

X-SPDT SWITCH GaAs MMIC

■ GENERAL DESCRIPTION

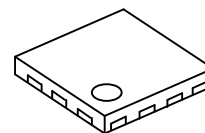
The NJG1662MD7 is a GaAs X (cross) - SPDT switch MMIC, which is designed for switching of balanced dual band filters.

The NJG1662MD7 features very low phase error between on-state paths, low insertion loss, low control voltage and wide frequency coverage. The ESD protection circuit are integrated in the IC to achieve high ESD tolerance.

The ultra-small and ultra-thin EQFN14-D7 package is adopted.

*) X-SPDT is a paired SPDT switch controlled synchronously. The X-SPDT includes two SPDT switches whose RF lines have a crossing inside the chip.

■ PACKAGE OUTLINE



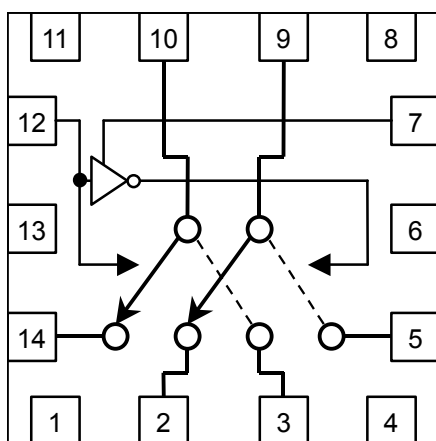
NJG1662MD7

■ FEATURES

- Low phase error ± 3 deg @f=2.0GHz
- Low operation voltage $V_{DD}=+1.5\sim+4.5V$
- Low control voltage $V_{CTL(H)}=+1.3V$ min.
- Low insertion loss 0.3dB typ. @f=1.0GHz, $P_{IN}=0dBm$
 0.4dB typ. @f=2.0GHz, $P_{IN}=0dBm$
- High isolation 28dB typ. @f=1.0GHz, $P_{IN}=0dBm$
 22dB typ. @f=2.0GHz, $P_{IN}=0dBm$
- Small and thin package EQFN14-D7 (Package size: 1.6x1.6x0.397mm typ., Lead and Halogen-Free)

■ PIN CONFIGURATION

(Top View)



Pin connection

- | | |
|--------|----------|
| 1. GND | 10. PC1 |
| 2. PA2 | 11. GND |
| 3. PB1 | 12. VCTL |
| 4. GND | 13. GND |
| 5. PB2 | 14. PA1 |
| 6. GND | |
| 7. VDD | |
| 8. GND | |
| 9. PC2 | |

■ TRUTH TABLE

“H”= $V_{CTL(H)}$, “L”= $V_{CTL(L)}$

ON PATH	VCTL
PC1-PA1,PC2-PA2	H
PC1-PB1,PC2-PB2	L

NOTE: The Information on this datasheet will be subject to change without notice.

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■ 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}	$V_{DD}=2.7\text{V}$, $V_{CTL}=0\text{V}/1.8\text{V}$ PC1,PC2,PA1,PA2,PB1,PB2	28	dBm
Supply voltage	V_{DD}	VDD terminal	5.0	V
Control voltage	V_{CTL}	VCTL terminal	5.0	V
Power dissipation	P_D	Four-layer FR4 PCB with through-hole (74.2mmx74.2mm), $T_j=150^{\circ}\text{C}$	1300	mW
Operating temp.	T_{opr}		-40~+85	$^{\circ}\text{C}$
Storage temp.	T_{stg}		-55~+150	$^{\circ}\text{C}$

■ ELECTRICAL CHARACTERISTICS

(General conditions: $T_a=+25^{\circ}\text{C}$, $Z_s=Z_l=50\Omega$, $V_{DD}=2.7\text{V}$, $V_{CTL(L)}=0\text{V}$, $V_{CTL(H)}=1.8\text{V}$, with application circuit)

