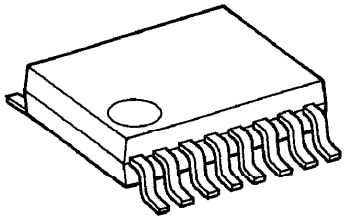
TOSHIBA BIPOLAR LINEAR INTEGRATED CIRCUIT SILICON MONOLITHIC

T A 3 1 1 6 1 F N G

WIDE-BAND IF DETECTOR IC WITH BUILT-IN HIGH-SPEED MIXER

A wide-band IF detector IC capable of operating at 10.7MHz and designed for the high-speed bit rates used in mobile communication and other systems. This IC is suitable for a receiver for digital mobile communication. High speed mixer, FM detector for 100kHz and high speed response RSSI function are built-in.



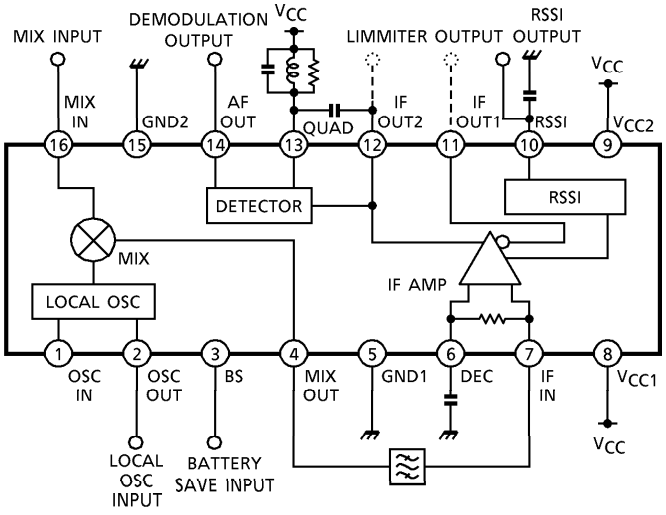
SSOP16-P-225-0.65B

Weight : 0.09g (Typ.)

FEATURES

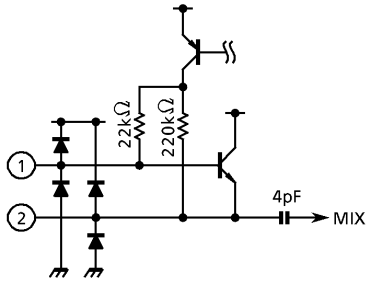
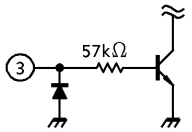
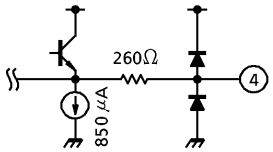
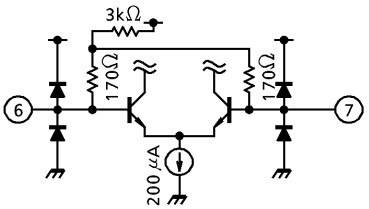
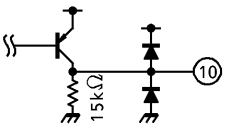
- MIX operating frequency : 40~300MHz
- 12dB sensitivity : 21dBμVEMF (input 50Ω)
- Current consumption : 5.5mA (Typ.)
- Operating voltage range : 2.3~5.5V
- Small package : SSOP24pin (0.65mm pitch)

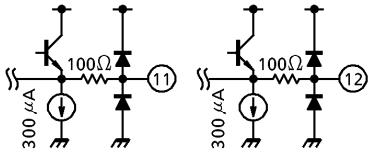
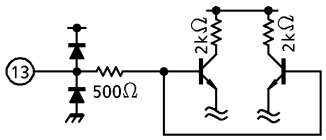
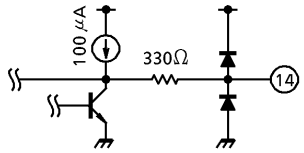
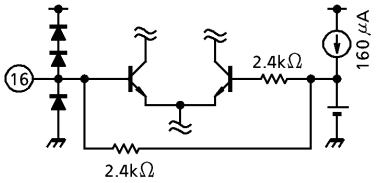
BLOCK DIAGRAM



TA31161FNG Package is Pb-Free.

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

PIN No.	PIN NAME	FUNCTION	EQUIVALENT INTERNAL CIRCUIT
1	OSC IN	LOCAL OSC input terminal. Can form an oscillator with an internal transistor and external crystal oscillator. Can also operate as a MIX using the signal input externally from Pin 1 or Pin 2.	
2	OSC OUT		
3	BS	Battery save terminal. Setting this terminal to low results in battery save state. Setting the terminal to high results in activate state.	
4	MIX OUT	MIX output terminal. Externally connects filters. Output impedance is around 330Ω.	
5	GND1	GND terminal	—
6	DEC	Bias terminal for IF input terminals. Connects external capacitor. The value of the capacitor should be sufficiently large at 10.7MHz.	
7	IF IN	IF input terminal. Connected after the filters.	
8	V_{CC1}	Power supply terminal. (MIX and part of IF)	—
9	V_{CC2}	Power supply terminal. (part of IF and detector)	—
10	RSSI	RSSI output terminal. Voltage output type.	

PIN No.	PIN NAME	FUNCTION	EQUIVALENT INTERNAL CIRCUIT
11	IF OUT1	IF limiter output terminal. Output of pin 11 and pin 12 is opposite phase.	
12	IF OUT2		
13	QUAD	Phase signal input terminal for FM DETECTOR.	
14	AF OUT	Modulation signal output terminal. Output impedance is around 360Ω.	
15	GND2	GND terminal	—
16	MIX IN	MIX input terminal. Double-balance MIX.	

