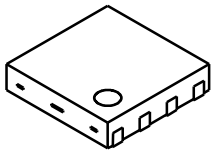
SP3T SWITCH GaAs MMIC

■ GENERAL DESCRIPTION

The NJG1804K64 is a GaAs SP3T switch MMIC which is suitable for WLAN(802.11a/b/g/n/ac) and Bluetooth applications. This MMIC switches between a common RF port and three RF ports by three control voltages. The NJG1804K64 features very low insertion loss, high isolation at wide frequency range up to 6.0GHz. The ultra small and ultra thin DFN8-64 package is adopted.

■ PACKAGE OUTLINE



NJG1804K64

■ APPLICATION

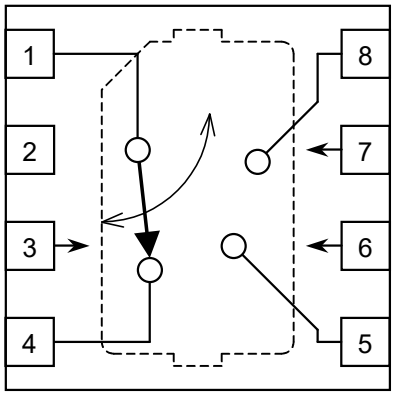
- 802.11a/b/g/n/ac WLAN applications
- Bluetooth
- General purpose switching applications

■ FEATURES

● Low control voltage	$V_{CTL(H)}$=1.9V to 5.0V
● Low insertion Loss	0.50dB typ. @f=2.4 to 2.5GHz, 0.60dB typ. @f=4.9 to 5.9GHz
● High isolation	30dB typ. @f=2.4 to 2.5GHz, 26dB typ. @f=4.9 to 5.9GHz
● Ultra small & ultra thin package	DFN8-64 (Package size: 1.5 x 1.5 x 0.375mm)
● RoHS compliant and Halogen free, MSL1	

■ PIN CONFIGURATION

(TOP VIEW)



1. PC
2. NC
3. VCTL1
4. P1
5. P2
6. VCTL2
7. VCTL3
8. P3

Exposed pad: GND

■ TRUTH TABLE

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

VCTL1	VCTL2	VCTL3	PATH
H	L	L	PC-P1
L	H	L	PC-P2
L	L	H	PC-P3

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

■ ABSOLUTE MAXIMUM RATINGS

Ta=+25°C

PARAMETER	SYMBOL	CONDITIONS	RATINGS	UNITS
Input power	P_{IN}	$V_{CTL(H)}$=3.3V, $V_{CTL(L)}$=0V, ON state port	+30	dBm
Control voltage	V_{CTL}		5.0	V
Power dissipation	P_D	Four-layer FR4 PCB without through holes (76.2 x 114.3mm), Tj=150°C	380	mW
Operating temperature	T_{opr}		-40 to +105	°C
Storage temperature	T_{stg}		-55 to +150	°C

■ ELECTRICAL CHARACTERISTICS 1 (DC Characteristics)

General conditions: Ta=+25°C, $V_{CTL(H)}$=3.3V, $V_{CTL(L)}$=0V

PARAMETERS	SYMBOL	CONDITIONS	MIN	TYP	MAX	UNITS
Control voltage (HIGH)	$V_{CTL(H)}$		1.9	3.3	5.0	V
Control voltage (LOW)	$V_{CTL(L)}$		-0.2	-	0.2	V
Control current	I_{CTL}		-	4	10	μA

■ ELECTRICAL CHARACTERISTICS 2 (RF Characteristics)

General conditions: Ta=+25°C, $V_{CTL(H)}$=3.3V, $V_{CTL(L)}$=0V, Zs=Zl=50Ω

PARAMETERS	SYMBOL	CONDITIONS	MIN	TYP	MAX	UNITS
Insertion loss 1	LOSS1	f=2.4GHz to 2.5GHz	-	0.50	0.70	dB
Insertion loss 2	LOSS2	f=4.9GHz to 5.9GHz	-	0.60	0.80	dB
Isolation 1	ISL1	f=2.4GHz to 2.5GHz	27	30	-	dB
Isolation 2	ISL2	f=4.9GHz to 5.9GHz	24	26	-	dB
Input power at 1dB compression point 1	$P_{-1dB}1$	f=2.4GHz to 2.5GHz	+26	+29	-	dBm
Input power at 1dB compression point 2	$P_{-1dB}2$	f=4.9GHz to 5.9GHz	+26	+29	-	dBm
Return loss 1	RL1	f=2.4GHz to 2.5GHz	15	25	-	dB
Return loss 2	RL2	f=4.9GHz to 5.9GHz	15	20	-	dB
Switching time	T_{SW}	50% CTL to 10%/90% RF	-	80	300	ns

