

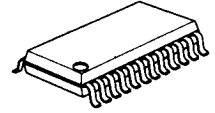
## FM IF WITH LOG AMPLIFIER

### ■ GENERAL DESCRIPTION

The **NJM2232A** is high precision FM IF IC with log amplifier, designed to be used for handy type wireless apparatus.

The **NJM2232A** includes in one chip of IC, at each block, the mixer, local oscillator, limiter amplifier, log amplifier, FM detector, and so on, with which set up the IF block of handy type wireless apparatus that requires high precision electronic detection.

### ■ PACKAGE OUTLINE



**NJM2232AM**

### ■ FEATURES

- RSSI features are excellent
  - Linearity  $\pm 1\text{dB}$
  - Dynamic Range 90dB
  - Temperature  $\pm 2\text{dB}$
- Low power dissipation ( $V_{CC}=6\text{V}$ ) 5.2mA typ.
- Operating voltage 5 to 9V
- Package Outline DMP24
- Bipolar Technology

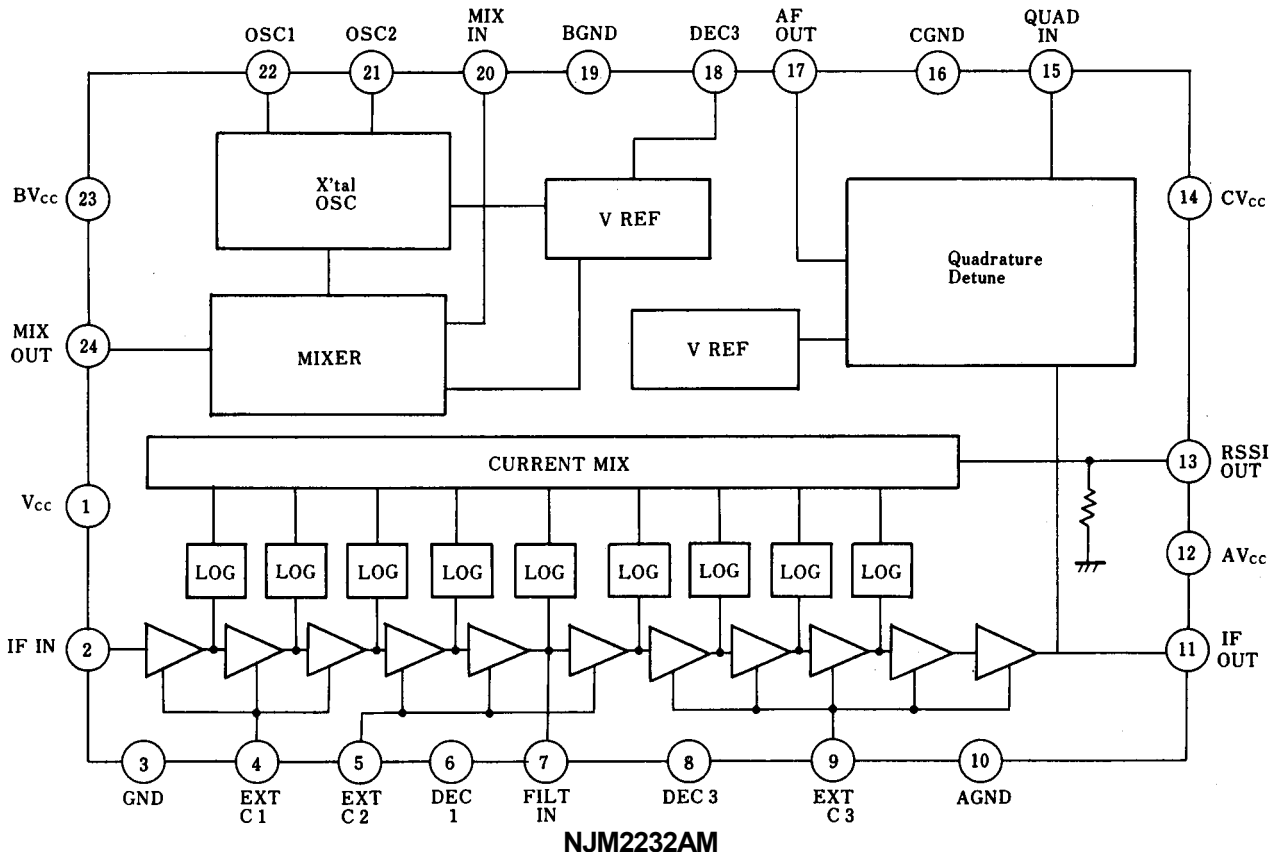
### ■ RECOMMENDED OPERATIONAL CONDITION

- Operating Voltage  $V^+$  5.0 to 9.0V

### ■ APPLICATION

- Automobile telephone
- Codeless telephone
- MCA
- Celler Radio
- Business Wireless apparatus
- Various measuring units

