

SPDT SWITCH GaAs MMIC

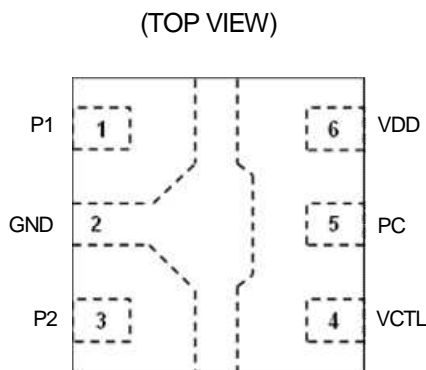
■ FEATURES

- AEC-Q100 grade 2 qualified
- Low voltage logic control $V_{CTL}(H) = 1.8\text{ V typ.}$
- Operation voltage $V_{DD} = 3.3\text{ V typ.}$
- Low insertion loss
 - 0.45 dB typ. @ 2.4 GHz to 2.5 GHz
 - 0.45 dB typ. @ 3.4 GHz to 3.8 GHz
 - 0.40 dB typ. @ 4.9 GHz to 6.0 GHz
- High isolation
 - 25dB typ. @ 2.4 GHz to 2.5 GHz
 - 25dB typ. @ 3.4 GHz to 3.8 GHz
 - 25dB typ. @ 4.9GHz to 6.0 GHz
- $P_{-1dB} = +31\text{ dBm typ. @ 2.4 to 6.0 GHz}$
- Ultra small & ultra-thin Package DFN6-75
(Package Size: 1.0 x 1.0 x 0.375 mm typ.)
- RoHS compliant and Halogen Free, MSL1

■ APPLICATION

- 802.11 a/b/g/n/ac/ax networks applications
- Transmit/receive switching, antenna switching and others switching applications
- Automotive WiFi applications

■ BLOCK DIAGRAM (DFN6-75)



■ GENERAL DESCRIPTION

The NJG1815AK75-A is a 1bit control SPDT switch. This switch is used for WLAN system.

The switch features low insertion loss, high isolation for high frequency up to 6GHz, and high handing power performance at 1.8V control voltage. Integrated ESD protection device on each port achieves excellent ESD robustness.

Integrated DC blocking capacitors at all RF ports and the ultra-small package of DNF6-75 offer very small mounting area.

■ TRUTH TABLE

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

ON Path	VCTL
PC-P1	H
PC-P2	L

■ PIN CONFIGURATION

PIN NO.	SYMBOL	DESCRIPTION
1	P1	RF terminal
2	GND	Ground terminal
3	P2	RF terminal
4	VCTL	Control signal input terminal.
5	PC	Common RF terminal
6	VDD	Voltage supply terminal

■ PRODUCT NAME INFORMATION

NJG1815A K75 -A (TE1)
| |
Part number Package Automotive Taping form

■ ORDERING INFORMATION

PART NUMBER	PACKAGE OUTLINE	RoHS	HALOGEN-FREE	TERMINAL FINISH	MARKING	WEIGHT (mg)	MOQ (pcs.)
NJG1815AK75-A	DFN6-75	Yes	Yes	Ni/Pd/Au	4	1.2	5,000

■ ABSOLUTE MAXIMUM RATINGS

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

PARAMETER	SYMBOL	RATINGS	UNIT
RF input power	P_{IN}	+31 ⁽¹⁾	dBm
Supply voltage	V_{DD}	6.0	V
Control voltage	V_{CTL}	6.0	V
Power dissipation ⁽²⁾	P_D	380	mW
Operating temperature	T_{opr}	-40 to +105	°C
Storage temperature	T_{stg}	-55 to +150	°C

(1): $V_{DD} = 3.3 \text{ V}$, ON port

(2): Four-layer FR4 PCB with through-hole (76.2 x 114.3 mm), $T_j = 150^\circ\text{C}$

■ 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
Supply voltage	V_{DD}		2.5	3.3	5.0	V
Operating current	I_{DD}	No RF input, $V_{DD} = 3.3\text{ V}$	-	15	30	μA
Control voltage (LOW)	$V_{CTL(L)}$		0	-	0.45	V
Control voltage (HIGH)	$V_{CTL(H)}$		1.5	1.8	5.0	V
Control current	I_{CTL}	$V_{CTL(H)} = 1.8\text{V}$	-	3	10	μA

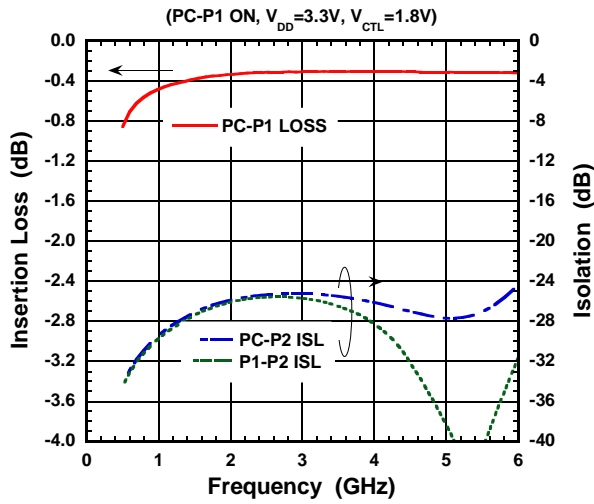
■ ELECTRICAL CHARACTERISTICS 2 (RF CHARACTERISTICS)

(General conditions: $T_a = +25^\circ\text{C}$, $Z_s = Z_l = 50\Omega$, $V_{DD} = 3.3\text{ V}$, $V_{CTL(H)} = 1.8\text{V}$, $V_{CTL(L)} = 0\text{V}$, with application circuit)

