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BIPOLAR DIGITAL INTEGRATED CIRCUIT

UPB1510GV

3.0 GHz INPUT DIVIDE BY 4 PRESCALER IC FOR DBS TUNERS

DESCRIPTION

The UPB1510GV is a 3.0 GHz input divide by 4 prescaler IC for DBS tuner applications. This IC is suitable for use of frequency divider for PLL synthesizer block. This IC is a shrink package version of the μ PB585G so that this small package contributes to reduce the mounting space.

This IC is manufactured using our 20 GHz 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 operating frequency : $f_{in} = 0.5$ to 3.0 GHz
- High-density surface mounting : 8-pin plastic SSOP (4.45 mm (175))
- Low current consumption : $I_{CC} = 14$ mA TYP. @ $V_{CC} = 5$ V
- Fixed division : $\div 4$

APPLICATIONS

- 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 (Solder Contains Lead)

| Part Number | Package | Marking | Supplying Form |
|-------------------|--|---------|--|
| μ PB1510GV-E1 | 8-pin plastic SSOP (4.45 mm (175)) | 1510 | <ul style="list-style-type: none">• Embossed tape 8 mm wide• Pin 1 indicates pull-out direction of tape• Qty 1 kpcs/reel |

Remark To order evaluation samples, contact your nearby sales office.

Part number for sample order: μ PB1510GV

ORDERING INFORMATION (Pb-Free)

| Part Number | Package | Marking | Supplying Form |
|---------------------|--|---------|--|
| μ PB1510GV-E1-A | 8-pin plastic SSOP (4.45 mm (175)) | 1510 | <ul style="list-style-type: none">• Embossed tape 8 mm wide• Pin 1 indicates pull-out direction of tape• Qty 1 kpcs/reel |

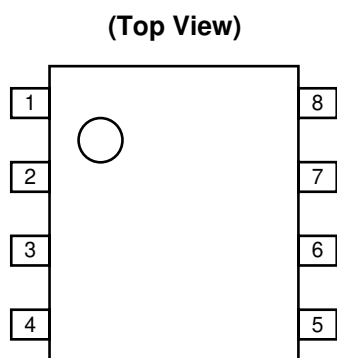
Remark To order evaluation samples, contact your nearby sales office.

Part number for sample order: μ PB1510GV

Caution Observe precautions when handling because these devices are sensitive to electrostatic discharge.

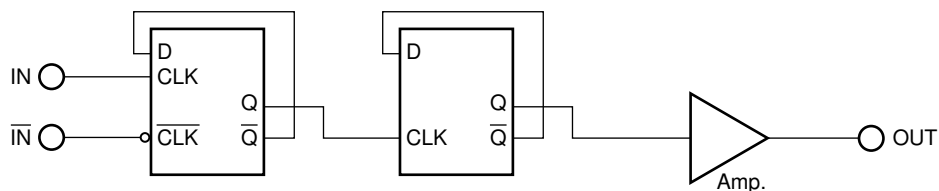
The information in this document is subject to change without notice. Before using this document, please confirm that this is the latest version.

