SPDT SWITCH GaAs MMIC

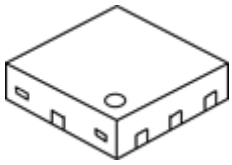
■ GENERAL DESCRIPTION

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

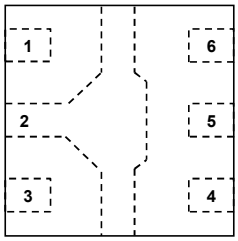
802.11 a/b/g/n/ac/ax networks applications
Transmit/receive switching, antenna switching and others switching applications
Smart phone, WLAN module, data card and others mobile applications

■ 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°C, Z_S=Z_l=50Ω

PARAMETER	SYMBOL	CONDITIONS	RATINGS	UNITS
RF Input Power	P_{IN}	V_{DD} =3.3V, 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°C	380	mW
Operating Temperature	T_{opr}		-40 to +105	°C
Storage Temperature	T_{stg}		-55 to +150	°C

■ ELECTRICAL CHARACTERISTICS1 (DC CHARACTERISTICS)

(General conditions: T_a=+25°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}=3.3V	-	15	30	μA
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)=1.8V	-	3	10	μA

■ **ELECTRICAL CHARACTERISTICS2** (RF CHARACTERISTICS)

(General conditions: V_{DD}=3.3V, V_{CTL}(H)=1.8V, V_{CTL}(L)=0V, T_a=+25°C, Z_S=Z_l=50Ω, 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

