DATA SHEET

NEC

BIPOLAR ANALOG INTEGRATED CIRCUIT

μPC3200GS

FREQUENCY DOWN CONVERTER FOR VHF TO UHF BAND TV/VCR TUNER

DESCRIPTION

The μPC3200GS is a Silicon monolithic IC designed for TV/VCR tuner applications. This IC consists of a double balanced mixer (DBM), local oscillator, preamplifier for prescaler 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 SOP (Small Outline Package) suitable for surface mounting.

FEATURES

- VHF to UHF band 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 SOP suitable for surface mounting

ORDERING INFORMATION

Part Number	Package	Package Style
μPC3200GS-E1	20-pin plastic SOP (300 mil)	Embossed tape 24 mm wide. 2.5 k/REEL. Pin 1 indicates pull-out direction of tape.

For evaluation sample order, please contact your local NEC office. (Part number for sample order: μPC3200GS)

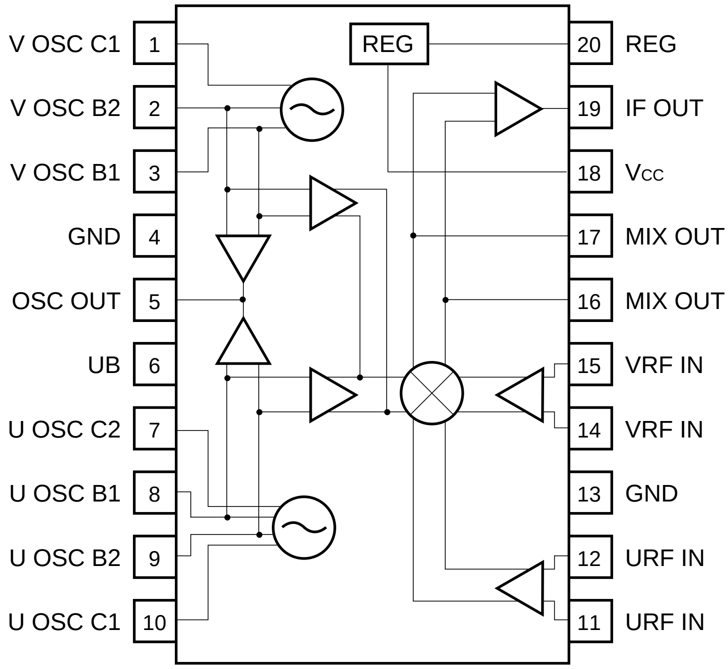
Caution electro-static sensitive device

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.

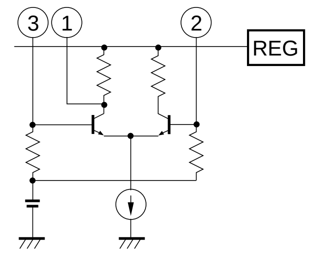
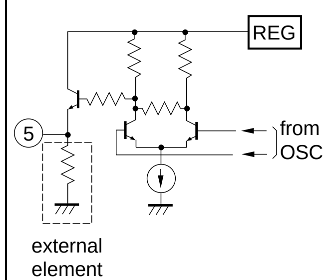
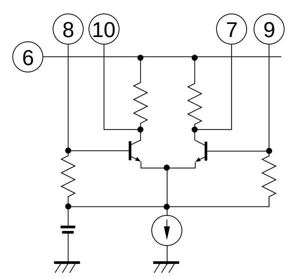
Document No. P12037EJ3V0DS00 (3rd edition)
Date Published October 1999 N CP(K)
Printed in Japan

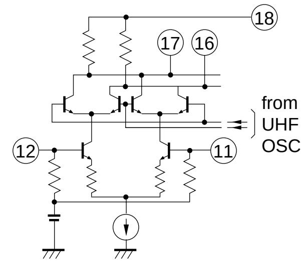
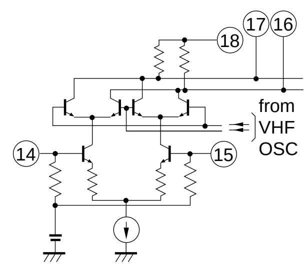
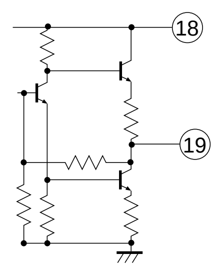
The mark ★ shows major revised points.

INTERNAL BLOCK DIAGRAM AND PIN CONFIGURATION (Top View)



PIN EXPLANATION

Pin No.	Symbol	Pin Voltage TYP. above: VHF mode below: UHF mode	Function and Explanation	Equivalent Circuit
1	VOSC collector (Tr. 1)	6.20 6.90	Collector pin of VHF oscillator. Connected to LC resonator through feedback capacitor ~ 3 pF.	
2	VOSC base (Tr. 2)	3.50 5.90	Base pin of VHF oscillator. Assemble LC resonator with 1 pin to oscillate with active feedback loop.	
3	VOSC base (Tr. 1)	3.50 5.90	Base pin of VHF oscillator. Grounded through capacitor ~ 10 pF.	
4	GND	0.0 0.0	VHF and UHF oscillator's GND pin.	
5	OSC output	5.85 5.85	UHF and VHF oscillator output pin. In case of F/S tuner application, connected PLL synthesizer IC's input pin. Grounded through 1.5 kΩ resistor.	
6	UB	– 9.0	Switching pin for VHF or UHF operation. VHF operation = open UHF operation = 9.0 V	
7	UOSC collector (Tr. 2)	6.90 6.25	Collector pin of UHF oscillator with balance amplifier. Assemble LC resonator with 8 pin through capacitor ~ 1 pF to oscillate with active feedback loop. Double balanced oscillator with transistor 1 and transistor 2.	
8	UOSC base (Tr. 1)	6.00 3.90	Base pin of UHF oscillator with balance amplifier. Connected to LC resonator through feedback capacitor ~ 360 pF.	
9	UOSC base (Tr. 2)	6.00 3.90	Base pin of UHF oscillator with balance amplifier. Connected to LC resonator through feedback capacitor ~ 360 pF.	
10	UOSC collector (Tr. 1)	6.90 6.25	Collector pin of UHF oscillator. Assemble LC resonator with 9 pin through capacitor ~ 1 pF to oscillate with active feedback loop.	

Pin No.	Symbol	Pin Voltage TYP. above: VHF mode below: UHF mode	Function and Explanation	Equivalent Circuit
11	URF input	3.10 3.10	URF signal input pin from antenna.	
12	URF input (bypass)	3.10 3.10	Bypass pin for UHF MIX input. Grounded through capacitor.	
13	GND	0.0 0.0	GND pin of MIX, IF amplifier and regulator.	
14	VRF input	3.10 3.10	VRF signal input pin from antenna.	
15	VRF input (bypass)	3.10 3.10	Bypass pin for VHF MIX input. Grounded through capacitor.	
16	MIX output 2	7.10 7.05	VHF and UHF MIX output pin. These pins should be equipped with tank circuit to adjust intermediate frequency.	
17	MIX output 1	7.10 7.05		
18	V_{CC}	9.0 9.0	Power supply pin for VHF-UHF band functions.	
19	IF output	2.80 2.80	IF output pin of VHF-UHF band functions.	
20	REG	6.90 6.90	Monitor pin of regulator output voltage.	

