SONY

# CXA3225N

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

### Description

The CXA3225N is a TV tuner monolithic 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 20-pin SSOP package and is suitable for miniaturizing voltage synthesizer tuner.

### Features

- Low power consumption (5 V, 46 mA typ.)
- Single 5 V power supply
- Superior cross modulation
- Balance-type UHF oscillator with good oscillation stability (4 pins)
- IF output can be selected from symmetrical or asymmetrical
- Double-tuned filter can be connected to MIX output
- SSOP 20-pin package

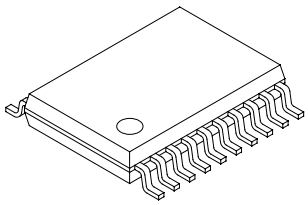
### Applications

- TV tuners
- VCR tuners
- CATV tuners

### Structure

Bipolar silicon monolithic IC

20 pin SSOP (Plastic)



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

| | | | |
|---|---|---|---|
| • Supply voltage | $V_{CC}1$ | –0.3 to +5.5 | V |
| • Storage temperature | Tstg | –55 to +150 | °C |
| • Allowable power dissipation | $P_D$ | 465 | mW |

(when mounted on a printed circuit board)

### Operating Conditions

| | | | |
|---|---|---|---|
| • Supply voltage | $V_{CC}1$ | 4.75 to 5.30 | V |
| • Operating temperature | Topr | –20 to +75 | °C |

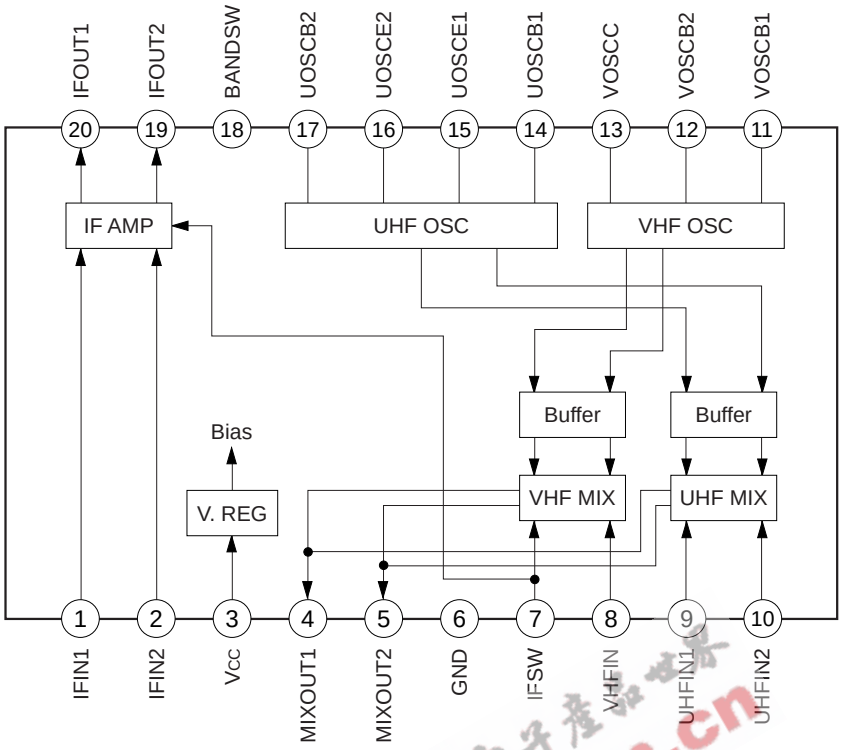




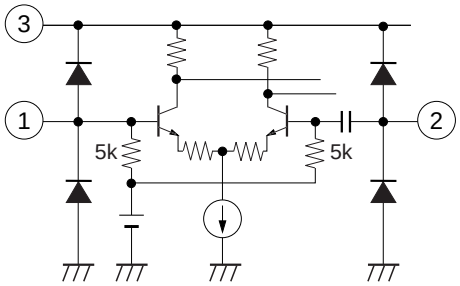
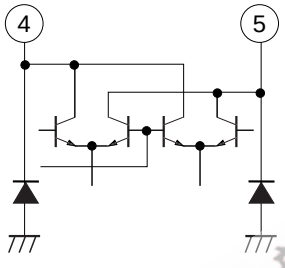
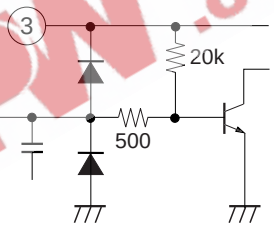
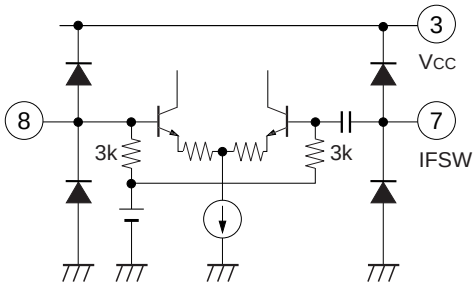
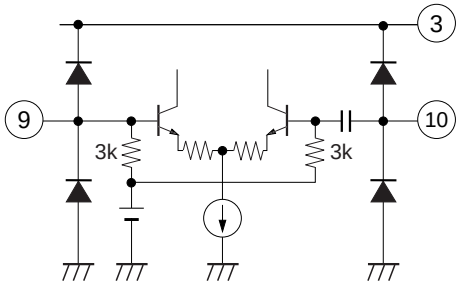


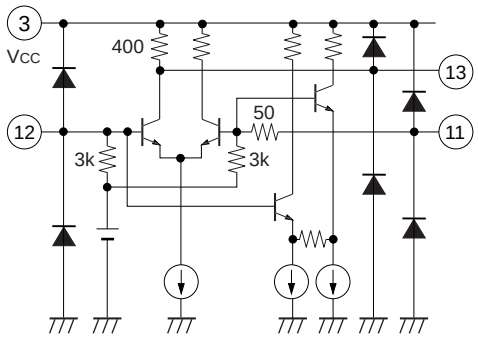
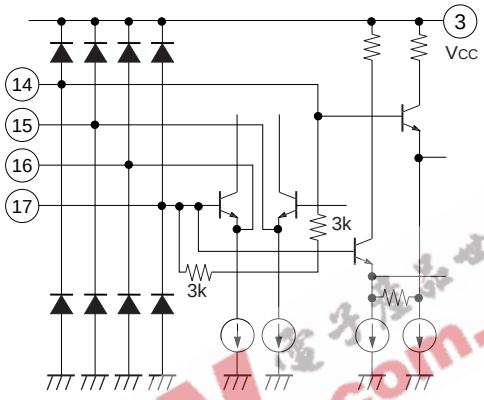
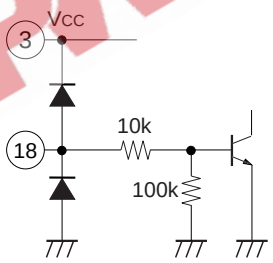
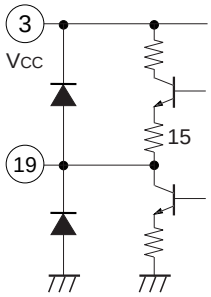
E98950-TE