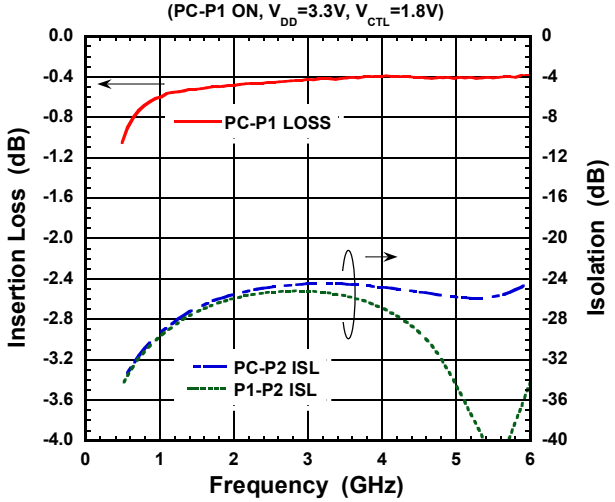
■ TERMINAL INFORMATION

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

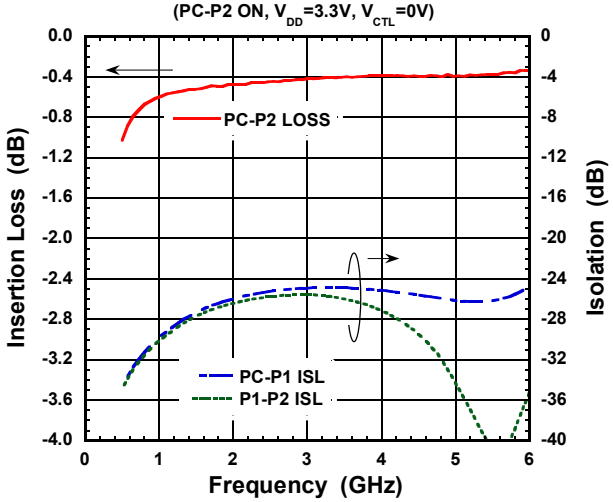
Loss, ISL vs Frequency

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



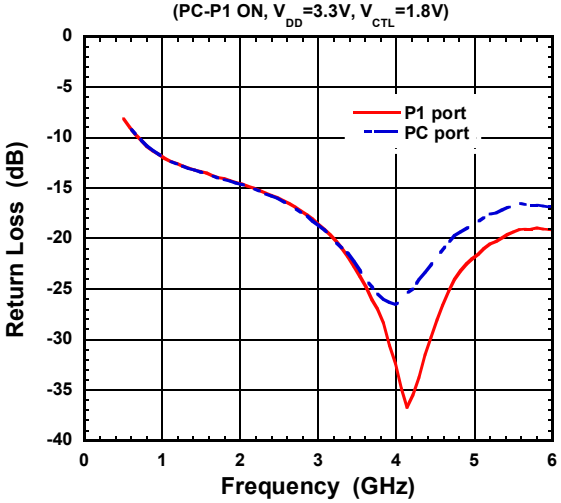
Loss, ISL vs Frequency

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



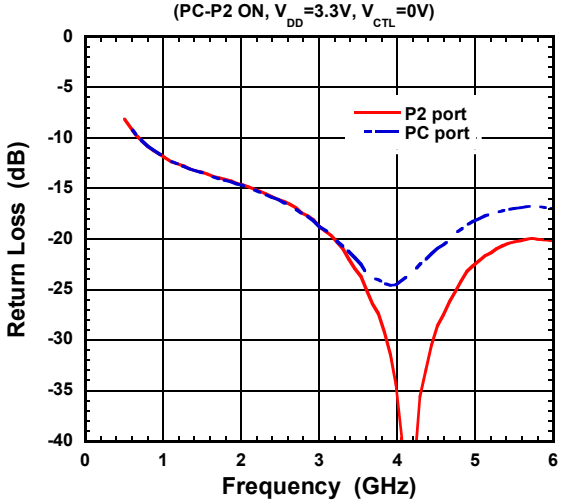
Return Loss vs Frequency

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



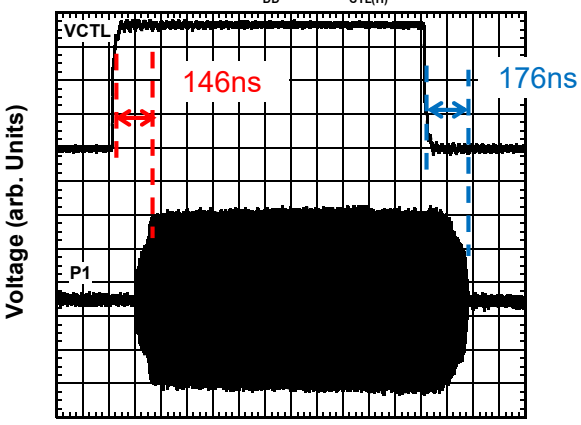
Return Loss vs Frequency

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



Switching Time

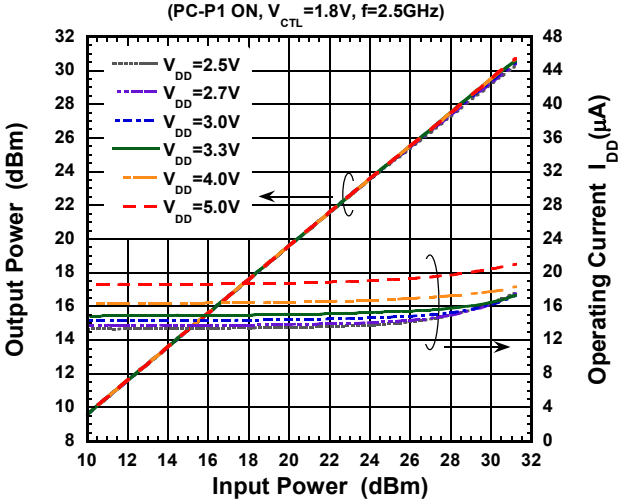
(PC-P1 path, V_{DD}=3.3V, $V_{CTL(H)}$=1.8V)



