



# BIPOLAR ANALOG INTEGRATED CIRCUIT

# $\mu$ PC8232T5N

## SiGe:C LOW NOISE AMPLIFIER FOR GPS

### DESCRIPTION

The  $\mu$ PC8232T5N is a silicon germanium carbon (SiGe:C) monolithic integrated circuit designed as low noise amplifier for GPS. This device exhibits low noise figure and high power gain characteristics, so this IC can improve the sensitivity of GPS receiver. In addition, the  $\mu$ PC8232T5N which is included output matching circuit contributes to reduce external components and system size.

The package is a 6-pin plastic TSON (Thin Small Out-line Non-leaded) suitable for surface mount.

This IC is manufactured using our UHS4 (Ultra High Speed Process) SiGe:C bipolar process.

### FEATURES

- Low noise : NF = 0.95 dB TYP. @  $f_{in} = 1.575$  MHz
- High gain :  $G_P = 17$  dB TYP. @  $f_{in} = 1.575$  MHz
- Low current consumption :  $I_{CC} = 3.0$  mA TYP. @  $V_{CC} = 3.0$  V
- Built-in power-saving function
- High-density surface mounting : 6-pin plastic TSON package (1.5 × 1.5 × 0.37 mm)
- Included output matching circuit
- Included very robust bandgap regulator (Small  $V_{CC}$  and  $T_A$  dependence)
- Included protection circuits for ESD

### APPLICATION

- Low noise amplifier for GPS

### ORDERING INFORMATION

Part Number	Order Number	Package	Marking	Supplying Form
$\mu$ PC8232T5N-E2	$\mu$ PC8232T5N-E2-A	6-pin plastic TSON (Pb-Free)	6L	<ul style="list-style-type: none"><li>• 8 mm wide embossed taping</li><li>• Pin 1, 6 face the perforation side of the tape</li><li>• Qty 3 kpcs/reel</li></ul>

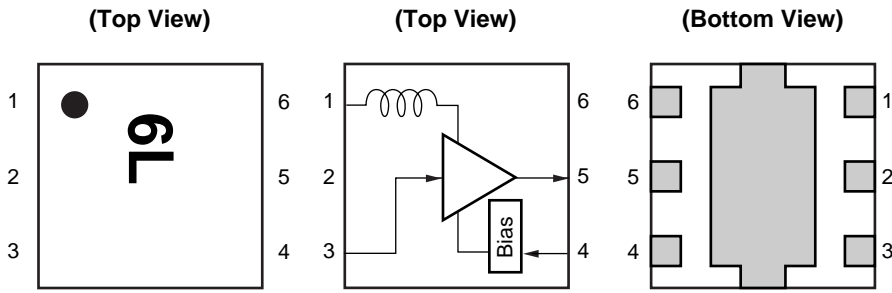
**Remark** To order evaluation samples, contact your nearby sales office.

Part number for sample order:  $\mu$ PC8232T5N-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	V <sub>CC</sub>
2	GND
3	INPUT
4	Power Save
5	OUTPUT
6	V <sub>CC</sub>

**Remark** Exposed pad : GND

**ABSOLUTE MAXIMUM RATINGS**

Parameter	Symbol	Test Conditions	Ratings	Unit
Supply Voltage	V <sub>CC</sub>	T <sub>A</sub> = +25°C	4.0	V
Power-Saving Voltage	V <sub>PS</sub>	T <sub>A</sub> = +25°C	4.0	V
Total Power Dissipation	P <sub>tot</sub>		150	mW
Operating Ambient Temperature	T <sub>A</sub>		-40 to +85	°C
Storage Temperature	T <sub>stg</sub>		-55 to +150	°C
Input Power	P <sub>in</sub>		+10	dBm

