

**13 GHz INPUT DIVIDE BY 4 PRESCALER IC  
FOR SATELLITE COMMUNICATIONS****DESCRIPTION**

The  $\mu$ PB1513TU is a silicon germanium (SiGe) monolithic integrated circuit designed as a divide by 4 prescaler IC for satellite communications and point-to-point/multi-point radios.

The package is 8-pin lead-less minimold suitable for surface mount.

This IC is manufactured using our 50 GHz  $f_{max}$  UHS2 (Ultra High Speed Process) SiGe bipolar process.

**FEATURES**

- Operating frequency :  $f_{in} = 5$  to 13 GHz
- Low current consumption :  $I_{cc} = 48$  mA @  $V_{cc} = 5.0$  V
- High-density surface mounting : 8-pin lead-less minimold
- Supply voltage :  $V_{cc} = 4.5$  to 5.5 V
- Division ratio : 4

**APPLICATIONS**

- Point-to-point/Multi-point radios
- VSAT radios

**ORDERING INFORMATION**

Part Number	Order Number	Package	Marking	Supplying Form
$\mu$ PB1513TU-E2	$\mu$ PB1513TU-E2-A	8-pin lead-less minimold (Pb-Free) <sup>Note</sup>	1513	<ul style="list-style-type: none"><li>• 8 mm wide embossed taping</li><li>• Pin 5, 6, 7, 8 indicates pull-out direction of 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.

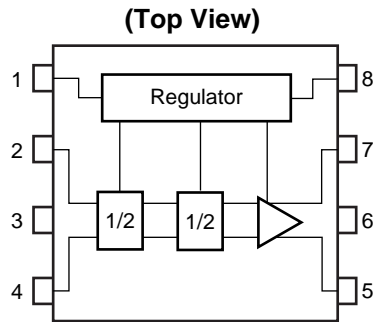
**Remark** To order evaluation samples, contact your nearby sales office.

Part number for sample order:  $\mu$ PB1513TU

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

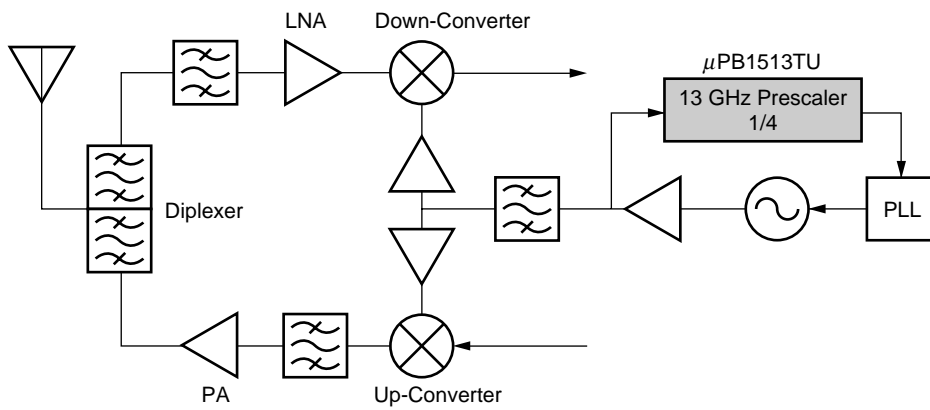
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**INTERNAL BLOCK DIAGRAM AND PIN CONNECTIONS**



Pin No.	Pin Name
1	V <sub>cc1</sub>
2	IN
3	GND
4	$\overline{\text{IN}}$
5	$\overline{\text{OUT}}$
6	GND
7	OUT
8	V <sub>cc2</sub>

**SYSTEM APPLICATION EXAMPLE**



**PIN EXPLANATION**

Pin No.	Pin Name	Applied Voltage (V)	Function and Applications
1	V <sub>cc1</sub>	5	Power supply pin. This pin must be equipped with bypass capacitor (example : 100 pF and 10 nF) to minimize ground impedance.
2	IN	–	Signal input pin. This pin should be coupled to signal source with capacitor (example : 100 pF) for DC cut.
3	GND	0	Ground pin. Ground pattern on the board should be formed as widely as possible to minimize ground impedance.
4	$\overline{\text{IN}}$	–	Signal input bypass pin. This pin must be equipped with bypass capacitor (example : 100 pF) to minimize ground impedance.
5	$\overline{\text{OUT}}$	–	Divided frequency output pin. This pin should be coupled to load device with capacitor (example : 100 pF) for DC cut.
6	GND	0	Ground pin. Ground pattern on the board should be formed as widely as possible to minimize ground impedance.
7	OUT	–	Divided frequency output pin. This pin should be coupled to load device with capacitor (example : 100 pF) for DC cut.
8	V <sub>cc2</sub>	5	Power supply pin. This pin must be equipped with bypass capacitor (example : 100 pF and 10 nF) to minimize ground impedance.

