

## SPDT SWITCH GaAs MMIC

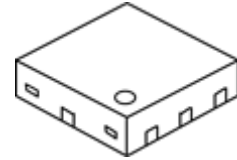
### ■ GENERAL DESCRIPTION

The NJG1806K75 is a 1bit control SPDT switch IC suited for switching transmit receive signals at WLAN application and receive signals at 3G/ LTE systems.

The NJG1806K75 features low insertion loss, high isolation, and high handling power down to 1.8V control voltage at high frequency up to 6GHz.

This switch has ESD protection devices to achieve excellent ESD performances. And the ultra small and ultra thin package of DFN6-75 is adopted.

### ■ PACKAGE OUTLINE



NJG1806K75

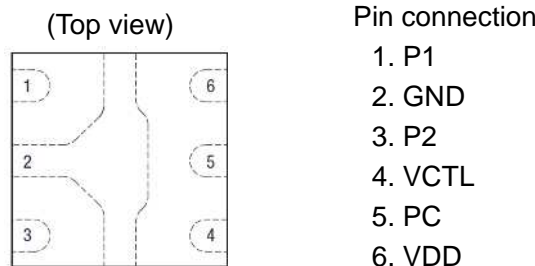
### ■ APPLICATION

- 802.11a/b/g/n/ac/ax networks and 3G/ LTE applications
- WLAN Module/ Repeaters, Cellular phone and others mobile device.

### ■ FEATURES

- Low control voltage  $V_{CTL(H)}=1.8V$  typ.
- Voltage operation  $V_{DD}=3.3V$  typ.
- Low insertion loss
  - 0.35dB typ. @f=0.7GHz
  - 0.35dB typ. @f=1.9GHz
  - 0.35dB typ. @f=2.4 to 2.5GHz
  - 0.40dB typ. @f=4.9 to 5.9GHz
- High isolation
  - 30dB typ. @f=0.7GHz
  - 25dB typ. @f=1.9GHz
  - 25dB typ. @f=2.4 to 2.5GHz
  - 25dB typ. @f=4.9 to 5.9GHz
- P-1dB  $P_{-1dB}=+31dBm$  typ. @0.7 to 5.9 GHz
- Ultra small & ultra thin package DFN6-75 (Package Size: 1.0x1.0x0.375mm typ.)
- RoHS compliant and Halogen Free, MSL1

### ■ PIN CONFIGURATION



### ■ 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        | $P_{IN}$  | $V_{DD}=3.3\text{V}$ ,<br>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<br>with through-hole<br>(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 loss 1                     | LOSS1      | f=0.7GHz                    | -   | 0.35 | 0.55 | dB    |
| Insertion loss 2                     | LOSS2      | f=1.9GHz,                   | -   | 0.35 | 0.55 | dB    |
| Insertion loss 3                     | LOSS3      | f=2.4 to 2.5GHz             | -   | 0.35 | 0.55 | dB    |
| Insertion loss 4                     | LOSS4      | f=4.9 to 5.9GHz             | -   | 0.40 | 0.60 | dB    |
| Isolation 1                          | ISL1       | f=0.7GHz                    | 28  | 30   | -    | dB    |
| Isolation 2                          | ISL2       | f=1.9GHz                    | 23  | 25   | -    | dB    |
| Isolation 3                          | ISL3       | f=2.4 to 2.5GHz             | 23  | 25   | -    | dB    |
| Isolation 4                          | ISL4       | f=4.9 to 5.9GHz             | 23  | 25   | -    | dB    |
| Return loss 1                        | RL1        | f=0.7GHz                    | 15  | 20   | -    | dB    |
| Return loss 2                        | RL2        | f=1.9GHz                    | 18  | 28   | -    | dB    |
| Return loss 3                        | RL3        | f=2.4 to 2.5GHz             | 18  | 28   | -    | dB    |
| Return loss 4                        | RL4        | f=4.9 to 5.9GHz             | 15  | 20   | -    | dB    |
| Input power at 1dB compression point | $P_{-1dB}$ | f=0.7 to 5.9GHz             | +28 | +31  | -    | dBm   |
| Switching time                       | $T_{SW}$   | 50% $V_{CTL}$ to 10%/90% RF | -   | 150  | 300  | ns    |

## ■ TERMINAL INFORMATION

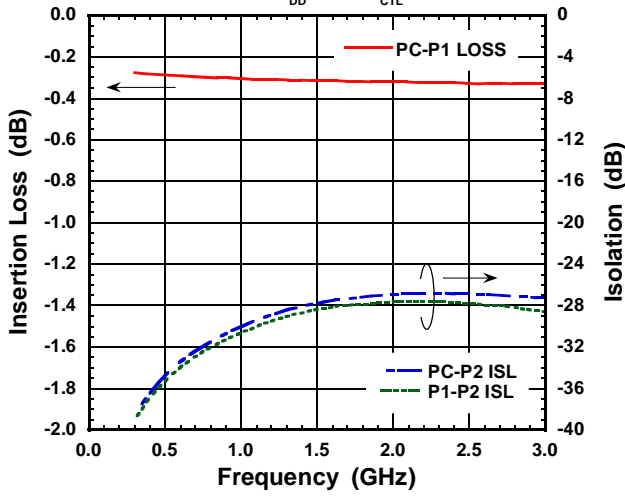
| No. | SYMBOL | DESCRIPTION  |
|-----|--------|--|
| 1   | P1     | RF terminal. An external DC blocking capacitor is required.  |
| 2   | GND    | Ground terminal. Please connect this terminal with ground plane as close as possible for excellent RF performance.   |
| 3   | P2     | RF terminal. An external DC blocking capacitor is required.  |
| 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. An external DC blocking capacitor is required.   |
| 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

General conditions:  $V_{DD}=3.3V$ ,  $V_{CTL}=1.8/0V$ ,  $f=0.7$  to  $2.0GHz$ ,  $T_a=+25^\circ C$ ,  $Z_S=Z_L=50\Omega$ , with application circuit

