

DPDT SWITCH GaAs MMIC

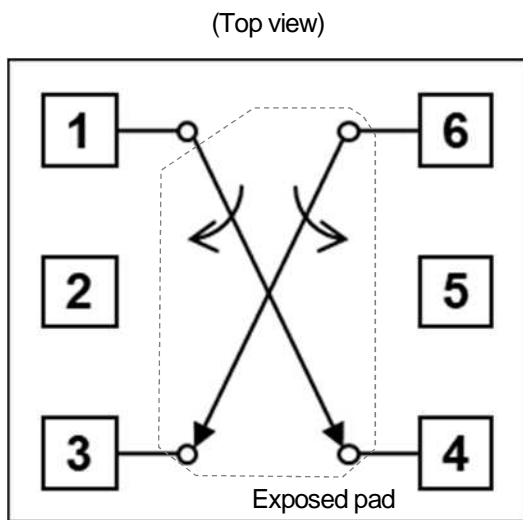
FEATURES

- Low control voltage 1.8V min.
- Low current consumption 0.1μA typ.
- Low insertion loss 0.45dB typ. @f=920MHz
- High isolation 30dB typ. @f=920MHz
- $P_{-0.1dB}$ +30dBm typ. @f=920MHz
- Small package 1.6 x 1.6mm, t=0.397mm
- RoHS compliant and Halogen Free, MSL1

APPLICATION

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

BLOCK DIAGRAM (ESON6-G1)



FUNCTIONAL DESCRIPTION

“H”= $V_{CTL(H)}$, “L”= $V_{CTL(L)}$

通過経路	VCTL1	VCTL2
ANT1-OUT2 ANT2-OUT1	H	L
ANT1-OUT1 ANT2-OUT2	L	H

GENERAL DESCRIPTION

The NJG1813KG1 is a 2bit control DPDT switch IC suited for LPWA applications.

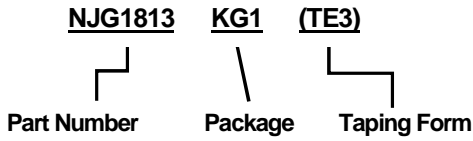
The NJG1813KG1 is compatible with 1.8 V low control voltage and features low current consumption important for LPWA applications.

The small and thin ESON6-G1 package is adopted.

PIN CONFIGURATION

PIN NO.	SYMBOL	DESCRIPTION
1	ANT2	RF terminal
2	VCTL2	Control signal input terminal
3	OUT2	RF terminal
4	OUT1	RF terminal
5	VCTL1	Control signal input terminal
6	ANT1	RF terminal
Exposed pad	GND	Ground terminal

■ PRODUCT NAME INFORMATION



■ ORDERING INFORMATION

PART NUMBER	PACKAGE OUTLINE	RoHS	HALOGEN-FREE	TERMINAL FINISH	MARKING	WEIGHT (mg)	MOQ (pcs.)
NJG1813KG1	ESON6-G1	Yes	Yes	Sn-Bi	1813	3.5	3,000

■ ABSOLUTE MAXIMUM RATINGS

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

PARAMETER	SYMBOL	RATINGS	UNIT
Control Voltage	V_{CTL}	4.5	V
RF Input Power	P_{IN}	+33	dBm
Power Dissipation ⁽¹⁾	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): Mounted on four-layer FR4 PCB with through-hole (101.5 × 114.5 mm), $T_j = 150^{\circ}\text{C}$

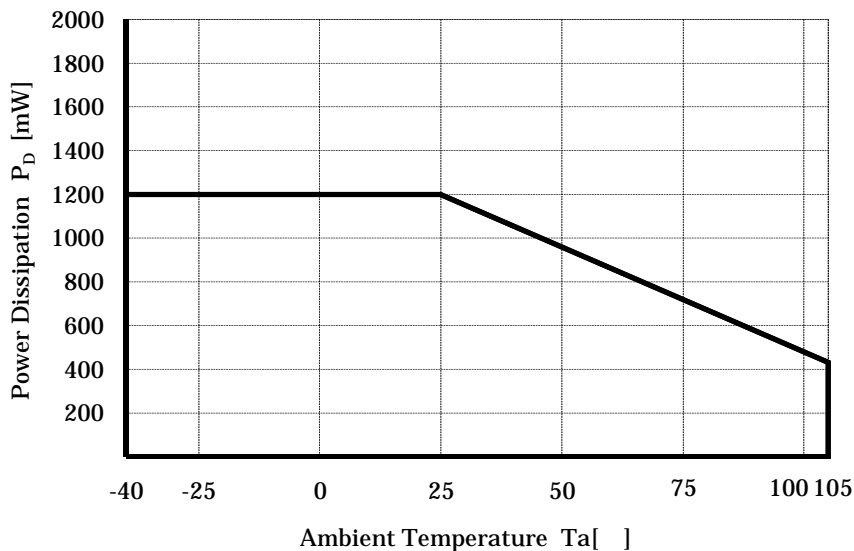
■ POWER DISSIPATION VS.AMBIENT TEMPERATURE

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

(Please note the surface mount package has a 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 PCB



■ ELECTRICAL CHARACTERISTICS (DC CHARACTERISTICS)

$V_{CTL(H)}=3.0V$, $V_{CTL(L)}=0V$, $T_a=25^{\circ}C$, $Z_s=Z_l=50\Omega$, with application circuit

