DATA SHEET

NEC

BIPOLAR ANALOG INTEGRATED CIRCUIT

μPC3202GR

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

DESCRIPTION

The μPC3202GR is Silicon monolithic IC designed for TV/VCR tuner applications. This IC consists of a double balanced mixer (DBM), local oscillator, preamplifier for precscaler operation, IF amplifier, regulator, 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 band operation.
- Low power dissipation Vcc = 5 V, Icc = 41 mA TYP.
- Packaged in 20-pin SSOP suitable for surface mounting

ORDERING INFORMATION

Part Number	Package	Package Style
μPC3202GR-E1	20-pin plastic SSOP (225 mil)	Embossed tape 12 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: μPC3202GR)

Caution electro-static sensitive device

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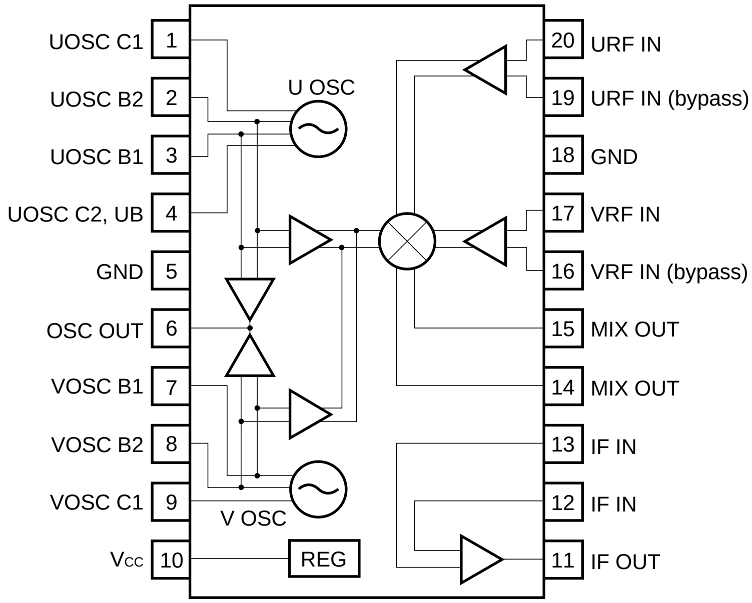
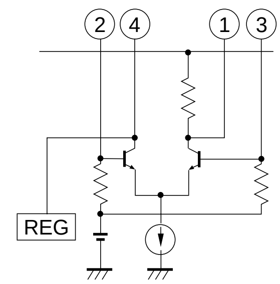
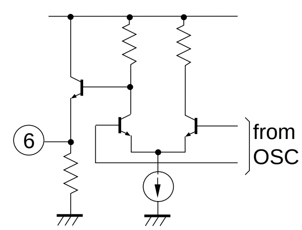
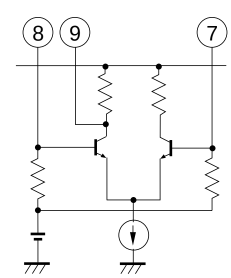
Printed in Japan

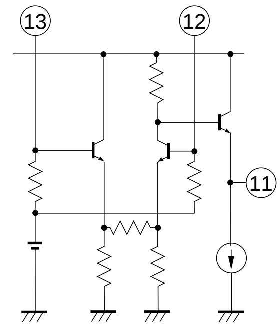
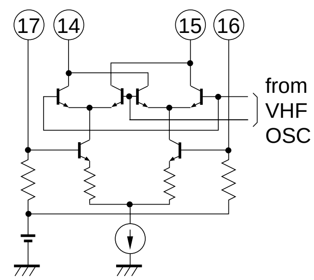
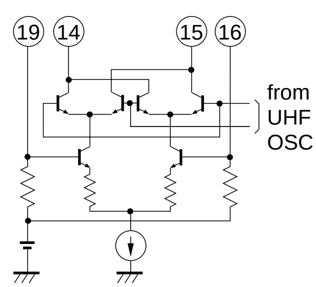
The mark ★ shows major revised points.

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	UOSC collector (Tr.1)	5.00 3.60	Collector pin of UHF oscillator. Assemble LC resonator with 2 pin through 1 pF capacitor to oscillate with active feedback loop.	
2	UOSC base (Tr.2)	0.0 1.90	Base pin of UHF oscillator with balance amplifier. Connected to LC resonator through 360 pF feedback capacitor.	
3	UOSC base (Tr.1)	0.0 1.90	Base pin of UHF oscillator with balance amplifier. Connected to LC resonator through 360 pF feedback capacitor.	
4	UOSC collector (Tr.2) and UB	0.0 5.00	Collector pin of UHF oscillator with balance amplifier. Grounded through 6 pF capacitor. Double balanced oscillator with transistor 1 and transistor 2. And this pin is switch for VHF or UHF. VHF operation = GND UHF operation = 5.0 V	
5	GND	0.0 0.0	GND pin for VHF and UHF oscillator	
6	OSC output	2.70 2.35	VHF and UHF oscillator signal output pin. In case of F/S tuner application, connected PLL symthesizer IC’s input pin.	
7	VOSC base (Tr.1)	1.95 0.0	Base pin of VHF oscillator. Grounded through 10 pF capacitor.	
8	VOSC base (Tr.2)	1.95 0.0	Base pin of VHF oscillator. Assemble LC resonator with 10 pin to oscillate with active feedback loop.	
9	VOSC collector (Tr.2)	3.60 5.00	Collector pin of VHF oscillator. Connected to LC resonator through 3 pF feedback capacitor.	
10	Vcc	5.00 5.00	Power supply pin.	

Pin No.	Symbol	Pin Voltage TYP. above: VHF mode below: UHF mode	Function and Explanation	Equivalent Circuit
11	IF output	2.55 2.55	IF signal output pin for VHF and UHF operation.	
12	IF IN	2.00 2.00	IF signal input pins. Connected to Mixer output pins through 1000 pF capacitors.	
13	IF IN	2.00 2.00		
14	MIX OUT	5.00 5.00	VHF and UHF MIX output pins. These pins should be equipped with tank circuit to adjust intermediate frequency	
15	MIX OUT	5.00 5.00		
16	VRF IN (bypass)	2.80 2.85	Bypass pin for VHF MIX input. Grounded through 1000 pF capacitor.	
17	VRF IN	2.80 2.85	VHF RF signal input pin.	
18	GND	0.0 0.0	GND pin of MIX, IF amplifier and regulator.	
19	URF IN (bypass)	2.85 2.80	Bypass pin for UHF MIX input. Grounded through 1000 pF capacitor.	
20	URF IN	2.85 2.80	UHF RF signal input pin.	

