

NT1819NAAE2S

Absorptive High Isolation SPDT Switch

FEATURES

- Operation voltage: 3.3 V typ. (2.5 to 5.0 V)
- Low control voltage: 1.8 V typ.
- Low insertion loss:
0.70/0.80/0.85/0.90/1.2 dB typ.
@0.7/3.85/4.7/6.0/7.125 GHz
- High isolation:
70/62/60/55/51 dB typ.
@0.7/3.85/4.7/6.0/7.125 GHz, PC-P1/P2
70/61/60/58/55 dB typ.
@0.7/3.85/4.7/6.0/7.125 GHz, P1-P2
- High linearity: $P_{-0.1\text{dB}} = +31\text{ dBm}$ typ.
- Switching time: 250 ns typ.
- Small package: 3.0 x 3.0 mm typ.
- Frequency range: 0.2 to 7.125 GHz
- Operation current: 200 μA typ.
- No DC blocking capacitor requirement unless external DC bias
- RoHS compliant, Halogen free, MSL1

APPLICATIONS

- Cellular base transceiver station (small/macro cell, etc.)
- Other wireless communication applications

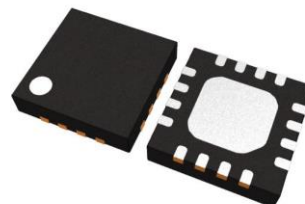
GENERAL DESCRIPTION

The NT1819NAAE2S is an absorptive high isolation SPDT switch suitable for 5G cellular infrastructure and so on.

This switch features high isolation characteristics between RF terminals and achieves 60 dB isolation at 3.85 GHz and 50 dB isolation at 7.125 GHz. It is available for various applications needed high isolation between circuits or devices.

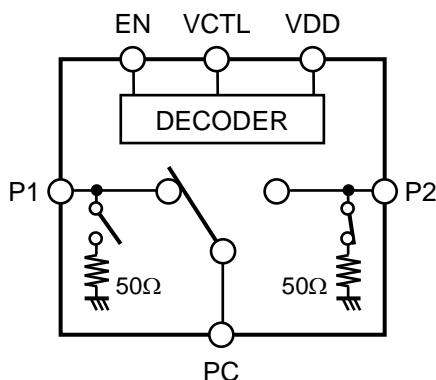
The P1 terminal and P2 terminal of NT1819NAAE2S are terminated into 50Ω at unused state. Therefore, it is prevented for miss-match when another circuit is connected to this switch.

The NT1819NAAE2S adopts compact 3 x 3 mm QFN3030-16-NA surface mount package, so this switch can contribute to small mounting area.



QFN3030-16-NA
3.0 x 3.0 x 0.75 (mm)

BLOCK DIAGRAM



■ PRODUCT NAME INFORMATION

NT1819 NA A E2 S

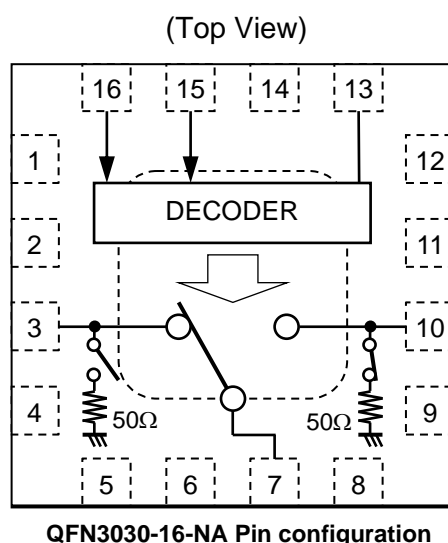
Description of configuration

Composition	Item	Description
NA	Package code	Indicates the package. Refer to the order information.
A	Version	Indicates the product version. "A" is initial version.
E2	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)
NT1819NAAE2S	QFN3030-16-NA	Yes	Yes	SnBi	17	1,500

■ PIN DESCRIPTIONS



Pin No.	Pin Name	Description
1	GND	Ground terminal
2	GND	Ground terminal
3	P1	RF terminal 1
4	GND	Ground terminal
5	NC(GND)	No connect terminal (need to connect Ground plane)
6	NC(GND)	No connect terminal (need to connect Ground plane)
7	PC	Common RF terminal
8	NC(GND)	No connect terminal (need to connect Ground plane)
9	GND	Ground terminal
10	P2	RF terminal 2
11	GND	Ground terminal
12	GND	Ground terminal
13	VDD	Voltage supply terminal
14	NC(GND)	No connect terminal (need to connect Ground plane)
15	VCTL	Control signal input terminal
16	EN	Control signal input terminal
Exposed PAD		Need to connect Ground plane

Please refer to "[APPLICATION CIRCUIT](#)" for details.

■ TRUTH TABLE

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

ON PATH	VCTL	EN
PC-P1	H	L
PC-P2	L	L
All OFF	H	H
	L	H

■ 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}	+34 ^{*1}	dBm
		+27 ^{*2}	
Power dissipation	P_D ^{*3}	1400	mW
Operating temperature range	T_{opr}	-40 to +105	$^{\circ}\text{C}$
Storage temperature range	T_{stg}	-55 to +150	$^{\circ}\text{C}$

^{*1} $V_{DD} = 3.3\text{ V}$, ON port^{*2} $V_{DD} = 3.3\text{ V}$, OFF port^{*3} 4-layer FR4 PCB with through-hole (101.5 x 114.5 mm), $T_j = +150^{\circ}\text{C}$

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.

^{*1} 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 (θ_{ja})	$\theta_{ja} = 89.3\text{ }^{\circ}\text{C/W}$

θ_{ja} : Junction-to-Ambient Thermal Resistance

■ ELECTROSTATIC DISCHARGE RATINGS

	Conditions	Pin No.	Pin Name	Protection Voltage	
				Ground	VDD
HBM	C = 100 pF, R = 1.5 kΩ	1	GND	COM.	±2000 V
		2	GND	COM.	±2000 V
		3	P1	±2000 V	±2000 V
		4	GND	COM.	±500 V
		5	NC(GND)	-	-
		6	NC(GND)	-	-
		7	PC	±2000 V	±2000 V
		8	NC(GND)	-	-
		9	GND	COM.	±500 V
		10	P2	±2000 V	±2000 V
		11	GND	COM.	±2000 V
		12	GND	COM.	±2000 V
		13	VDD	±2000 V	COM.
		14	NC(GND)	-	-
		15	VCTL	±2000 V	±2000 V
		16	EN	±2000 V	±2000 V

	Conditions	Protection Voltage
CDM	Field Induced CDM	±1000 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}	2.5 to 5.0	V
Control voltage (High)	V _{CTL} (H)	1.35 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	2.5	3.3	5.0	V
Operating current	I_{DD}	No RF input, $V_{DD} = 3.3\text{ V}$	-	200	350	μA
Control voltage (High)	$V_{CTL(H)}$	VCTL terminal, EN terminal	1.35	1.8	5.0	V
Control voltage (Low)	$V_{CTL(L)}$	VCTL terminal, EN terminal	0	-	0.45	V
Control current	I_{CTL}	$V_{CTL(H)} = 1.8\text{ V}$	-	5	10	μA

■ ELECTRICAL CHARACTERISTICS 2 (RF)

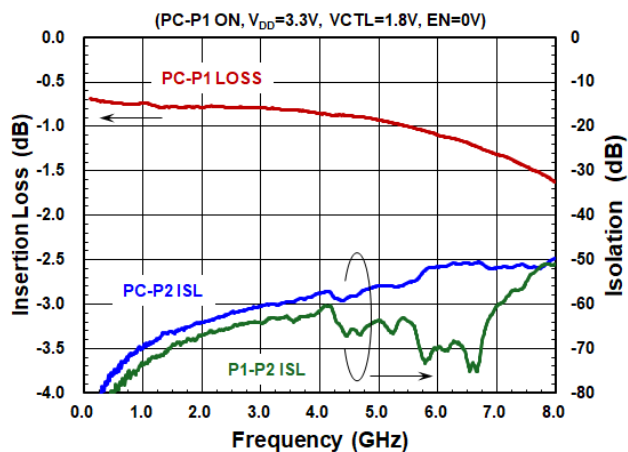
General conditions: $V_{DD} = 3.3\text{ V}$, $V_{CTL(H)} = 1.8\text{ V}$, $V_{CTL(L)} = 0\text{ V}$, $T_a = +25^\circ\text{C}$, $Z_s = Z_l = 50\Omega$, with application circuit