PARAMETER	SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Control Voltage (HIGH)	$V_{CTL(H)}$		1.8	3.0	4.0	V
Control Voltage (LOW)	$V_{CTL(L)}$		-0.2	-	0.2	V
Control Current	I_{CTL}	RF OFF, $V_{CTL(H)}=3.0V$, $V_{CTL(L)}=0V$	-	0.1	2.5	μA

■ ELECTRICAL CHARACTERISTICS (RF CHARACTERISTICS)

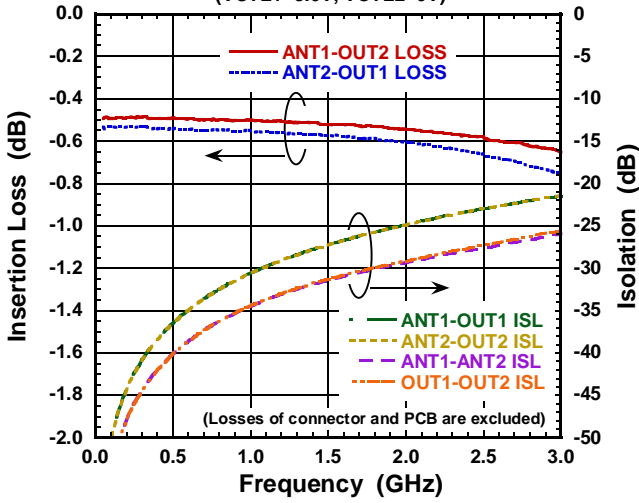
$V_{CTL(H)}=3.0V$, $V_{CTL(L)}=0V$, $T_a=25^{\circ}C$, $Z_s=Z_l=50\Omega$, with application circuit

PARAMETER	SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Insertion loss	LOSS	f=920MHz	-	0.45	0.68	dB
Isolation1	ISL1	f=920MHz, ANT1/2 to OUT1/2	26	30	-	dB
Isolation2	ISL2	f=920MHz, ANT1 to ANT2, OUT1 to OUT2	26	30	-	dB
Input power at 0.1dB compression point	$P_{-0.1dB}$	f=920MHz	+27	+30	-	dBm
VSWR	VSWR	f=920MHz	-	1.1	1.5	-
Switching time	T_{SW}	50% VCTL to 10%/90% RF	-	100	300	ns

ELECTRICAL CHARACTERISTICS

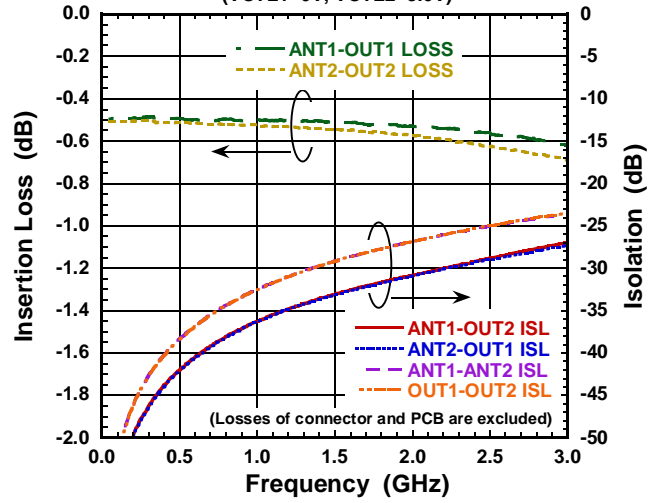
Insertion Loss vs Frequency

(VCTL1=3.0V, VCTL2=0V)



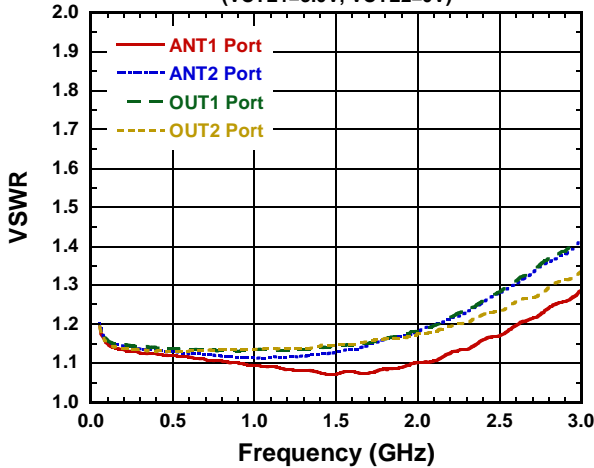
Insertion Loss vs Frequency

(VCTL1=0V, VCTL2=3.0V)



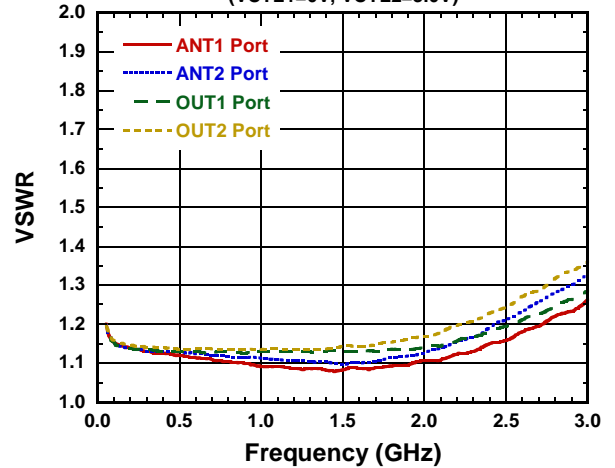
VSWR vs Frequency

(VCTL1=3.0V, VCTL2=0V)



