SONY

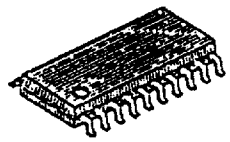
CXA1683M/N

Low-Voltage FM IF Amplifier for Cordless Telephone

Description

The CXA1683M/N is a low-voltage FM IF amplifier designed for cordless telephones. It has a built-in audio third-pole LPF, squelch filter amplifier, and meter circuit. In addition, it operates on 1.8V so that it is ideal for set shrinkage and weight reduction.

CXA1683M
20 pin SOP (Plastic)



CXA1683N
20 pin VSOP (Plastic)

Features

- Audio LPF at the detection output stage (cut-off frequency can be varied)
- Squelch filter operational amplifier
- Signal strength and meter circuit (RSSI)
- Wide operational range (1.8V to 6V) and low current consumption (Icc of 4.0mA (typ.) at a Vcc of 2.3V)

Structure

Bipolar silicon monolithic IC

Applications

Cordless telephones and FM communication devices

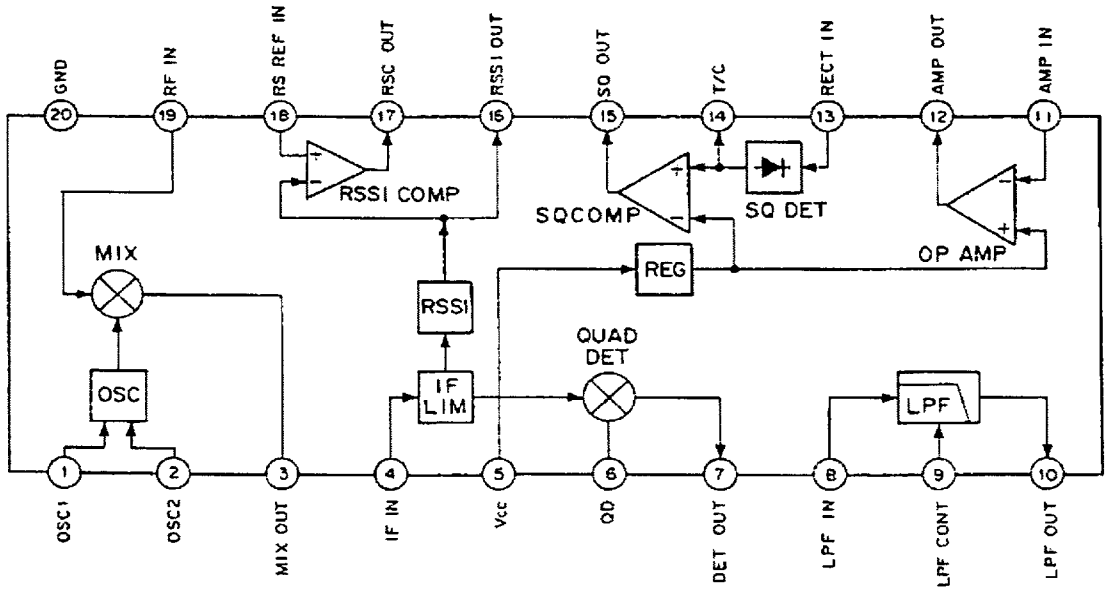
Absolute Maximum Ratings (Ta=25°C)

• Supply voltage	Vcc	7	V
• Operating temperature	Topr	−20 to +75	°C
• Storage temperature	Tstg	−65 to +150	°C
• Allowable power dissipation	PD	500	mW

Operating Condition (Ta=25°C)

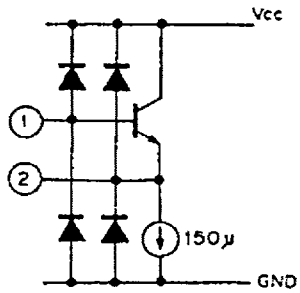
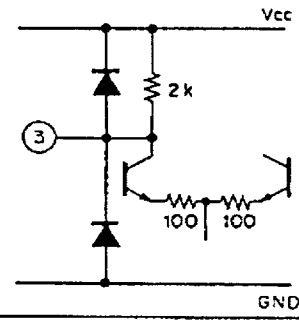
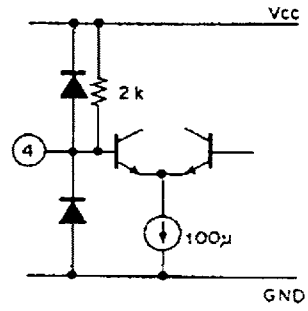
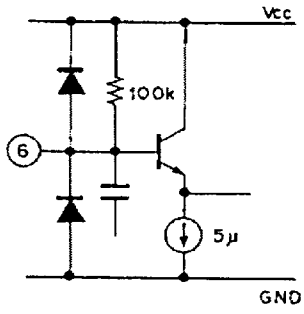
Supply voltage	Vcc	1.8 to 6.0	V

