kHz,<br>f <sub>MOD</sub> = 400Hz | 55   | 63     | —    | dB                   |
| LOCAL OSC Input Level                 | V <sub>LO</sub> | —            | —   | 95   | 100    | 105  | dB <sub>μ</sub> V    |

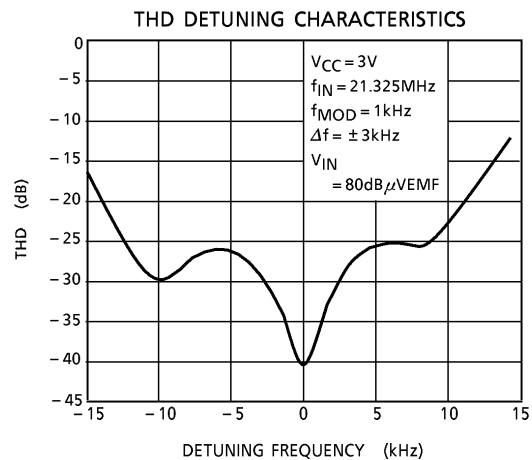
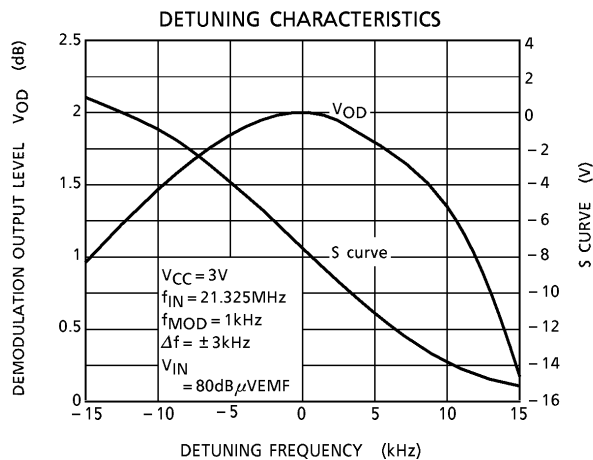
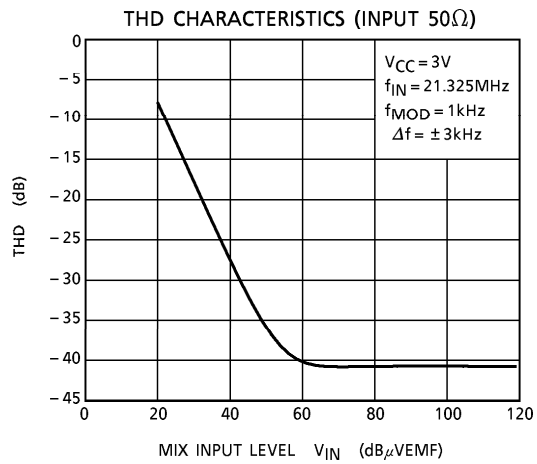
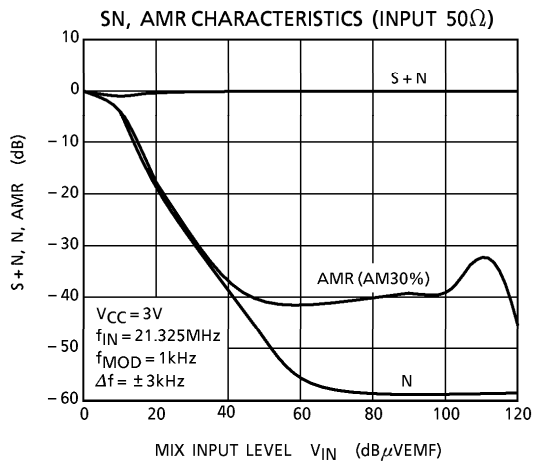
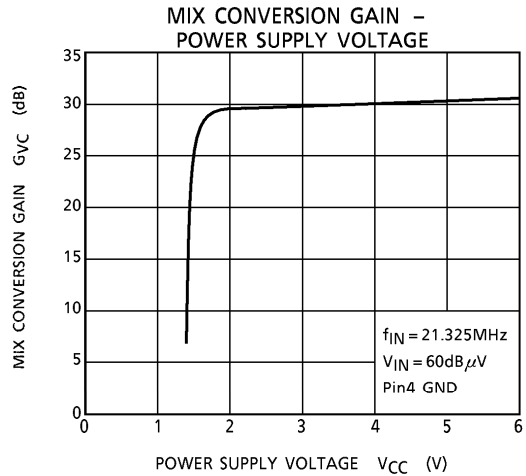
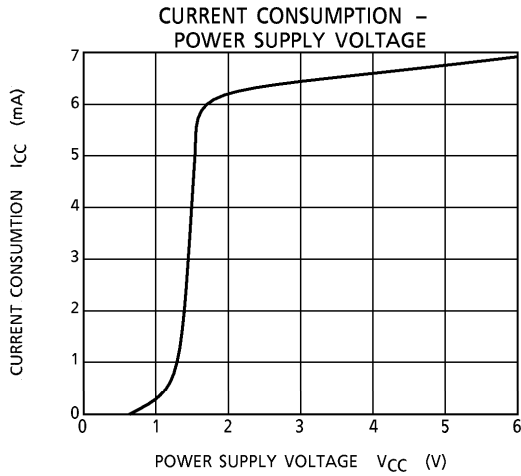


