

SPDT SWITCH GaAs MMIC

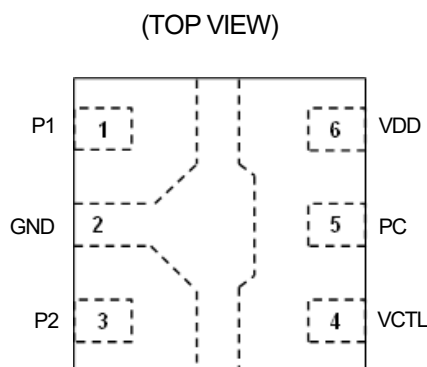
■ FEATURES

- AEC-Q100 grade 2
- Low voltage logic control $V_{CTL}(H) = 1.8\text{ V typ.}$
- Operation voltage $V_{DD} = 3.3\text{ V typ.}$
- Low insertion loss
 - 0.45 dB typ. @ 2.4 GHz to 2.5 GHz
 - 0.45 dB typ. @ 3.4 GHz to 3.8 GHz
 - 0.40 dB typ. @ 4.9 GHz to 6.0 GHz
- High isolation
 - 25dB typ. @ 2.4 GHz to 2.5 GHz
 - 25dB typ. @ 3.4 GHz to 3.8 GHz
 - 25dB typ. @ 4.9GHz to 6.0 GHz
- $P_{-1dB} = +31\text{ dBm typ. @ 2.4 to 6.0 GHz}$
- Ultra small & ultra-thin Package DFN6-75
(Package Size: 1.0 x 1.0 x 0.375 mm typ.)
- RoHS compliant and Halogen Free, MSL1

■ APPLICATION

- 802.11 a/b/g/n/ac/ax networks applications
- Transmit/receive switching, antenna switching and others switching applications
- Automotive WiFi applications

■ BLOCK DIAGRAM (DFN6-75)



■ GENERAL DESCRIPTION

The NJG1815AK75-A is a 1bit control SPDT switch. This switch is used for WLAN system.

The switch features low insertion loss, high isolation for high frequency up to 6GHz, and high handing power performance at 1.8V control voltage. Integrated ESD protection device on each port achieves excellent ESD robustness.

Integrated DC blocking capacitors at all RF ports and the ultra-small package of DNF6-75 offer very small mounting area.

■ TRUTH TABLE

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

ON PATH	VCTL
PC-P1	H
PC-P2	L

■ PIN CONFIGURATION

PIN NO.	SYMBOL	DESCRIPTION
1	P1	RF terminal
2	GND	Ground terminal
3	P2	RF terminal
4	VCTL	Control signal input terminal.
5	PC	Common RF terminal
6	VDD	Voltage supply terminal

Automotive NJG1815AK75-A

■ PRODUCT NAME INFORMATION

NJG1815A K75 -A (TE1)

Part number Package Automotive Taping form

■ ORDERING INFORMATION

PART NUMBER	PACKAGE OUTLINE	RoHS	HALOGEN-FREE	TERMINAL FINISH	MARKING	WEIGHT (mg)	MOQ (pcs.)
NJG1815AK75-A	DFN6-75	Yes	Yes	Ni/Pd/Au	4	1.2	5,000

■ ABSOLUTE MAXIMUM RATINGS

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

PARAMETER	SYMBOL	RATINGS	UNIT
RF input power	P_{IN}	+31 ⁽¹⁾	dBm
Supply voltage	V_{DD}	6.0	V
Control voltage	V_{CTL}	6.0	V
Power dissipation ⁽²⁾	P_D	380	mW
Operating temperature	T_{opr}	-40 to +105	$^{\circ}\text{C}$
Storage temperature	T_{stg}	-55 to +150	$^{\circ}\text{C}$

(1): $V_{DD} = 3.3\text{ V}$, ON port

(2): Four-layer FR4 PCB with through-hole (76.2 x 114.3 mm), $T_j = 150^{\circ}\text{C}$

■ ELECTRICAL CHARACTERISTICS 1 (DC CHARACTERISTICS)

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

PARAMETER	SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Supply voltage	V_{DD}		2.5	3.3	5.0	V
Operating current	I_{DD}	No RF input, $V_{DD} = 3.3\text{ V}$	-	15	30	μA
Control voltage (LOW)	$V_{CTL(L)}$		0	-	0.45	V
Control voltage (HIGH)	$V_{CTL(H)}$		1.5	1.8	5.0	V
Control current	I_{CTL}	$V_{CTL(H)} = 1.8\text{V}$	-	3	10	μA

■ ELECTRICAL CHARACTERISTICS 2 (RF CHARACTERISTICS)

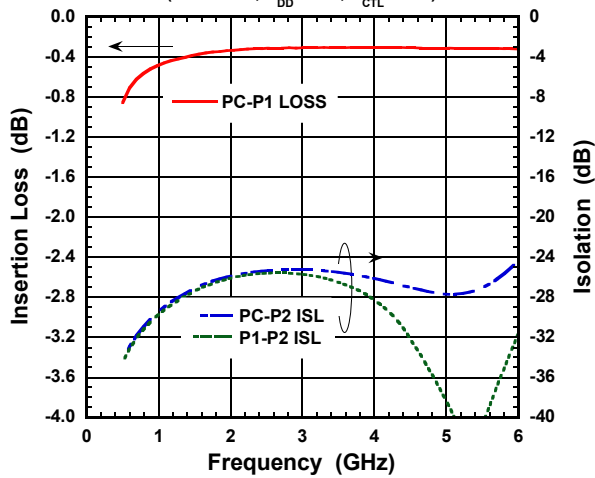
(General conditions: $T_a = +25^\circ\text{C}$, $Z_s = Z_L = 50\Omega$, $V_{DD} = 3.3\text{ V}$, $V_{CTL(H)} = 1.8\text{V}$, $V_{CTL(L)} = 0\text{V}$, with application circuit)

