NEC

BIPOLAR ANALOG INTEGRATED CIRCUIT

μPC3207GR

FREQUENCY DOWN CONVERTER FOR VHF TO UHF BAND RECEIVER

DESCRIPTION

The μPC3207GR is a Silicon monolithic IC designed for receiver applications. This IC consists of a double balanced mixer (DBM), local oscillator, preamplifier for precscaler operation, IF amplifier, regulator, UHF/VHF switching circuit, and so on. This one-chip IC covers a wide frequency band from VHF to UHF bands. This IC is packaged in 20-pin SSOP (Shrink Small Outline Package) suitable for surface mounting.

FEATURES

- VHF to UHF bands operation.
- Low distortion CM: VHF (@f_{RF} = 470 MHz) 96 dBμ
  UHF (@f_{RF} = 890 MHz) 92 dBμ
- Supply voltage : 9 V
- Packaged in 20-pin SSOP suitable for surface mounting

APPLICATIONS

- Tuners for TV and VCR
- Receivers for VHF to UHF bands

ORDERING INFORMATION

Part Number	Package	Supplying Form
μPC3207GR-E1	20-pin plastic SSOP (225 mil)	Embossed tape 12 mm wide. Pin 1 indicates pull-out direction of tape. Qty 2.5 kp/reel.

To order evaluation samples, please contact your local NEC office. (Part number for sample order: μPC3207GR)

Caution electro-static sensitive device

The information in this document is subject to change without notice. Before using this document, please confirm that this is the latest version.
Not all devices/types available in every country. Please check with local NEC representative for availability and additional information.

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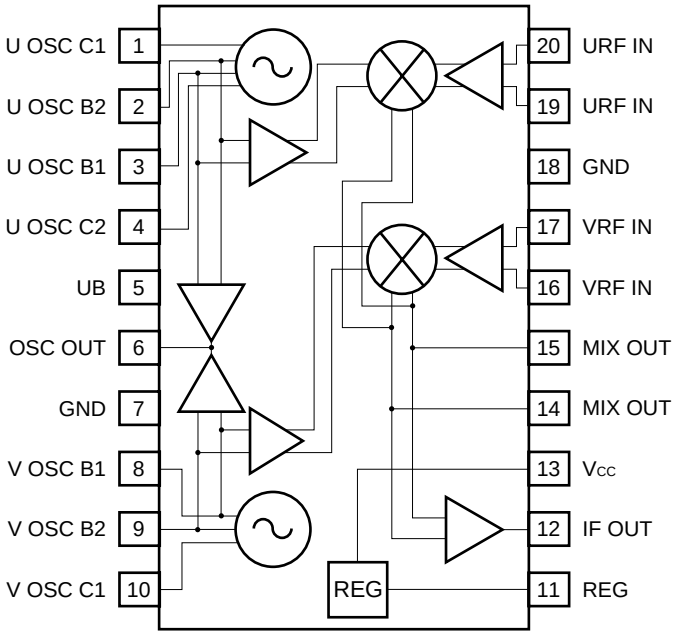
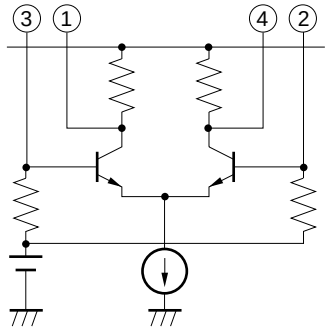
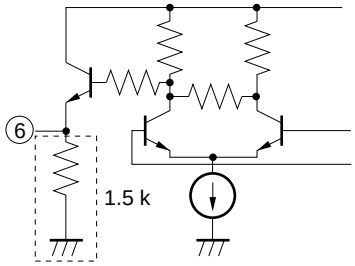
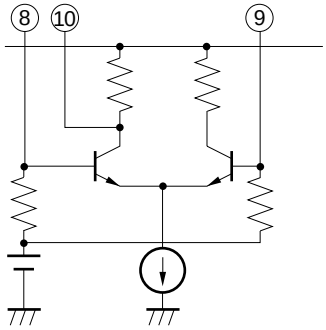
Date Published October 1999 N CP(K)
Printed in Japan

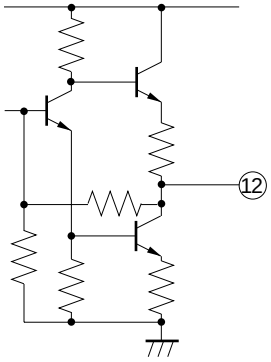
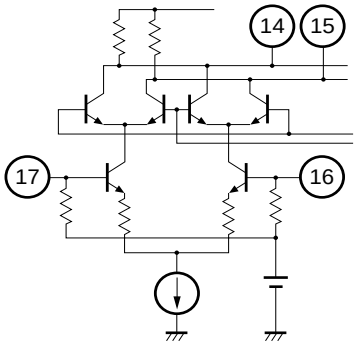
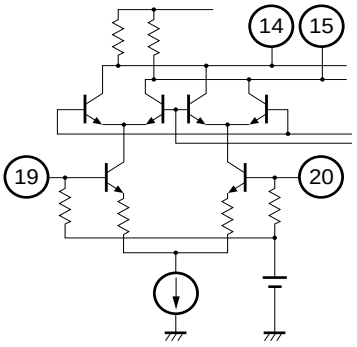
The mark ★ shows major revised points.

INTERNAL BLOCK DIAGRAM AND PIN CONFIGURATION (TOP VIEW)



PIN EXPLANATION

Pin No.	Symbol	Function and Explanation	Equivalent Circuit
1	UOSC collector (Tr. 1)	Collector pin of UHF oscillator with balance amplifier. Assemble LC resonator with 2 pin through capacitor ≃ 1 pF to oscillate with active feedback loop.	
2	UOSC base (Tr.2)	Base pin of UHF oscillator with balance amplifier. Connected to LC resonator through feedback capacitor ≃ 360 pF.	
3	UOSC base (Tr. 1)		
4	UOSC collector (Tr. 2)	Collector pin of UHF oscillator with balance amplifier. Assemble LC resonator with 2 pin through capacitor ≃ 1 pF to oscillate with active feedback loop. Double balanced oscillator with transistor 1 and transistor 2.	
5	UB	Switching pin for VHF or UHF operation. VHF operation = open UHF operation = 9.0 V	
6	OSC output	UHF and VHF oscillator output pin. In case of F/S tuner application, connected PLL symthesizer IC's input pin. Grounded through 1.5 kΩ resistor.	 * External element
7	GND	GND pin of VHF and UHF oscillator.	
8	VOSC base (Tr. 1)	Base pin of VHF oscillator. Grounded through capacitor ≃ 10 pF.	
9	VOSC base (Tr. 2)	Base pin of VHF oscillator. Assemble LC resonator with 10 pin to oscillate with active feedback loop.	
10	VOSC collector (Tr. 1)	Collector pin of VHF oscillator. Connected to LC resonator through feedback capacitor ≃ 3 pF.	

Pin No.	Symbol	Function and Explanation	Equivalent Circuit
11	REG	Monitor pin of regulator output voltage.	
12	IF output	IF signal output pin of VHF-UHF band functions.	
13	V_{CC}	Power supply pin for VHF-UHF band functions.	
14	MIX output1	VHF and UHF MIX output pins. These pins should be equipped with tank circuit to adjust intermediate frequency.	
15	MIX output2		
16	VRF input (bypass)	Bypass pin for VHF MIX input. Grounded through capacitor.	
17	VRF input	VRF signal input pin.	
18	GND	GND pin of MIX, IF amplifier and regulator.	
19	URF input (bypass)	Bypass pin for UHF Mü\œinput. Grounded through capacitor.	
20	URF input	URF signal input pin.	

