PRELIMINARY DATA SHEET

NEC

BIPOLAR ANALOG INTEGRATED CIRCUIT

μPC3207GR

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

DESCRIPTION

The μPC3207GR is a 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, 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

ORDERING INFORMATION

Part Number	Package	Package Style
μPC3207GR-E1	20-pin plastic SSOP (225 mil)	Embossed tape 12 mm wide. 2.5 k/REEL. Pin 1 indicates pull-out direction of tape

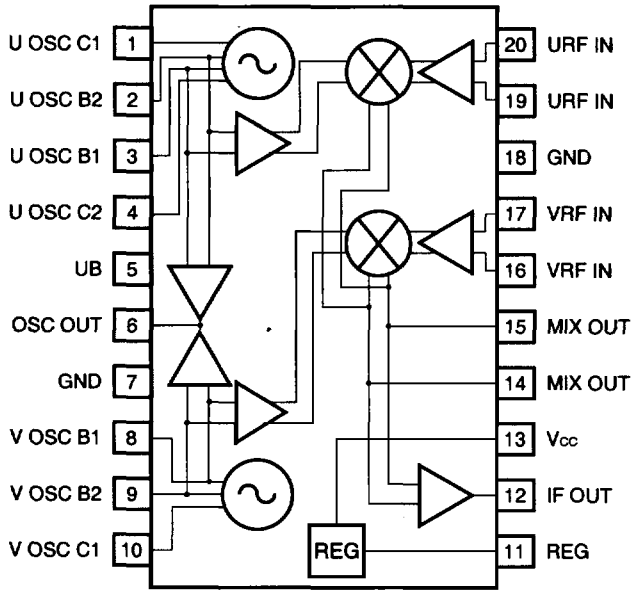
To order evaluation samples, please contact your local NEC office. (Part number for sample order: μPC3207GR)

Caution electro-static sensitive device

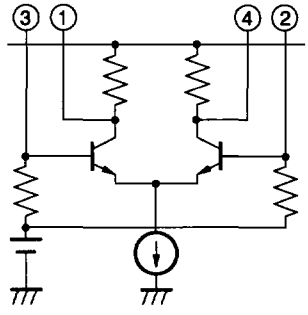
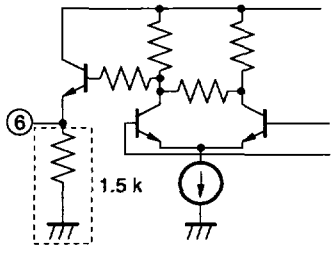
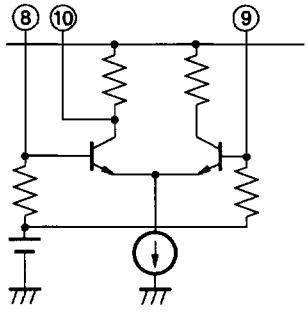
The information in this document is subject to change without notice.

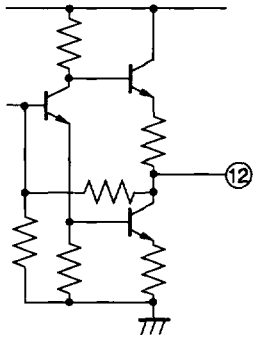
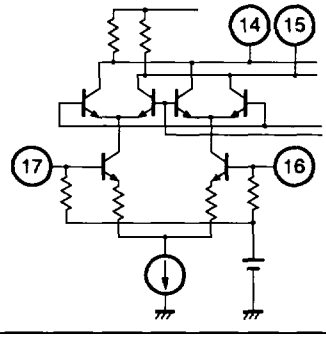
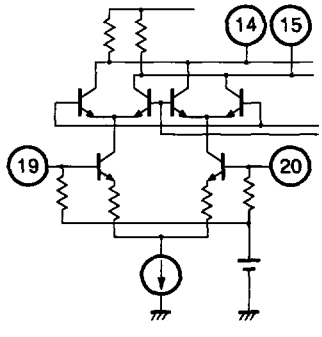
Document No. P13717EJ1V0DS00 (1st edition)
Date Published August 1998 N CP(K)
Printed in Japan

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	Vcc	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 MIX input. 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_{CC1}	@VHF, no input signal	Notes 1, 2	31.0	38.0	45.0	mA
Circuit Current 2	I_{CC2}	@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

