

## Tx AND Rx MCP IC FOR 1.9 GHz PHS

### DESCRIPTION

The μPC8220T5A is MCP (Multi Chip Packaging) IC consisted of silicon germanium (SiGe) bipolar process and LDMOS designed for use as transmitting and receiving for 1.9 GHz PHS.

This device is packaged in surface mount 16-pin plastic TSON (Thin Small Outline Non-leaded) package.

This IC manufactured using our 50 GHz  $f_{max}$  UHS2 (Ultra High Speed Process) SiGe bipolar process and LDMOS (Lateral Diffusion MOS FET Process).

### FEATURES

– Tx Block –

- Circuit Current (DRV + PA) :  $I = 160$  mA TYP. @  $V_{CC} = V_{ds} = 3.0$  V,  $f = 1.9$  GHz,  $P_{in} = -19$  dBm,  $P_{out} = +20.5$  dBm
- Output Power :  $P_{out} = +20.5$  dBm MIN. @  $V_{CC} = V_{ds} = 3.0$  V,  $f = 1.9$  GHz,  $P_{in} = -19$  dBm
- Power Gain :  $GP = 39.5$  dB MIN. @  $V_{CC} = V_{ds} = 3.0$  V,  $f = 1.9$  GHz,  $P_{in} = -19$  dBm
- Adjacent Channel Power :  $P_{adj1} = -65$  dBc TYP. @  $V_{CC} = V_{ds} = 3.0$  V,  $f = 1.9$  GHz,  $P_{out} = +20.5$  dBm,  $\Delta \pm 600$  kHz  
 $P_{adj2} = -70$  dBc TYP. @  $V_{CC} = V_{ds} = 3.0$  V,  $f = 1.9$  GHz,  $P_{out} = +20.5$  dBm,  $\Delta \pm 900$  kHz
- Harmonics Frequency Level :  $2f_0 = -45$  dBc TYP. @  $V_{CC} = V_{ds} = 3.0$  V,  $P_{out} = +20.5$  dBm  
 $3f_0 = -60$  dBc TYP. @  $V_{CC} = V_{ds} = 3.0$  V,  $P_{out} = +20.5$  dBm
- Gain 1 dB Compression Output Power :  $P_{O(1\text{ dB})} = +21$  dBm TYP. @  $V_{CC} = V_{ds} = 3.0$  V

– Rx Block –

- Circuit Current :  $I_{CC} = 11.5$  mA TYP. @  $V_{CC} = 3.0$  V
- Conversion Gain :  $CG = 21.5$  dB TYP. @  $f_{RF} = 1.9$  GHz,  $f_{IF} = 240$  MHz,  $f_{Lo} = 1.66$  GHz
- Noise Figure :  $NF = 3.1$  dB TYP. @ SSB
- Input 3rd Order Distortion :  $IIP_3 = -14.5$  dBm TYP. @  $f_{RF1} = 1.9$  GHz,  $f_{RF2} = 1.9006$  GHz,  $P_{RF} = -35$  dBm/tone Intercept Point
- Image Rejection Ratio :  $IMR = 40$  dBc TYP. @  $f_{RF1} = 1.9$  GHz,  $f_{RF2} = 1.42$  GHz,  $P_{RF} = -35$  dBm/tome
- High-density Surface Mounting : 16-pin plastic TSON package ( $3.3 \times 2.3 \times 0.6$  mm)

### APPLICATION

- PHS

### ORDERING INFORMATION

Part Number	Order Number	Package	Marking	Supplying Form
μPC8220T5A-E1	μPC8220T5A-E1-A	16-pin plastic TSON (Pb-Free) <sup>Note</sup>	8220	<ul style="list-style-type: none"> <li>• Embossed tape 12 mm wide</li> <li>• Pin 8, 9 face the perforation side of the tape</li> <li>• Qty 3 kpcs/reel</li> </ul>

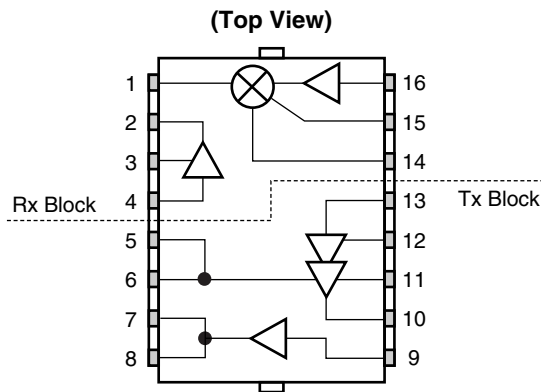
**Note** With regards to terminal solder (the solder contains lead) plated products (conventionally plated), contact your nearby sales office.