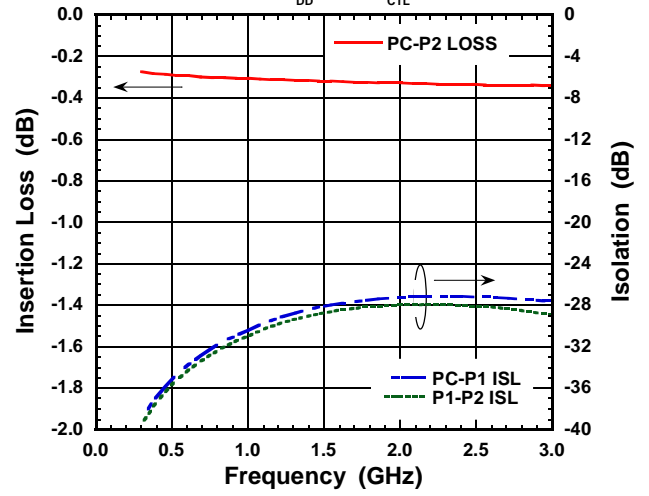
### Loss, ISL vs Frequency

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



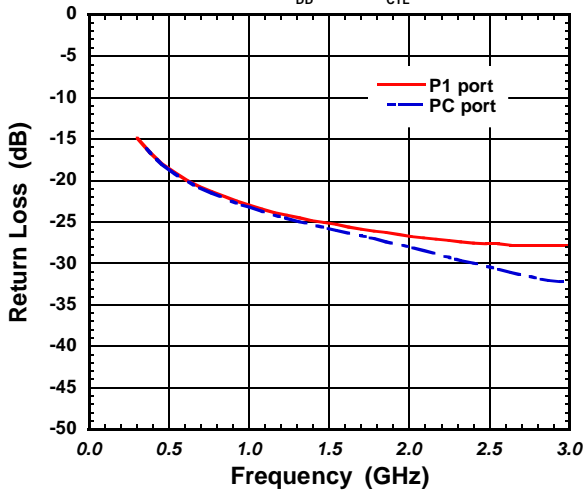
### Loss, ISL vs Frequency

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



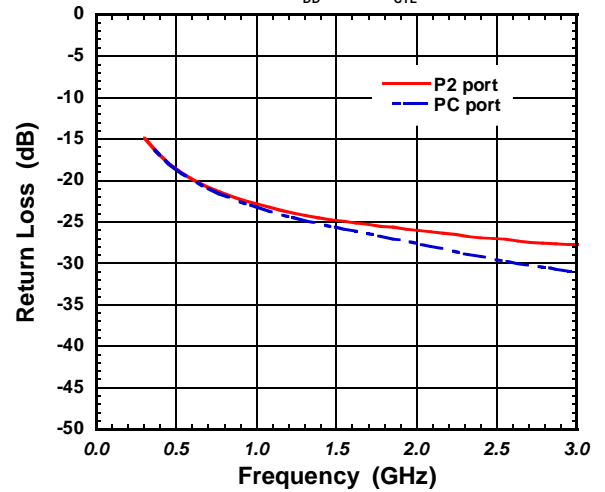
### Return Loss vs Frequency

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



### Return Loss vs Frequency

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

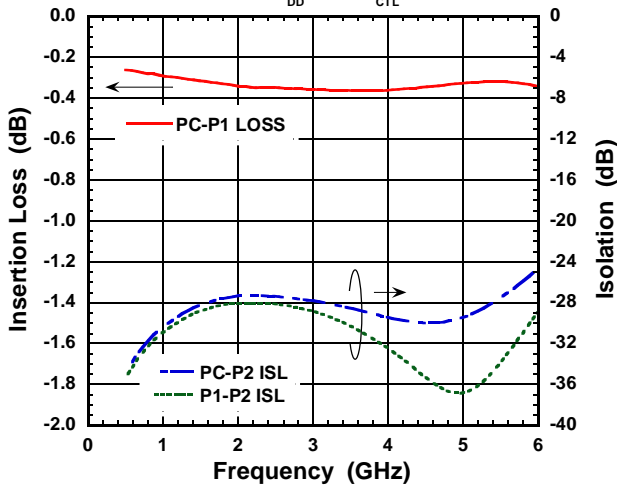


## ■ ELECTRICAL CHARACTERISTICS

General conditions:  $V_{DD}=3.3V$ ,  $V_{CTL}=1.8/0V$ ,  $f=2.0$  to  $5.9GHz$ ,  $T_a=+25^\circ C$ ,  $Z_S=Z_L=50\Omega$ , with application circuit