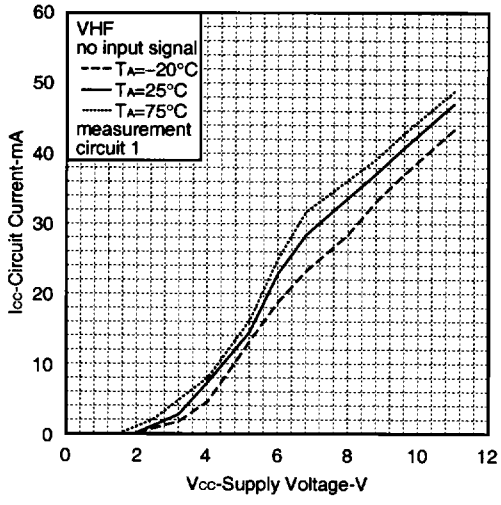
STANDARD CHARACTERISTICS (T_A = 25 °C, V_{CC} = 9 V, f_{IF} = 45 MHz, f_{OSC} = f_{RF} + 45 MHz, P_{OSC} = −10 dBm)

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

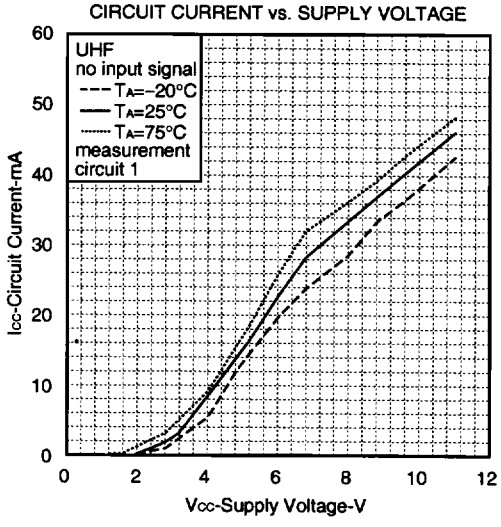
Note By measurement circuit 4, f_{undes} = f_{des} + 6 MHz, P_{des} = −30 dBm, AM 100 kHz, 30 % modulation, DES/CM = 46 dBc

