

Ultra low current consumption SPDT switch

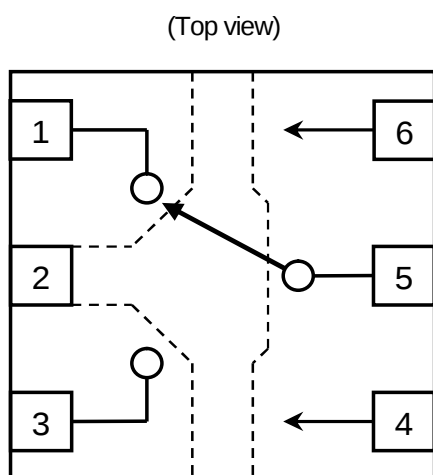
■FEATURES

- Low control voltage 1.6 V min.
- Low current consumption 0.1 μ A typ.
- Low insertion loss 0.45 dB typ. @f = 920 MHz
- High isolation 30 dB typ. @f = 920 MHz
- P_{-0.1dB} +30 dBm typ. @f = 920 MHz
- Small package 1.0 mm x 1.0 mm, t = 0.375 mm
- RoHS compliant and Halogen Free, MSL1

■APPLICATION

- LPWA (SIGFOX, LoRaWAN, Wi-SUN) applications
- Antenna switching, path switching, general purpose switching applications

■BLOCK DIAGRAM (DFN6-75)



■FUNCTIONAL DESCRIPTION

“H” = V_{CTL}(H), “L” = V_{CTL}(L)

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

■GENERAL DESCRIPTION

The NJG1816K75 is a 2 bit control SPDT switch GaAs MMIC suited for LPWA applications.

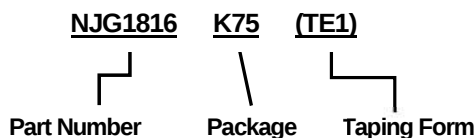
The NJG1816K75 operates at low control voltage from 1.6 V. The NJG1816K75 is the best choice for IoT devices with battery operation because of ultra low current consumption.

The small and thin DFN6-75 package is adopted.

■PIN CONFIGURATION

PIN NO.	SYMBOL	DESCRIPTION
1	P1	RF terminal
2	NC(GND)	Ground terminal
3	P2	RF terminal
4	VCTL2	Control signal input terminal
5	PC	RF terminal
6	VCTL1	Control signal input terminal

■ PRODUCT NAME INFORMATION



■ ORDERING INFORMATION

PART NUMBER	PACKAGE OUTLINE	RoHS	HALOGEN-FREE	TERMINAL FINISH	MARKING	WEIGHT (mg)	MOQ (pcs.)
NJG1816K75	DFN6-75	Yes	Yes	Ni/Pd/Au	5	1.2	5,000

■ ABSOLUTE MAXIMUM RATINGS

$T_a = 25^{\circ}\text{C}$, $Z_s = Z_L = 50\ \Omega$

PARAMETER	SYMBOL	RATINGS	UNIT
RF input power ⁽¹⁾	P_{IN}	+30	dBm
Control voltage	V_{CTL}	4.5	V
Power dissipation ⁽²⁾	P_D	380	mW
Operating temperature	T_{opr}	-40 to +105	$^{\circ}\text{C}$
Storage temperature	T_{stg}	-55 to +150	$^{\circ}\text{C}$

(1): $V_{CTL}(L) = 0\text{ V}$, $V_{CTL}(H) = 1.8\text{ V}$, on state port

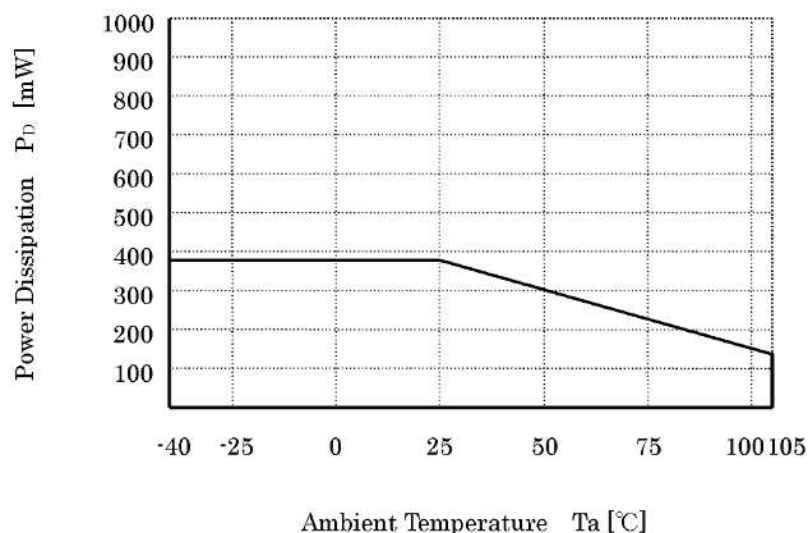
(2): Mounted on four-layer FR4 PCB with through-hole (76.2 × 114.3 mm), $T_j = 150\ ^{\circ}\text{C}$

■ POWER DISSIPATION VS.AMBIENT TEMPERATURE

Please, refer to the following Power Dissipation and Ambient Temperature.