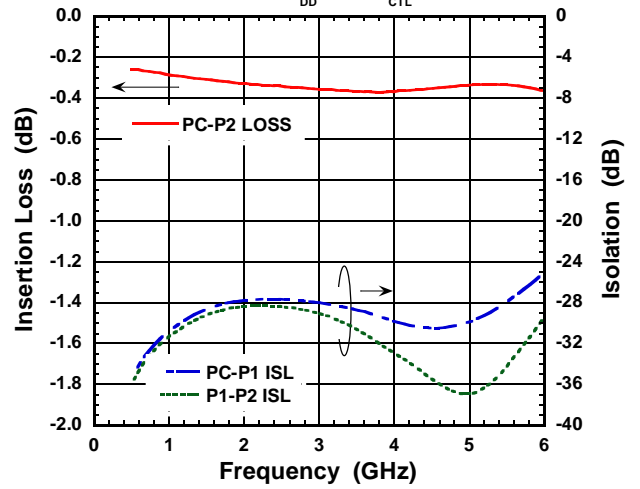
### Loss, ISL vs Frequency

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



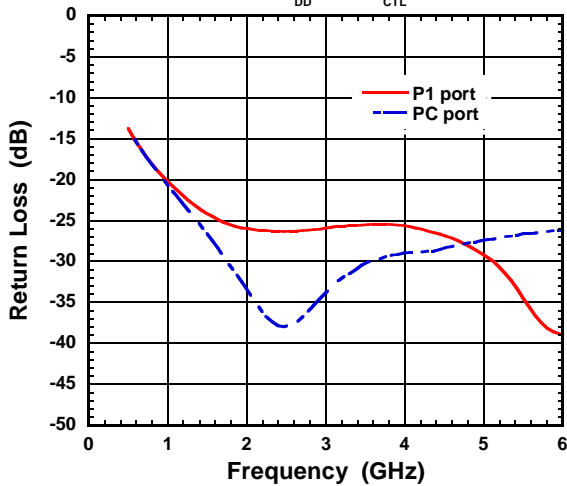
### Loss, ISL vs Frequency

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



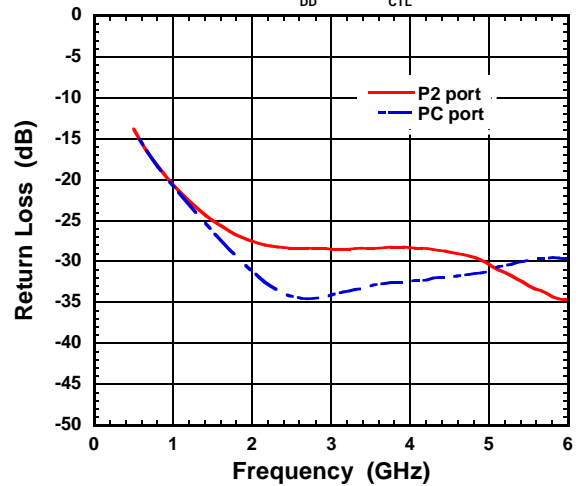
### Return Loss vs Frequency

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



### Return Loss vs Frequency

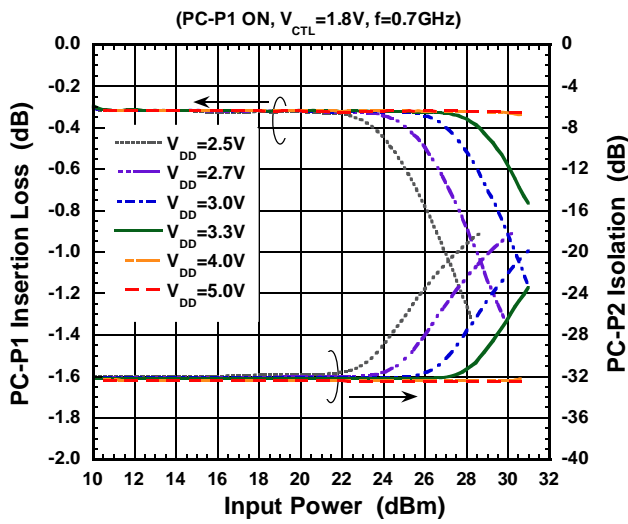
(PC-P2 ON,  $V_{DD}=3.3V$ ,  $V_{CTL}=0V$ )



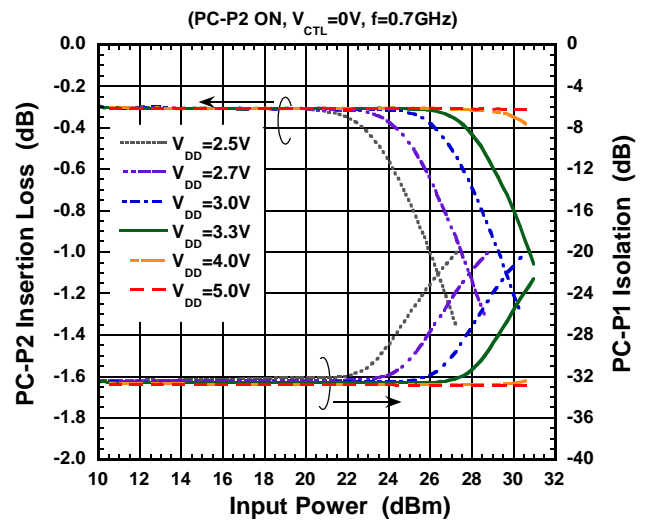
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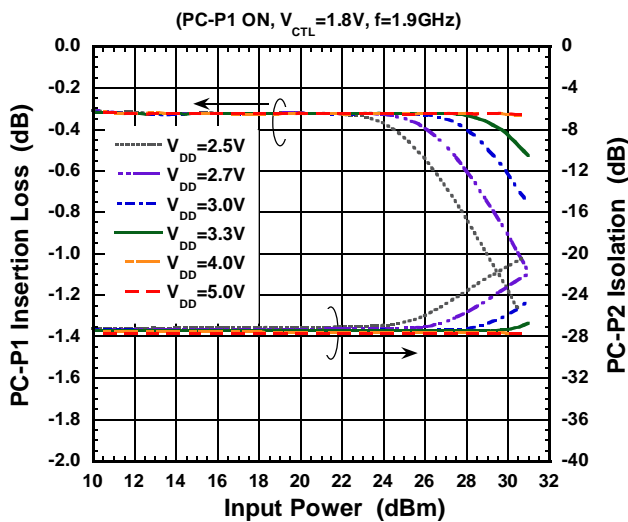
### Loss, ISL vs Input Power



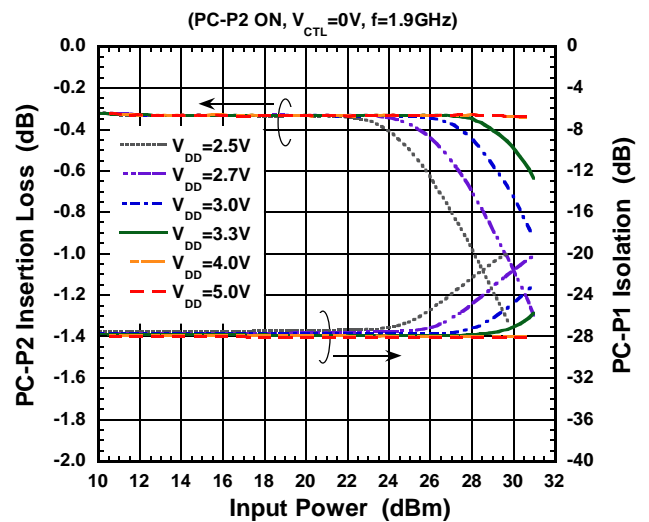
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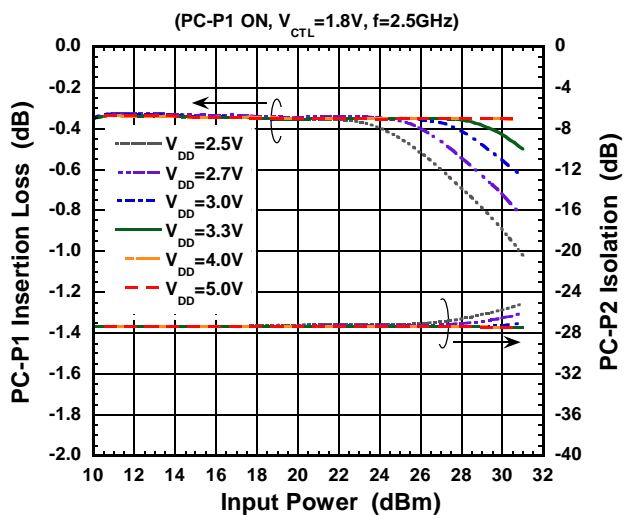
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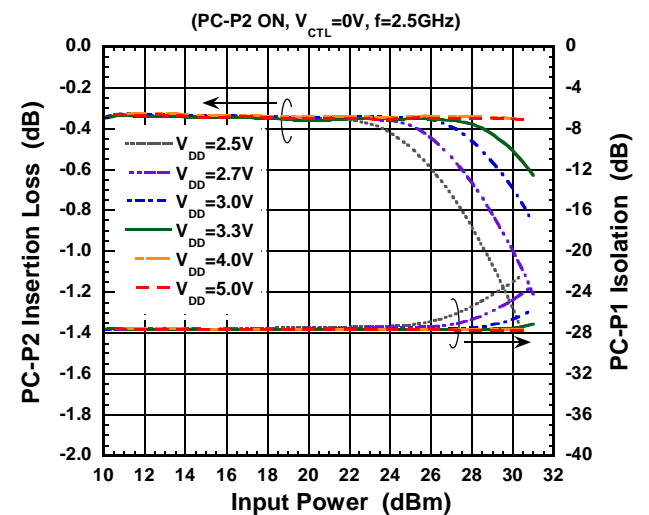
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### Loss, ISL vs Input Power



