

BIPOLAR DIGITAL INTEGRATED CIRCUIT

μ PB1508GV

3 GHz INPUT DIVIDE BY 2 PRESCALER IC FOR DBS TUNERS

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

μ 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

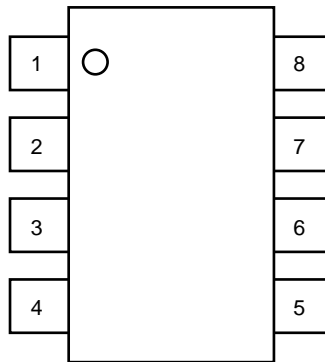
ORDERING INFORMATION

| PART NUMBER | PACKAGE | MARKING | SUPPLYING FORM |
|-------------------|---------------------------------|---------|---|
| μ 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: μ PB1508GV)

Caution: Electro-static sensitive devices

PIN CONNECTION (Top View)



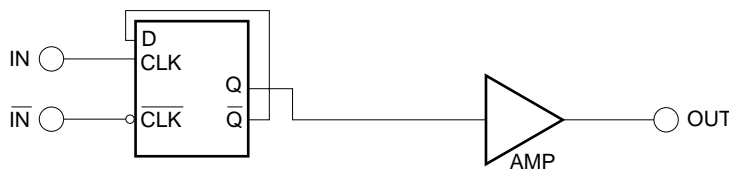
| Pin No. | Pin name |
|---------|------------------------|
| 1 | V _{CC} |
| 2 | IN |
| 3 | $\overline{\text{IN}}$ |
| 4 | GND |
| 5 | GND |
| 6 | NC |
| 7 | OUT |
| 8 | NC |

PRODUCT LINE-UP

| Product No. | I _{CC} (mA) | f _{in} (GHz) | V _{CC} (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) | |

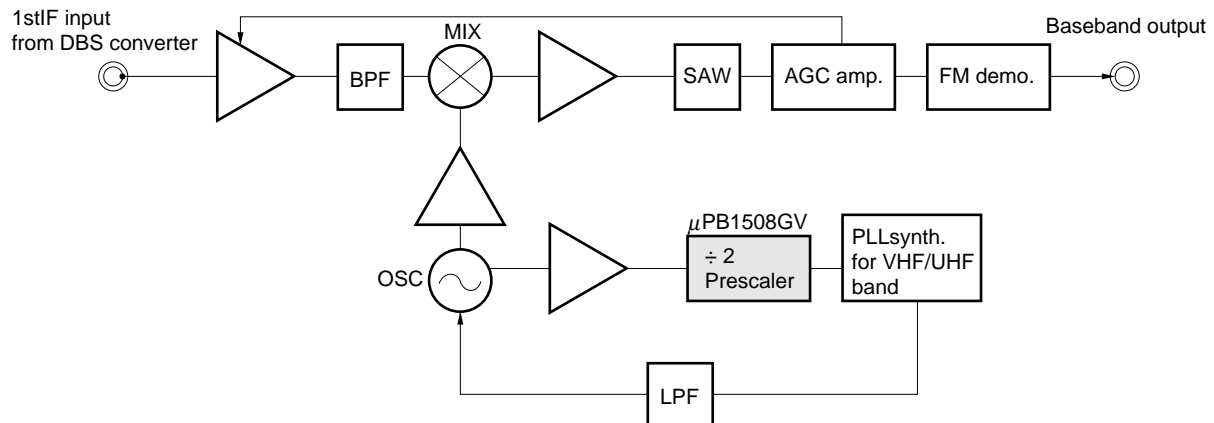
Remarks This table shows the TYP values of main parameters. Please refer to ELECTRICAL CHARACTERISTICS.
 μPB581A, μPB581C and μPB584G are discontinued.

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 _{CC} | 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 _{CC} | T _A = +25 °C | 6.0 | V |
| Input voltage | V _{in} | T _A = +25 °C | 6.0 | V |
| Total power dissipation | P _D | Mounted on double sided copper clad 50 × 50 × 1.6 mm epoxy glass PWB (T _A = +85 °C) | 250 | mW |
| Operating ambient temperature | T _A | | -40 to +85 | °C |
| Storage temperature | T _{stg} | | -55 to +150 | °C |

