

SPDT SWITCH GaAs MMIC

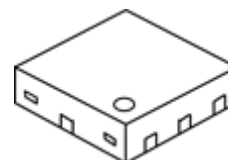
■ GENERAL DESCRIPTION

The NJG1801K75 is a SPDT switch IC suited for switching transmit/receive signals at 802.11 a/b/g/n/ac/ax, Bluetooth, UWB and others wireless communication application.

The NJG1801K75 features low insertion loss, high isolation, and high handling power.

This switch exhibits wide frequency coverage up to 8.5GHz. And the ultra small and ultra thin package of DFN6-75 is adopted.

■ PACKAGE OUTLINE



NJG1801K75

■ APPLICATION

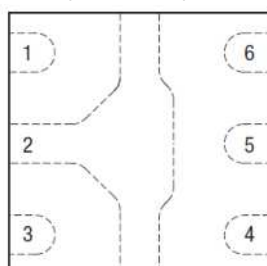
WLAN 802.11a/ b/g/n/ac/ax, Bluetooth, UWB networks
Communication Modules, Smartphones, Access points, and others mobile devices
Antenna switching, Transmit / receive switching, path switching applications

■ FEATURES

- Control voltage range 1.8 to 5.0 V (3.0 V typ.)
- Low insertion loss 0.35 dB typ. @ f = 2.4 to 2.5 GHz
0.45 dB typ. @ f = 4.9 to 5.9 GHz
0.60 dB typ. @ f = 8.5 GHz
- High isolation 28 dB typ. @ f = 2.4 to 2.5 GHz
30 dB typ. @ f = 4.9 to 5.9 GHz
20 dB typ. @ f = 8.5 GHz
- P-1dB P_{-1dB} = +31 dBm typ. @ f = 2.5 GHz
P_{-1dB} = +31 dBm typ. @ f = 5.9 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

■ PIN CONFIGURATION

(Top view)



Pin connection

1. P1
2. GND
3. P2
4. VCTL2
5. PC
6. VCTL1

■ TRUTH TABLE

“H” = V_{CTL}(H), “L” = V_{CTL}(L)

ON PATH	VCTL1	VCTL2
PC-P1	L	H
PC-P2	H	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}	$V_{CTL}(L) = 0\text{ V}$, $V_{CTL}(H) = 3.0\text{ V}$, ON State Port	+31	dBm
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
Control Voltage (HIGH)	$V_{CTL}(H)$		1.8	3.0	5.0	V
Control Voltage (LOW)	$V_{CTL}(L)$		-0.2	-	0.2	V
Control Current	I_{CTL}		-	5	10	μA

■ ELECTRICAL CHARACTERISTICS2 (RF CHARACTERISTICS)

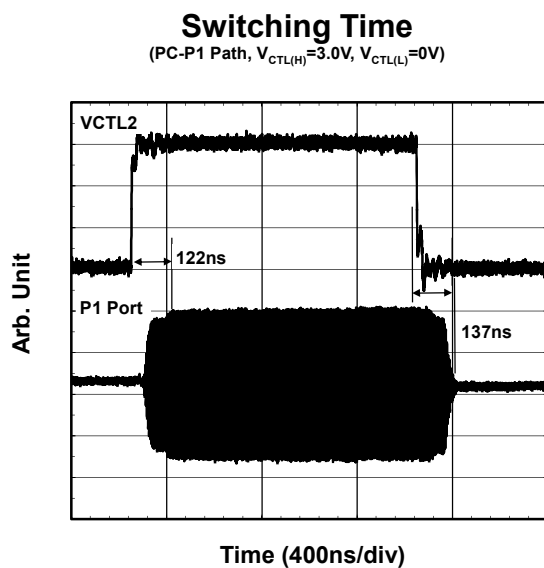
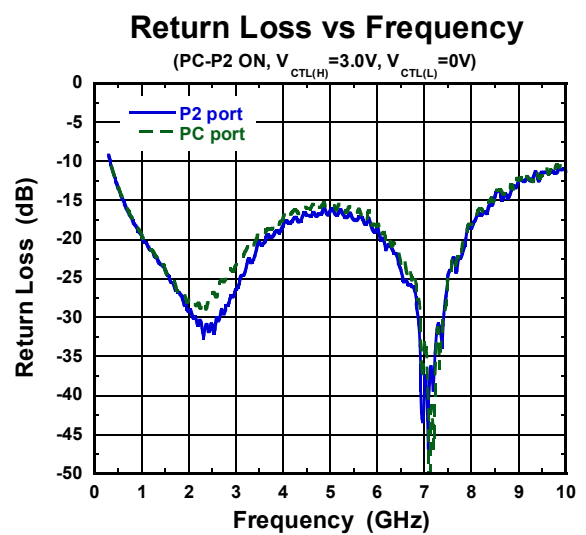
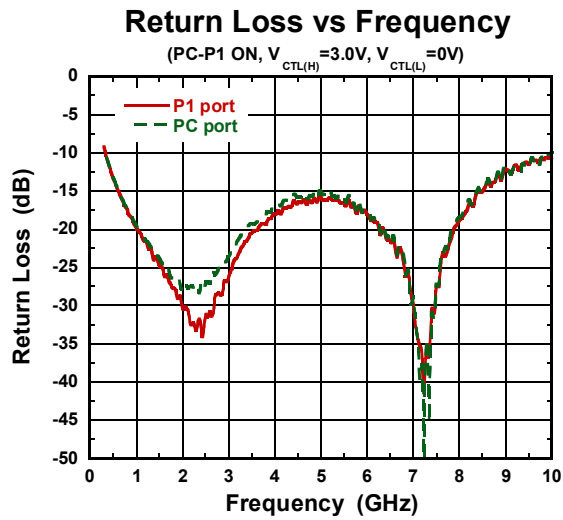
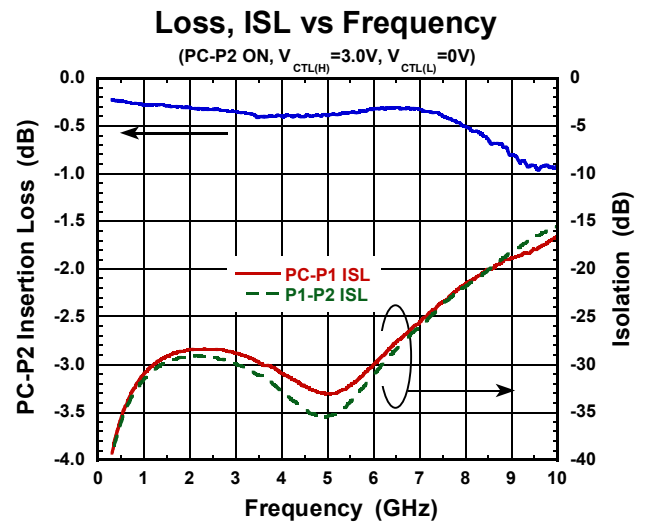
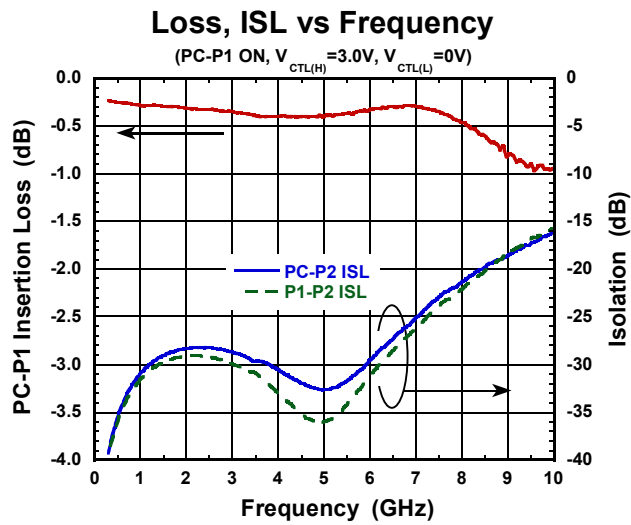
(General conditions: $V_{CTL}(H) = 3.0\text{ V}$, $V_{CTL}(L) = 0\text{ V}$, $T_a = +25^\circ\text{C}$, $Z_S = Z_L = 50\ \Omega$, with application circuit)