ABSOLUTE MAXIMUM RATINGS (T_A = 25°C unless otherwise specified)

Parameter	Symbol	Condition	Ratings	Unit
Supply voltage 1	V_{CC}		6.0	V
Supply voltage 2	UB		6.0	V
Power dissipation	P_D	T_A = 80°C *1	466	mW
Operation temperature range	T_A		–20 to +80	°C
Storage temperature range	T_{stg}		–55 to +150	°C

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

RECOMMENDED OPERATING RANGE

Parameter	Symbol	MIN.	TYP.	MAX.	Unit
Supply voltage 1	V_{CC}	4.5	5.0	5.5	V
Supply voltage 2	UB	4.5	5.0	5.5	V
Operation temperature range	T_A	–20	+25	+80	°C

ELECTRICAL CHARACTERISTICS (T_A = 25°C, V_{CC} = 5 V, f_{osc} = f_{RF} + 45 MHz, 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	*1	34.0	41.0	48.0	mA
Circuit Current 2	Icc2	@UHF, no input signal	*1	34.0	41.0	48.0	mA
Conversion Gain 1	CG1	f_{RF} = 55 MHz, P_{RF} = –30 dBm	*2	22.0	25.0	28.0	dB
Conversion Gain 2	CG2	f_{RF} = 200 MHz, P_{RF} = –30 dBm	*2	22.0	25.0	28.0	dB
Conversion Gain 3	CG3	f_{RF} = 470 MHz, P_{RF} = –30 dBm	*2	22.0	25.0	28.0	dB
Conversion Gain 4	CG4	f_{RF} = 470 MHz, P_{RF} = –30 dBm	*2	26.0	29.0	32.0	dB
Conversion Gain 5	CG5	f_{RF} = 800 MHz, P_{RF} = –30 dBm	*2	26.0	29.0	32.0	dB
Noise Figure 1	NF1	f_{RF} = 55 MHz	*3	–	10.5	13.0	dB
Noise Figure 2	NF2	f_{RF} = 200 MHz	*3	–	10.5	13.0	dB
Noise Figure 3	NF3	f_{RF} = 470 MHz	*3	–	10.5	13.0	dB
Noise Figure 4	NF4	f_{RF} = 470 MHz	*3	–	9.5	12.0	dB
Noise Figure 5	NF5	f_{RF} = 800 MHz	*3	–	10.0	13.0	dB
Maximum Output Power 1	$P_{O(SAT)}1$	f_{RF} = 55 MHz, P_{RF} = 0 dBm	*2	4.0	6.0	–	dBm
Maximum Output Power 2	$P_{O(SAT)}2$	f_{RF} = 200 MHz, P_{RF} = 0 dBm	*2	4.0	6.0	–	dBm
Maximum Output Power 3	$P_{O(SAT)}3$	f_{RF} = 470 MHz, P_{RF} = 0 dBm	*2	4.0	6.0	–	dBm
Maximum Output Power 4	$P_{O(SAT)}4$	f_{RF} = 470 MHz, P_{RF} = 0 dBm	*2	4.0	6.0	–	dBm
Maximum Output Power 5	$P_{O(SAT)}5$	f_{RF} = 800 MHz, P_{RF} = 0 dBm	*2	4.0	6.0	–	dBm

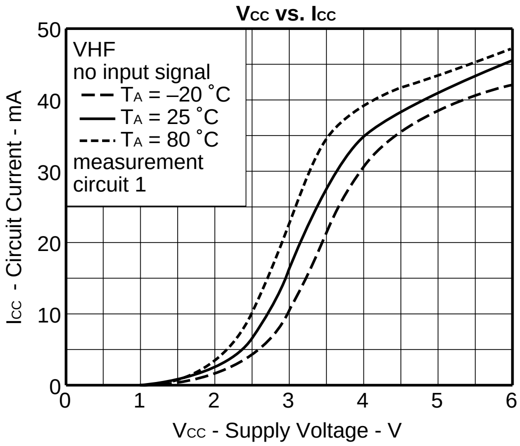
***1** By measurement circuit 1
***2** By measurement circuit 2
***3** By measurement circuit 3

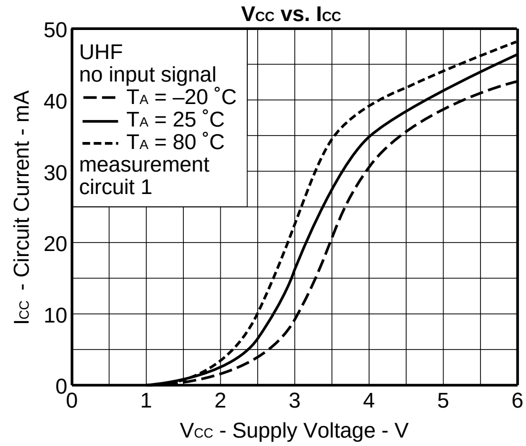
STANDARD CHARACTERISTICS (Reference Values) (T_A = 25°C, V_{CC} = 5 V)

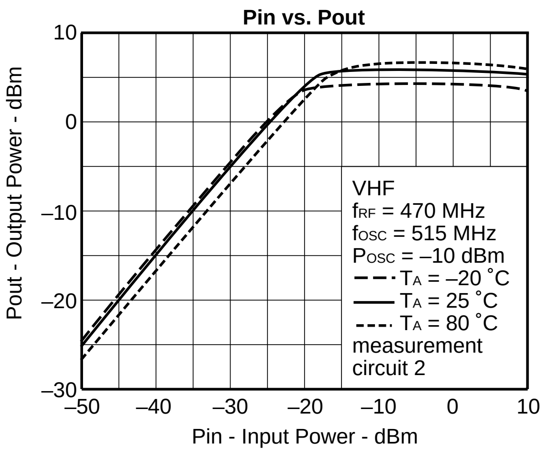
Parameter	Symbol	Test Conditions	Value for Reference	Unit
Third order intermodulation distortion 1	$IM_3 1$	VHF, $f_{RF}1$ = 470 MHz, $f_{RF}2$ = 476 MHz, Pin = –30 dBm each, f_{OSC} = 515 MHz, P_{OSC} = –10 dBm ***1**	55	dBc
Third order intermodulation distortion 2	$IM_3 2$	UHF, $f_{RF}1$ = 800 MHz, $f_{RF}2$ = 806 MHz, Pin = –30 dBm each, f_{OSC} = 845 MHz, P_{OSC} = –10 dBm ***1**	46	dBc
1% cross-modulation distortion 1	CM1	VHF, f_{RF} = 470 MHz, fundes = 476 MHz, f_{OSC} = 515 MHz, P_{RF} = –40 dBm, P_{OSC} = –10 dBm, AM100 kHz, 30% modulation, DES/CM = 46 dBc ***1**	96	dBμ
1% cross-modulation distortion 2	CM2	UHF, f_{RF} = 800 MHz, fundes = 806 MHz, f_{OSC} = 845 MHz, P_{RF} = –40 dBm, P_{OSC} = –10 dBm, AM100 kHz, 30% modulation, DES/CM = 46 dBc ***1**	88	dBμ

