# NT1821GVAE1S
# 1.0 to 7.125 GHz High Isolation SPDT Switch

## FEATURES

- Frequency range: 1.0 to 7.125 GHz
- Operation voltage range: 1.6 to 5.0 V (1.8 V typ.)
- Low control voltage: 1.2 V typ.
- Low insertion loss:
  0.60 dB typ. @ 2.4 to 2.5 GHz
  0.50 dB typ. @ 4.9 to 5.9 GHz
  0.58 dB typ. @ 5.9 to 7.125 GHz
- High isolation:
  40 dB typ. @ 2.4 to 2.5 GHz
  38 dB typ. @ 4.9 to 5.9 GHz
  42 dB typ. @ 5.9 to 7.125 GHz
- High linearity: $P_{-1dB}$ = +31 dBm typ.
- Small package: 1.0 x 1.0 mm typ.
  t = 0.38mm max.
- RoHS compliant, Halogen free, MSL1

## APPLICATIONS

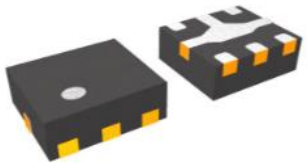
- 802.11a/b/g/n/ac/ax/be networks
- Wi-Fi module, access point, smartphone and other mobile devices
- Transmit/receive switching, antenna switching, and other switching applications

## GENERAL DESCRIPTION

The NT1821 is a high isolation SPDT switch intended for wireless communication system, especially suitable for Wi-Fi 7 application.

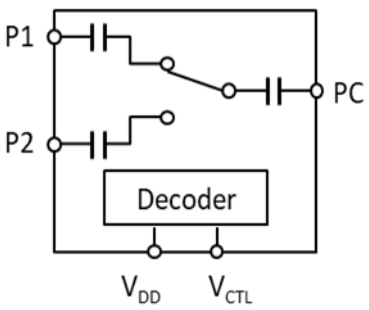
The NT1821 features high isolation between RF terminals around 40 dB in high frequency up to 7.125 GHz. It achieves low insertion loss and high linearity for 1.8 V low operating voltage, and 1.2 V low control voltage.

Integrated DC blocking capacitors at all RF ports and the 1.0 mm x 1.0 mm small size package offer very small mounting area.



DFN1010-6-GV
1.0 × 1.0 × 0.38 (mm)

## BLOCK DIAGRAM



## ■ PRODUCT NAME INFORMATION

**NT1821 GV A E1 S**

Description of configuration

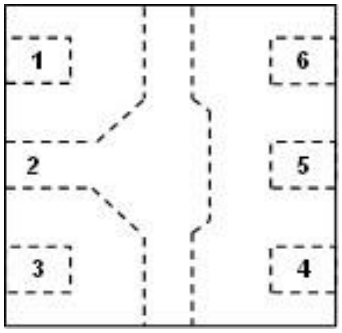
| Composition | Item | Description |
|---|---|---|
| GV | Package code | Indicates the package. Refer to the order information. |
| A | Version | Indicates the product version. “A” is initial version. |
| E1 | Packing | Refer to the packing specifications. |
| S | Grade | Indicates the quality grade. “S” means general-purpose and consumer application. Operating temperature range: -40ºC to +105ºC, Test temperature: +25ºC |

## ■ ORDER INFORMATION

| PRODUCT NAME | PACKAGE | RoHS | HALOGEN-FREE | PLATING COMPOSITION | WEIGHT (mg) | QUANTITY (pcs/reel) |
|---|---|---|---|---|---|---|
| NT1821GVAE1S | DFN1010-6-GV | Yes | Yes | Ni/Pd/Au | 1.2 | 5000 |

## ■ PIN DESCRIPTION

(Top View)




**DFN1010-6-GV Pin configuration**

| Pin No. | Pin Name | Description |
|---|---|---|
| 1 | P1 | RF terminal |
| 2 | GND | Ground terminal |
| 3 | P2 | RF terminal |
| 4 | VCTL | Control signal input terminal |
| 5 | PC | RF terminal |
| 6 | VDD | Voltage supply terminal |

Please refer to "APPLICATION CIRCUIT" for details.

## ■ TRUTH TABLE

"H" = $V_{CTL}$(H), "L" = $V_{CTL}$(L)

| ON PATH | VCTL |
|---|---|
| PC-P1 | H |
| PC-P2 | L |

## ■ ABSOLUTE MAXIMUM RATINGS

General conditions: $T_a$ = +25°C, $Z_s$ = $Z_l$ = 50 Ω

| | Symbol | Ratings | Unit |
|---|---|---|---|
| Supply voltage | $V_{DD}$ | 6.0 | V |
| Control voltage | $V_{CTL}$ | 6.0 | V |
| RF input power | $P_{IN}$ *1 | +31 | dBm |
| Power dissipation | $P_D$ *2 | 380 | mW |
| Operating temperature range | $T_{opr}$ | −40 to +105 | °C |
| Storage temperature range | $T_{stg}$ | −55 to +150 | °C |

*1 $V_{DD}$ = 1.8 V, ON port
*2 4-layer FR4 PCB with through-hole (76.2 x 114.3mm), $T_j$ = +150°C

| ABSOLUTE MAXIMUM RATINGS |
|---|
| Electronic and mechanical stress momentarily exceeded absolute maximum ratings may cause permanent damage and may degrade the lifetime and safety for both device and system using the device in the field. The functional operation at or over these absolute maximum ratings is not assured. |

*3 Calculate the power consumption of the IC from the operating conditions and calculate the junction temperature with the thermal resistance.
Please refer to "*THERMAL CHARACTERISTICS*" for the thermal resistance under our measurement board conditions.

## ■ THERMAL CHARACTERISTICS

| Parameter | Measurement Result |
|---|---|
| Thermal Resistance (θja) | θja = 328 °C/W |

θja: Junction-to-Ambient Thermal Resistance

## ■ ELECTROSTATIC DISCHARGE RATINGS

| | Conditions | Protection Voltage |
|---|---|---|
| HBM | C = 100pF, R = 1.5kΩ | ±2000V |
| CDM | Field Induced CDM | ±1000V |

| ELECTROSTATIC DISCHARGE RATINGS |
|---|
| The electrostatic discharge tests are done based on JEDEC JS-001 and JS-002.<br>In the HBM method, ESD is applied using the power supply pin and GND pin as reference pins. |

## ■ RECOMMENDED OPERATING CONDITIONS

| | Symbol | Value | Unit |
|---|---|---|---|
| Supply voltage | $V_{DD}$ | 1.6 to 5.0 | V |
| Control voltage | $V_{CTL}$ | 1.08 to 5.0 | V |
| Operating temperature range | $T_a$ | -40 to +105 | °C |

| RECOMMENDED OPERATING CONDITIONS |
|---|
| All of electronic equipment should be designed that the mounted semiconductor devices operate within the recommended operating conditions. The semiconductor devices cannot operate normally over the recommended operating conditions, even if when they are used over such conditions by momentary electronic noise or surge. And the semiconductor devices may receive serious damage when they continue to operate over the recommended operating conditions. |

## ■ ELECTRICAL CHARACTERISTICS 1 (DC)

General conditions: $T_a$ = +25°C, $Z_s$ = $Z_l$ = 50 Ω

| Parameter | Symbol | Conditions | MIN | TYP | MAX | Unit |
|---|---|---|---|---|---|---|
| Supply voltage | $V_{DD}$ | VDD terminal | 1.6 | 1.8 | 5.0 | V |
| Operating current | $I_{DD}$ | No RF input, $V_{DD}$ = 1.8 V | - | 20 | 40 | μA |
| Control voltage (High) | $V_{CTL}$(H) | VCTL terminal | 1.08 | 1.2 | 5.0 | V |
| Control voltage (Low) | $V_{CTL}$(L) | VCTL terminal | -0.2 | - | 0.3 | V |
| Control current | $I_{CTL}$ | $V_{CTL}$(H) = 1.2 V | - | 4 | 10 | μA |

