

# PRELIMINARY DATA SHEET



## GaAs INTEGRATED CIRCUIT uPG2159T5K

### L,S-BAND MINIATURE SPDT SWITCH

#### DESCRIPTION

The uPG2159T5K is a GaAs MMIC L,S-band SPDT (Single Pole Double Throw) switch designed for mobile phone and the other L,S-band applications.

This device can operate from frequency 0.05GHz to 3.0GHz, with low insertion loss and high isolation

This device is housed in a 6-pin TSSON (Thin Shrink Small Out-line Non-Leaded) package, and is suitable for high-density surface mounting.

#### FEATURES

- Switch Control Voltage :  $V_{cont(H)} = 1.8$  to  $3.3V$  (2.7V TYP.)  
:  $V_{cont(L)} = -0.2$  to  $0.2V$  (0V TYP.)
- Low Insertion Loss :  $L_{ins1} = 0.20dB$  TYP. @  $f = 0.05$  to  $0.5GHz$ ,  $V_{cont(H)} = 2.7V$ ,  $V_{cont(L)} = 0V$   
:  $L_{ins2} = 0.21dB$  TYP. @  $f = 0.5$  to  $1.0GHz$ ,  $V_{cont(H)} = 2.7V$ ,  $V_{cont(L)} = 0V$   
:  $L_{ins3} = 0.23dB$  TYP. @  $f = 1.0$  to  $2.0GHz$ ,  $V_{cont(H)} = 2.7V$ ,  $V_{cont(L)} = 0V$   
:  $L_{ins4} = 0.25dB$  TYP. @  $f = 2.0$  to  $2.5GHz$ ,  $V_{cont(H)} = 2.7V$ ,  $V_{cont(L)} = 0V$   
:  $L_{ins5} = 0.27dB$  TYP. @  $f = 2.5$  to  $3.0GHz$ ,  $V_{cont(H)} = 2.7V$ ,  $V_{cont(L)} = 0V$
- High Isolation :  $ISL1 = 27dB$  TYP. @  $f = 0.05$  to  $0.5GHz$ ,  $V_{cont(H)} = 2.7V$ ,  $V_{cont(L)} = 0V$   
:  $ISL2 = 27dB$  TYP. @  $f = 0.5$  to  $1.0GHz$ ,  $V_{cont(H)} = 2.7V$ ,  $V_{cont(L)} = 0V$   
:  $ISL3 = 27dB$  TYP. @  $f = 1.0$  to  $2.0GHz$ ,  $V_{cont(H)} = 2.7V$ ,  $V_{cont(L)} = 0V$   
:  $ISL4 = 27dB$  TYP. @  $f = 2.0$  to  $2.5GHz$ ,  $V_{cont(H)} = 2.7V$ ,  $V_{cont(L)} = 0V$   
:  $ISL5 = 27dB$  TYP. @  $f = 2.5$  to  $3.0GHz$ ,  $V_{cont(H)} = 2.7V$ ,  $V_{cont(L)} = 0V$
- Power Handling :  $P_{in(1dB)} = +25.5dBm$  TYP. @  $f = 0.5$  to  $3.0GHz$ ,  $V_{cont(H)} = 2.7V$ ,  $V_{cont(L)} = 0V$   
:  $P_{in(0.1dB)} = +22.0dBm$  TYP. @  $f = 0.5$  to  $3.0GHz$ ,  $V_{cont(H)} = 2.7V$ ,  $V_{cont(L)} = 0V$
- High-density surface mounting : 6-pin TSSON package (1.0 × 1.0 × 0.37 mm)

#### APPLICATIONS:

- L,S-band digital cellular or cordless telephone
- W-LAN, Bluetooth™, ZigBee, etc.