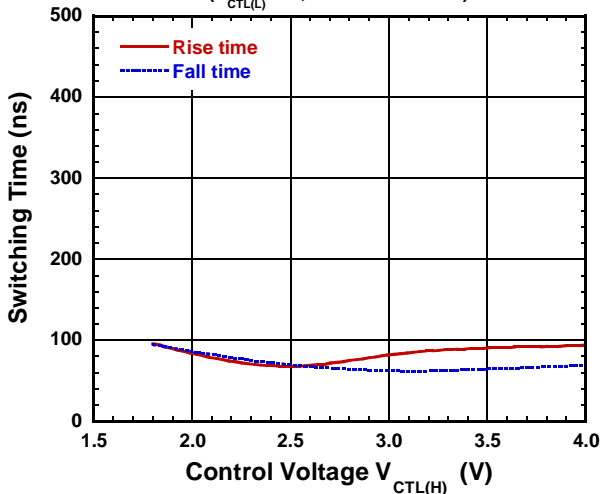
VSWR vs Frequency

(VCTL1=0V, VCTL2=3.0V)



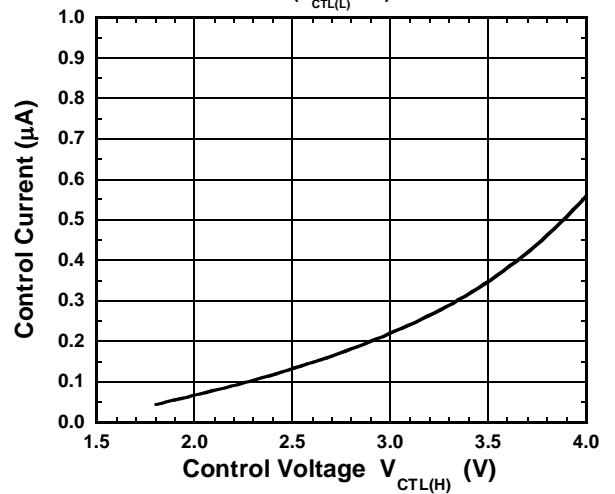
Switching Time vs Control Voltage

(V_{CTL(L)}=0V, ANT1-OUT2 Port)



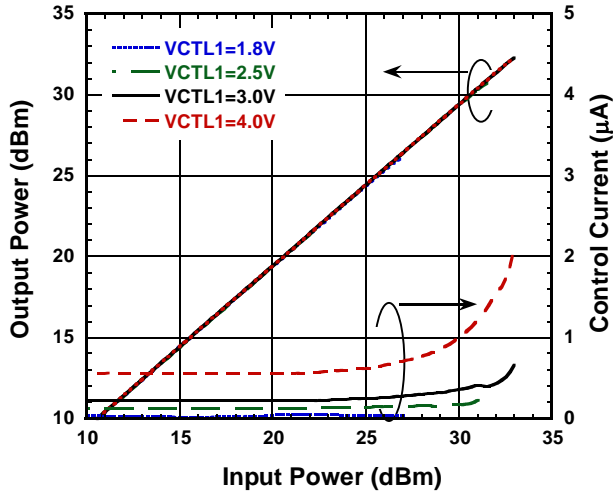
Control Current vs Control Voltage

(V_{CTL(L)}=0V)

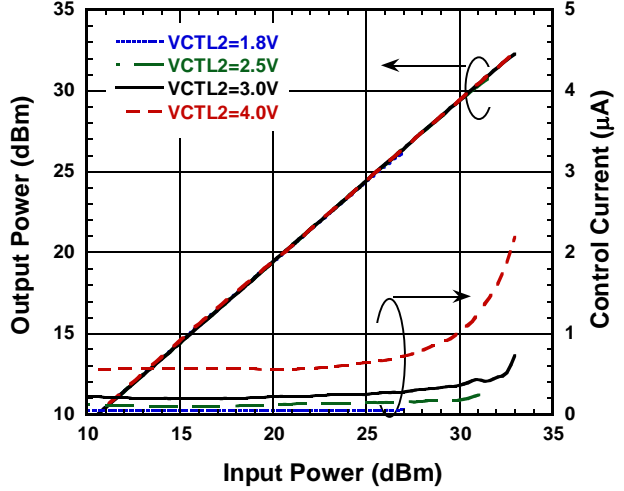


■ ELECTRICAL CHARACTERISTICS

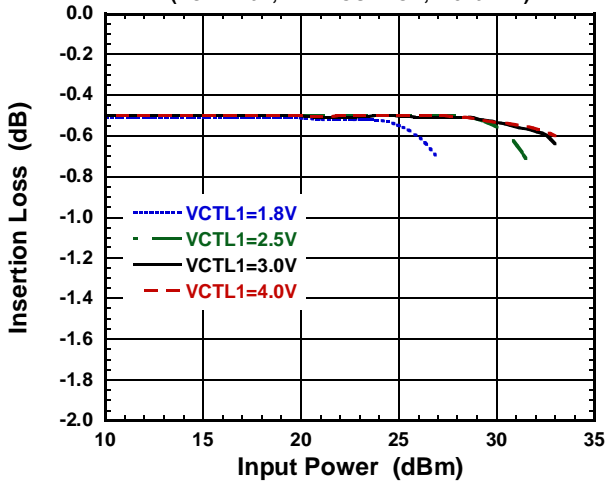
Output Power, Control Current vs Input Power
(VCTL2=0V, ANT1-OUT2 ON, f=920MHz)



