DATA SHEET

NEC

GaAs INTEGRATED CIRCUIT

μPG2159T6R

L, S-BAND SPDT SWITCH

DESCRIPTION

The μPG2159T6R 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 2 control switching by control voltage 1.8 to 3.3 V. This device can operate frequency from 0.05 GHz 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) (T6R) package. And this package is able to high-density surface mounting.

FEATURES

- Switch control voltage : $V_{cont\ (H)}$ = 1.8 to 3.3 V (2.7 V TYP.)
  : $V_{cont\ (L)}$ = −0.2 to 0.2 V (0 V TYP.)
- Low insertion loss : $L_{ins}1$ = 0.20 dB TYP. @ f = 0.05 to 0.5 GHz, $V_{cont\ (H)}$ = 2.7 V, $V_{cont\ (L)}$ = 0 V
  : $L_{ins}2$ = 0.21 dB TYP. @ f = 0.5 to 1.0 GHz, $V_{cont\ (H)}$ = 2.7 V, $V_{cont\ (L)}$ = 0 V
  : $L_{ins}3$ = 0.23 dB TYP. @ f = 1.0 to 2.0 GHz, $V_{cont\ (H)}$ = 2.7 V, $V_{cont\ (L)}$ = 0 V
  : $L_{ins}4$ = 0.25 dB TYP. @ f = 2.0 to 2.5 GHz, $V_{cont\ (H)}$ = 2.7 V, $V_{cont\ (L)}$ = 0 V
  : $L_{ins}5$ = 0.27 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 0.5 GHz, $V_{cont\ (H)}$ = 2.7 V, $V_{cont\ (L)}$ = 0 V
  : ISL2 = 27 dB TYP. @ f = 0.5 to 1.0 GHz, $V_{cont\ (H)}$ = 2.7 V, $V_{cont\ (L)}$ = 0 V
  : ISL3 = 27 dB TYP. @ f = 1.0 to 2.0 GHz, $V_{cont\ (H)}$ = 2.7 V, $V_{cont\ (L)}$ = 0 V
  : ISL4 = 27 dB TYP. @ f = 2.0 to 2.5 GHz, $V_{cont\ (H)}$ = 2.7 V, $V_{cont\ (L)}$ = 0 V
  : ISL5 = 27 dB TYP. @ f = 2.5 to 3.0 GHz, $V_{cont\ (H)}$ = 2.7 V, $V_{cont\ (L)}$ = 0 V
- Handling power : $P_{in\ (1\ dB)}$ = +25.5 dBm TYP. @ f = 0.5 to 3.0 GHz, $V_{cont\ (H)}$ = 2.7 V, $V_{cont\ (L)}$ = 0 V
  : $P_{in\ (0.1\ dB)}$ = +22.0 dBm TYP. @ f = 0.5 to 3.0 GHz, $V_{cont\ (H)}$ = 2.7 V, $V_{cont\ (L)}$ = 0 V
- High-density surface mounting : 6-pin plastic TSSON (T6R) package (1.0 × 1.0 × 0.37 mm)

APPLICATIONS

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

ORDERING INFORMATION

Part Number	Order Number	Package	Marking	Supplying Form
μPG2159T6R-E2	μPG2159T6R-E2-A	6-pin plastic TSSON (T6R) (Pb-Free)	G7	• Embossed tape 8 mm wide • Pin 1, 6 face the perforation side of the tape • Qty 5 kpcs/reel

Remark To order evaluation samples, contact your nearby sales office.
Part number for sample order: μPG2159T6R

Caution Although this device is designed to be as robust as possible, ESD (Electrostatic Discharge) can damage this device. This device must be protected at all times from ESD. Static charges may easily produce potentials of several kilovolts on the human body or equipment, which can discharge without detection. Industry-standard ESD precautions must be employed at all times.

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Not all products and/or types are available in every country. Please check with an NEC Electronics sales representative for availability and additional information.

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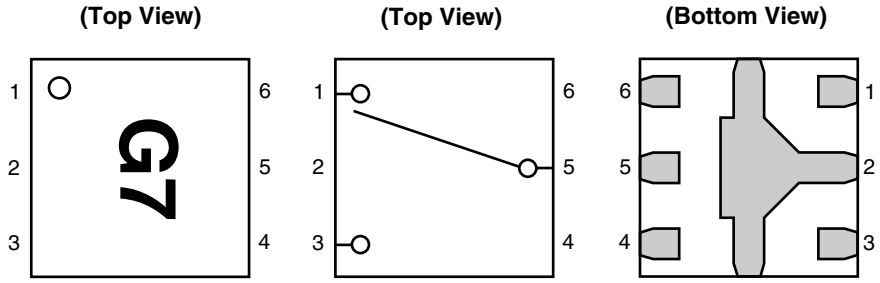
PIN CONNECTIONS AND INTERNAL BLOCK DIAGRAM