Parameter	Symbol	Conditions	MIN	TYP	MAX	Unit
Insertion loss	LOSS	$f = 0.7\text{ GHz}$	-	0.70	0.90	dB
		$f = 1.9\text{ GHz}$	-	0.75	0.95	
		$f = 2.7\text{ GHz}$	-	0.80	1.00	
		$f = 3.85\text{ GHz}$	-	0.80	1.00	
		$f = 4.7\text{ GHz}$	-	0.85	1.15	
		$f = 6.0\text{ GHz}$	-	0.90	1.20	
		$f = 7.125\text{ GHz}$	-	1.20	1.60	
Isolation 1 (PC-P1/PC-P2)	ISL1	$f = 0.7\text{ GHz}$	65	70	-	dB
		$f = 1.9\text{ GHz}$	60	64	-	
		$f = 2.7\text{ GHz}$	58	62	-	
		$f = 3.85\text{ GHz}$	56	62	-	
		$f = 4.7\text{ GHz}$	55	60	-	
		$f = 6.0\text{ GHz}$	50	55	-	
		$f = 7.125\text{ GHz}$	47	51	-	
Isolation 2 (P1-P2)	ISL2	$f = 0.7\text{ GHz}$	67	70	-	dB
		$f = 1.9\text{ GHz}$	65	70	-	
		$f = 2.7\text{ GHz}$	60	65	-	
		$f = 3.85\text{ GHz}$	56	61	-	
		$f = 4.7\text{ GHz}$	55	60	-	
		$f = 6.0\text{ GHz}$	52	58	-	
		$f = 7.125\text{ GHz}$	50	55	-	
Return loss 1 (ON terminal)	RL1	$f = 0.7\text{ GHz}$	18	25	-	dB
		$f = 1.9\text{ GHz}$	18	23	-	
		$f = 2.7\text{ GHz}$	18	23	-	
		$f = 3.85\text{ GHz}$	16	22	-	
		$f = 4.7\text{ GHz}$	16	20	-	
		$f = 6.0\text{ GHz}$	12	18	-	
		$f = 7.125\text{ GHz}$	9	12	-	
Return loss 2 (OFF terminal)	RL2	$f = 0.7\text{ GHz}$	18	25	-	dB
		$f = 1.9\text{ GHz}$	18	25	-	
		$f = 2.7\text{ GHz}$	18	25	-	
		$f = 3.85\text{ GHz}$	16	23	-	
		$f = 4.7\text{ GHz}$	16	20	-	
		$f = 6.0\text{ GHz}$	12	20	-	
		$f = 7.125\text{ GHz}$	11	20	-	
Input power at 0.1 dB compression point	$P_{-0.1\text{dB}}$	$f = 0.7\text{ to }7.125\text{ GHz}$	+29	+31	-	dBm
Switching time	T_{SW}	50% VCTL to 10% / 90% RF	-	250	400	ns

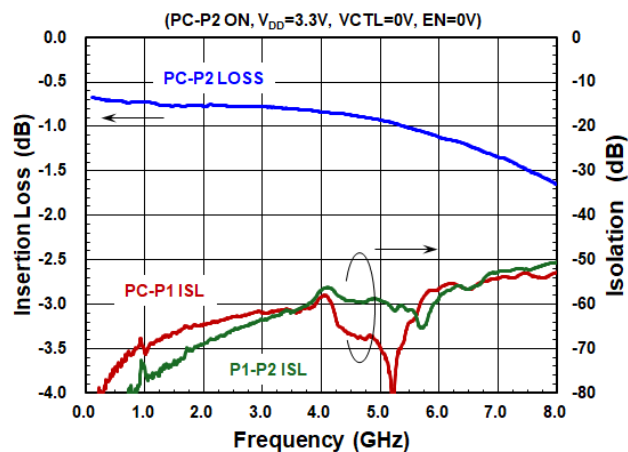
■ TYPICAL CHARACTERISTICS

General conditions: $V_{DD} = 3.3\text{ V}$, $V_{CTL(H)} = 1.8\text{ V}$, $V_{CTL(L)} = 0\text{ V}$, $T_a = +25^\circ\text{C}$, $Z_s = Z_l = 50\Omega$, with application circuit
(Typical Characteristics are intended to be used as reference data; they are not guaranteed.)