## ■ ELECTRICAL CHARACTERISTICS 2 (RF)

General conditions: $V_{DD}$ = 1.8 V, $V_{CTL}$(H) = 1.2 V, $V_{CTL}$(L) = 0 V, $T_a$ = +25°C, $Z_s$ = $Z_l$ = 50 Ω, with application circuit

| Parameter | Symbol | Conditions | MIN | TYP | MAX | Unit |
|---|---|---|---|---|---|---|
| Insertion loss | LOSS | f = 2.4 to 2.5 GHz | - | 0.60 | 0.82 | dB |
| | | f = 4.9 to 5.9 GHz | - | 0.50 | 0.74 | |
| | | f = 5.9 to 7.125 GHz | - | 0.58 | 0.78 | |
| Isolation (PC-P1/PC-P2) | ISL1 | f = 2.4 to 2.5 GHz | 35 | 40 | - | dB |
| | | f = 4.9 to 5.9 GHz | 34 | 38 | - | |
| | | f = 5.9 to 7.125 GHz | 37 | 42 | - | |
| Isolation (P1-P2) | ISL2 | f = 2.4 to 2.5 GHz | 37 | 40 | - | dB |
| | | f = 4.9 to 5.9 GHz | 35 | 38 | - | |
| | | f = 5.9 to 7.125 GHz | 36 | 40 | - | |
| Return loss | RL | f = 2.4 to 2.5 GHz | 16 | 20 | - | dB |
| | | f = 4.9 to 5.9 GHz | 15 | 19 | - | |
| | | f = 5.9 to 7.125 GHz | 14 | 17 | - | |
| Input power at 1 dB compression point | $P_{-1dB}$ | f = 2.4 to 7.125GHz | +28 | +31 | - | dBm |
| Switching time | $T_{SW}$ | 50% VCTL to 10%90% RF | - | 200 | 400 | ns |

## ■ ELECTRICAL CHARACTERISTICS 3 (RF)

General conditions: $V_{DD}$ = 3.3 V, $V_{CTL}$(H) = 1.2 V, $V_{CTL}$(L) = 0 V, $T_a$ = +25°C, $Z_s$ = $Z_l$ = 50 Ω, with application circuit

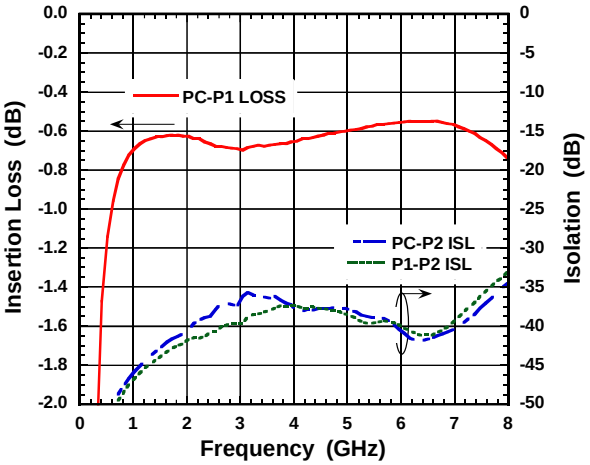
| Parameter | Symbol | Conditions | MIN | TYP | MAX | Unit |
|---|---|---|---|---|---|---|
| Insertion loss | LOSS | f = 2.4 to 2.5 GHz | - | 0.55 | - | dB |
| | | f = 4.9 to 5.9 GHz | - | 0.45 | - | |
| | | f = 5.9 to 7.125 GHz | - | 0.52 | - | |
| Isolation (PC-P1/PC-P2) | ISL1 | f = 2.4 to 2.5 GHz | - | 41 | - | dB |
| | | f = 4.9 to 5.9 GHz | - | 39 | - | |
| | | f = 5.9 to 7.125 GHz | - | 43 | - | |
| Isolation (P1-P2) | ISL2 | f = 2.4 to 2.5 GHz | - | 41 | - | dB |
| | | f = 4.9 to 5.9 GHz | - | 39 | - | |
| | | f = 5.9 to 7.125 GHz | - | 41 | - | |
| Return loss | RL | f = 2.4 to 2.5 GHz | - | 20 | - | dB |
| | | f = 4.9 to 5.9 GHz | - | 20 | - | |
| | | f = 5.9 to 7.125 GHz | - | 18 | - | |
| Input power at 1 dB compression point | $P_{-1dB}$ | f = 2.4 to 7.125GHz | +31 | - | - | dBm |
| Switching time | $T_{SW}$ | 50% VCTL to 10%90% RF | - | 200 | 400 | ns |

## ■ TYPICAL CHARACTERISTICS

General conditions: $V_{DD}$ = 1.8 V, $V_{CTL}$(H) = 1.2 V, $V_{CTL}$(L) = 0 V, $T_a$ = +25°C, $Z_S$ = $Z_I$ = 50Ω, with application circuit
(Typical Characteristics are intended to be used as reference data; they are not guaranteed.)

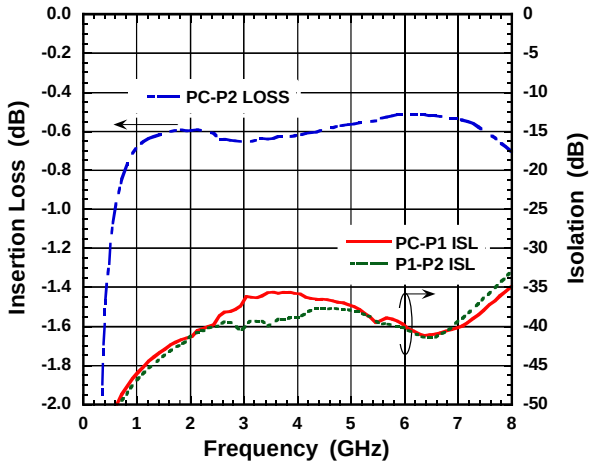
### Loss, Isolation vs Frequency

( PC-P1 ON, $V_{DD}$=1.8V )



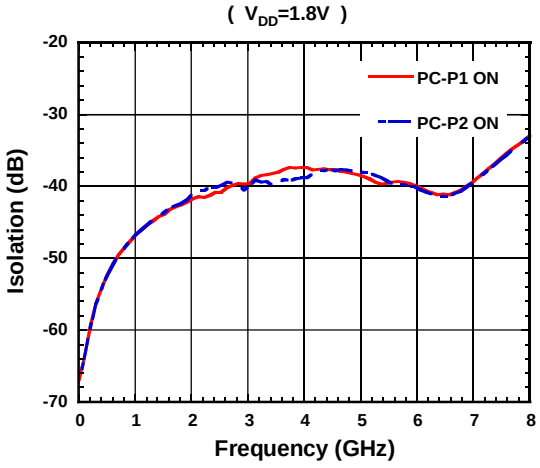

### Loss, Isolation vs Frequency

( PC-P2 ON, $V_{DD}$=1.8V )



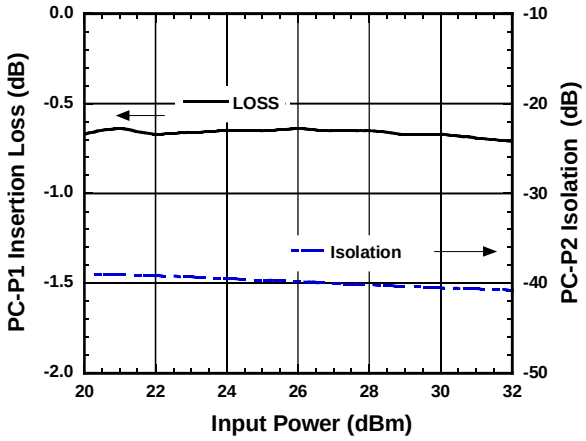

### P1-P2 Isolation vs. Frequency

( $V_{DD}$=1.8V )



