NEC

GaAs INTEGRATED CIRCUIT
μPG2160T5K

L, S-BAND SPDT SWITCH

DESCRIPTION

The μPG2160T5K is a GaAs MMIC for L, S-band SPDT (Single Pole Double Throw) switch which was developed for mobile phone and another L, S-band applications.

This device can operate frequency from 0.5 to 3.0 GHz, having the low insertion loss and high isolation.

This device is housed in a 6-pin plastic TSSON (Thin Shrink Small Out-line Non-leaded) package. And this package is able to high-density surface mounting.

FEATURES

- Supply voltage : V_{DD} = 2.4 to 2.8 V (2.6 V TYP.)
- Switch control voltage : $V_{cont (H)}$ = 2.4 to V_{DD} (2.6 V TYP.)
  : $V_{cont (L)}$ = −0.2 to 0.2 V (0 V TYP.)
- Low insertion loss : $L_{ins}1$ = 0.30 dB TYP. @ f = 0.5 to 1.0 GHz, V_{DD} = 2.6 V, $V_{cont (H)}$ = 2.6 V, $V_{cont (L)}$ = 0 V
  : $L_{ins}2$ = 0.35 dB TYP. @ f = 1.0 to 2.0 GHz, V_{DD} = 2.6 V, $V_{cont (H)}$ = 2.6 V, $V_{cont (L)}$ = 0 V
  : $L_{ins}3$ = 0.40 dB TYP. @ f = 2.0 to 2.5 GHz, V_{DD} = 2.6 V, $V_{cont (H)}$ = 2.6 V, $V_{cont (L)}$ = 0 V
  : $L_{ins}4$ = 0.50 dB TYP. @ f = 2.5 to 3.0 GHz, V_{DD} = 2.6 V, $V_{cont (H)}$ = 2.6 V, $V_{cont (L)}$ = 0 V
- High isolation : $ISL1$ = 25 dB TYP. @ f = 0.5 to 1.0 GHz, V_{DD} = 2.6 V, $V_{cont (H)}$ = 2.6 V, $V_{cont (L)}$ = 0 V
  : $ISL2$ = 18 dB TYP. @ f = 1.0 to 2.0 GHz, V_{DD} = 2.6 V, $V_{cont (H)}$ = 2.6 V, $V_{cont (L)}$ = 0 V
  : $ISL3$ = 17 dB TYP. @ f = 2.0 to 2.5 GHz, V_{DD} = 2.6 V, $V_{cont (H)}$ = 2.6 V, $V_{cont (L)}$ = 0 V
  : $ISL4$ = 13 dB TYP. @ f = 2.5 to 3.0 GHz, V_{DD} = 2.6 V, $V_{cont (H)}$ = 2.6 V, $V_{cont (L)}$ = 0 V
- Handling power : $P_{in (0.1 dB)}$ = +21.0 dBm TYP. @ f = 2.0/2.5 GHz, V_{DD} = 2.6 V, $V_{cont (H)}$ = 2.6 V, $V_{cont (L)}$ = 0 V
- High-density surface mounting : 6-pin plastic TSSON package ($1.0 \times 1.0 \times 0.37$ mm)

APPLICATIONS

- L, S-band digital cellular or cordless telephone
- W-LAN, WLL and Bluetooth™ etc.

ORDERING INFORMATION

| Part Number	Order Number	Package	Marking	Supplying Form
μPG2160T5K-E2	μPG2160T5K-E2-A	6-pin plastic TSSON (Pb-Free) **Note**	G4	• Embossed tape 8 mm wide • Pin 1, 6 face the perforation side of the tape • Qty 5 kpcs/reel

Note With regards to terminal solder (the solder contains lead) plated products (conventionally plated), contact your nearby sales office.

Remark To order evaluation samples, contact your nearby sales office.
Part number for sample order: μPG2160T5K

Caution Observe precautions when handling because these devices are sensitive to electrostatic discharge.