TYPICAL CHARACTERISTICS

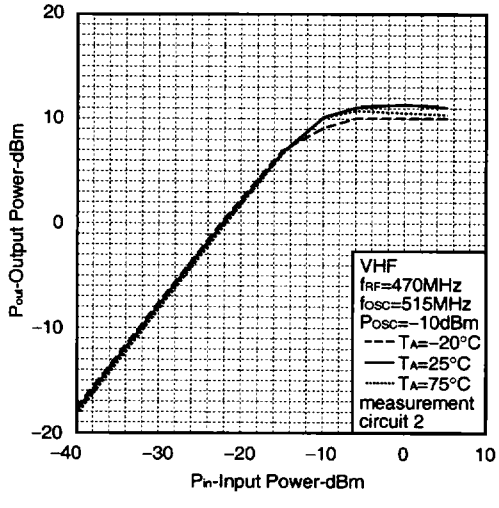
CIRCUIT CURRENT vs. SUPPLY VOLTAGE



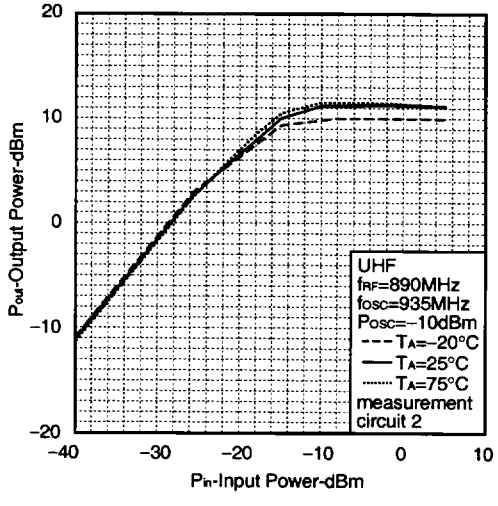
CIRCUIT CURRENT vs. SUPPLY VOLTAGE



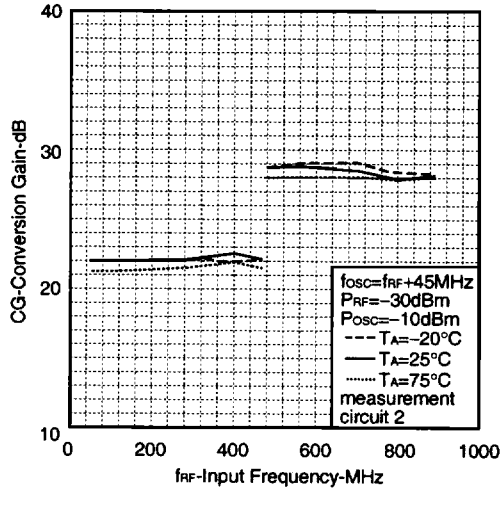
OUTPUT POWER vs. INPUT POWER



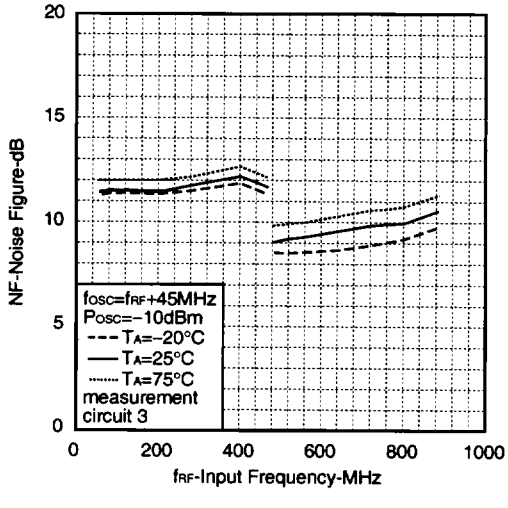
OUTPUT POWER vs. INPUT POWER



CONVERSION GAIN vs. INPUT FREQUENCY

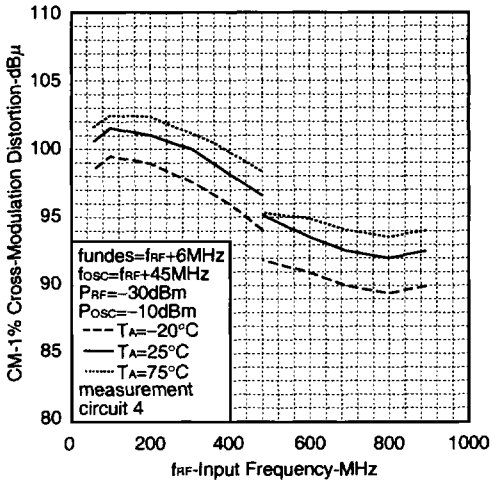


NOISE FIGURE vs. INPUT FREQUENCY

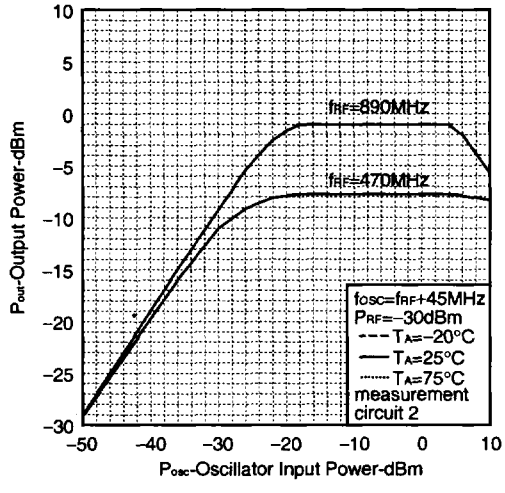


STANDARD CHARACTERISTICS (Vcc = 9 V)

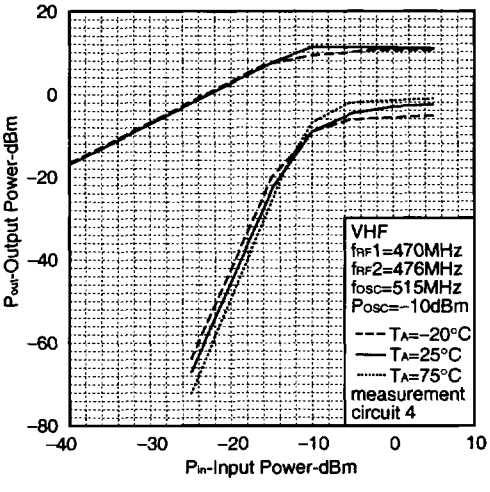
1% CROSS-MODULATION DISTORTION vs. INPUT FREQUENCY