PARAMETERS	SYMBOL	CONDITIONS	MIN	TYP	MAX	UNITS
Supply voltage	V_{DD}		1.5	2.7	4.5	V
Operating current	I_{DD}	$P_{IN}=0\text{dBm}$	-	16	30	μA
Control voltage (LOW)	$V_{CTL(L)}$		0	-	0.4	V
Control voltage (HIGH)	$V_{CTL(H)}$		1.3	1.8	V_{DD}	V
Control current	I_{CTL}	$f=2.0\text{GHz}$, $P_{IN}=0\text{dBm}$	-	5	10	μA
Insertion loss 1	LOSS1	$f=1.0\text{GHz}$, $P_{IN}=0\text{dBm}$	-	0.30	0.45	dB
Insertion loss 2	LOSS2	$f=2.0\text{GHz}$, $P_{IN}=0\text{dBm}$	-	0.40	0.55	dB
Insertion loss 3	LOSS3	$f=2.5\text{GHz}$, $P_{IN}=0\text{dBm}$	-	0.45	0.60	dB
Isolation 1	ISL1	PC1-PA1, PC2-PA2 PC1-PB1, PC2-PB2 $f=1.0\text{GHz}$, $P_{IN}=0\text{dBm}$	26	28	-	dB
Isolation 2	ISL2	PC1-PA1, PC2-PA2 PC1-PB1, PC2-PB2 $f=2.0\text{GHz}$, $P_{IN}=0\text{dBm}$	20	22	-	dB
Isolation 3	ISL3	PC1-PA1, PC2-PA2 PC1-PB1, PC2-PB2 $f=2.5\text{GHz}$, $P_{IN}=0\text{dBm}$	18	20	-	dB
Isolation 4	ISL4	PC1-PC2 port $f=2.0\text{GHz}$, $P_{IN}=0\text{dBm}$	26	28	-	dB
Phase error	PE	$f=2.0\text{GHz}$, between on paths	-3	0	3	deg
Input power at 0.2dB compression point	$P_{-0.2\text{dB}}$	$f=2.0\text{GHz}$	20	24	-	dBm
VSWR	VSWR	$f=2.0\text{GHz}$, On port	-	1.2	1.3	
Switching time	T_{SW}	50% CTL to 10%/90% RF	-	1.5	5.0	μs

■ TERMINAL INFORMATION

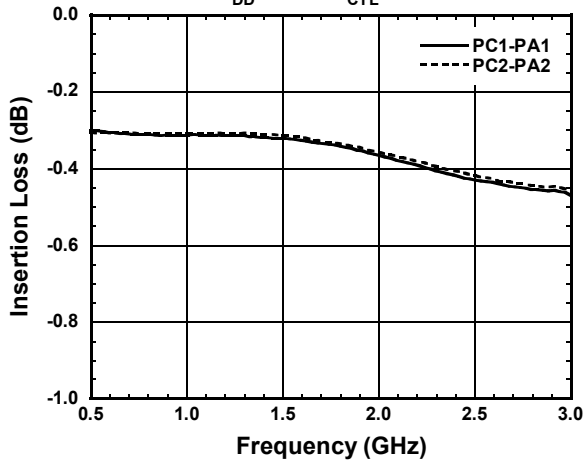
No.	SYMBOL	DESCRIPTION
1	GND	Ground terminal. Please connect this terminal with ground plane as close as possible for good RF performance.
2	PA2	This port is connected to PC2 terminal by applying High-level (1.3~4.5V) at VCTL terminal. An external capacitor is required to block DC voltage of internal circuit.
3	PB1	This port is connected to PC1 terminal by applying Low-level (0~0.4V) at VCTL terminal. An external capacitor is required to block DC voltage of internal circuit.
4	GND	Ground terminal. Please connect this terminal with ground plane as close as possible for good RF performance.
5	PB2	This port is connected to PC2 terminal by applying Low-level (0~0.4V) at VCTL terminal. An external capacitor is required to block DC voltage of internal circuit.
6	GND	Ground terminal. Please connect this terminal with ground plane as close as possible for good RF performance.
7	VDD	A supply voltage terminal (1.5~4.5V). Please place a bypass capacitor between this terminal and GND for avoiding RF noise from outside.
8	GND	Ground terminal. Please connect this terminal with ground plane as close as possible for good RF performance.
9	PC2	Common RF port. This port is connected with either of PA2 or PB2. An external capacitor is required to block DC voltage of internal circuit.
10	PC1	Common RF port. This port is connected with either of PA1 or PB1. An external capacitor is required to block DC voltage of internal circuit.
11	GND	Ground terminal. Please connect this terminal with ground plane as close as possible for good RF performance.
12	VCTL	Control signal input terminal. This terminal is set to high-level (1.3V~4.5V) or low-level (0~0.4V).
13	GND	Ground terminal. Please connect this terminal with ground plane as close as possible for good RF performance.
14	PA1	This port is connected to PC1 terminal by applying High-level (1.3~4.5V) at VCTL terminal. An external capacitor is required to block DC voltage of internal circuit.