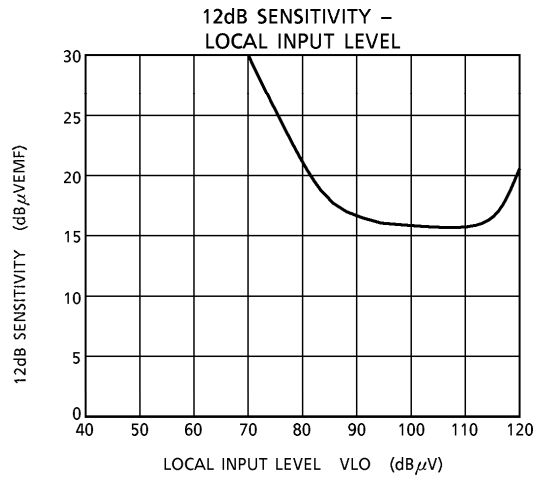
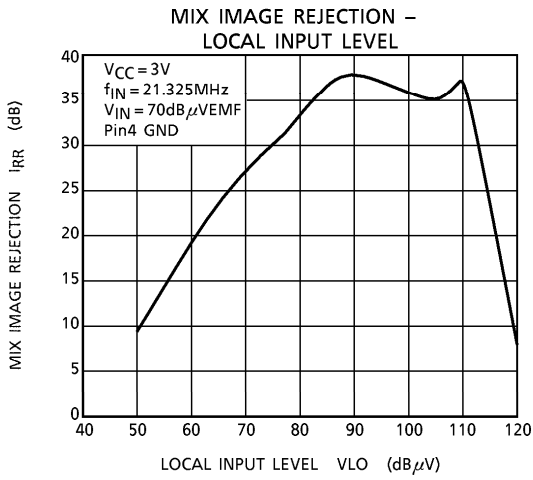
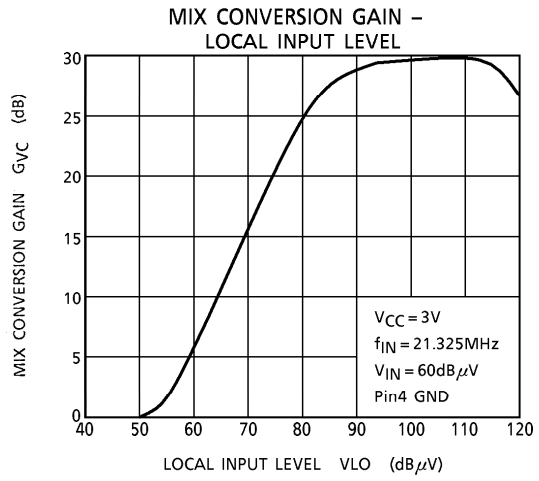
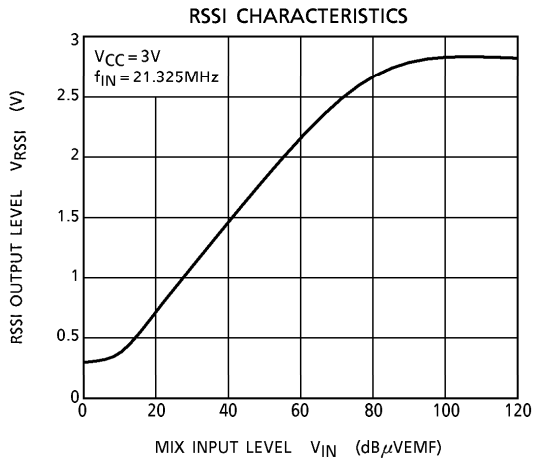
**ELECTRICAL CHARACTERISTICS** (Unless otherwise specified  $V_{CC} = 3.0V$ ,  $f_{IN} = 21.325MHz$ ,  $\Delta f = \pm 3kHz$ ,  
 $f_{MOD} = 1kHz$ ,  $T_a = 25^\circ C$ )

