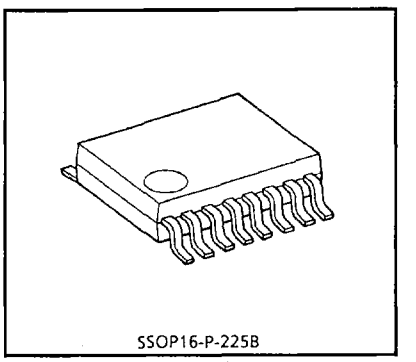
WIDE-BAND IF DETECTOR WITH BUILT-IN HIGH-SPEED MIX.

FEATURES

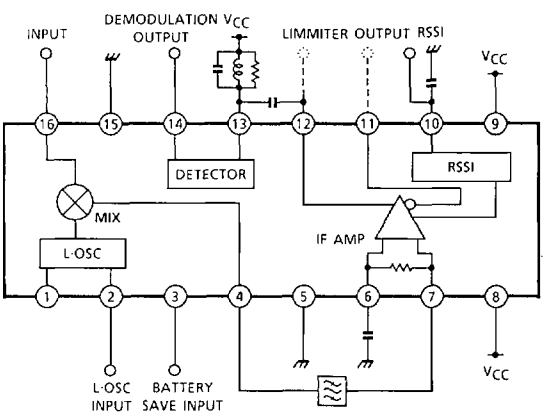
- A wide-band IF detector integrated circuit capable of operating at 10.7MHz and designed for the high-speed bit rates used in mobile communication and other systems.
- Ideal for use as a receiver for digital mobile communication.
- MIX. operating frequency is in 40~300MHz range.
- Built-in frequency modulation detector (for 100kHz).
- High sensitivity
- High-speed RSSI response
- Low current consumption : 5.5mA (Typ.)
- Low-voltage operability (2.3~5.5V) makes it suitable for use in portable equipment.
- Miniature flat package : SSOP16 (0.65mm pitch)



SSOP16-P-225B

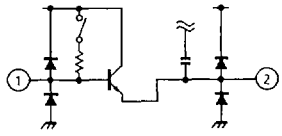
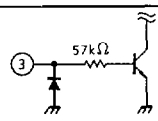
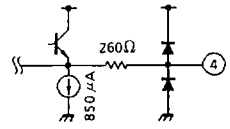
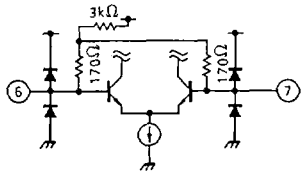
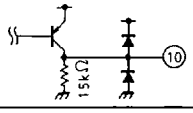
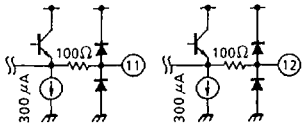
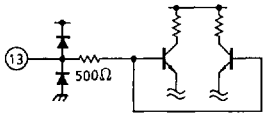
Weight : 0.09g (Typ.)

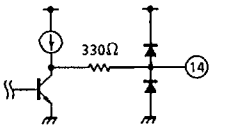
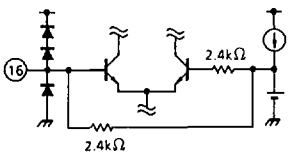
BLOCK DIAGRAM



TA31161FN-1

PIN FUNCTION (The constants in the equivalent circuit diagrams indicate the design standards.)

PIN No.	PIN NAME	FUNCTION	EQUIVALENT INTERNAL CIRCUIT
1	OSC IN	Local oscillator input terminal. Can form an oscillator with an internal transistor and external crystal oscillator. Can also operate as a mixer using the signal input externally from 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 330Ω (Typ.)	
5	GND1	Ground 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.	
11	IF_{OUT1}	IF output limiter terminal. Output of pins 11 and 12 is opposite phase.	
12	IF_{OUT2}		
13	QUAD	Phase input terminal for FM detector (frequency modulation detector).	