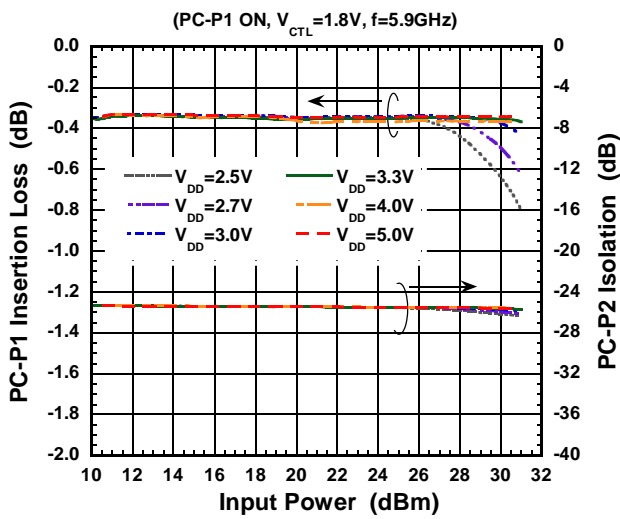
### Loss, ISL vs Input Power



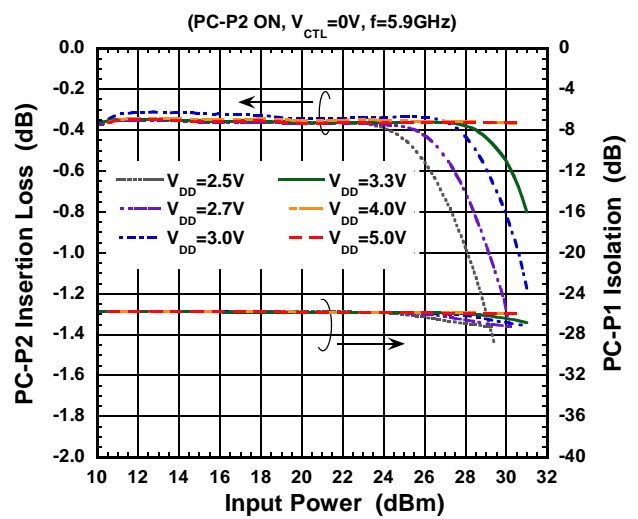
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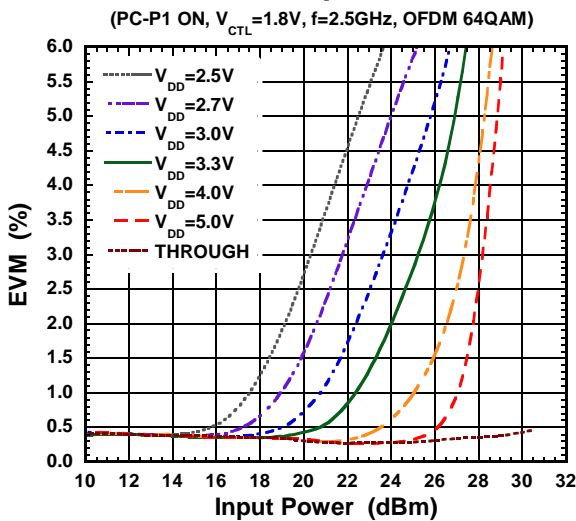
### Loss, ISL vs Input Power