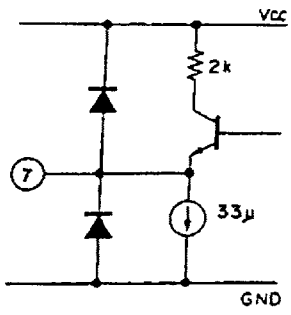
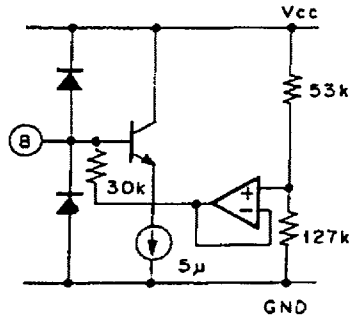
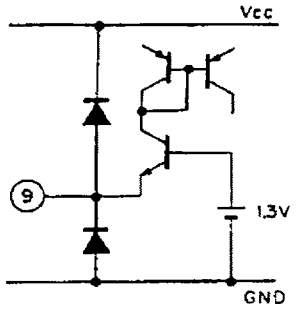
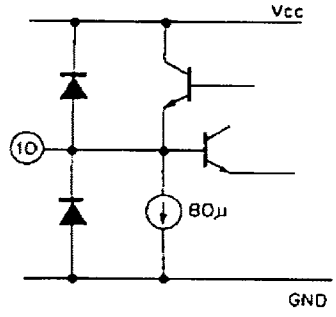
Block Diagram and Pin Configuration (Top View)

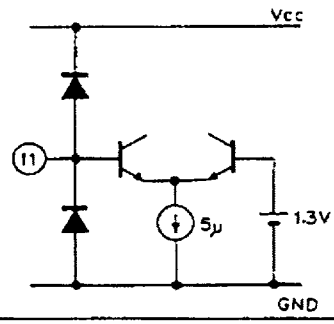
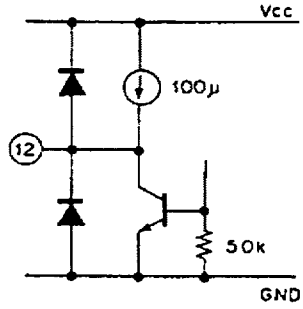
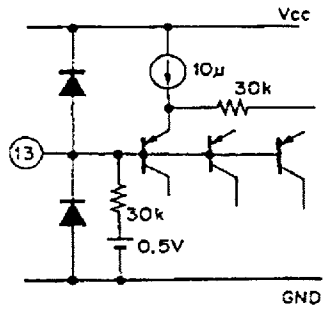
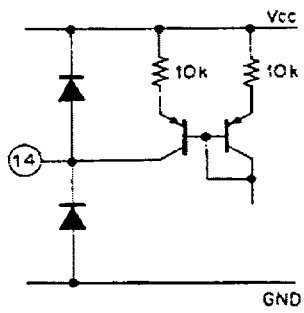


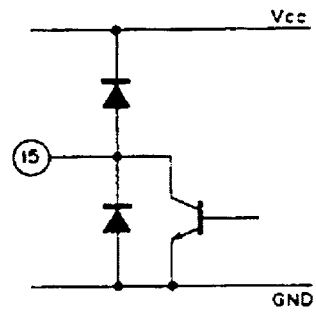
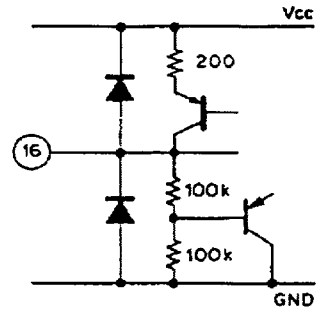
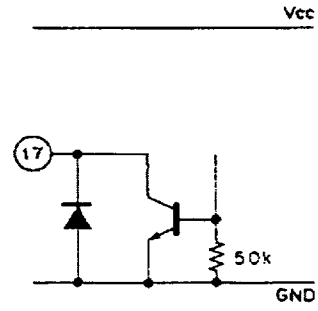
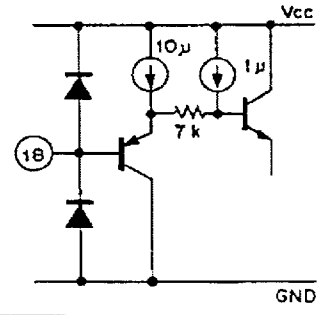
E92701 – ST