PIN No.	PIN NAME	FUNCTION	EQUIVALENT INTERNAL CIRCUIT
14	AF OUT	Modulation signal output terminal. Output impedance is 360Ω (Typ.).	
15	GND2	Ground terminal	
16	MIX IN	MIX. input terminal. Double-balance MIX.	

1. Local Oscillator 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.

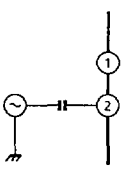


Fig.1

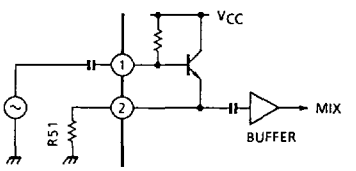


Fig.2

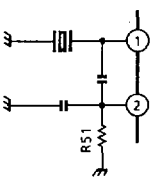


Fig.3

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.

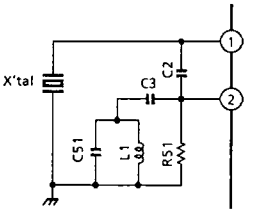


Fig.4

3. RSSI Function

A DC voltage corresponding to the input level of the IF IN terminal (Pin 7) is output to the RSSI terminal (Pin 10). While the linear range is about 70dB when V_{CC} = 3V, the range can be expanded as in Fig.5. However, in such a case, note that the temperature characteristics of the RSSI output may alter due to a disparity between the temperature coefficient of the external resistor and the internal resistance of the IC.

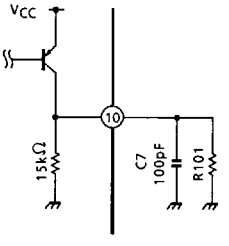
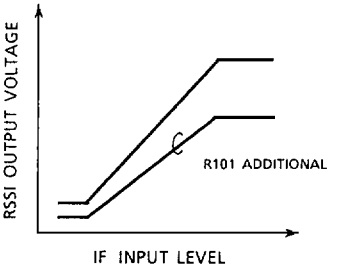


Fig.5



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 (Ta = 25°C)

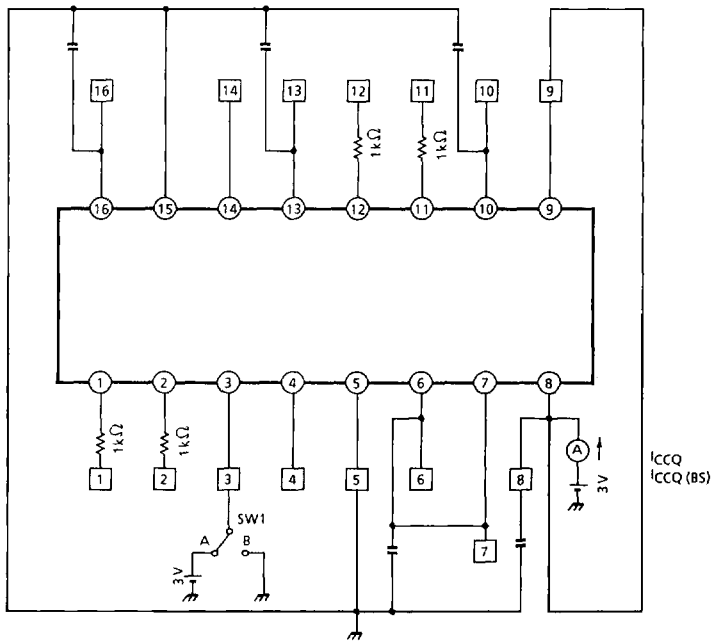
CHARACTERISTICS	SYMBOL	TEST CIR-CUIT	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Operating Voltage Range	$V_{CC\ opr}$	—		2.3	3	5.5	V
Current Consumption	I_{CCQ}	1	When local oscillation stopped	—	5.5	7.5	mA
Battery Save Current	$I_{CCQ\ (BS)}$	1	BS = L state	—	0	10	μA
Mixer Operating Frequency	f_{opr}	—		40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

※ Tested in application circuit.