PARAMETERS	SYMBOL	CONDITIONS	MIN	TYP	MAX	UNITS
Insertion loss1	LOSS1	$f = 2.4\text{ to }2.5\text{ GHz}$	-	0.35	0.55	dB
Insertion loss2	LOSS2	$f = 4.9\text{ to }5.9\text{ GHz}$	-	0.45	0.70	dB
Insertion loss3	LOSS3	$f = 8.5\text{ GHz}$	-	0.60	0.85	dB
Isolation1	ISL1	$f = 2.4\text{ to }2.5\text{ GHz}$	25	28	-	dB
Isolation2	ISL2	$f = 4.9\text{ to }5.9\text{ GHz}$	25	30	-	dB
Isolation3	ISL3	$f = 8.5\text{ GHz}$	16	20	-	dB
Return loss1	RL1	$f = 2.4\text{ to }2.5\text{ GHz}$	18	28	-	dB
Return loss2	RL2	$f = 4.9\text{ to }5.9\text{ GHz}$	15	20	-	dB
Return loss3	RL3	$f = 8.5\text{ GHz}$	10	16	-	dB
Input power at 1dB compression point1	P_{-1dB1}	$f = 2.4\text{ to }2.5\text{ GHz}$	+29	+31	-	dBm
Input power at 1dB compression point2	P_{-1dB2}	$f = 4.9\text{ to }5.9\text{ GHz}$	+28	+31	-	dBm
Input power at 1dB compression point3	P_{-1dB3}	$f = 8.5\text{ GHz}$	+11	-	-	dBm
Switching time	T_{SW}	50% VCTL to 10%/90% RF	-	100	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	VCTL2	Control voltage input terminal.
5	PC	Common RF terminal. An external DC blocking capacitor is required.
6	VCTL1	Control voltage input terminal.

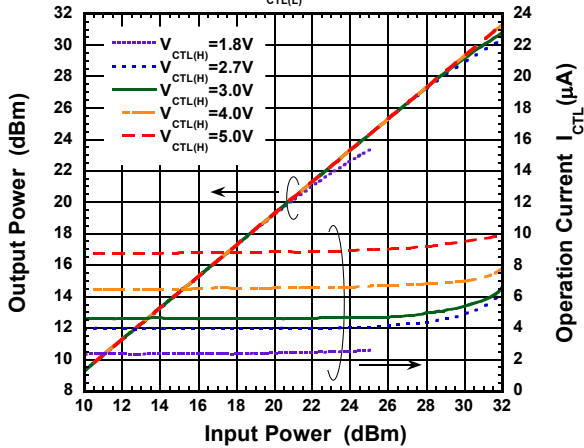
ELECTRICAL CHARACTERISTICS



■ ELECTRICAL CHARACTERISTICS

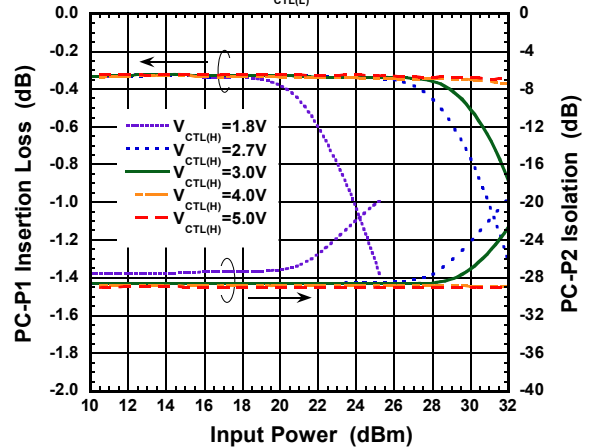
Output Power, I_{CTL} vs Input Power

(PC-P1 ON, $V_{CTL(L)}=0V$, $f=2.5GHz$)