### ■ BLOCK DIAGRAM



# NJM2232A

## ■ TERMINAL EXPLANATION

PIN	SYMBOL	Function
1	V <sub>CC</sub>	Supply Voltage Input of IF-AMP 1, RSSI and Reference
2	IF IN	IF-AMP1 ( Limitter Amp.) Signal Input
3	GND	Ground of IF-AMP 1, RSSI and Reference
4	EXT. C1	Capacitor Connection Terminal 1 (Limitter Amp. AC Decoupling)
5	EXT. C2	Capacitor Connection Terminal 2 (Limitter Amp. AC Decoupling)
6	DEC 1	Reference Decoupling Capacitor 1
7	FILT IN	Filter Input between IF-AMP 1 and IF-AMP 2
8	DEC 2	Reference Decoupling Capacitor 2
9	EXT.C3	Capacitor Connection Terminal 3 (Limitter Amp. AC Decoupling)
10	AGND	Ground of IF-AMP 2, and RSSI
11	IF OUT	IF-AMP 2 (Limitter Amp.) Signal Output
12	AV <sub>CC</sub>	Supply Voltage Input of IF-AMP 2 and RSSI
13	RSSI	RSSI Input
14	CV <sub>CC</sub>	FM-DISCRI Supply Voltage Input
15	QUAD IN	Quadrature Detector Input
16	CGND	FM-DISCRI Ground
17	AF OUT	Audio Signal Output
18	DEC 3	Reference Decoupling Capacitor 3
19	BGND	Mixer Ground
20	MIX IN	Mixer Signal Input
21	OSC 2	Crystal Oscillator Terminal 2
22	OSC 1	Crystal Oscillator Terminal 1
23	BV <sub>CC</sub>	Mixer Supply Voltage Input
24	MIX OUT	Mixer Signal Output

## ■ ABSOLUTE MAXIMUM RATINGS

(T<sub>a</sub>=25°C)

PARAMETER	SYMBOL	RATINGS	UNIT
Supply Voltage	V <sup>+</sup>	12	V
Power Dissipation	P <sub>D</sub>	700	mW
Operating Temperature Range	T <sub>opr</sub>	-20 to +75	°C
Storage Temperature Range	T <sub>stg</sub>	-40 to +125	°C

## ■ ELECTRICAL CHARACTERISTICS

(V<sup>+</sup>=6V, T<sub>a</sub>=25°C±2°C)

PARAMETER	SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Operating Current	I <sub>CC</sub>	11, 21, 22pin, no loading	-	5.2	8.5	mA
Mixer Voltage Gain	G <sub>MIX</sub>	f <sub>IN</sub> =90MHz, -40dBm	18	20	22	dB
RSSI Output Voltage (1)	V <sub>L1</sub>	f <sub>IN</sub> =455kHz, -90dBm	0.135	-	0.405	V
RSSI Output Voltage (2)	V <sub>L2</sub>	f <sub>IN</sub> =455kHz, -80dBm	0.41	-	0.71	V
RSSI Output Voltage (3)	V <sub>L3</sub>	f <sub>IN</sub> =455kHz, 0dBm	2.56	-	2.94	V
RSSI Linearity	V <sub>LIN</sub>	(Note 1)	-1	0	1	dB
RSSI Dynamic Range	DR	(Note 1)	90	-	-	dB
IF Output Voltage	V <sub>IF</sub>	f <sub>IN</sub> =455kHz, -50dBm	1.2	1.4	1.6	V
Audio Output Voltage	V <sub>OUT</sub>	Standard Modulation Signal (Note 2)	150	200	250	mV
Total Harmonic Distortion	THD	Standard Modulation Signal (Note 2)	-	-	1	%
S / N Ratio	S / N	Standard Modulation Signal (Note 2)	40	-	-	dB
AMRR	AMR	Standard Modulation Signal (Note 3)	30	-	-	dB