CHARACTERISTICS		SYMBOL	TEST CIR-CUIT	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
BS Input Voltage	"H" Level	$V_{TH\,(H)}$	—	Active state	2	—	V_{CC}	V
	"L" Level	$V_{TH\,(L)}$	—	BS state	GND	—	0.2	
Demodulation Output Level		V_O	2	DIV ± 100kHz	150	200	260	mV_{rms}
Demodulation Frequency		f_{DET}	—		—	100	—	kHz
12dB Sensitivity		12dB S/N	※		—	21	—	dBμV EMF
S/N Ratio		S/N	※		—	55		dB
AM Rejection Ratio		AMR	※		—	40	—	dB

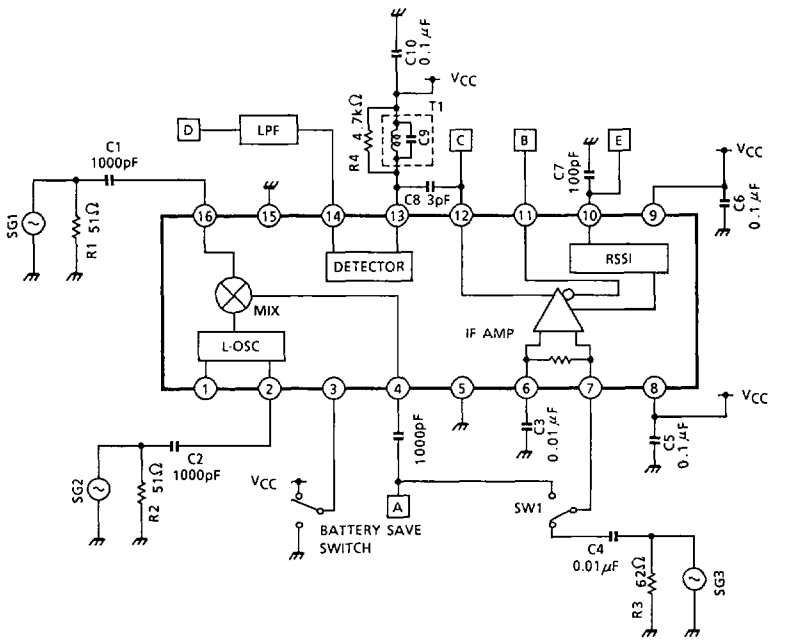
※ Tested in application circuit.

TEST CIRCUIT 1



※ Capacitor without specified is 0.01μF
SW1 on A side when I_{CCQ} tested
SW1 on B side when $I_{CCQ\,(BS)}$ tested

TEST CIRCUIT 2



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

F1 : FX-6506
(MURATA MFG. CO., LTD.)

Test conditions for mixer conversion gain G_{VC}
- SG1 90.7MHz, 50dBμV EMF
- SG2 80.0MHz, 100dBμV EMF
- G_{VC} = value at point [A] − 50dB

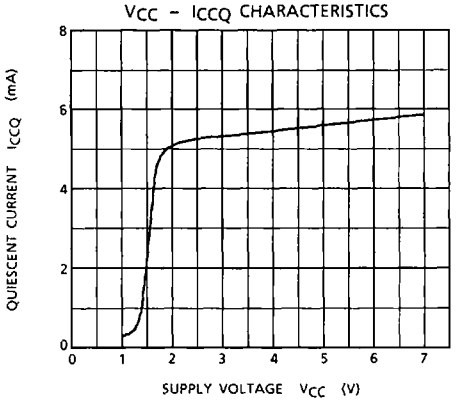
Test conditions for RSSI level output $V_{(RSSI)}$
- SG3 10.7MHz, 70dBμV EMF
- $V_{(RSSI)}$ = voltage at point [E]