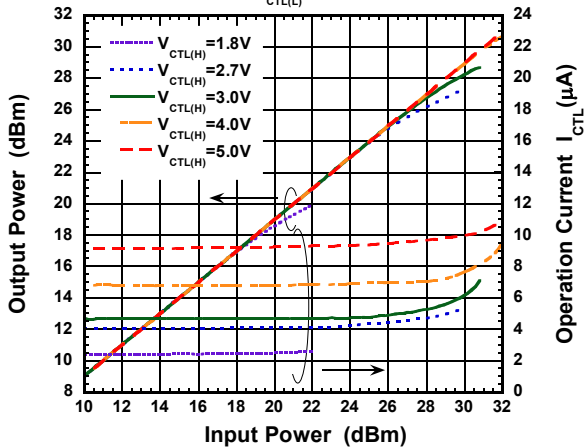
Loss, ISL vs Input Power

(PC-P1 ON, $V_{CTL(L)}=0V$, $f=2.5GHz$)



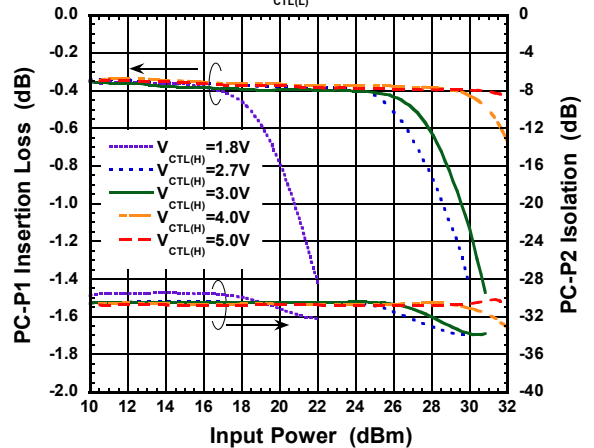
Output Power, I_{CTL} vs Input Power

(PC-P1 ON, $V_{CTL(L)}=0V$, $f=5.9GHz$)



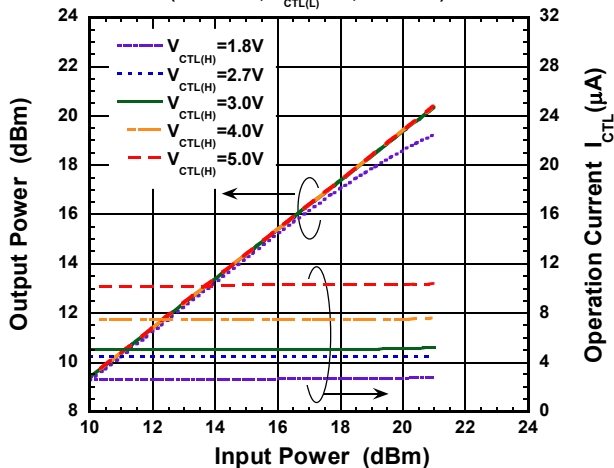
Loss, ISL vs Input Power

(PC-P1 ON, $V_{CTL(L)}=0V$, $f=5.9GHz$)



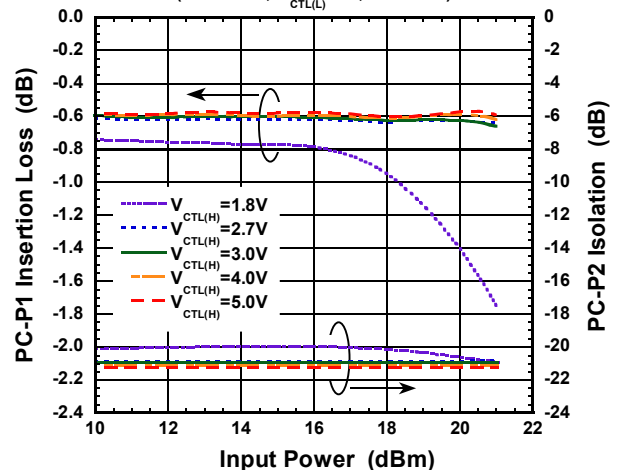
Output Power, I_{CTL} vs Input Power

(PC-P1 ON, $V_{CTL(L)}=0V$, $f=8.5GHz$)



Loss, ISL vs Input Power

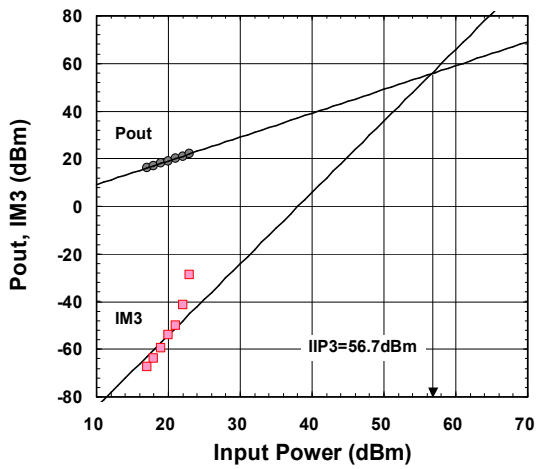
(PC-P1 ON, $V_{CTL(L)}=0V$, $f=8.5GHz$)