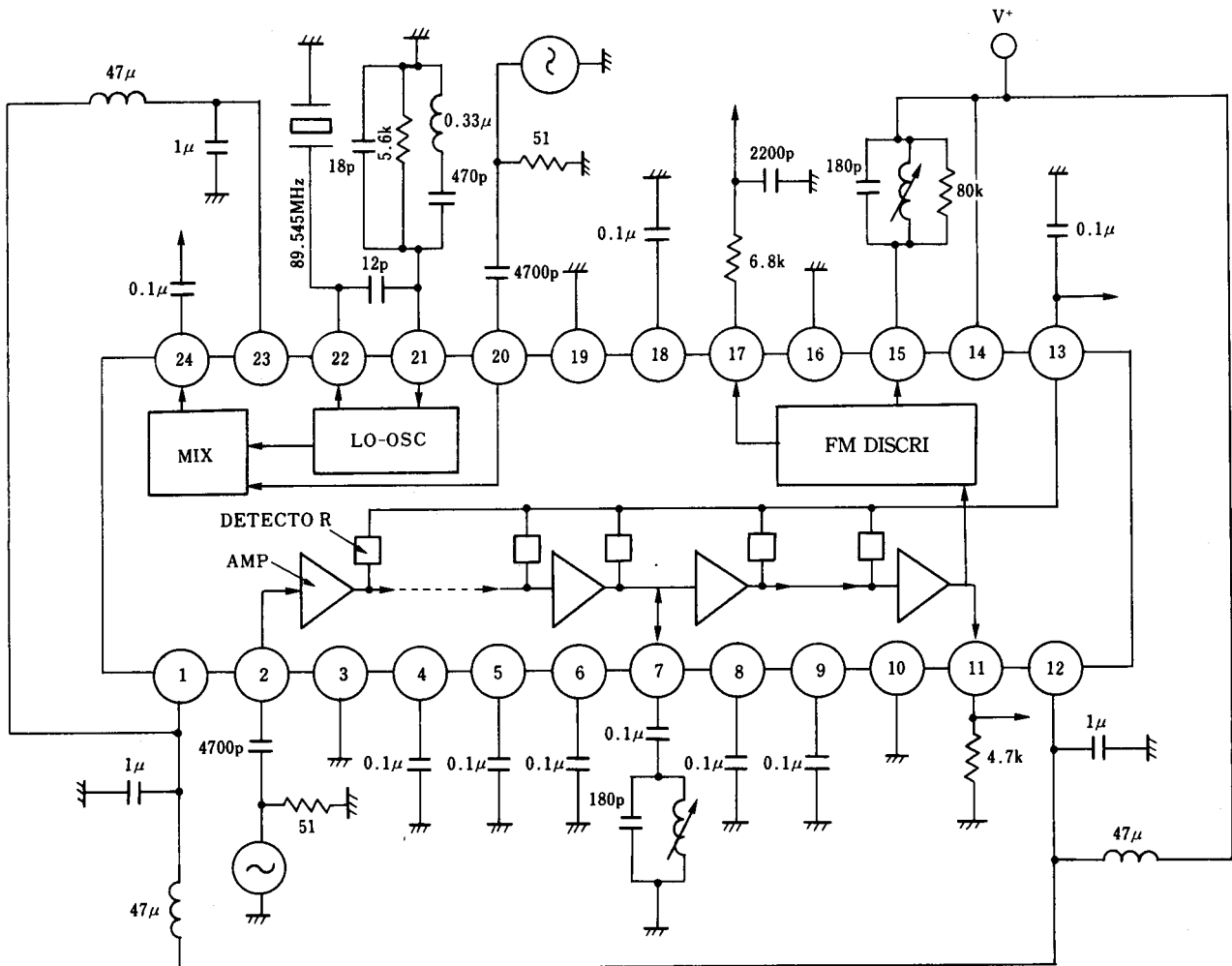
(Note 1) RSSI Linearity has 10 measuring points (-90, -80 to 0dBm) from where getting the ideal linearity by way of mini square method, and that each 10 measured spots should stay on within the range of ±1dB that can be obtained during the process of the measurement.