Test conditions for IF output level V_O (IF)
- SG3 5MHz, 80dBμV EMF
- V_O (IF) = peak output level at point [B] or point [C]

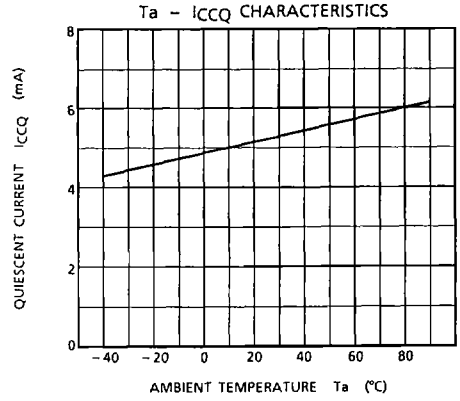
Test conditions for detect output V_O
- SG3 10.7MHz, modulation level ±100kHz, modulation frequency 1kHz, 80dBμV EMF
- V_O = voltage at point [D]

When V_{CC} = 3V, battery save switch on V_{CC} side, SW1 on SG3 side
([A] side only when G_{VC} tested)

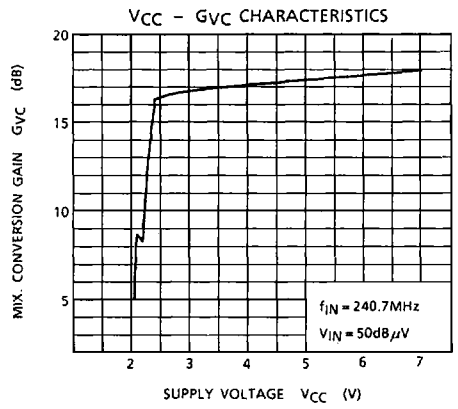
V_{CC} – I_{CCQ} CHARACTERISTICS



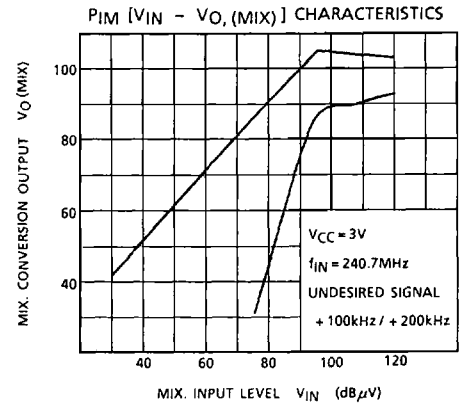
Ta – I_{CCQ} CHARACTERISTICS



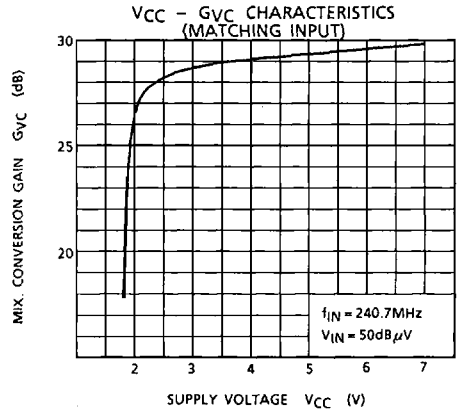
V_{CC} – G_{VC} CHARACTERISTICS



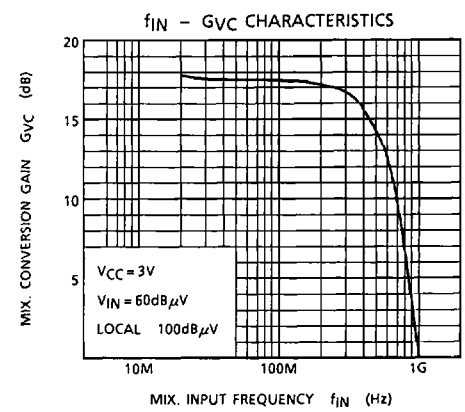
P_{IM} [V_{IN} – $V_{O,(MIX)}$] CHARACTERISTICS



