

**All Band TV Tuner IC (VHF-CATV-UHF)**

**Description**

The CXA1664M is a single chip TV tuner IC which performs as an oscillator, mixer for VHF/CATV and UHF bands. An IF amplifier is also provided.

This IC adopts a 16-pin SOP package in response to the trend toward miniaturizing the tuner and automatic IC mounting. This IC achieves a large reduction of external parts in addition to miniaturizing the tuner and increasing manufacturing productivity, reliability and design efficiency.

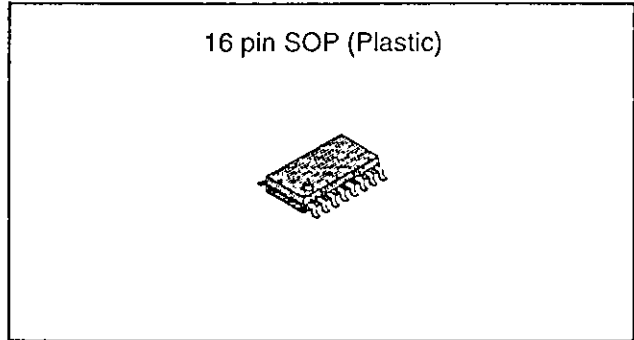
This IC has the reverse pin configuration to the CXA1665M.

**Features**

- On-chip oscillator and mixer for UHF band
- Low noise figure
- Reduced spurious interference
- Superior cross modulation distortion
- Stable oscillating characteristics

**Absolute Maximum Ratings (Ta=25°C)**

- Supply voltage  $V_{cc}$  11 V
- Storage temperature  $T_{stg}$  -65 to +150 °C
- Allowable power dissipation  $P_d$  980 mW  
(When mounted on a board)



**Applications**

- CTV tuner
- CATV UP-DOWN converter
- FM detector for 2nd IF satellite broadcasts

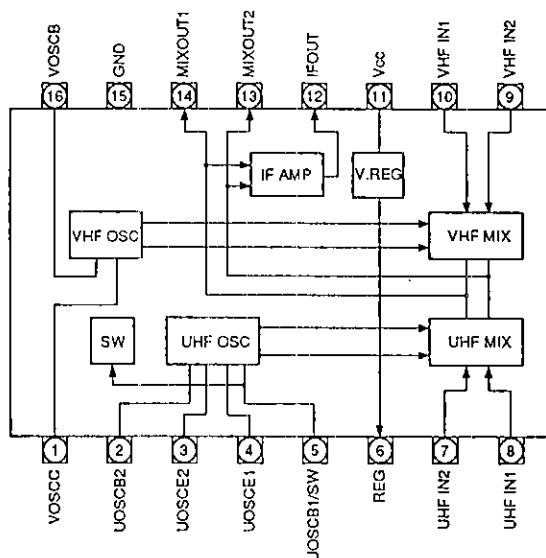
**Structure**

Bipolar silicon monolithic IC

**Operating Conditions**

- Supply voltage  $V_{cc}$  9.0±0.9 V
- Operating temperature  $T_{opr}$  -20 to +75 °C

**Block Diagram and Pin Configuration (Top View)**



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Pin Description and Equivalent Circuit

| Pin No. | Symbol     | Typical voltage (V)                                  | Equivalent circuit | Description   |
|---------|------------|--|--------------------|---|
| 1       | VOSC C     | Under VHF operation; 6.7<br>Under UHF operation; 9.0 |                    | VHF oscillator.   |
| 16      | VOSC B     | 3.5<br>3.7   |                    |   |
| 2       | UOSC B2    | 3.7<br>3.4   |                    | UHF oscillator.<br>Pin 5 is used for both U/V switches.   |
| 3       | UOSC E2    | 3.2<br>2.6   |                    |   |
| 4       | UOSC E1    | 0<br>2.6   |                    |   |
| 5       | UOSC B1/SW | 0<br>3.4   |                    |   |
| 6       | REG        | 6.0  |                    |   |
| 7       | UHF IN2    | 3.3<br>3.2   |                    | UHF input.<br>The balanced input to Pins 7 and 8, or a decoupling capacitor is connected at Pin 7 to GND and Pin 8 is used for input. |
| 8       | UHF IN1    | 3.3<br>3.2   |                    |   |