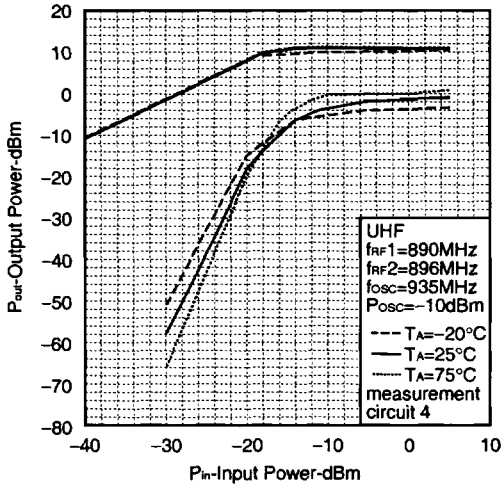
OUTPUT POWER vs. OSC INPUT POWER



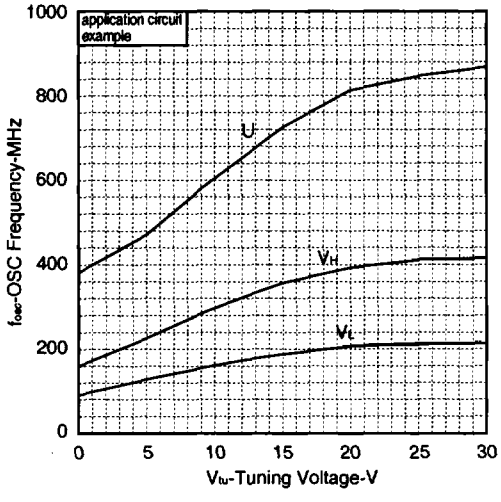
3rd INTERMODULATION DISTORTION



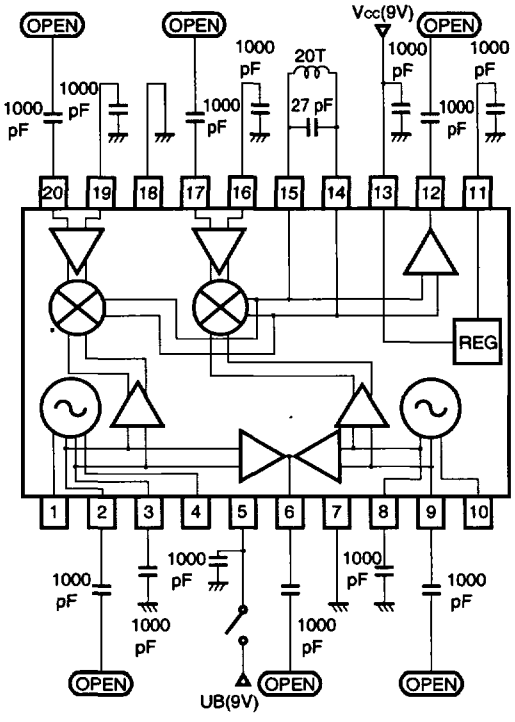
3rd INTERMODULATION DISTORTION



