

## 10W High Power SPDT Switch

### ■ FEATURES

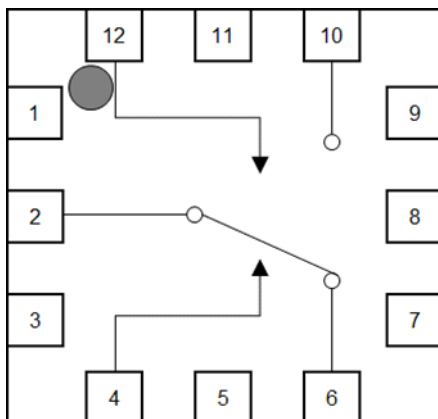
- Control voltage range 2.7 V to 5.0 V
- Low insertion loss
  - 0.35 dB typ. @ 3.85 GHz,  $V_{CTL}(H) = 3.3 V$
  - 0.40 dB typ. @ 4.7 GHz,  $V_{CTL}(H) = 3.3 V$
  - 0.45 dB typ. @ 6.0 GHz,  $V_{CTL}(H) = 3.3 V$
- High isolation
  - 27dB typ. @ 3.85 GHz,  $V_{CTL}(H) = 3.3 V$
  - 27dB typ. @ 4.7 GHz,  $V_{CTL}(H) = 3.3 V$
  - 25dB typ. @ 6.0 GHz,  $V_{CTL}(H) = 3.3 V$
- High linearity
  - $P_{-0.1dB} = +40 dBm$  typ. @ 6.0 GHz,  $V_{CTL}(H) = 3.3 V$
- High switching speed 150 ns typ.
- Small & thin Package
  - EQFN12-E4 (2.0 mm x 2.0 mm x 0.397 mm typ.)
- RoHS compliant and Halogen Free, MSL1

### ■ APPLICATION

- 5G (Sub-6GHz) Small-cell base station
- Commercial radio application
- Transmit/receive switching, antenna switching and others switching applications

### ■ BLOCK DIAGRAM (EQFN12-E4)

(TOP VIEW)



### ■ GENERAL DESCRIPTION

The NJG1817ME4 is a high power SPDT switch GaAs MMIC suitable for 5G base station system, also is used commercial radio system requiring high power.

This switch has high power handling capability of +40dBm. Features are high linearity and low insertion loss up to 6GHz. Furthermore, high switching speed of the NJG1817ME4 is enough capable on 5G communications. Integrated ESD protection device on each RF port achieves excellent ESD robustness.

The NJG1817ME4 is packaged 2mm x 2mm EQFN12-E4 small size package despite its high power handling.

### ■ TRUTH TABLE

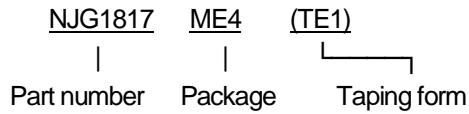
“H” =  $V_{CTL}(H)$ , “L” =  $V_{CTL}(L)$

ON PATH	VCTL1	VCTL2
PC-P1	H	L
PC-P2	L	H

### ■ PIN CONFIGURATION

PIN NO.	SYMBOL	DESCRIPTION
1	NC(GND)	No connected terminal (Connect to ground)
2	PC	Common RF terminal
3	NC(GND)	No connected terminal (Connect to ground)
4	VCTL1	Control signal input terminal.
5	NC(GND)	No connected terminal (Connect to ground)
6	P1	RF terminal
7	GND	Ground terminal
8	GND	Ground terminal
9	GND	Ground terminal
10	P2	RF terminal
11	NC(GND)	No connected terminal (Connect to ground)
12	VCTL2	Control signal input terminal.
Exposed Pad		Ground terminal

## ■ PRODUCT NAME INFORMATION



## ■ ORDERING INFORMATION

PART NUMBER	PACKAGE OUTLINE	RoHS	HALOGEN-FREE	TERMINAL FINISH	MARKING	WEIGHT (mg)	QUANTITY PER REEL (pcs/reel)
NJG1817ME4	EQFN12-E4	Yes	Yes	SnBi	1817	4.7	3,000

## ■ ABSOLUTE MAXIMUM RATINGS

(General conditions:  $T_a = +25^{\circ}\text{C}$ )

PARAMETER	SYMBOL	RATINGS	UNIT
RF input power	$P_{IN}$	+40 <sup>(1)</sup>	dBm
Control voltage	$V_{CTL}$	6.0	V
Power dissipation <sup>(2)</sup>	$P_D$	1200	mW
Operating temperature	$T_{opr}$	-40 to +105	$^{\circ}\text{C}$
Storage temperature	$T_{stg}$	-55 to +150	$^{\circ}\text{C}$

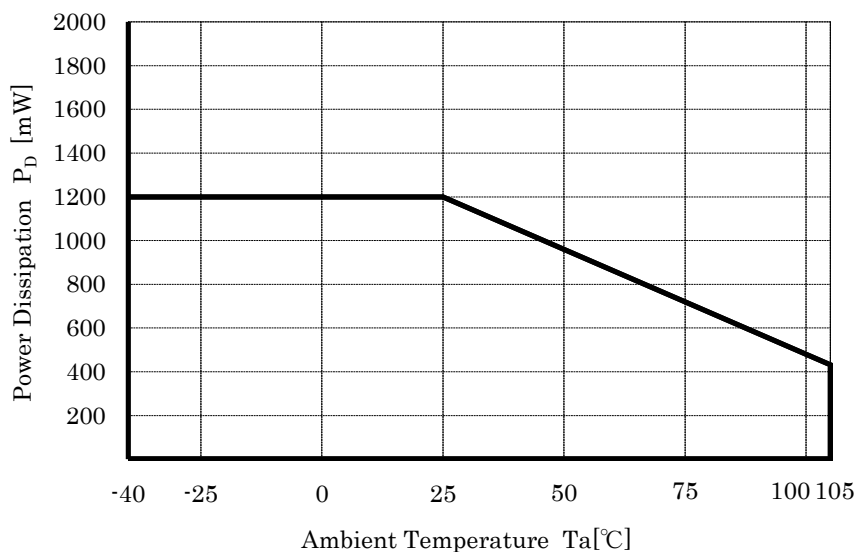
(1):  $V_{CTL}(H) = 3.3\text{ V}$ ,  $V_{CTL}(L) = 0\text{ V}$ , on state port

(2): 4-layer FR4 PCB with through-hole (101.5 x 114.5 mm),  $T_j = 150^{\circ}\text{C}$

## ■ POWER DISSIPATION VS.AMBIENT TEMPERATURE

Please, refer to the following Power Dissipation and Ambient Temperature.  
 (Please note the surface mount package has a low maximum rating of Power Dissipation [ $P_D$ ], a special attention should be paid in designing of thermal radiation.)

**Power Dissipation— Ambient Temperature Characteristic**  
 Mounted on PCB board



## ■ ELECTRICAL CHARACTERISTICS 1 (DC CHARACTERISTICS)

(General conditions:  $T_a = +25^\circ\text{C}$ ,  $Z_s = Z_l = 50 \Omega$ , with application circuit)

PARAMETER	SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Control voltage (HIGH)	$V_{CTL(H)}$		2.7	3.3	5.0	V
Control voltage (LOW)	$V_{CTL(L)}$		-0.2	0	0.2	V
Control current	$I_{CTL}$	$V_{CTL(H)} = 3.3\text{V}$ , $V_{CTL(L)} = 0\text{V}$	-	7	15	$\mu\text{A}$

## ■ ELECTRICAL CHARACTERISTICS 2 (RF CHARACTERISTICS)

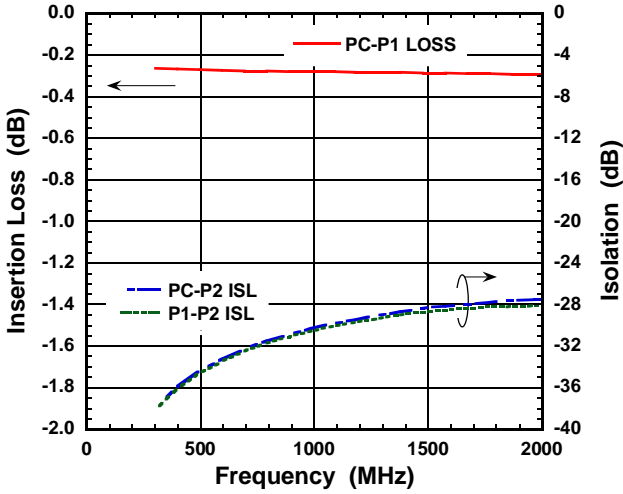
(General conditions:  $V_{CTL(H)} = 3.3\text{ V}$ ,  $V_{CTL(L)} = 0\text{ V}$ ,  $T_a = +25^\circ\text{C}$ ,  $Z_s = Z_l = 50 \Omega$ , with application circuit)

