

## SPDT SWITCH GaAs MMIC

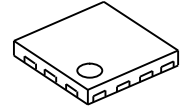
### GENERAL DESCRIPTION

The NJG1669MD7 is a GaAs SPDT switch IC suited for WiMAX CPE and data card application. The NJG1669MD7 features low insertion loss, high power handling and high isolation.

This device exhibits wide frequency coverage up to 6.0GHz. And also this switch MMIC includes ESD protection circuits.

An ultra- small and ultra-thin package of EQFN14-D7 is adopted.

### PACKAGE OUTLINE



NJG1669MD7

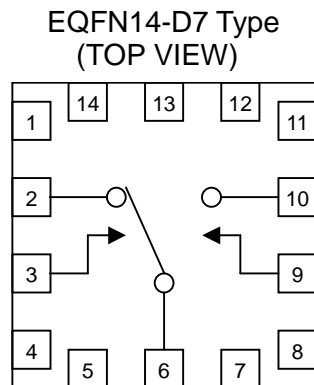
### APPLICATIONS

WiMAX, WLAN, LTE, 3G applications  
 High linearity switching applications like CPE, Modem, Router and Access point  
 Antenna switching, path switching and band switching applications

### FEATURES

- Control voltage +2.0V~+5.0V
  - Low insertion loss
    - 0.35dB typ. @f=2.5GHz, P<sub>IN</sub>=30dBm, V<sub>CTL(H)</sub>=3.0V
    - 0.40dB typ. @f=3.5GHz, P<sub>IN</sub>=30dBm, V<sub>CTL(H)</sub>=3.0V
    - 0.45dB typ. @f=6.0GHz, P<sub>IN</sub>=30dBm, V<sub>CTL(H)</sub>=3.0V
  - High isolation
    - 28dB typ. @f=2.5GHz, P<sub>IN</sub>=30dBm, V<sub>CTL(H)</sub>=3.0V
    - 29dB typ. @f=3.5GHz, P<sub>IN</sub>=30dBm, V<sub>CTL(H)</sub>=3.0V
    - 25dB typ. @f=6.0GHz, P<sub>IN</sub>=30dBm, V<sub>CTL(H)</sub>=3.0V
  - High P<sub>-0.1dB</sub> Compression
    - 37dBm typ. @f=2.5GHz, V<sub>CTL(H)</sub>=3.0V
    - 37dBm typ. @f=3.5GHz, V<sub>CTL(H)</sub>=3.0V
  - Ultra- small and ultra-thin package
  - Lead-free and halogen-free
- EQFN14-D7 (package Size: 1.6 x 1.6x 0.397mm typ.)

### PIN CONFIGURATION



- |            |             |
|------------|-------------|
| 1. NC(GND) | 8. NC(GND)  |
| 2. P2      | 9. CTL1     |
| 3. CTL2    | 10. P1      |
| 4. NC(GND) | 11. NC(GND) |
| 5. NC(GND) | 12. NC(GND) |
| 6. PC      | 13. GND     |
| 7. NC(GND) | 14. NC(GND) |

### TRUTH TABLE

“H”=V<sub>CTL(H)</sub>, “L”=V<sub>CTL(L)</sub>

CTL1	CTL2	PATH
H	L	PC-P1
L	H	PC-P2

NOTE: The information on this datasheet is subject to change without notice

## ■ ABSOLUTE MAXIMUM RATINGS

(T<sub>a</sub>=25°C, Z<sub>s</sub>=Z<sub>l</sub>=50Ω)

PARAMETER	SYMBOL	CONDITIONS	RATINGS	UNITS
RF Input power	P <sub>IN</sub>	V <sub>CTL</sub> =0/3V	38	dBm
Control voltage	V <sub>CTL</sub>	CTL terminal	6.0	V
Power dissipation	P <sub>D</sub>	Four-layer FR4 PCB with through-hole (74.2x74.2mm), T <sub>j</sub> =150°C	1300	mW
Operating temperature	T <sub>opr</sub>		-40~+85	°C
Storage temperature	T <sub>stg</sub>		-55~+150	°C

