

# BIPOLAR DIGITAL INTEGRATED CIRCUIT

# $\mu$ PB1508GV

### 3 GHz INPUT DIVIDE BY 2 PRESCALER IC FOR DBS TUNERS

$\mu$ PB1508GV is a 3.0 GHz input divide by 2 prescaler IC for DBS tuner applications.  $\mu$ PB1508GV can make VHF/UHF band PLL frequency synthesizer apply to DBS/ECS tuners.  $\mu$ PB1508GV is a shrink package version of  $\mu$ PB584G so that this small package contributes to reduce the mounting space.

$\mu$ PB1508GV is manufactured using NEC's high fr NESAT™ IV silicon bipolar process. This process uses silicon nitride passivation film and gold electrodes. These materials can protect chip surface from external pollution and prevent corrosion/migration. Thus, this IC has excellent performance, uniformity and reliability.

#### FEATURES

- High toggle frequency :  $f_{in} = 0.5 \text{ GHz to } 3.0 \text{ GHz}$
- High-density surface mounting : 8 pin plastic SSOP (175 mil)
- Low current consumption : 5 V, 12 mA
- Fixed division :  $\div 2$

#### APPLICATION

- Prescaler between local oscillator and PLL frequency synthesizer included modulus prescaler
- DBS tuners with kit use of VHF/UHF band PLL frequency synthesizer

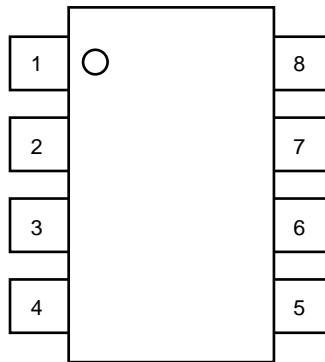
#### ORDERING INFORMATION

PART NUMBER	PACKAGE	MARKING	SUPPLYING FORM
$\mu$ PB1508GV-E1	8 pin plastic SSOP (175 mil)	1508	Embossed tape 8 mm wide. Pin 1 is in tape pull-out direction. 1 000 p/reel.

**Remarks** To order evaluation samples, please contact your local NEC sales office.  
(Part number for sample order:  $\mu$ PB1508GV)

**Caution: Electro-static sensitive devices**

**PIN CONNECTION (Top View)**



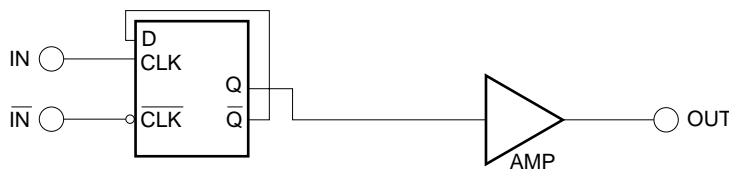
Pin No.	Pin name
1	V <sub>CC</sub>
2	IN
3	$\overline{\text{IN}}$
4	GND
5	GND
6	NC
7	OUT
8	NC

**PRODUCT LINE-UP**

Product No.	I <sub>CC</sub> (mA)	f <sub>in</sub> (GHz)	V <sub>CC</sub> (V)	Package	Pin Connection
μPB581A	30	0.5 to 2.8	4.5 to 5.5	8 pins CAN	—
μPB581C	30	0.5 to 2.2	4.5 to 5.5	8 pins DIP (300 mil)	NEC Original
μPB584G	18	0.5 to 2.5	4.5 to 5.5	8 pins SOP (225 mil)	NEC Original
μPB1508GV	12	0.5 to 3.0	4.5 to 5.5	8 pins SSOP (175 mil)	