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 = 80 °C[Note]	700	mW
Operating Ambient Temperature	T_A		–40 to +80	°C
Storage Temperature	T_{stg}		–60 to +150	°C

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

RECOMMENDED OPERATION 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	+80	°C

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

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

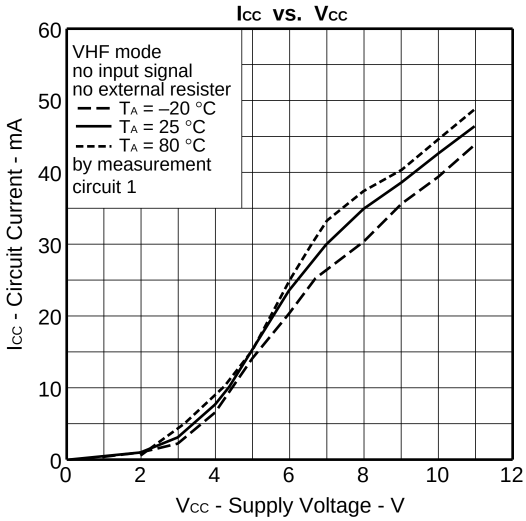
Notes 1. By measurement circuit 1
2. By measurement circuit 2
3. By measurement circuit 3

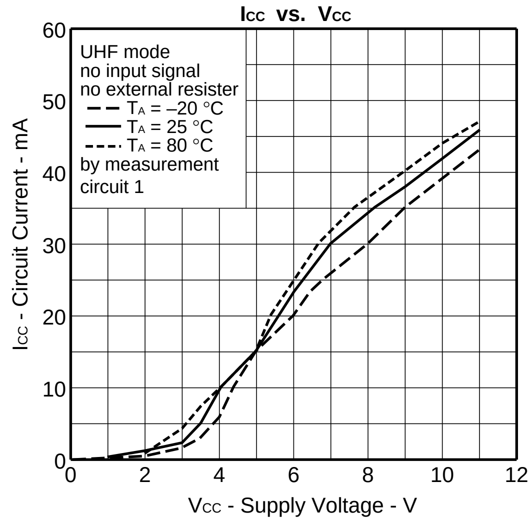
STANDARD CHARACTERISTICS (Reference Values) (T_A = 25 °C, V_{CC} = 9 V Note)

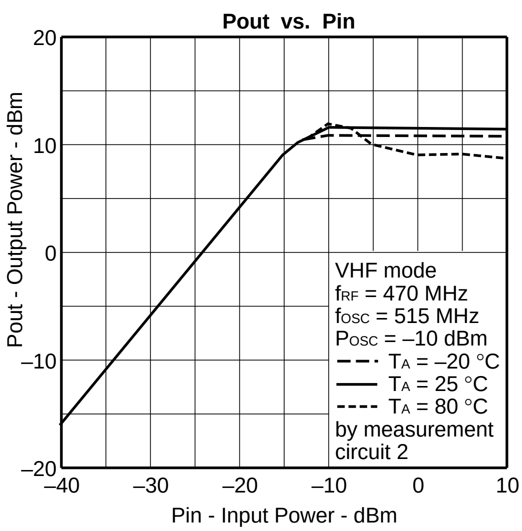
Parameter	Symbol	Test Conditions	Value for Reference	Unit
1 % cross-modulation distortion 1	CM1	fdes = 55 MHz, fundes = fdes + 6 MHz, Pdes = –30 dBm, f_{IF} = 45 MHz, P_{OSC} = –10 dBm AM 100 kHz, 30 % modulation, DES/CM = 46 dBc	100	dBμ
1 % cross-modulation distortion 2	CM2	fdes = 200 MHz, fundes = fdes + 6 MHz, Pdes = –30 dBm, f_{IF} = 45 MHz, P_{OSC} = –10 dBm AM 100 kHz, 30 % modulation, DES/CM = 46 dBc	100	dBμ
1 % cross-modulation distortion 3	CM3	fdes = 470 MHz, fundes = fdes + 6 MHz, Pdes = –30 dBm, f_{IF} = 45 MHz, P_{OSC} = –10 dBm AM 100 kHz, 30 % modulation, DES/CM = 46 dBc	96	dBμ
1 % cross-modulation distortion 4	CM4	fdes = 470 MHz, fundes = fdes + 6 MHz, Pdes = –30 dBm, f_{IF} = 45 MHz, P_{OSC} = –10 dBm AM 100 kHz, 30 % modulation, DES/CM = 46 dBc	94	dBμ
1 % cross-modulation distortion 5	CM5	fdes = 890 MHz, fundes = fdes + 6 MHz, Pdes = –30 dBm, f_{IF} = 45 MHz, P_{OSC} = –10 dBm AM 100 kHz, 30 % modulation, DES/CM = 46 dBc	92	dBμ

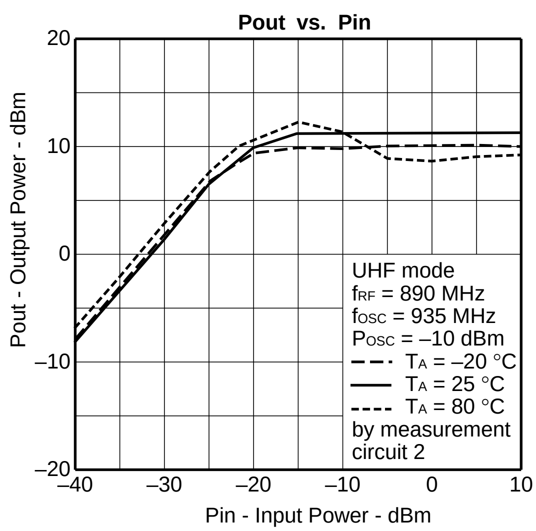
Note By measurement circuit 4

TYPICAL CHARACTERISTICS (V_{CC} = 9 V)



