

### L, S-BAND SINGLE CONTROL SPDT SWITCH

#### DESCRIPTION

The  $\mu$ PG2160T5K is a GaAs MMIC for L, S-band SPDT (Single Pole Double Throw) switch which was developed for mobile phone and other L, S-band applications.

This device can operate frequency from 0.5 to 3.0 GHz, with 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 is suitable for 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 :  $L_{ins1} = 0.30$  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  
:  $L_{ins2} = 0.35$  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  
:  $L_{ins3} = 0.40$  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  
:  $L_{ins4} = 0.50$  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 :  $P_{in}(0.1\text{ dB}) = +21.0$  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
$\mu$ PG2160T5K-E2	$\mu$ PG2160T5K-E2-A	6-pin plastic TSSON (Pb-Free) <sup>Note</sup>	G4	<ul style="list-style-type: none"> <li>• Embossed tape 8 mm wide</li> <li>• Pin 1, 6 face the perforation side of the tape</li> <li>• Qty 5 kpcs/reel</li> </ul>

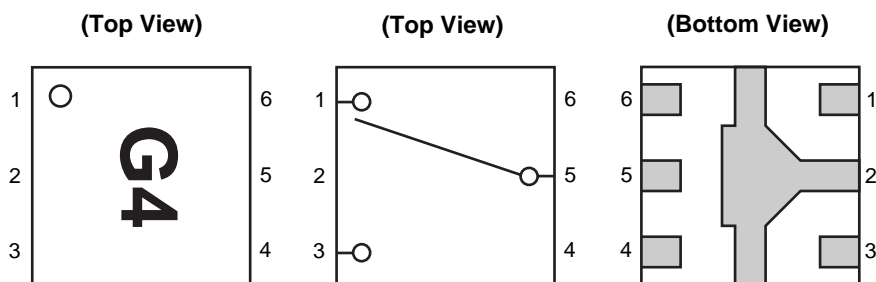
**Note** With regards to terminal solder (the solder contains lead) plated products (conventionally plated), contact your nearby sales office.

**Remark** To order evaluation samples, contact your nearby sales office.  
Part number for sample order:  $\mu$ PG2160T5K-A

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

The information in this document is subject to change without notice. Before using this document, please confirm that this is the latest version.

## 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 ( $T_A = +25^{\circ}\text{C}$ , 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	$^{\circ}\text{C}$
Storage Temperature	$T_{stg}$	–55 to +135	$^{\circ}\text{C}$

RECOMMENDED OPERATING RANGE ( $T_A = +25^{\circ}\text{C}$ , unless otherwise specified)

Parameter	Symbol	MIN.	TYP.	MAX.	Unit
Supply Voltage <sup>Note</sup>	$V_{DD}$	2.4	2.6	2.8	V
Switch Control Voltage (H) <sup>Note</sup>	$V_{cont (H)}$	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**

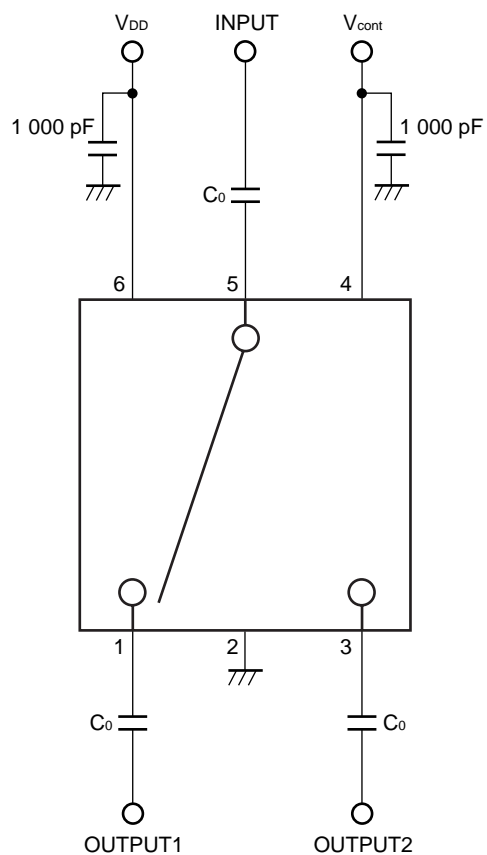
( $T_A = +25^\circ\text{C}$ ,  $V_{DD} = 2.6\text{ V}$ ,  $V_{\text{cont}}(\text{H}) = 2.6\text{ V}$ ,  $V_{\text{cont}}(\text{L}) = 0\text{ V}$ , DC cut capacitors = 56 pF, unless otherwise specified)

