

## SPDT SWITCH GaAs MMIC

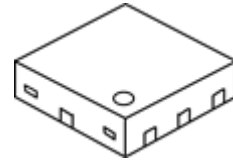
### ■ GENERAL DESCRIPTION

The NJG1815K75 is a 1bit control SPDT switch. The switch is used for WLAN system.

The switch features low insertion loss, high isolation for high frequency up to 6GHz, and high handling 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 DFN6-75 offer very small mounting area.

### ■ PACKAGE OUTLINE



NJG1815K75

### ■ APPLICATION

802.11 a/b/g/n/ac/ax networks applications

Transmit/receive switching, antenna switching and others switching applications

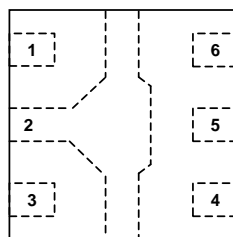
Smart phone, WLAN module, data card and others mobile applications

### ■ FEATURES

- Low control voltage  $V_{CTL(H)}=1.8V$  typ.
- Voltage operation  $V_{DD}=3.3V$  typ.
- Low insertion loss 0.45dB typ. @f=2.4 to 2.5GHz
- 0.40dB typ. @f=4.9 to 6.0GHz
- High isolation 25dB typ. @f=2.4 to 2.5GHz
- 25dB typ. @f=4.9 to 6.0GHz
- P-1dB  $P_{-1dB}=+31dBm$  typ. @f=2.4 to 6.0GHz
- Ultra small & ultra thin package DFN6-75 (Package Size: 1.0x1.0x0.375mm typ.)
- RoHS compliant and Halogen Free, MSL1

### ■ PIN CONFIGURATION

(Top view)



Pin connection

1. P1
2. GND
3. P2
4. VCTL
5. PC
6. VDD

### ■ TRUTH TABLE

“H”= $V_{CTL(H)}$ , “L”= $V_{CTL(L)}$

ON PATH	VCTL
PC-P1	H
PC-P2	L

NOTE: Please note that any data or drawing in this catalog is subject to change.

## ■ ABSOLUTE MAXIMUM RATINGS

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

PARAMETER	SYMBOL	CONDITIONS	RATINGS	UNITS
RF Input Power	$P_{IN}$	$V_{DD}=3.3\text{V}$ , ON State Port	+31	dBm
Supply Voltage	$V_{DD}$		6.0	V
Control Voltage	$V_{CTL}$		6.0	V
Power Dissipation	$P_D$	4-layer FR4 PCB with through-hole (76.2x114.3mm), $T_j=150^{\circ}\text{C}$	380	mW
Operating Temperature	$T_{opr}$		-40 to +105	$^{\circ}\text{C}$
Storage Temperature	$T_{stg}$		-55 to +150	$^{\circ}\text{C}$

## ■ ELECTRICAL CHARACTERISTICS1 (DC CHARACTERISTICS)

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

PARAMETERS	SYMBOL	CONDITIONS	MIN	TYP	MAX	UNITS
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	$\mu\text{A}$
Control Voltage (HIGH)	$V_{CTL(H)}$		1.35	1.8	5.0	V
Control Voltage (LOW)	$V_{CTL(L)}$		0	-	0.45	V
Control Current	$I_{CTL}$	$V_{CTL(H)}=1.8\text{V}$	-	3	10	$\mu\text{A}$

## ■ ELECTRICAL CHARACTERISTICS2 (RF CHARACTERISTICS)

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

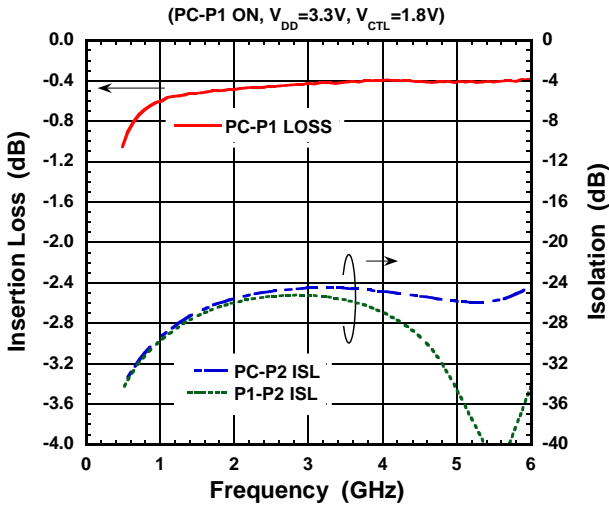
PARAMETERS	SYMBOL	CONDITIONS	MIN	TYP	MAX	UNITS
Insertion loss1	LOSS1	f=2.4 to 2.5GHz	-	0.45	0.65	dB
Insertion loss2	LOSS2	f=3.4 to 3.8GHz	-	0.45	0.65	dB
Insertion loss3	LOSS3	f=4.9 to 6.0GHz	-	0.40	0.60	dB
Isolation1	ISL1	f=2.4 to 2.5GHz	23	25	-	dB
Isolation2	ISL2	f=3.4 to 3.8GHz	22	25	-	dB
Isolation3	ISL3	f=4.9 to 6.0GHz	22	25	-	dB
Return loss1	RL1	f=2.4 to 2.5GHz	13	16	-	dB
Return loss2	RL2	f=3.4 to 3.8GHz	15	20	-	dB
Return loss3	RL3	f=4.9 to 6.0GHz	15	20	-	dB
Input power at 1dB compression point	$P_{-1dB}$	f=2.4 to 6.0GHz	+28	+31	-	dBm
Switching time	$T_{SW}$	50% $V_{CTL}$ to 10%/90% RF	-	150	400	ns