#### ORDERING INFORMATION

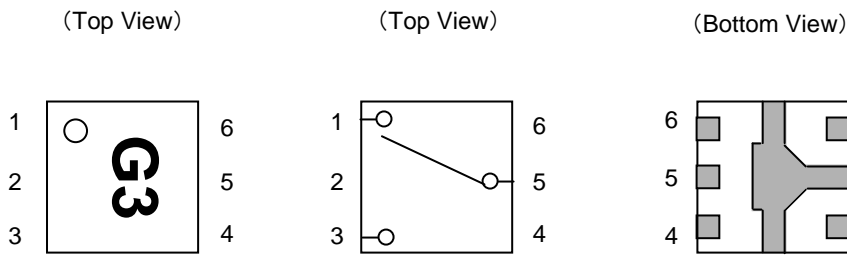
Part Number	Order Number	Package	Marking	Supplying Form
uPG2159T5K-E2	uPG2159T5K-E2-A	6-pin plastic TSSON (Pb-Free)	G3	<ul style="list-style-type: none"> <li>• Embossed tape 8mm wide</li> <li>• Pin 1, 6 face the perforation side of the tape</li> <li>• Qty 5 kpcs/reel</li> </ul>

**Remark** To order evaluation samples, contact your nearby sales office.  
Part number for sample order : uPG2159T5K-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	OUTPUT1
2	GND
3	OUTPUT2
4	V <sub>cont2</sub>
5	INPUT
6	V <sub>cont1</sub>

**SW TRUTH TABLE**

V <sub>cont1</sub>	V <sub>cont2</sub>	INPUT-OUTPUT1	INPUT-OUTPUT2
Low	High	OFF	ON
High	Low	ON	OFF

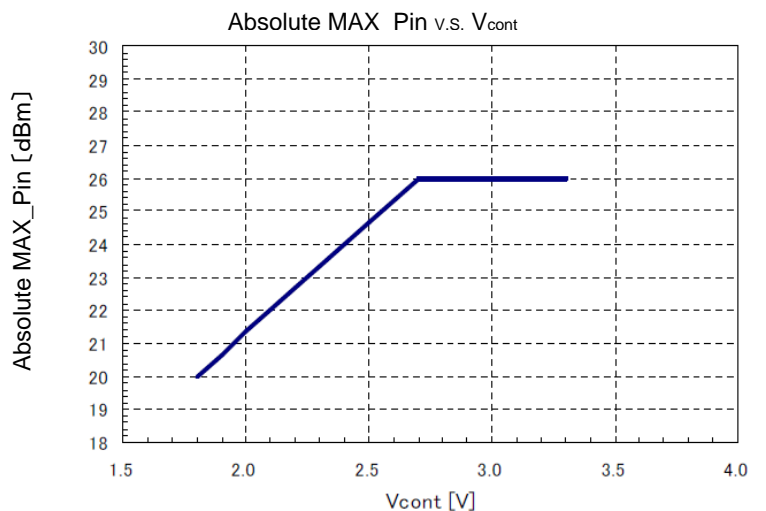
**ASOLUTE MAXIMUM RATINGS (Unless otherwise specified, T<sub>A</sub> = +25°C)**

Parameter	Symbol	Ratings	Unit
Switch Control Voltage <small>Note1</small>	V <sub>cont</sub>	+6.0	V
Input Power <small>Note2</small>	P <sub>in</sub>	+26.0	dBm
Input Power <small>Note3</small>	P <sub>in</sub>	+8+V <sub>cont</sub> * 20/3	dBm
Operating Ambient Temperature	T <sub>A</sub>	-45 to +85	°C
Storage Temperature	T <sub>stg</sub>	-55 to +150	°C

**Note1** | V<sub>cont1</sub> - V<sub>cont2</sub> | ≤ 6.0V

**Note2** 2.7 ≤ | V<sub>cont1</sub> - V<sub>cont2</sub> | ≤ 3.3V

**Note3** 1.8 ≤ | V<sub>cont1</sub> - V<sub>cont2</sub> | ≤ 2.7V



**RECOMMENDED OPERATING RANGE ( Unless otherwise specified, T<sub>A</sub> = +25°C)**

Parameter	Symbol	MIN.	TYP.	MAX.	Unit
Switch Control Voltage (H)	V <sub>cont</sub> (H)	1.8	2.7	3.3	V
Switch Control Voltage (L)	V <sub>cont</sub> (L)	-0.2	0	0.2	V

**ELECTRICAL CHARACTERISTICS1**(  $T_A = +25^{\circ}\text{C}$ ,  $V_{\text{cont(H)}} = 2.7\text{V}$ ,  $V_{\text{cont(L)}} = 0\text{V}$ , DC blocking capacitors = 56pF, Unless otherwise specified )