Parameter	Symbol	Test Conditions	MIN.	TYP.	MAX.	Unit
Insertion Loss 1	$L_{\text{ins1}}$	$f = 0.5\text{ to }1.0\text{ GHz}$	–	0.30	0.45	dB
Insertion Loss 2	$L_{\text{ins2}}$	$f = 1.0\text{ to }2.0\text{ GHz}$	–	0.35	0.50	
Insertion Loss 3	$L_{\text{ins3}}$	$f = 2.0\text{ to }2.5\text{ GHz}$	–	0.40	0.55	
Insertion Loss 4	$L_{\text{ins4}}$	$f = 2.5\text{ to }3.0\text{ GHz}$	–	0.50	0.65	
Isolation 1	ISL1	$f = 0.5\text{ to }1.0\text{ GHz}$	22	25	–	dB
Isolation 2	ISL2	$f = 1.0\text{ to }2.0\text{ GHz}$	15	18	–	
Isolation 3	ISL3	$f = 2.0\text{ to }2.5\text{ GHz}$	14	17	–	
Isolation 4	ISL4	$f = 2.5\text{ to }3.0\text{ GHz}$	10	13	–	
Input Return Loss	$RL_{\text{in}}$	$f = 0.5\text{ to }3.0\text{ GHz}$	15	20	–	dB
Output Return Loss	$RL_{\text{out}}$	$f = 0.5\text{ to }3.0\text{ GHz}$	15	20	–	dB
0.1 dB Loss Compression Input Power <sup>Note</sup>	$P_{\text{in}}(0.1\text{ dB})$	$f = 2.0/2.5\text{ GHz}$	+18.0	+21.0	–	dBm
2nd Harmonics	$2f_0$	$f = 2.0/2.5\text{ GHz}$ , $P_{\text{in}} = +10\text{ dBm}$	65	75	–	dBc
3rd Harmonics	$3f_0$	$f = 2.0/2.5\text{ GHz}$ , $P_{\text{in}} = +10\text{ dBm}$	65	75	–	dBc
Supply Current	$I_{DD}$	No signal	–	50	100	$\mu\text{A}$
Switch Control Current	$I_{\text{cont}}$		–	4	20	$\mu\text{A}$
Switch Control Speed	$t_{\text{sw}}$	50% CTL to 90/10% RF	–	150	–	ns