**Remark** To order evaluation samples, contact your nearby sales office.  
Part number for sample order: μPC8220T5A

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

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Not all devices/types available in every country. Please check with local NEC Compound Semiconductor Devices representative for availability and additional information.

PIN CONNECTIONS AND INTERNAL BLOCK DIAGRAM



Pin No.	Pin Name	Pin No.	Pin Name
1	RF <sub>in</sub>	9	INPUT2
2	LNA <sub>out</sub>	10	OUTPUT1
3	GND (LNA)	11	V <sub>CC</sub> (TX)
4	LNA <sub>in</sub>	12	GND (DRV)
5	GND (DRV)	13	INPUT1
6	GND (DRV)	14	IF OUT
7	OUT2 (PA)	15	V <sub>CC</sub> (RX)
8	OUT2 (PA)	16	Lo IN

NOTE ON CORRECT USE

Exposed heatsink at bottom on package that is combined with GND (ground) must be soldered to PCB RF/DC ground.

ABSOLUTE MAXIMUM RATINGS (T<sub>A</sub> = +25°C, unless otherwise specified)

Parameter	Symbol	Ratings	Unit
LNA Output Voltage	V <sub>LNAout</sub>	4.0	V
Mixer Output Voltage	V <sub>CC</sub> , IF <sub>out</sub>	4.0	V
Driver Output Voltage	V <sub>CC</sub> , V <sub>out1</sub>	4.0	V
PA Drain-Source Voltage	V <sub>ds</sub>	8.0	V
PA Gate-Source Voltage	V <sub>gs</sub>	8.0	V
Input Power 1	P <sub>in1</sub>	+10	dBm
Input Power 2	P <sub>in2</sub>	+16	dBm
LNA Input Power	P <sub>LNAin</sub>	+10	dBm
Local Input Power	P <sub>LoIn</sub>	+10	dBm
Channel Temperature	T <sub>ch</sub>	150	°C
Operating Ambient Temperature	T <sub>A</sub>	-30 to +70	°C
Storage Temperature	T <sub>stg</sub>	-55 to +150	°C
Power Dissipation of Package	P <sub>D</sub>	5.33 <sup>Note</sup>	W
Circuit Current 1 (LNA + Mixer)	I <sub>CC1</sub>	21	mA
Circuit Current 2 (PA Driver)	I <sub>CC2</sub>	70	mA
Circuit Current 3 (PA)	I <sub>ds</sub>	259	mA

**Note** Mounted on 33 × 21 × 0.4 mm polyimide PCB

**RECOMMENDED OPERATING RANGE ( $T_A = +25^\circ\text{C}$ , unless otherwise specified)**

Parameter	Symbol	MIN.	TYP.	MAX.	Unit
LNA Output Voltage	$V_{LNAout}$	2.7	3.0	3.3	V
Mixer Output Voltage	$V_{CC, IFout}$	2.7	3.0	3.3	V
Driver Output Voltage	$V_{CC, V_{out1}}$	2.7	3.0	3.3	V
PA Drain-Source Voltage	$V_{ds}$	2.7	3.0	3.5	V
PA Gate-Source Voltage	$V_{gs}$	0	2.0	2.5	V
Operating Ambient Temperature	$T_A$	-30	+25	+70	$^\circ\text{C}$
RF Input Frequency	$f_{RF}$	1.8	1.9	2.0	GHz
Local Input Power	$P_{LoIn}$	-20	-15	-10	dBm

**ELECTRICAL CHARACTERISTICS**

– Tx Block – (TA = +25°C, VCC = Vds = 3.0 V, Zs = ZL = 50 Ω, unless otherwise specified)