| Pin No. | Symbol   | Typical voltage (V) | Equivalent circuit | Description   |
|---------|----------|---------------------|--------------------|---|
| 9       | VHF IN2  | 3.2                 |                    | VHF input; normally a decoupling capacitor is connected at Pin 10 to GND and Pin 9 is used for input. |
|         |          | 3.3                 |                    |   |
| 10      | VHF IN1  | 3.2                 |                    |   |
|         |          | 3.3                 |                    |   |
| 11      | Vcc      | 9                   |                    | Power supply.   |
| 12      | IF OUT   | 4.5                 |                    | IF output.  |
|         |          | 4.5                 |                    |   |
| 13      | MIX OUT2 | 7.5                 |                    | Mixer output and IF amplifier input.  |
|         |          | 7.3                 |                    |   |
| 14      | MIX OUT1 | 7.5                 |                    |   |
|         |          | 7.3                 |                    |   |
| 15      | GND      | 0                   |                    | GND   |

## Electrical Characteristics

(See Electrical Characteristics Test Circuit. Ta=25°C, Vcc=9V)

| Item                         | Symbol      | Condition  | Min. | Typ. | Max. | Unit |
|------------------------------|-------------|--|------|------|------|------|
| Circuit current              | IccV        | VHF operation; no signal   | 30   | 45   | 58   | mA   |
|                              | IccU        | UHF operation; no signal   | 29   | 44   | 57   | mA   |
| Conversion gain *1           | CG1         | VHF operation; fRF=55MHz; Input level -40dBm   | 20   | 23   | 26   | dB   |
|                              | CG2         | VHF operation; fRF=360MHz; Input level -40dBm  | 20   | 23   | 26   | dB   |
|                              | CG3         | UHF operation; fRF=360MHz; Input level -40dBm  | 25   | 28   | 31   | dB   |
|                              | CG4         | UHF operation; fRF=800MHz; Input level -40dBm  | 25   | 28   | 31   | dB   |
| Noise figure *1<br>*2        | NF1         | VHF operation; fRF=55MHz   |      | 10   | 13   | dB   |
|                              | NF2         | VHF operation; fRF=360MHz  |      | 10   | 13   | dB   |
|                              | NF3         | UHF operation; fRF=360MHz  |      | 7    | 11   | dB   |
|                              | NF4         | UHF operation; fRF=800MHz  |      | 8    | 12   | dB   |
| 1% cross modulation *1<br>*3 | CM1         | VHF operation; fd=55MHz, fUD=±12MHz  | 96   | 100  |      | dB μ |
|                              | CM2         | VHF operation; fd=360MHz, fUD=±12MHz   | 94   | 98   |      | dB μ |
|                              | CM3         | UHF operation; fd=360MHz, fUD=±12MHz   | 88   | 92   |      | dB μ |
|                              | CM4         | UHF operation; fd=800MHz, fUD=±12MHz   | 87   | 91   |      | dB μ |
| Max. output power            | Pomax (sat) | 50 Ω load  | +8   | +11  |      | dBm  |
| Switch ON drift              | Δ fsw1      | VHF operation; fosc=100MHz<br>frequency drift for the time from 3s to 3min after switch ON |      |      | ±300 | kHz  |
|                              | Δ fsw2      | VHF operation; fosc=405MHz<br>frequency drift for the time from 3s to 3min after switch ON |      |      | ±500 | kHz  |
|                              | Δ fsw3      | UHF operation; fosc=405MHz<br>frequency drift for the time from 3s to 3min after switch ON |      |      | ±500 | kHz  |
|                              | Δ fsw4      | UHF operation; fosc=845MHz<br>frequency drift for the time from 3s to 3min after switch ON |      |      | ±500 | kHz  |
| +B supply voltage drift      | Δ fst1      | VHF operation; fosc=100MHz<br>frequency shift when Vcc+9V changes ±5%                      |      |      | ±200 | kHz  |
|                              | Δ fst2      | VHF operation; fosc=405MHz<br>frequency shift when Vcc+9V changes ±5%                      |      |      | ±250 | kHz  |
|                              | Δ fst3      | UHF operation; fosc=405MHz<br>frequency shift when Vcc+9V changes ±5%                      |      |      | ±250 | kHz  |
|                              | Δ fst4      | UHF operation; fosc=845MHz<br>frequency shift when Vcc+9V changes ±5%                      |      |      | ±250 | kHz  |

\*1) Measured value for untuned inputs.