OSC FREQUENCY vs. TUNING VOLTAGE

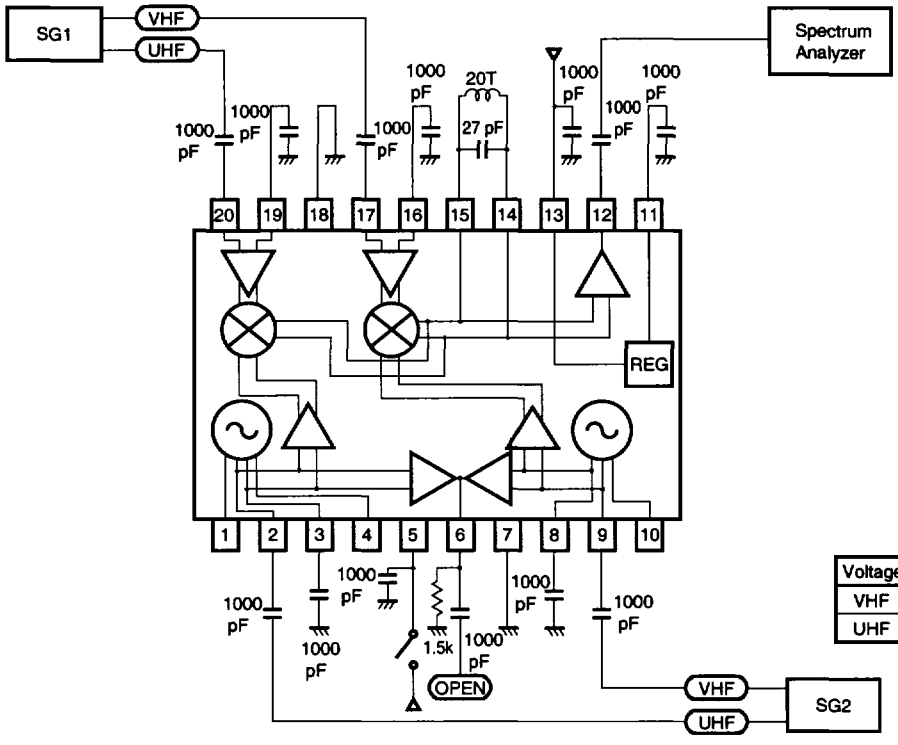


MEASUREMENT CIRCUIT 1



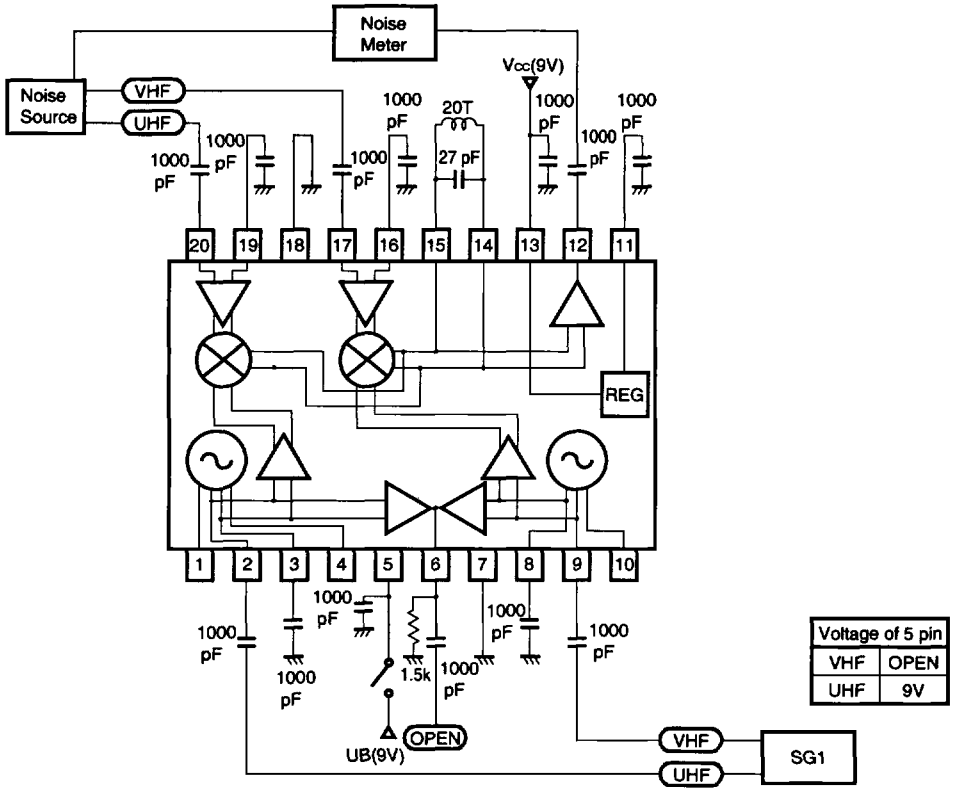
Voltage of 5 pin	
VHF	OPEN
UHF	9V

MEASUREMENT CIRCUIT 2