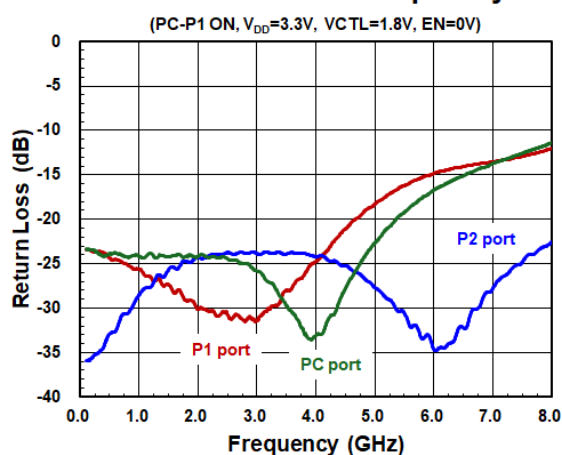
Insertion Loss, Isolation vs Frequency



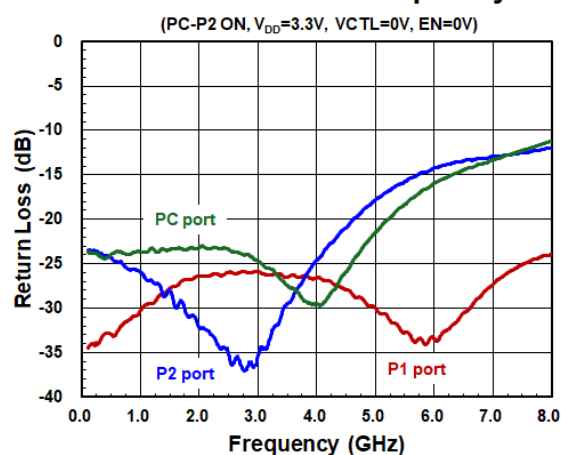
Insertion Loss, Isolation vs Frequency



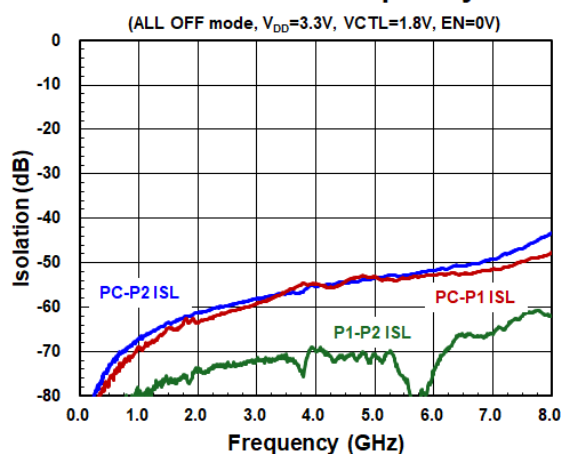
Return Loss vs Frequency



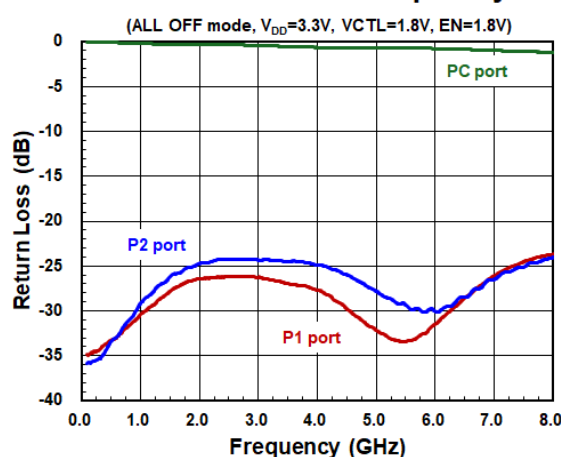
Return Loss vs Frequency



Isolation vs Frequency



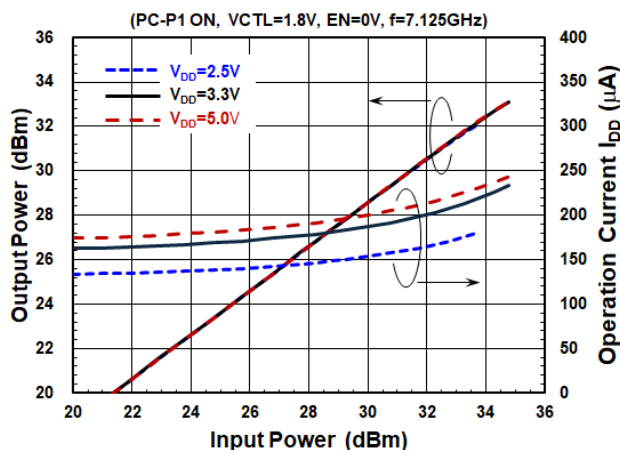
Return Loss vs Frequency



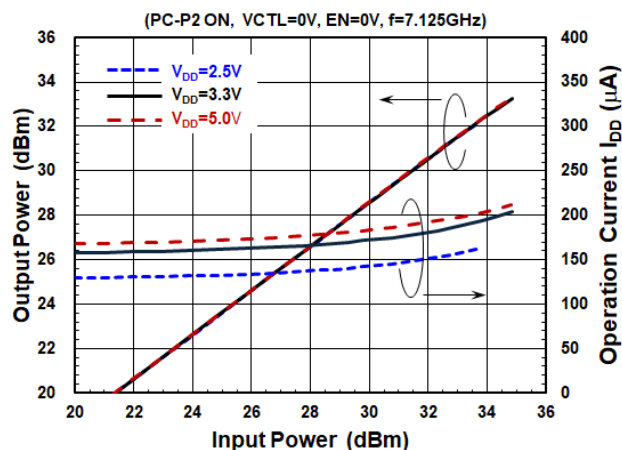
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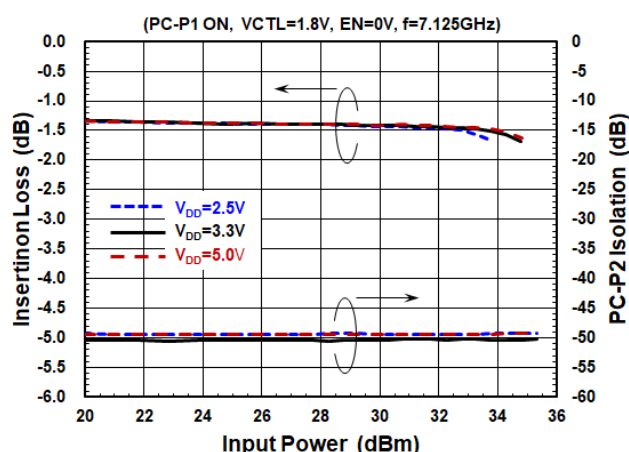
Output Power, I_{DD} vs Input Power



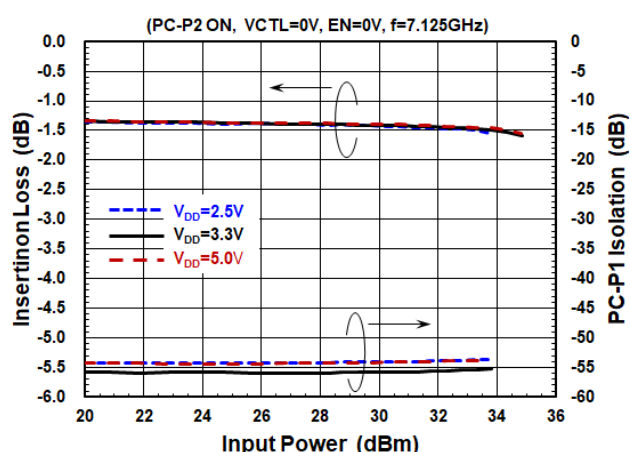
Output Power, I_{DD} vs Input Power



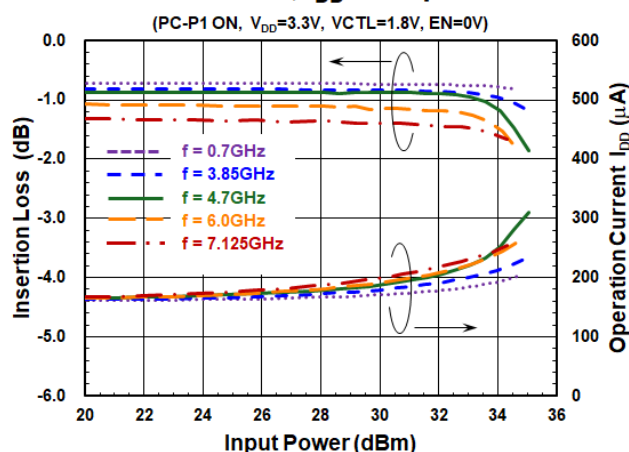
Insertion Loss, Isolation vs Input Power



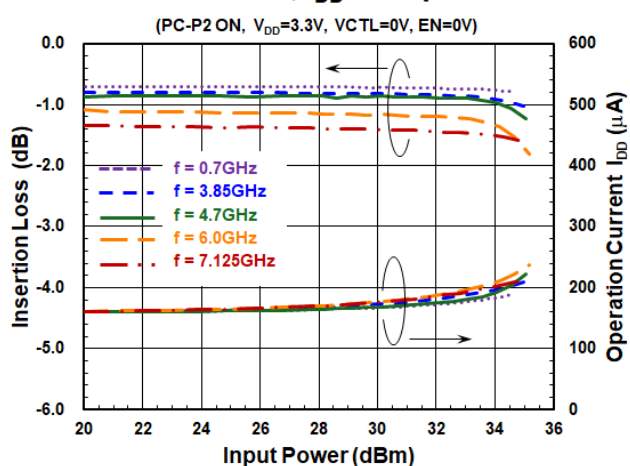
Insertion Loss, Isolation vs Input Power



Insertion Loss, I_{DD} vs Input Power



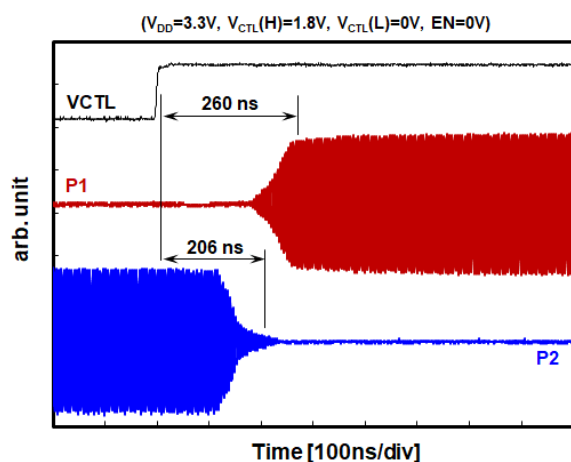
Insertion Loss, I_{DD} vs Input Power



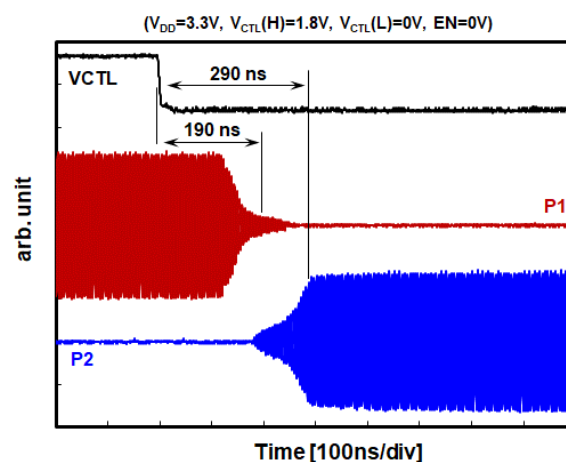
■ TYPICAL CHARACTERISTICS

General conditions: $V_{DD} = 3.3\text{ V}$, $V_{CTL(H)} = 1.8\text{ V}$, $V_{CTL(L)} = 0\text{ V}$, $T_a = +25^\circ\text{C}$, $Z_s = Z_l = 50\Omega$, with application circuit
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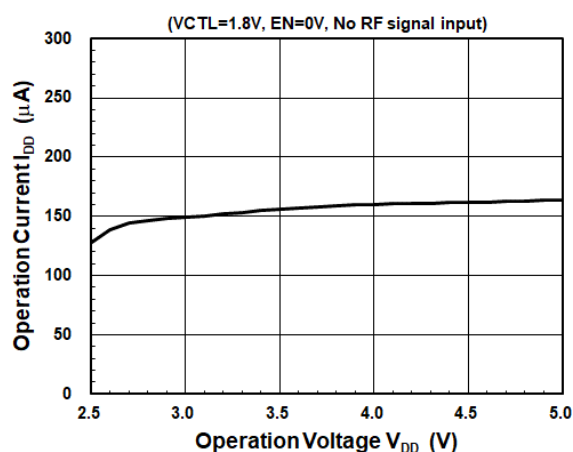
Switching Time