1. LOCAL OSC External Injection Method

Inject as shown in Fig.1, setting the injection level between 95dBμV~100dBμV. A built-in buffer AMP. minimizes leakage from the mixer.
Input from pin 1 is possible ; however, when the input frequency is high, the level at pin 2 may not be sufficient, causing a decrease in sensitivity.
In such a case, add resistor R51 and set the input signal so that the signal at pin 2 is adequate.
Connect as in Fig.3 to use internal transistor for oscillation.
R51 is the resistor that determines the oscillation current.

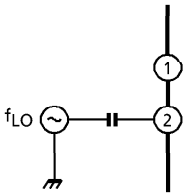


Fig.1

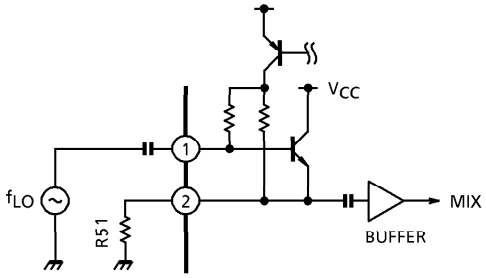


Fig.2

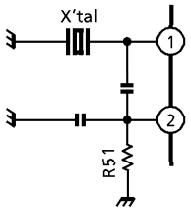


Fig.3

2. Overtone Oscillation

Fig.4 shows the basic configuration of the local oscillation circuit using overtone oscillation.
The C51 and L1 tuning circuits prevent crystal fundamental oscillation.
Therefore, set C51 and L1 to inductive at the fundamental frequency and capacitive at the overtone frequency.
Since the level at pin 2 may decrease and the sensitivity may fall at high frequency as with external injection, adjust the oscillation level using R51.
The internal emitter follower circuit can oscillate up to 100MHz.

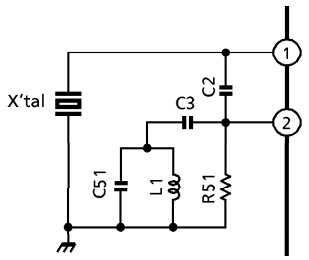


Fig.4

3. RSSI Function

The DC voltage output on RSSI varies according to the IF-IN input level. The DC voltage can be lowered by attaching an external resistor.
However, the range of input-output linear relationship cannot be extended.
If an external resistor is attached, the temperature characteristics of RSSI output may change due to the difference of temperature coefficient between the external resistor and the IC itself.

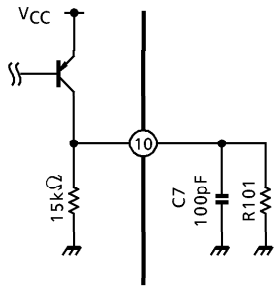
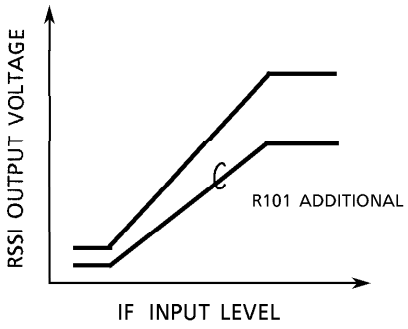


Fig.5



4. Disusing Pin Connection

In case of disusing MIX and LOCAL OSC, disusing pin connects as shown in Fig.6.
In case of disusing FM DETECTOR, disusing pin connects as shown in Fig.7.

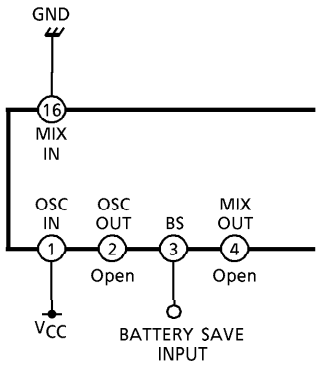


Fig.6

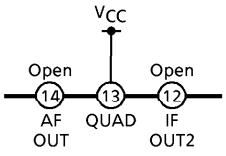


Fig.7

MAXIMUM RATINGS (Ta = 25°C)

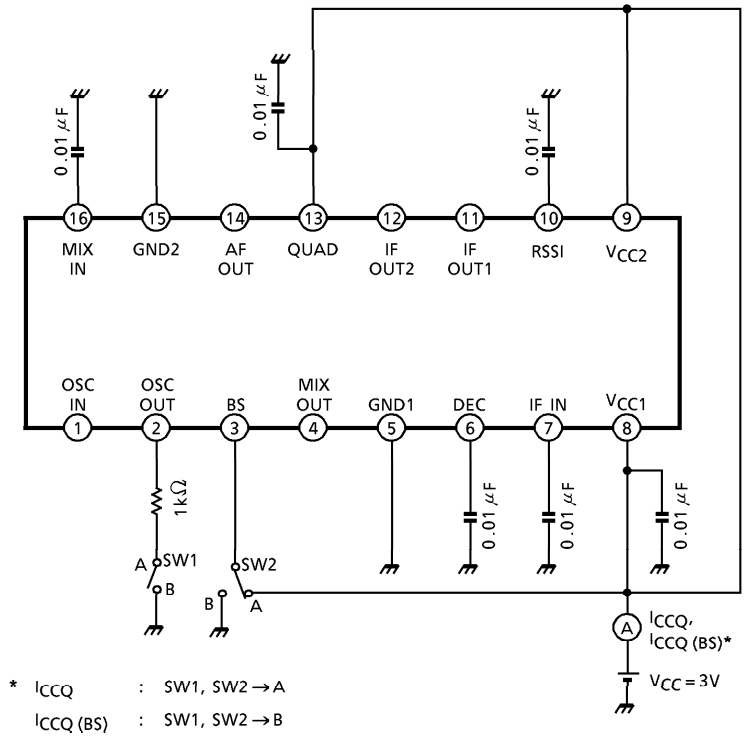
CHARACTERISTICS	SYMBOL	RATINGS	UNIT
Power Supply Voltage	V_{CC}	6	V
Power Dissipation	P_D	240	mW
Operating Temperature	T_{opr}	−35~85	°C
Storage Temperature	T_{stg}	−55~150	°C