PARAMETER	SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Insertion loss	LOSS	$f = 2.4\text{ to }2.5\text{ GHz}$	-	0.45	0.65	dB
		$f = 3.4\text{ to }3.8\text{ GHz}$	-	0.45	0.65	
		$f = 4.9\text{ to }6.0\text{ GHz}$	-	0.40	0.60	
Isolation	ISL	$f = 2.4\text{ to }2.5\text{ GHz}$	23	25	-	dB
		$f = 3.4\text{ to }3.8\text{ GHz}$	22	25	-	
		$f = 4.9\text{ to }6.0\text{ GHz}$	22	25	-	
Return loss	RL	$f = 2.4\text{ to }2.5\text{ GHz}$	13	16	-	dB
		$f = 3.4\text{ to }3.8\text{ GHz}$	15	20	-	
		$f = 4.9\text{ to }6.0\text{ GHz}$	15	20	-	
Input power at 1dB compression point	$P_{-1\text{dB}}$	$f = 2.4\text{ to }6.0\text{ GHz}$	+28	+31	-	dBm
Switching time	T_{SW}	50% V_{CTL} to 10/90% RF	-	150	400	ns

■ ELECTRICAL CHARACTERISTICS

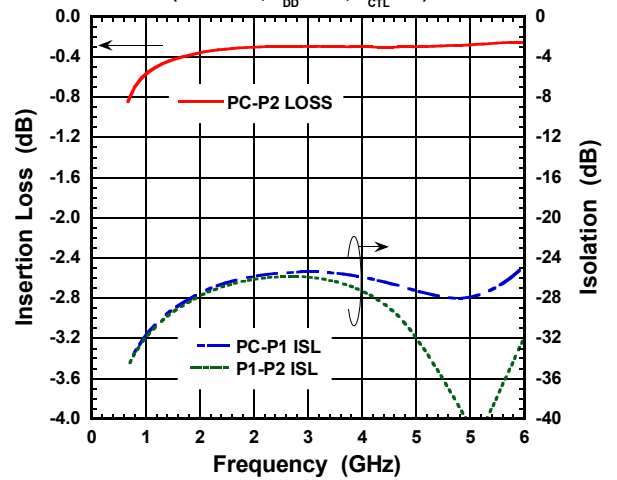
Loss, ISL vs Frequency

(PC-P1 ON, $V_{DD}=3.3V$, $V_{CTL}=1.8V$)



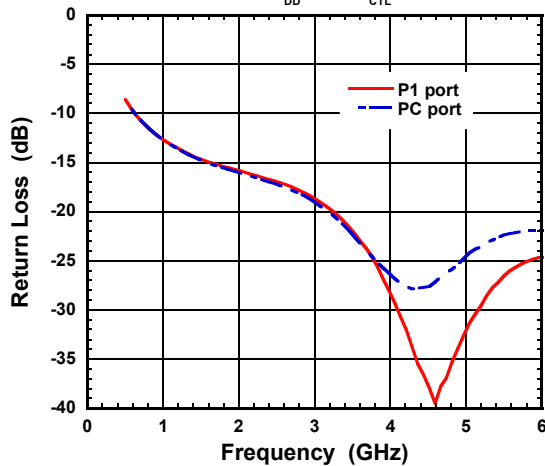
Loss, ISL vs Frequency

(PC-P2 ON, $V_{DD}=3.3V$, $V_{CTL}=0V$)



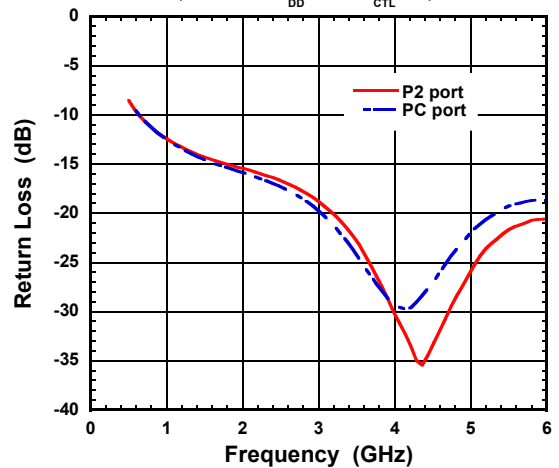
Return Loss vs Frequency

(PC-P1 ON, $V_{DD}=3.3V$, $V_{CTL}=1.8V$)



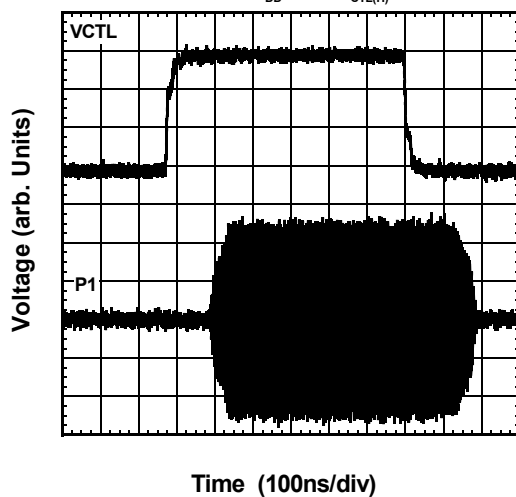
Return Loss vs Frequency

(PC-P2 ON, $V_{DD}=3.3V$, $V_{CTL}=0V$)



Switching Time

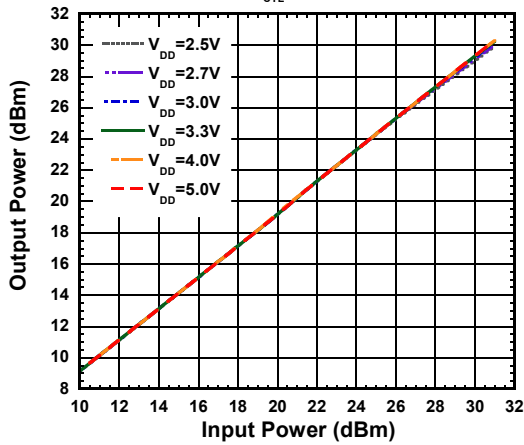
(PC-P1 path, $V_{DD}=3.3V$, $V_{CTL(H)}=1.8V$)