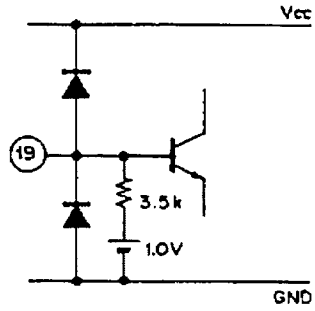
Pin Description

Pin No.	Symbol	Typical pin voltage DC	Typical pin voltage AC	I/O resistance	Equivalent circuit	Description
1	OSC1	1.7V	—	—		Connect to a crystal oscillator to form a Colpitts oscillation circuit. Input to Pin 1 when external oscillator is used.
2	OSC2	1.0V	—	—		
3	MIX OUT	2.1V	—	2kΩ		Mixer output pin.
4	IF IN	2.3V	—	2kΩ		Limiter input pin.
5	Vcc	2.3V	—	—	—	Vcc pin.
6	QD	2.3V	—	—		Connects to a resonance circuit for QUAD DET.

Pin No.	Symbol	Typical pin voltage DC	Typical pin voltage AC	I/O resistance	Equivalent circuit	Description
7	DET OUT	0.65V	—	—		Outputs FM detected signal.
8	LPF IN	1.6V	300mVp-p (max.)	—		Input pin for AF third-pole filter.
9	LPF CONT	—	—	—		Connects resistance that determines cut-off frequency of AF third-pole LPF.
10	LPF OUT	1.6V	400mVp-p (max.)	—		Output pin for AF third-pole LPF.

Pin No.	Symbol	Typical pin voltage DC	Typical pin voltage AC	I/O resistance	Equivalent circuit	Description
11	AMP IN	—	—	—		Operational amplifier input pin (negative)
12	AMP OUT	—	—	—		Operational amplifier output pin.
13	RECT IN	0.5V	400mVp-p (max.)	—		Squelch detection circuit input pin.
14	T/C	—	—	—		Sets the squelch circuit gain and time constant.

Pin No.	Symbol	Typical pin voltage DC	Typical pin voltage AC	I/O resistance	Equivalent circuit	Description
15	SQ OUT	—	—	—		Squelch comparator output pin.
16	RSSI OUT	—	—	—		RSSI output pin.
17	RSC OUT	—	—	—		RSSI comparator output pin.
18	RSREF IN	—	—	—		Reference voltage input pin for RSSI comparator.

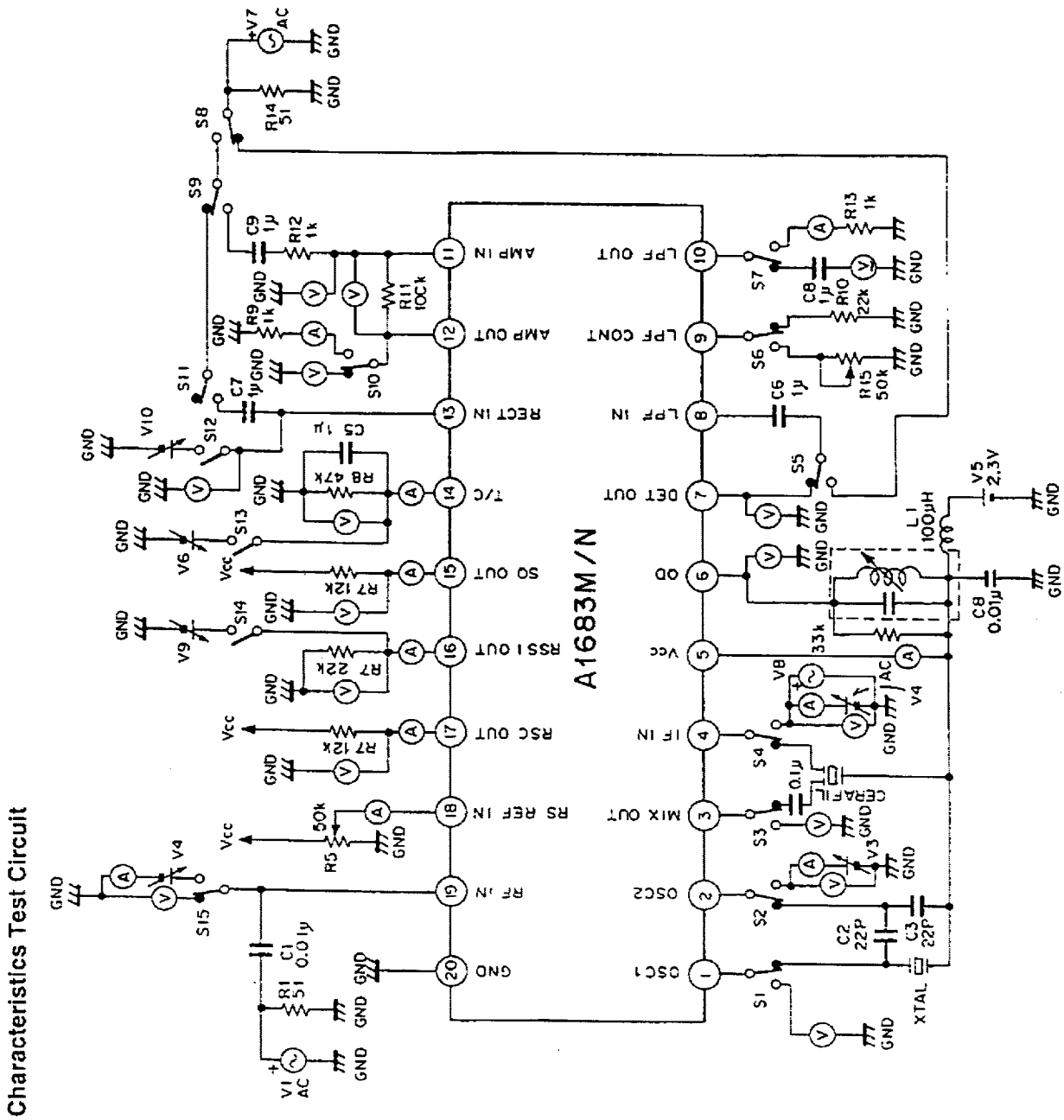
Pin No.	Symbol	Typical pin voltage		I/O resistance	Equivalent circuit	Description
		DC	AC			
19	RF IN	1.0V	—	3.5kΩ		Input pin to mixer.
20	GND	0V	—	—	—	GND pin.