ELECTRICAL CHARACTERISTICS

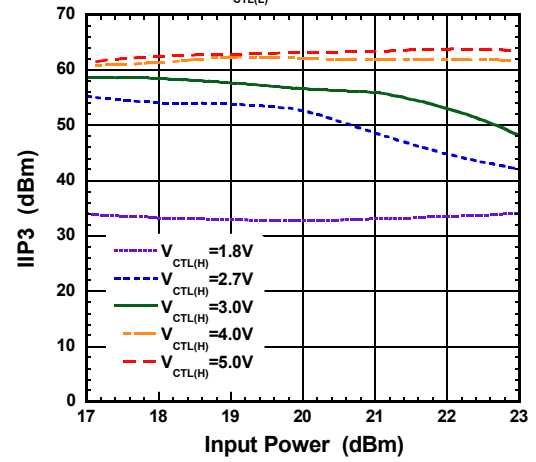
Output Power, IM3 vs Input Power

(PC-P1 ON, $V_{CTL(H)}=3.0V$, $V_{CTL(L)}=0V$, $f=2.5GHz+2.501GHz$)



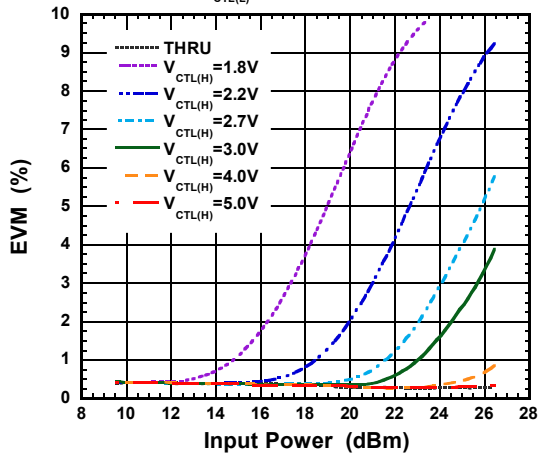
IIP3 vs Input Power

(PC-P1 ON, $V_{CTL(L)}=0V$, $f=2.5GHz+2.501GHz$)



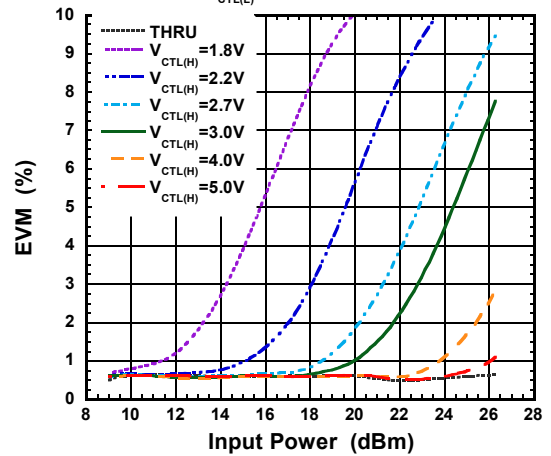
EVM vs Input Power

(PC-P1 ON, $V_{CTL(L)}=0V$, $f=2.5GHz$, OFDM 64QAM)



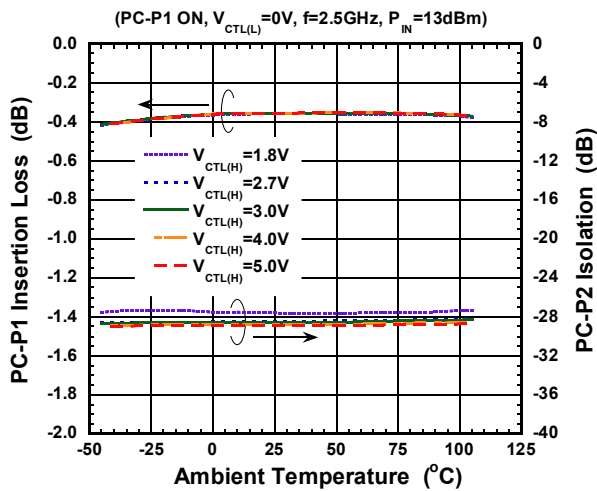
EVM vs Input Power

(PC-P1 ON, $V_{CTL(L)}=0V$, $f=5.9GHz$, OFDM 64QAM)

