Ningbo Bird.

INFORMATION

Product No. : **Q13FC1450001200**

Model : **FC-145**

32.768 kHz 12.5 pF ± 20

SPEC. No. : **Q05-337-12A**

DATE : **Jan. 13. 2006**

EPSON TOYOCOM CORPORATION

8548 Naka-minowa
Minowa-machi Kamiina-gun
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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 is not authorized for use as critical components in life support device or systems.

Contents

Item No.	Item	Page
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[3]	Static characteristics	2
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[1] Absolute maximum ratings

Item	Symbol	Rating value
Storage temperature	TSTG	-55℃ to +125℃
Maximum drive level	DL	1.0 μW

[2] Operating range

		Value		
Item	Symbol	Min.	Typ.	Max.
Operating temperature range	TOPR	-40℃		+85℃
Drive level	DL	0.01 μW	0.1 μW	0.5μW
Vibration mode		Fundamental		

[3] Static characteristics

Item	Symbol	Value	Note
Frequency	f1	32.768 kHz	
Frequency tolerance	Δ f/f	± 20 ×10^{-6}	CL =12.5 pF Ta = +25± 3℃, Drive level : 0.1 μW Not include aging
Series resistance	R1	70 kΩ Max.	CI meter : Saunders 140B Drive level : 0.5 μW
Motional capacitance	C1	Typ. 3.4 fF	
Shunt capacitance	C0	Typ. 1.2 pF	
Turnover temperature	0T	+25 ± 5 ℃	Values are calculated by the frequencies at +10, +25, +40℃ with C-MOS circuit.
Temperature coefficient	a	-4.0 × 10^{-8} /℃^{2} Max.	
Isolation resistance	IR	500 MΩ Min.	DC 100V, 60 seconds Between terminal #1 and terminal #2
Aging	fa	± 3 ×10^{-6} / year	Ta = +25 ℃ ± 3 ℃ Drive level : 0.1 μW

[4] Environmental and Mechanical characteristics

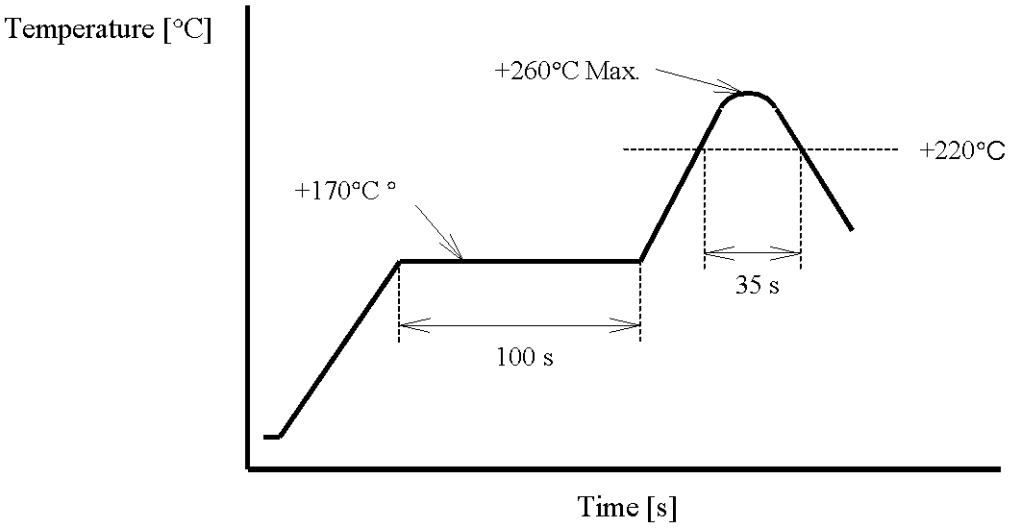
No.	Items	Value	Conditions
1	Shock resistance	*3Δ f/f : ± 8 ×10^{-6}	100g dummy(SEIKO EPSON Standard), Natural drop from 1 500 mm height on to the concrete. 3 directions × 10 times *2
2	Vibration resistance	*3Δ f/f : ± 3 ×10^{-6}	10 Hz to 55 Hz amplitude 0.75 mm 55 Hz to 500 Hz acceleration 98 m/s^2 10 Hz → 500 Hz → 10 Hz 15 min./cycle 6 h (2 hours , 3 directions) *2
3	Soldering heat resistance	Δ f/f : ± 5 ×10^{-6}	For convention reflow soldering furnace (2 times)
4	High temperature storage	*3Δ f/f : ± 10 ×10^{-6}	+125 °C × 1000 h *1
		*3Δ f/f : ± 7 ×10^{-6}	+85°C× 1000 h *1
5	Low temperature storage	*3Δ f/f : ± 10 ×10^{-6}	-55 °C× 1000 h *1
6	High temperature and humidity	*3Δ f/f : ± 10 ×10^{-6}	+85°C × 85%RH × 1000 h *1
7	Temperature cycle	*3Δ f/f : ± 10 ×10^{-6}	-55 °C↔ +125°C 30 minutes at each temperature × 100 cycles *1
8	Sealing	*3 1 × 10^{-8}hPa•l / s Max.	For He leak detector
9	Shear	No peeling-off at a soldered part	20 N press for 10 ± 1 s. Ref. IEC 60068-2-21
10	Pull - off	No peeling-off at a soldered part	20 N press for 10 ± 1 s. Ref. IEC 60068-2-21
11	Substrate bending	No peeling-off at a soldered part	Bend width reaches 3 mm and hold for 5 s ± 1 s × 1 time Ref. IEC 60068-2-21
12	Solvent resistance	The marking shall be legible	Ref. JIS C 0052 or IEC 60068-2-45