Electrical Characteristics

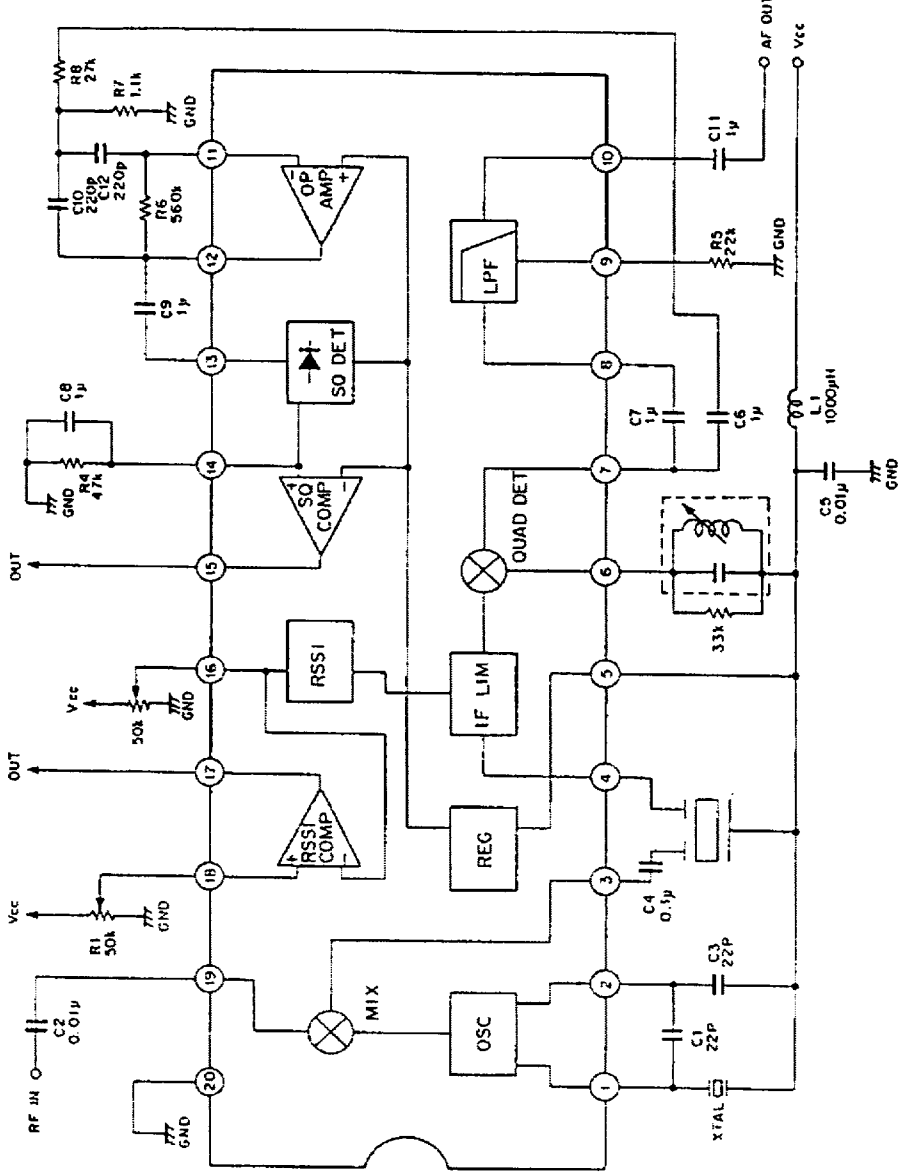
(V_{CC}=2.3V, f_C=21.7MHz, f_{MOD}=1kHz, f_{DEV}=1.7kHz, AM_{MOD}=30%, Ta=25°C)

