

## 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.

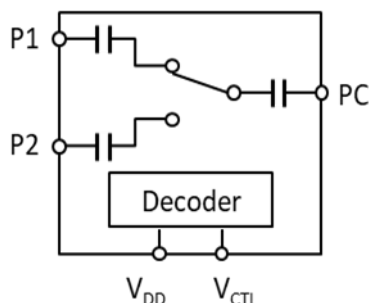
The NT1821 features high isolation between RF terminals around 40 dB in high frequency up to 7.125 GHz. It achieves low insertion loss and high linearity for 1.8 V low operating voltage, and 1.2 V low control voltage.

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 x 1.0 x 0.38 (mm)

#### BLOCK DIAGRAM



## ■ PRODUCT NAME INFORMATION

**NT1821 GV A E1 S**

Description of configuration

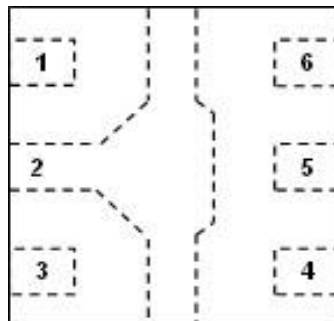
Composition	Item	Description
GV	Package code	Indicates the package. Refer to the order information.
A	Version	Indicates the product version. "A" is initial version.
E1	Packing	Refer to the packing specifications.
S	Grade	Indicates the quality grade. "S" means general-purpose and consumer application.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

## ■ 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:  $T_a = +25^{\circ}\text{C}$ ,  $Z_s = Z_l = 50\ \Omega$ 

	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	$^{\circ}\text{C}$
Storage temperature range	$T_{stg}$	-55 to +150	$^{\circ}\text{C}$

<sup>\*1</sup>  $V_{DD} = 1.8\text{ V}$ , ON port<sup>\*2</sup> 4-layer FR4 PCB with through-hole (76.2 x 114.3mm),  $T_j = +150^{\circ}\text{C}$ 

## 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.

<sup>\*3</sup> 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 ( $\theta_{ja}$ )	$\theta_{ja} = 328\ ^{\circ}\text{C/W}$

$\theta_{ja}$ : Junction-to-Ambient Thermal Resistance

## ■ ELECTROSTATIC DISCHARGE RATINGS

	Conditions	Protection Voltage
HBM	$C = 100\text{pF}$ , $R = 1.5\text{k}\Omega$	$\pm 2000\text{V}$
CDM	Field Induced CDM	$\pm 1000\text{V}$

## ELECTROSTATIC DISCHARGE RATINGS

The electrostatic discharge tests are done based on JEDEC JS-001 and JS-002.  
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:  $T_a = +25^{\circ}\text{C}$ ,  $Z_s = Z_l = 50\ \Omega$ 

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, $V_{DD} = 1.8\text{ V}$	-	20	40	$\mu\text{A}$
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	$I_{CTL}$	$V_{CTL(H)} = 1.2\text{ V}$	-	4	10	$\mu\text{A}$

## ■ ELECTRICAL CHARACTERISTICS 2 (RF)

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

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

## ■ ELECTRICAL CHARACTERISTICS 3 (RF)

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

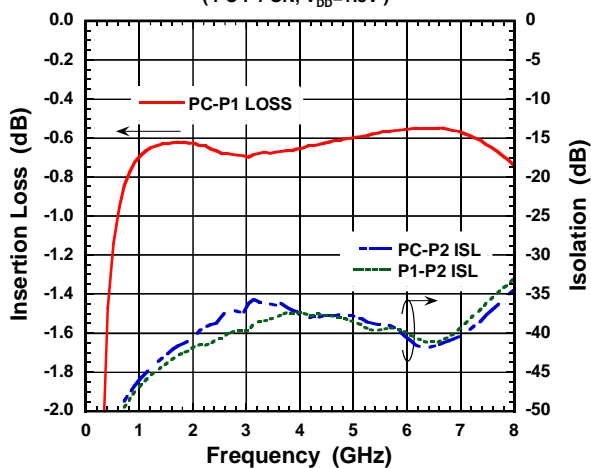
Parameter	Symbol	Conditions	MIN	TYP	MAX	Unit
Insertion loss	LOSS	$f = 2.4\text{ to }2.5\text{ GHz}$	-	0.55	-	dB
		$f = 4.9\text{ to }5.9\text{ GHz}$	-	0.45	-	
		$f = 5.9\text{ to }7.125\text{ GHz}$	-	0.52	-	
Isolation (PC-P1/PC-P2)	ISL1	$f = 2.4\text{ to }2.5\text{ GHz}$	-	41	-	dB
		$f = 4.9\text{ to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

## ■ TYPICAL CHARACTERISTICS

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

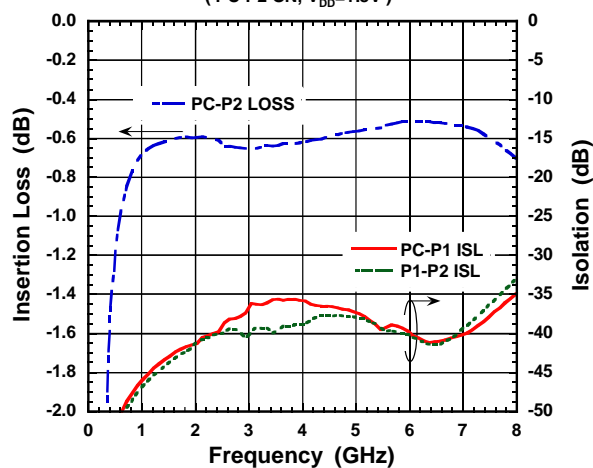
### Loss, Isolation vs Frequency

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



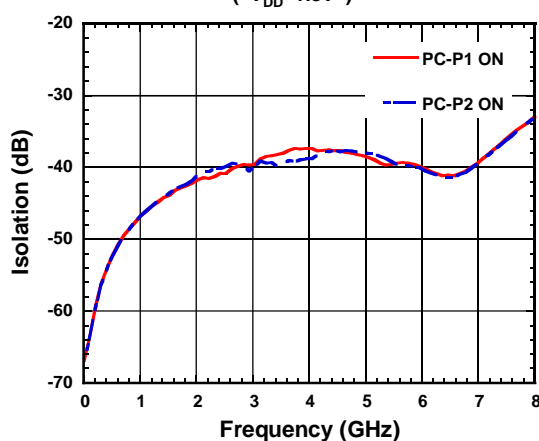
### Loss, Isolation vs Frequency

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



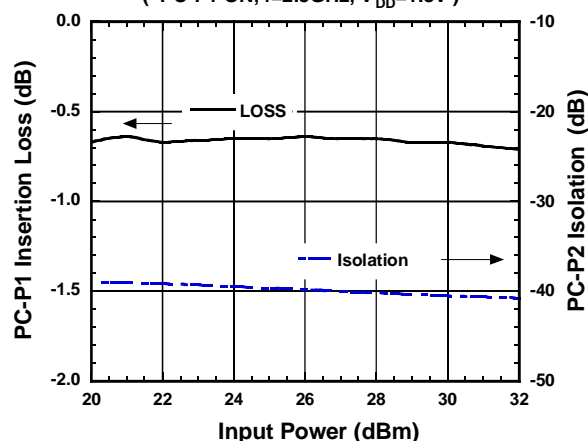
### P1-P2 Isolation vs. Frequency

( $V_{DD}=1.8\text{ V}$ )