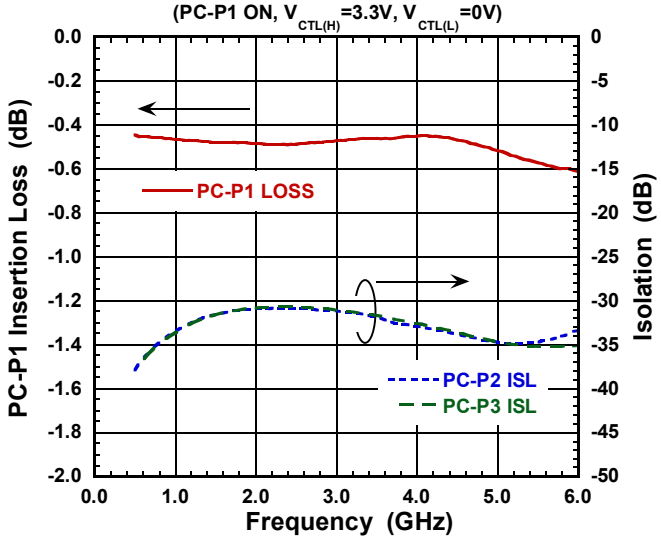
■ TERMINAL INFORMATION

No.	SYMBOL	DESCRIPTION
1	PC	Common RF terminal. An external DC blocking capacitor is required.
2	NC	No connected terminal. This terminal is not connected with internal circuit. This terminal please connects to the PCB ground plane or floating.
3	VCTL1	Control voltage input terminal.
4	P1	RF terminal. An external DC blocking capacitor is required.
5	P2	RF terminal. An external DC blocking capacitor is required.
6	VCTL2	Control voltage input terminal.
7	VCTL3	Control voltage input terminal.
8	P3	RF terminal. An external DC blocking capacitor is required.
Exposed Pad	GND	Ground terminal. Connect exposed pad to ground plane as close as possible for excellent RF performance.

■ ELECTRICAL CHARACTERISTICS

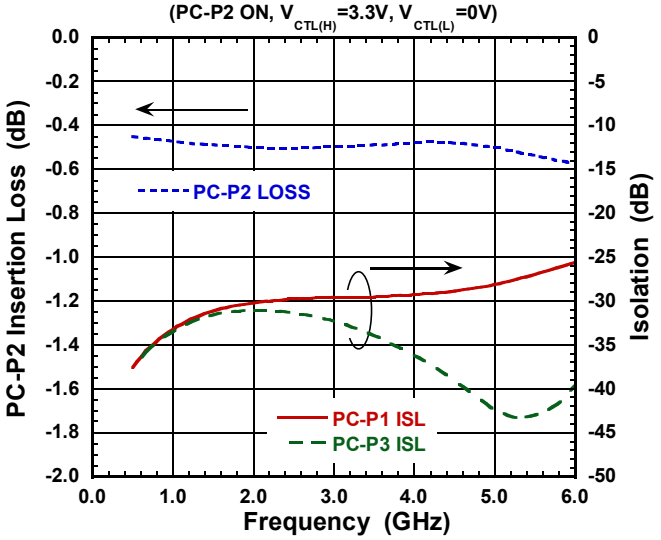
LOSS, ISL vs Frequency

(PC-P1 ON, $V_{CTL(H)}$=3.3V, $V_{CTL(L)}$=0V)



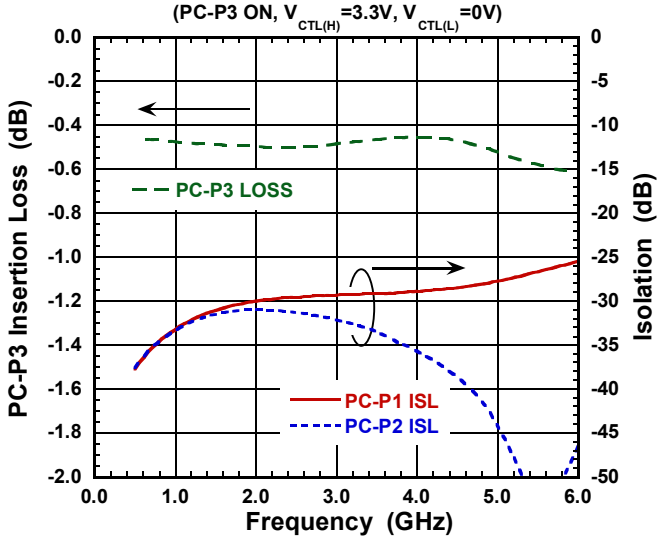
LOSS, ISL vs Frequency

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



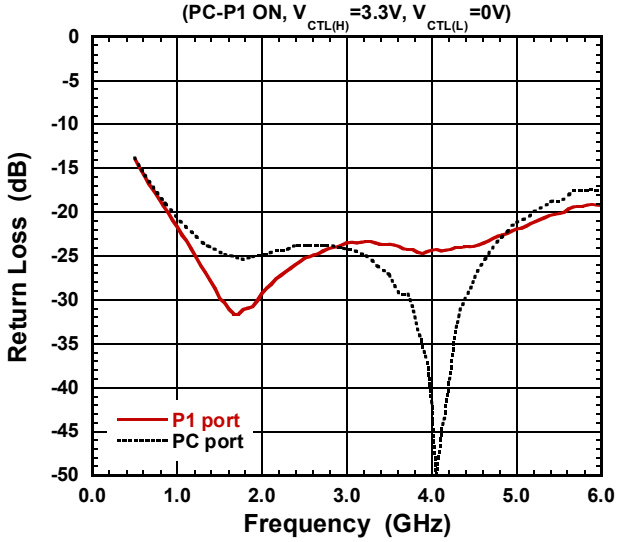
LOSS, ISL vs Frequency

(PC-P3 ON, $V_{CTL(H)}$=3.3V, $V_{CTL(L)}$=0V)



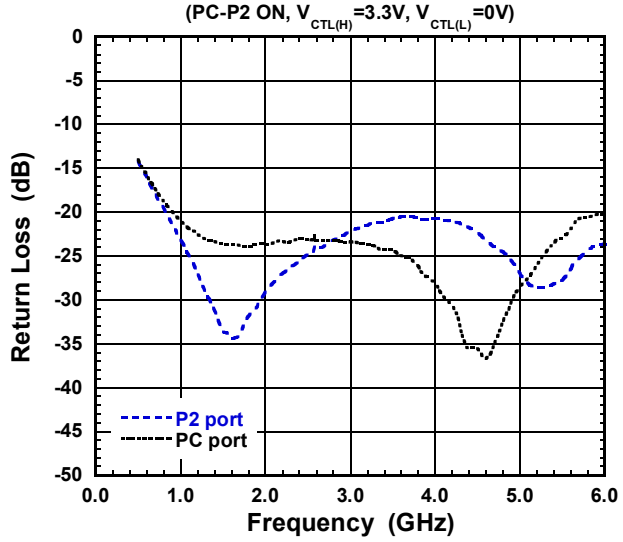
Return Loss vs Frequency

(PC-P1 ON, $V_{CTL(H)}$=3.3V, $V_{CTL(L)}$=0V)