Also in the process of the measurement, RSSI dynamic range 90dB can be obtained at the same time.

(Note 2) f<sub>IN</sub>=455kHz, -20dBm, f<sub>MOD</sub>=1kHz, f<sub>DEV</sub>=3kHz

(Note 3) f<sub>IN</sub>=455kHz, -20dBm, f<sub>MOD</sub>=1kHz, AM 30%MOD

## ■ TEST CIRCUIT



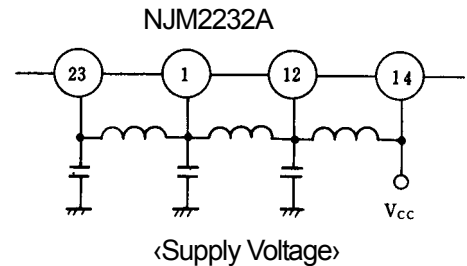
Adjustable Coil:L-5K4-R(Mitsumi)

# NJM2232A

## ■ TERMINAL EXPLANATION

### (1) Supply Voltage

The supply voltage is to be delivered at each block, such as limiter Amplifier block ((1), (12) pin), Mixer block (23) pin, FM Discrimination block (14) pin and so on. When applying the voltage, proceed it supplying from the latter block to front in order of the block structure. When the mixer block and FM block are not required the IC is not operation, no functioning as long as the power supply is off.



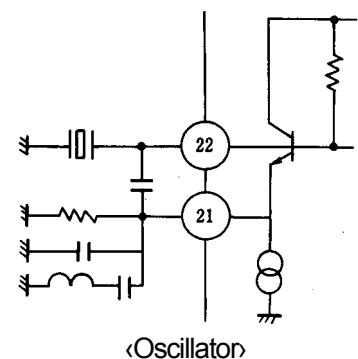
### (2) Mixer Input

Mixer input impedance (20) pin is designed to be set at 1.5kΩ (standard) on voltage. It is advisable to input after DC cutting for desired matched circuit.

### (3) Oscillator

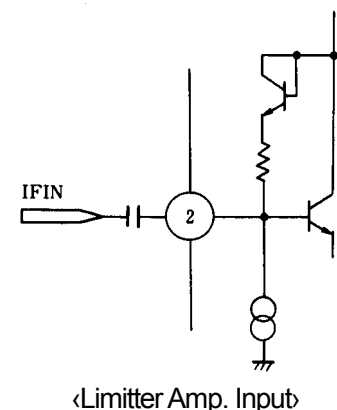
As far as the local oscillator input goes, there are 2 methods as shown below.

1. Input after setting the crystal oscillating circuit, on (21), (22) pins.
2. Connect (21) pin directly on supply voltage, and then input the external local oscillator output directly to pin 22.



### (4) Filter (to be used between Mixer and Limiter Amp.)

Mixer output impedance (24) pin is 2kΩ (standard), Limiter Amp. Impedance (2) pin is 18kΩ (standard) are desired. Input harmonizing to the filter to be used for adequate matched circuit.



### (5) Limiter Amp. Input

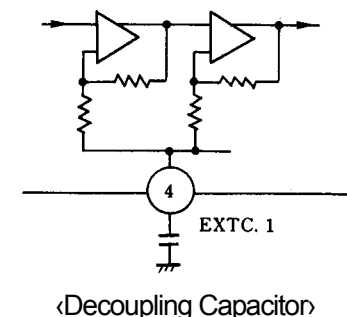
Limiter amp. impedance is designed to be 18kΩ (standard). Be sure to input after DC cutting.

### (6) Decoupling Capacitance

(4), (5), (9) pins capacitor are AC decoupling capacitor, Which are set as a part of amplifier feed back circuit of Limmitter amp. block. Please apply about 0.1μF capacitance.

### (7) Reference Capacitor

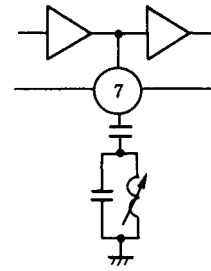
(6), (8), (18) pins capacitor are AC decoupling capacitor which are to be connected to the internal reference. Please apply 0.1μF capacitance.



(8) Limitter Amp. Inter Section Filter

The limitter amp, the inter section filter is composed of the resonator applied with the tuning coil as in the drawing.