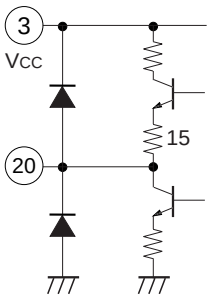
## Block Diagram and Pin Configuration



**Pin Description and Equivalent Circuit**

| Pin No. | Symbol | Typical pin voltage (V) | Equivalent circuit | Description |
|---|---|---|---|---|
| 1 | IFIN1 | 2.4 |  | IF amplifier input. |
| 2 | IFIN2 | 2.4 | | |
| 3 | Vcc | 5.0 | | Power supply. |
| 4 | MIXOUT1 | 4.4 during VHF reception<br>4.3 during UHF reception |  | Mixer outputs.<br>These pins are output with open collector, and they must be connected to the power supply via the load. |
| 5 | MIXOUT2 | 4.4 during VHF reception<br>4.3 during UHF reception | | |
| 6 | GND | 0 | | GND. |
| 7 | IFSW | 0.8 (when open) |  | Switching of VHF input ground and IF symmetrical/ asymmetrical output.<br>Asymmetrical output is selected for open state; symmetrical output for grounding. When used as an asymmetrical output, ground this pin with a capacitor. |
| 8 | VHFIN | 2.4 during VHF reception<br>2.6 during UHF reception |  | VHF inputs.<br>Input format is asymmetrical input. |
| 9 | UHFIN1 | 2.6 during VHF reception<br>2.3 during UHF reception |  | UHF inputs.<br>Input the signal to Pins 9 and 10 symmetrically or ground Pin 10 with a capacitor and input to Pin 9. |
| 10 | UHFIN2 | 2.6 during VHF reception<br>2.3 during UHF reception | | |

| Pin No. | Symbol | Typical pin voltage (V) | Equivalent circuit | Description |
|---|---|---|---|---|
| 11 | VOSCB1 | 2.1 during VHF reception<br>2.2 during UHF reception |  | External resonance circuit connection for VHF oscillators. Pin 12 is grounded with a capacitor. |
| 12 | VOSCB2 | 2.1 during VHF reception<br>2.2 during UHF reception | | |
| 13 | VOSCC | 4.2 during VHF reception<br>5 during UHF reception | | |
| 14 | UOSCB1 | 2.3 during VHF reception<br>2.1 during UHF reception |  | External resonance circuit connection for UHF oscillators. |
| 15 | UOSCE1 | 1.8 during VHF reception<br>1.5 during UHF reception | | |
| 16 | UOSCE2 | 1.8 during VHF reception<br>1.4 during UHF reception | | |
| 17 | UOSCB2 | 2.3 during VHF reception<br>2.1 during UHF reception | | |
| 18 | BANDSW | |  | Band switching.<br>UHF operation for 3.0 V or more, and VHF operation for 0.5 V or less or open state. |
| 19 | IFOUT2 | 2.8 during symmetrical output<br>4.5 during asymmetrical output |  | IF output during symmetrical output.<br>The opposite phase signal to Pin 20 is output during symmetrical output.<br>When asymmetrical output is selected, the signal is not output. |

| Pin No. | Symbol | Typical pin voltage (V) | Equivalent circuit | Description |
|---|---|---|---|---|
| 20 | IFOUT1 | 2.8 during symmetrical output<br>2.8 during asymmetrical output |  | IF output. |

**Electrical Characteristics** See the Electrical Characteristics Measurement Circuit

(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 | 35 | 46 | 55 | mA |
| | $I_{CC}$VB | VHF operation symmetrical output no input signal | 47 | 58 | 67 | mA |
| | $I_{CC}$UU | UHF operation asymmetrical output no input signal | 39 | 50 | 59 | mA |
| | $I_{CC}$UB | UHF operation symmetrical output no input signal | 51 | 62 | 71 | mA |
| Conversion gain *1 | CG1U | VHF operation $f_{RF}$=50 MHz asymmetrical output | 20 | 23 | 26 | dB |
| | CG2U | VHF operation $f_{RF}$=430 MHz asymmetrical output | 20 | 23 | 26 | dB |
| | CG3U | UHF operation $f_{RF}$=430 MHz asymmetrical output | 23 | 26 | 29 | dB |
| | CG4U | UHF operation $f_{RF}$=850 MHz asymmetrical output | 23 | 26 | 29 | dB |
| | CG1B *4 | VHF operation $f_{RF}$=50 MHz symmetrical output | 29 | 32 | 35 | dB |
| | CG2B *4 | VHF operation $f_{RF}$=430 MHz symmetrical output | 29 | 32 | 35 | dB |
| | CG3B *4 | UHF operation $f_{RF}$=430 MHz symmetrical output | 32 | 35 | 38 | dB |
| | CG4B *4 | UHF operation $f_{RF}$=850 MHz symmetrical output | 32 | 35 | 38 | dB |
| Noise figure *1, *2 | NF1 | VHF operation $f_{RF}$=50 MHz asymmetrical output | | 12 | 16 | dB |
| | NF2 | VHF operation $f_{RF}$=430 MHz asymmetrical output | | 13 | 17 | dB |
| | NF3 | UHF operation $f_{RF}$=430 MHz asymmetrical output | | 10 | 13 | dB |
| | NF4 | UHF operation $f_{RF}$=850 MHz asymmetrical output | | 12 | 15 | dB |
| 1 % cross modulation *1 *3 | CM1 | VHF operation $f_D$=50 MHz $f_{UD}$=±12 MHz asymmetrical output | 99 | 103 | | dBµ |
| | CM2 | VHF operation $f_D$=430 MHz $f_{UD}$=±12 MHz asymmetrical output | 96 | 100 | | dBµ |
| | CM3 | UHF operation $f_D$=430 MHz $f_{UD}$=±12 MHz asymmetrical output | 96 | 100 | | dBµ |
| | CM4 | UHF operation $f_D$=850 MHz $f_{UD}$=±12 MHz asymmetrical output | 95 | 99 | | dBµ |
| Maximum output power | Pomax (sat) | 50 Ω load, asymmetrical output | 7 | 10 | | dBm |
| Switch ON drift | Δfsw1 | VHF operation $f_{OSC}$=100 MHz Δf from 3 seconds to 3 minutes after switch ON | | | ±300 | kHz |
| | Δfsw2 | VHF operation $f_{OSC}$=470 MHz Δf from 3 seconds to 3 minutes after switch ON | | | ±600 | kHz |
| | Δfsw3 | UHF operation $f_{OSC}$=470 MHz Δf from 3 seconds to 3 minutes after switch ON | | | ±350 | kHz |
| | Δfsw4 | UHF operation $f_{OSC}$=895 MHz Δf from 3 seconds to 3 minutes after switch ON | | | ±350 | kHz |