■ ELECTRICAL CHARACTERISTICS

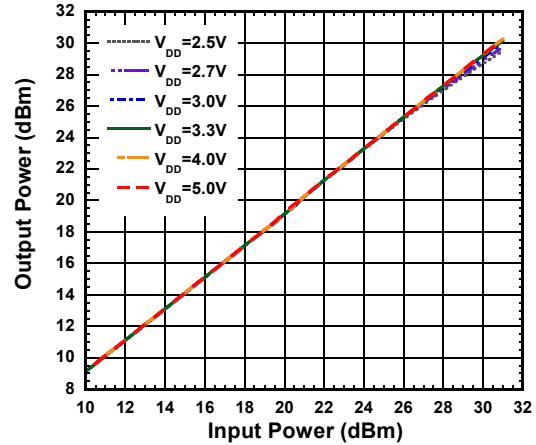
Output Power vs Input Power

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



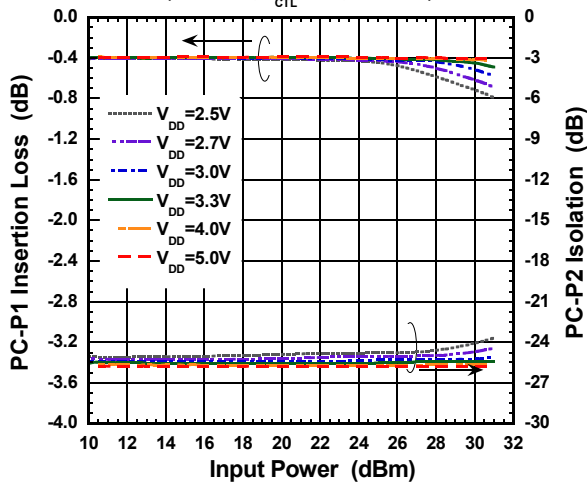
Output Power vs Input Power

(PC-P2 ON, $V_{CTL}=0V$, $f=2.5GHz$)



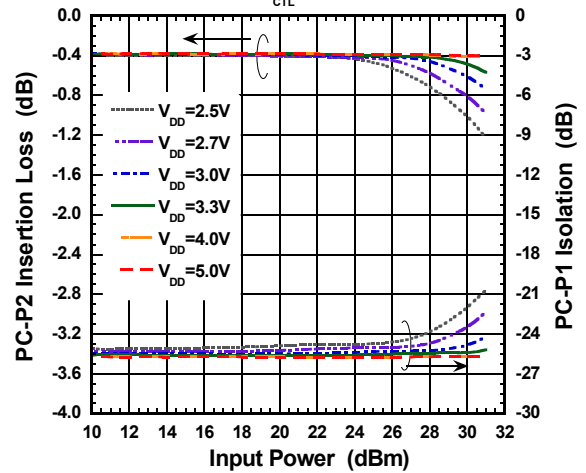
Loss, ISL vs Input Power

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



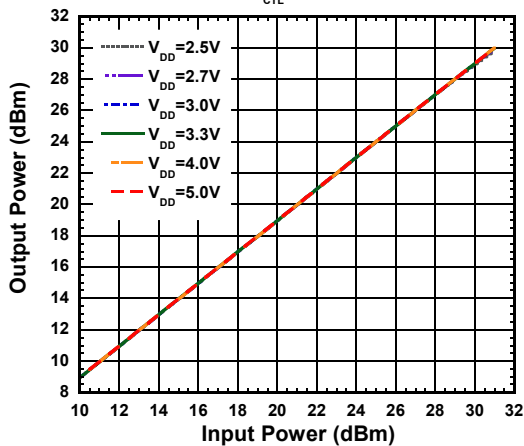
Loss, ISL vs Input Power

(PC-P2 ON, $V_{CTL}=0V$, $f=2.5GHz$)



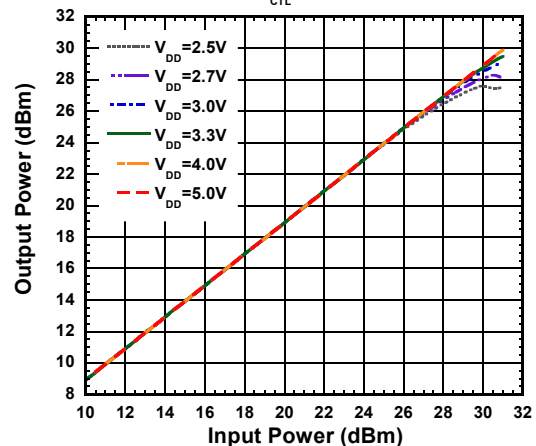
Output Power vs Input Power

(PC-P1 ON, $V_{CTL}=1.8V$, $f=6.0GHz$)



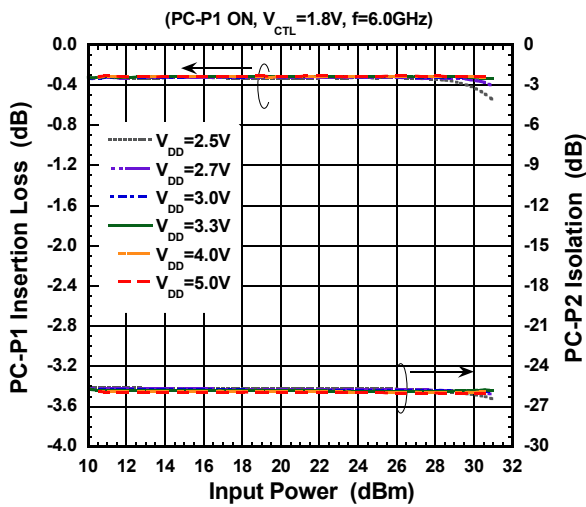
Output Power vs Input Power

(PC-P2 ON, $V_{CTL}=0V$, $f=6.0GHz$)