**Note**  $P_{\text{in}}(0.1\text{ dB})$  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.

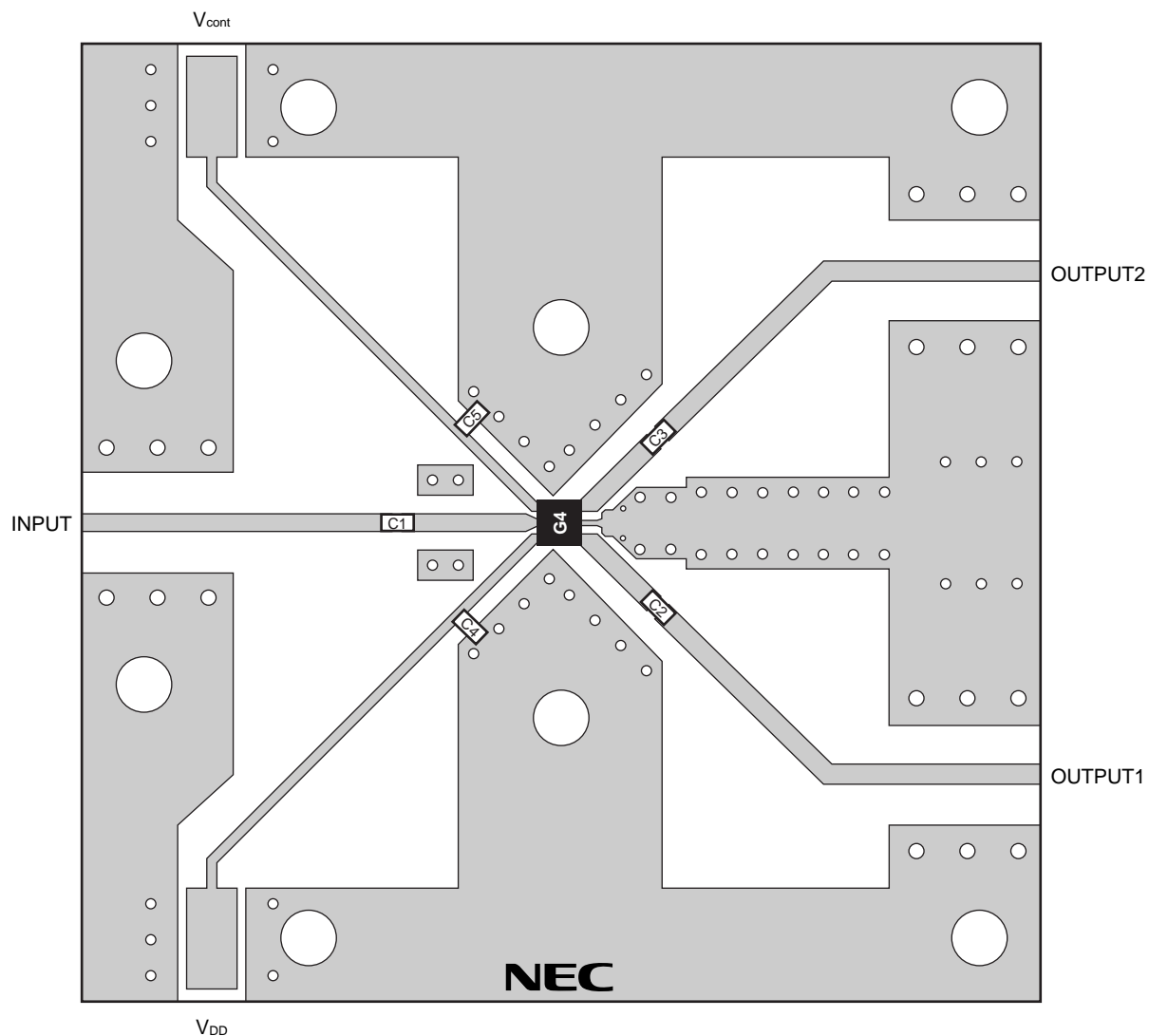
# EVALUATION CIRCUIT



**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**

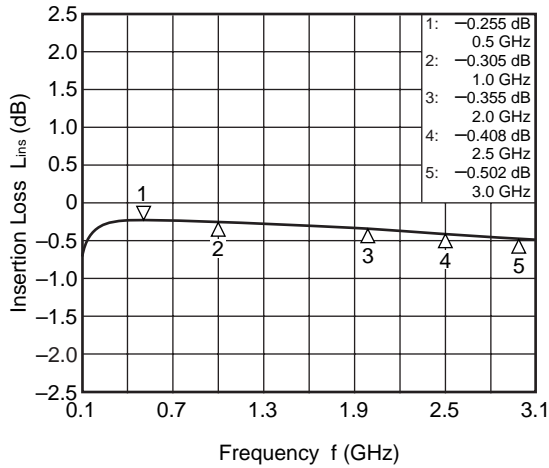


**USING THE NEC EVALUATION BOARD**

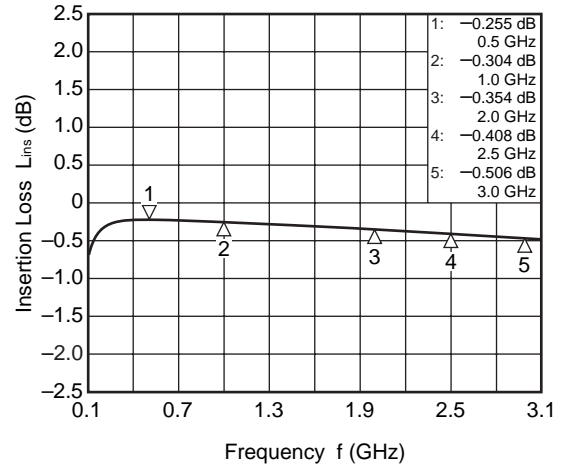
Symbol	Values
C1, C2, C3	56 pF
C4, C5	1 000 pF