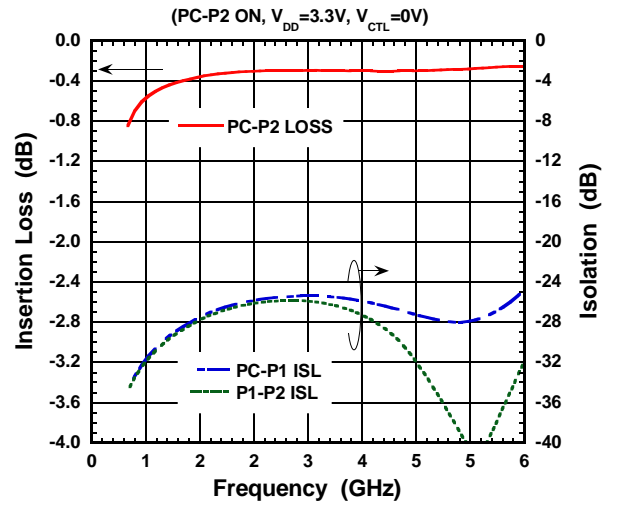
PARAMETER	SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Insertion loss	LOSS	$f = 2.4$ to 2.5 GHz	-	0.45	0.65	dB
		$f = 3.4$ to 3.8 GHz	-	0.45	0.65	
		$f = 4.9$ to 6.0 GHz	-	0.40	0.60	
Isolation	ISL	$f = 2.4$ to 2.5 GHz	23	25	-	dB
		$f = 3.4$ to 3.8 GHz	22	25	-	
		$f = 4.9$ to 6.0 GHz	22	25	-	
Return loss	RL	$f = 2.4$ to 2.5 GHz	13	16	-	dB
		$f = 3.4$ to 3.8 GHz	15	20	-	
		$f = 4.9$ to 6.0 GHz	15	20	-	
Input power at 1dB compression point	P_{-1dB}	$f = 2.4$ to 6.0 GHz	+28	+31	-	dBm
Switching time	T_{SW}	50% V_{CTL} to 10/90% RF	-	150	400	ns

■ ELECTRICAL CHARACTERISTICS

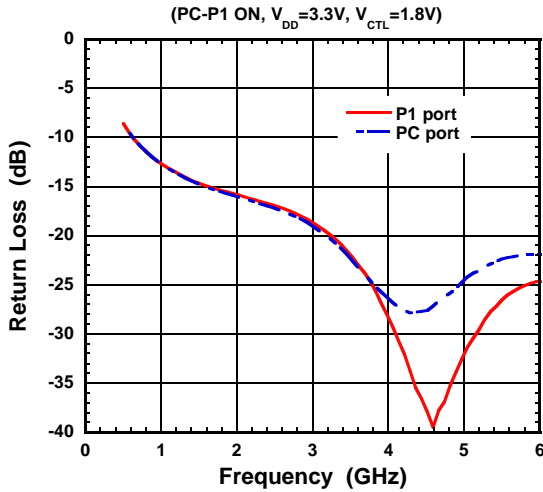
Loss, ISL vs Frequency



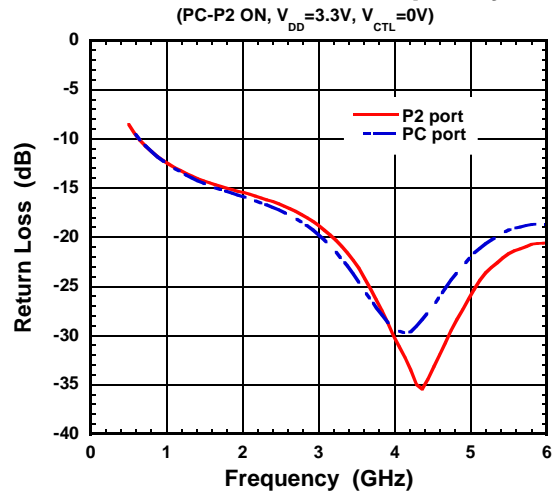
Loss, ISL vs Frequency



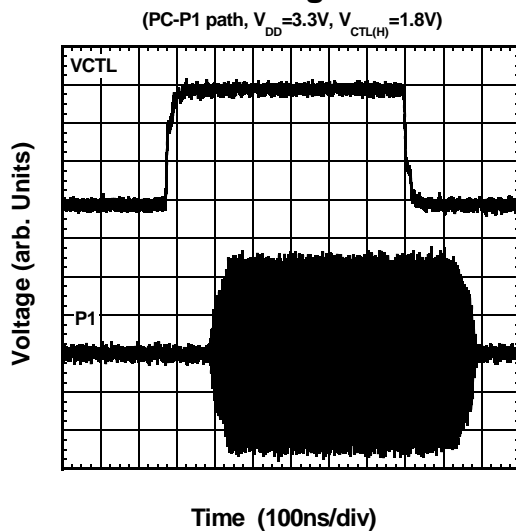
Return Loss vs Frequency



Return Loss vs Frequency



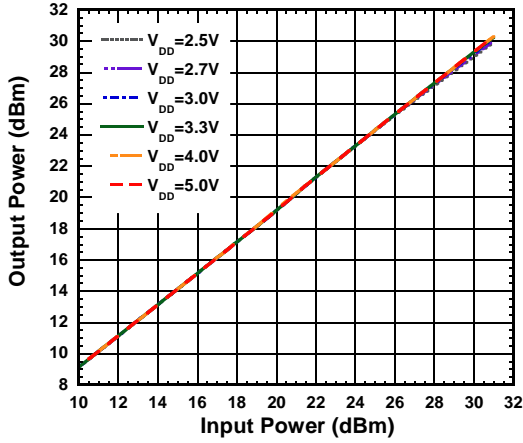
Switching Time



■ ELECTRICAL CHARACTERISTICS

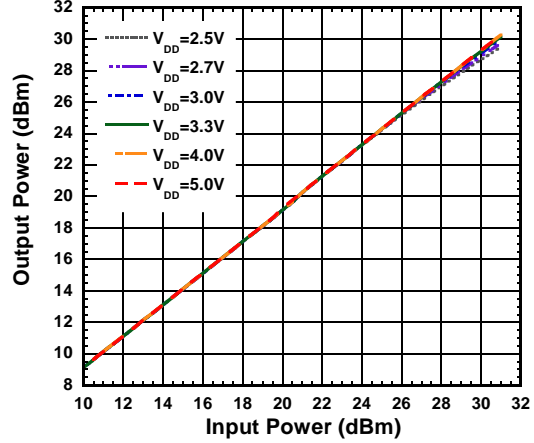
Output Power vs Input Power

(PC-P1 ON, $V_{CTL}=1.8V$, $f=2.5GHz$)