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

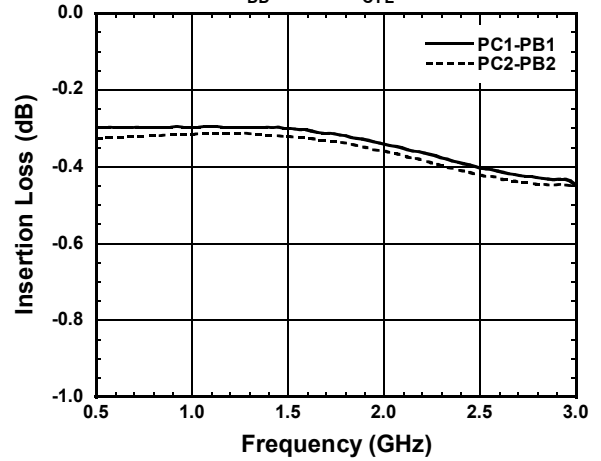
Insertion Loss vs. Frequency

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



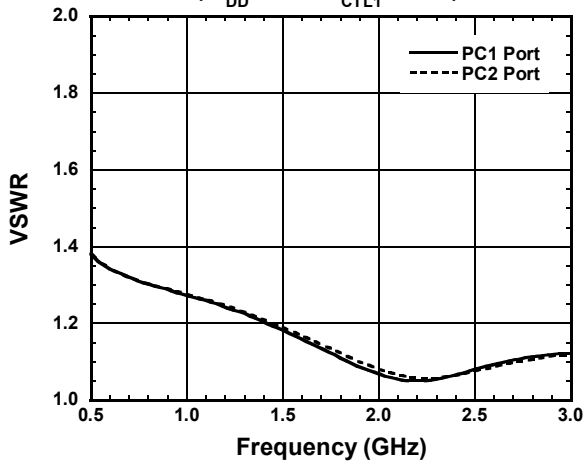
Insertion Loss vs. Frequency

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



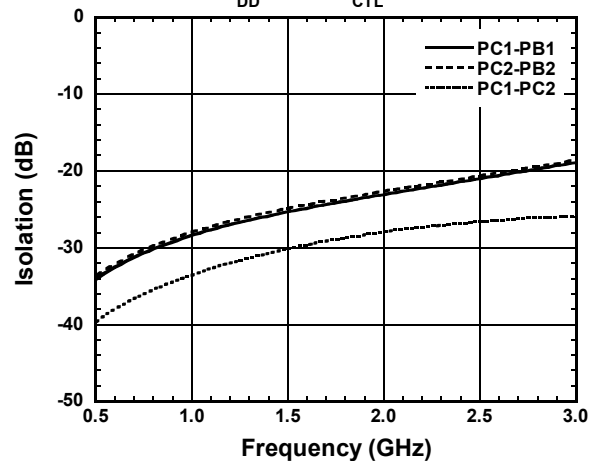
VSWR vs. Frequency

($V_{DD}=2.7V$, $V_{CTL1}=1.8V$)