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

Remark Exposed pad : GND

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 Note1	V
Input Power	P_{in}	+26.0 Note2, 4	dBm
Input Power	P_{in}	+8 + V_{cont} * 20/3 Note3, 4	dBm
Operating Ambient Temperature	T_A	–45 to +85	°C
Storage Temperature	T_{stg}	–55 to +150	°C

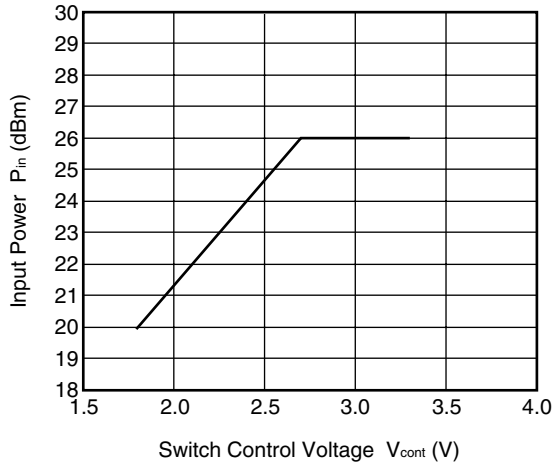
Notes 1. $|V_{cont}1 - V_{cont}2| \leq 6.0$ V

2. $2.7\ V \leq |V_{cont}1 - V_{cont}2| \leq 3.3$ V

3. $1.8\ V \leq |V_{cont}1 - V_{cont}2| \leq 2.7$ V

4. Please refer to following chart.

INPUT POWER vs.
SWITCH CONTROL VOLTAGE



Remark The graph indicates nominal characteristics.

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	3.3	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 0.5 GHz Note1	–	0.20	0.35	dB
Insertion Loss 2	$L_{ins}2$	f = 0.5 to 1.0 GHz	–	0.21	0.35	dB
Insertion Loss 3	$L_{ins}3$	f = 1.0 to 2.0 GHz	–	0.23	0.40	dB
Insertion Loss 4	$L_{ins}4$	f = 2.0 to 2.5 GHz	–	0.25	0.42	dB
Insertion Loss 5	$L_{ins}5$	f = 2.5 to 3.0 GHz	–	0.27	0.45	dB
Isolation 1	ISL1	f = 0.05 to 0.5 GHz Note1	24	27	–	dB
Isolation 2	ISL2	f = 0.5 to 1.0 GHz	24	27	–	dB
Isolation 3	ISL3	f = 1.0 to 2.0 GHz	24	27	–	dB
Isolation 4	ISL4	f = 2.0 to 2.5 GHz	24	27	–	dB
Isolation 5	ISL5	f = 2.5 to 3.0 GHz	24	27	–	dB
Input Return Loss 1	$RL_{in}1$	f = 0.05 to 0.5 GHz Note1	15	20	–	dB
Input Return Loss 2	$RL_{in}2$	f = 0.5 to 3.0 GHz	15	20	–	dB
Output Return Loss 1	$RL_{out}1$	f = 0.05 to 0.5 GHz Note1	15	20	–	dB
Output Return Loss 2	$RL_{out}2$	f = 0.5 to 3.0 GHz	15	20	–	dB
0.1 dB Loss Compression Input Power Note2	$P_{in (0.1 dB)}$	f = 2.0 GHz/2.5 GHz	+20.0	+22.0	–	dBm
		f = 0.5 to 3.0 GHz	–	+22.0	–	dBm
1 dB Loss Compression Input Power Note3	$P_{in (1 dB)}$	f = 0.5 to 3.0 GHz	–	+25.5	–	dBm
2nd Harmonics	$2f_0$	f = 2.0 GHz/2.5 GHz, P_{in} = +10 dBm	65	77	–	dBc
3rd Harmonics	$3f_0$	f = 2.0 GHz/2.5 GHz, P_{in} = +10 dBm	60	80	–	dBc
Input 3rd Order Intercept Point	IIP_3	f = 0.5 to 3.0 GHz, 2 tone 5 MHz spacing	–	+49.0	–	dBm
Switch Control Current	I_{cont}		–	0.2	1.0	μA
Switch Control Speed	t_{SW}	50% CTL to 90/10%	–	20	200	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.