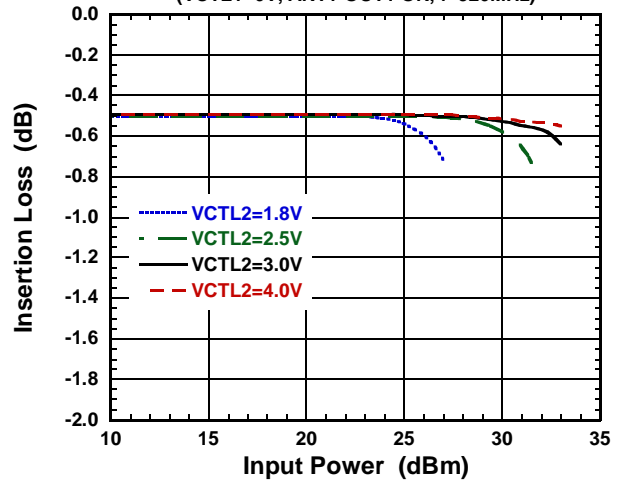
Output Power, Control Current vs Input Power
(VCTL1=0V, ANT1-OUT1 ON, f=920MHz)



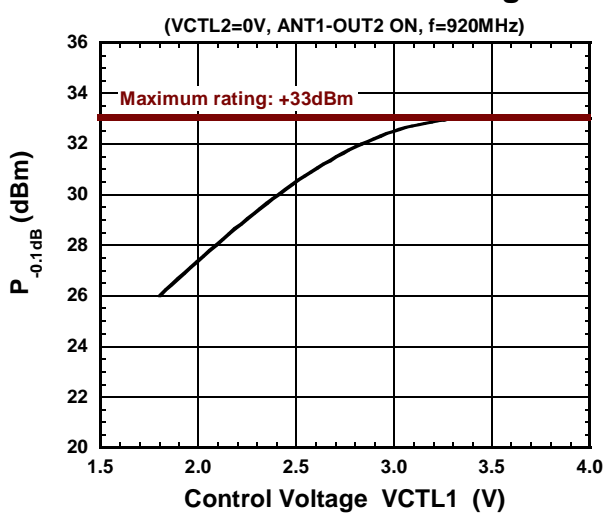
Insertion Loss vs Input Power
(VCTL2=0V, ANT1-OUT2 ON, f=920MHz)



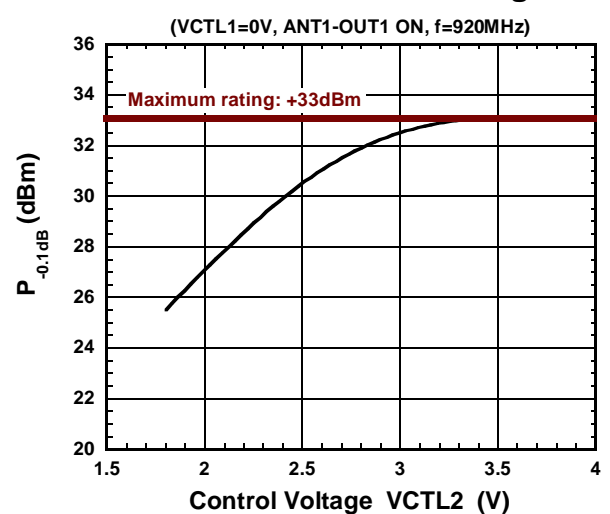
Insertion Loss vs Input Power
(VCTL1=0V, ANT1-OUT1 ON, f=920MHz)



P_{-0.1dB} vs Control Voltage
(VCTL2=0V, ANT1-OUT2 ON, f=920MHz)



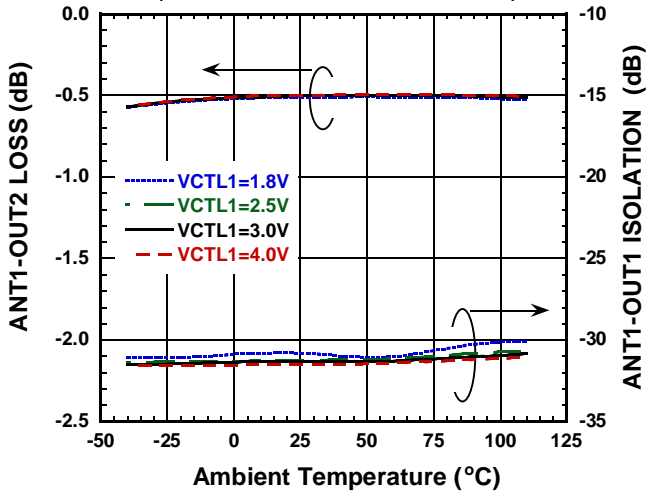
P_{-0.1dB} vs Control Voltage
(VCTL1=0V, ANT1-OUT1 ON, f=920MHz)