ABSOLUTE MAXIMUM RATINGS (T_A = +25 °C UNLESS OTHERWISE SPECIFIED)

Parameter	Symbol	Condition	Rating	Unit
Supply Voltage 1	V_{CC}		11.0	V
Supply Voltage 2	UB		11.0	V
Power Dissipation	P_D	T_A = 75 °C**Note**	500	mW
Operating Ambient Temperature	T_A		–40 to +75	°C
Storage Temperature	T_{stg}		–60 to +150	°C

Note Mounted on 50 × 50 × 1.6 mm double epoxy glass board.

RECOMMENDED OPERATING RANGE

Parameter	Symbol	MIN.	TYP.	MAX.	Unit
Supply Voltage 1	V_{CC}	8.0	9.0	10.0	V
Supply Voltage 2	UB	8.0	9.0	10.0	V
Operating Ambient Temperature	T_A	–20	+25	+75	°C

ELECTRICAL CHARACTERISTICS

(T_A = +25 °C, V_{CC} = 9 V, f_{IF} = 45 MHz, f_{OSC} = f_{RF} + 45 MHz, P_{OSC} = –10 dBm)

Parameter	Symbol	Test Conditions	MIN.	TYP.	MAX.	Unit
Circuit Current 1	$I_{CC}1$	@VHF, no input signal **Notes 1, 2**	31.0	38.0	45.0	mA
Circuit Current 2	$I_{CC}2$	@UHF, no input signal **Notes 1, 2**	31.0	38.0	45.0	mA
Conversion Gain 1	CG1	VHF, f_{RF} = 55 MHz, P_{RF} = –30 dBm **Note 3**	18.5	22.0	25.5	dB
Conversion Gain 2	CG2	VHF, f_{RF} = 200 MHz, P_{RF} = –30 dBm **Note 3**	18.5	22.0	25.5	dB
Conversion Gain 3	CG3	VHF, f_{RF} = 470 MHz, P_{RF} = –30 dBm **Note 3**	18.5	22.0	25.5	dB
Conversion Gain 4	CG4	UHF, f_{RF} = 470 MHz, P_{RF} = –30 dBm **Note 3**	24.5	28.0	31.5	dB
Conversion Gain 5	CG5	UHF, f_{RF} = 890 MHz, P_{RF} = –30 dBm **Note 3**	24.5	28.0	31.5	dB
Noise Figure 1	NF1	VHF, f_{RF} = 55 MHz **Note 4**	—	11.0	14.0	dB
Noise Figure 2	NF2	VHF, f_{RF} = 200 MHz **Note 4**	—	11.0	14.0	dB
Noise Figure 3	NF3	VHF, f_{RF} = 470 MHz **Note 4**	—	11.0	14.0	dB
Noise Figure 4	NF4	UHF, f_{RF} = 470 MHz **Note 4**	—	9.5	12.5	dB
Noise Figure 5	NF5	UHF, f_{RF} = 890 MHz **Note 4**	—	10.0	13.0	dB
Maximum Output Power 1	$P_{o\,(sat)}1$	VHF, f_{RF} = 55 MHz, P_{RF} = 0 dBm **Note 3**	7.0	10.0	—	dBm
Maximum Output Power 2	$P_{o\,(sat)}2$	VHF, f_{RF} = 200 MHz, P_{RF} = 0 dBm **Note 3**	7.0	10.0	—	dBm
Maximum Output Power 3	$P_{o\,(sat)}3$	VHF, f_{RF} = 470 MHz, P_{RF} = 0 dBm **Note 3**	7.0	10.0	—	dBm
Maximum Output Power 4	$P_{o\,(sat)}4$	UHF, f_{RF} = 470 MHz, P_{RF} = 0 dBm **Note 3**	7.0	10.0	—	dBm
Maximum Output Power 5	$P_{o\,(sat)}5$	UHF, f_{RF} = 890 MHz, P_{RF} = 0 dBm **Note 3**	7.0	10.0	—	dBm

Notes 1. no resistance of OSC output

2. By measurement circuit 1

3. By measurement circuit 2

4. By measurement circuit 3

STANDARD CHARACTERISTICS

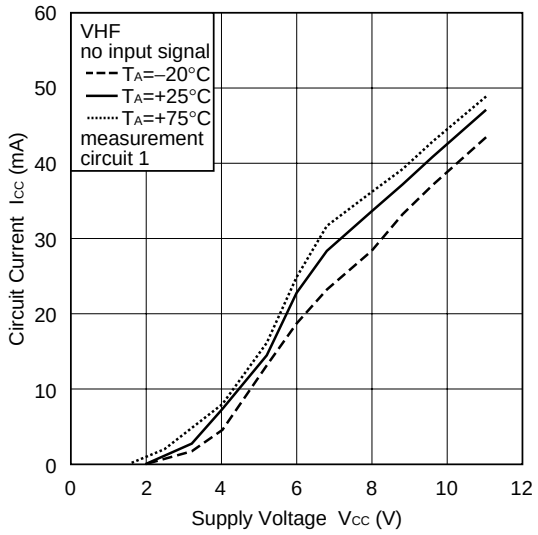
(T_A = +25 °C, V_{CC} = 9 V, f_{IF} = 45 MHz, f_{OSC} = f_{RF} + 45 MHz, P_{OSC} = –10 dBm)

Parameter	Symbol	Test Conditions	Reference Value	Unit
1 % cross-modulation distortion 1	CM1	f_{RF} = 55 MHz **Note**	100	dBμ
1 % cross-modulation distortion 2	CM2	f_{RF} = 200 MHz **Note**	100	dBμ
1 % cross-modulation distortion 3	CM3	f_{RF} = 470 MHz **Note**	96	dBμ
1 % cross-modulation distortion 4	CM4	f_{RF} = 470 MHz **Note**	94	dBμ
1 % cross-modulation distortion 5	CM5	f_{RF} = 890 MHz **Note**	92	dBμ

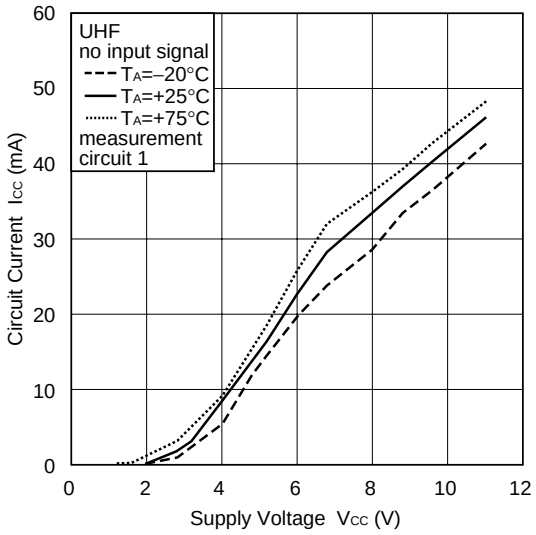
Note By measurement circuit 4, f_{undes} = f_{des} + 6 MHz, P_{RF} = –30 dBm, AM 100 kHz, 30 % modulation, DES/CM = 46 dBc

