

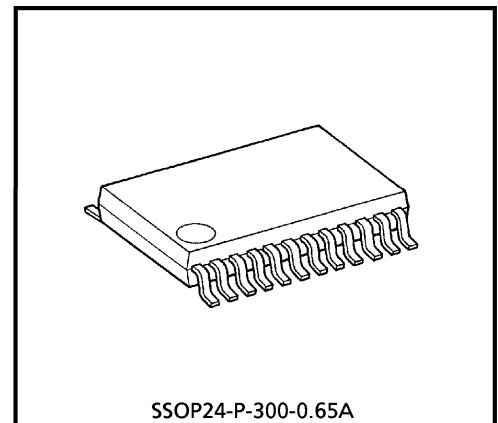
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FILTERLESS IF DETECTOR IC FOR CORDLESS TELEPHONE

This IF detector IC includes the external 2nd IF ceramic filter and the external discriminator in itself and that realized to be able to eliminate the external parts extremely.

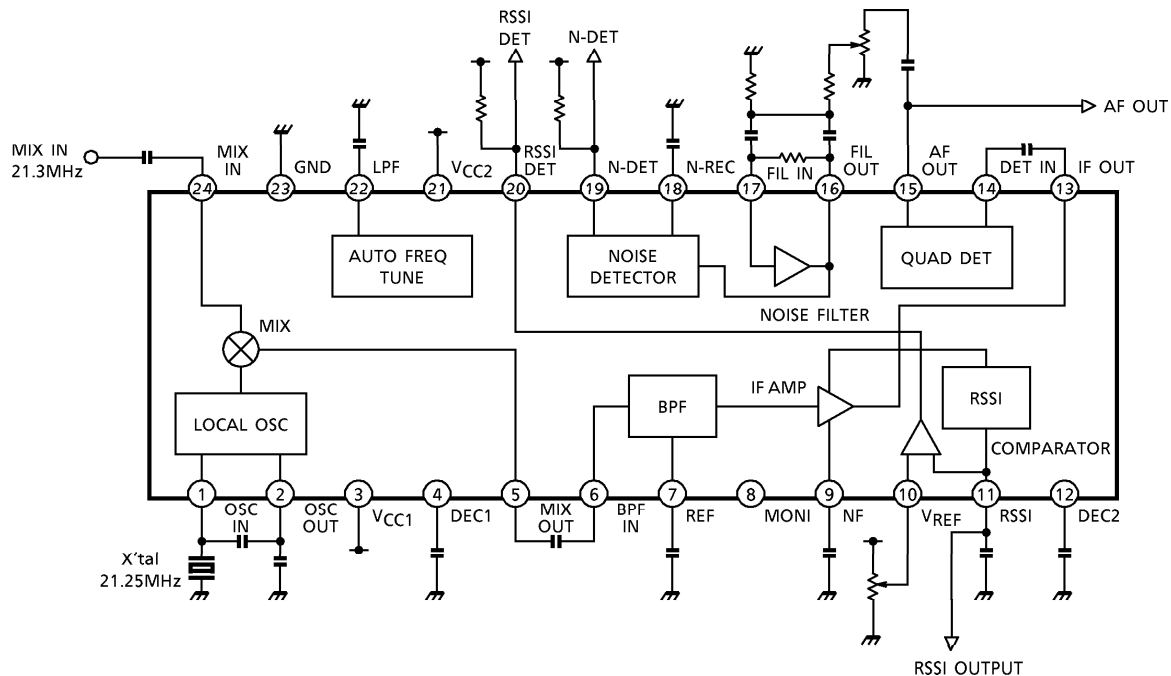
FEATURES

- No need of the external ceramic filter and discriminator
- Low voltage operation : $V_{CC} = 1.8V \sim 5.5V$
- High sensitivity : 12dB sensitivity 20dB μV EMF (50 Ω Input)
- Built-in noise detector circuit
- RSSI function
- Small package : SSOP24 pin (0.65mm pitch)



Weight : 0.14g (Typ.)