**ABSOLUTE MAXIMUM RATINGS**

Parameter	Symbol	Test Conditions	Ratings	Unit
Supply Voltage	V <sub>CC</sub>	T <sub>A</sub> = +25°C	6	V
Total Power Dissipation	P <sub>D</sub>	T <sub>A</sub> = +85°C <b>Note</b>	867	mW
Thermal Resistance (junction to ground paddle)	R <sub>th(j-c)</sub>	T <sub>A</sub> = +85°C <b>Note</b>	75	°C/W
Operating Ambient Temperature	T <sub>A</sub>		-40 to +85	°C
Storage Temperature	T <sub>stg</sub>		-55 to +150	°C

**Note** Mounted on 33 × 21 × 0.4 mm polyimide PCB, with copper patterning on both sides.

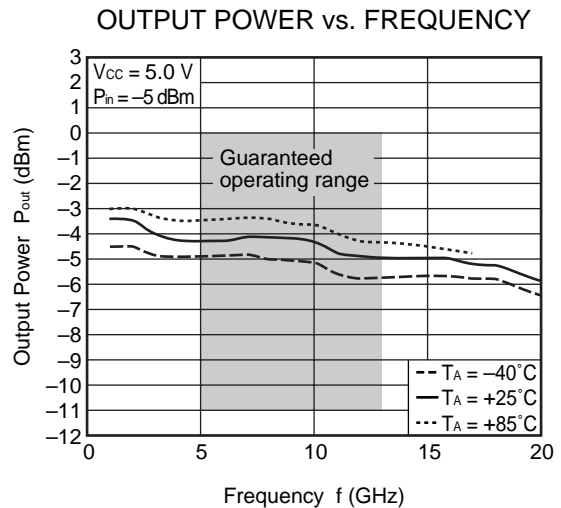
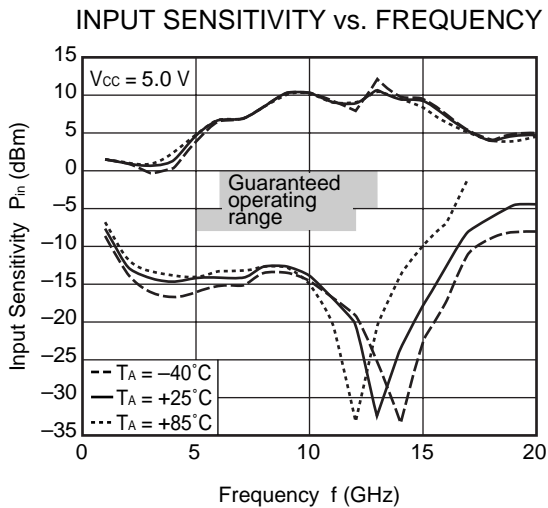
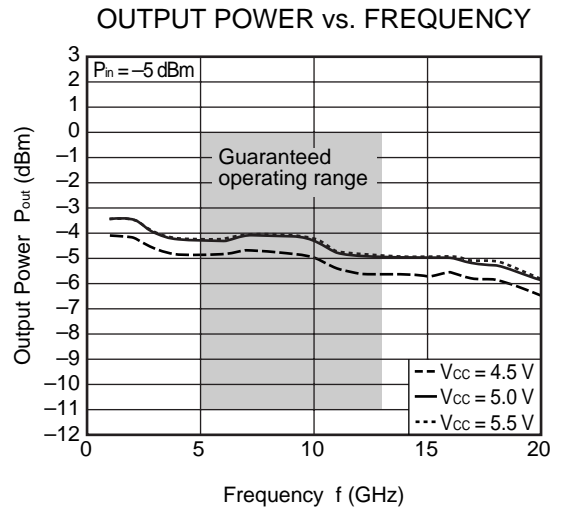
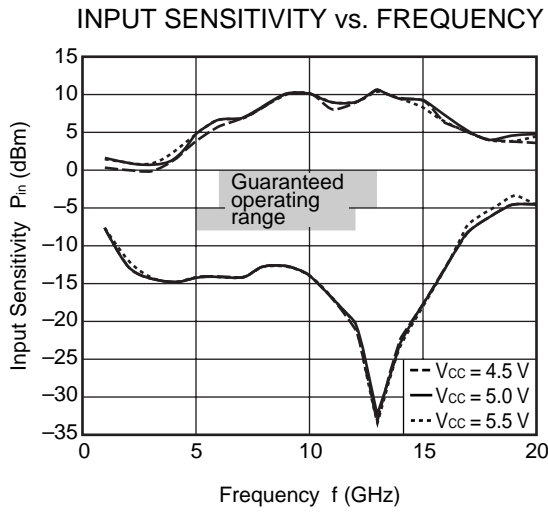
**RECOMMENDED OPERATING RANGE**