Parameter	Symbol	Test Conditions	MIN.	TYP.	MAX.	Unit
Insertion Loss1	L <sub>ins1</sub>	f = 0.05 to 0.5GHz <sup>Note1</sup>	-	0.20	0.35	dB
Insertion Loss2	L <sub>ins2</sub>	f = 0.5 to 1.0GHz	-	0.21	0.35	dB
Insertion Loss3	L <sub>ins3</sub>	f = 1.0 to 2.0GHz	-	0.23	0.40	dB
Insertion Loss4	L <sub>ins4</sub>	f = 2.0 to 2.5GHz	-	0.25	0.42	dB
Insertion Loss5	L <sub>ins5</sub>	f = 2.5 to 3.0GHz	-	0.27	0.45	dB
Isolation1	ISL1	f = 0.05 to 0.5GHz <sup>Note1</sup>	24	27	-	dB
Isolation2	ISL2	f = 0.5 to 1.0GHz	24	27	-	dB
Isolation3	ISL3	f = 1.0 to 2.0GHz	24	27	-	dB
Isolation4	ISL4	f = 2.0 to 2.5GHz	24	27	-	dB
Isolation5	ISL5	f = 2.5 to 3.0GHz	24	27	-	dB
Input Return Loss1	RL <sub>in1</sub>	f = 0.05 to 0.5GHz <sup>Note1</sup>	15	20	-	dB
Input Return Loss2	RL <sub>in2</sub>	f = 0.5 to 3.0GHz	15	20	-	dB
Output Return Loss1	RL <sub>out1</sub>	f = 0.05 to 0.5GHz <sup>Note1</sup>	15	20	-	dB
Output Return Loss2	RL <sub>out2</sub>	f = 0.5 to 3.0GHz	15	20	-	dB
0.1dB Loss Compression Input Power <sup>Note2</sup>	P <sub>in (0.1dB)</sub>	f = 2.0GHz/2.5GHz	+20.0	+22.0	-	dBm
		f = 0.5 to 3.0GHz	-	+22.0	-	dBm
1dB Loss Compression Input Power <sup>Note3</sup>	P <sub>in (1dB)</sub>	f = 0.5 to 3.0GHz	-	+25.5	-	dBm
2nd Harmonics	2f <sub>0</sub>	f = 2.0GHz/2.5GHz, P <sub>in</sub> =+10dBm	65	77	-	dBc
3rd Harmonics	3f <sub>0</sub>	f = 2.0GHz/2.5GHz, P <sub>in</sub> =+10dBm	60	80	-	dBc
Input Intercept Point	IIP <sub>3</sub>	f = 0.5 to 3.0GHz, 2tone 5MHz spacing	-	+49.0	-	dBm
Switch Control Current	I <sub>cont</sub>		-	0.2	1.0	uA
Switch Control Speed	t <sub>sw</sub>	50% CTL to 90/10%	-	20	200	ns