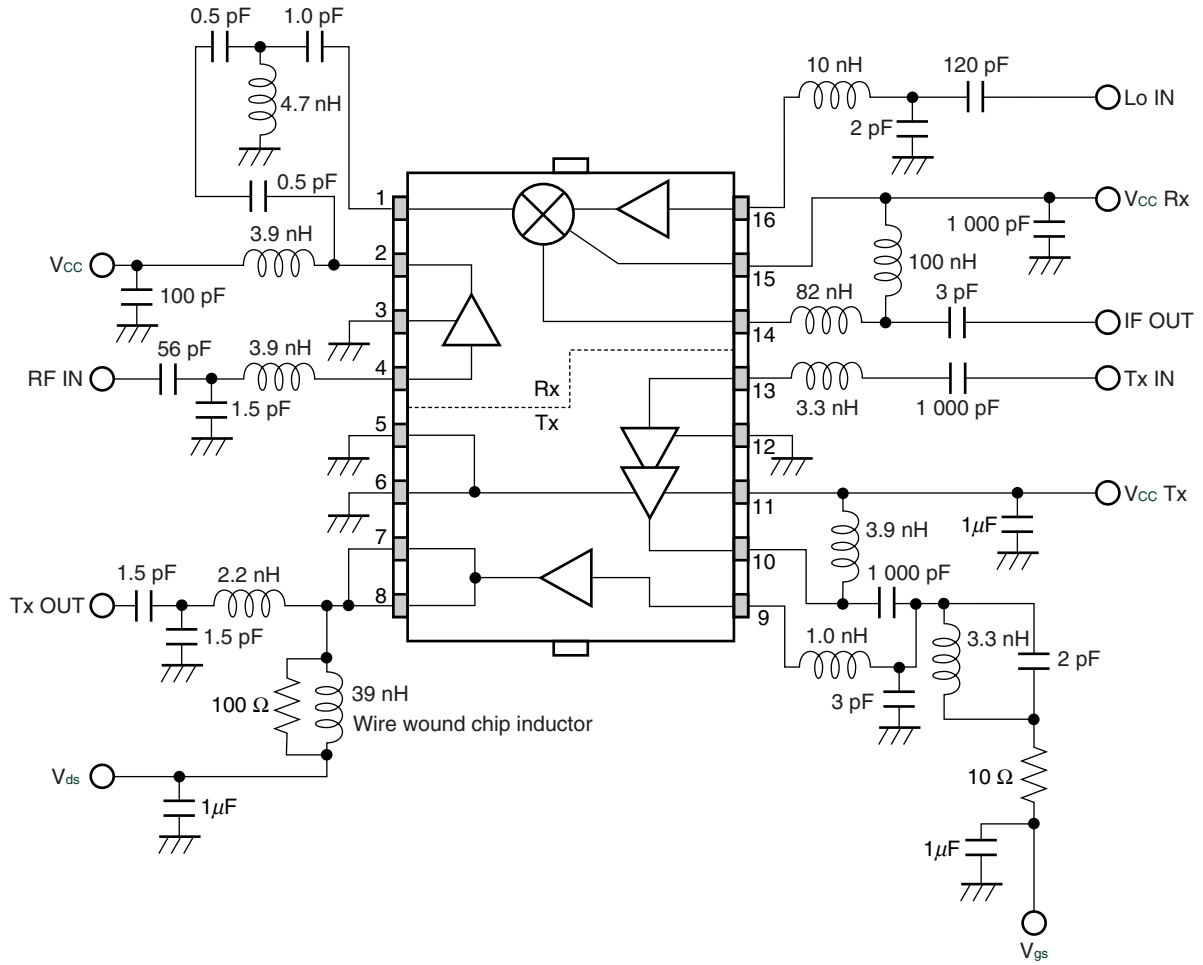
Parameter	Symbol	Test Conditions	MIN.	TYP.	MAX.	Unit
Threshold Voltage	V <sub>th</sub>	I <sub>ds</sub> = 8 mA, V <sub>ds</sub> = 3.5 V	1.15	1.4	1.65	V
Gate-Source Voltage	V <sub>gs</sub>	f = 1.9 GHz, P <sub>in</sub> = -19 dBm,	1.5	1.8	2.1	V
Circuit Current (DRV + PA)	I	P <sub>out</sub> = +20.5 dBm	–	160	190	mA
Input Return Loss	RL <sub>in</sub>	f = 1.9 GHz, P <sub>in</sub> = -19 dBm	–	10	–	dB
Output Return Loss	RL <sub>out</sub>		–	5	–	dB
Output Power	P <sub>out</sub>	f = 1.9 GHz, P <sub>in</sub> = -19 dBm,	+20.5	–	–	dBm
Power Gain (DRV + PA)	G <sub>P</sub>	V <sub>gs</sub> adjusting	39.5	40.5	–	dB
Power Gain (DRV)	G <sub>P (DRV)</sub>		–	31	–	dB
Power Gain (PA)	G <sub>P (PA)</sub>		–	9.5	–	dB
Liner Gain	G <sub>L</sub>	P <sub>in</sub> = -20 dBm	–	40.5	–	dB
Adjacent Channel Power 1	P <sub>adj1</sub>	f = 1.9 GHz, P <sub>out</sub> = +20.5 dBm Δ 600 kHz <sup>Note</sup>	–	-65	-58	dBc
Adjacent Channel Power 2	P <sub>adj2</sub>	f = 1.9 GHz, P <sub>out</sub> = +20.5 dBm Δ 900 kHz <sup>Note</sup>	–	-70	-60	dBc
Occupied Band Width	OBW	P <sub>out</sub> = +20.5 dBm <sup>Note</sup>	–	250	270	kHz
2nd Harmonics Frequency Level	2f <sub>0</sub>	P <sub>out</sub> = +20.5 dBm	-40	-45	–	dBc
3rd Harmonics Frequency Level	3f <sub>0</sub>	P <sub>out</sub> = +20.5 dBm	-55	-60	–	dBc
Gain 1 dB Compression Output Power	P <sub>O (1 dB)</sub>		–	+21.0	–	dBm

