DATA SHEET

NEC

BIPOLAR ANALOG INTEGRATED CIRCUIT

μPC8231TK

SiGe:C LOW NOISE AMPLIFIER FOR GPS/MOBILE COMMUNICATIONS

DESCRIPTION

The μPC8231TK is a silicon germanium carbon (SiGe:C) monolithic integrated circuit designed as low noise amplifier for GPS and mobile communications. This device exhibits low noise figure and high power gain characteristics. This device is enabled in the frequency range from 1.5 to 2.4 GHz by modifying the external matching circuit.

The package is 6-pin lead-less minimold, suitable for surface mount.

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

FEATURES

- Low noise : NF = 0.8 dB TYP. @ f_{in} = 1 575 MHz
- High gain : G_P = 20 dB TYP. @ f_{in} = 1 575 MHz
- Low current consumption : I_{CC} = 3.8 mA TYP. @ V_{CC} = 3.0 V
- Built-in power-saving function
- High-density surface mounting : 6-pin lead-less minimold package (1.5 × 1.1 × 0.55 mm)
- Included very robust bandgap regulator (Small V_{CC} and T_A dependence)
- Included protection circuits for ESD

APPLICATION

- Low noise amplifier for GPS and mobile communications

ORDERING INFORMATION

Part Number	Order Number	Package	Marking	Supplying Form
μPC8231TK-E2	μPC8231TK-E2-A	6-pin lead-less minimold (1511 PKG) (Pb-Free)	6K	• 8 mm wide embossed taping • 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: μPC8231TK

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.
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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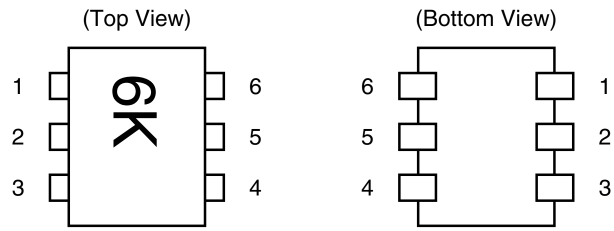
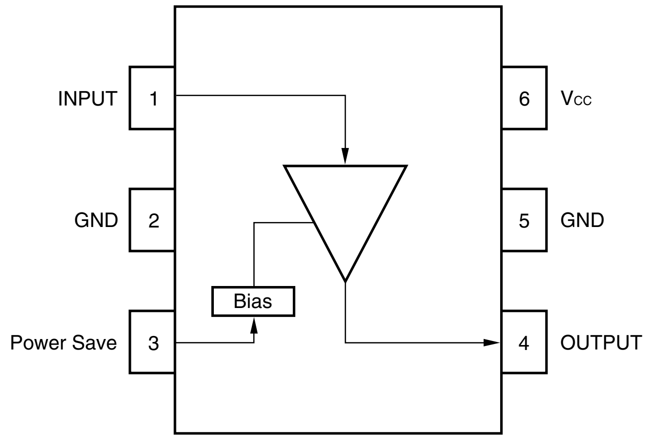
PIN CONNECTIONS



Pin No.	Pin Name
1	INPUT
2	GND
3	Power Save
4	OUTPUT
5	GND
6	V_{CC}

INTERNAL BLOCK DIAGRAM



ABSOLUTE MAXIMUM RATINGS

Parameter	Symbol	Test Conditions	Ratings	Unit
Supply Voltage	V_{CC}	T_A = +25°C	4.0	V
Power-Saving Voltage	V_{PS}	T_A = +25°C	4.0	V
Power Dissipation	P_D	T_A = +85°C **Note**	232	mW
Operating Ambient Temperature	T_A		–40 to +85	°C
Storage Temperature	T_{stg}		–55 to +150	°C
Input Power	P_{in}		+10	dBm