V_{CC} – G_{VC} CHARACTERISTICS (MATCHING INPUT)



f_{IN} – G_{VC} CHARACTERISTICS



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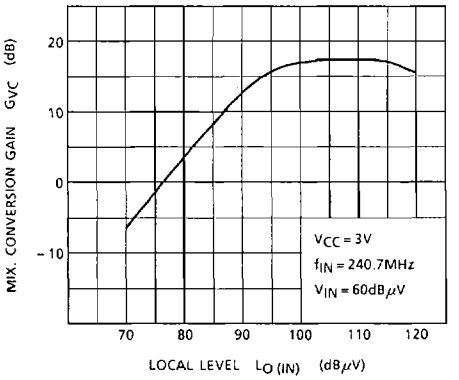
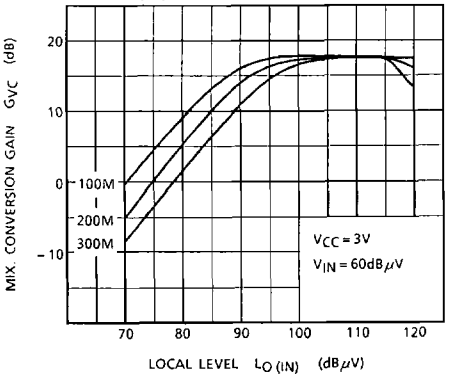
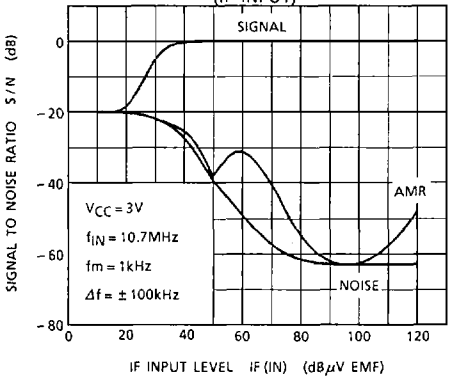
$L_{O\,(IN)}$ – G_{VC} CHARACTERISTICS



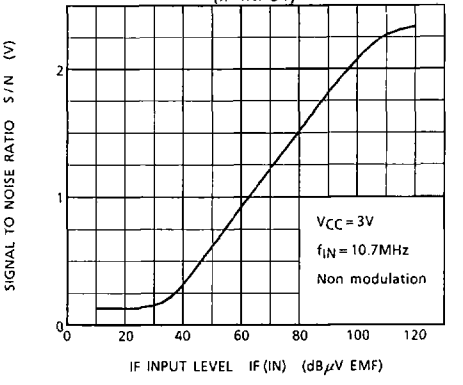
$L_{O\,(IN)}$ – G_{VC} CHARACTERISTICS



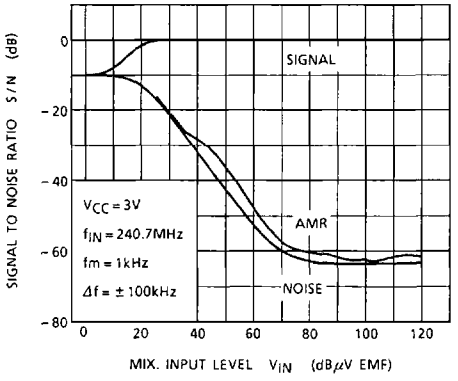
V_{IN} – S/N, AMR CHARACTERISTICS (IF INPUT)



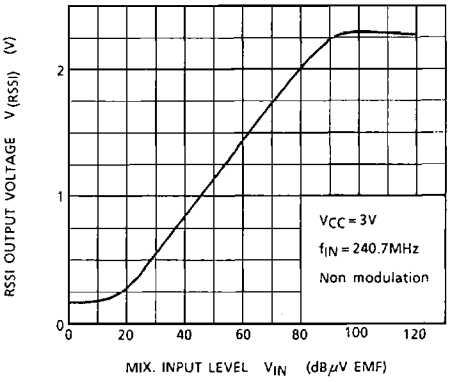
IF (IN) – $V_{(RSSI)}$ CHARACTERISTICS (IF INPUT)