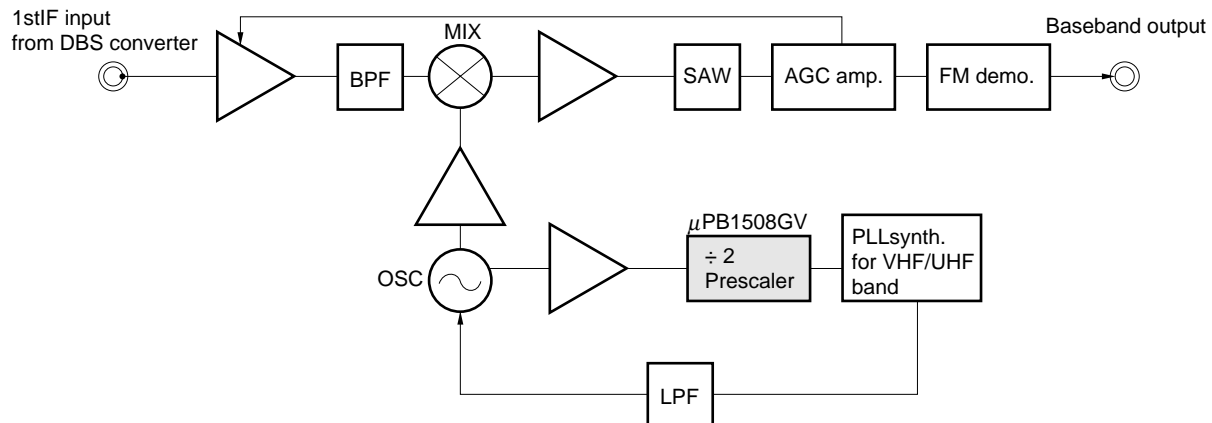
**Remarks** This table shows the TYP values of main parameters. Please refer to ELECTRICAL CHARACTERISTICS.  
 μPB581A, μPB581C and μPB584G are discontinued.

**INTERNAL BLOCK DIAGRAM**



**SYSTEM APPLICATION EXAMPLE**

**RF unit block of DBS tuners**



**PIN EXPLANATION**

Pin No.	Symbol	Applied voltage	PIN voltage	Functions and explanation
1	V <sub>CC</sub>	4.5 to 5.5	—	Power supply pin. This pin must be equipped with bypass capacitor (eg 1 000 pF) to minimize ground impedance.
2	IN	—	1.7 to 4.95	Signal input pin. This pin should be coupled to signal source with capacitor (eg 1 000 pF) for DC cut.
3	$\overline{\text{IN}}$	—	1.7 to 4.95	Signal input bypass pin. This pin must be equipped with bypass capacitor (eg 1 000 pF) to minimize ground impedance.
4, 5	GND	0	—	Ground pin. Ground pattern on the board should be formed as wide as possible to minimize ground impedance.
6, 8	NC	—	—	Non connection pins. These pins should be opened.
7	OUT	—	1.0 to 4.7	Divided frequency output pin. This pin is designed as emitter follower output. This pin can be connected to input of prescaler within PLL synthesizer through DC cut capacitor.

**ABSOLUTE MAXIMUM RATINGS**

PARAMETER	SYMBOL	CONDITION	RATINGS	UNIT
Supply voltage	V <sub>CC</sub>	T <sub>A</sub> = +25 °C	6.0	V
Input voltage	V <sub>in</sub>	T <sub>A</sub> = +25 °C	6.0	V
Total power dissipation	P <sub>D</sub>	Mounted on double sided copper clad 50 × 50 × 1.6 mm epoxy glass PWB (T <sub>A</sub> = +85 °C)	250	mW
Operating ambient temperature	T <sub>A</sub>		-40 to +85	°C
Storage temperature	T <sub>stg</sub>		-55 to +150	°C