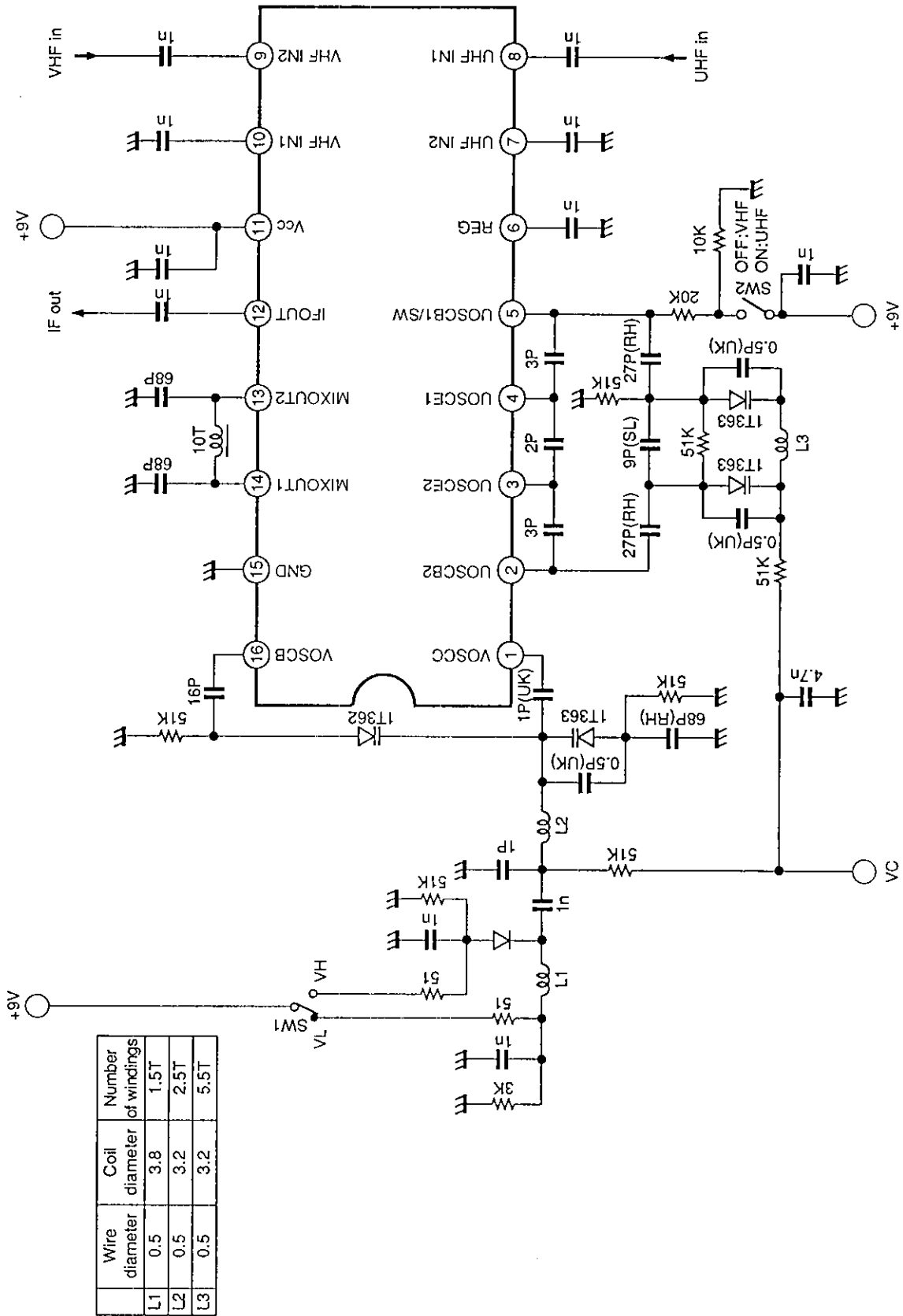
\*2) Noise figure is uncorrected for image.