**RECOMMENDED OPERATING RANGE**

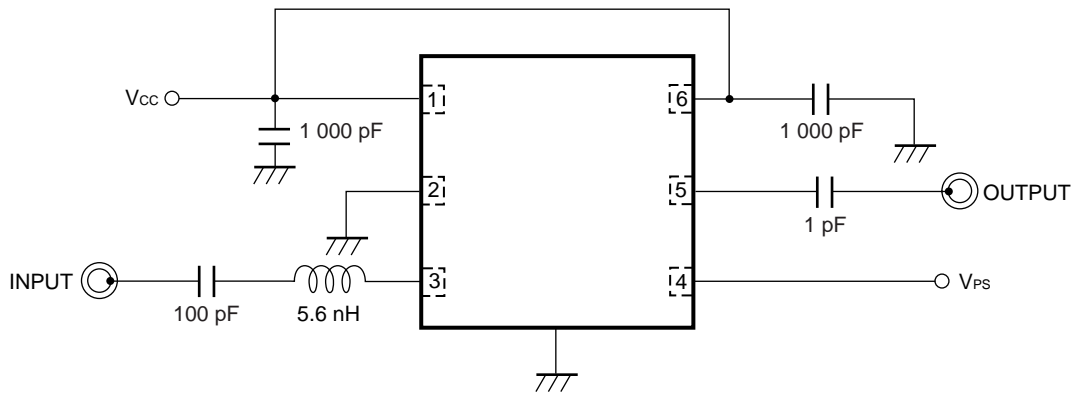
Parameter	Symbol	MIN.	TYP.	MAX.	Unit
Supply Voltage	V <sub>CC</sub>	2.5	3.0	3.3	V
Operating Ambient Temperature	T <sub>A</sub>	-40	+25	+85	°C
Power Save Turn-on Voltage	V <sub>PSon</sub>	1.6	-	V <sub>CC</sub>	V
Power Save Turn-off Voltage	V <sub>PSoff</sub>	0	-	0.4	V

