DPDT SWITCH GaAs MMIC

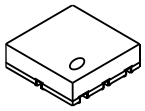
■ GENERAL DESCRIPTION

NJG1648HB6 is a GaAs DPDT switch IC that features low loss, low current consumption and low control voltage.

This IC includes logic decoder, and can be operated by 1bit control signal at low control voltage from +1.3V.

A small & thin USB8-B6 package is adopted.

■ PACKAGE OUTLINE



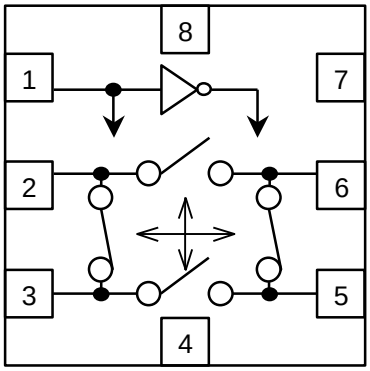
NJG1648HB6

■ FEATURES

● 1bit low control voltage operation	+1.3V min.
● Low voltage operation	+2.5V min
● Low current consumption	20uA typ.
● Low control current consumption	5uA typ.
● Low insertion loss	0.20dB typ. @f=500MHz, P_{IN}=+18dBm
	0.25dB typ. @f=1GHz, P_{IN}=+18dBm
	0.40dB typ. @f=2GHz, P_{IN}=+18dBm
● Small & thin package	USB8-B6 (Package size: 1.5 x 1.5 x 0.55 mm typ.)

■ PIN CONFIGURATION

USB8-B6 Type
(Top View)



Pin connection
1. CTL
2. P1
3. P2
4. GND
5. P3
6. P4
7. VDD
8. GND

■ TRUTH TABLE

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

CTL	PATH
H	P1-P4, P2-P3
L	P1-P2, P3-P4

NOTE: Please note that any information on this catalog will be subject to change.

■ ABSOLUTE MAXIMUM RATINGS

T_a=+25°C, Z_s=Z_l=50ohm

PARAMETER	SYMBOL	CONDITIONS	CONDITIONS	UNITS
Supply Voltage	V_{DD}	VDD terminal	5.0	V
Control Voltage	V_{CTL}	CTL terminal	5.0	V
RF Input Power	P_{in}	V_{DD}=2.7V, V_{CTL}=0V/1.8V, P1, P2, P3, P4 Terminal	27	dBm
Power Dissipation	P_D	At on PCB board	160	mW
Operating Temp.	T_{opr}		-40~+85	°C
Storage Temp.	T_{stg}		-55~+150	°C

■ ELECTRICAL CHARACTERISTICS

General conditions: V_{DD}=2.7V, $V_{CTL(L)}$=0V, $V_{CTL(H)}$=1.8V, T_a=+25°C Z_S=Z_l=50Ω, with test circuit

PARAMETERS	SYMBOL	CONDITIONS	MIN	TYP	MAX	UNITS
Supply Voltage	V_{DD}	VDD terminal	2.5	2.7	5.0	V
Operating Current	I_{DD}	Pin=+18dBm	-	20	35	uA
Control Voltage (LOW)	$V_{CTL\ (L)}$		-	-	0.4	V
Control Voltage (HIGH)	$V_{CTL\ (H)}$		1.3	1.8	V_{DD}	V
Control Current	I_{CTL}	CTL Terminal	-	5	10	uA
Insertion Loss 1	LOSS1	f=500MHz, P_{IN}=+18dBm	-	0.20	0.40	dB
Insertion Loss 2	LOSS2	f=1GHz, P_{IN}=+18dBm	-	0.25	0.45	dB
Insertion Loss 3	LOSS3	f=2GHz, P_{IN}=+18dBm	-	0.40	0.60	dB
Isolation 1	ISL1	f=500MHz, P_{IN}=+18dBm	24	26	-	dB
Isolation 2	ISL2	f=1GHz, P_{IN}=+18dBm	19	21	-	dB
Isolation 3	ISL3	f=2GHz, P_{IN}=+18dBm	13	15	-	dB
Pin at 0.2dB Compression Point	$P_{-0.2dB}$	f=2GHz	20	23	-	dBm
VSWR	VSWR	f=2GHz, ON State	-	1.2	1.4	
Switching time	T_{SW}	RF signal switching	-	2	5	us