*1 Value measured with untuned input.

*2 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/30 % AM, and an interference signal level where S/I=46 dB measured with a spectrum analyzer.

*4 Value which is measured as 420 Ω load impedance and compensated loss by 180 Ω resistor connected to Pins 19 and 20.

| Item | Symbol | Measurement conditions | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|
| Supply voltage drift | Δfst1 | VHF operation fosc=100 MHz<br>Δf when Vcc 5 V ± 5 % variation | | | ±200 | kHz |
| | Δfst2 | VHF operation fosc=470 MHz<br>Δf when Vcc 5 V ± 5 % variation | | | ±250 | kHz |
| | Δfst3 | UHF operation fosc=470 MHz<br>Δf when Vcc 5 V ± 5 % variation | | | ±150 | kHz |
| | Δfst4 | UHF operation fosc=895 MHz<br>Δf when Vcc 5 V ± 5 % variation | | | ±150 | kHz |
| Band switching voltage | VswV | VHF operation | 0 | | 0.5 | V |
| | VswU | UHF operation | 3 | | 5.5 | V |

## Description of Operation

(See the Electrical Characteristics Measurement Circuit.)

### VHF oscillator circuit

This circuit is a differential amplifier-type oscillator circuit. Pin 13 is the output, Pin 11 is the input and Pin 12 is the GND.

Oscillation is performed by connecting an LC resonance circuit including a variable capacitance diode, to Pin 13 via coupled capacitance, inputting to Pin 11 with feedback capacitance, and applying positive feedback.

Note that if the capacitance across Pins 11 and 13 is too large, positive feedback may be applied via a parasitic capacitance causing undesired stray oscillation. The resistor connected Pin 11 prevents the parasitic oscillation.

### VHF mixer circuit

The mixer circuit employs a double balanced mixer with little local oscillation signal leakage. The input format is the base input type. Pin 7 is grounded and the RF signal is input to Pin 8. The RF signal is converted to IF frequency by the signal supplied from the oscillator and then output to Pins 4 and 5. Pins 4 and 5 are open collectors, so the power must be supplied externally. The electric potential of Pins 4 and 5 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 the differential oscillation operation via an LC resonance circuit including a variable capacitance diode. The resonance capacitors which configure the Colppits oscillator are connected between Pins 14 and 15, 15 and 16, 16 and 17. The LC resonance circuit including the variable capacitance diode Di is connected between Pins 14 and 17.

### UHF mixer circuit

This circuit employs a double balanced mixer like the VHF mixer circuit. The RF signal is input to Pins 9 and 10. There are two input methods; one is the symmetrical input where the signal is input to Pins 9 and 10 differentially and the other is the asymmetrical input where Pin 9 is grounded via a capacitor and the signal is input to Pin 10.

Pins 4 and 5 are the mixer outputs. Pins 4 and 5 are open collectors, so the power must be supplied externally. The electric potential of Pins 4 and 5 at this time must be DC 4.0 V or more.

### IF amplifier circuit

The signals frequency converted by the mixer are output from Pins 4 and 5, and then they are input to the IF input Pins 1 and 2 via the external tuned circuit. As the IF tuned circuit, the single-tuned circuit shown in the Electrical Characteristics Measurement Circuit or double-tuned circuits can be connected. When used as the single-tuned filter, be sure to connect it via the capacitor so that the DC voltage may not be applied to Pins 1 and 2.

The signal amplified by the IF amplifier is output with symmetrical or asymmetrical output format. Selecting symmetrical or asymmetrical is performed at Pin 7. Asymmetrical output when Pin 7 is grounded via the capacitor; symmetrical output when it is directly grounded. During symmetrical output, SAW filter direct connection is possible and during asymmetrical output. During asymmetrical output, output is performed from Pin 20, and during symmetrical output, output is performed from Pins 19 and 20. The output impedance is approximately 30 Ω.

### U/V switch circuit

UHF operation is chosen by applying voltage of 3 V or more to Pin 18, VHF operation for 0 V or open.

**Notes on Operation**

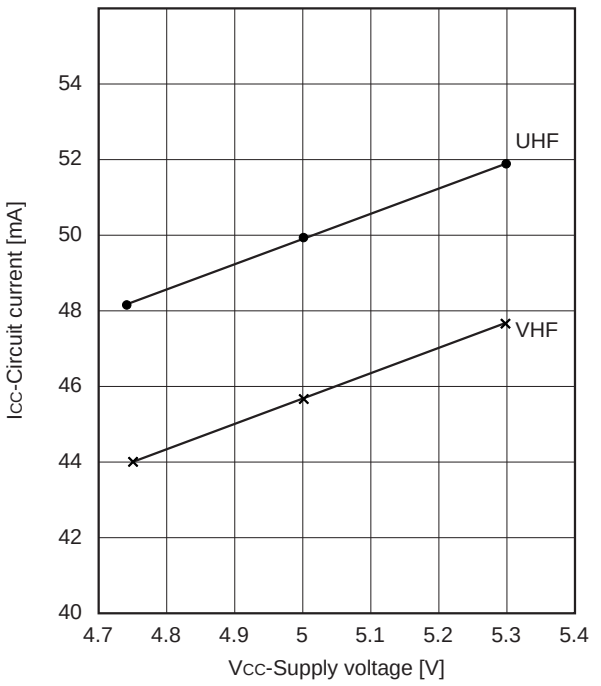
1. Care should be taken for grounding, etc. when placing external parts as the operating frequencies are high.