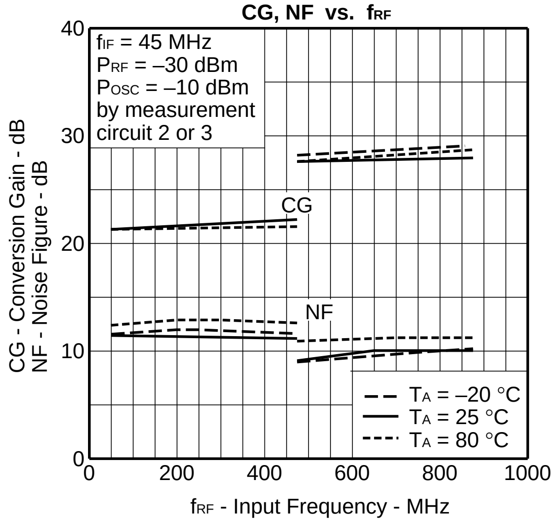




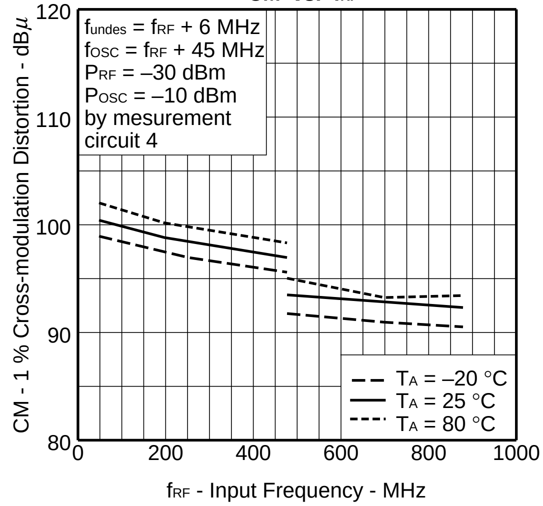


TYPICAL CHARACTERISTICS (V_{CC} = 9 V)