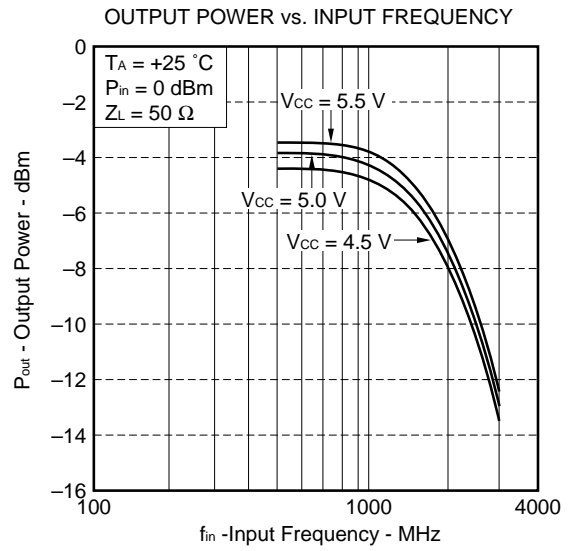
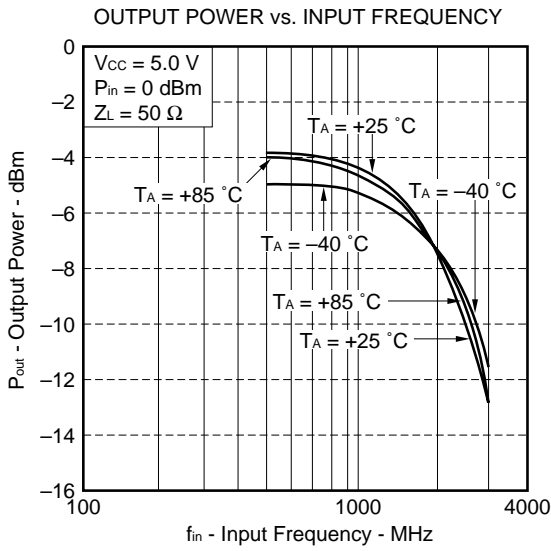
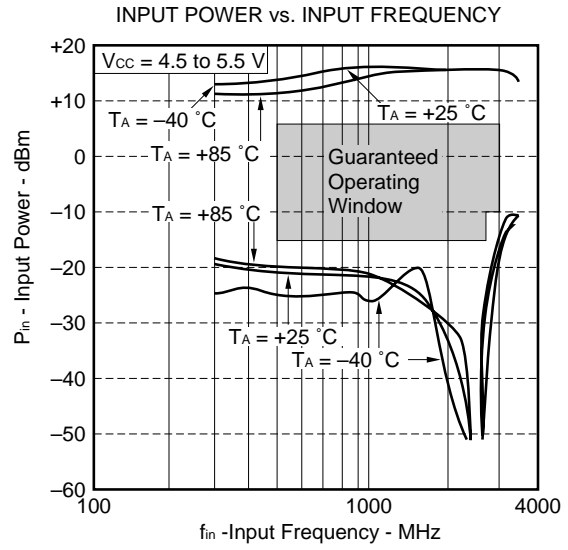
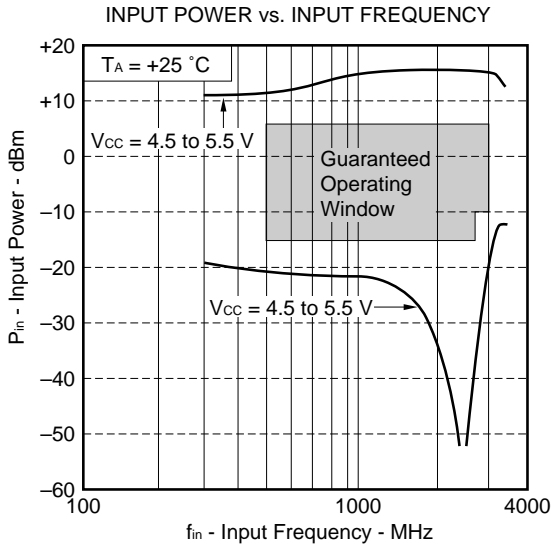
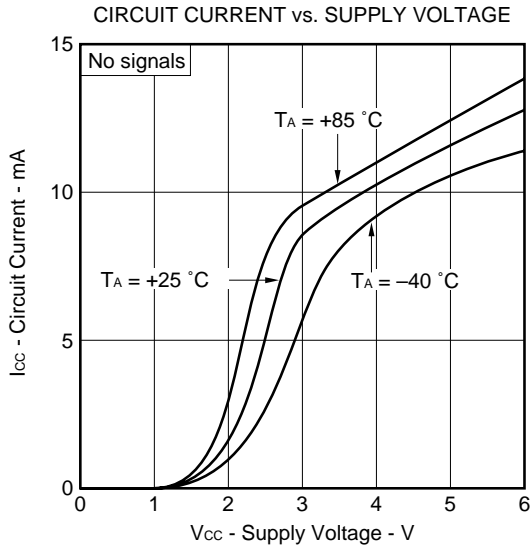
**RECOMMENDED OPERATING CONDITIONS**

