

L, S-BAND SPDT SWITCH

DESCRIPTION

The μ PG2158T5K is a GaAs MMIC for L, S-band SPDT (Single Pole Double Throw) switch which was developed for mobile phone and another L, S-band application.

This device can operate 2 control switching by control voltage 1.8 to 5.3 V. This device can operate frequency from 0.05 to 3.0 GHz, having the low insertion loss and high isolation.

This device is housed in a 6-pin plastic TSSON (Thin Shrink Small Out-line Non-leaded) package. And this package is able to high-density surface mounting.

FEATURES

- Switch control voltage : $V_{\text{cont (H)}} = 1.8$ to 5.3 V (2.7 V TYP.)
: $V_{\text{cont (L)}} = -0.2$ to $+0.2$ V (0 V TYP.)
- Low insertion loss : $L_{\text{INS1}} = 0.40$ dB TYP. @ $f = 0.05$ to 1.0 GHz, $V_{\text{cont (H)}} = 2.7$ V, $V_{\text{cont (L)}} = 0$ V
: $L_{\text{INS2}} = 0.45$ dB TYP. @ $f = 1.0$ to 2.0 GHz, $V_{\text{cont (H)}} = 2.7$ V, $V_{\text{cont (L)}} = 0$ V
: $L_{\text{INS3}} = 0.47$ dB TYP. @ $f = 2.0$ to 2.5 GHz, $V_{\text{cont (H)}} = 2.7$ V, $V_{\text{cont (L)}} = 0$ V
: $L_{\text{INS4}} = 0.53$ dB TYP. @ $f = 2.5$ to 3.0 GHz, $V_{\text{cont (H)}} = 2.7$ V, $V_{\text{cont (L)}} = 0$ V
- High isolation : $ISL1 = 27$ dB TYP. @ $f = 0.05$ to 1.0 GHz, $V_{\text{cont (H)}} = 2.7$ V, $V_{\text{cont (L)}} = 0$ V
: $ISL2 = 19$ dB TYP. @ $f = 1.0$ to 2.0 GHz, $V_{\text{cont (H)}} = 2.7$ V, $V_{\text{cont (L)}} = 0$ V
: $ISL3 = 17$ dB TYP. @ $f = 2.0$ to 2.5 GHz, $V_{\text{cont (H)}} = 2.7$ V, $V_{\text{cont (L)}} = 0$ V
: $ISL4 = 17$ dB TYP. @ $f = 2.5$ to 3.0 GHz, $V_{\text{cont (H)}} = 2.7$ V, $V_{\text{cont (L)}} = 0$ V
- Handling power : $P_{\text{in (0.1 dB)}} = +29.0$ dBm TYP. @ $f = 2.0/2.5$ GHz, $V_{\text{cont (H)}} = 2.7$ V, $V_{\text{cont (L)}} = 0$ V
: $P_{\text{in (1 dB)}} = +30.5$ dBm TYP. @ $f = 2.0/2.5$ GHz, $V_{\text{cont (H)}} = 2.7$ V, $V_{\text{cont (L)}} = 0$ V
- High-density surface mounting : 6-pin plastic TSSON package ($1.0 \times 1.0 \times 0.37$ mm)

APPLICATIONS

- L, S-band digital cellular or cordless telephone
- W-LAN, WLL and Bluetooth™ etc.

ORDERING INFORMATION

| Part Number | Order Number | Package | Marking | Supplying Form |
|--------------------|----------------------|--|---------|--|
| μ PG2158T5K-E2 | μ PG2158T5K-E2-A | 6-pin plastic TSSON (Pb-Free) ^{Note} | G2 | <ul style="list-style-type: none"> • Embossed tape 8 mm wide • Pin 1, 6 face the perforation side of the tape • Qty 5 kpcs/reel |

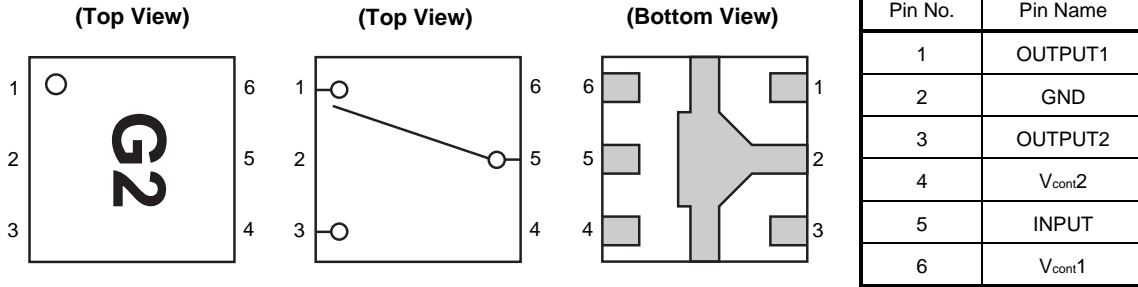
Note With regards to terminal solder (the solder contains lead) plated products (conventionally plated), contact your nearby sales office.

