SONY

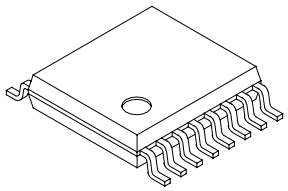
# CXA3125N

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

### Description

The CXA3125N is a TV tuner IC which integrates local oscillator and mixer circuits for VHF band, local oscillator and mixer circuits for UHF band, and an IF amplifier onto a single chip. This IC adopts a 16-pin SSOP package and is suitable for miniaturizing voltage synthesizer tuner.

16 pin SSOP (Plastic)



### Features

- Low noise figure
- Superior cross modulation
- Low power consumption (5 V, 43 mA typ.)
- IF output can be selected from symmetrical or asymmetrical
- SSOP 16-pin package

### Applications

- TV tuners
- VCR tuners
- CATV tuners

### Structure

Bipolar silicon monolithic IC

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

| | | | |
|---|---|---|---|
| • Supply voltage | $V_{CC}$ | –0.3 to +5.5 | V |
| • Storage temperature | Tstg | –55 to +150 | °C |
| • Allowable power dissipation | $P_D$ | 625 | mW |

(when mounted on a printed circuit board)

### Operating Conditions

| | | | |
|---|---|---|---|
| • Supply voltage | $V_{CC}$ | 4.75 to 5.30 | V |
| • Operating temperature | Topr | –20 to +75 | °C |

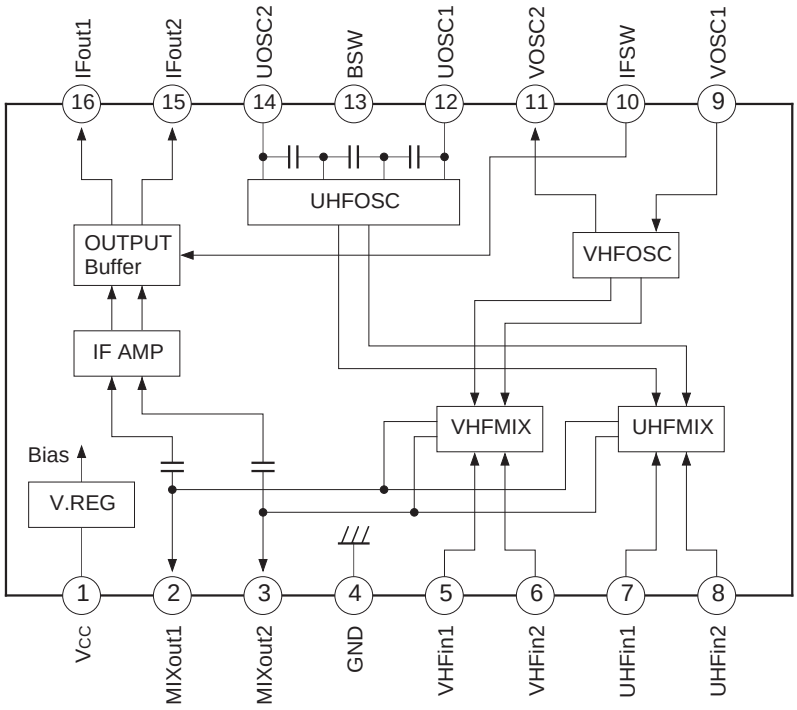




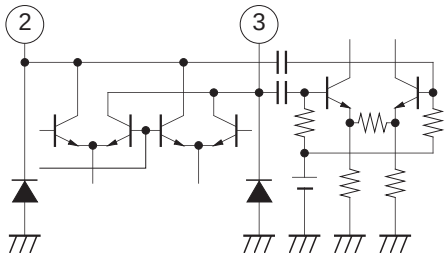
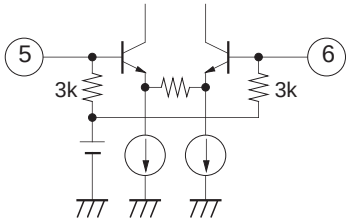
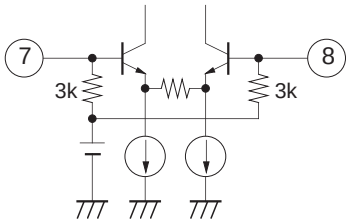
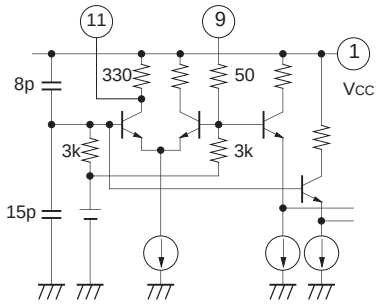
E97705A85-TE

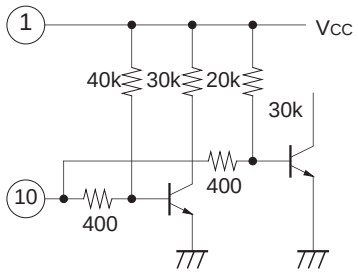
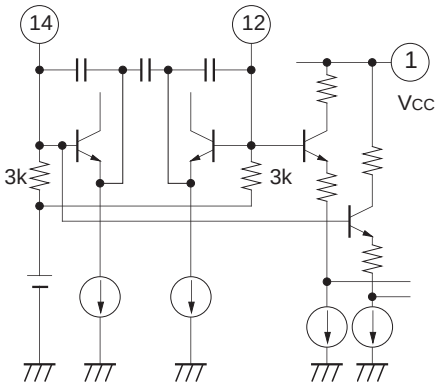
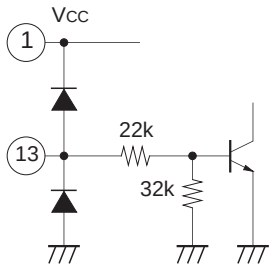
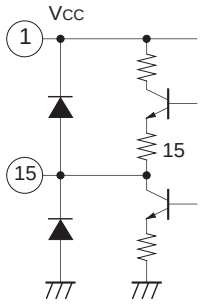
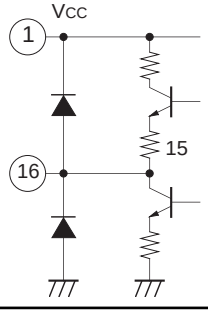
## Block Diagram and Pin Configuration