■ TERMINAL INFOMATION

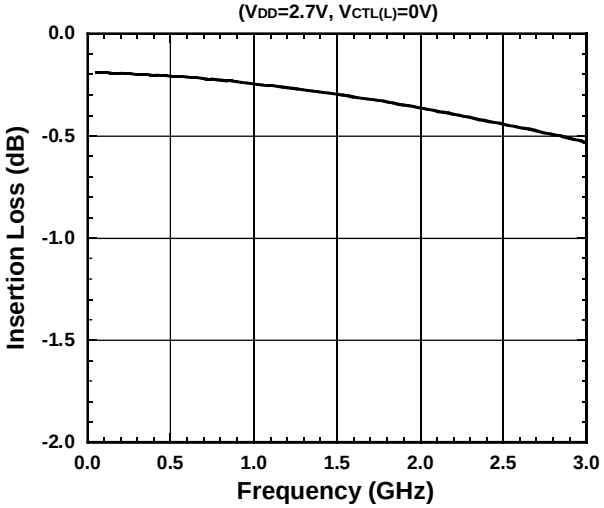
No.	SYMBOL	DESCRIPTION
1	CTL	Control signal input terminal. This terminal is set to High-Level (+1.3V~VDD) or Low-Level (~+0.4V).
2	P1	RF port. This port is connected with P4 port by controlling 1pin-CTL(H) (+1.3~+VDD). This port is connected with P2 port by controlling 1pin- CTL(L) (~+0.4V) . A DC cut capacitor is required at this terminal to block DC voltage of inner circuit.
3	P2	RF port. This port is connected with P3 port by controlling 1pin- CTL(H) (+1.3~+VDD). This port is connected with P1 port by controlling 1pin- CTL(L) (~+0.4V). A DC cut capacitor is required at this terminal to block DC voltage of inner circuit.
4	GND	Ground terminal. Please connect this terminal with ground plane as close as possible for excellent RF performance.
5	P3	RF port. This port is connected with P2 port by controlling 1pin- CTL(H) (+1.3~+VDD). This port is connected with P4 port by controlling 1pin-$V_{CTL(L)}$ (~+0.4V). A DC cut capacitor is required at this terminal to block DC voltage of inner circuit.
6	P4	RF port. This port is connected with P1 port by controlling 1pin- CTL(H) (+1.3~+VDD). This port is connected with P3 port by controlling 1pin- CTL(L) (~+0.4V). A DC cut capacitor is required at this terminal to block DC voltage of inner circuit.
7	VDD	Positive voltage supply terminal. The positive voltage (+2.5~+5.0V) have to be supplied. Please connect a bypass capacitor with GND terminal for excellent RF performance.
8	GND	Ground terminal. Please connect this terminal with ground plane as close as possible for excellent RF performance.

■ ELECTRICAL CHARACTERISTICS

(f=0.1~3.0GHz, with application circuit, Losses of external circuit are excluded)

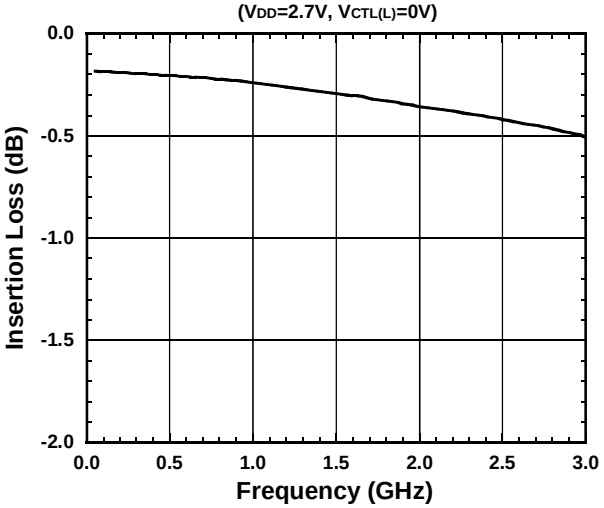
P1-P2 Insertion Loss vs. Frequency

(V_{DD}=2.7V, $V_{CTL(L)}$=0V)



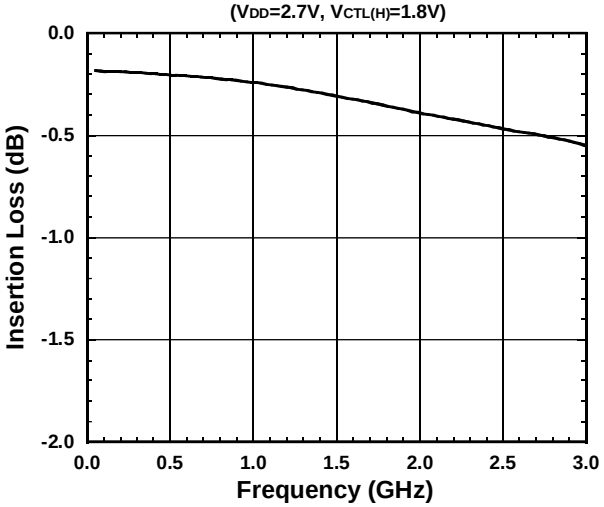
P3-P4 Insertion Loss vs. Frequency

(V_{DD}=2.7V, $V_{CTL(L)}$=0V)



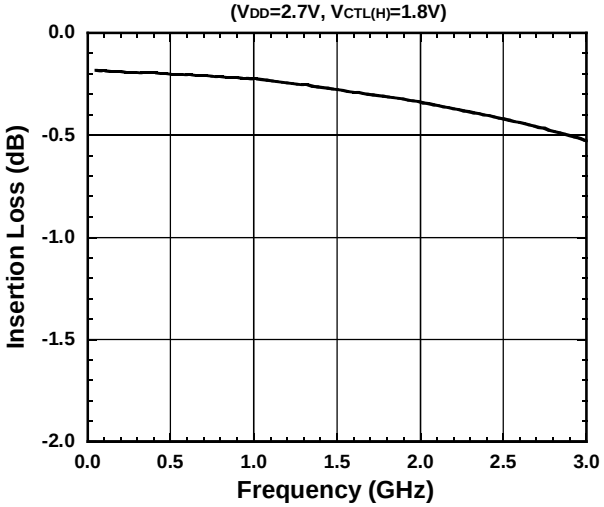
P1-P4 Insertion Loss vs. Frequency

(V_{DD}=2.7V, $V_{CTL(H)}$=1.8V)



