DATA SHEET

NEC

GaAs INTEGRATED CIRCUIT

μPG2158T5K

L, S-BAND SPDT SWITCH

DESCRIPTION

The μPG2158T5K 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 application.

This device can operate 2 control switching by control voltage 1.8 to 5.3 V. This device can operate frequency from 0.05 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

- Switch control voltage : $V_{cont\ (H)}$ = 1.8 to 5.3 V (2.7 V TYP.)
  : $V_{cont\ (L)}$ = −0.2 to +0.2 V (0 V TYP.)
- Low insertion loss : $L_{INS}1$ = 0.40 dB TYP. @ f = 0.05 to 1.0 GHz, $V_{cont\ (H)}$ = 2.7 V, $V_{cont\ (L)}$ = 0 V
  : $L_{INS}2$ = 0.45 dB TYP. @ f = 1.0 to 2.0 GHz, $V_{cont\ (H)}$ = 2.7 V, $V_{cont\ (L)}$ = 0 V
  : $L_{INS}3$ = 0.47 dB TYP. @ f = 2.0 to 2.5 GHz, $V_{cont\ (H)}$ = 2.7 V, $V_{cont\ (L)}$ = 0 V
  : $L_{INS}4$ = 0.53 dB TYP. @ f = 2.5 to 3.0 GHz, $V_{cont\ (H)}$ = 2.7 V, $V_{cont\ (L)}$ = 0 V
- High isolation : ISL1 = 27 dB TYP. @ f = 0.05 to 1.0 GHz, $V_{cont\ (H)}$ = 2.7 V, $V_{cont\ (L)}$ = 0 V
  : ISL2 = 19 dB TYP. @ f = 1.0 to 2.0 GHz, $V_{cont\ (H)}$ = 2.7 V, $V_{cont\ (L)}$ = 0 V
  : ISL3 = 17 dB TYP. @ f = 2.0 to 2.5 GHz, $V_{cont\ (H)}$ = 2.7 V, $V_{cont\ (L)}$ = 0 V
  : ISL4 = 17 dB TYP. @ f = 2.5 to 3.0 GHz, $V_{cont\ (H)}$ = 2.7 V, $V_{cont\ (L)}$ = 0 V
- Handling power : $P_{in\ (0.1\ dB)}$ = +29.0 dBm TYP. @ f = 2.0/2.5 GHz, $V_{cont\ (H)}$ = 2.7 V, $V_{cont\ (L)}$ = 0 V
  : $P_{in\ (1\ dB)}$ = +30.5 dBm TYP. @ f = 2.0/2.5 GHz, $V_{cont\ (H)}$ = 2.7 V, $V_{cont\ (L)}$ = 0 V
- High-density surface mounting : 6-pin plastic TSSON package (1.0 × 1.0 × 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
μPG2158T5K-E2	μPG2158T5K-E2-A	6-pin plastic TSSON (Pb-Free) Note	G2	• 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: μPG2158T5K

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

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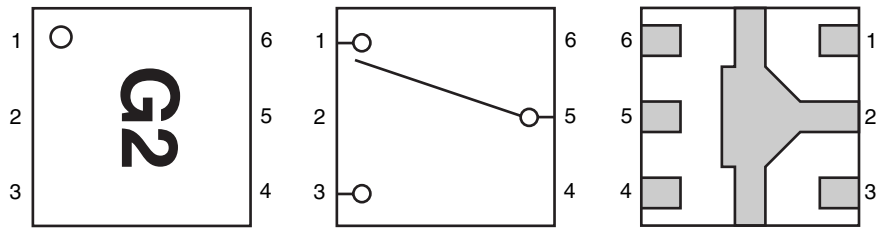
The mark ★ shows major revised points.