## ■ ELECTRICAL CHARACTERISTICS

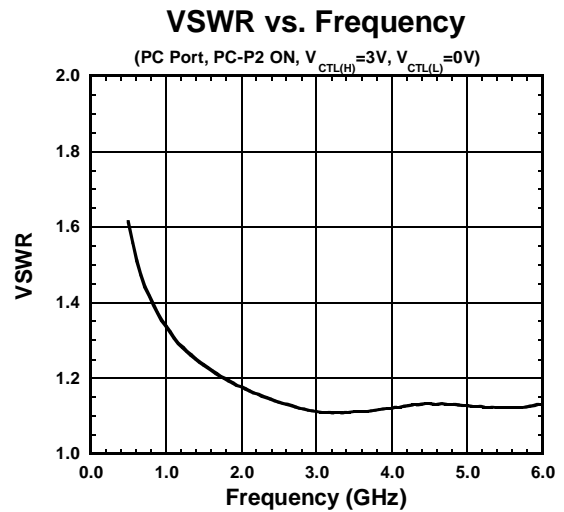
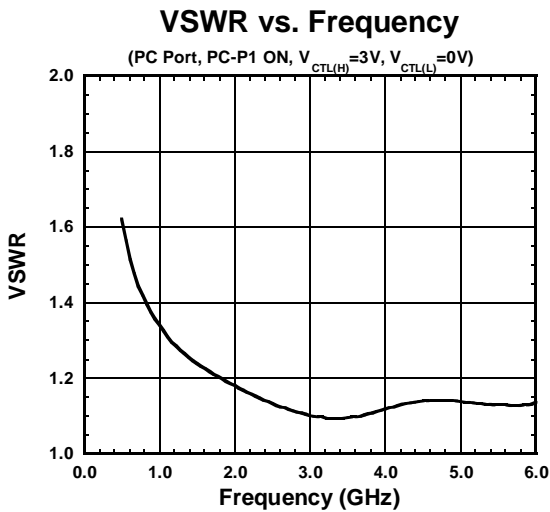
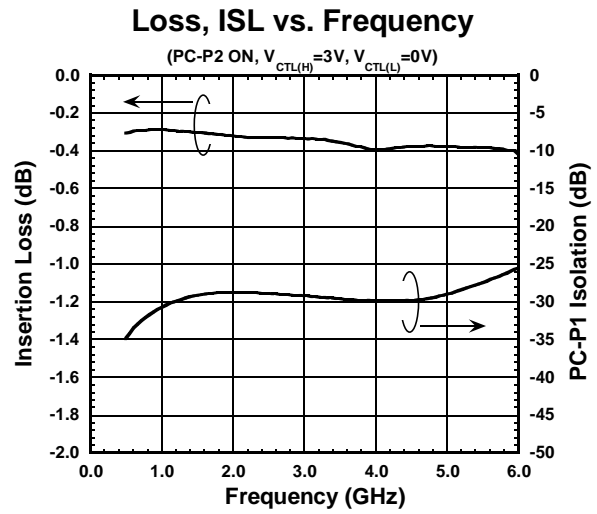
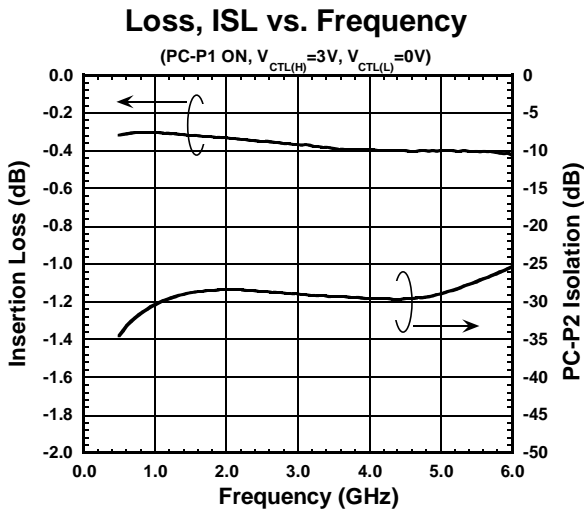
(General conditions: T<sub>a</sub>=+25°C, V<sub>CTL(L)</sub>=0V, V<sub>CTL(H)</sub>=3V, Z<sub>s</sub>=Z<sub>l</sub>=50Ω)

