

**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

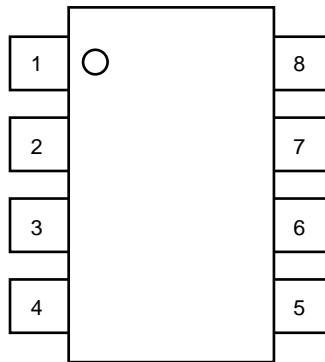
**ORDERING INFORMATION**

| PART NUMBER       | PACKAGE                         | MARKING | SUPPLYING FORM  |
|-------------------|---------------------------------|---------|---|
| $\mu$ PB1508GV-E1 | 8 pin plastic SSOP<br>(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)**



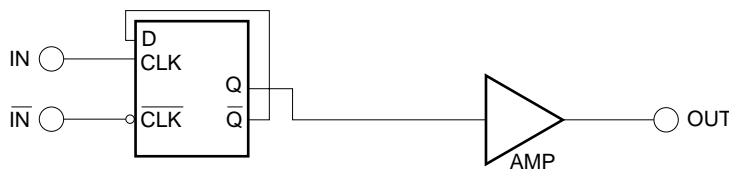
| Pin No. | Pin name               |
|---------|------------------------|
| 1       | V <sub>CC</sub>        |
| 2       | IN                     |
| 3       | $\overline{\text{IN}}$ |
| 4       | GND                    |
| 5       | GND                    |
| 6       | NC                     |
| 7 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

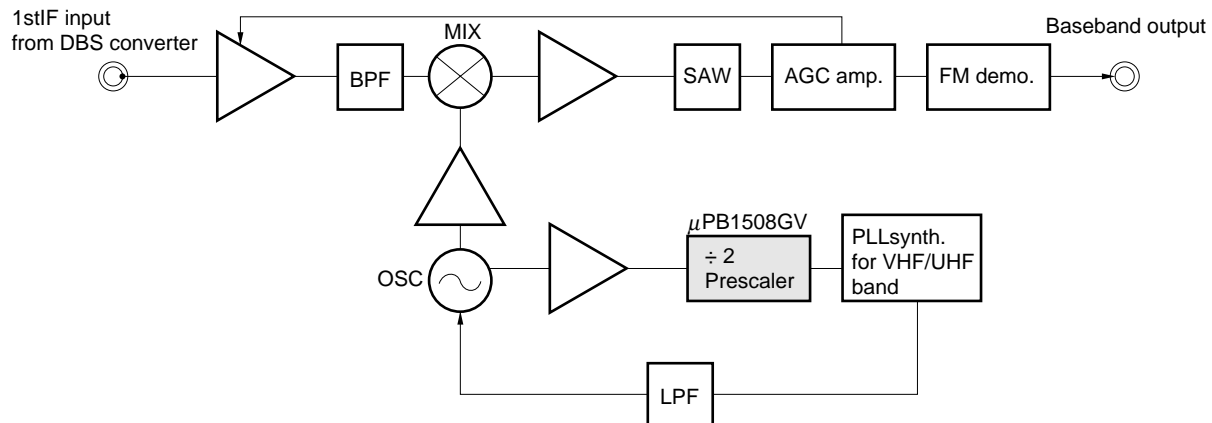
**Remarks** This table shows the TYP values of main parameters. Please refer to ELECTRICAL CHARACTERISTICS.  
 μPB581A, μPB581C and μPB584G are discontinued.