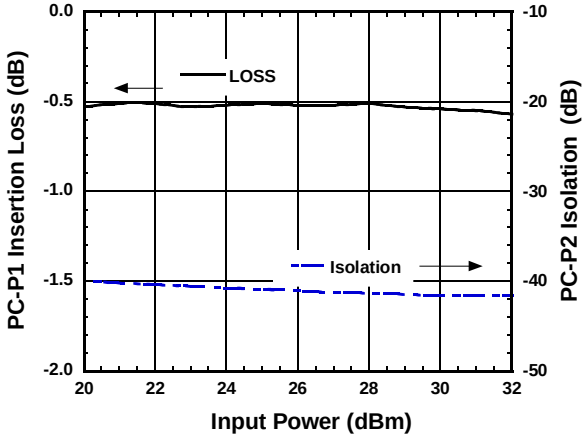

### Loss, Isolation vs. Input Power

( PC-P1 ON, f=2.5GHz, $V_{DD}$=1.8V )



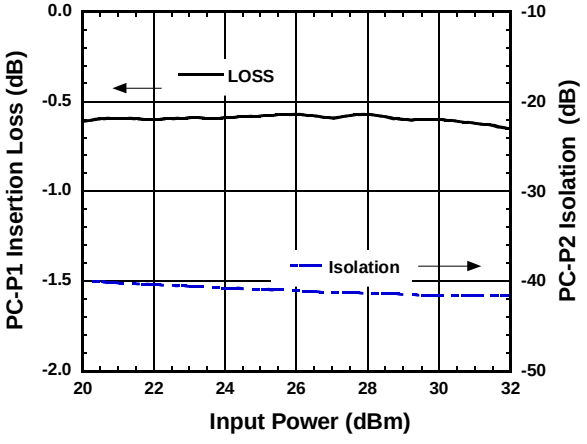

### Loss, Isolation vs. Input Power

( PC-P1 ON, f=5.9GHz, $V_{DD}$=1.8V )




### Loss, Isolation vs. Input Power

( PC-P1 ON, f=7.125GHz, $V_{DD}$=1.8V )

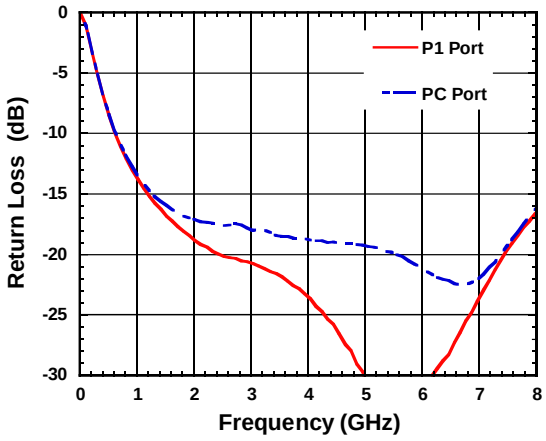


## ■ TYPICAL CHARACTERISTICS

General conditions: $V_{DD}$ = 1.8 V, $V_{CTL}$(H) = 1.2 V, $V_{CTL}$(L) = 0 V, $T_a$ = +25°C, $Z_s$ = $Z_l$ = 50Ω, with application circuit
(Typical Characteristics are intended to be used as reference data; they are not guaranteed.)

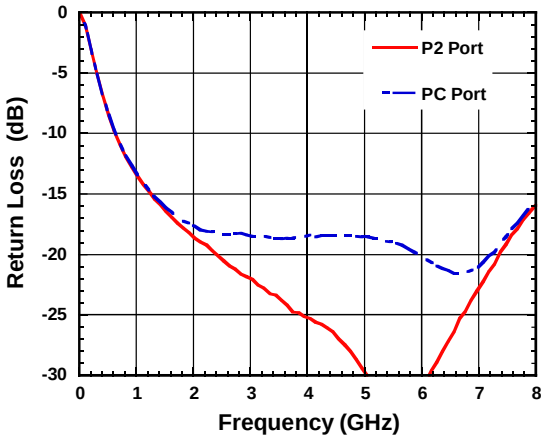
**Return Loss vs. Frequency**

**( PC-P1 ON, $V_{DD}$=1.8V )**



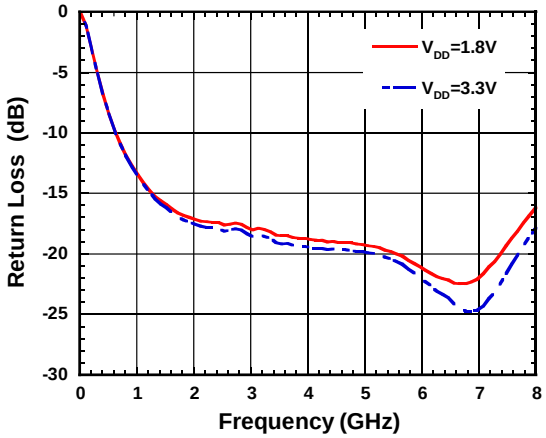

**Return Loss vs. Frequency**

**( PC-P2 ON, $V_{DD}$=1.8V )**



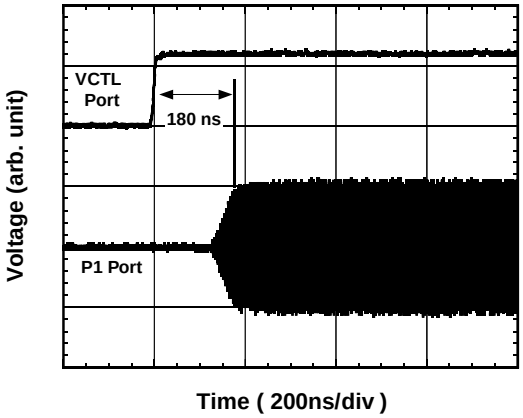

**PC Port Return Loss vs. Frequency**

**( PC-P1 ON )**




**Switching Time**

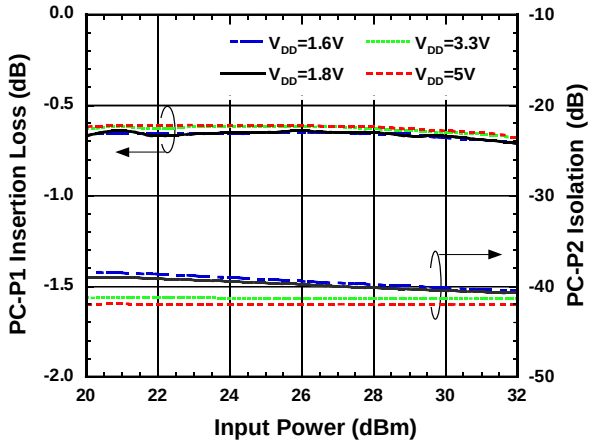
**( $V_{CTL}$(H)=1.2V, $V_{CTL}$(L)=0V )**



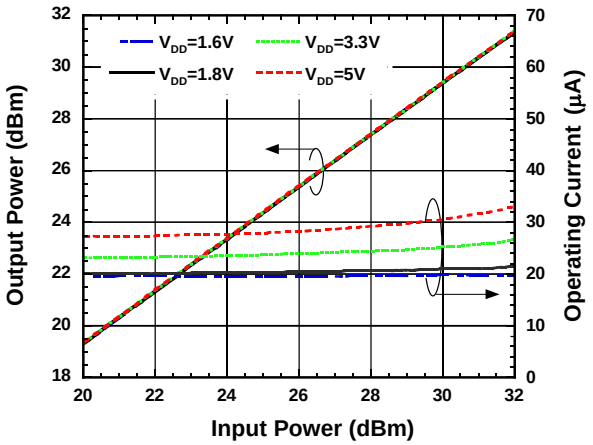
## ■ TYPICAL CHARACTERISTICS

General conditions: $T_a$ = +25°C, $Z_S$ = $Z_l$ = 50Ω, with application circuit
(Typical Characteristics are intended to be used as reference data; they are not guaranteed.)