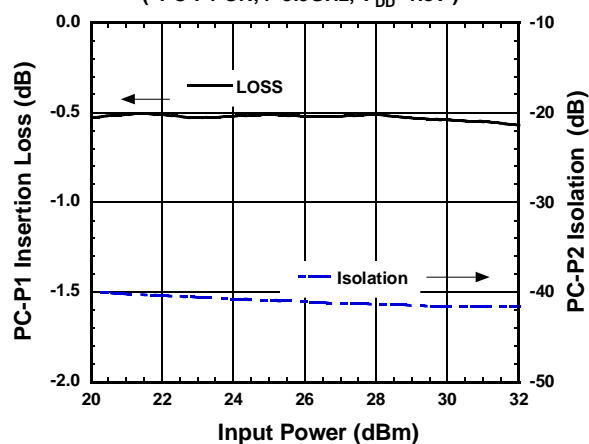
### Loss, Isolation vs. Input Power

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



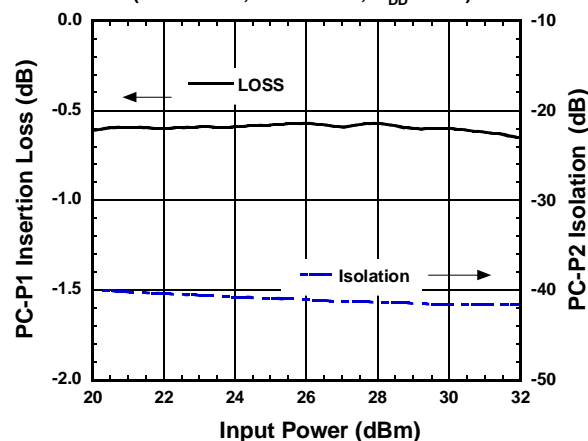
### Loss, Isolation vs. Input Power

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



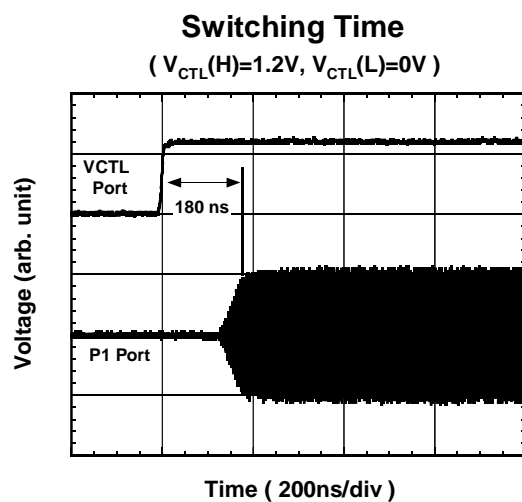
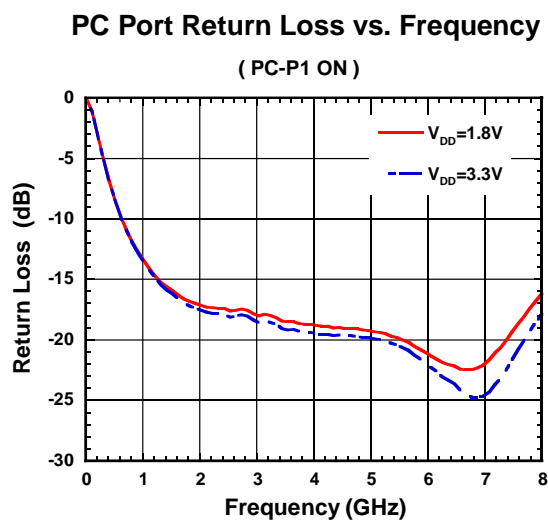
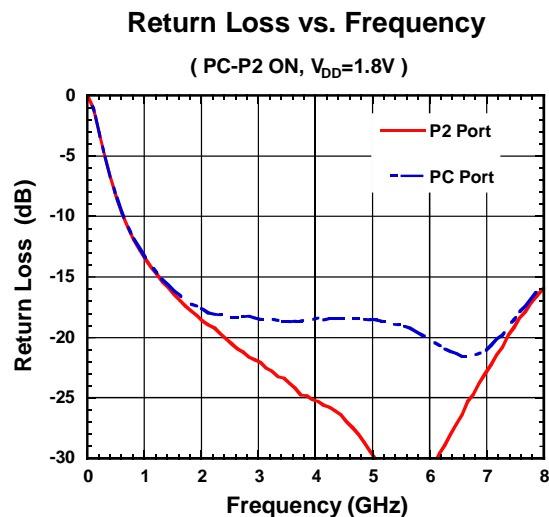
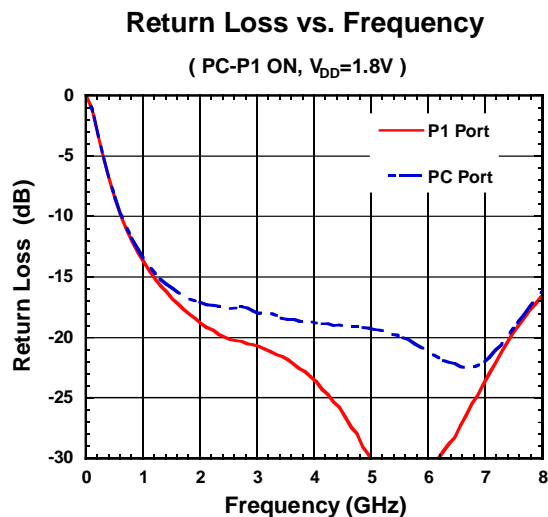
### Loss, Isolation vs. Input Power

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



## ■ TYPICAL CHARACTERISTICS

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





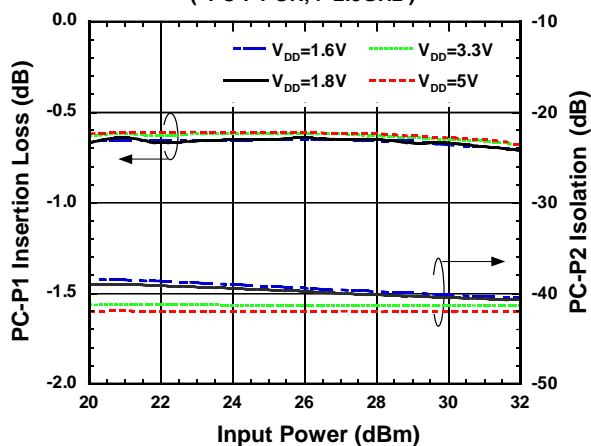
## ■ TYPICAL CHARACTERISTICS

General conditions:  $T_a = +25^\circ\text{C}$ ,  $Z_s = Z_L = 50\Omega$ , with application circuit

(Typical Characteristics are intended to be used as reference data; they are not guaranteed.)