Parameter	Symbol	MIN.	TYP.	MAX.	Unit
Supply Voltage	V <sub>CC</sub>	4.5	5.0	5.5	V
Operating Ambient Temperature	T <sub>A</sub>	-40	+25	+85	°C

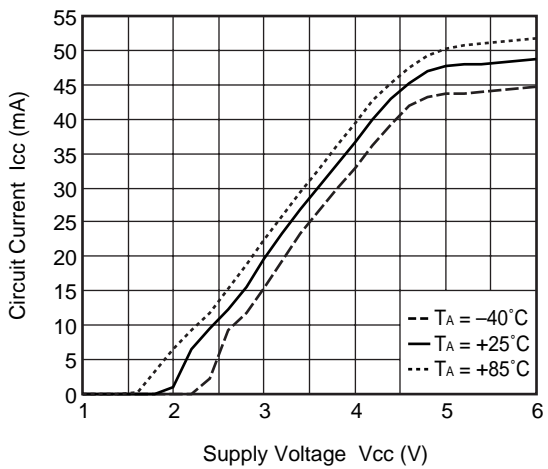
**ELECTRICAL CHARACTERISTICS (V<sub>CC</sub> = 4.5 to 5.5 V, T<sub>A</sub> = -40 to +85°C, Z<sub>s</sub> = Z<sub>L</sub> = 50 Ω)**

Parameter	Symbol	Test Conditions	MIN.	TYP.	MAX.	Unit
Circuit Current	I <sub>CC</sub>	No Signals	-	48	75	mA
Input Sensitivity	P <sub>in1</sub>	f <sub>in</sub> = 5 to 6 GHz	-8	-	-5	dBm
	P <sub>in2</sub>	f <sub>in</sub> = 6 to 12 GHz	-8	-	0	dBm
	P <sub>in3</sub>	f <sub>in</sub> = 12 to 13 GHz	-5	-	0	dBm
Output Power	P <sub>out</sub>	f <sub>in</sub> = 5 to 13 GHz, single ended, P <sub>in</sub> = -5 dBm	-11	-4	2	dBm

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



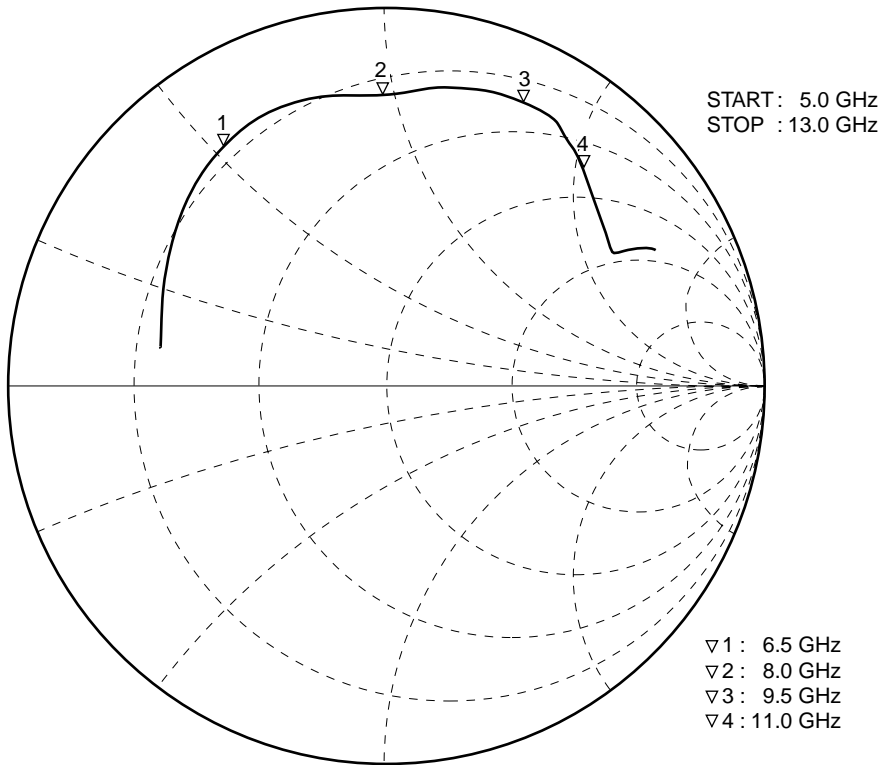
★ **CIRCUIT CURRENT vs. SUPPLY VOLTAGE**