## ■ TERMINAL INFORMATION

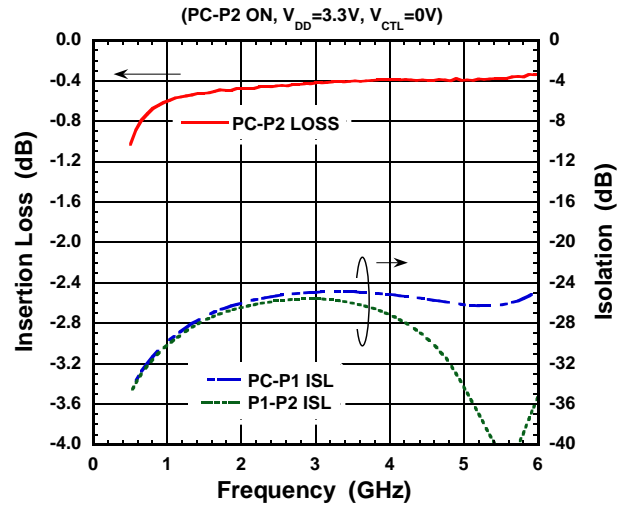
No.	SYMBOL	DESCRIPTION
1	P1	RF terminal. No DC blocking capacitor is required for this port because of internal capacitor.
2	GND	Ground terminal. Please connect this terminal with ground plane as close as possible for excellent RF performance.
3	P2	RF terminal. No DC blocking capacitor is required for this port because of internal capacitor.
4	VCTL	Control voltage input terminal. This terminal is set to High-Level (+1.35 to +5.0V) or Low-Level (0 to +0.45V).
5	PC	Common RF terminal. No DC blocking capacitor is required for this port because of internal capacitor.
6	VDD	Positive voltage supply terminal. The positive voltage (+2.5 to +5.0V) has to be supplied. Please connect a bypass capacitor with GND terminal for excellent RF performance.