**ELECTRICAL CHARACTERISTICS**

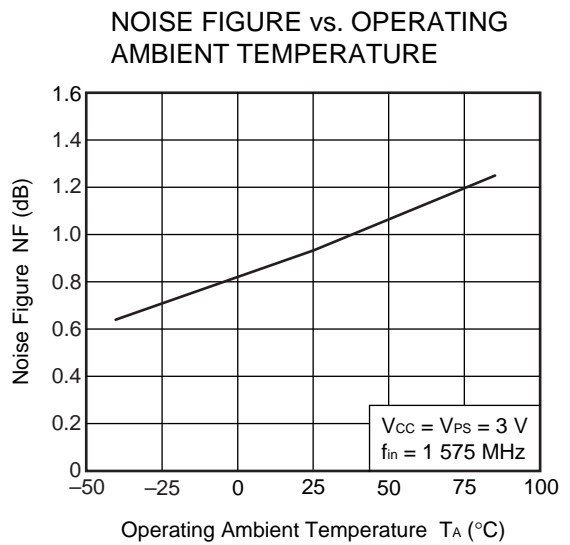
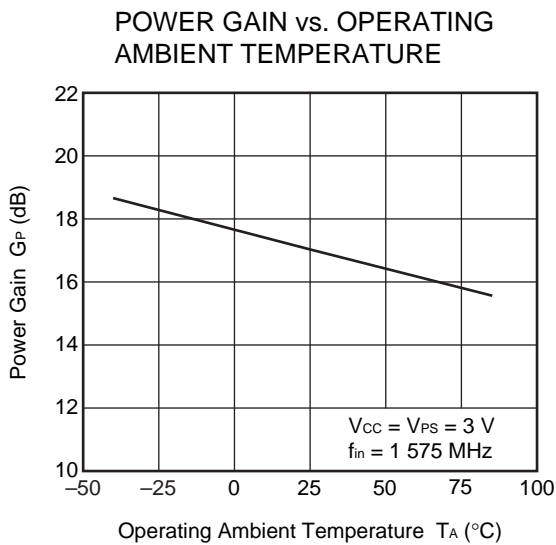
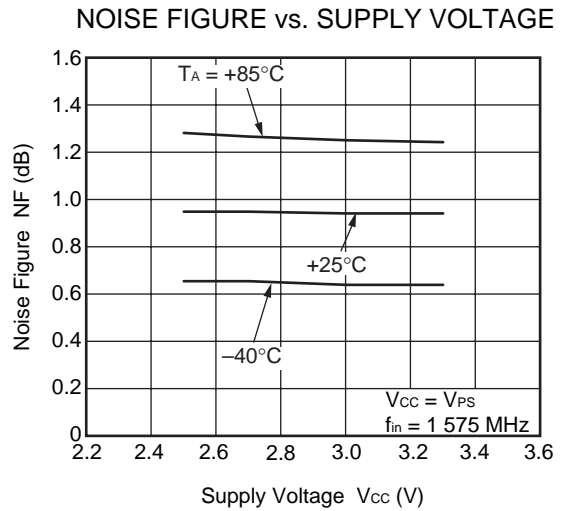
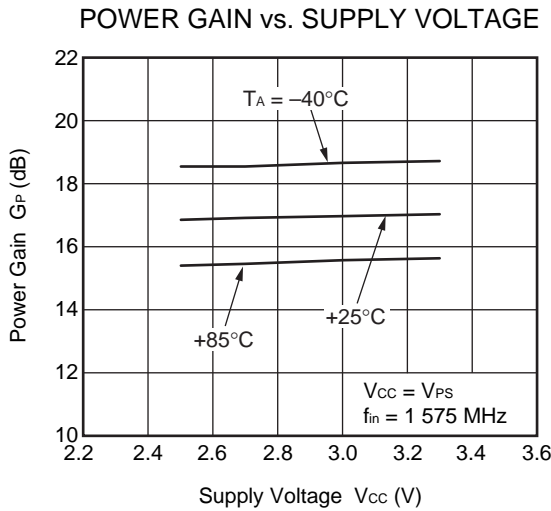
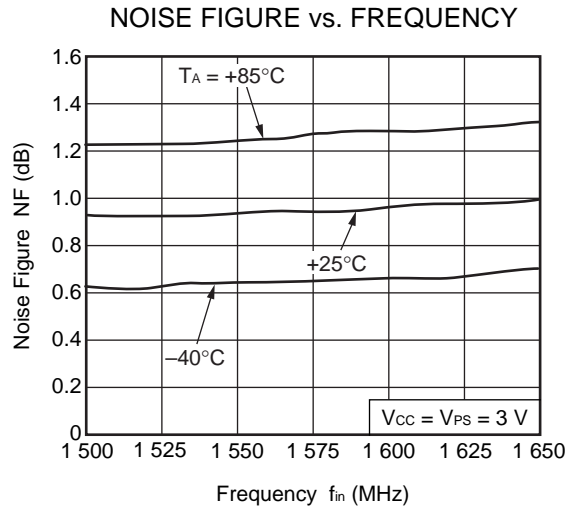
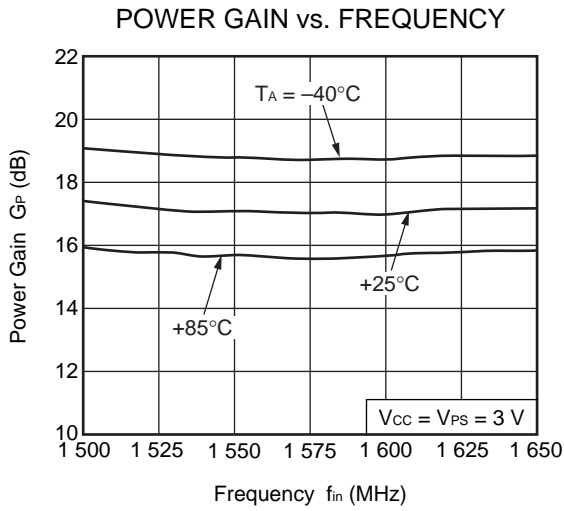
( $T_A = +25^\circ\text{C}$ ,  $V_{CC} = V_{PS} = 3.0\text{ V}$ ,  $f_{in} = 1\ 575\text{ MHz}$ , unless otherwise specified)