Remark To order evaluation samples, contact your nearby sales office.
Part number for sample order: μ PG2158T5K-A

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 AND INTERNAL BLOCK DIAGRAM



TRUTH TABLE

| V _{cont1} | V _{cont2} | INPUT-OUTPUT1 | INPUT-OUTPUT2 |
|--------------------|--------------------|---------------|---------------|
| Low | High | OFF | ON |
| High | Low | ON | OFF |

ABSOLUTE MAXIMUM RATINGS (T_A = +25°C, unless otherwise specified)

| Parameter | Symbol | Ratings | Unit |
|-------------------------------|-------------------|----------------------|------|
| Switch Control Voltage | V _{cont} | +6.0 ^{Note} | V |
| Input Power | P _{in} | +31 | dBm |
| Operating Ambient Temperature | T _A | -45 to +85 | °C |
| Storage Temperature | T _{stg} | -55 to +150 | °C |

Note |V_{cont1} - V_{cont2}| ≤ 6.0 V

RECOMMENDED OPERATING RANGE (T_A = +25°C, unless otherwise specified)

| Parameter | Symbol | MIN. | TYP. | MAX. | Unit |
|----------------------------|-----------------------|------|------|------|------|
| Switch Control Voltage (H) | V _{cont (H)} | 1.8 | 2.7 | 5.3 | V |
| Switch Control Voltage (L) | V _{cont (L)} | -0.2 | 0 | +0.2 | V |

ELECTRICAL CHARACTERISTICS 1(TA = +25°C, V_{cont} (H) = 2.7 V, V_{cont} (L) = 0 V, DC cut capacitors = 56 pF, unless otherwise specified)

| Parameter | Symbol | Test Conditions | MIN. | TYP. | MAX. | Unit |
|--|--------------------------|--|-------|-------|------|------|
| Insertion Loss 1 | L _{INS1} | f = 0.05 to 1.0 GHz ^{Note 1} | – | 0.40 | 0.45 | dB |
| Insertion Loss 2 | L _{INS2} | f = 1.0 to 2.0 GHz | – | 0.45 | 0.50 | |
| Insertion Loss 3 | L _{INS3} | f = 2.0 to 2.5 GHz | – | 0.47 | 0.55 | |
| Insertion Loss 4 | L _{INS4} | f = 2.5 to 3.0 GHz | – | 0.53 | 0.60 | |
| Isolation 1 | ISL1 | f = 0.05 to 1.0 GHz ^{Note 1} | 23 | 27 | – | dB |
| Isolation 2 | ISL2 | f = 1.0 to 2.0 GHz | 16 | 19 | – | |
| Isolation 3 | ISL3 | f = 2.0 to 2.5 GHz | 14 | 17 | – | |
| Isolation 4 | ISL4 | f = 2.5 to 3.0 GHz | 14 | 17 | – | |
| Input Return Loss | RL _{in} | f = 0.05 to 3.0 GHz ^{Note 1} | 15 | 20 | – | dB |
| Output Return Loss | RL _{out} | f = 0.05 to 3.0 GHz ^{Note 1} | 15 | 20 | – | dB |
| 0.1 dB Loss Compression Input Power ^{Note 2} | P _{in} (0.1 dB) | f = 2.0/2.5 GHz | +26.0 | +29.0 | – | dBm |
| | | f = 0.5 to 3.0 GHz | – | +29.0 | – | |
| 1 dB Loss Compression Input Power ^{Note 3} | P _{in} (1 dB) | f = 0.5 to 3.0 GHz | – | +30.5 | – | dBm |
| 2nd Harmonics | 2f ₀ | f = 2.0/2.5 GHz, P _{in} = +20 dBm | 65 | 75 | – | dBc |
| 3rd Harmonics | 3f ₀ | f = 2.0/2.5 GHz, P _{in} = +20 dBm | 65 | 75 | – | dBc |
| Input 3rd Order Distortion Intercept Point | IIP ₃ | f = 0.5 to 3.0 GHz 2 tone 5 MHz spacing | – | +60 | – | dBm |
| Switch Control Current | I _{cont} | No signal | – | 0.2 | 20 | μA |
| Switch Control Speed | t _{sw} | 50% CTL to 90/10% RF | – | 50 | 500 | ns |