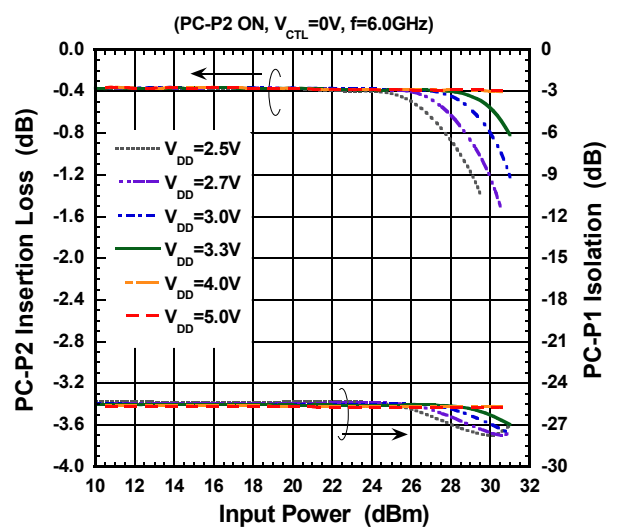


■ ELECTRICAL CHARACTERISTICS

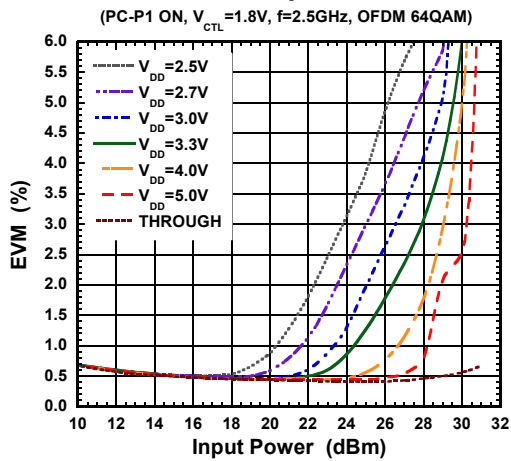
Loss, ISL vs Input Power



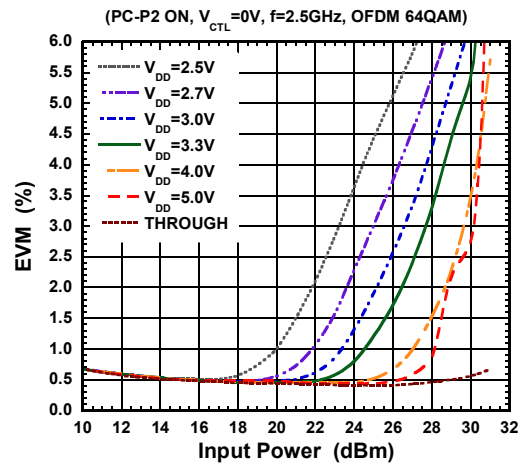
Loss, ISL vs Input Power



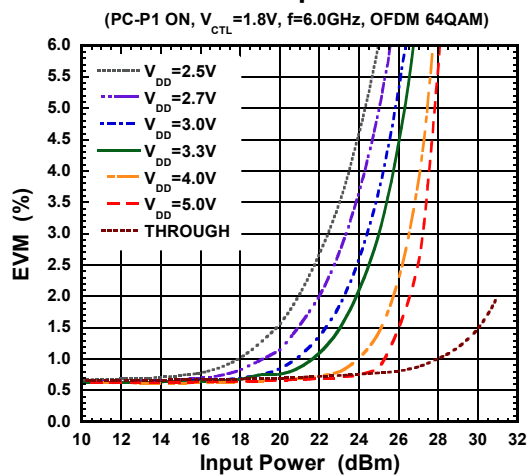
EVM vs Input Power



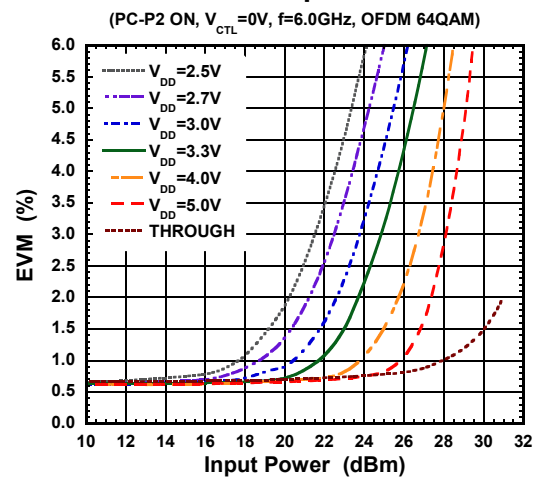
EVM vs Input Power



EVM vs Input Power

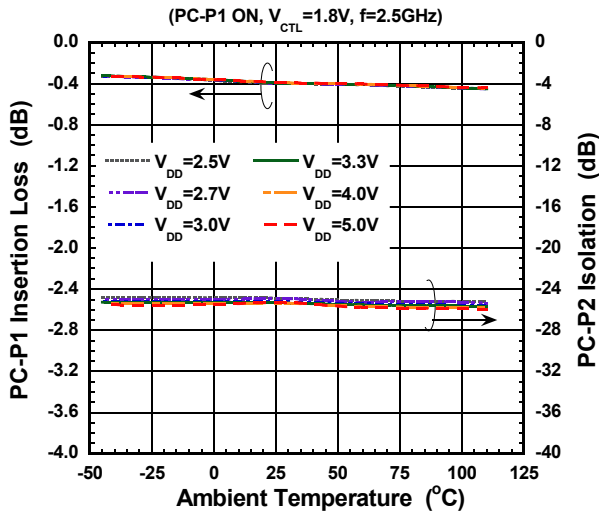