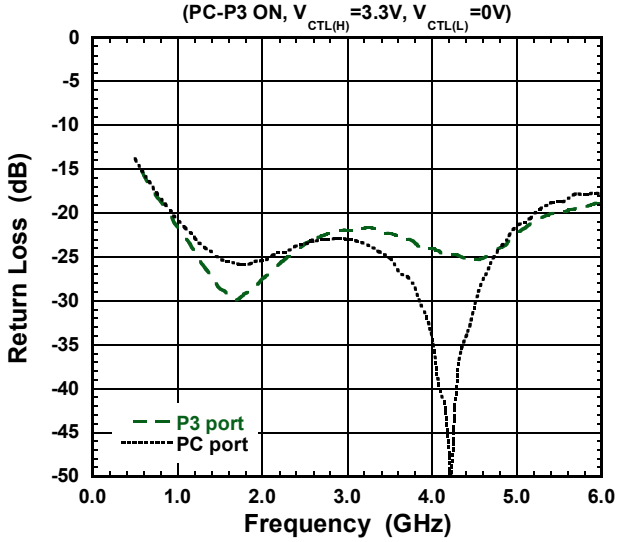
Return Loss vs Frequency

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



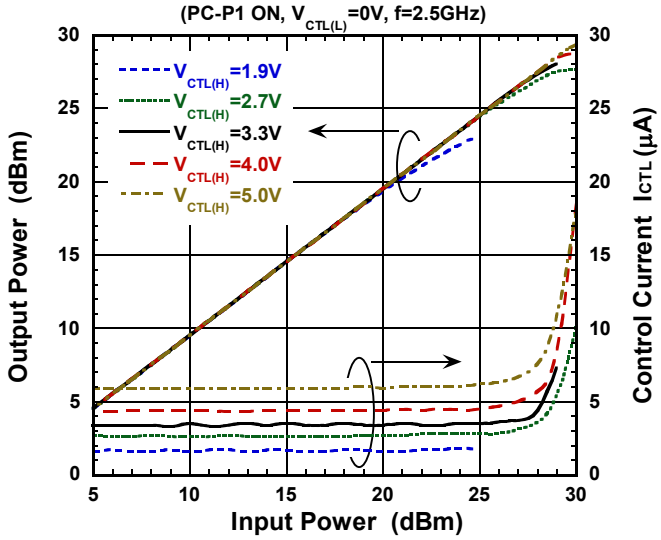
Return Loss vs Frequency

(PC-P3 ON, $V_{CTL(H)}$=3.3V, $V_{CTL(L)}$=0V)