CXA3125N



**Pin Description and Equivalent Circuit**

| Pin No. | Symbol | Typical pin voltage (V) | Equivalent circuit | Description |
|---|---|---|---|---|
| 1 | $V_{CC}$ | 5.0 | | Power supply. |
| 2 | MIXout1 | During VHF reception 4.4<br>During UHF reception 4.3 |  | Mixer outputs and IF amplifier inputs. These pins are output with open collector, and they must be connected to power supply via load. |
| 3 | MIXout2 | 4.4<br>4.3 | | |
| 4 | GND | 0 | | GND. |
| 5 | VHFin1 | 2.4<br>0 |  | VHF inputs.<br>Normally a capacitor is connected at Pin 5 to GND and Pin 6 is used for input. |
| 6 | VHFin2 | 2.4<br>0 | | |
| 7 | UHFin1 | 0<br>2.4 |  | UHF inputs. Symmetrical input to Pins 7 and 8 or a capacitor is connected at Pin 8 to GND and Pin 7 is used for input. |
| 8 | UHFin2 | 0<br>2.4 | | |
| 9 | VOSC1 | 3.1<br>3.2 |  | External resonance circuit connection for VHF oscillators. |
| 11 | VOSC2 | 4.0<br>5.0 | | |

| Pin No. | Symbol | Typical pin voltage (V) | Equivalent circuit | Description |
|---|---|---|---|---|
| 10 | IFSW | 0.8 (when open) |  | Symmetrical/asymmetrical selection of IF output. Asymmetrical output is selected for open state; symmetrical output, for connecting to GND. When used as an asymmetrical output, connect to GND with a capacitor. |
| 12 | UOSC1 | 3.2<br>3.0 |  | External resonance circuit connection for UHF oscillators. |
| 14 | UOSC2 | 3.2<br>3.0 | | |
| 13 | BSW | — |  | Band switching. UHF operation when 3 V or more voltage is applied externally, and VHF operation when 0.5 V or less voltage is applied. |
| 15 | IFout2 | During symmetrical output 3.0<br>During asymmetrical output 4.3 |  | IF outputs during symmetrical output. The reverse phase signal to Pin 16 is output during symmetrical output. When asymmetrical output is selected, the signal is not output. |
| 16 | IFout1 | During symmetrical output 3.0<br>During asymmetrical output 2.5 |  | IF outputs. |

**Electrical Characteristics** See the Electrical Characteristics Measurement Circuits 1 and 2.

(Ta=25 °C, $V_{CC}$=5 V)

| Item | Symbol | Measurement conditions | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|
| Circuit current | $I_{CC}$VU | VHF operation asymmetrical output no input signal | 32 | 43 | 52 | mA |
| | $I_{CC}$VB | VHF operation symmetrical output no input signal | 35 | 46 | 55 | mA |
| | $I_{CC}$UU | UHF operation asymmetrical output no input signal | 33 | 44 | 53 | mA |
| | $I_{CC}$UB | UHF operation symmetrical output no input signal | 36 | 47 | 56 | mA |
| Conversion gain *1 | CG1U | VHF operation $f_{RF}$=55 MHz asymmetrical output | 22 | 25 | 28 | dB |
| | CG2U | VHF operation $f_{RF}$=360 MHz asymmetrical output | 22 | 25 | 28 | dB |
| | CG3U | UHF operation $f_{RF}$=360 MHz asymmetrical output | 27 | 30 | 33 | dB |
| | CG4U | UHF operation $f_{RF}$=800 MHz asymmetrical output | 27 | 30 | 33 | dB |
| | CG1B | VHF operation $f_{RF}$=55 MHz symmetrical output*6 | 26 | 29 | 32 | dB |
| | CG2B | VHF operation $f_{RF}$=360 MHz symmetrical output*6 | 26 | 29 | 32 | dB |
| | CG3B | UHF operation $f_{RF}$=360 MHz symmetrical output*6 | 31 | 34 | 37 | dB |
| | CG4B | UHF operation $f_{RF}$=800 MHz symmetrical output*6 | 31 | 34 | 37 | dB |
| Noise figure *1, *2 | NF1 | VHF operation $f_{RF}$=55 MHz asymmetrical output | | 11 | 15 | dB |
| | NF2 | VHF operation $f_{RF}$=360 MHz asymmetrical output | | 11 | 15 | dB |
| | NF3 | UHF operation $f_{RF}$=360 MHz asymmetrical output | | 9 | 12 | dB |
| | NF4 | UHF operation $f_{RF}$=800 MHz asymmetrical output | | 9.5 | 12.5 | dB |
| 1 % cross modulation *1 *3 | CM1 | VHF operation $f_D$=55 MHz $f_{UD}$=±12 MHz asymmetrical output | 96 | 100 | | dBµ |
| | CM2 | VHF operation $f_D$=360 MHz $f_{UD}$=±12 MHz asymmetrical output | 96 | 100 | | dBµ |
| | CM3 | UHF operation $f_D$=360 MHz $f_{UD}$=±12 MHz asymmetrical output | 90 | 94 | | dBµ |
| | CM4 | UHF operation $f_D$=800 MHz $f_{UD}$=±12 MHz asymmetrical output | 90 | 94 | | dBµ |
| Maximum output power | Pomax (sat) | 50 Ω load, asymmetrical output | | +10 | | dBm |
| Switch ON drift *4 | Δfsw1 | VHF operation $f_{OSC}$=100 MHz | | | ±300 | kHz |
| | Δfsw2 | VHF operation $f_{OSC}$=405 MHz | | | ±400 | kHz |
| | Δfsw3 | UHF operation $f_{OSC}$=405 MHz | | | ±400 | kHz |
| | Δfsw4 | UHF operation $f_{OSC}$=845 MHz | | | ±400 | kHz |
| +B drift *5 | Δfst1 | VHF operation $f_{OSC}$=100 MHz | | | ±200 | kHz |
| | Δfst2 | VHF operation $f_{OSC}$=405 MHz | | | ±250 | kHz |
| | Δfst3 | UHF operation $f_{OSC}$=405 MHz | | | ±250 | kHz |
| | Δfst4 | UHF operation $f_{OSC}$=845 MHz | | | ±250 | kHz |
| Band switch voltage | $V_{SW}$V | VHF operation | 0 | | 0.5 | V |
| | $V_{SW}$U | UHF operation | 3 | | 5.5 | V |

