

INFORMATION

Model : **SG-645PCW**

SPEC. No. : **A09-254-1A**

DATE : **Jul. 17. 2009**

EPSON TOYOCOM CORPORATION

**8548 Naka-minowa
Minowa-machi Kamiina-gun
Nagano-ken
399-4696 Japan**

INTRODUCTION

1. The contents is subject to change without notice.
Please exchange the specification sheets regarding the product's warranty.
2. This sheet is not intended to guarantee or provide an approval of implementation of industrial patents.
3. We have prepared this sheet as carefully as possible.
If you find it incomplete or unsatisfactory in any respect, We would welcome your comments.

This product complies with RoHS Directive.

This Product supplied (and any technical information furnished, if any) by Epson Toyocom Corporation shall not be used for the development and manufacture of weapon of mass destruction or for other military purposes.

Making available such products and technology to any third party who may use such products or technologies for the said purposes are also prohibited.

This product listed here is designed as components or parts for electronics equipment in general consumer use. We do not expect that any of these products would be incorporated or otherwise used as a component or part for the equipment, which requires an extra high reliability, such as satellite, rocket and other space systems, and medical equipment, the functional purpose of which is to keep life.

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[1] Absolute maximum ratings

Parameter	Symbol	Value	Unit	Note
Supply voltage	V _{DD} -GND	-0.5 to +7.0	V	
Storage temperature *	T _{STG}	-55 to +125	°C	Stored as bare product after unpacking.
Input voltage	V _{IN}	-0.5 to V _{DD} +0.5	V	

* Concerning the frequency change, please refer page 7 [8] Environmental and mechanical characteristics.

[2] Operating range

Parameter	Symbol	Value			Unit	Note
		Min.	Typ.	Max.		
Supply voltage	V _{DD}	3.0	3.3	3.6	V	
Supply voltage	GND	0.0		0.0	V	
Input voltage	V _{IN}	GND		V _{DD}	V	
Nominal frequency	f _o	32.0001		135	MHz	T _a =-40 °C to +85 °C, CL=15 pF
Operating temperature	T _{OPR}	-40		+85	°C	32.0001 MHz≤f _o ≤135 MHz, CL=15 pF
Output load	CL			15	pF	32.0001 MHz≤f _o ≤135 MHz T _a =-40 °C to +85 °C

- Start up time(0 % V_{DD}→90 % V_{DD}) of power source should be more than 150 μs.

[3] Frequency characteristics

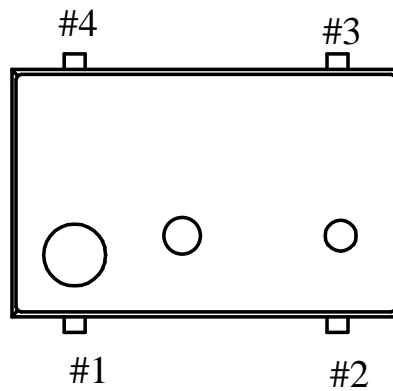
Output frequency 133 MHz

(GND=0.0 V, Load CL ≤ Max.)

Parameter	Symbol	Value[1 × 10 ⁻⁶]	Note
Frequency stability *	Δ f/f _o	B : ± 50	T _a =-20 °C to +70 °C
Aging	Δ f _a	± 5 (Typ.-3)	T _a =+25 °C, V _{DD} =3.3 V First year

* This includes initial frequency tolerance, temperature characteristics, input voltage characteristics, and load characteristics, but excludes aging.

[4] Terminal assignment



Terminal name	Terminal No.	Terminal type.
OE	1	INPUT
GND	2	—
OUT	3	OUTPUT
V _{DD}	4	—

OE pin : High or open. → Specified frequency output = enable.
OE pin : Low. → Output is high impedance = disabled.

[5] Electrical characteristics

(Please see page 2 [2] Operating range $V_{DD}=3.3\text{ V}\pm 0.3\text{ V}$, $GND=0.0\text{ V}$)

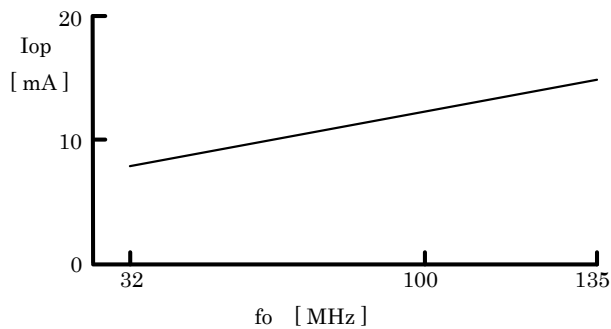
Parameter	Symbol	Value		Unit	Note
		Min.	Max.		
Start up time	tosc		10	ms	
Current consumption	IOP		28	mA	No load ($f_o=135\text{ MHz}$)
Disable current	IOE		16	mA	OE=GND($f_o=135\text{ MHz}$)
Output rise time *1	tr		3.0	ns	20 % $V_{DD}\rightarrow 80\% V_{DD}$, $CL\leq 15\text{ pF}$
			4.0		20 % $V_{DD}\rightarrow 80\% V_{DD}$, $CL\leq 30\text{ pF}$
Output fall time *1	tf		3.0	ns	80 % $V_{DD}\rightarrow 20\% V_{DD}$, $CL\leq 15\text{ pF}$
			4.0		80 % $V_{DD}\rightarrow 20\% V_{DD}$, $CL\leq 30\text{ pF}$
Output duty *1	tw/t	40	60	%	50 % V_{DD} Level, $CL=15\text{ pF}$ $32.0001\text{ MHz}\leq f_o\leq 135\text{ MHz}$
High level output voltage	V_{OH}	$V_{DD}-0.4$		V	$I_{OH} = -8\text{ mA}$
Low level output voltage	V_{OL}		0.4	V	$I_{OL} = 8\text{ mA}$
High level input voltage	V_{IH}	$0.7 V_{DD}$		V	OE terminal
Low level input voltage	V_{IL}		$0.2 V_{DD}$	V	OE terminal
Input current	I_{IH}	-5	5	μA	$V_{IN} = V_{DD}$
	I_{IL}		10	μA	$V_{IN} = GND$
Output disable time *2	tpXZ		25	ns	OE terminal High \rightarrow Low
Output enable time *2	tpZX		25	ns	OE terminal Low \rightarrow High