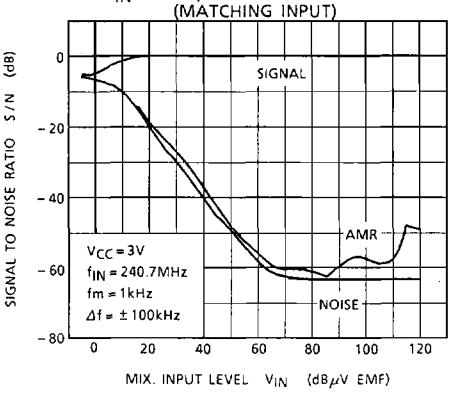
V_{IN} – S/N, AMR CHARACTERISTICS



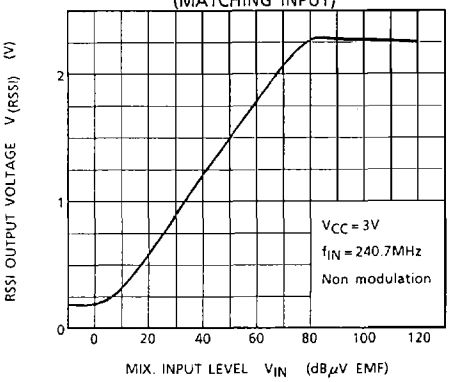
V_{IN} – $V_{(RSSI)}$ CHARACTERISTICS



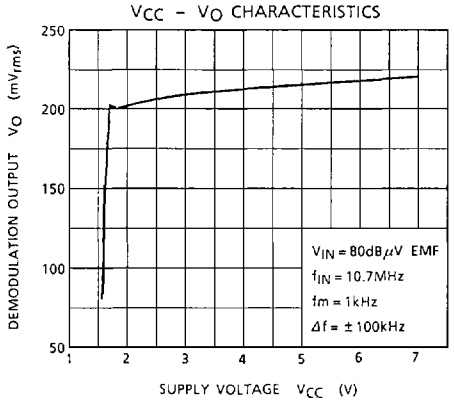
V_{IN} – S/N, AMR CHARACTERISTICS (MATCHING INPUT)



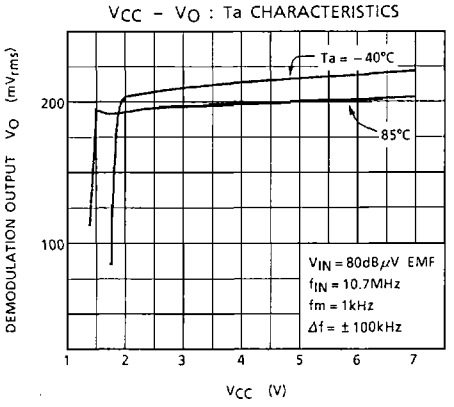
V_{IN} – $V_{(RSSI)}$ CHARACTERISTICS (MATCHING INPUT)