**Note** P<sub>in</sub> = -19 dBm, CW: Measure by changing to modulation wave, after setting from adjusting by V<sub>gs</sub> to P<sub>out</sub> = +20.5 dBm.

– Rx Block – (TA = +25°C, VCC = 3.0 V, f<sub>RF</sub> = 1.9 GHz, f<sub>IF</sub> = 240 MHz, f<sub>Lo</sub> = 1.66 GHz, P<sub>LoIn</sub> = -15 dBm, Zs = ZL = 50 Ω, unless otherwise specified)

Parameter	Symbol	Test Conditions	MIN.	TYP.	MAX.	Unit
Circuit Current	I <sub>cc</sub>	No Signal	8.9	11.5	15.0	mA
Circuit Current (LNA)	I <sub>ccLNA</sub>	No Signal	1.25	1.8	–	mA
Conversion Gain (LNA + Mixer)	CG	P <sub>RF</sub> = -35 dBm	19.0	21.5	25.5	dB
Conversion Gain (LNA)	CG (LNA)	P <sub>RF</sub> = -35 dBm	–	15.5	–	dB
Conversion Gain (Mixer)	CG (Mixer)	P <sub>RF</sub> = -20 dBm	–	6.0	–	dB
Noise Figure	NF	SSB	–	3.1	4.5	dB
Input 3rd Order Distortion Intercept Point	IIP <sub>3</sub>	f <sub>RF1</sub> = 1.9 GHz, f <sub>RF2</sub> = 1.9006 GHz, P <sub>RF</sub> = -35 dBm/tone	-16.5	-14.5	–	dBm
Image Rejection Ratio	IMR	f <sub>RF1</sub> = 1.9 GHz, f <sub>RF2</sub> = 1.42 GHz, P <sub>RF</sub> = -35 dBm/tone	30	40	–	dBc
1/2 IF Ratio	1/2 IFR	f <sub>RF1</sub> = 1.9 GHz, f <sub>RF2</sub> = 1.78 GHz, P <sub>RF</sub> = -35 dBm/tone, f <sub>IF</sub> = 240 MHz	40	50	–	dBc
Local Leak	Lo <sub>Leak</sub>	Lo <sub>in</sub> → LNA <sub>in</sub> Leak	–	-62	-50	dBm