**TYPICAL CHARACTERISTICS** ( $T_A = +25^\circ\text{C}$ ,  $V_{DD} = 2.6\text{ V}$ ,  $V_{\text{cont}}(\text{H}) = 2.6\text{ V}$ ,  $V_{\text{cont}}(\text{L}) = 0\text{ V}$ , DC cut capacitors = 56 pF, using test fixture, unless otherwise specified)

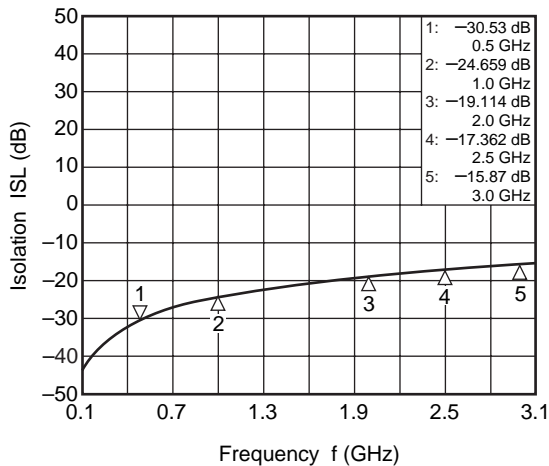
INPUT-OUTPUT1  
INSERTION LOSS vs. FREQUENCY



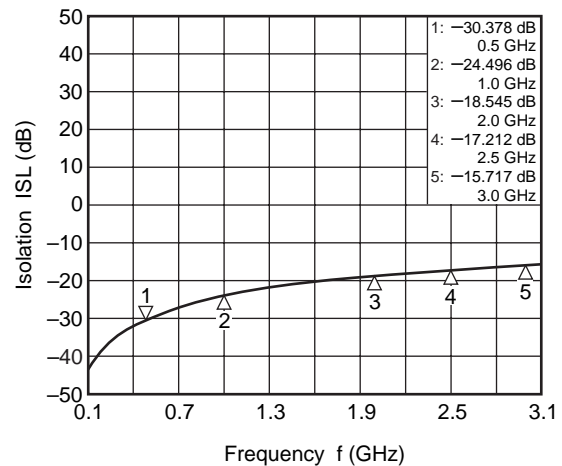
INPUT-OUTPUT2  
INSERTION LOSS vs. FREQUENCY