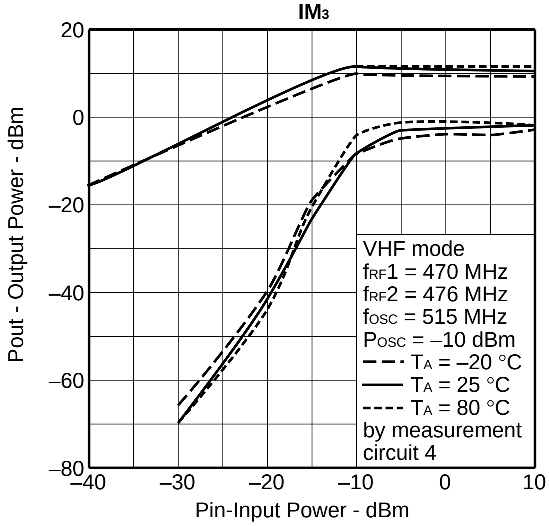
CG, NF vs. f_{RF}



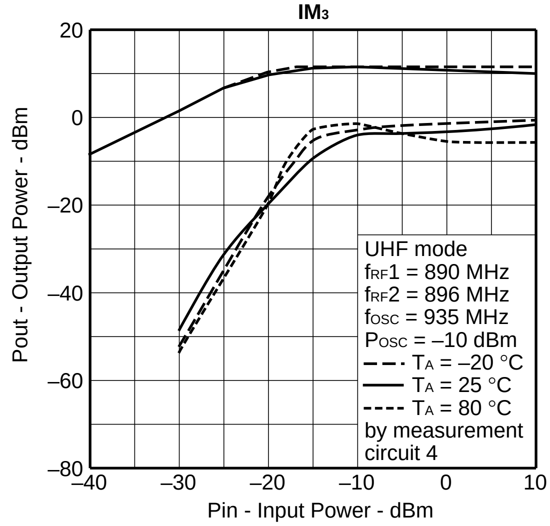
CM vs. f_{RF}



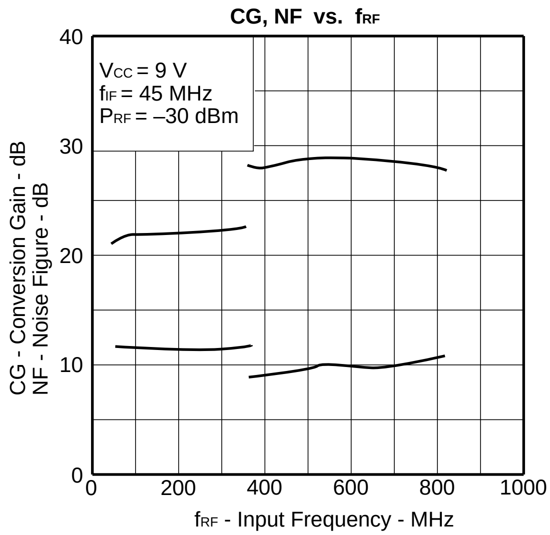
IM_3

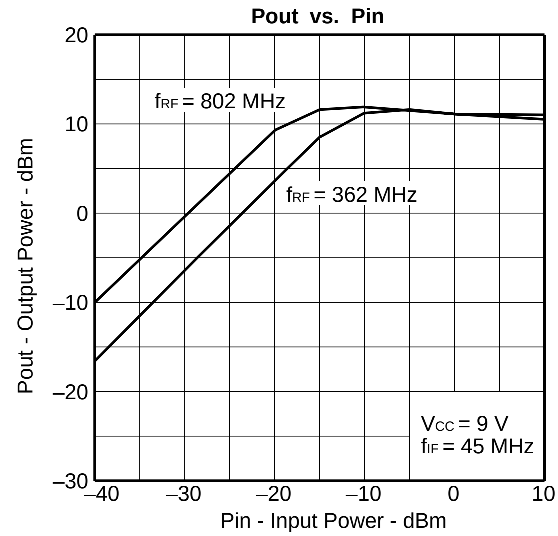


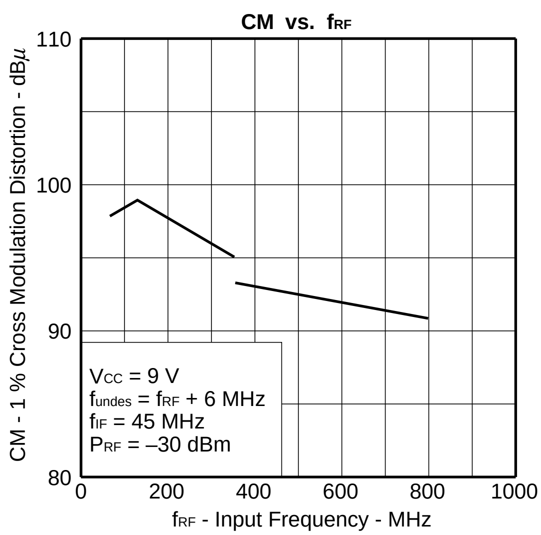
IM_3

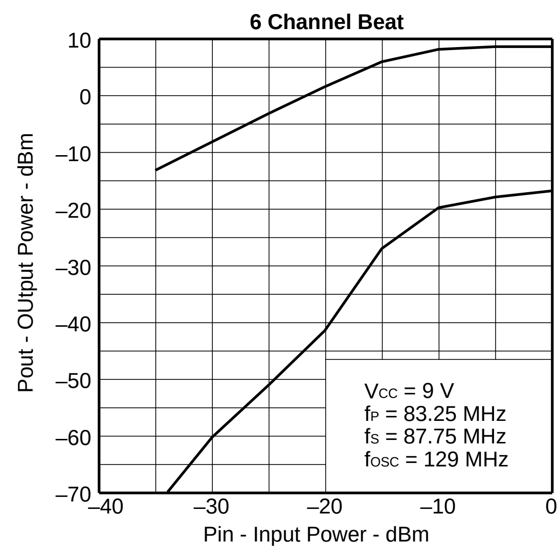


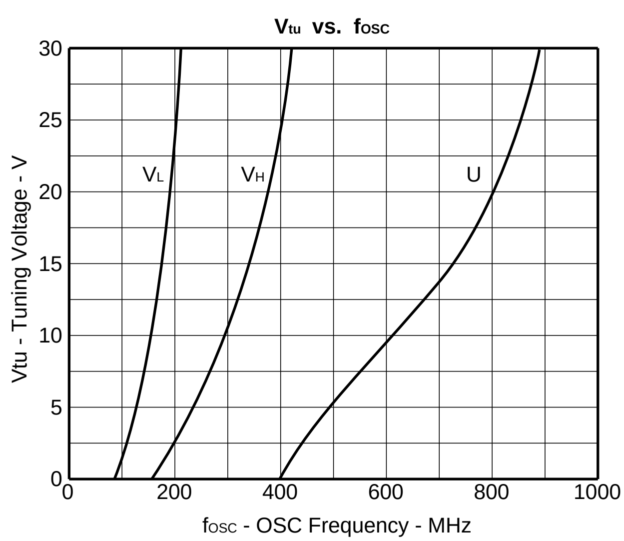
STANDARD CHARACTERISTICS (by application circuit example)





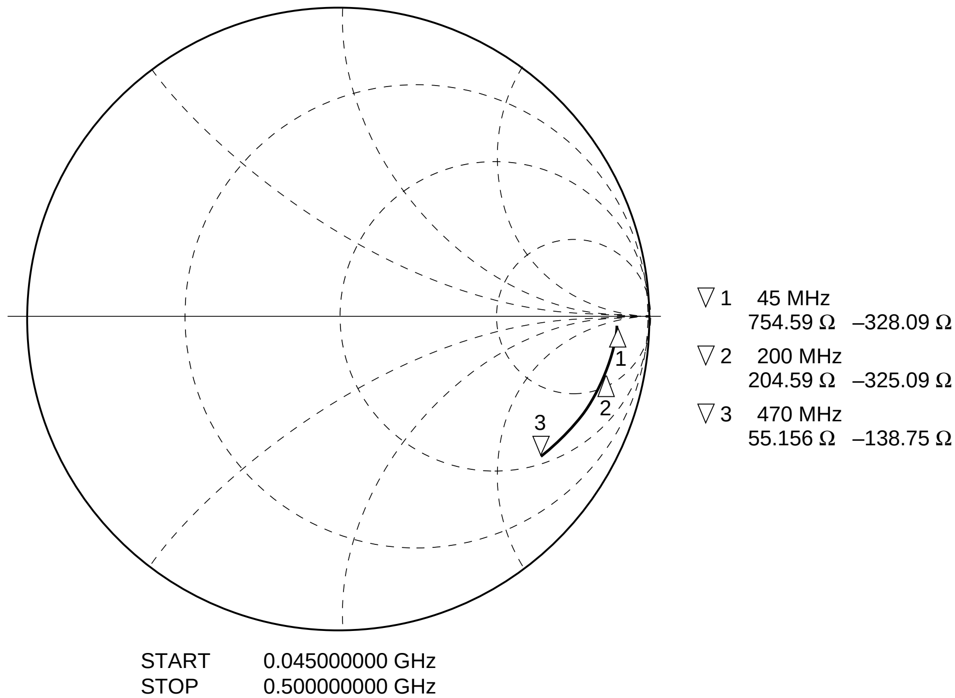




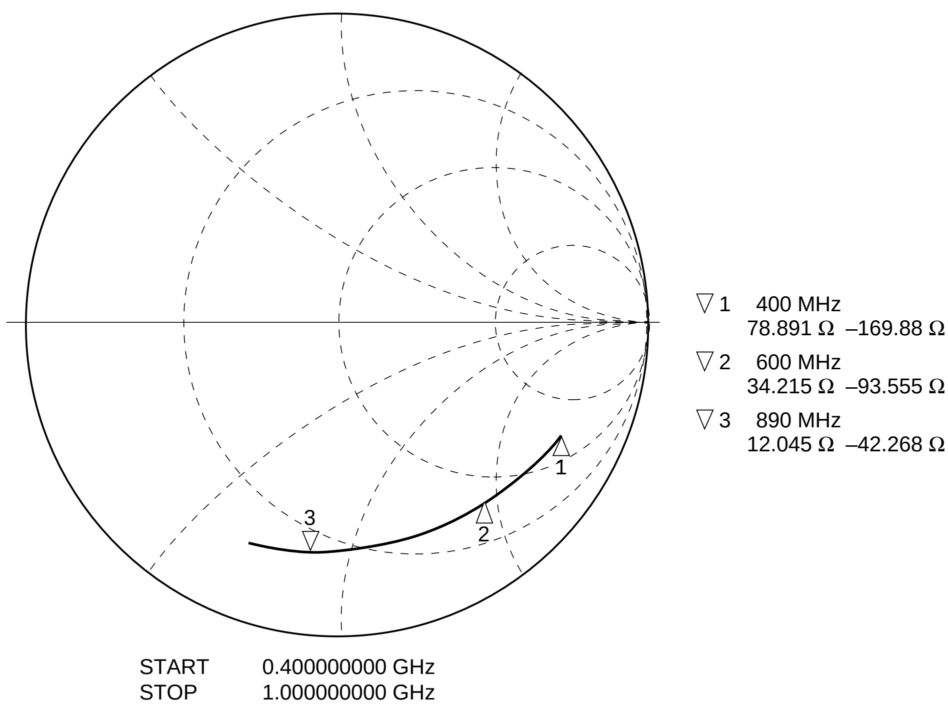


INPUT IMPEDANCE (by measurement circuit 5)