| CHARACTERISTIC                        | SYMBOL      | TEST CIRCUIT | TEST CONDITION                                | MIN. | TYP. | MAX.         | UNIT    |
|---------------------------------------|-------------|--------------|---|------|------|--------------|---------|
| RSSI Output Voltage                   | $V_{RSSI1}$ | 1            | $V_{IN} = 15dB_{\mu}VEMF$                     | —    | —    | 1            | V       |
|                                       | $V_{RSSI2}$ |              | $V_{IN} = 20dB_{\mu}VEMF$                     | 0.45 | 0.75 | 1.05         | V       |
|                                       | $V_{RSSI3}$ |              | $V_{IN} = 75dB_{\mu}VEMF$                     | 2.2  | 2.6  | 3.0          | V       |
| RSSI COMPARATOR Reference Input Range | $V_{REF}$   | —            | —   | 0.3  | —    | $V_{CC} - 1$ | V       |
| RSSI COMPARATOR Hysteresis Width      | $V_{HYS}$   | —            | —   | —    | 30   | —            | mV      |
| RSSI COMPARATOR Output Voltage        | $V_{RDET}$  | 1            | $I_{SINK} = 0.2mA$                            | —    | 0.1  | 0.5          | V       |
| RSSI COMPARATOR Output Leak Current   | $I_{RLEAK}$ | 1            | $V_{RDET} = V_{CC}$ ,<br>$V_{RSSI} > V_{REF}$ | —    | 0    | 5            | $\mu A$ |
| NOISE DET Output Voltage              | $V_{NDET}$  | 1            | $I_{SINK} = 0.2mA$                            | —    | 0.1  | 0.5          | V       |
| NOISE DET Output Leak Current         | $I_{NLEAK}$ | 1            | $V_{NDET} = V_{CC}$                           | —    | 0    | 5            | $\mu A$ |
| Noise Comparator Detect Level         | $V_{TH-H}$  | 1            | —   | —    | 0.5  | 0.7          | V       |
|                                       | $V_{TH-L}$  |              | —   | 0.3  | 0.4  | —            | V       |