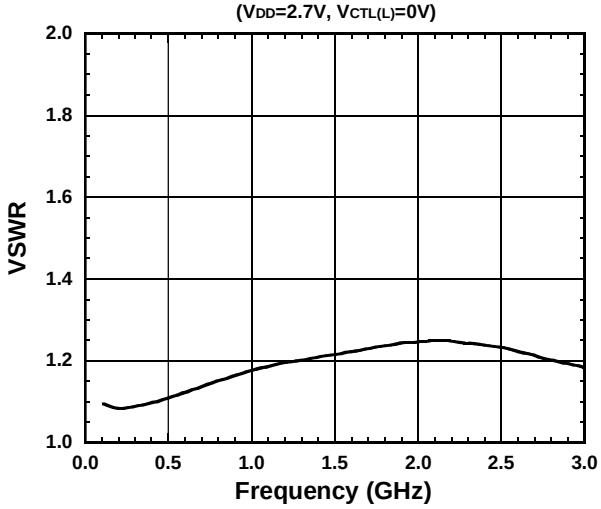
P2-P3 Insertion Loss vs. Frequency

(V_{DD}=2.7V, $V_{CTL(H)}$=1.8V)



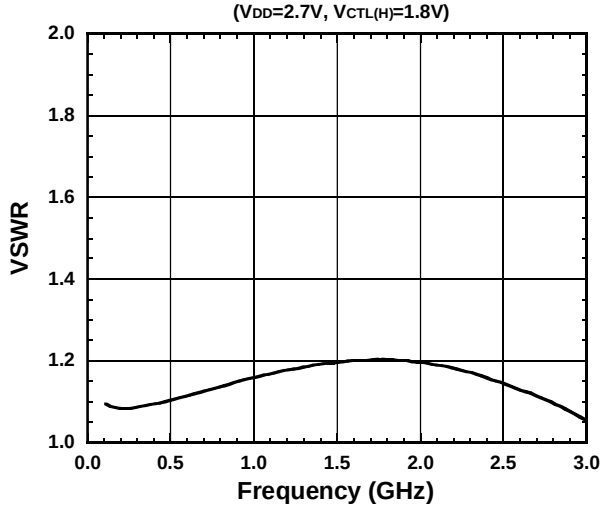
P1-P2 VSWR vs. Frequency

(V_{DD}=2.7V, $V_{CTL(L)}$=0V)



P1-P4 VSWR vs. Frequency

(V_{DD}=2.7V, $V_{CTL(H)}$=1.8V)

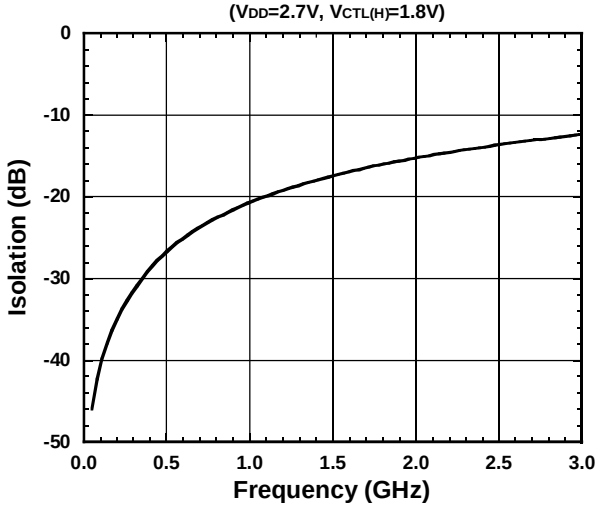


■ ELECTRICAL CHARACTERISTICS

(f=0.1~3.0GHz, with application circuit, Losses of external circuit are excluded)

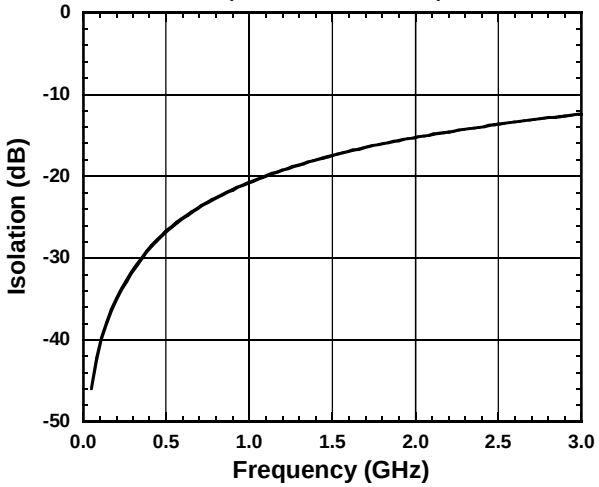
P1-P2 Isolation vs. Frequency

(V_{DD}=2.7V, $V_{CTL(H)}$=1.8V)