ELECTRICAL CHARACTERISTICS (Unless otherwise specified V_{CC} = 3V、$f_{IN\ (MIX)}$ = 90.7MHz、$f_{IN\ (IF)}$ = 10.7MHz、f_{MOD} = 1kHz、Δf = ± 100kHz、Ta = 25°C)

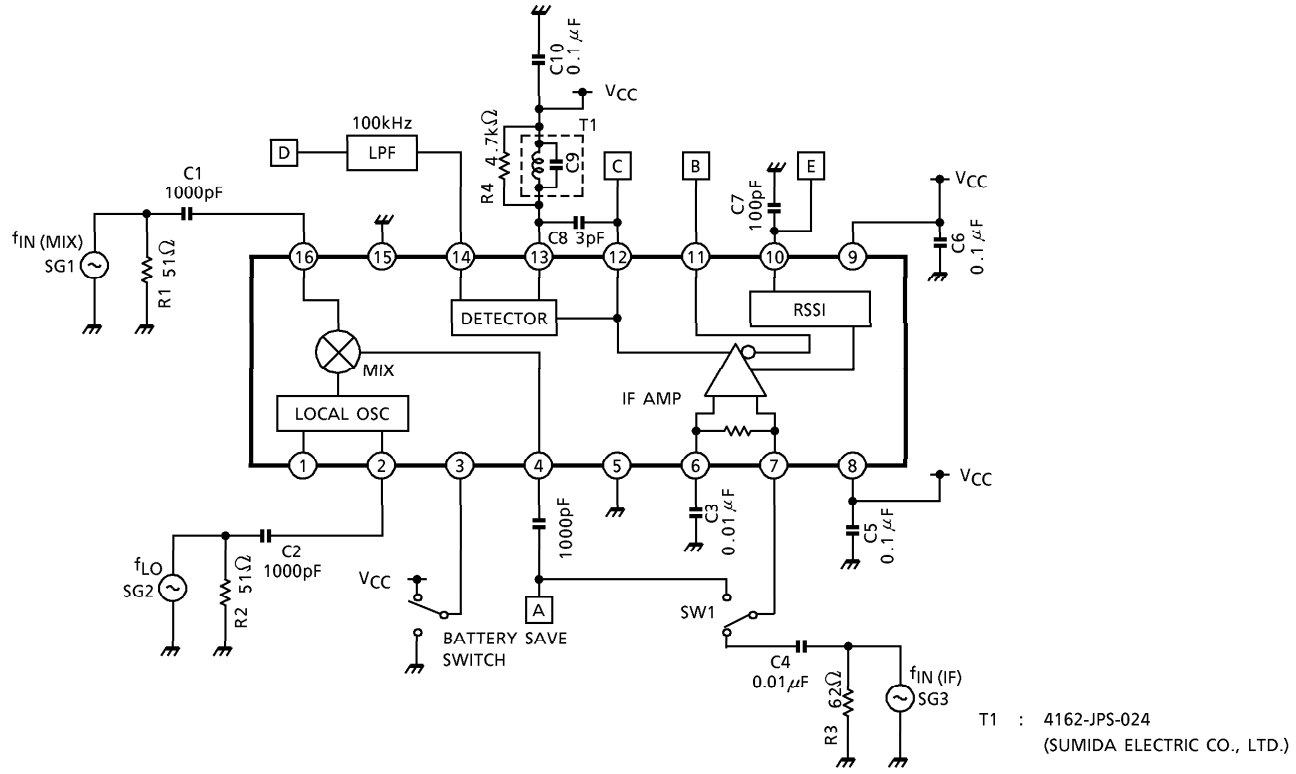
CHARACTERISTICS	SYMBOL	TEST CIR-CUIT	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Operating Voltage Range	$V_{CC\ opr}$	—	—	2.3	3	5.5	V
Current Consumption	I_{CCQ}	1	When local oscillation stopped	—	5.5	7.5	mA
Battery Save Current	$I_{CCQ\ (BS)}$	1	BS = "L"	—	0	10	μA
MIX Operating Frequency	f_{IN}	—	—	40	240	300	MHz
MIX Conversion Gain	G_{VC}	2	$V_{IN\ (MIX)}$ = 50dBμV	15	19	23	dB
MIX Intercept Point	P_{IM}	—	$V_{IN\ (MIX)}$ = 80dBμVEMF	—	95	—	dBμV
MIX Equivalent Input Resistance	$R_{IN\ (MIX)}$	—	—	—	1	—	kΩ
MIX Equivalent Input Capacitance	$C_{IN\ (MIX)}$	—	—	—	3	—	pF
MIX 1dB Compression Level	$D_{R\ (MIX)}$	—	MIX input level at G_{VC} 1dB down.	—	90	—	dBμV
MIX Output Resistance	$R_{O\ (MIX)}$	—	—	—	330	—	Ω
LOCAL OSC Operating Frequency	f_{LO}	—	—	40	—	100	MHz
Recommended Local Input Level	V_{LO}	—	—	—	100	—	dBμV
Local Equivalent Input Resistance	$R_{IN\ (LO)}$	—	—	—	1	—	kΩ
Local Equivalent Input Capacitance	$C_{IN\ (LO)}$	—	—	—	2.4	—	pF
IF Input Resistance Value	$R_{IN\ (IF)}$	—	—	—	330	—	Ω
IF AMP Gain	$G_{V\ (IF)}$	—	—	—	72	—	dB
IF Output Level	$V_{O\ (IF)}$	2	—	400	500	600	mV_{p-p}
RSSI Variation Width	$V_{D\ (RSSI)}$	—	—	—	70	—	dB
RSSI Output Resistance	$R_{(RSSI)}$	—	—	10.5	15	19.5	kΩ
RSSI Output Voltage	$V_{(RSSI)}$	2	V_{IN} = 70dBμV EMF, Non modulation	1.0	1.2	1.4	V