<VRF INPUT: 14 PIN>

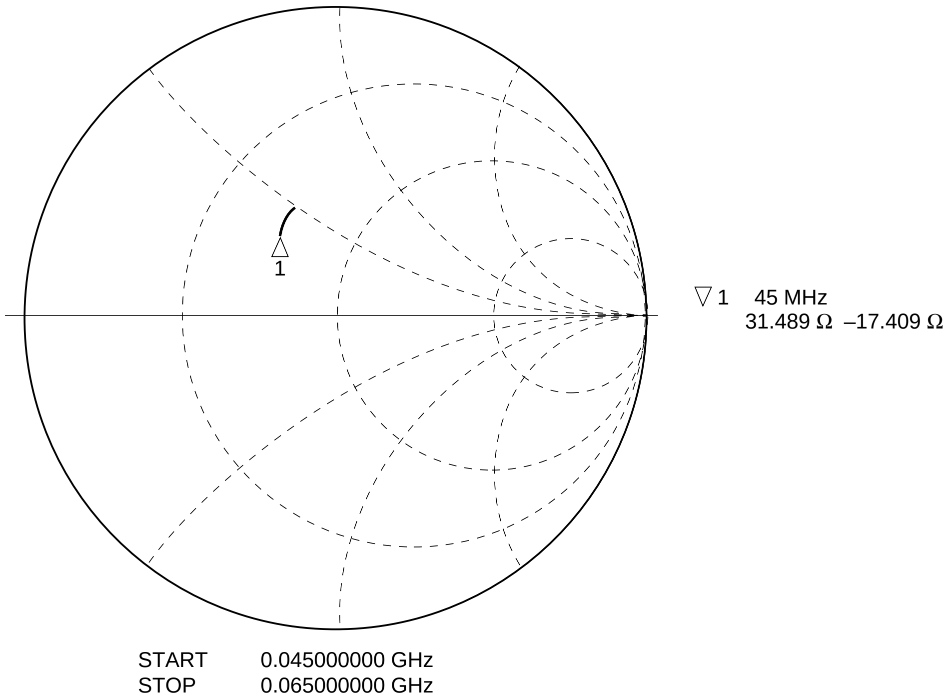


<URF INPUT: 11 PIN>

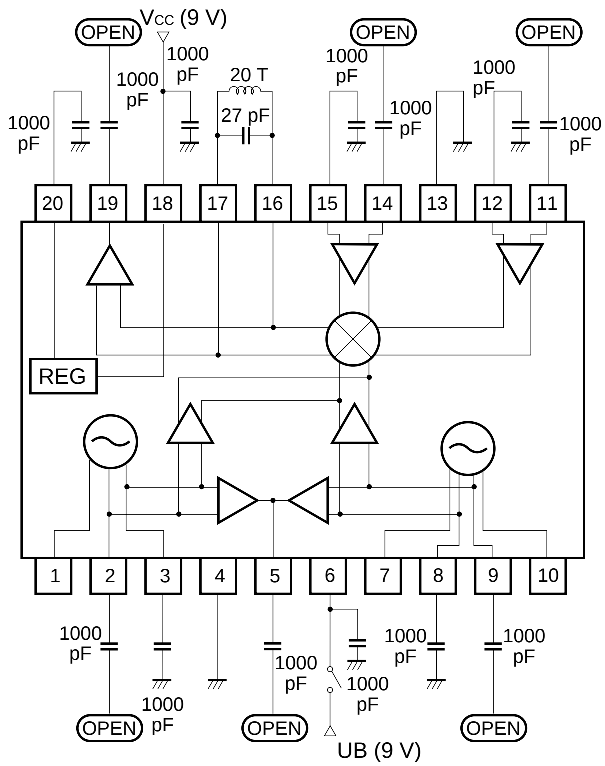


OUTPUT IMPEDANCE (by measurement circuit 5)