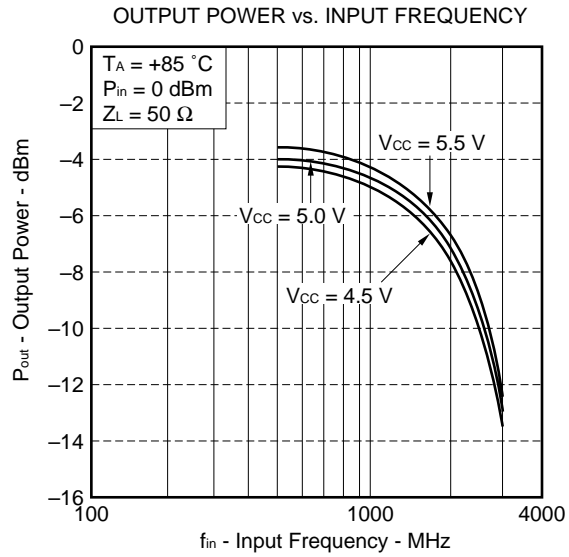
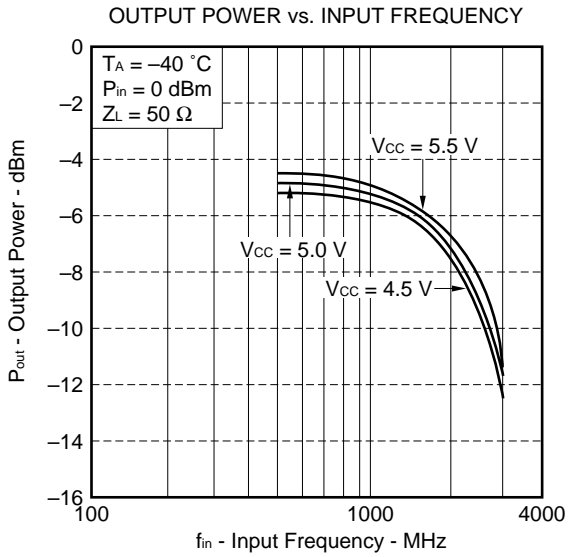
PARAMETER	SYMBOL	MIN.	TYP.	MAX.	UNIT	REMARKS
Supply voltage	V <sub>CC</sub>	4.5	5.0	5.5	V	
Operating ambient temperature	T <sub>A</sub>	-40	+25	+85	°C	

**ELECTRICAL CHARACTERISTICS (T<sub>A</sub> = -40 to +85 °C, V<sub>CC</sub> = 4.5 to 5.5 V, Z<sub>S</sub> = Z<sub>L</sub> = 50 Ω)**

PARAMETER	SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Circuit current	I <sub>CC</sub>	No signals	7.6	12	14.5	mA
Upper limit operating frequency 1	f <sub>in(U)1</sub>	P <sub>in</sub> = -10 to +6 dBm	3.0	—	—	GHz
Upper limit operating frequency 2	f <sub>in(U)2</sub>	P <sub>in</sub> = -15 to +6 dBm	2.7	—	—	GHz
Lower limit operating frequency	f <sub>in(L)</sub>	P <sub>in</sub> = -15 to +6 dBm	—	—	0.5	GHz
Input power 1	P <sub>in1</sub>	f <sub>in</sub> = 2.7 to 3.0 GHz	-10	—	+6	dBm
Input power 2	P <sub>in2</sub>	f <sub>in</sub> = 0.5 to 2.7 GHz	-15	—	+6	dBm
Output power	P <sub>out</sub>	P <sub>in</sub> = 0 dBm, f <sub>in</sub> = 2 GHz	-12	-7	—	dBm

TYPICAL CHARACTERISTICS (unless otherwise specified  $T_A = +25^\circ\text{C}$ )

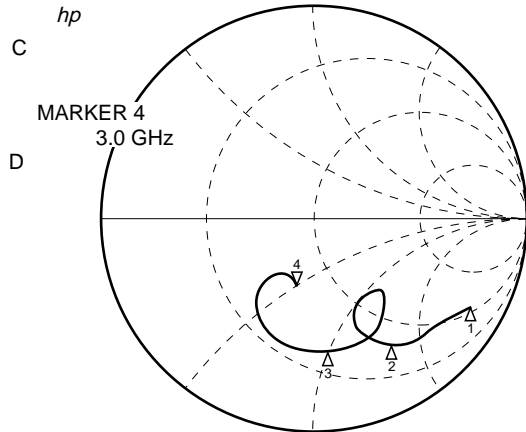




S<sub>11</sub> vs. INPUT FREQUENCY

V<sub>cc</sub> = 5.0 V

$S_{11}$  Z  
 REF 1.0 Units  
 $\frac{4}{V}$  200.0 mUnits/  
 34.604  $\Omega$  -26.496  $\Omega$   
 hp