ELECTRICAL CHARACTERISTICS

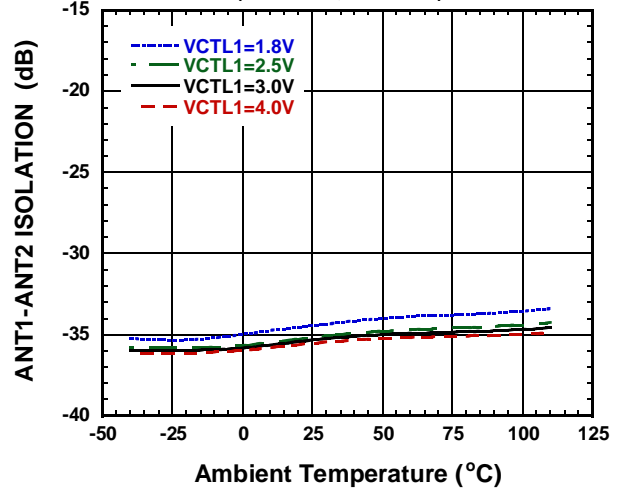
LOSS, ISL1 vs Temperature

(VCTL2=0V, ANT1-OUT2 ON, f=920MHz)



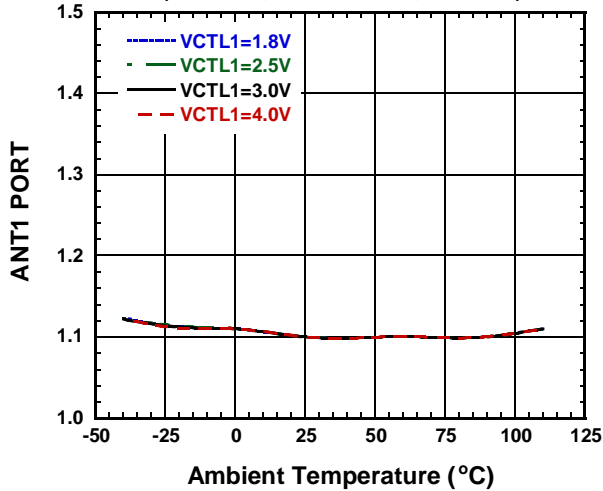
ISL2 vs Temperature

(VCTL2=0V, f=920MHz)



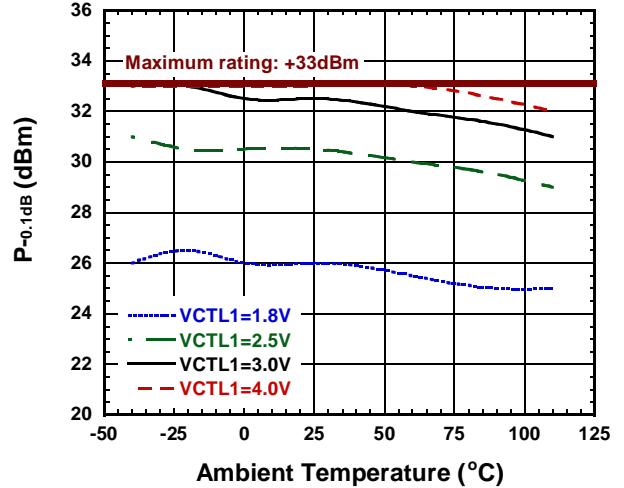
VSWR vs Temperature

(VCTL2=0V, ANT1-OUT2 ON, f=920MHz)



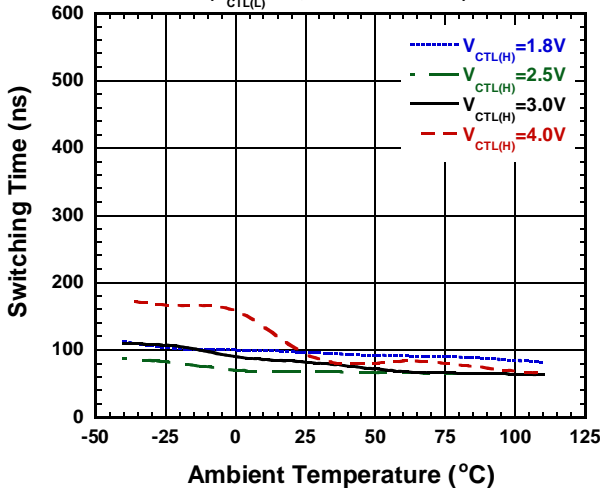
P_{-0.1dB} vs Temperature

(VCTL2=0V, ANT1-OUT2 ON, f=920MHz)



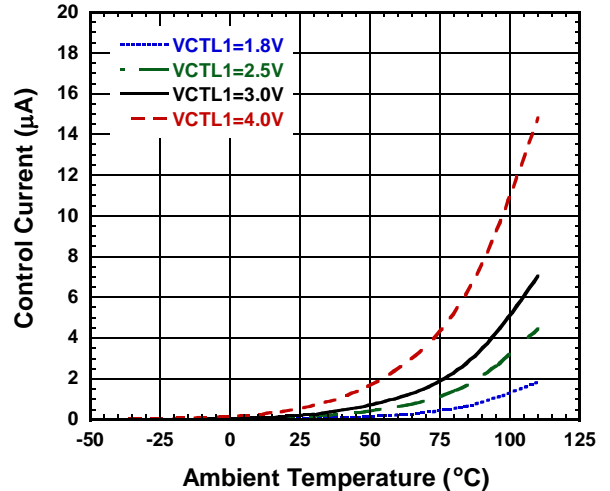
Switching Time(rise) vs Temperature

(V_{CTL(L)}=0V, ANT1-OUT2 Port)