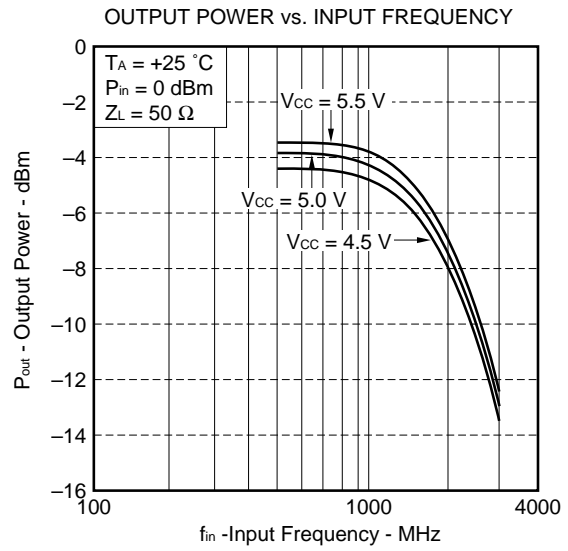
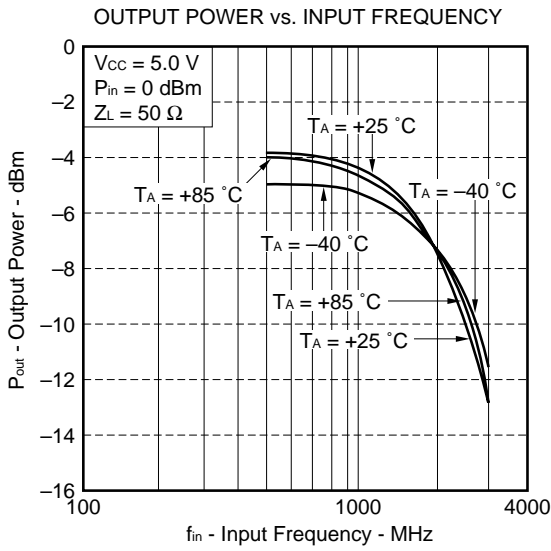
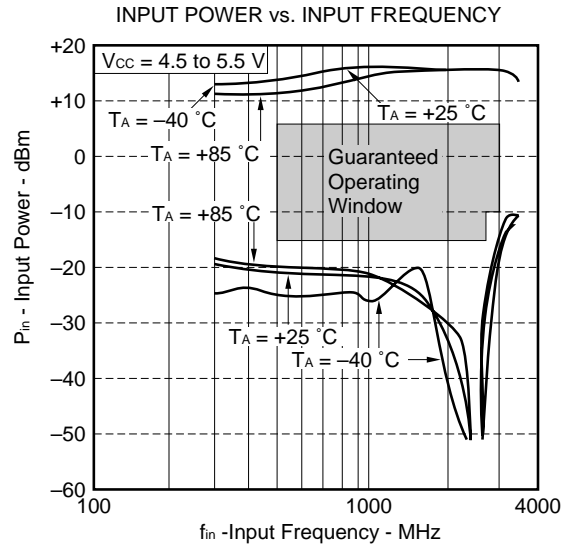
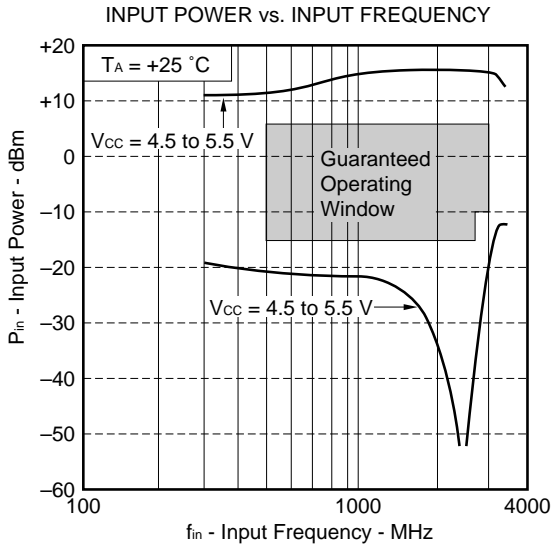
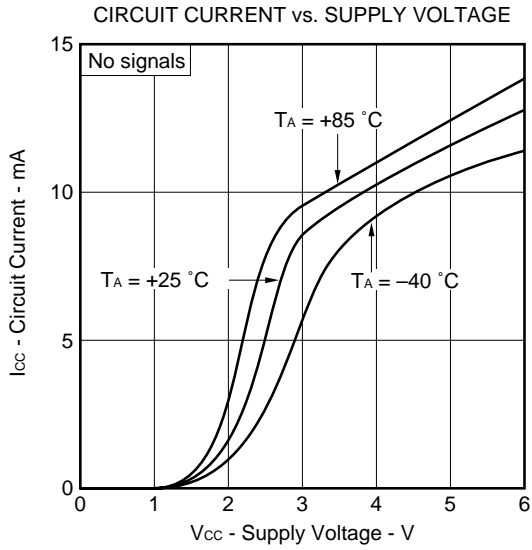
RECOMMENDED OPERATING CONDITIONS