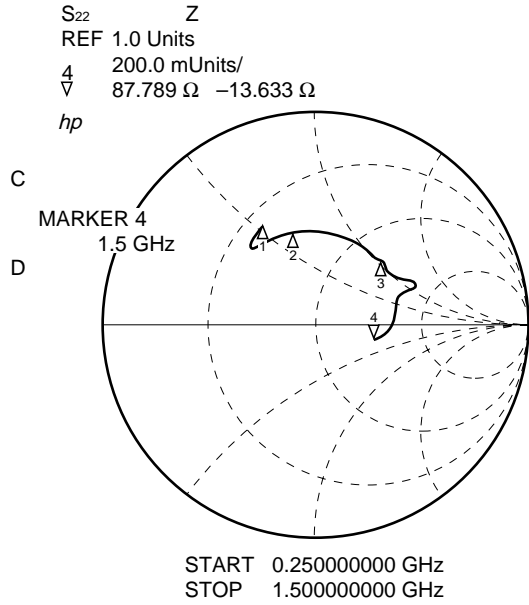
START 0.500000000 GHz  
 STOP 3.000000000 GHz

$\Delta_1$ : 500 MHz  
 $\Delta_2$ : 1000 MHz  
 $\Delta_3$ : 2000 MHz  
 $\Delta_4$ : 3000 MHz

FREQUENCY MHz	S <sub>11</sub>	
	MAG	ANG
500.0000	.850	-30.2
600.0000	.796	-37.8
700.0000	.790	-39.2
800.0000	.754	-45.2
900.0000	.766	-53.7
1000.0000	.701	-57.6
1100.0000	.660	-62.3
1200.0000	.606	-67.2
1300.0000	.571	-70.3
1400.0000	.521	-70.6
1500.0000	.495	-68.3
1600.0000	.441	-60.6
1700.0000	.479	-45.1
1800.0000	.602	-62.3
1900.0000	.595	-74.2
2000.0000	.608	-82.9
2100.0000	.603	-89.8
2200.0000	.599	-97.3
2300.0000	.588	-107.7
2400.0000	.532	-122.0
2500.0000	.396	-132.0
2600.0000	.325	-127.1
2700.0000	.270	-123.6
2800.0000	.232	-122.7
2900.0000	.258	-105.8
3000.0000	.351	-103.7

S<sub>22</sub> vs. OUTPUT FREQUENCY

V<sub>CC</sub> = 5.0 V, f<sub>in</sub> = 498 MHz

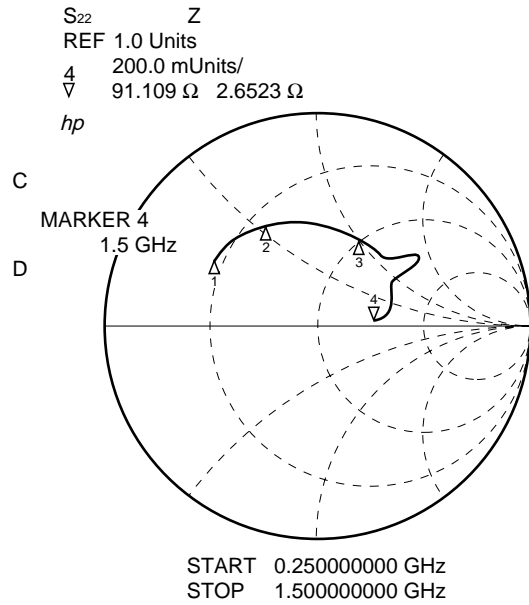


FREQUENCY MHz	S <sub>22</sub>	
	MAG	ANG
250.0000	.526	118.9
300.0000	.463	131.2
350.0000	.466	124.7
400.0000	.460	117.1
450.0000	.441	110.2
500.0000	.456	103.0
550.0000	.353	94.8
600.0000	.438	91.1
650.0000	.444	83.9
700.0000	.436	78.3
750.0000	.435	71.8
800.0000	.431	65.9
850.0000	.431	60.3
900.0000	.431	53.7
950.0000	.408	49.2
1000.0000	.445	44.9
1050.0000	.428	41.0
1100.0000	.429	33.7
1150.0000	.355	42.7
1200.0000	.418	20.0
1250.0000	.403	17.1
1300.0000	.392	9.6
1350.0000	.368	3.3
1400.0000	.343	-3.4
1450.0000	.319	-9.2
1500.0000	.289	-14.1