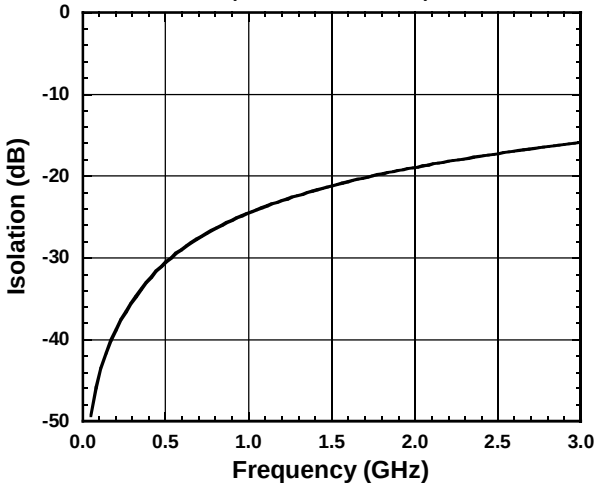
P3-P4 Isolation vs. Frequency

(V_{DD}=2.7V, $V_{CTL(H)}$=1.8V)



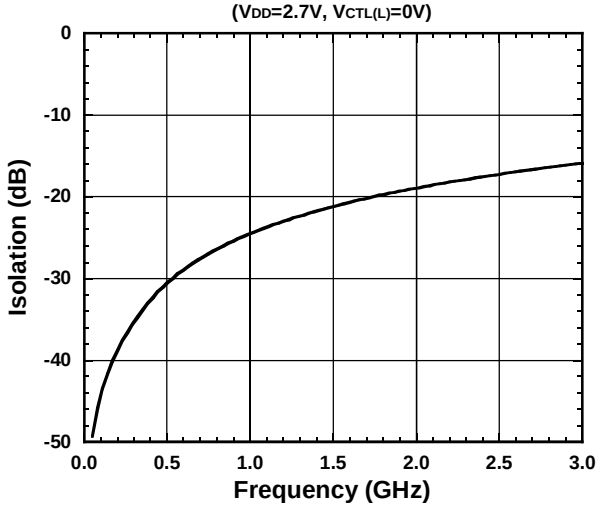
P1-P4 Isolation vs. Frequency

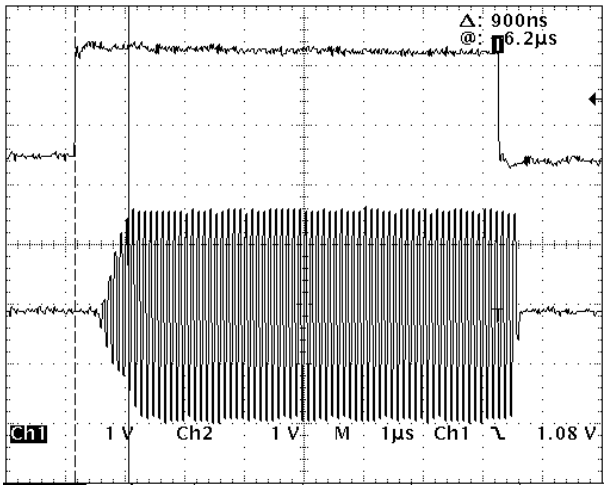
(V_{DD}=2.7V, $V_{CTL(L)}$=0V)



P2-P3 Isolation vs. Frequency

(V_{DD}=2.7V, $V_{CTL(L)}$=0V)



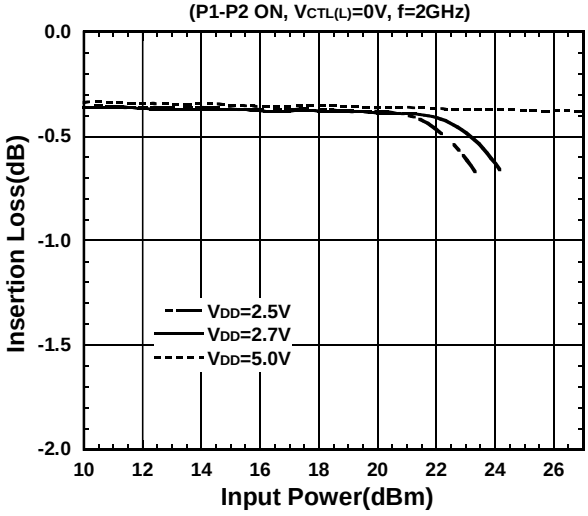


■ ELECTRICAL CHARACTERISTICS

(With application circuit, Losses of external circuit are excluded)

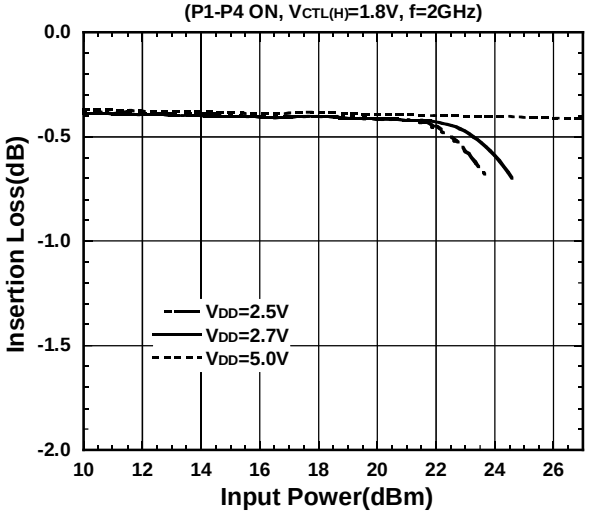
Insertion Loss vs. Input Power

(P1-P2 ON, $V_{CTL(L)}$=0V, f=2GHz)