(Please note the surface mount package has a small 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 board



■ ELECTRICAL CHARACTERISTICS (DC CHARACTERISTICS)

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

PARAMETER	SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Control voltage (HIGH)	$V_{CTL(H)}$	VCTL1, VCTL2 terminal	1.6	1.8	4.0	V
Control voltage (LOW)	$V_{CTL(L)}$	VCTL1, VCTL2 terminal	-0.2	-	0.2	V
Control current	I_{CTL}		-	0.1	2.0	μA

■ ELECTRICAL CHARACTERISTICS (RF CHARACTERISTICS)

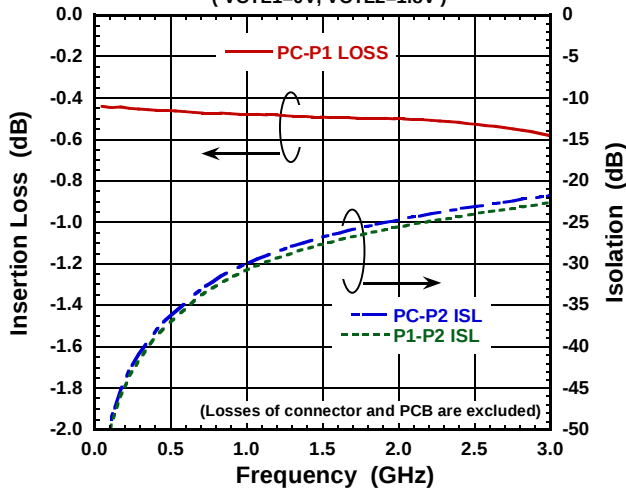
$V_{CTL(H)} = 1.8 \text{ V}$, $V_{CTL(L)} = 0 \text{ V}$, $T_a = 25^\circ\text{C}$, $Z_s = Z_l = 50 \Omega$, with application circuit

PARAMETER	SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Insertion loss	LOSS	$f = 920 \text{ MHz}$	-	0.45	0.65	dB
Isolation	ISL	$f = 920 \text{ MHz}$	26	30	-	dB
Input power at 0.1 dB compression point	$P_{-0.1\text{dB}}$	$f = 920 \text{ MHz}$	+25	+30	-	dBm
VSWR	VSWR	$f = 920 \text{ MHz}$	-	1.1	1.4	-
Switching time	T_{SW}	50% V_{CTL} to 10%/90% RF	-	100	300	ns

■ ELECTRICAL CHARACTERISTICS

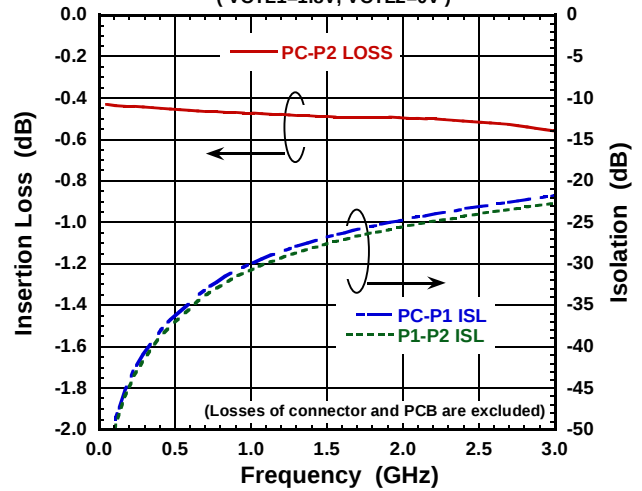
Loss, ISL vs Frequency

(VCTL1=0V, VCTL2=1.8V)



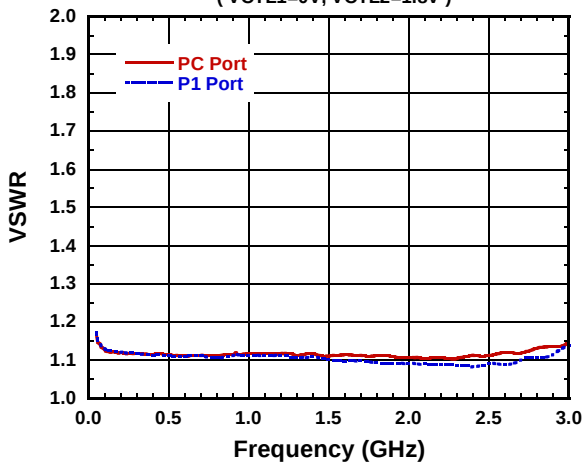
Loss, ISL vs Frequency

(VCTL1=1.8V, VCTL2=0V)