## ■ ELECTRICAL CHARACTERISTICS

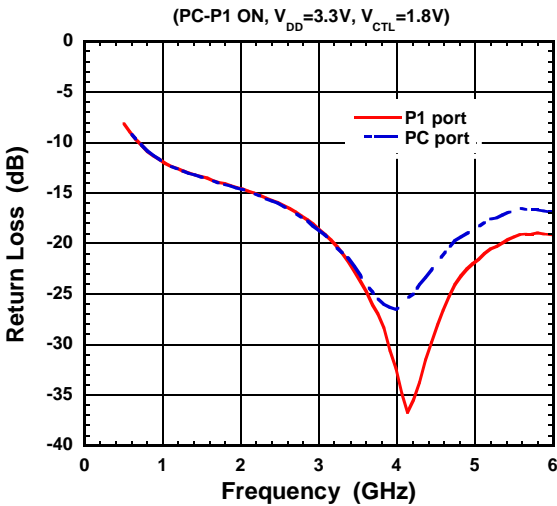
### Loss, ISL vs Frequency



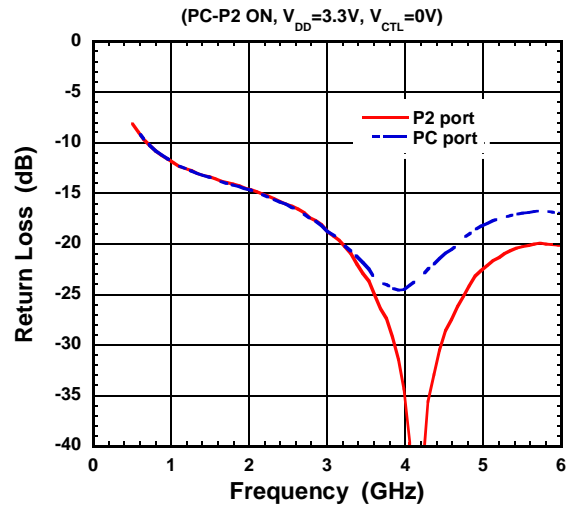
### Loss, ISL vs Frequency



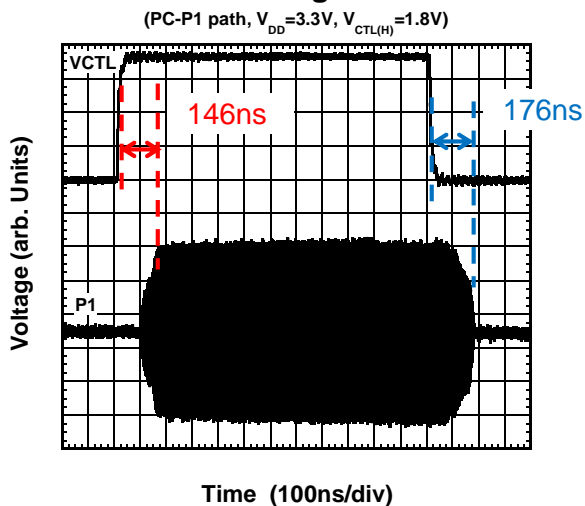
### Return Loss vs Frequency



### Return Loss vs Frequency

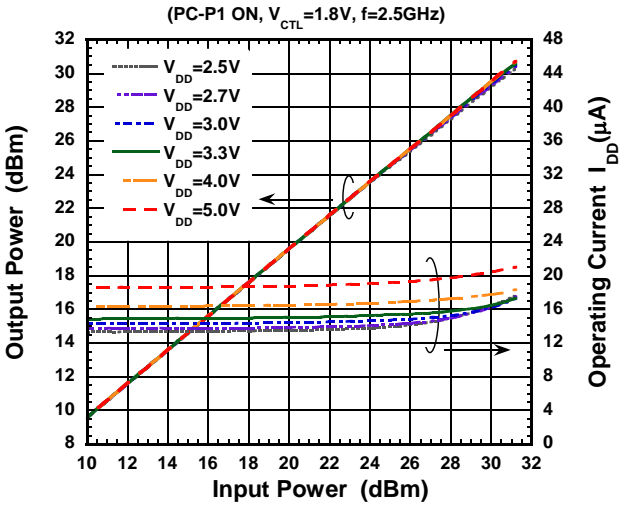


### Switching Time

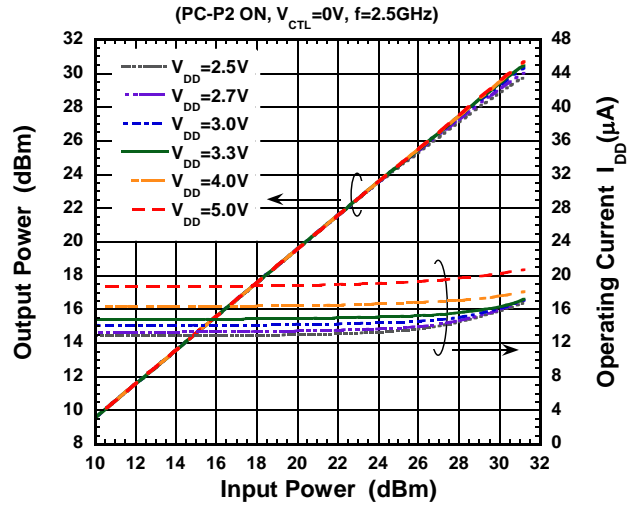


## ■ ELECTRICAL CHARACTERISTICS

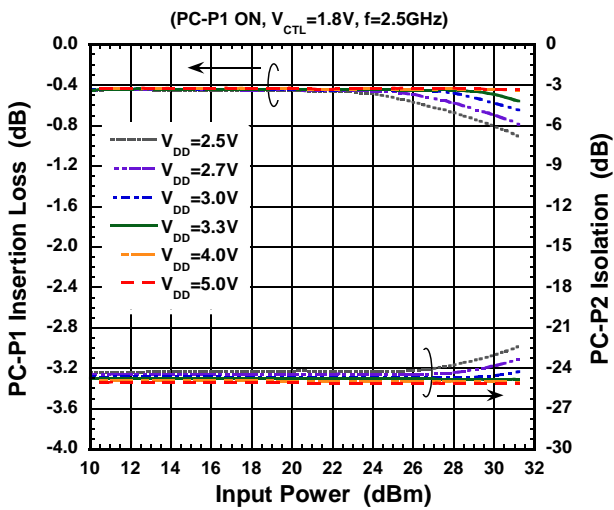
### Output Power, $I_{DD}$ vs Input Power



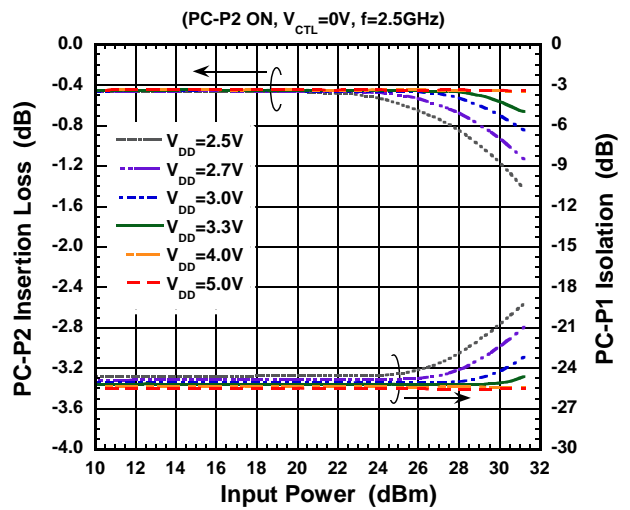
### Output Power, $I_{DD}$ vs Input Power