\*3) Desired signal (fd) input level is -33dBm.

undesired signal (fUD) is 100kHz at 30% AM.

The measurement value is undesired signal level, it measured with a spectrum analyzer at S/I=46dB.

Electrical Characteristics Test Circuit



| Wire diameter | Coil diameter | Number of windings |
|---------------|---------------|--------------------|
| L1            | 3.8           | 1.5T               |
| L2            | 3.2           | 2.5T               |
| L3            | 3.2           | 5.5T               |

## Description of Operation (See Electrical Characteristics Test Circuit.)

### (1) VHF oscillator circuit

The differential oscillator circuit with an output at Pin 1 and an input at Pin 16.

Connect an LC resonance circuit comprising a varicap diode to Pin 1 through a coupling capacitor. The positive feedback from the resonance circuit is applied to Pin 16 through a feedback capacitor to execute oscillation. Note that if a parasitic capacitance across Pins 16 and 1 is too large, it may cause undesired oscillation.

### (2) VHF mixer circuit

This is a double-balanced mixer having small leakage of local oscillation signal. The RF signal is input to Pins 9 and 10. In normal use, the signal is input to one pin while the other pin is connected to GND by decoupling capacitor. The RF signal is converted to IF with the signal supplied from oscillator. The converted RF is sent to the IF amplifier and output to Pins 13 and 14 simultaneously.

### (3) UHF oscillator circuit

UHF oscillator is formed from two collector-grounded Colpitts oscillators, and oscillation is provided at the differential input through an LC resonator circuit including a varicap diode.

The Pin 5 also functions as UHF/VHF switch pin.

### (4) UHF mixer circuit

This is the double-balanced mixer like the VHF mixer. The RF signal is input to Pins 7 and 8. There is a balanced differential input from pre-stage double tune circuit, or an unbalanced input to Pin 8 with the capacitor connected at Pin 7 to GND. Balanced input achieves better NF rather than unbalanced input.

Otherwise, the conditions and usage are the same as those for the VHF mixer circuit.

### (5) IF amplifier circuit

The mixer output signal is amplified by the IF amplifier and output to Pin 12. The output impedance is about  $75\ \Omega$ .

### (6) UHF/VHF switch circuit

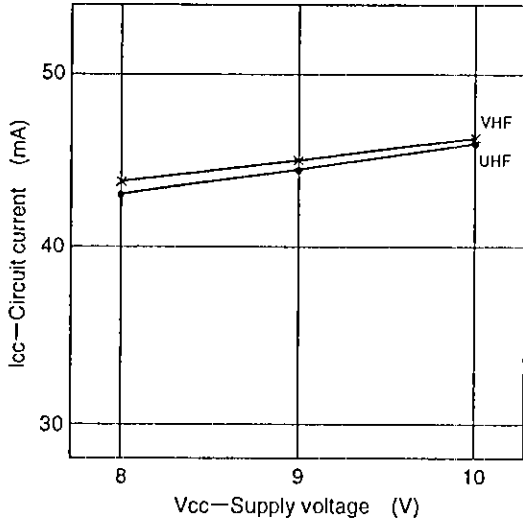
UHF/VHF mode is selected by the DC voltage at Pin 5. UHF operation is chosen by inputting 9V through a  $20\text{k}\Omega$  resistor, and VHF operation by inputting 0V. If the UHF switch voltage is 12V not 9V, adjust the resistance to approximately  $30\text{k}\Omega$  so that the DC voltage becomes almost equal between Pins 2 and 5. Be sure to connect a resistor for discharging (approx.  $10\text{k}\Omega$ ) if OPEN not 0V is chosen for the VHF switch voltage.