CHARACTERISTICS	SYMBOL	TEST CIR-CUIT	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
High Level Inupt Voltage	V_H	—	BS	2	—	V_{CC}	V
Low Level Input Voltage	V_L	—	BS	GND	—	0.2	
Demodulation Output Level	V_{OD}	2	—	150	200	260	mV_{rms}
Demodulation Frequency	f_{DET}	—	—	—	100	—	kHz
12dB Sensitivity	12dB SN	—	MIX INPUT	—	21	—	$dB\mu V$ EMF
SN Ratio	SN	—	MIX INPUT	—	55	—	dB
AM Rejection Ratio	AMR	—	MIX INPUT	—	40	—	dB

TEST CIRCUIT 1

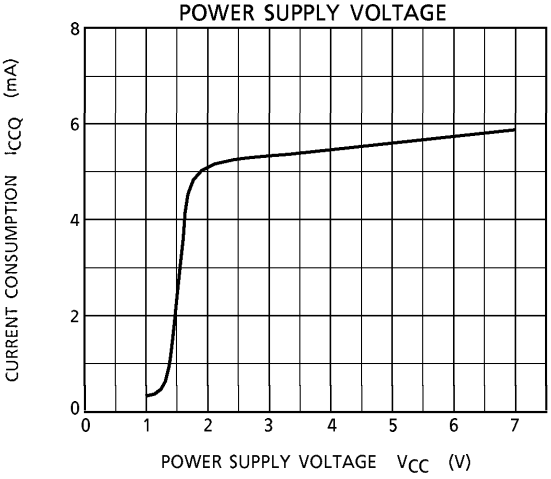


TEST CIRCUIT 2

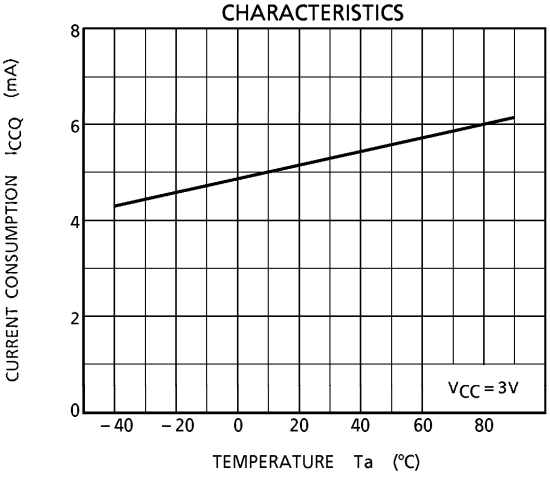


Test conditions for mixer conversion gain G_{VC}
SG1 $f_{IN\,(MIX)} = 90.7MHz$, $V_{IN\,(MIX)} = 50dB\mu V$ EMF
SG2 $f_{LO} = 80.0MHz$, $V_{LO} = 100dB\mu V$ EMF
G_{VC} = value at point [A] − 50dB
Test conditions for RSSI level output $V_{(RSSI)}$
SG3 $f_{IN\,(IF)} = 10.7MHz$, $V_{IN\,(IF)} = 70dB\mu V$ EMF
$V_{(RSSI)}$ = voltage at point [E]
Test conditions for IF output level V_O (IF)
SG3 $f_{IN\,(IF)} = 5MHz$, $V_{IN\,(IF)} = 80dB\mu V$ EMF
V_O (IF) = peak output level at point [B] or point [C]
Test conditions for detect output V_{OD}
SG3 $f_{IN\,(IF)} = 10.7MHz$, $\Delta f = \pm 100kHz$, $f_{MOD} = 1kHz$, $V_{IN\,(IF)} = 80dB\mu V$ EMF
V_{OD} = voltage at point [D]
When $V_{CC} = 3V$, battery save switch on V_{CC} side, SW1 on SG3 side
([A] side only when G_{VC} tested)

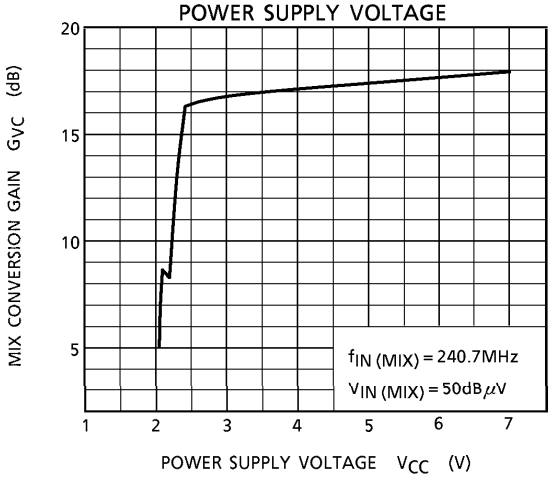
CURRENT CONSUMPTION – POWER SUPPLY VOLTAGE