Item	Symbol	Measurement conditions	Min.	Typ.	Max.	Unit
Current consumption	I_{CC}	V_{IN}=0		4.0	5.0	mA
Mixer gain	$G_{V\ (MIX)}$	R_L=2kΩ	7.5	10	13	dB
Mixer input resistance	$R_{IN\ (MIX)}$		2.4	3.5	4.7	kΩ
Limiting sensitivity	$V_{IL\ (MIX)}$			10		dBμ
IF AMP input resistance	$R_{IN\ (IF)}$		1.45	2.0	2.4	kΩ
Detection output voltage	$V_{O\ (AF)}$		55	80	105	mVrms
Detection output current	$I_{O\ (AF)}$		50			μA
S/N ratio	S/N	V_{IN}=–20dBm	43	54		dB
Total higher harmonic distortion	THD			1	3.0	%
AM rejection ratio	AMRR	V_{IN}=–40dBm	34			dB
RSSI output voltage	V_{RSSI1}	$V_{IN\ (IF)}$=–90dBm		90		mV
	V_{RSSI2}	$V_{IN\ (IF)}$=–50dBm		490		mV
	V_{RSSI3}	$V_{IN\ (IF)}$=–20dBm		830		mV
RSSI dynamic range	D_{RSSI}			70		dB
Variable range of LPF cut-off frequency	$F_{C2\ (LPF)}$		2.0		4.5	kHz
Precision of LPF cut-off frequency	$F_{C\ (LPF)}$		–12		12	%
Squelch output low level	$V_{OL\ (SQ)}$	I_O=0.2mA			0.3	V
RSSI COMP input bias current	$I_{B\ (RSSI)}$				0.3	μA

Electrical Characteristics Test Circuit



Application Circuit



Application circuits shown are typical examples illustrating the operation of the devices. Sony cannot assume responsibility for any problems arising out of the use of these circuits or for any infringement of third party patent and other right due to same.

Description of Operation

The FM RF signal input to Pin 19, is combined with the oscillator output and frequency modulated to an IF of 455kHz at the mixer. The IF signal is output from Pin 3, passes through a 455kHz ceramic filter and is input to an IF limiter amplifier through Pin 4. The limiter amplifier, having a gain of approximately 100dB, performs amplitude limiting on the input signal and inputs it to the detector (QUAD DET).
The detector performs frequency and amplitude conversion on this signal by combining it with a signal that has been phase-shifted by approximately 90 degrees to obtain an audio signal. This signal then passes through a 100kHz cut-off LPF, and is output to Pin 7. After the output from Pin 7 passes through DC, it passes through a third-pole LPF and is output from Pin 10. The cut-off frequency of this filter is approximately 3kHz, and can be varied according to the resistance attached to Pin 9.
The output from Pin 7 is also input to a squelch circuit on a separate line. (The squelch circuit is designed to cut the audio output through detection of a degraded S/N ratio. When the performance of the limiter deteriorates and the AM component of the signal increases for weak electric field. In addition, this circuit can be used to determine the signal strength as well.) The output from Pin 7 passes though a band-pass filter to obtain a noise output, and is output to the squelch detector circuit at Pin 13 (SQ DET). For the squelch circuit, use a band-pass filter with a center frequency of roughly 30kHz and a gain of approximately 20dB.
Full-wave rectification is performed by the squelch detector circuit, and the output is connected to the squelch comparator (SQ COMP). The output from Pin 16 is matched to the input level of RFIN (Pin 19) by the RSSI output to vary the DC voltage. (RSSI detects the input signal level.) The voltage from RSSI passes through the comparator (RSSI COMP) and is output to Pin 17. The reference voltage for the comparator is applied to Pin 18.

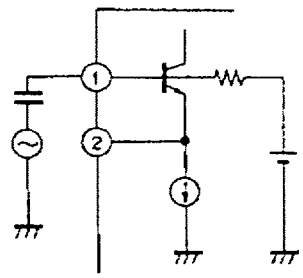
Notes on Operation

The CXA1683M/N handles high-frequency signals. In addition, the voltage gain of the IF amplifier is very high, reaching approximately 100dB. So, the following precautions listed below.