## Notes on Usage

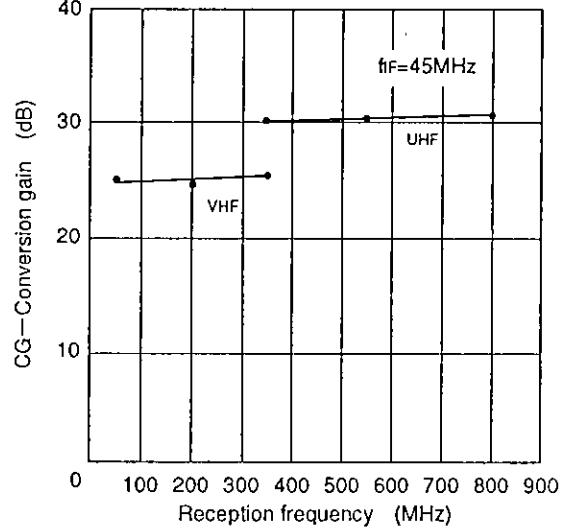
Care should be taken such as grounding in placing external parts because high frequencies are present. Adjust accordingly to prevent heat problems with special care such as the GND pattern for heat dissipation at the portion for IC mount where heat dissipations accumulate.

Example of Representative Characteristics

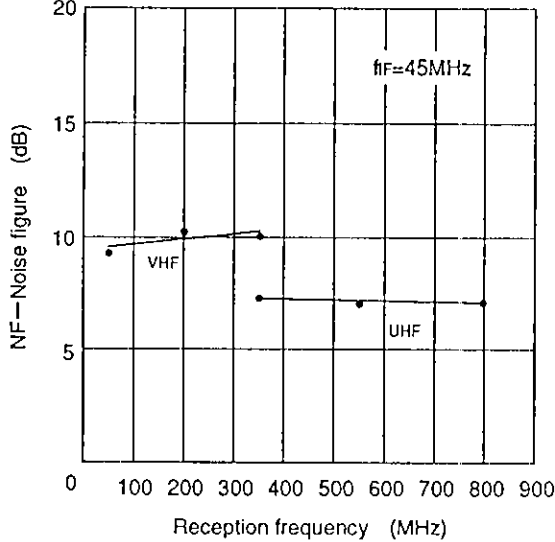
Circuit current vs. Supply voltage



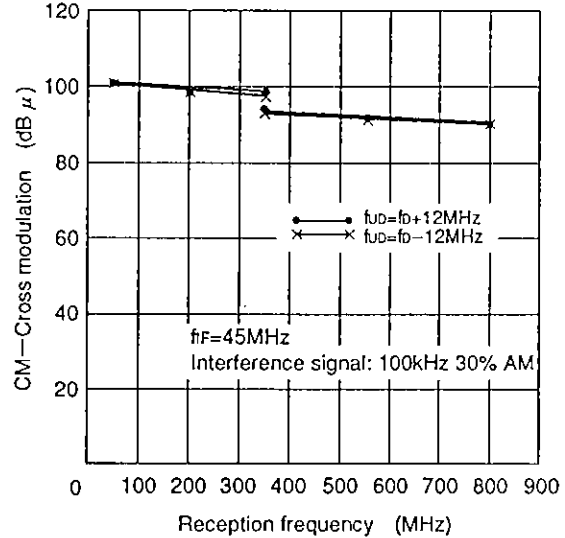
Conversion gain vs. Reception frequency (Untuned input)



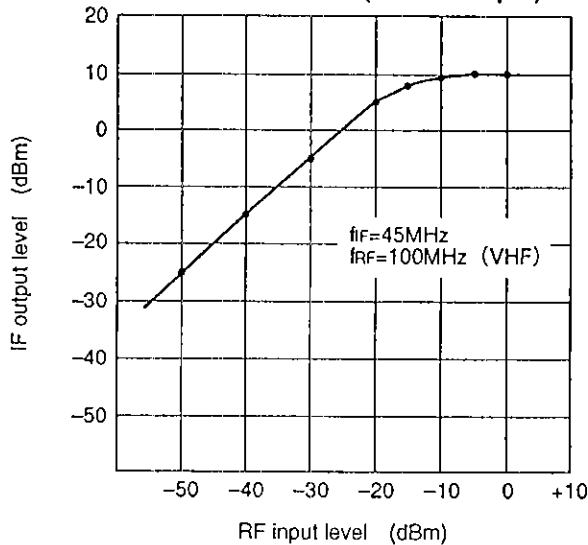
Noise figure vs. Reception frequency (Untuned input, in DSB)