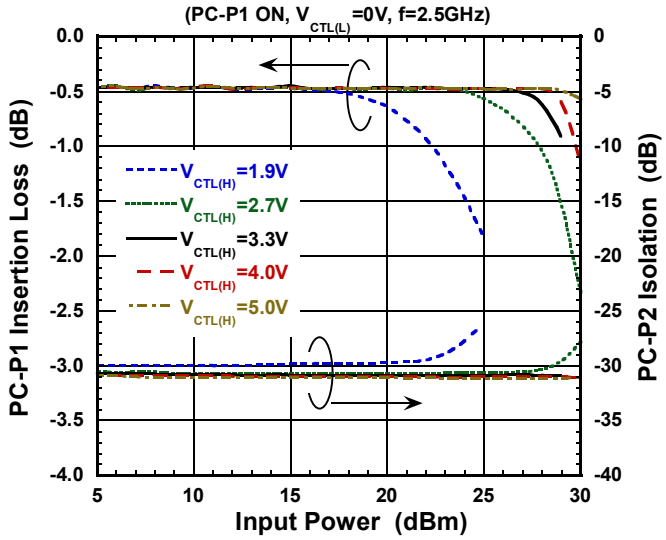


■ ELECTRICAL CHARACTERISTICS

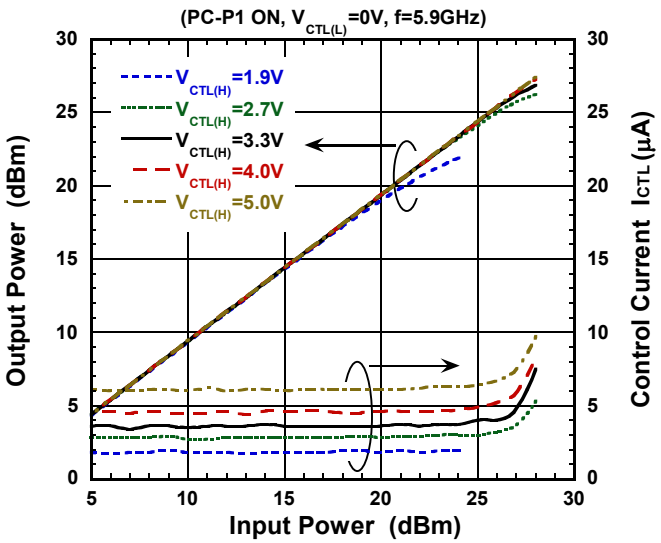
Output Power, ICTL vs Input Power



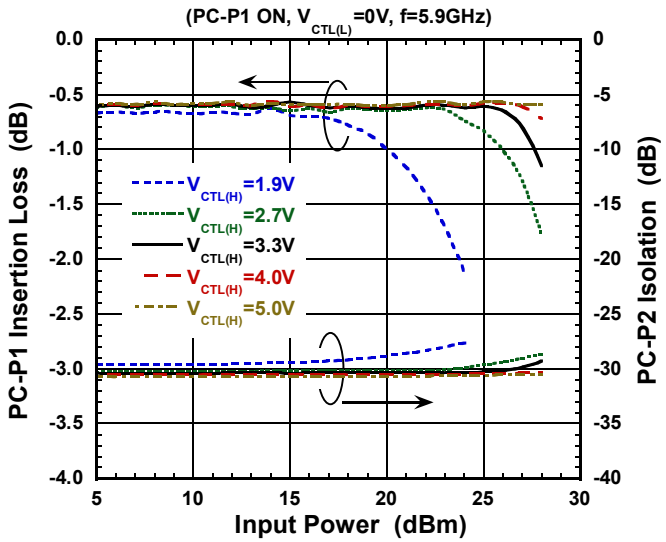
LOSS, ISL vs Input Power



Output Power, ICTL vs Input Power

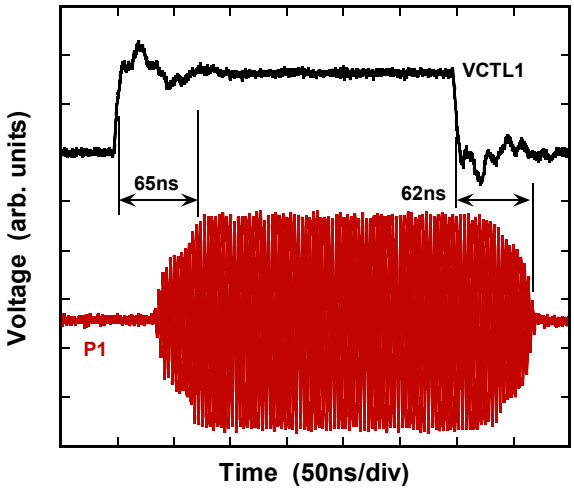


LOSS, ISL vs Input Power



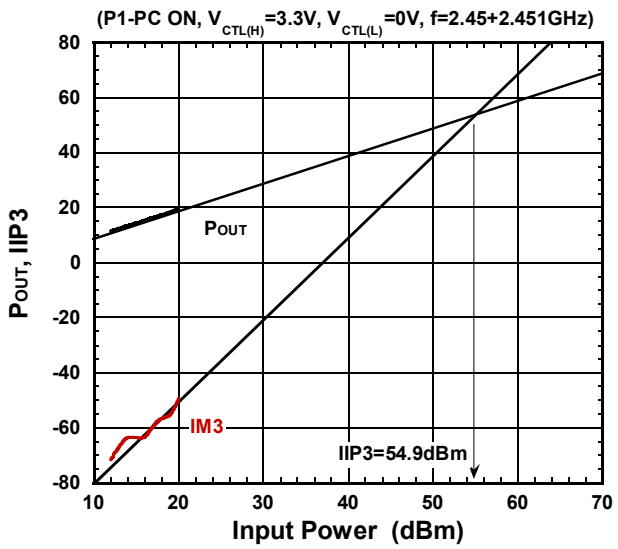
Switching Time

(PC-P1/P3 path, VCTL1=3.3/0V, VCTL3=0/3.3V, VCTL2=0V)