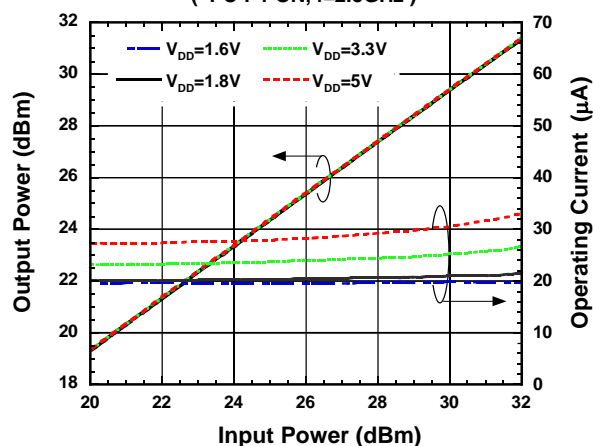
Loss, Isolation vs. Input Power

( PC-P1 ON,  $f=2.5\text{GHz}$  )



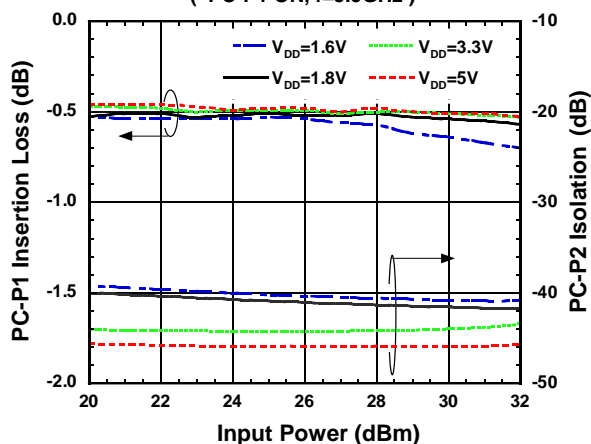
Output Power,  $I_{DD}$  vs. Input Power

( PC-P1 ON,  $f=2.5\text{GHz}$  )



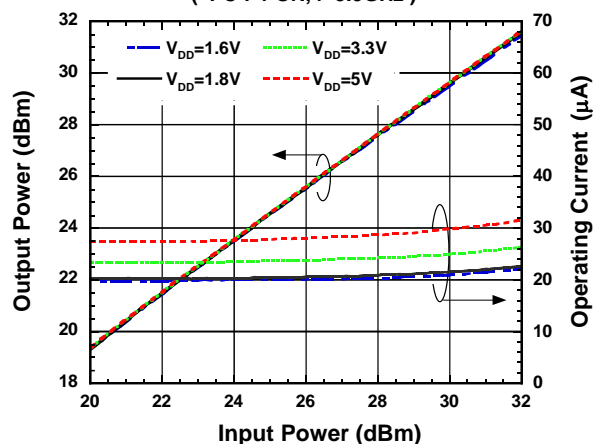
Loss, Isolation vs. Input Power

( PC-P1 ON,  $f=5.9\text{GHz}$  )



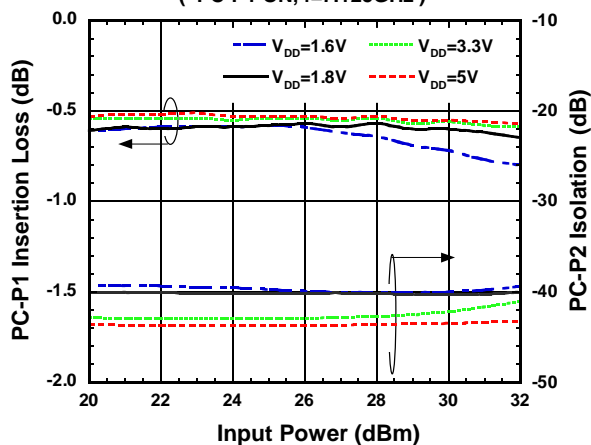
Output Power,  $I_{DD}$  vs. Input Power

( PC-P1 ON,  $f=5.9\text{GHz}$  )



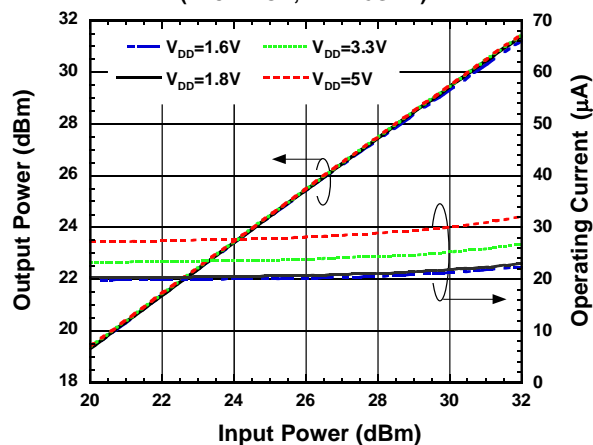
Loss, Isolation vs. Input Power

( PC-P1 ON,  $f=7.125\text{GHz}$  )