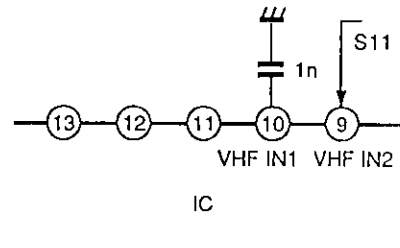
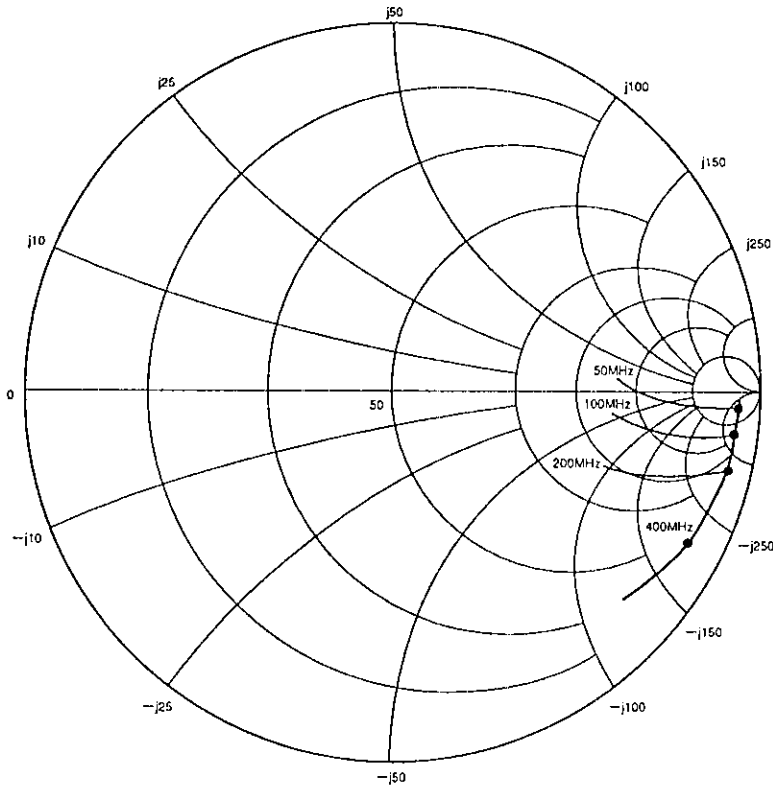
Next adjacent cross modulation vs. Reception frequency (Untuned input)



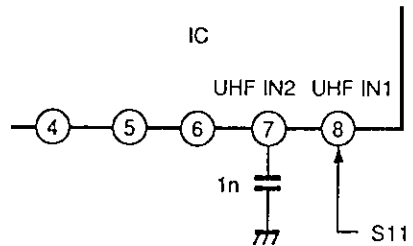
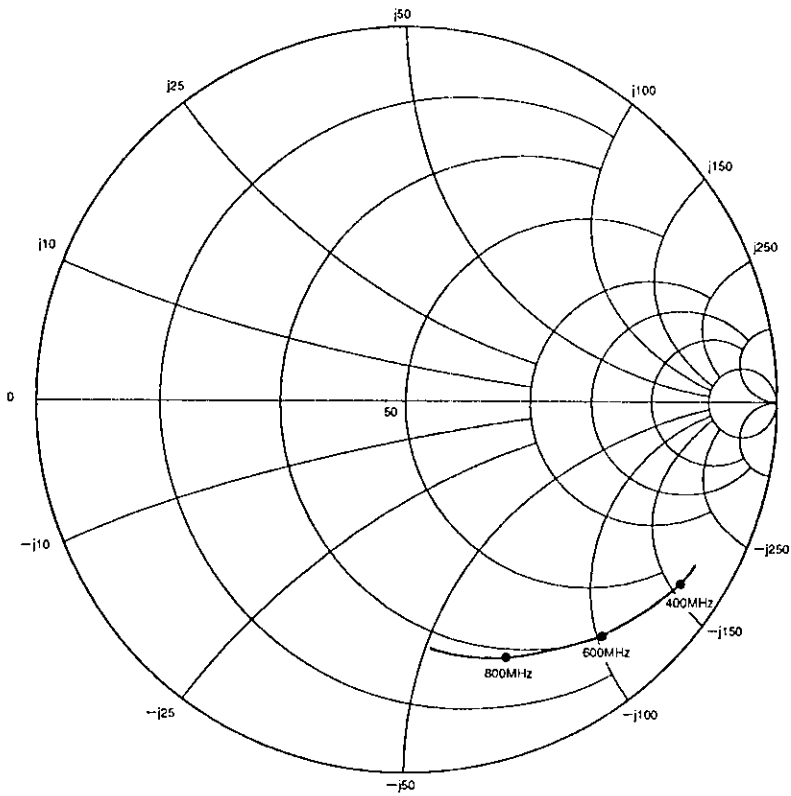
I/O characteristics (Untuned Input)