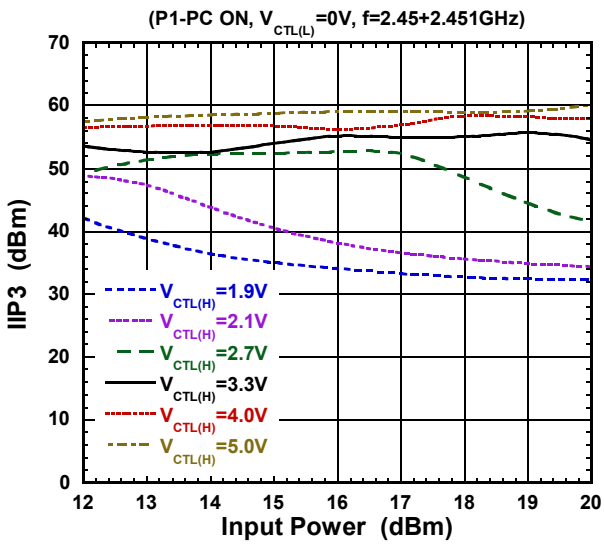


■ ELECTRICAL CHARACTERISTICS

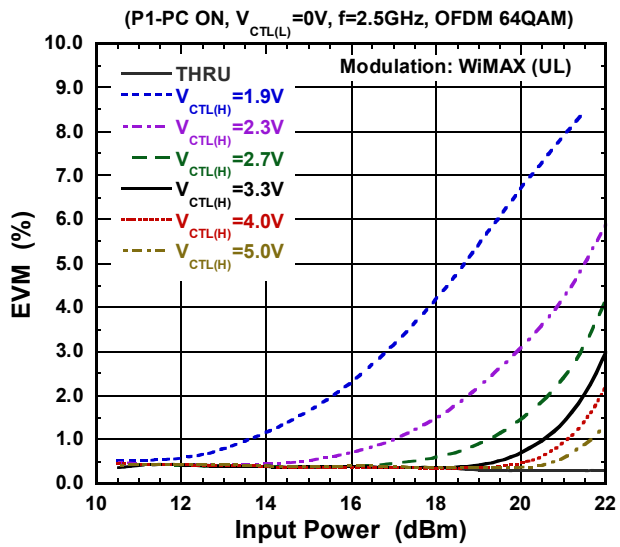
Output Power, IM3 vs Input Power



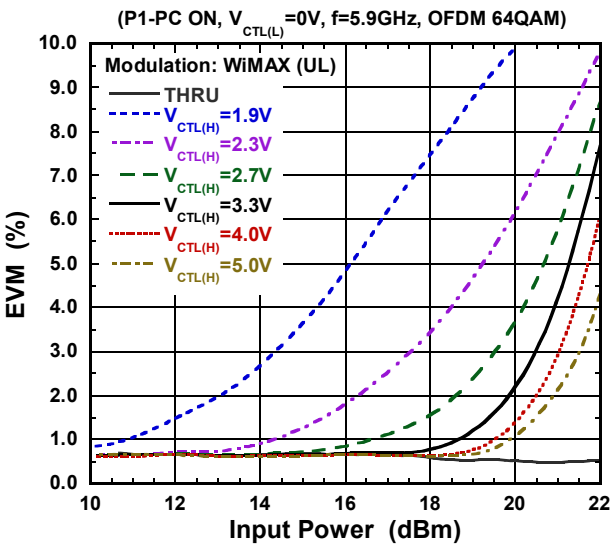
IIP3 vs Input Power



EVM vs Input Power(f=2.5GHz)



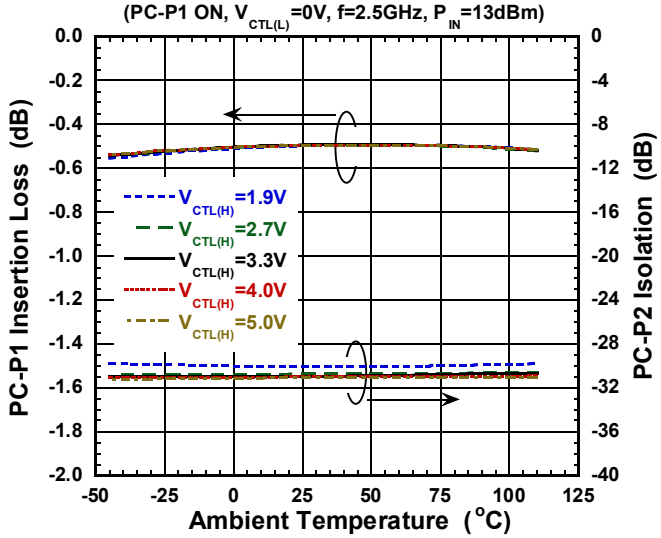
EVM vs Input Power(f=5.9GHz)



■ ELECTRICAL CHARACTERISTICS

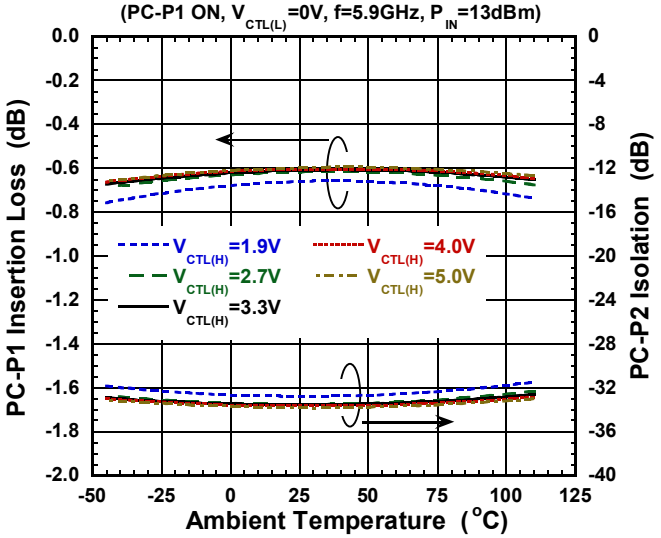
LOSS, ISL vs Temperature

(PC-P1 ON, $V_{CTL(L)}$=0V, f=2.5GHz, P_{IN}=13dBm)



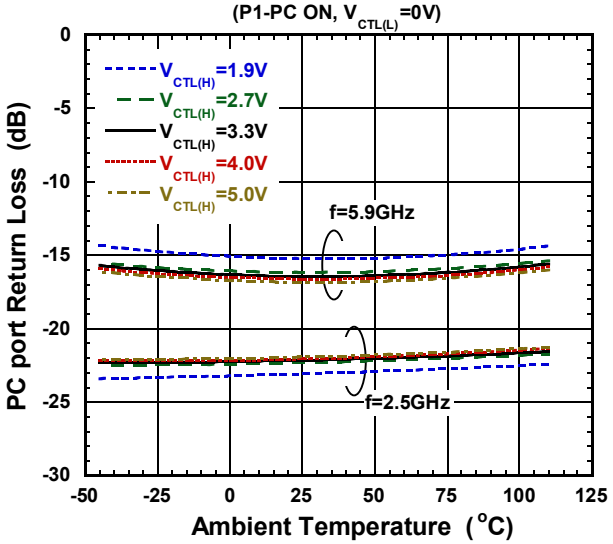
LOSS, ISL vs Temperature

(PC-P1 ON, $V_{CTL(L)}$=0V, f=5.9GHz, P_{IN}=13dBm)