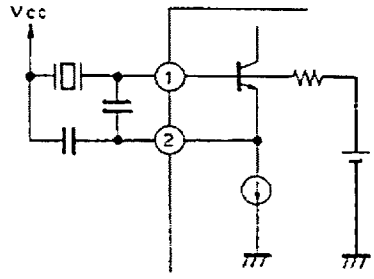
1. Use as wide pattern as possible on the power supply (Pin 5) and the GND (Pin 20), and insert a by-pass capacitor.
2. Separate the input and output lines as much as possible, and wire them as short as possible.
3. Make the impedance of the GND pattern as low as possible.

Application Note

1) Oscillator
The figures below show how to use the CXA1683M/N oscillator.



(a) Inputting a local oscillation signal from an external circuit.



(b) Configuring a Colpitts oscillation circuit.

2) Mixer

The CXA1683M/N mixer is of double balanced type. Its input is at Pin 19. Input through a suitable matching circuit. Make the input impedance 3.5kΩ . The mixer output is at Pin 3 and 2kΩ load resistance is built in.

3) IF Limiter

The IF limiter of this IC has a gain of approximately 100dB. So that, observe the following points regarding the wiring to the IF limiter input pin (Pin 4), the QD pin (Pin 6) and the DET OUT pin (Pin 7).

a) Make the wires to the mixer output (Pin 3) and the IF limiter input (Pin 4) as short as possible, and separate the two of them as much as possible.

b) Make the wire to the RLC or the ceramic discriminator as short as possible to minimize the interference on the mixer output and the IF limiter input because the IF limiter output appears on QD (Pin 6).

4) Detector

The detector is of quad latch type. An R-L-C resonance circuit or a ceramic discriminator circuit to shift the phase of the IF signal is connected to QD (Pin 6). The output of this detector passes through an LPF of approximately 100kHz and is output to DET OUT (Pin 7).

5) LPF

The LPF is a third-pole filter and cut-off frequency can be varied according to the resistance connected to LPF CONT (Pin 9).

6) Operational amplifier

The CXA1683M/N incorporate an operational amplifier for the squelch circuit. The operational amplifier positive input pin is connected to an internal 1.3V regulator. Let it have a gain when being used.

7) Squelch detector

The squelch detector is implemented with a full-wave rectifier circuit. Current is output to T/C (Pin 14). This output is also connected to the squelch comparator input as well. Connect C and R to Pin 14.

8) Squelch comparator

The input of this comparator is connected to the output of the just mentioned squelch detector. The output of Pin 15 is an open collector.

9) RSSI

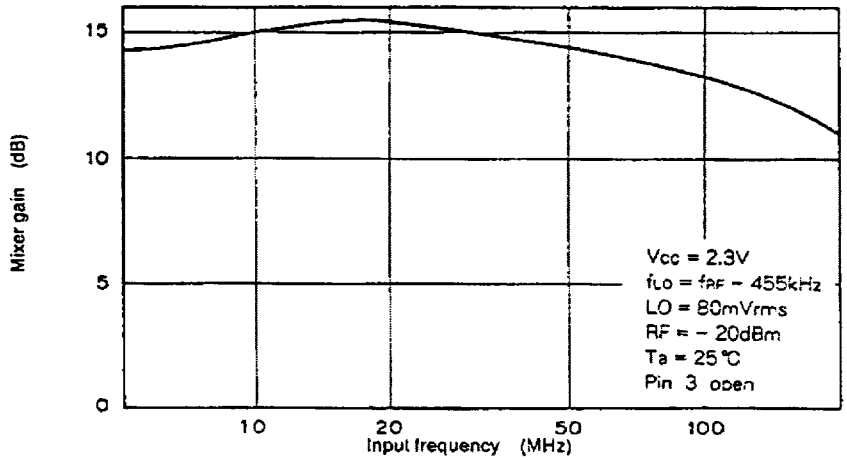
RSSI is the current output pin. Voltage conversion is performed via an external resistance.