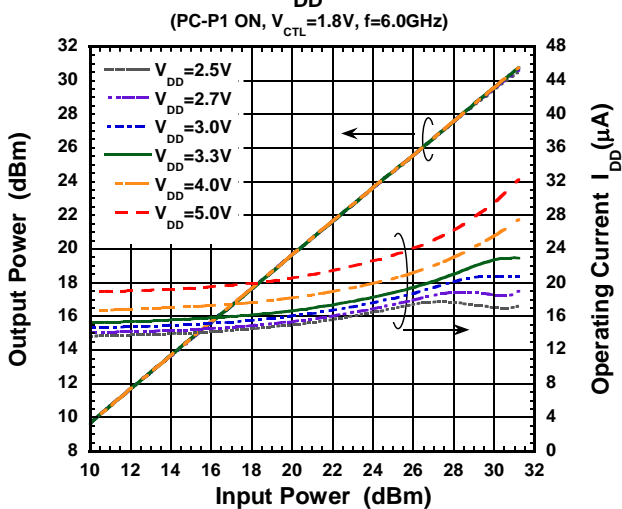
### Loss, ISL vs Input Power



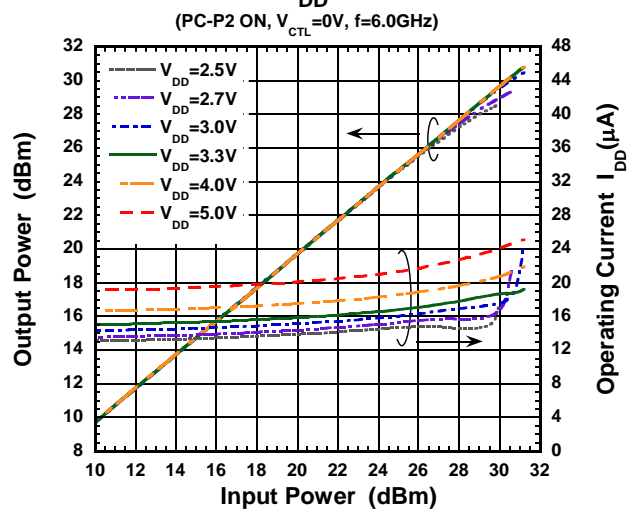
### Loss, ISL vs Input Power



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



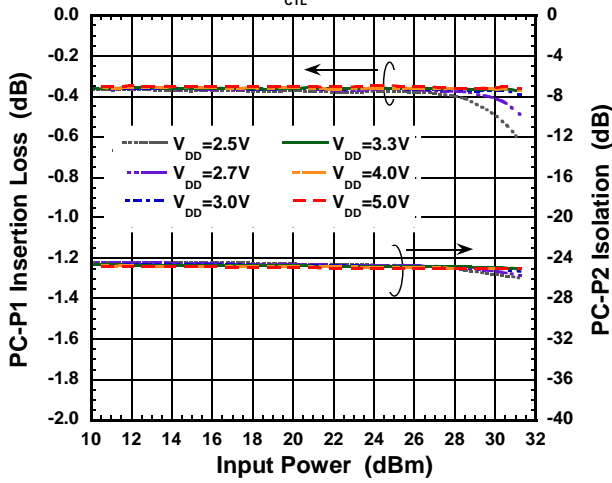
### Output Power, $I_{DD}$ vs Input Power



## ELECTRICAL CHARACTERISTICS

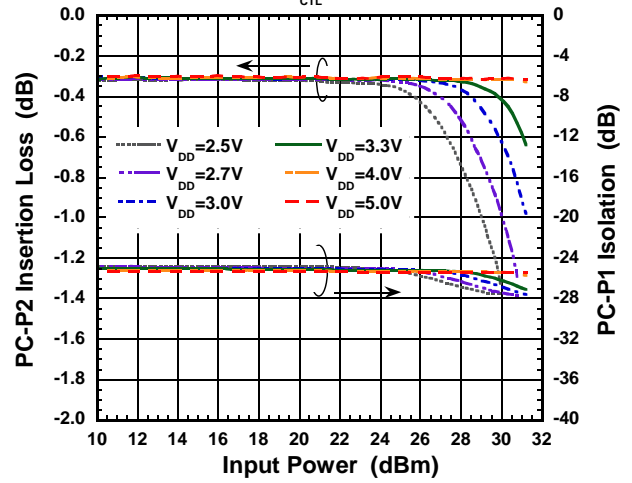
### Loss, ISL vs Input Power

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



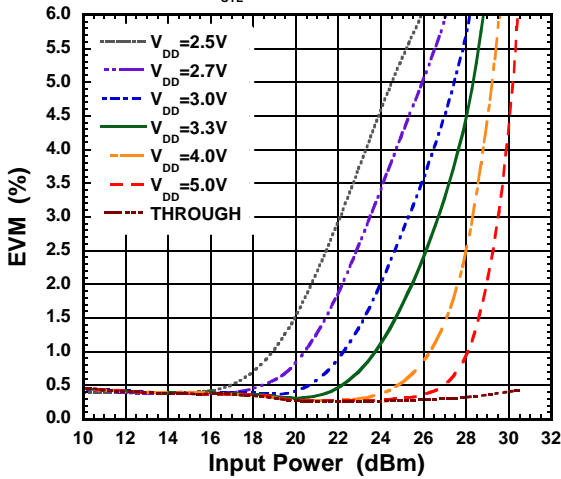
### Loss, ISL vs Input Power

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



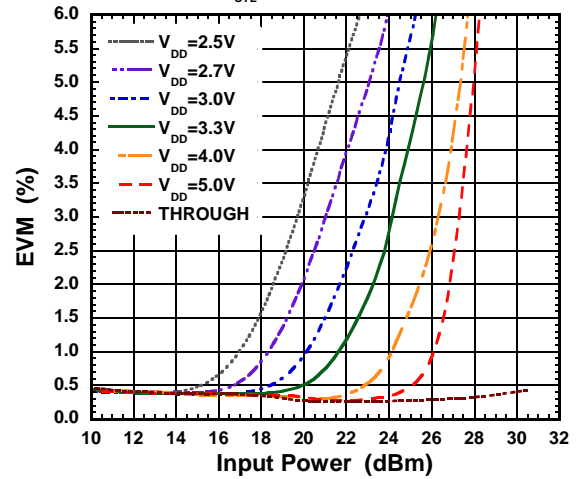
### EVM vs Input Power

(PC-P1 ON,  $V_{CTL}=1.8V$ ,  $f=2.5GHz$ , OFDM 64QAM)



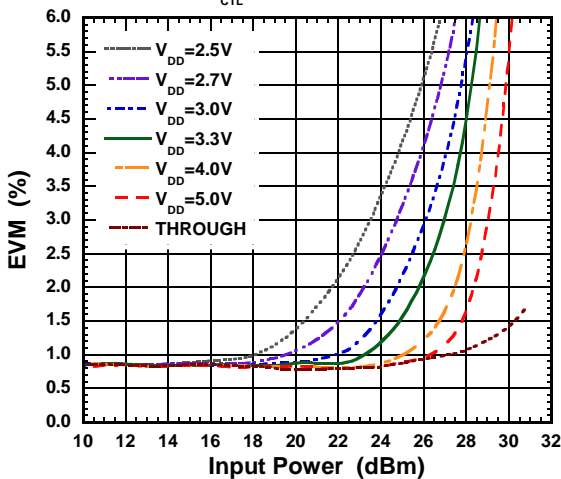
### EVM vs Input Power

(PC-P2 ON,  $V_{CTL}=0V$ ,  $f=2.5GHz$ , OFDM 64QAM)



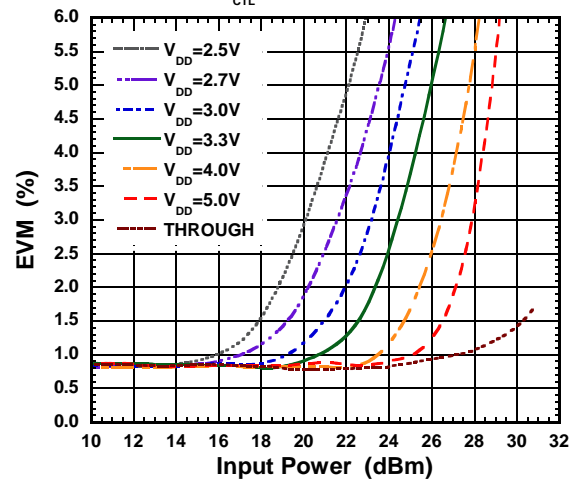
### EVM vs Input Power

(PC-P1 ON,  $V_{CTL}=1.8V$ ,  $f=6.0GHz$ , OFDM 64QAM)