< Notes >

1. *1 Each test done independently.
2. *2 Measuring 2 h to 24 h later leaving in room temperature after each test. Drive level : 0.5 μW
3. *3 Pre conditionings(Treat the Reflow 2 times with the following profile) Initial value shall be after 24 h at room temperature.
   Shift of series resistance at before and after the test should be less than ±20 % or less than ±15kΩ.
   In case high temperature storage(+125°C × 1 000 h), Soldering heat resistance,shift of series resistance at before and after the test should be less than ±30 % or ±20 kΩ.

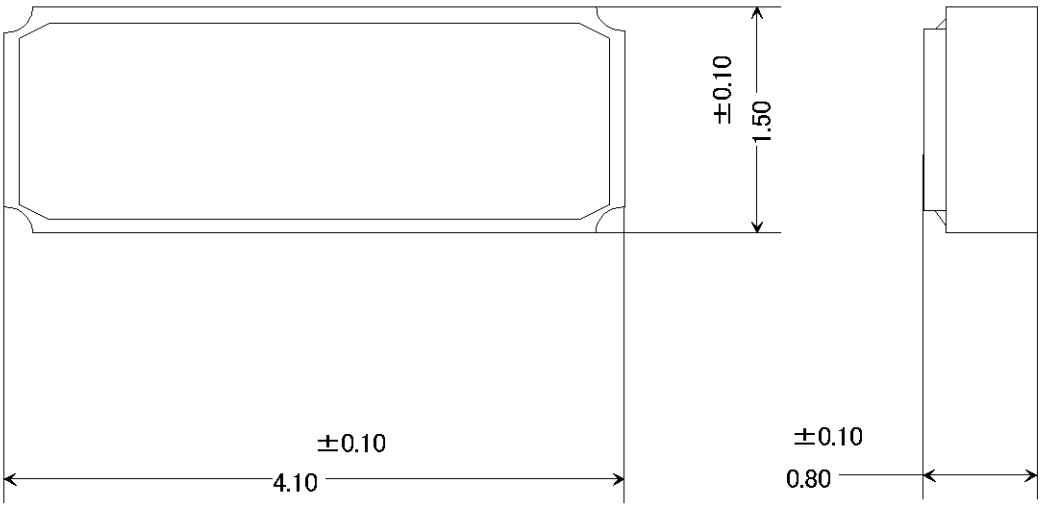
♦ Infrared-reflow

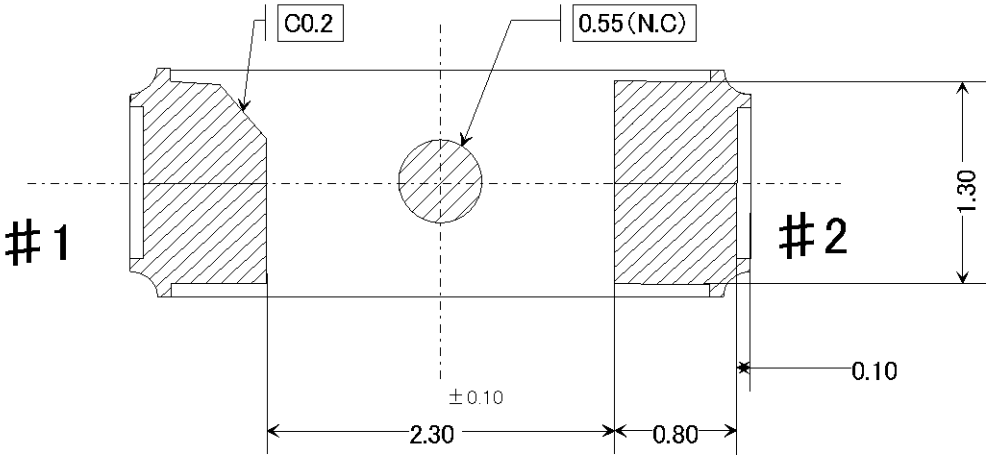
Pre heating temperature: +170 [°C] Pre heating time: 100 [s]
Heating temperature : +220 [°C] Heating time : 30 [s]