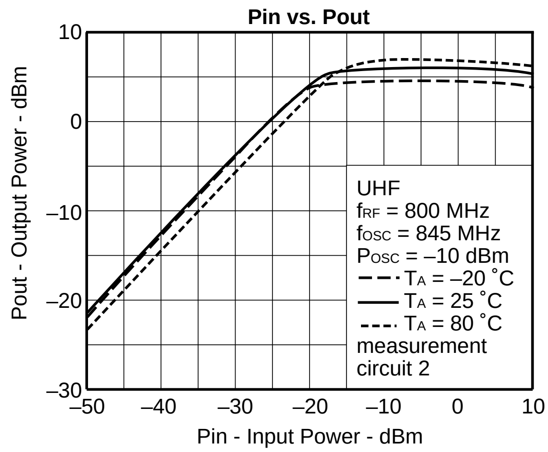
***1** By measurement circuit 4

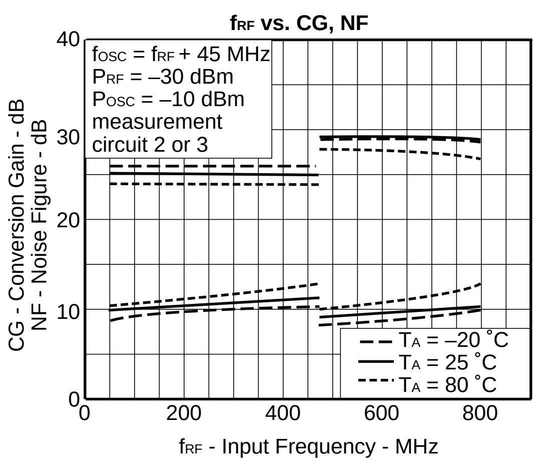
TYPICAL CHARACTERISTICS (V_{CC} = 5 V)



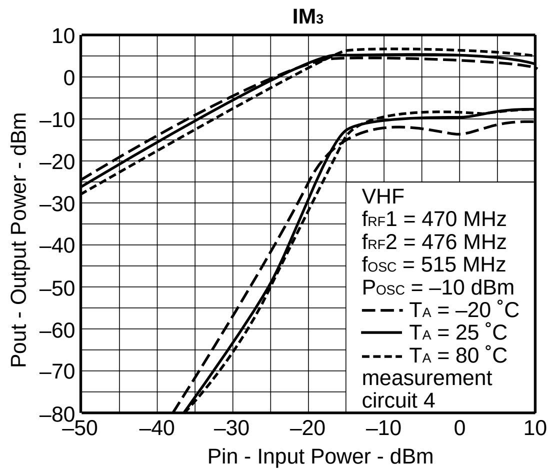


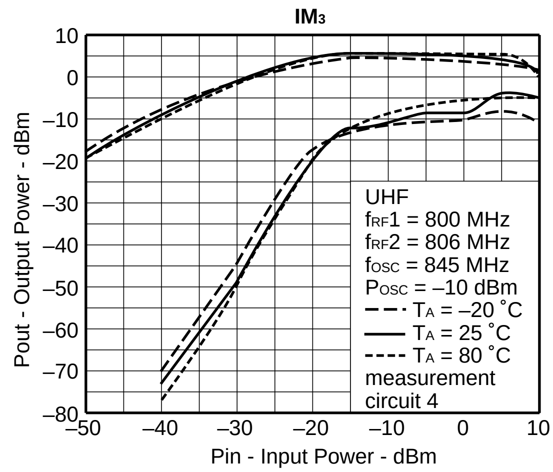


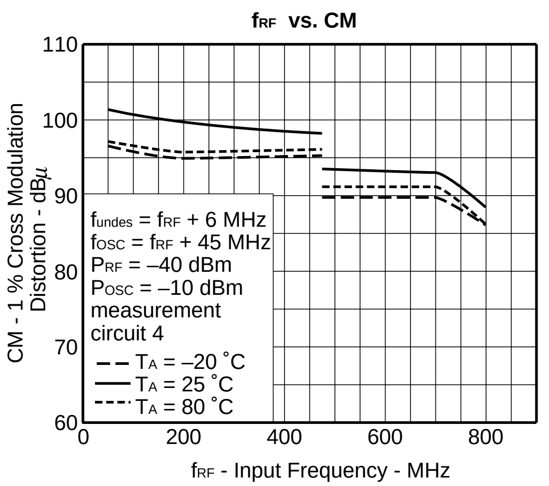




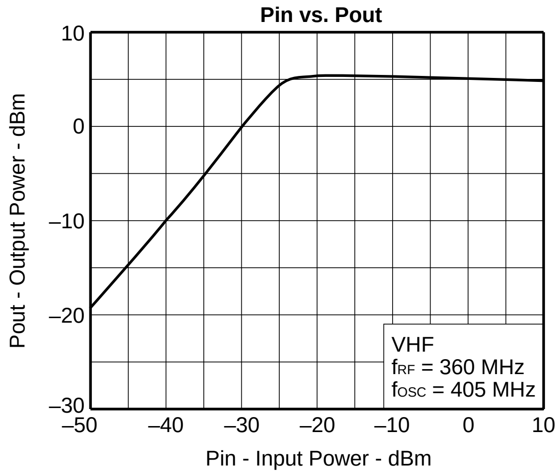
STANDARD CHARACTERISTICS (V_{CC} = 5 V)