EVM vs Input Power

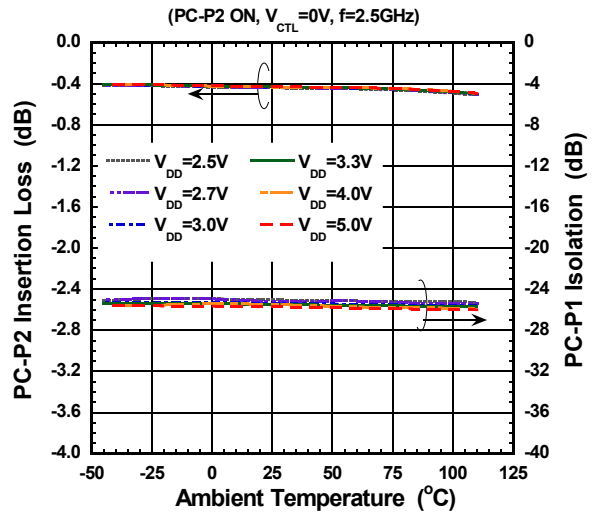


ELECTRICAL CHARACTERISTICS

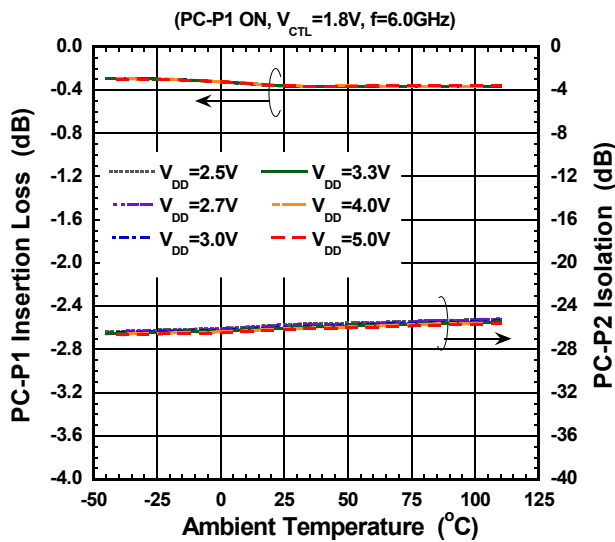
Loss, ISL vs Temperature



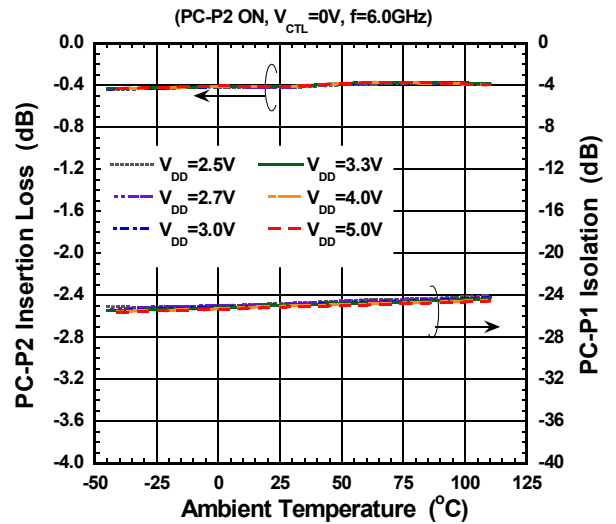
Loss, ISL vs Temperature



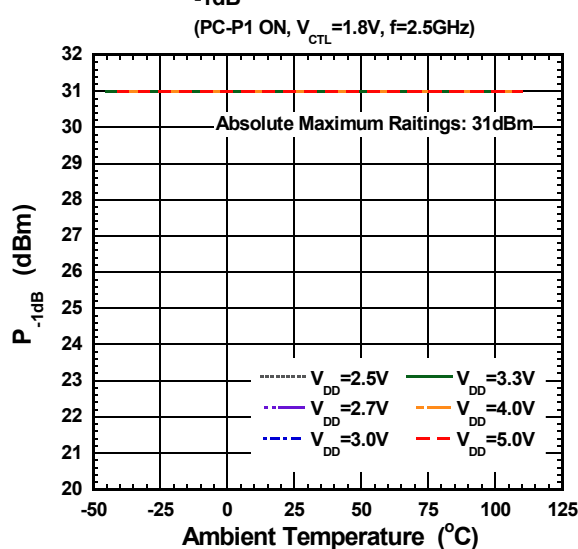
Loss, ISL vs Temperature



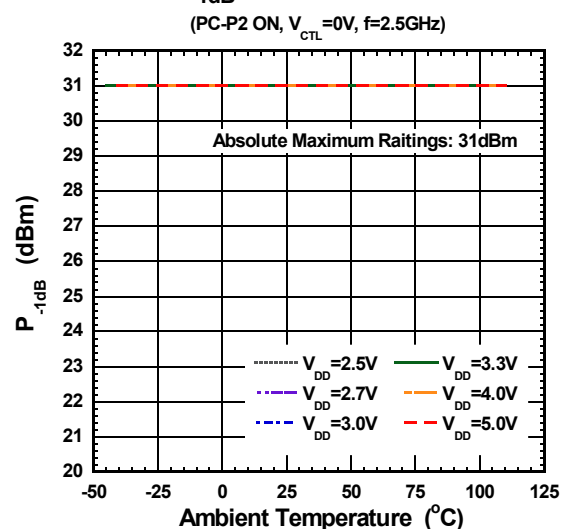
Loss, ISL vs Temperature