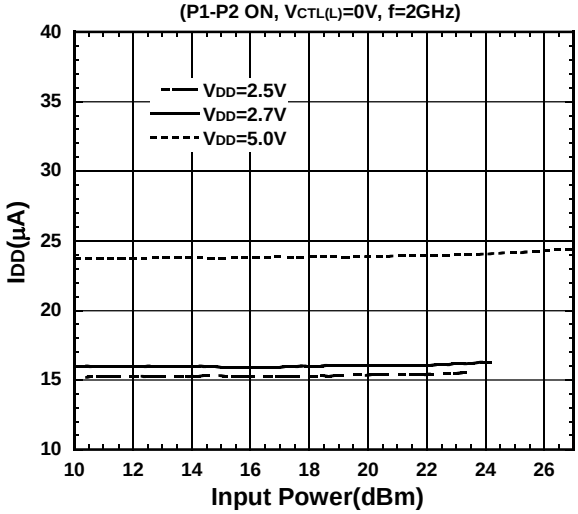
Insertion Loss vs. Input Power

(P1-P4 ON, $V_{CTL(H)}$=1.8V, f=2GHz)



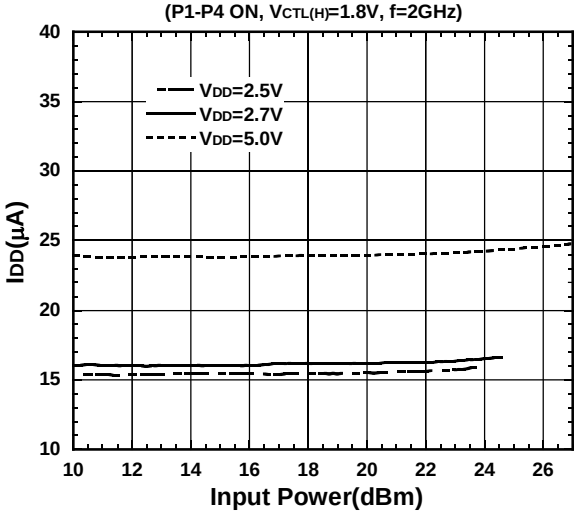
I_{DD} vs. Input Power

(P1-P2 ON, $V_{CTL(L)}$=0V, f=2GHz)



I_{DD} vs. Input Power

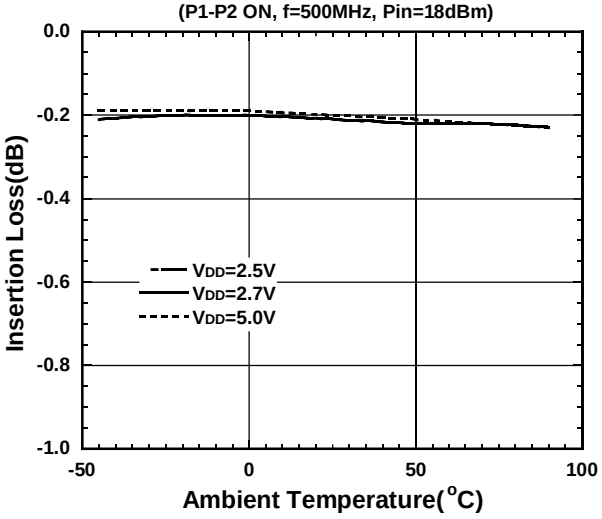
(P1-P4 ON, $V_{CTL(H)}$=1.8V, f=2GHz)



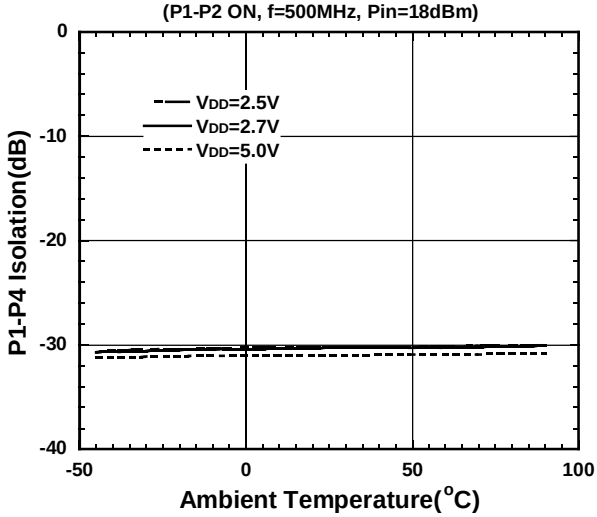
■ ELECTRICAL CHARACTERISTICS

(With application circuit, Losses of external circuit are excluded)

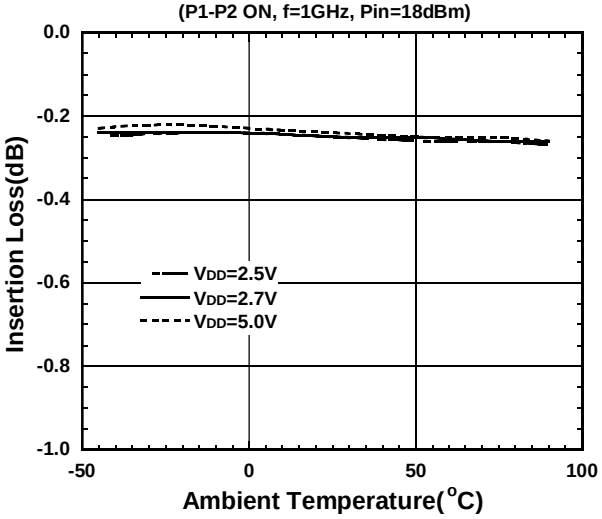
Insertion Loss vs. Ambient Temperature
(P1-P2 ON, f=500MHz, Pin=18dBm)