10) RSSI comparator

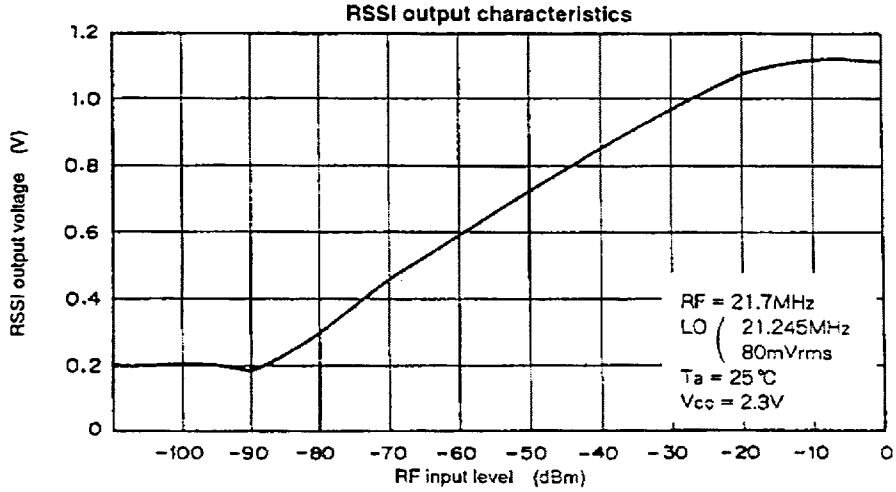
The RSSI comparator input is connected to Pin 16. A reference voltage is applied to Pin 18. The comparator operates by dividing the input voltage in half with an internal resistance and comparing it to the reference voltage.

Example of Representative Characteristics

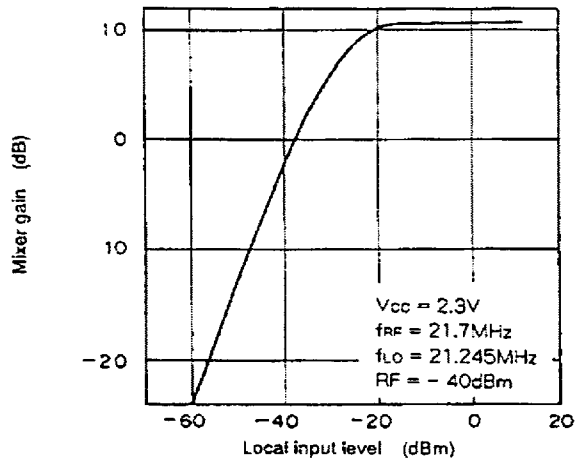
Mixer gain



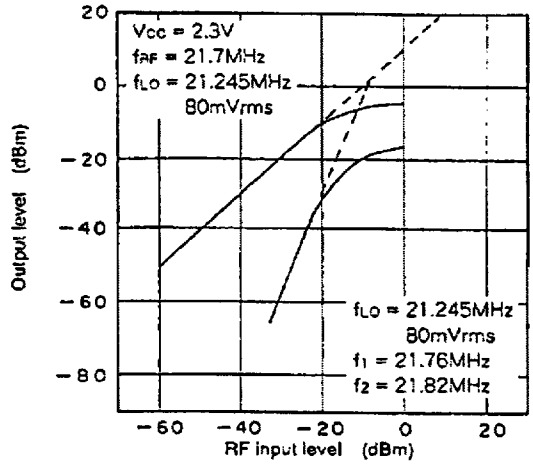
RSSI output characteristics



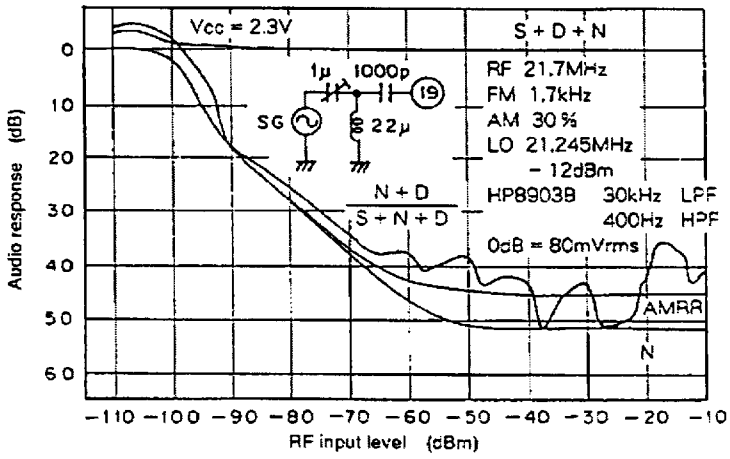
Local input vs. Mixer gain



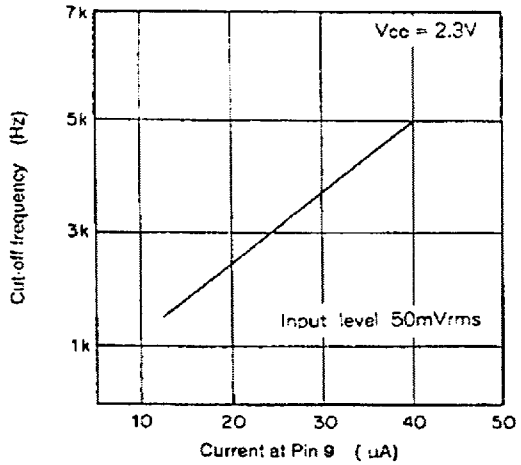
Mixer I/O characteristics and third-stage intercept point