[5] Dimensions and Marking layout

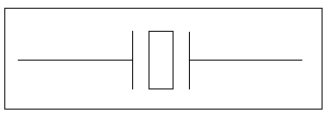
1. Dimensions





Package : Ceramic(Al_2O_3)
Terminal Au plate : 0.5 μm Min.
Lid : Glass

2. Internal Connection

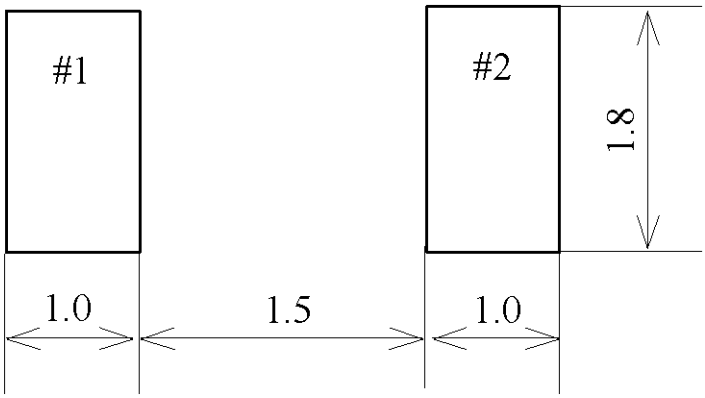


#1 #2

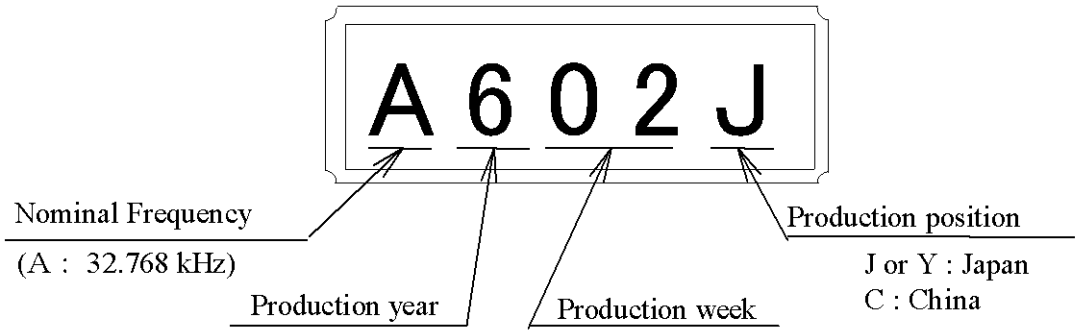
Type	FC-145	Terminal treatment	Au plating	Unit	1 = 1 mm

3. Recommended soldering pattern

Unit : 1 = 1 mm



4. Marking layout



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

Type	FC-145	Unit	1=1 mm

[6] Notes

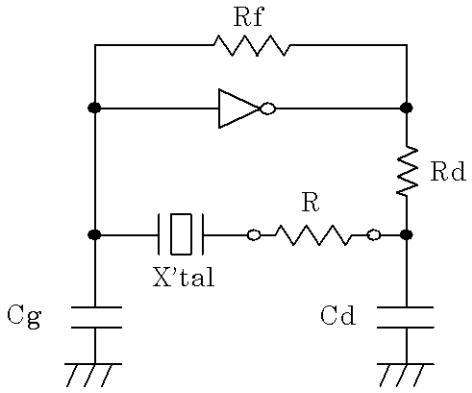
1. Max two (2) times reflow is allowed. Once miss soldering is happened, hand work soldering by soldering iron is recommended. (+350°C × within 5 s)

2. Patterning should be followed by our recommended one.

3. Applying excessive excitation force to the crystal resonator may cause deterioration damage.

4. Unless adequate negative resistance is allocated in the oscillation circuit, start up time of oscillation may be increased, or no oscillation may occur.