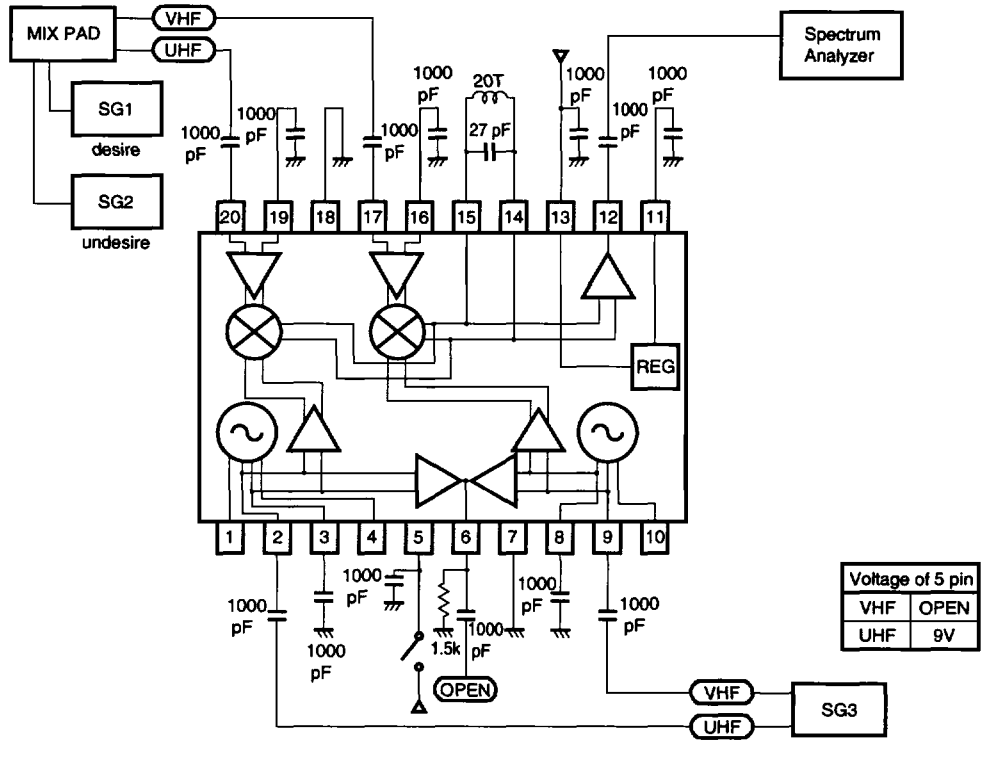


Voltage of 5 pin	
VHF	OPEN
UHF	9V

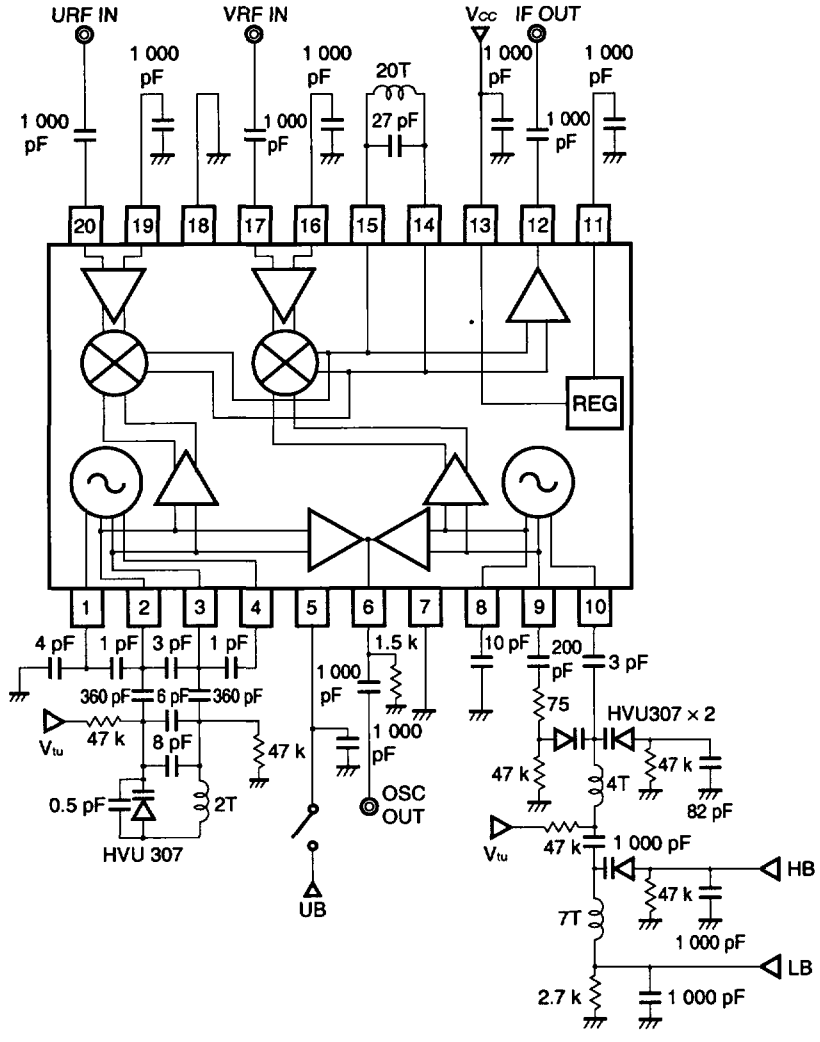
MEASUREMENT CIRCUIT 3



MEASUREMENT CIRCUIT 4



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)