Notes 1. DC cut capacitors = 1 000 pF at f = 0.05 to 0.5 GHz

- P_{in} (0.1 dB) is measured the input power level when the insertion loss increases more 0.1 dB than that of linear range.
- P_{in} (1 dB) is measured the input power level when the insertion loss increases more 1 dB than that of linear range.

Caution This device is used it is necessary to use DC cut capacitors.

The value of DC cut capacitors should be chosen to accommodate the frequency of operation, bandwidth, switching speed and the condition with actual board of your system. The range of recommended DC cut capacitor value is less than 100 pF.

ELECTRICAL CHARACTERISTICS 2**(TA = +25°C, V_{cont} (H) = 1.8 V, V_{cont} (L) = 0 V, DC cut capacitors = 56 pF, unless otherwise specified)**

| Parameter | Symbol | Test Conditions | MIN. | TYP. | MAX. | Unit |
|--|--------------------------|---------------------------------------|-------|-------|------|---------|
| Insertion Loss 1 | L _{INS1} | f = 0.05 to 1.0 GHz ^{Note 1} | – | 0.40 | 0.47 | dB |
| Insertion Loss 2 | L _{INS2} | f = 1.0 to 2.0 GHz | – | 0.46 | 0.52 | |
| Insertion Loss 3 | L _{INS3} | f = 2.0 to 2.5 GHz | – | 0.48 | 0.57 | |
| Insertion Loss 4 | L _{INS4} | f = 2.5 to 3.0 GHz | – | 0.54 | 0.62 | |
| Isolation 1 | ISL1 | f = 0.05 to 1.0 GHz ^{Note 1} | 23 | 27 | – | dB |
| Isolation 2 | ISL2 | f = 1.0 to 2.0 GHz | 16 | 19 | – | |
| Isolation 3 | ISL3 | f = 2.0 to 2.5 GHz | 14 | 17 | – | |
| Isolation 4 | ISL4 | f = 2.5 to 3.0 GHz | 14 | 17 | – | |
| Input Return Loss | RL _{in} | f = 0.05 to 3.0 GHz ^{Note 1} | 15 | 20 | – | dB |
| Output Return Loss | RL _{out} | f = 0.05 to 3.0 GHz ^{Note 1} | 15 | 20 | – | dB |
| 0.1 dB Loss Compression Input Power ^{Note 2} | P _{in (0.1 dB)} | f = 2.0/2.5 GHz | +19.0 | +22.0 | – | dBm |
| | | f = 0.5 to 3.0 GHz | – | +22.0 | – | |
| 1 dB Loss Compression Input Power ^{Note 3} | P _{in (1 dB)} | f = 0.5 to 3.0 GHz | – | +25.0 | – | dBm |
| Switch Control Current | I _{cont} | No signal | – | 0.2 | 20 | μ A |
| Switch Control Speed | t _{sw} | 50% CTL to 90/10% RF | – | 50 | 500 | ns |

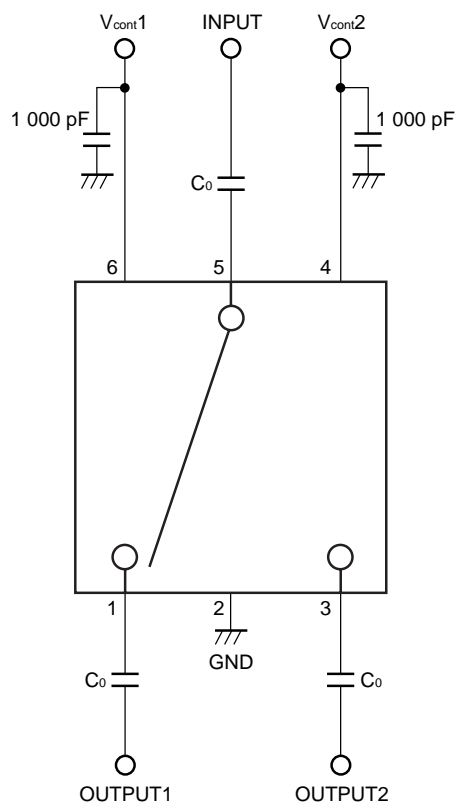
Notes 1. DC cut capacitors = 1 000 pF at f = 0.05 to 0.5 GHz

- 2.** P_{in (0.1 dB)} is measured the input power level when the insertion loss increases more 0.1 dB than that of linear range.
- 3.** P_{in (1 dB)} is measured the input power level when the insertion loss increases more 1 dB than that of linear range.