*1 Input level –40 dBm, Value measured with untuned input.

*2 Noise figure is the NF meter direct-reading value (DSB measurement).

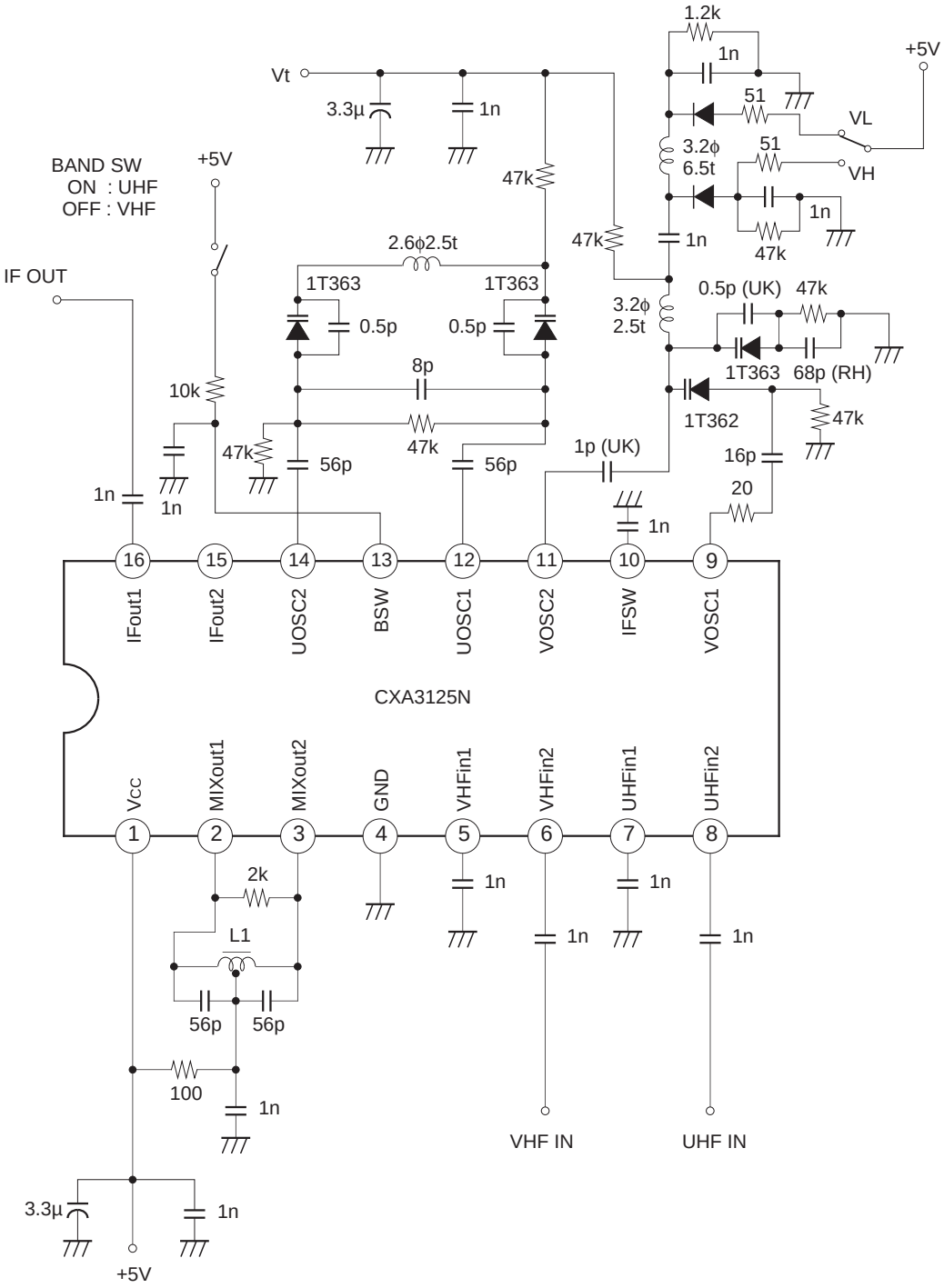
*3 Value with a desired reception signal input level of –30 dBm, an interference signal of 100 kHz at ±12 MHz : 30 % AM, and an interference signal level where S/I=46 dB measured with a spectrum analyzer.