**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<br>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   |

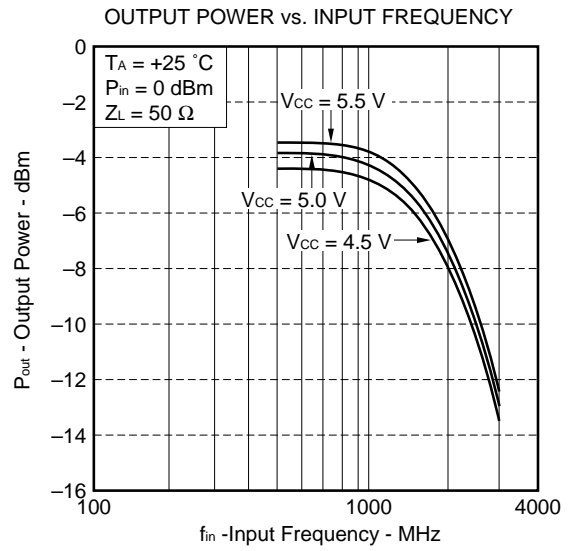
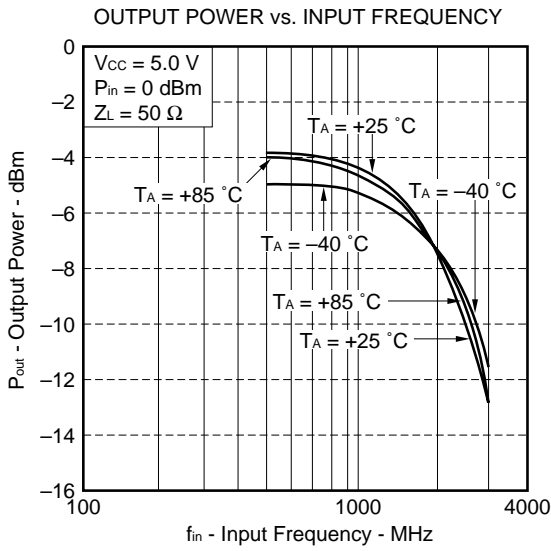
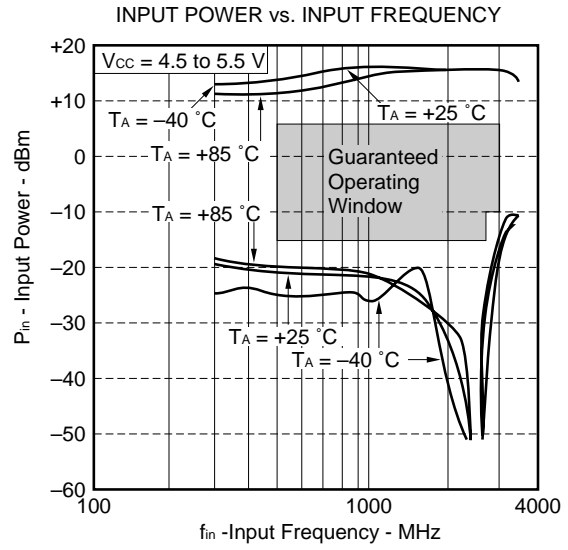
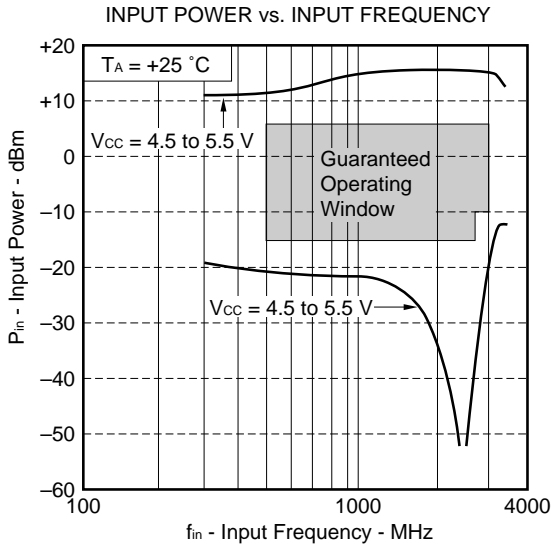
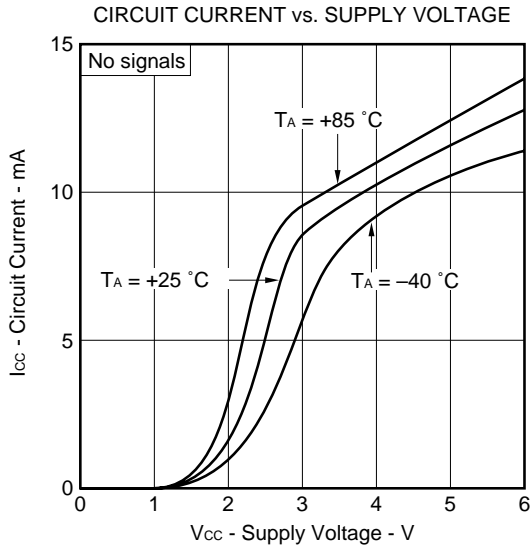
**RECOMMENDED OPERATING CONDITIONS**