   How to check the negative resistance.



(1) Connect the resistance (R) to the circuit in series with the crystal resonator.
(2) Adjust R so that oscillation can start (or stop).
(3) Measure R when oscillation just start (or stop) in above (2).
(4) Get the negative resistance
-R = R + CI value.
(5) Recommended -R
$|-R| > CI \times (5 \sim 10)$

5. The shortest patterning line on board is recommendable.
   Too long line on board may cause of abnormal oscillation.

6. To avoid mull function, no pattern under or near the crystal is allowed.
   Solder paste should be more than 150 μm thickness.

7. This device must be stored at the normal temperature and humidity conditions before mounting on a board.

8. Too much exciting shock or vibration may cause deterioration on damage.
   Depending on the condition such as a shock in assembly machinery, the products may be damaged.
   Please check your condition in advance to maintain shock level to be smallest.

9. Depending on the conditions, ultrasonic cleaning may cause resonant damage of the internal crystal resonator. Since we are unable to determine the conditions (type of cleaning unit, power, time, conditions inside the bath, etc.) to be used in your company, we cannot guarantee the safety of this unit when it is cleaned in an ultrasonic cleaner.

10. Ink marking may be damaged by some kind of solvent, please take precautions when choosing solvent by your selves.

11. Please refer to packing specification regarding how to storage the products in the pack.

TAPING SPECIFICATION

1. APPLICATION

This document is applicable to FC-145.

2. CONTENTS

Item No.	Item	Page
[1]	Taping specification	1 to 2
[2]	Inner carton	3
[3]	Shipping carton	
[4]	Marking	4
[5]	Quantity	
[6]	Storage environment	
[7]	Handling	

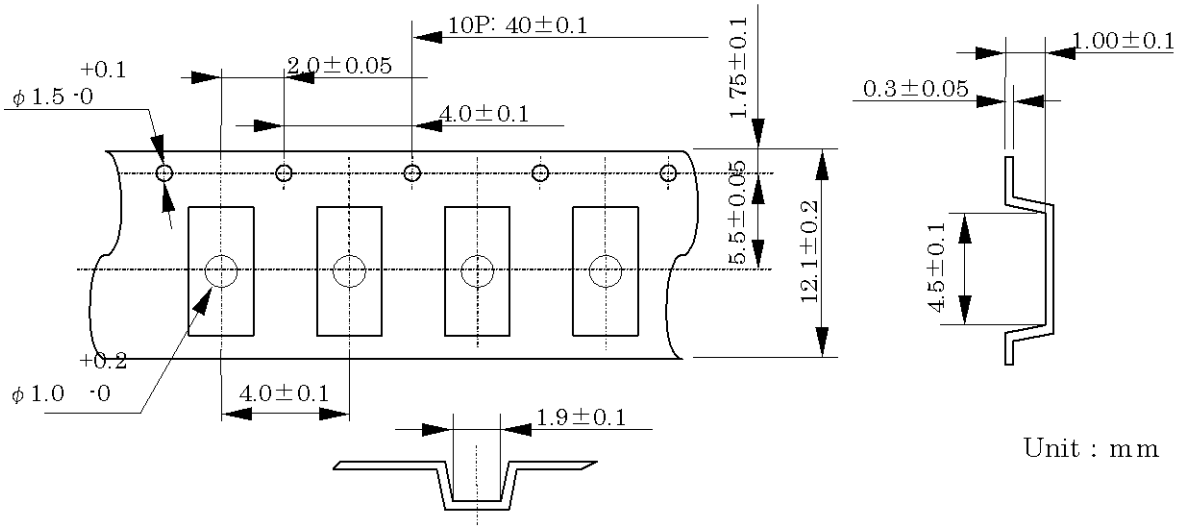
[1] Taping specification

Subject to EIA-481 , EIAJ EDX7602 , IEC 60286 , and JIS C0806.