Note Mounted on double-side copper-clad 50 × 50 × 1.6 mm epoxy glass PWB

RECOMMENDED OPERATING RANGE

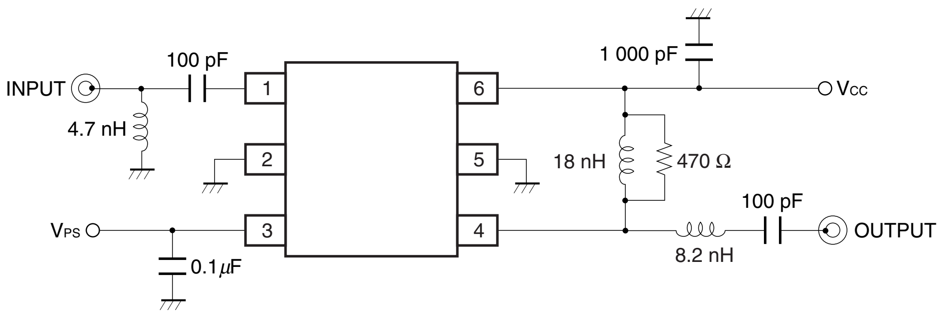
Parameter	Symbol	MIN.	TYP.	MAX.	Unit
Supply Voltage	V_{CC}	2.7	3.0	3.3	V
Operating Ambient Temperature	T_A	–40	+25	+85	°C
Power Save Turn-on Voltage	V_{PSon}	1.6	–	V_{CC}	V
Power Save Turn-off Voltage	V_{PSoff}	0	–	0.4	V

ELECTRICAL CHARACTERISTICS

(T_A = +25°C, V_{CC} = V_{PS} = 3.0 V, f_{in} = 1 575 MHz, unless otherwise specified)

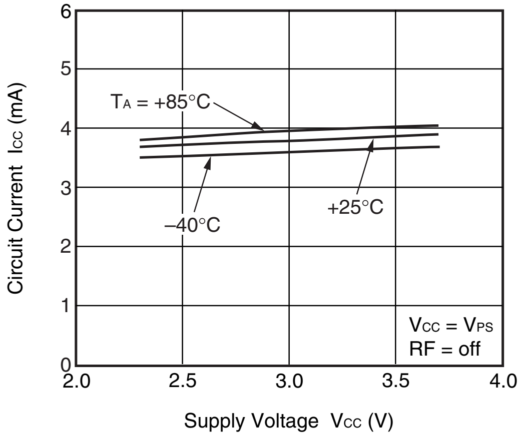
Parameter	Symbol	Test Conditions	MIN.	TYP.	MAX.	Unit
Circuit Current	I_{CC}	No Signal (V_{PS} = 3.0 V)	2.8	3.8	5.1	mA
		At Power-Saving Mode (V_{PS} = 0 V)	–	–	1	μA
Power Gain	G_P	P_{in} = –35 dBm	17.5	20	22.5	dB
Noise Figure	NF		–	0.8	1.1	dB
Input 3rd Order Distortion Intercept Point	IIP_3	$f_{in}1$ = 1 574 MHz, $f_{in}2$ = 1 575 MHz	–	–10	–	dBm
Input Return Loss	RL_{in}		7	10	–	dB
Output Return Loss	RL_{out}		10	18	–	dB
Isolation	ISL		–	35	–	dB
Gain 1 dB Compression Input Power	$P_{in\ (1\ dB)}$		–	–22	–	dBm

TEST CIRCUIT

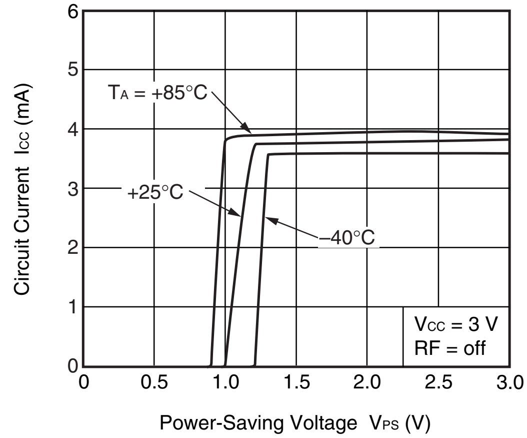


TYPICAL CHARACTERISTICS (T_A = +25°C, unless otherwise specified)