BLOCK DIAGRAM



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. Colpitts oscillator is formed by internal emitter follower and external crystal. And external local signal injection is possible from pin 1 or pin 2.	
2	OSC OUT		
3	VCC1	Power supply terminal.	—
4	DEC1	AGC terminal for MIX conversion gain. This terminal connects capacitor to GND.	
5	MIX OUT	MIX Output terminal. Output impedance is around 1.1kΩ.	
6	BPF IN	Internal BPF input terminal.	
7	REF	Internal BPF decoupling terminal for DC bias. 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. 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. Dynamic range is around 80dB.	
12	DEC2	QUAD DET AFC terminal. This terminal connects to capacitor to GND.	
13	IF OUT	Output terminal of IF AMP.	
14	DET IN	QUAD DET input terminal.	
15	AF OUT	Demodulated output terminal. Output impedance is around 1.1kΩ.	

PIN No.	PIN NAME	FUNCTION	INTERNAL EQUIVALENT CIRCUIT
16	FIL OUT	FIL AMP input/output terminal. 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		
18	N-REC	Rectifire 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_0 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 50kHz by mixing 2nd MIX and LOCAL OSC 21.250MHz to be input to BPF.

This BPF is of high Q with center frequency $f_0 = 50\text{kHz}$, -3dB band width $\text{BW} = 8\text{kHz}$ and attenuation 57dB 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.

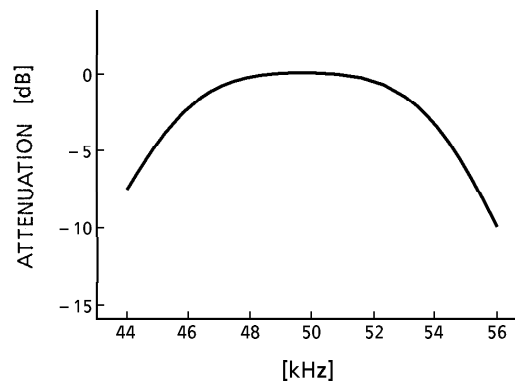


Fig.1 BPF characteristics

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 95~105dB μV . A built-in BUFFER amp minimizes leakage from MIX.

Inputting from pin2 as shown in Fig.3, set the injection level at pin2 between 95dB μV and 105dB μV .

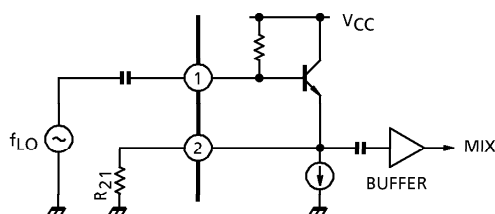


Fig.2

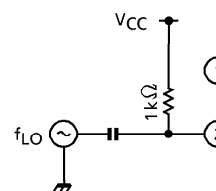


Fig.3

3. NOISE FILTER AMP

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

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

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

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

at $R_2 \gg R_p$

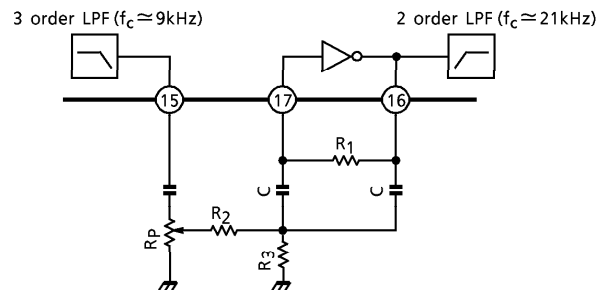


Fig.4

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 50kHz.

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

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

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

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

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

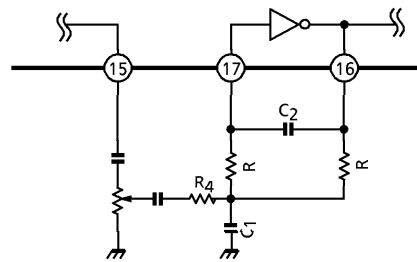


Fig.5

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} .