PARAMETER	SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Insertion loss	LOSS	f = 0.7GHz	-	0.30	0.45	dB
		f = 3.85 GHz	-	0.35	0.50	
		f = 4.7 GHz	-	0.40	0.60	
		f = 6.0 GHz	-	0.45	0.65	
Isolation	ISL	f = 0.7 GHz	28	30	-	dB
		f = 3.85 GHz	25	27	-	
		f = 4.7 GHz	25	27	-	
		f = 6.0 GHz	22	25	-	
Input power at 0.1dB compression point	$P_{-0.1\text{dB}}$	f = 6.0 GHz	+39	+40	-	dBm
VSWR	VSWR	f = 0.7 GHz	-	1.1	1.3	-
		f = 3.85 GHz	-	1.1	1.3	
		f = 4.7 GHz	-	1.1	1.3	
		f = 6.0 GHz	-	1.2	1.4	
Switching time	$T_{SW}$	50% $V_{CTL}$ to 10%/ 90% RF	-	150	350	ns

■ ELECTRICAL CHARACTERISTICS (With application circuit list 1, loss of external circuit are excluded.)

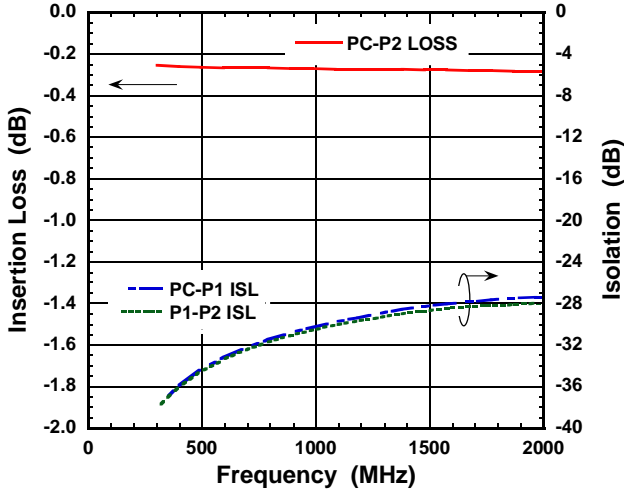
**Loss, Isolation vs Frequency**

(PC-P1 ON, VCTL1=3.3V, VCTL2=0V)



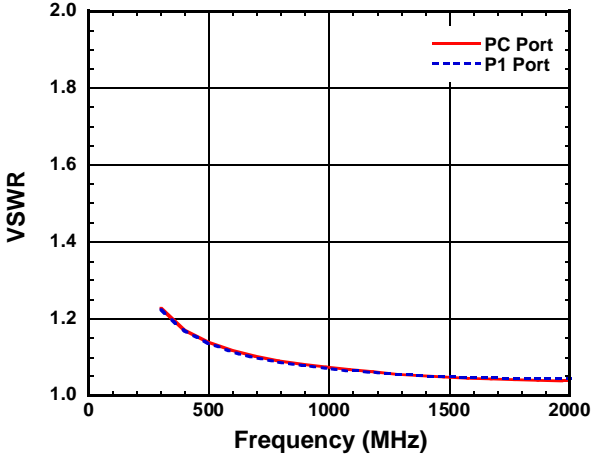
**Loss, Isolation vs Frequency**

(PC-P2 ON, VCTL1=0V, VCTL2=3.3V)



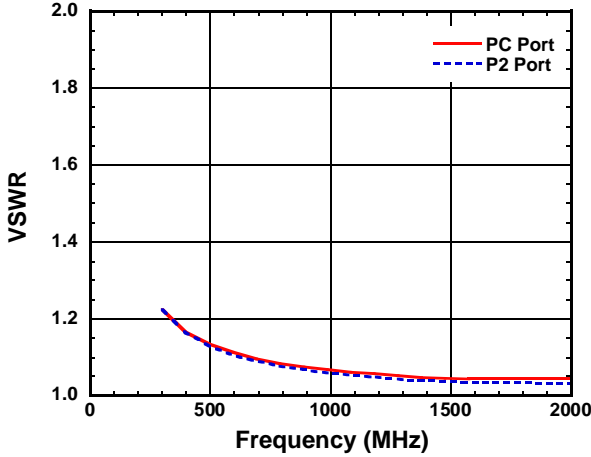
**VSWR vs. Frequency**

(VCTL1=3.3V, VCTL2=0V)



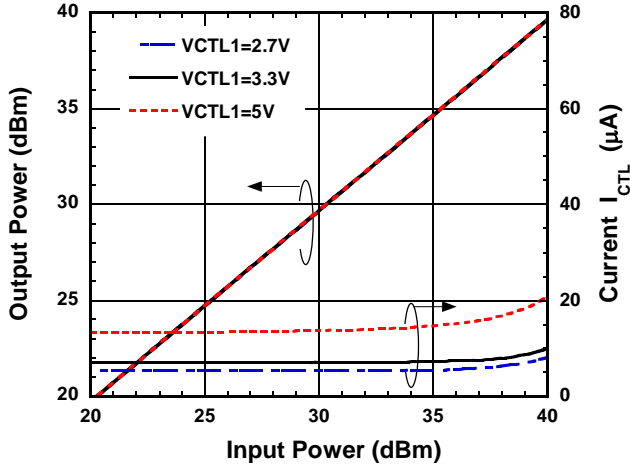
**VSWR vs. Frequency**

(VCTL1=0V, VCTL2=3.3V)



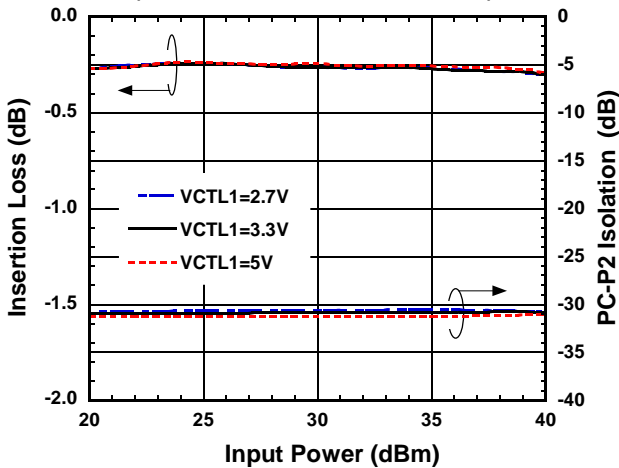
**Output Power, Current vs. Input Power**

(PC-P1 ON, VCTL2=0V, f=700MHz)



**Loss, Isolation vs. Input Power**

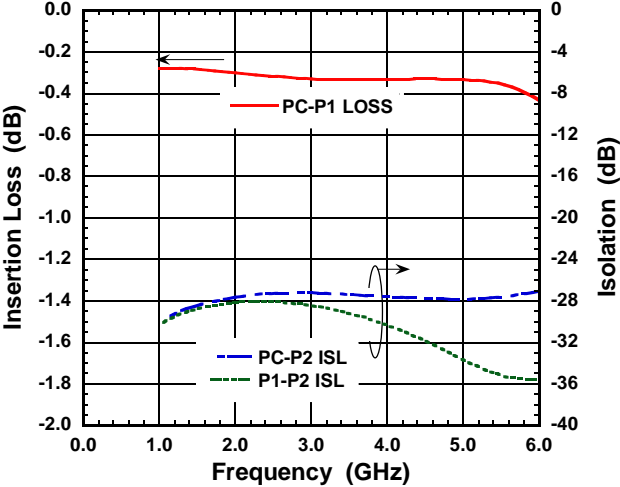
(PC-P1 ON, VCTL2=0V, f=700MHz)



■ ELECTRICAL CHARACTERISTICS (With application circuit list 2, losses of external circuit are excluded.)