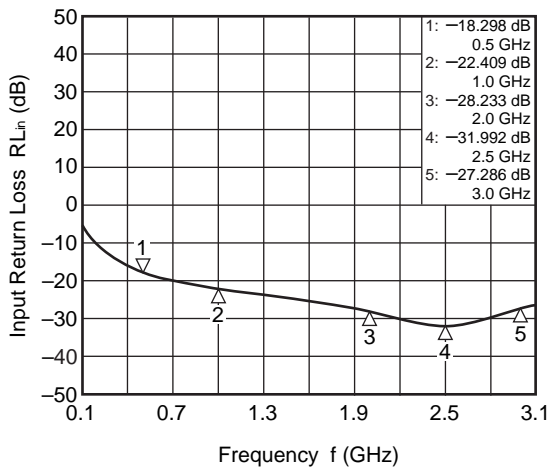
INPUT-OUTPUT1  
ISOLATION vs. FREQUENCY



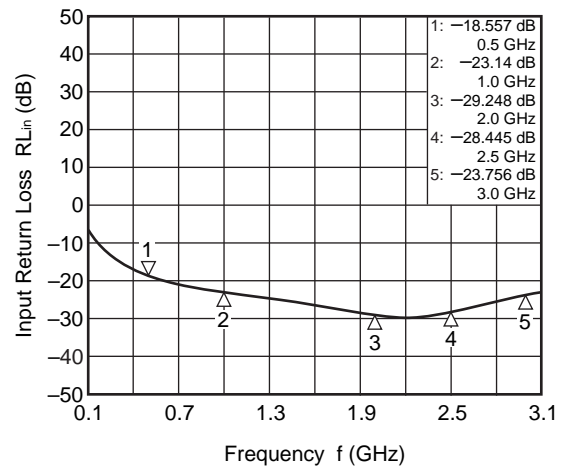
INPUT-OUTPUT2  
ISOLATION vs. FREQUENCY



INPUT-OUTPUT1  
INPUT RETURN LOSS vs. FREQUENCY

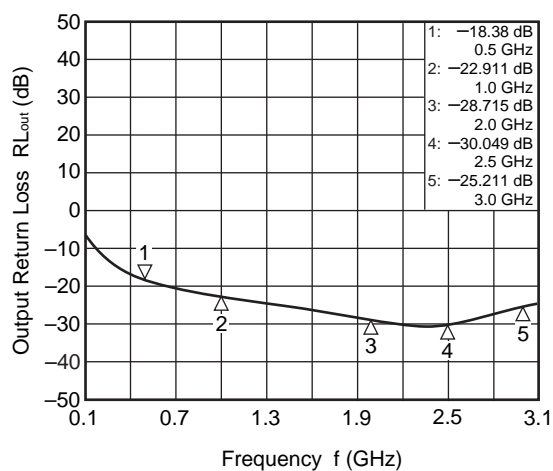


INPUT-OUTPUT2  
INPUT RETURN LOSS vs. FREQUENCY

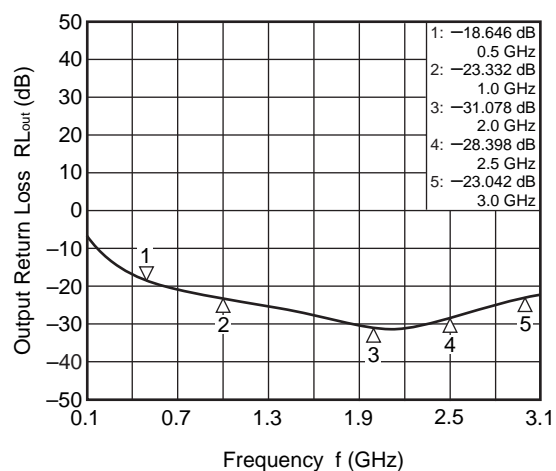


**Remark** The graphs indicate nominal characteristics.

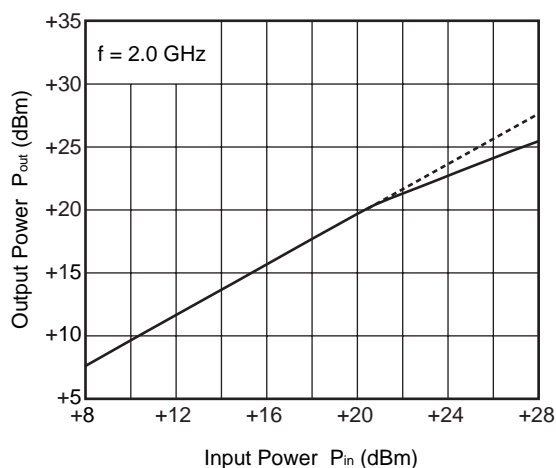
INPUT-OUTPUT1  
OUTPUT RETURN LOSS vs. FREQUENCY