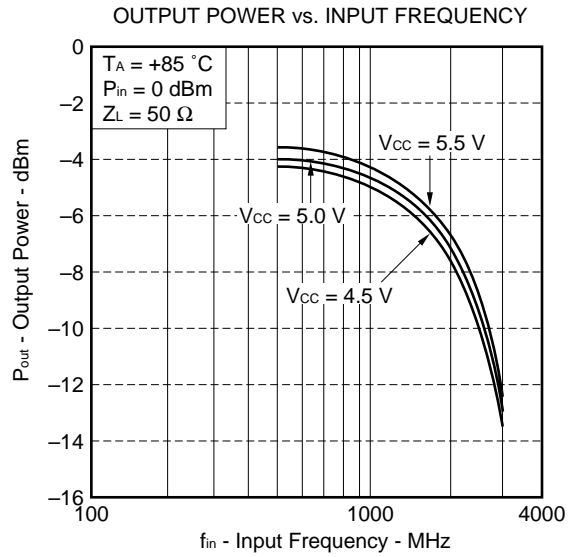
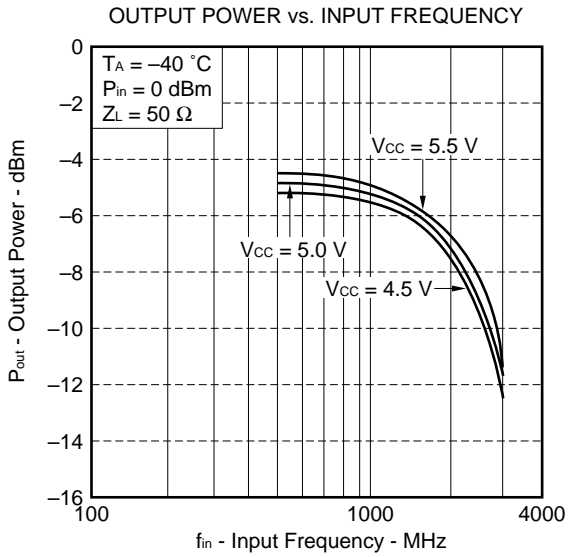
| PARAMETER | SYMBOL | MIN. | TYP. | MAX. | UNIT | REMARKS |
|-------------------------------|-----------------|------|------|------|------|---------|
| Supply voltage | V _{CC} | 4.5 | 5.0 | 5.5 | V | |
| Operating ambient temperature | T _A | -40 | +25 | +85 | °C | |

ELECTRICAL CHARACTERISTICS (T_A = -40 to +85 °C, V_{CC} = 4.5 to 5.5 V, Z_S = Z_L = 50 Ω)