■ ELECTRICAL CHARACTERISTICS

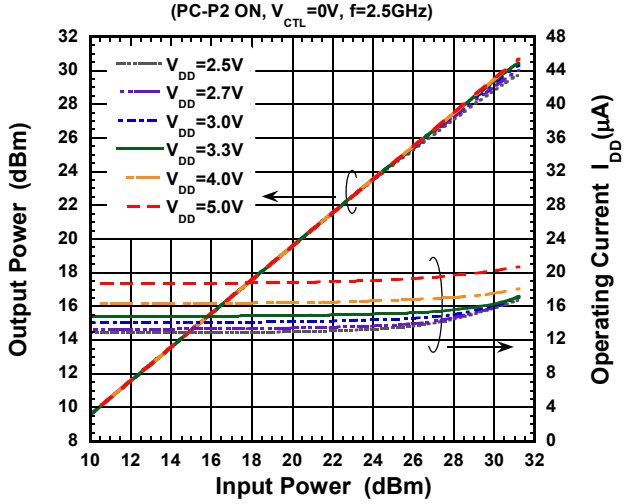
Output Power, I_{DD} vs Input Power

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



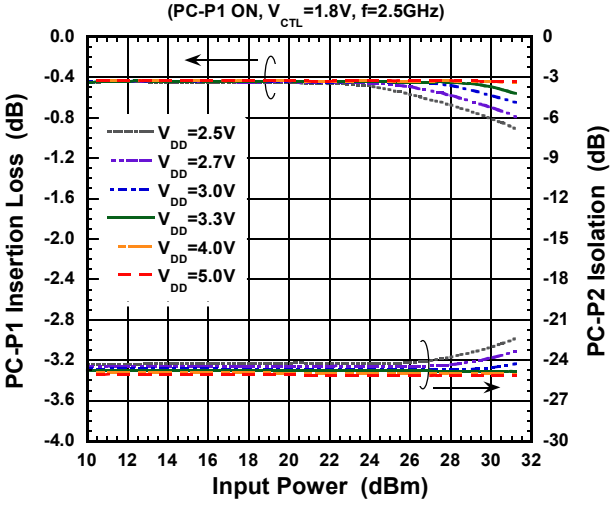
Output Power, I_{DD} vs Input Power

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



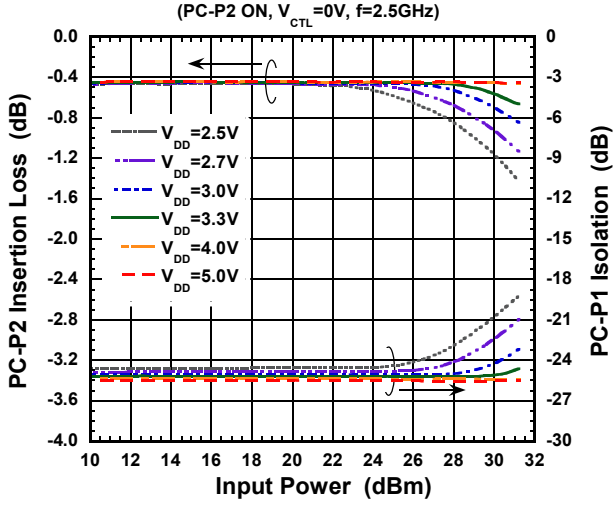
Loss, ISL vs Input Power

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



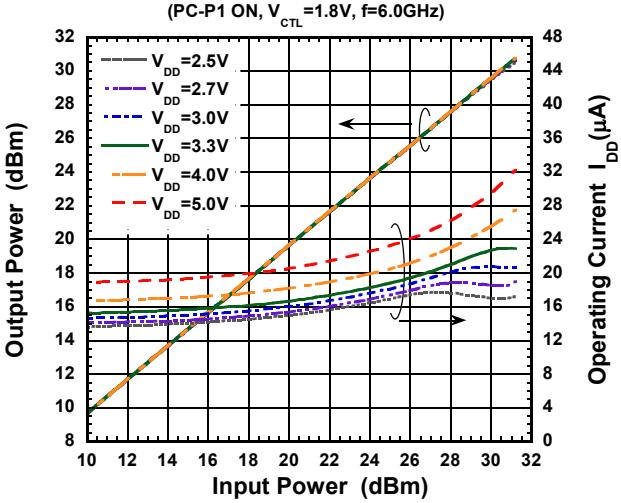
Loss, ISL vs Input Power

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



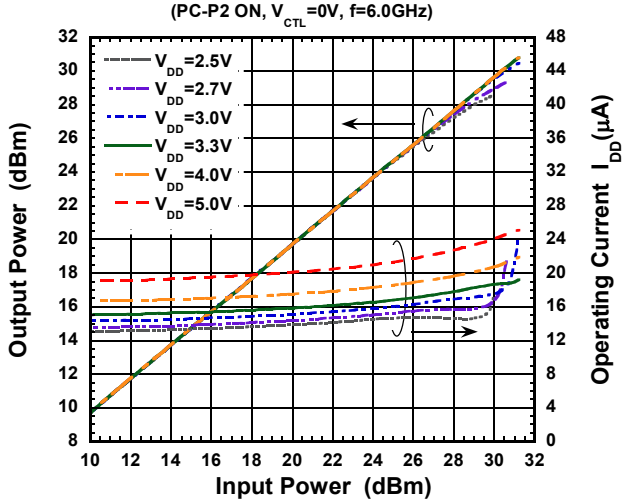
Output Power, I_{DD} vs Input Power

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



Output Power, I_{DD} vs Input Power

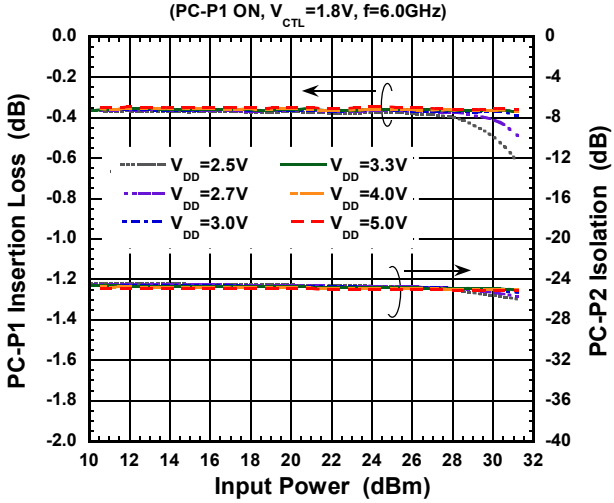
(PC-P2 ON, V_{CTL}=0V, f=6.0GHz)