Isolation vs. Frequency

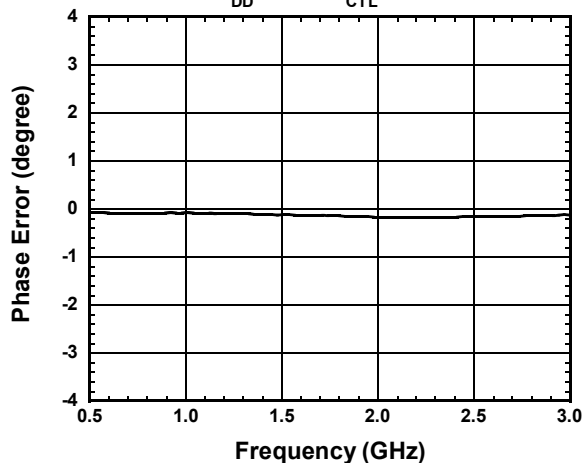
($V_{DD}=2.7V$, $V_{CTL}=1.8V$)



PC1-PA1, PC2-PA2

Phase Error vs. Frequency

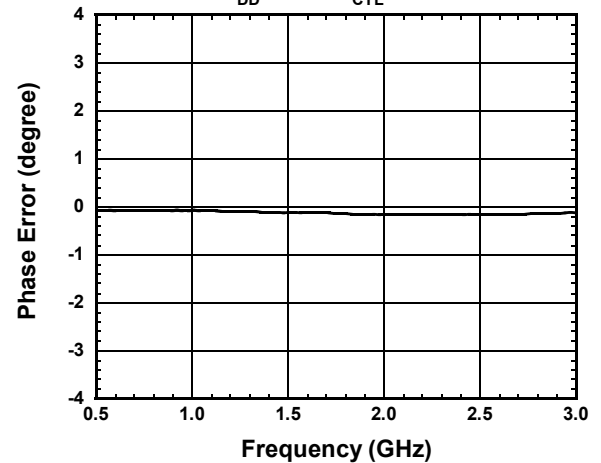
($V_{DD}=2.7V$, $V_{CTL}=1.8V$)



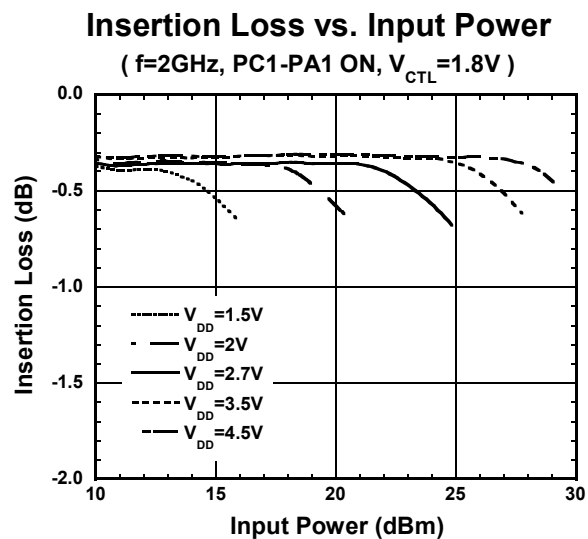
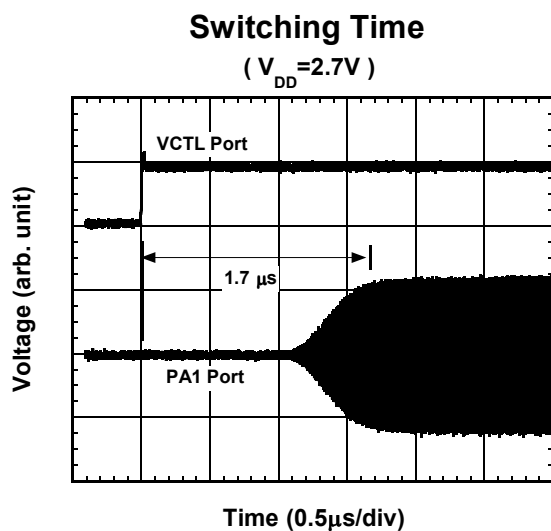
PC1-PA1, PC2-PA2