Output Power,  $I_{DD}$  vs. Input Power

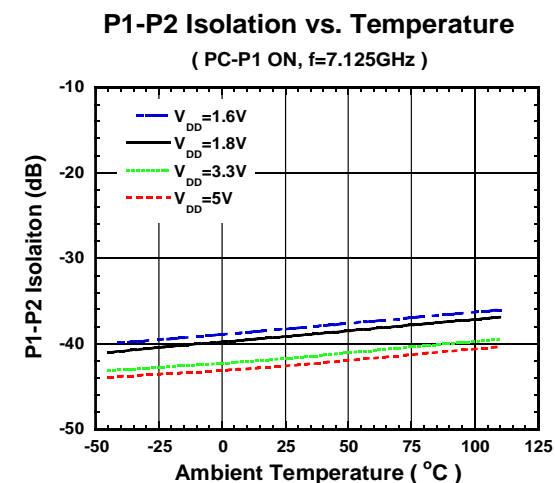
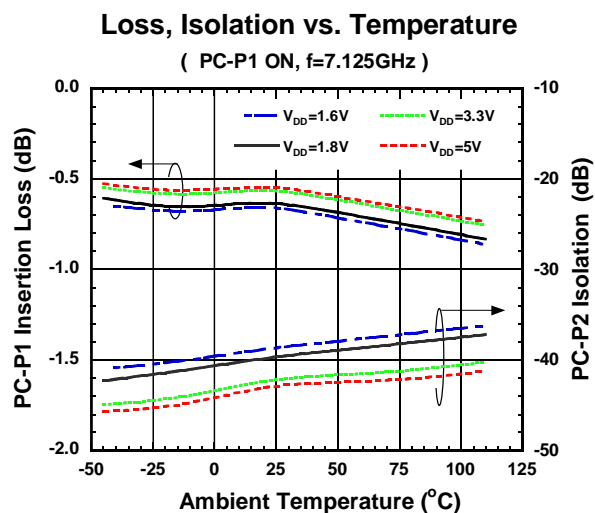
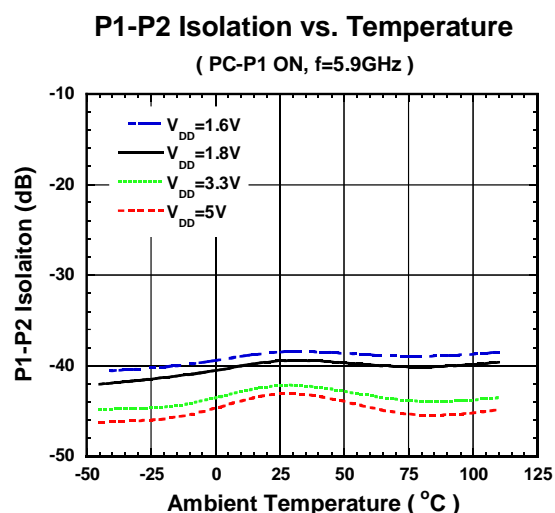
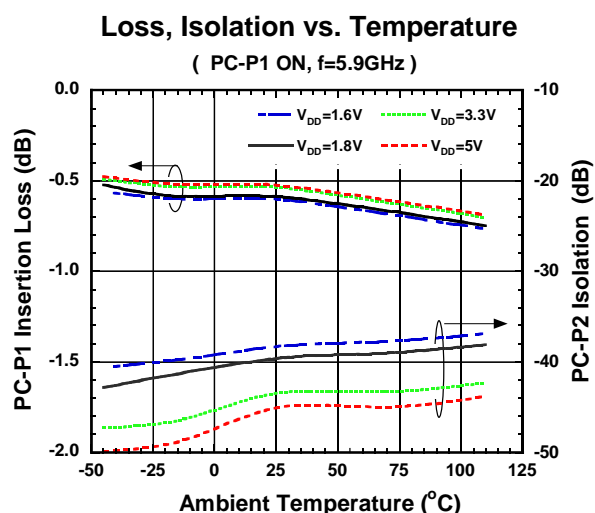
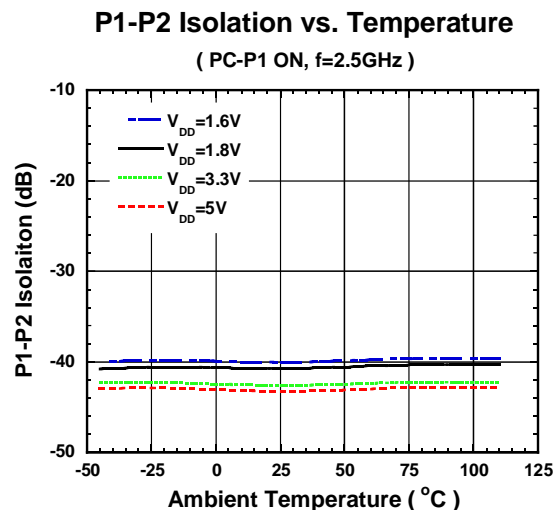
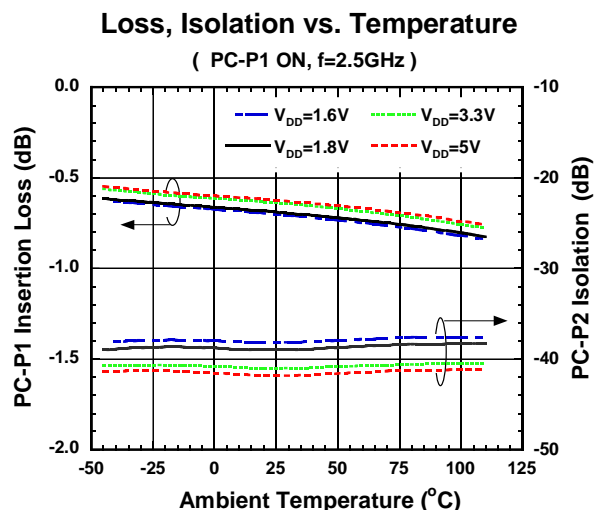
( PC-P1 ON,  $f=7.125\text{GHz}$  )



## ■ TYPICAL CHARACTERISTICS

General conditions:  $Z_s = Z_l = 50\Omega$ , with application circuit

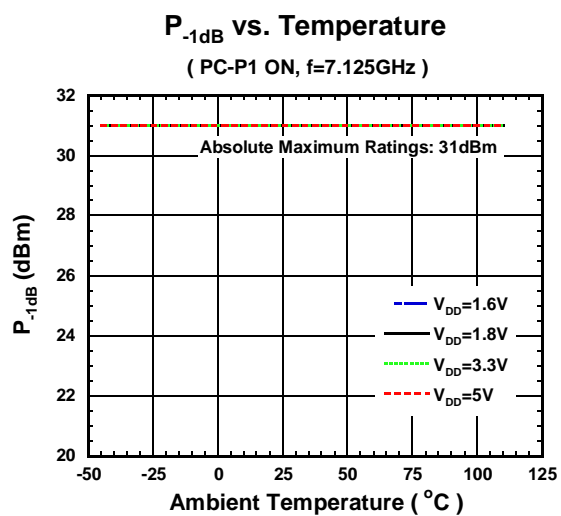
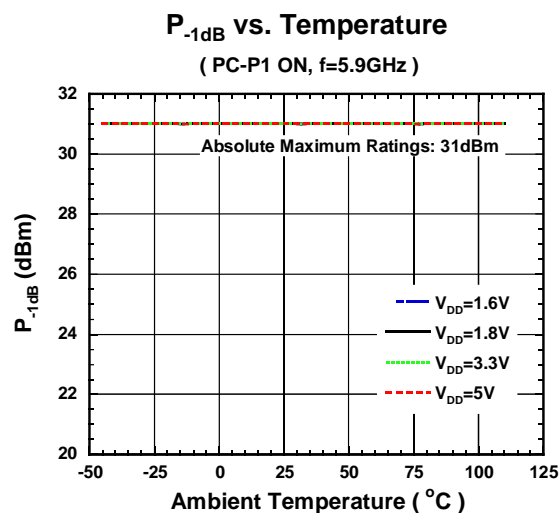
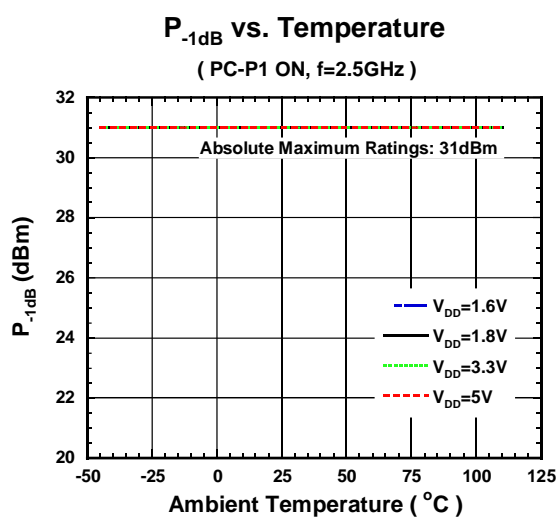
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## ■ TYPICAL CHARACTERISTICS