**Remark** The graphs indicate nominal characteristics.

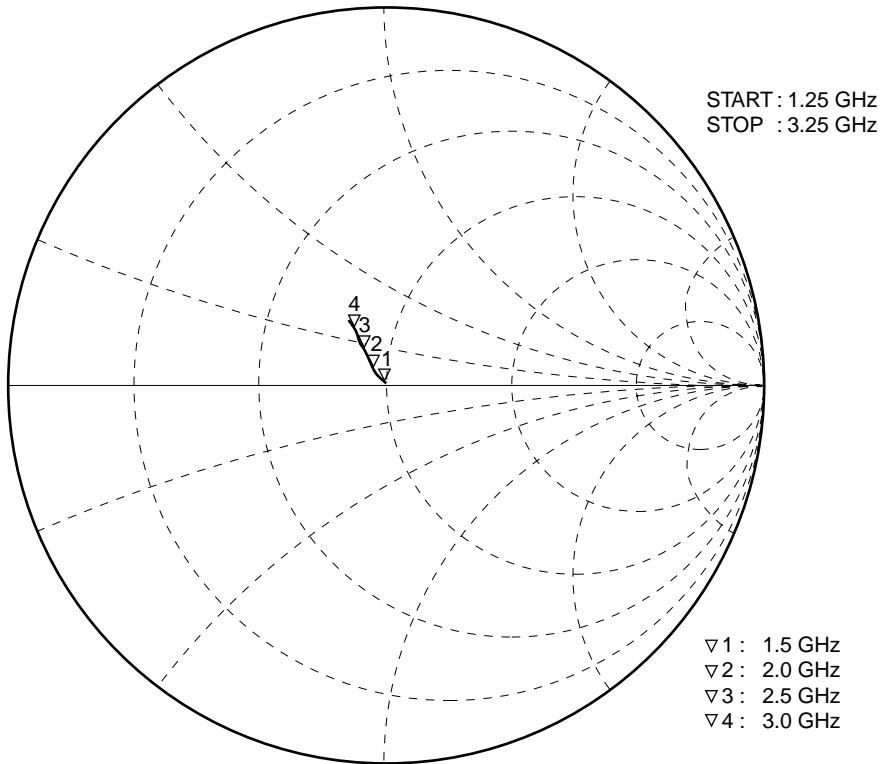
★ S-PARAMETERS ( $T_A = +25^\circ\text{C}$ ,  $V_{CC} = 5.0\text{ V}$ )