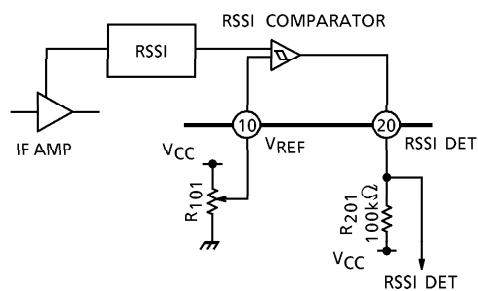


Fig.6

MAXIMUM RATINGS (Ta = 25°C)

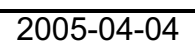
CHARACTERISTIC	SYMBOL	RATING	UNIT
Supply Voltage	V _{CC}	7	V
Power Dissipation	P _D	780	mW
Operating Temperature	T _{opr}	− 20~ + 70	°C
Storage Temperature	T _{stg}	− 55~ + 150	°C

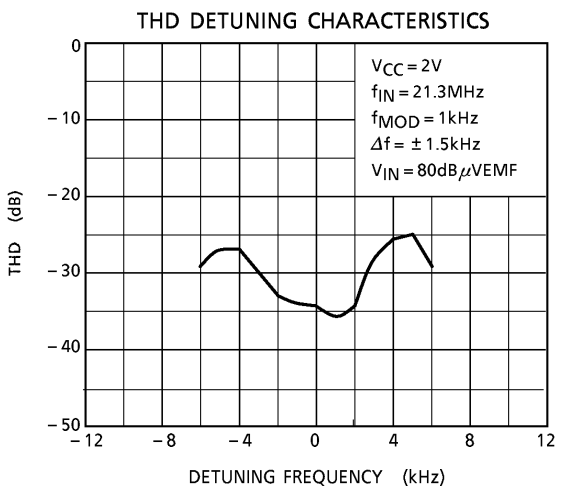