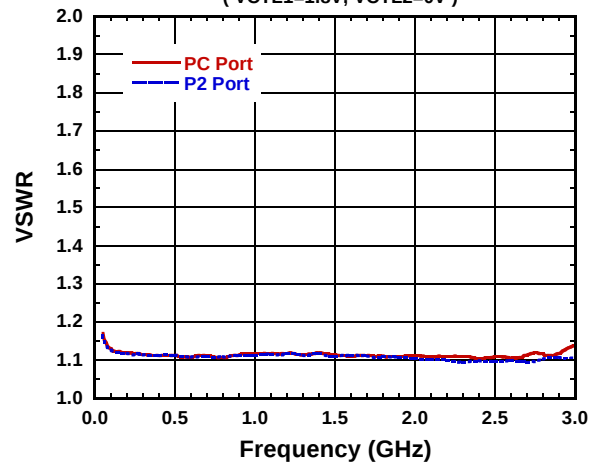
VSWR vs Frequency

(VCTL1=0V, VCTL2=1.8V)



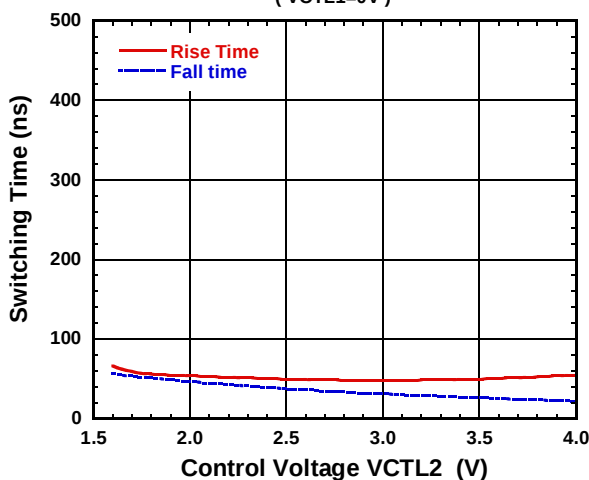
VSWR vs Frequency

(VCTL1=1.8V, VCTL2=0V)

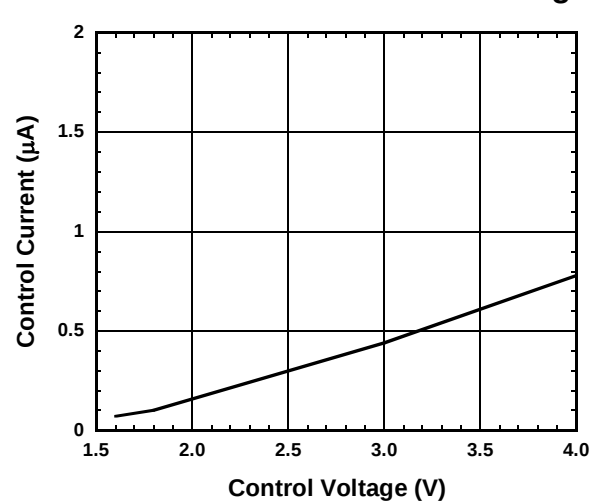


Switching Time vs Control Voltage

(VCTL1=0V)