PIN CONNECTIONS



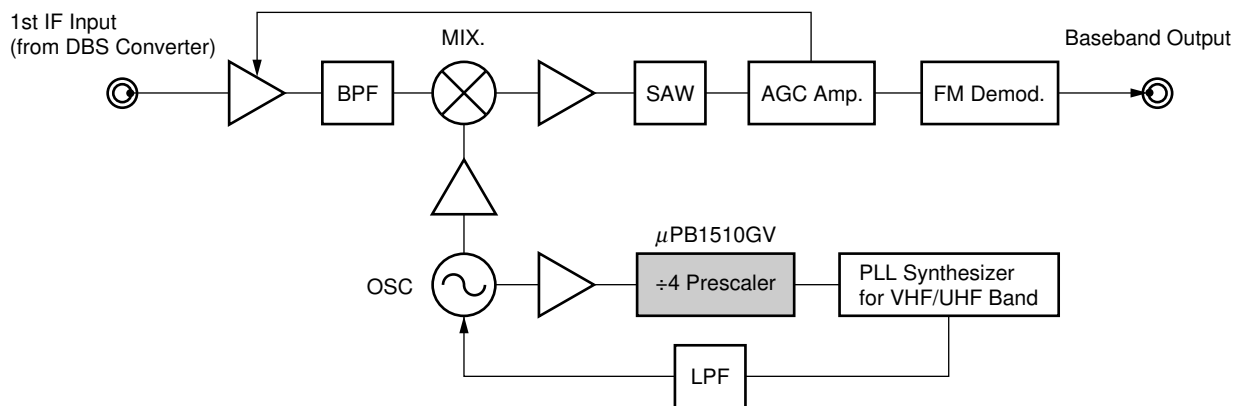
| Pin No. | Pin Name |
|---------|------------------------|
| 1 | V _{cc} |
| 2 | IN |
| 3 | $\overline{\text{IN}}$ |
| 4 | GND |
| 5 | GND |
| 6 | NC |
| 7 | OUT |
| 8 | NC |

INTERNAL BLOCK DIAGRAM



SYSTEM APPLICATION EXAMPLE

RF unit block of DBS tuners



PIN EXPLANATION

| Pin No. | Pin Name | Applied Voltage (V) | Pin Voltage (V) | Function and Application |
|---------|------------------------|---------------------|-----------------|--|
| 1 | V _{CC} | 4.5 to 5.5 | – | Supply voltage pin. This pin must be equipped with bypass capacitor (example: 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 (example: 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 (example: 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 | Test Conditions | Ratings | Unit |
|-------------------------------|------------------|------------------------------------|-------------|------|
| Supply Voltage | V _{CC} | T _A = +25°C | 6.0 | V |
| Power Dissipation | P _D | T _A = +85°C Note | 250 | mW |
| Operating Ambient Temperature | T _A | | -40 to +85 | °C |
| Storage Temperature | T _{stg} | | -55 to +150 | °C |

Note Mounted on double-sided copper-clad 50 × 50 × 1.6 mm epoxy glass PWB

RECOMMENDED OPERATING RANGE

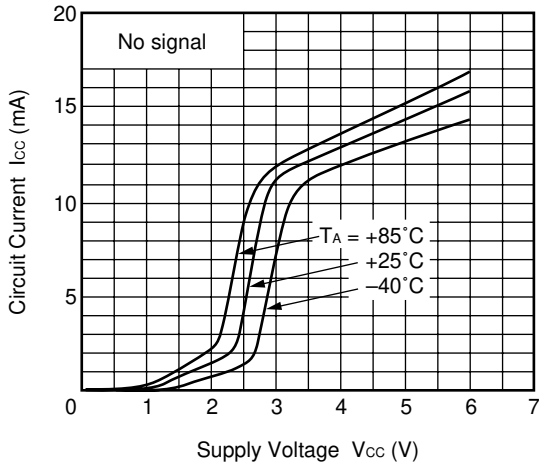
| Parameter | Symbol | MIN. | TYP. | MAX. | Unit |
|-------------------------------|-----------------|------|------|------|------|
| Supply Voltage | V _{CC} | 4.5 | 5.0 | 5.5 | V |
| Operating Ambient Temperature | T _A | -40 | +25 | +85 | °C |