PIN CONNECTIONS AND INTERNAL BLOCK DIAGRAM
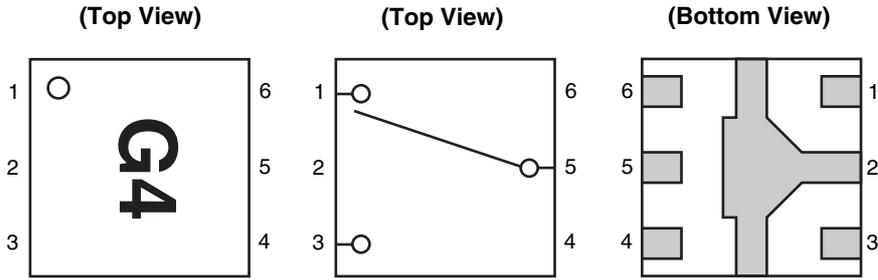
Pin No.	Pin Name
1	OUTPUT1
2	GND
3	OUTPUT2
4	V_{cont}
5	INPUT
6	V_{DD}

TRUTH TABLE

V_{cont}	INPUT−OUTPUT1	INPUT−OUTPUT2
High	OFF	ON
Low	ON	OFF

ABSOLUTE MAXIMUM RATINGS (T_A = +25°C, unless otherwise specified)

Parameter	Symbol	Ratings	Unit
Supply Voltage	V_{DD}	+6.0	V
Switch Control Voltage	V_{cont}	+6.0	V
Input Power	P_{in}	+26	dBm
Operating Ambient Temperature	T_A	−45 to +85	°C
Storage Temperature	T_{stg}	−55 to +135	°C

RECOMMENDED OPERATING RANGE (T_A = +25°C, unless otherwise specified)

Parameter	Symbol	MIN.	TYP.	MAX.	Unit
Supply Voltage [Note]	V_{DD}	2.4	2.6	2.8	V
Switch Control Voltage (H) [Note]	$V_{cont (H)}$	2.4	2.6	V_{DD}	V
Switch Control Voltage (L)	$V_{cont (L)}$	−0.2	0	0.2	V

Note $V_{cont (H)} \leq V_{DD}$

ELECTRICAL CHARACTERISTICS

(T_A = +25°C, V_{DD} = 2.6 V, $V_{cont (H)}$ = 2.6 V, $V_{cont (L)}$ = 0 V, DC cut capacitors = 56 pF, unless otherwise specified)

Parameter	Symbol	Test Conditions	MIN.	TYP.	MAX.	Unit
Insertion Loss 1	$L_{ins}1$	f = 0.5 to 1.0 GHz	–	0.30	0.45	dB
Insertion Loss 2	$L_{ins}2$	f = 1.0 to 2.0 GHz	–	0.35	0.50	
Insertion Loss 3	$L_{ins}3$	f = 2.0 to 2.5 GHz	–	0.40	0.55	
Insertion Loss 4	$L_{ins}4$	f = 2.5 to 3.0 GHz	–	0.50	0.65	
Isolation 1	ISL1	f = 0.5 to 1.0 GHz	22	25	–	dB
Isolation 2	ISL2	f = 1.0 to 2.0 GHz	15	18	–	
Isolation 3	ISL3	f = 2.0 to 2.5 GHz	14	17	–	
Isolation 4	ISL4	f = 2.5 to 3.0 GHz	10	13	–	
Input Return Loss	RL_{in}	f = 0.5 to 3.0 GHz	15	20	–	dB
Output Return Loss	RL_{out}	f = 0.5 to 3.0 GHz	15	20	–	dB
0.1 dB Loss Compression Input Power [Note]	$P_{in (0.1 dB)}$	f = 2.0/2.5 GHz	+18.0	+21.0	–	dBm
2nd Harmonics	$2f_0$	f = 2.0/2.5 GHz, P_{in} = +10 dBm	65	75	–	dBc
3rd Harmonics	$3f_0$	f = 2.0/2.5 GHz, P_{in} = +10 dBm	65	75	–	dBc
Supply Current	I_{DD}	No signal	–	50	100	μA
Switch Control Current	I_{cont}		–	4	20	μA
Switch Control Speed	t_{SW}	50% CTL to 90/10% RF	–	150	–	ns

Note $P_{in (0.1 dB)}$ is measured the input power level when the insertion loss increases more 0.1 dB than that of linear range.