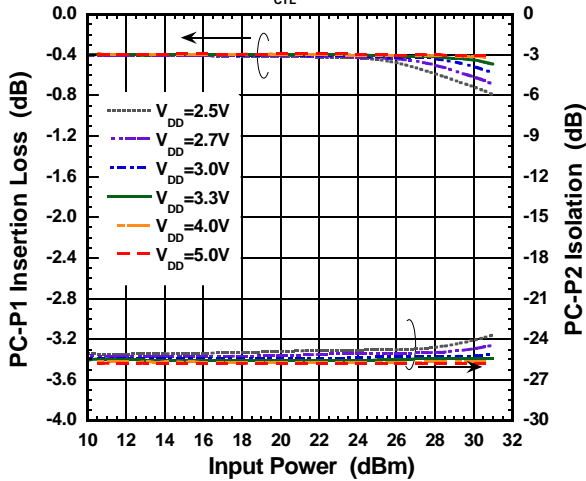
Output Power vs Input Power

(PC-P2 ON, $V_{CTL}=0V$, $f=2.5GHz$)



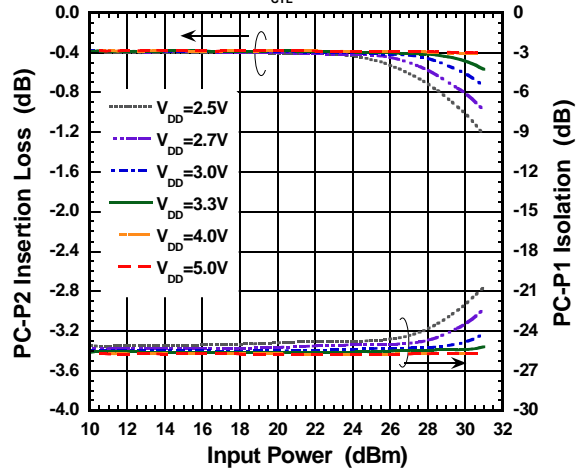
Loss, ISL vs Input Power

(PC-P1 ON, $V_{CTL}=1.8V$, $f=2.5GHz$)



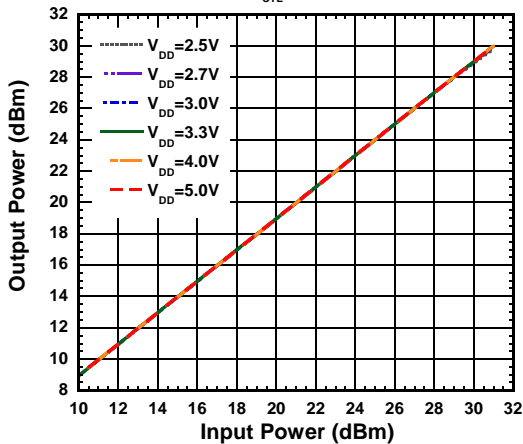
Loss, ISL vs Input Power

(PC-P2 ON, $V_{CTL}=0V$, $f=2.5GHz$)



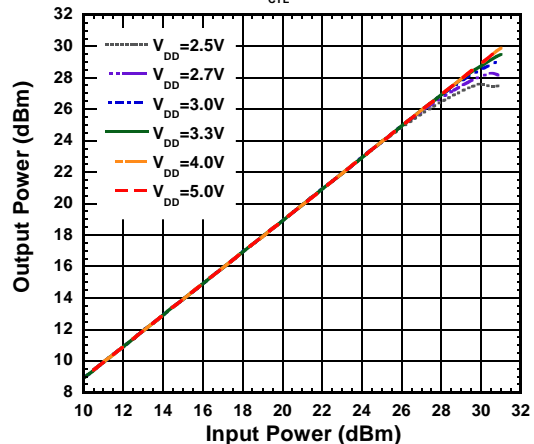
Output Power vs Input Power

(PC-P1 ON, $V_{CTL}=1.8V$, $f=6.0GHz$)



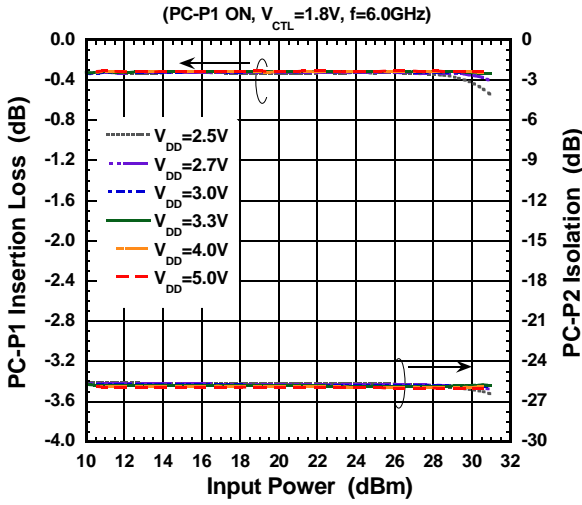
Output Power vs Input Power

(PC-P2 ON, $V_{CTL}=0V$, $f=6.0GHz$)