TYPICAL CHARACTERISTICS

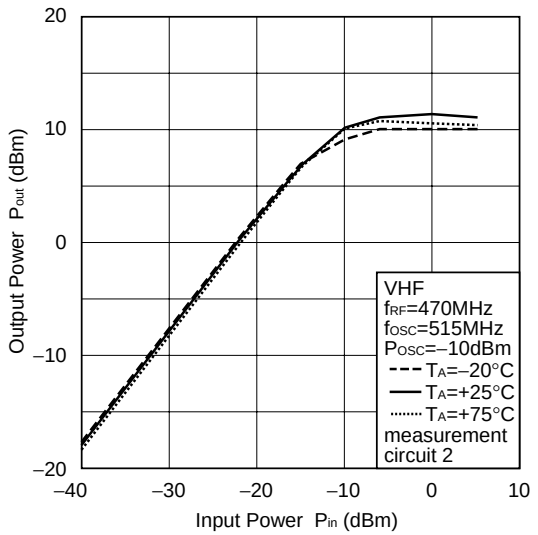
CIRCUIT CURRENT vs. SUPPLY VOLTAGE



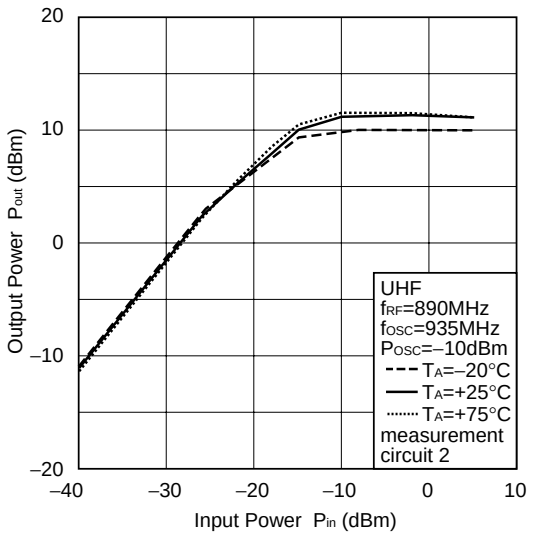
CIRCUIT CURRENT vs. SUPPLY VOLTAGE



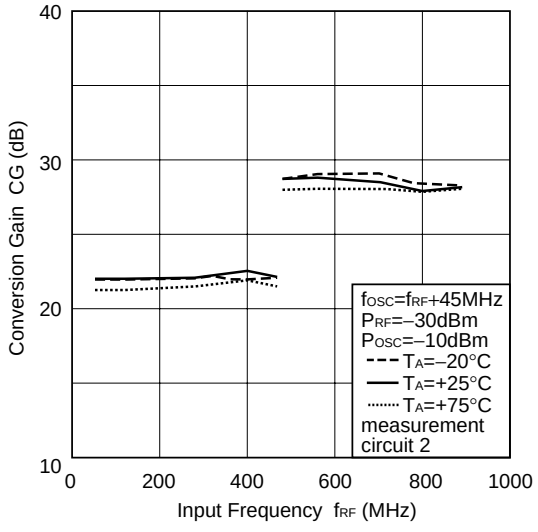
OUTPUT POWER vs. INPUT POWER



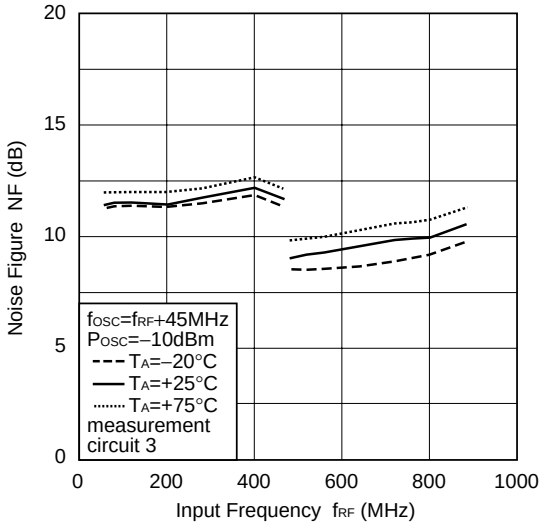
OUTPUT POWER vs. INPUT POWER



CONVERSION GAIN vs. INPUT FREQUENCY

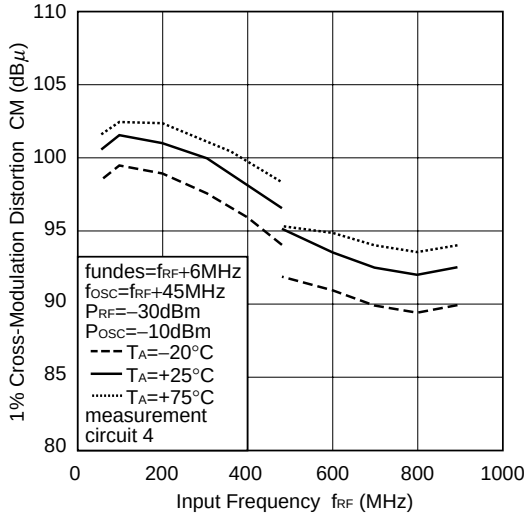


NOISE FIGURE vs. INPUT FREQUENCY

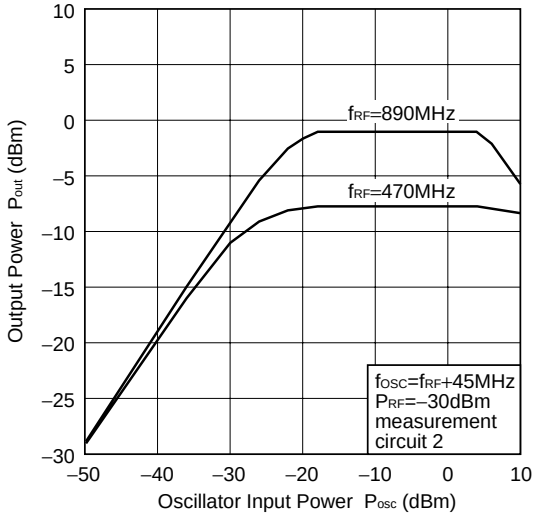


STANDARD CHARACTERISTICS (V_{CC} = 9 V)

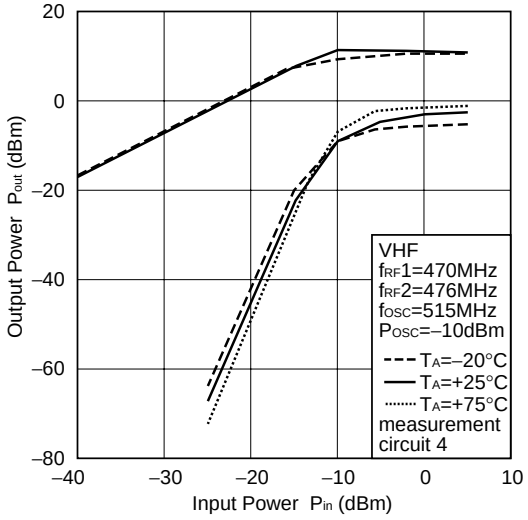
1% CROSS-MODULATION DISTORTION vs. INPUT FREQUENCY