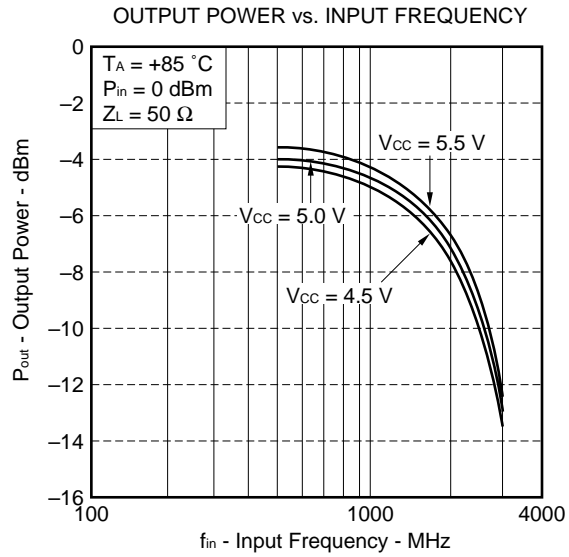
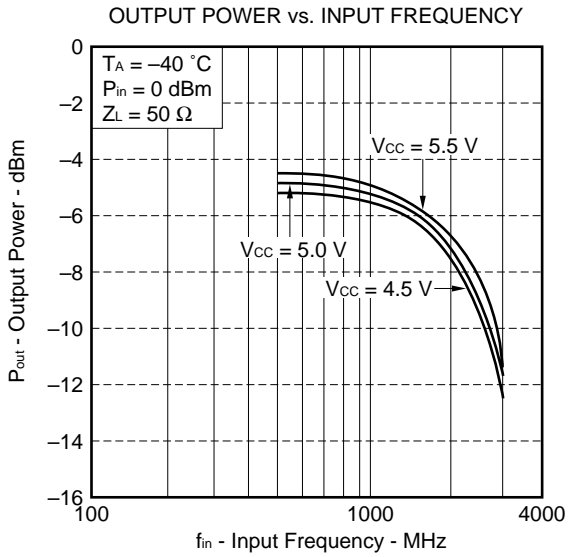
| PARAMETER                     | SYMBOL          | MIN. | TYP. | MAX. | UNIT | REMARKS |
|-------------------------------|-----------------|------|------|------|------|---------|
| Supply voltage                | V <sub>CC</sub> | 4.5  | 5.0  | 5.5  | V    |         |
| Operating ambient temperature | 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  $T_A = +25^\circ\text{C}$ )