- △<sub>1</sub>: 250 MHz
- △<sub>2</sub>: 500 MHz
- △<sub>3</sub>: 1000 MHz
- △<sub>4</sub>: 1500 MHz

S<sub>22</sub> vs. OUTPUT FREQUENCY

V<sub>CC</sub> = 5.0 V, f<sub>in</sub> = 3002 MHz



FREQUENCY MHz	S <sub>22</sub>	
	MAG	ANG
250.0000	.555	146.6
300.0000	.545	139.9
350.0000	.571	136.1
400.0000	.529	127.9
450.0000	.521	122.4
500.0000	.515	116.9
550.0000	.510	104.5
600.0000	.492	106.6
650.0000	.487	100.9
700.0000	.482	95.3
750.0000	.473	89.9
800.0000	.461	83.8
850.0000	.454	78.4
900.0000	.449	72.3
950.0000	.430	69.6
1000.0000	.443	64.3
1050.0000	.444	58.8
1100.0000	.440	52.3
1150.0000	.438	46.0
1200.0000	.501	37.5
1250.0000	.408	32.9
1300.0000	.388	25.1
1350.0000	.359	16.3
1400.0000	.335	9.7
1450.0000	.304	3.1
1500.0000	.285	4.6

- △<sub>1</sub>: 250 MHz
- △<sub>2</sub>: 500 MHz
- △<sub>3</sub>: 1000 MHz
- △<sub>4</sub>: 1500 MHz