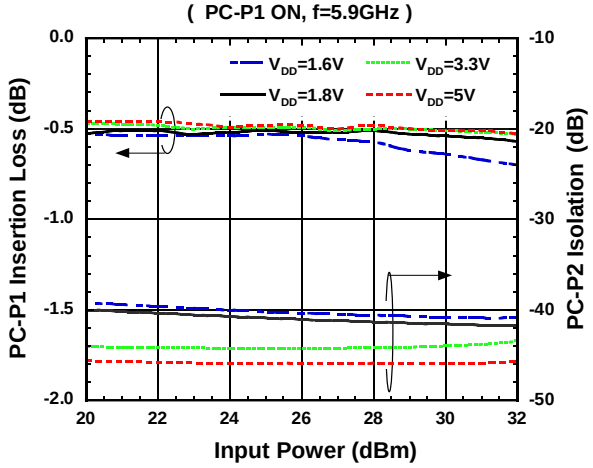
Loss, Isolation vs. Input Power
( PC-P1 ON, f=2.5GHz )



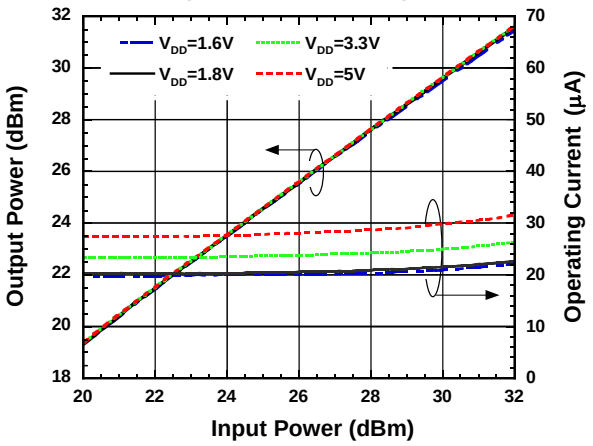

Output Power, $I_{DD}$ vs. Input Power
( PC-P1 ON, f=2.5GHz )



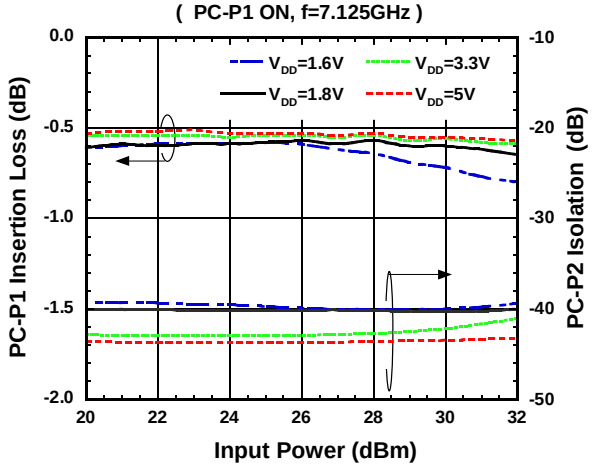

Loss, Isolation vs. Input Power
( PC-P1 ON, f=5.9GHz )



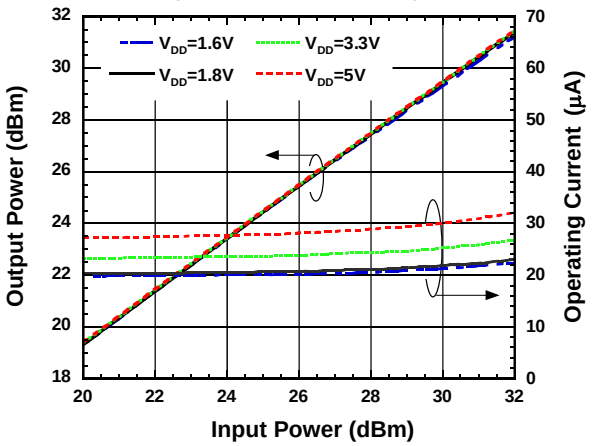

Output Power, $I_{DD}$ vs. Input Power
( PC-P1 ON, f=5.9GHz )




Loss, Isolation vs. Input Power
( PC-P1 ON, f=7.125GHz )




Output Power, $I_{DD}$ vs. Input Power
( PC-P1 ON, f=7.125GHz )

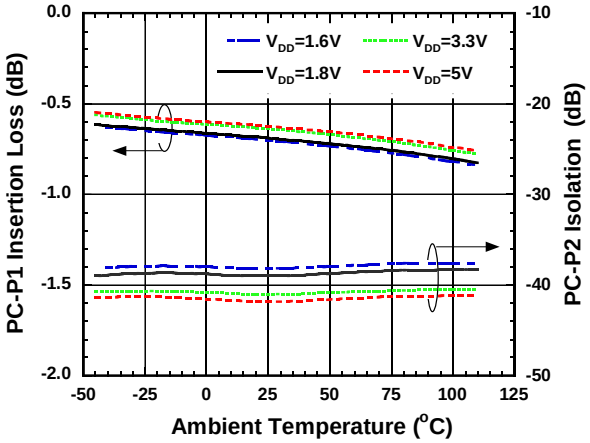


## ■ TYPICAL CHARACTERISTICS

General conditions: $Z_S = Z_l = 50\Omega$, with application circuit
(Typical Characteristics are intended to be used as reference data; they are not guaranteed.)