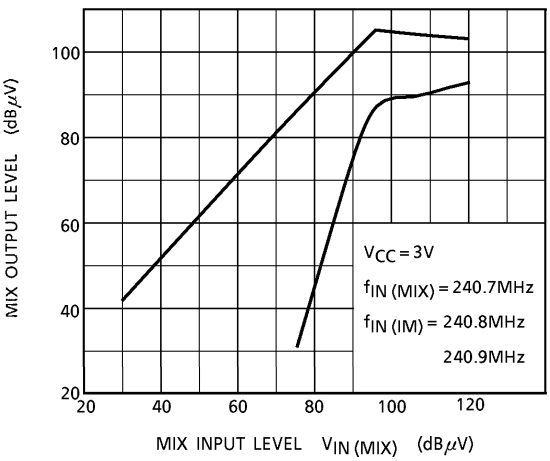
CURRENT CONSUMPTION TEMPERATURE CHARACTERISTICS



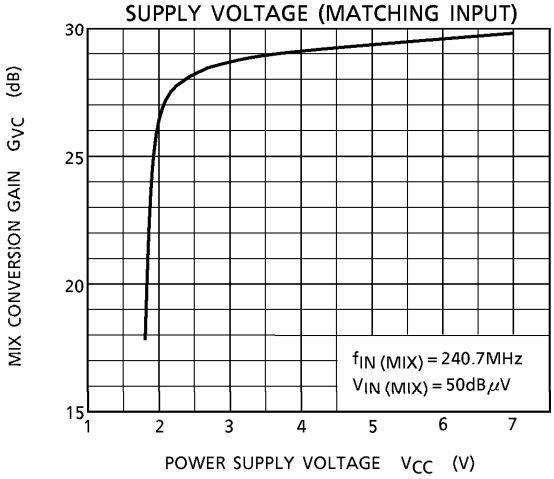
MIX CONVERSION GAIN – POWER SUPPLY VOLTAGE



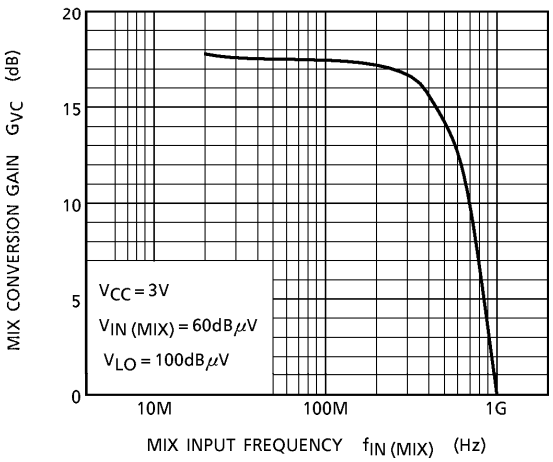
MIX INTERCEPT POINT CHARACTERISTICS



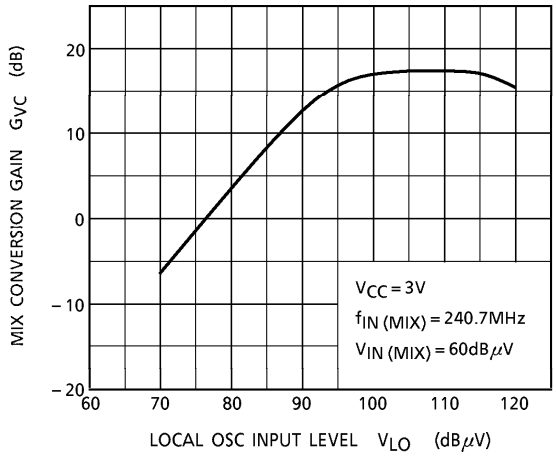
MIX CONVERSION GAIN – POWER SUPPLY VOLTAGE (MATCHING INPUT)



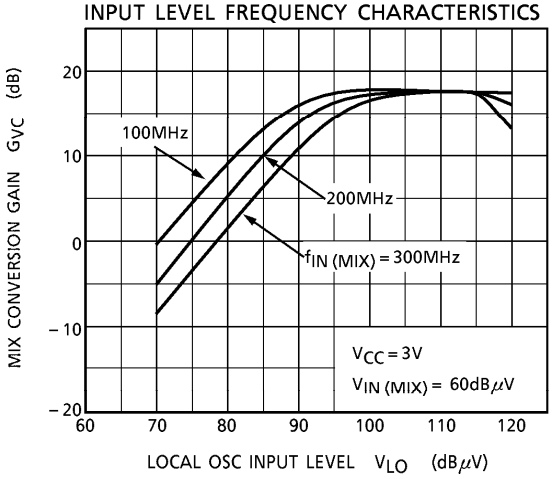
MIX FREQUENCY CHARACTERISTICS



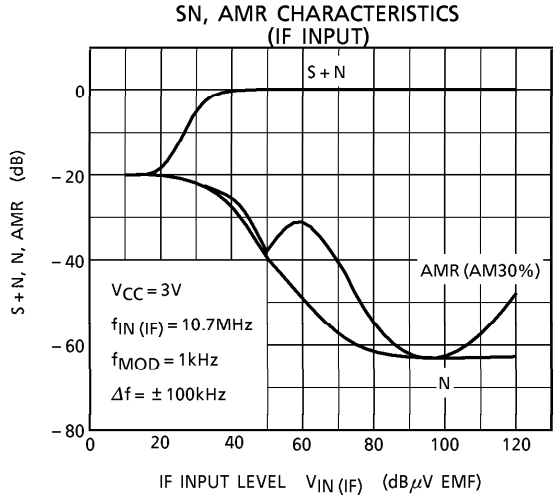
MIX CONVERSION GAIN – LOCAL OSC INPUT LEVEL