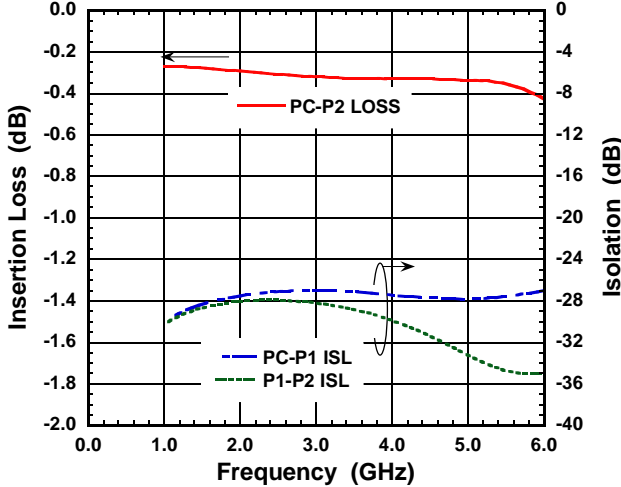
Loss, Isolation vs Frequency

( PC-P1 ON, VCTL1=3.3V, VCTL2=0V )



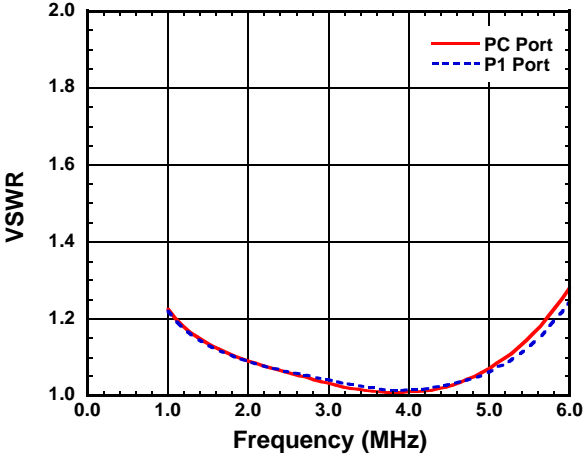
Loss, Isolation vs Frequency

( PC-P2 ON, VCTL1=0V, VCTL2=3.3V )



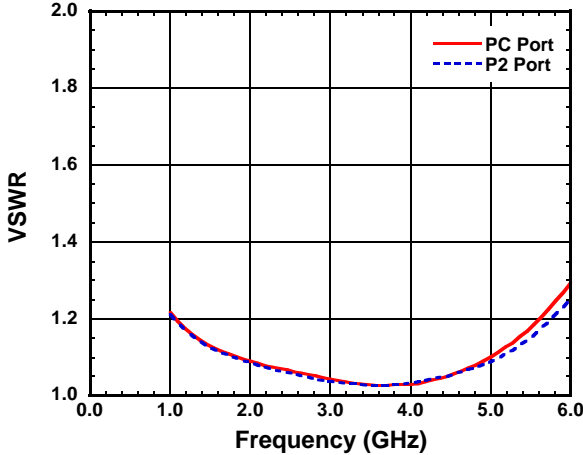
VSWR vs. Frequency

( VCTL1=3.3V, VCTL2=0V )



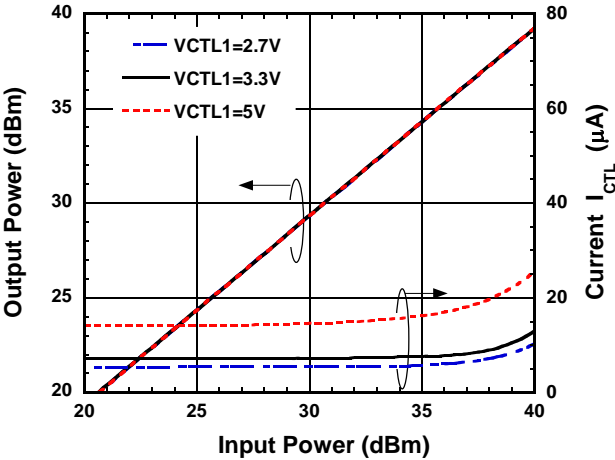
VSWR vs. Frequency

( VCTL1=0V, VCTL2=3.3V )

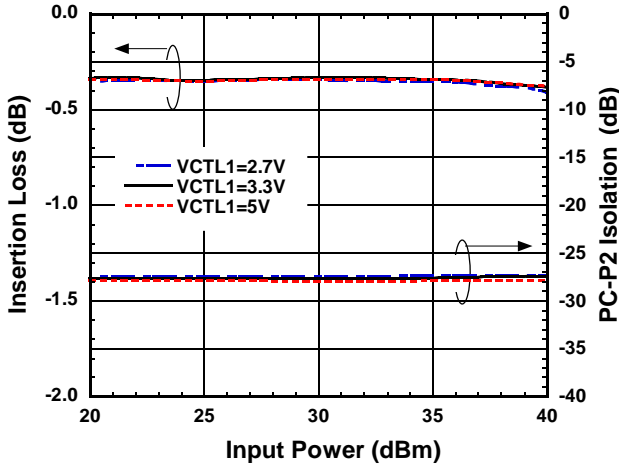


■ ELECTRICAL CHARACTERISTICS (With application circuit list 2, losses of external circuit are excluded.)

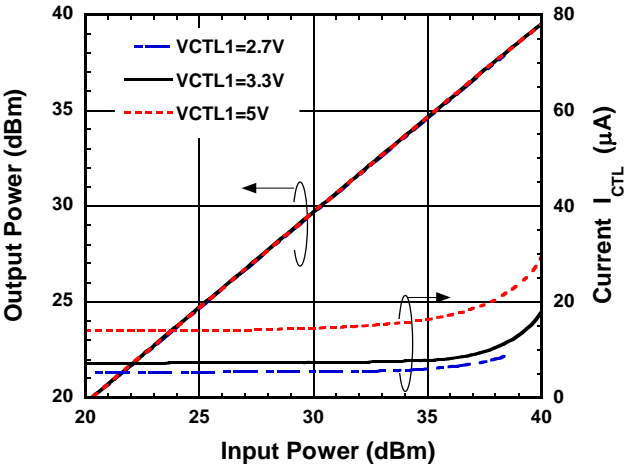
Output Power, Current vs. Input Power  
( PC-P1 ON, VCTL2=0V, f=3.85GHz )



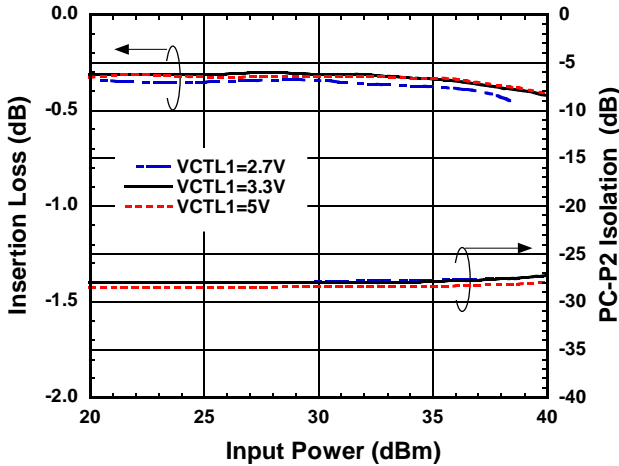
Loss, Isolation vs. Input Power  
( PC-P1 ON, VCTL2=0V, f=3.85GHz )



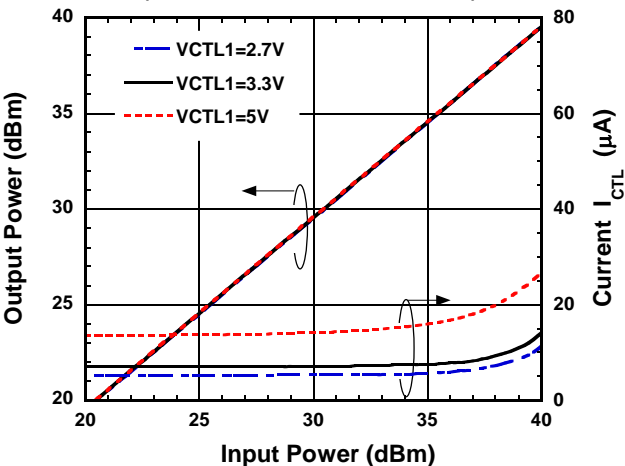
Output Power, Current vs. Input Power  
( PC-P1 ON, VCTL2=0V, f=4.7GHz )