Caution This device is used it is necessary to use DC cut capacitors.

The value of DC cut capacitors should be chosen to accommodate the frequency of operation, bandwidth, switching speed and the condition with actual board of your system. The range of recommended DC cut capacitor value is less than 100 pF.

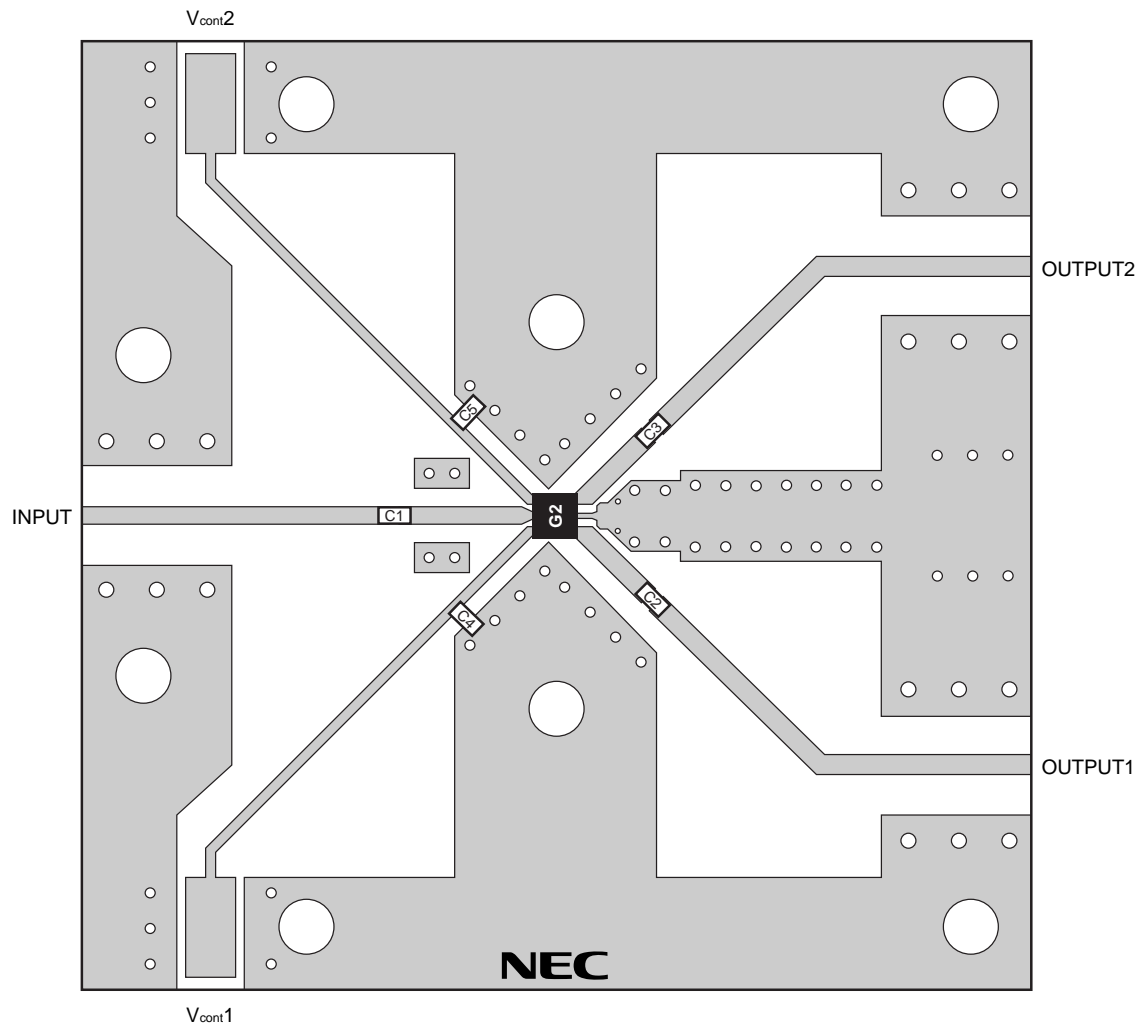
EVALUATION CIRCUIT



Remark C_0 : 0.05 to 0.5 GHz 1 000 pF