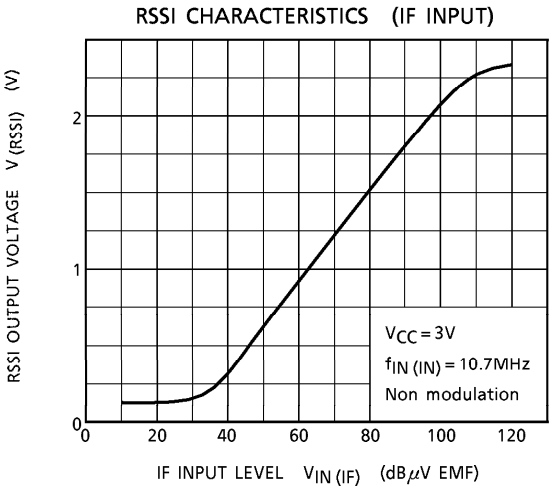
MIX CONVERSION GAIN – LOCAL OSC INPUT LEVEL FREQUENCY CHARACTERISTICS



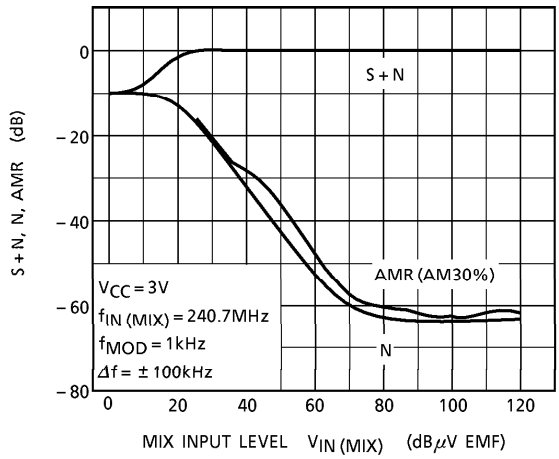
SN, AMR CHARACTERISTICS (IF INPUT)



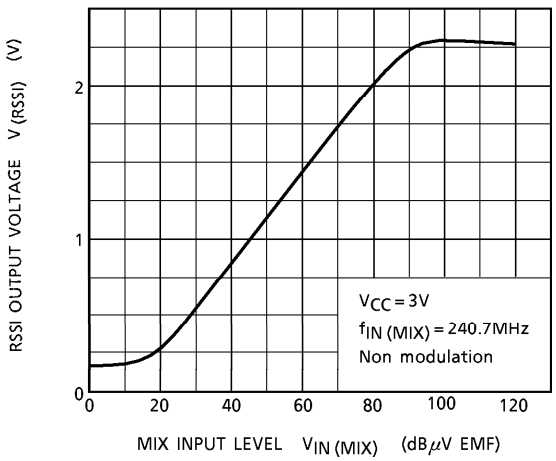
RSSI CHARACTERISTICS (IF INPUT)



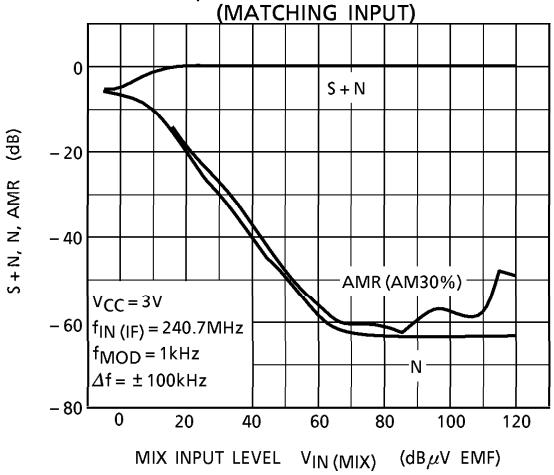
SN, AMR CHARACTERISTICS (MIX INPUT)



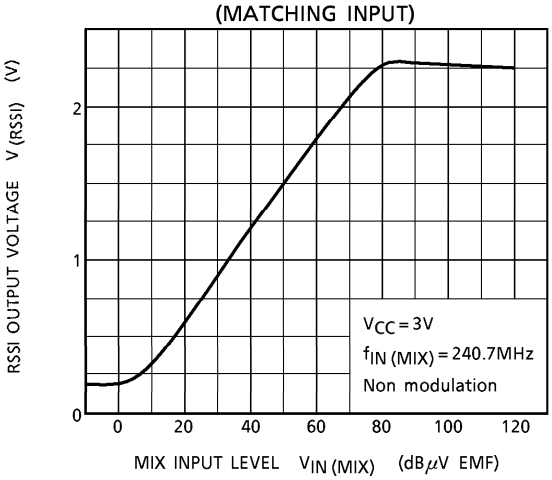
RSSI CHARACTERISTICS (MIX INPUT)