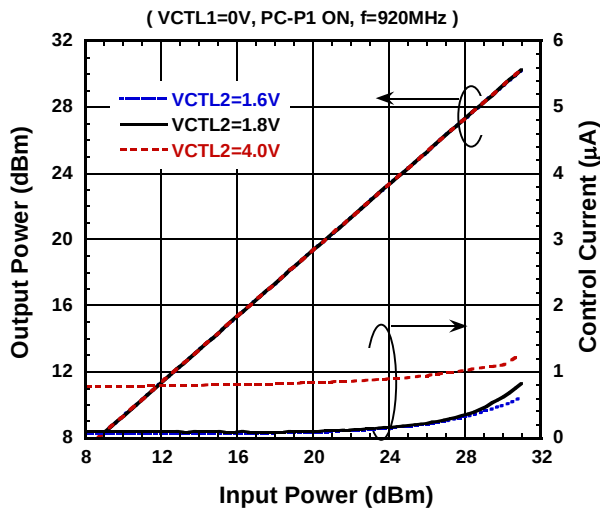


Control Current vs Control Voltage

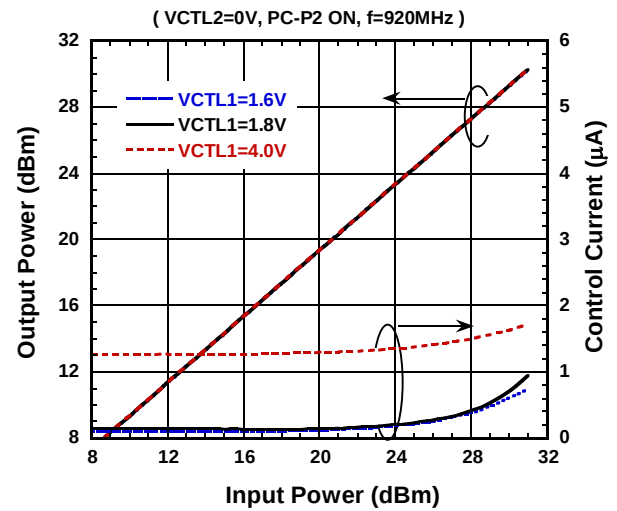


■ ELECTRICAL CHARACTERISTICS

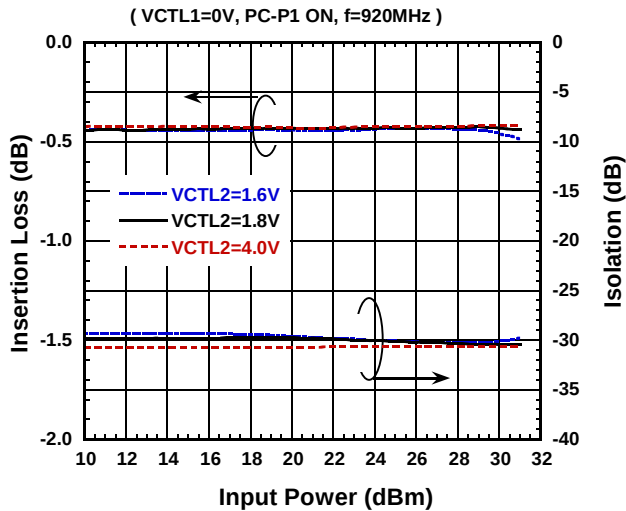
Output Power, ICTL vs Input Power



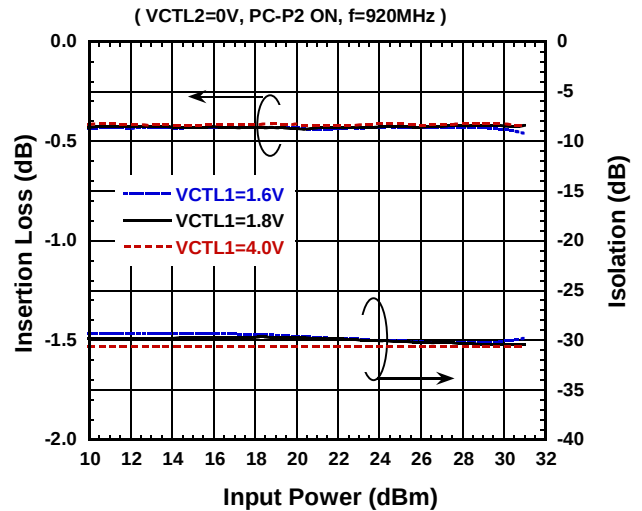
Output Power, ICTL vs Input Power



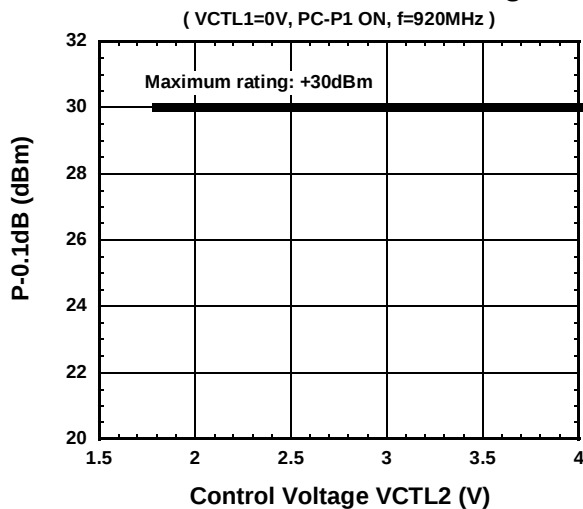
Insertion Loss, Isolation vs Input Power



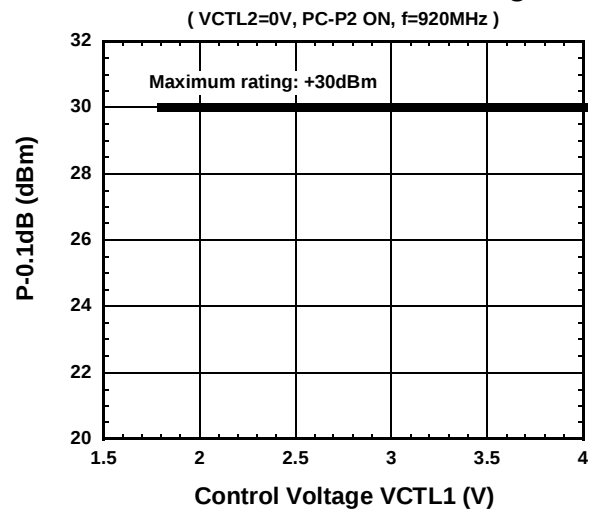
Insertion Loss, Isolation vs Input Power