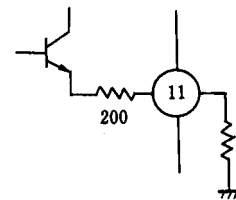
Upon designing the RSSI linearity, it is advisable to apply the resonator coil with no loading  $Q=55$ ,  $L=680\mu\text{H}$  condition, and so proceed DC cutting before the coil.



⟨Inter Section Filter⟩

(9) Limitter Amplifier

As shown in the drawing, the limitter amp. is the open emitter, and the limitter amp. output can be obtained by putting adequate resistor to pin (11).

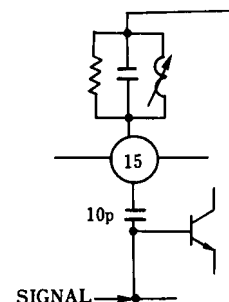


⟨Limitter Amp. Output⟩

(10) Quadrature Detecting phase Shifter

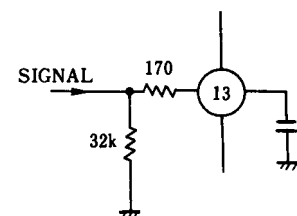
In order to detect quadrature, input the signal that has shifted the phase for 90 degree from pin (15) to RLC paralleled resonator.

The resistor value should be decided to obtain the desired audio output.



⟨Phase Shifter⟩

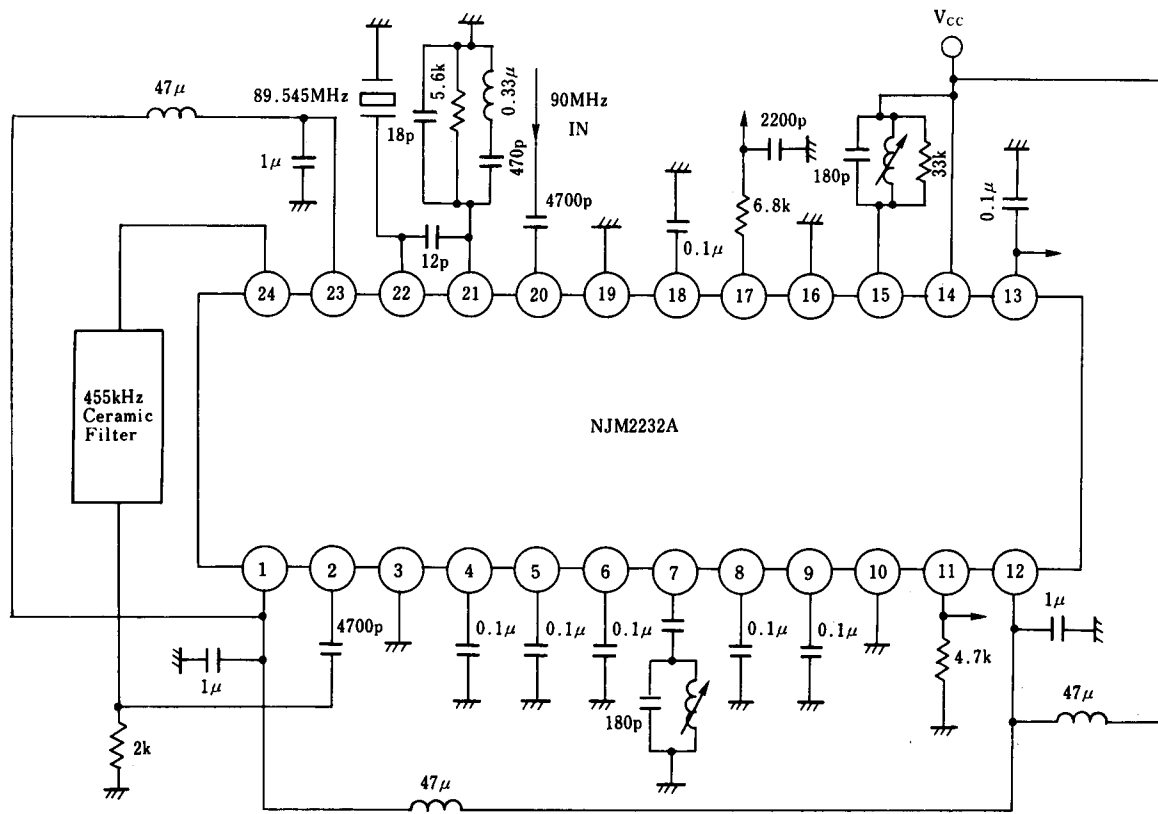
(11) RSSI detecting current shall be shifted from current into voltage by the internal resistor  $32\text{k}\Omega$ , And at the same time, please put the external capacitor value to be able to stay constantly for the desired time.