PARAMETER	SYMBOL	CONDITIONS	MIN	TYP	MAX	UNITS
Control voltage (L)	V <sub>CTL(L)</sub>		-0.2	-	0.2	V
Control voltage (H)	V <sub>CTL(H)</sub>		2.0	3.0	5.0	V
Control current	I <sub>CTL</sub>		-	15	30	μA
Insertion loss 1	LOSS1	f=2.5GHz	-	0.35	0.55	dB
Insertion loss 2	LOSS2	f=3.5GHz	-	0.40	0.60	dB
Insertion loss 3	LOSS3	f=6.0GHz	-	0.45	0.65	dB
Isolation 1	ISL1	f=2.5GHz	25	28	-	dB
Isolation 2	ISL2	f=3.5GHz	26	29	-	dB
Isolation 3	ISL3	f=6.0GHz	22	25	-	dB
Input power at 0.1dB compression point 1	P <sub>-0.1dB(1)</sub>	f=2.5GHz	34	37	-	dBm
Input power at 0.1dB compression point 2	P <sub>-0.1dB(2)</sub>	f=3.5GHz	34	37	-	dBm
VSWR	VSWR	f=3.5GHz, ON STATE	-	1.1	1.4	
2nd Harmonics 1	2f <sub>0(1)</sub>	f=2.5GHz, P <sub>IN</sub> =30dBm	-	-40	-30	dBm
2nd Harmonics 2	2f <sub>0(2)</sub>	f=3.5GHz, P <sub>IN</sub> =30dBm	-	-40	-30	dBm
3rd Harmonics 1	3f <sub>0(1)</sub>	f=2.5GHz, P <sub>IN</sub> =30dBm	-	-40	-30	dBm
3rd Harmonics 2	3f <sub>0(2)</sub>	f=3.5GHz, P <sub>IN</sub> =30dBm	-	-40	-30	dBm
Switching time	T <sub>SW</sub>	50% DC to 10/90% RF	-	350	-	ns

## ■ TERMINAL INFORMATION

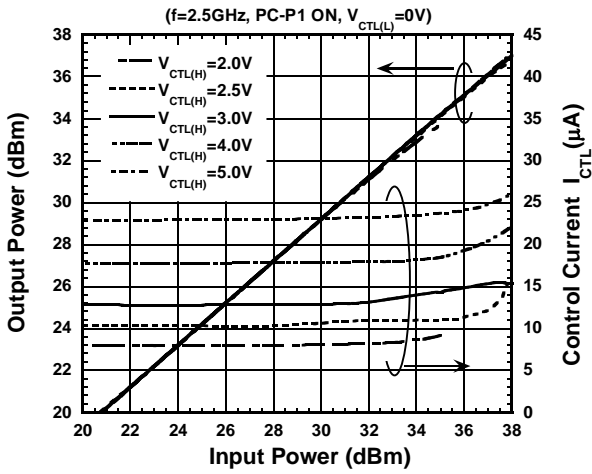
No.	SYMBOL	DESCRIPTION
1,4,5,7,8, 11,12,14	NC (GND)	No connected terminals. Please connect these terminals with a ground plane as close as possible for good RF performance.
2	P2	RF port. This port is connected with PC port by controlling 3rd pin to $V_{CTL(H)}$ and 9th pin to $V_{CTL(L)}$ . An external capacitor is required to block the DC bias voltage of internal circuit.
3	CTL2	Control signal input terminal. Please connect a bypass capacitor (10pF) with a ground plane for avoiding RF noise from outside.
6	PC	Common RF port. An external capacitor is required to block the DC bias voltage of internal circuit.
9	CTL1	Control signal input terminal. Please connect a bypass capacitor (10pF) with a ground plane for avoiding RF noise from outside.
10	P1	RF port. This port is connected with PC port by controlling 3rd pin to $V_{CTL(L)}$ and 9th pin to $V_{CTL(H)}$ . An external capacitor is required to block the DC bias voltage of internal circuit.
13	GND	Ground terminal. Please connect this terminal with a ground plane as close as possible for good RF performance.