: 0.5 to 3.0 GHz 56 pF

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

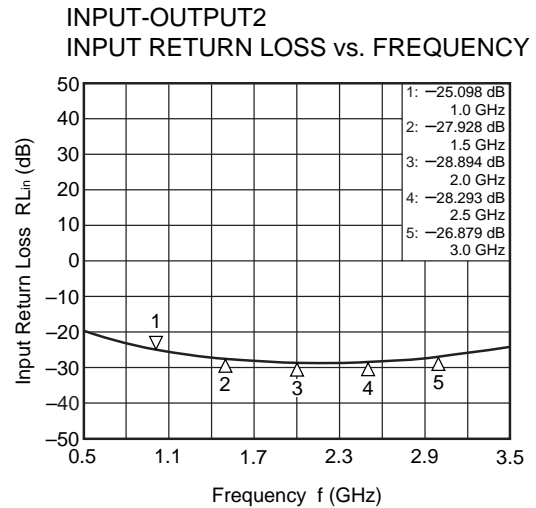
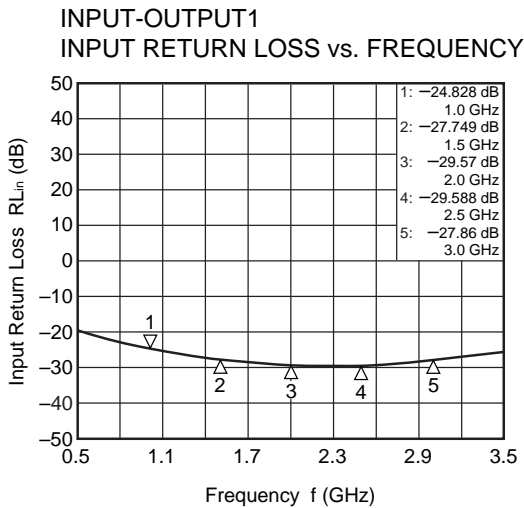
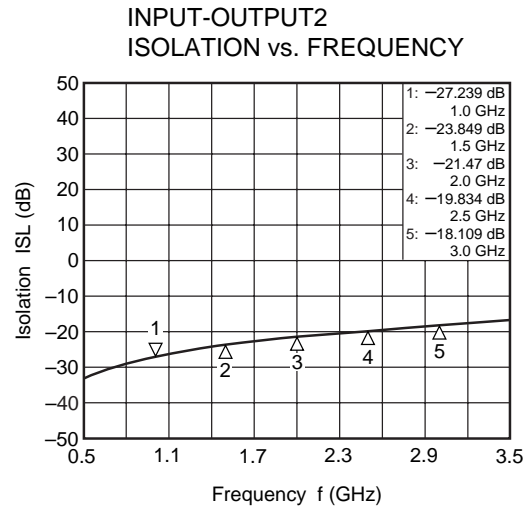
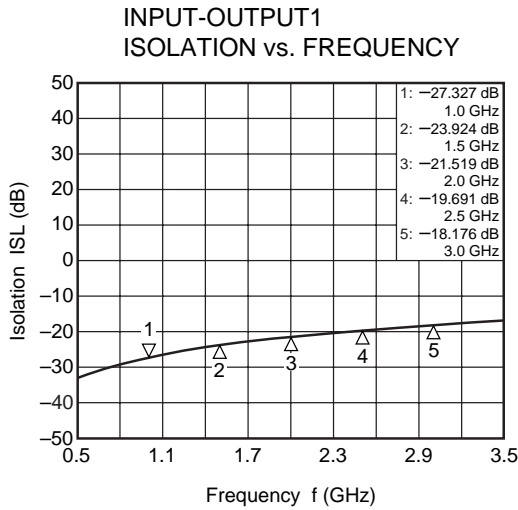
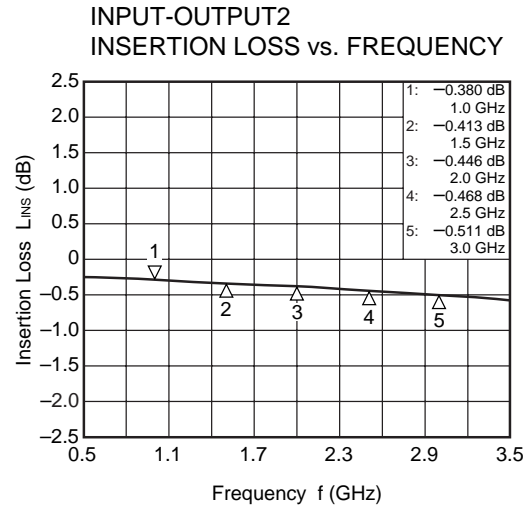
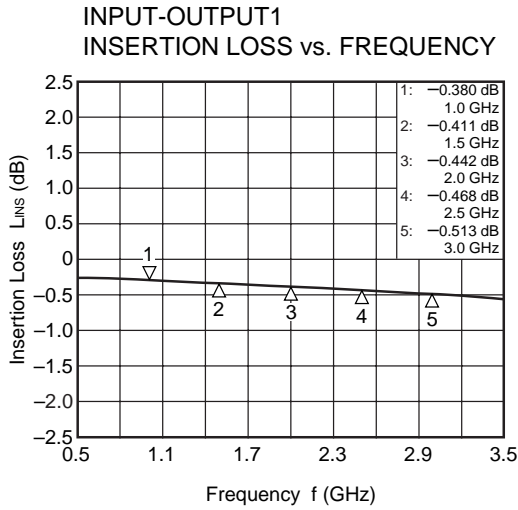
ILLUSTRATION OF THE TEST CIRCUIT ASSEMBLED ON EVALUATION BOARD