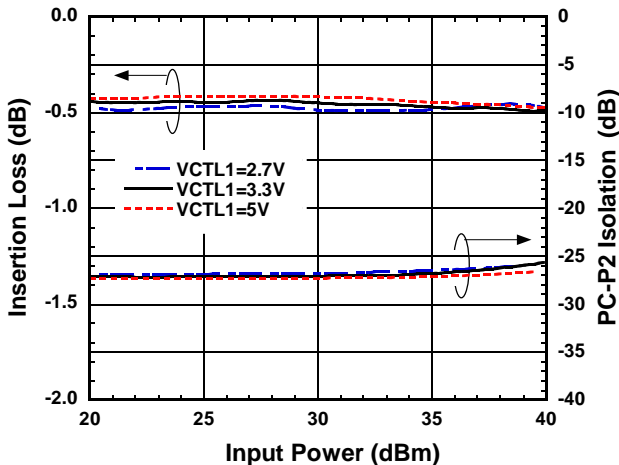
Loss, Isolation vs. Input Power  
( PC-P1 ON, VCTL2=0V, f=4.7GHz )



Output Power, Current vs. Input Power  
( PC-P1 ON, VCTL2=0V, f=6GHz )



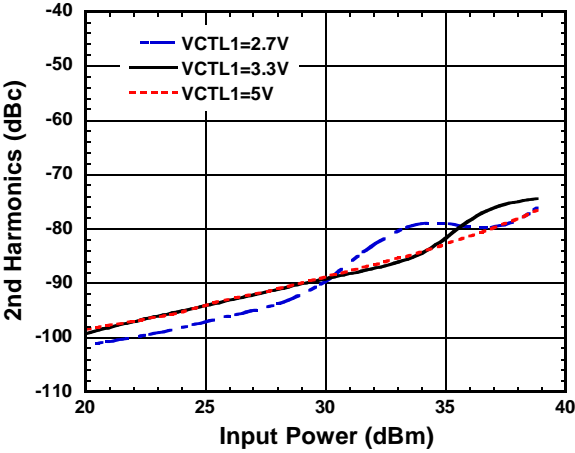
Loss, Isolation vs. Input Power  
( PC-P1 ON, VCTL2=0V, f=6GHz )



■ ELECTRICAL CHARACTERISTICS (With application circuit list 2, losses of external circuit are excluded.)

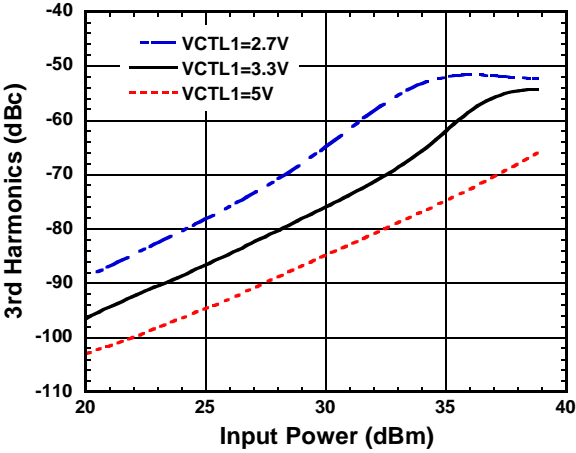
2nd Harmonics vs. Input Power

(f=3.85GHz, VCTL2=0V, PC-P1 ON)



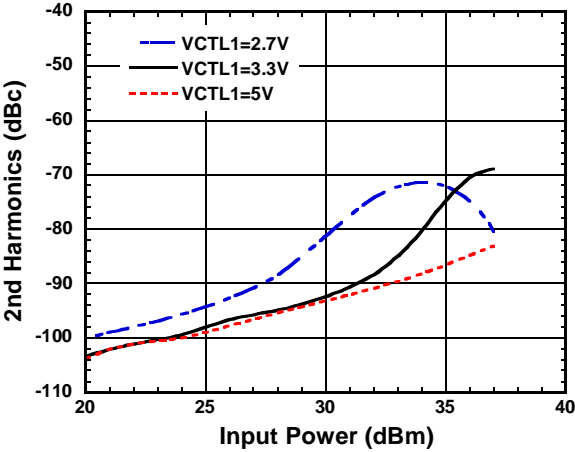
3rd Harmonics vs. Input Power

(f=3.85GHz, VCTL2=0V, PC-P1 ON)



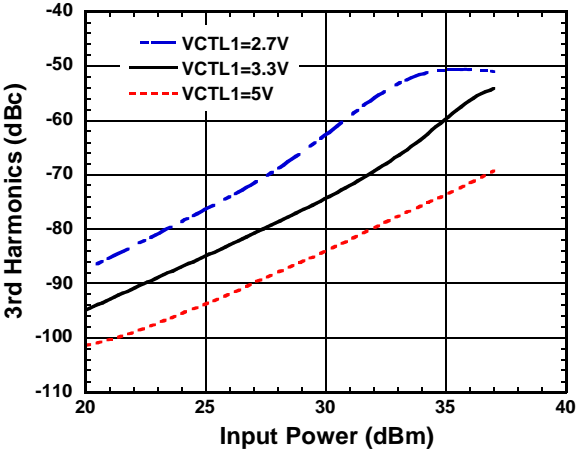
2nd Harmonics vs. Input Power

(f=4.7GHz, VCTL2=0V, PC-P1 ON)



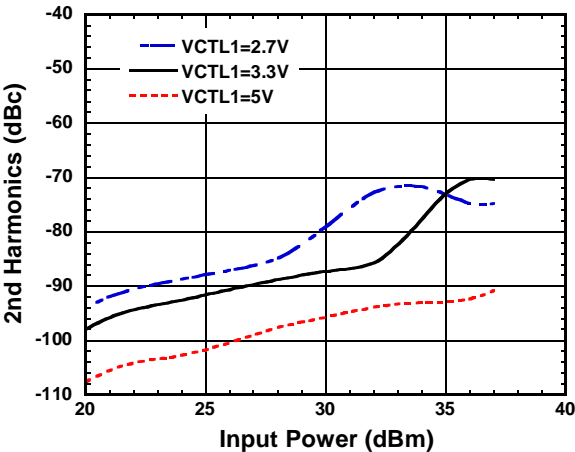
3rd Harmonics vs. Input Power

(f=4.7GHz, VCTL2=0V, PC-P1 ON)



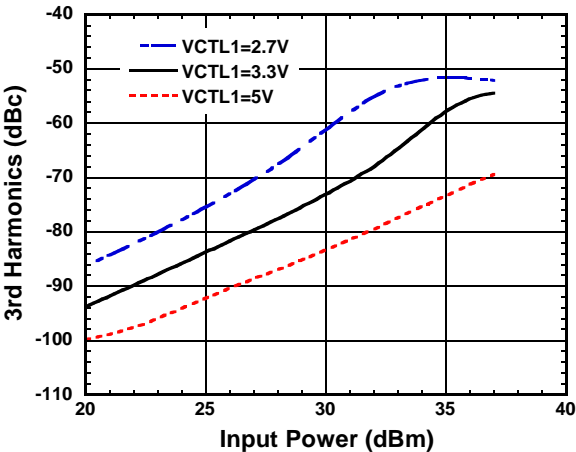
2nd Harmonics vs. Input Power

(f=6GHz, VCTL2=0V, PC-P1 ON)