<IF OUTPUT: 19 PIN>

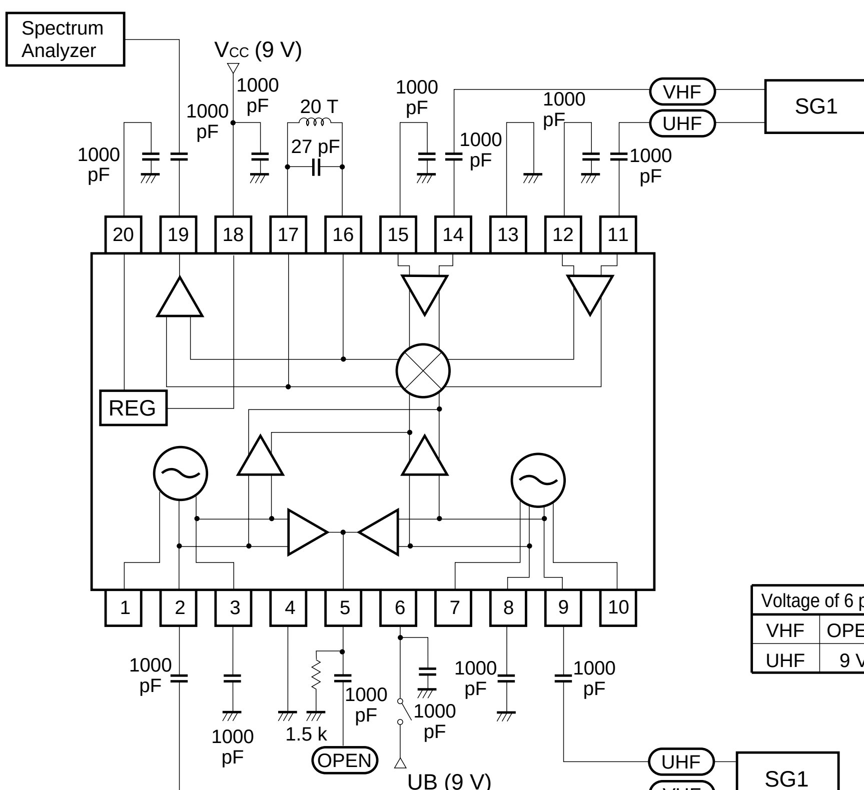


MEASUREMENT CIRCUIT 1



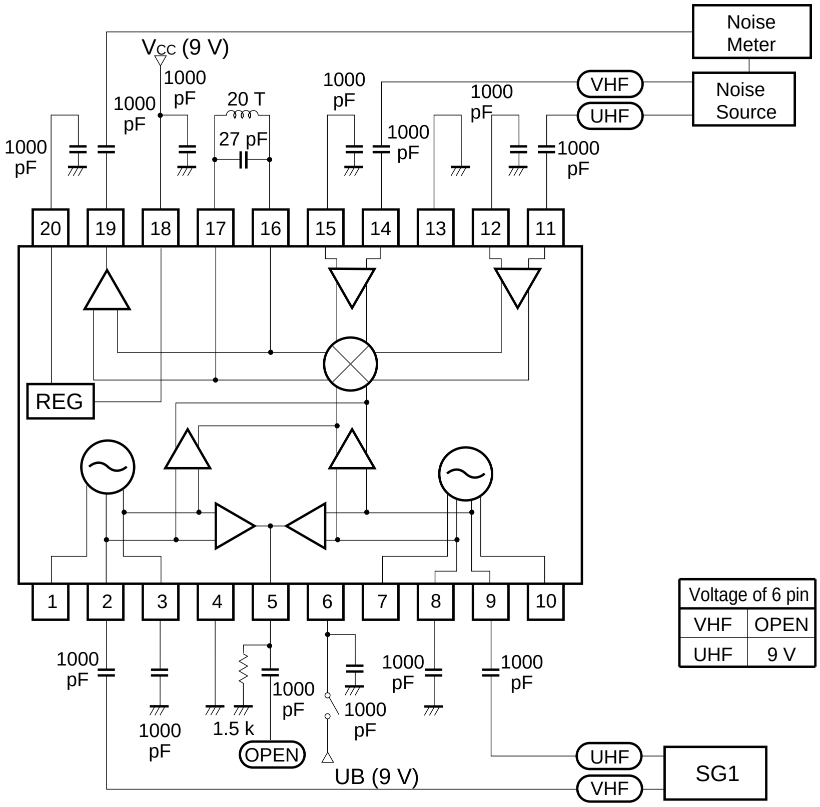
Voltage of 6 pin	
VHF	OPEN
UHF	9 V

MEASUREMENT CIRCUIT 2



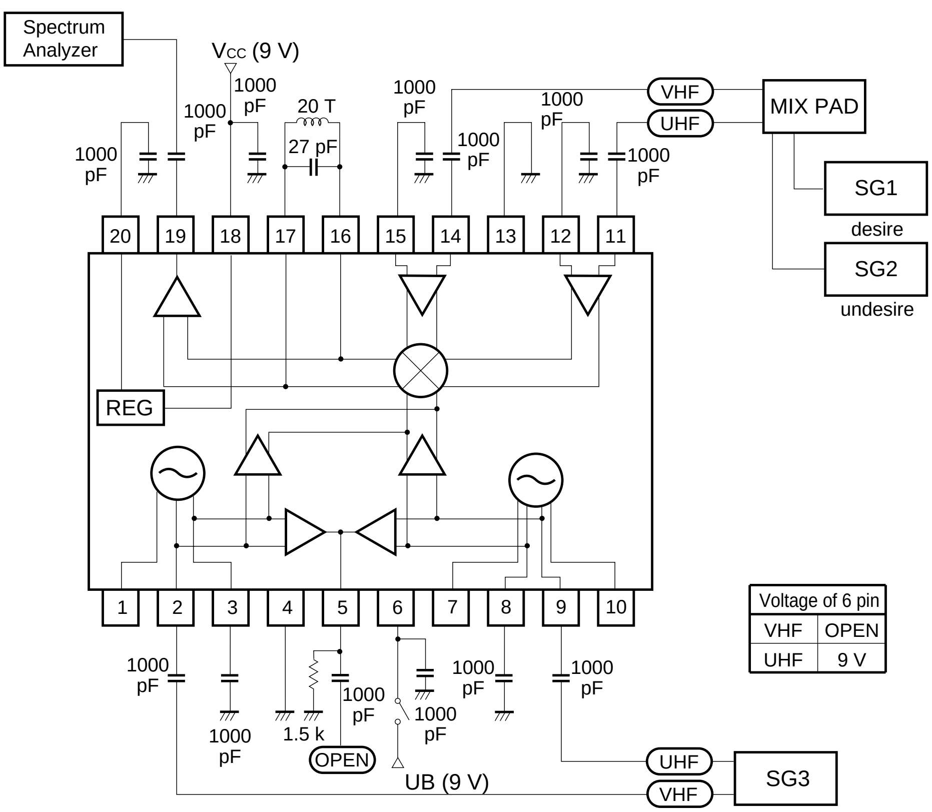
Voltage of 6 pin	
VHF	OPEN
UHF	9 V

MEASUREMENT CIRCUIT 3



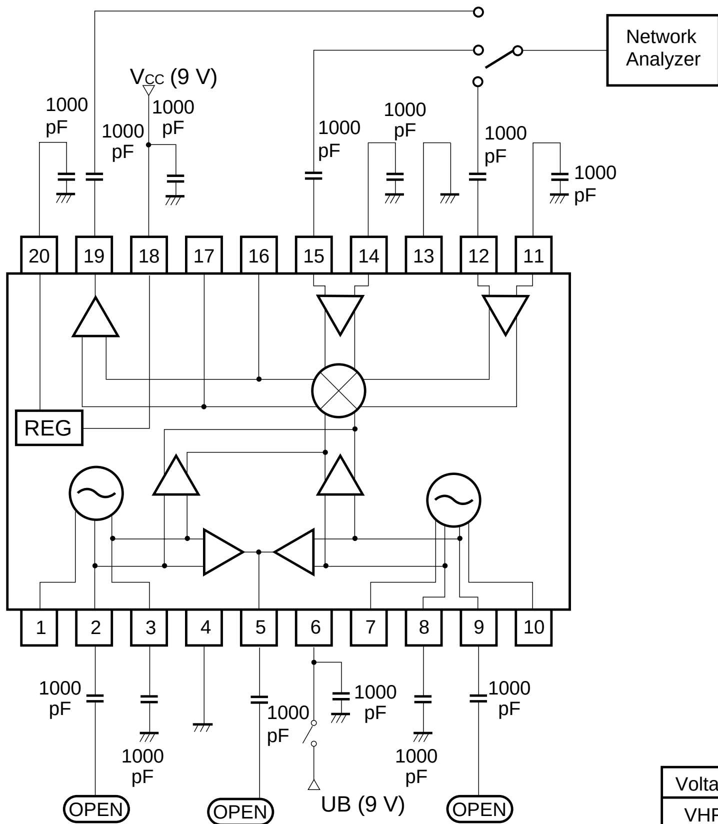
Voltage of 6 pin	