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

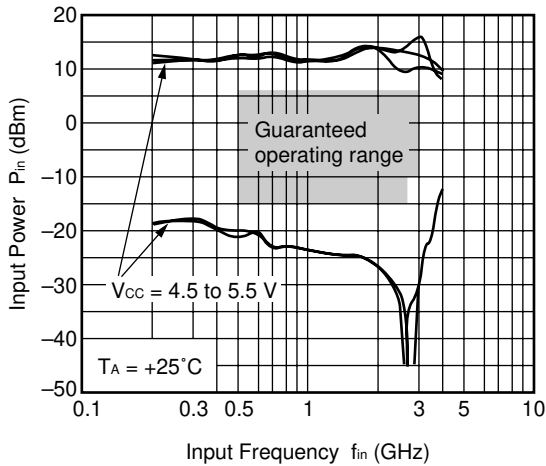
| Parameter | Symbol | Test Conditions | MIN. | TYP. | MAX. | Unit |
|-----------------------------------|----------------------|--|------|------|------|------|
| Circuit Current | I _{CC} | No Signals | 10.5 | 14 | 17 | mA |
| Upper Limit Operating Frequency 1 | f _{in (U)1} | P _{in} = -10 to +6 dBm | 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} = 2.0 GHz | -12 | -7 | - | dBm |

TYPICAL CHARACTERISTICS ($T_A = +25^\circ\text{C}$, $V_{CC} = 5\text{ V}$, unless otherwise specified)