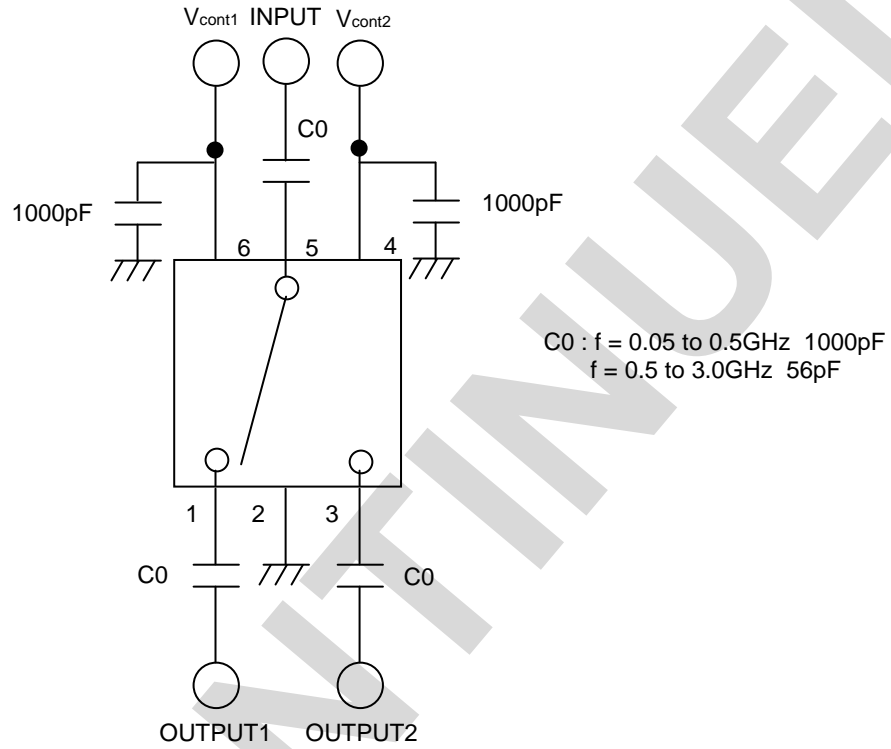
**Note1.** DC blocking capacitors = 1000pF 0.05 to 0.5GHz**Note2.** P<sub>in (0.1dB)</sub> is the measured input power level when the insertion loss increases 0.1dB more than that of linear range.**Note3.** P<sub>in (1dB)</sub> is the measured input power level when the insertion loss increases 1dB more than that of linear range.

**ELECTRICAL CHARACTERISTICS2**( TA = +25°C, V<sub>cont(H)</sub> = 1.8V, V<sub>cont(L)</sub> = 0V, DC blocking capacitors = 56pF, Unless otherwise specified )

Parameter	Symbol	Test Conditions	MIN.	TYP.	MAX.	Unit
Insertion Loss6	L <sub>ins6</sub>	f = 0.05 to 0.5GHz <sup>Note1</sup>	-	0.21	0.36	dB
Insertion Loss7	L <sub>ins7</sub>	f = 0.5 to 1.0GHz	-	0.22	0.37	dB
Insertion Loss8	L <sub>ins8</sub>	f = 1.0 to 2.0GHz	-	0.24	0.41	dB
Insertion Loss9	L <sub>ins9</sub>	f = 2.0 to 2.5GHz	-	0.26	0.43	dB
Insertion Loss10	L <sub>ins10</sub>	f = 2.5 to 3.0GHz	-	0.28	0.46	dB
Isolation6	ISL6	f = 0.05 to 0.5GHz <sup>Note1</sup>	23	26	-	dB
Isolation7	ISL7	f = 0.5 to 1.0GHz	23	26	-	dB
Isolation8	ISL8	f = 1.0 to 2.0GHz	23	26	-	dB
Isolation9	ISL9	f = 2.0 to 2.5GHz	23	26	-	dB
Isolation10	ISL10	f = 2.5 to 3.0GHz	23	26	-	dB
Input Return Loss3	RL <sub>in3</sub>	f = 0.05 to 0.5GHz <sup>Note1</sup>	15	20	-	dB
Input Return Loss4	RL <sub>in4</sub>	f = 0.5 to 3.0GHz	15	20	-	dB
Output Return Loss3	RL <sub>out3</sub>	f = 0.05 to 0.5GHz <sup>Note1</sup>	15	20	-	dB
Output Return Loss4	RL <sub>out4</sub>	f = 0.5 to 3.0GHz	15	20	-	dB
0.1dB Loss Compression Input Power <sup>Note2</sup>	P <sub>in (0.1dB)</sub>	f = 2.0GHz/2.5GHz	12	+15.5	-	dBm
		f = 0.5 to 3.0GHz	-	+15.5	-	dBm
1dB Loss Compression Input Power <sup>Note3</sup>	P <sub>in (1dB)</sub>	f = 0.5 to 3.0GHz	-	+19.5	-	dBm
Switch Control Current	I <sub>cont</sub>	RF None	-	0.2	1.0	uA
Switch Control Speed	t <sub>sw</sub>	50% CTL to 90/10% RF	-	20	200	ns

**Note1.** DC blocking capacitors = 1000pF 0.05 to 0.5GHz**Note2.** P<sub>in (0.1dB)</sub> is the measured input power level when the insertion loss increases 0.1dB more than that of linear range.**Note3.** P<sub>in (1dB)</sub> is the measured input power level when the insertion loss increases 1dB more than that of linear range.