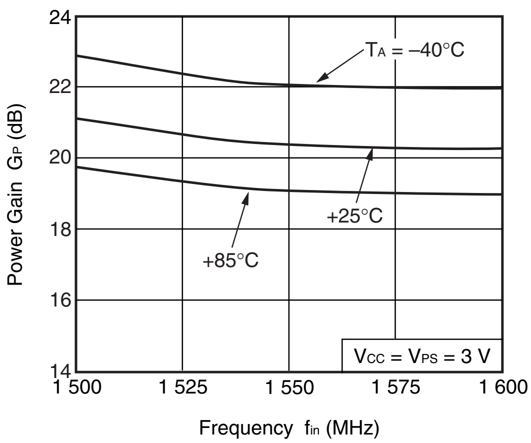
CIRCUIT CURRENT vs. SUPPLY VOLTAGE



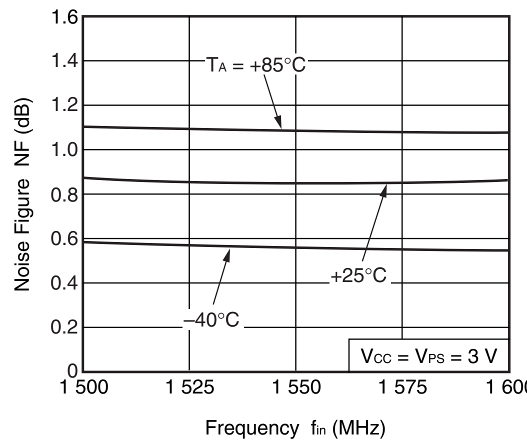
CIRCUIT CURRENT vs.
POWER-SAVING VOLTAGE



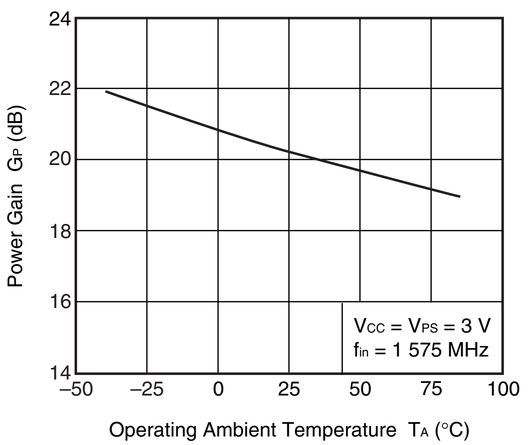
POWER GAIN vs. FREQUENCY



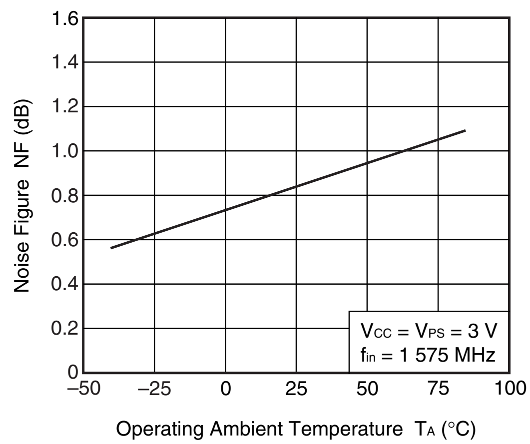
NOISE FIGURE vs. FREQUENCY



POWER GAIN vs. OPERATING
AMBIENT TEMPERATURE

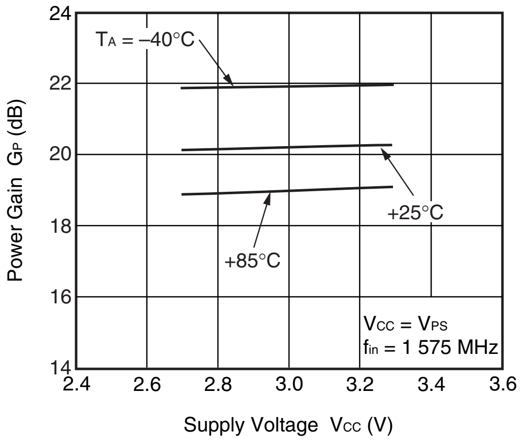


NOISE FIGURE vs. OPERATING
AMBIENT TEMPERATURE

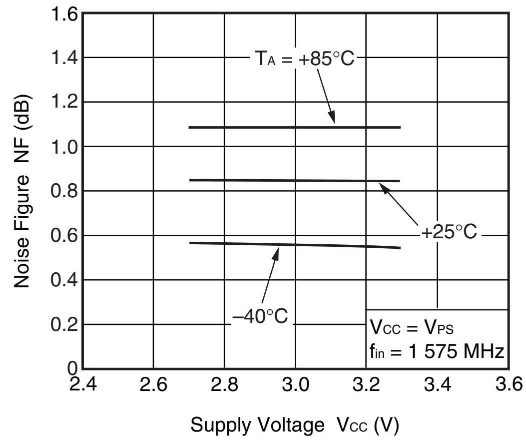


Remark The graphs indicate nominal characteristics.