2. Be sure to design the printed circuit board considering the radiation of heat by placing the GND pattern at the bottom of the IC.

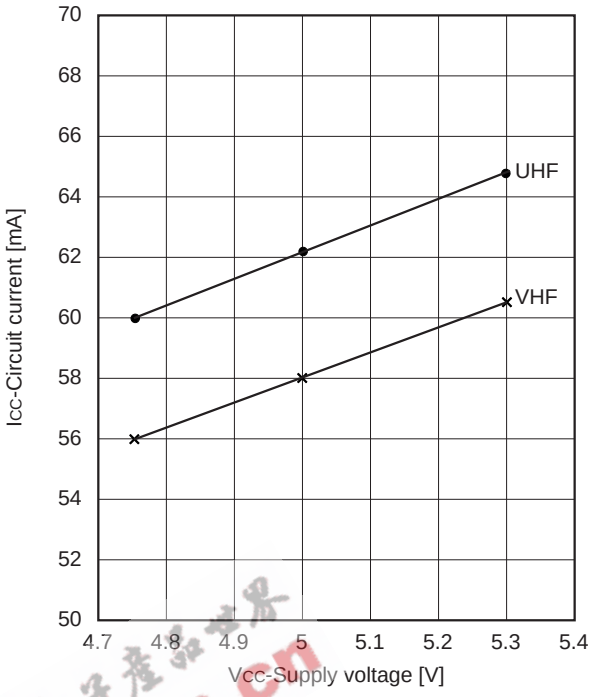
3. Care should also be taken to prevent electrostatic damage because of using high frequency process.

## Example of Representative Characteristics

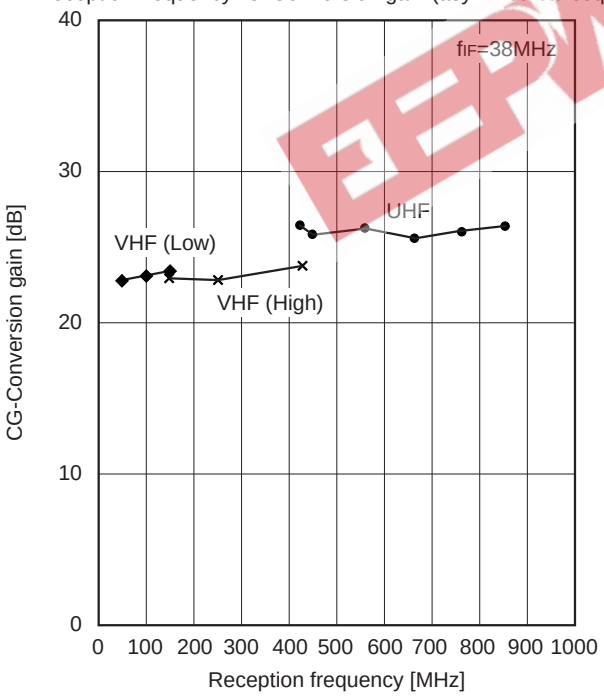
Supply voltage vs. Circuit current (asymmetrical output)



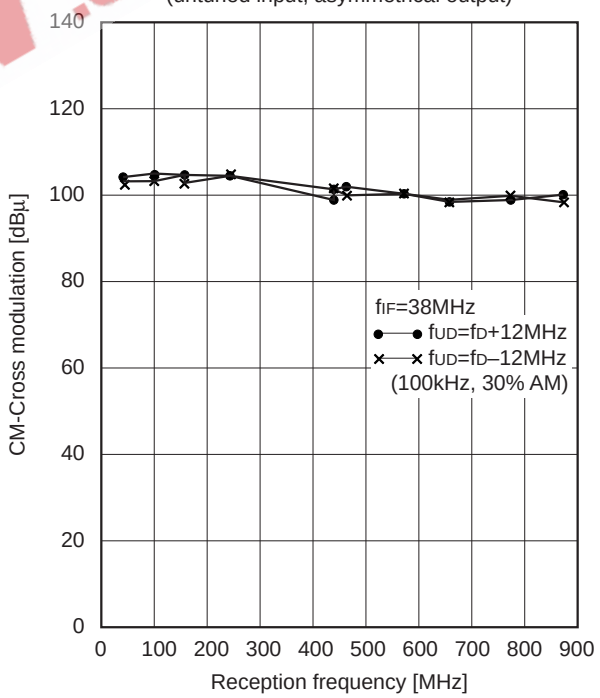

Supply voltage vs. Circuit current (symmetrical output)



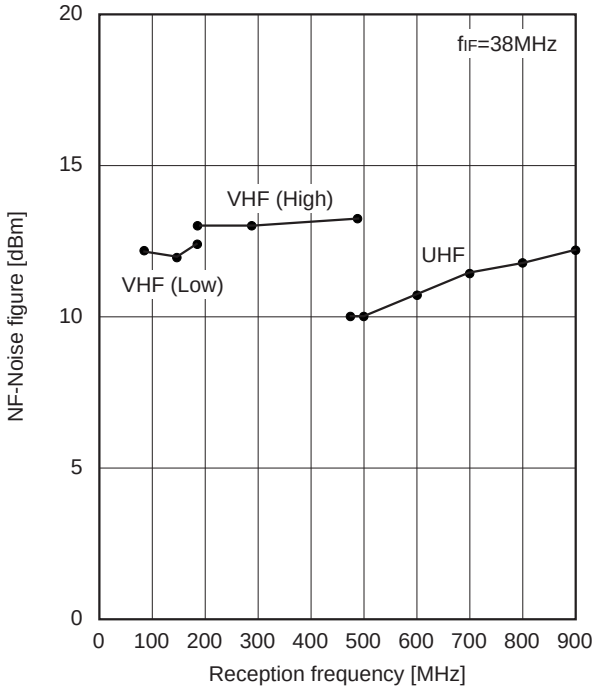

Reception frequency vs. Conversion gain (asymmetrical output)