*4 Frequency variation from 3 seconds to 3 minutes after switch ON.

*5 Frequency variation when $V_{CC}$=5 V ±5 % variation.

*6 Value which is measured as 410 Ω load impedance and compensated loss by 180 Ω resistor connected to Pins 15 and 16.

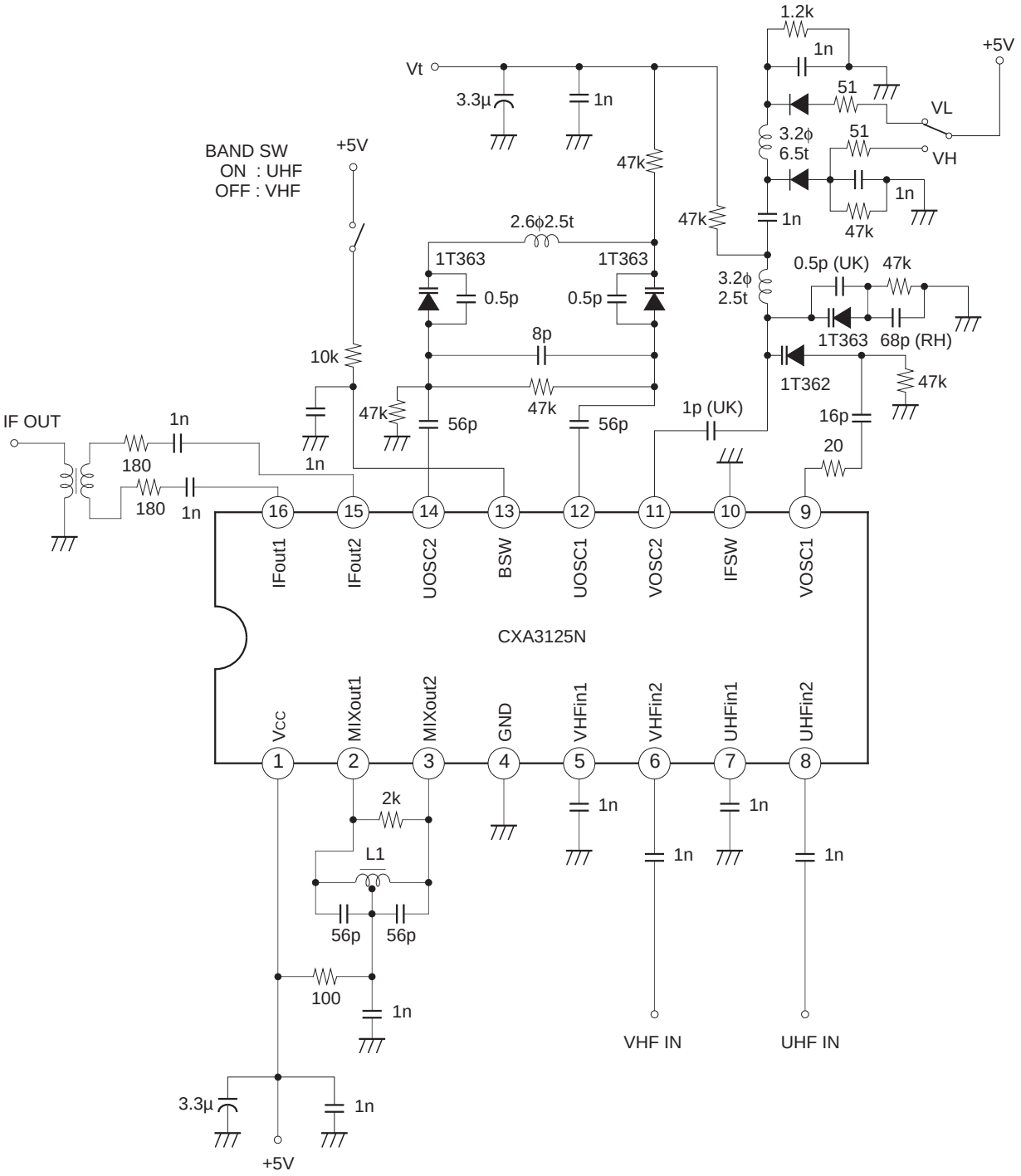
**Electrical Characteristics Measurement Circuit 1** (asymmetrical output)




L1 is a pentagonal coil 4.5 t/4.5 t
L without indication is an air-core coil of 0.5 mm diameter.

These components value are the setting for USA frequency variation range.

**Electrical Characteristics Measurement Circuit 2** (symmetrical output)




L1 is a pentagonal coil 4.5 t/4.5 t
L without indication is an air-core coil of 0.5 mm diameter.

These components value are the setting for USA frequency variation range.

## Description of Operation

(See the Electrical Characteristics Measurement Circuit.)

### VHF oscillator circuit

This circuit is a differential amplifier type oscillator circuit. Pin 11 is the output and Pin 9 is the input.

Oscillation is performed by connecting an LC resonance circuit including a varicap to Pin 11 via coupled capacitance, inputting to Pin 9 with feedback capacitance, and applying positive feedback.