PIN CONNECTIONS AND INTERNAL BLOCK DIAGRAM

(Top View) (Top View) (Bottom View)



Pin No.	Pin Name
1	OUTPUT1
2	GND
3	OUTPUT2
4	$V_{cont}2$
5	INPUT
6	$V_{cont}1$

TRUTH TABLE

$V_{cont}1$	$V_{cont}2$	INPUT–OUTPUT1	INPUT–OUTPUT2
Low	High	OFF	ON
High	Low	ON	OFF

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

Parameter	Symbol	Ratings	Unit
Switch Control Voltage	V_{cont}	+6.0 Note	V
Input Power	P_{in}	+31	dBm
Operating Ambient Temperature	T_A	–45 to +85	°C
Storage Temperature	T_{stg}	–55 to +150	°C

Note $|V_{cont}1 - V_{cont}2| \leq 6.0$ V

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

Parameter	Symbol	MIN.	TYP.	MAX.	Unit
Switch Control Voltage (H)	$V_{cont\ (H)}$	1.8	2.7	5.3	V
Switch Control Voltage (L)	$V_{cont\ (L)}$	–0.2	0	+0.2	V

ELECTRICAL CHARACTERISTICS 1

(T_A = +25°C, $V_{cont\ (H)}$ = 2.7 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 = 0.05 to 1.0 GHz Note 1	–	0.40	0.45	dB
Insertion Loss 2	$L_{INS}2$	f = 1.0 to 2.0 GHz	–	0.45	0.50	
Insertion Loss 3	$L_{INS}3$	f = 2.0 to 2.5 GHz	–	0.47	0.55	
Insertion Loss 4	$L_{INS}4$	f = 2.5 to 3.0 GHz	–	0.53	0.60	
Isolation 1	ISL1	f = 0.05 to 1.0 GHz Note 1	23	27	–	dB
Isolation 2	ISL2	f = 1.0 to 2.0 GHz	16	19	–	
Isolation 3	ISL3	f = 2.0 to 2.5 GHz	14	17	–	
Isolation 4	ISL4	f = 2.5 to 3.0 GHz	14	17	–	
Input Return Loss	RL_{in}	f = 0.05 to 3.0 GHz Note 1	15	20	–	dB
Output Return Loss	RL_{out}	f = 0.05 to 3.0 GHz Note 1	15	20	–	dB
0.1 dB Loss Compression Input Power Note 2	$P_{in\ (0.1\ dB)}$	f = 2.0/2.5 GHz	+26.0	+29.0	–	dBm
		f = 0.5 to 3.0 GHz	–	+29.0	–	
1 dB Loss Compression Input Power Note 3	$P_{in\ (1\ dB)}$	f = 0.5 to 3.0 GHz	–	+30.5	–	dBm
2nd Harmonics	$2f_0$	f = 2.0/2.5 GHz, P_{in} = +20 dBm	65	75	–	dBc
3rd Harmonics	$3f_0$	f = 2.0/2.5 GHz, P_{in} = +20 dBm	65	75	–	dBc
Input 3rd Order Distortion Intercept Point	IIP_3	f = 0.5 to 3.0 GHz 2 tone 5 MHz spacing	–	+60	–	dBm
Switch Control Current	I_{cont}	No signal	–	0.2	20	μA
Switch Control Speed	t_{SW}	50% CTL to 90/10% RF	–	50	500	ns

Notes 1. DC cut capacitors = 1 000 pF at f = 0.05 to 0.5 GHz

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

3. $P_{in\ (1\ dB)}$ is measured the input power level when the insertion loss increases more 1 dB than that of linear range.

Caution This device is used it is necessary to use DC cut capacitors.
The value of DC cut capacitors should be chosen to accommodate the frequency of operation, bandwidth, switching speed and the condition with actual board of your system. The range of recommended DC cut capacitor value is less than 100 pF.