(1) Tape dimensions TE1204L

Material of the Carrier Tape : PS

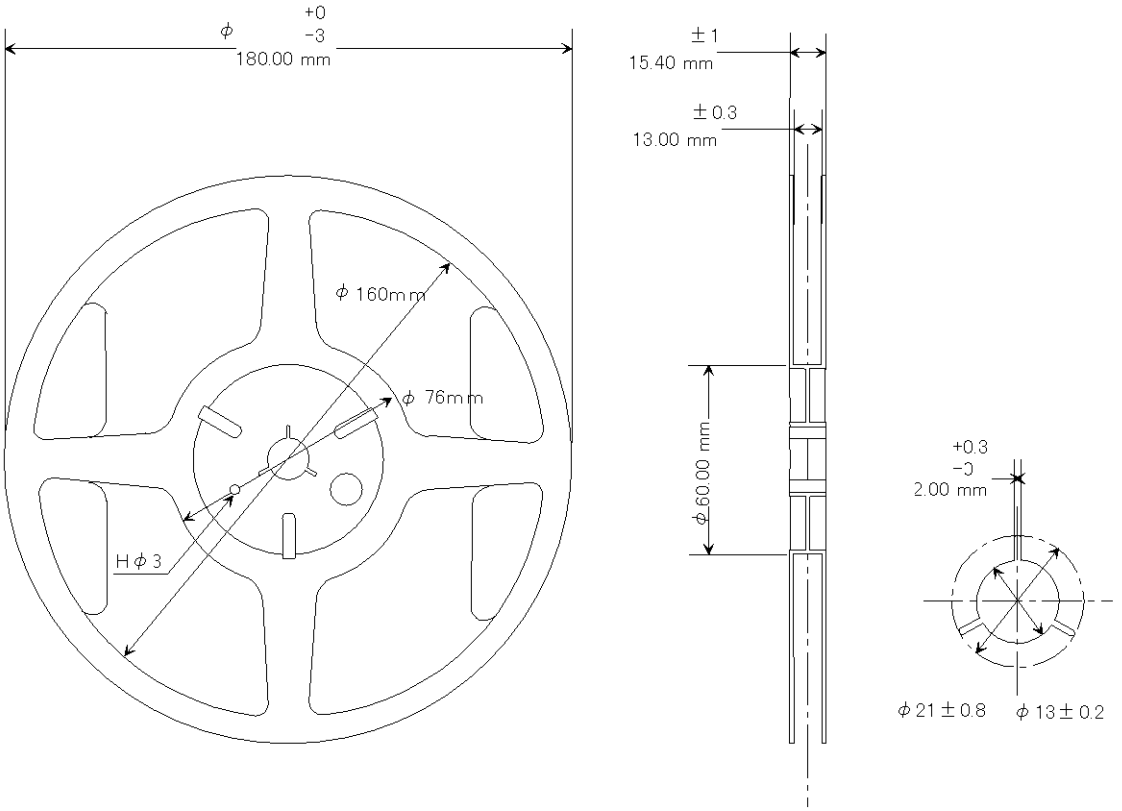
Material of the Top Tape : PET+PE



Unit : mm

(2) Reel dimensions EIAJRRM φ180

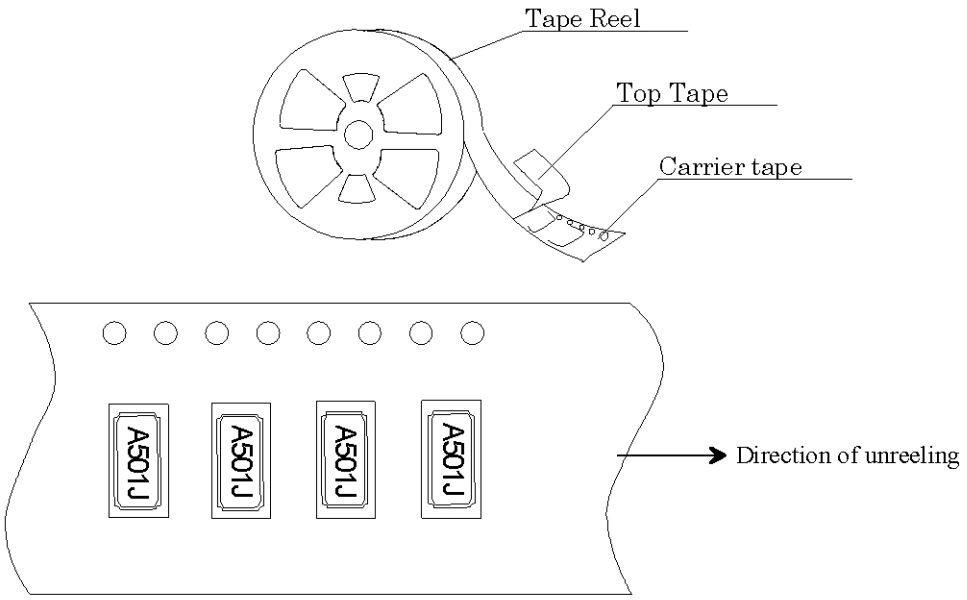
Material of the Reel : PS



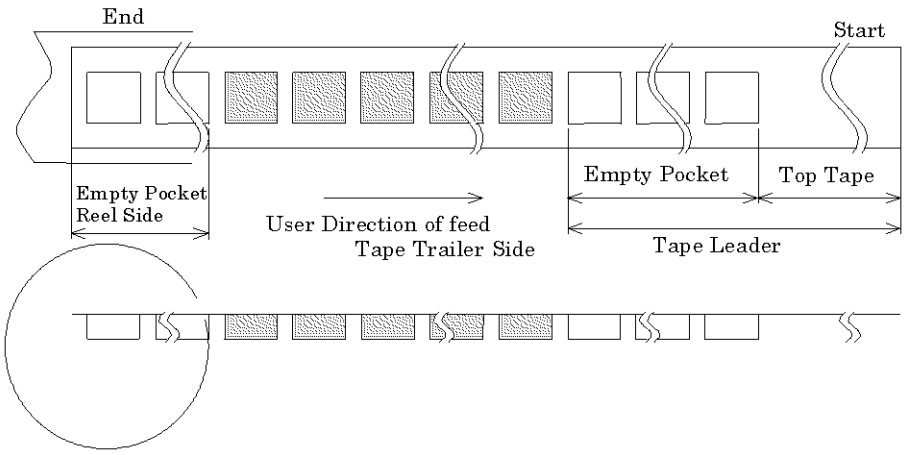
Form and Size of reel window shows are one of the example

(3) Packing

(a) Tape & Reel