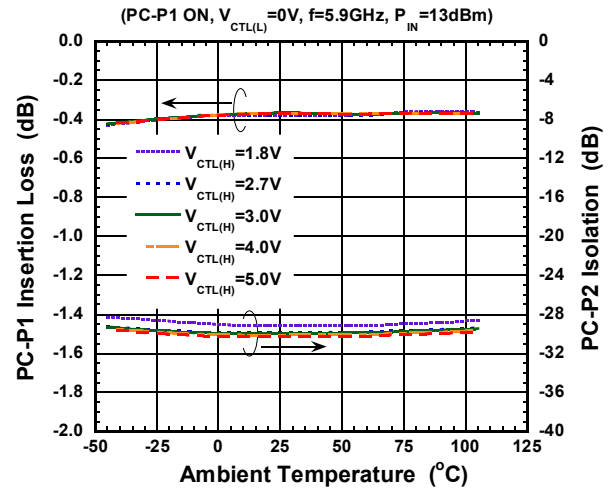


ELECTRICAL CHARACTERISTICS

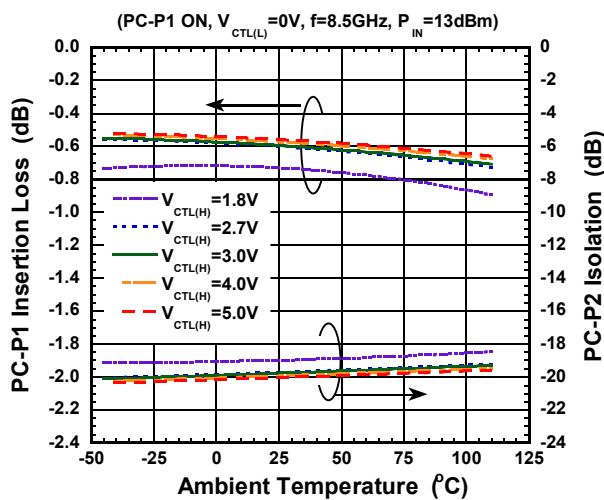
Loss, ISL vs Temperature



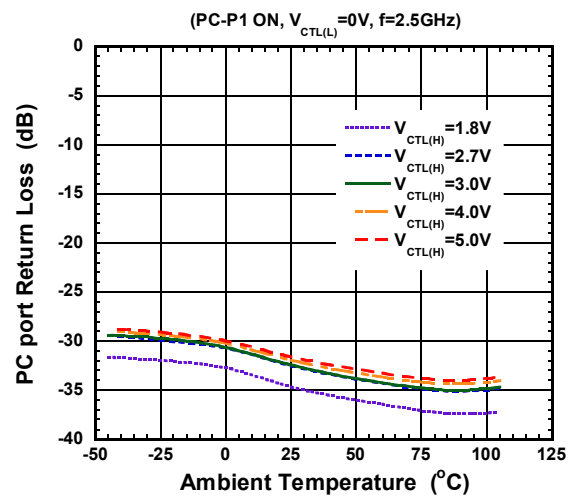
Loss, ISL vs Temperature



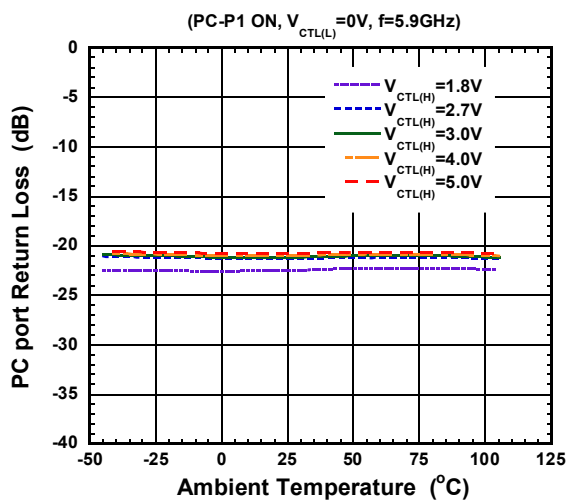
Loss, ISL vs Temperature



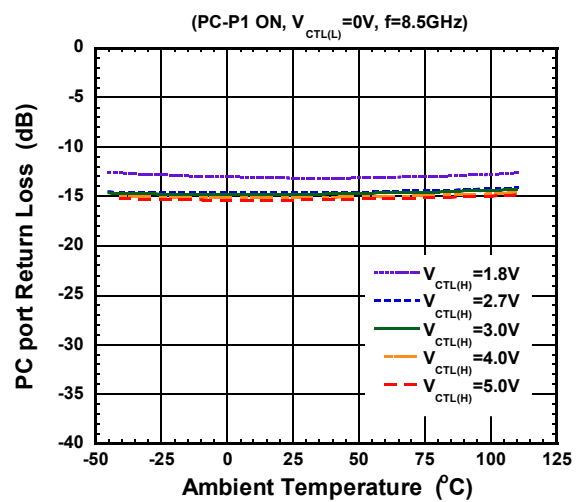
Return Loss vs Temperature



Return Loss vs Temperature



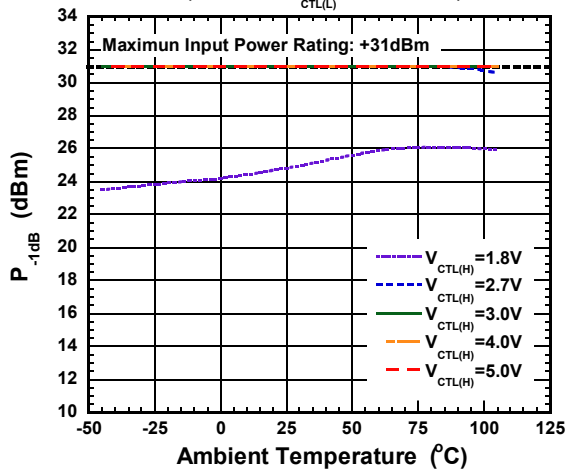
Return Loss vs Temperature



ELECTRICAL CHARACTERISTICS

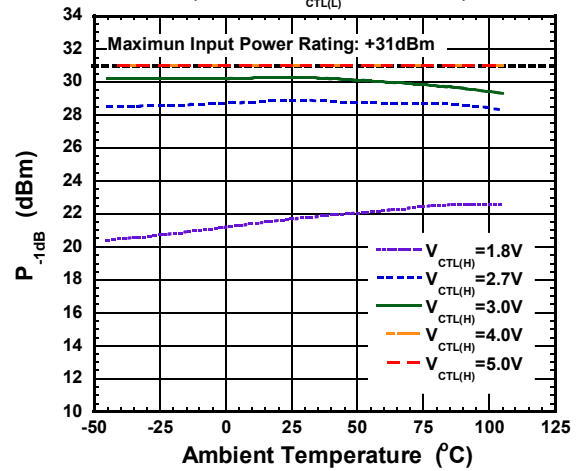
P_{-1dB} vs Temperature

(PC-P1 ON, $V_{CTL(L)} = 0V$, $f = 2.5GHz$)