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

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

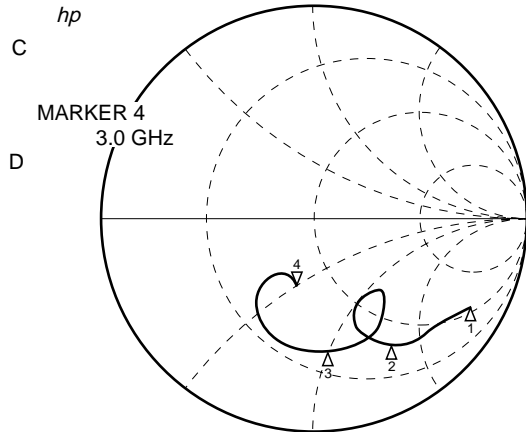




S₁₁ vs. INPUT FREQUENCY

V_{cc} = 5.0 V

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



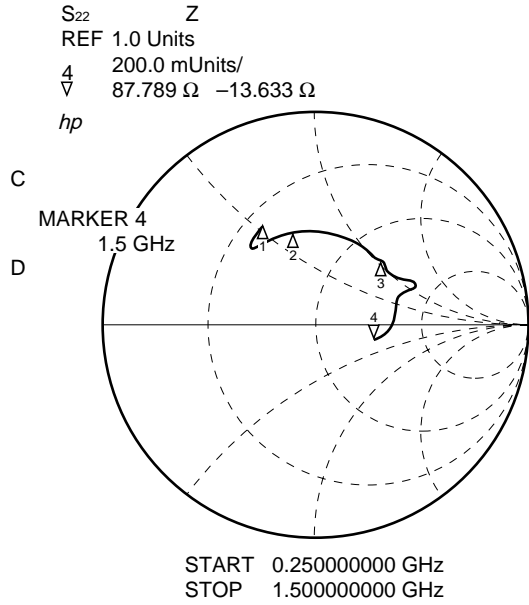
START 0.500000000 GHz
 STOP 3.000000000 GHz

Δ_1 : 500 MHz
 Δ_2 : 1000 MHz
 Δ_3 : 2000 MHz
 Δ_4 : 3000 MHz

| FREQUENCY MHz | S ₁₁ | |
|------------------|-----------------|--------|
| | 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 |

S₂₂ vs. OUTPUT FREQUENCY

V_{CC} = 5.0 V, f_{in} = 498 MHz

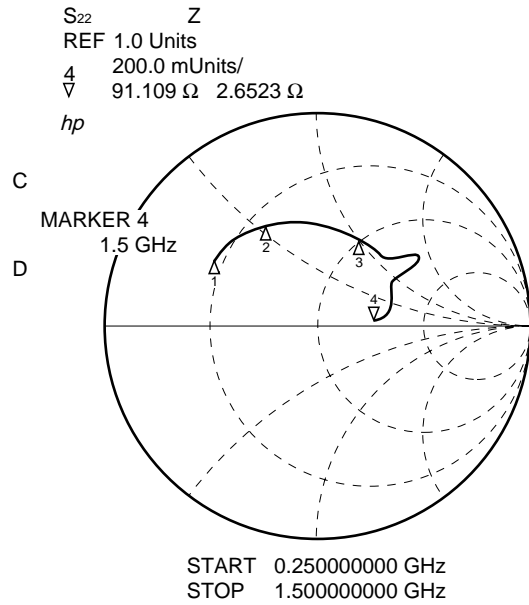


| FREQUENCY MHz | S ₂₂ MAG | ANG |
|------------------|------------------------|-------|
| 250.0000 | .526 | 118.9 |
| 300.0000 | .463 | 131.2 |
| 350.0000 | .466 | 124.7 |
| 400.0000 | .460 | 117.1 |
| 450.0000 | .441 | 110.2 |
| 500.0000 | .456 | 103.0 |
| 550.0000 | .353 | 94.8 |
| 600.0000 | .438 | 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 |