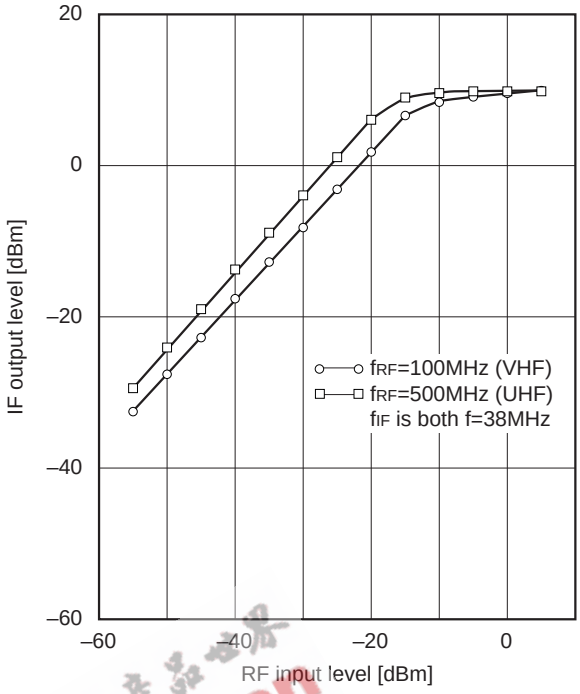

Reception frequency vs. Next adjacent cross modulation (untuned input, asymmetrical output)



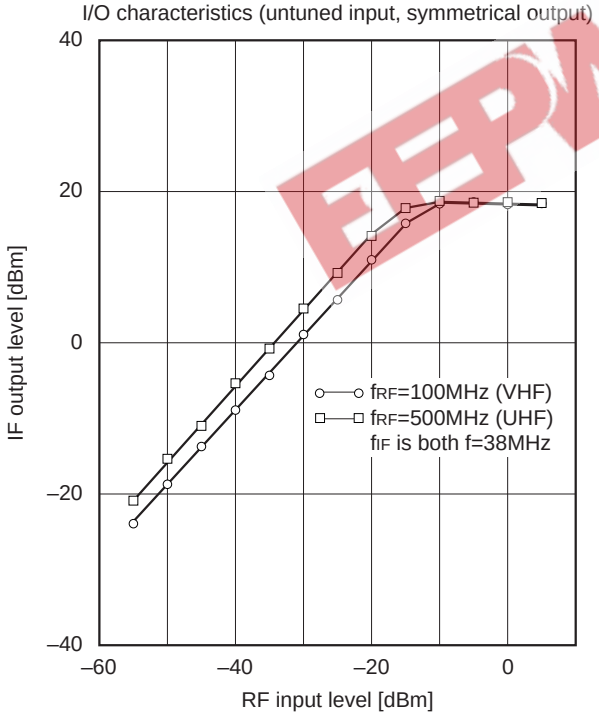
Reception frequency vs. Noise figure
(untuned input, asymmetrical output, DSB display)



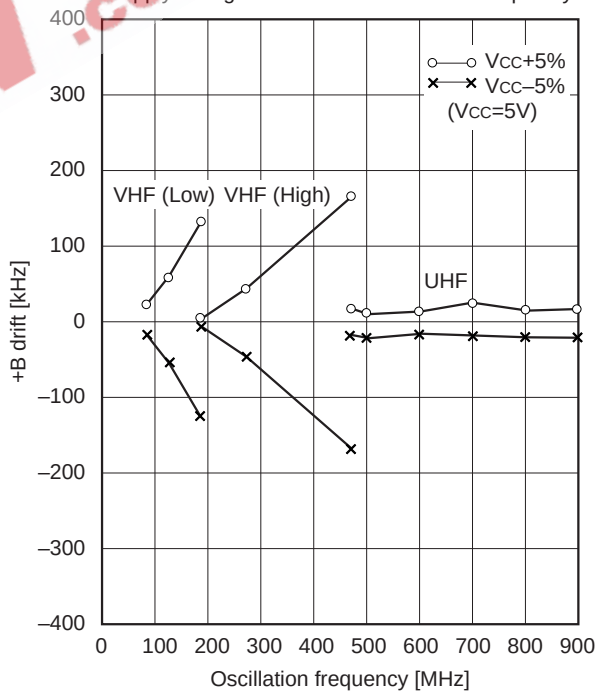

I/O characteristics (untuned input, asymmetrical output)