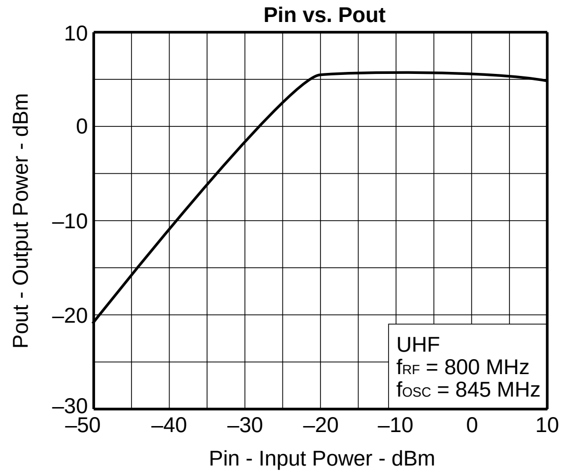


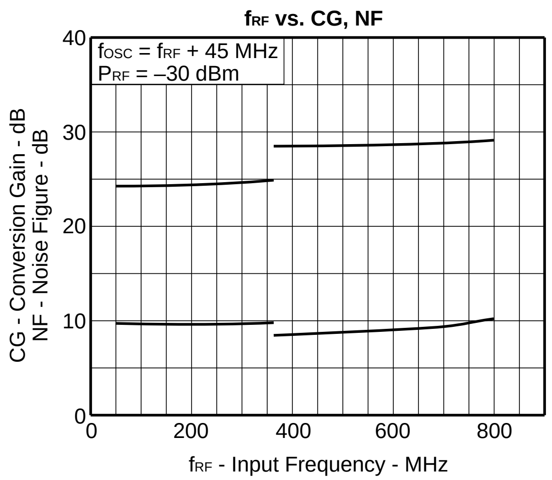


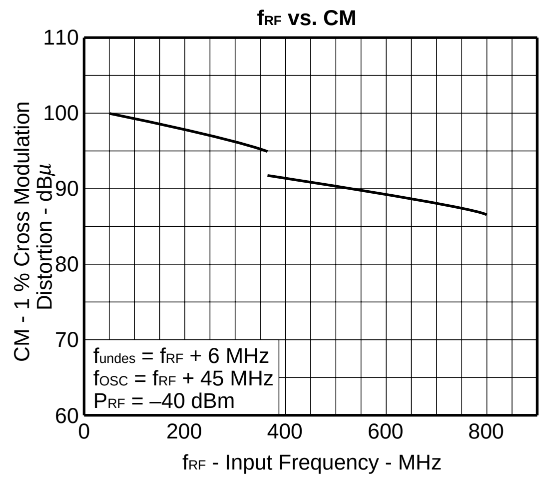


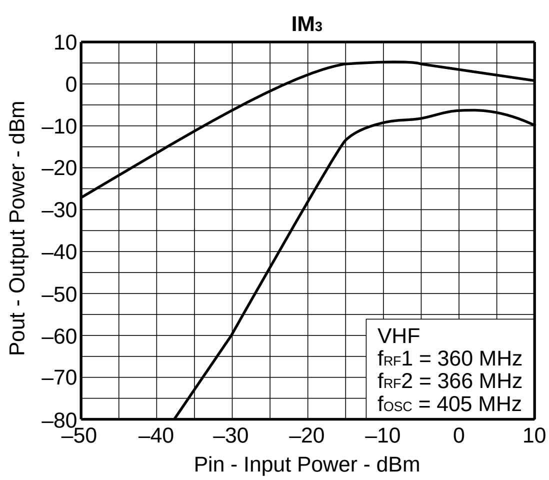
STANDARD CHARACTERISTICS (V_{CC} = 5 V, T_A = 25°C, on Application circuit example)

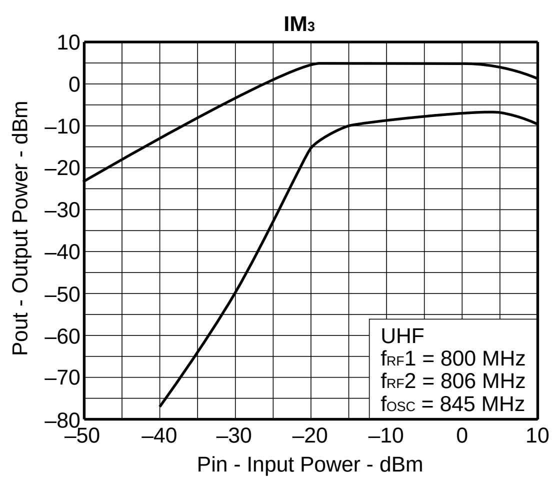






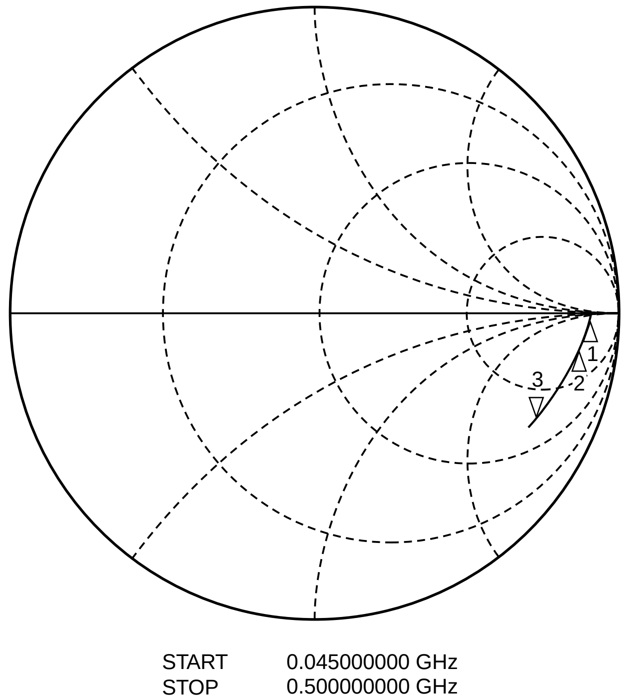






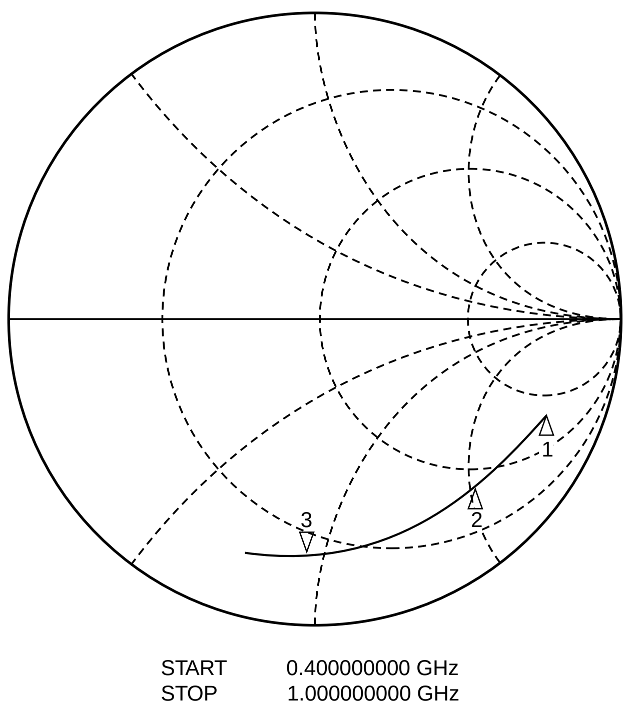
INPUT IMPEDANCE (By measurement circuit 5)

<VRF INPUT: 17 PIN>



∇1 45 MHz
890.25 Ω – 235.69 Ω
∇2 200 MHz
357.45 Ω – 356.78 Ω
∇3 470 MHz
95.016 Ω – 179.81 Ω