ELECTRICAL CHARACTERISTICS 2

(T_A = +25°C, $V_{cont\ (H)}$ = 1.8 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 = 0.05 to 1.0 GHz Note 1	–	0.40	0.47	dB
Insertion Loss 2	$L_{INS}2$	f = 1.0 to 2.0 GHz	–	0.46	0.52	
Insertion Loss 3	$L_{INS}3$	f = 2.0 to 2.5 GHz	–	0.48	0.57	
Insertion Loss 4	$L_{INS}4$	f = 2.5 to 3.0 GHz	–	0.54	0.62	
Isolation 1	ISL1	f = 0.05 to 1.0 GHz Note 1	23	27	–	dB
Isolation 2	ISL2	f = 1.0 to 2.0 GHz	16	19	–	
Isolation 3	ISL3	f = 2.0 to 2.5 GHz	14	17	–	
Isolation 4	ISL4	f = 2.5 to 3.0 GHz	14	17	–	
Input Return Loss	RL_{in}	f = 0.05 to 3.0 GHz Note 1	15	20	–	dB
Output Return Loss	RL_{out}	f = 0.05 to 3.0 GHz Note 1	15	20	–	dB
0.1 dB Loss Compression Input Power Note 2	$P_{in\ (0.1\ dB)}$	f = 2.0/2.5 GHz	+19.0	+22.0	–	dBm
		f = 0.5 to 3.0 GHz	–	+22.0	–	
1 dB Loss Compression Input Power Note 3	$P_{in\ (1\ dB)}$	f = 0.5 to 3.0 GHz	–	+25.0	–	dBm
Switch Control Current	I_{cont}	No signal	–	0.2	20	μA
Switch Control Speed	t_{SW}	50% CTL to 90/10% RF	–	50	500	ns

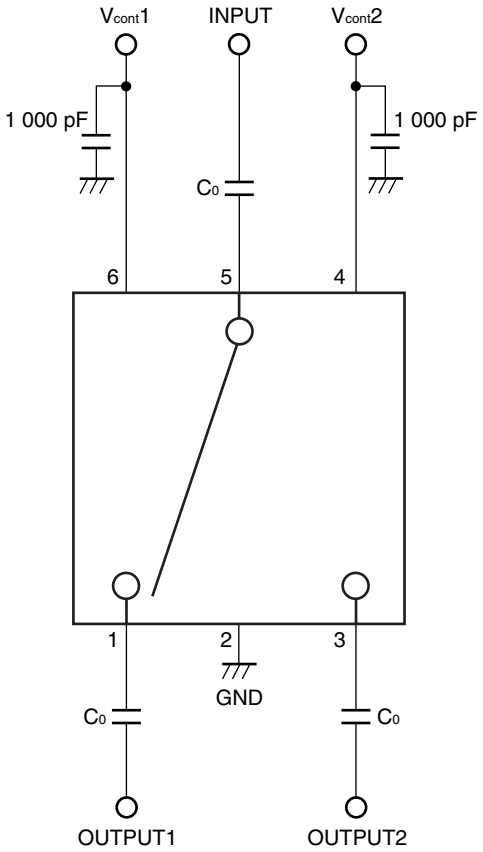
Notes 1. DC cut capacitors = 1 000 pF at f = 0.05 to 0.5 GHz

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

3. $P_{in\ (1\ dB)}$ is measured the input power level when the insertion loss increases more 1 dB than that of linear range.

Caution This device is used it is necessary to use DC cut capacitors.
The value of DC cut capacitors should be chosen to accommodate the frequency of operation, bandwidth, switching speed and the condition with actual board of your system. The range of recommended DC cut capacitor value is less than 100 pF.