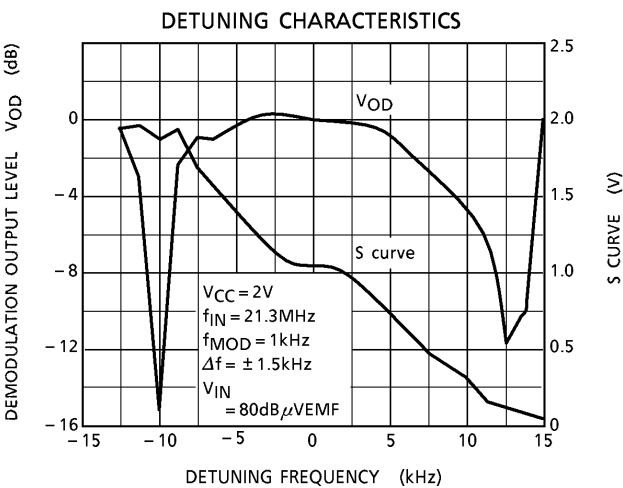
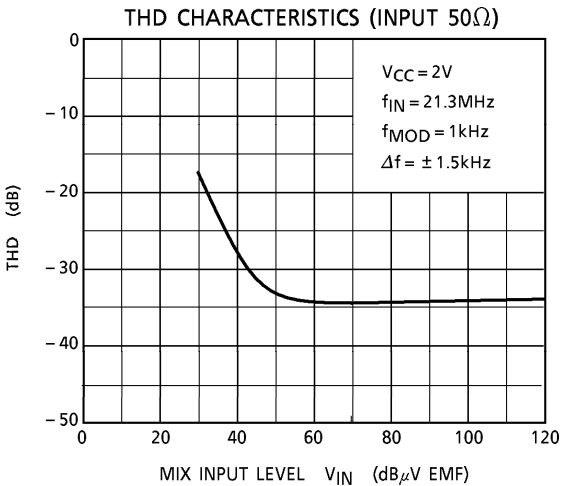
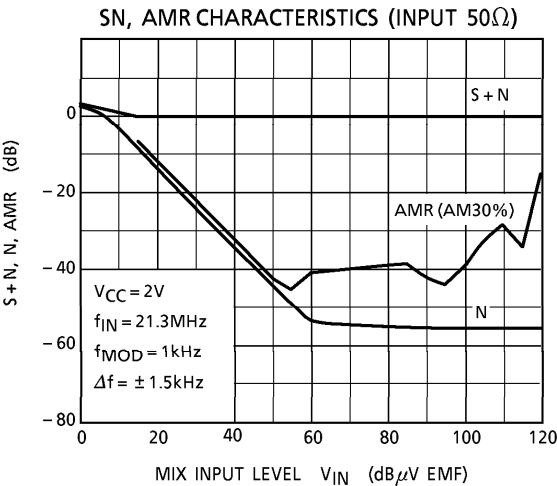
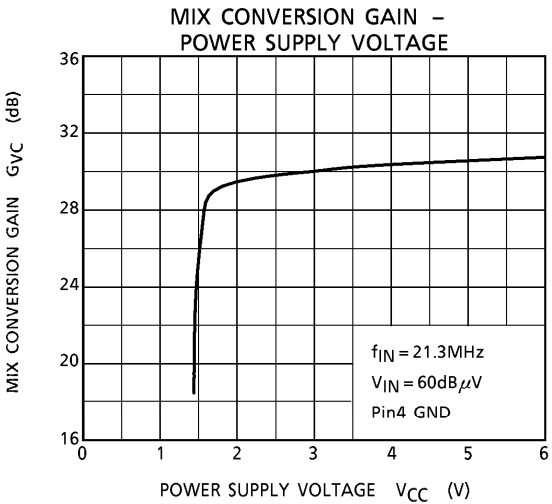
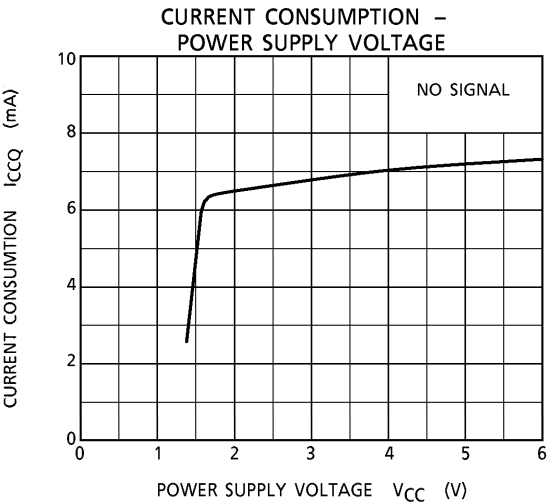
ELECTRICAL CHARACTERISTICS (Unless otherwise specified V_{CC} = 2.0V, f_{IN} = 21.30MHz, Δf = ± 1.5kHz, f_{MOD} = 1kHz, Ta = 25°C)