■ ELECTRICAL CHARACTERISTICS

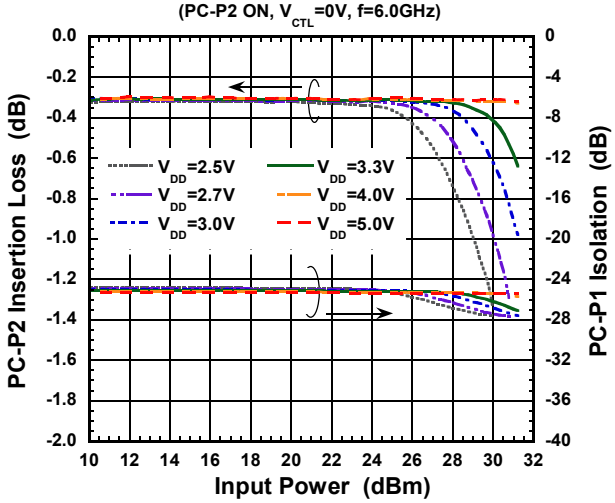
Loss, ISL vs Input Power

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



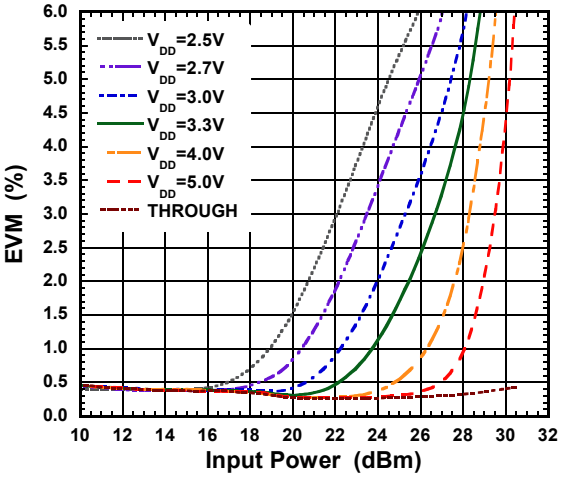
Loss, ISL vs Input Power

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



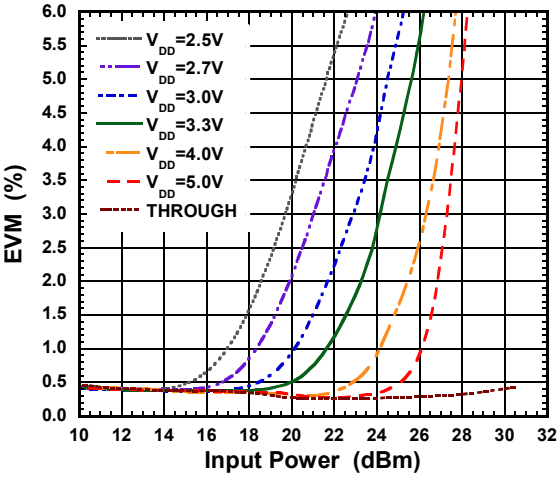
EVM vs Input Power

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



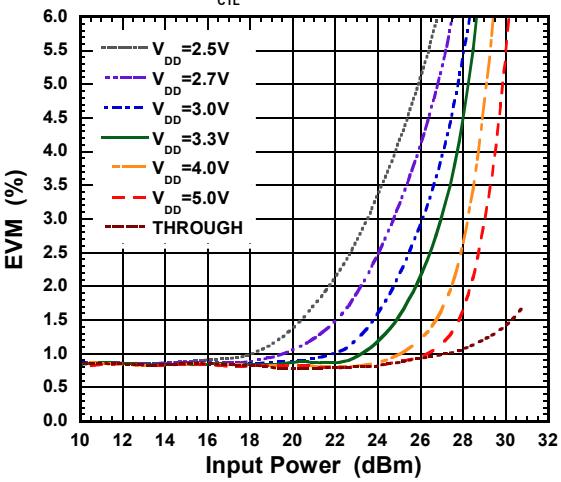
EVM vs Input Power

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



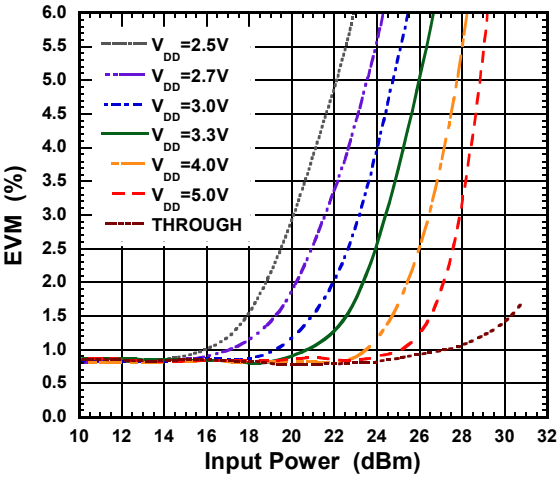
EVM vs Input Power

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



EVM vs Input Power

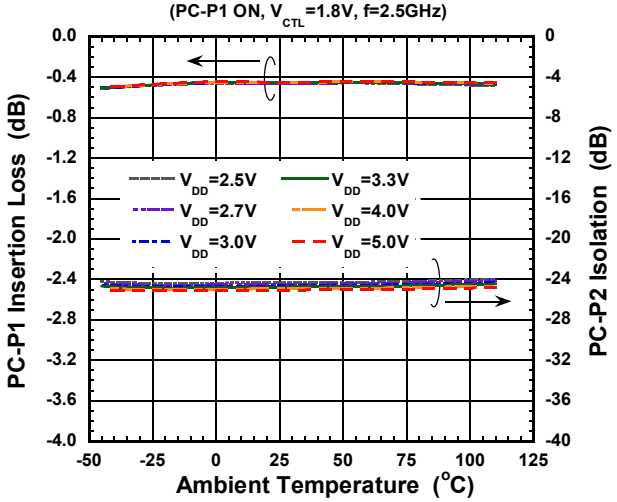
(PC-P2 ON, V_{CTL}=0V, f=6.0GHz, OFDM 64QAM)