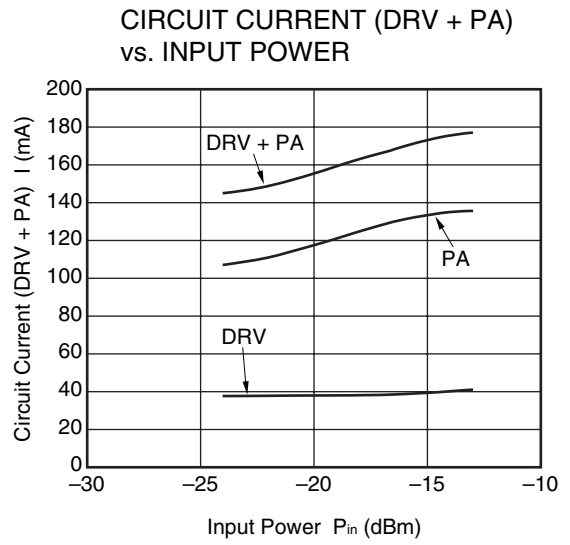
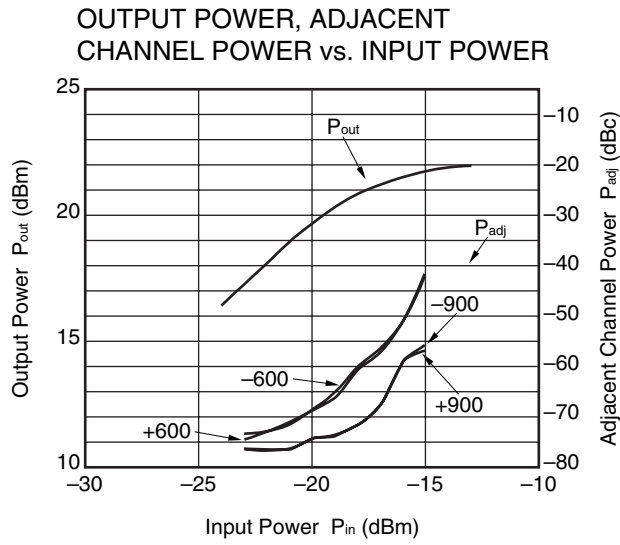
EVALUATION CIRCUIT ( $V_{CC} = V_{ds} = 3.0\text{ V}$ )



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

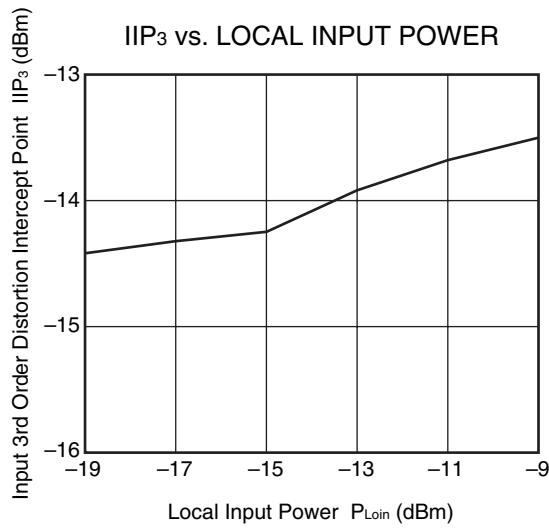
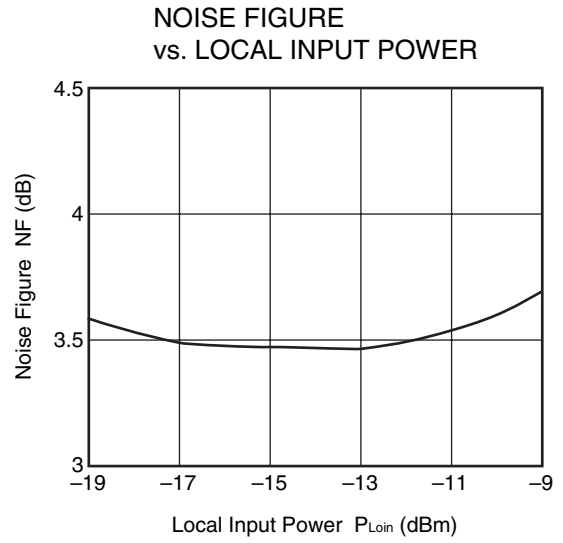
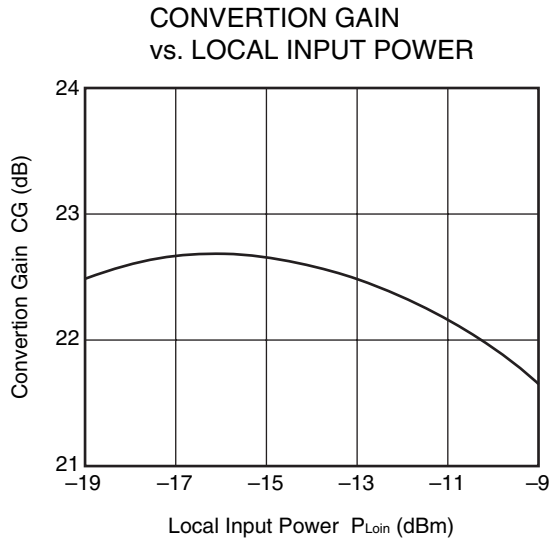
**TYPICAL CHARACTERISTICS ( $T_A = +25^\circ\text{C}$ , unless otherwise specified)**