■ ELECTRICAL CHARACTERISTICS (With Application circuit, Loss of external circuit are excluded)

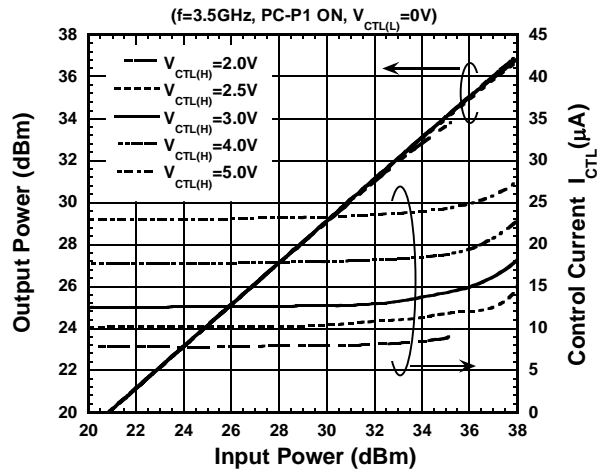


## ELECTRICAL CHARACTERISTICS (With Application circuit, Loss of external circuit are excluded)

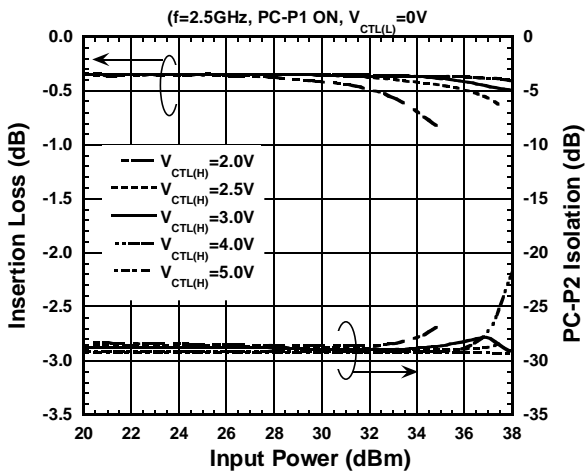
### Output Power, $I_{CTL}$ vs. Input Power



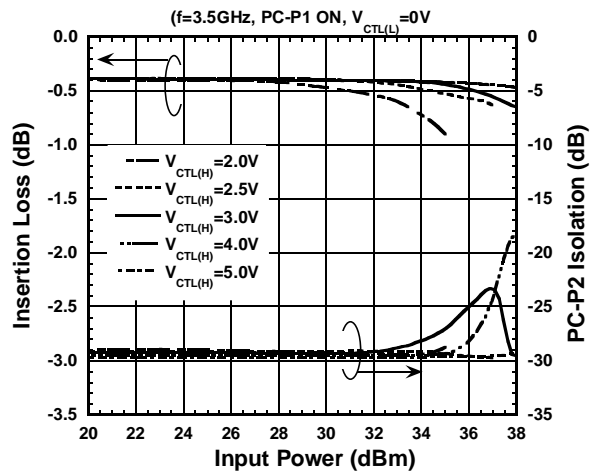
### Output Power, $I_{CTL}$ vs. Input Power