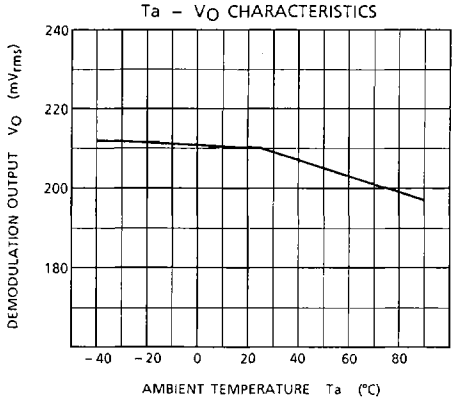
V_{CC} – V_O CHARACTERISTICS



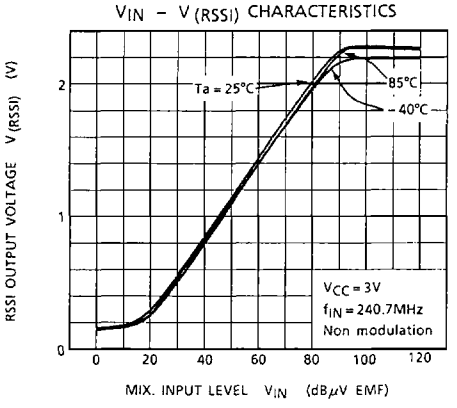
V_{CC} – V_O : Ta CHARACTERISTICS



Ta – V_O CHARACTERISTICS



V_{IN} – $V_{(RSSI)}$ CHARACTERISTICS



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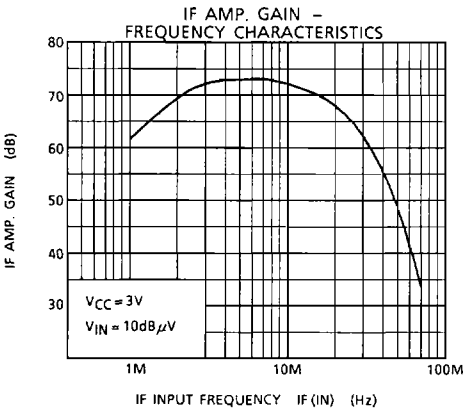
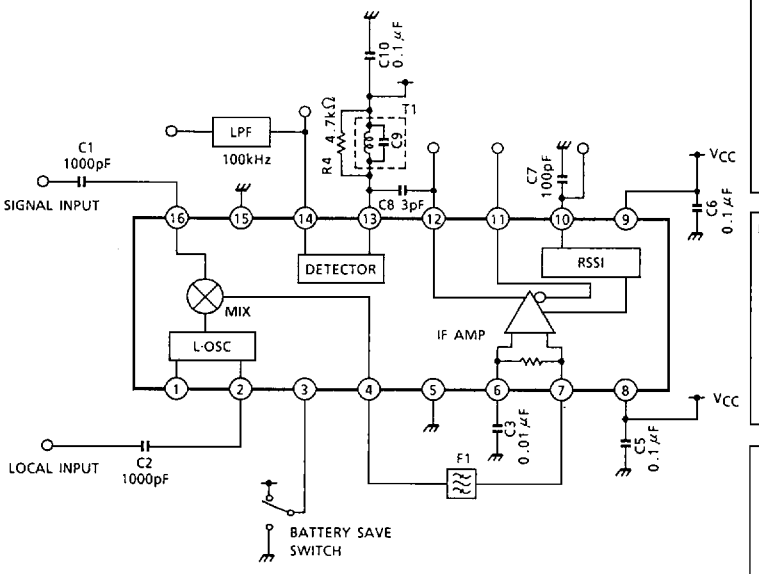
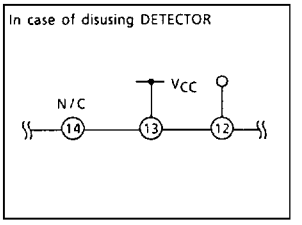
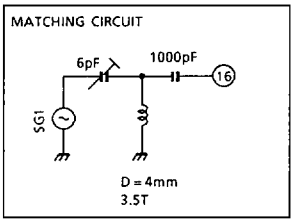

IF AMP. GAIN –
FREQUENCY CHARACTERISTICS
IF AMP. GAIN (dB)
80
70
60
50
40
30
V_{CC} = 3V
V_{IN} = 10dBμV
1M
10M
100M
IF INPUT FREQUENCY IF (IN) (Hz)

APPLICATION CIRCUIT







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

F1 : FX-6506
(MURATA MFG. CO., LTD.)

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TA31161FN-12