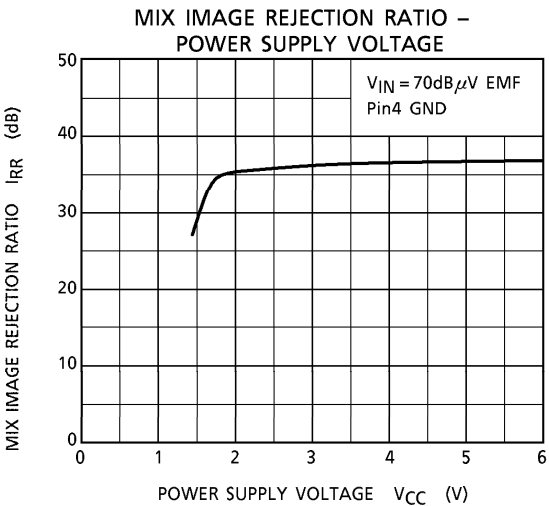
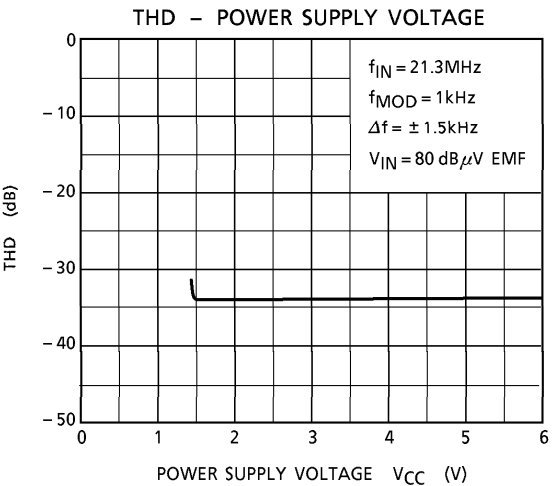
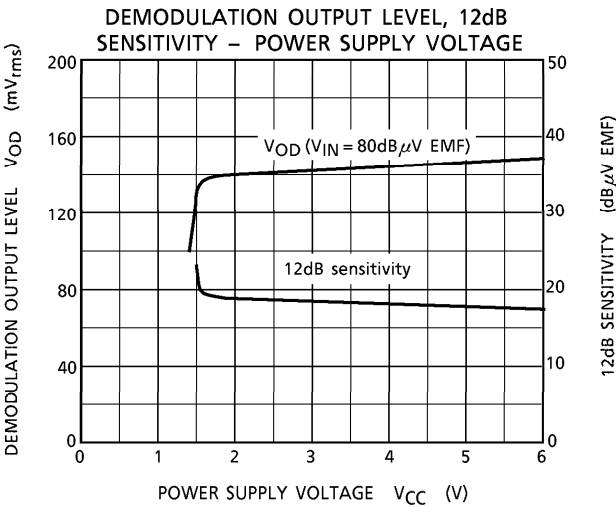
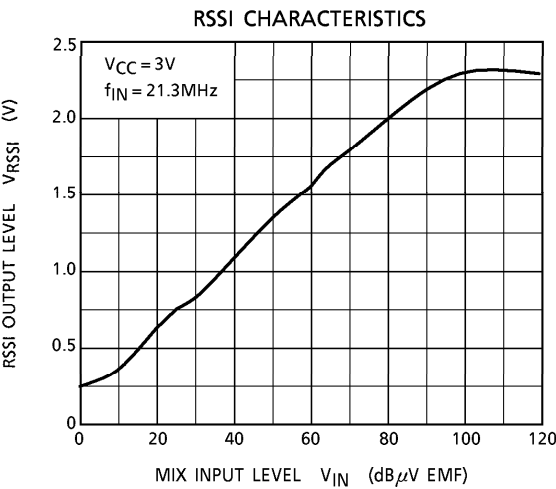
CHARACTERISTIC	SYMBOL	TEST CIRCUIT	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Power Supply Voltage	V _{CC}	—	—	1.8	2.0	5.5	V
Current Consumption	I _{CC}	1	No Signal	4.3	6.7	9.0	mA
MIX Operating Frequency	f _{IN}	—	—	—	21.30	—	MHz
MIX Image Rejection Ratio	I _{RR}	1	V _{IN} = 70dB μ VEMF, Pin4 GND	20	35	—	dB
MIX Conversion Gain	G _{VC}	1	V _{IN} = 60dB μ V, Pin4 GND	26	29.5	—	dB
MIX Intercept Point	I _p	—	—	—	103	—	dB μ VEMF
MIX Input Impedance	R _{IN}	—	—	—	5	—	k Ω
	C _{IN}	—	—	—	3	—	pF
12dB Sensitivity	12dB SN	—	—	—	20	—	dB μ VEMF
Demodulation Output Level	V _{OD}	1	V _{IN} = 80dB μ VEMF	110	140	170	mV _{rms}
SN Ratio	SN	1	V _{IN} = 80dB μ VEMF	40	54	—	dB
AM Rejection Ratio	AMR	—	AM = 30%, V _{IN} = 80dB μ VEMF	—	38	—	dB
Demodulation Output Distortion	THD	1	V _{IN} = 80dB μ VEMF	—	− 35	− 30	dB
Demodulation Output Cut-off Frequency	f _C	—	− 3dB	—	3	—	kHz
Pass Band Width	BW	1	− 3dB	6	8	—	kHz
Rejection Level at Adjacent Channel	ATT _{ADJ}	1	f _{SEP} = ± 12.5kHz, f _{MOD} = 400Hz	50	57	—	dB
LOCAL OSC Input Level	V _{LO}	—	—	95	100	105	dB μ V