S<sub>11</sub>-FREQUENCY



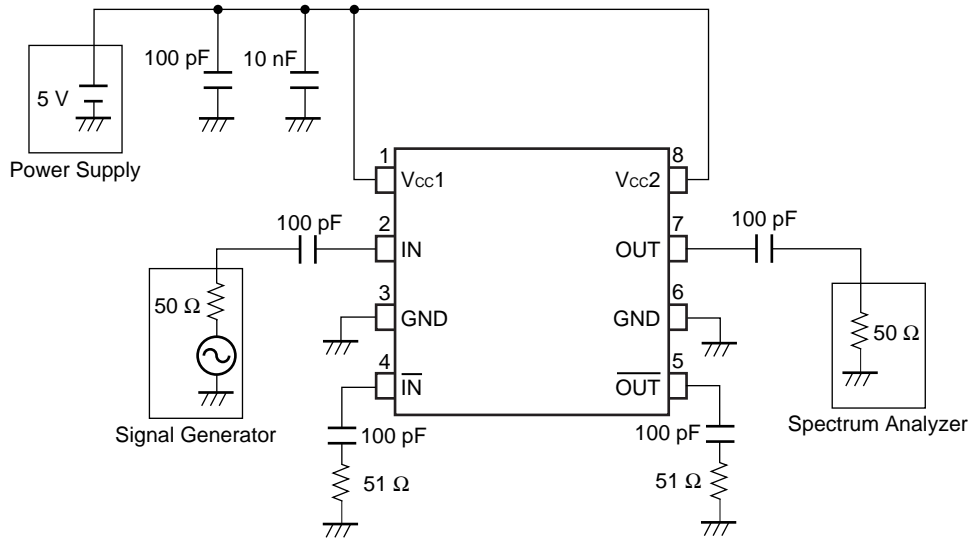
FREQUENCY GHz	MAG	S <sub>11</sub> ANG
5.0	0.603	170.5
6.0	0.705	139.7
7.0	0.782	112.0
8.0	0.766	90.6
9.0	0.820	71.2
10.0	0.832	57.9
11.0	0.768	46.3
12.0	0.698	32.2
13.0	0.798	26.6

S<sub>22</sub>-FREQUENCY



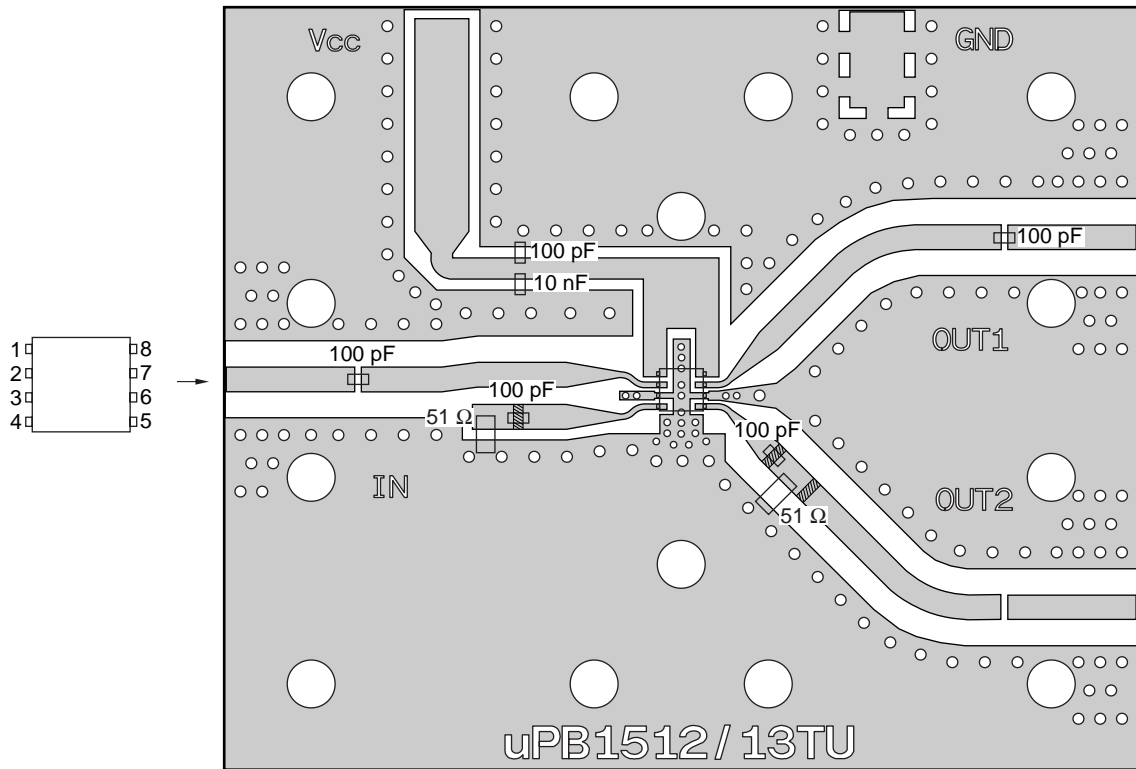
FREQUENCY GHz	MAG	S <sub>22</sub> ANG
1.25	0.002	90.3
1.4	0.011	133.3
1.6	0.024	132.3
1.8	0.038	130.2
2.0	0.054	127.3
2.2	0.073	126.8
2.4	0.092	124.5
2.6	0.117	122.6
2.8	0.137	121.9
3.0	0.164	120.3
3.2	0.186	120.3
3.25	0.196	121.0