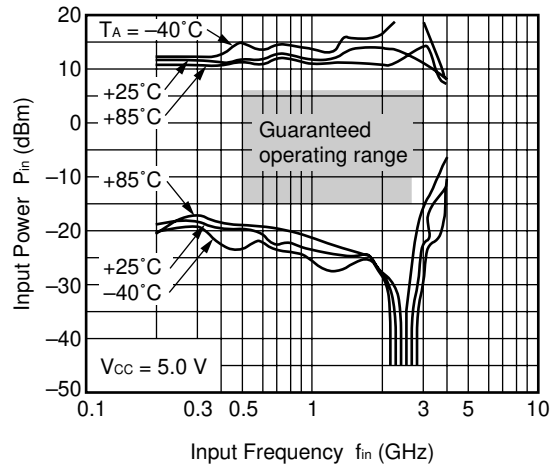
CIRCUIT CURRENT vs. SUPPLY VOLTAGE



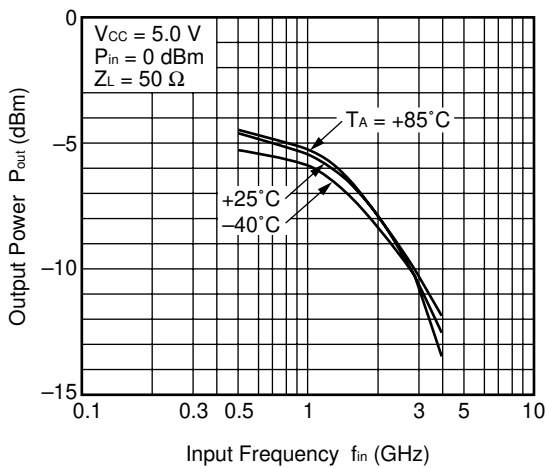
INPUT POWER vs. INPUT FREQUENCY



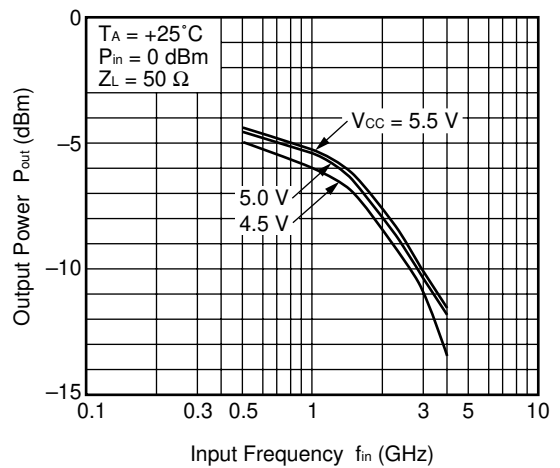
INPUT POWER vs. INPUT FREQUENCY



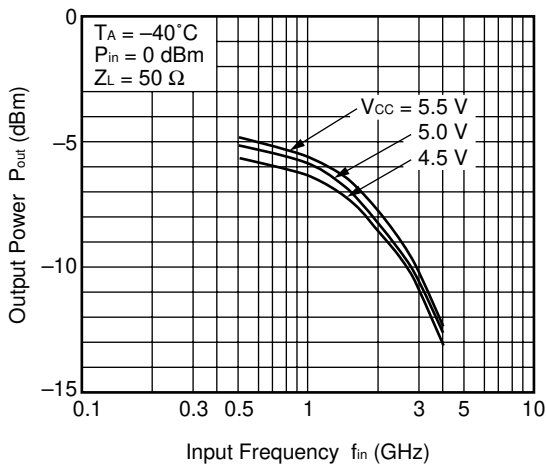
OUTPUT POWER vs. INPUT FREQUENCY



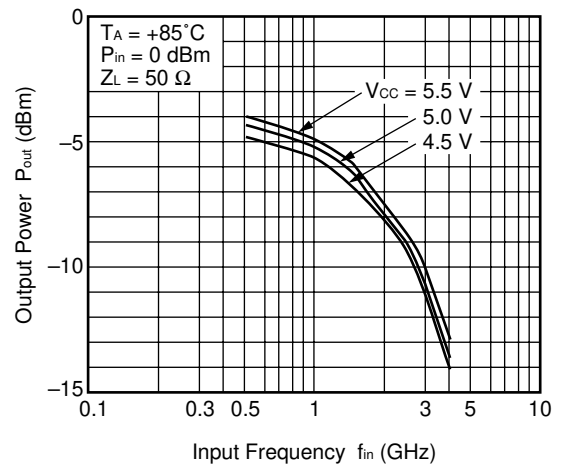
OUTPUT POWER vs. INPUT FREQUENCY



OUTPUT POWER vs. INPUT FREQUENCY



OUTPUT POWER vs. INPUT FREQUENCY

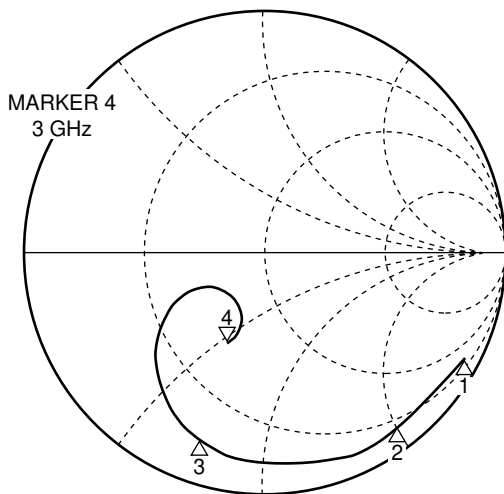


Remark The graphs indicate nominal characteristics.

S₁₁ vs. INPUT FREQUENCY

$V_{CC} = 5.0\text{ V}$, $T_A = +25^\circ\text{C}$, $Z_O = 50\ \Omega$

S_{11} Z
 REF 1.0 Units
 4 200.0 mUnits/
 ∇ 27.159 Ω -27.582 Ω
 hp



∇ 1 : 500 MHz
 ∇ 2 : 1 000 MHz
 ∇ 3 : 2 000 MHz
 ∇ 4 : 3 000 MHz

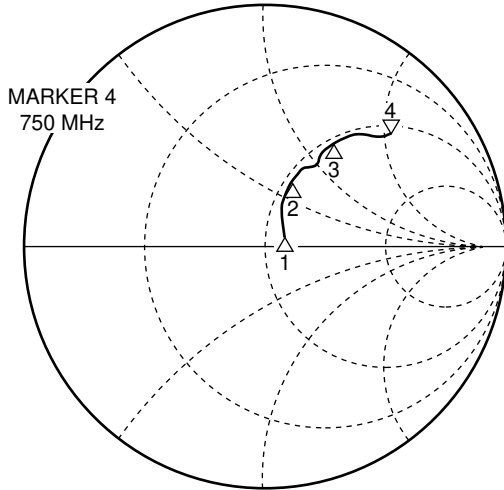
| Frequency (MHz) | S_{11} (Ω) |
|-----------------|-----------------------|
| 500 | 37.1-j207.8 |
| 1 000 | 14.2-j105.1 |
| 2 000 | 7.9-j35.8 |
| 3 000 | 27.1-j27.5 |