[6] Test circuit

*1 [7] 1) Output waver form

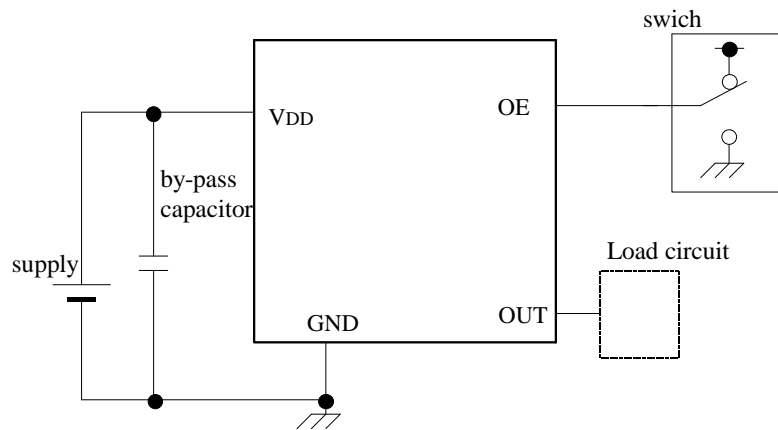
*2 [7] 2) OE function and timing

◆Reference : Current consumption Typ. value ($V_{DD} = 3.3\text{ V}$, $T_a = +25^\circ\text{C}$, No load)



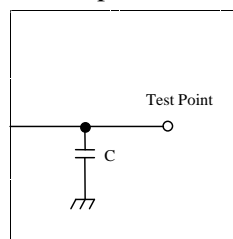
[6] Test circuit

1) Waveform observation

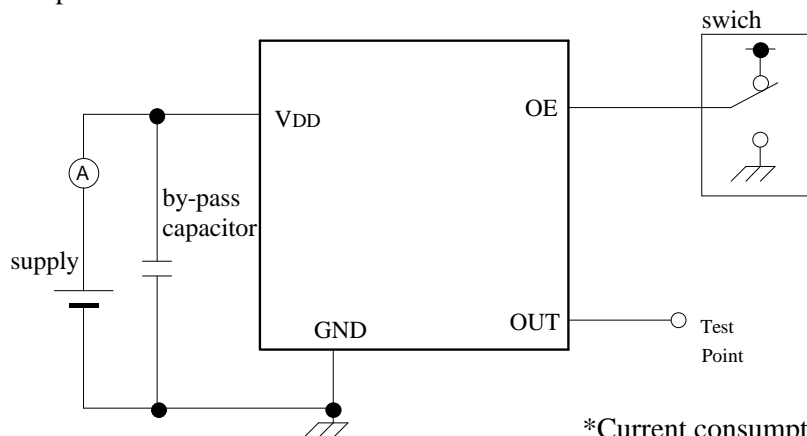


Load circuit

load capacitance



2) Current consumption



*Current consumption under the disable function should be $OE = GND$.

3) Condition

(1) Oscilloscope

- Band width should be minimum 5 times higher (wider) than measurement frequency.
- Probe earth should be placed closely from test point and lead length should be as short as possible.

* Recommendable to use miniature socket. (Don't use earth lead.)

(2) 'CL' includes probe capacitance.

(3) By-pass capacitor (0.01 μF to 0.1 μF) is placed closely between VDD and GND.

(4) Use the current meter whose internal impedance value is small.

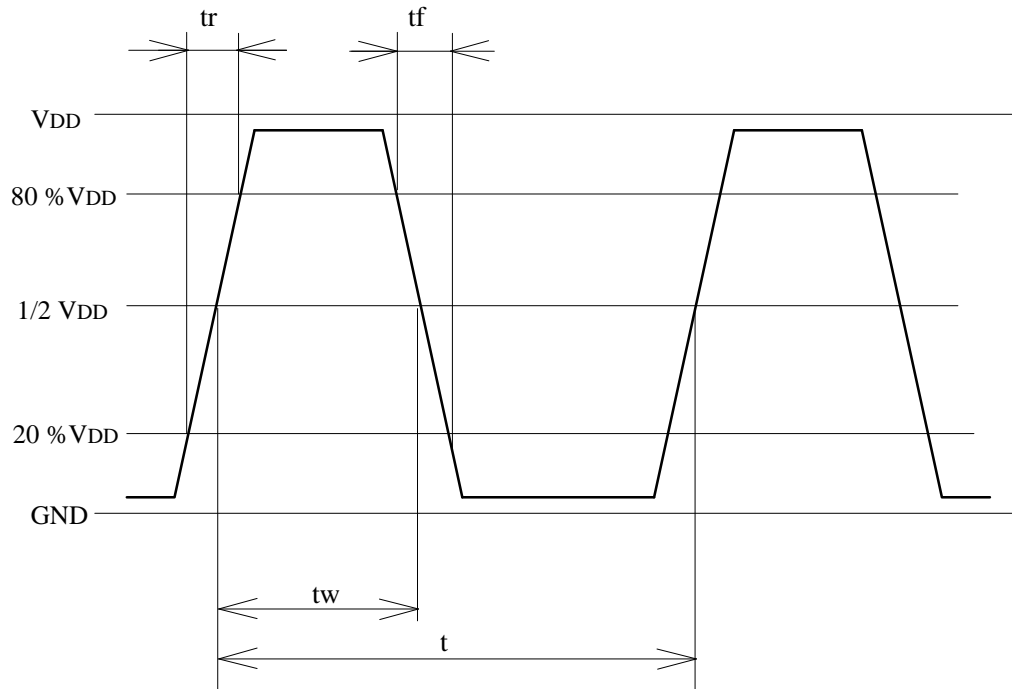
(5) Power supply

- Start up time (0 % VDD \rightarrow 90 % VDD) of power source should be more than 150 μs .
- Impedance of power supply should be as lowest as possible.