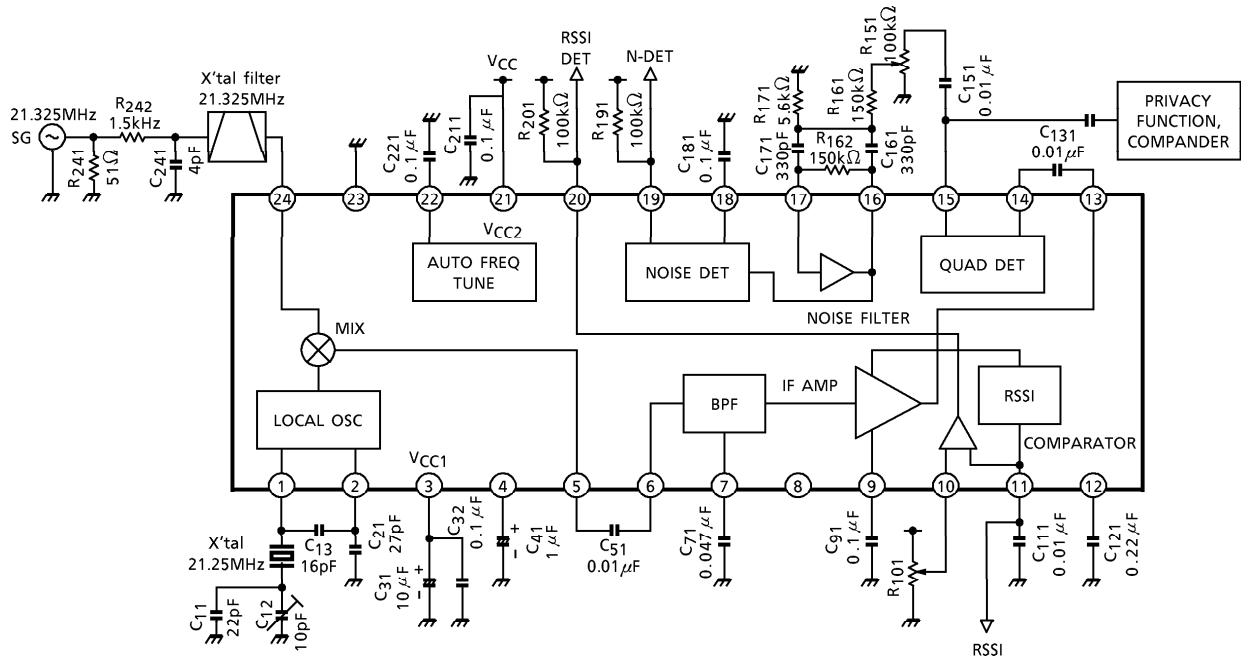
TEST CIRCUIT 1





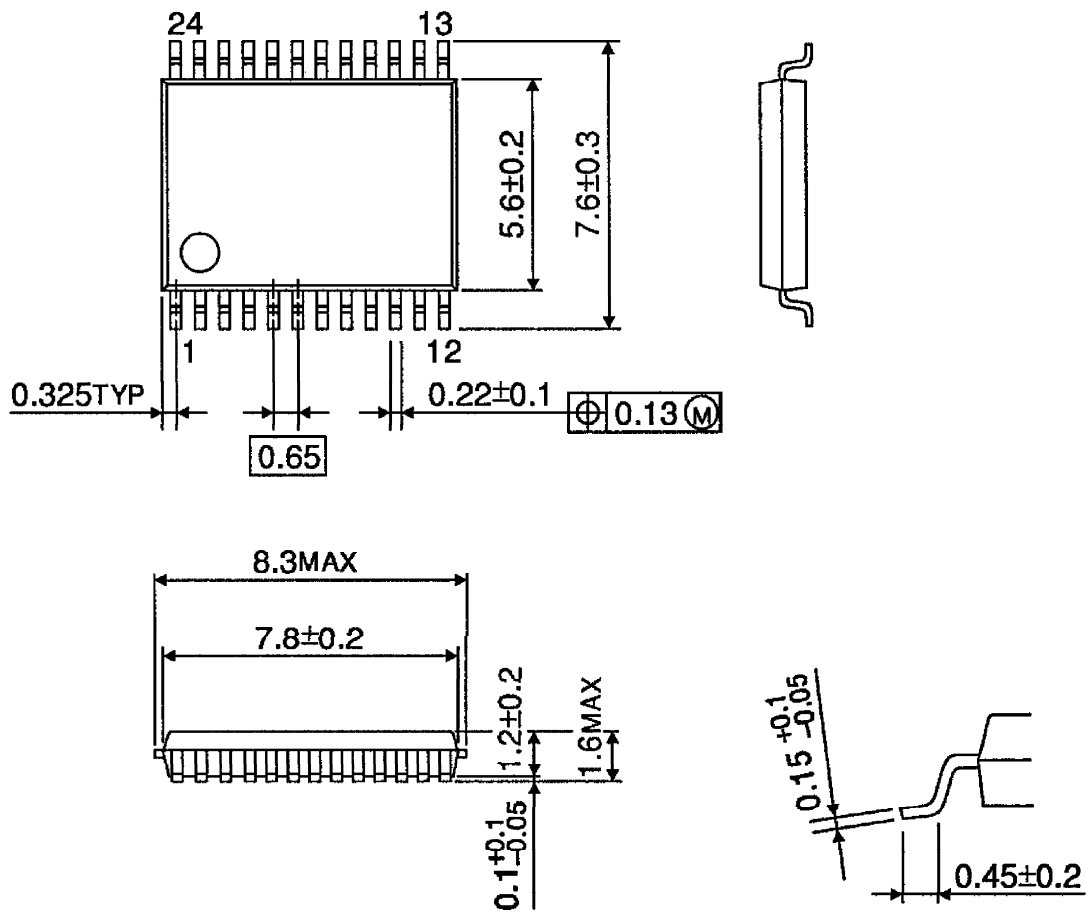


APPLICATION CIRCUIT



PACKAGE DIMENSIONS  
SSOP24-P-300-0.65A

UNIT : mm



Weight : 0.14g (Typ.)

About solderability, following conditions were confirmed

Solderability

- (1) Use of Sn-63Pb solder bath
  - Solder bath temperature = 230
  - Dipping time = 5seconds
  - The number of times = once
  - Use of R-type flux
- (2) Use of Sn-3.0Ag-0.5Cu solder bath
  - Solder bath temperature = 245
  - Dipping time = 5seconds
  - The number of times = once
  - Use of R-type flux

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000707EBA

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