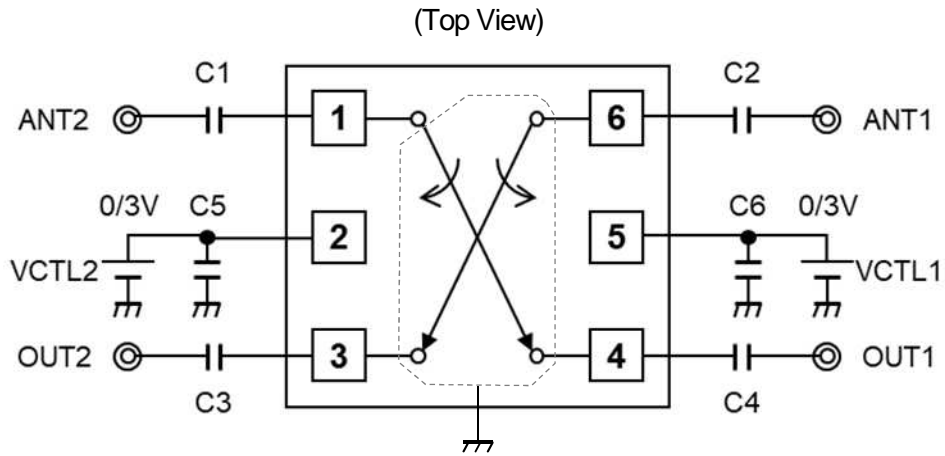


Control Current vs Temperature

(VCTL2=0V)



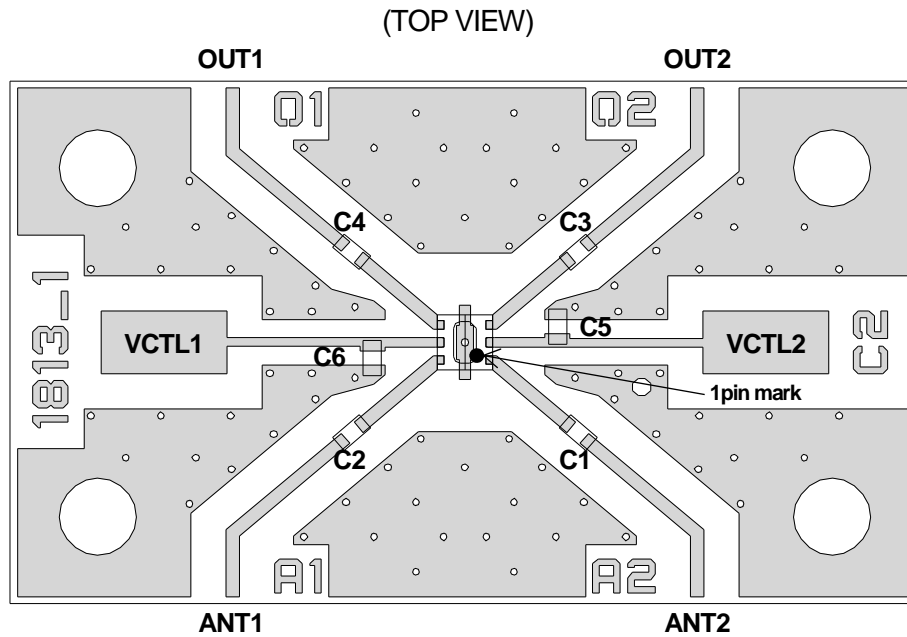
■ APPLICATION CIRCUIT



■ PARTS LIST

Part ID	Value	Notes
C1 to C4	1000pF	MURATA (GRM15)
C5 to C6	10pF	MURATA (GRM15)

■ EVALUATION BOARD



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

Frequency (MHz)	Loss (dB)
420	0.21
920	0.29
2000	0.48
2400	0.53
2700	0.56

PCB: FR-4
 $t=0.2\text{mm}$
 MICROSTRIP LINE WIDTH: 0.4mm ($Z_0=50\Omega$)
 PCB SIZE: $26.0 \times 15.0\text{mm}$

■ PRECAUTIONS

- [1] The DC blocking capacitors (C1, C2, C3, C4) 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 (C5, C6) 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.

RECOMMENDED FOOTPRINT PATTERN (ESON6-G1)