[7] Timing chart

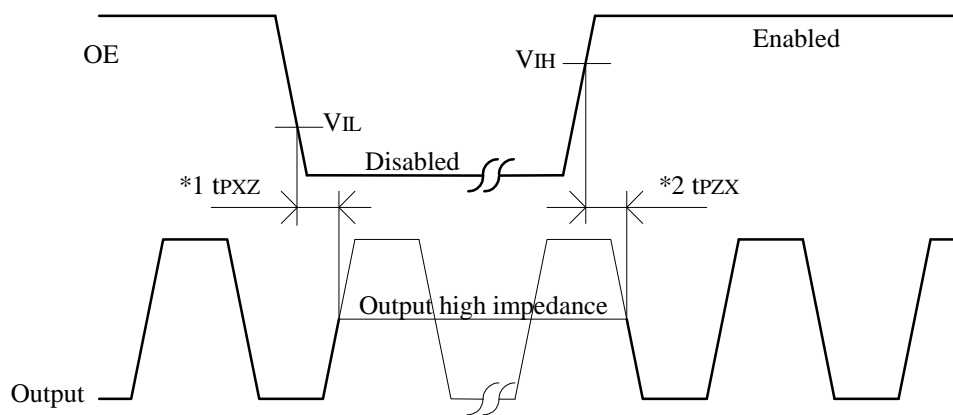
1) C-MOS load

$$\text{Duty} = \frac{t_w}{t} \times 100 (\%)$$



2) OE function and timing

OE function	Osc. circuit	Output status
High or Open	Oscillation	Specified frequency is output : Enable
Low	Oscillation	Output becomes high impedance : Disable



*1 The time taken from OE= V_{IL} to output = Disable (high impedance)

*2 The time taken from OE= V_{IH} to output = Enable

[8] Environmental and mechanical characteristics

(The company evaluation condition We evaluate it by the following examination item and examination condition.)

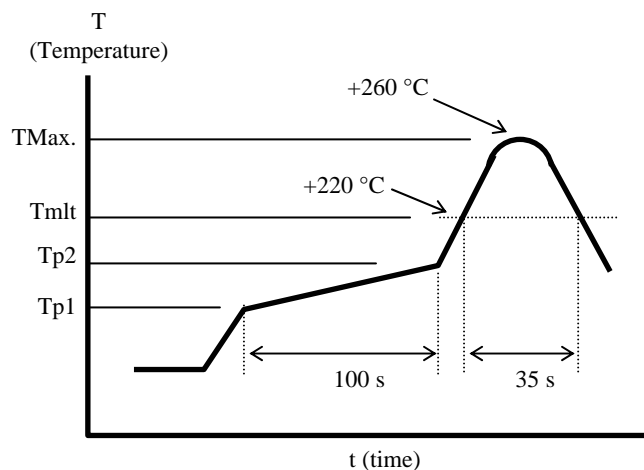
No.	Item	Value *1		Test Conditions
		$\Delta f / f$ *2 [1×10^{-6}]	Electrical characteristics	
1	High temperature storage	*3 ± 80	Satisfy Item [5] after test.	+125 °C × 1 000 h
2	Low temperature storage	*3 ± 10		-55 °C × 1 000 h
3	High temperature bias	*3 ± 20		+85 °C × 3.6 V × 1 000 h
4	Low temperature bias	*3 ± 10		-40 °C × 3.6 V × 1 000 h
5	Temperature humidity bias	*3 ± 20		+85 °C × 85 %RH × 3.6 V × 1 000 h
6	Temperature cycle	*3 ± 20		-55 °C ↔ +125 °C 30 min. at each temperature 100 cycles
7	Resistance to soldering heat	± 10		a) Infrared – reflow soldering furnace (2 time) b) Dip termination into solder bath at +260 °C ± 5 °C for 10 s , 2 times
8	Drop	± 20		Free drop from 750 mm height on a hard wooden board for 3 times (Board thickness is more than 30 mm)
9	Vibration	± 10		10 Hz to 55 Hz amplitude 0.75 mm 55 Hz to 500 Hz acceleration 98 m/s ² 10 Hz → 500 Hz → 10 Hz 15 min./cycle 6 h (2 hours , 3 directions)
10	Pull - off	No peeling-off at a solder part		10 N press for 10 s ± 1 s Ref. EIAJ ED-4702
11	Solderability	Termination must be 95 % covered with fresh solder		Dip termination into solder bath at +235 °C ± 5 °C for 5 s. (Using Rosin Flux)
12	Solvent resistance	The marking shall be legible		Ref. JIS C 0052 or IEC 60068-2-45

< Notes >

- *1 Each test done independently.
- *2 Measuring 2 h to 24 h later leaving in room temperature after each test.
- *3 Pre conditioning.
 1. +125 °C × 24 h to +85 °C × 85 % × 48 h → reflow 2 times
 2. Initial value shall be after 24 h at room temperature.

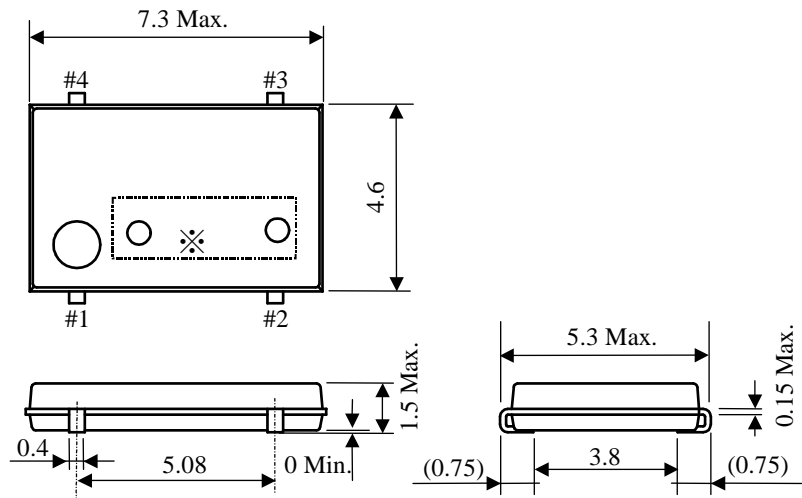
Infrared-reflow soldering furnace

- 1.Pre heating temperature : Tp1 ~ Tp2 = +170 °C
- 2.Peak temperature must not exceed +260 °C and the duration of over +220 °C should be 35 s.



[9] Dimensions and marking layout

1) Dimensions

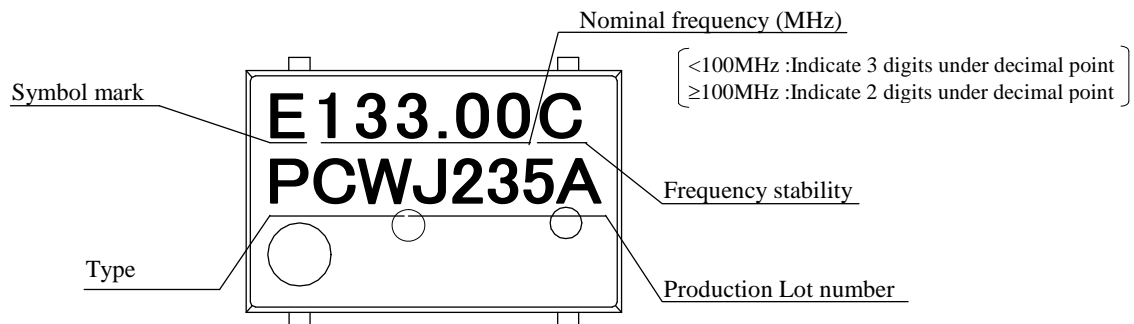


Terminal treatment: Pb-free solder plating

Unit: mm

* :The cylinder case of crystal can be seen in this area, but it has not affect on the performance of the device.