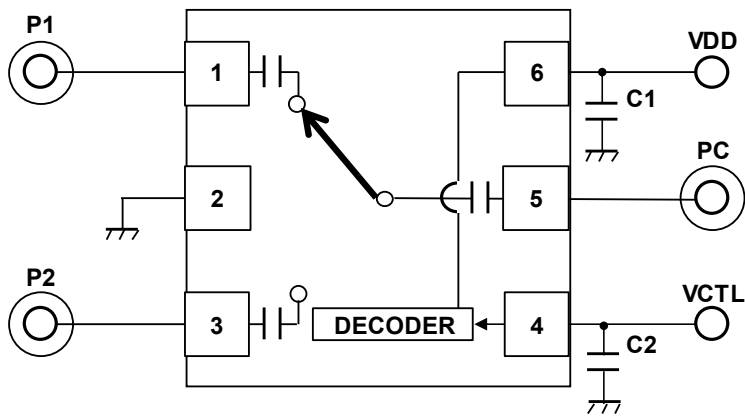
General conditions:  $Z_s = Z_L = 50\Omega$ , with application circuit

(Typical Characteristics are intended to be used as reference data; they are not guaranteed.)



■ APPLICATION CIRCUIT

(Top View.)



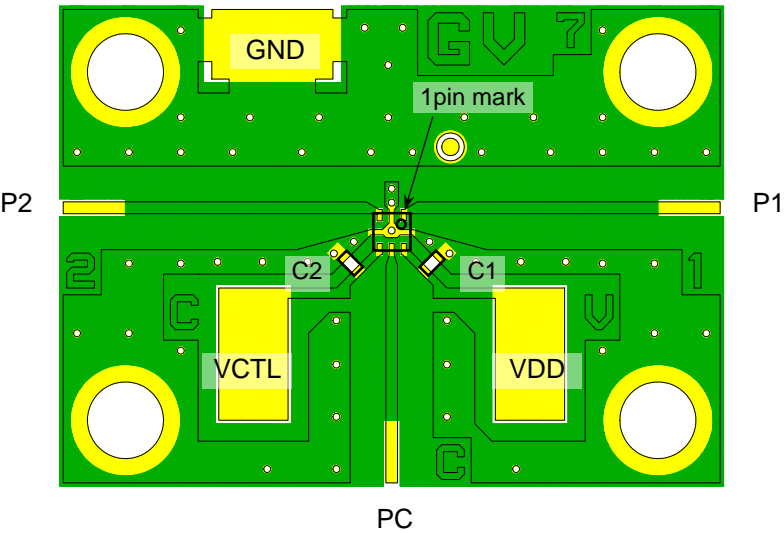
NT1821GVAE1S Typical Application Circuit

<Parts list>

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

● Evaluation / PCB Layout

(TOP VIEW)



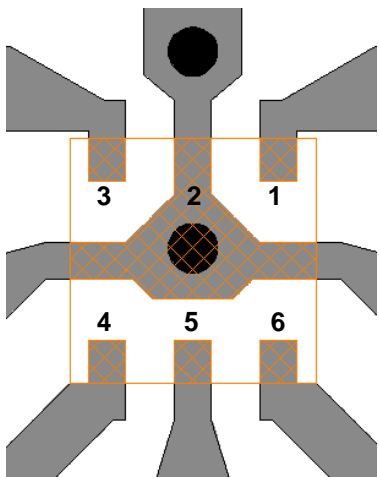
PCB: FR-4, t = 0.2 mm  
Capacitor size: 0603 (0.6 x 0.3 mm)  
Strip line width: 0.34 mm  
PCB size: 19.4 x 14.0 mm  
Through hole diameter: 0.2 mm

■ 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)



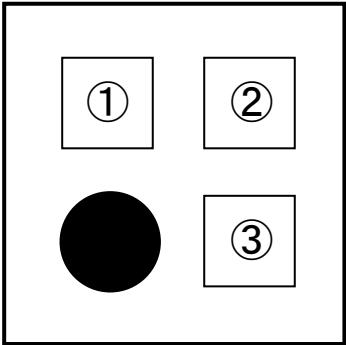
- PCB
- PKG Terminal
- PKG Outline
- GND Via Hole  
Diameter  $\phi = 0.2$  mm