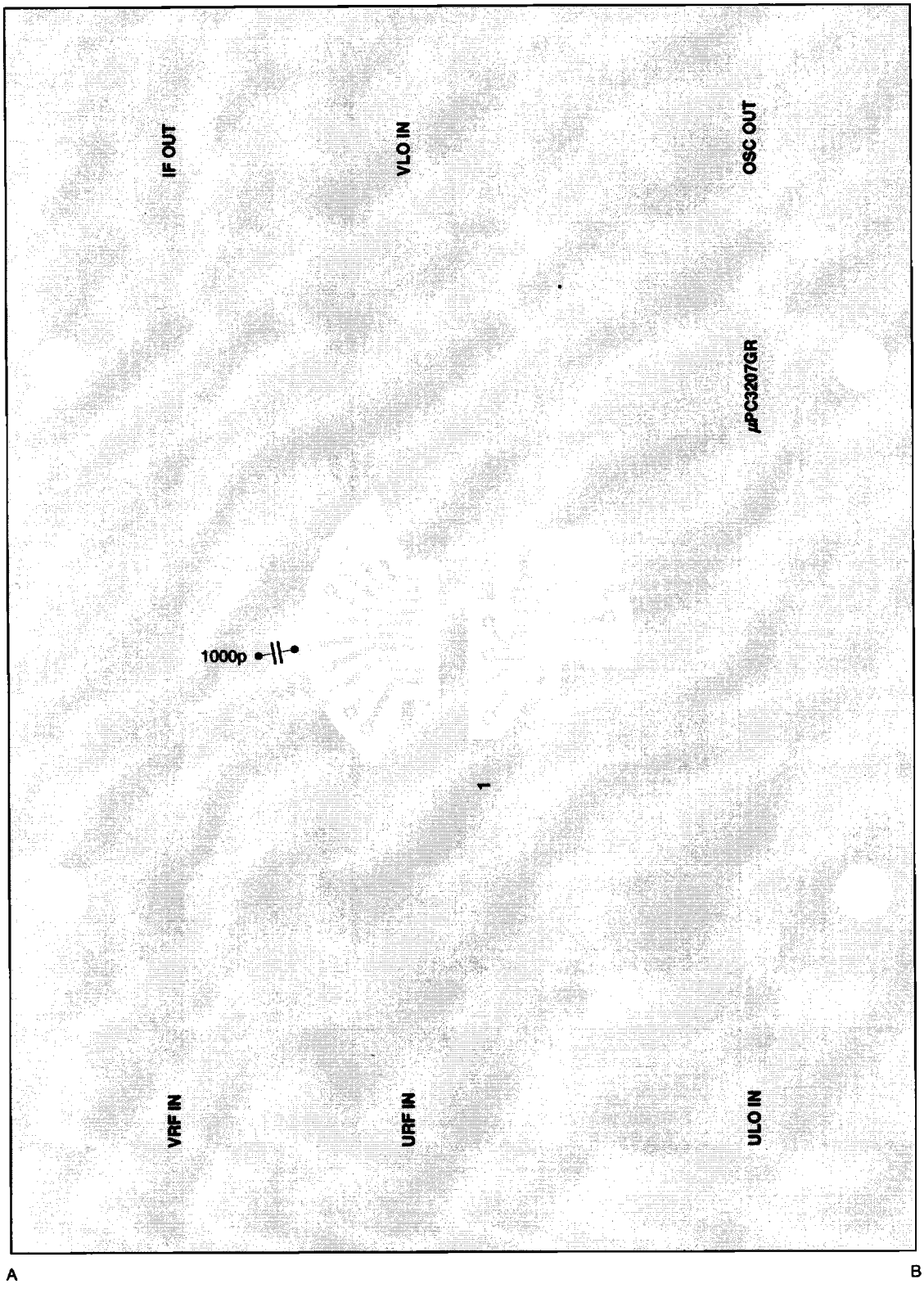
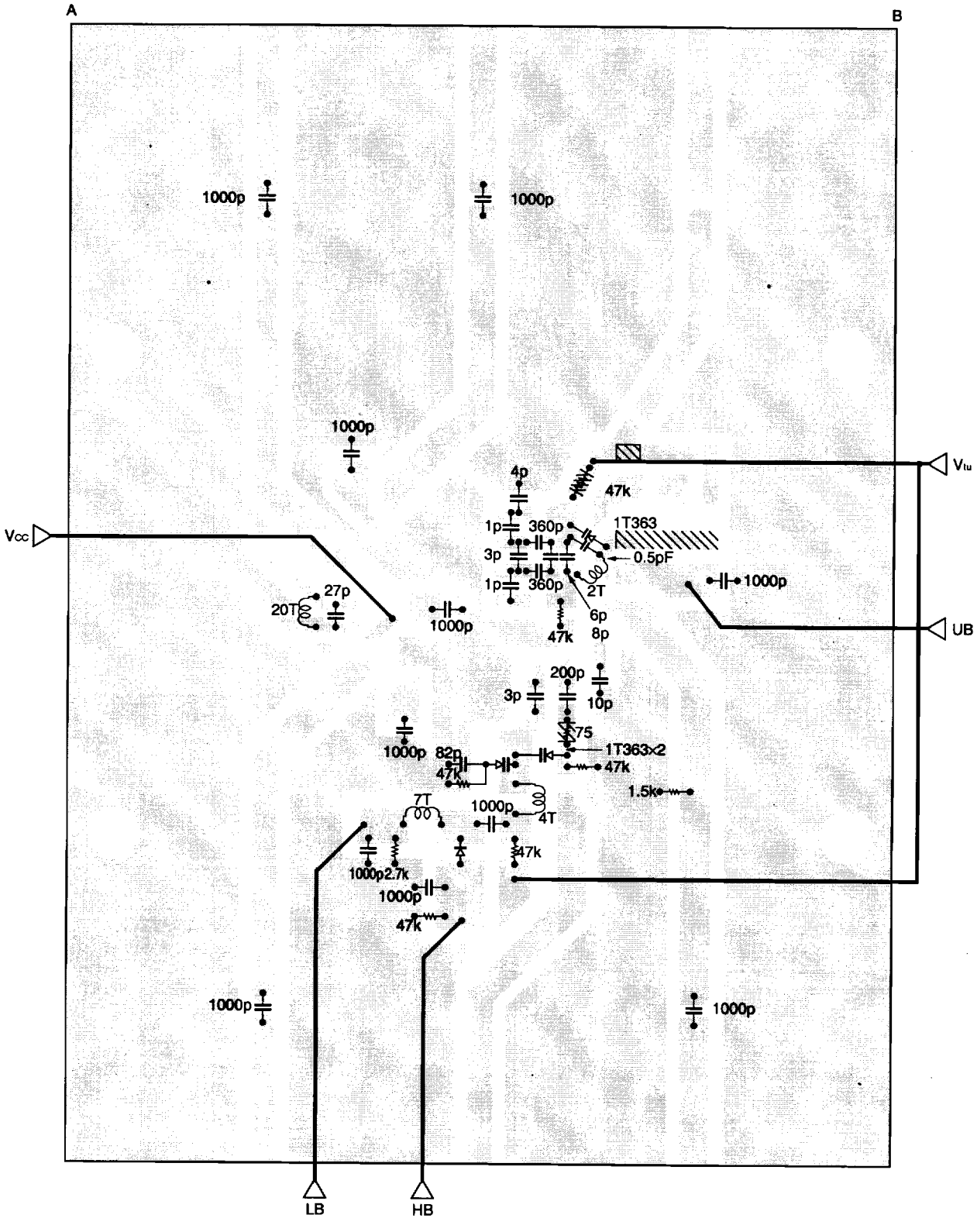