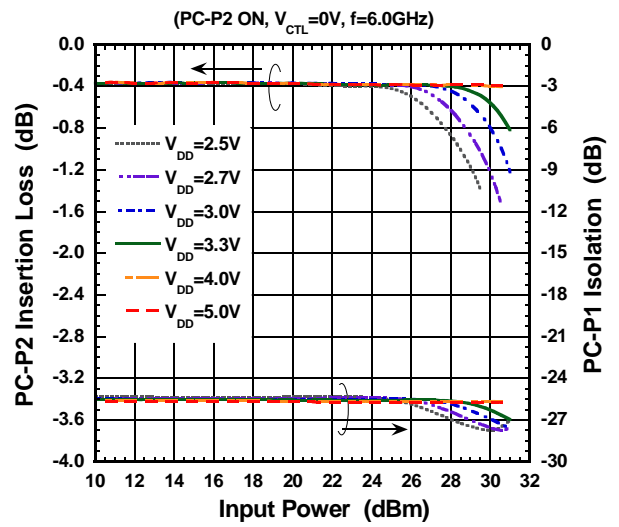


■ ELECTRICAL CHARACTERISTICS

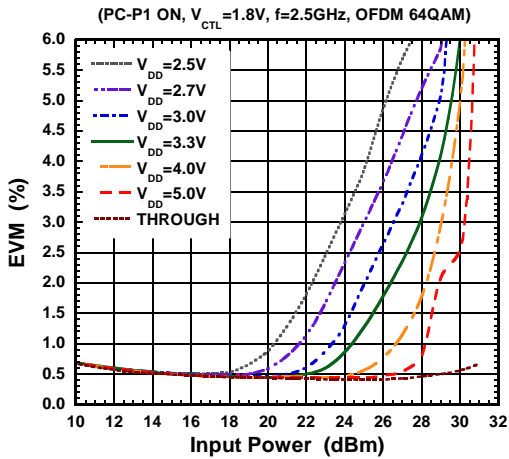
Loss, ISL vs Input Power



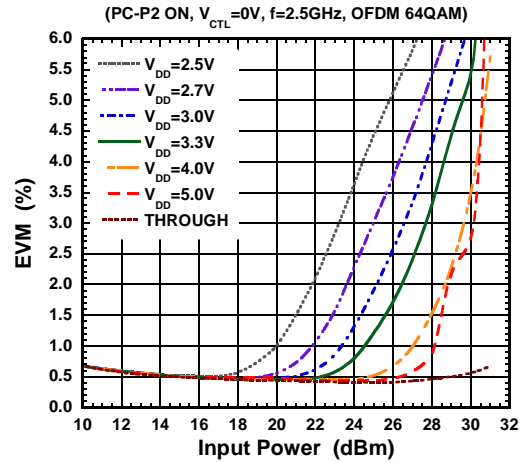
Loss, ISL vs Input Power



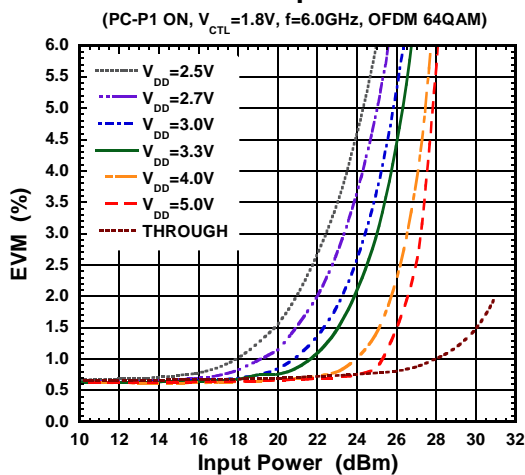
EVM vs Input Power



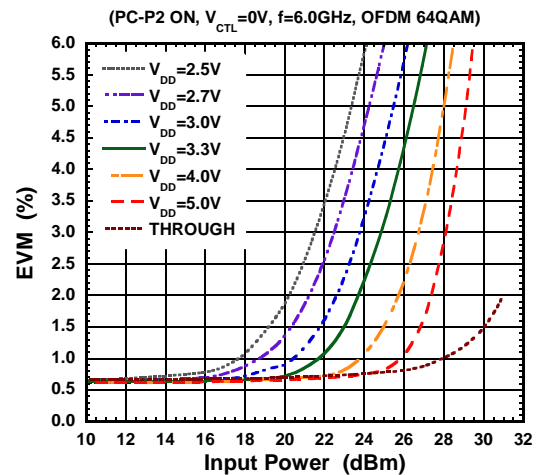
EVM vs Input Power



EVM vs Input Power

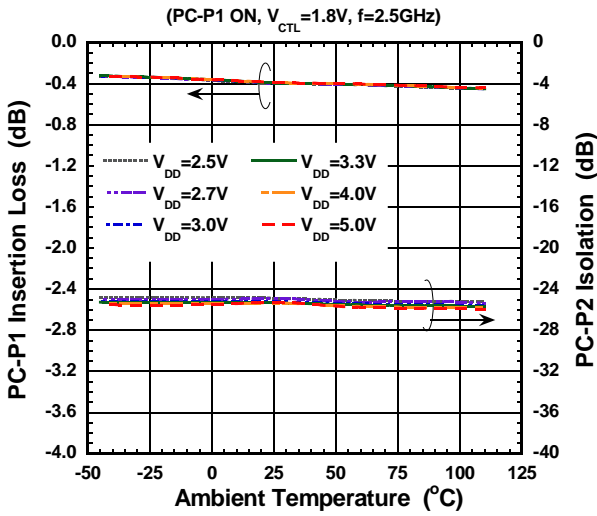


EVM vs Input Power

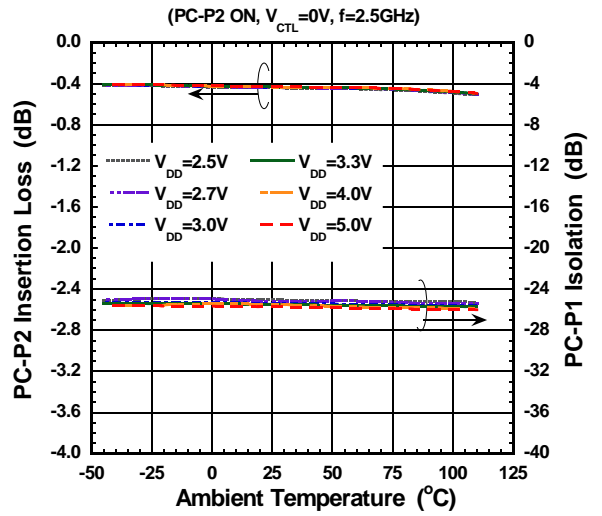


ELECTRICAL CHARACTERISTICS