● 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

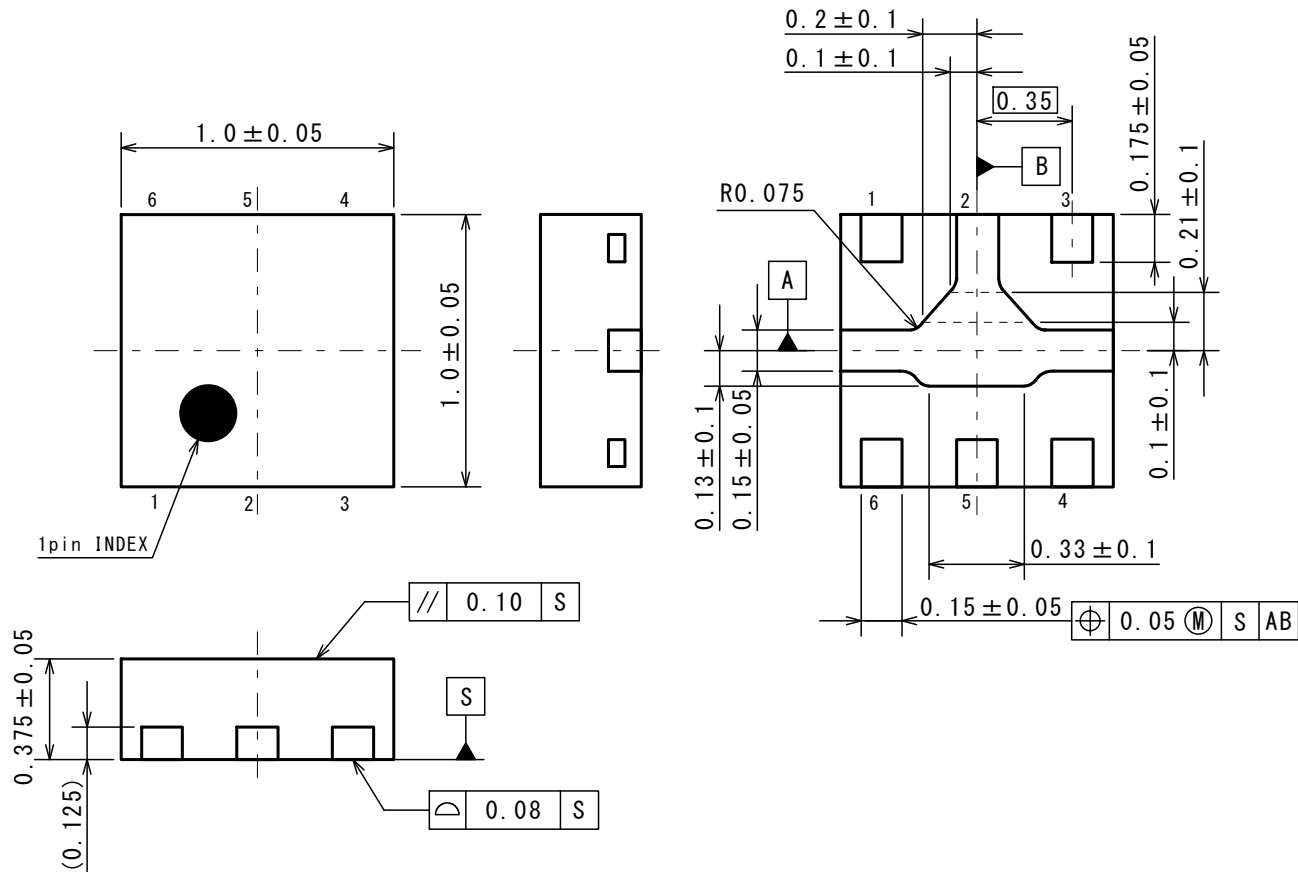
Product Name	③
NT1821GVAE1S	7

■ REVISION HISTORY

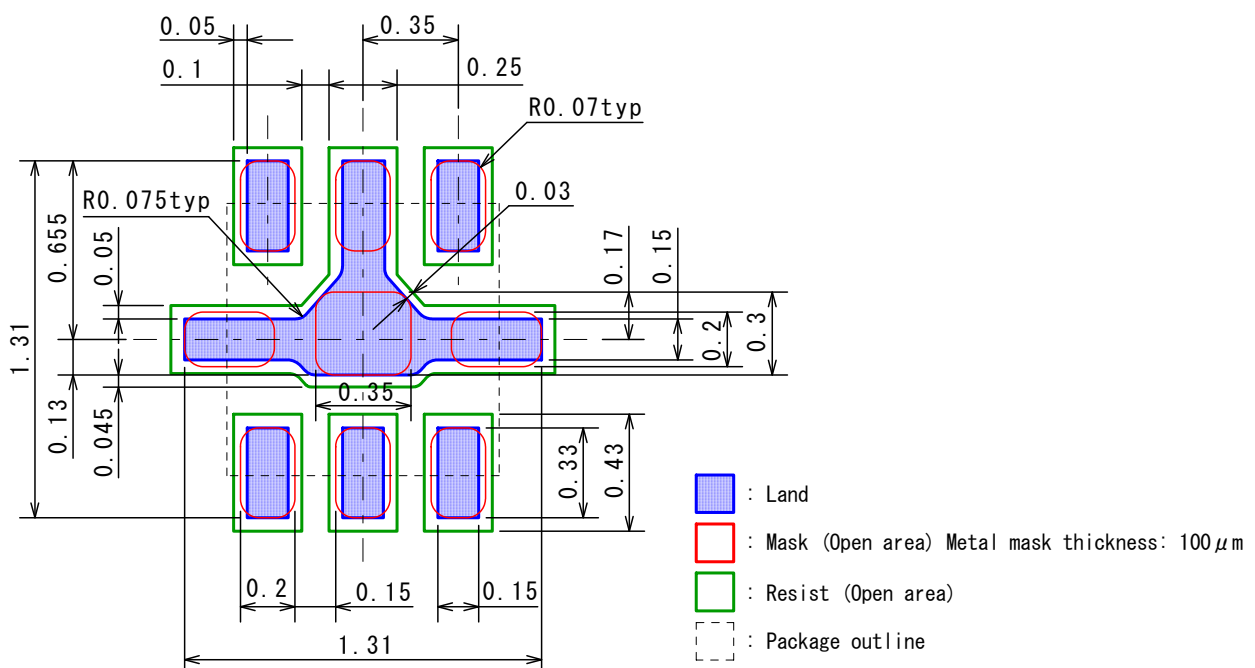
Date	Revision	Changes
October 21, 2024	Ver. 1.0	Initial release