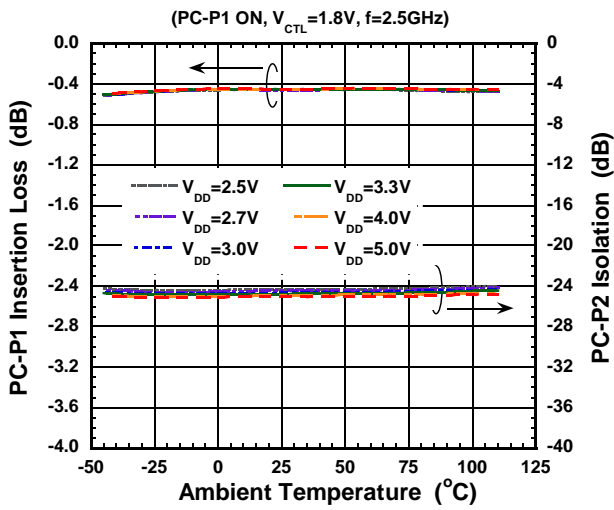
### EVM vs Input Power

(PC-P2 ON,  $V_{CTL}=0V$ ,  $f=6.0GHz$ , OFDM 64QAM)

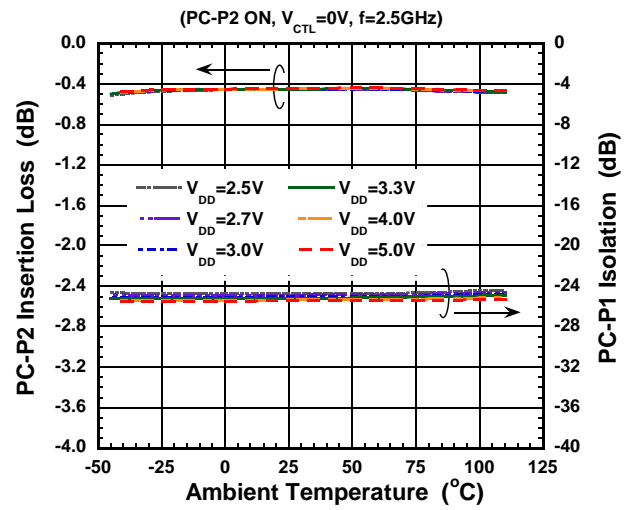


## ■ ELECTRICAL CHARACTERISTICS

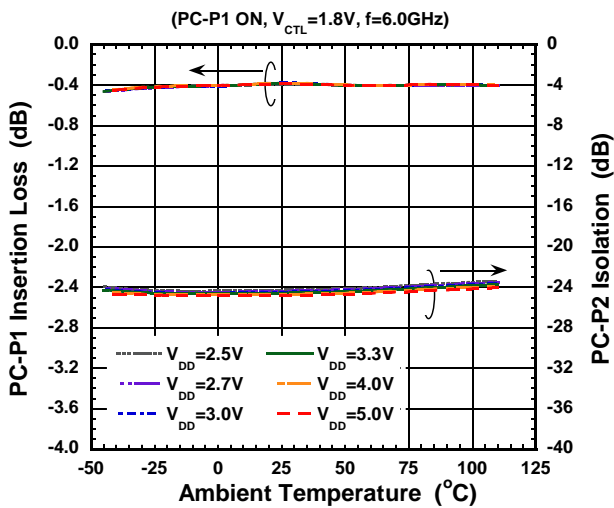
### Loss, ISL vs Temperature



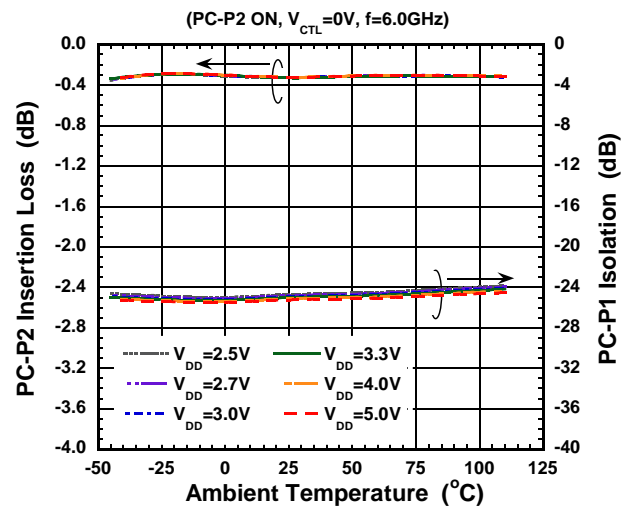
### Loss, ISL vs Temperature



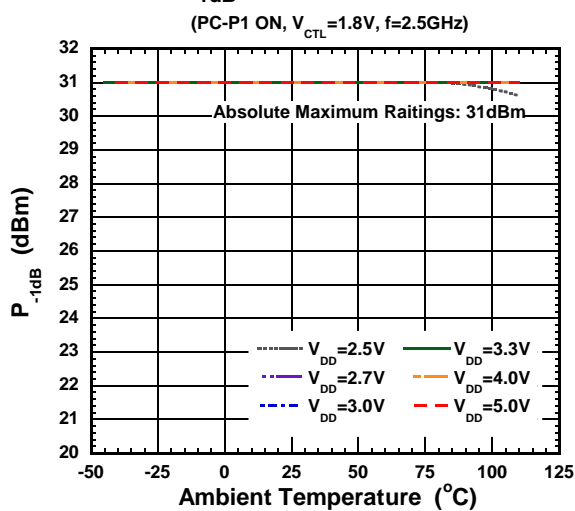
### Loss, ISL vs Temperature



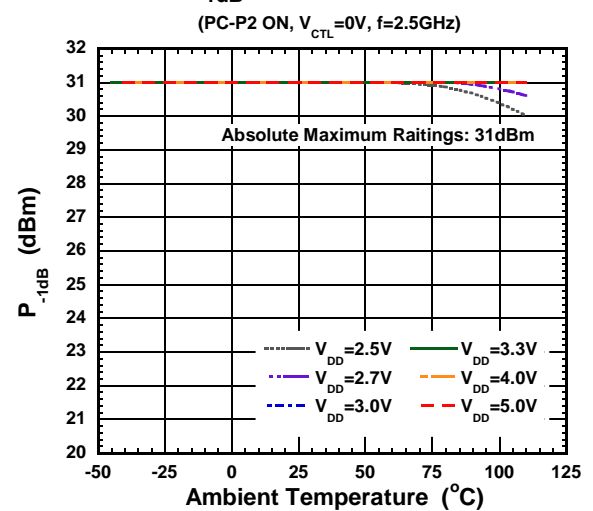
### Loss, ISL vs Temperature



### $P_{-1dB}$ vs Temperature

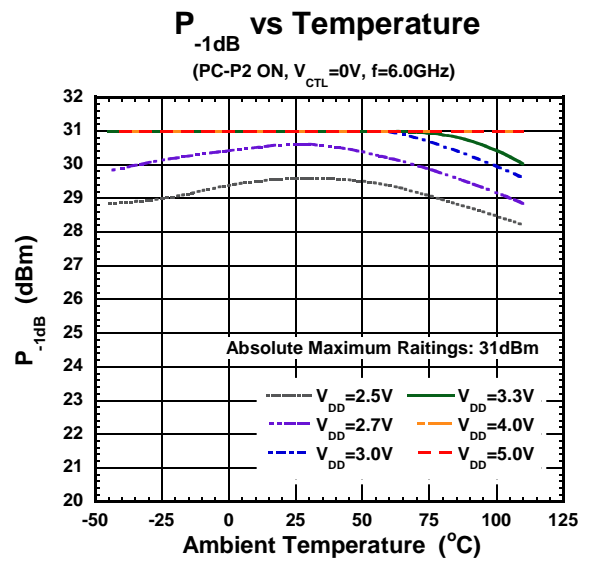
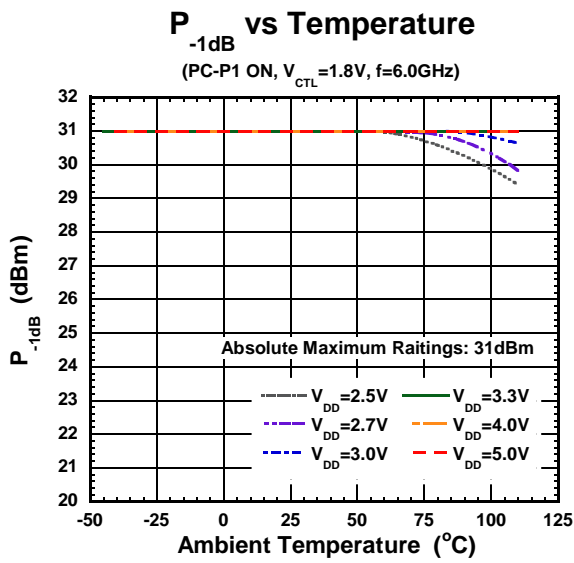