Note that if the capacitance across Pins 9 and 11 is too large, positive feedback may be applied via a parasitic capacitance causing undesired stray oscillation.

### VHF mixer circuit

The mixer circuit employs a double symmetrical mixer with little local oscillation signal leakage. The RF signal is input to Pins 6 and 7. During normal use, the RF signal is input to one pin while the other pin is connected to GND. The RF signal is converted to IF frequency by the signal supplied from the oscillator and then output to Pins 2 and 3. Pins 2 and 3 are open collectors, so power must be supplied externally. Connect to $V_{CC}$ through L which configures external filter or resistor. The electric potential of Pins 2 and 3 at this time must be DC 4.0 V or more.

### UHF oscillator circuit

This oscillator circuit is designed so that two collector ground type Colpitts oscillators perform differential oscillation operation via an LC resonance circuit including a varicap. Feedback capacitance is built into IC, and an LC resonance circuit including a varicap is connected between Pins 12 and 14 via coupled capacitance.

### UHF mixer circuit

This circuit employs a double symmetrical mixer like the VHF mixer circuit. The RF signal is input to Pins 7 and 8. There is a symmetrical input at the differential from both edges of the secondary coil of the pre-stage double-tuned circuits, or an asymmetrical input to Pin 7 with a capacitor connected at Pin 8 to GND. Otherwise, the conditions and usage are the same as those for the VHF mixer circuit.

### IF amplifier circuit

The signals frequency converted by the mixer are output from Pins 2 and 3, and at the same time are AC coupled inside the IC and input to the IF amplifier. Single-tuned filters are connected to Pins 2 and 3 in order to improve the interference characteristics of the IF amplifier.

The signal amplified by the IF amplifier is output with symmetrical or asymmetrical output format. Selecting symmetrical or asymmetrical is performed at Pin 10. Asymmetrical output when Pin 10 is for open state; symmetrical output when connected to GND. During symmetrical output, SAW filter direct connection is possible and during asymmetrical output, output stage drive capability is increased to drive 75 Ω load. During asymmetrical output, output is performed from Pin 16, and during symmetrical output, output is performed from Pins 15 and 16. The output impedance is approximately 35 Ω for symmetrical output; 30 Ω for asymmetrical output. When asymmetrical output is selected, connect Pin 10 to GND through capacitor.

### U/V switch circuit

UHF operation is chosen by applying voltage of 3 V or more to Pin 13 VHF operation for 0 V or open.

**Notes on Operation**

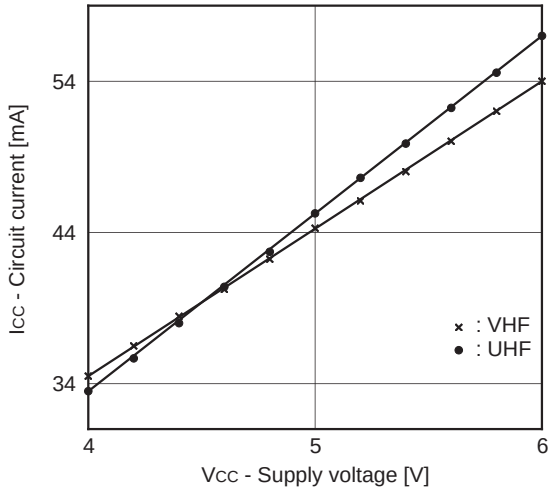
1. Care should be taken for grounding, etc. when placing external parts as high operating frequencies are present.

2. The GND pattern also serves as heat dissipation pins, care should be taken to prevent heat problems.

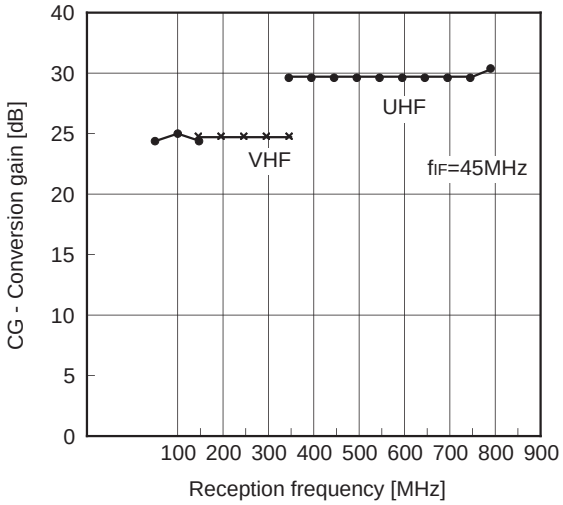
3. Care should also be taken to prevent electrostatic damage because of using high frequency process.

## Example of Representative Characteristics

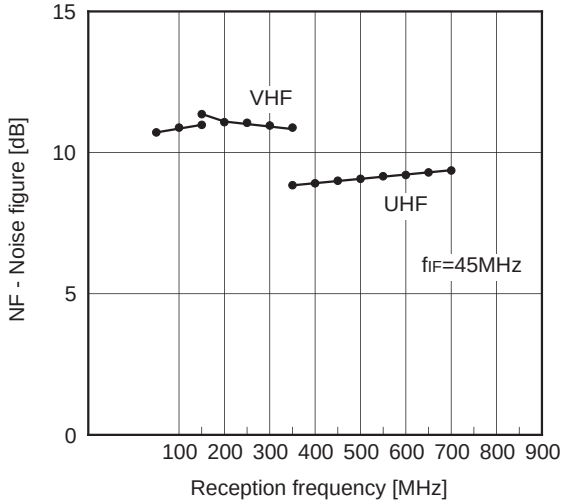
Supply voltage vs. Circuit current
(for asymmetrical output)