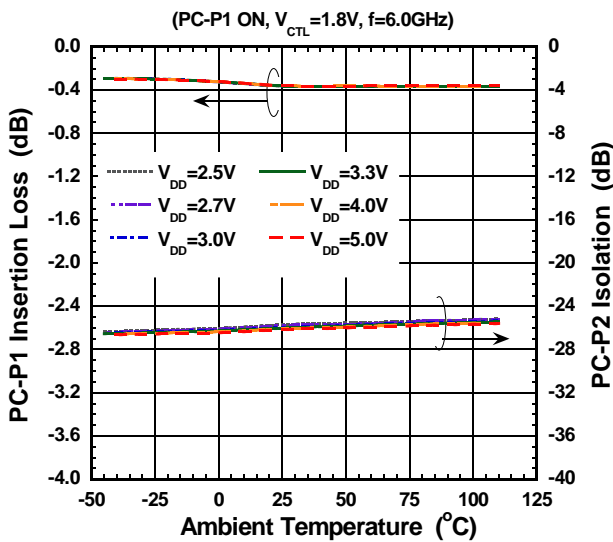
Loss, ISL vs Temperature



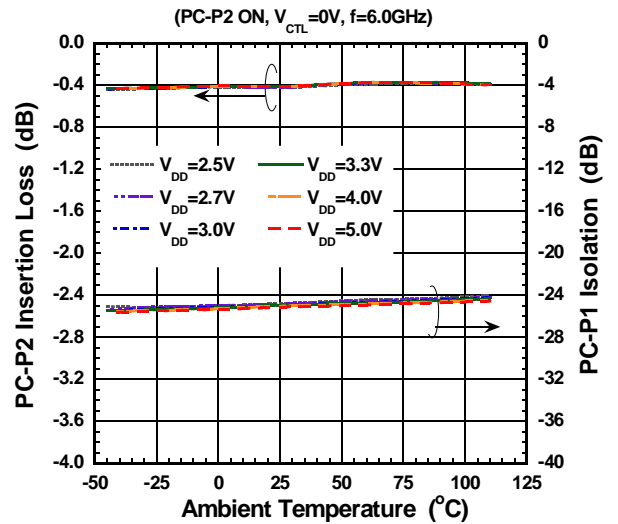
Loss, ISL vs Temperature



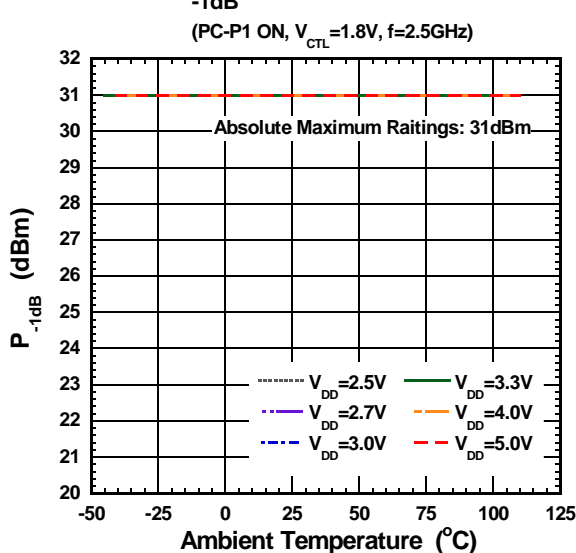
Loss, ISL vs Temperature



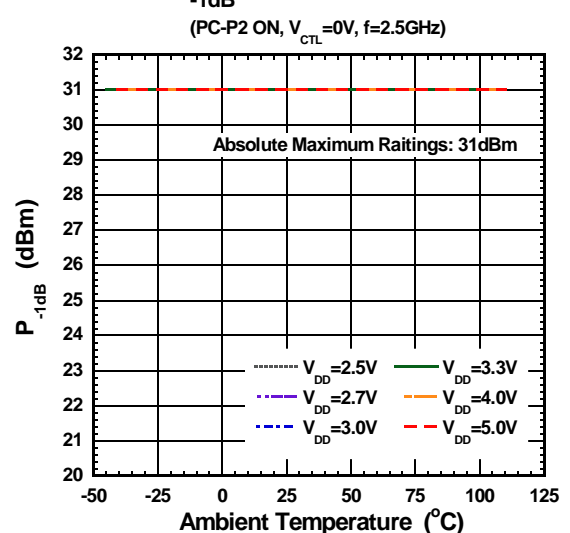
Loss, ISL vs Temperature



P_{-1dB} vs Temperature



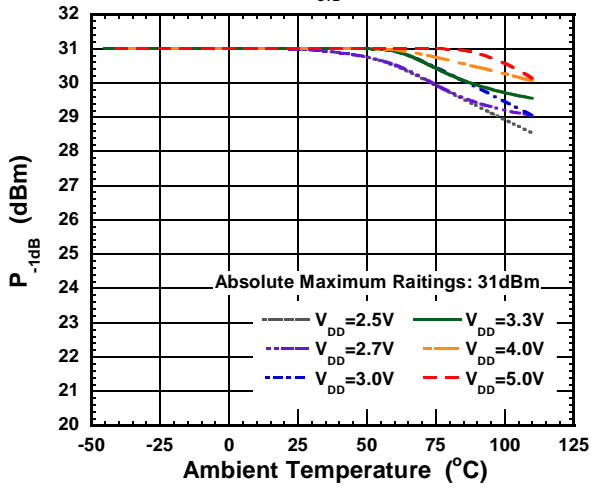
P_{-1dB} vs Temperature



■ ELECTRICAL CHARACTERISTICS

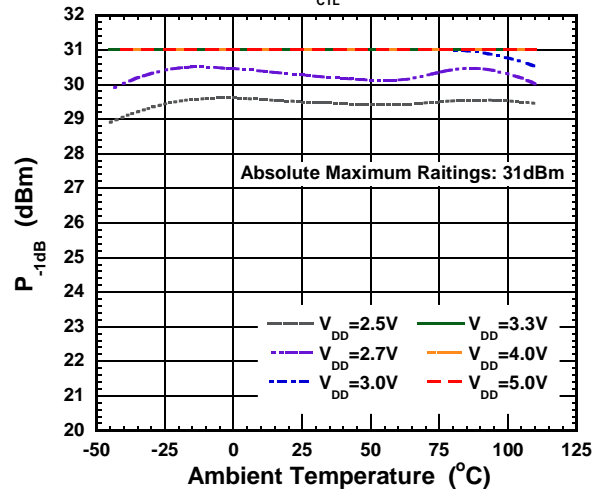
P_{-1dB} vs Temperature

(PC-P1 ON, $V_{CTL}=1.8V$, $f=6.0GHz$)