START 0.500000000 GHz
 STOP 3.000000000 GHz

S₂₂ vs. OUTPUT FREQUENCY

V_{CC} = 5.0 V, f_{in} = 500 MHz, T_A = +25°C, Z_O = 50 Ω

S₂₂ Z
 REF 1.0 Units
 4 200.0 mUnits/
 ▽ 60.925 Ω 104.77 Ω
 hp



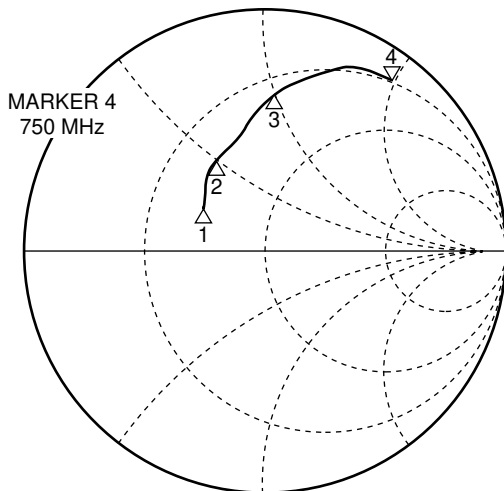
▽1 : 125 MHz
 ▽2 : 250 MHz
 ▽3 : 500 MHz
 ▽4 : 750 MHz

| Frequency (MHz) | S ₂₂ (Ω) |
|-----------------|---------------------|
| 125 | 55.5+j6.7 |
| 250 | 53.7+j30.4 |
| 500 | 55.0+j60.3 |
| 750 | 60.9+j104.8 |