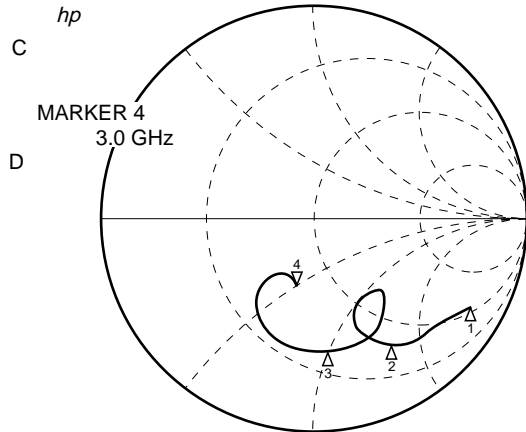




S<sub>11</sub> vs. INPUT FREQUENCY

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



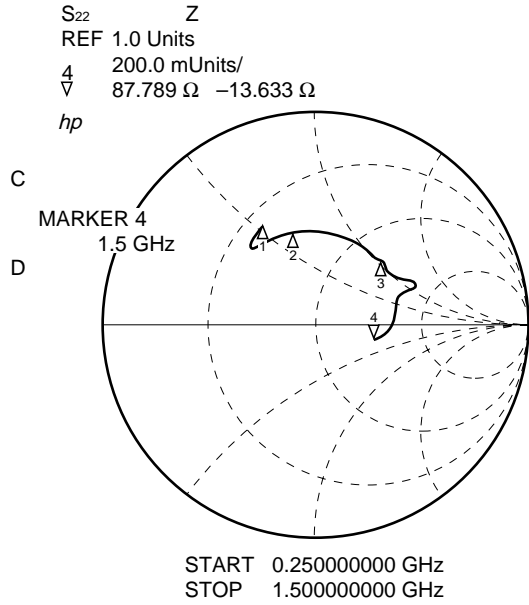
START 0.500000000 GHz  
 STOP 3.000000000 GHz

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

| FREQUENCY<br>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

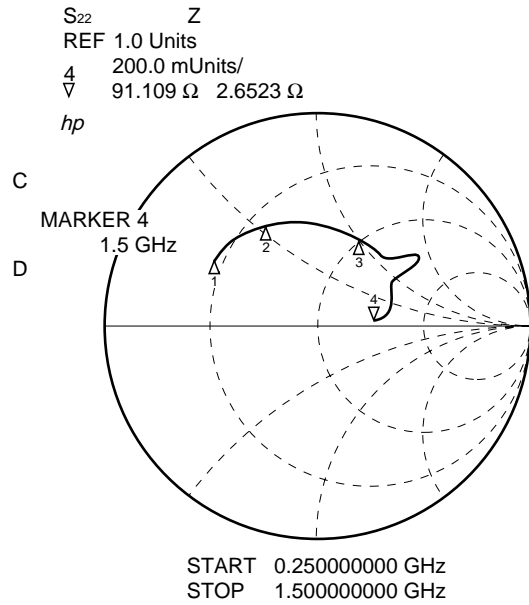


| FREQUENCY<br>MHz | S <sub>22</sub><br>MAG | ANG   |
|------------------|------------------------|-------|
| 250.0000         | .526                   | 118.9 |
| 300.0000         | .463                   | 131.2 |
| 350.0000         | .466                   | 124.7 |
| 400.0000         | .460                   | 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<br>MHz | S <sub>22</sub><br>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