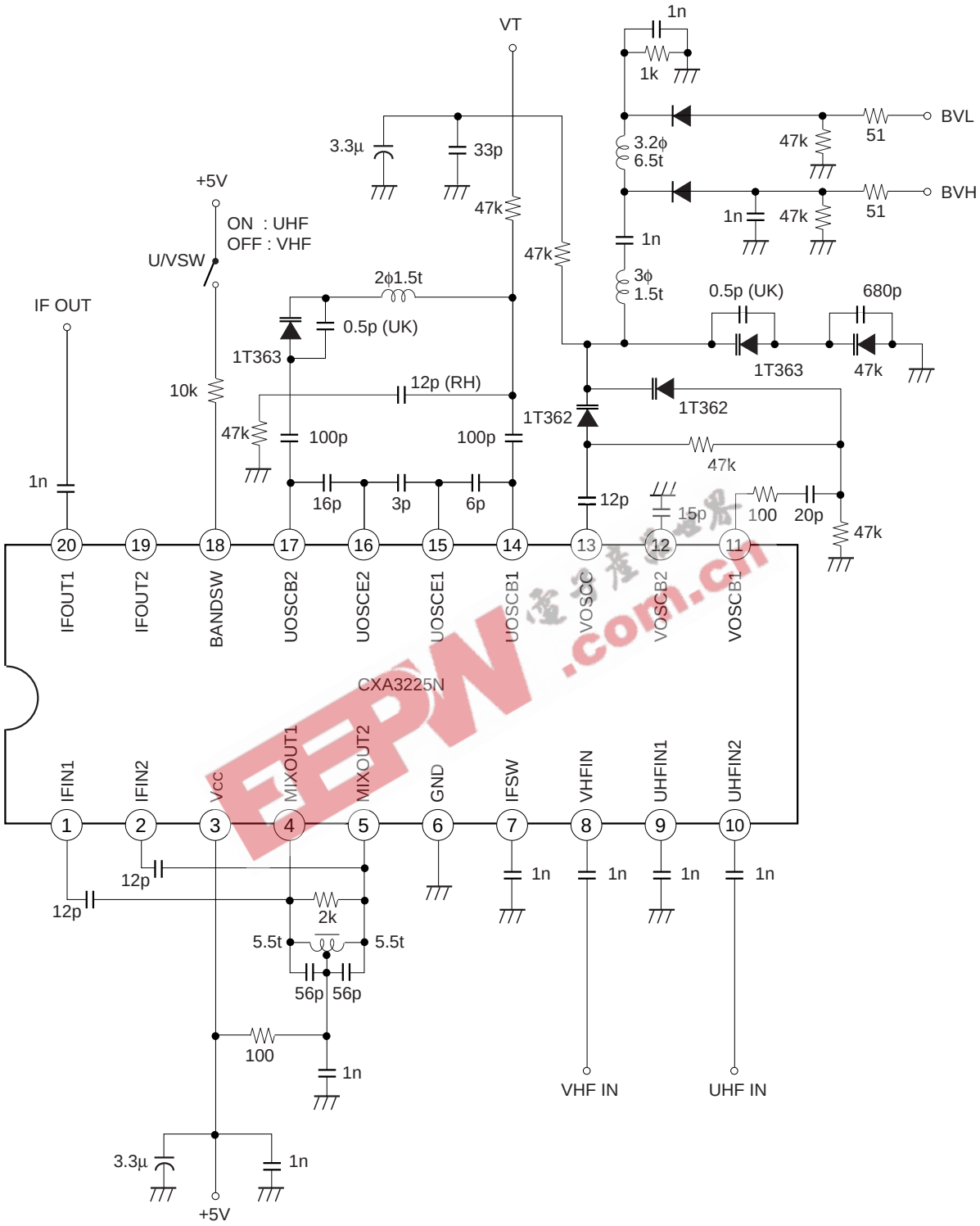

I/O characteristics (untuned input, symmetrical output)