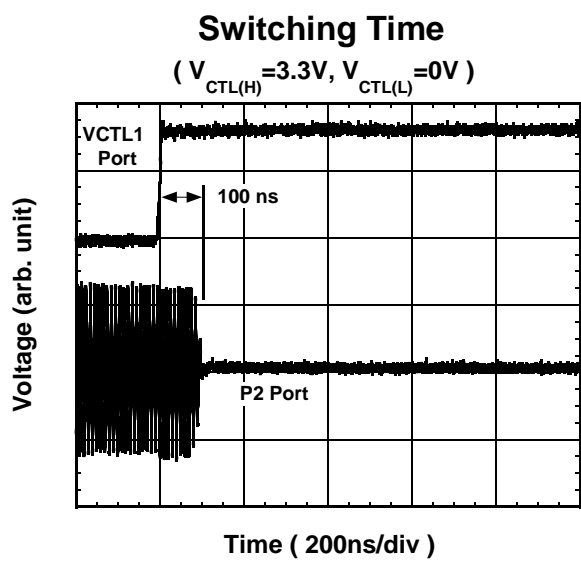
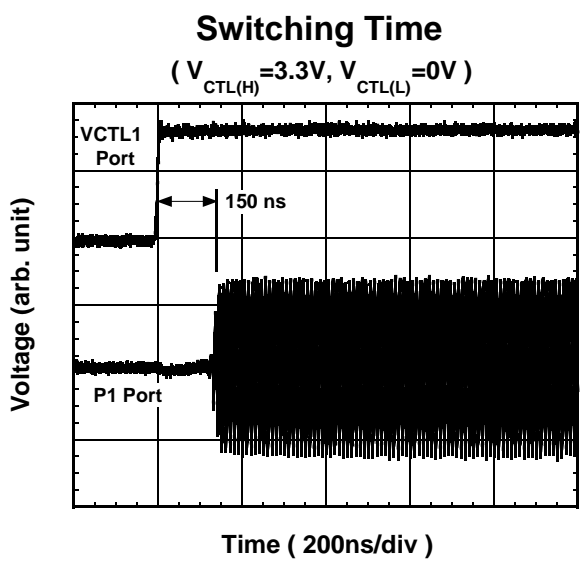
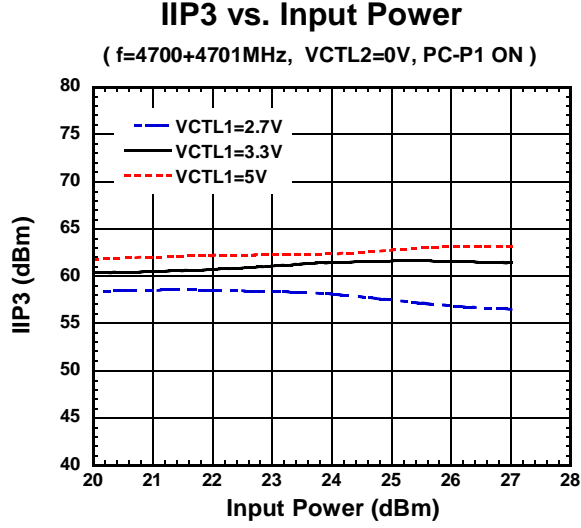
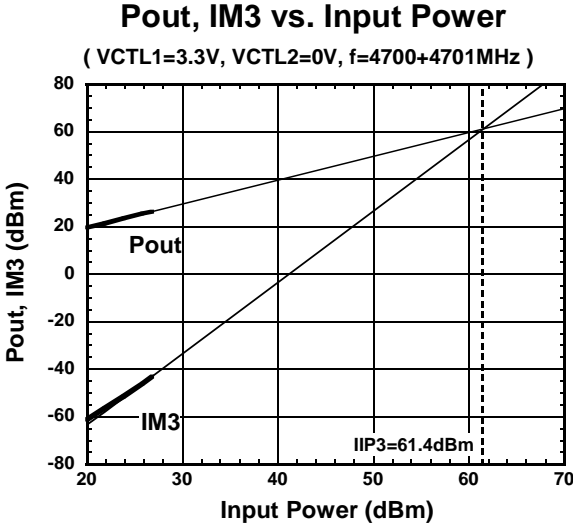
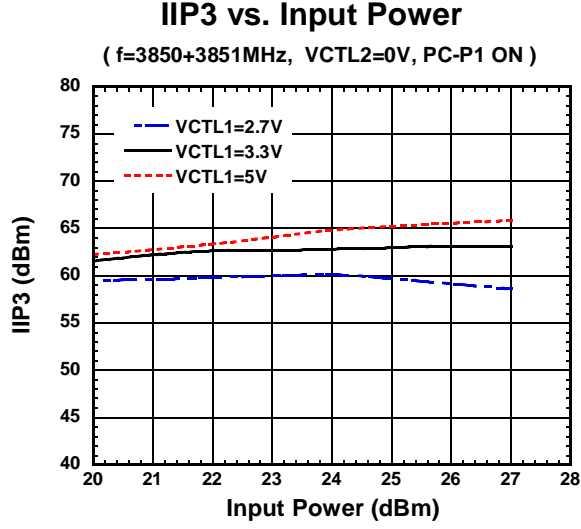
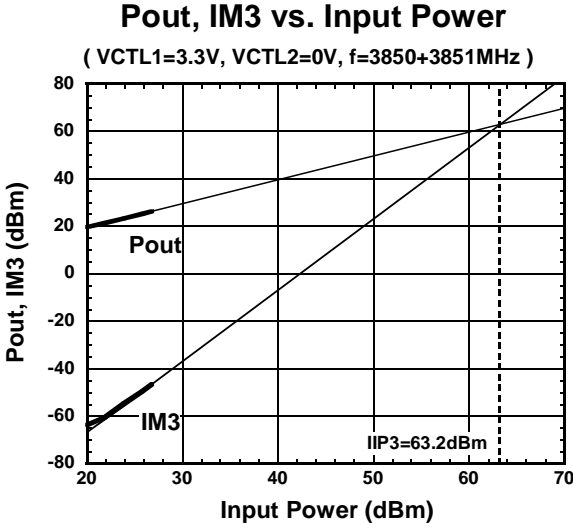


3rd Harmonics vs. Input Power

(f=6GHz, VCTL2=0V, PC-P1 ON)

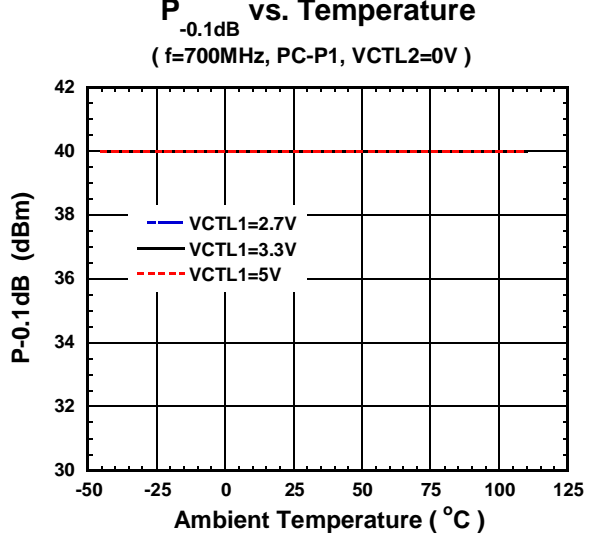
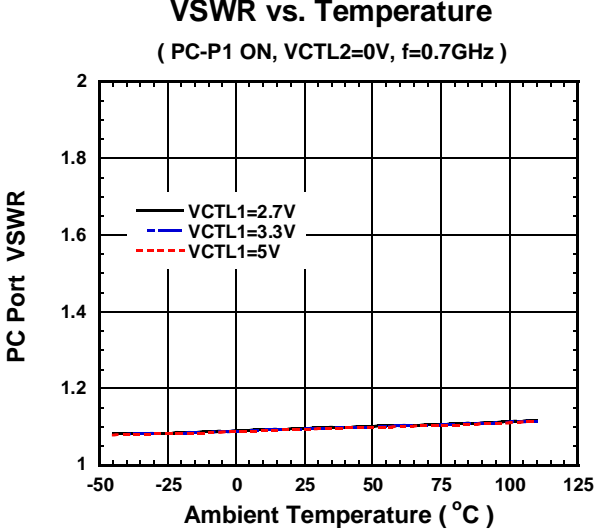
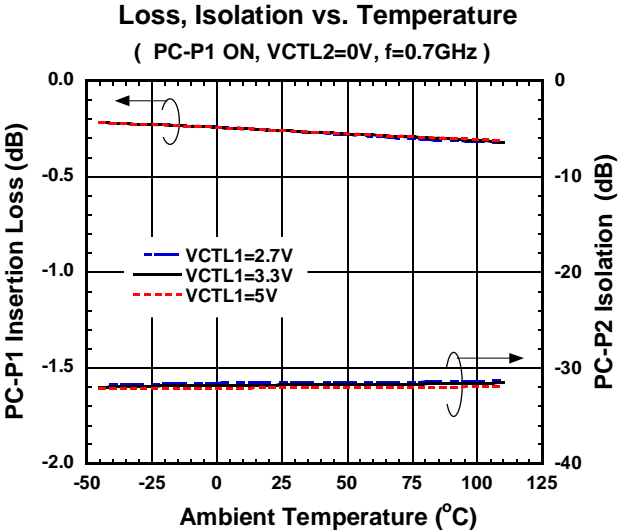


■ ELECTRICAL CHARACTERISTICS (With application circuit list 2, losses of external circuit are excluded.)