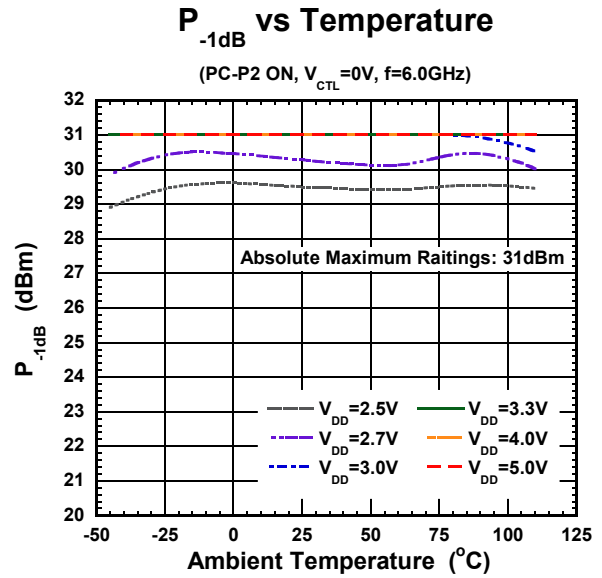
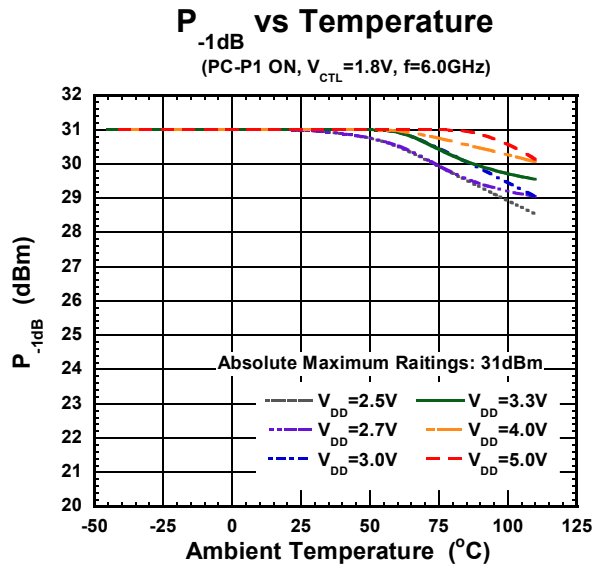
P_{-1dB} vs Temperature



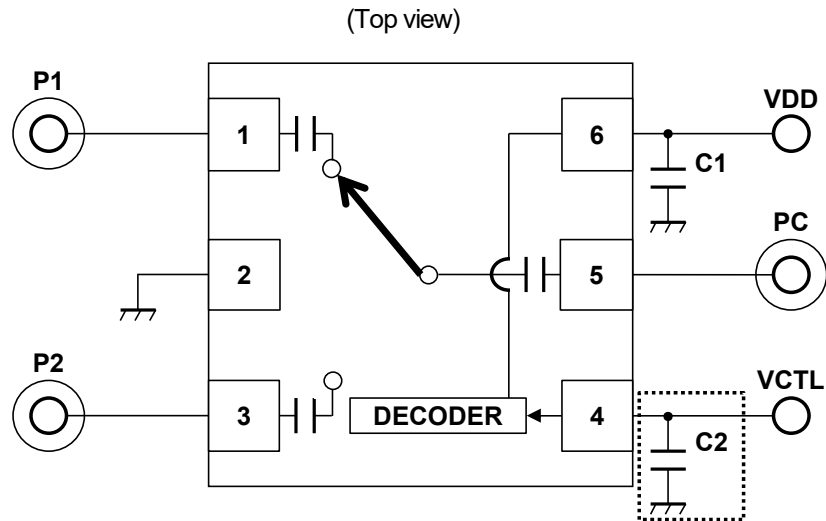
P_{-1dB} vs Temperature



■ ELECTRICAL CHARACTERISTICS



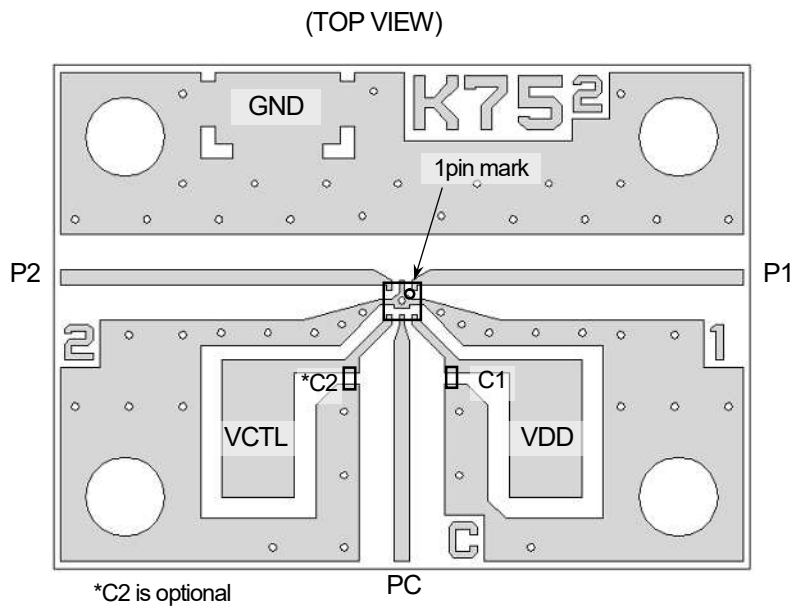
■ APPLICATION CIRCUIT



NOTE:

The bypass capacitor C2 is optional, and is recommended only when the control line is affected under noisy environment.