■ ELECTRICAL CHARACTERISTICS

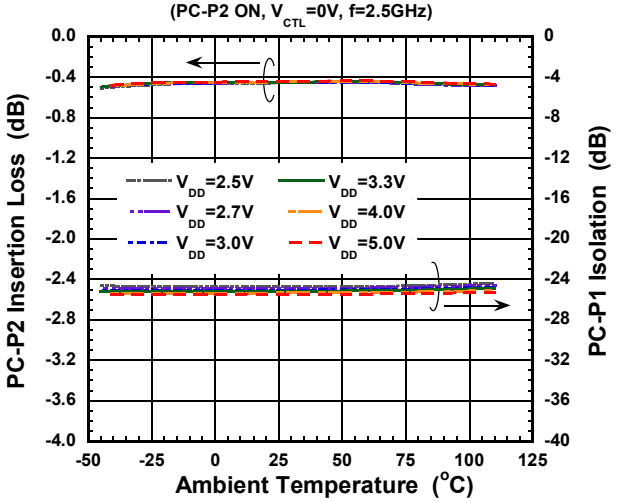
Loss, ISL vs Temperature

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



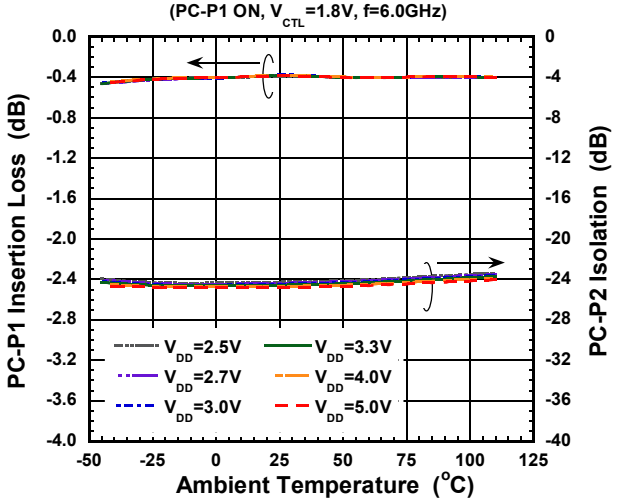
Loss, ISL vs Temperature

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



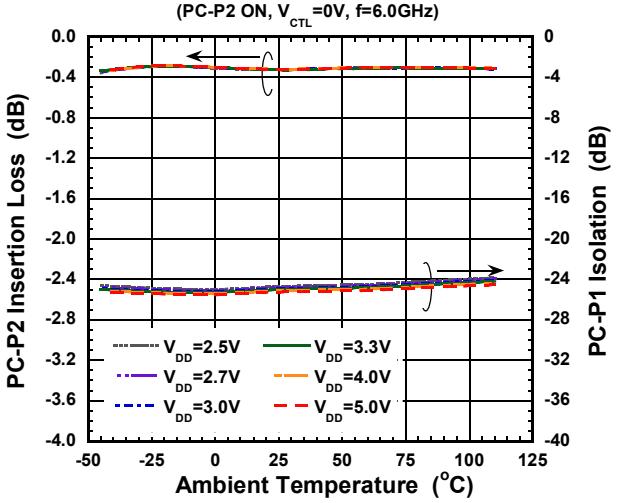
Loss, ISL vs Temperature

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