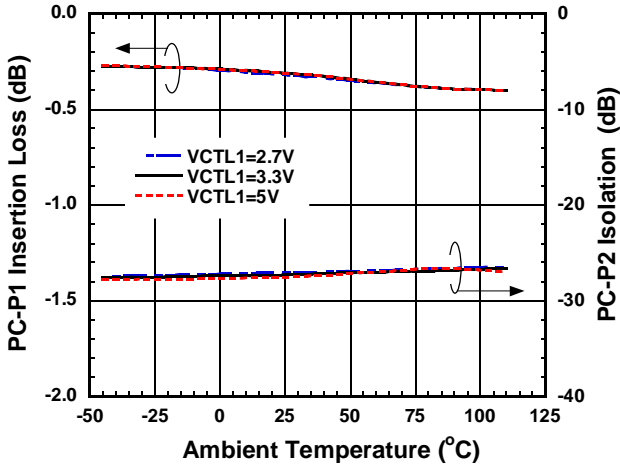


■ ELECTRICAL CHARACTERISTICS (With application circuit list 1, losses of external circuit are excluded.)

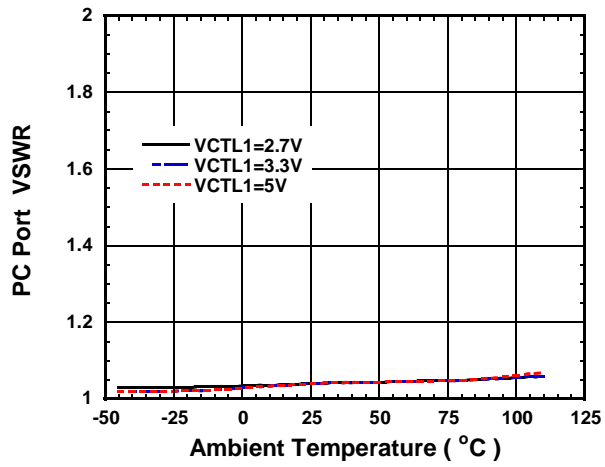


■ ELECTRICAL CHARACTERISTICS (With application circuit list 2, losses of external circuit are excluded.)

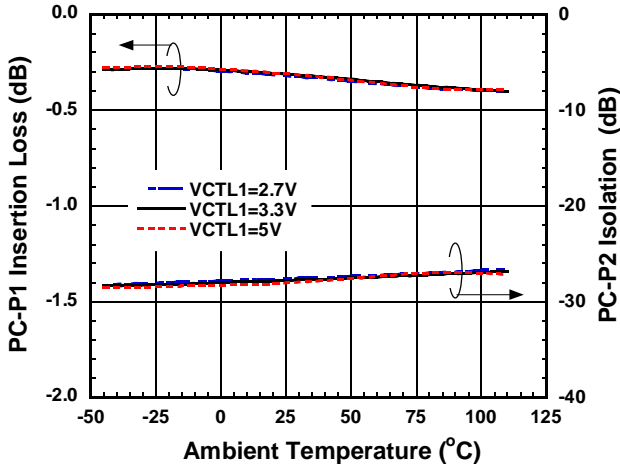
Loss, Isolation vs. Temperature  
( PC-P1 ON, VCTL2=0V, f=3.85GHz )



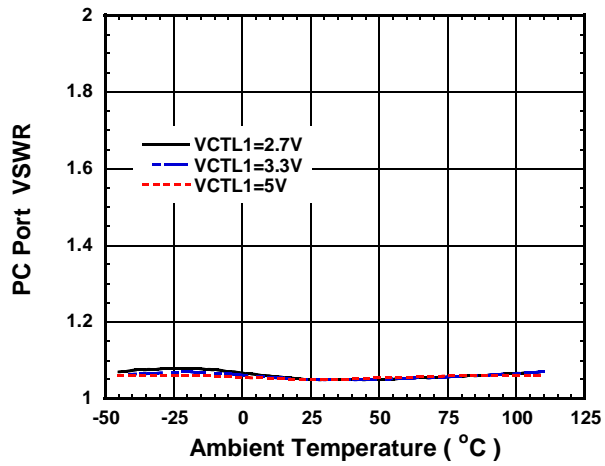
VSWR vs. Temperature  
( PC-P1 ON, VCTL2=0V, f=3.85GHz )



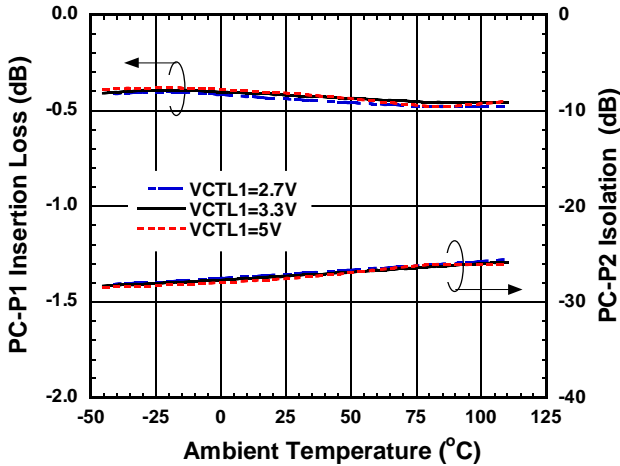
Loss, Isolation vs. Temperature  
( PC-P1 ON, VCTL2=0V, f=4.7GHz )



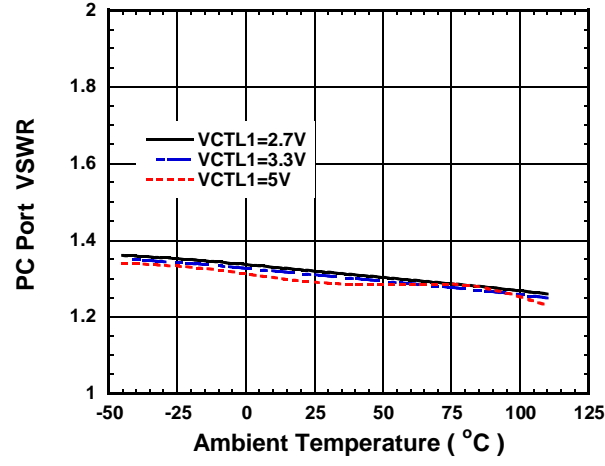
VSWR vs. Temperature  
( PC-P1 ON, VCTL2=0V, f=4.7GHz )



Loss, Isolation vs. Temperature  
( PC-P1 ON, VCTL2=0V, f=6GHz )

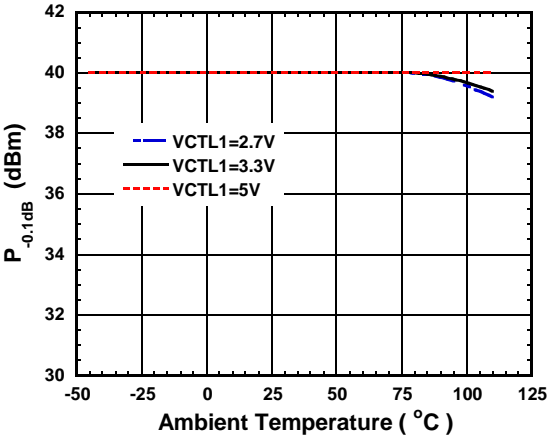


VSWR vs. Temperature  
( PC-P1 ON, VCTL2=0V, f=6GHz )

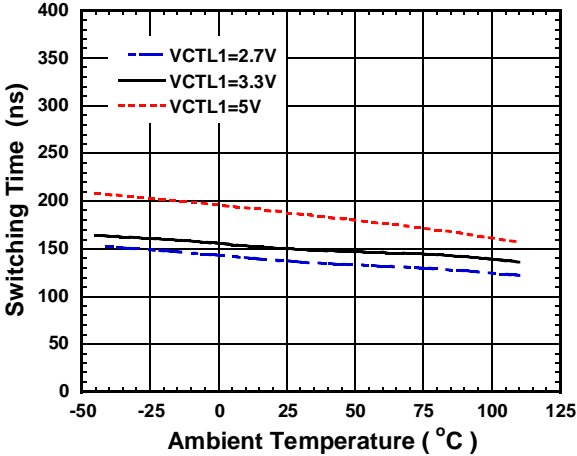


■ ELECTRICAL CHARACTERISTICS (With application circuit list 2, losses of external circuit are excluded.)