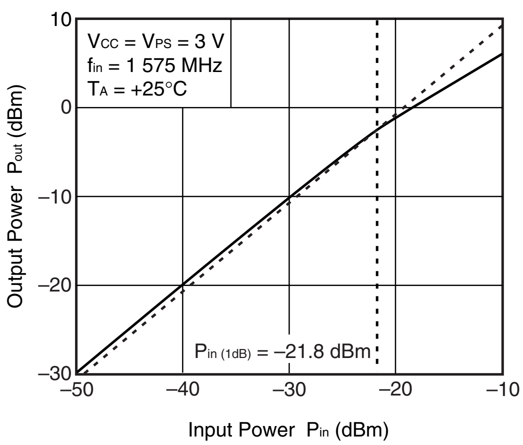
POWER GAIN vs. SUPPLY VOLTAGE



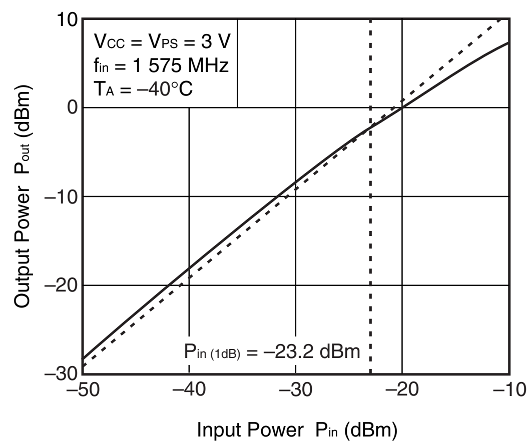
NOISE FIGURE vs. SUPPLY VOLTAGE



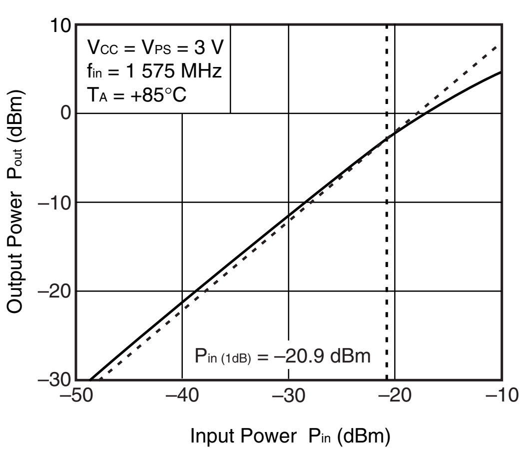
OUTPUT POWER vs. INPUT POWER



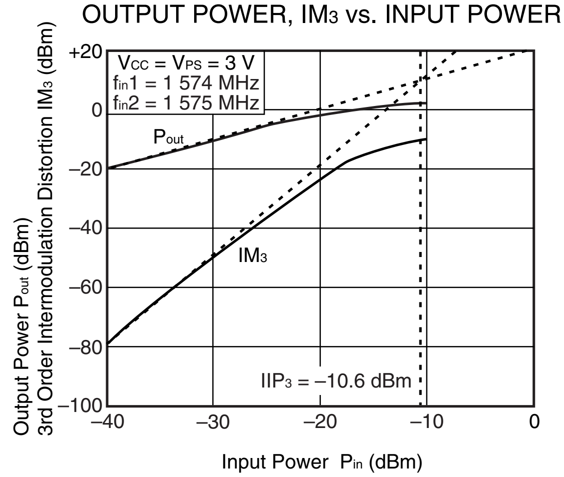
OUTPUT POWER vs. INPUT POWER



OUTPUT POWER vs. INPUT POWER



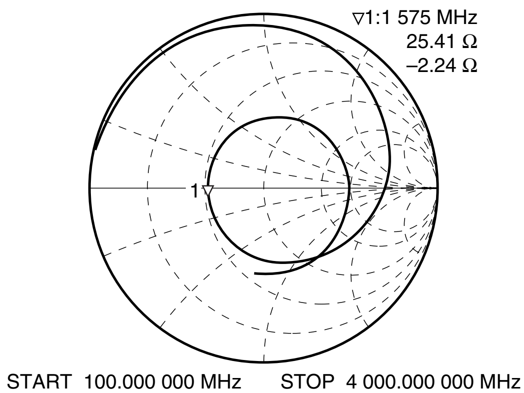
OUTPUT POWER, IM3 vs. INPUT POWER



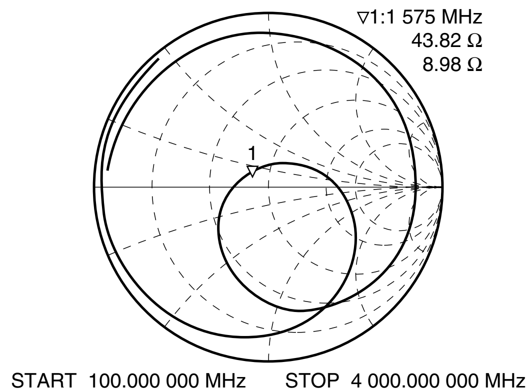
Remark The graphs indicate nominal characteristics.

S-PARAMETERS (T_A = +25°C, V_{CC} = V_{PS} = 3.0 V, monitored at connector on board)