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 6	$L_{ins}6$	f = 0.05 to 0.5 GHz Note1	–	0.21	0.36	dB
Insertion Loss 7	$L_{ins}7$	f = 0.5 to 1.0 GHz	–	0.22	0.37	dB
Insertion Loss 8	$L_{ins}8$	f = 1.0 to 2.0 GHz	–	0.24	0.41	dB
Insertion Loss 9	$L_{ins}9$	f = 2.0 to 2.5 GHz	–	0.26	0.43	dB
Insertion Loss 10	$L_{ins}10$	f = 2.5 to 3.0 GHz	–	0.28	0.46	dB
Isolation 6	ISL6	f = 0.05 to 0.5 GHz Note1	23	26	–	dB
Isolation 7	ISL7	f = 0.5 to 1.0 GHz	23	26	–	dB
Isolation 8	ISL8	f = 1.0 to 2.0 GHz	23	26	–	dB
Isolation 9	ISL9	f = 2.0 to 2.5 GHz	23	26	–	dB
Isolation 10	ISL10	f = 2.5 to 3.0 GHz	23	26	–	dB
Input Return Loss 3	$RL_{in}3$	f = 0.05 to 0.5 GHz Note1	15	20	–	dB
Input Return Loss 4	$RL_{in}4$	f = 0.5 to 3.0 GHz	15	20	–	dB
Output Return Loss 3	$RL_{out}3$	f = 0.05 to 0.5 GHz Note1	15	20	–	dB
Output Return Loss 4	$RL_{out}4$	f = 0.5 to 3.0 GHz	15	20	–	dB
0.1 dB Loss Compression Input Power Note2	$P_{in\ (0.1\ dB)}$	f = 2.0 GHz/2.5 GHz	+12	+15.5	–	dBm
		f = 0.5 to 3.0 GHz	–	+15.5	–	dBm
1 dB Loss Compression Input Power Note3	$P_{in\ (1\ dB)}$	f = 0.5 to 3.0 GHz	–	+19.5	–	dBm
Switch Control Current	I_{cont}	RF None	–	0.2	1.0	μA
Switch Control Speed	t_{SW}	50% CTL to 90/10% RF	–	20	200	ns

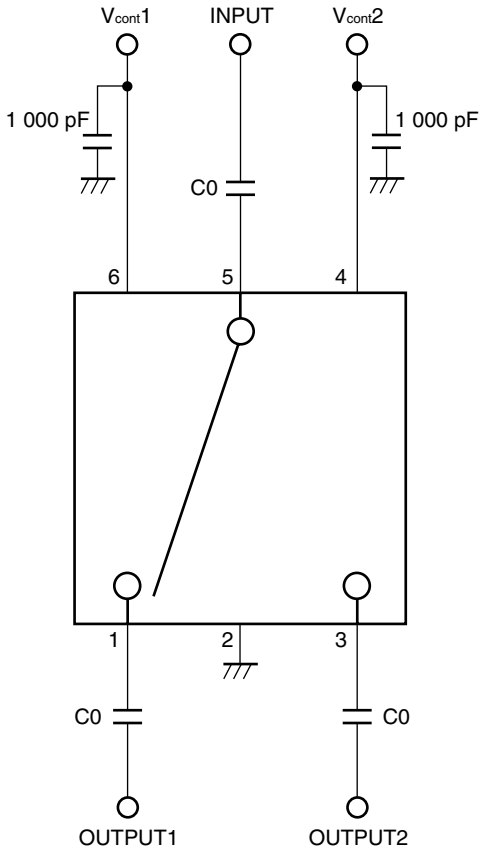
Notes 1. DC cut capacitors = 1 000 pF at f = 0.05 to 0.5 GHz

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.

EVALUATION CIRCUIT



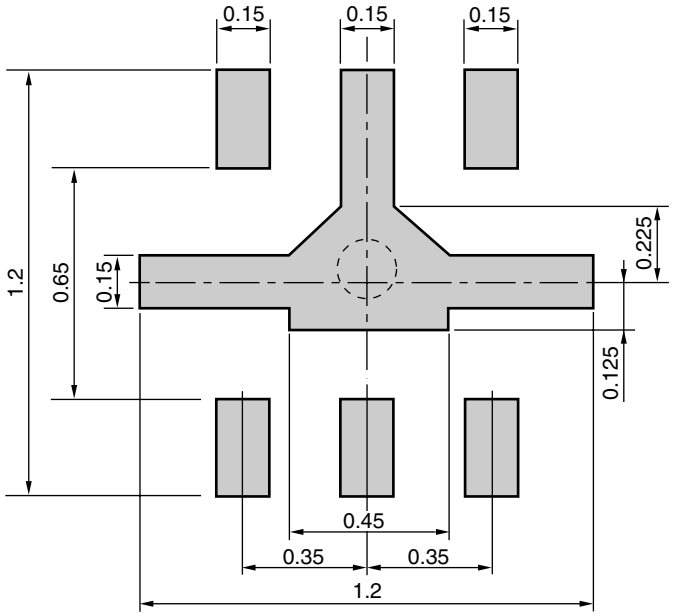
Remark C0 : 0.05 to 0.5 GHz 1 000 pF
: 0.5 to 3.0 GHz 56 pF

The application circuits and their parameters are for reference only and are not intended for use in actual design-ins.