2) Marking layout



◆ The above marking layout shows only marking contents and their approximate position and it is not for font, size and exact position.

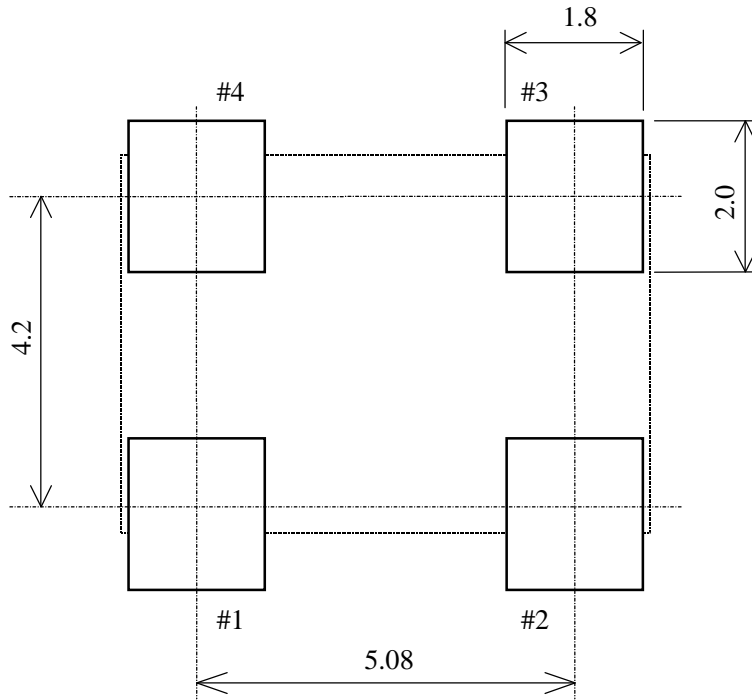
[10] Notes

- 1) This device is made with C-MOS IC.
Please take precautions to prevent damage due to electrical static discharge.
- 2) We recommend placing a 0.01 μF to 0.1 μF capacitor closely between V_{DD} and GND to obtain stable operation and protect against power line ripple.
- 3) V_{DD} and GND pattern shall be as big as possible so that high frequency impedance shall be small.
- 4) We can not recommend to put filtering element into power line so as to reduce noise. Oscillator might be unstable oscillation because high frequency impedance of power line become higher. When use filtering element, please verify electrical construction and or element's spec.
- 5) Power ripple : 200 mV P-P max.
- 6) As a long output line may cause irregular output, please take care to design output line is as short as possible, and also keeps high level signal source away from this device.
- 7) Another high level signal line may cause the operation error, so please do not place high level signal line close to this device.
- 8) This device contains a crystal resonator, so please don't expose not give too much shock or vibration.
We recommend to storage device under normal temperature and humidity to keep the specification.
- 9) An automatic insertion is available, however, the internal crystal resonator might be damaged in case that too much shock or vibration is applied by machine condition.
Be sure to check your machine condition in advance.
- 10) Ultrasonic cleaning can be applicable on the SG-8002JF, however, since the oscillator might be damaged under some conditions, please exercise in advance.
- 11) Some kind of solvent may damage plastic package or marking ink; please take precautions when choosing solvent.
- 12) We recommend to use and store under room temperature and normal humidity to secure frequency accuracy and prevent moisture.
- 13) When don't intend to use OE pin, please connect the pin to V_{DD} .
We recommend to install a resistor in between to mitigate effect by surge etc.

[11] Recommendable patterning and glue position

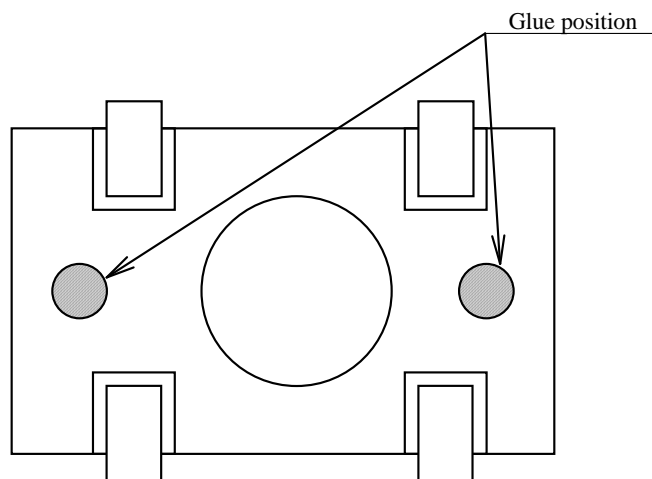
The soldering pad sample indicated as like following:

1) Soldering position (Unit : mm)



2) Glue position

Adhesive is recommended to be put on below position to avoid ejector pin dent.



TAPING SPECIFICATION

. Application

This standard will apply to SOJ 4 pin package.

Spec : JF package

. Contents

Item No.	Item	Page
{ 1 }	Taping specification	1 to 2
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{ 7 }	Handling	