Parameter	Symbol	Test Conditions	MIN.	TYP.	MAX.	Unit
Circuit Current	$I_{CC}$	No Signal ( $V_{PS} = 3.0\text{ V}$ )	2.3	3.0	4.1	mA
		At Power-Saving Mode ( $V_{PS} = 0\text{ V}$ )	–	–	1	$\mu\text{A}$
Power Gain	$G_P$	$P_{in} = -35\text{ dBm}$	15	17	19	dB
Noise Figure	NF		–	0.95	1.25	dB
Input 3rd Order Distortion Intercept Point	IIP <sub>3</sub>	$f_{in1} = 1\ 574\text{ MHz}$ , $f_{in2} = 1\ 575\text{ MHz}$	–	–8	–	dBm
Input Return Loss	$RL_{in}$		7	10	–	dB
Output Return Loss	$RL_{out}$		10	20	–	dB
Isolation	ISL		–	40	–	dB
Gain 1 dB Compression Input Power	$P_{in(1\text{ dB})}$		–	–21	–	dBm

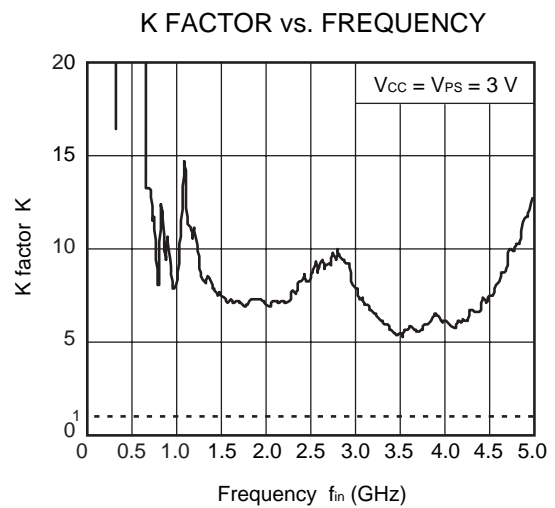
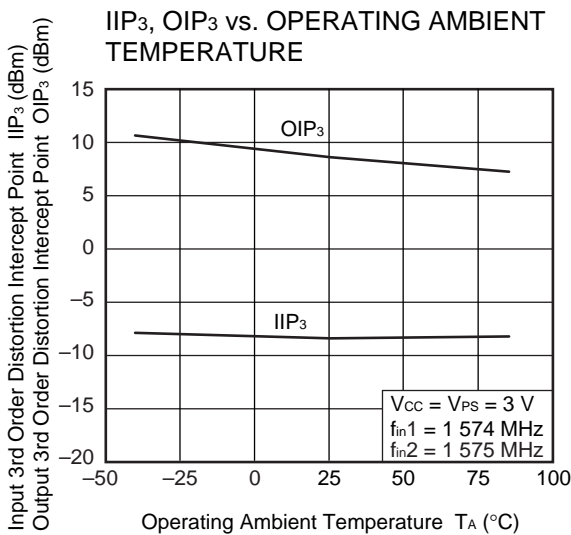
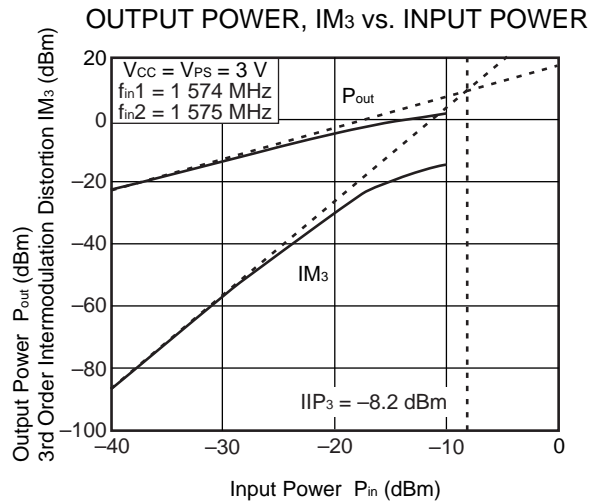
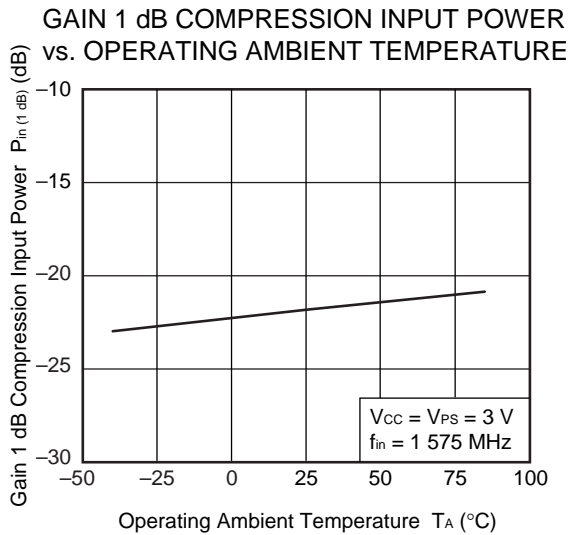
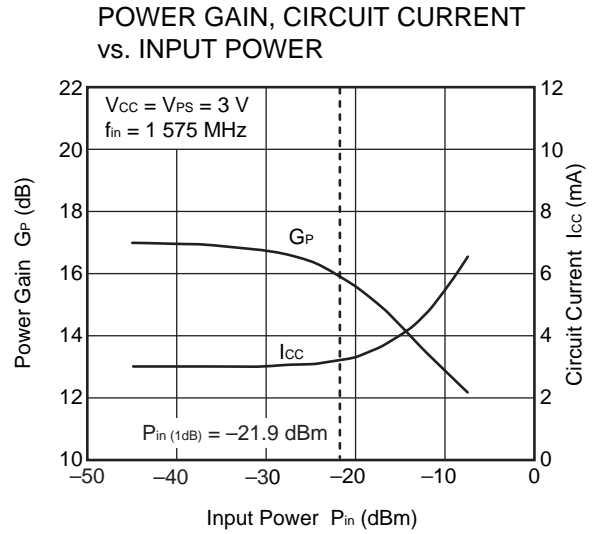
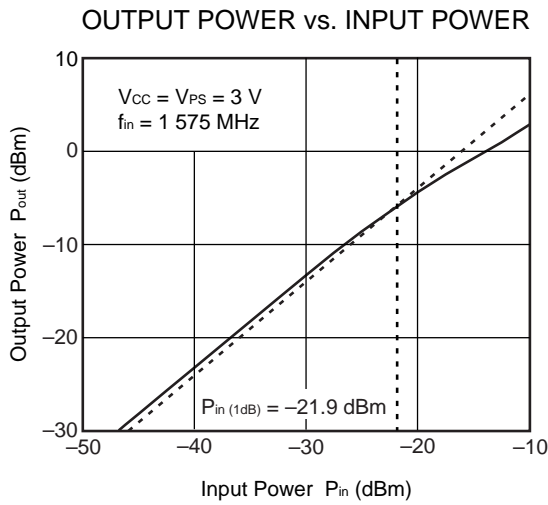
**TEST CIRCUIT**