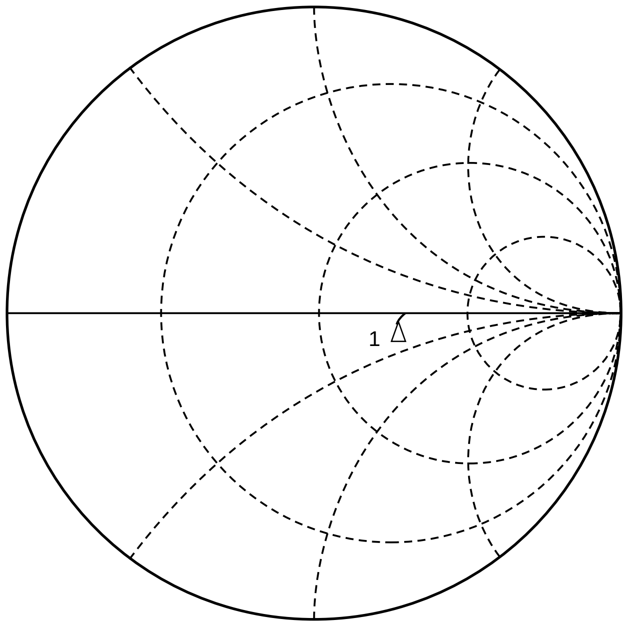
<VRF INPUT: 20 PIN>



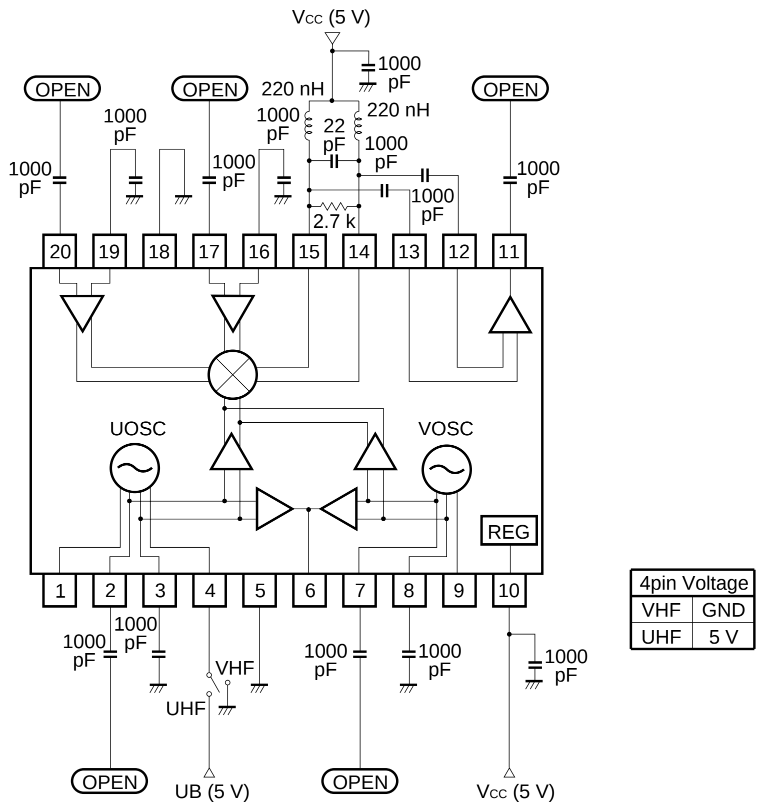
∇1 400 MHz
100.35 Ω – 190.80 Ω
∇2 600 MHz
40.156 Ω – 103.16 Ω
∇3 890 MHz
12.047 Ω – 46.439 Ω

OUTPUT IMPEDANCE (By measurement circuit 5)