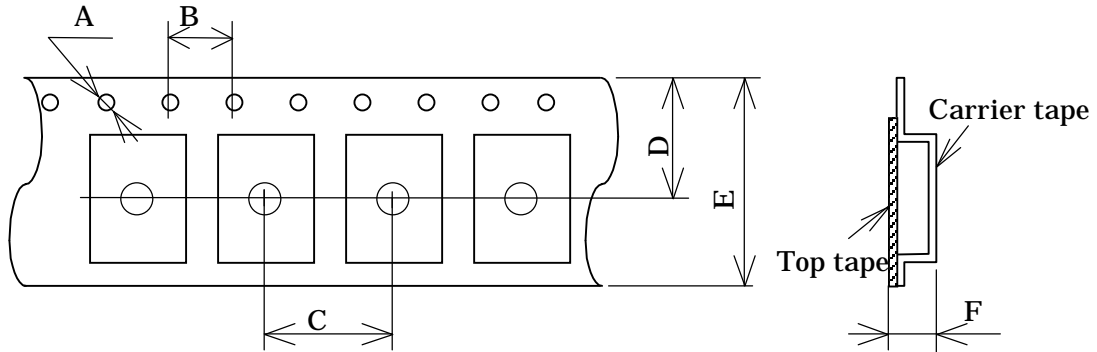
[1] Taping specification

Subject to EIA-481& EIAJ EDX-7602, IEC 60286, JIS C-0806

(1) Tape dimensions

Material of the carrier tape : PS

Material of the top tape : PET

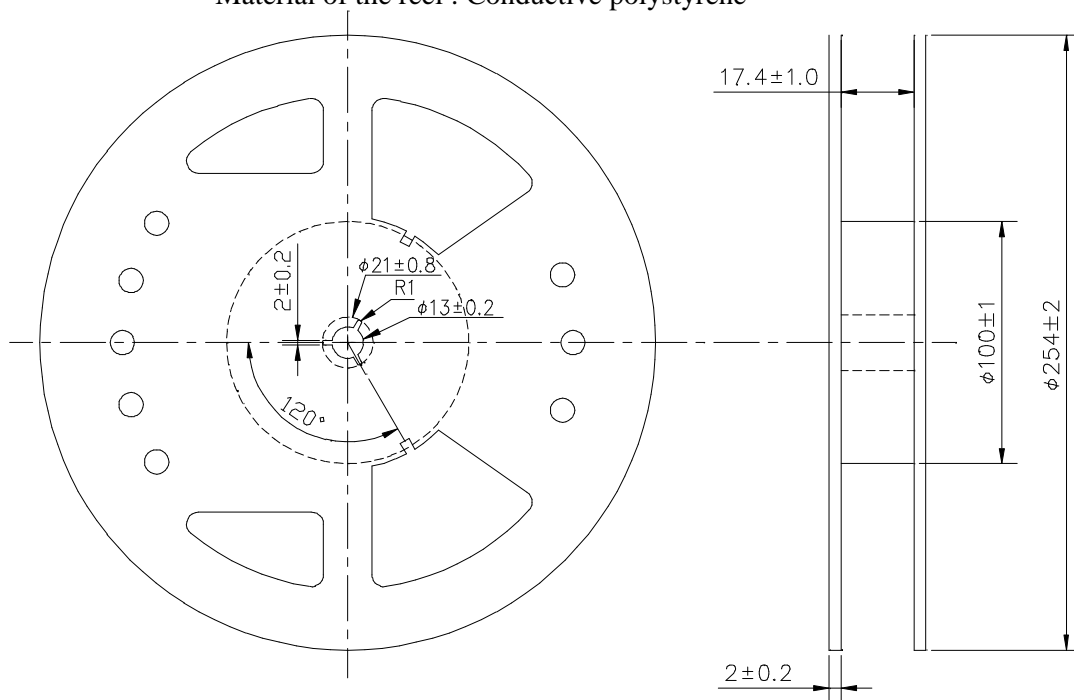


Symbol	A	B	C	D	E	F
Value	1.5	4.0	8.0	9.25	16.0	2.3

Unit : mm

(2) Reel dimensions

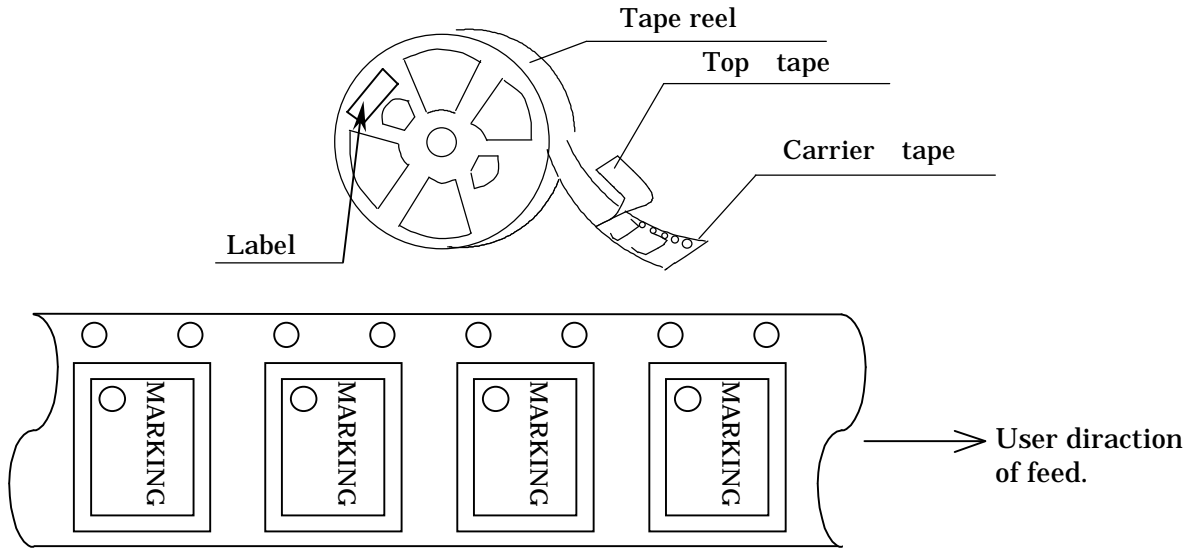
Material of the reel : Conductive polystyrene