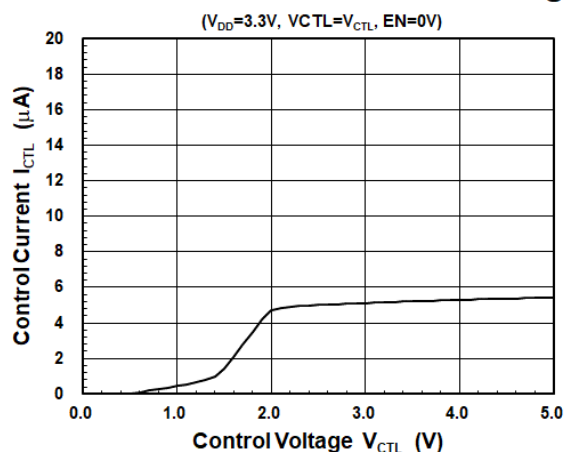
Switching Time



Operation Current vs Operation Voltage



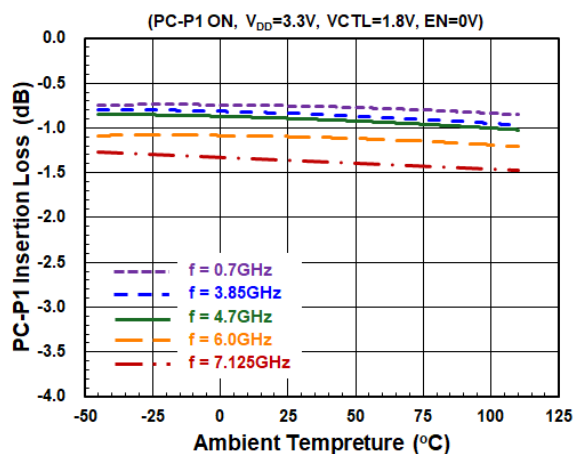
Control Current vs Control Voltage



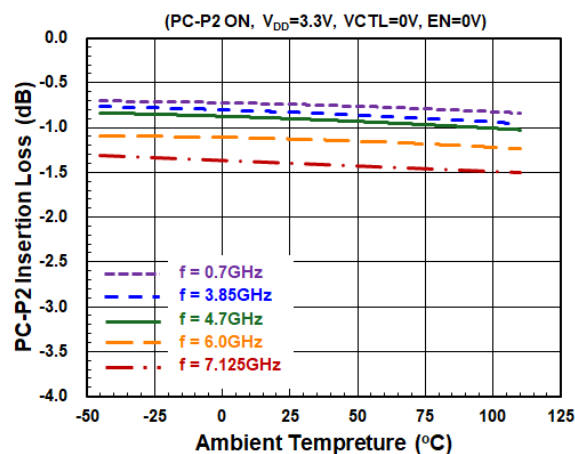
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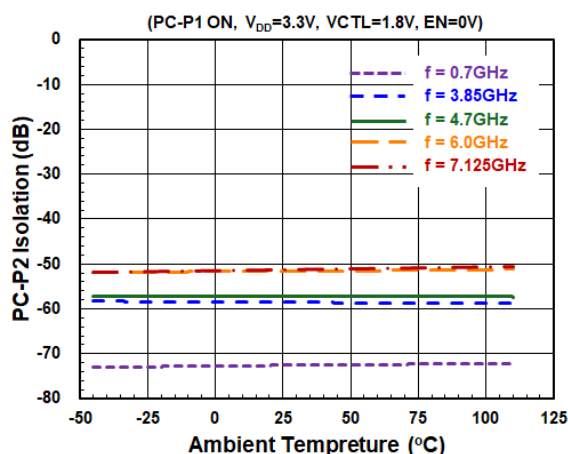
Insertion Loss vs Ambient Temperature



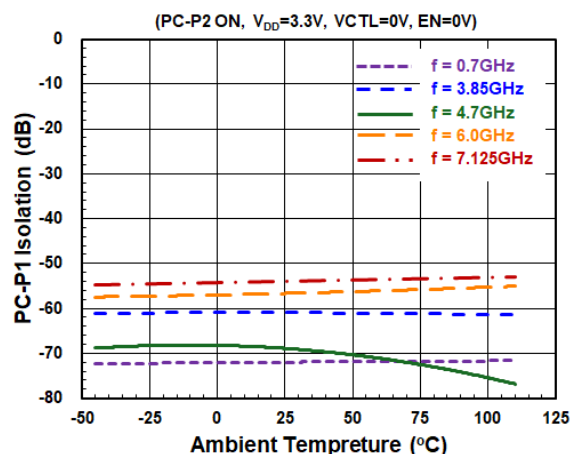
Insertion Loss vs Ambient Temperature



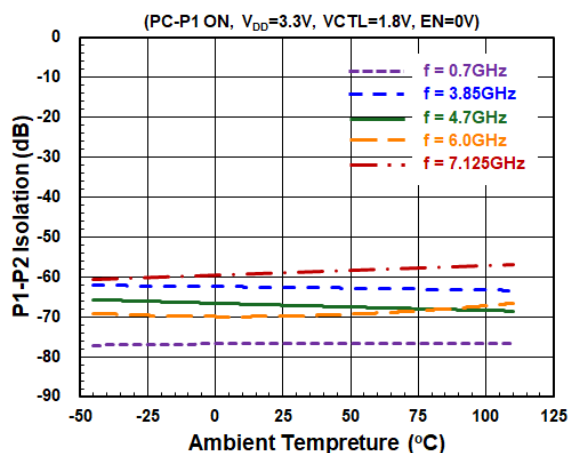
PC-P2 Isolation vs Ambient Temperature



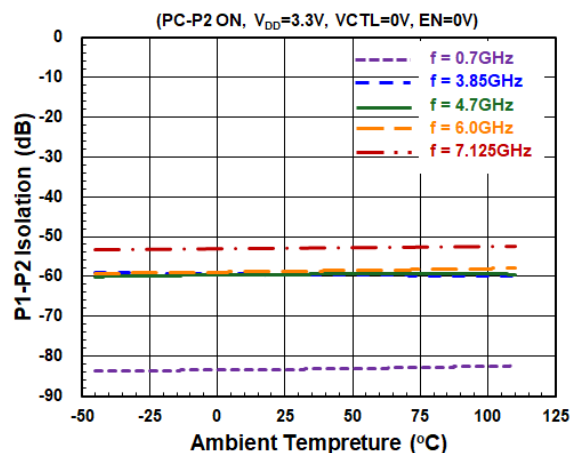
PC-P1 Isolation vs Ambient Temperature



P1-P2 Isolation vs Ambient Temperature



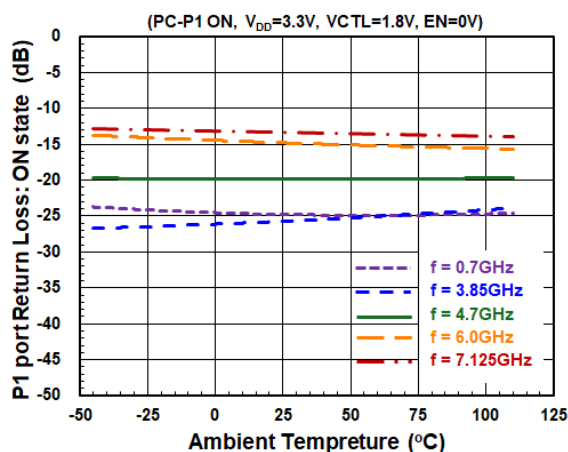
P1-P2 Isolation vs Ambient Temperature



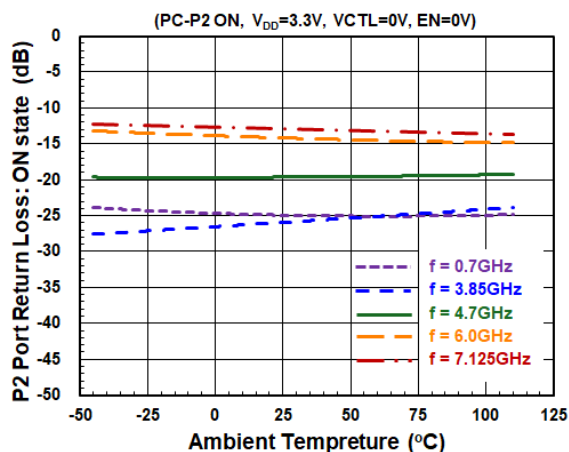
■ TYPICAL CHARACTERISTICS

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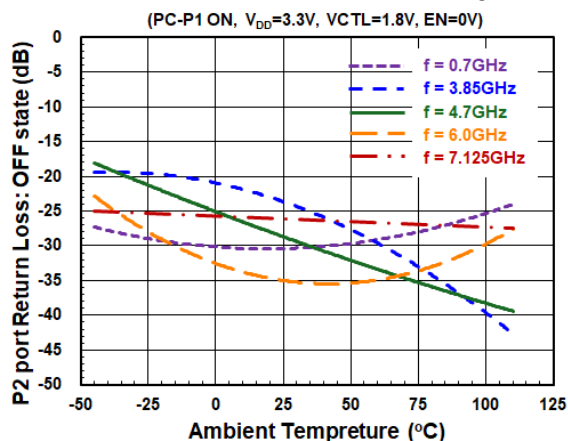
Return Loss 1 vs Ambient Temperature