### $P_{-1dB}$ vs Temperature

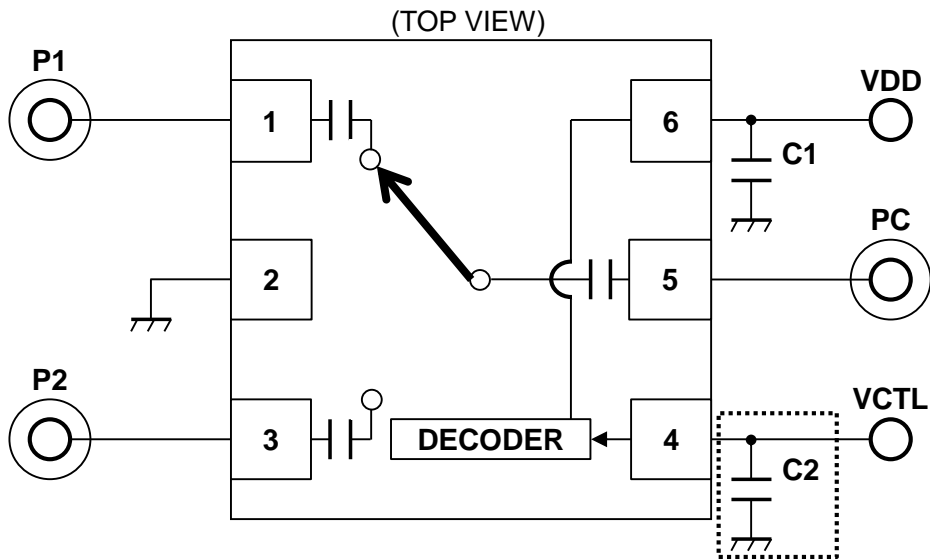




## ELECTRICAL CHARACTERISTICS



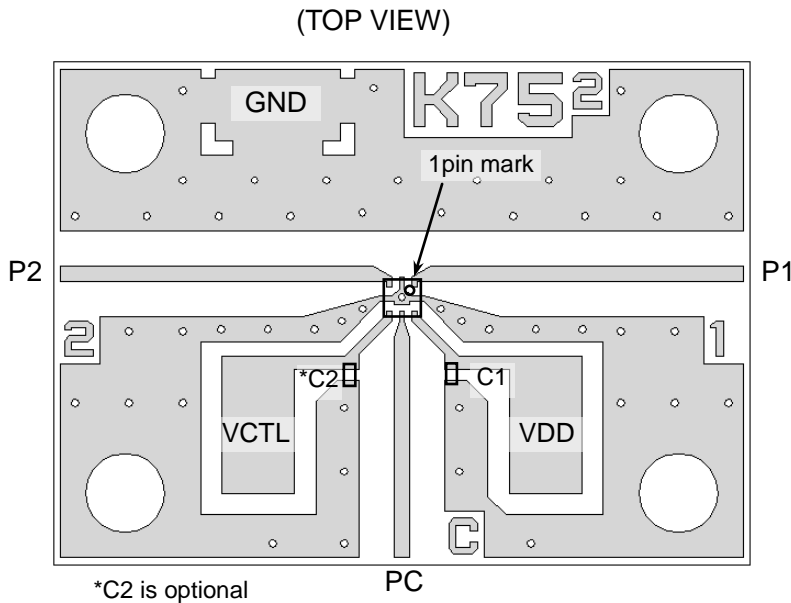
## APPLICATION CIRCUIT



### NOTE:

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

## PCB LAYOUT



PCB: FR-4, t=0.2mm

Capacitor Size: 0603 (0.6 x 0.3 mm)