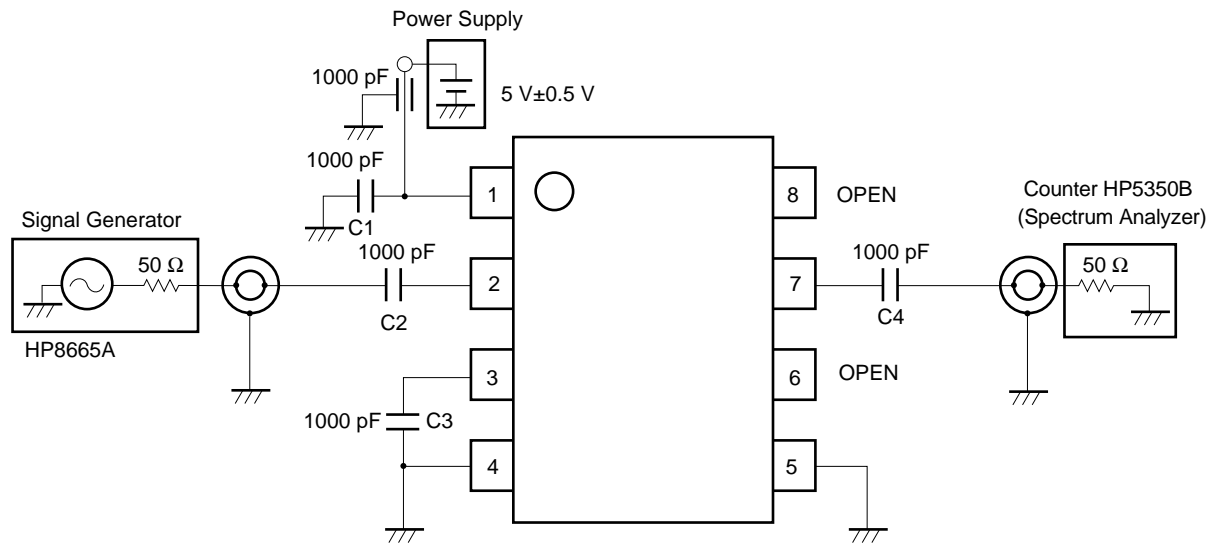
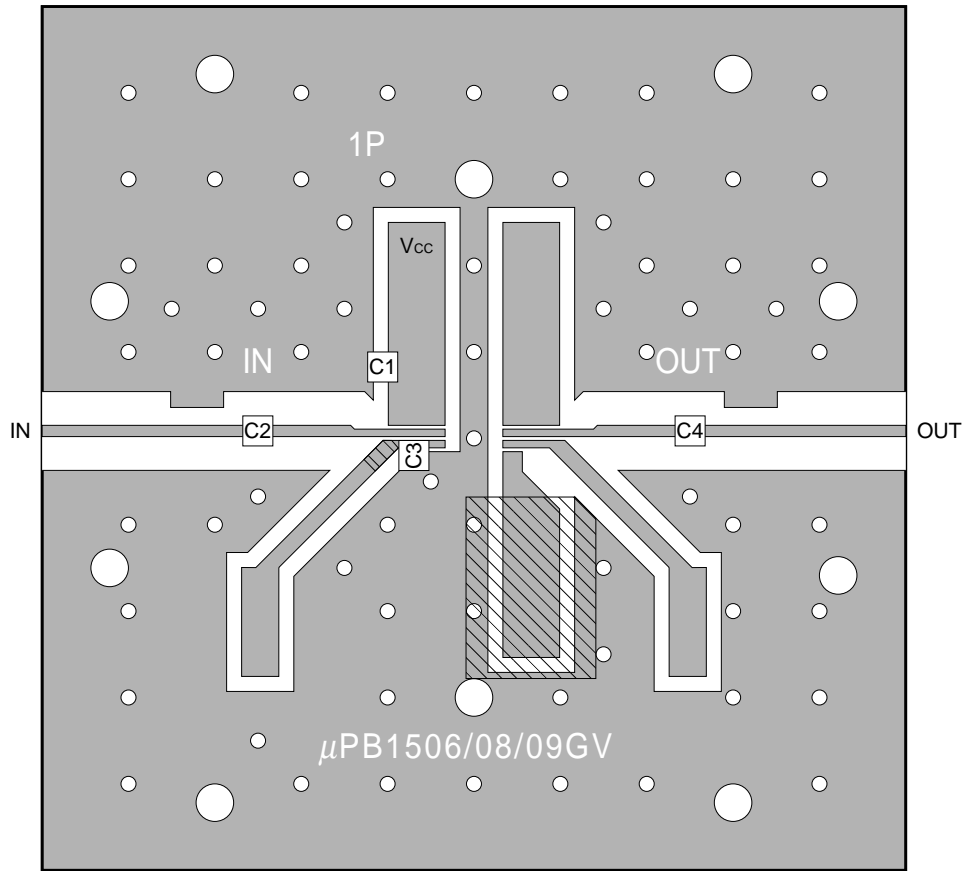