VHF	OPEN
UHF	9 V

MEASUREMENT CIRCUIT 4



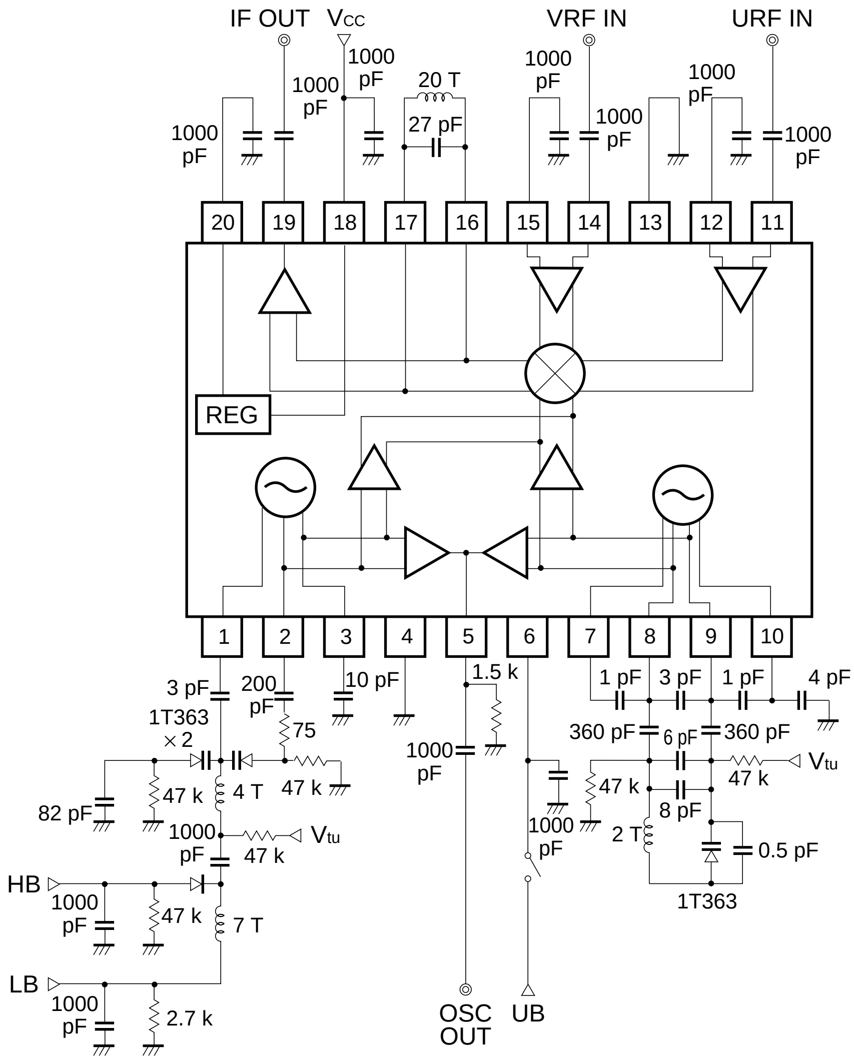
Voltage of 6 pin	
VHF	OPEN
UHF	9 V

MEASUREMENT CIRCUIT 5



Voltage of 6 pin	
VHF	OPEN
UHF	9 V

APPLICATION CIRCUIT EXAPLE



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)

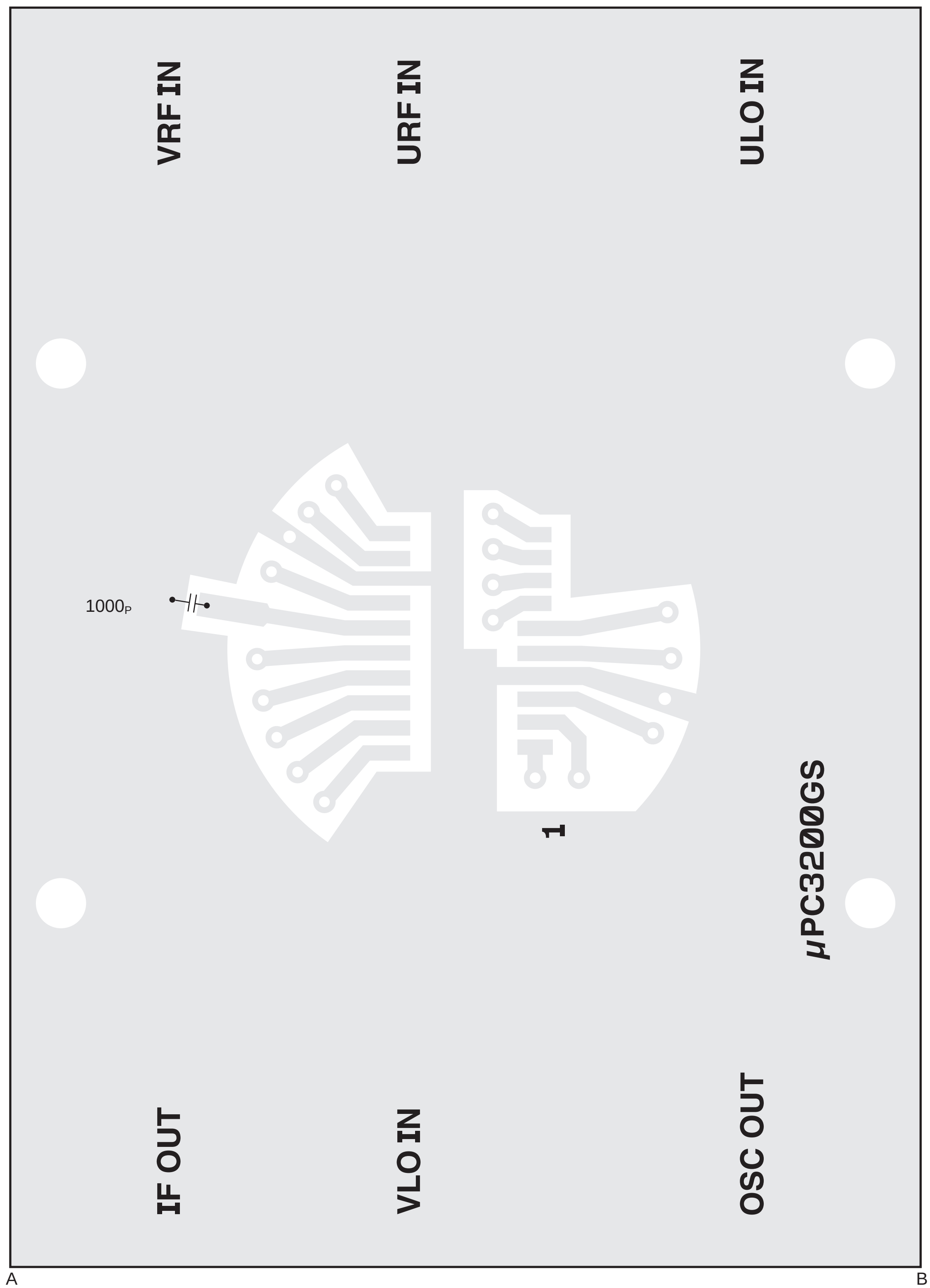
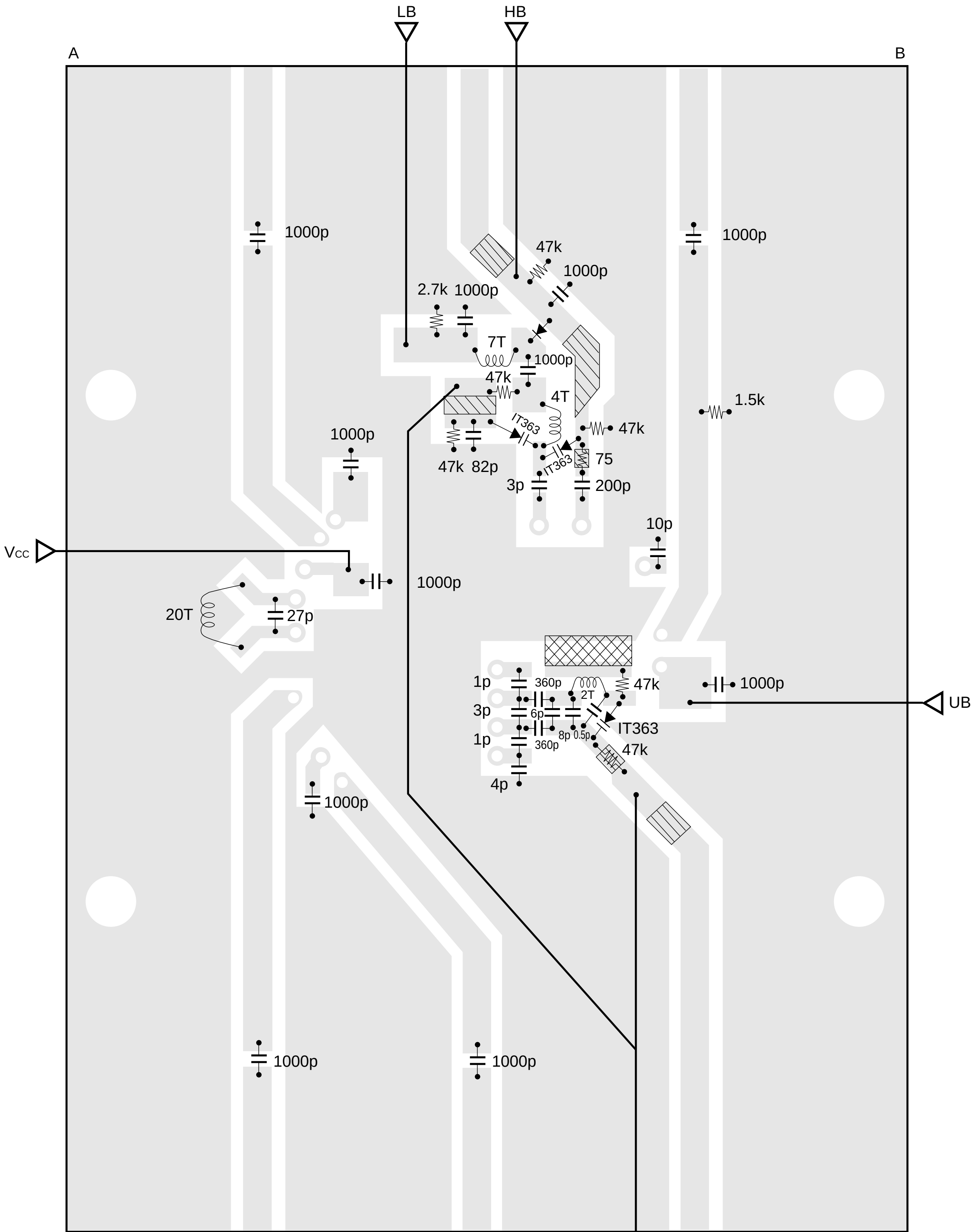