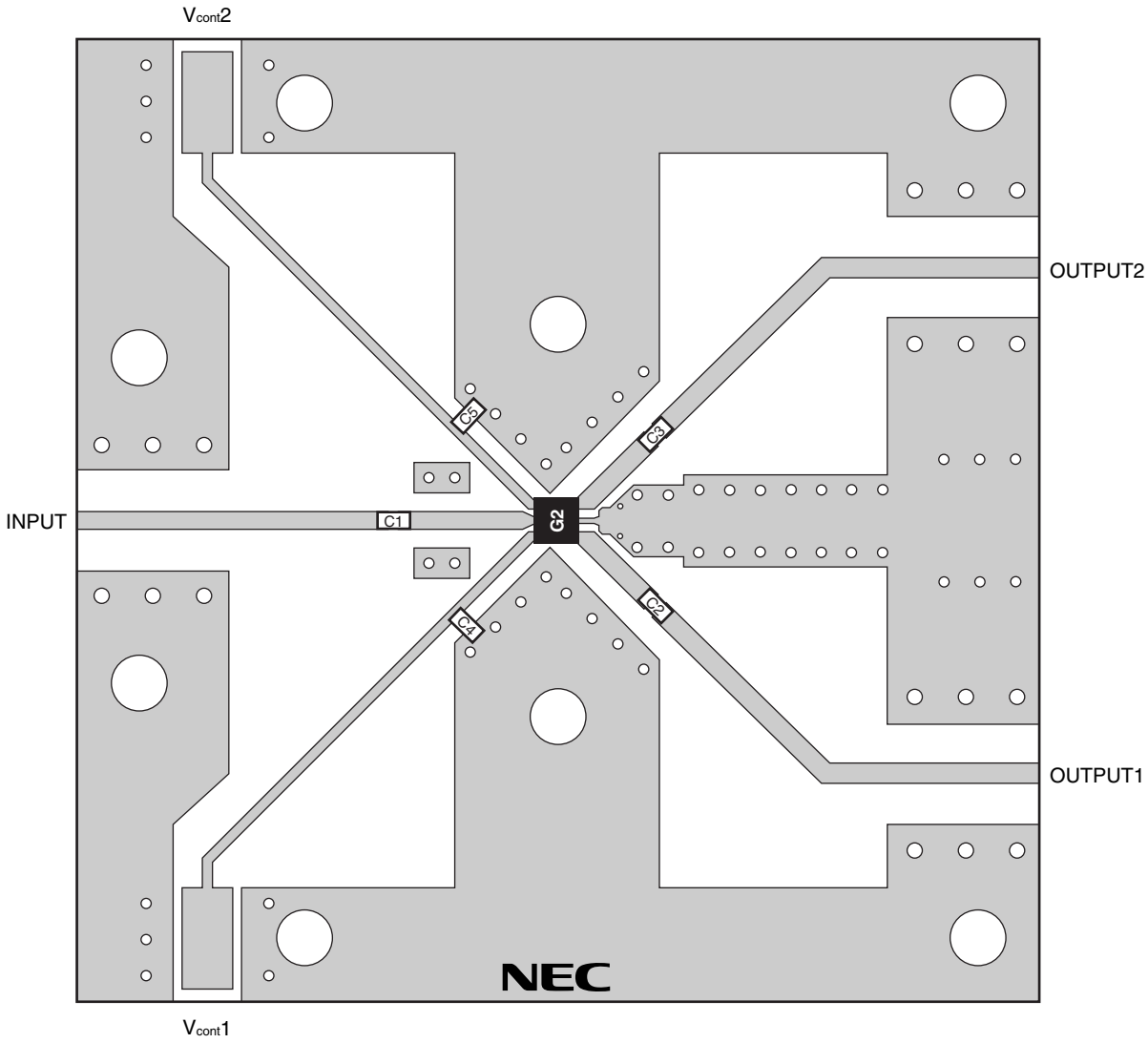
EVALUATION CIRCUIT



Remark C_0 : 0.05 to 0.5 GHz 1 000 pF
: 0.5 to 3.0 GHz 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