ILLUSTRATION OF THE TEST CIRCUIT ASSEMBLED ON EVALUATION BOARD



COMPONENT LIST

| SYMBOL   | VALUE   |
|----------|---------|
| C1 to C4 | 1000 pF |

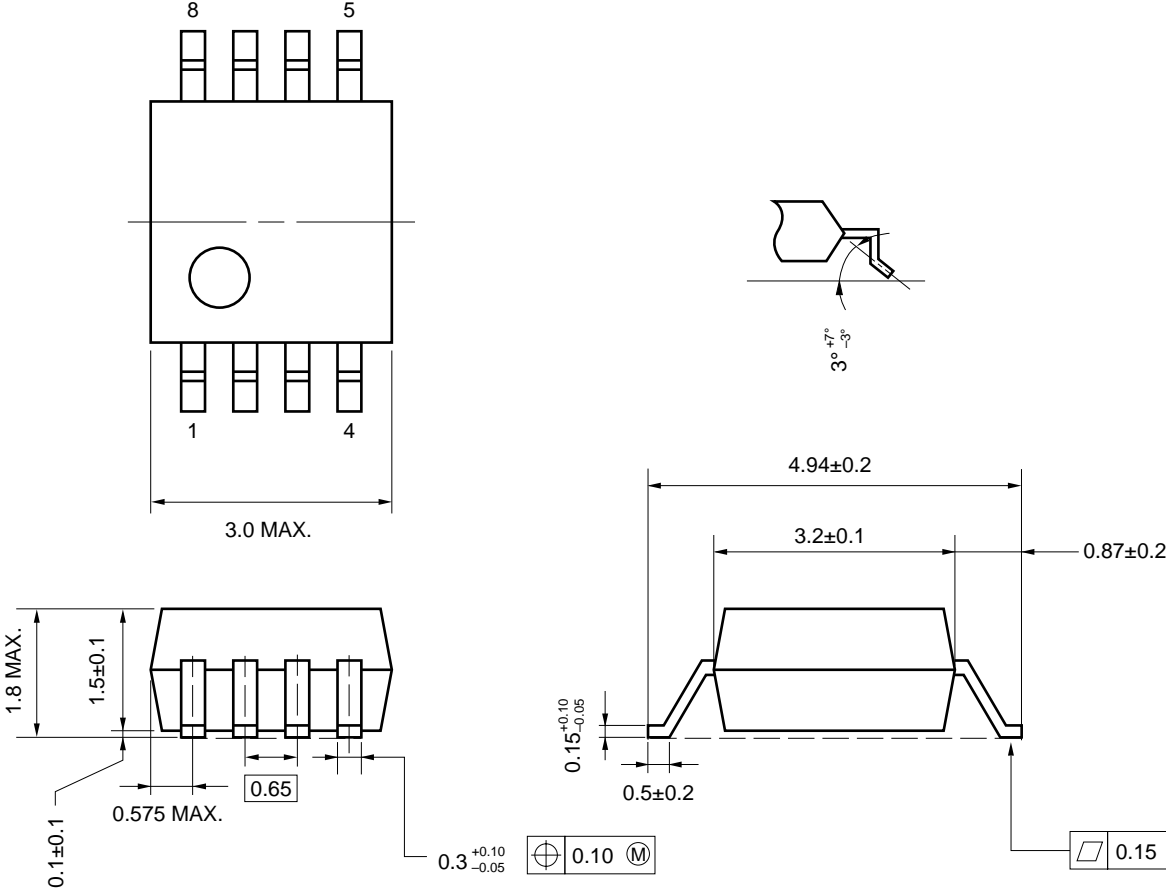
EVALUATION BOARD CHARACTERS

- (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.

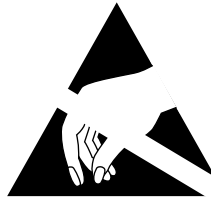
**μPB1508GV**

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

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**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:** Aircrafts, aerospace equipment, submersible repeaters, nuclear reactor control systems, life support systems or medical equipment for life support, etc.

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Anti-radioactive design is not implemented in this product.