EVALUATION CIRCUIT

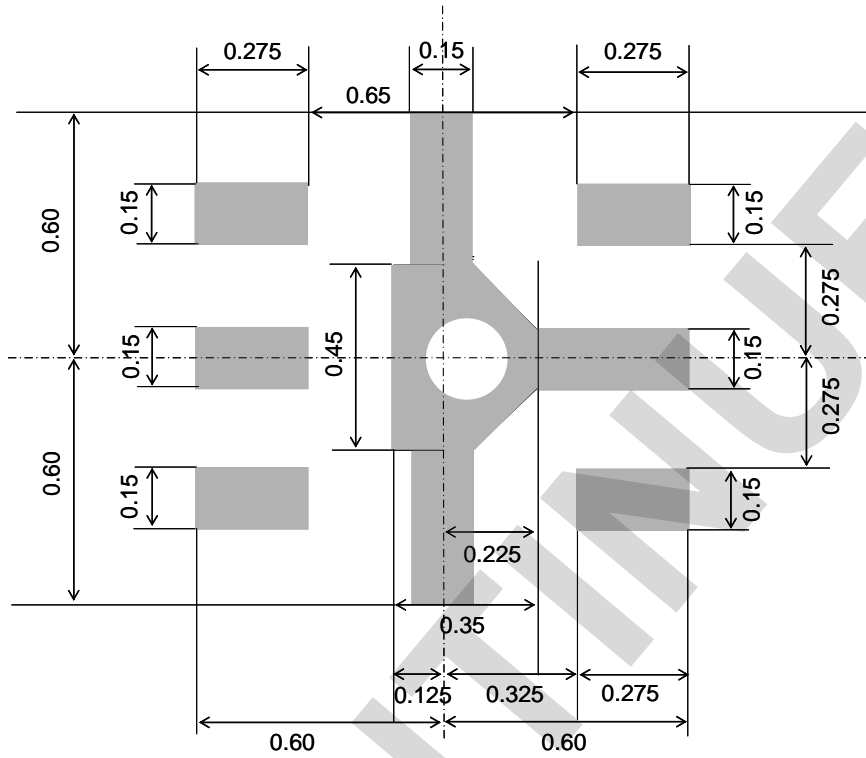


The application circuits and their parameters are for reference only and are not intended for use in actual design-ins.