Caution   **This device is used it is necessary to use DC cut capacitors.**
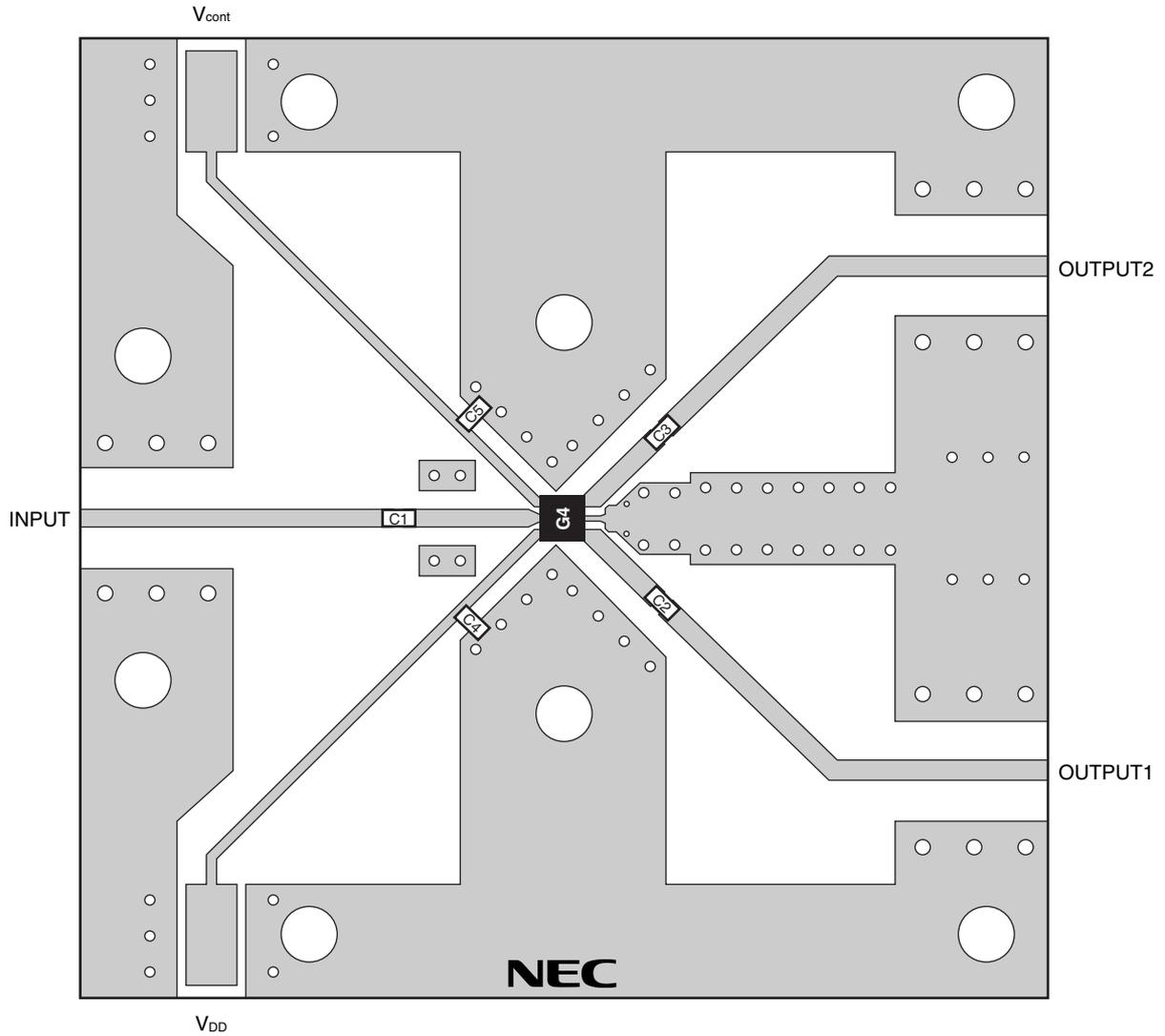
EVALUATION CIRCUIT
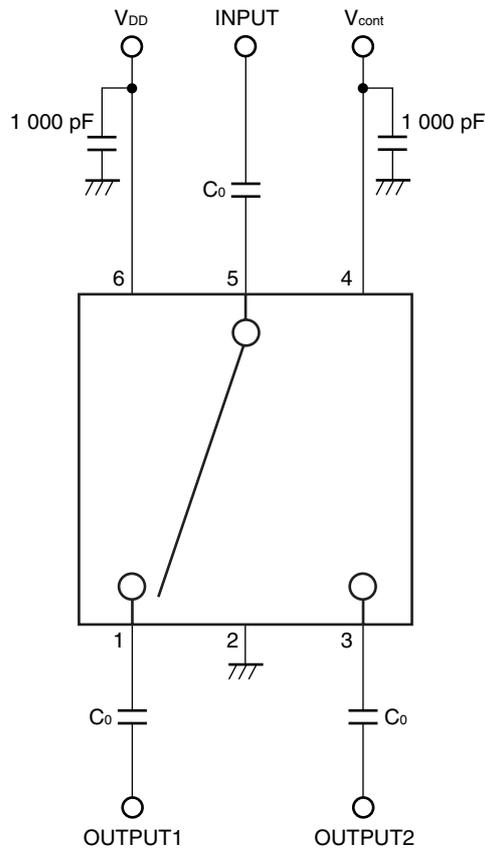
Remark C_0 : 56 pF