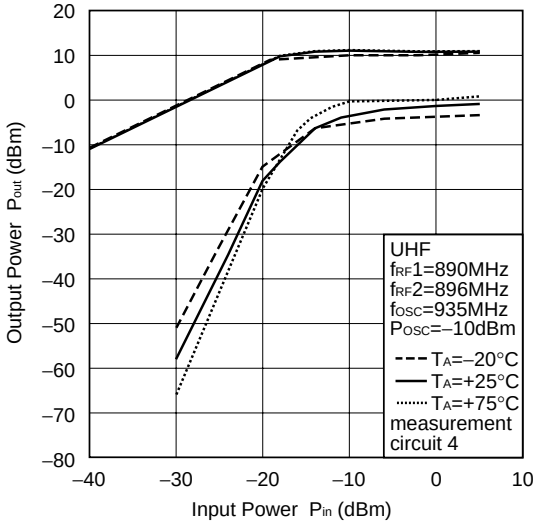
OUTPUT POWER vs. OSC INPUT POWER



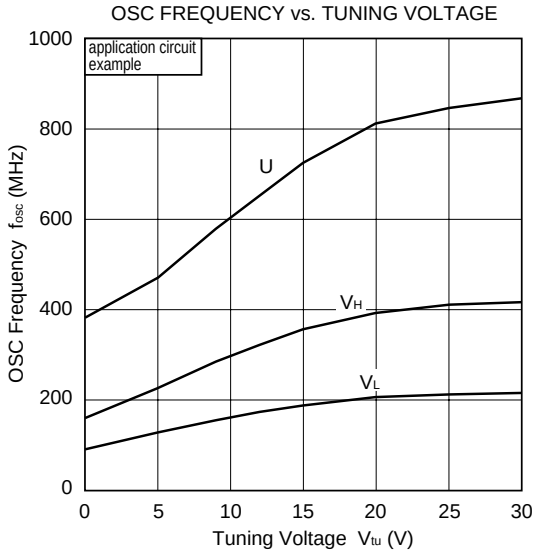
3rd ORDER INTERMODULATION DISTORTION



3rd ORDER INTERMODULATION DISTORTION



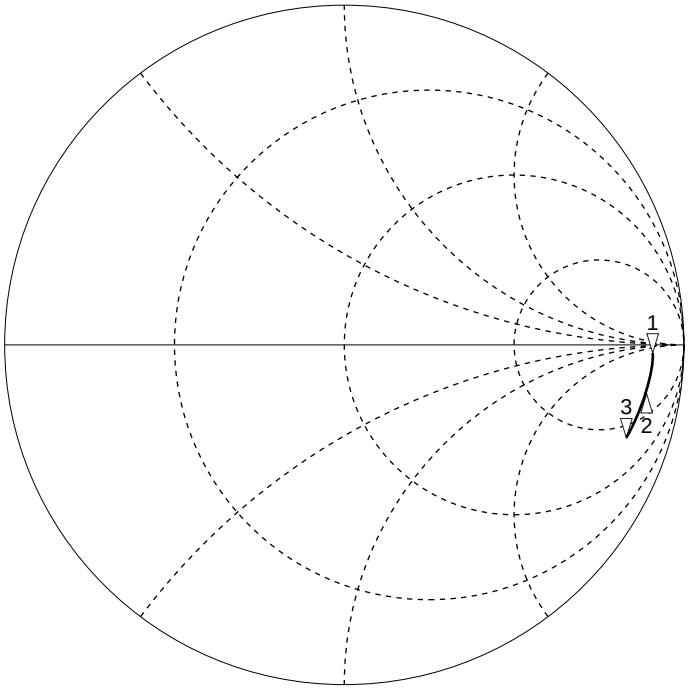
OSC FREQUENCY vs. TUNING VOLTAGE



INPUT IMPEDANCE (BY MEASUREMENT CIRCUIT 5)

<VRF INPUT: 17 PIN>

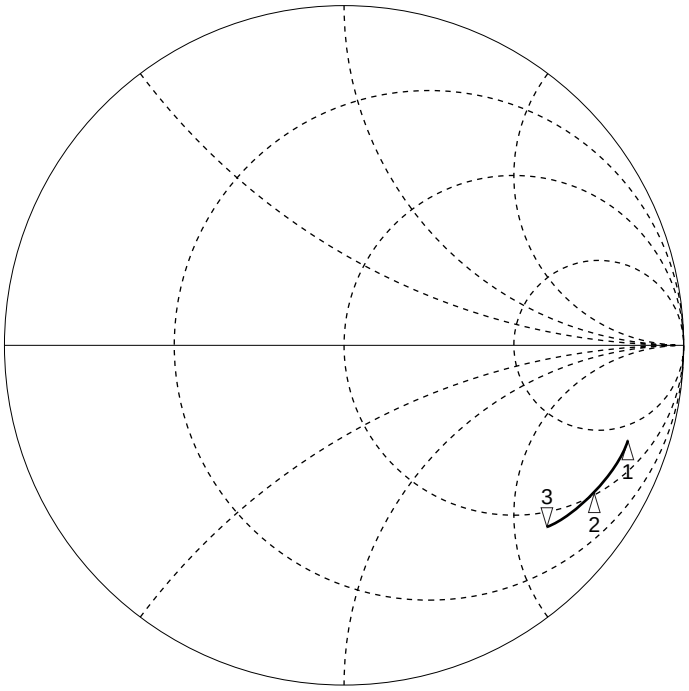
▽ 1: 45 MHz 851.97 Ω –275.69 Ω
▽ 2: 200 MHz 346.66 Ω –441.2 Ω
▽ 3: 450 MHz 112.42 Ω –265.13 Ω



START 0.045000000 GHz
STOP 0.450000000 GHz

<URF INPUT: 20 PIN>

▽ 1: 400 MHz 105.59 Ω –265.56 Ω
▽ 2: 650 MHz 55.539 Ω –169.88 Ω
▽ 3: 900 MHz 39.918 Ω –119.70 Ω

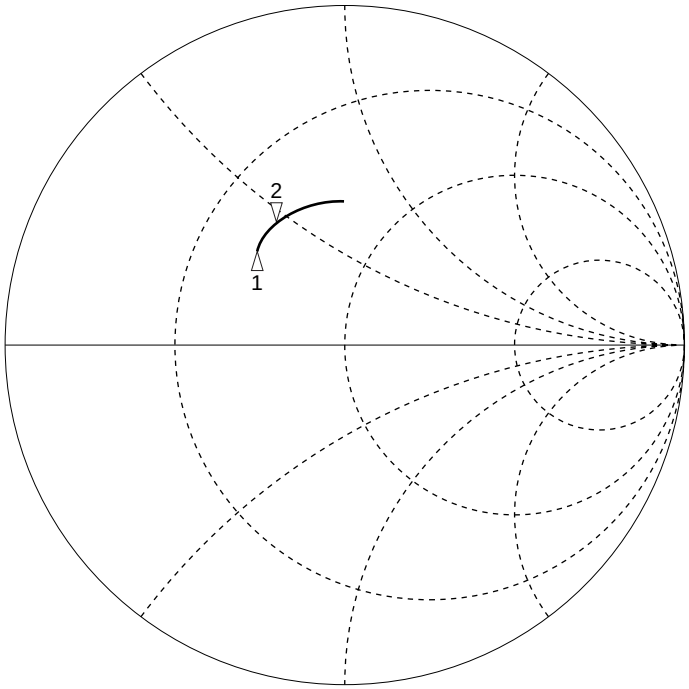


START 0.400000000 GHz
STOP 0.900000000 GHz

OUTPUT IMPEDANCE (BY MEASUREMENT CIRCUIT 5)