Phase Error vs. Frequency

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



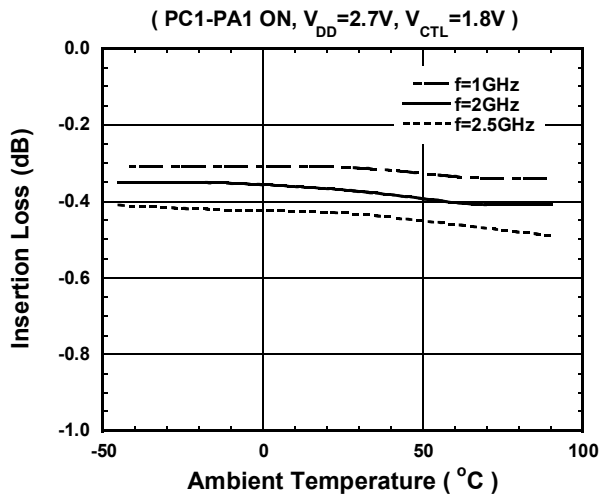
■ ELECTRICAL CHARACTERISTICS (With Application circuit, Loss of external circuit are excluded)



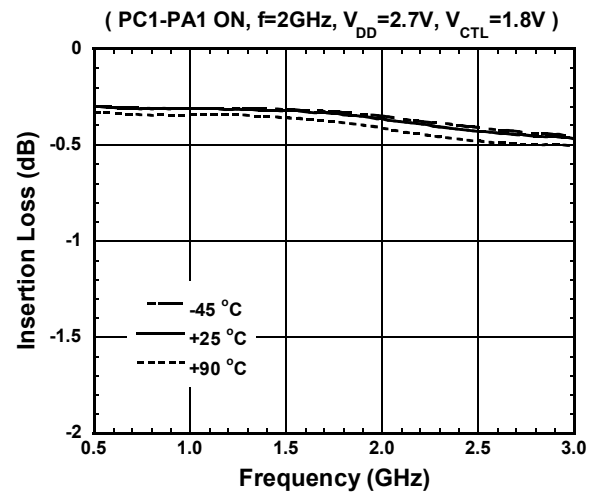
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■ ELECTRICAL CHARACTERISTICS (With Application circuit, Loss of external circuit are excluded)