The application circuits and their parameters are for reference only and are not intended for use in actual design-ins.
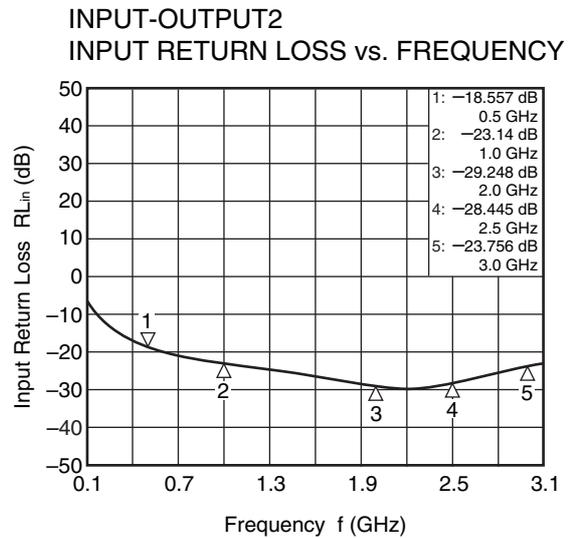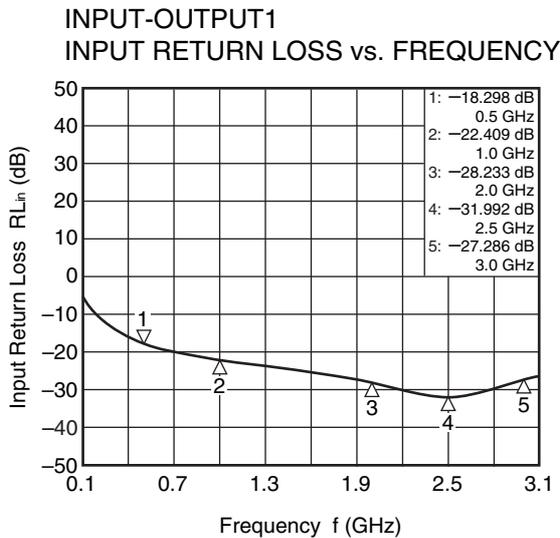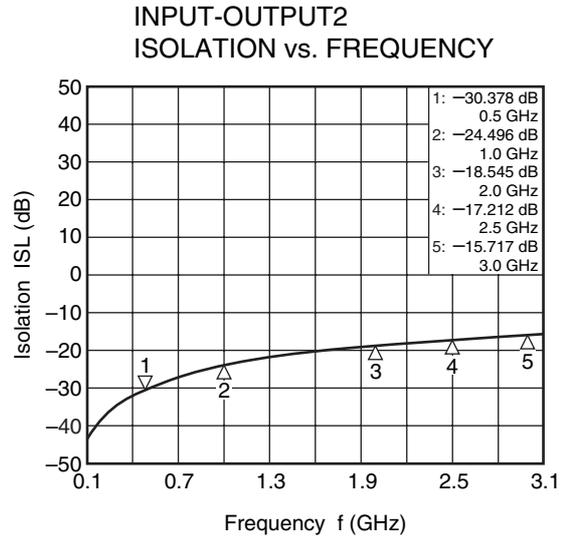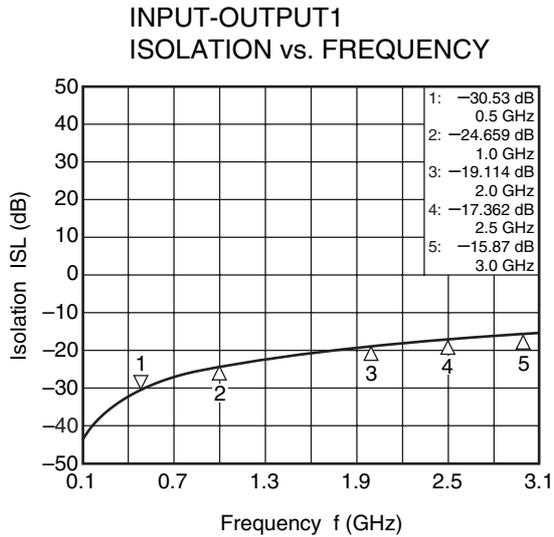
ILLUSTRATION OF THE TEST CIRCUIT ASSEMBLED ON EVALUATION BOARD