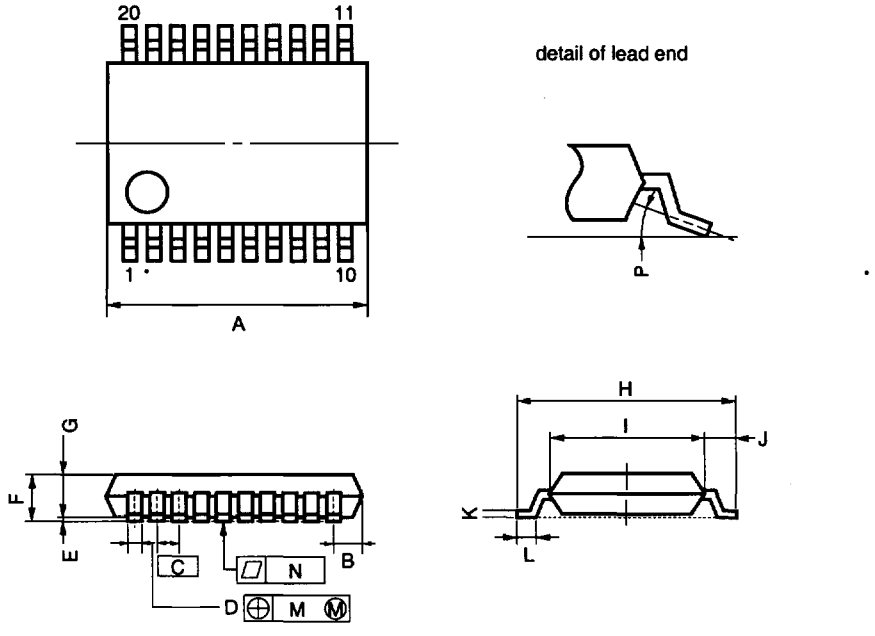
ILLUSTRATION OF THE EVALUATION BOARD FOR APPLICATION CIRCUIT EXAMPLE (Back side)



represents cutout

PACKAGE DIMENSIONS

20 Pin Plastic SSOP (225 mil) (Unit: mm)



NOTE
Each lead centerline is located within 0.12 mm (0.005 inch) of its true position (T.P.) at maximum material condition.

ITEM	MILLIMETERS	INCHES
A	7.00 MAX.	0.276 MAX.
B	0.575 MAX.	0.023 MAX.
C	0.65 (T.P.)	0.026 (T.P.)
D	$0.22^{+0.10}_{-0.05}$	$0.009^{+0.004}_{-0.002}$
E	0.1±0.1	0.004±0.004
F	1.8 MAX.	0.071 MAX.
G	1.5±0.1	0.058±0.004
H	6.4±0.2	0.253±0.008
I	4.4±0.1	0.174±0.004
J	1.0	0.040
K	$0.15^{+0.10}_{-0.05}$	$0.060^{+0.004}_{-0.002}$
L	0.5±0.2	$0.020^{+0.008}_{-0.004}$
M	0.10	0.004
N	0.15	0.006
P	$3^{\circ+7^{\circ}}_{-3^{\circ}}$	$3^{\circ+7^{\circ}}_{-3^{\circ}}$

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 Vcc 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).

μPC3207GR

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[Note]: 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[Note]: None	VP15-00-3
Partial heating method	Terminal temperature: 300 °C or below, Flow time: 3 seconds or below, 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]

NESAT (NEC Silicon Advanced Technology) is a trademark of NEC Corporation.

M4 96.5