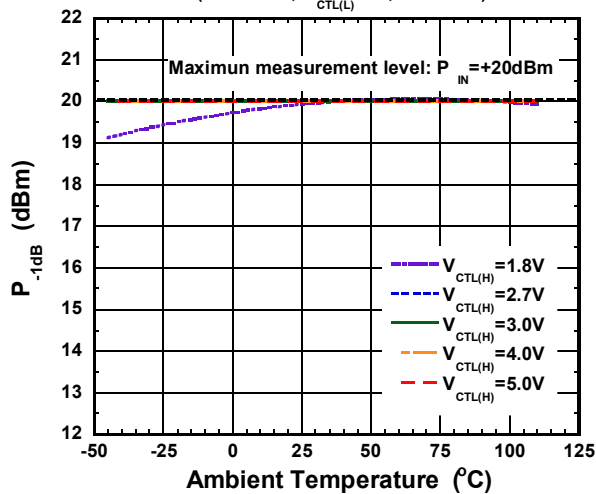
P_{-1dB} vs Temperature

(PC-P1 ON, $V_{CTL(L)} = 0V$, $f = 5.9GHz$)



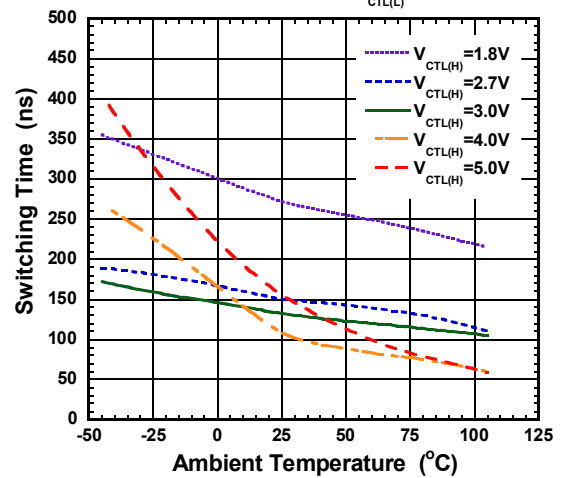
P_{-1dB} vs Temperature

(PC-P1 ON, $V_{CTL(L)} = 0V$, $f = 8.5GHz$)