■ EVALUATION BOARD



PCB: FR-4, t = 0.2 mm
 Capacitor size: 0603 (0.6 x 0.3 mm)
 Strip line width: 0.4 mm
 PCB size: 19.4 x 14.0 mm
 Through hole diameter: 0.2 mm

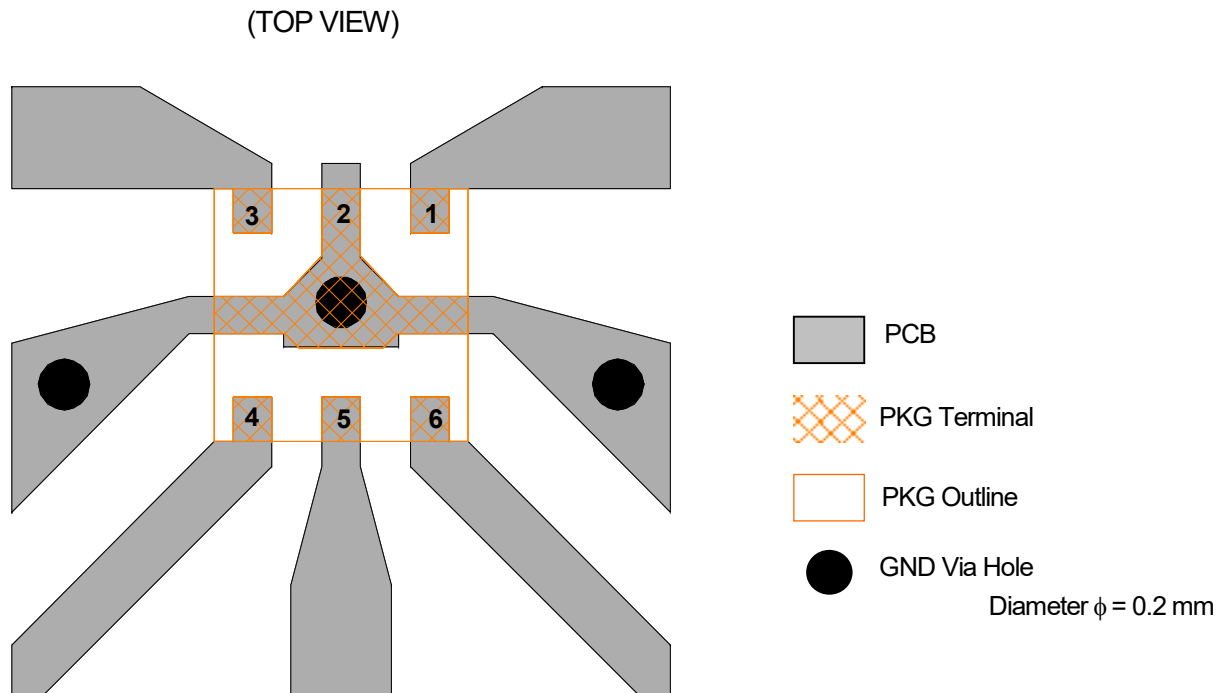
■ Loss of PCB and connectors

Frequency (GHz)	Loss (dB)
2.4	0.28
2.5	0.28
3.4	0.35
3.8	0.39
4.9	0.52
6.0	0.72

■ PARTS LIST

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

■PCB LAYOUT GUIDELINE



■PRECAUTIONS

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

■ HANDLING PRECAUTIONS

PIN NO.	SYMBOL	ESD RATINGS		
		Human Body Model ⁽¹⁾		Charged Device Model ⁽²⁾
Common terminal		Ground	I/O	
1	P1	Class 1C	Class 2	Class C6
2	GND	COM.	-	Class C6
3	P2	Class 1C	Class 2	Class C6
4	VCTL1	Class 1C	Class 1C	Class C6
5	PC	Class 2	Class 2	Class C6
6	VDD	Class 1C	-	Class C6

(1): According to JEDEC JS-001

(2): According to JEDEC JS-002

CAUTION:

This product may be damaged with electric static discharge (ESD) or spike voltage. Please handle with care to avoid these damages.