ELECTRICAL CHARACTERISTICS (Unless otherwise specified $V_{CC} = 2.0V$, $f_{IN} = 21.30MHz$, $\Delta f = \pm 1.5kHz$,
 $f_{MOD} = 1kHz$, $T_a = 25^\circ C$)

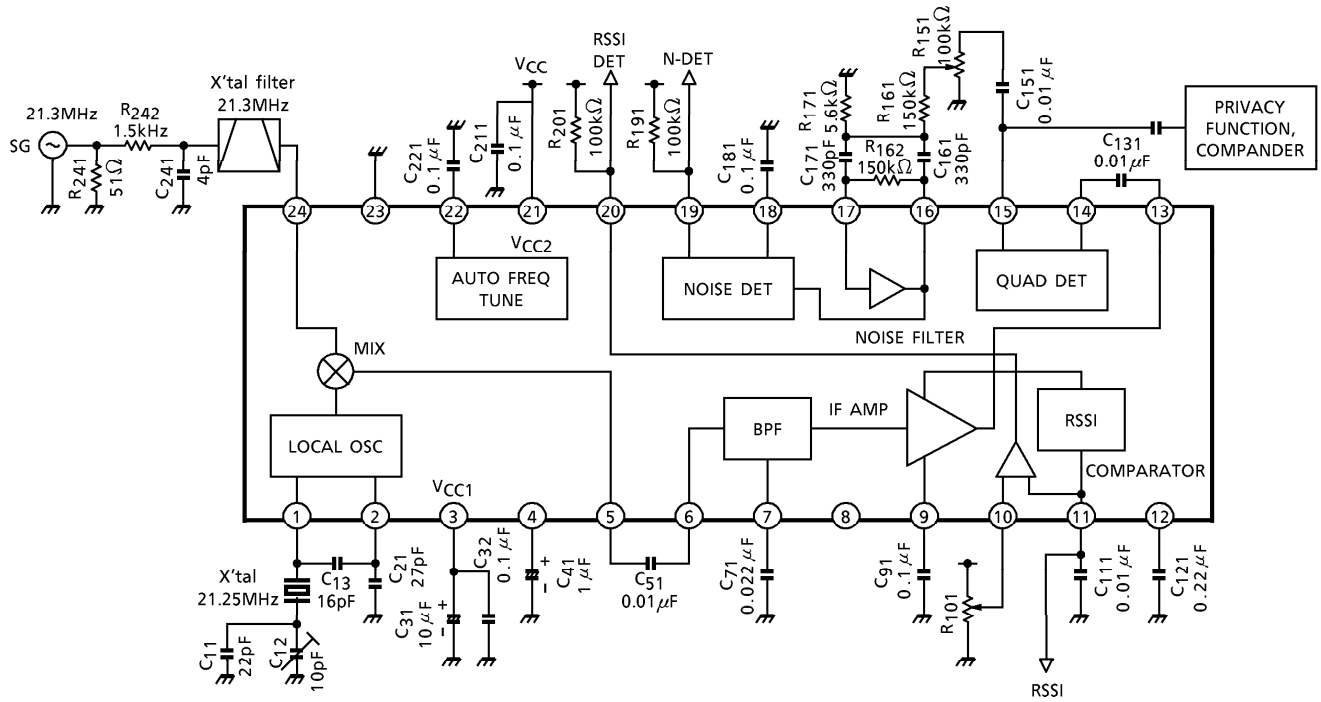
CHARACTERISTIC	SYMBOL	TEST CIR-CUIT	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
RSSI Output Voltage	V_{RSSI1}	1	$V_{CC} = 3V$, $V_{IN} = 20dB_{\mu VEMF}$	0.3	0.6	0.9	V
	V_{RSSI2}		$V_{CC} = 3V$, $V_{IN} = 90dB_{\mu VEMF}$	1.8	2.2	2.6	V
RSSI COMPARATOR Reference Input Range	V_{REF}	—	—	0.3	—	$V_{CC} - 1$	V
RSSI 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	$V_{RDET} = V_{CC}$, $V_{RSSI} > V_{REF}$	—	0	5	μA
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	μA
Noise Comparator Detect Level	V_{TH-H}	1	—	—	0.5	0.7	V
	V_{TH-L}		—	0.3	0.4	—	V