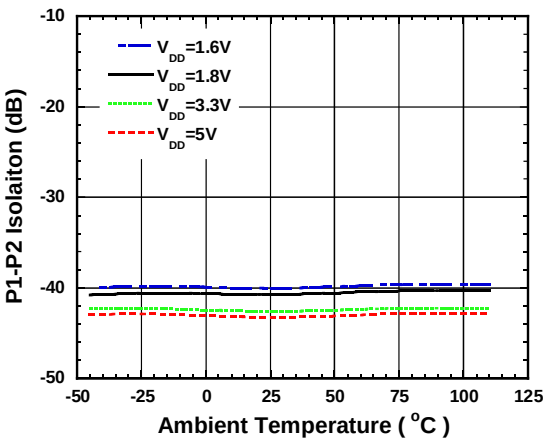
**Loss, Isolation vs. Temperature**

**( PC-P1 ON, f=2.5GHz )**



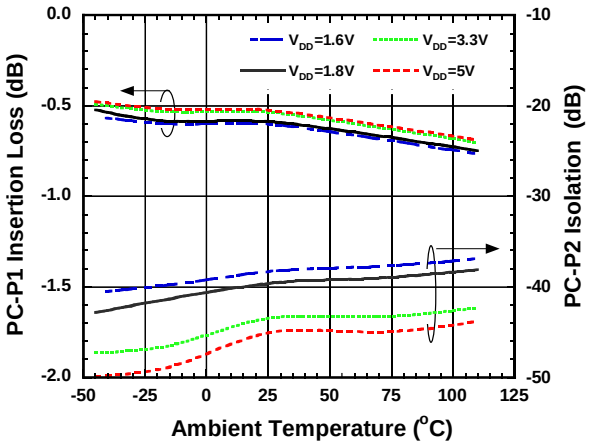

**P1-P2 Isolation vs. Temperature**

**( PC-P1 ON, f=2.5GHz )**



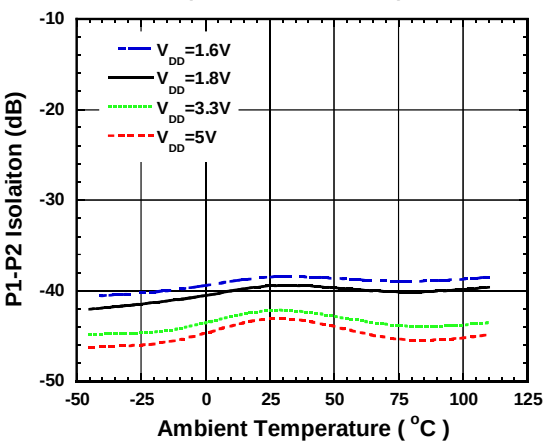

**Loss, Isolation vs. Temperature**

**( PC-P1 ON, f=5.9GHz )**



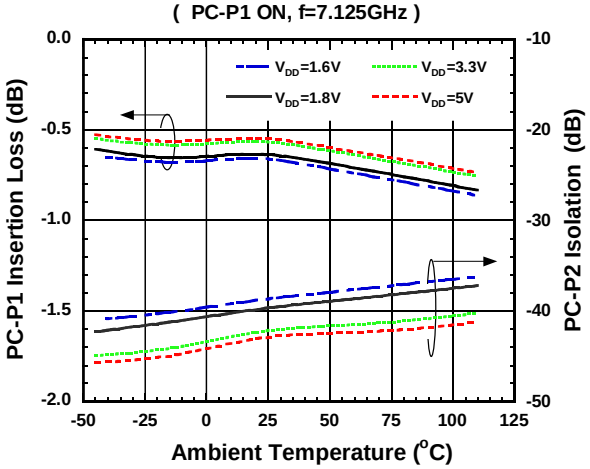

**P1-P2 Isolation vs. Temperature**

**( PC-P1 ON, f=5.9GHz )**



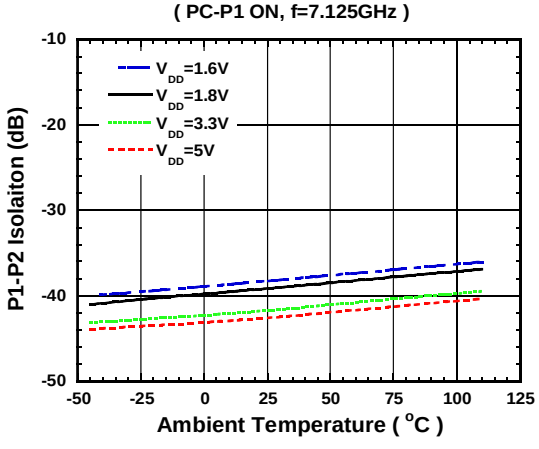

**Loss, Isolation vs. Temperature**

**( PC-P1 ON, f=7.125GHz )**



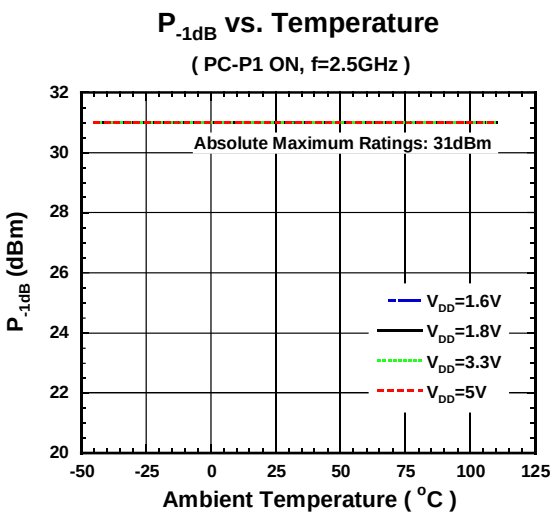

**P1-P2 Isolation vs. Temperature**

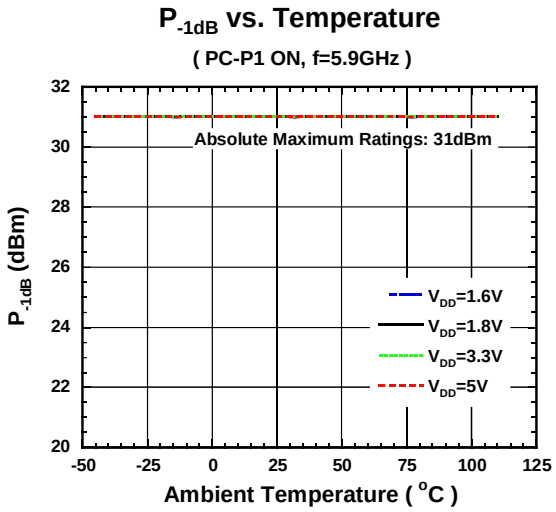
**( PC-P1 ON, f=7.125GHz )**

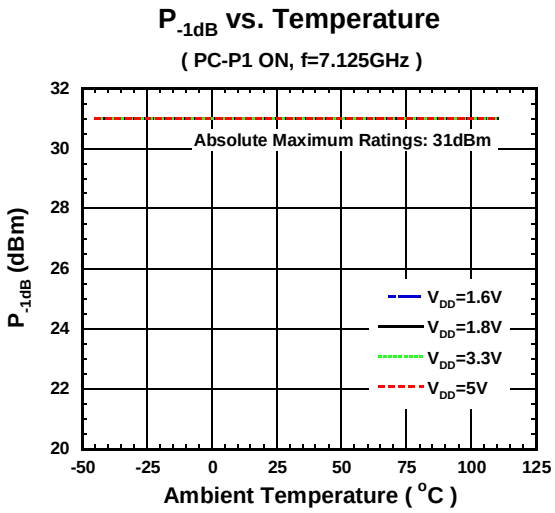


## ■ TYPICAL CHARACTERISTICS

General conditions: $Z_S = Z_I = 50\Omega$, with application circuit
(Typical Characteristics are intended to be used as reference data; they are not guaranteed.)

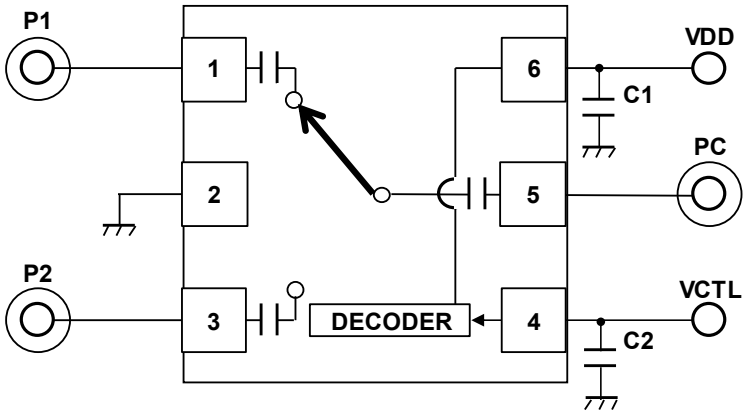


## ■ APPLICATION CIRCUIT

(Top View.)



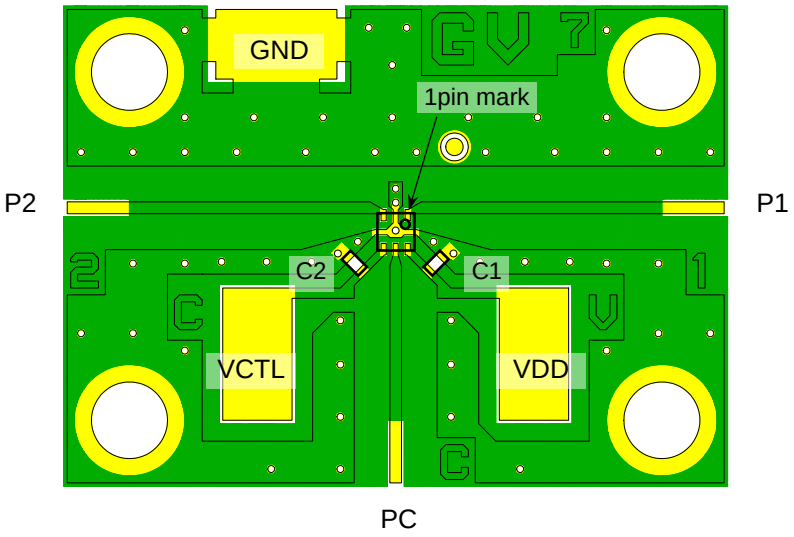

**NT1821GVAE1S Typical Application Circuit**

**<Parts list>**

| Part ID | Value | Notes |
|---|---|---|
| C1 | 1000 pF | GRM03 series (MURATA) |
| C2 | 10 pF | GRM03 series (MURATA) |