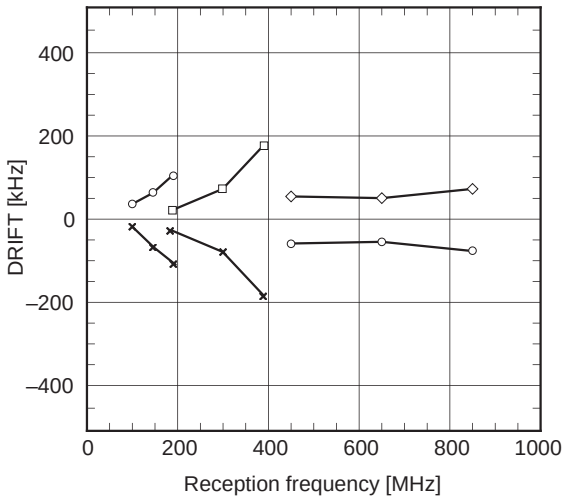

Reception frequency vs. Conversion gain
(for asymmetrical output)



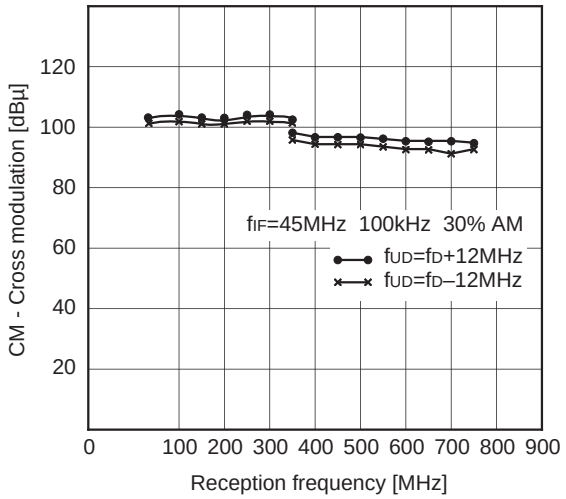

Reception frequency vs. Noise figure
(untuned input, for asymmetrical output, DSB display)



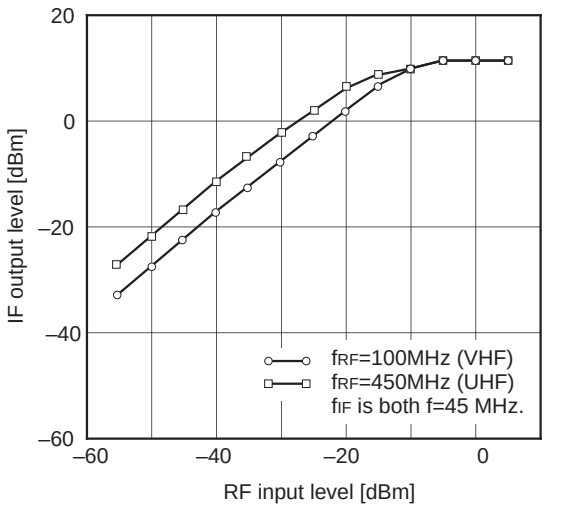

Reception frequency vs. +B drift



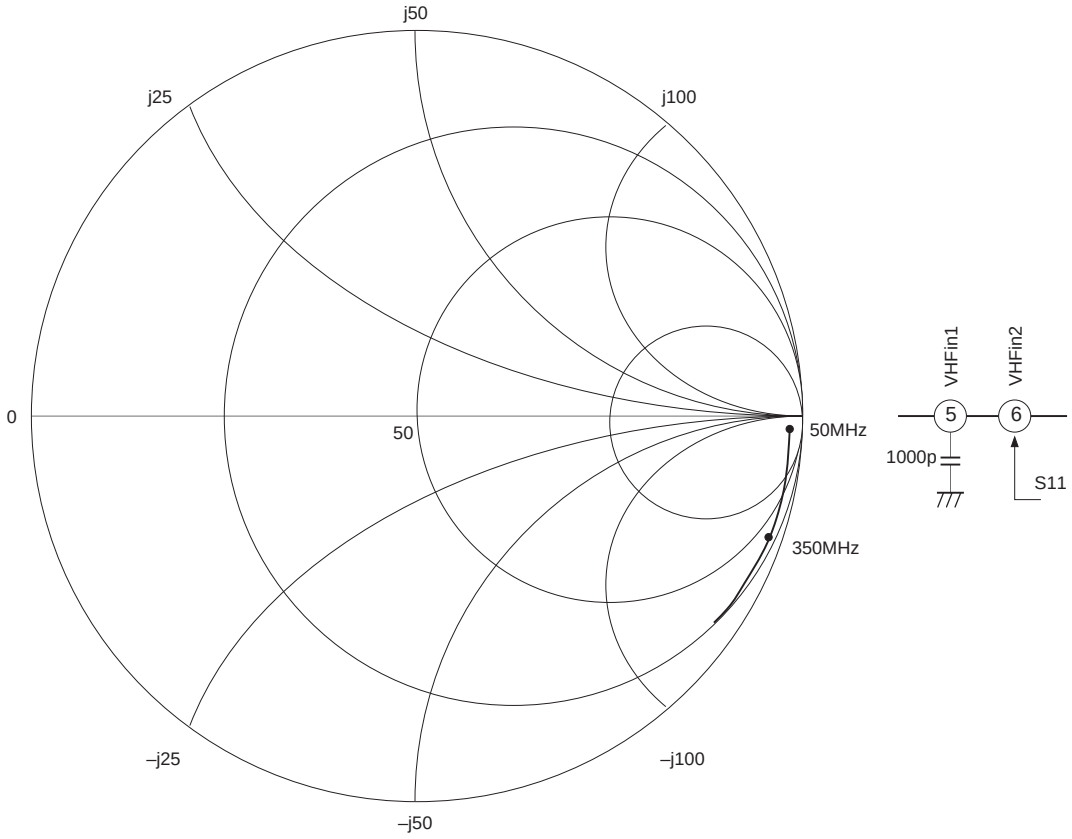

Reception frequency vs. Next adjacent cross modulation
(untuned input, for asymmetrical output)