USING THE NEC EVALUATION BOARD

Symbol	Values
C1, C2, C3	56 pF
C4, C5	1 000 pF

TYPICAL CHARACTERISTICS (T$_A$ = +25°C, V$_{DD}$ = 2.6 V, V$_{cont\ (H)}$ = 2.6 V, V$_{cont\ (L)}$ = 0 V, DC cut capacitors = 56 pF, using test fixture, unless otherwise specified)

INPUT-OUTPUT1
INSERTION LOSS vs. FREQUENCY

1: −0.255 dB
   0.5 GHz
2: −0.305 dB
   1.0 GHz
3: −0.355 dB
   2.0 GHz
4: −0.408 dB
   2.5 GHz
5: −0.502 dB
   3.0 GHz

INPUT-OUTPUT2
INSERTION LOSS vs. FREQUENCY

1: −0.255 dB
   0.5 GHz
2: −0.304 dB
   1.0 GHz
3: −0.354 dB
   2.0 GHz
4: −0.408 dB
   2.5 GHz
5: −0.506 dB
   3.0 GHz

INPUT-OUTPUT1
ISOLATION vs. FREQUENCY

1: −30.53 dB
   0.5 GHz
2: −24.659 dB
   1.0 GHz
3: −19.114 dB
   2.0 GHz
4: −17.362 dB
   2.5 GHz
5: −15.87 dB
   3.0 GHz

INPUT-OUTPUT2
ISOLATION vs. FREQUENCY

1: −30.378 dB
   0.5 GHz
2: −24.496 dB
   1.0 GHz
3: −18.545 dB
   2.0 GHz
4: −17.212 dB
   2.5 GHz
5: −15.717 dB
   3.0 GHz

INPUT-OUTPUT1
INPUT RETURN LOSS vs. FREQUENCY

1: −18.298 dB
   0.5 GHz
2: −22.409 dB
   1.0 GHz
3: −28.233 dB
   2.0 GHz
4: −31.992 dB
   2.5 GHz
5: −27.286 dB
   3.0 GHz

INPUT-OUTPUT2
INPUT RETURN LOSS vs. FREQUENCY

1: −18.557 dB
   0.5 GHz
2: −23.14 dB
   1.0 GHz
3: −29.248 dB
   2.0 GHz
4: −28.445 dB
   2.5 GHz
5: −23.756 dB
   3.0 GHz

Remark The graphs indicate nominal characteristics.

INPUT-OUTPUT1
OUTPUT RETURN LOSS vs. FREQUENCY

1:	−18.38 dB
	0.5 GHz
2:	−22.911 dB
	1.0 GHz
3:	−28.715 dB
	2.0 GHz
4:	−30.049 dB
	2.5 GHz
5:	−25.211 dB
	3.0 GHz
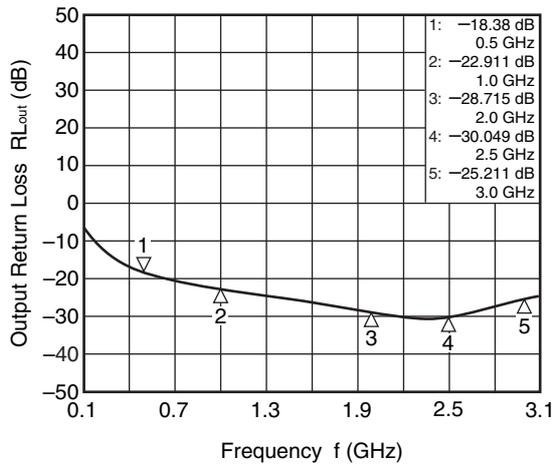
INPUT-OUTPUT2
OUTPUT RETURN LOSS vs. FREQUENCY