INPUT-OUTPUT2  
OUTPUT RETURN LOSS vs. FREQUENCY



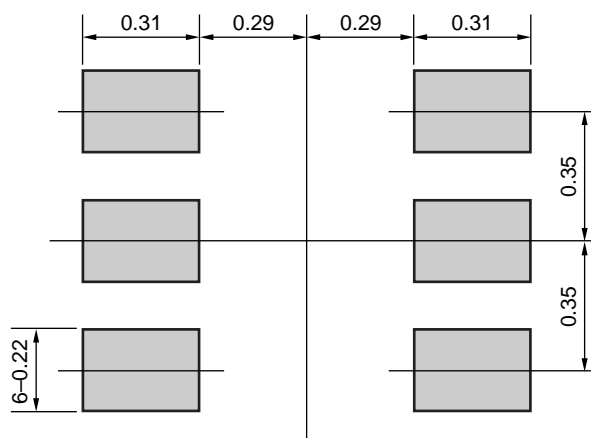
OUTPUT POWER vs. INPUT POWER



**Remark** The graphs indicate nominal characteristics.

## MOUNTING PAD DIMENSIONS

## 6-PIN PLASTIC TSSOP (UNIT: mm)



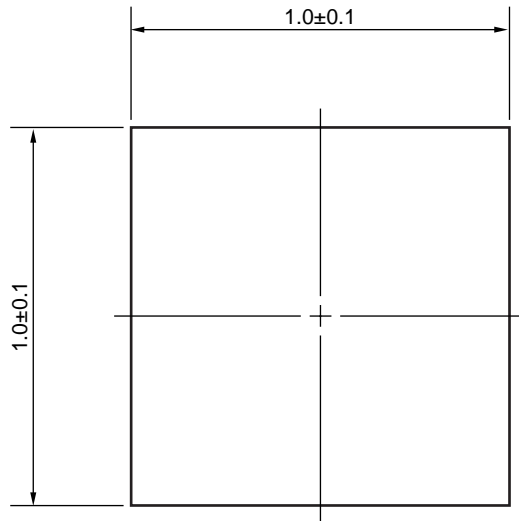
**Remark** The mounting pad layouts in this document are for reference only.



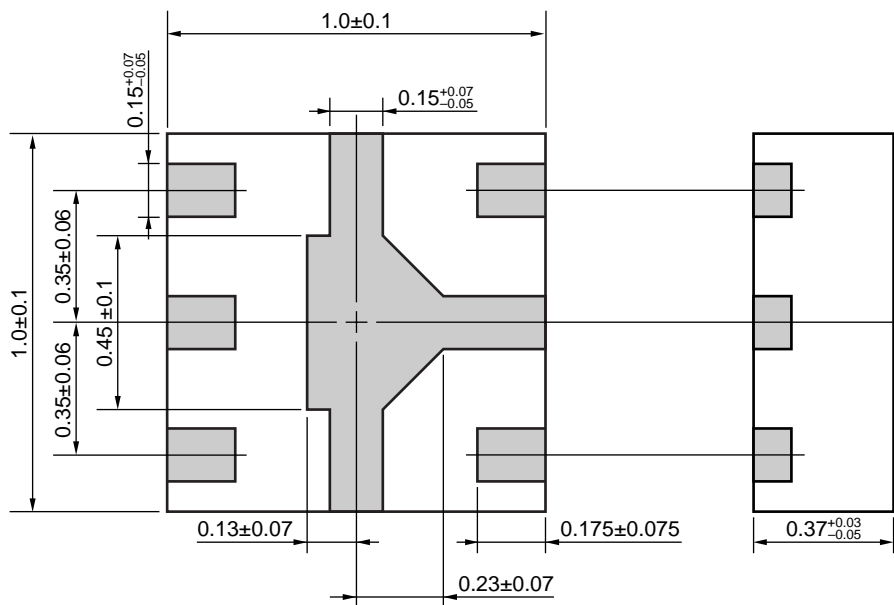
**PACKAGE DIMENSIONS**

**6-PIN PLASTIC TSSOP (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 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	IR260
Wave Soldering	Peak temperature (molten solder temperature) : 260°C or below 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	WS260
Partial Heating	Peak temperature (terminal temperature) : 350°C or below Soldering time (per side of device) : 3 seconds or less Maximum chlorine content of rosin flux (% mass) : 0.2%(Wt.) or below	HS350

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

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**Caution**

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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.

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► For further information, please contact

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This status is based on CEL's understanding of the EU Directives and knowledge of the materials that go into its products as of the date of disclosure of this information.

Restricted Substance per RoHS	Concentration Limit per RoHS (values are not yet fixed)	Concentration contained in CEL devices	
		-A	-AZ
Lead (Pb)	< 1000 PPM	Not Detected	(*)
Mercury	< 1000 PPM	Not Detected	
Cadmium	< 100 PPM	Not Detected	
Hexavalent Chromium	< 1000 PPM	Not Detected	
PBB	< 1000 PPM	Not Detected	
PBDE	< 1000 PPM	Not Detected	

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