USING THE NEC EVALUATION BOARD

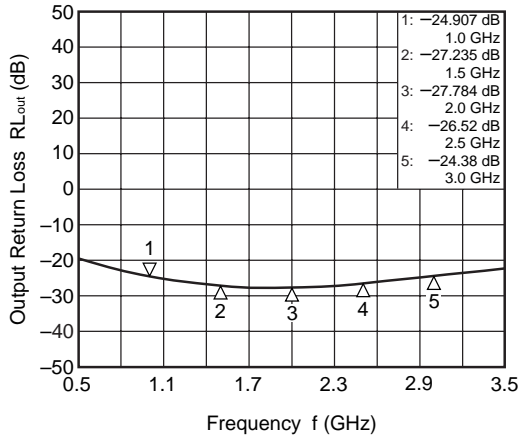
| Symbol | Values |
|------------|----------|
| C1, C2, C3 | 56 pF |
| C4, C5 | 1 000 pF |

TYPICAL CHARACTERISTICS ($T_A = +25^\circ\text{C}$, $V_{\text{cont}}(\text{H}) = 2.7\text{ V}$, $V_{\text{cont}}(\text{L}) = 0\text{ V}$, DC cut capacitors = 56 pF, using test fixture, unless otherwise specified)

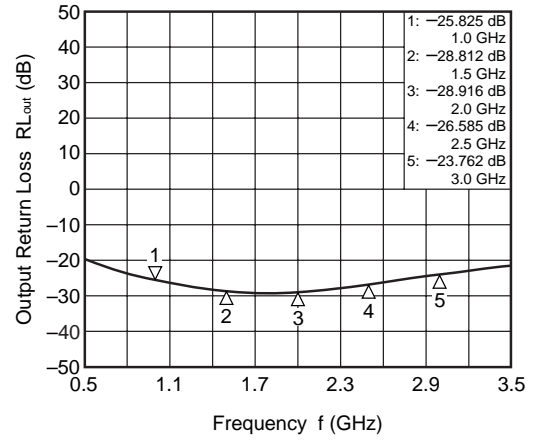


Remark The graphs indicate nominal characteristics.

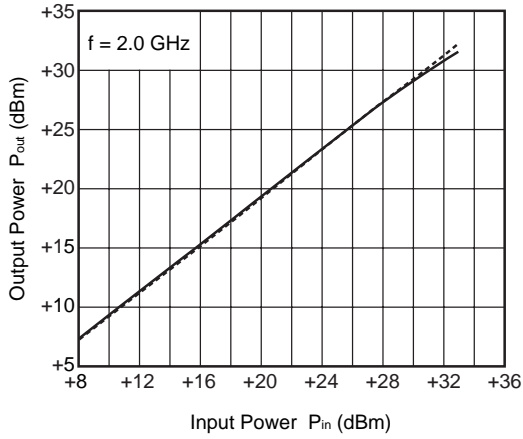
INPUT-OUTPUT1
OUTPUT RETURN LOSS vs. FREQUENCY