## ■ PACKAGE DIMENSIONS

UNIT: mm



## ■ EXAMPLE OF SOLDER PADS DIMENSIONS





## Nisshinbo Micro Devices Inc.

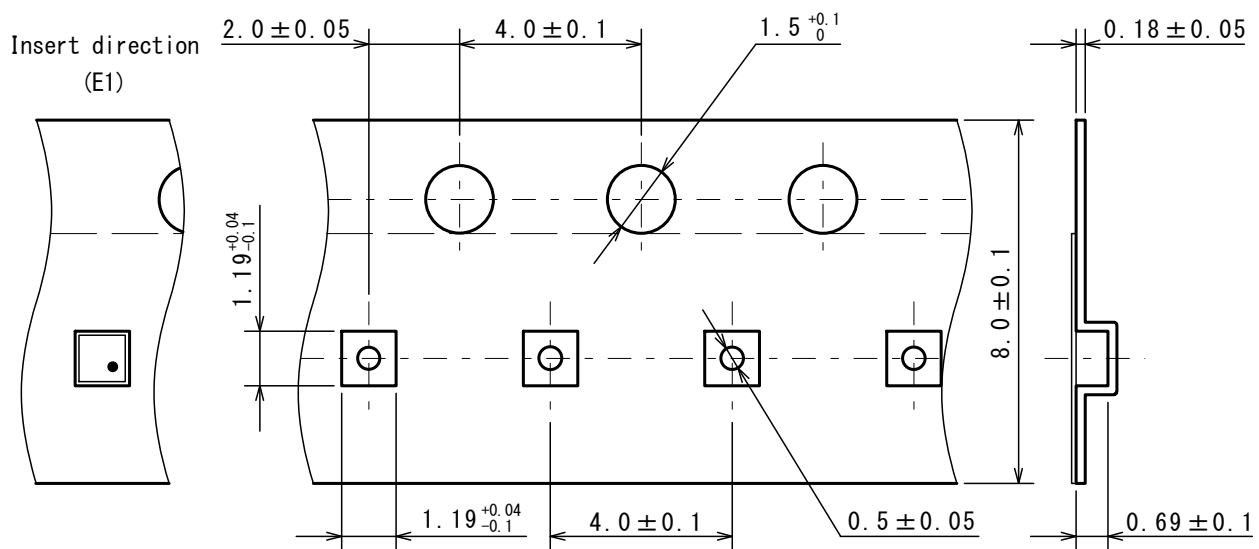
DFN1010-6-GV

PI-DFN1010-6-GV-E-A

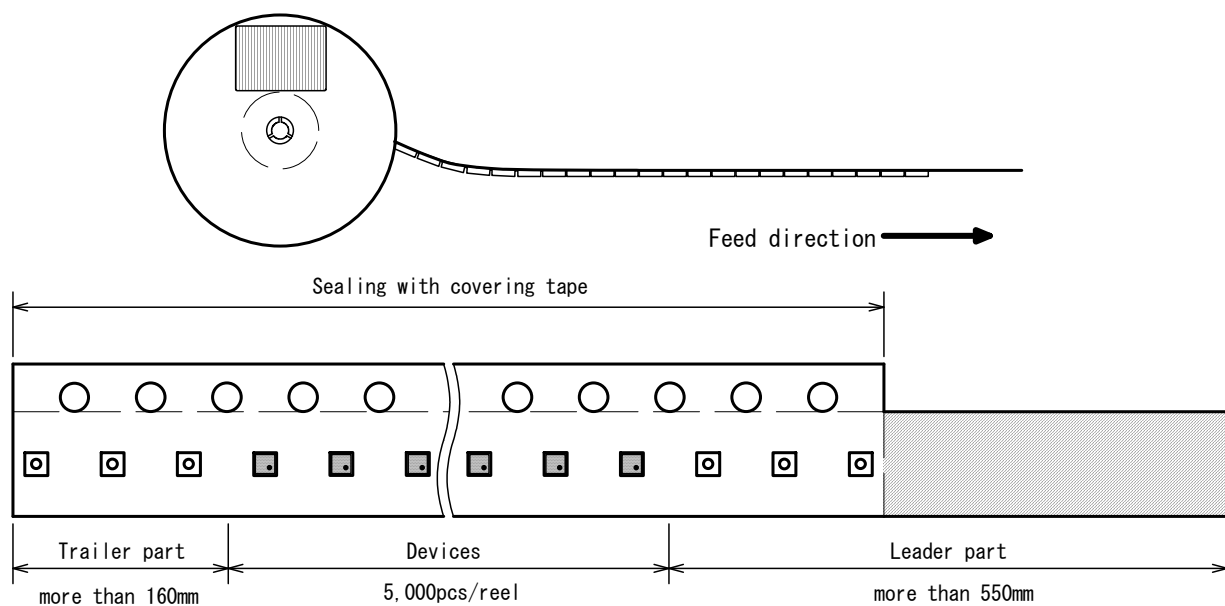
## ■ PACKING SPEC

UNIT: mm

## (1) Taping dimensions / Insert direction

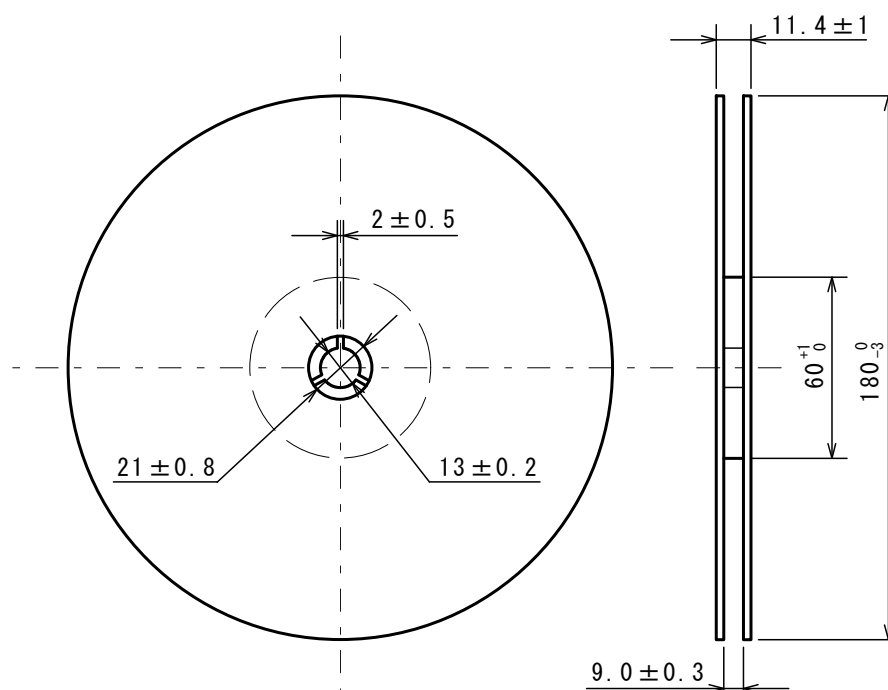


## (2) Taping state

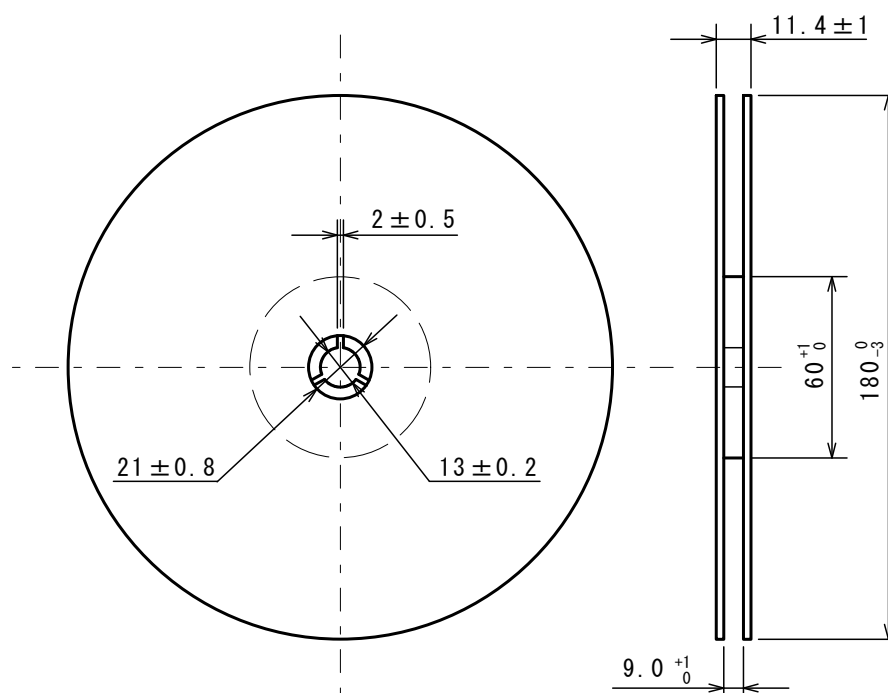


## (3) Reel dimensions

## Type1



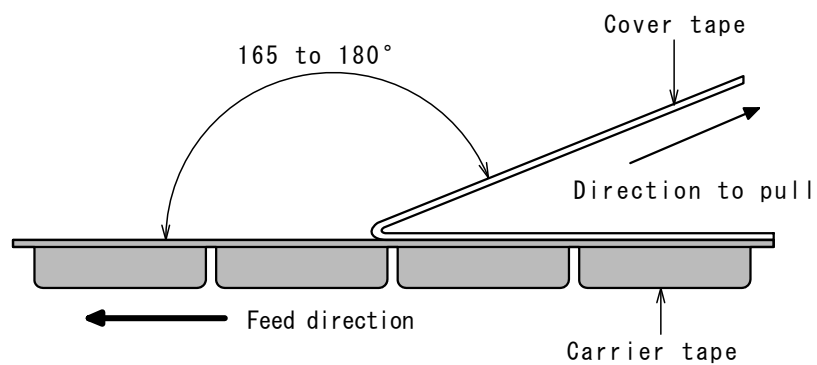
## Type2



## (4) Peeling strength

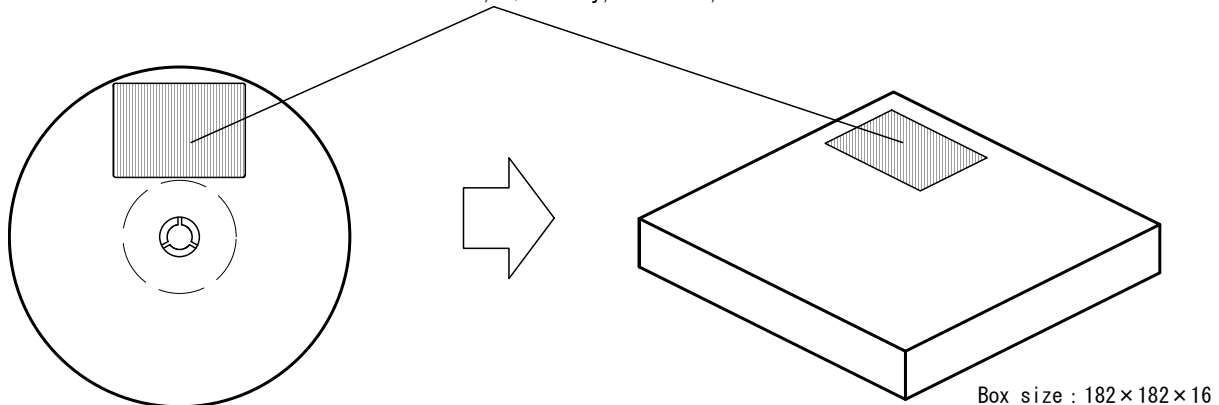
Peeling strength of cover tape

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

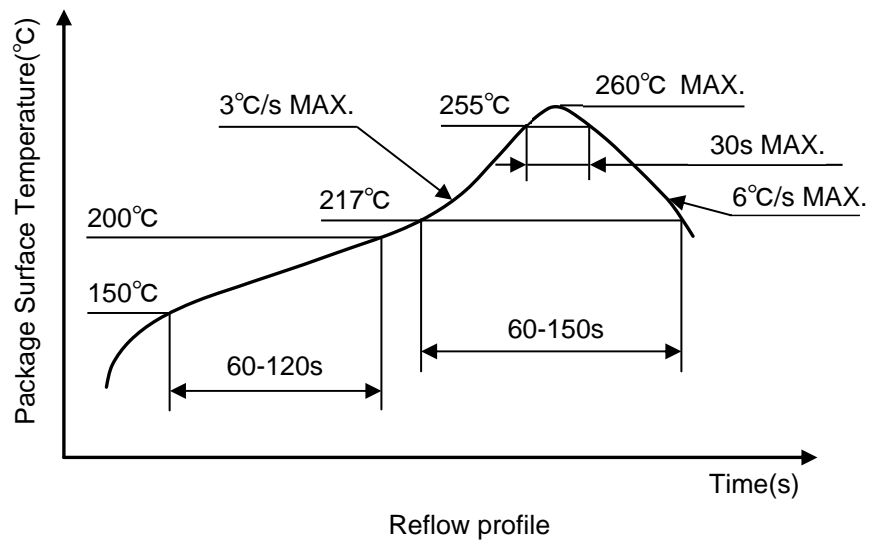


## (5) Packing state

&lt;Label&gt; Product name, Quantity, Lot No., Mark



## ■ HEAT-RESISTANCE PROFILES



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3. This product and any technical information relating thereto are subject to complementary export controls (so-called KNOW controls) under the Foreign Exchange and Foreign Trade Law, and related politics ministerial ordinance of the law. (Note that the complementary export controls are inapplicable to any application-specific products, except rockets and pilotless aircraft, that are insusceptible to design or program changes.) Accordingly, when exporting or carrying abroad this product, follow the Foreign Exchange and Foreign Trade Control Law and its related regulations with respect to the complementary export controls.
4. The technical information described in this document shows typical characteristics and example application circuits for the products. The release of such information is not to be construed as a warranty of or a grant of license under our or any third party's intellectual property rights or any other rights.
5. The products listed in this document are intended and designed for use as general electronic components in standard applications (office equipment, telecommunication equipment, measuring instruments, consumer electronic products, amusement equipment etc.). Those customers intending to use a product in an application requiring extreme quality and reliability, for example, in a highly specific application where the failure or misoperation of the product could result in human injury or death should first contact us.
  - Aerospace Equipment
  - Equipment Used in the Deep Sea
  - Power Generator Control Equipment (nuclear, steam, hydraulic, etc.)
  - Life Maintenance Medical Equipment
  - Fire Alarms / Intruder Detectors
  - Vehicle Control Equipment (automotive, airplane, railroad, ship, etc.)
  - Various Safety Devices
  - Traffic control system
  - Combustion equipment