P-0.1dB vs Control Voltage

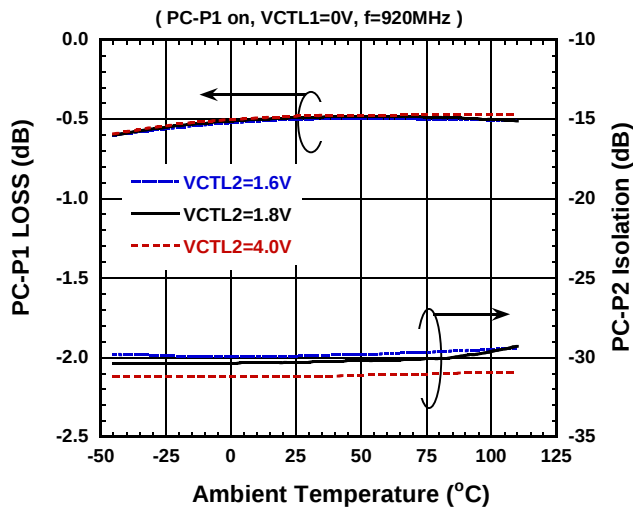


P-0.1dB vs Control Voltage

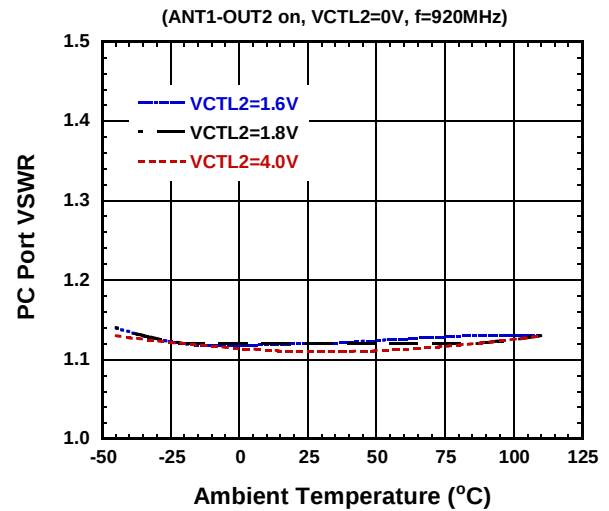


■ ELECTRICAL CHARACTERISTICS

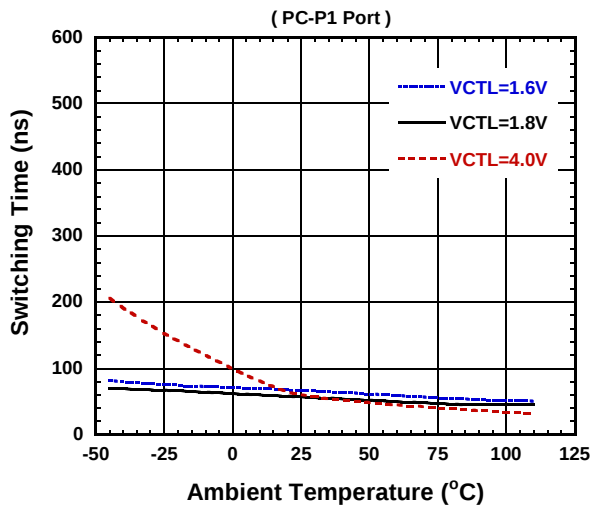
LOSS, Isolation vs Temperature



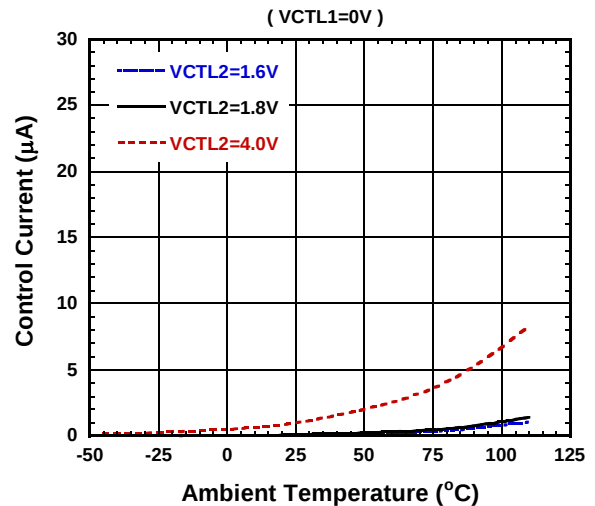
VSWR vs Temperature



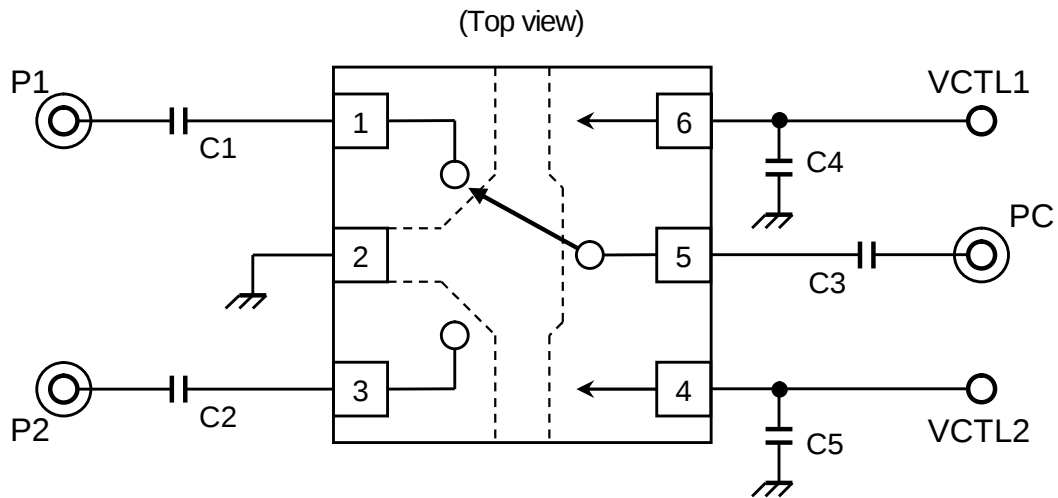
Switching Time vs Temperature



Control Current vs Temperature