ILLUSTRATION OF THE EVALUATION BOARD FOR APPLICATION CIRCUIT EXAMPLE (Back side)

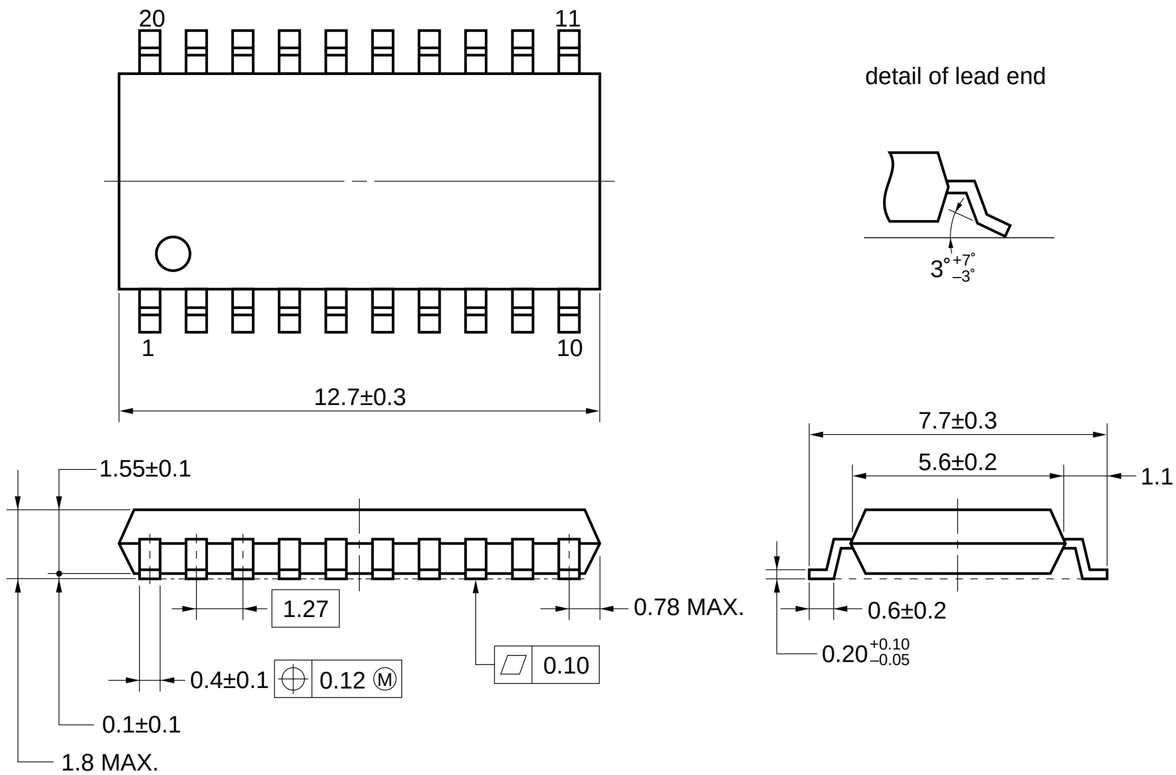


represents cutout.

represents short-circuit strip.

PACKAGE DIMENSIONS

★ **20 PIN PLASTIC SOP (300 mil) (UNIT: mm)**



NOTE Each lead centerline is located within 0.12 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.
(5) A matching circuit must be externally attached to output port.

RECOMMENDED SOLDERING CONDITIONS

The following conditions (see table below) must be met when soldering this product.

Please consult with our sales officers in case other soldering process is used or in case soldering is done under different conditions.

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

μPC3200GS

Soldering Process	Soldering Conditions	Symbol
Infrared Ray Reflow	Peak package's surface temperature: 235 °C or below, Reflow time: 30 seconds or below (at 210 °C), Number of reflow process: 3, Exposure limit[Note]: None	IR35-00-3
VPS	Peak package's surface temperature: 215 °C or below, Reflow time: 40 seconds or below (at 200 °C), Number of reflow process: 3, Exposure limit[Note]: None	VP15-00-3
Partial Heating Method	Terminal temperature: 300 °C or below, Flow time: 3 seconds or below (per one pin), Exposure limit[Note]: None	

Note Exposure limit before soldering after dry-pack package is opened.
Storage conditions: 25 °C and relative humidity at 65% or less.

Caution Do not apply more than single process at once, except for "Partial heating method".

[MEMO]

[MEMO]

[MEMO]

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