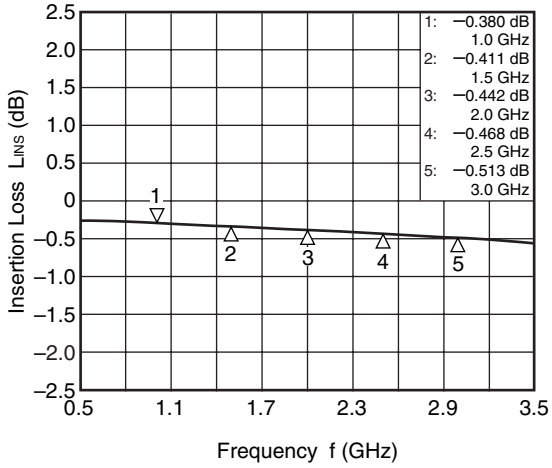


USING THE NEC EVALUATION BOARD

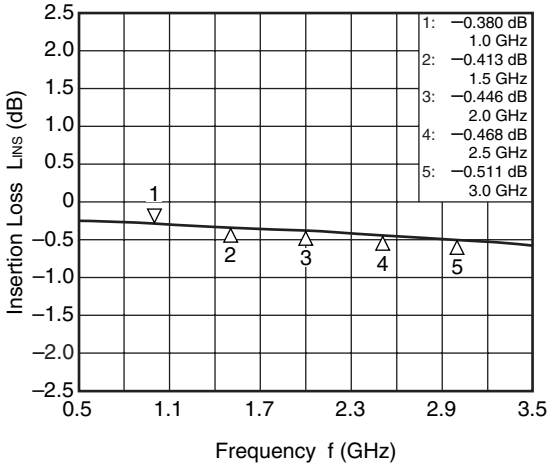
Symbol	Values
C1, C2, C3	56 pF
C4, C5	1 000 pF

TYPICAL CHARACTERISTICS (T_A = +25°C, $V_{cont\ (H)}$ = 2.7 V, $V_{cont\ (L)}$ = 0 V, DC cut capacitors = 56 pF, using test fixture, unless otherwise specified)

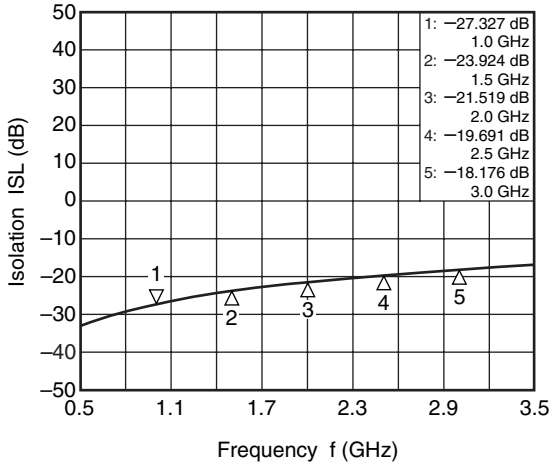
INPUT-OUTPUT1
INSERTION LOSS vs. FREQUENCY



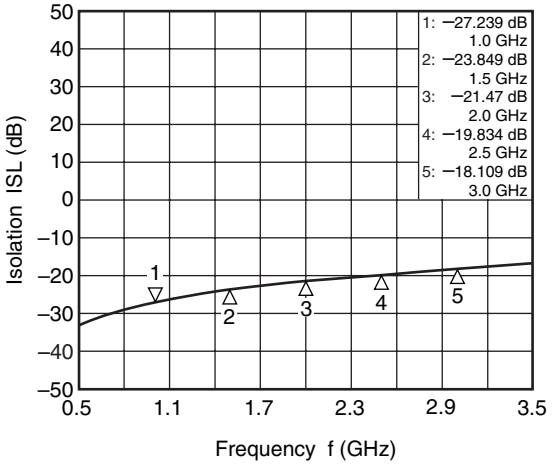
INPUT-OUTPUT2
INSERTION LOSS vs. FREQUENCY