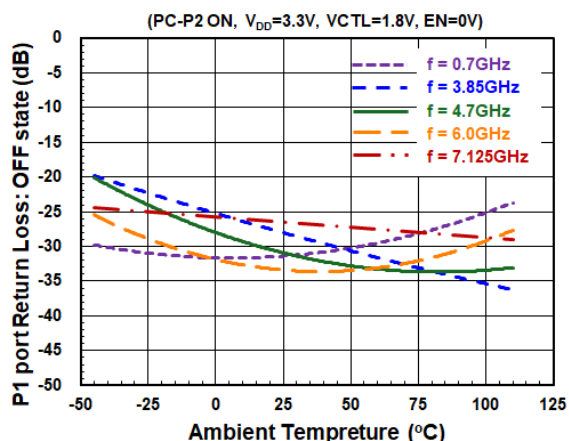
Return Loss 1 vs Ambient Temperature



Return Loss 2 vs Ambient Temperature

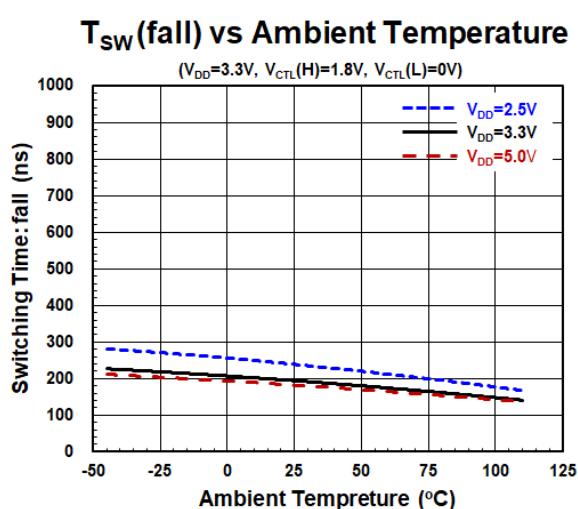
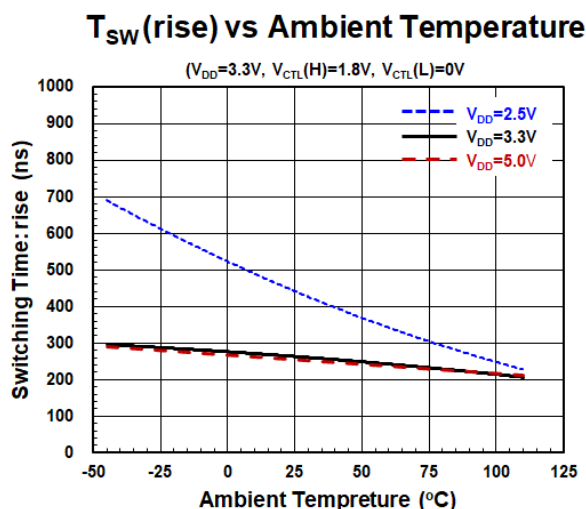
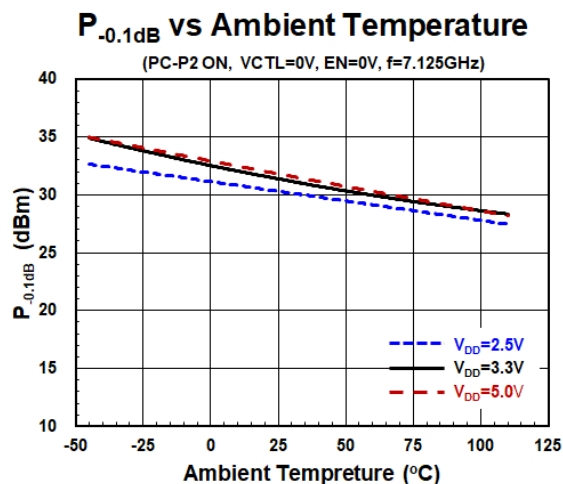
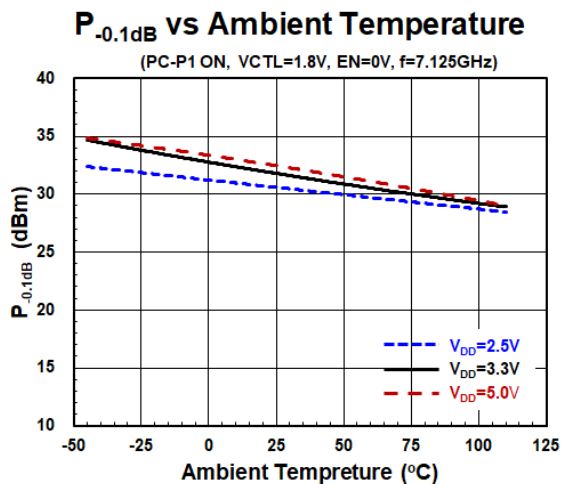