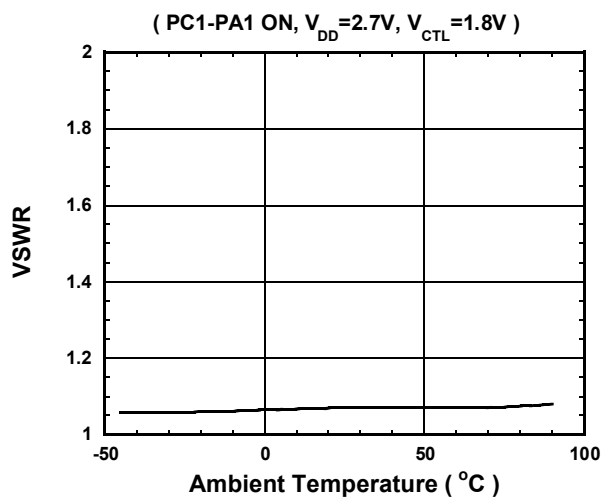
Insertion Loss vs. Ambient Temperature



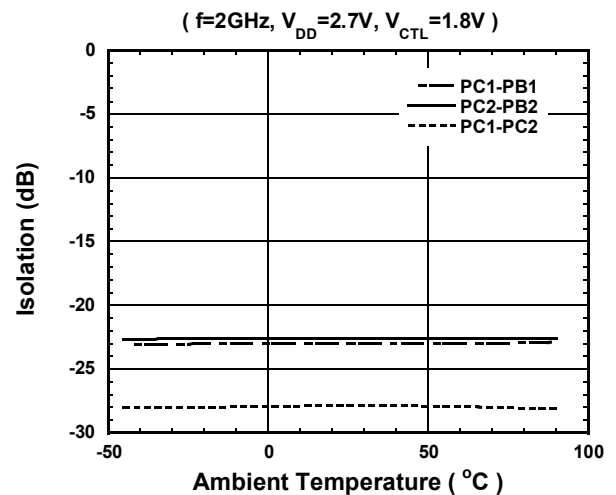
Insertion Loss vs. Frequency



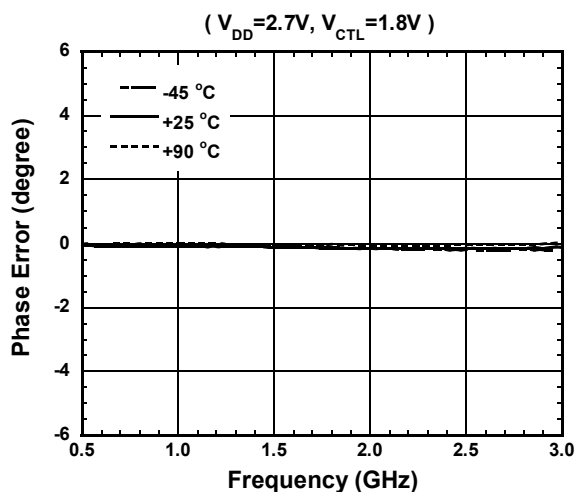
VSWR vs. Ambient Temperature



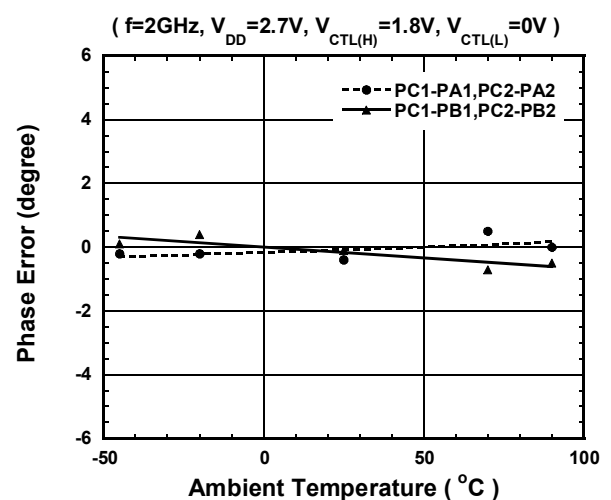
Isolation vs. Ambient Temperature



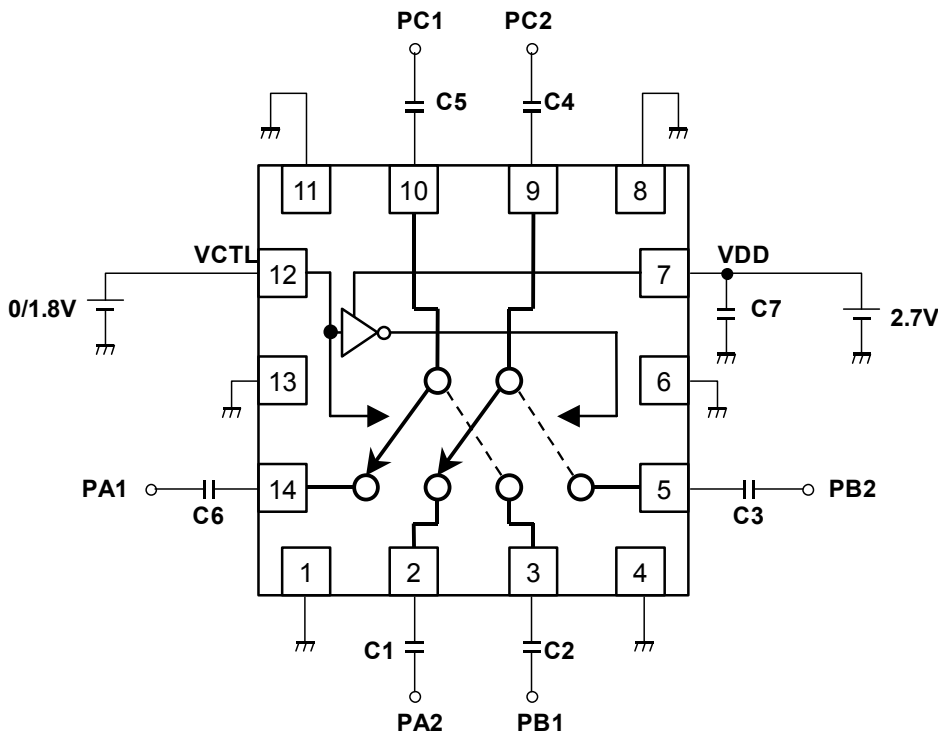
PC1-PA1, PC2-PA2 Phase Error vs. Frequency



Phase Error vs. Ambient Temperature