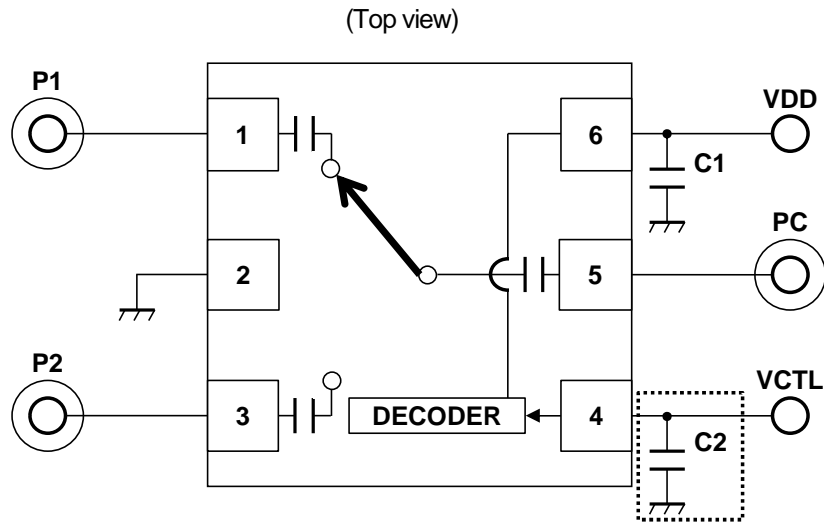


P_{-1dB} vs Temperature

(PC-P2 ON, $V_{CTL}=0V$, $f=6.0GHz$)



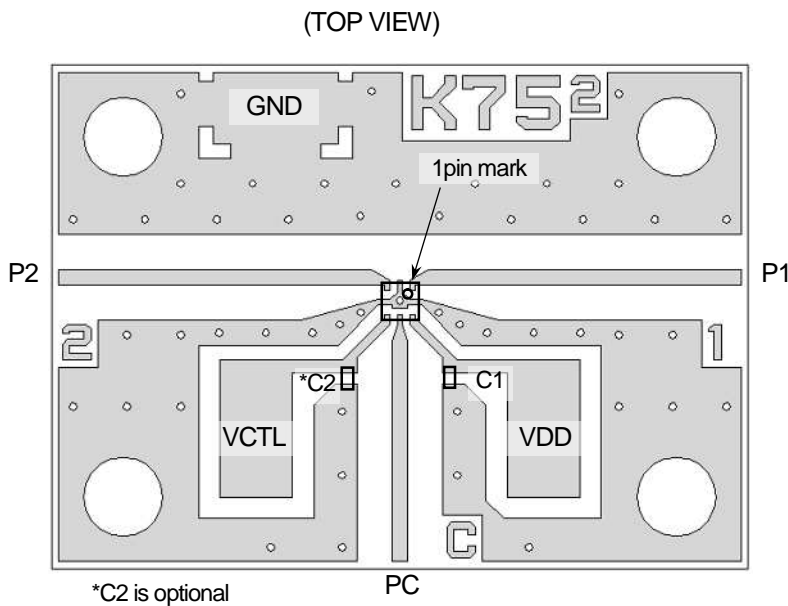
APPLICATION CIRCUIT



NOTE:

The bypass capacitor C2 is optional, and is recommended only when the control line is affected under noisy environment.

EVALUATION BOARD



PCB: FR-4, t = 0.2 mm
 Capacitor size: 0603 (0.6 x 0.3 mm)
 Strip line width: 0.4 mm
 PCB size: 19.4 x 14.0 mm
 Through hole diameter: 0.2 mm

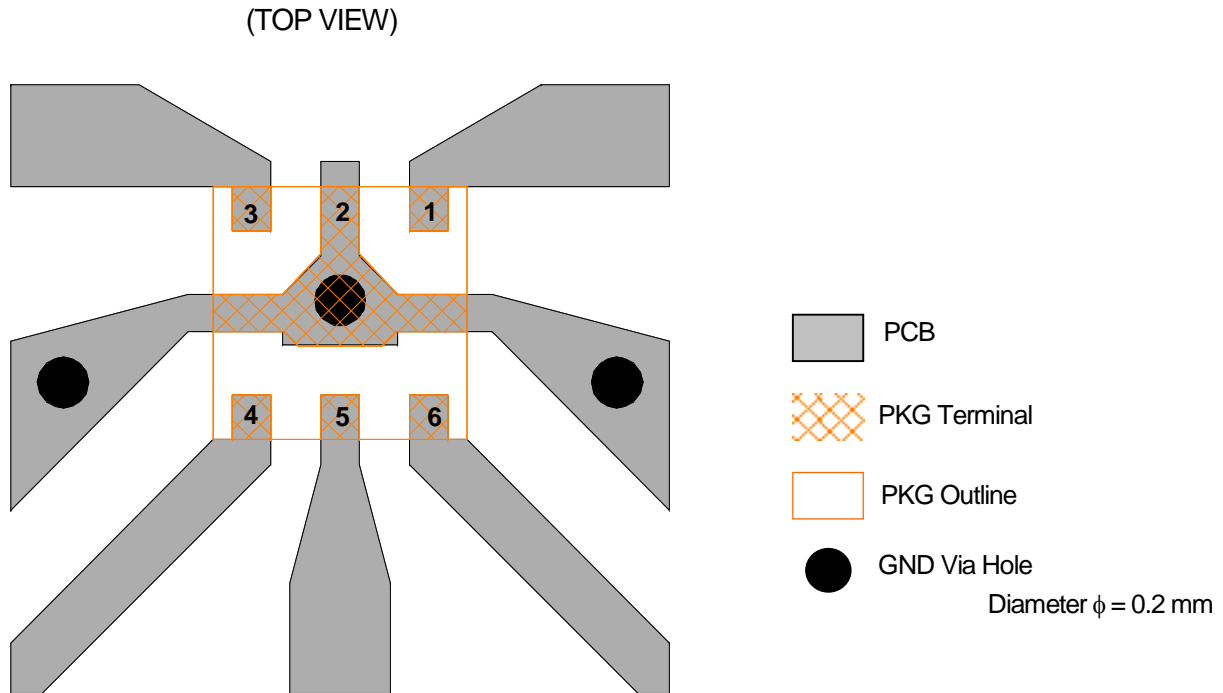
Loss of PCB and connectors

Frequency (GHz)	Loss (dB)
2.4	0.28
2.5	0.28
3.4	0.35
3.8	0.39
4.9	0.52
6.0	0.72

PARTS LIST

Part ID	Value	Notes
C1	1000 pF	MURATA MFG
C2	10 pF	(GRM03 Series)

PCB LAYOUT GUIDELINE



PRECAUTIONS

For good RF performance, exposed pad should be connected to PCB ground plane as close as possible.