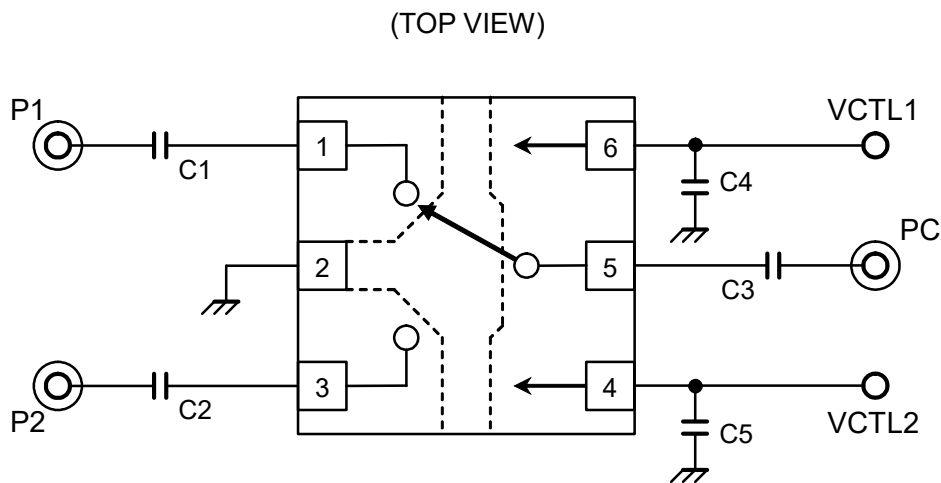


Switching Time(rise) vs Temperature

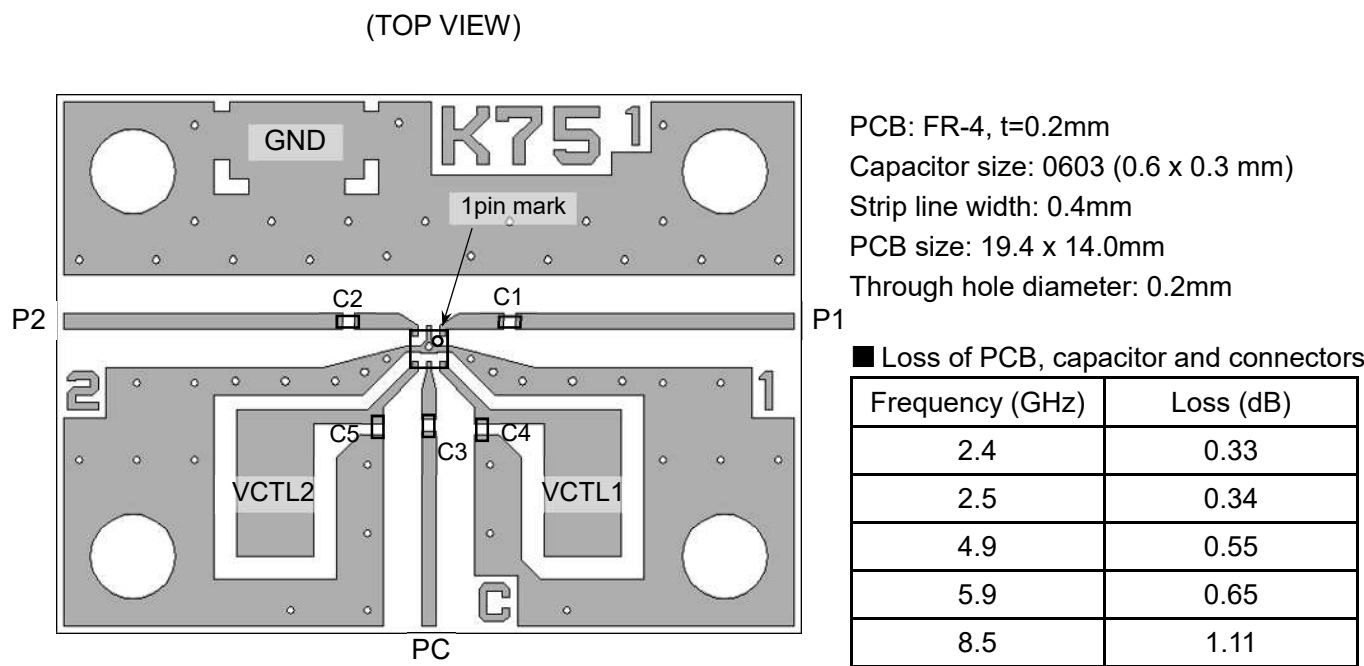
(PC-P1 path, P1 port, $V_{CTL(L)} = 0V$)