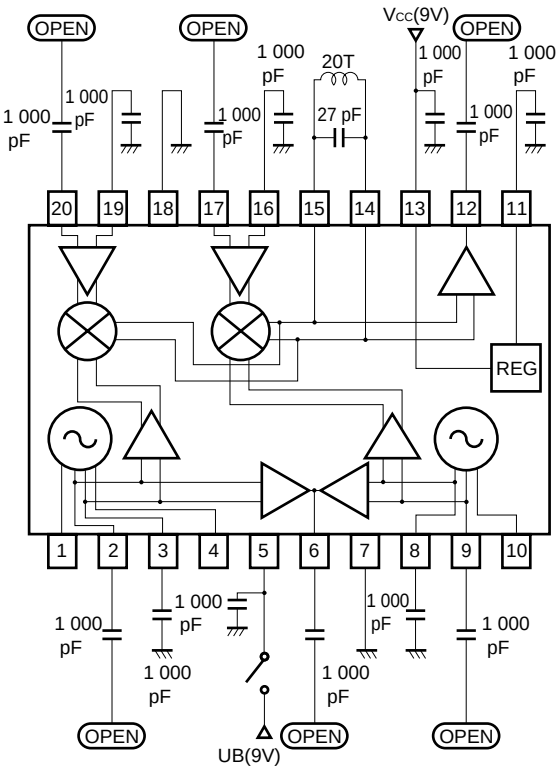
<IF OUTPUT: 12 PIN>

▽ 1: 45 MHz 25.903 Ω +17.223 Ω
▽ 2: 60 MHz 26.446 Ω +22.927 Ω



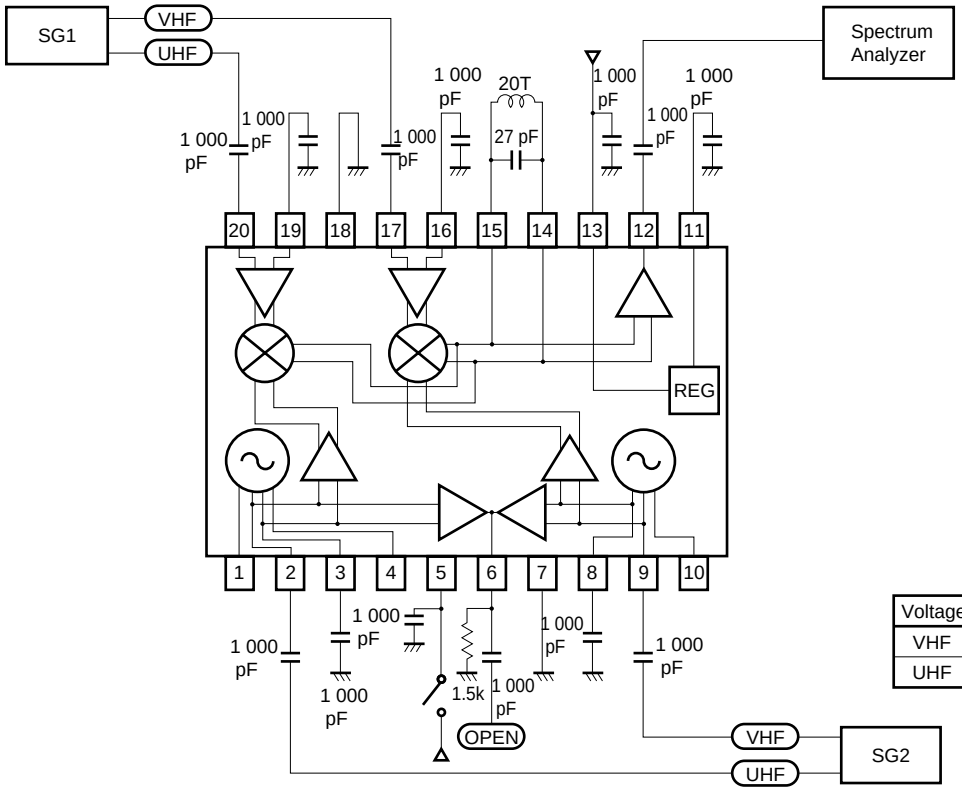
START 0.045000000 GHz
STOP 0.095000000 GHz