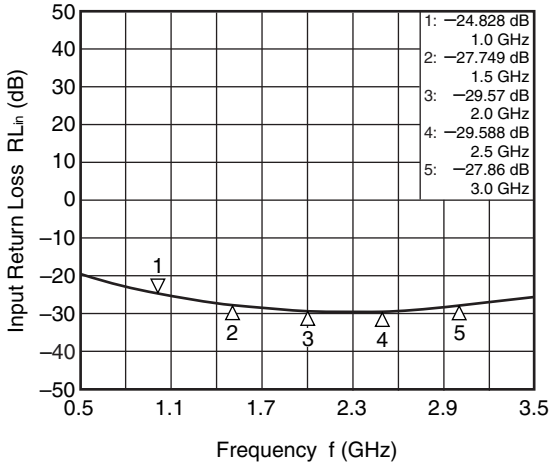
INPUT-OUTPUT1
ISOLATION vs. FREQUENCY



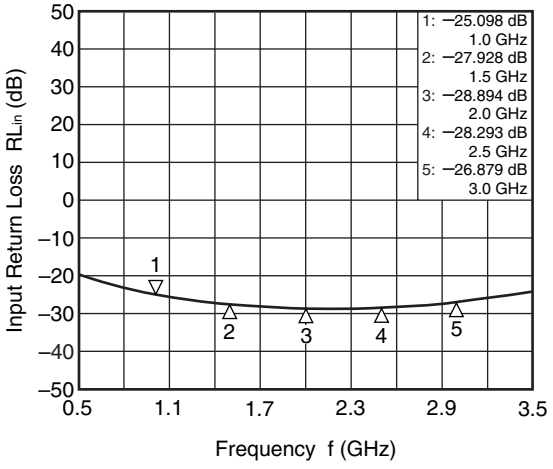
INPUT-OUTPUT2
ISOLATION vs. FREQUENCY



INPUT-OUTPUT1
INPUT RETURN LOSS vs. FREQUENCY

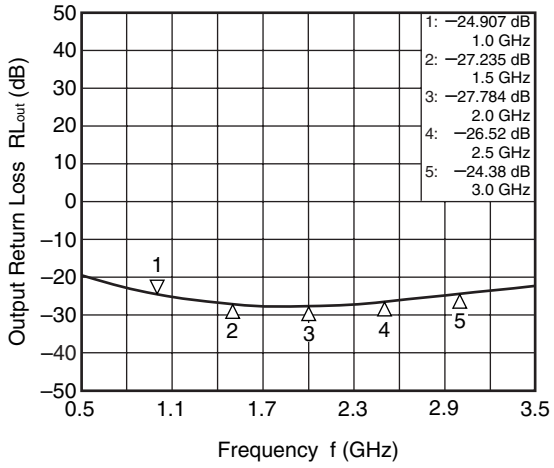


INPUT-OUTPUT2
INPUT RETURN LOSS vs. FREQUENCY

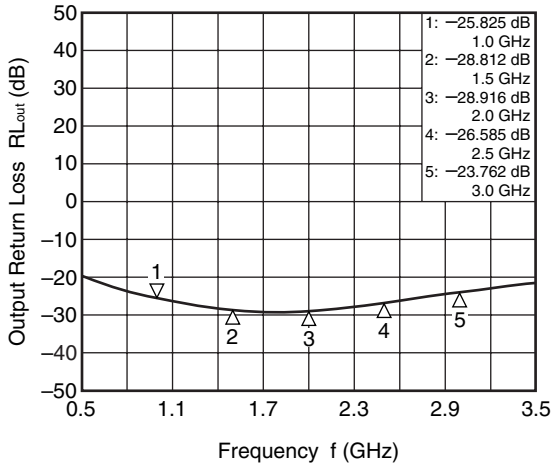


Remark The graphs indicate nominal characteristics.