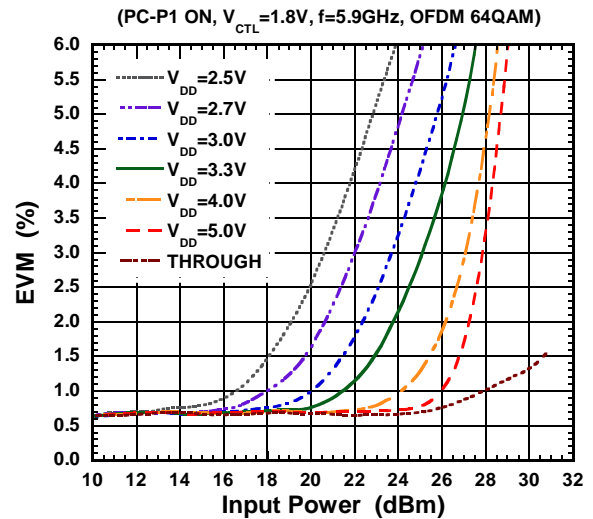
### Loss, ISL vs Input Power



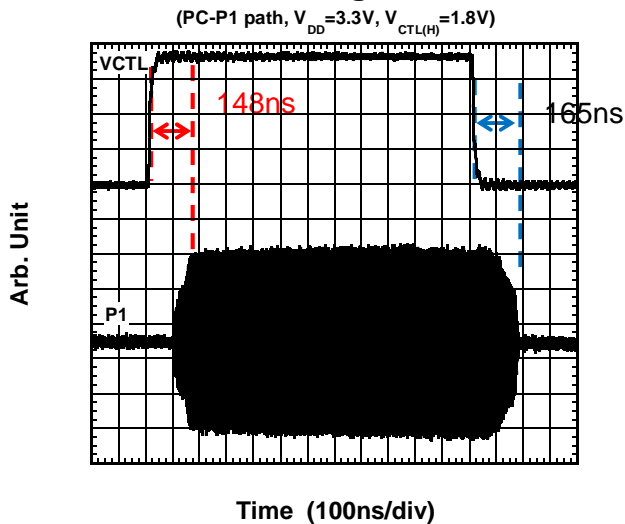
### EVM vs Input Power



### EVM vs Input Power



### Switching Time

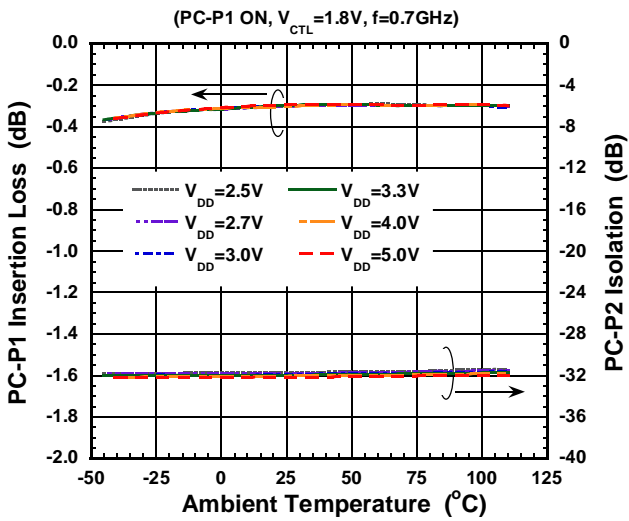




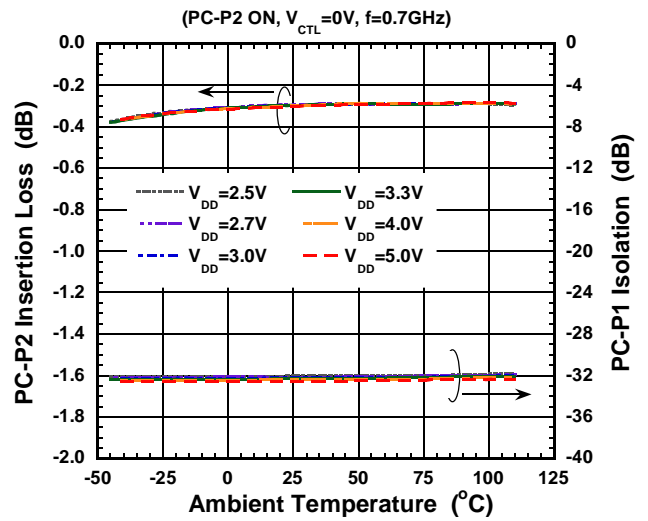
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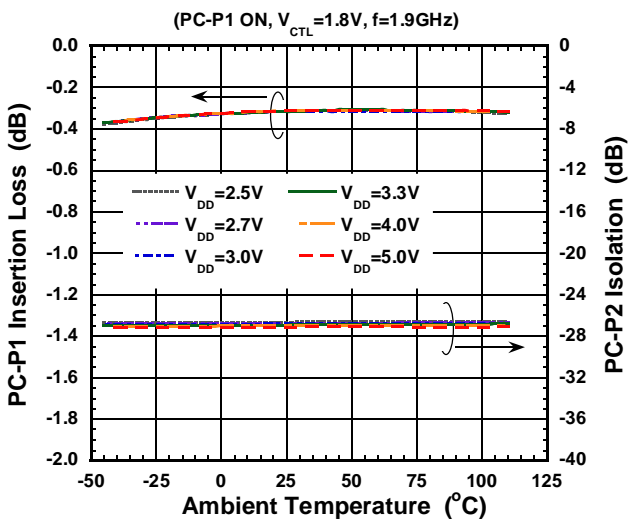
### Loss, ISL vs Temperature



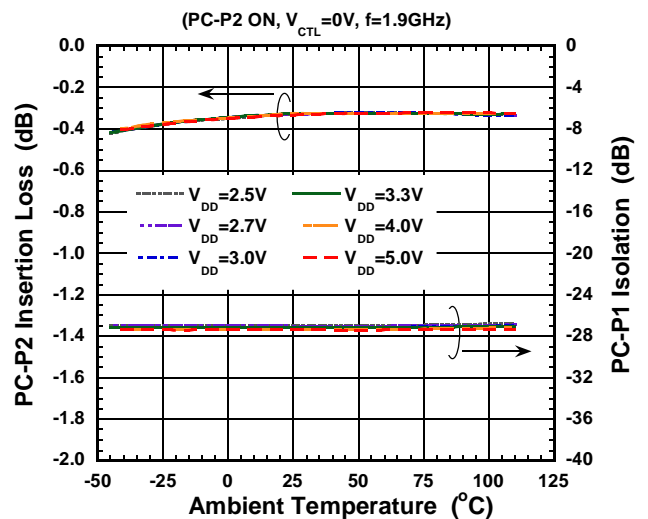
### Loss, ISL vs Temperature



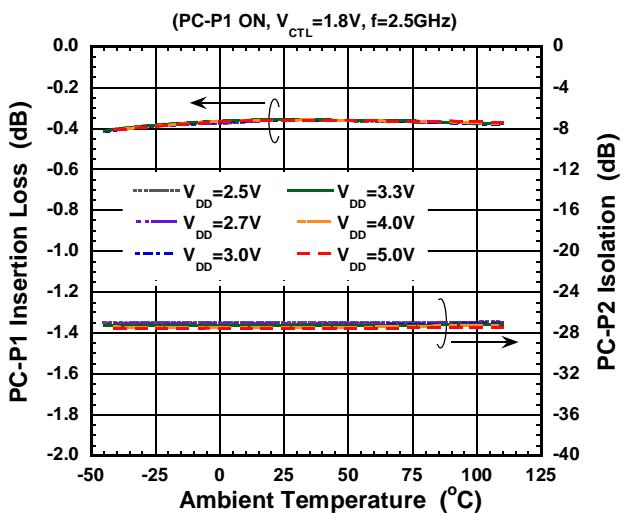
### Loss, ISL vs Temperature



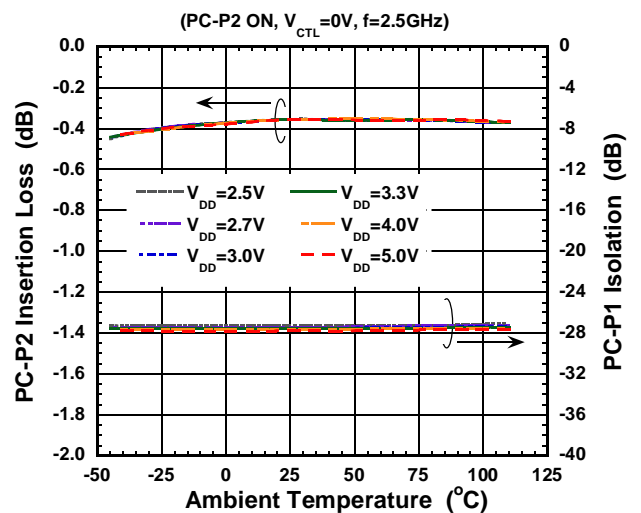
### Loss, ISL vs Temperature



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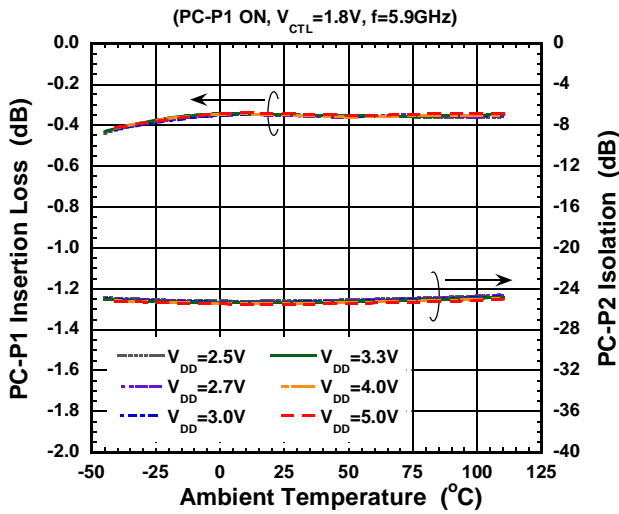
### Loss, ISL vs Temperature