Strip Line Width: 0.4mm

PCB Size: 19.4 x 14.0mm

Through Hole Diameter: 0.2mm

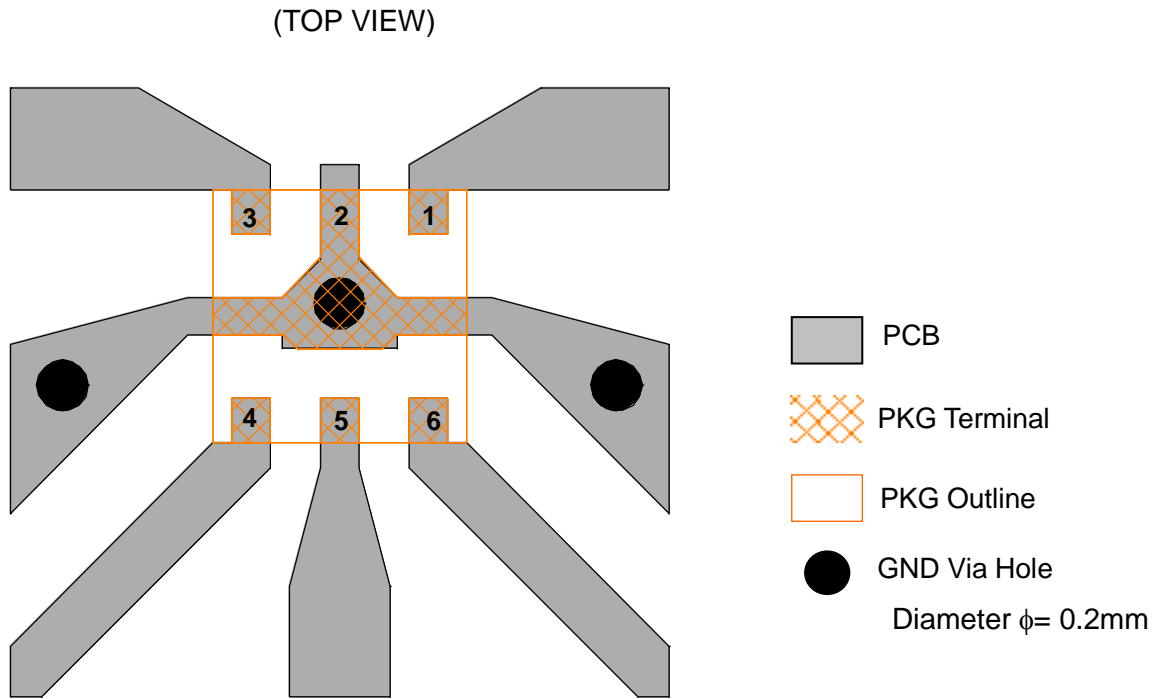
### Loss of PCB and connectors

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

No.	Value	Notes
C1	1000pF	Murata MFG (GRM03 series)
C2	10pF	

## ■ PCB LAYOUT GUIDELINE



## PRECAUTIONS

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


## RECOMMENDED FOOTPRINT PATTERN (6pin DFN Package 1.0x1.0mm) <Reference>

Package: 1.0mm x 1.0mm

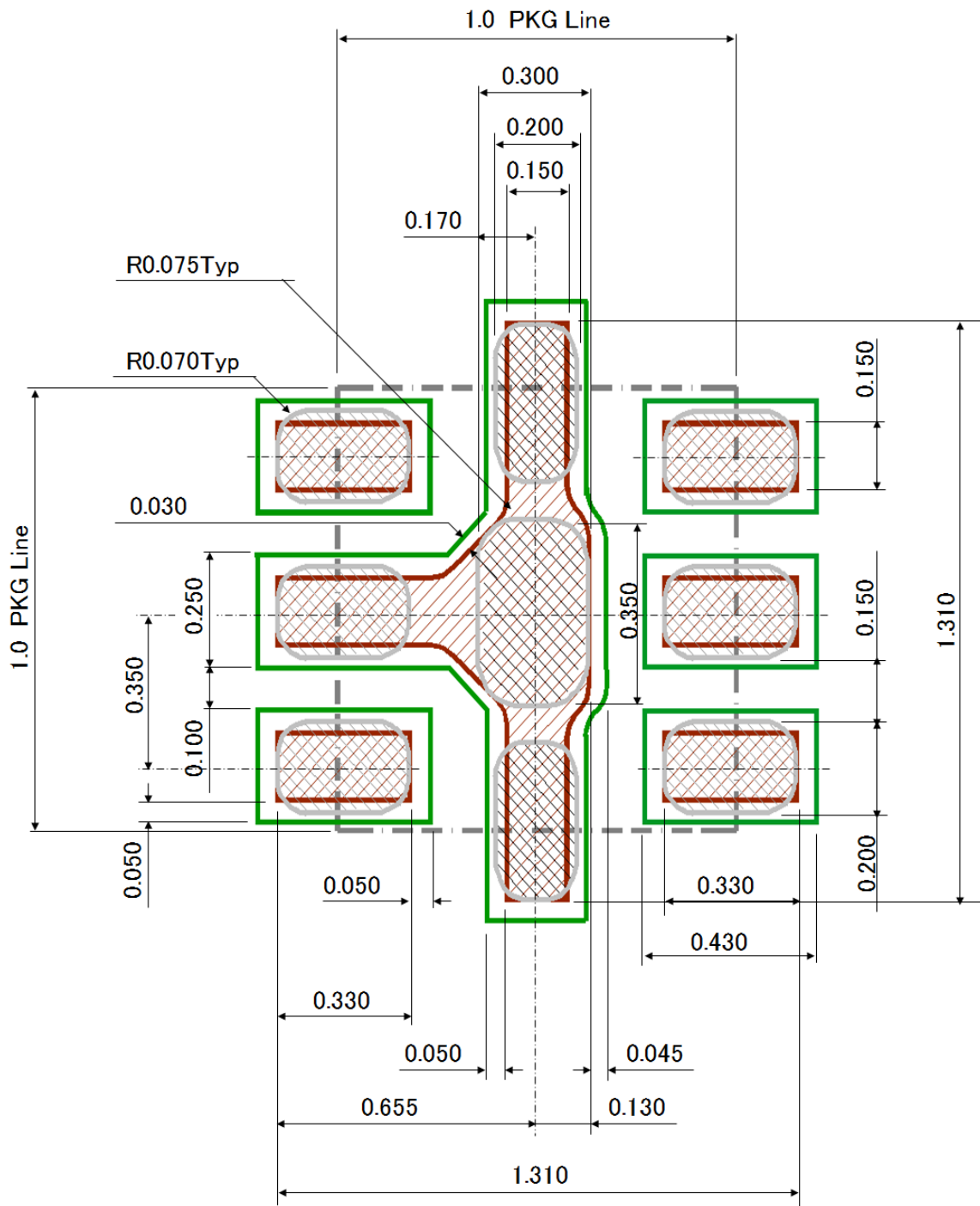
Pin pitch: 0.35mm

 : Land

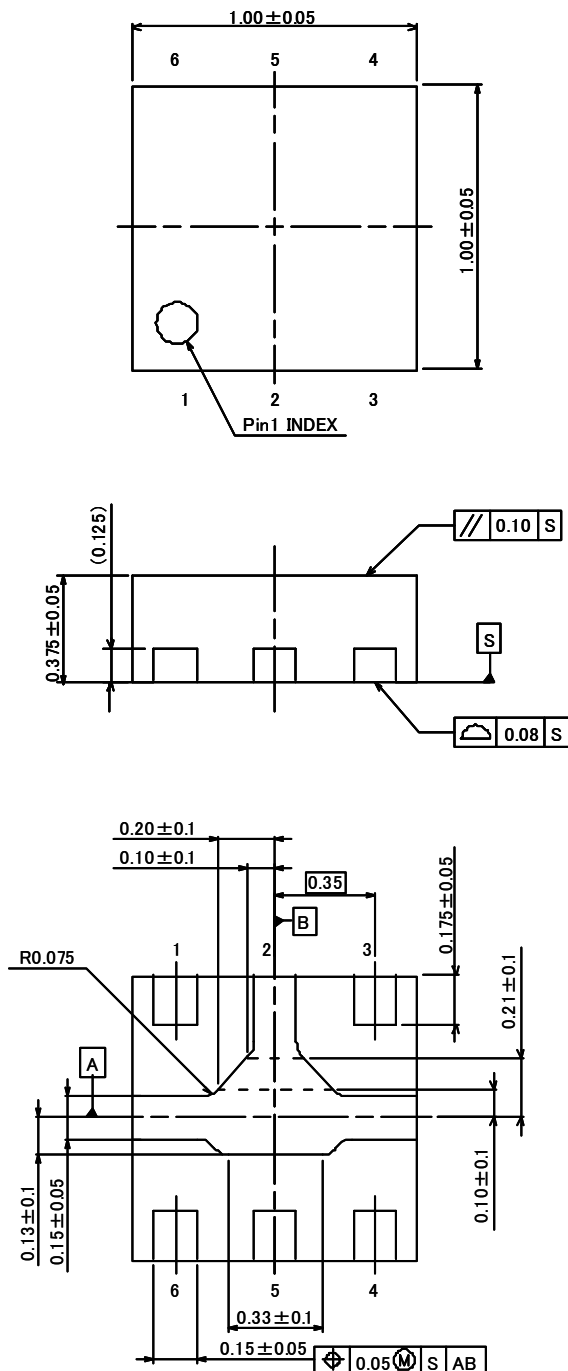
 : Mask (Open area) \*Metal mask thickness: 100μm

 : Resist (Open area)

Unit : mm



## ■ PACKAGE OUTLINE (DFN6-75)



Unit	: mm
Board	: Cu
Terminal Treat	: Ni/Pd/Au
Molding Material	: Epoxy resin
Weight	: 1.2mg

### Cautions on using this product

- This product contains Gallium-Arsenide (GaAs) which is a harmful material.
- Do NOT eat or put into mouth.
- Do NOT dispose in fire or break up this product.
- Do NOT chemically make gas or powder with this product.
- To waste this product, please obey the relating law of your country.

### [CAUTION]

The specifications on this databook are only given for information, without any guarantee as regards either mistakes or omissions. The application circuits in this databook are described only to show representative usages of the product and not intended for the guarantee or permission of any right including the industrial rights.

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