1:	−18.646 dB
	0.5 GHz
2:	−23.332 dB
	1.0 GHz
3:	−31.078 dB
	2.0 GHz
4:	−28.398 dB
	2.5 GHz
5:	−23.042 dB
	3.0 GHz
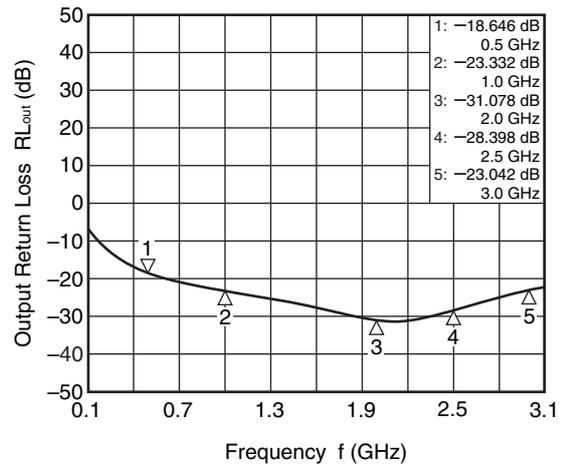
OUTPUT POWER vs. INPUT POWER

f = 2.0 GHz
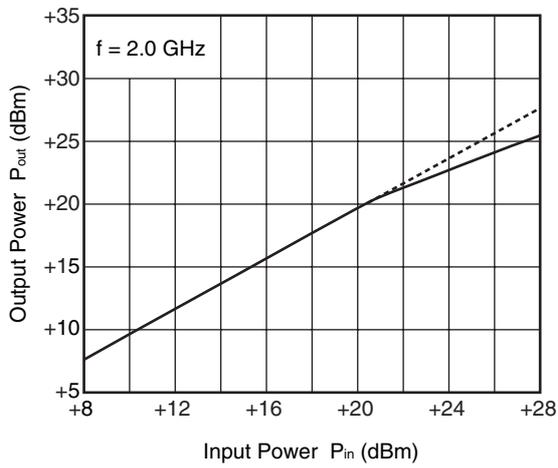
Remark The graphs indicate nominal characteristics.

MOUNTING PAD DIMENSIONS

6-PIN PLASTIC TSSON (UNIT: mm)
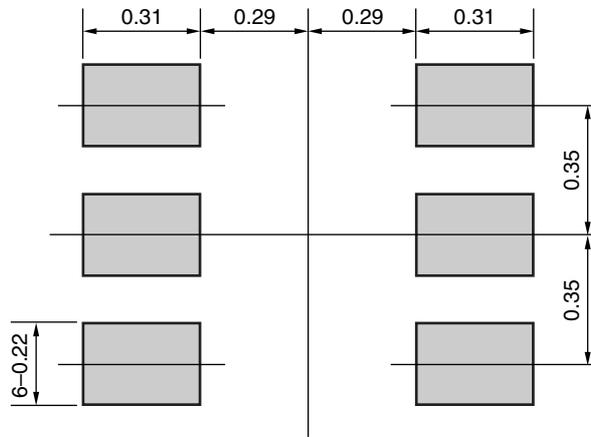
Remark The mounting pad layouts in this document are for reference only.

PACKAGE DIMENSIONS

6-PIN PLASTIC TSSON (UNIT: mm)