Return Loss 2 vs Ambient Temperature

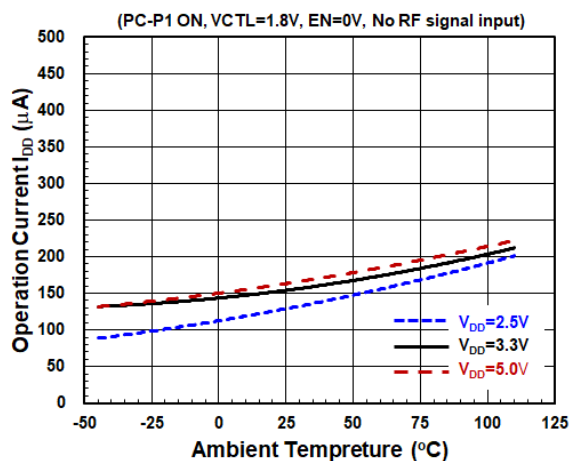


■ TYPICAL CHARACTERISTICS

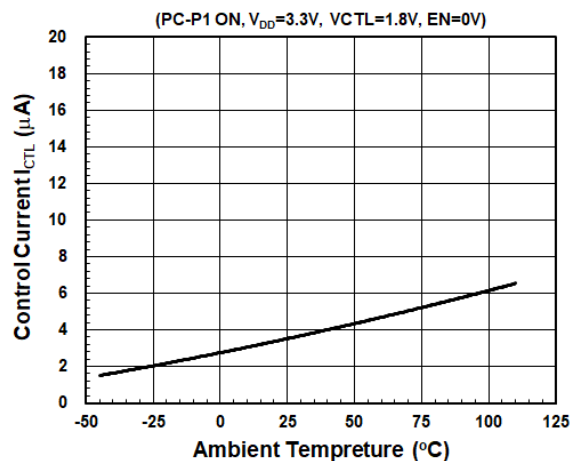
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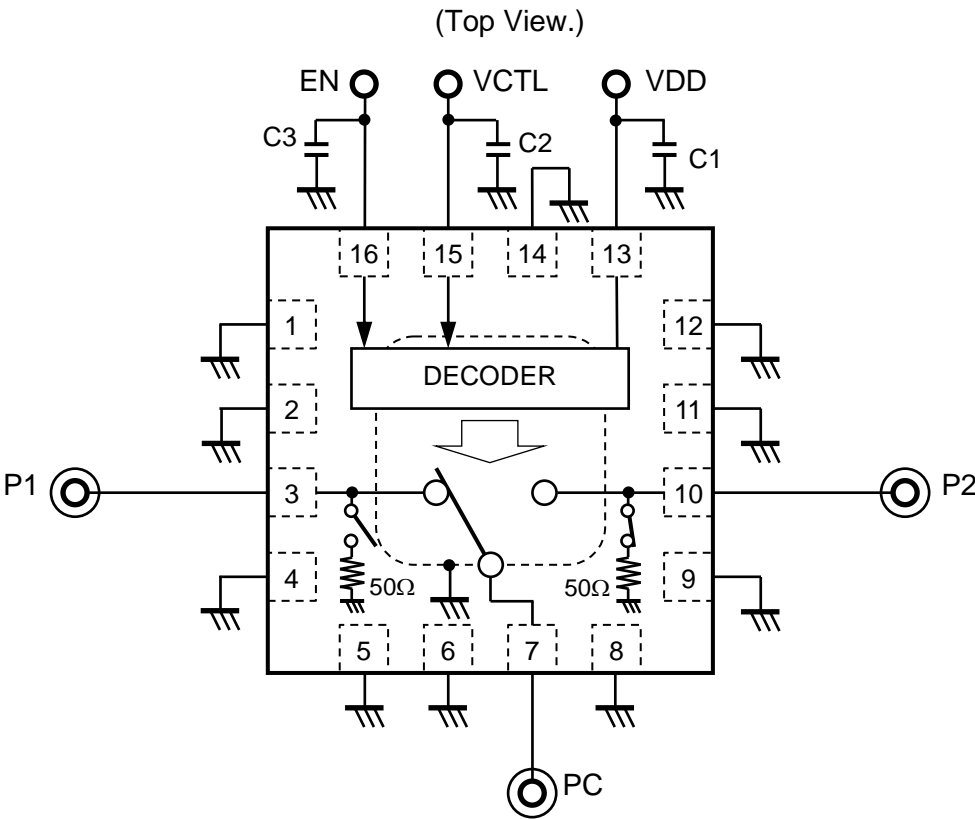
Operation Current vs Ambient Temperature



Control Current vs Ambient Temperature



■ APPLICATION CIRCUIT



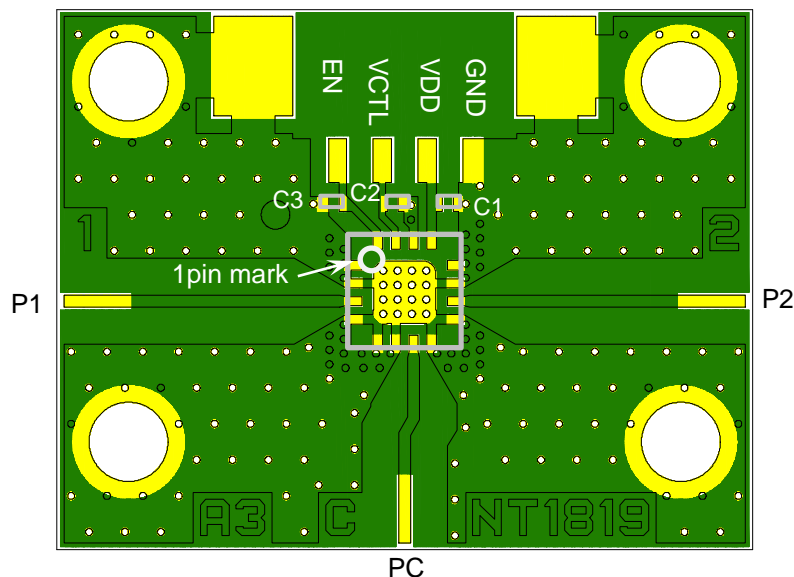
NT1819NAAE2S Typical Application Circuit

<Parts list>

Part ID	Value	Notes
C1	1000 pF	GRM03 series (muRata MFG)
C2, C3	10 pF	GRM03 series (muRata MFG)

• 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

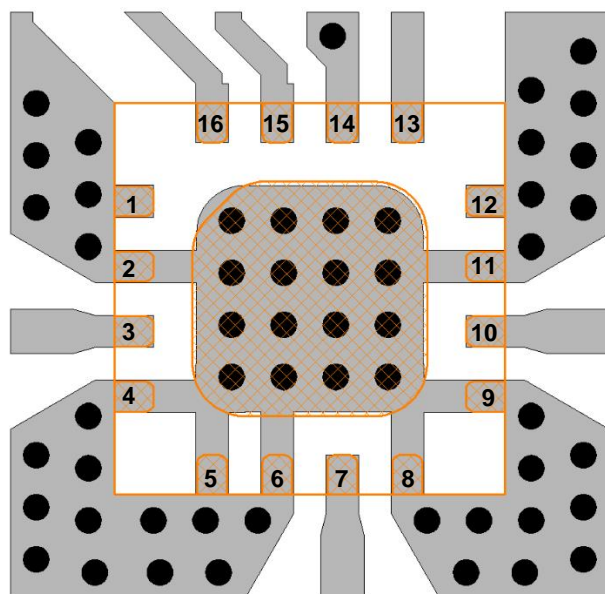
Through hole diameter: 0.2 mm





■ Loss of PCB and Connectors

Frequency (GHz)	Loss (dB)
0.7	0.16
1.9	0.25
2.7	0.32
3.85	0.42
4.7	0.49
6.0	0.61
7.125	0.70

• PCB layout guideline

(TOP VIEW)

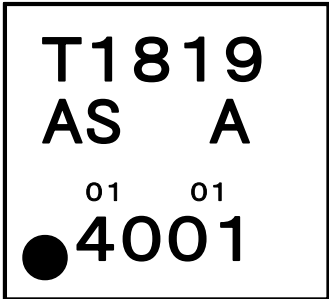


-  PCB
-  Package terminal
-  Package outline
-  GND VIA hole
Diameter $\phi = 0.2$ mm

• Precautions

- No DC blocking capacitor is required for RF terminals. However, since each RF terminals are ground level, DC blocking capacitors are needed when another device biased DC connect to this IC.
- For avoiding the degradation of RF performance, the bypass capacitors (C1, C2, C3) should be placed as close as possible to VDD, VCTL, EN terminals.
- For good RF performance, all GND terminals and Exposed PAD should be connected to PCB ground plane, and through hole for ground should also be placed near GND terminals and Exposed PAD.

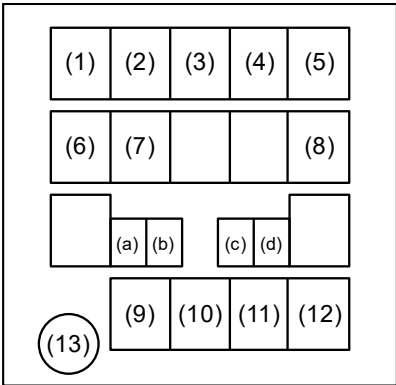
● MARKING SPECIFICATION



QFN3030-16-NA 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.