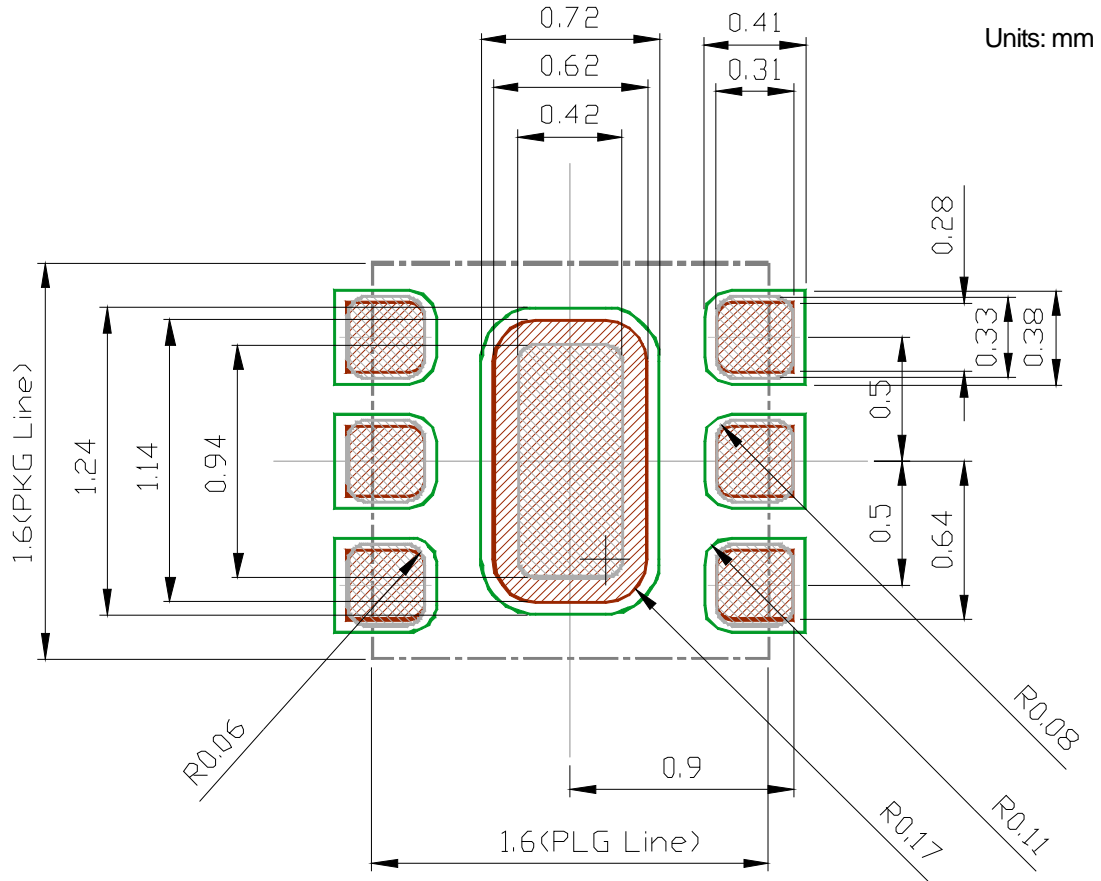
PKG: 1.6 mm x 1.6 mm

Pin pitch: 0.5 mm

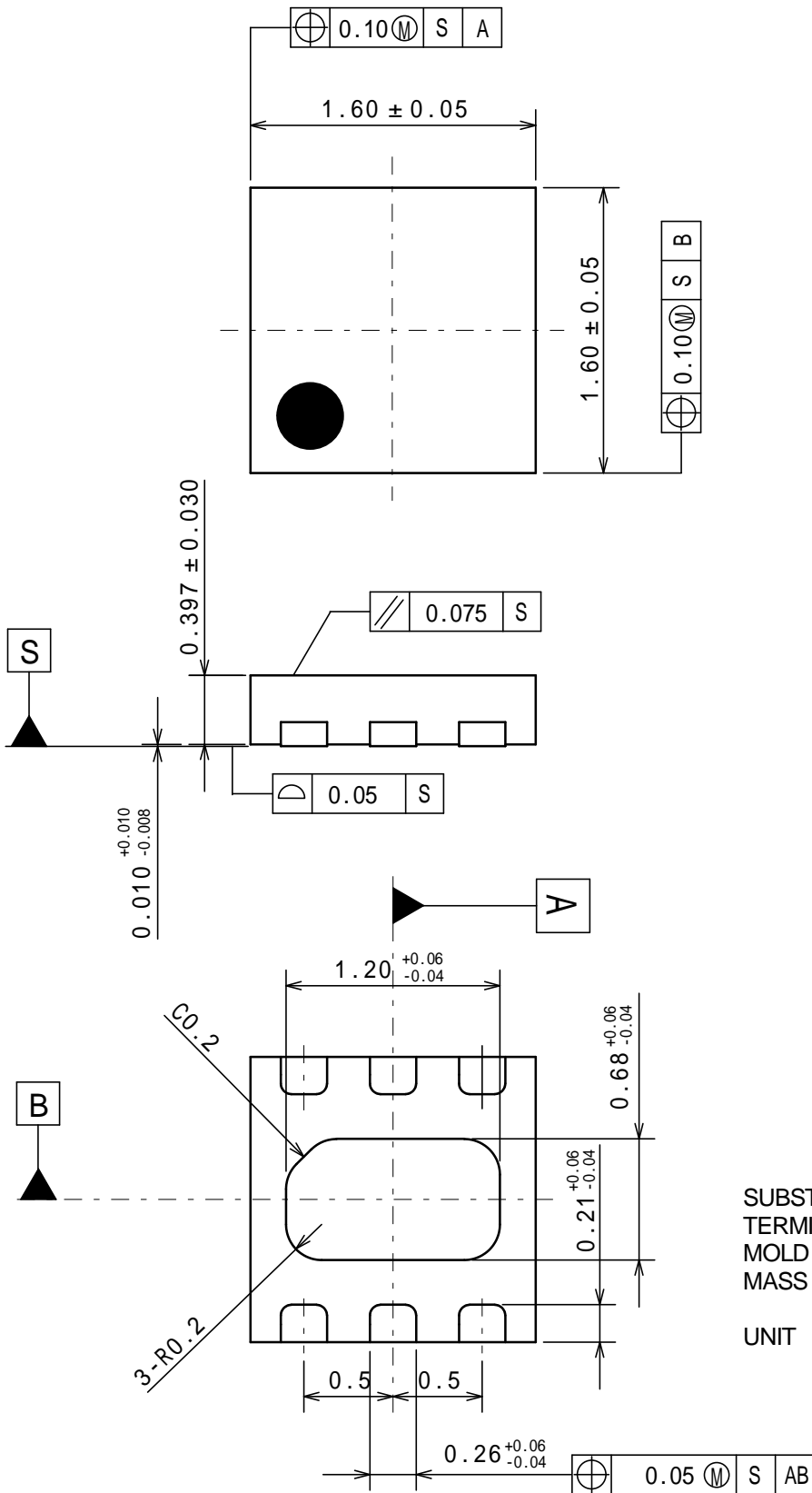
: Land

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

: Resist (Open area)