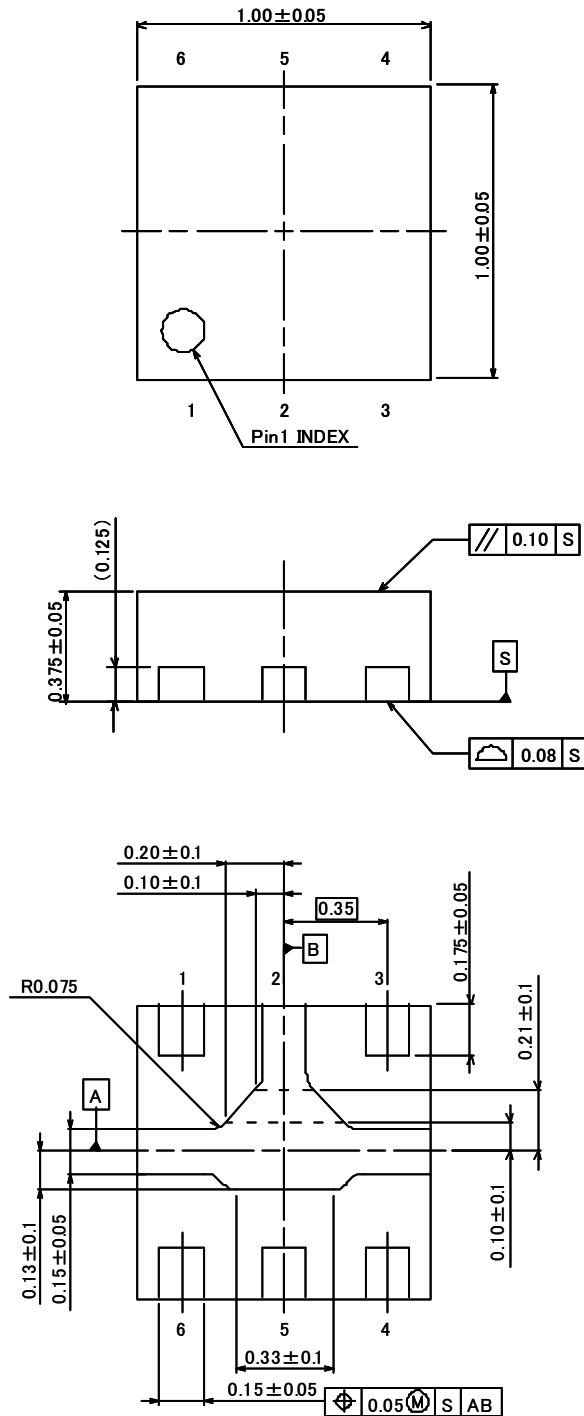
Pin pitch: 0.35 mm

 : Mask (Open area) *Metal mask thickness: 100 μm



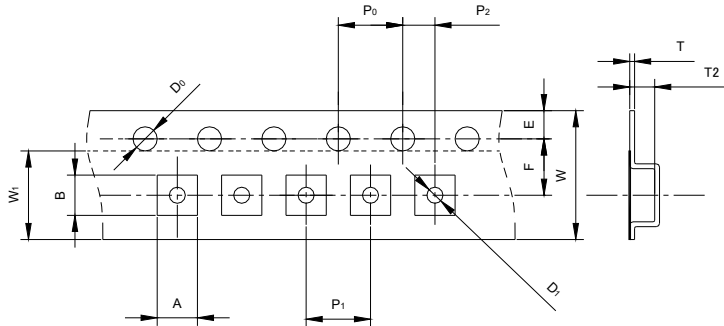
Automotive NJG1815AK75-A

■PACKAGE OUTLINE (DFN6-75)



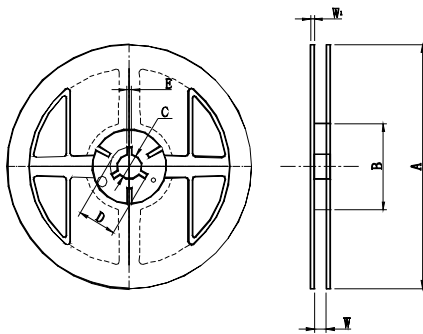
PACKING SPECIFICATION (DFN6-75)

TAPING DIMENSIONS



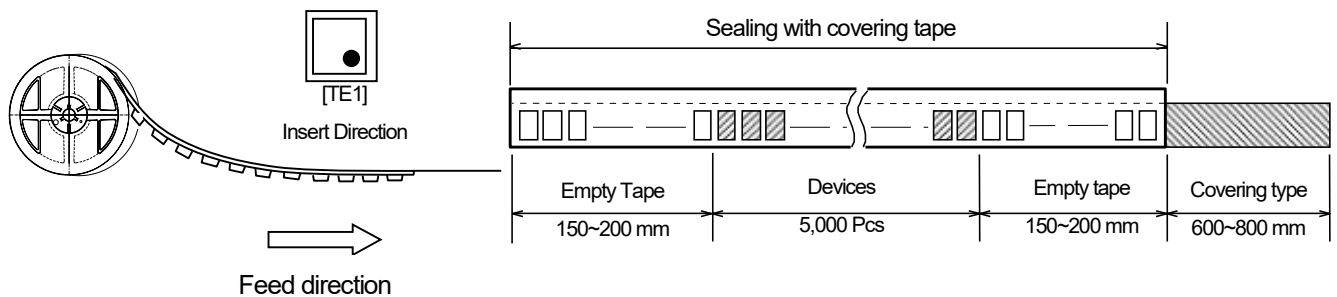
SYMBOL	DIMENSION	REMARKS
A	$1.19 + 0.04/-0.01$	BOTTOM
B	$1.19 + 0.04/-0.01$	BOTTOM
D0	$1.5 + 0.1/-0.0$	
D1	0.5 ± 0.05	
E	1.75 ± 0.1	
F	3.5 ± 0.05	
P0	4.0 ± 0.1	
P1	4.0 ± 0.1	
P2	2.0 ± 0.05	
T	0.18 ± 0.05	
T2	0.69 ± 0.10	
W	8.0 ± 0.1	
W1	5.5 ± 0.1	THICKNESS

REEL DIMENSIONS

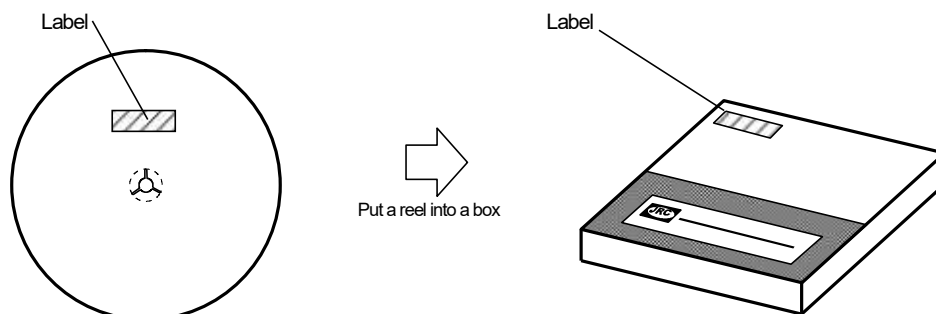


SYMBOL	DIMENSION
A	$\phi 180 + 0/-3$
B	$\phi 60 + 1/-0$
C	$\phi 13 \pm 0.2$
D	$\phi 21 \pm 0.8$
E	2 ± 0.5
W	9.0 ± 0.3
W1	1.2

TAPING STATE



PACKING STATE



Automotive NJG1815AK75-A

■ REVISION HISTORY

Date	Revision	Changes
25.Sep.2020	Ver.1.0	New Release

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 - Power Generator Control Equipment (nuclear, steam, hydraulic, etc.)
 - Life Maintenance Medical Equipment
 - Fire Alarms / Intruder Detectors
 - Vehicle Control Equipment (airplane, railroad, ship, etc.)
 - Various Safety Devices
 - Traffic control system
 - Combustion equipment

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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.
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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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