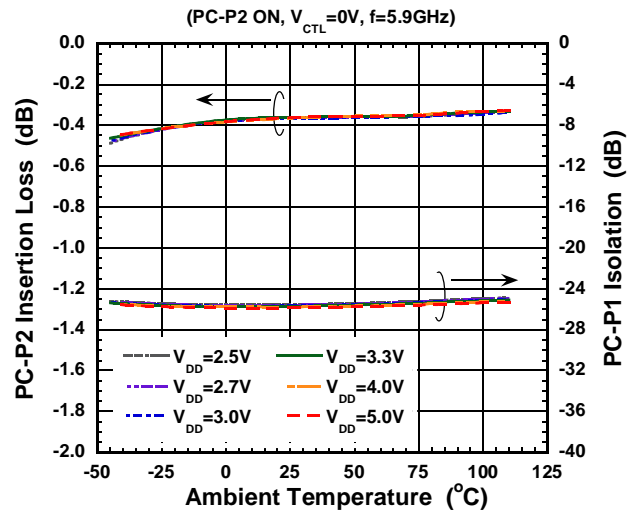
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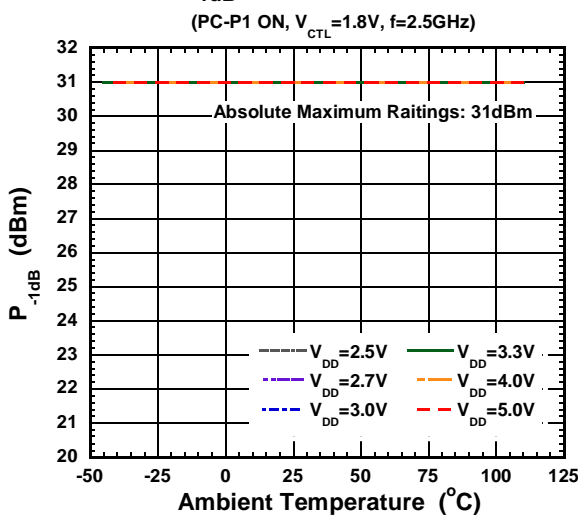
### Loss, ISL vs Temperature