### Loss, ISL vs. Input Power

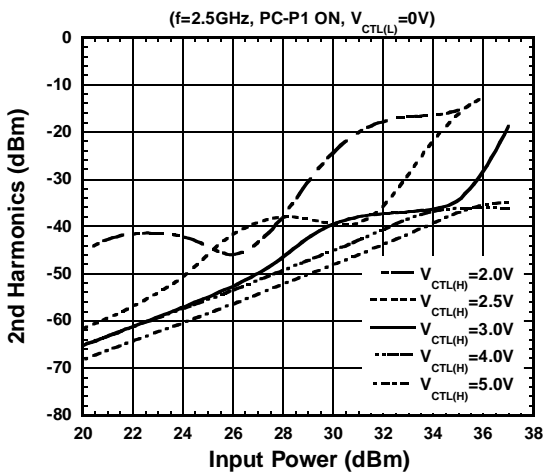


### Loss, ISL vs. Input Power

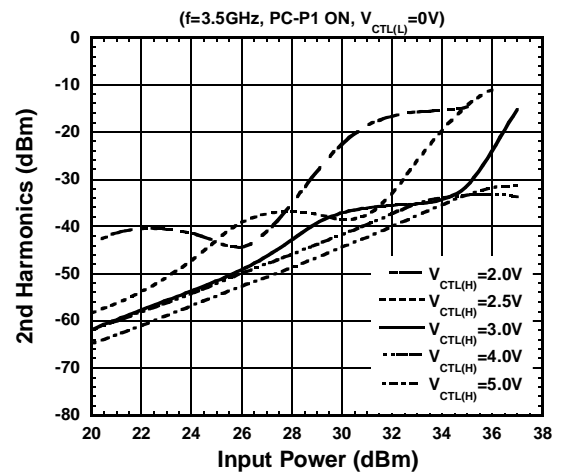


## ELECTRICAL CHARACTERISTICS (With Application circuit, Loss of external circuit are excluded)

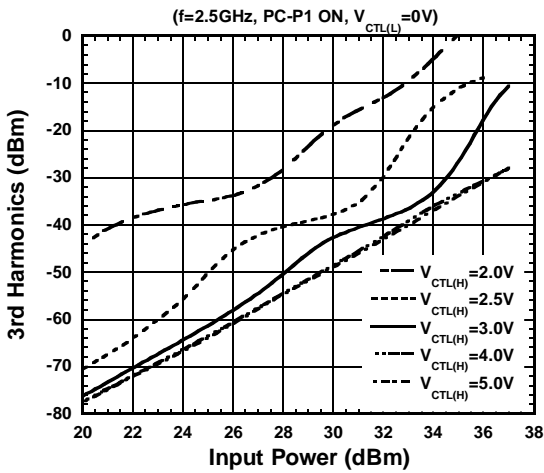
### 2nd Harmonics vs. Input Power



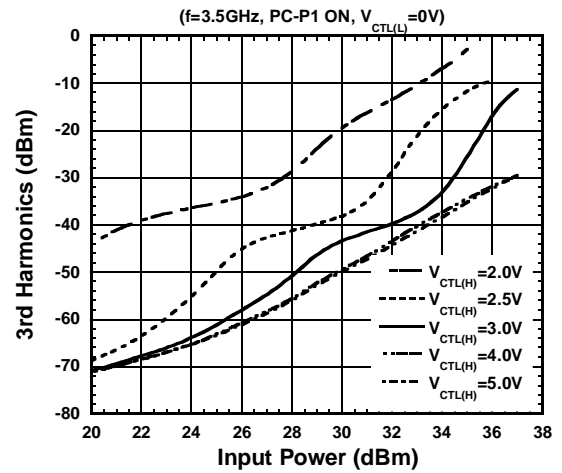
### 2nd Harmonics vs. Input Power



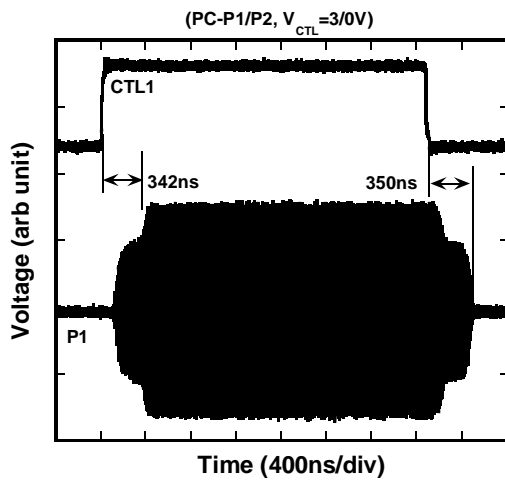
### 3rd Harmonics vs. Input Power



### 3rd Harmonics vs. Input Power

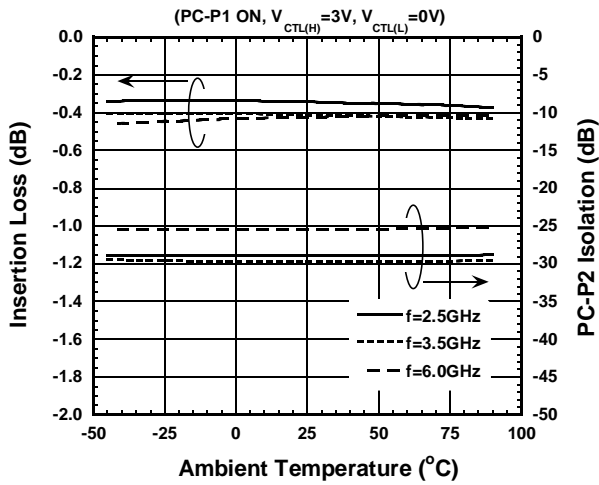