■ PACKAGE OUTLINE



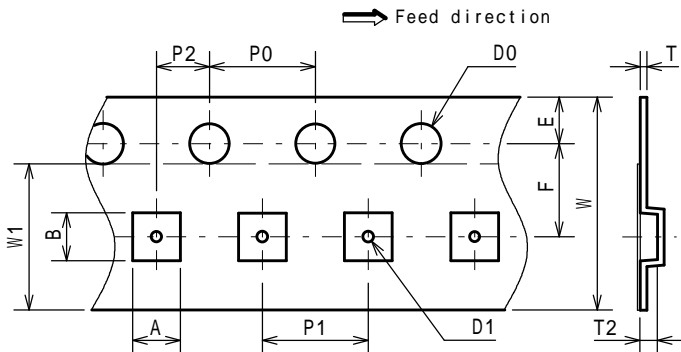
SUBSTRATE MATERIAL : Copper
 TERMINAL FINISH : Solder plating
 MOLD MATERIAL : Epoxy resin
 MASS (TYP.) : 3.5 (mg)

UNIT : mm

PACKING SPECIFICATION

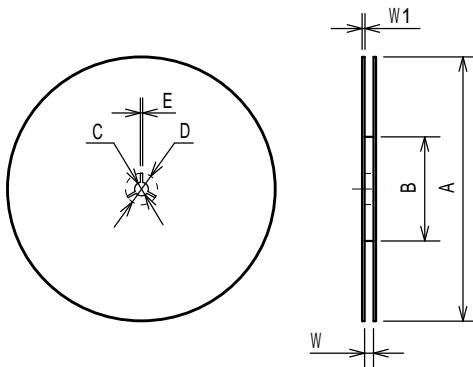
UNIT: mm

TAPING DIMENSION



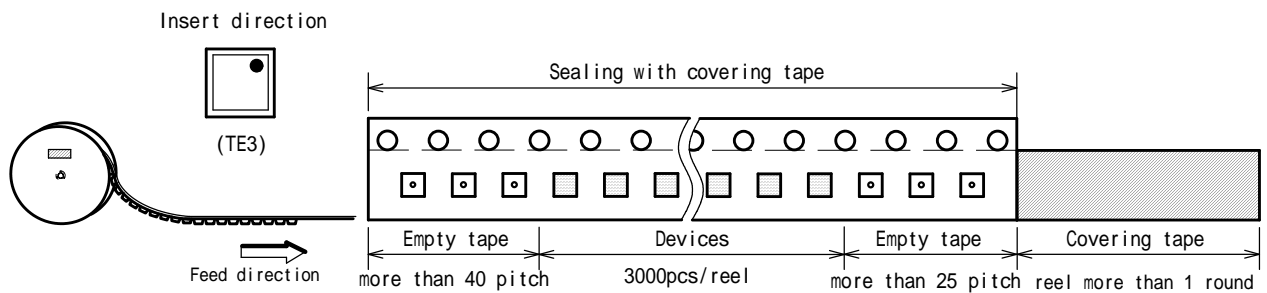
SYMBOL	DIMENSION	REMARKS
A	1.85 ± 0.05	BOTTOM DIMENSION
B	1.85 ± 0.05	BOTTOM DIMENSION
D0	1.5 ^{+0.1} ₀	
D1	0.5 ± 0.1	
E	1.75 ± 0.1	
F	3.5 ± 0.05	
P0	4.0 ± 0.1	
P1	4.0 ± 0.1	
P2	2.0 ± 0.05	
T	0.25 ± 0.05	
T2	0.65 ± 0.05	
W	8.0 ± 0.2	
W1	5.5	THICKNESS 0.1max

REEL DIMENSION

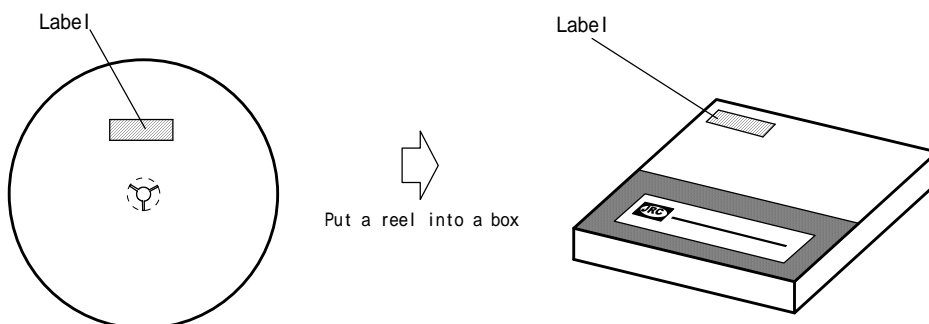


SYMBOL	DIMENSION
A	180 ⁰ _{-1.5}
B	60 ⁺¹ ₀
C	13 ± 0.2
D	21 ± 0.8
E	2 ± 0.5
W	9 ^{+0.3} ₀
W1	1.2

TAPING STATE



PACKING STATE



[CAUTION]

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