MEASUREMENT CIRCUIT



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

ILLUSTRATION OF THE MEASUREMENT CIRCUIT ASSEMBLED ON EVALUATION BOARD

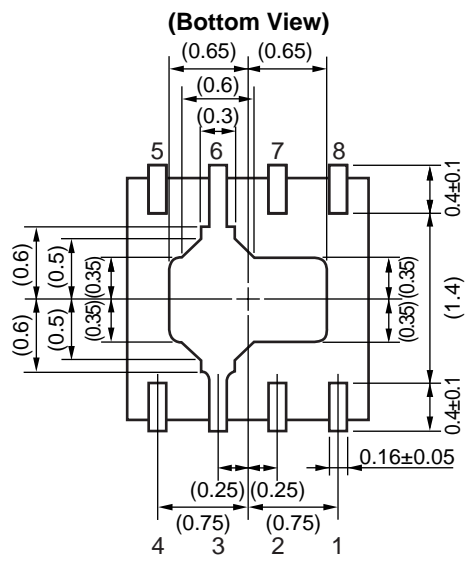
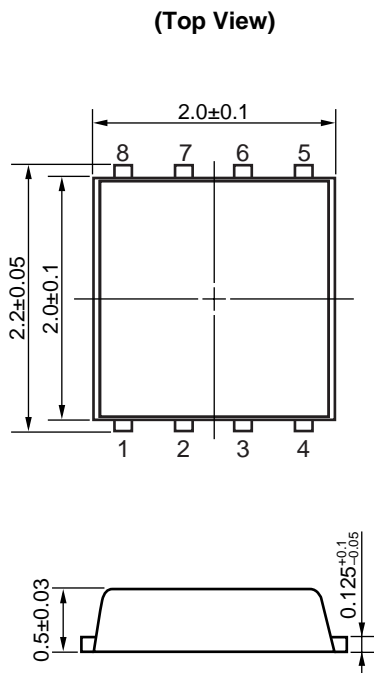


- Remarks**
1. 33 × 21 × 0.4 mm double-sided copper-clad polyimide PCB
  2. Back side: GND pattern
  3. Solder plated on pattern
  4.  represents cutout
  5. ○: Through holes



PACKAGE DIMENSIONS

8-PIN LEAD-LESS MINIMOLD (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).
- (3) Keep the track length of the ground terminals as short as possible.
- (4) Bypass capacitance must be attached to V<sub>cc</sub> line.
- (5) Exposed heatsink at bottom on package must be soldered to PCB RF/DC ground.

**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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**NEC Compound Semiconductor Devices, Ltd.** <http://www.ncsd.necel.com/>

E-mail: [salesinfo@ml.ncsd.necel.com](mailto:salesinfo@ml.ncsd.necel.com) (sales and general)

[techinfo@ml.ncsd.necel.com](mailto:techinfo@ml.ncsd.necel.com) (technical)

Sales Division TEL: +81-44-435-1588 FAX: +81-44-435-1579

**NEC Compound Semiconductor Devices Hong Kong Limited**

E-mail: [ncsd-hk@elhk.nec.com.hk](mailto:ncsd-hk@elhk.nec.com.hk) (sales, technical and general)

Hong Kong Head Office TEL: +852-3107-7303 FAX: +852-3107-7309

Taipei Branch Office TEL: +886-2-8712-0478 FAX: +886-2-2545-3859

Korea Branch Office TEL: +82-2-558-2120 FAX: +82-2-558-5209

**NEC Electronics (Europe) GmbH** <http://www.ee.nec.de/>

TEL: +49-211-6503-0 FAX: +49-211-6503-1327

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TEL: +1-408-988-3500 FAX: +1-408-988-0279

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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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**Телефон:** +7 812 627 14 35

**Электронная почта:** [sales@st-electron.ru](mailto:sales@st-electron.ru)

**Адрес:** 198099, Санкт-Петербург,  
Промышленная ул, дом № 19, литера Н,  
помещение 100-Н Офис 331