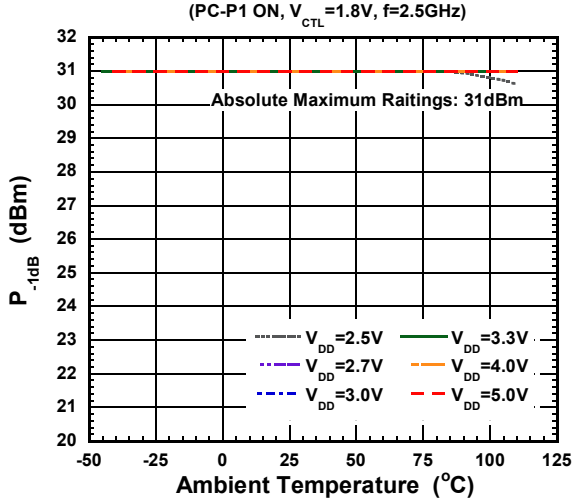
Loss, ISL vs Temperature

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



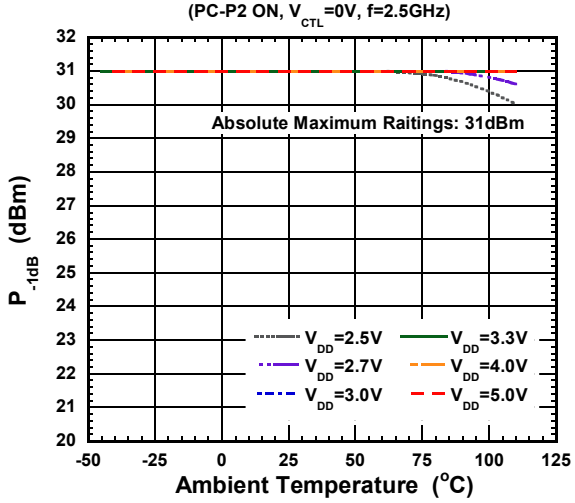
P_{-1dB} vs Temperature

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

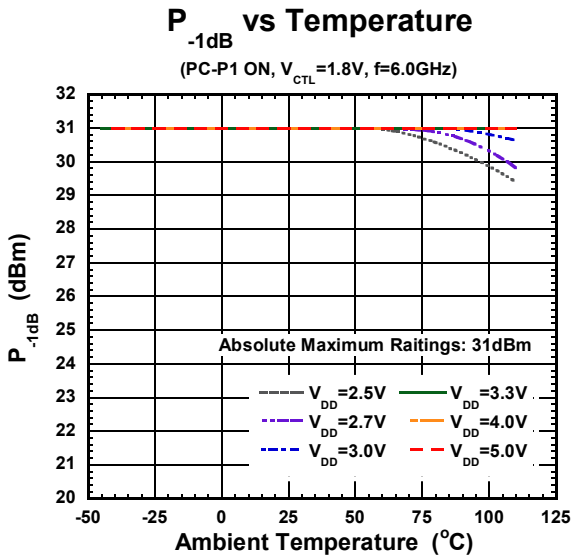


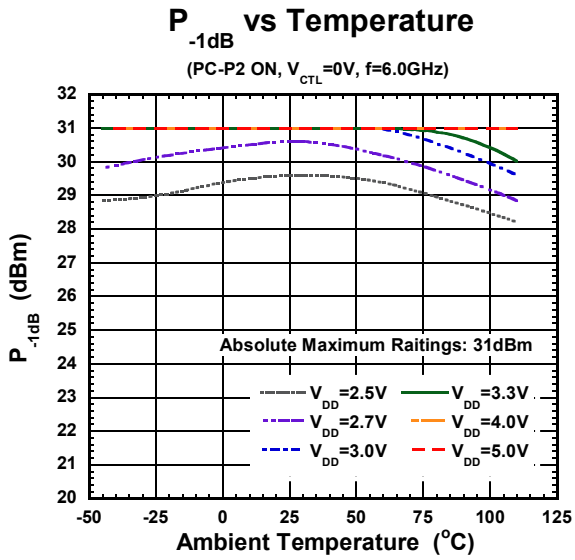
P_{-1dB} vs Temperature

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