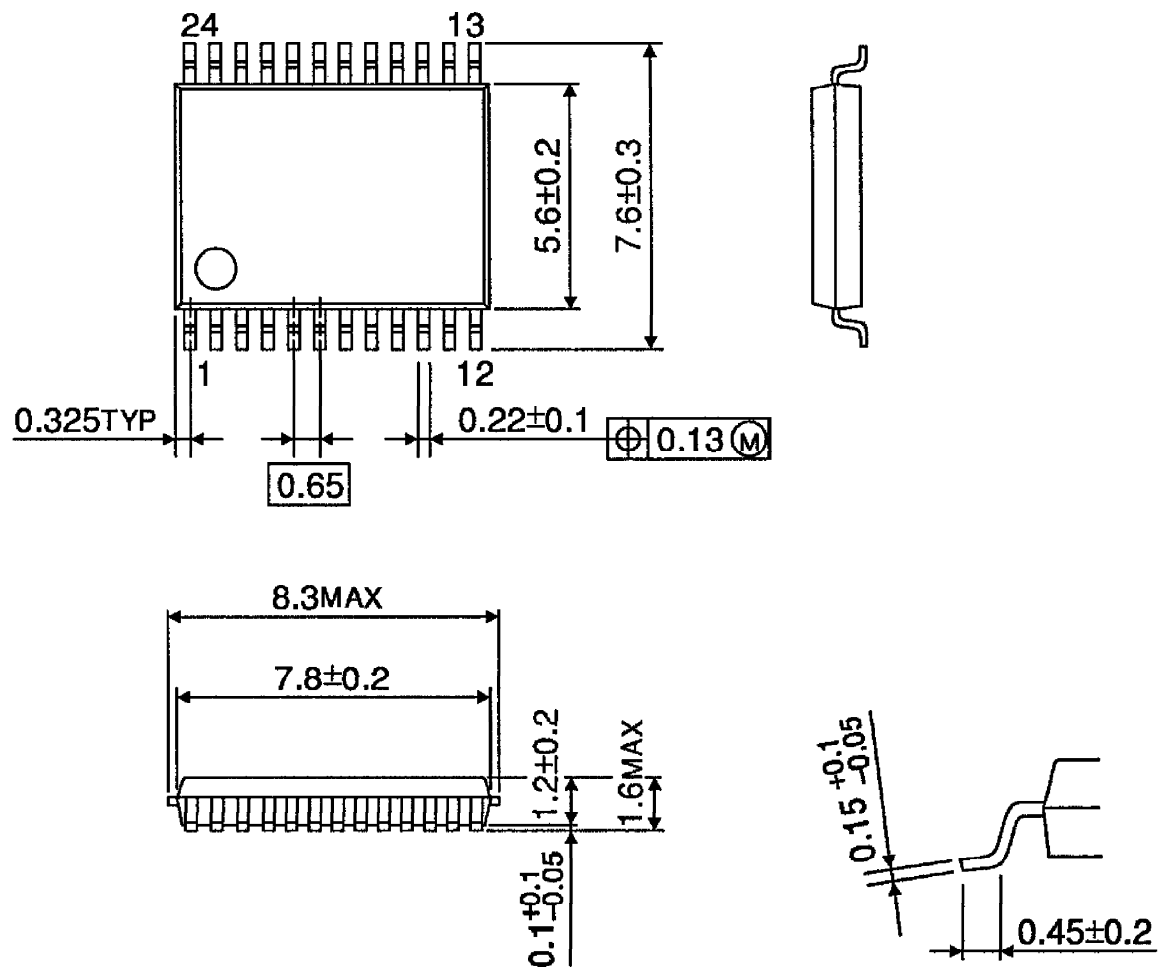


APPLICATION CIRCUIT



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°C
 - dipping time = 5 seconds
 - the number of times = once
 - use of R-type flux
 - (2) Use of Sn-3.0Ag-0.5Cu solder Bath
 - solder bath temperature = 245°C
 - dipping time = 5 seconds
 - the number of times = once
 - use of R-type flux

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030619EBA

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