HANDLING PRECAUTIONS

PIN NO.	SYMBOL	ESD RATINGS		
		Human Body Model ⁽¹⁾		Charged Device Model ⁽²⁾
Common terminal		Ground	I/O	
1	P1	Class 1C	Class 2	Class C6
2	GND	COM.	-	Class C6
3	P2	Class 1C	Class 2	Class C6
4	VCTL1	Class 1C	Class 1C	Class C6
5	PC	Class 2	Class 2	Class C6
6	VDD	Class 1C	-	Class C6

(1): According to JEDEC JS-001

(2): According to JEDEC JS-002

CAUTION:

This product may be damaged with electric static discharge (ESD) or spike voltage. Please handle with care to avoid these damages.


■ RECOMMENDED FOOTPRINT PATTERN (DFN6-75 PACKAGE) <Reference>

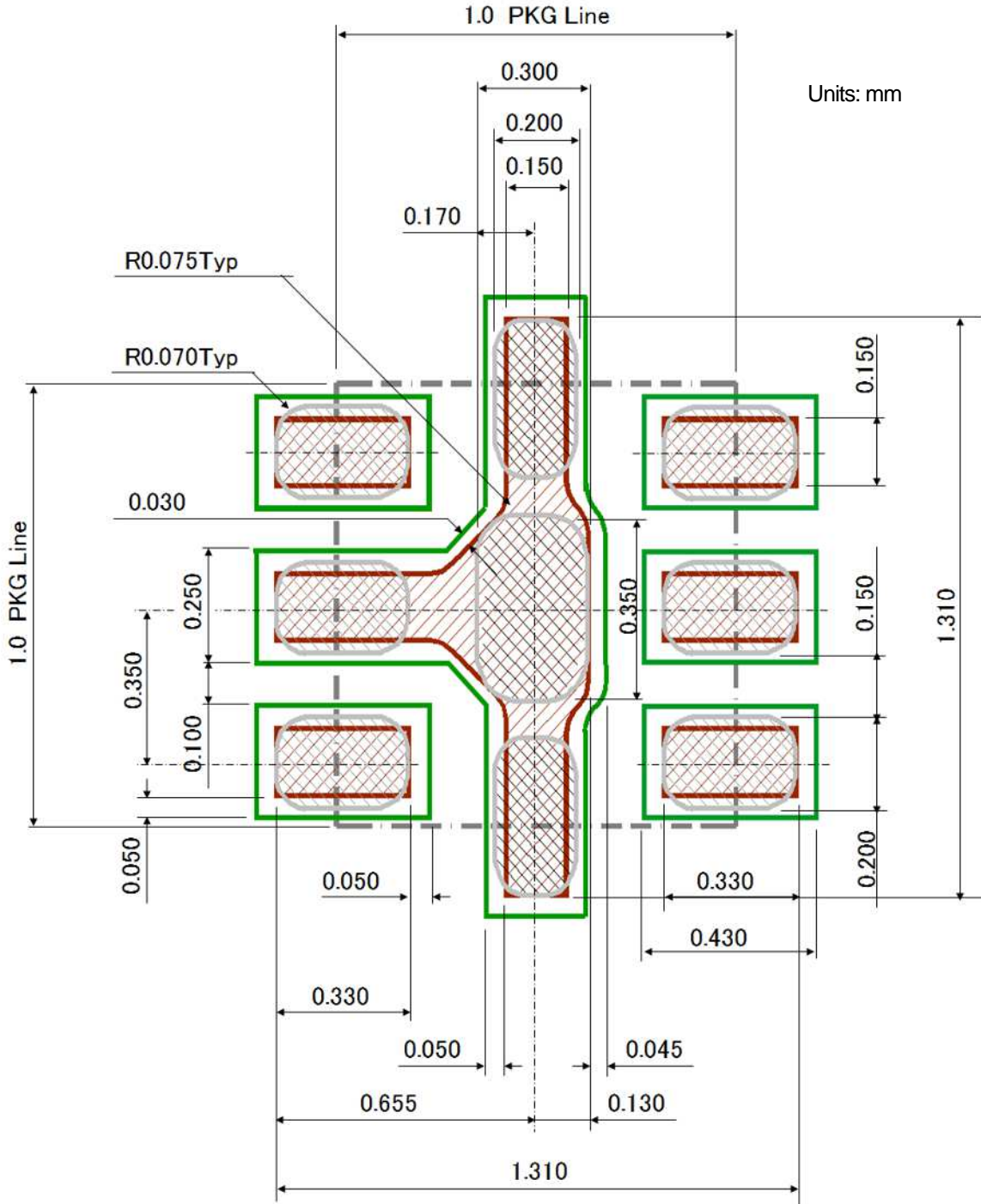
Package: 1.0 mm x 1.0 mm

Pin pitch: 0.35 mm

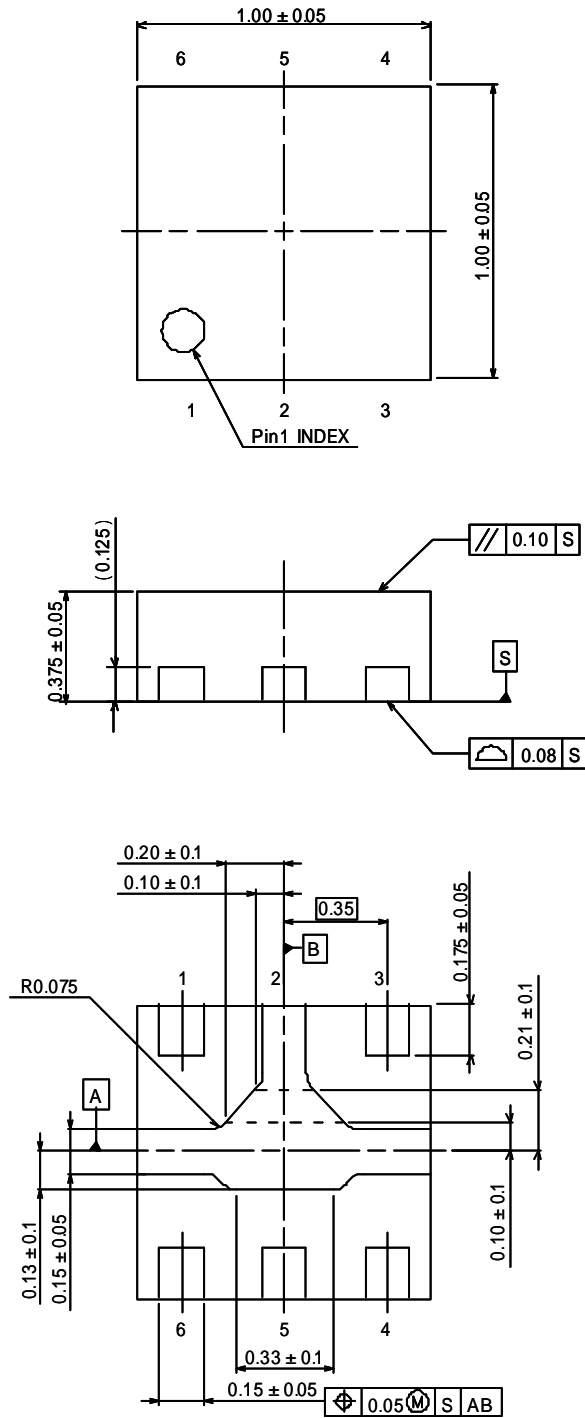
 : Land

 : Mask (Open area) *Metal mask thickness: 100 μm

 : Resist (Open area)



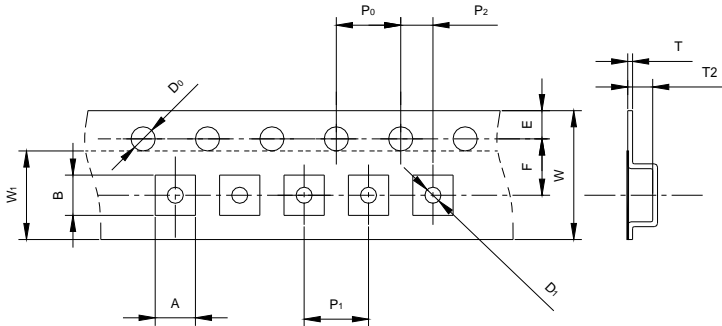
PACKAGE OUTLINE (DFN6-75)



Unit	: mm
Board	: Cu
Terminal Treat	: Ni/Pd/Au