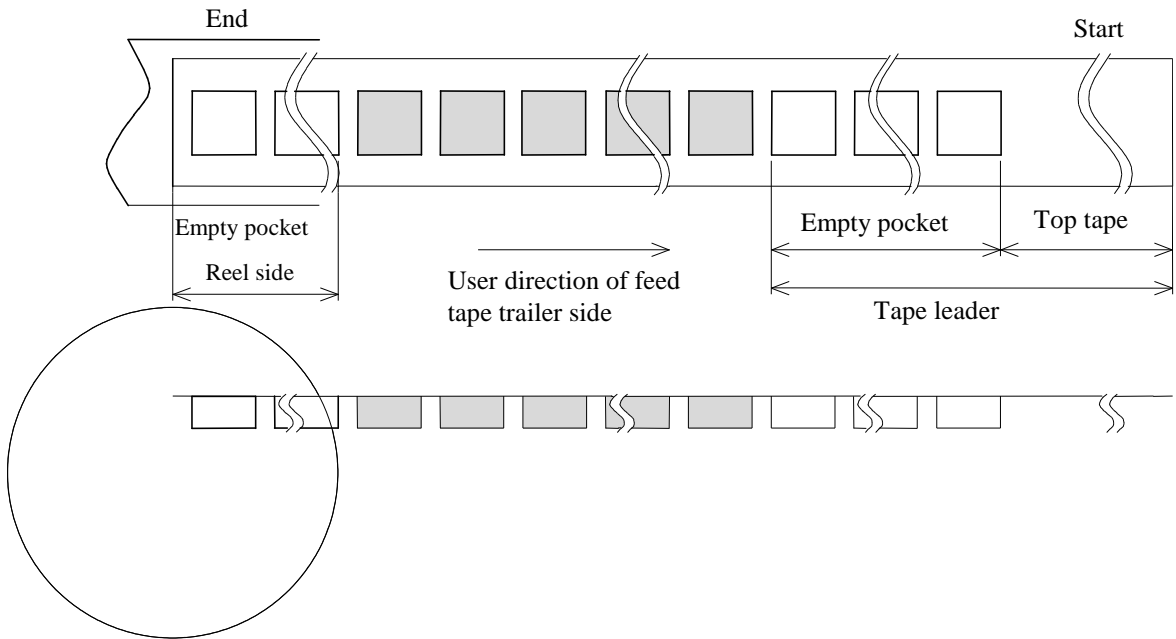
Form and Size of reel window shows are one of the example

(3) Packing

Tape & reel



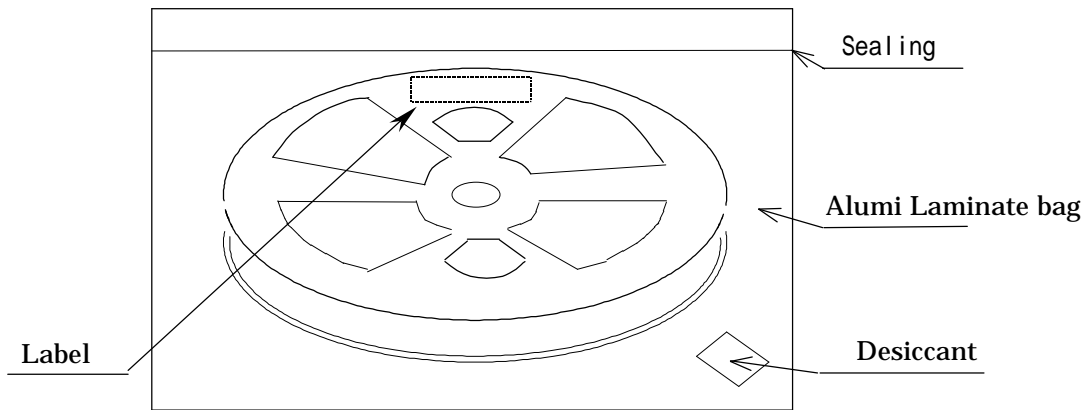
Start & end point



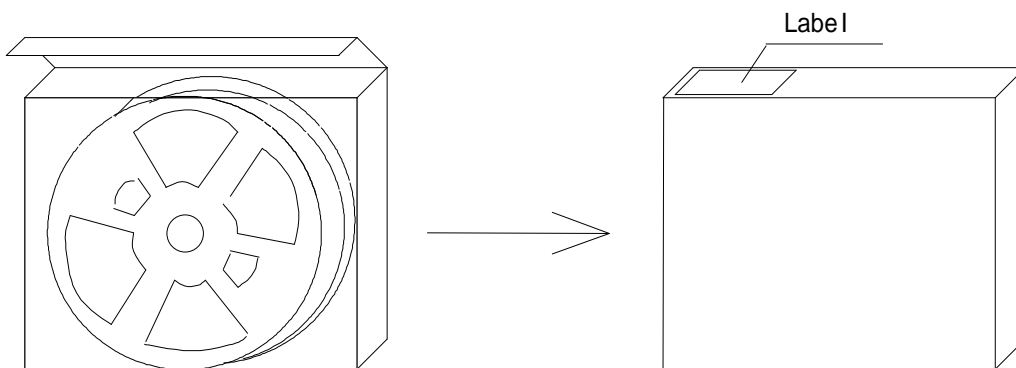
Item		Empty space
Tape leader	Top tape	Min. 1 000 mm
	Carrier tape	Min. 10 pockets
Tape trailer	Top tape	Min. 0 mm
	Carrier tape	Min. 10 pockets

[2] Inner carton

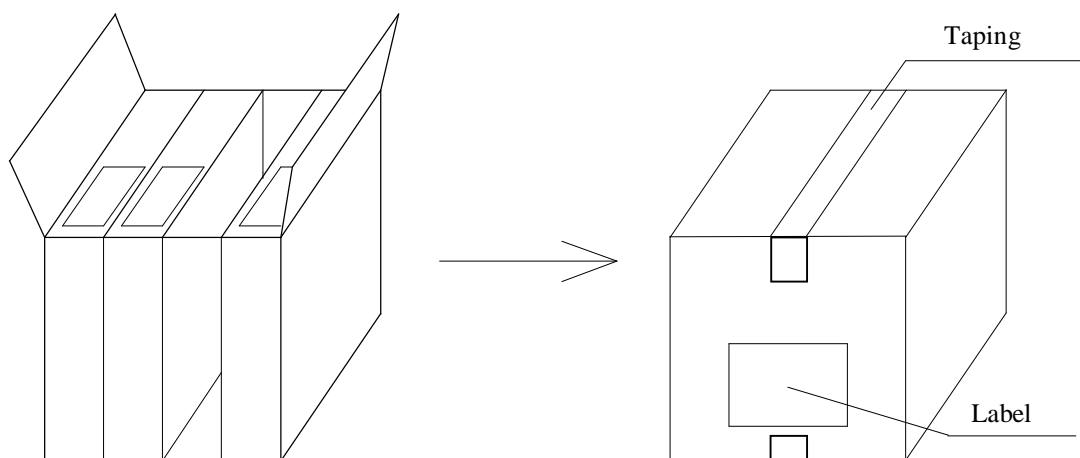
a) Packing to antistatic bag



b) Packing to inner carton



[3] Shipping carton



[4] Marking

(1) Reel marking

- Reel marking shall consist of :

- 1) Parts name
- 2) Quantity
- 3) Manufacturing date or symbol
- 4) Manufacturer's date or symbol
- 5) Others (if necessary)

(2) Inner carton marking

- Same as reel marking.