In case your company desires to use this product for any applications other than general electronic equipment mentioned above, make sure to contact our company in advance. Note that the important requirements mentioned in this section are not applicable to cases where operation requirements such as application conditions are confirmed by our company in writing after consultation with your company.

6. We are making our continuous effort to improve the quality and reliability of our products, but semiconductor products are likely to fail with certain probability. In order to prevent any injury to persons or damages to property resulting from such failure, customers should be careful enough to incorporate safety measures in their design, such as redundancy feature, fire containment feature and fail-safe feature. We do not assume any liability or responsibility for any loss or damage arising from misuse or inappropriate use of the products.
7. The products have been designed and tested to function within controlled environmental conditions. Do not use products under conditions that deviate from methods or applications specified in this datasheet. Failure to employ the products in the proper applications can lead to deterioration, destruction or failure of the products. We shall not be responsible for any bodily injury, fires or accident, property damage or any consequential damages resulting from misuse or misapplication of the products.
8. **Quality Warranty**
  - 8-1. **Quality Warranty Period**  
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.
  - 8-2. **Quality Warranty Remedies**  
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.
9. Anti-radiation design is not implemented in the products described in this document.
10. The X-ray exposure can influence functions and characteristics of the products. Confirm the product functions and characteristics in the evaluation stage.
11. WLCSP products should be used in light shielded environments. The light exposure can influence functions and characteristics of the products under operation or storage.
12. Warning for handling Gallium and Arsenic (GaAs) products (Applying to GaAs MMIC, Photo Reflector). These products use Gallium (Ga) and Arsenic (As) which are specified as poisonous chemicals by law. For the prevention of a hazard, do not burn, destroy, or process chemically to make them as gas or power. When the product is disposed of, please follow the related regulation and do not mix this with general industrial waste or household waste.
13. Please contact our sales representatives should you have any questions or comments concerning the products or the technical information.



**Nisshinbo Micro Devices Inc.**

**Official website**

<https://www.nisshinbo-microdevices.co.jp/en/>

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