(b) Start & End Point



(c) Peel force of the cover tape

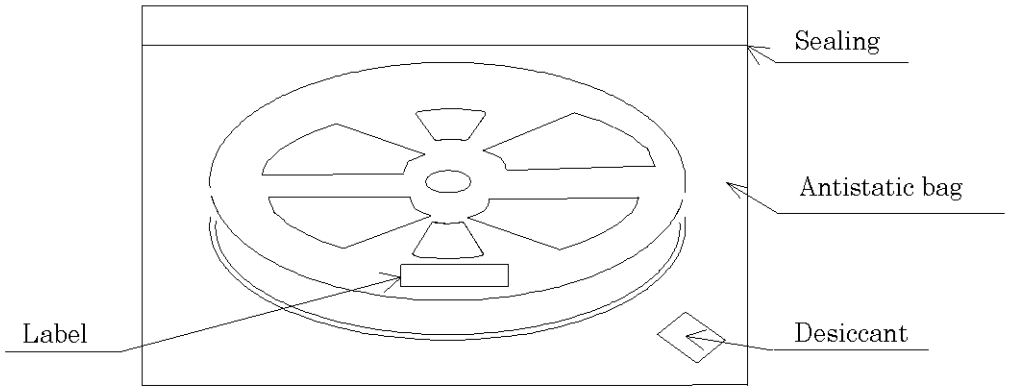
(1) angle : cover tape during peel off and the direction of unreeling shall be 165° to 180°.

(2) peel speed : 5 mm/s.

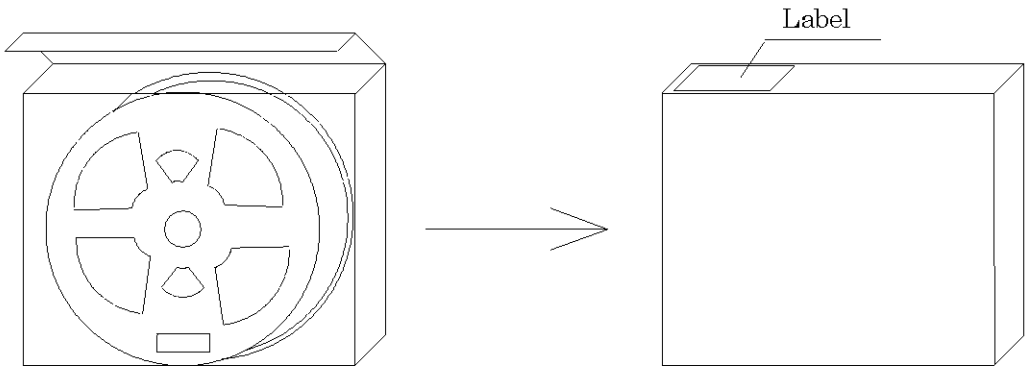
Item		Empty Space
Tape Leader	Top Tape	Min. 1 000 mm
	Carrier Tape	Min. 20 pockets
Tape Trailer	Top Tape	Min. 100 mm
	Carrier Tape	Min. 20 pockets