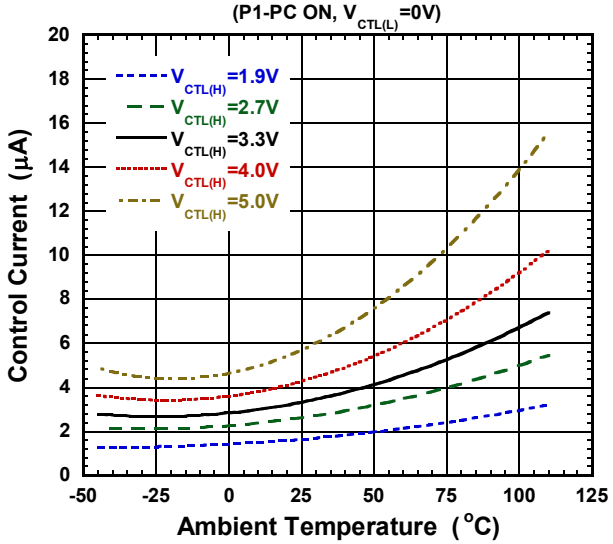
Return Loss vs Temperature

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



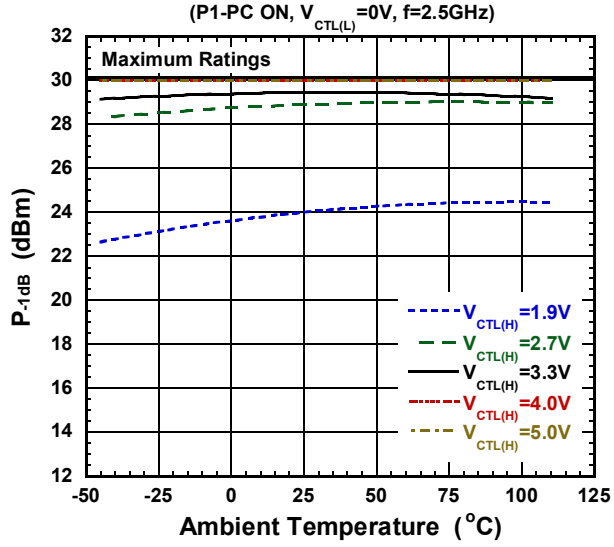
Control Current vs Temperature

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



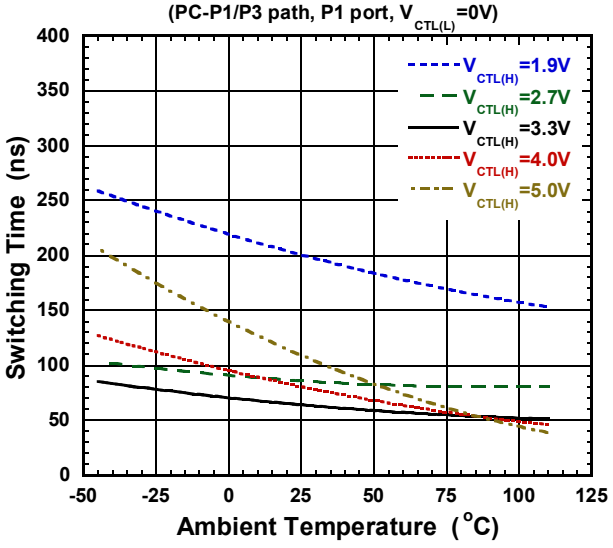
P_{-1dB} vs Temperature

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

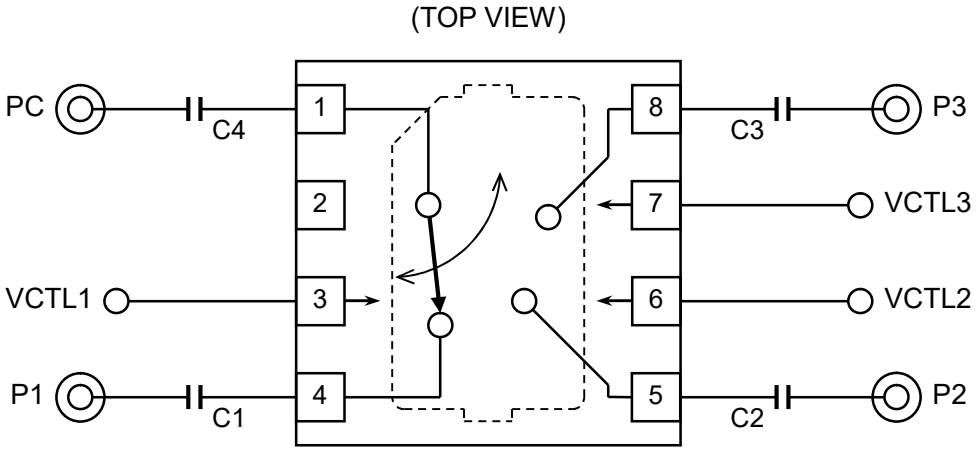


Switching Time(rise) vs Temperature

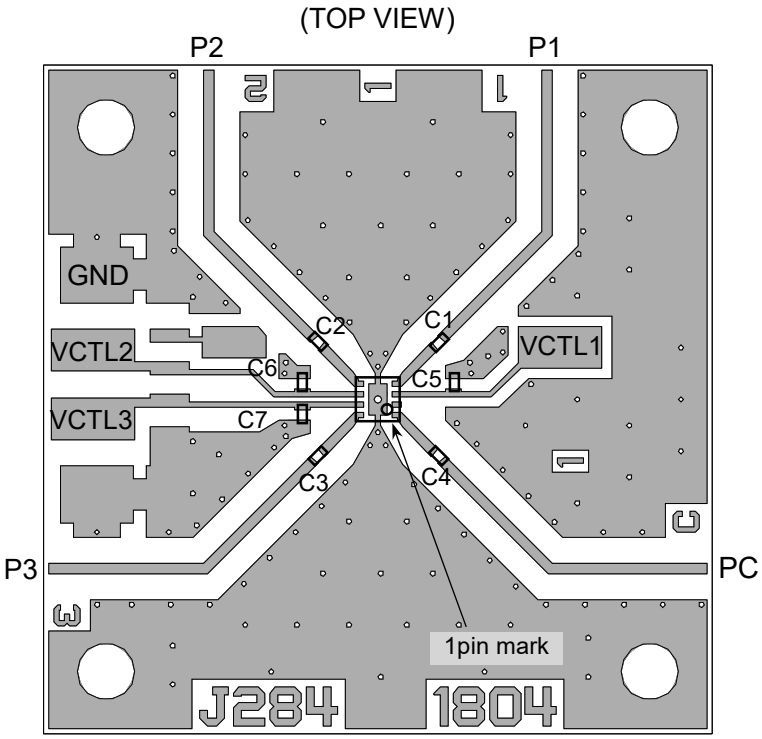
(PC-P1/P3 path, P1 port, $V_{CTL(L)}$=0V)



■ APPLICATION CIRCUIT