**P<sub>-0.1dB</sub> vs. Temperature**  
(f=6GHz, PC-P1, VCTL2=0V)

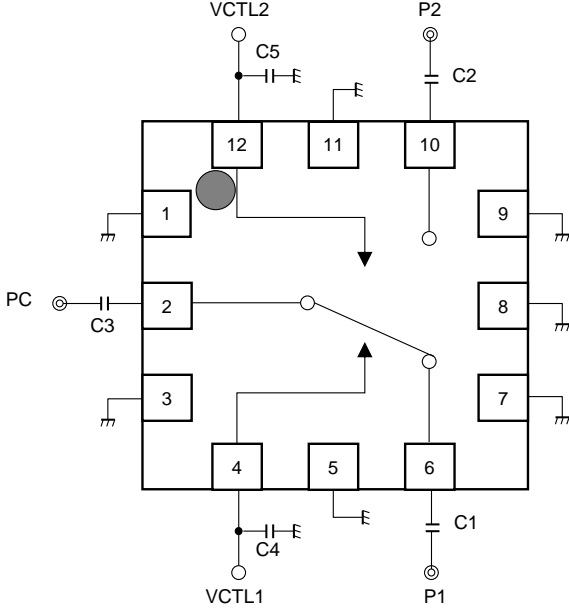


**Switching Time vs. Temperature**  
(PC-P1, VCTL2=0V)



■ APPLICATION CIRCUIT

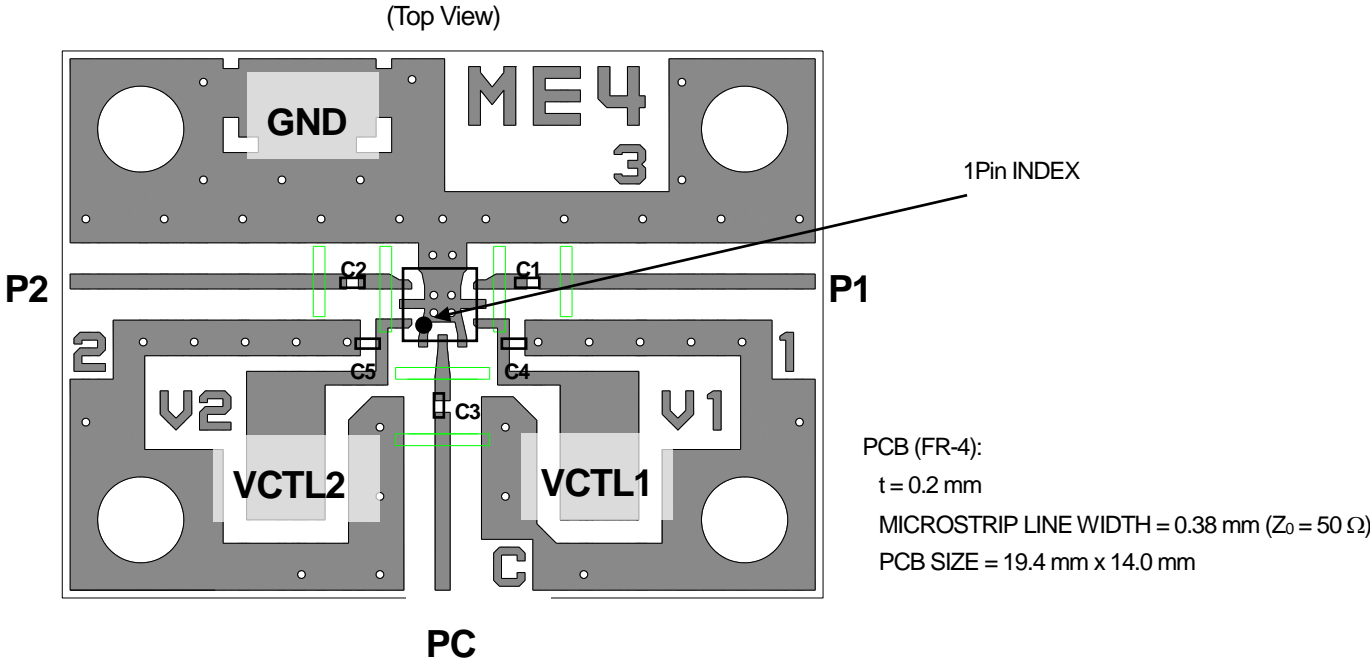
(Top View)



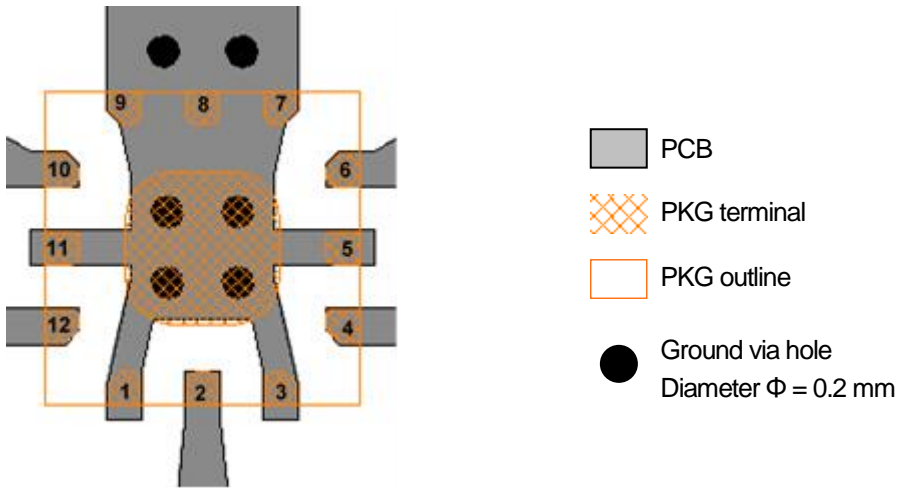
< PARTS LIST >

Part ID	Value		Notes
	List 1	List 2	
	f = 0.3 to 2.0 GHz	f = 2.0 to 6.0 GHz	
C1 to C3	100 pF	27 pF	MURATA (GRM03)
C4, C5	10 pF	10 pF	MURATA (GRM03)

## ■ EVALUATION BOARD



## ■ PCB LAYOUT GUIDELINE (EQFN12-E4)






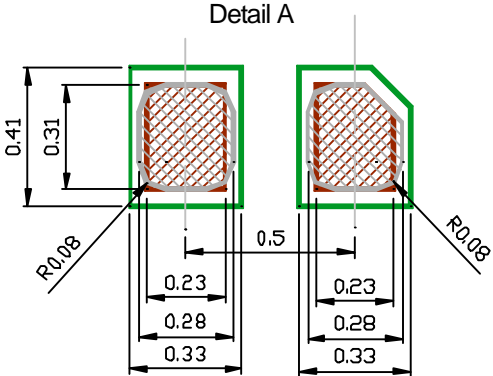
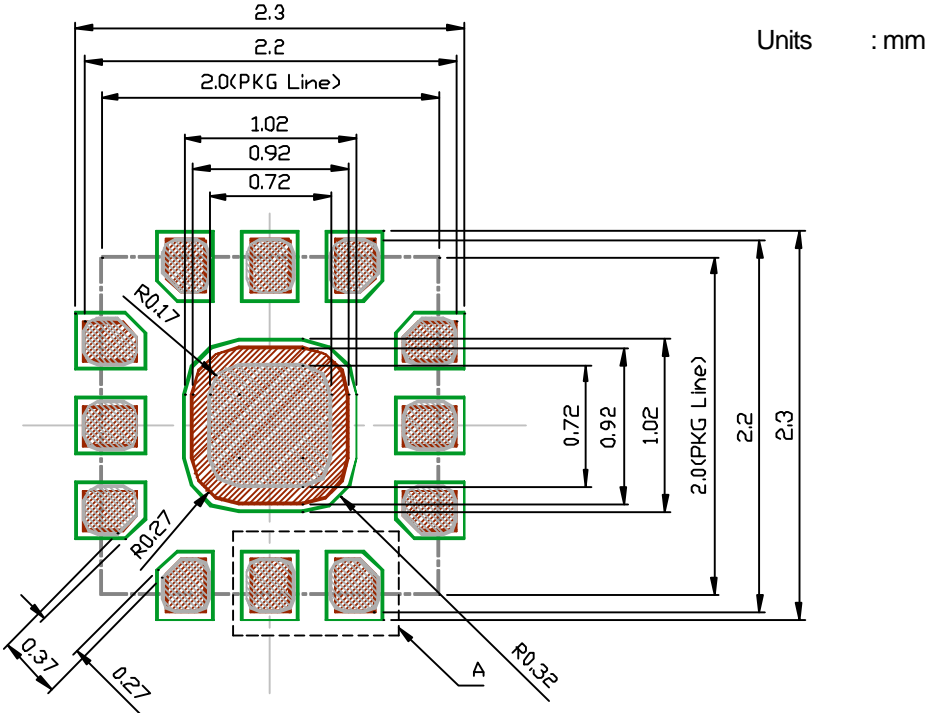
### PRECAUTIONS

- [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, all GND terminals are must be connected to PCB ground plane of the substrate, and through - holes for GND should be placed near the IC.
- [3] Please connect Exposed PAD to PCB ground plane of substrate, and through - holes for ground should be placed under the IC.
- [4] Please place through holes under the IC as many as possible in order to improve thermal conduction.