(3) Shipping carton marking

- Shipping carton marking shall consist of :

- 1) Parts name
- 2) Quantity

[5] Quantity

- 1 000 pcs./reel

[6] Storage environment

- (1) To storage the reel at 15 °C to 35 °C, 25 %RH to 85 %RH of humidity.
- (2) To open the packing just before using.
- (3) Not to expose the sun.
- (4) Not to storage with some erosive chemicals.
- (5) Nothing is allowed to put on the reel or carton to prevent mechanical damage.

[7] Handling

- To handle with care to prevent the damage of tape, reel and products.

■ PROCESS QUALITY CONTROL

NO. SG645**W-00-AEE-2

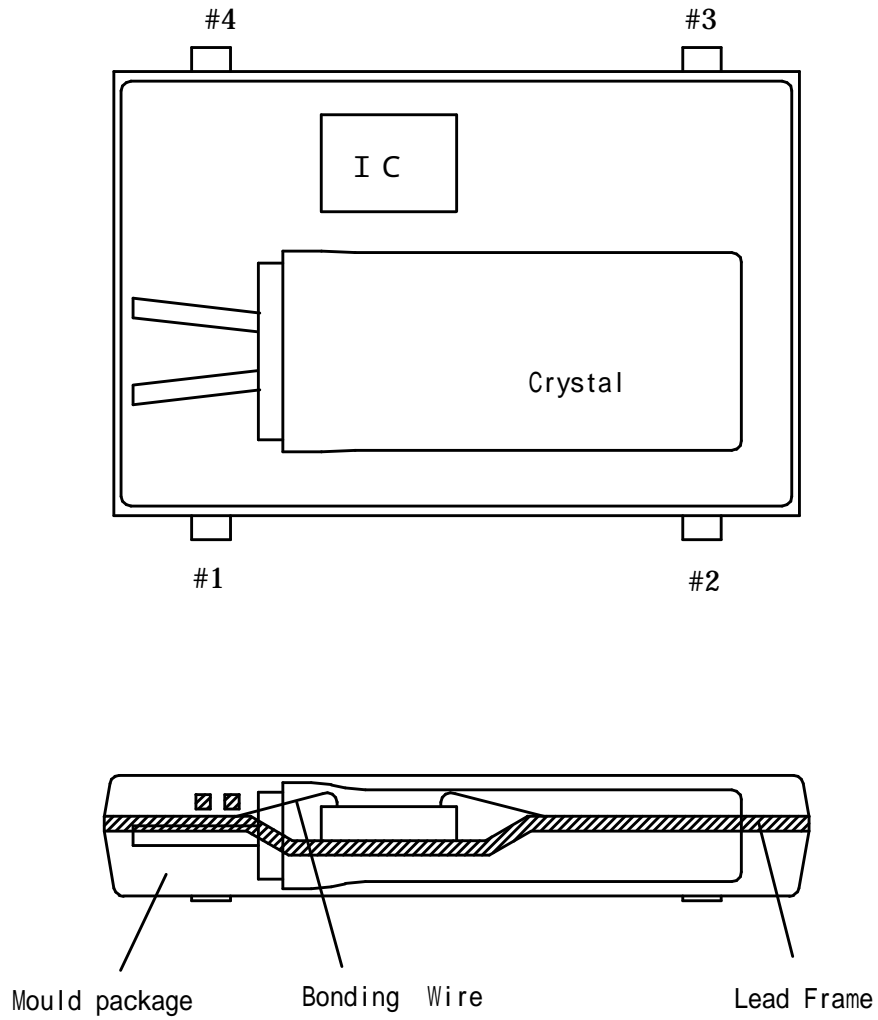
CRYSTAL OSCILLATOR SG-645**W

05.10.20
EPSON TOYOCOM CORP.
AT(Consumer) Business Unit

[Handwritten signatures]

Manufacturing process chart	No.	Section in charge	Standards	Inspection, control item	Instruments	Inspection methods	Record
	1	Inspection Section	Purchasing specification Incoming inspection standard	Appearance Dimension	Microscope	Sampling	Data sheet
	2	Subcontractor Company	Specification sheet	Appearance	Microscope	Sampling	Data sheet
	3	Malaysia Plant (Production Section)	Manufacturing instruction sheet	Appearance	Microscope	Sampling	Data sheet
	4	Malaysia Plant (Production Section)	Manufacturing instruction sheet	Bonding strength Appearance	Gauge Microscope	Sampling	Data sheet
	5	Malaysia Plant (Production Section)	Manufacturing instruction sheet	Appearance	Microscope	Sampling	Data sheet
	6	Malaysia Plant (Production Section)	Manufacturing instruction sheet	Shape of bonded wire	X-ray radio graphic equipment	Sampling	Data sheet
	7	Subcontractor Company	Solder plating specification	Plating thickness	Fluorescent X-ray	Sampling	Data sheet
	8	Malaysia Plant (Production Section)	Manufacturing instruction sheet	Appearance	Visual inspection	Sampling	Data sheet
	9	Malaysia Plant (Production Section)	Manufacturing instruction sheet	Appearance	Microscope	Sampling	Data sheet
	10	Malaysia Plant (Production Section)	Manufacturing instruction sheet	Electrical characteristics (Frequency) Master check	Frequency adjusting machine	100% inspection One/Day	Data sheet
	11	Malaysia Plant (Production Section)	Manufacturing instruction sheet	Electrical characteristics Appearance Master check	Measuring equipment Visual inspection	100% inspection or Sampling One/Day	Data sheet
	12	Malaysia Plant (Inspection Section)	Delivery Specification Outgoing inspection standard	Electrical characteristics Appearance Master check	Measuring equipment Visual inspection	Sampling One/Day	Data sheet
	13	Malaysia Plant (Production Section)	Manufacturing instruction sheet	Tape peeling strength Frequency check function	Peeling strength test machine	Sampling One/Day	Data sheet
	14	Malaysia Plant (Production Control Section)	Manufacturing instruction sheet Daily shipping list	Customers Type Quantity			Delivery Slip

Structure diagram S G - 6 4 5 * * W series



L I S T	
Name of part	Material
Lead Frame	42 Alloy
Transfer Moulding Compound	Epoxy Compound
Lead Frame Surface Treatment (Outer Lead)	Solder Plating
IC	C-MOS
IC Conductive Adhesive	Ag Paste
Bonding Wire	Au
Crystal Mount	Welding



RELIABILITY TEST DATA

Product Name : SG-645W / **G Series**

The Company evaluation condition

We evaluate environmental and mechanical characteristics by the following test condition .