Mark Index



Mark Explanation

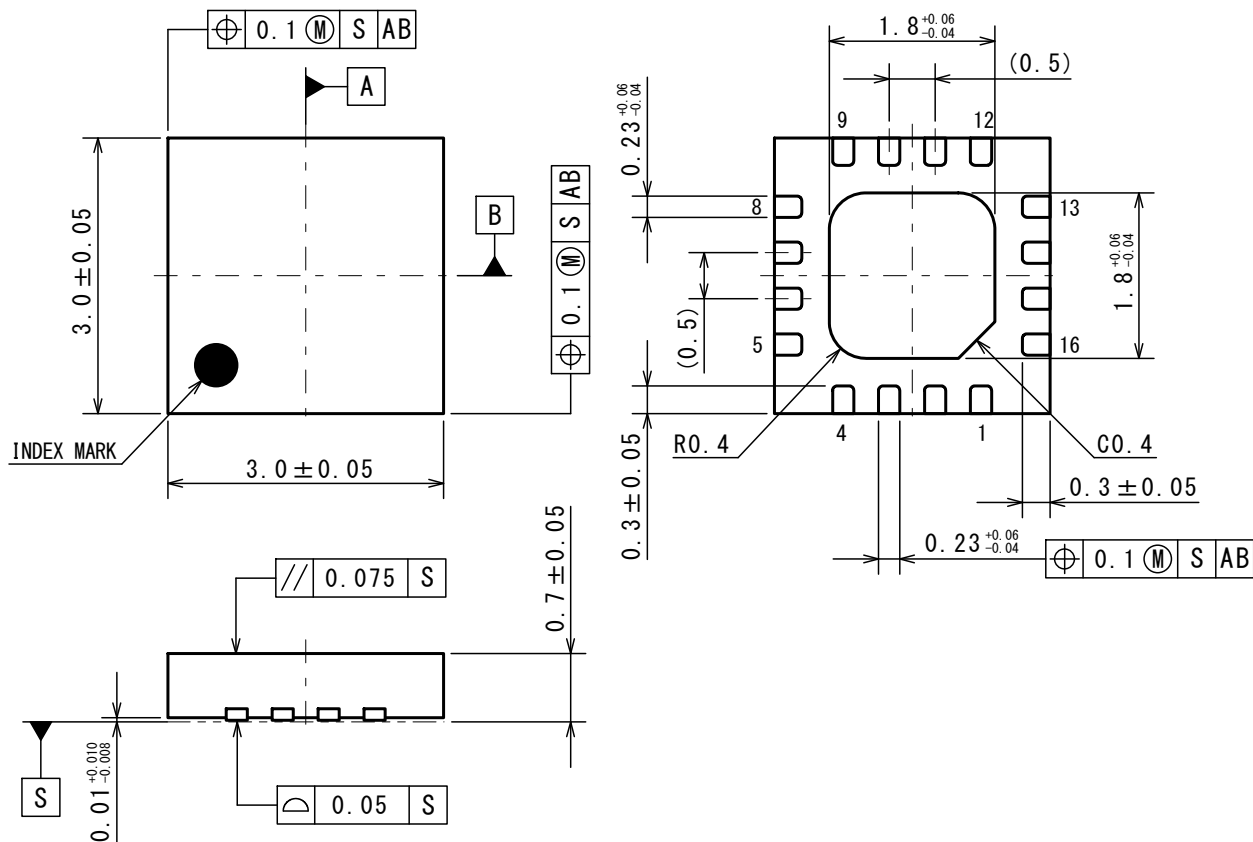
Product name	Product category code	(1)
	Product code	(2)~(5)
	Product version	(6)
	Quality grade	(7)
Lot	Year code	(9)
	Serial number	(10)~(12)
	—	-
	—	-
Production code		(8)
Index mark		(13)
Mold address		(a)~(d)

REVISION HISTORY

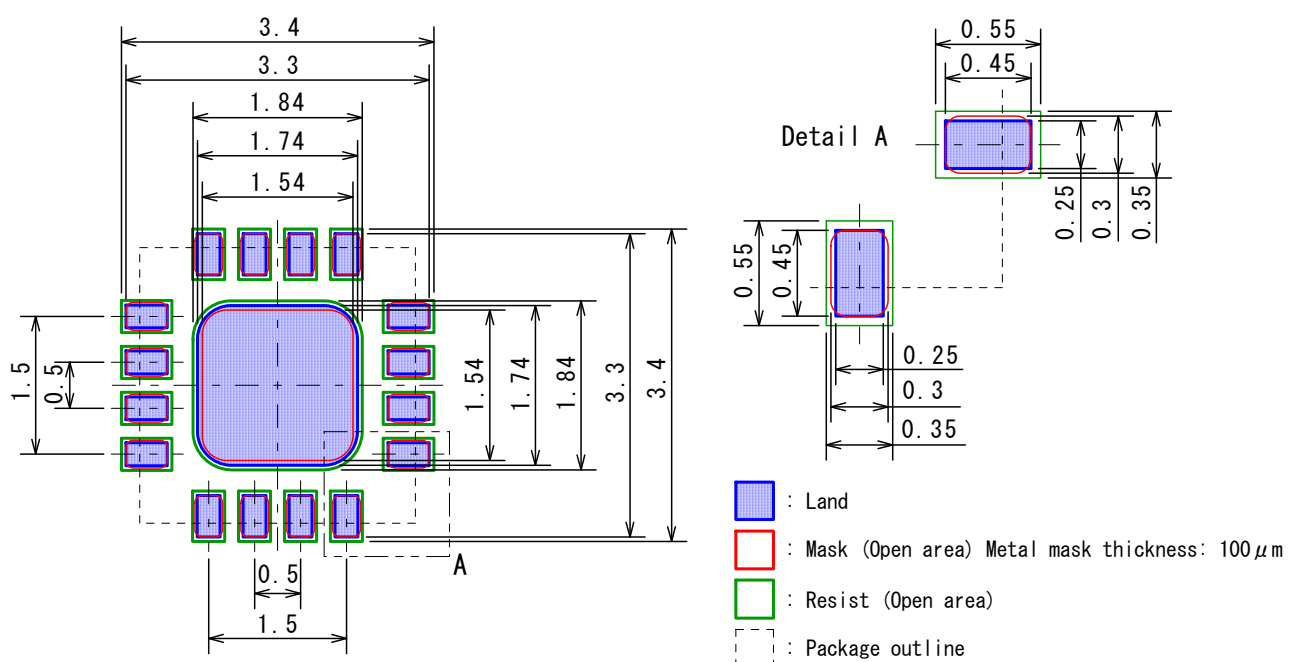
Date	Revision	Contents of Changes
September 4, 2024	Ver. 1.0	Initial release

■ PACKAGE DIMENSIONS

UNIT: mm



■ EXAMPLE OF SOLDER PADS DIMENSIONS



Nisshinbo Micro Devices Inc.