▼ RECOMMENDED FOOTPRINT PATTERN (EQFN12-E4 PACKAGE Reference)

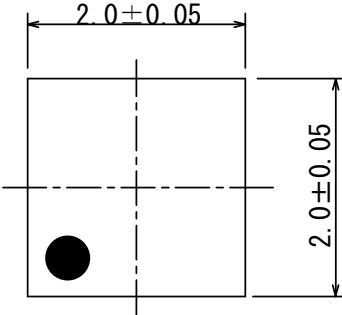
PKG: 2.0 mm x 2.0 mm  
Pin pitch: 0.5 mm

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



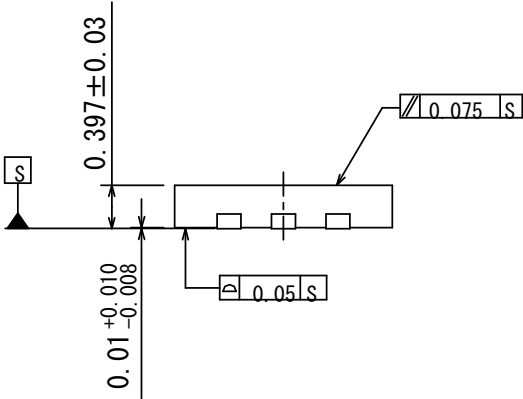
v PACKAGE OUTLINE (EQFN12-E4)

TOP VIEW

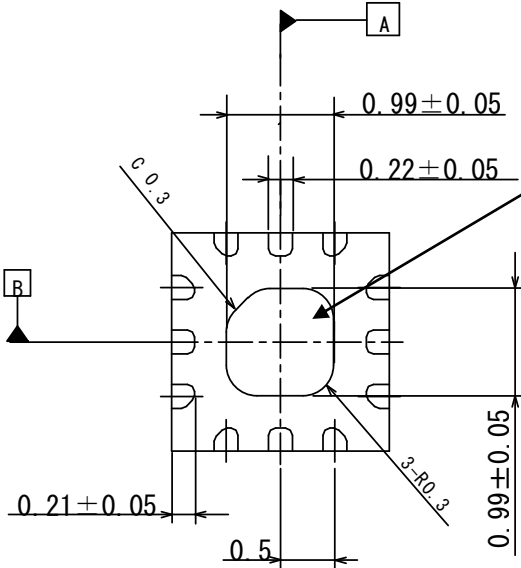


Units	: mm
Board	: Cu
Terminal treat	: SnBi
Molding material	: Epoxy resin
Weight	: 4.7mg

SIDE VIEW



BOTTOM VIEW

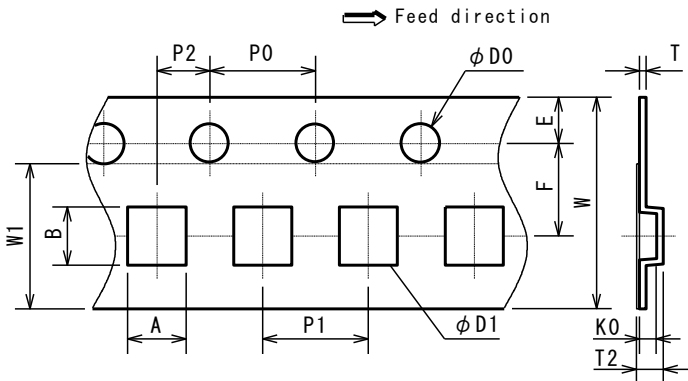


Ground connection is required.

**PACKING SPECIFICATION**

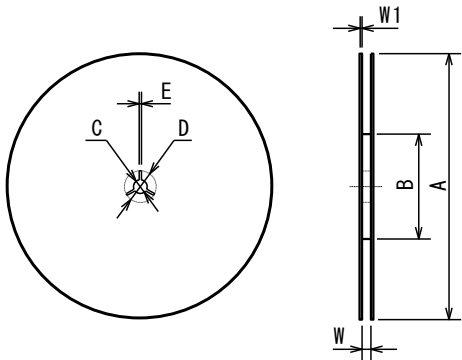
Unit: mm

**TAPING DIMENSIONS**



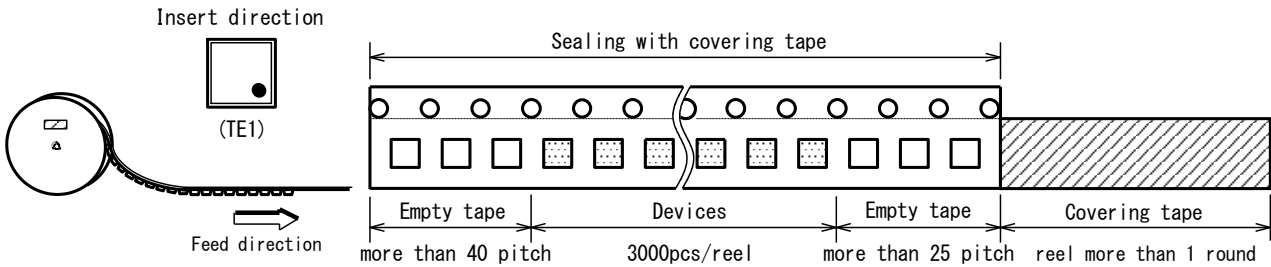
SYMBOL	DIMENSION	REMARKS
A	2.25±0.05	BOTTOM DIMENSION
B	2.25±0.05	BOTTOM DIMENSION
D0	1.5 <sup>+0.1</sup> <sub>0</sub>	
D1	0.5±0.1	
E	1.75±0.1	
F	3.5±0.05	
P0	4.0±0.1	
P1	4.0±0.1	
P2	2.0±0.05	
T	0.25±0.05	
T2	1.00±0.07	
K0	0.65±0.05	
W	8.0±0.2	
W1	5.5	THICKNESS 0.1max

**REEL DIMENSIONS**

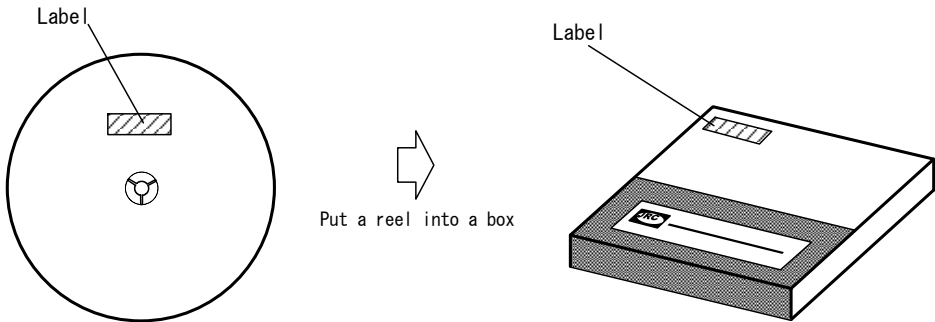


SYMBOL	DIMENSION
A	φ 180 <sup>0</sup> <sub>-1.5</sub>
B	φ 60 <sup>+1</sup> <sub>0</sub>
C	φ 13±0.2
D	φ 21±0.8
E	2±0.5
W	9 <sup>+1</sup> <sub>0</sub>
W1	1.2

**TAPING STATE**



**PACKING STATE**





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.
4. The technical information described in this document shows typical characteristics and example application circuits for the products. The release of such information is not to be construed as a warranty of or a grant of license under our or any third party's intellectual property rights or any other rights.
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.



**Nisshinbo Micro Devices Inc.**

**Official website**

<https://www.nisshinbo-microdevices.co.jp/en/>

**Purchase information**

<https://www.nisshinbo-microdevices.co.jp/en/buy/>