No. OUT7-34-0501E

No.	ITEM	TEST CONDITIONS	VALUE *1		TEST	FAIL
			$\Delta f / f$ *2 [1×10^{-6}]	Electrical characteristics	Qty [n]	Qty [n]
1	High temperature storage	+125 °C × 1 000 h	*3 ± 80	Satisfy specification after test	22	0
2	Low temperature storage	-55 °C × 1 000 h	*3 ± 10		22	0
3	High temperature bias	+85 °C × spec. bias × 1 000 h	*3 ± 20		22	0
4	Low temperature bias	-40 °C × spec. bias × 1 000 h	*3 ± 10		22	0
5	Temperature humidity bias	+85 °C × 85 %RH × spec. bias × 1 000 h	*3 ± 20		22	0
6	Temperature cycle	-55 °C ⇄ +125 °C 30 min at each temp. 100 cycles	*3 ± 20		22	0
7	Resistance to soldering heat	For infrared-reflow or convention reflow soldering furnace (2 times)	± 10		11	0
8	Drop	Free drop from 750 mm height on a hard wooden board for 3 times (Board is thickness more than 30 mm)	± 20		11	0
9	Vibration	10 Hz to 55 Hz amplitude 0.75 mm 55 Hz to 500 Hz acceleration 98 m/s ² 10 Hz → 500 Hz → 10 Hz 15 min / cycle 6 h (2 h × 3 directions)	± 10		11	0
10	Pull - off	Put weight of 2.5 N on top of the termination Bending following angle : +90 ° to -90 ° to 0 °	No peeling - off at a solder part		11	0
11	Solderability	Dip termination into solder bath at +235 °C ± 5 °C for 5 s (Using Rosin Flux)	Termination must be 95 % covered with fresh solder		11	0
12	Solvent resistance	Ref. JIS C 0052 or IEC 60068-2-45	The marking shall be legible		11	0

Notes

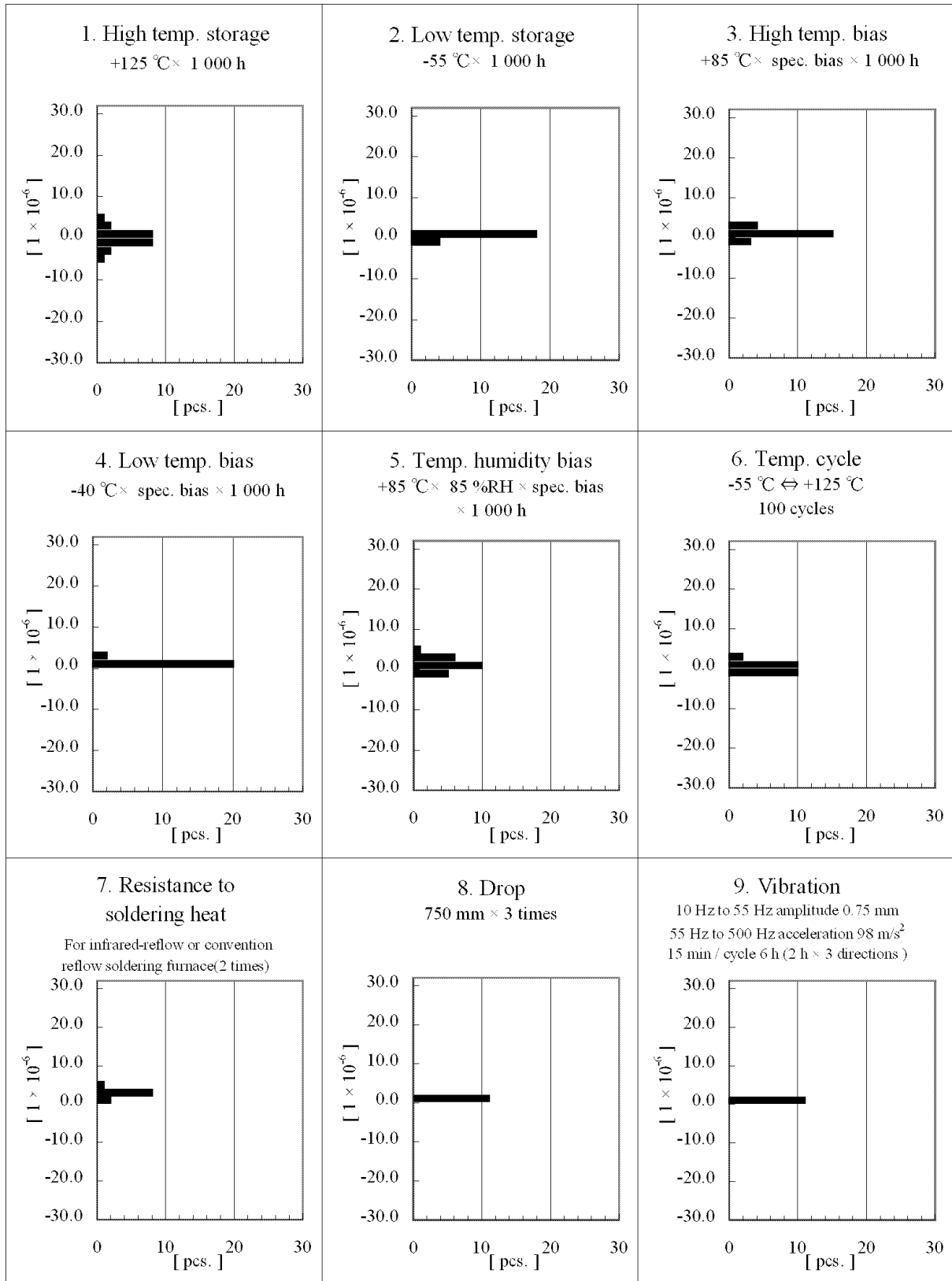
- *1 Each test done independently.
- *2 Measuring 2 h to 24 h later leaving in room temperature after each test.
- *3 Pre conditionings Initial value shall be after 24 h at room temperature.
- PH / PT / SH / ST : Assurance range -40 °C bias to +85 °C bias is under 40 MHz.
- PH / PT / SH / ST : As to 40 MHz to 125 MHz , guarantee -20 °C bias to +70 °C bias temperature range by -40 °C bias to +85 °C bias test.
- PC / SC : Guarantee -20 °C bias to +70 °C bias temperature range by -40 °C bias to +85 °C bias test.

**AT (Consumer) Business Unit
Production Management Div.**

signature


Tomohiro Kishi

Qualification Data



※ Though these data show about 5 V spec. , guarantee 3 V, for both spec. have same crystal.