**- Tx Block - ( $V_{CC} = V_{ds} = 3.0\text{ V}$ ,  $f = 1.9\text{ GHz}$ ,  $P_{in} = -19\text{ dBm}$ ,  $P_{out} = +20.5\text{ dBm}$ )**



**Remark** The graphs indicate nominal characteristics.

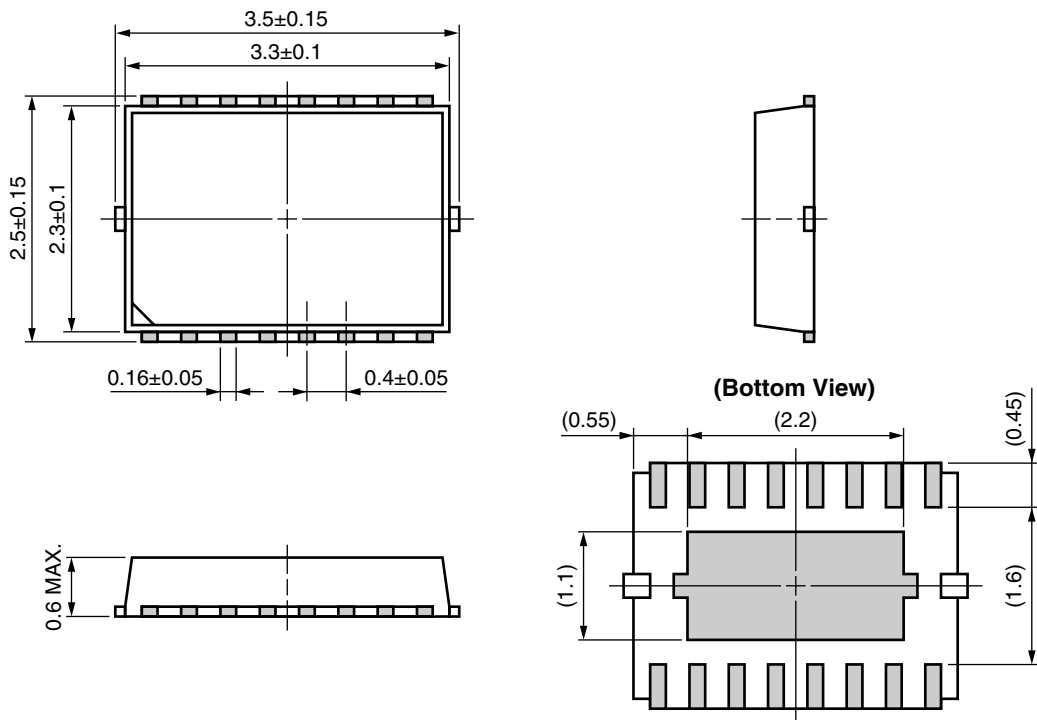
– Rx Block – ( $V_{CC} = 3.0\text{ V}$ ,  $f_{RF1} = 1.90\text{ GHz}$ ,  $P_{RF1} = -35\text{ dBm}$ ,  $f_{RF2} = 1.9006\text{ GHz}$ ,  $P_{RF2} = -35\text{ dBm}$ ,  $f_{Lo} = 1.66\text{ GHz}$ )



**Remark** The graphs indicate nominal characteristics.

PACKAGE DIMENSIONS

16-PIN PLASTIC TSON (UNIT: mm)



Remark ( ) : Reference value

**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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