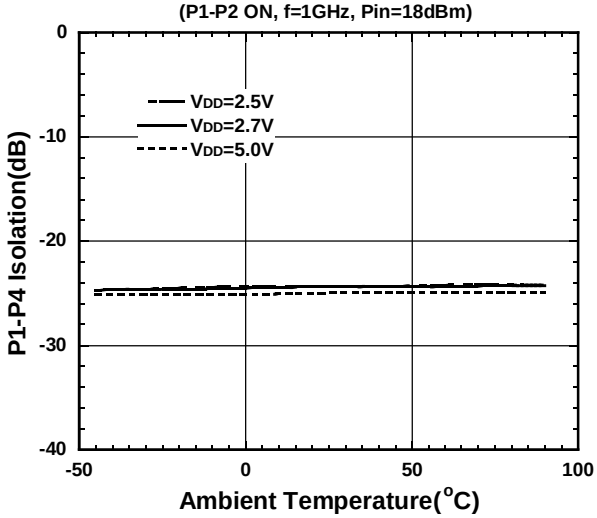
Isolation vs. Ambient Temperature
(P1-P2 ON, f=500MHz, Pin=18dBm)



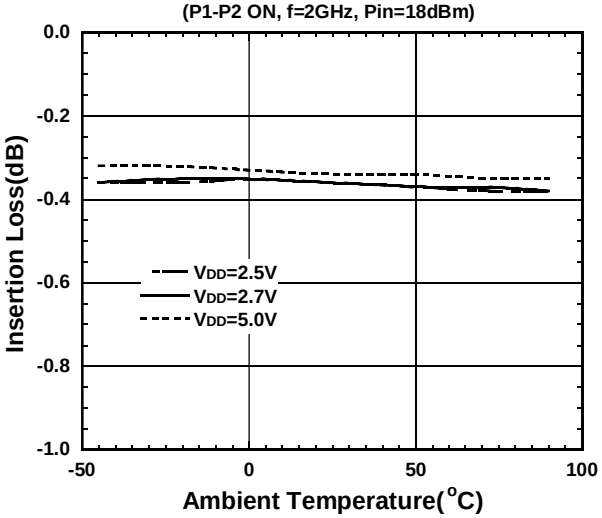
Insertion Loss vs. Ambient Temperature
(P1-P2 ON, f=1GHz, Pin=18dBm)



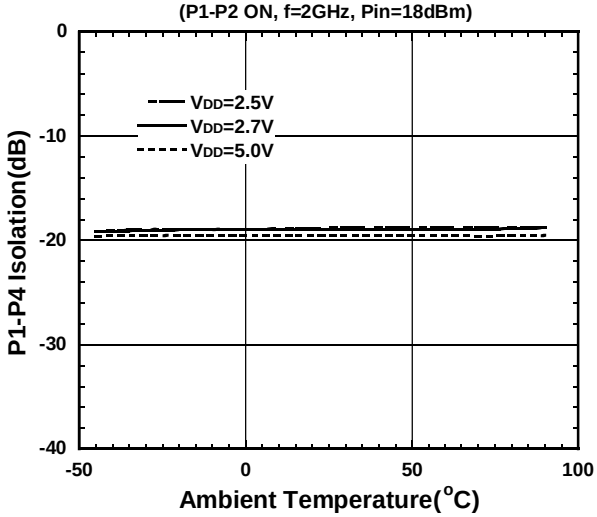
Isolation vs. Ambient Temperature
(P1-P2 ON, f=1GHz, Pin=18dBm)



Insertion Loss vs. Ambient Temperature
(P1-P2 ON, f=2GHz, Pin=18dBm)



Isolation vs. Ambient Temperature
(P1-P2 ON, f=2GHz, Pin=18dBm)

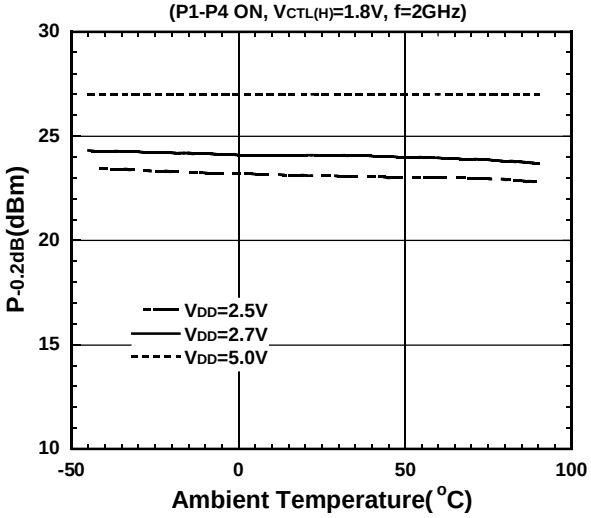


■ ELECTRICAL CHARACTERISTICS

(With application circuit)