APPLICATION CIRCUIT



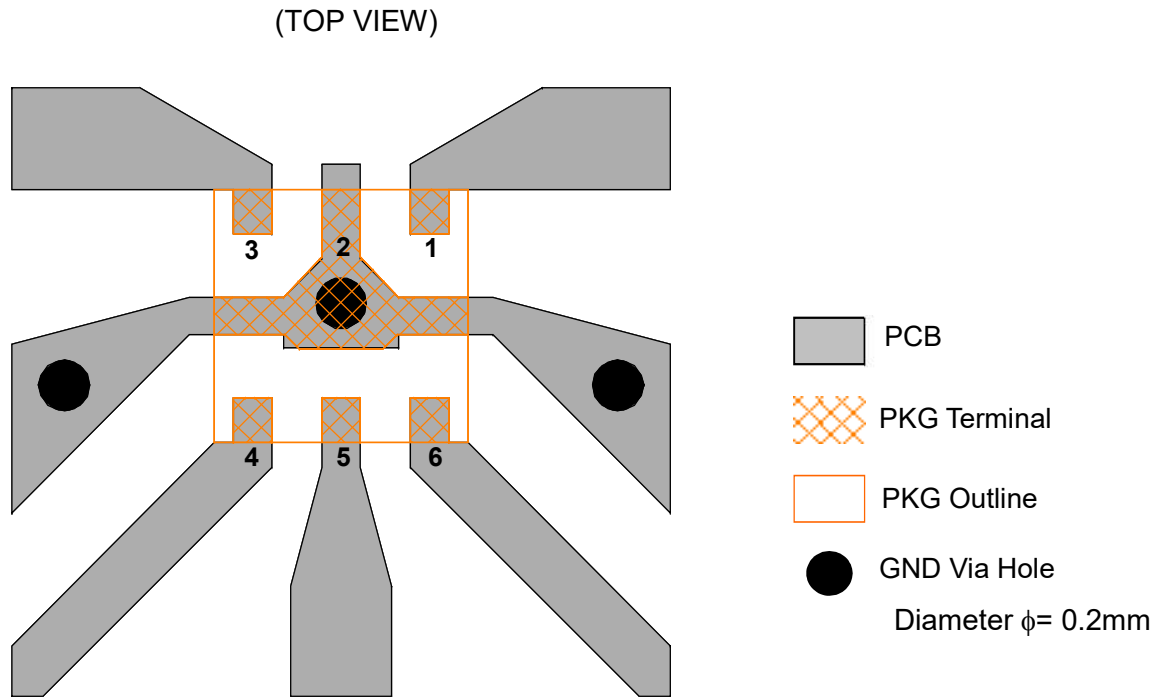
RECOMMENDED PCB DESIGN



PARTS LIST

No.	Value	Notes
C1 to C3	27 pF	Murata MFG (GRM03 series)
C4 to C5	10 pF	

■ 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>

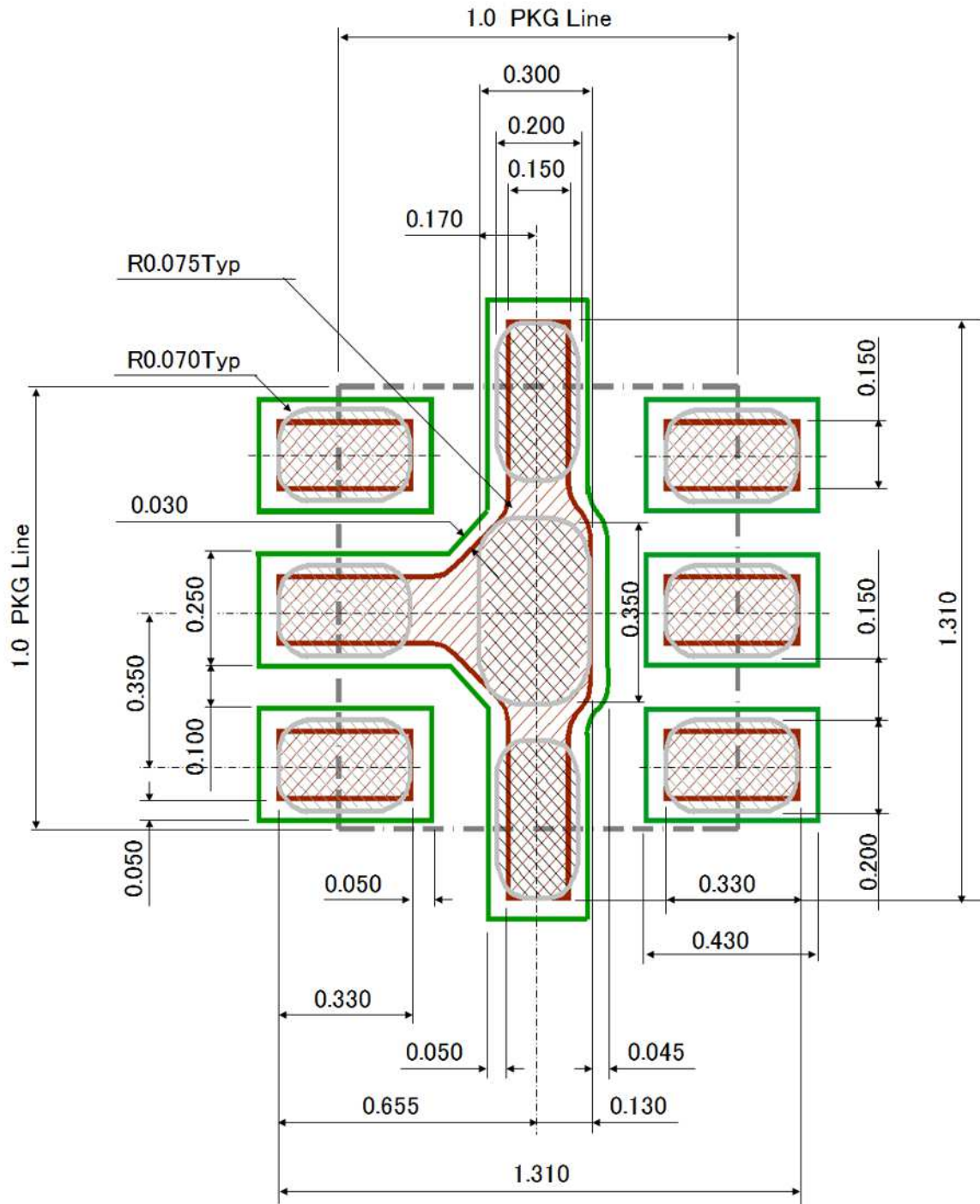
Package: 1.0mm x 1.0mm

Pin pitch: 0.35mm

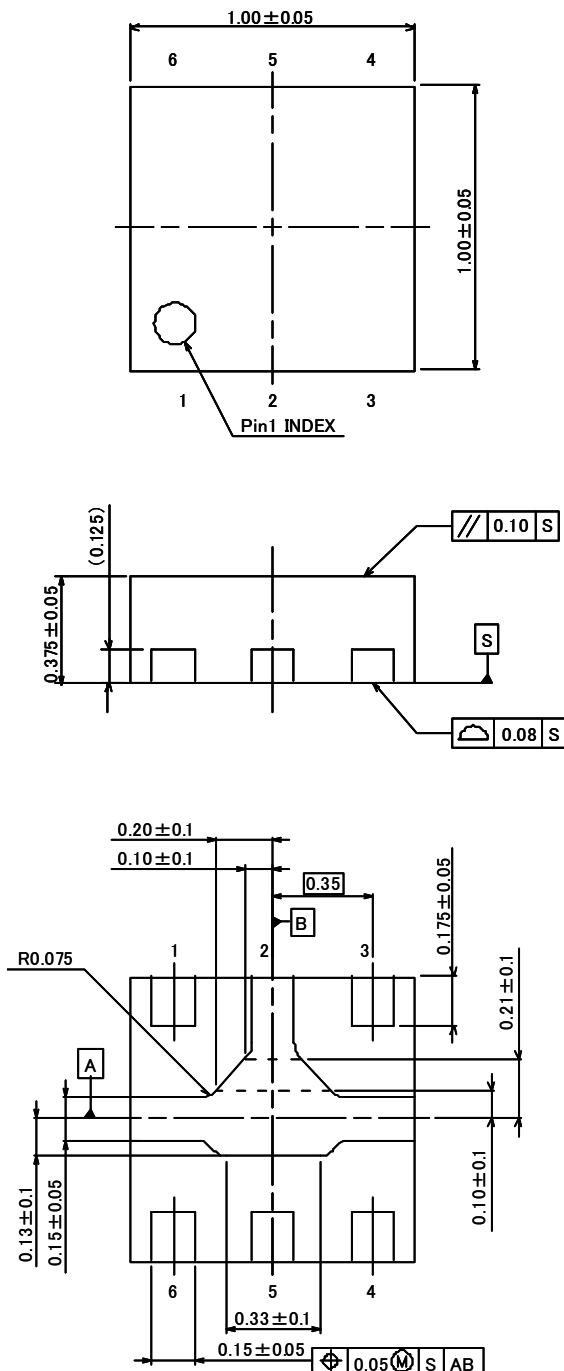
 : Land

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

 : Resist (Open area)



■ 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]

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

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 - Fire Alarms / Intruder Detectors
 - Vehicle Control Equipment (automotive, 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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