⟨RSSI Output⟩

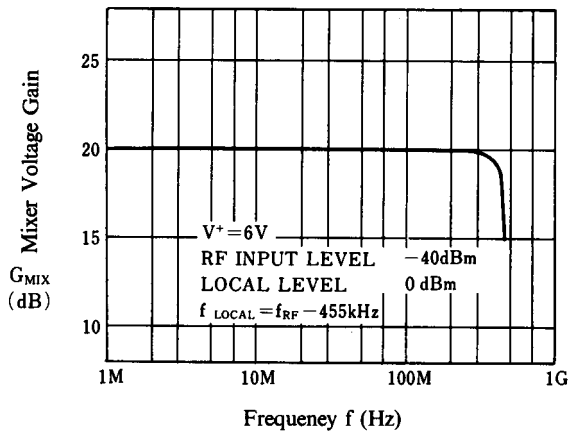
# NJM2232A

## ■ TYPICAL APPLICATION

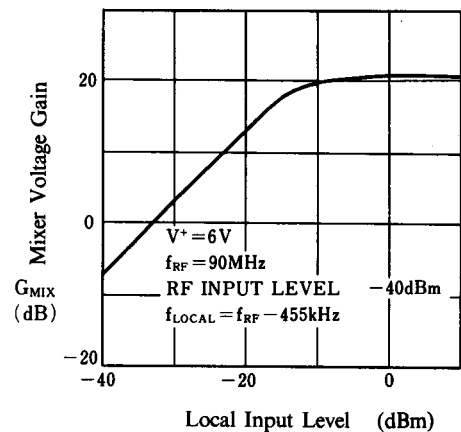


## ■ TYPICAL CHARACTERISTICS

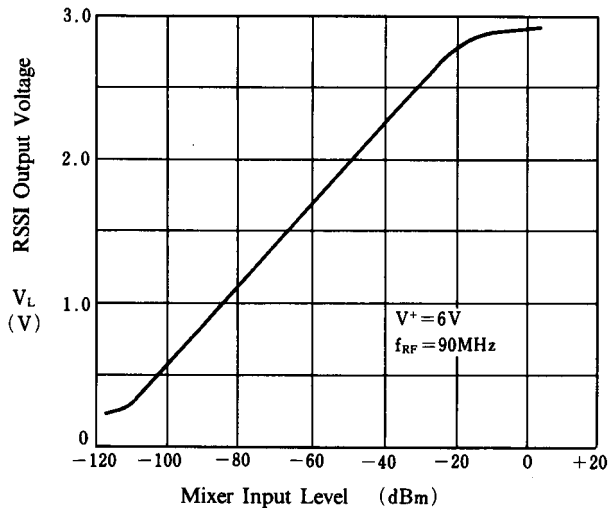
### Mixer Voltage Gain vs. Frequency



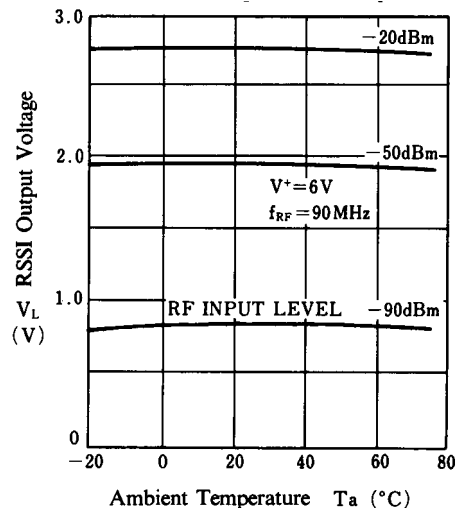
### Mixer Voltage Gain vs. Local Input Level



### RSSI Characteristics vs. Mixer Input



### RSSI Output Voltage vs. Temperature



**[CAUTION]**

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