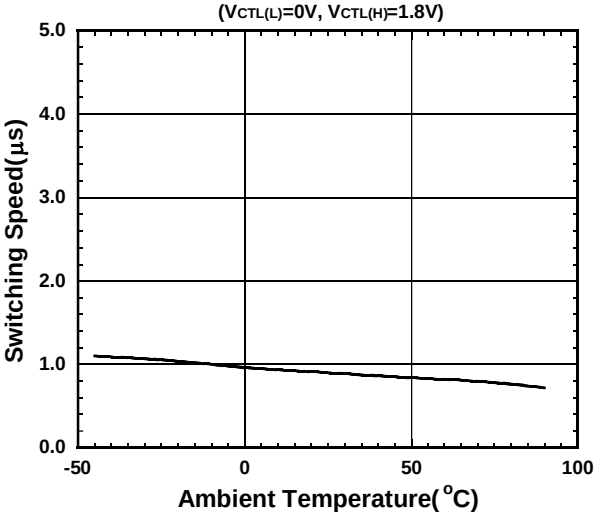
$P_{-0.2dB}$ vs. Ambient Temperature

(P1-P4 ON, $V_{CTL(H)}$=1.8V, f=2GHz)



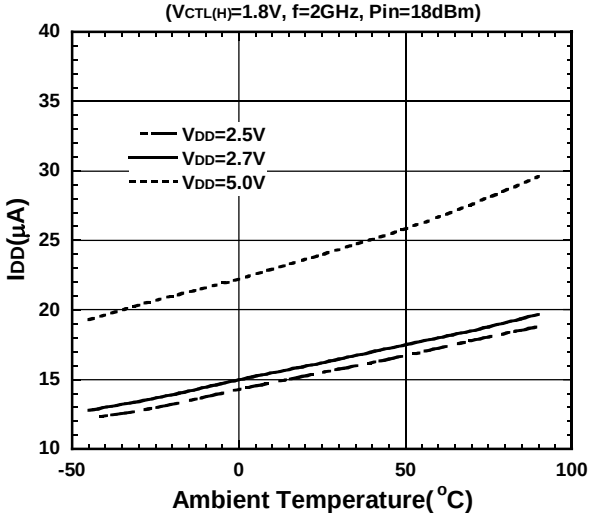
Switching Speed vs. Ambient Temperature

($V_{CTL(L)}$=0V, $V_{CTL(H)}$=1.8V)



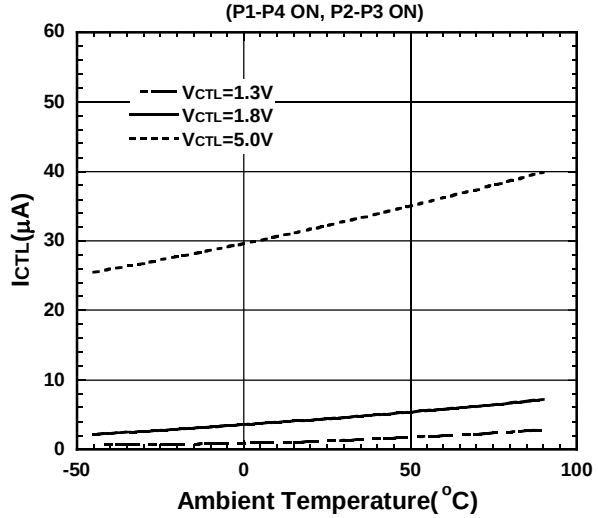
I_{DD} vs. Ambient Temperature

($V_{CTL(H)}$=1.8V, f=2GHz, Pin=18dBm)

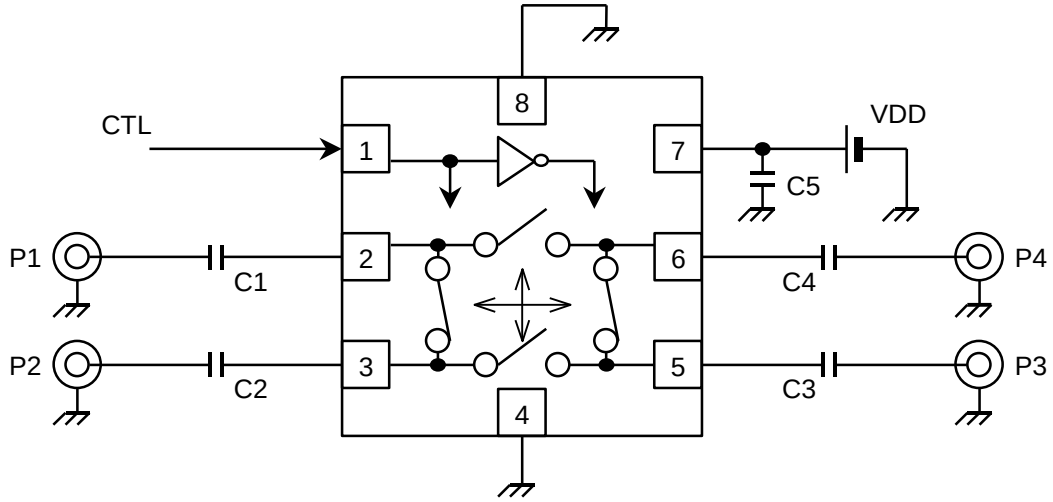


I_{CTL} vs. Ambient Temperature

(P1-P4 ON, P2-P3 ON)