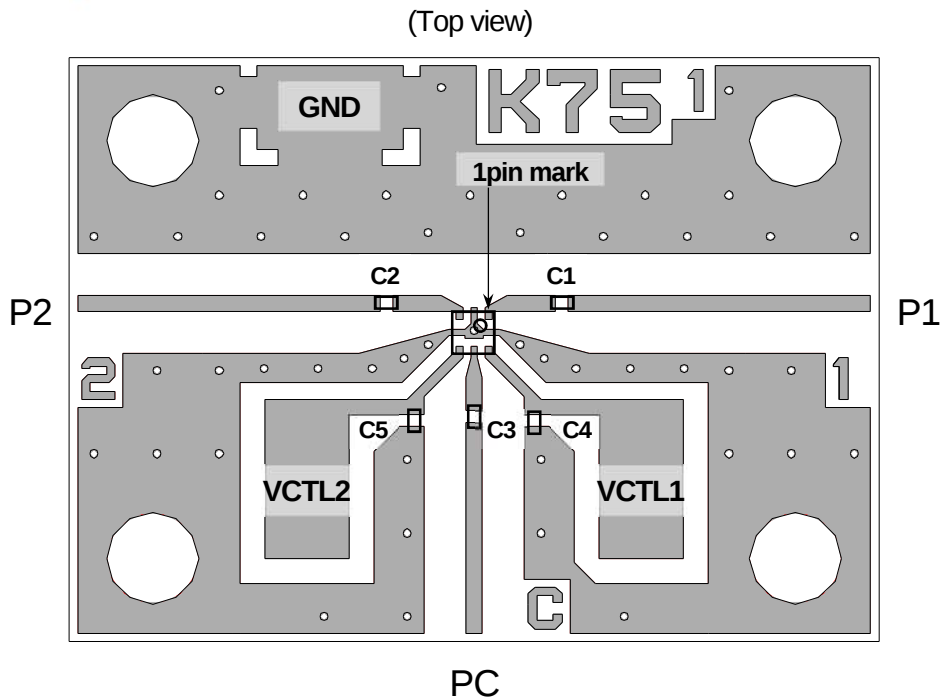
■ APPLICATION CIRCUIT



■ PARTS LIST

Part ID	Value	Notes
C1 to C3	1000 pF	MURATA (GRM03)
C4 to C5	10 pF	MURATA (GRM03)

■ EVALUATION BOARD



Losses of PCB and connectors, $T_a = +25^\circ\text{C}$

Frequency (MHz)	Loss (dB)
920	0.22

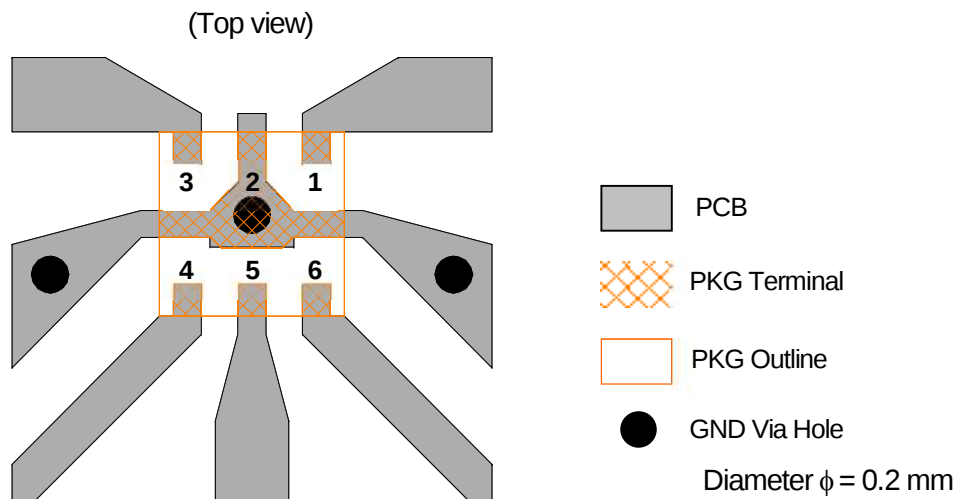
PCB: FR-4

$t = 0.2 \text{ mm}$

MICROSTRIP LINE WIDTH: 0.4 mm ($Z_0 = 50 \Omega$)