● **Evaluation / PCB Layout**

(TOP VIEW)



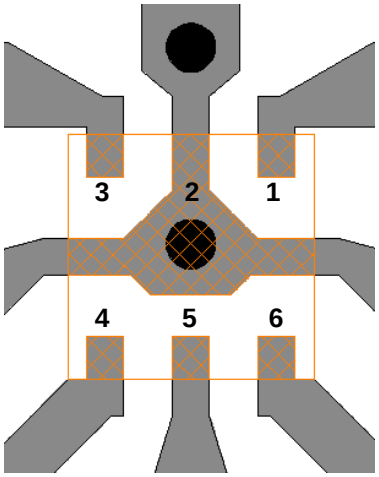

PCB: FR-4, t = 0.2 mm
Capacitor size: 0603 (0.6 x 0.3 mm)
Strip line width: 0.34 mm
PCB size: 19.4 x 14.0 mm
Through hole diameter: 0.2 mm

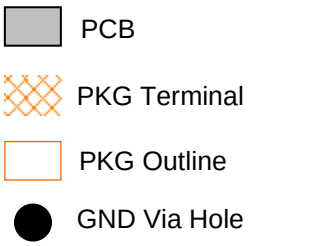
■ Loss of PCB and Connectors

| Frequency (GHz) | Loss (dB) |
|---|---|
| 2.5 | 0.34 |
| 5 | 0.60 |
| 6 | 0.70 |
| 7 | 0.80 |

● **PCB Layout Guideline**

(TOP VIEW)



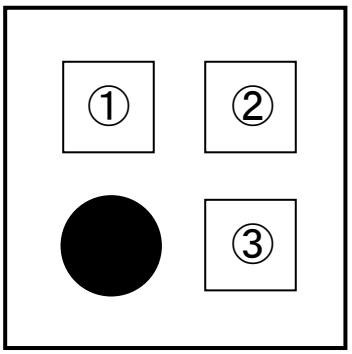

●**PRECAUTIONS**

For good RF performance, exposed pad should be connected to PCB ground plane as close as possible

## ■ MARKING SPECIFICATION

①, ②: Lot Number ⋯ Alphanumeric Serial Number

③: Product Code




**DFN1010-6-GV Marking Specification**

| NOTICE |
|---|
| There can be variation in the marking when different AOI (Automated Optical Inspection) equipment is used. In the case of recognizing the marking characteristic with AOI, please contact our sales or distributor before attempting to use AOI. |

**DFN1010-6-GV Marking List**

| Product Name | ③ |
|---|---|
| NT1821GVAE1S | 7 |

## ■ REVISION HISTORY

| Date | Revision | Changes |
|---|---|---|
| October 21, 2024 | Ver. 1.0 | Initial release |

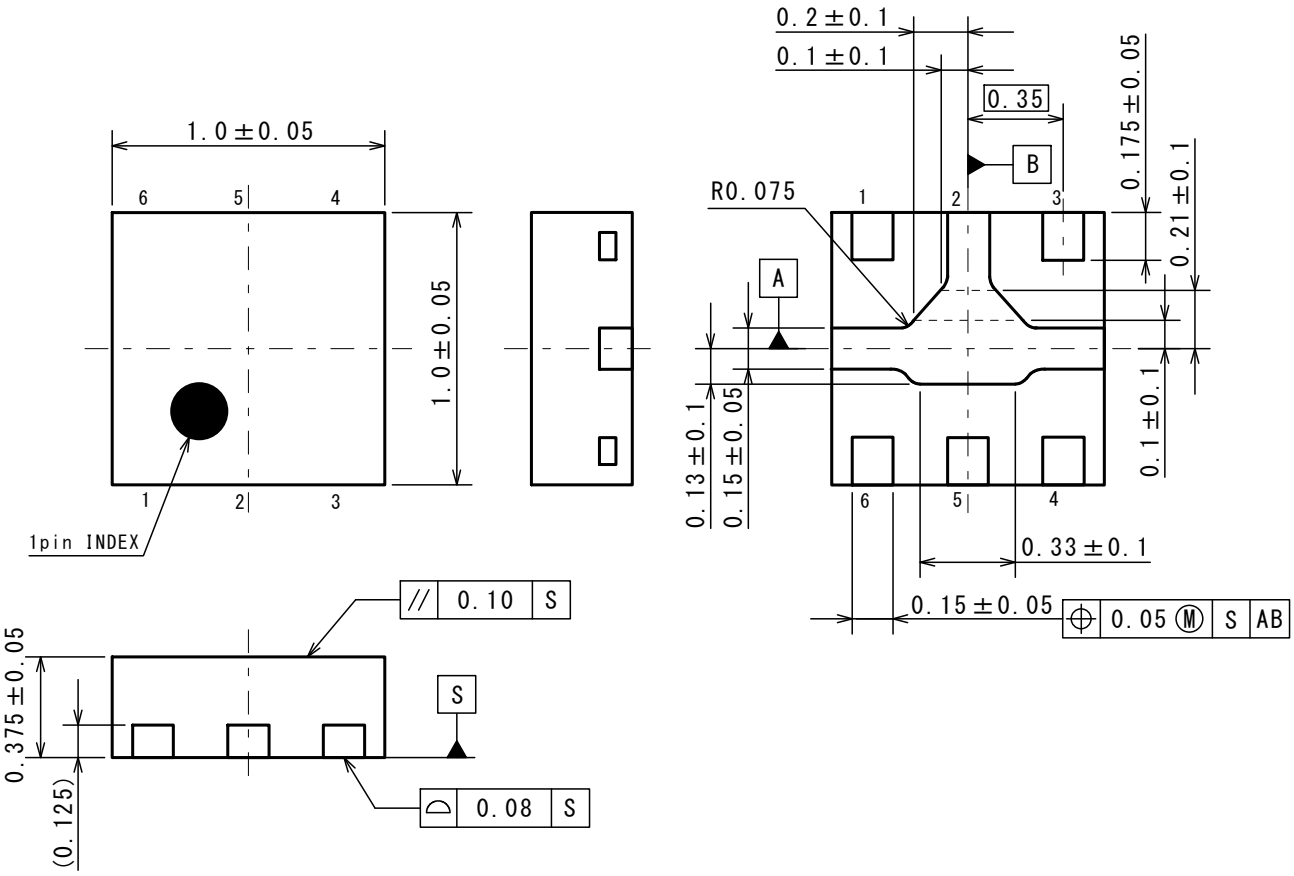
# Nisshinbo Micro Devices Inc.