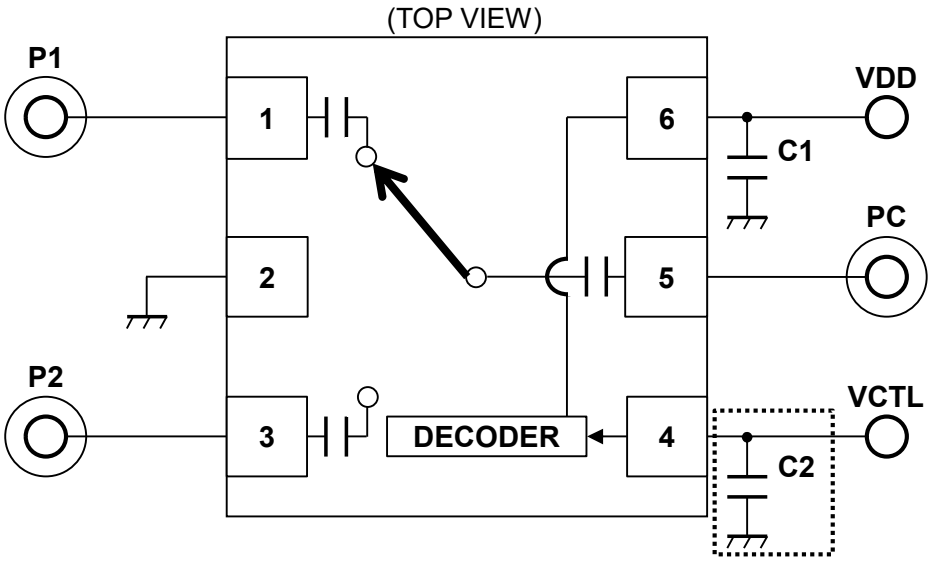


■ ELECTRICAL CHARACTERISTICS





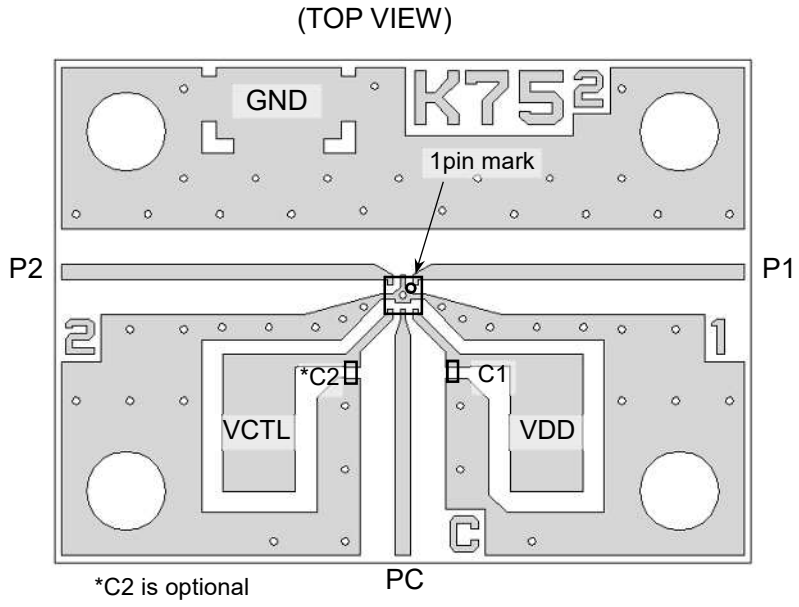
■ APPLICATION CIRCUIT



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

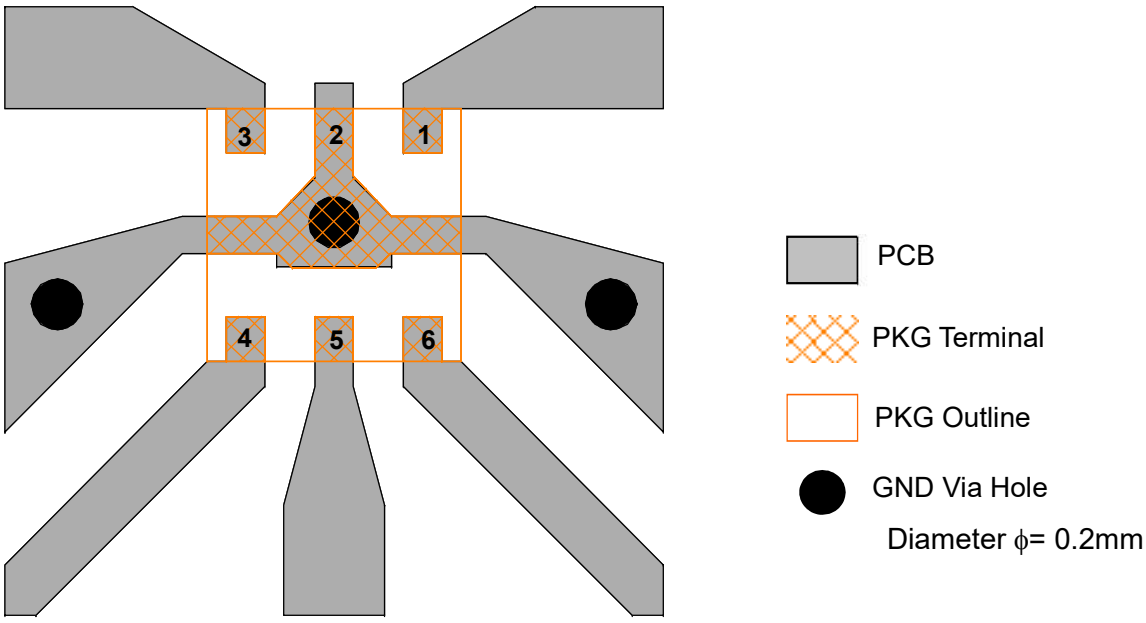
Frequency (GHz)	Loss (dB)
2.4	0.28
2.5	0.28
3.4	0.35
3.8	0.39
4.9	0.52
6.0	0.72

■ PARTS LIST

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

■ PCB LAYOUT GUIDELINE

(TOP VIEW)