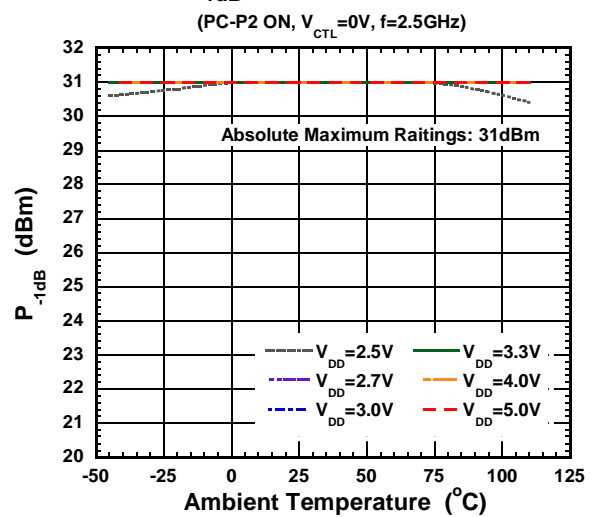
### Loss, ISL vs Temperature



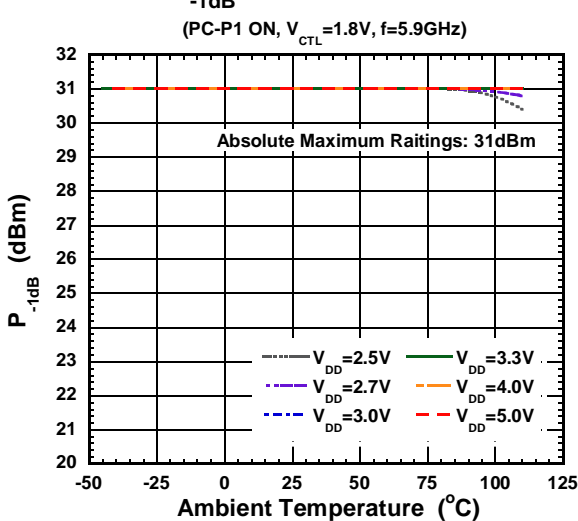
### $P_{-1dB}$ vs Temperature



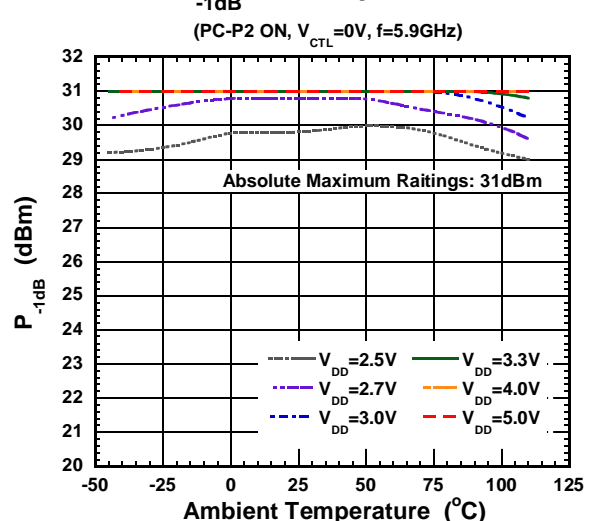
### $P_{-1dB}$ vs Temperature



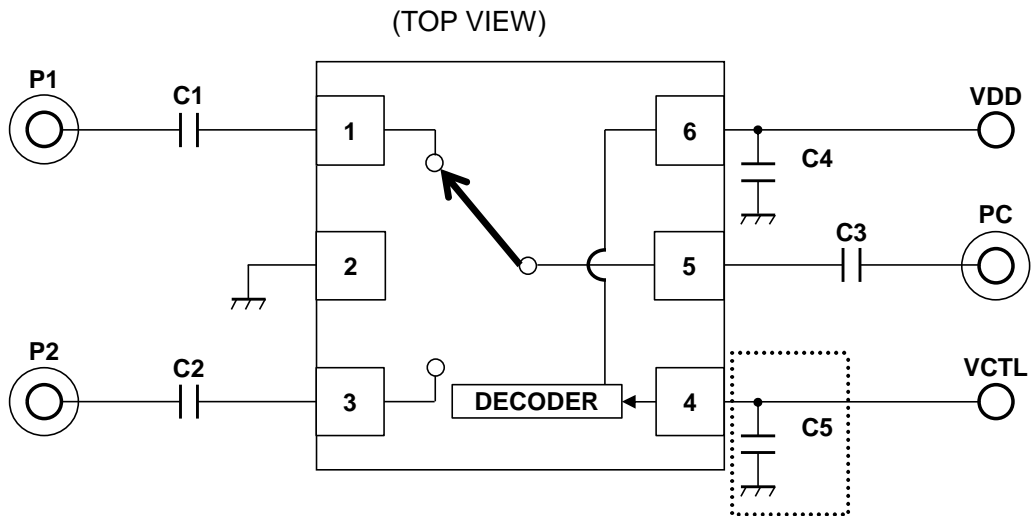
### $P_{-1dB}$ vs Temperature



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



## APPLICATION CIRCUIT



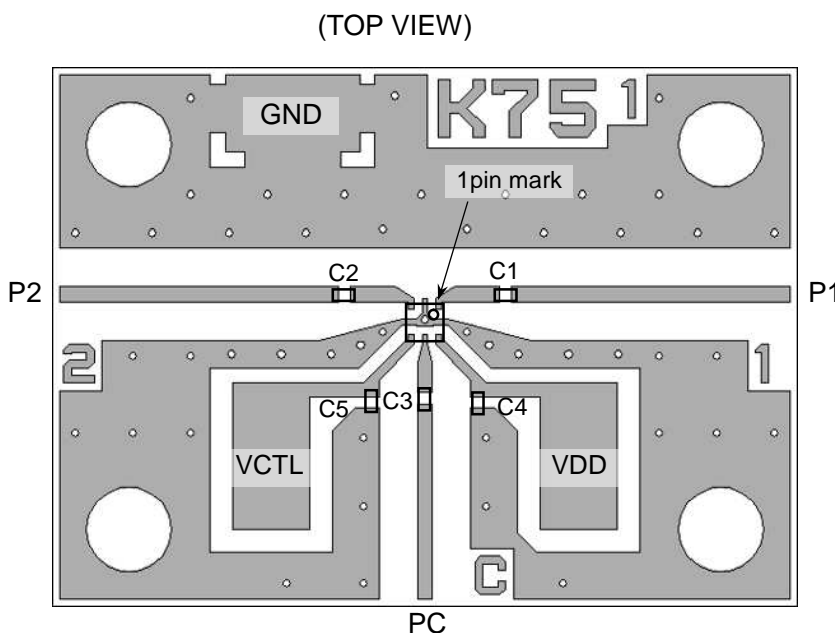
### NOTE:

The bypass capacitor, C5 is optional, and is recommended only when the control line is affected under noisy environment.

## PARTS LIST

| Parts No. | Value                           |                                 | Notes                        |
|-----------|---------------------------------|---------------------------------|------------------------------|
|           | Frequency range<br>0.7 ~ 2.0GHz | Frequency range<br>2.0 ~ 5.9GHz |                              |
| C1 to C3  | 56pF                            | 27pF                            | Murata MFG<br>(GRM03 series) |
| C4        | 1000pF                          | 1000pF                          |                              |
| C5        | 10pF                            | 10pF                            |                              |

## RECOMMENDED PCB DESIGN

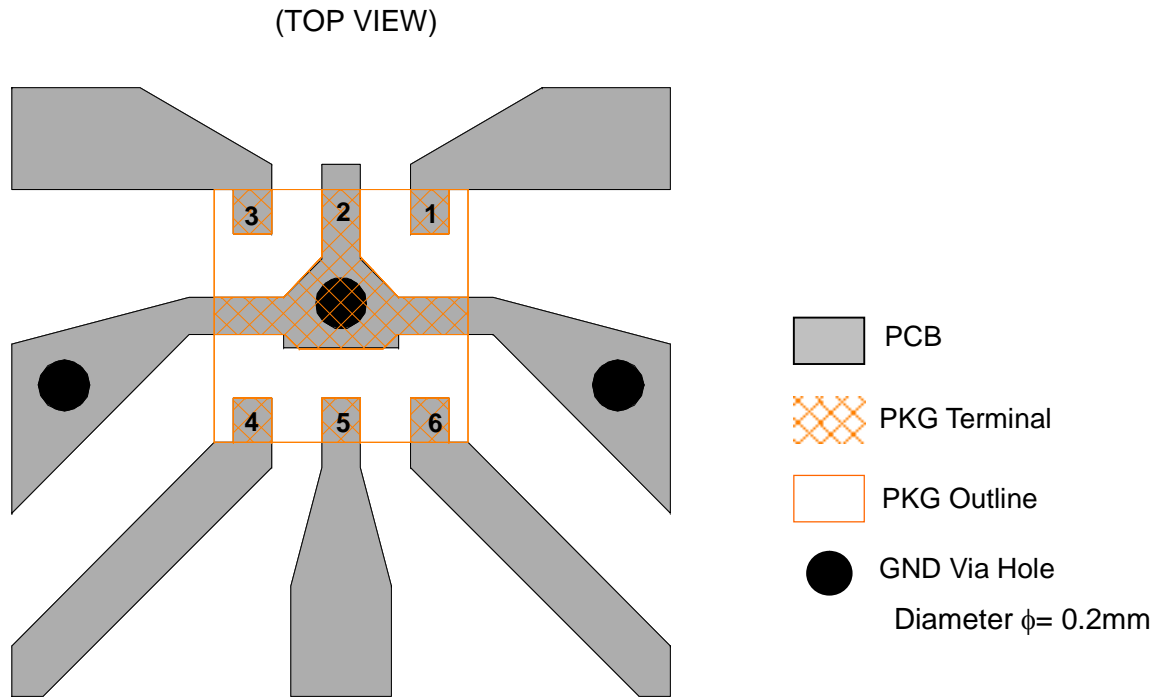


PCB: FR-4, t=0.2mm  
 Capacitor Size: 0603 (0.6 x 0.3 mm)  
 Strip Line Width: 0.4mm  
 PCB Size: 19.4 x 14.0mm  
 Through Hole Diameter: 0.2mm