MEASUREMENT CIRCUIT 1



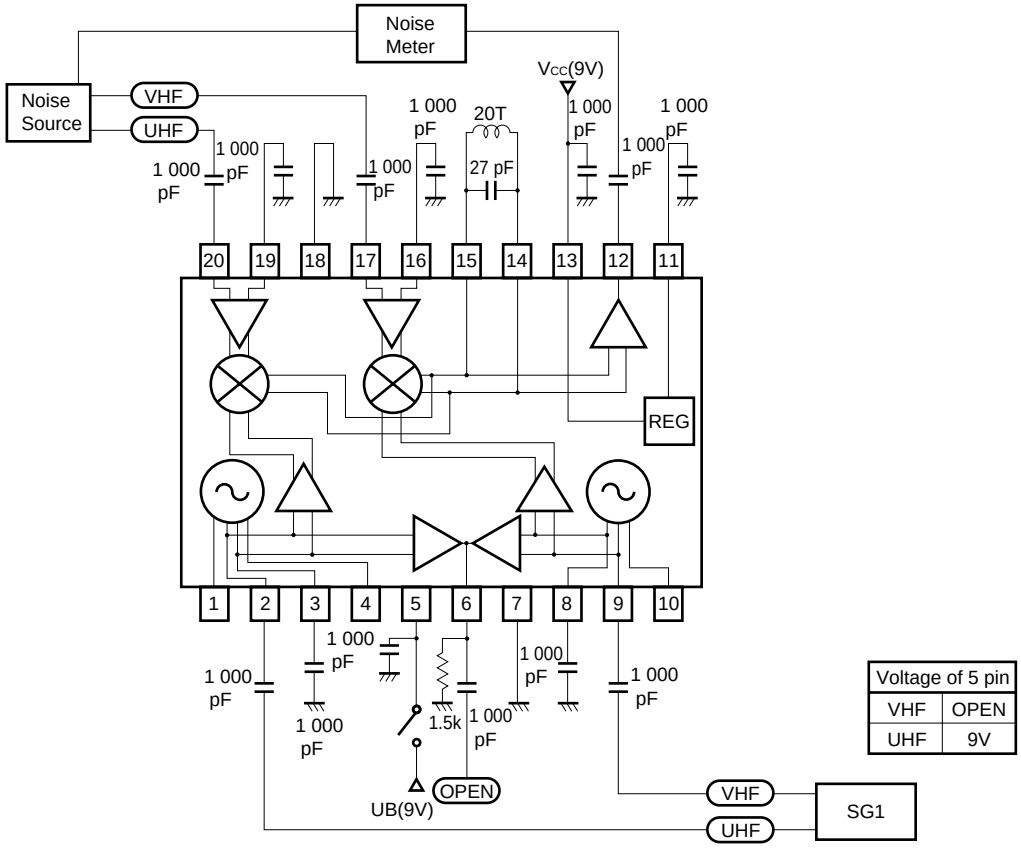
Voltage of 5 pin	
VHF	OPEN
UHF	9V

MEASUREMENT CIRCUIT 2



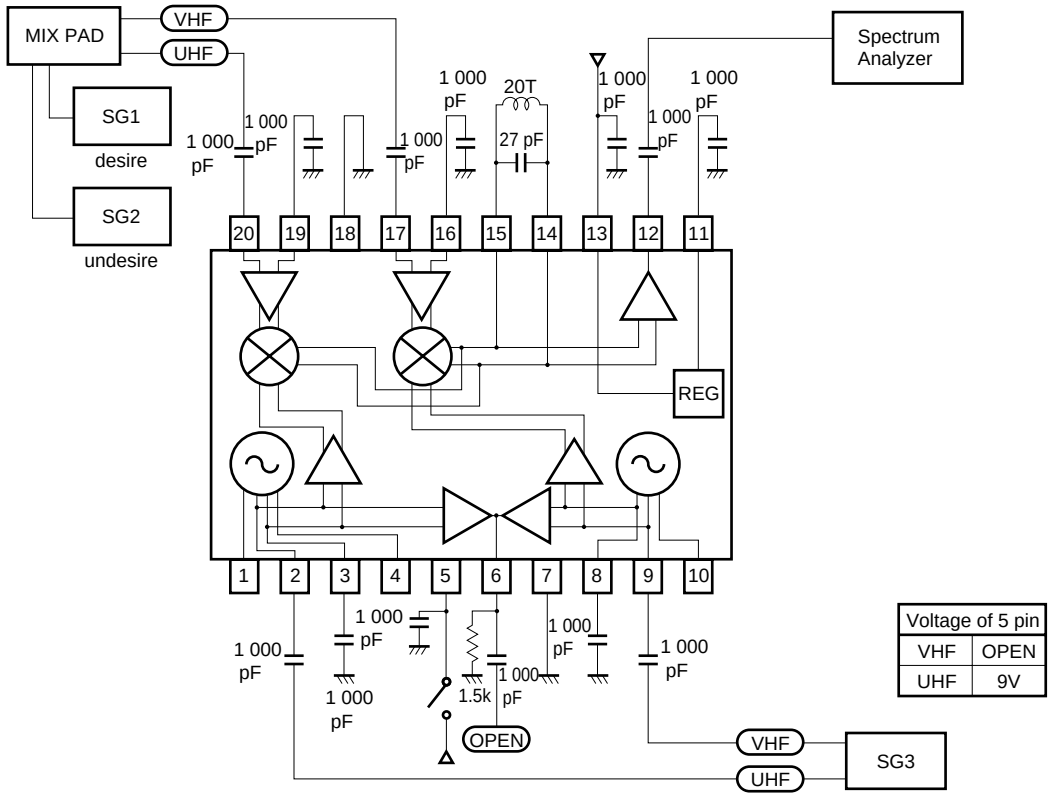
Voltage of 5 pin	
VHF	OPEN
UHF	9V

MEASUREMENT CIRCUIT 3



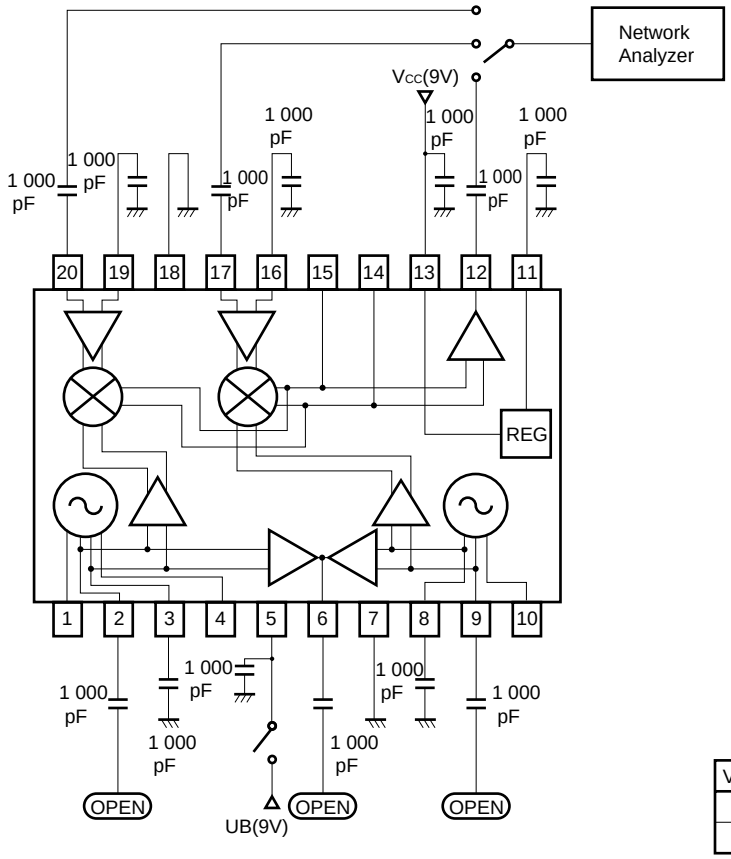
Voltage of 5 pin	
VHF	OPEN
UHF	9V

MEASUREMENT CIRCUIT 4



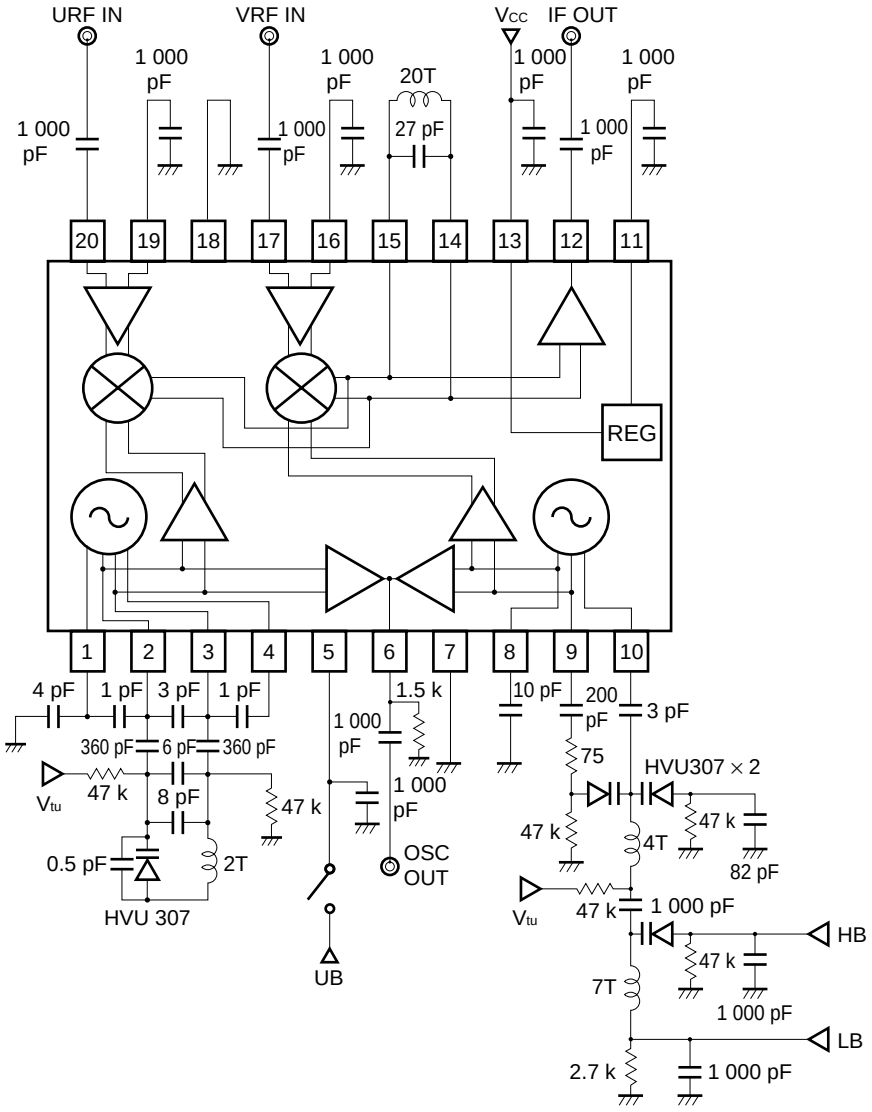
Voltage of 5 pin	
VHF	OPEN
UHF	9V

MEASUREMENT CIRCUIT 5



Voltage of 5 pin	
VHF	OPEN
UHF	9V

APPLICATION CIRCUIT EXAMPLE



The application circuits and their parameters are for reference only and are not intended for use in actual design-ins.