TEST CIRCUIT

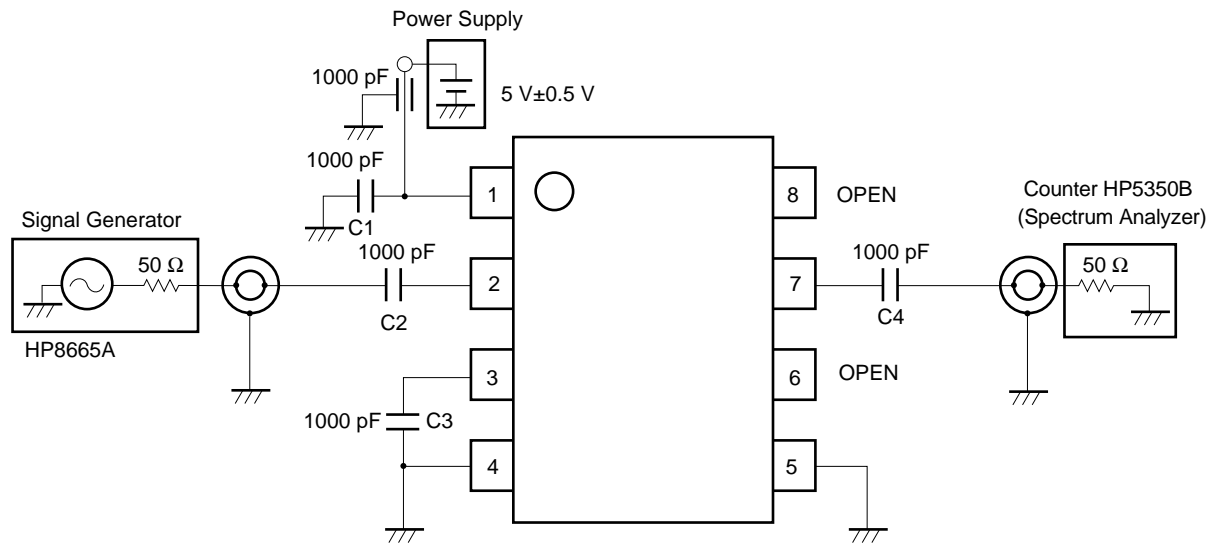
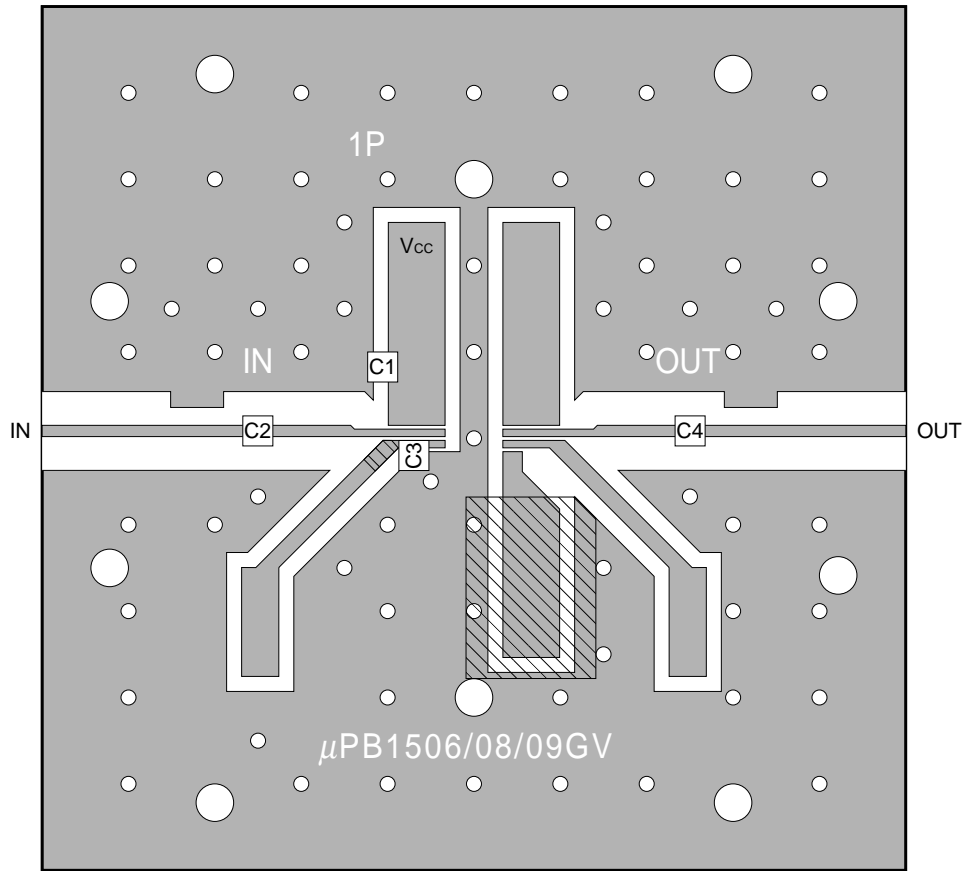