■ RECOMMENDED PCB DESIGN



PCB: FR-4, t=0.2mm
Capacitor size: 0603 (0.6 x 0.3 mm)
Strip line width: 0.38mm
PCB size: 25.8 x 25.8mm
Through hole diameter: 0.2mm

■ Losses of PCB, capacitors and connectors

Frequency (GHz)	Loss (dB)
2.4	0.50
2.5	0.52
4.9	0.87
5.9	1.02

NOTE

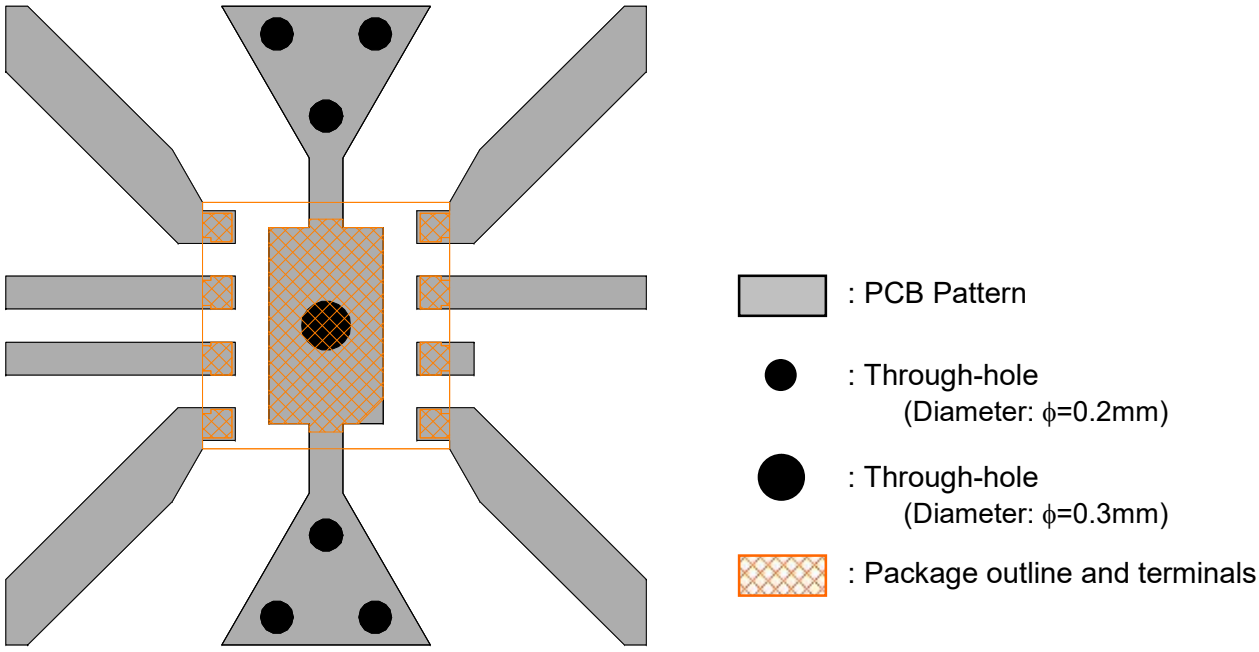
The bypass capacitors, C5 to C7 are optional, and are recommended only when the control lines are affected under noisy environment.

■ PARTS LIST

No.	Value	Notes
C1 to C4	27pF	Murata MFG (GRM03 series)
C5 to C7	10pF	

■ PCB LAYOUT GUIDELINE

(TOP VIEW)