### Loss of PCB, capacitor and connectors

| Frequency (GHz) | Loss (dB) |
|-----------------|-----------|
| 0.7             | 0.15      |
| 1.9             | 0.26      |
| 2.4             | 0.30      |
| 2.5             | 0.31      |
| 4.9             | 0.59      |
| 5.9             | 0.71      |

## PCB LAYOUT GUIDELINE



## PRECAUTIONS

- [1] The DC blocking capacitors should be placed at RF terminals. Please choose appropriate capacitance value at the application frequency.
- [2] 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

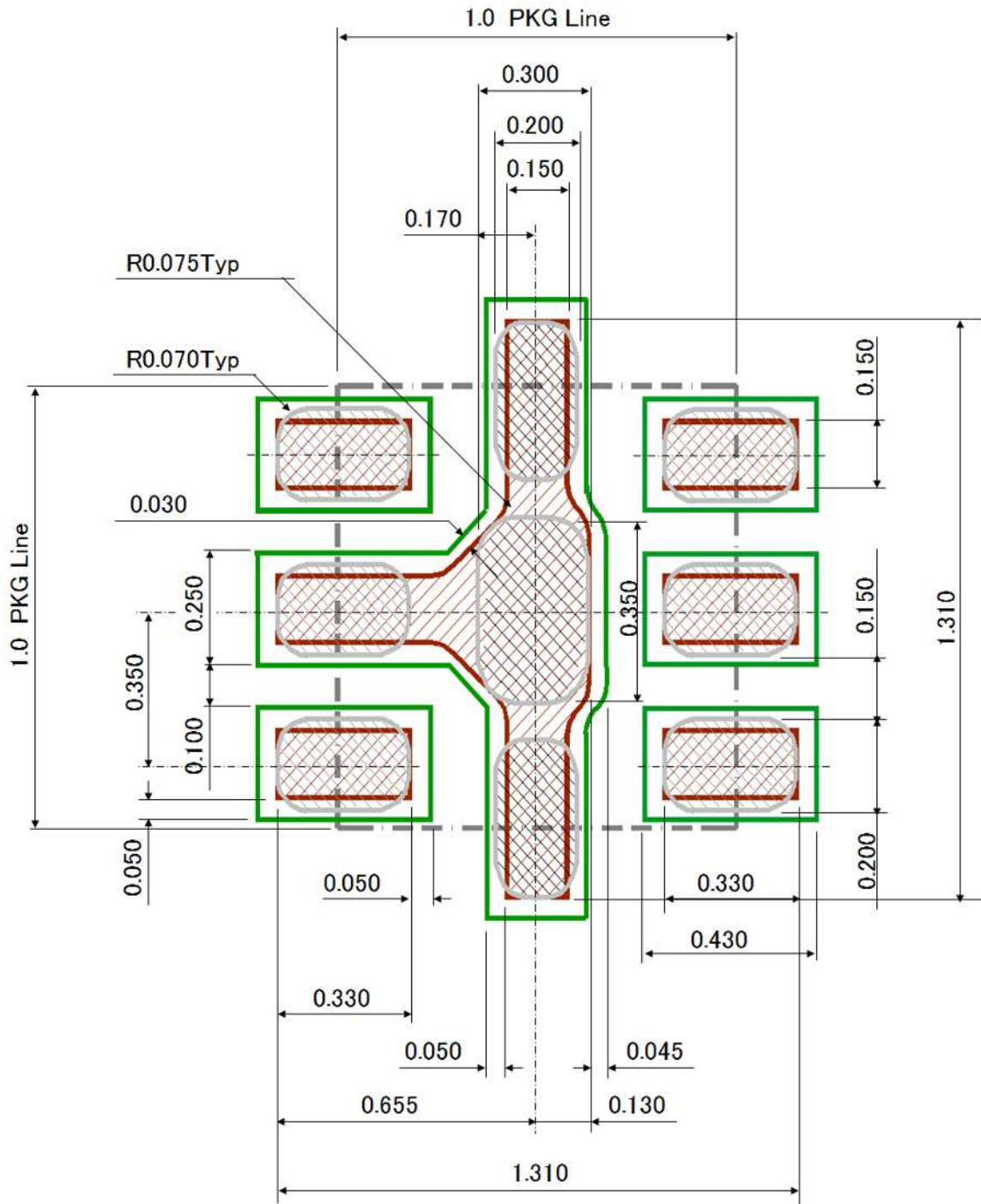
Pin pitch: 0.35mm

 : Land

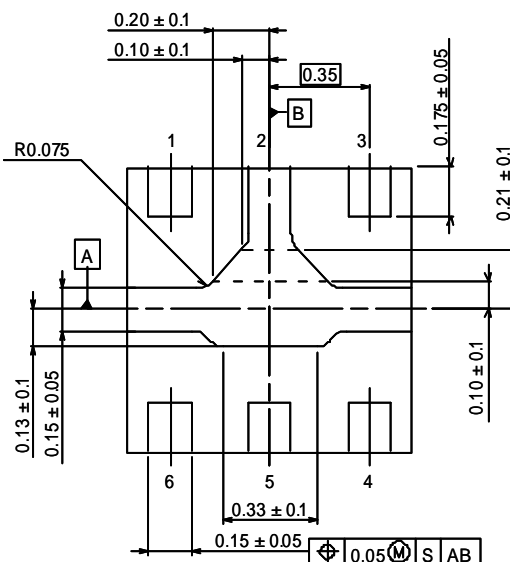
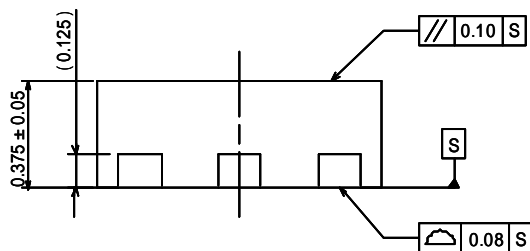
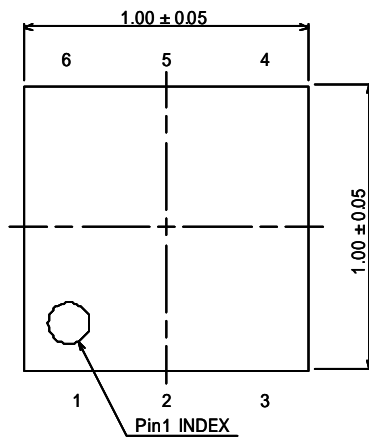
 : Mask (Open area) \*Metal mask thickness: 100μm

 : 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.