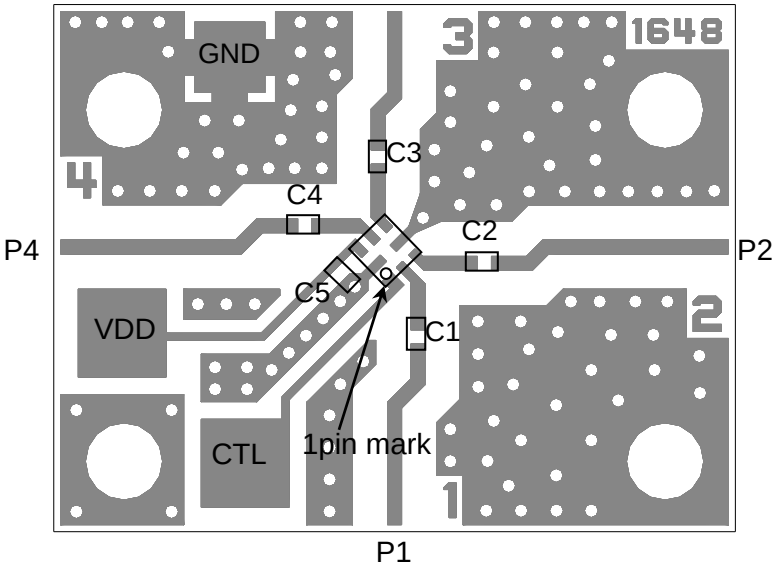
■ APPLICATION CIRCUIT



PARTS LIST

Parts	Constant	Notes
C1~C5	1000pF	MURATA (GRM15)

■ TEST PCB LAYOUT

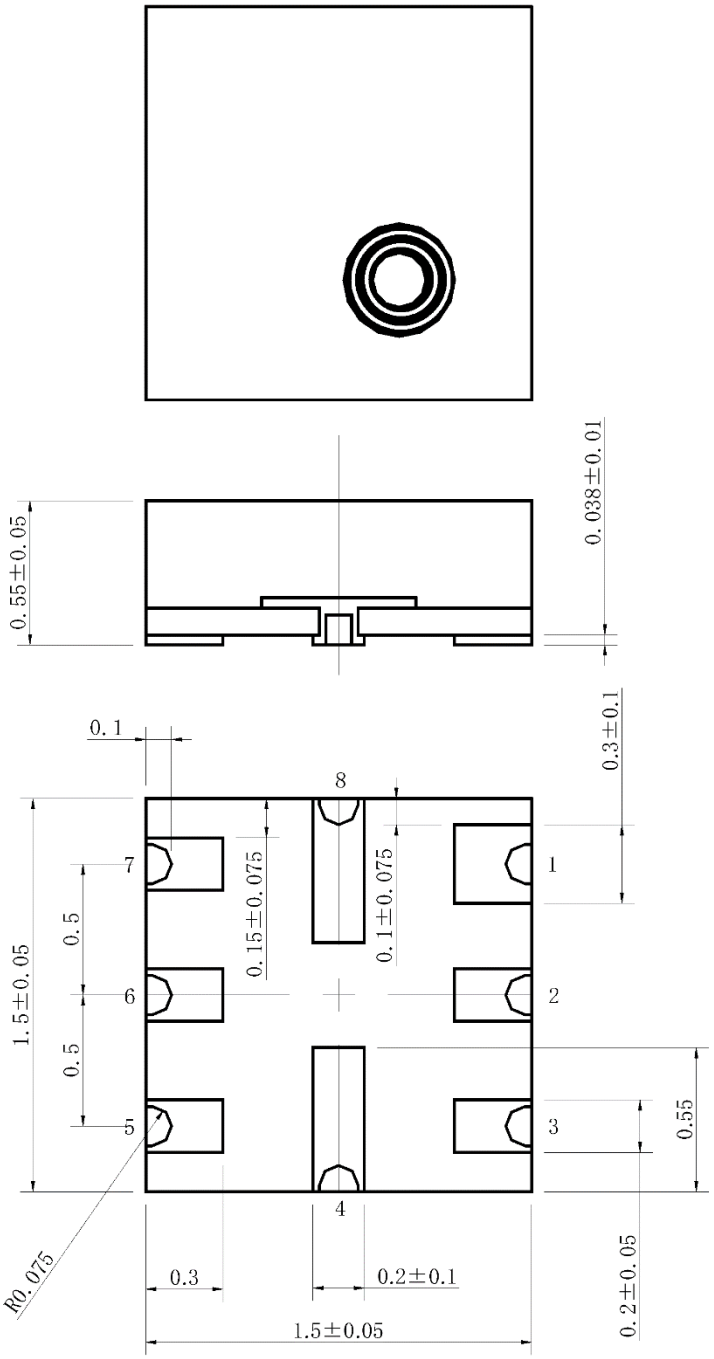


PCB SIZE=19.4x15.0mm
PCB: FR-4, t=0.2mm
CAPACITOR: size 1005
Strip line Width==0.4mm

PRECAUTIONS

[1] The DC blocking capacitors have to be placed at RF terminal of PC1, PC2, PC3, PC4.
[2] To reduce stripline influence on RF characteristics, please locate bypass capacitors (C5) close to terminal.
[3] To avoid degradation of isolation or high power characteristics, please layout ground pattern right under this IC.

■ PACKAGE OUTLINE (USB8-B6)



UNIT : mm

SUBSTRATE MATERIAL: Glass epoxy board
TERMINAL FINISH: Au Plating (Cu/Ni/Au)
MOLD MATERIAL: Epoxy resin
MASS(TYP.): 2.4mg

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.
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    - Aerospace Equipment
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    - 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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