- △₁: 250 MHz
- △₂: 500 MHz
- △₃: 1000 MHz
- △₄: 1500 MHz

S₂₂ vs. OUTPUT FREQUENCY

V_{CC} = 5.0 V, f_{in} = 3002 MHz



| FREQUENCY MHz | S ₂₂ 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 |

- △₁: 250 MHz
- △₂: 500 MHz
- △₃: 1000 MHz
- △₄: 1500 MHz

TEST CIRCUIT

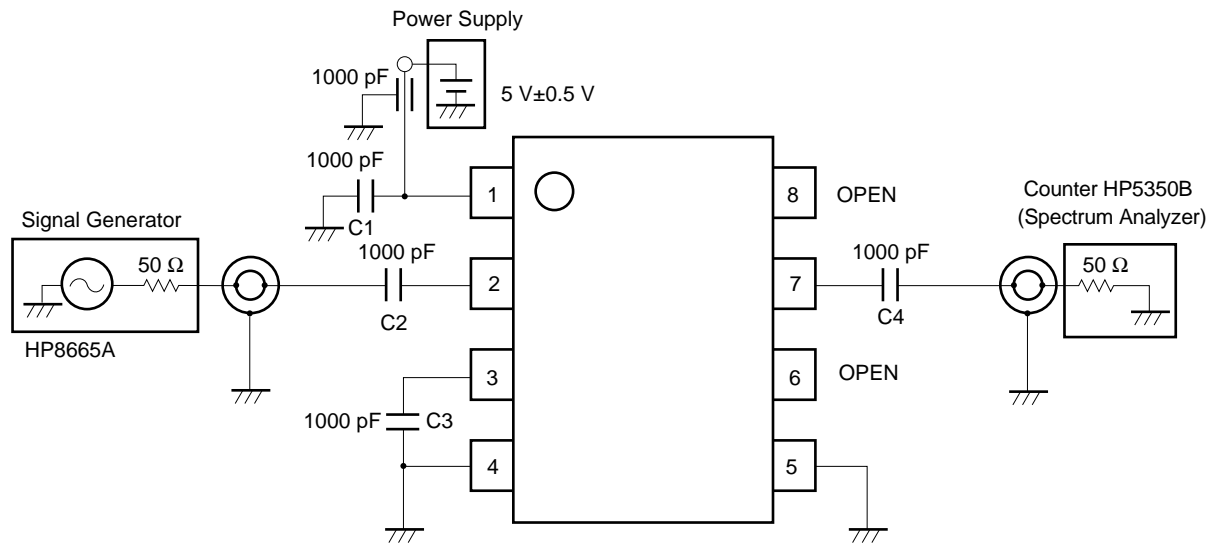
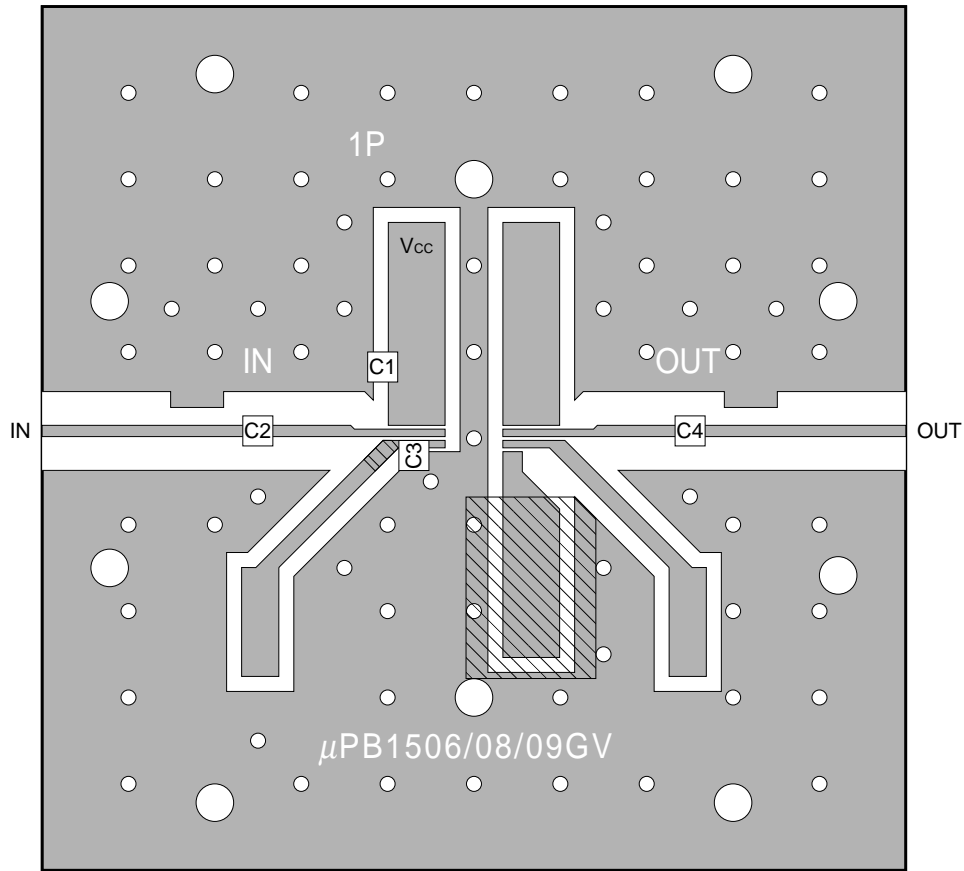