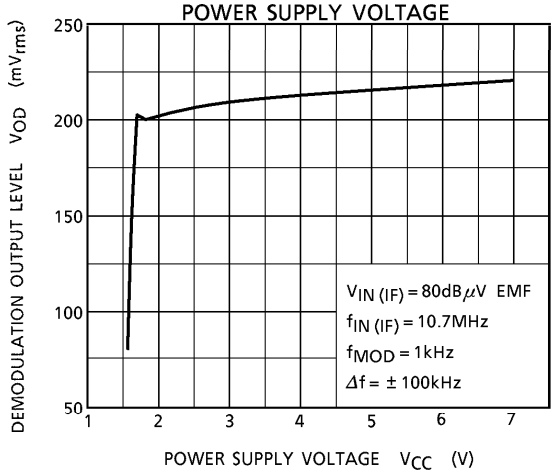
SN, AMR CHARACTERISTICS
(MATCHING INPUT)



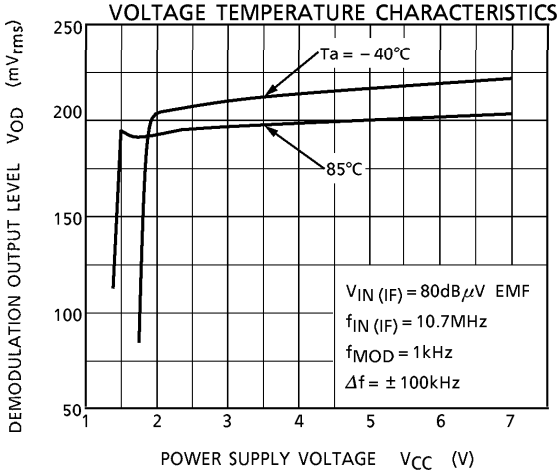
RSSI CHARACTERISTICS
(MATCHING INPUT)