START 0.125000000 GHz
 STOP 0.750000000 GHz

V_{CC} = 5.0 V, f_{in} = 3.0 GHz, T_A = +25°C, Z_O = 50 Ω

S₂₂ Z
 REF 1.0 Units
 4 200.0 mUnits/
 ▽ 15.613 Ω 98.168 Ω
 hp

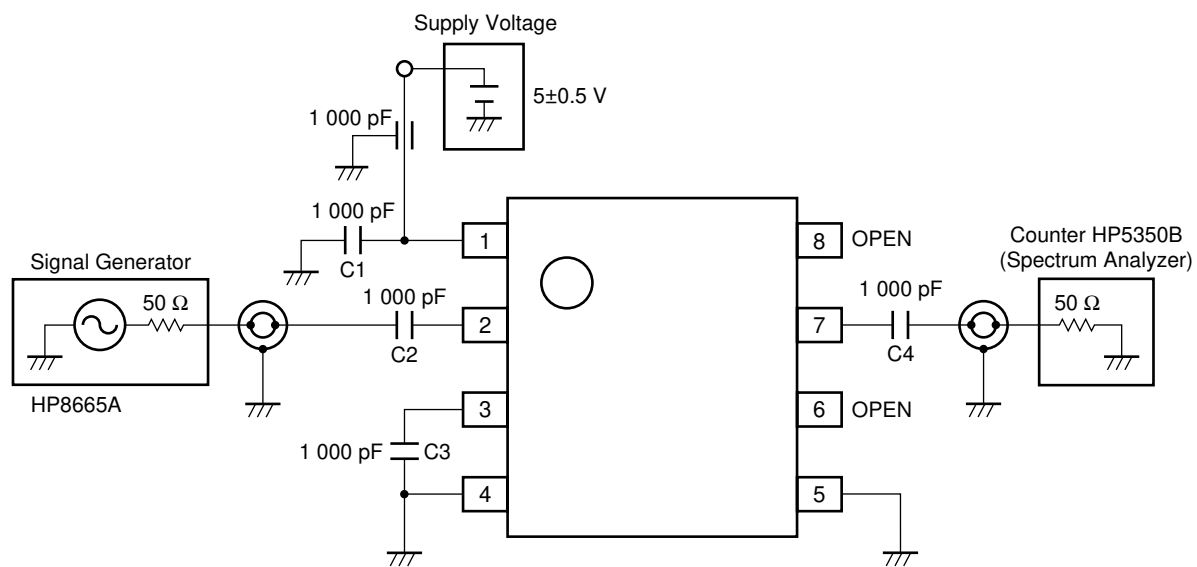


▽1 : 125 MHz
 ▽2 : 250 MHz
 ▽3 : 500 MHz
 ▽4 : 750 MHz

| Frequency (MHz) | S ₂₂ (Ω) |
|-----------------|---------------------|
| 125 | 28.5+j11.5 |
| 250 | 27.6+j23.6 |
| 500 | 20.5+j50.7 |
| 750 | 15.6+j98.2 |

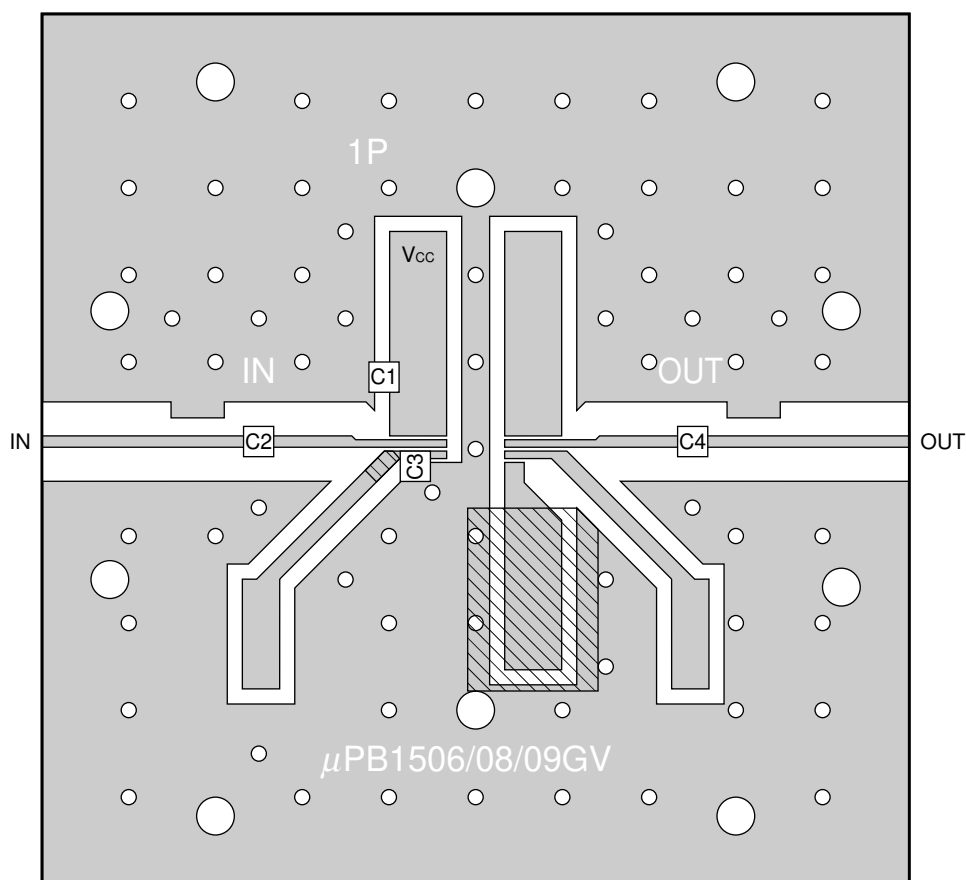
START 0.125000000 GHz
 STOP 0.750000000 GHz