VHF Input Impedance

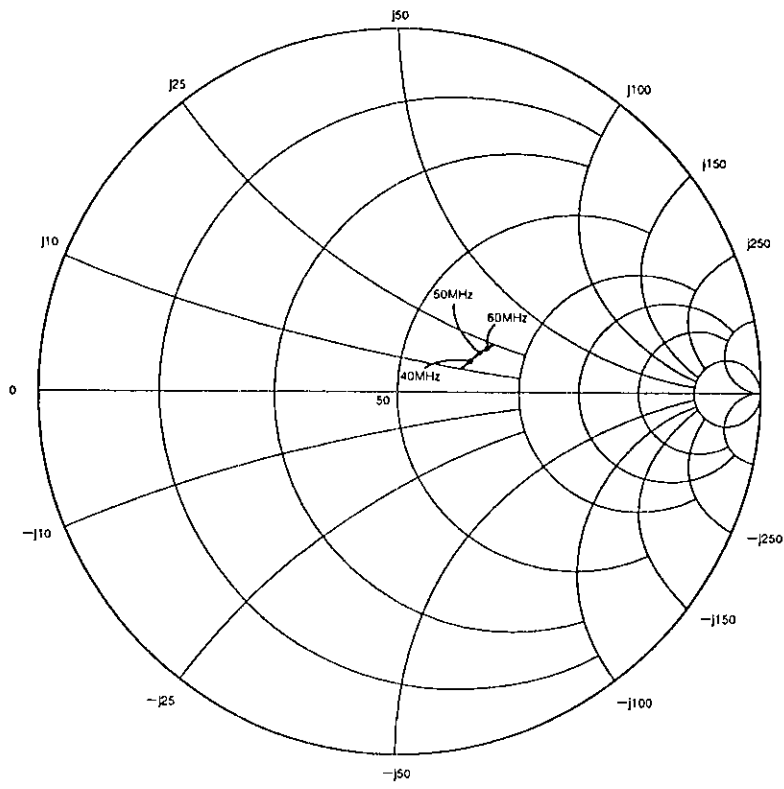


UHF Input Impedance



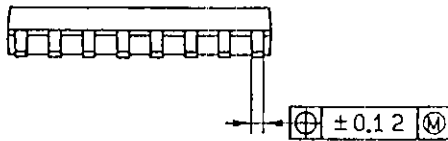
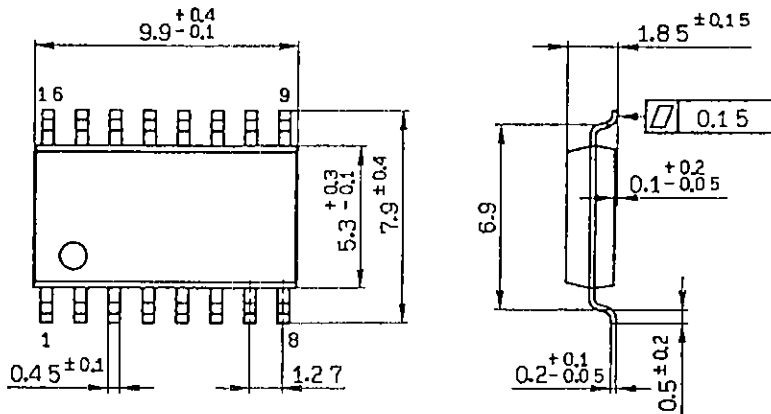


IF Output Impedance



Package Outline Unit: mm

16pin SOP (Plastic) 300mil 0.2g



|            |                  |
|------------|------------------|
| SONY NAME  | SOP-16P-L01      |
| EIAJ NAME  | *SOP016-P-0300-A |
| JEDEC CODE | _____            |