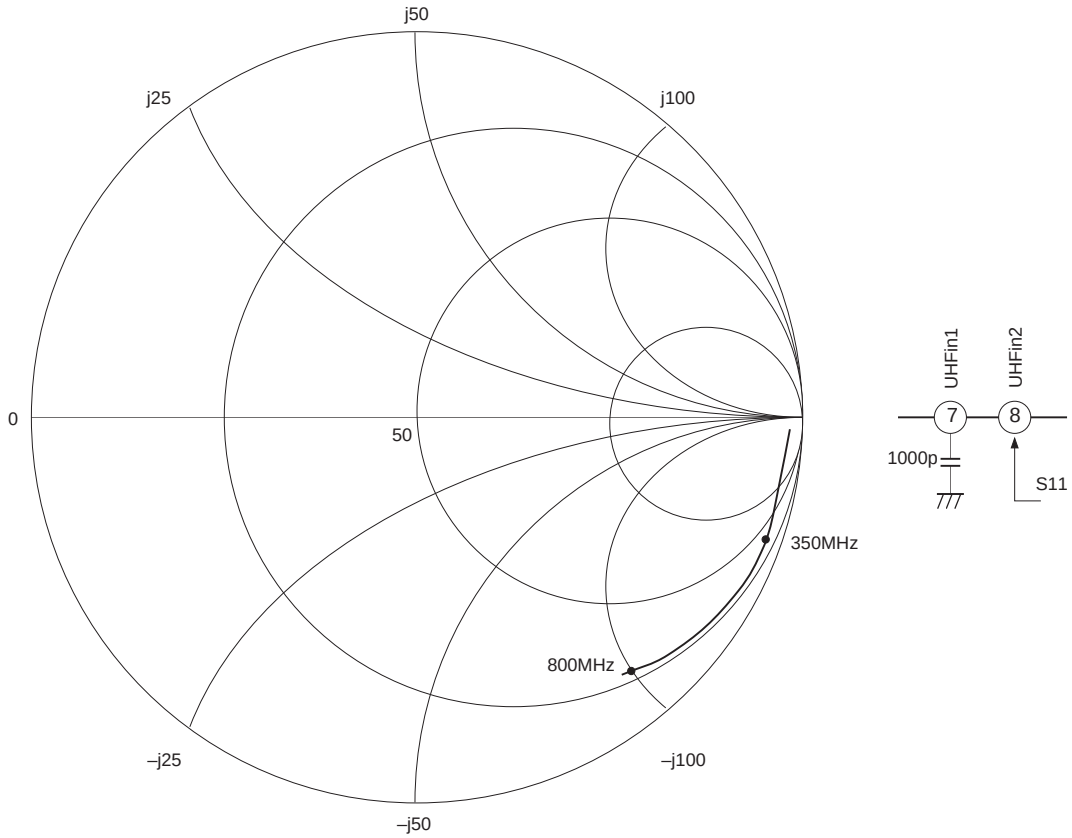

I/O characteristics (untuned input, for asymmetrical output)