(Top View)
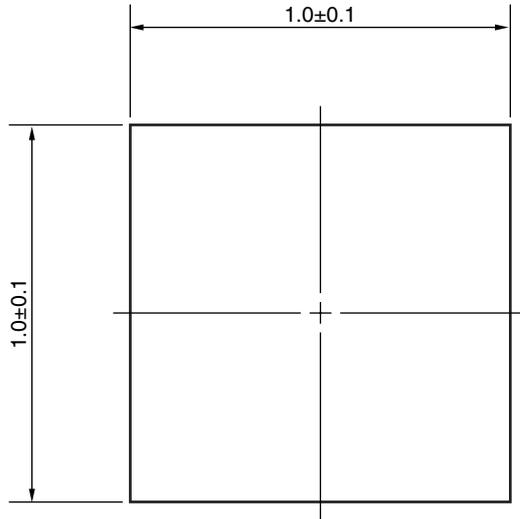
(Bottom View)
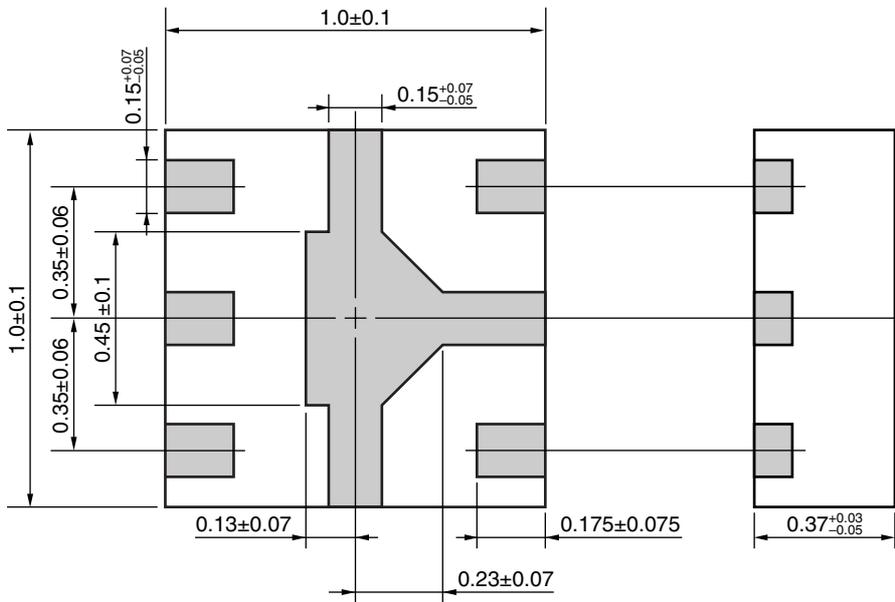
RECOMMENDED SOLDERING CONDITIONS

This product should be soldered and mounted under the following recommended conditions. For soldering methods and conditions other than those recommended below, contact your nearby sales office.

Soldering Method	Soldering Conditions		Condition Symbol
Infrared Reflow	Peak temperature (package surface temperature)	: 260°C or below	IR260
	Time at peak temperature	: 10 seconds or less	
	Time at temperature of 220°C or higher	: 60 seconds or less	
	Preheating time at 120 to 180°C	: 120±30 seconds	
	Maximum number of reflow processes	: 3 times	
	Maximum chlorine content of rosin flux (% mass)	: 0.2%(Wt.) or below	
Wave Soldering	Peak temperature (molten solder temperature)	: 260°C or below	WS260
	Time at peak temperature	: 10 seconds or less	
	Preheating temperature (package surface temperature)	: 120°C or below	
	Maximum number of flow processes	: 1 time	
	Maximum chlorine content of rosin flux (% mass)	: 0.2%(Wt.) or below	
Partial Heating	Peak temperature (terminal temperature)	: 350°C or below	HS350
	Soldering time (per side of device)	: 3 seconds or less	
	Maximum chlorine content of rosin flux (% mass)	: 0.2%(Wt.) or below	

Caution   Do not use different soldering methods together (except for partial heating).

Bluetooth is a trademark owned by Bluetooth SIG, Inc., U.S.A.

Caution GaAs Products	This product uses gallium arsenide (GaAs). GaAs vapor and powder are hazardous to human health if inhaled or ingested, so please observe the following points.
	• Follow related laws and ordinances when disposing of the product. If there are no applicable laws and/or ordinances, dispose of the product as recommended below.
	1. Commission a disposal company able to (with a license to) collect, transport and dispose of materials that contain arsenic and other such industrial waste materials.
	2. Exclude the product from general industrial waste and household garbage, and ensure that the product is controlled (as industrial waste subject to special control) up until final disposal.
	• Do not burn, destroy, cut, crush, or chemically dissolve the product.
	• Do not lick the product or in any way allow it to enter the mouth.