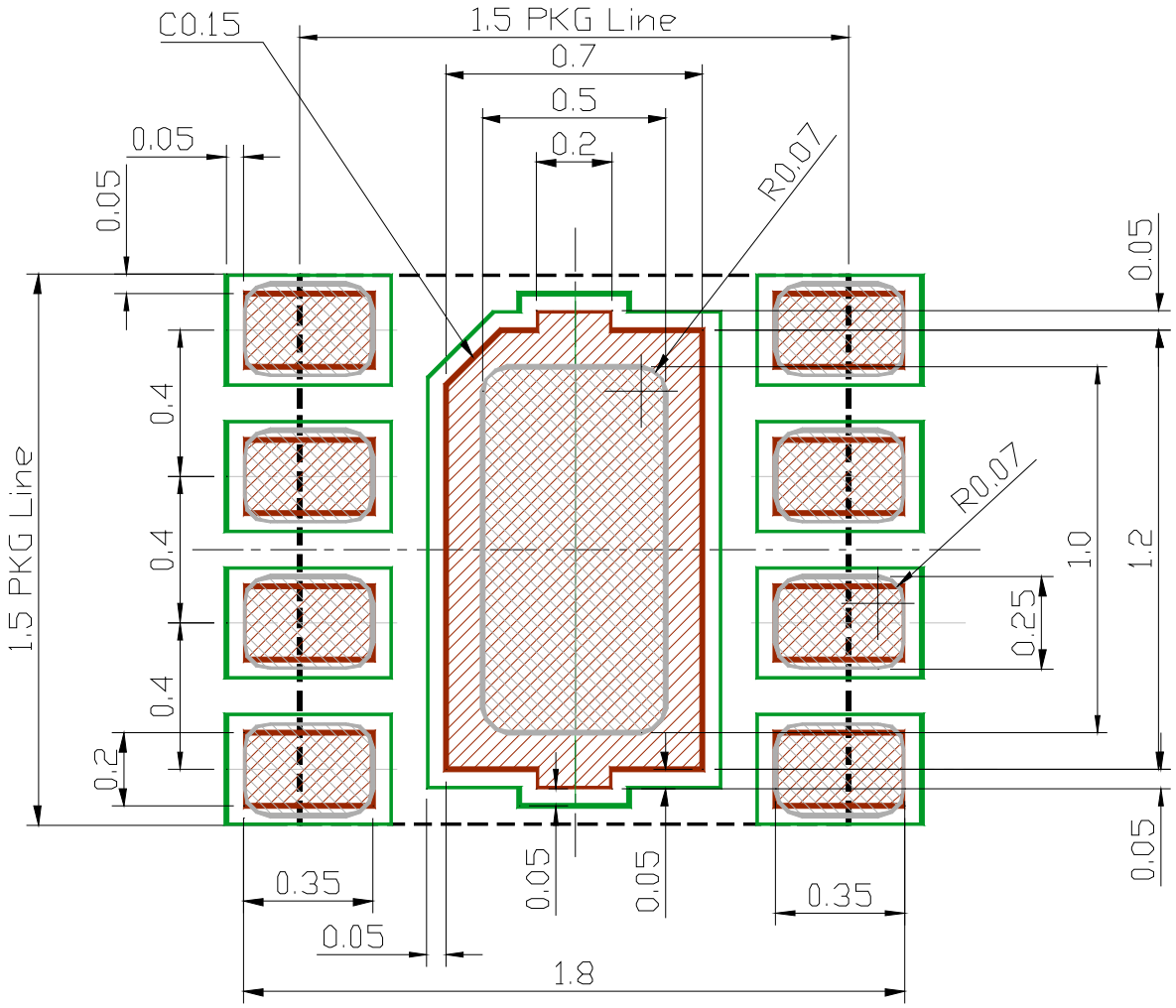
PRECAUTIONS

[1] The DC blocking capacitors should be placed at RF terminals. Please choose appropriate capacitance value at the application frequency.
[2] If the bypass capacitors (C5 to C7) are needed, they should be placed as close as possible to VCTL terminals.
[3] For good RF performance, exposed pad should be connected to PCB ground plane as close as possible.

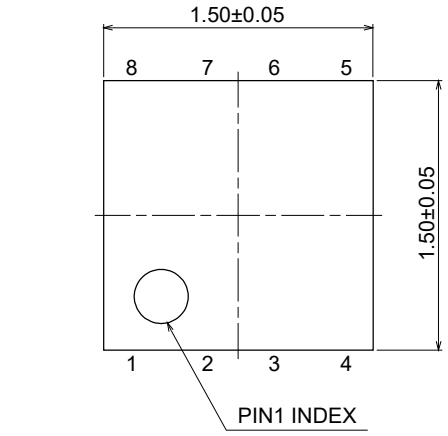
■ RECOMMENDED FOOTPRINT PATTERN (8pin DFN Package 1.5x1.5mm) <Reference>

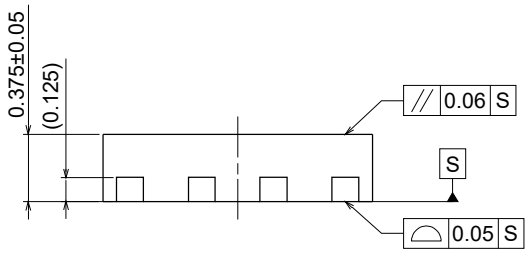
Package: 1.5mm x 1.5mm
Pin pitch: 0.4mm

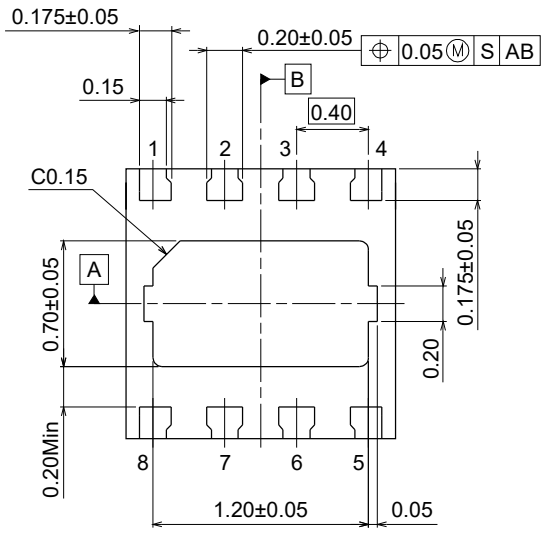
: Land
: Mask (Open area) *Metal mask thickness: 100um
: Resist (Open area)



■ PACKAGE OUTLINE (DFN8-64)







Unit	: mm
Board	: Copper
Terminal Treat	: Ni/Pd/Au
Molding Material	: Epoxy resin
Weight	: 2.8mg

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.

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    - 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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