### Switching Time

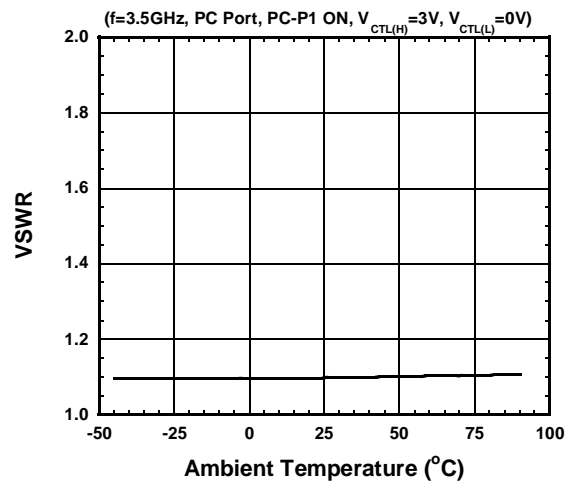


## ELECTRICAL CHARACTERISTICS (With Application circuit, Loss of external circuit are excluded)

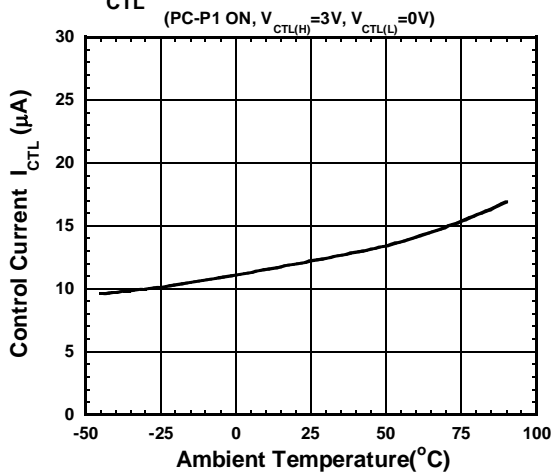
### Loss, ISL vs. Ambient Temperature



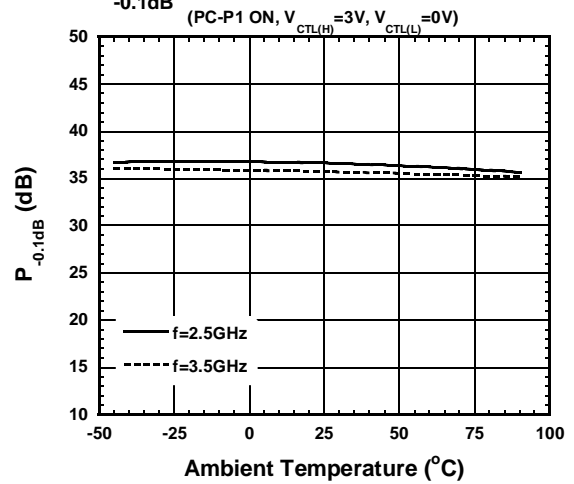
### VSWR vs. Ambient Temperature



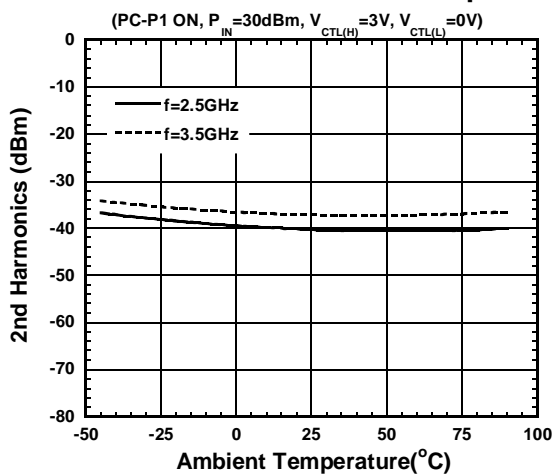
### $I_{CTL}$ vs. Ambient Temperature



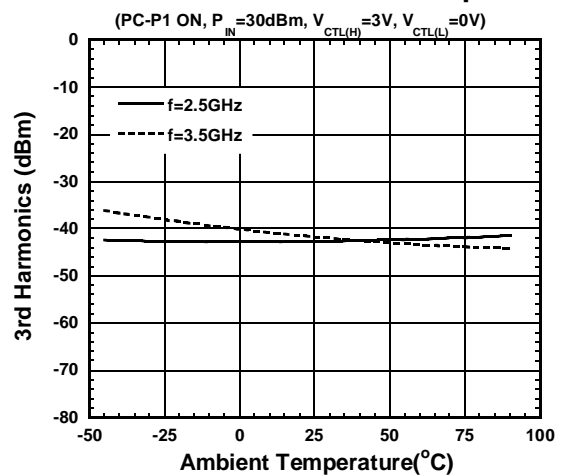
### $P_{-0.1dB}$ vs. Ambient Temperature