PCB SIZE: $19.4 \times 14.0 \text{ mm}$

■ PCB LAYOUT GUIDELINE

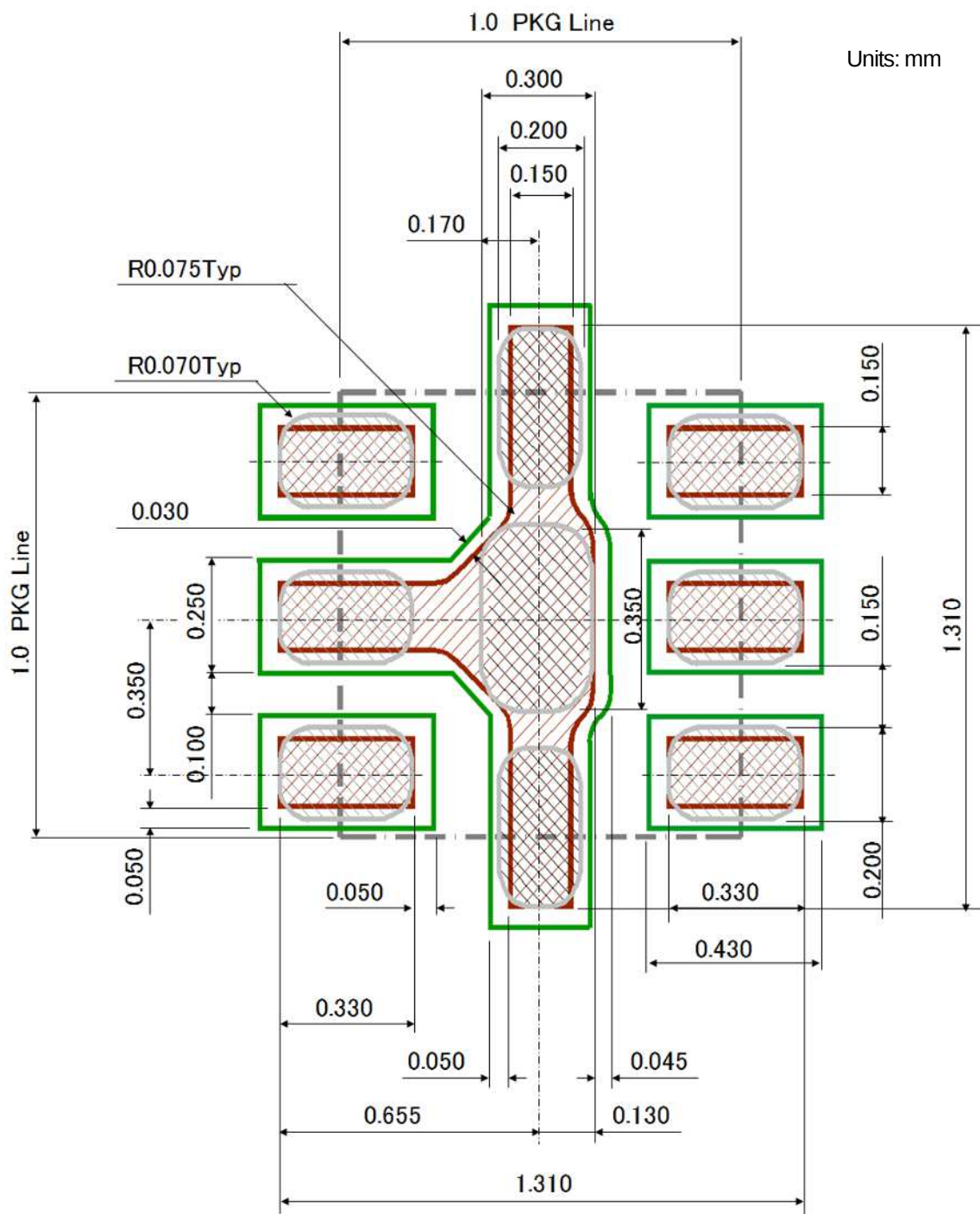


■ PRECAUTIONS

- [1] The DC blocking capacitors (C1, C2, C3) should be placed at RF terminals. Please choose appropriate capacitance value at the application frequency.
- [2] For avoiding the degradation of RF performance, the bypass capacitors (C4, C5) should be placed as close as possible to VCTL terminals.
- [3] For good RF performance, exposed pad should be connected to PCB ground plane of substrate, and through-holes should be placed near the IC.