INPUT-OUTPUT2
OUTPUT RETURN LOSS vs. FREQUENCY



OUTPUT POWER vs. INPUT POWER

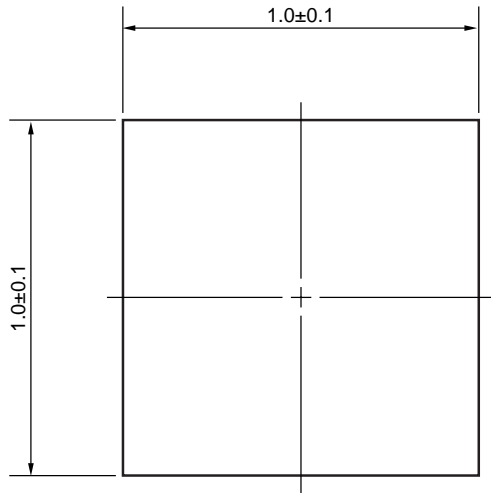


Remark The graphs indicate nominal characteristics.

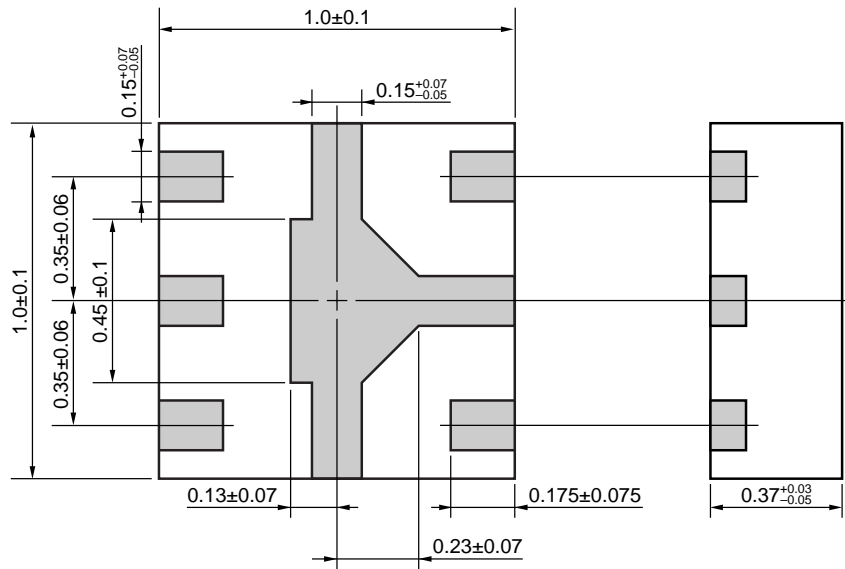
★ PACKAGE DIMENSIONS

6-PIN PLASTIC TSSOP (UNIT: mm)

(Top View)



(Bottom View)



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 |
| 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 (terminal 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).

Subject: Compliance with EU Directives

CEL certifies, to its knowledge, that semiconductor and laser products detailed below are compliant with the requirements of European Union (EU) Directive 2002/95/EC Restriction on Use of Hazardous Substances in electrical and electronic equipment (RoHS) and the requirements of EU Directive 2003/11/EC Restriction on Penta and Octa BDE.

CEL Pb-free products have the same base part number with a suffix added. The suffix –A indicates that the device is Pb-free. The –AZ suffix is used to designate devices containing Pb which are exempted from the requirement of RoHS directive (*). In all cases the devices have Pb-free terminals. All devices with these suffixes meet the requirements of the RoHS directive.

This status is based on CEL’s understanding of the EU Directives and knowledge of the materials that go into its products as of the date of disclosure of this information.

| Restricted Substance per RoHS | Concentration Limit per RoHS (values are not yet fixed) | Concentration contained in CEL devices | |
|-------------------------------|---|--|-----|
| | | -A | -AZ |
| Lead (Pb) | < 1000 PPM | Not Detected | (*) |
| Mercury | < 1000 PPM | Not Detected | |
| Cadmium | < 100 PPM | Not Detected | |
| Hexavalent Chromium | < 1000 PPM | Not Detected | |
| PBB | < 1000 PPM | Not Detected | |
| PBDE | < 1000 PPM | Not Detected | |

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