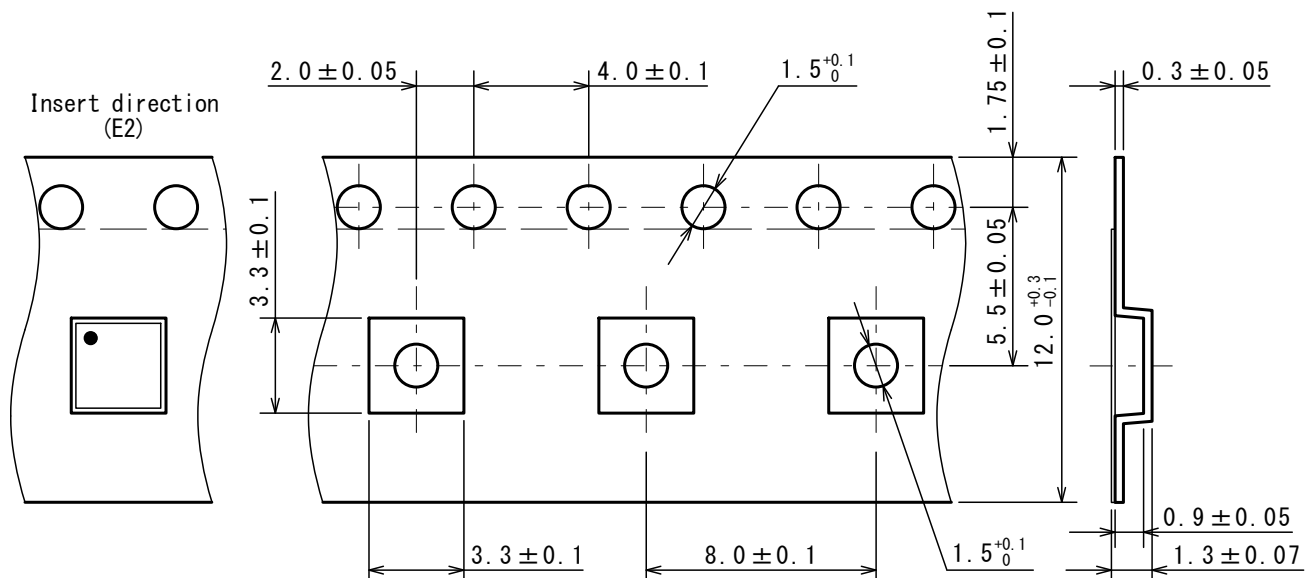
QFN3030-16-NA

PI-QFN3030-16-NA-E-A

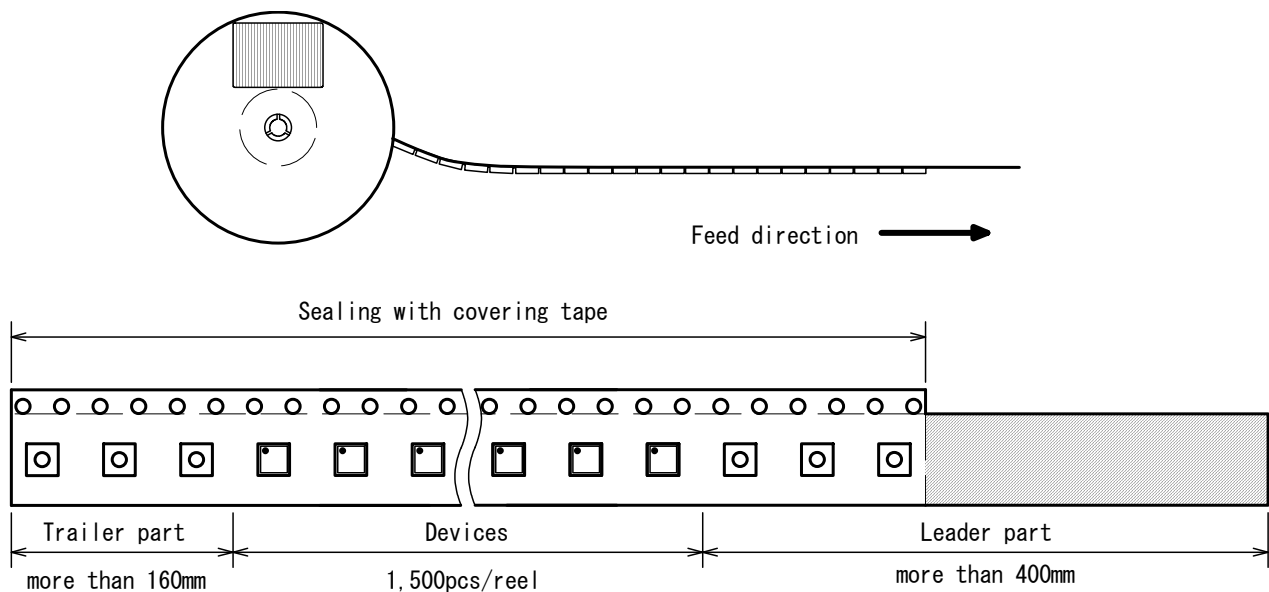
■ PACKING SPEC

UNIT: mm

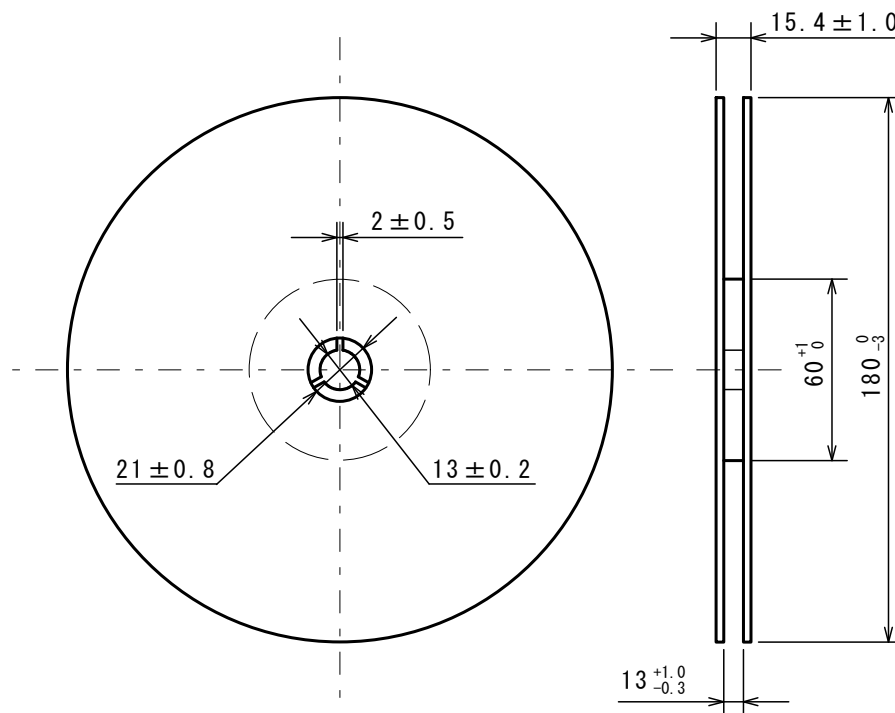
(1) Taping dimensions / Insert direction



(2) Taping state



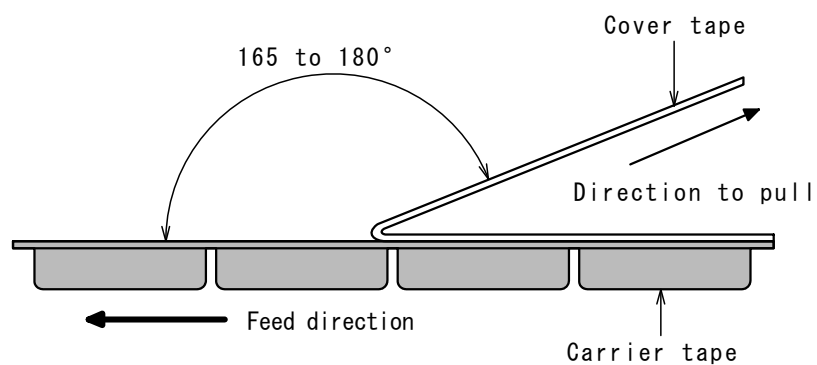
(3) Reel dimensions



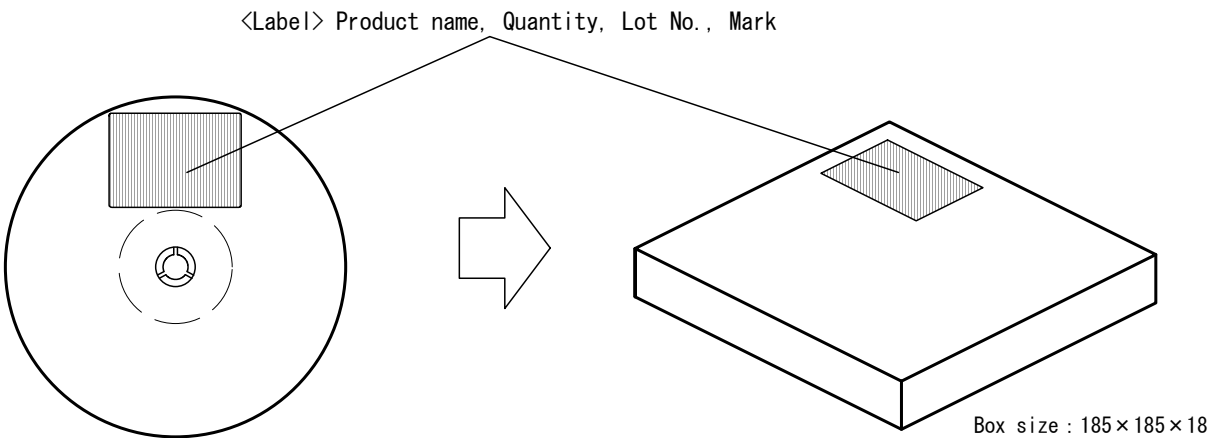
(4) Peeling strength

Peeling strength of cover tape

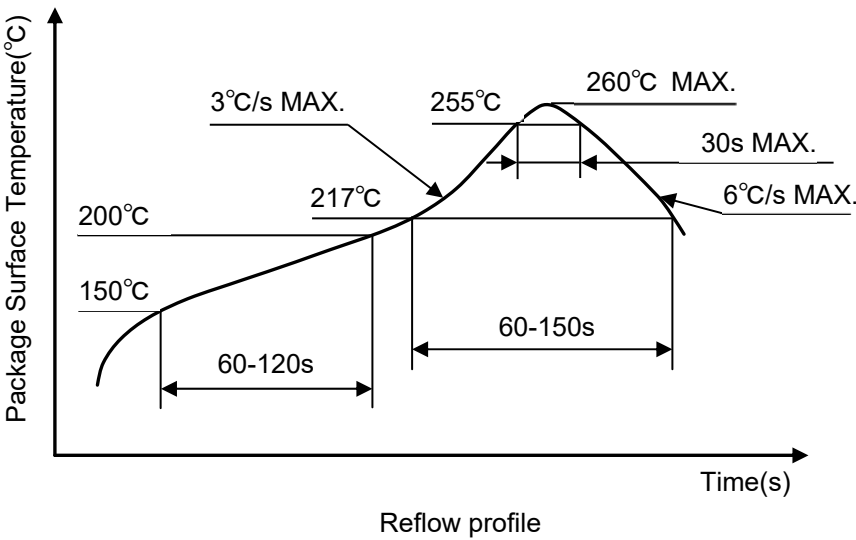
- Peeling angle 165 to 180° degrees to the taped surface.
- Peeling speed 300mm/min
- Peeling strength 0.1 to 1.3N



(5) Packing state



■ HEAT-RESISTANCE PROFILES



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 - Combustion equipment

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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.



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