### 2nd Harmonics vs. Ambient Temperature

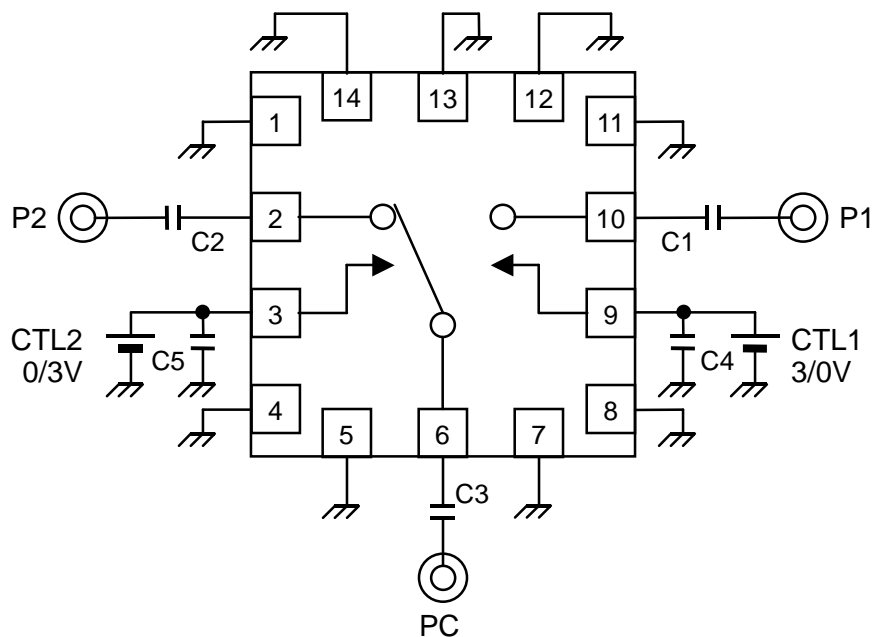


### 3rd Harmonics vs. Ambient Temperature



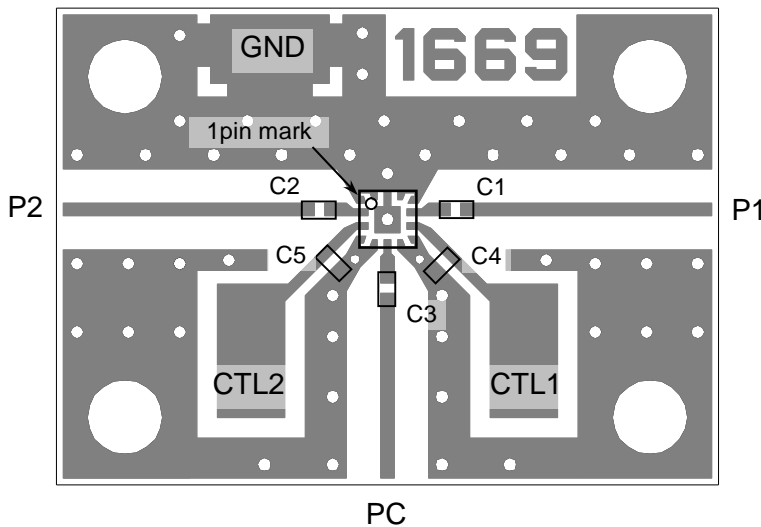
## APPLICATION CIRCUIT

(TOP VIEW)



## TEST PCB LAYOUT

(Top View)



PCB: FR-4, t=0.2mm  
 Capacitor size: 1005  
 Strip Line Width: 0.4mm  
 PCB size: 19.4 x 14.0mm