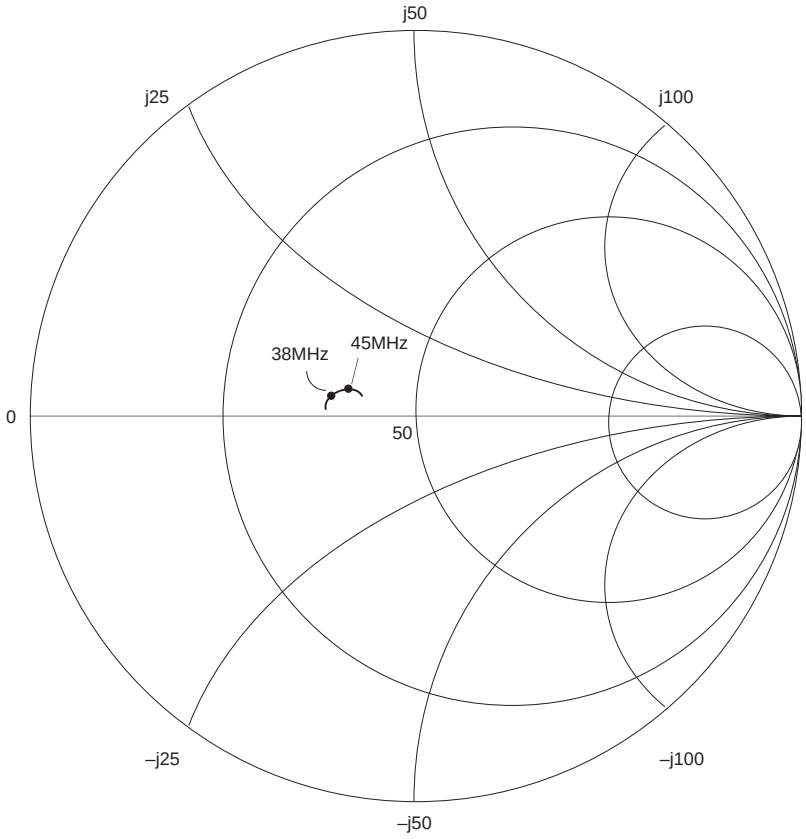
## VHF Input Impedance



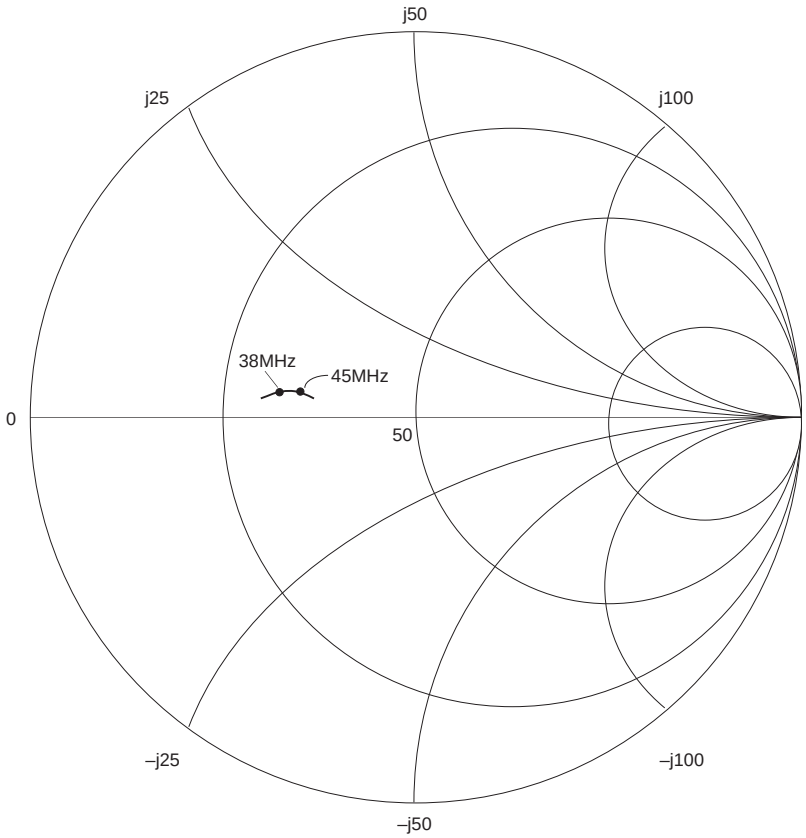

## UHF Input Impedance



**IF Output Impedance** (symmetrical output)

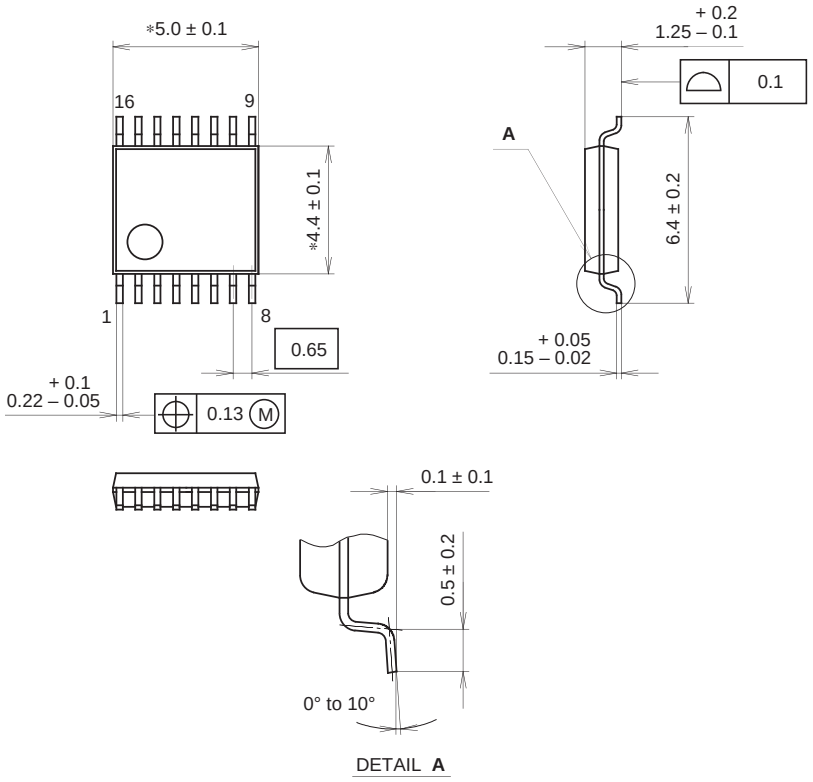



**IF Output Impedance** (asymmetrical output)



**Package Outline** Unit : mm

16PIN SSOP (PLASTIC)




DETAIL **A**

NOTE: Dimension "∗" does not include mold protrusion.

| | |
|---|---|
| SONY CODE | SSOP-16P-L01 |
| EIAJ CODE | SSOP016-P-0044 |
| JEDEC CODE | ———— |

PACKAGE STRUCTURE

| | |
|---|---|
| PACKAGE MATERIAL | EPOXY RESIN |
| LEAD TREATMENT | SOLDER / PALLADIUM PLATING |
| LEAD MATERIAL | 42/COPPER ALLOY |
| PACKAGE MASS | 0.1g |

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