ILLUSTRATION OF THE TEST CIRCUIT ASSEMBLED ON EVALUATION BOARD



COMPONENT LIST

SYMBOL	VALUE
C1 to C4	1000 pF

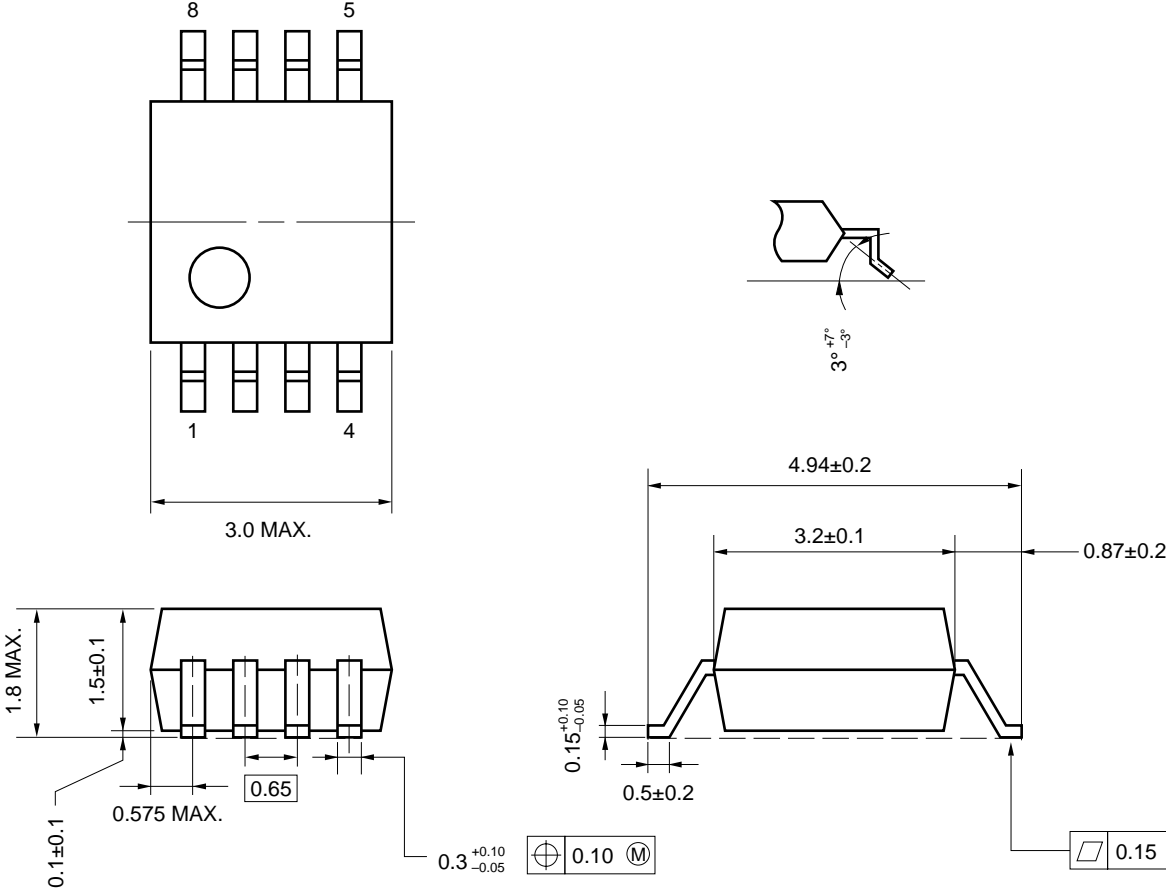
EVALUATION BOARD CHARACTERS

- (1) 35 μm thick double-sided copper clad 50 × 50 × 0.4 mm polyimide board
- (2) Back side: GND pattern
- (3) Solder plated patterns
- (4) ○ : Through holes
- (5) of pin 3 : pattern should be removed.
- (6) of pin 5 : short chip must be attached to be grounded.

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

PACKAGE DIMENSIONS

8 pin PLASTIC SSOP (175 mil) (unit : mm)



**NOTE CORRECT USE**

- (1) Observe precautions for handling because of electro-static sensitive devices.
- (2) Form a ground pattern as wide as possible to minimize ground impedance (to prevent undesired operation).
- (3) Keep the wiring length of the ground pins as short as possible.
- (4) Connect a bypass capacitor (e.g. 1 000 pF) to the Vcc pin.

**RECOMMENDED SOLDERING CONDITIONS**

This product should be soldered in the following recommended conditions. Other soldering methods and conditions than the recommended conditions are to be consulted with our sales representatives.

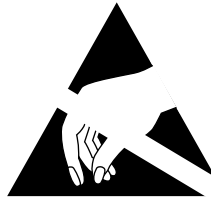
**μPB1508GV**

Soldering method	Soldering conditions	Recommended condition symbol
Infrared ray reflow	Package peak temperature: 235 °C, Hour: within 30 s. (more than 210 °C), Time: 3 times, Limited days: no.*	IR35-00-3
VPS	Package peak temperature: 215 °C, Hour: within 40 s. (more than 200 °C), Time: 3 times, Limited days: no.*	VP15-00-3
Wave soldering	Soldering tub temperature: less than 260 °C, Hour: within 10 s., Time: 1 time, Limited days: no.	WS60-00-1
Pin part heating	Pin area temperature: less than 300 °C, Hour: within 3 s./pin, Limited days: no.*	

\* It is the storage days after opening a dry pack, the storage conditions are 25 °C, less than 65 % RH.

**Caution The combined use of soldering method is to be avoided (However, except the pin area heating method).**

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



## ATTENTION

OBSERVE PRECAUTIONS  
FOR HANDLING  
ELECTROSTATIC  
SENSITIVE  
DEVICES

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Anti-radioactive design is not implemented in this product.