[2] Inner Carton

a) Packing to antistatic bag

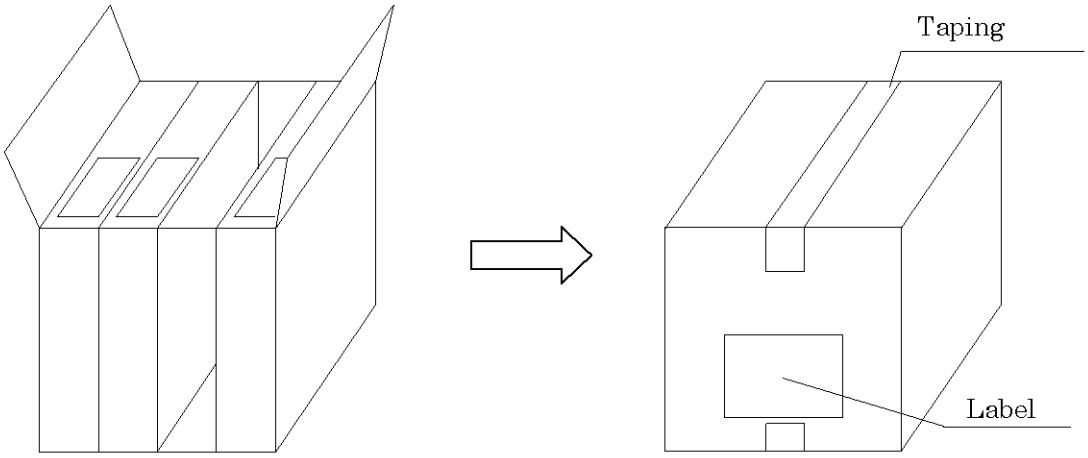


b) Packing to innercarton



[3] Shipping Carton

- Put inner boxes into an outer box.
- If there are room in the outer box,material is put in a shock absorbing together.



[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

- 3 000 pcs./reel

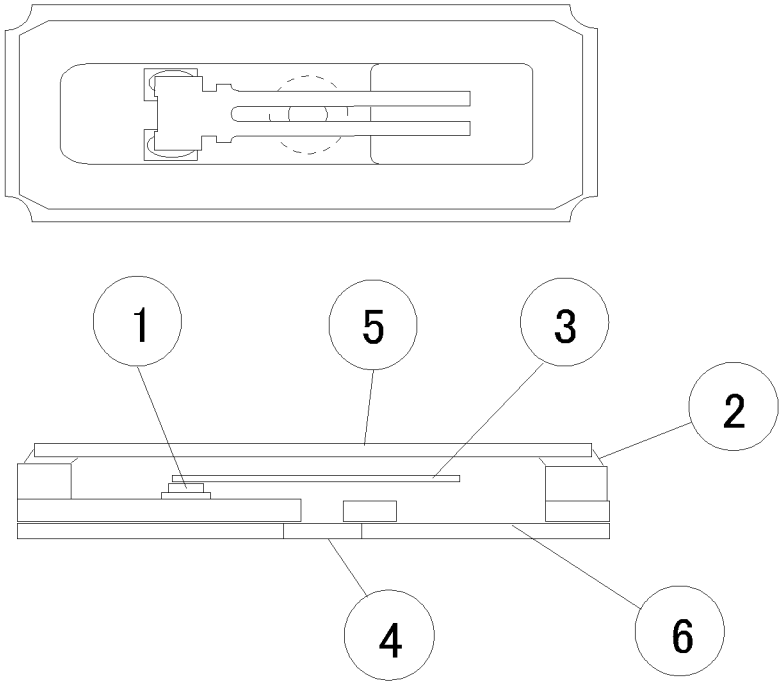
[6] Storage environment

(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.