TEST CIRCUIT



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

ILLUSTRATION OF THE TEST CIRCUIT ASSEMBLED ON EVALUATION BOARD



COMPONENT LIST

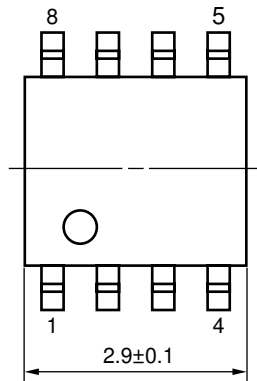
| | Value |
|----------|----------|
| C1 to C4 | 1 000 pF |

Notes

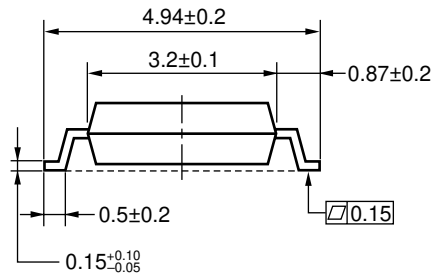
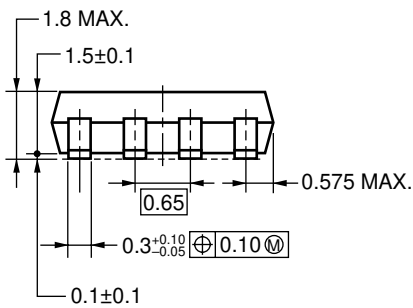
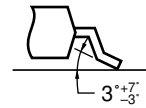
- (1) 35 μ m thick double-sided copper-clad 50 \times 50 \times 0.4 mm polyimide board.
- (2) Back side : GND pattern
- (3) Solder plated on pattern
- (4) \circ \circ : Through holes
- (5) of pin 3 : Pattern should be removed.
- (6) of pin 5 : Short chip must be attached to be grounded.

★ PACKAGE DIMENSIONS

8-PIN PLASTIC SSOP (4.45 mm (175)) (UNIT: mm)



detail of lead end



NOTES 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 undesired oscillation).
- (3) Keep the wiring length of the ground pins as short as possible.
- (4) Connect a bypass capacitor (example: 1 000 pF) to the V_{CC} pin.

★ **RECOMMENDED SOLDERING CONDITIONS**

This product should be soldered and mounted under the following recommended conditions. For soldering methods and conditions other than those recommended below, contact your nearby sales office.

| Soldering Method | Soldering Conditions | Condition Symbol |
|------------------|---|------------------|
| Infrared Reflow | Peak temperature (package surface temperature) : 260°C or below Time at peak temperature : 10 seconds or less Time at temperature of 220°C or higher : 60 seconds or less Preheating time at 120 to 180°C : 120±30 seconds Maximum number of reflow processes : 3 times Maximum chlorine content of rosin flux (% mass) : 0.2%(Wt.) or below | IR260 |
| VPS | Peak temperature (package surface temperature) : 215°C or below Time at temperature of 200°C or higher : 25 to 40 seconds Preheating time at 120 to 150°C : 30 to 60 seconds Maximum number of reflow processes : 3 times Maximum chlorine content of rosin flux (% mass) : 0.2%(Wt.) or below | VP215 |
| Wave Soldering | Peak temperature (molten solder temperature) : 260°C or below Time at peak temperature : 10 seconds or less Preheating temperature (package surface temperature) : 120°C or below Maximum number of flow processes : 1 time Maximum chlorine content of rosin flux (% mass) : 0.2%(Wt.) or below | WS260 |
| Partial Heating | Peak temperature (pin temperature) : 350°C or below Soldering time (per side of device) : 3 seconds or less Maximum chlorine content of rosin flux (% mass) : 0.2%(Wt.) or below | HS350 |

Caution Do not use different soldering methods together (except for partial heating).