ILLUSTRATION OF THE EVALUATION BOARD FOR APPLICATION CIRCUIT EXAMPLE (SURFACE)

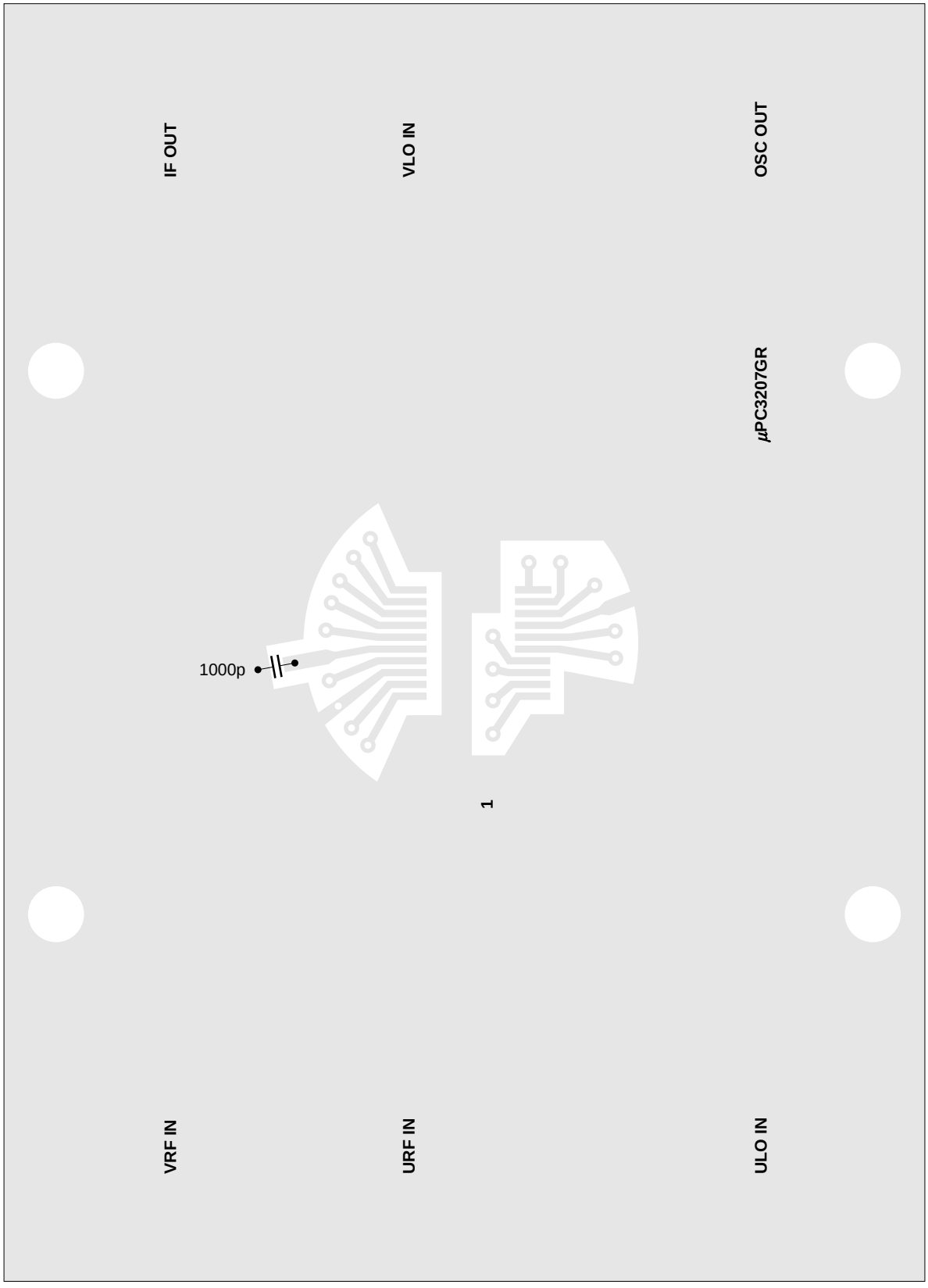
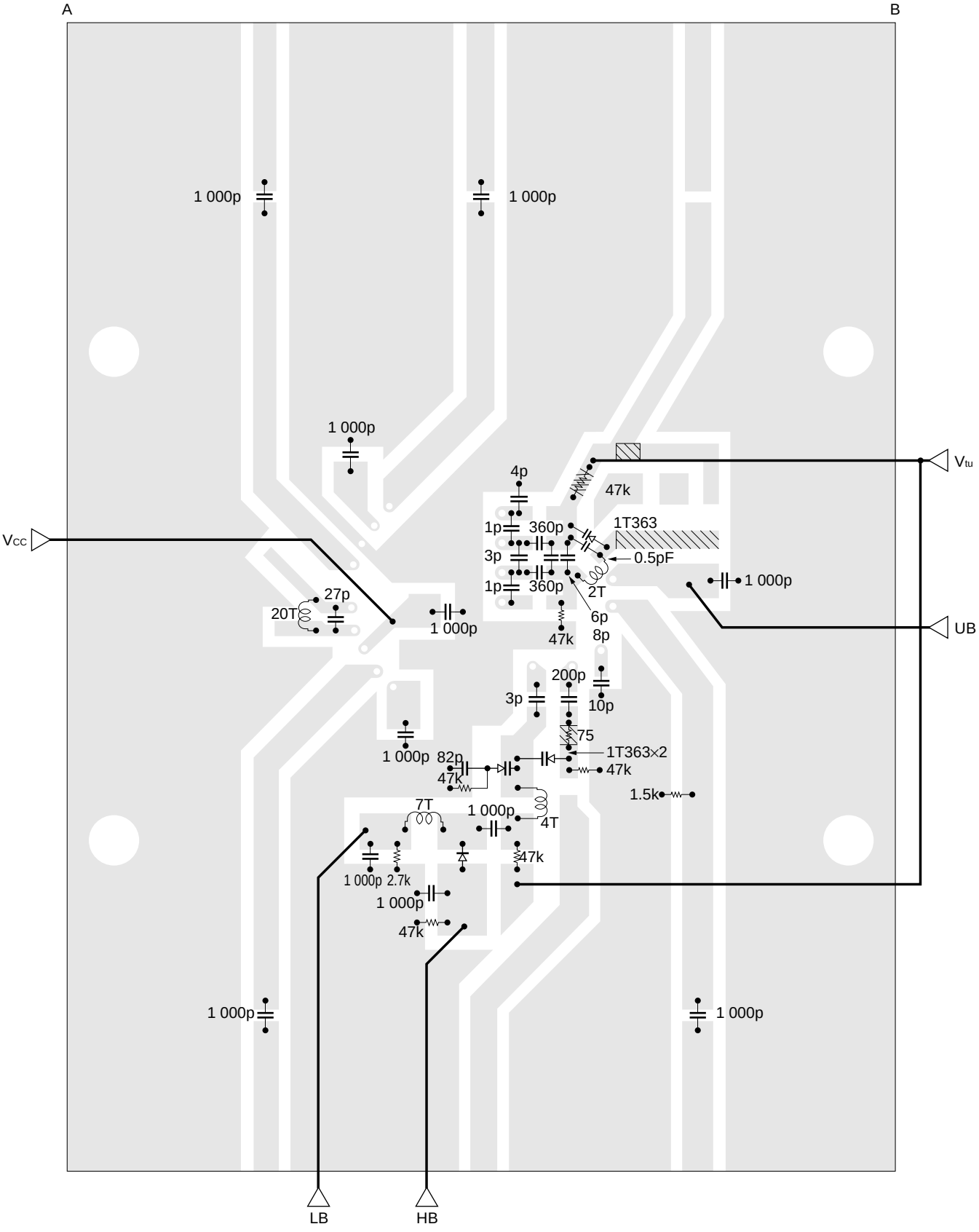