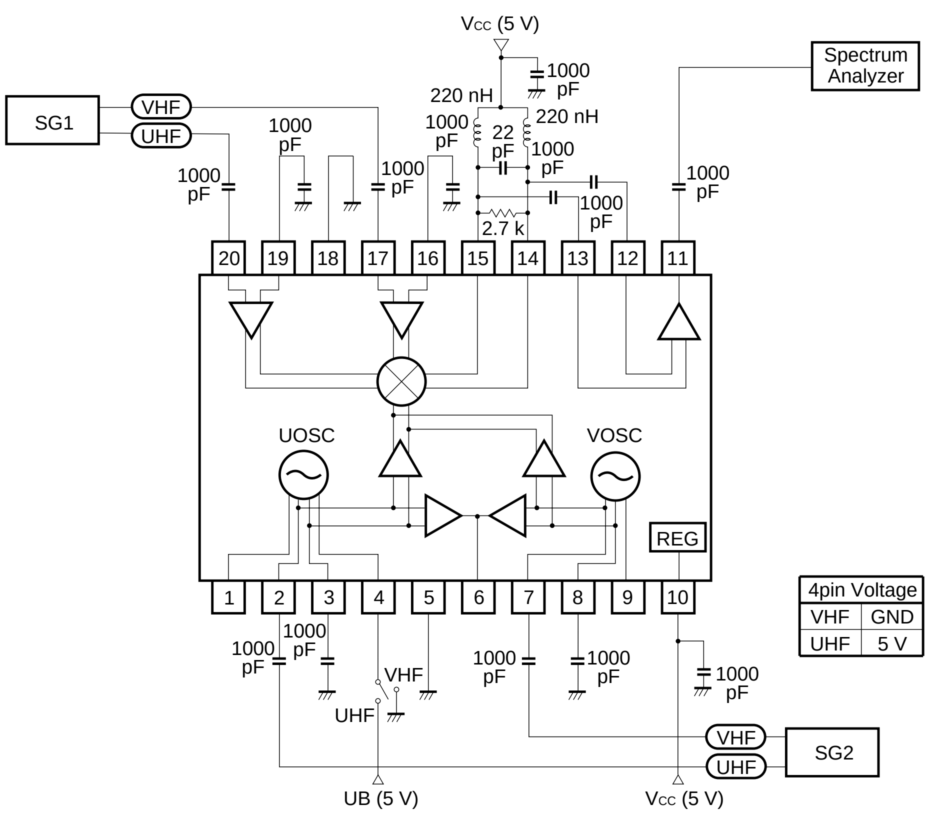
<IF OUTPUT: 11 PIN>



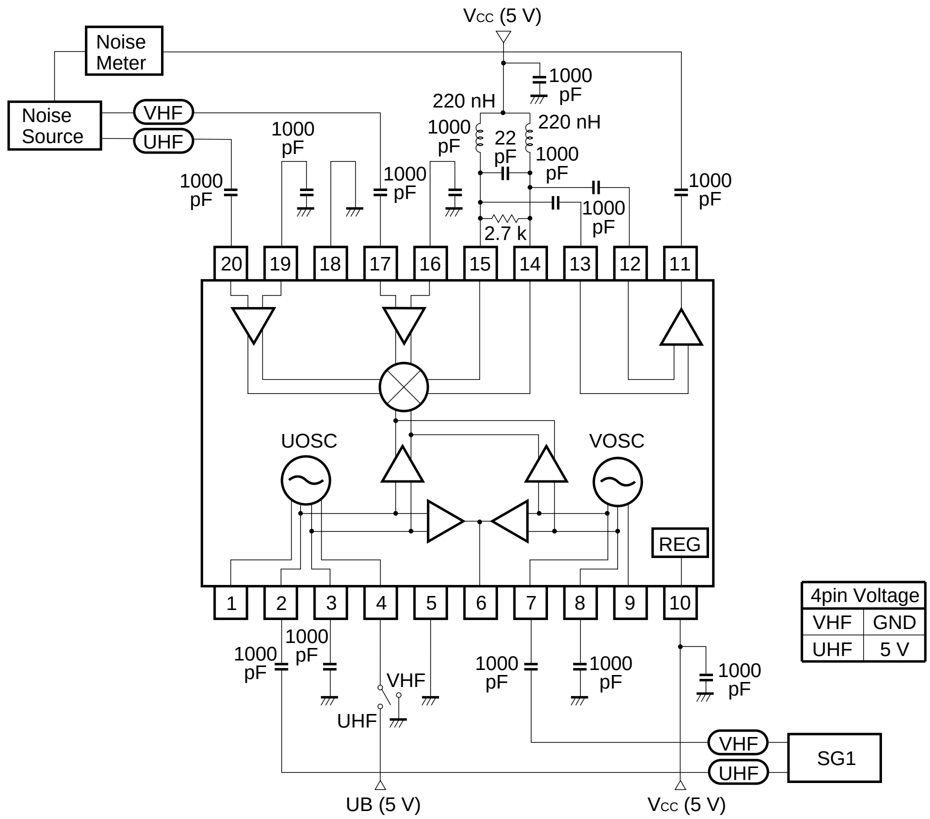
MEASUREMENT CIRCUIT 1



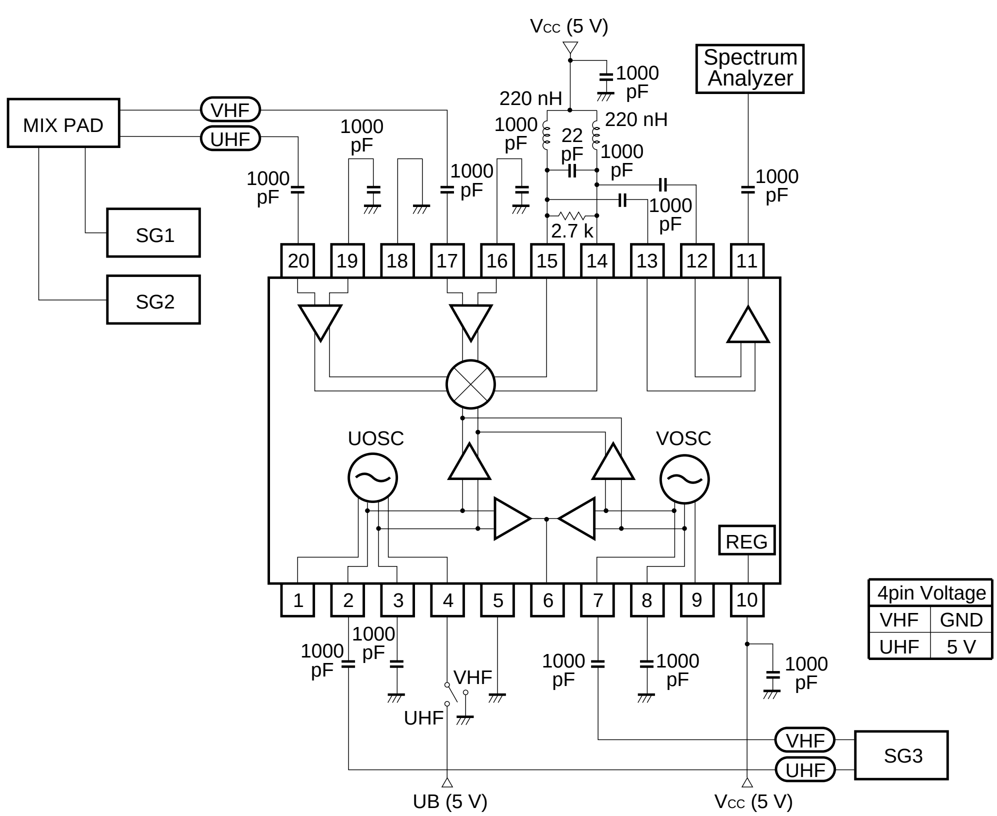
MEASUREMENT CIRCUIT 2



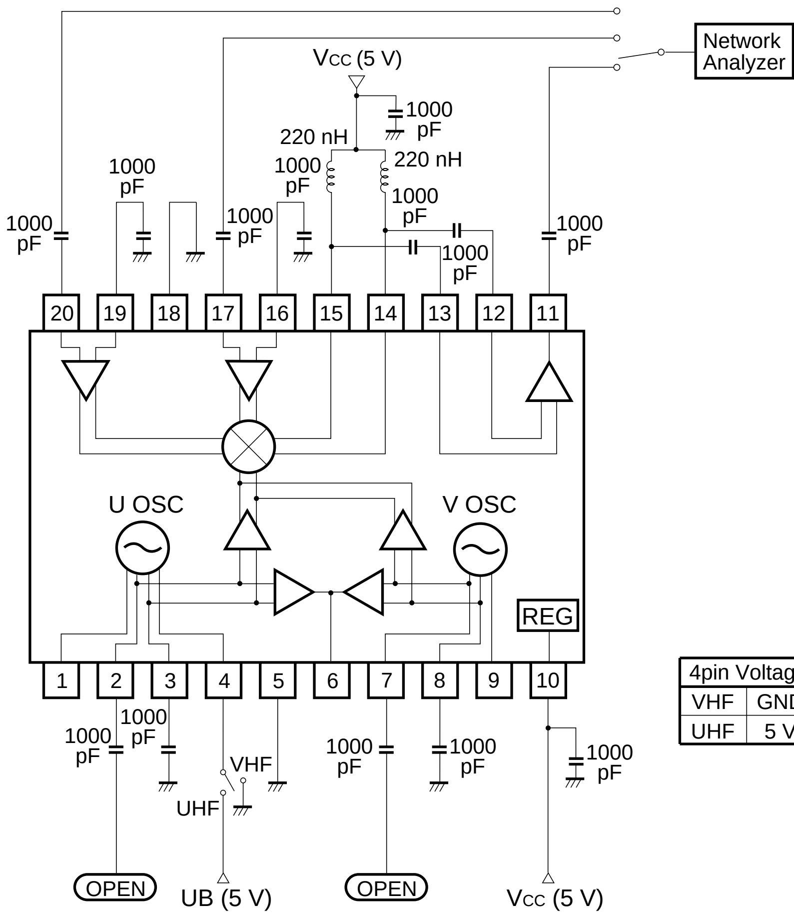
MEASUREMENT CIRCUIT 3