Molding Material	: Epoxy resin
Weight	: 1.2 mg

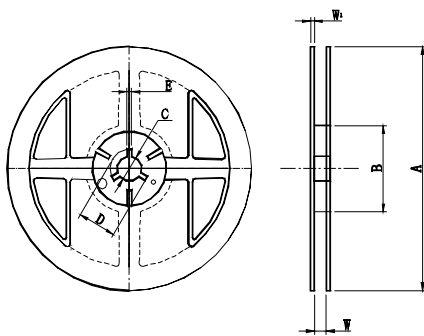
PACKING SPECIFICATION (DFN6-75)

TAPING DIMENSIONS



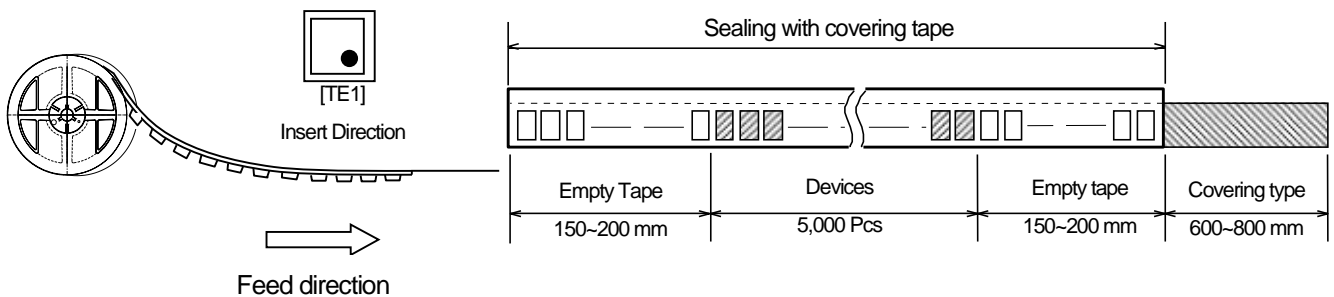
SYMBOL	DIMENSION	REMARKS
A	1.19 + 0.04/-0.01	BOTTOM
B	1.19 + 0.04/-0.01	BOTTOM
D0	1.5 + 0.1/-0.0	
D1	0.5 ± 0.05	
E	1.75 ± 0.1	
F	3.5 ± 0.05	
P0	4.0 ± 0.1	
P1	4.0 ± 0.1	
P2	2.0 ± 0.05	
T	0.18 ± 0.05	
T2	0.69 ± 0.10	
W	8.0 ± 0.1	
W1	5.5 ± 0.1	THICKNESS

REEL DIMENSIONS

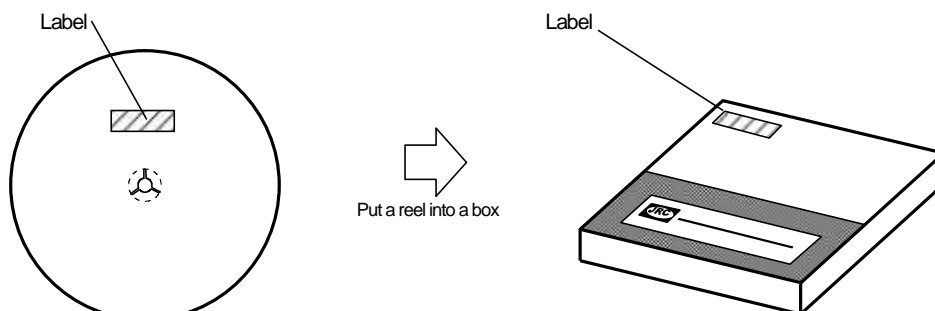


SYMBOL	DIMENSION
A	φ180 + 0/-3
B	φ60 + 1/-0
C	φ13 ± 0.2
D	φ21 ± 0.8
E	2 ± 0.5
W	9.0 ± 0.3
W1	1.2

TAPING STATE



PACKING STATE





■ REVISION HISTORY

Date	Revision	Changes
25.Sep.2020	Ver. 1.0	New Release

[CAUTION]

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 - Vehicle Control Equipment (Airplane, railroad, ship, etc.)
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