**TYPICAL CHARACTERISTICS ( $T_A = +25^\circ\text{C}$ , unless otherwise specified)**

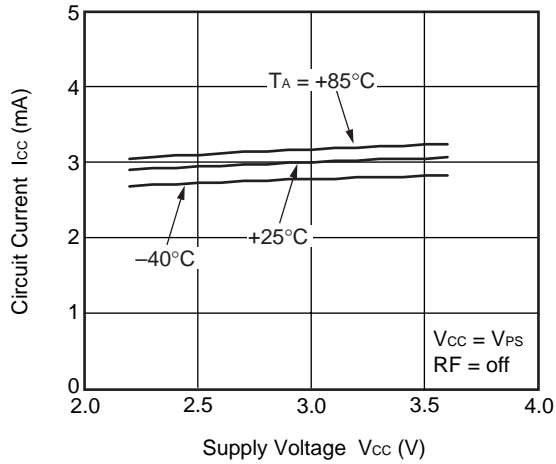


**Remark** The graphs indicate nominal characteristics.

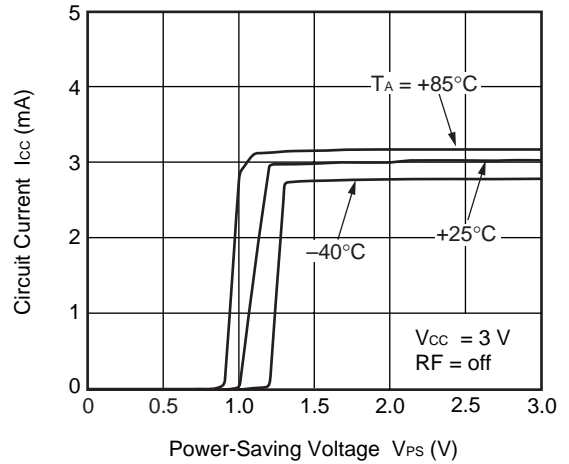


**Remark** The graphs indicate nominal characteristics.

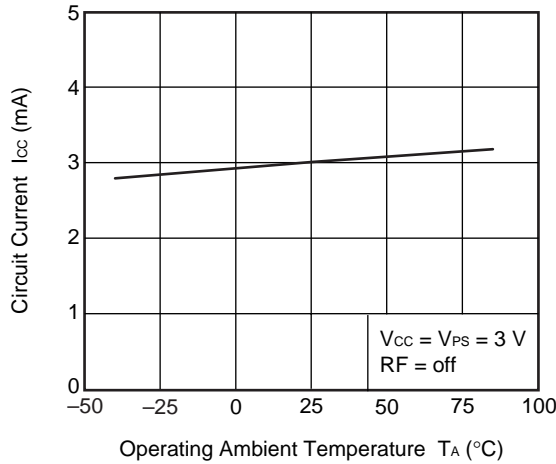
CIRCUIT CURRENT vs. SUPPLY VOLTAGE



CIRCUIT CURRENT vs. POWER-SAVING VOLTAGE



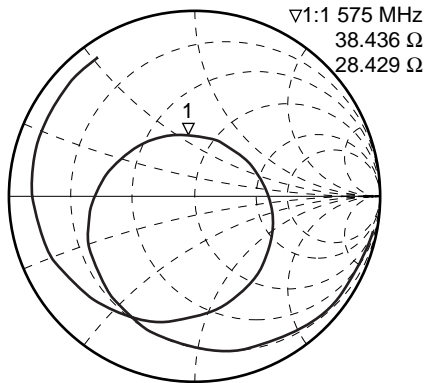
CIRCUIT CURRENT vs. OPERATING AMBIENT TEMPERATURE



**Remark** The graphs indicate nominal characteristics.

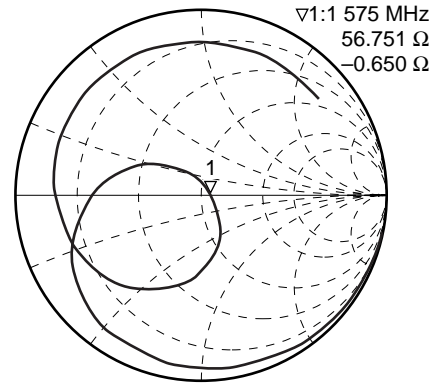
**S-PARAMETERS** ( $T_A = +25^\circ\text{C}$ ,  $V_{CC} = V_{PS} = 3.0\text{ V}$ , monitored at connector on board)