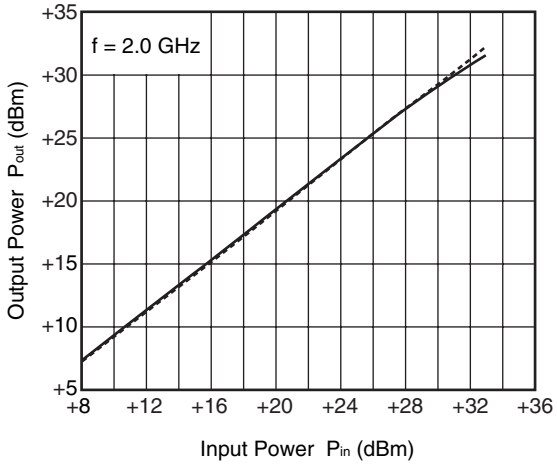
INPUT-OUTPUT1
OUTPUT RETURN LOSS vs. FREQUENCY



INPUT-OUTPUT2
OUTPUT RETURN LOSS vs. FREQUENCY



OUTPUT POWER vs. INPUT POWER

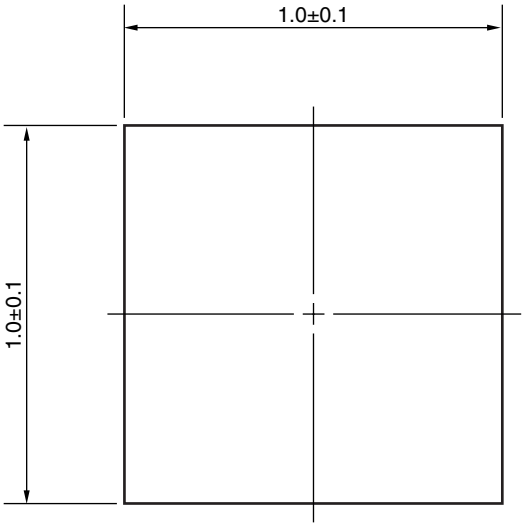


Remark The graphs indicate nominal characteristics.

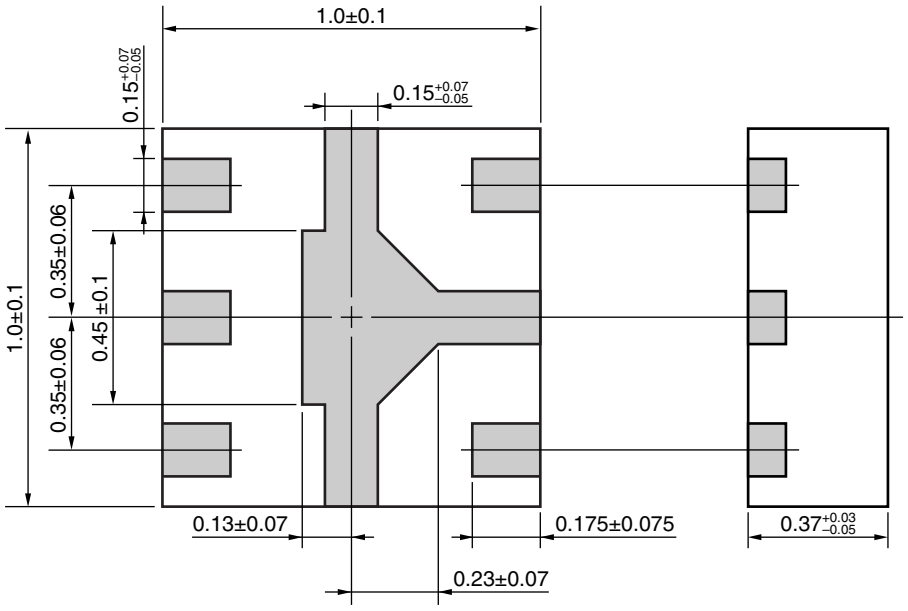
★ **PACKAGE DIMENSIONS**

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

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

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M8E 00.4-0110

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▶**For further information, please contact**

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