PRECAUTIONS

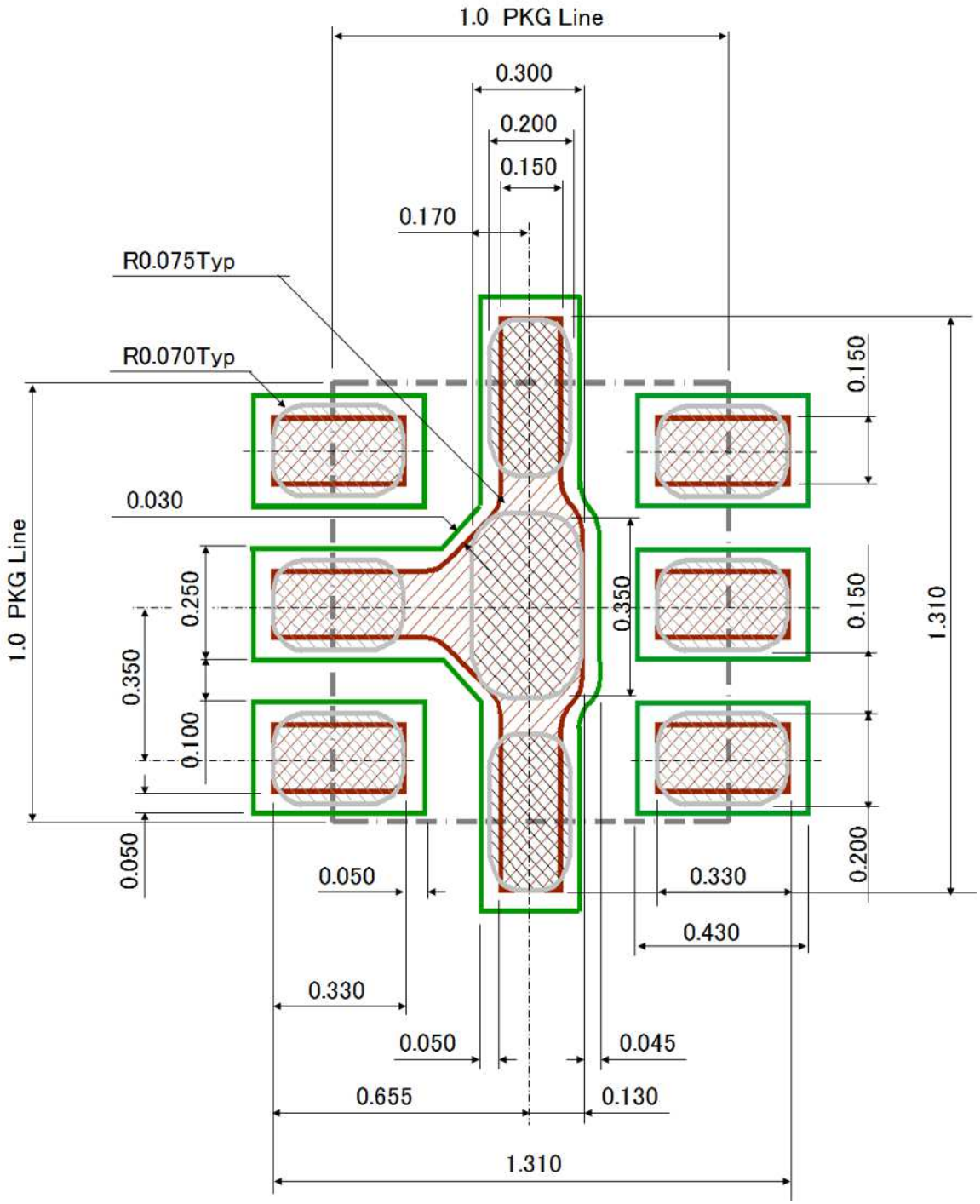
For good RF performance, exposed pad should be connected to PCB ground plane as close as possible.

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

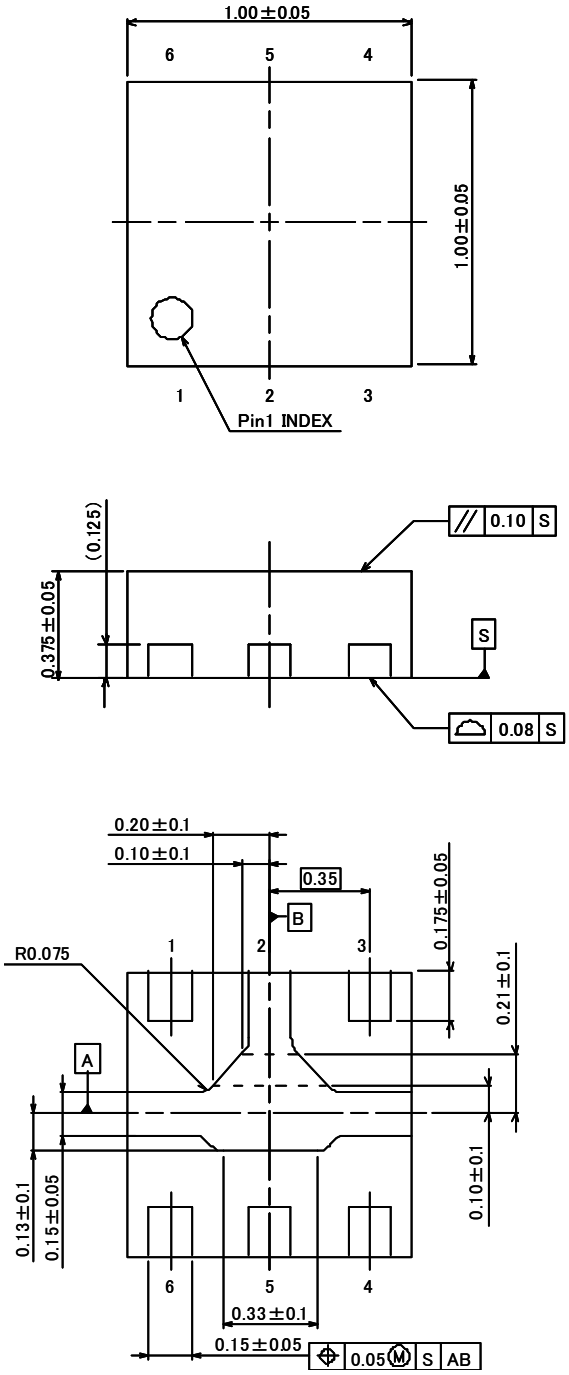
Package: 1.0mm x 1.0mm
Pin pitch: 0.35mm

: 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.

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

1. The products and the product specifications described in this document are subject to change or discontinuation of production without notice for reasons such as improvement. Therefore, before deciding to use the products, please refer to our sales representatives for the latest information thereon.
2. The materials in this document may not be copied or otherwise reproduced in whole or in part without the prior written consent of us.
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.
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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.

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