ILLUSTRATION OF THE TEST CIRCUIT ASSEMBLED ON EVALUATION BOARD



COMPONENT LIST

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

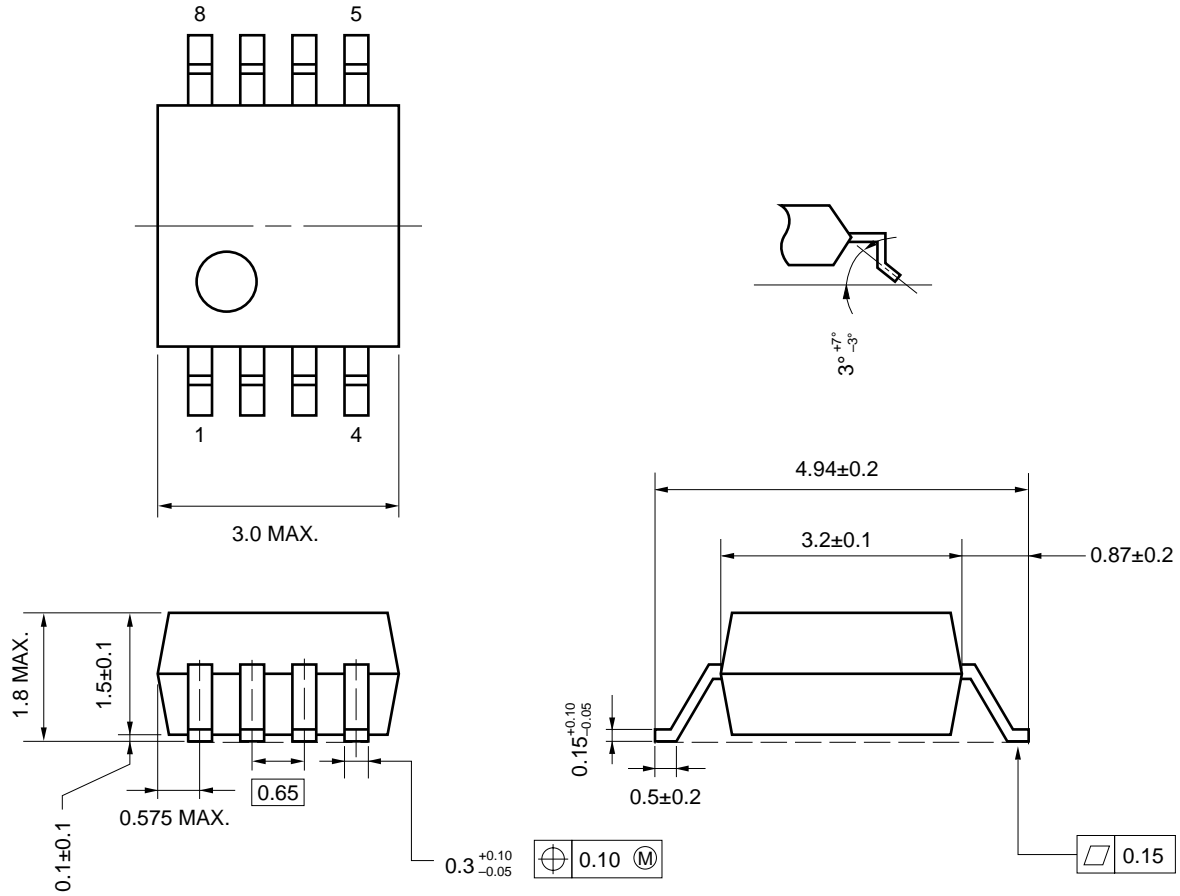
EVALUATION BOARD CHARACTERS

- (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

No part of this document may be copied or reproduced in any form or by any means without the prior written consent of NEC Corporation. NEC Corporation assumes no responsibility for any errors which may appear in this document.

NEC Corporation does not assume any liability for infringement of patents, copyrights or other intellectual property rights of third parties by or arising from use of a device described herein or any other liability arising from use of such device. No license, either express, implied or otherwise, is granted under any patents, copyrights or other intellectual property rights of NEC Corporation or others.

While NEC Corporation has been making continuous effort to enhance the reliability of its semiconductor devices, the possibility of defects cannot be eliminated entirely. To minimize risks of damage or injury to persons or property arising from a defect in an NEC semiconductor device, customers must incorporate sufficient safety measures in its design, such as redundancy, fire-containment, and anti-failure features.

NEC devices are classified into the following three quality grades:

"Standard", "Special", and "Specific". The Specific quality grade applies only to devices developed based on a customer designated "quality assurance program" for a specific application. The recommended applications of a device depend on its quality grade, as indicated below. Customers must check the quality grade of each device before using it in a particular application.

Standard: Computers, office equipment, communications equipment, test and measurement equipment, audio and visual equipment, home electronic appliances, machine tools, personal electronic equipment and industrial robots

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.

The quality grade of NEC devices is "Standard" unless otherwise specified in NEC's Data Sheets or Data Books. If customers intend to use NEC devices for applications other than those specified for Standard quality grade, they should contact an NEC sales representative in advance.

Anti-radioactive design is not implemented in this product.