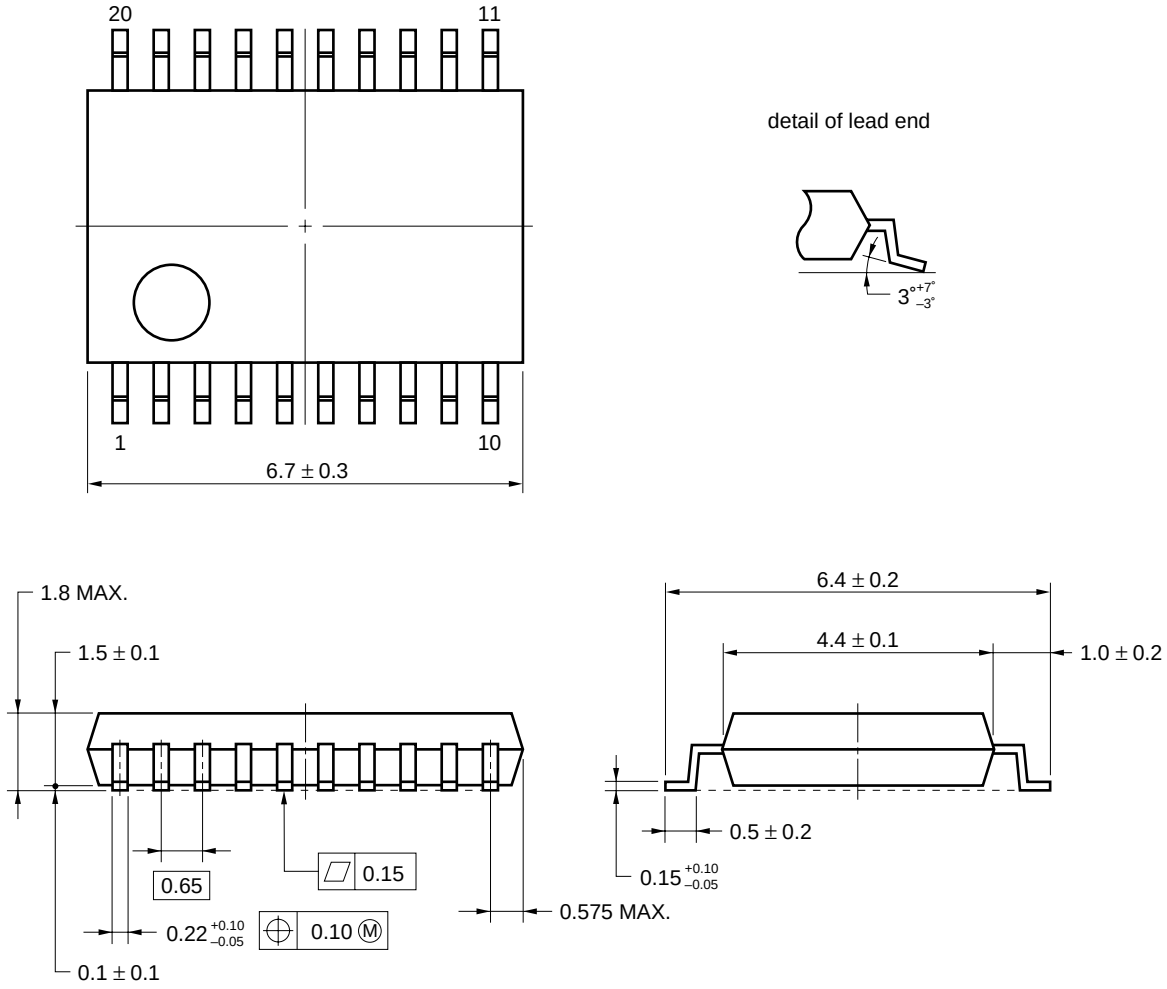
ILLUSTRATION OF THE EVALUATION BOARD FOR APPLICATION CIRCUIT EXAMPLE (BACK SIDE)



represents cutout

PACKAGE DIMENSIONS

★ **20 PIN PLASTIC SSOP (225 mil) (UNIT: mm)**



NOTE Each lead centerline is located within 0.10 mm of its true position (T.P.) at maximum material condition.

NOTE ON CORRECT USE

(1) Observe precautions for handling because of electro-static sensitive devices.

(2) Form a ground pattern as widely as possible to minimize ground impedance (to prevent undesires oscillation).

(3) Keep the track length of the ground pins as short as possible.

(4) A low pass filter must be attached to V_{CC} line.

RECOMMENDED SOLDERING CONDITIONS

This product should be soldered under the following recommended conditions. For soldering methods and conditions other than those recommended below, contact your NEC sales representative.

Soldering Method	Soldering Conditions	Recommended Condition Symbol
Infrared Reflow	Package peak temperature: 235 °C or below Time: 30 seconds or less (at 210 °C) Count: 3, Exposure limit: None**Note**	IR35-00-3
VPS	Package peak temperature: 215 °C or below Time: 40 seconds or less (at 200 °C) Count: 3, Exposure limit: None**Note**	VP15-00-3
Partial Heating	Pin temperature: 300 °C Time: 3 seconds or less (per side of device) Exposure limit: None**Note**	–

Note After opening the dry pack, keep it in a place below 25 °C and 65 % RH for the allowable storage period.

Caution Do not use different soldering methods together (except for partial heating).

For details of recommended soldering conditions for surface mounting, refer to information document SEMICONDUCTOR DEVICE MOUNTING TECHNOLOGY MANUAL (C10535E).

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- NEC devices are classified into the following three quality grades:
  "Standard", "Special", and "Specific". The Specific quality grade applies only to devices developed based on a customer designated “quality assurance program“ for a specific application. The recommended applications of a device depend on its quality grade, as indicated below. Customers must check the quality grade of each device before using it in a particular application.
  - Standard: Computers, office equipment, communications equipment, test and measurement equipment, audio and visual equipment, home electronic appliances, machine tools, personal electronic equipment and industrial robots
  - Special: Transportation equipment (automobiles, trains, ships, etc.), traffic control systems, anti-disaster systems, anti-crime systems, safety equipment and medical equipment (not specifically designed for life support)
  - Specific: Aircraft, aerospace equipment, submersible repeaters, nuclear reactor control systems, life support systems or medical equipment for life support, etc.

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M7 98.8