PKG: 1.0 mm x 1.0 mm
Pin pitch: 0.35 mm

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



[illegible]

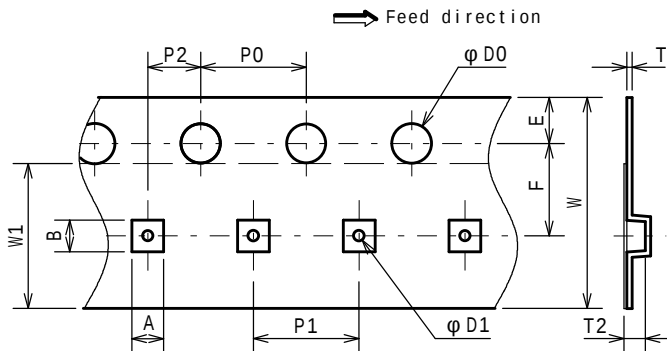
SUBSTRATE MATERIAL : Copper
TERMINAL FINISH : Ni/Pd/Au plating
MOLD MATERIAL : Epoxy resin
MASS (TYP.) : 1.2 (mg)

UNIT : mm

■ PACKING SPECIFICATION (DFN6-75)

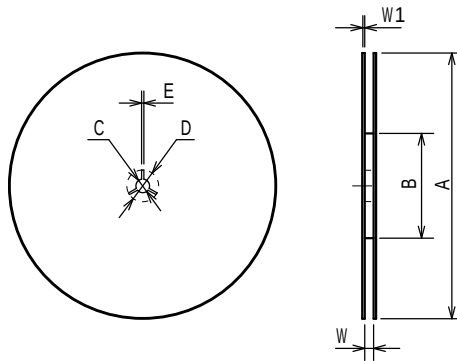
TAPING DIMENSIONS

Units: mm



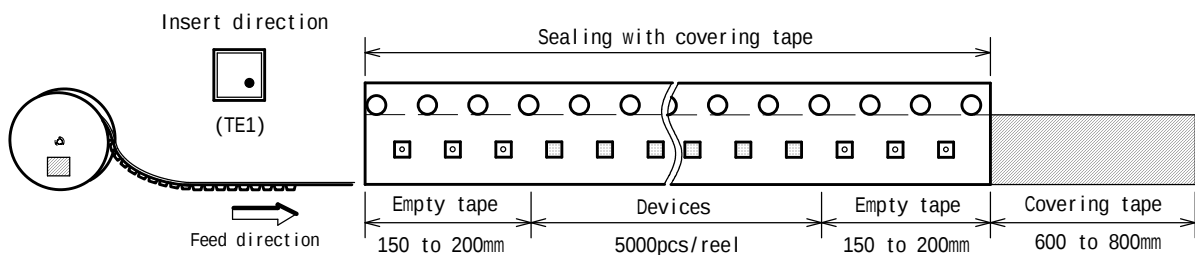
SYMBOL	DIMENSION	REMARKS
A	$1.19^{+0.04}_{-0.01}$	BOTTOM DIMENSION
B	$1.19^{+0.04}_{-0.01}$	BOTTOM DIMENSION
D0	$1.5^{+0.1}_{-0}$	
D1	0.5 ± 0.05	
E	1.75 ± 0.1	
F	3.5 ± 0.05	
P0	4.0 ± 0.1	
P1	4.0 ± 0.1	
P2	2.0 ± 0.05	
T	0.18 ± 0.05	
T2	0.69 ± 0.1	
W	8.0 ± 0.1	
W1	5.5 ± 0.1	THICKNESS 60 μ max

REEL DIMENSIONS

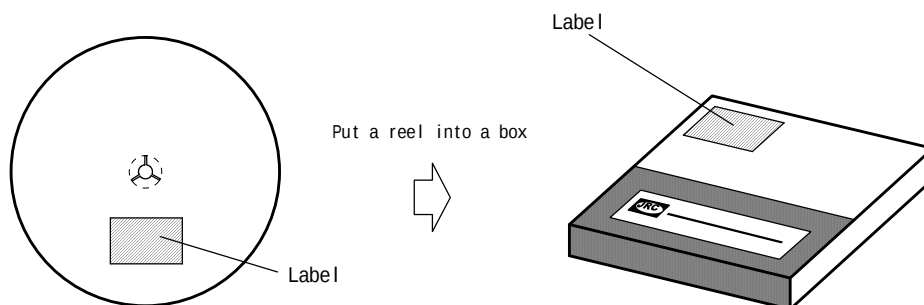


SYMBOL	DIMENSION
A	$\phi 180^{+0}_{-3}$
B	$\phi 60^{+1}_{-0}$
C	$\phi 13 \pm 0.2$
D	$\phi 21 \pm 0.8$
E	2 ± 0.5
W	9 ± 0.3
W1	1.2

TAPING STATE



PACKING STATE



[CAUTION]

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