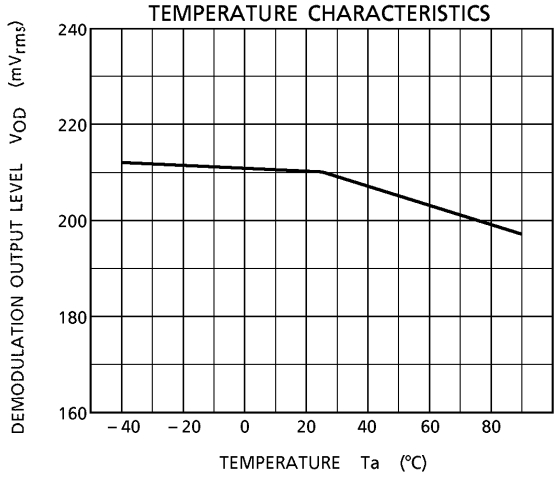
DEMODULATION OUTPUT LEVEL –
POWER SUPPLY VOLTAGE



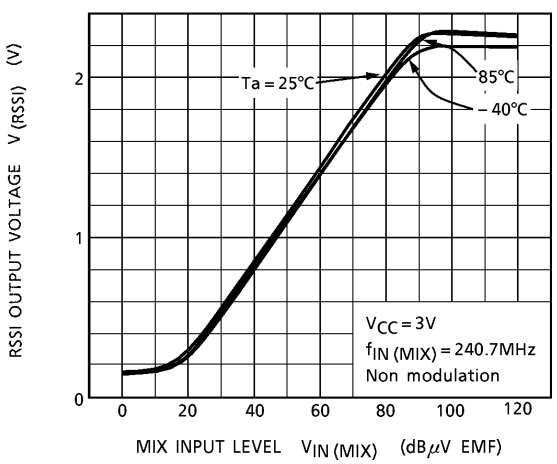
DEMODULATION OUTPUT LEVEL – POWER SUPPLY
VOLTAGE TEMPERATURE CHARACTERISTICS

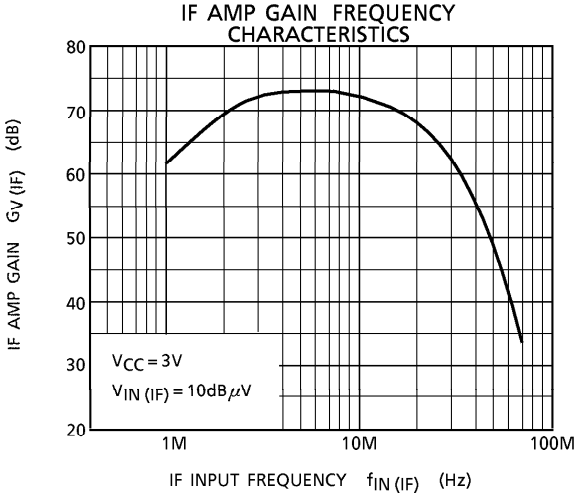


DEMODULATION OUTPUT LEVEL
TEMPERATURE CHARACTERISTICS

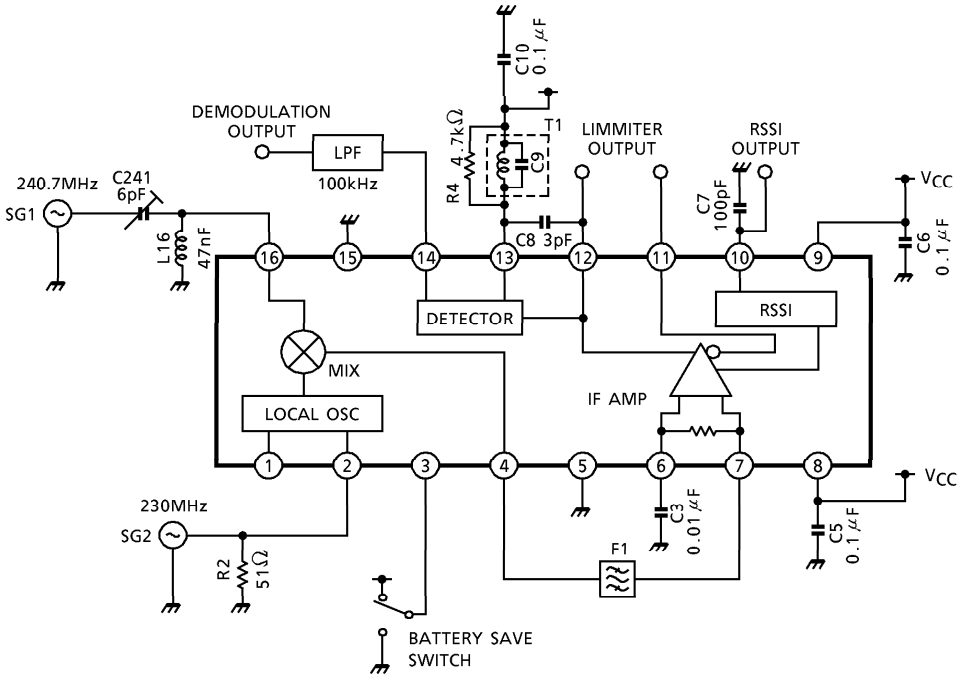


RSSI TEMPERATURE CHARACTERISTICS




IF AMP GAIN FREQUENCY CHARACTERISTICS
IF AMP GAIN $G_{V\,(IF)}$ (dB)
80
70
60
50
40
30
20
V_{CC} = 3V
$V_{IN\,(IF)}$ = 10dBμV
1M
10M
100M
IF INPUT FREQUENCY $f_{IN\,(IF)}$ (Hz)

APPLICATION CIRCUIT

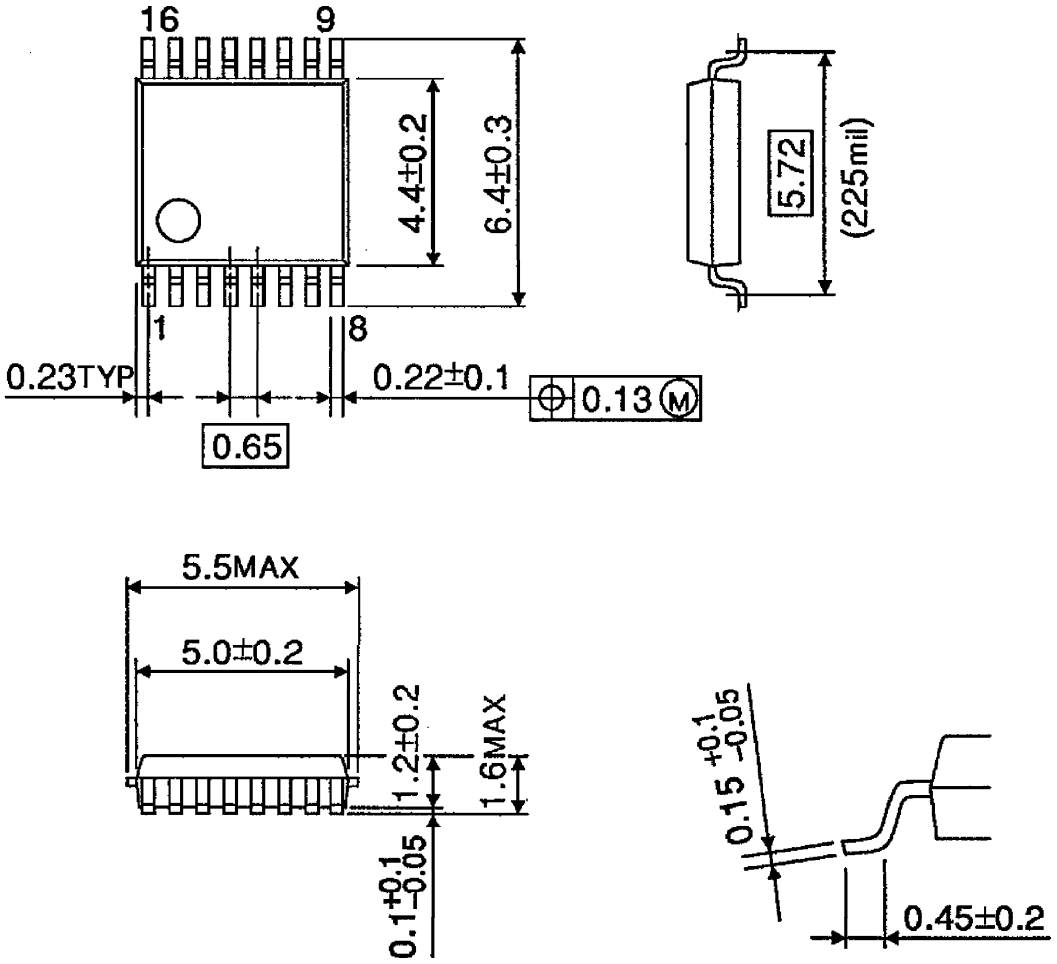


T1 : 4162-JPS-024
(SUMIDA ELECTRIC CO., LTD.)

F1 : CFEC10.7MK1
(MURATA MFG. CO., LTD.)

PACKAGE DIMENSIONS

SSOP16-P-225-0.65B Unit : mm



Weight : 0.09g (Typ.)

About solderability, following conditions were confirmed

● Solderability

(1) Use of Sn-63Pb solder bath
- Solder bath temperature = 230°C
- 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°C
- Dipping time = 5seconds
- The number of times = once
- Use of R-type flux

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000707EBA

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