APPLICATION CIRCUIT

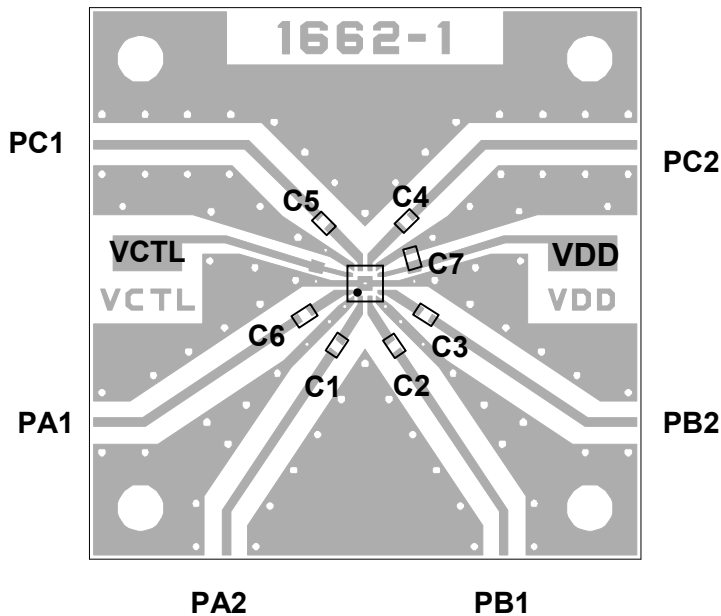


PARTS LIST

Part ID	Value	Notes
C1~C6	56pF	MURATA (GRM15)
C7	1000pF	

TEST PCB LAYOUT

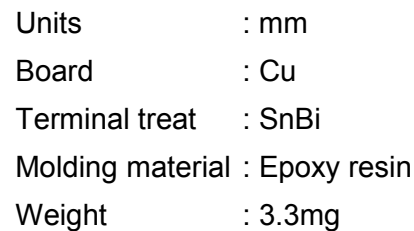
(TOP VIEW)



PCB: FR-4, t=0.2mm
Capacitor Size: 1005
Strip Line Width: 0.4mm
PCB Size: 26 x 26mm

Losses of PCB, capacitors and connectors

Frequency (GHz)	Loss (dB)
1.0	0.38
2.0	0.51
2.5	0.55



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