MEASUREMENT CIRCUIT 4

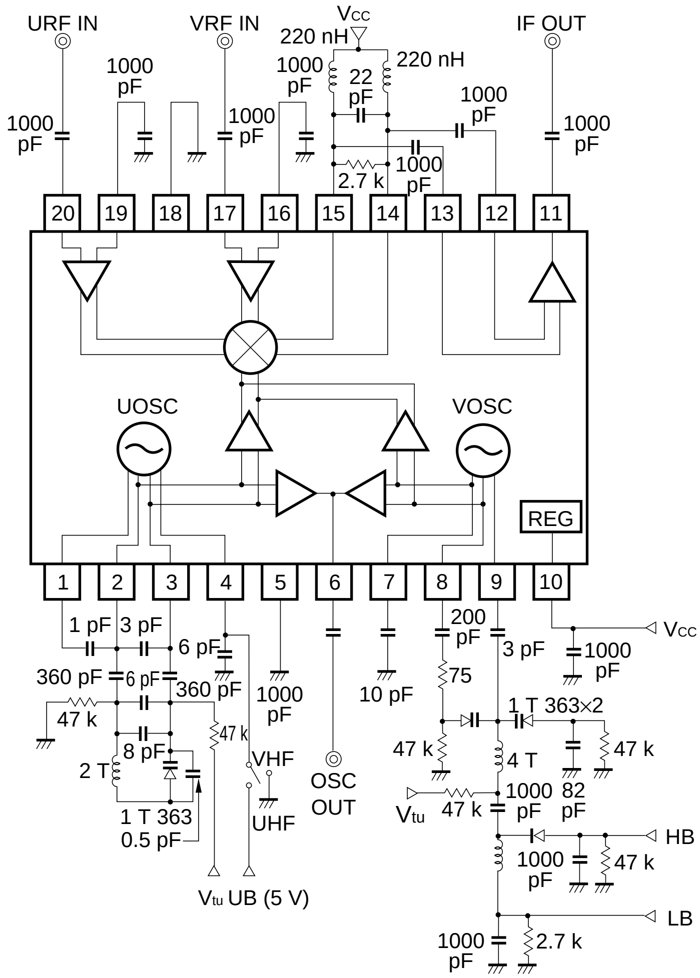


MEASUREMENT CIRCUIT 5



4pin Voltage	
VHF	GND
UHF	5 V

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)

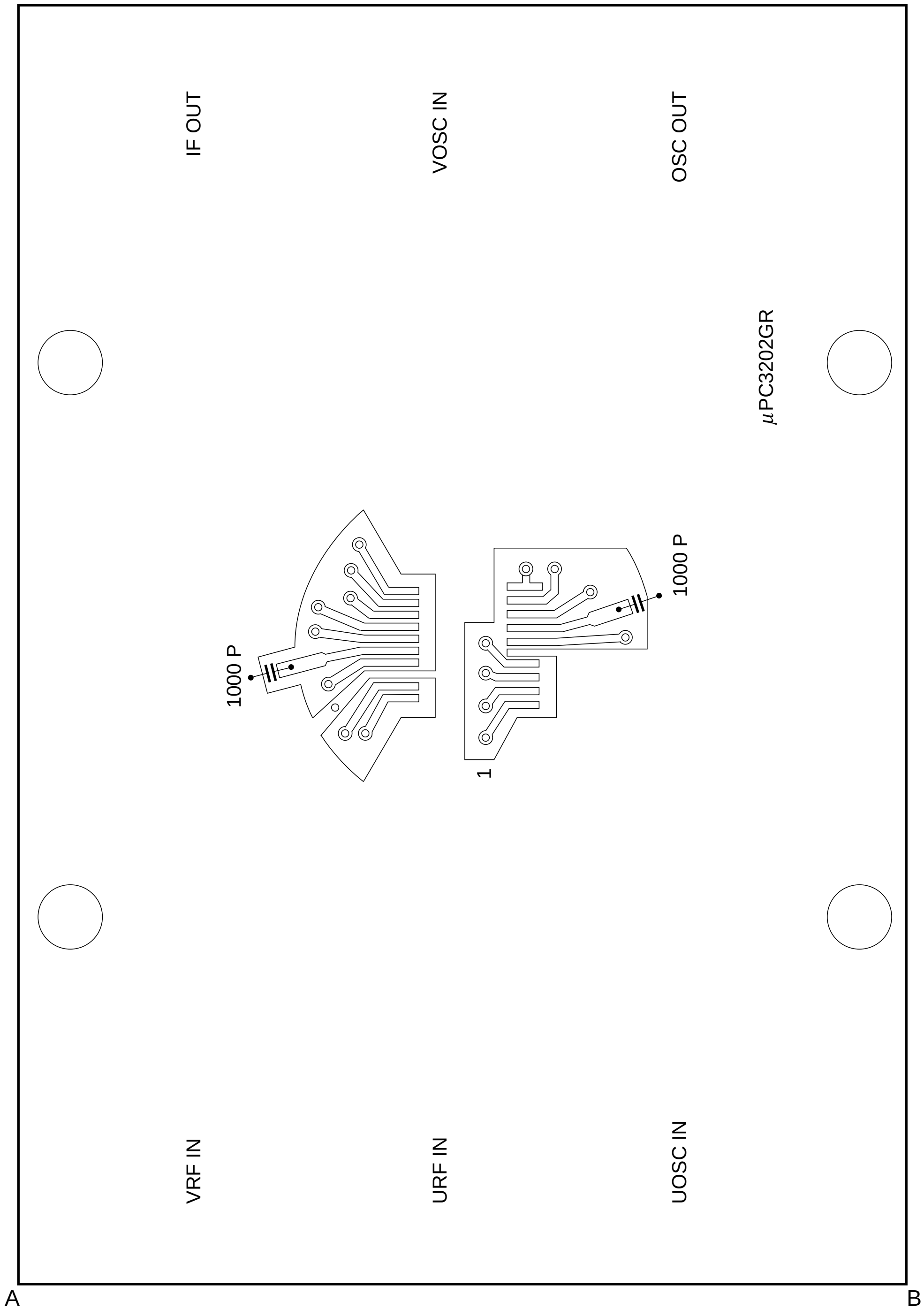
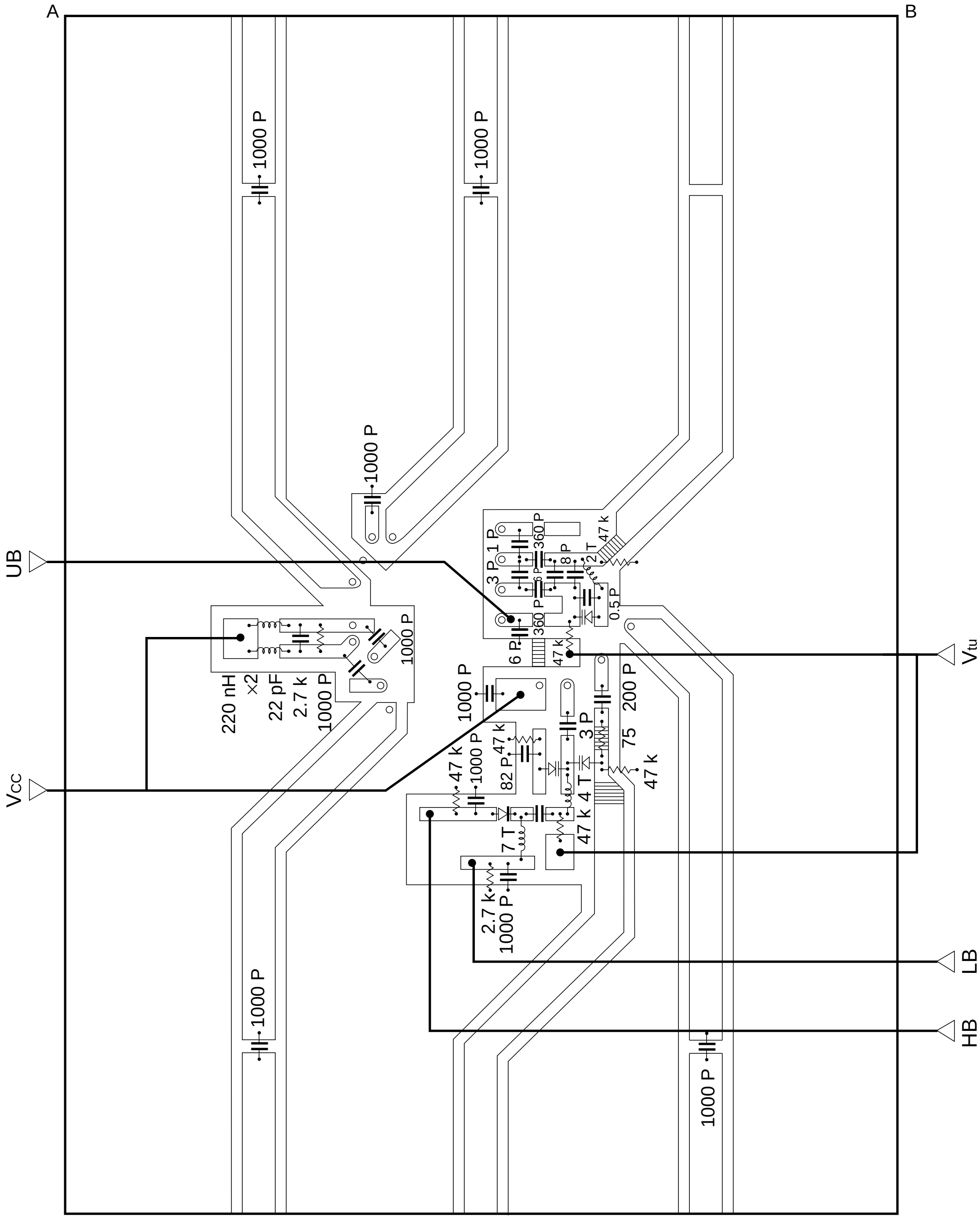