**S<sub>11</sub>-FREQUENCY**



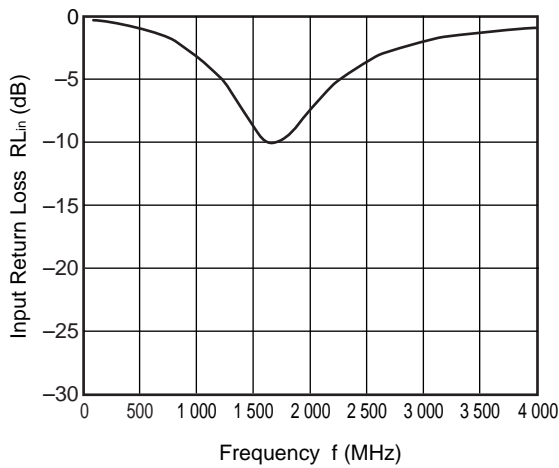
START 100.000 MHz STOP 4 100.000 MHz

**S<sub>22</sub>-FREQUENCY**

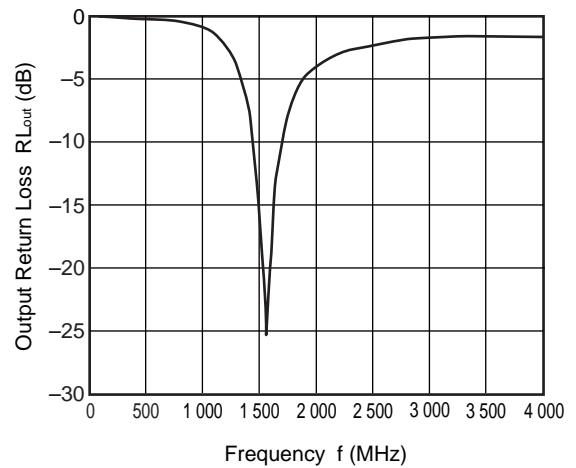


START 100.000 MHz STOP 4 100.000 MHz

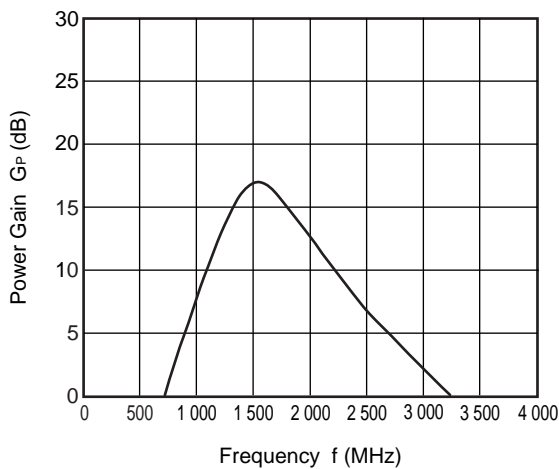
**INPUT RETURN LOSS vs. FREQUENCY**



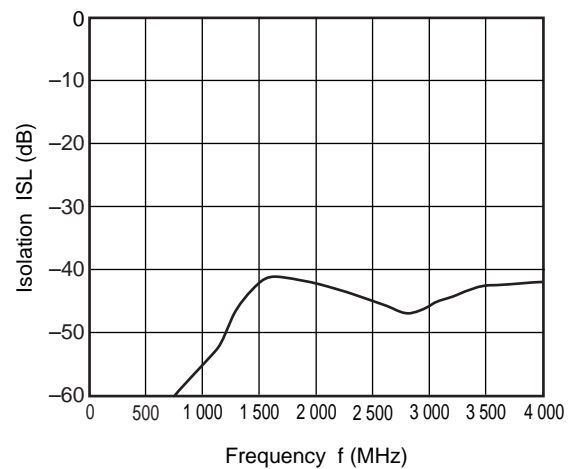
**OUTPUT RETURN LOSS vs. FREQUENCY**



**POWER GAIN vs. FREQUENCY**



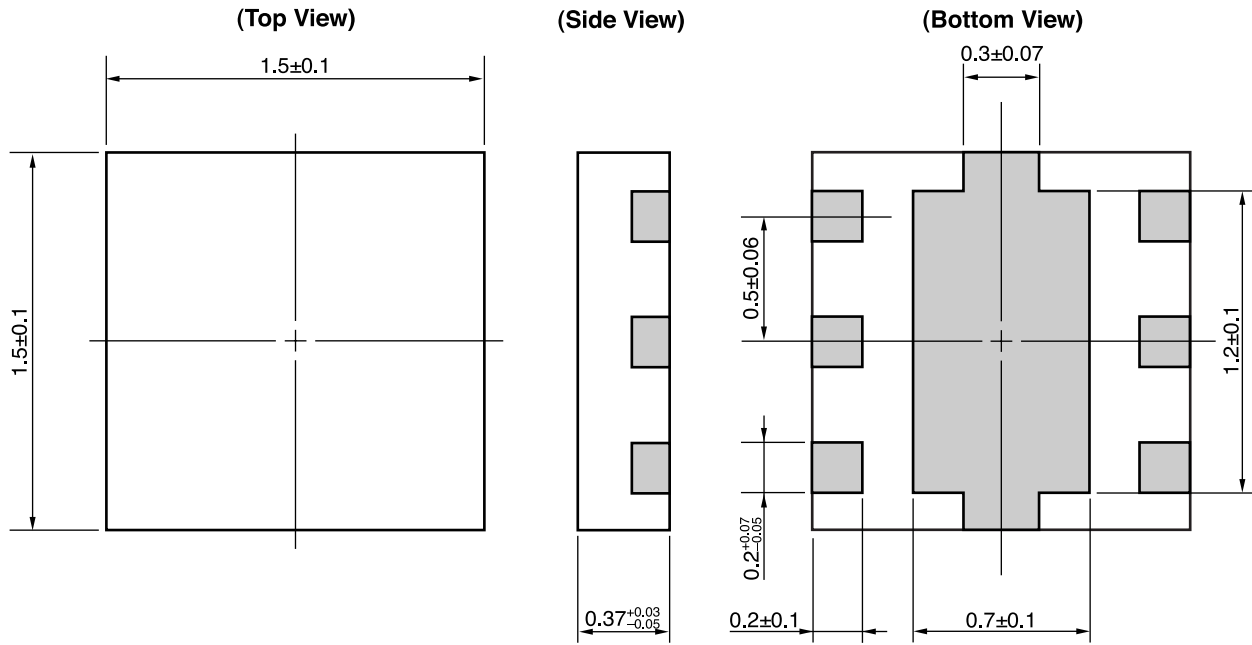
**ISOLATION vs. FREQUENCY**



**Remark** The graphs indicate nominal characteristics.

**PACKAGE DIMENSIONS**

**6-PIN PLASTIC TSON (UNIT: mm)**





**NOTES ON CORRECT USE**

- (1) Observe precautions for handling because of electro-static sensitive devices.
- (2) Form a ground pattern as widely as possible to minimize ground impedance (to prevent undesired oscillation).  
All the ground terminals must be connected together with wide ground pattern to decrease impedance difference.
- (3) The bypass capacitor should be attached to Vcc line.
- (4) Do not supply DC voltage to INPUT pin.

**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).**

- **The information in this document is current as of July, 2007. The information is subject to change without notice. For actual design-in, refer to the latest publications of NEC Electronics data sheets or data books, etc., for the most up-to-date specifications of NEC Electronics products. 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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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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