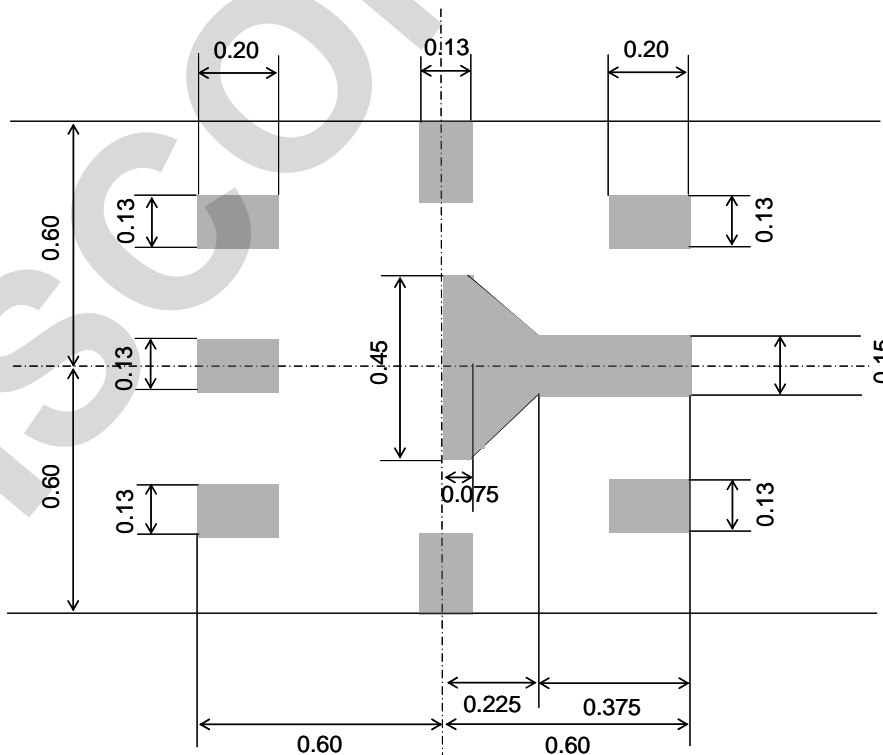
**MOUNTING PAD AND SOLDER MASK LAYOUT DIMENSIONS**

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

**MOUNTING PAD**



**SOLDER MASK**

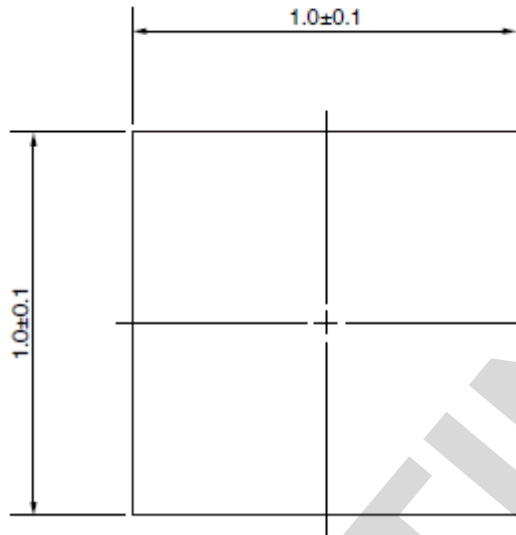


Solder thickness: 0.08 mm

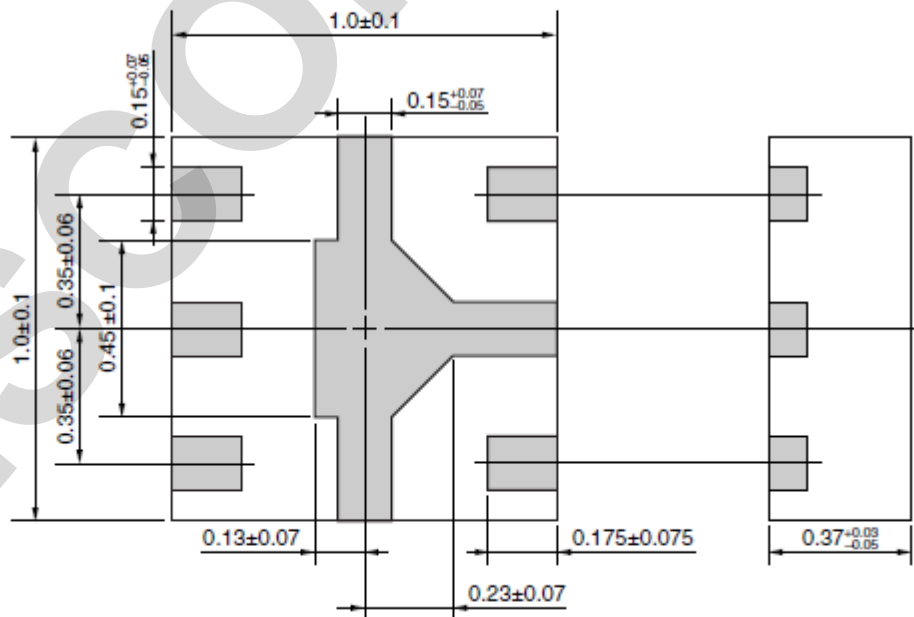
**Remark** The mounting pad and solder mask layouts in this document are for reference only.

6-PIN TSSOP (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) : 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 reflow processes : 1 time Maximum chlorine content of rosin flux (% mass) : 0.2 % (Wt.) or below	WS260
Partial Heating	Peak temperature (pin 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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M&E 02.11-1

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<b>Caution</b> GaAs products	The product contains gallium arsenide, GaAs. GaAs vapor and powder are hazardous to human health if inhaled or ingested. <ul style="list-style-type: none"><li>· Do not destroy or burn the product.</li><li>· Do not cut or cleave off any part of the product.</li><li>· Do not crush or chemically dissolve the product.</li><li>· Do not put the product in the mouth.</li></ul> Follow related laws and ordinances for disposal. The product should be from general industrial waste or household garbage.
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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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