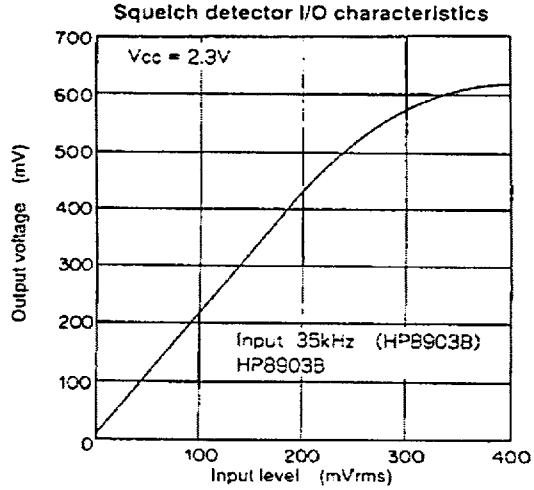
LPF OUT output characteristics



LPF cut-off control characteristics



Squelch detector I/O characteristics

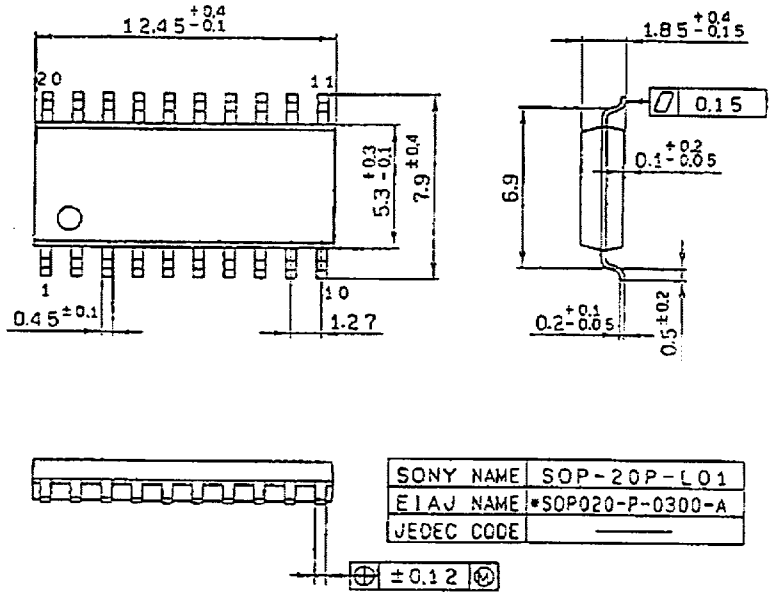


Package Outline

Unit : mm

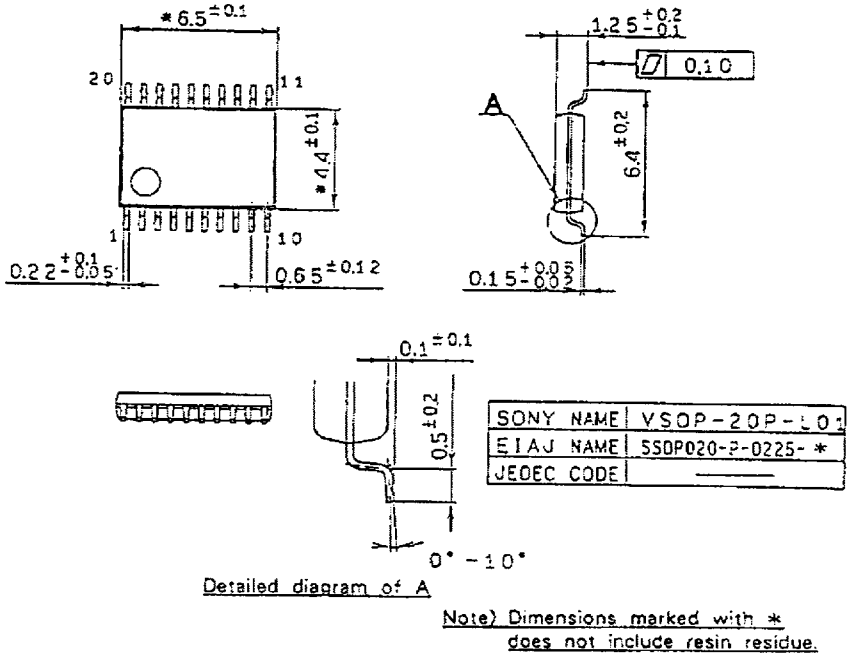
CXA1683M

20pin SOP (Plastic) 300mil 0.3g



CXA1683N

20pin VSOP (Plastic) 225mil



Detailed diagram of A

Note) Dimensions marked with * does not include resin residue.