Losses of PCB, capacitors and connectors

Frequency (GHz)	Loss (dB)
2.5	0.37
3.5	0.45
6.0	0.71

## PARTS LIST

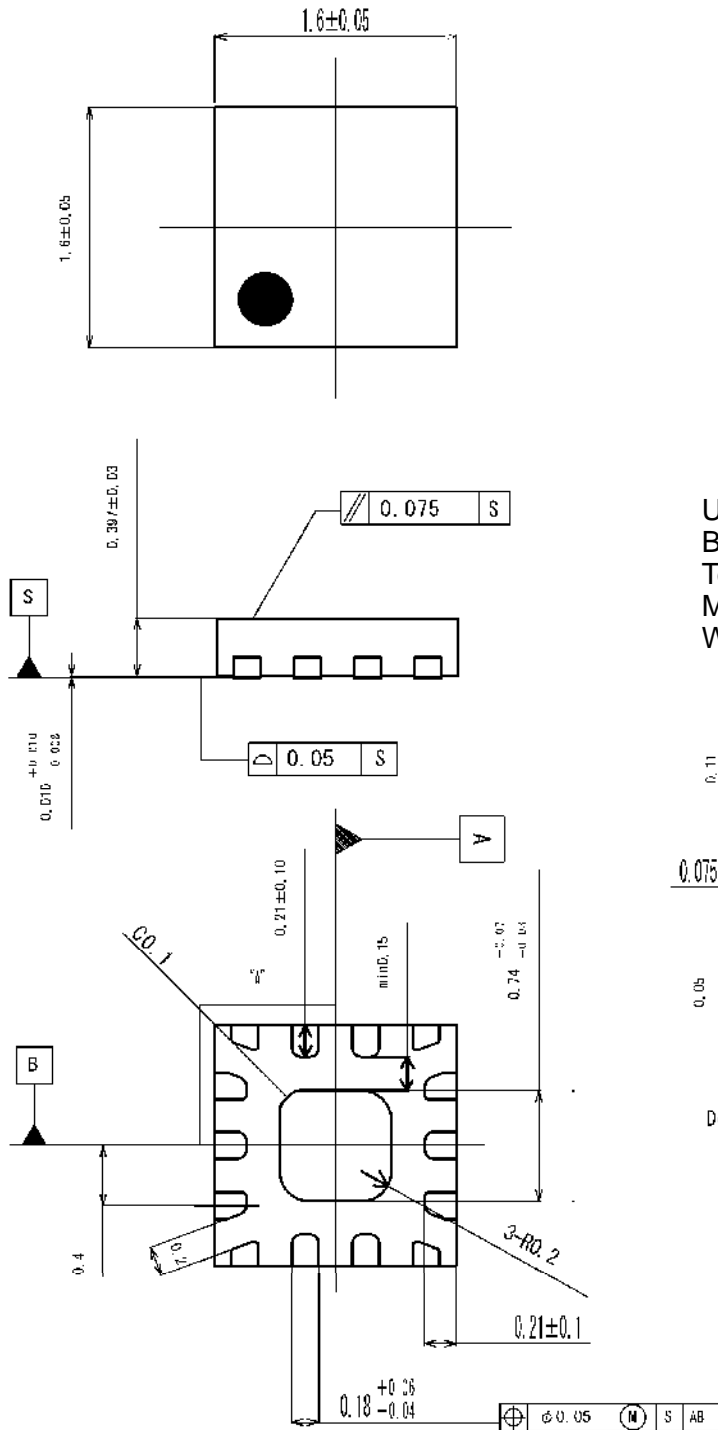
Parts ID	Value	Notes
C1~C3	27pF	Murata MFG (GRM15)
C4, C5	10pF	

## PRECAUTIONS

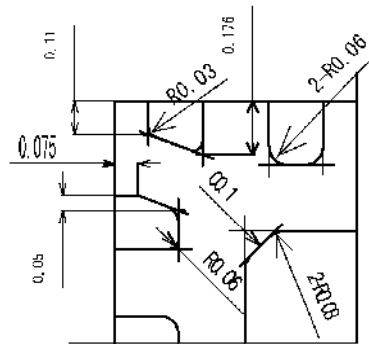
- [1] The DC blocking capacitors have to be placed at RF terminal of P1, P2 and PC.  
Please choose appropriate capacitance values to the application frequency.
- [2] For avoiding the degradation of RF performance, please place bypass capacitors (C4 and C5) as close as possible to each terminal.
- [3] For good RF performance, the GND terminals must be connected with the ground plane of substrate, and through - holes for GND should be placed the IC near.



## ■ PACKAGE OUTLINE (EQFN14-D7)



Units : mm  
 Board : Cu  
 Terminal treat : SnBi  
 Molding material : Epoxy resin  
 Weight : 3.4 mg



Details of "A" part (× 2)

### 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.

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  - 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

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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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