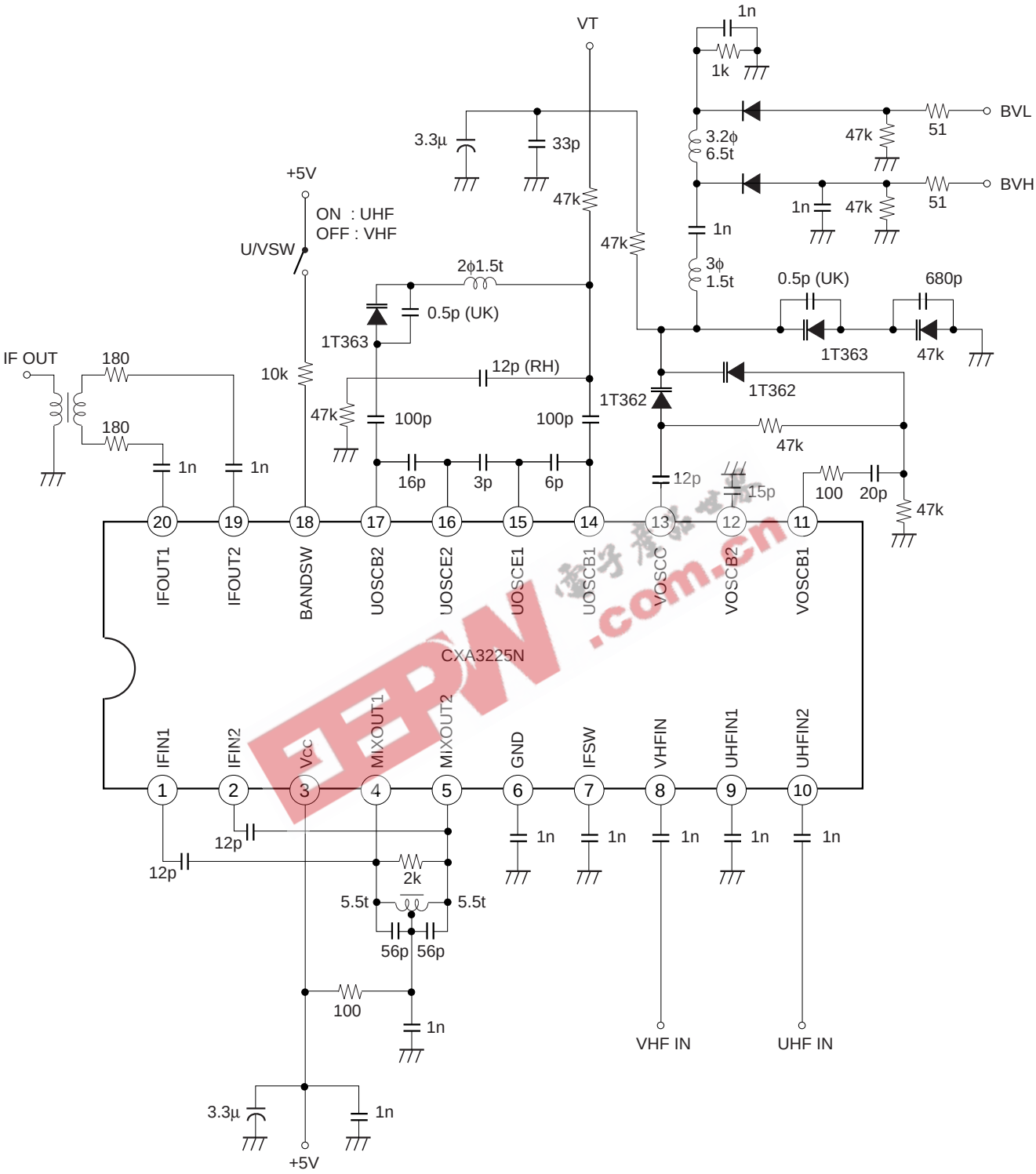

Supply voltage fluctuation of oscillation frequency



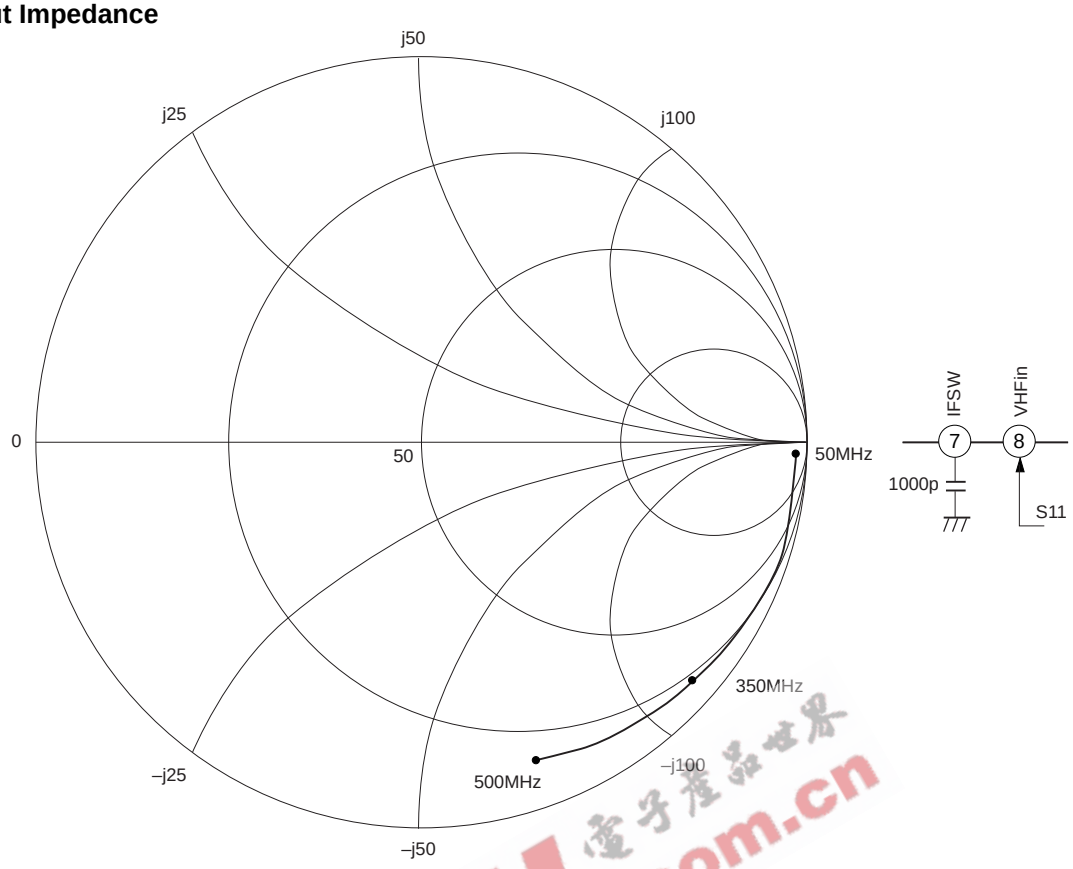
**Electrical Characteristics Measurement Circuit** (asymmetrical output)



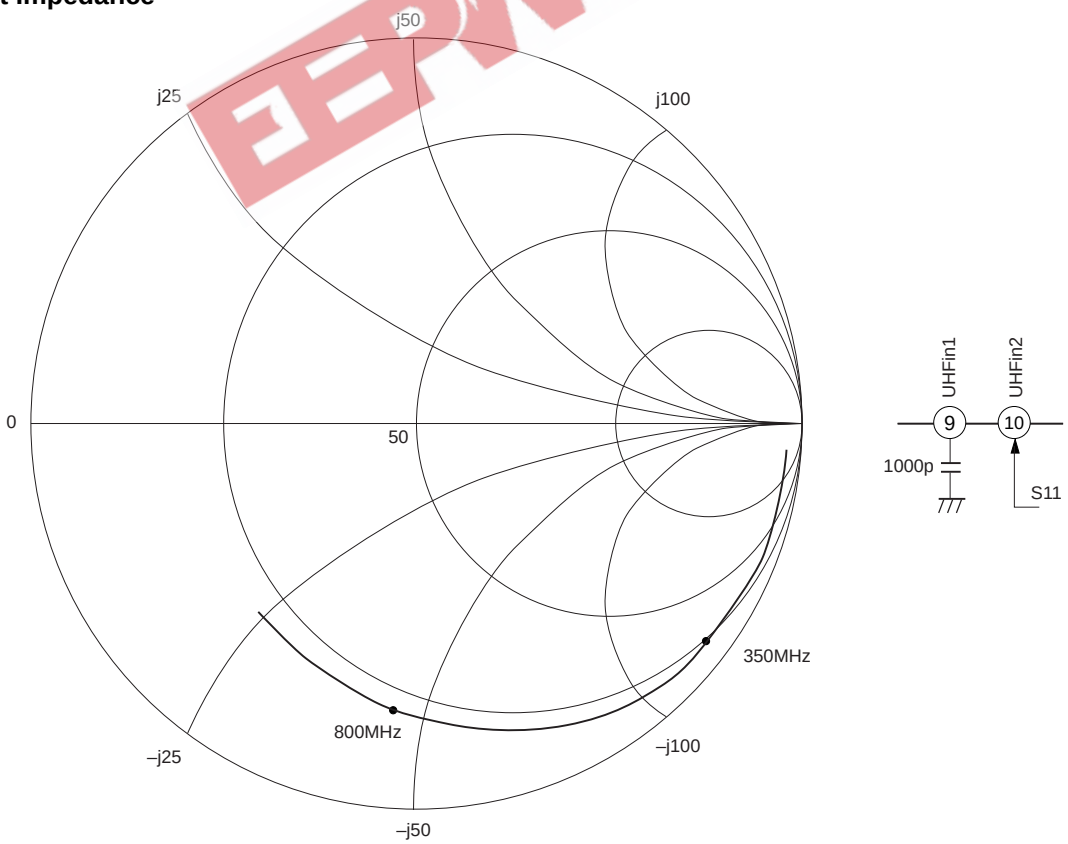
**Electrical Characteristics Measurement Circuit** (symmetrical output)