ILLUSTRATION OF THE EVALUATION BOARD FOR APPLICATION CIRCUIT EXAMPLE (Back side)

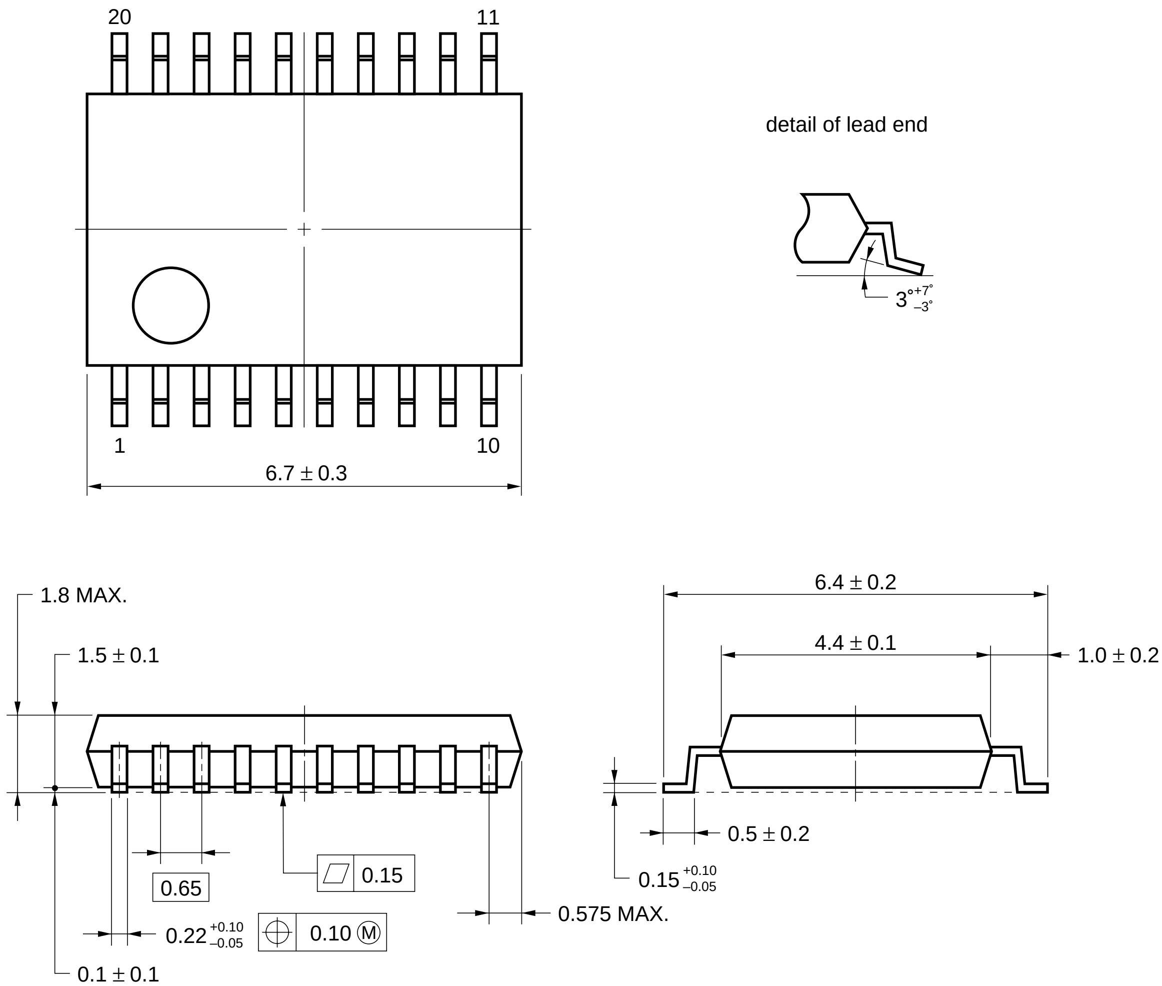


Notes:

- should be removed
- ○ ◯ :Through holes

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.
(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).**

μPC3202GR

Soldering Process	Soldering Conditions	Symbol
Infrared ray reflow	Peak package's surface temperature: 235°C or below, Reflow time: 30 seconds or below (210°C or higher), Number of reflow process: 3, Exposure limit*1 None)	IR35-00-3
VPS	Peak package's surface temperature: 215°C or below, Reflow time: 40 seconds or below (200°C or higher), Number of reflow process: 3, Exposure limit*1 None)	VP15-00-3
Partial heating method	Terminal temperature: 300°C or below, Flow time: 3 seconds or below, Exposure limit*1 Note	

***1** 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".

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