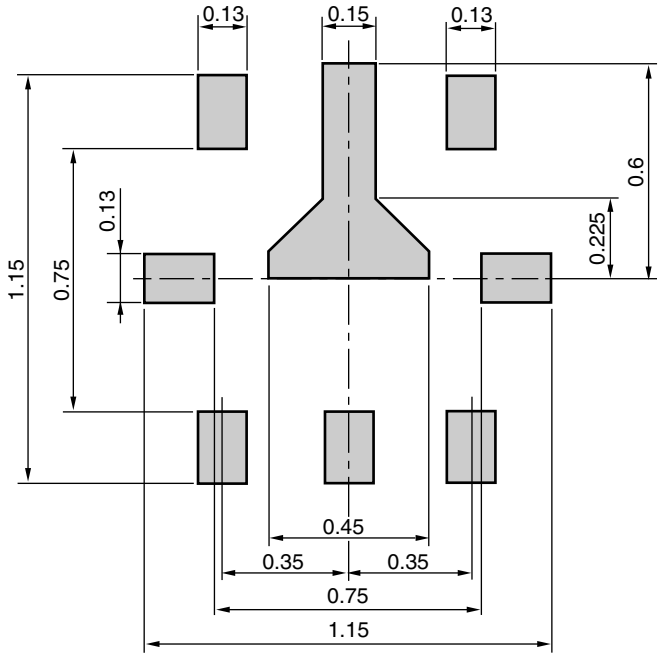
MOUNTING PAD AND SOLDER MASK LAYOUT DIMENSIONS

6-PIN PLASTIC TSSON (T6R) (UNIT: mm)

MOUNTING PAD



SOLDER MASK



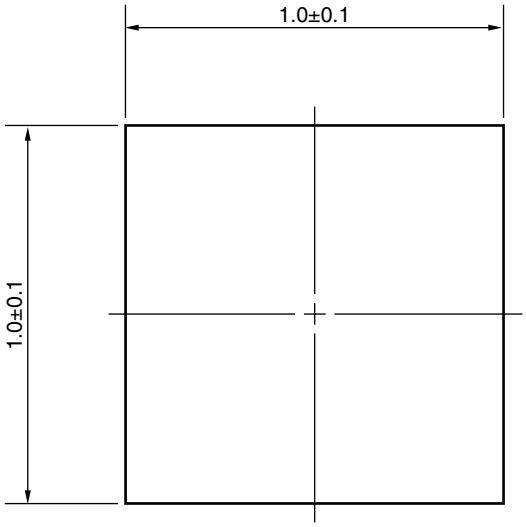
Solder thickness : 0.08 mm

Remark The mounting pad and solder mask layouts in this document are for reference only.

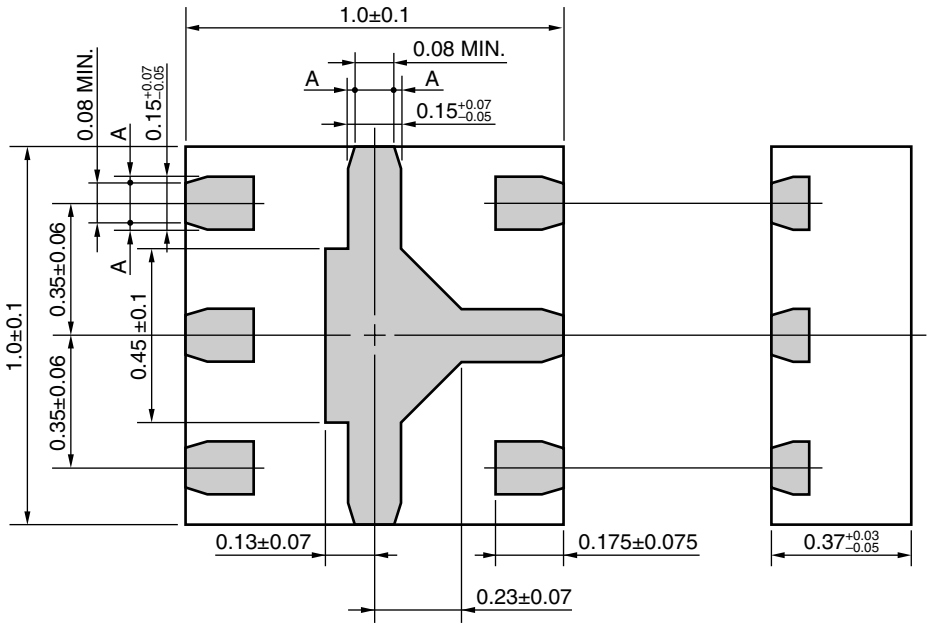
PACKAGE DIMENSIONS

6-PIN PLASTIC TSSON (T6R) (UNIT: mm)

(Top View)



(Bottom View)



Remark A > 0

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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