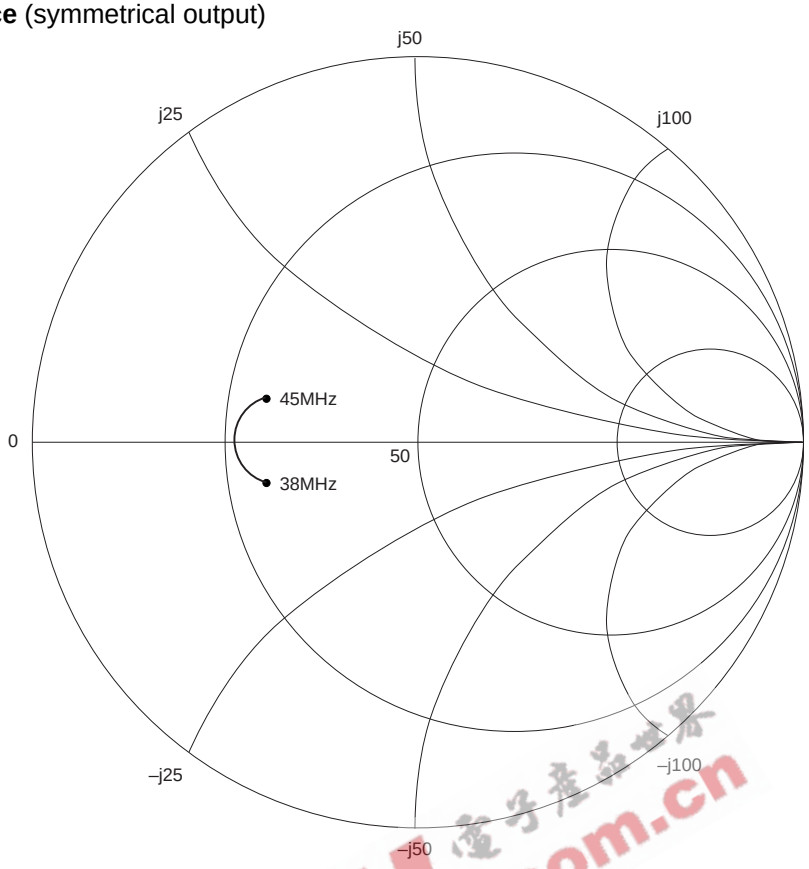
## VHF Input Impedance



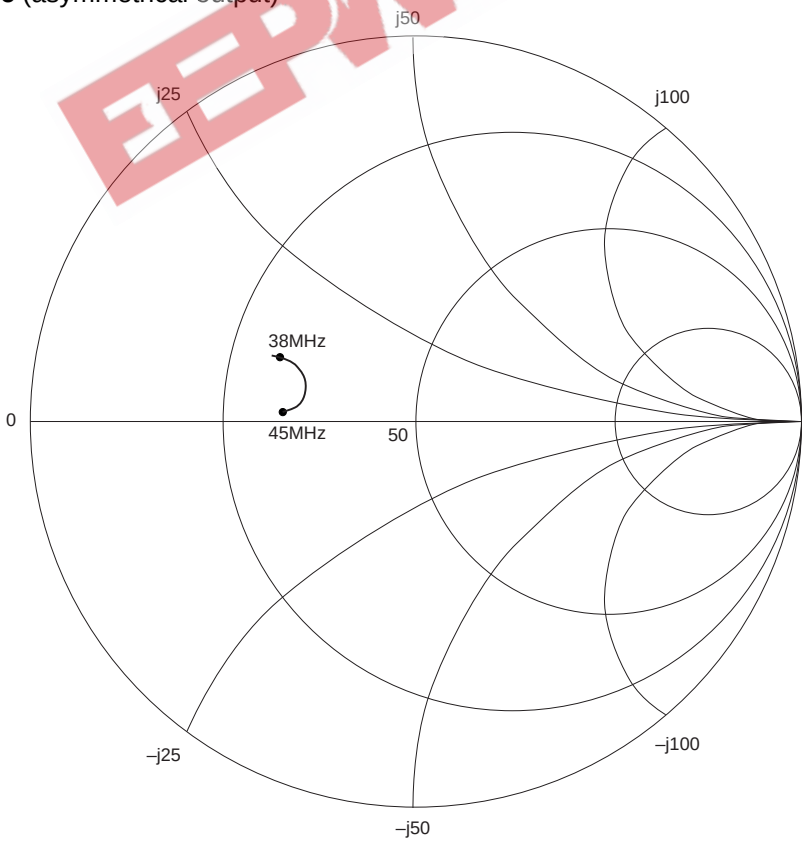

## UHF Input Impedance



**IF Output Impedance** (symmetrical output)

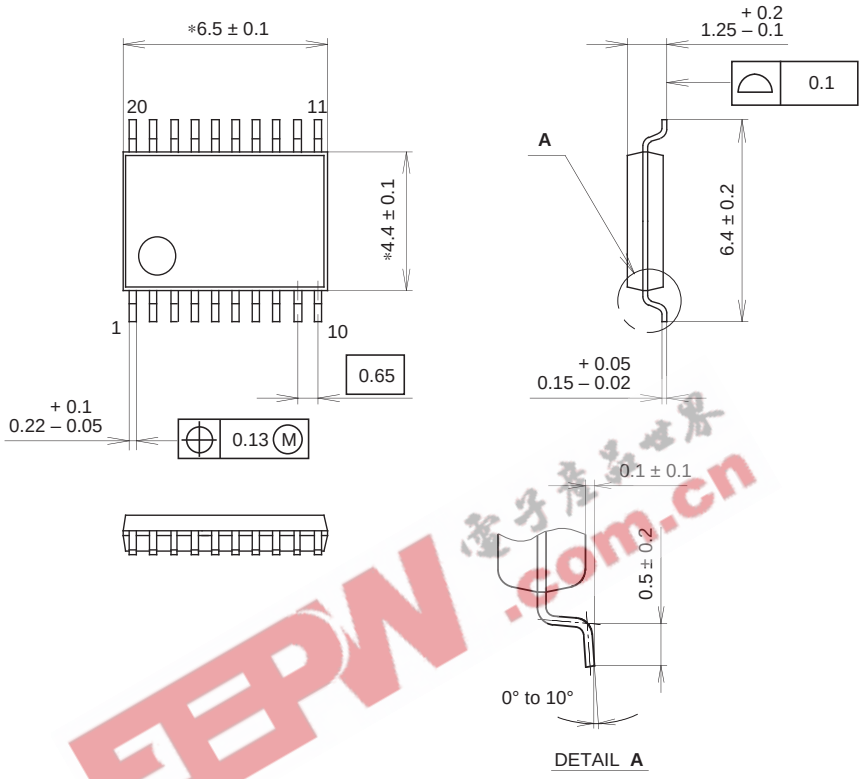



**IF Output Impedance** (asymmetrical output)



**Package Outline** Unit : mm

20PIN SSOP (PLASTIC)




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

| | |
|---|---|
| SONY CODE | SSOP-20P-L01 |
| EIAJ CODE | SSOP020-P-0044 |
| JEDEC CODE | ———— |

PACKAGE STRUCTURE

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

NOTE : PALLADIUM PLATING
This product uses S-PdPPF (Sony Spec.-Palladium Pre-Plated Lead Frame).