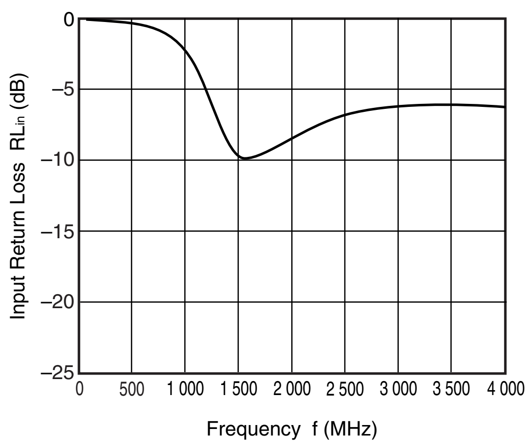
S11–FREQUENCY



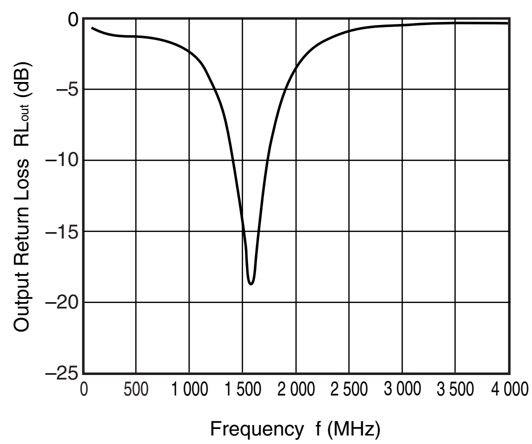
S22–FREQUENCY



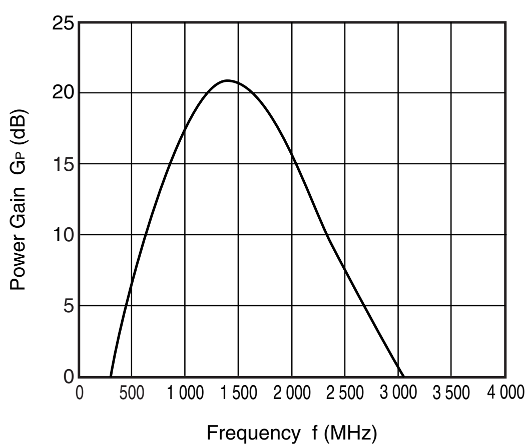
INPUT RETURN LOSS vs. FREQUENCY



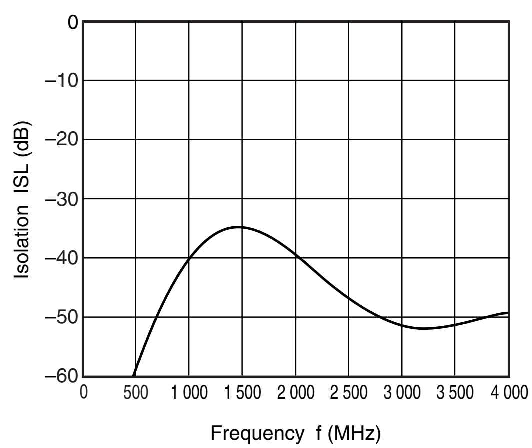
OUTPUT RETURN LOSS vs. FREQUENCY



POWER GAIN vs. FREQUENCY

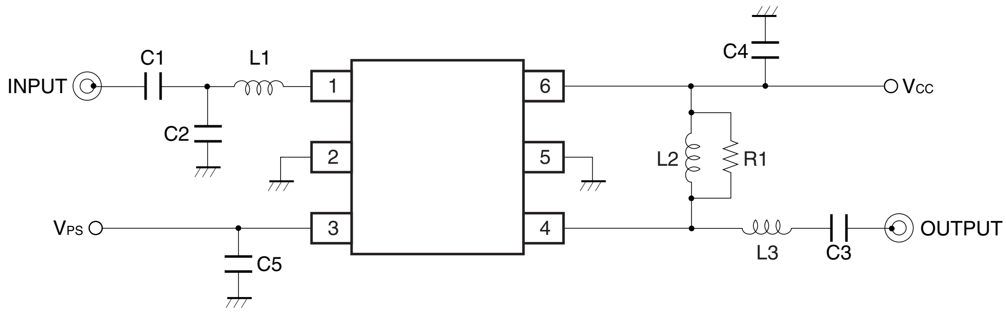


ISOLATION vs. FREQUENCY



Remark The graphs indicate nominal characteristics.

APPLIED CIRCUIT EXAMPLE



EXTERNAL PARTS CHART

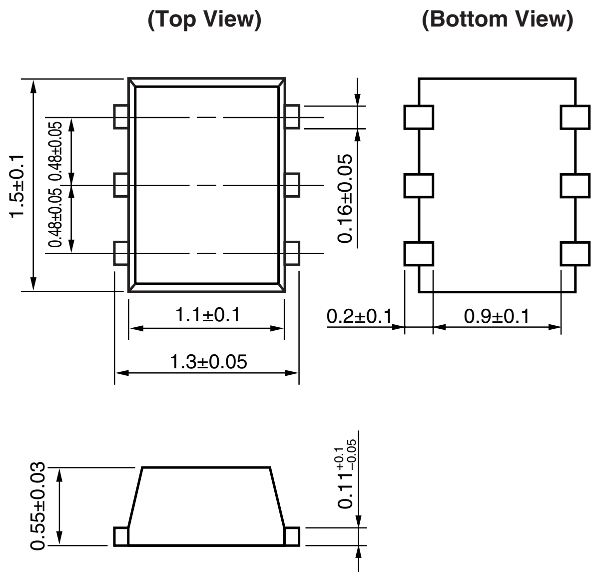
Symbol	Parts	Value				Unit
		1.575 GHz Band	1.9 GHz Band	2.14 GHz Band	2.4 GHz Band	
L1	Chip Inductor	5.6	3.9	3.3	2.7	nH
L2	Chip Inductor	18	12	8.2	6.8	nH
L3	Chip Inductor	10	8.2	6.8	5.6	nH
C1	Chip Capacitor	120	5.0	2.0	2.0	pF
C2	Chip Capacitor	1.3	0.7	0.5	0.3	pF
C3	Chip Capacitor	120	5.0	5.0	5.0	pF
C4	Chip Capacitor	1 000	1 000	1 000	1 000	pF
C5	Chip Capacitor	1 000	1 000	1 000	1 000	pF
R1	Chip Resistor	470	470	470	470	Ω

TYPICAL CHARACTERISTICS (T_A = +25°C, V_{CC} = V_{PS} = 3.0 V, unless otherwise specified)

Parameter	Symbol	Reference Value				Unit
		1.575 GHz	1.9 GHz	2.14 GHz	2.4 GHz	
Power Gain	G_P	20.0	19.0	18.0	17.0	dB
Noise Figure	NF	0.78	0.95	1.10	1.27	dB
Input Return Loss	RL_{in}	10.4	10.2	10.2	10.5	dB
Output Return Loss	RL_{out}	21.0	30.0	32.2	23.0	dB

PACKAGE DIMENSIONS

6-PIN LEAD-LESS MINIMOLD (1511 PKG) (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 V_{CC} 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	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).

▶For further information, please contact

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