DFN1010-6-GV

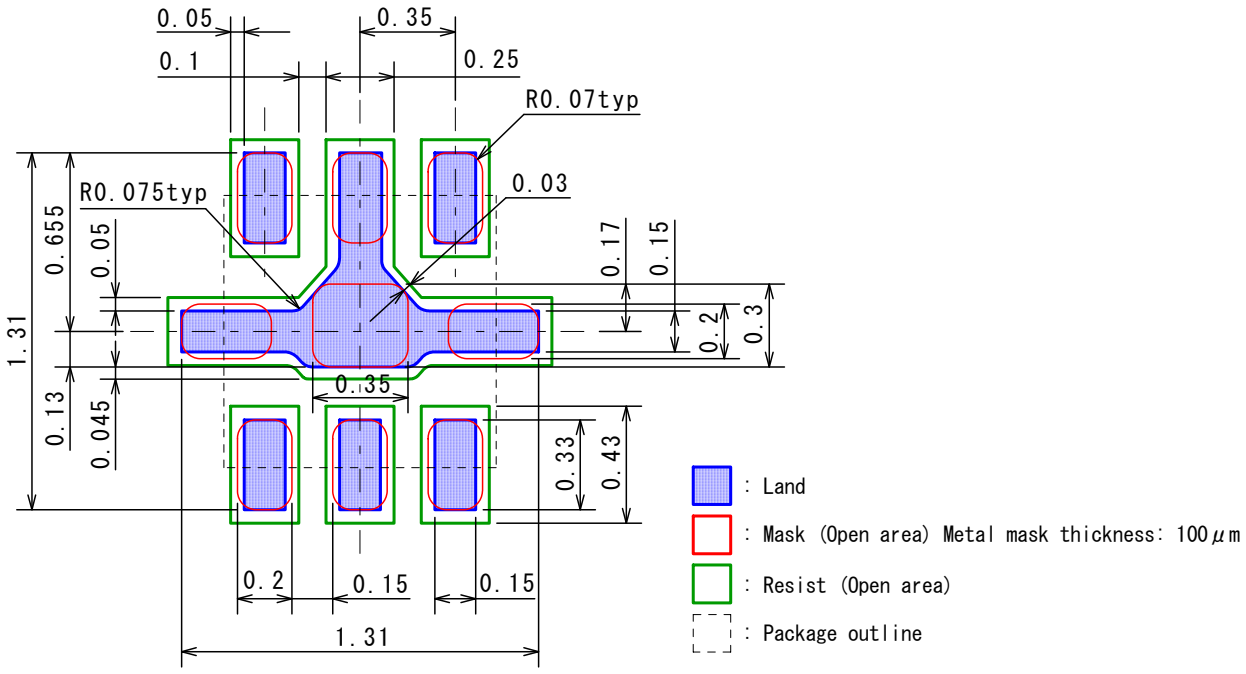
PI-DFN1010-6-GV-E-A

## ■ PACKAGE DIMENSIONS

UNIT: mm




## ■ EXAMPLE OF SOLDER PADS DIMENSIONS



**Nisshinbo Micro Devices Inc.**

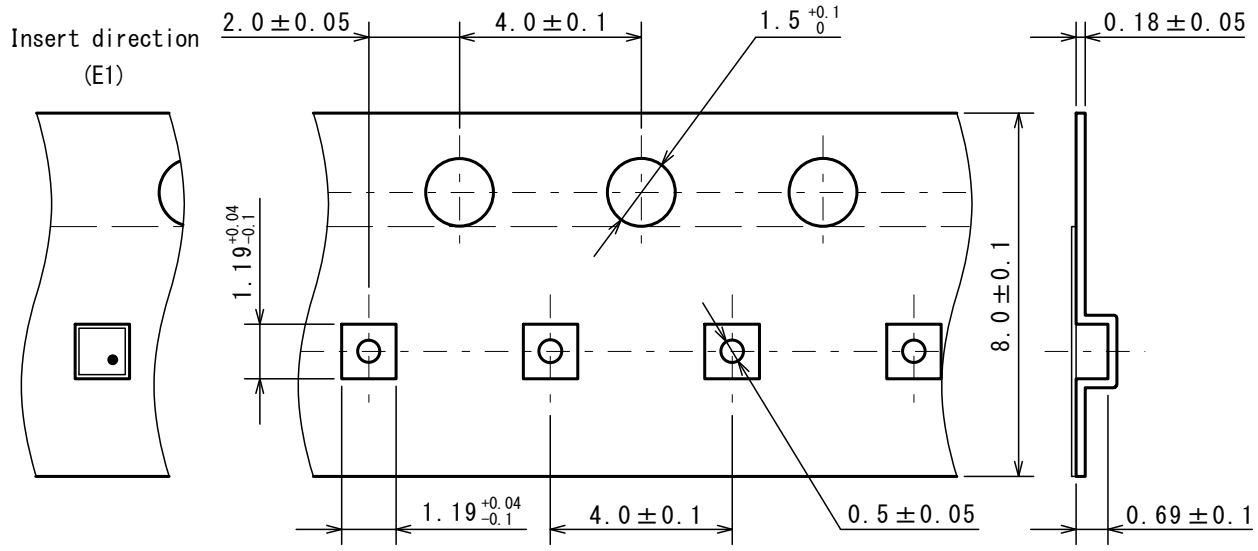
DFN1010-6-GV

PI-DFN1010-6-GV-E-A

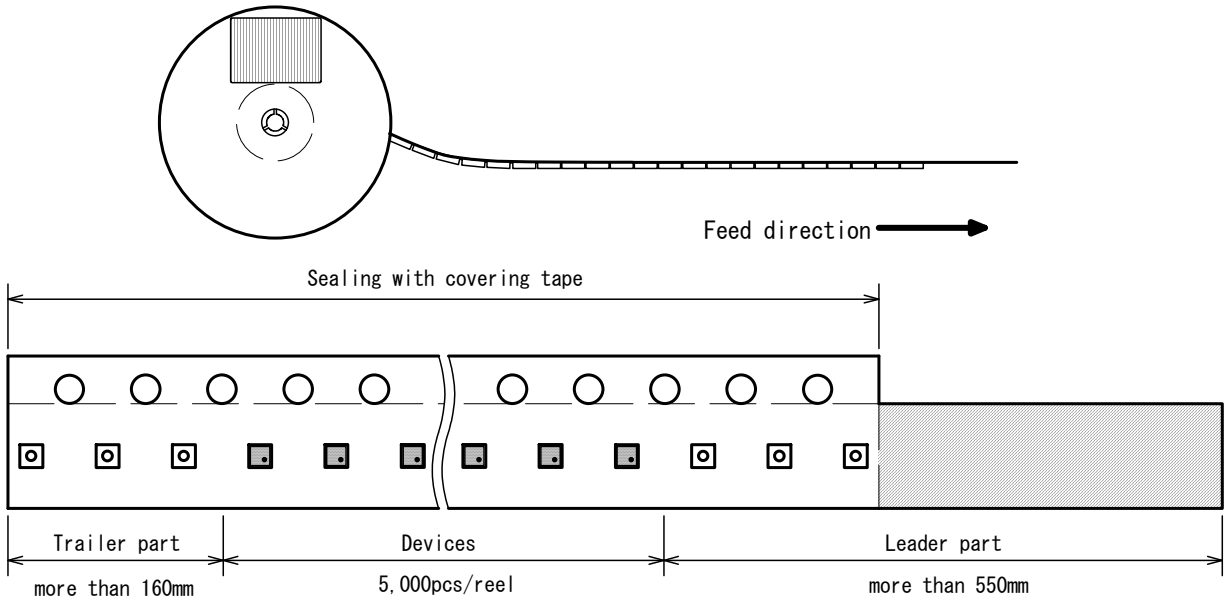
## ■ PACKING SPEC

UNIT: mm

(1) Taping dimensions / Insert direction

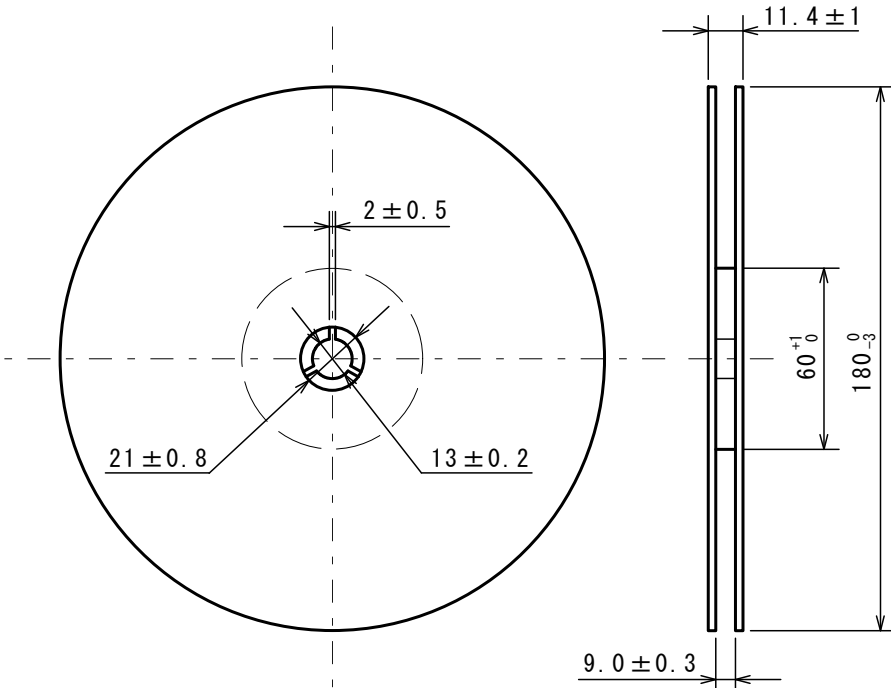



(2) Taping state

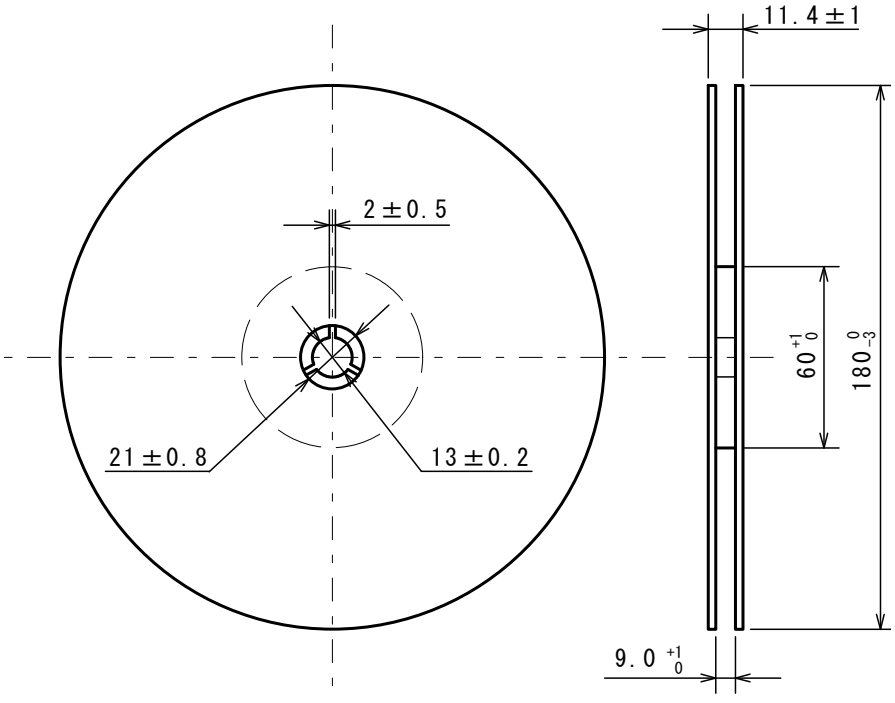


(3) Reel dimensions

Type1



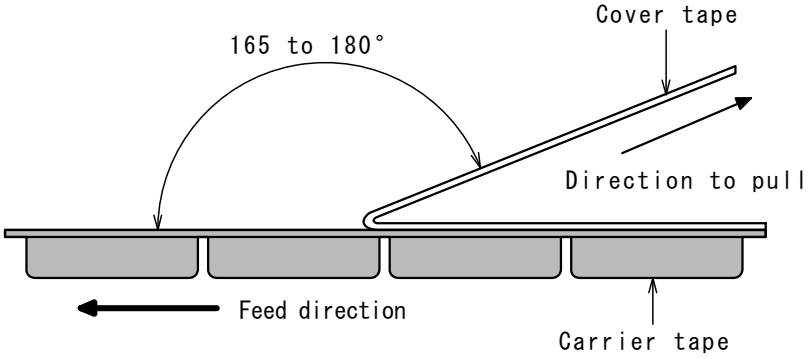

Type2



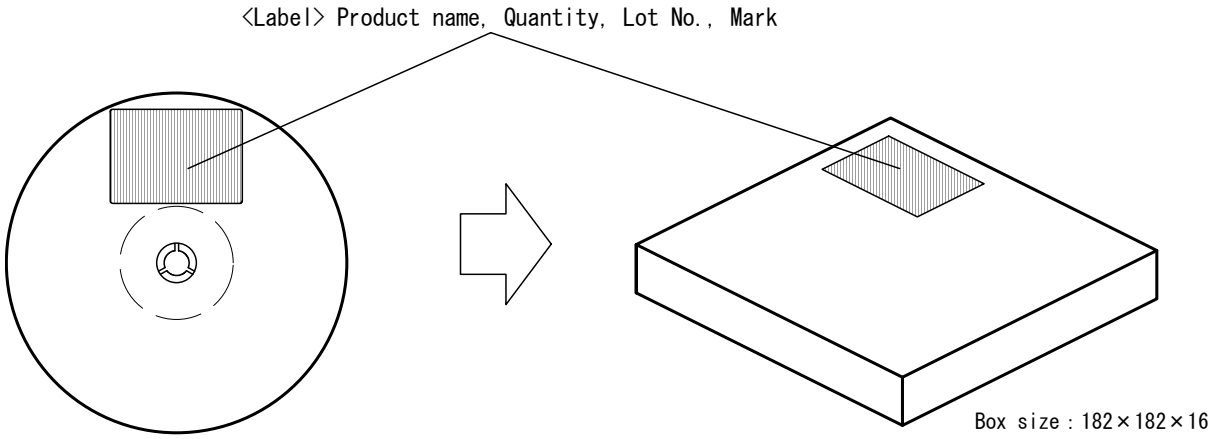
(4) Peeling strength

Peeling strength of cover tape

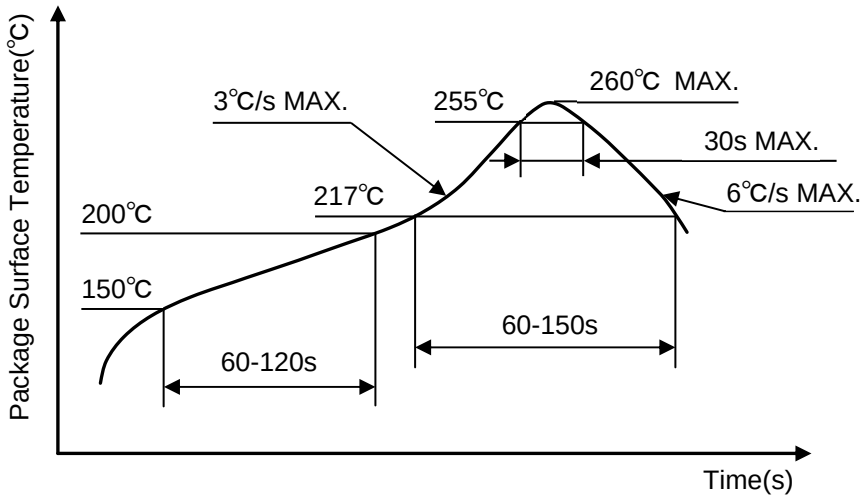
- Peeling angle 165 to 180° degrees to the taped surface.
- Peeling speed 300mm/min
- Peeling strength 0.1 to 1.0N




(5) Packing state



■ **HEAT-RESISTANCE PROFILES**




Reflow profile

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    - Fire Alarms / Intruder Detectors
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    - Various Safety Devices
    - Traffic control system
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    In the case of a product purchased through an authorized distributor or directly from us, the warranty period for this product shall be one (1) year after delivery to your company. For defective products that occurred during this period, we will take the quality warranty measures described in section 8-2. However, if there is an agreement on the warranty period in the basic transaction agreement, quality assurance agreement, delivery specifications, etc., it shall be followed.
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    When it has been proved defective due to manufacturing factors as a result of defect analysis by us, we will either deliver a substitute for the defective product or refund the purchase price of the defective product.
    Note that such delivery or refund is sole and exclusive remedies to your company for the defective product.
    8-3. Remedies after Quality Warranty Period
    With respect to any defect of this product found after the quality warranty period, the defect will be analyzed by us. On the basis of the defect analysis results, the scope and amounts of damage shall be determined by mutual agreement of both parties. Then we will deal with upper limit in Section 8-2. This provision is not intended to limit any legal rights of your company.
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