Structure diagram FC-145



LIST		
Name of part		Material
①	Cristal Adhesive	Ag Paste
②	Sealing	Seal Glass
③	Crystal chip	tuning fork
④	Sealing	Au/Ge
⑤	Lid	Glass
⑥	Package	Ceramic(Al2O3)

PROCESS QUALITY CONTROL

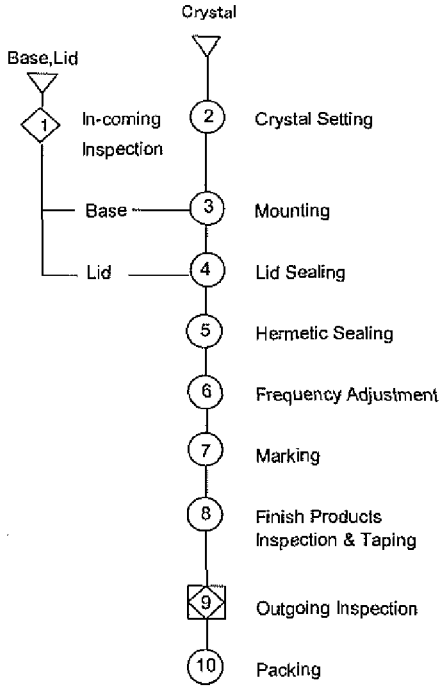
FC-145
No.C-0101-AAE-1

2005/4/1

EPSON TOYOCOM CORP.
INA PLANT QZ BU

PREPARED	CHECKED	APPROVED

Manufacturing process chart



No.	Section In Charge	Standards	Inspection Control Item	Inspection Methods	Instruments	Record
1	Inspection Section	Purchasing Specification	Appearance	Sampling	Visual Inspection	In-coming Inspection
	(INA Plant QA)	Incoming Inspection Standard	Dimension	Sampling	Tool Microscope	Data Sheet
2	SUB-CONTRACTOR	Manufacturing Instruction Sheet	Appearance	100% Inspection	Microscope	Process Data Sheet
3	SUB-CONTRACTOR	Manufacturing Instruction Sheet	Appearance	100% Inspection	Microscope	Process Data Sheet
4	SUB-CONTRACTOR	Manufacturing Instruction Sheet	Appearance	100% Inspection	Microscope	Process Data Sheet
5	SUB-CONTRACTOR	Manufacturing Instruction Sheet	Appearance	100% Inspection	Microscope	Process Data Sheet
6	SUB-CONTRACTOR	Manufacturing Instruction Sheet	Frequency	100% Inspection	Frequency Adjust-ment Machine	Data Sheet
7	SUB-CONTRACTOR	Manufacturing Instruction Sheet	Appearance	100% Inspection	Microscope	Process Data Sheet
			Marking Strength	Sampling	Rubbing Test	Data Sheet
8	SUB-CONTRACTOR	Manufacturing Instruction Sheet	Frequency	100% Inspection	Characteristics In-	Process Data Sheet
			Crystal Inpedance	100% Inspection	spection Machine	
			Appearance	100% Inspection	Microscope	
9	SUB-CONTRACTOR	Specification	Electrical Characteristics	Sampling	Measuring Equipment	Outgoing Inspection
		Outgoing Inspection Standard	Appearance	Sampling	Microscope	Data Sheet
			Dimension	Sampling	Tool Microscope	
10	SUB-CONTRACTOR	Packing Instruction	Customers Information	---	---	Shipment List
		Daily Shipping List	Production Type			
			Quantity			

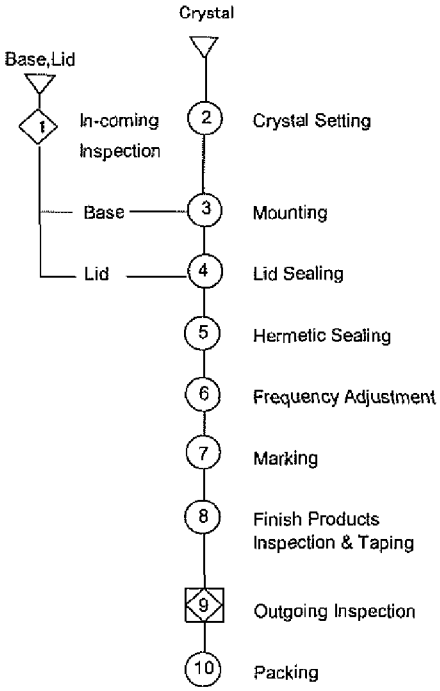
PROCESS QUALITY CONTROL

FC-145
No.C-0101-ASE-1

2005/4/1

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Manufacturing process chart	No.	Section In Charge	Standards	Inspection Control Item	Inspection Methods	Instruments	Record
	1	Inspection Section (INA Plant QA)	Purchasing Specification Incoming Inspection Standard	Appearance Dimension	Sampling Sampling	Visual Inspection Tool Microscope	In-coming Inspection Data Sheet
	2	Production Section	Manufacturing Instruction Sheet	Appearance	100% Inspection	Microscope	Process Data Sheet
	3	Production Section	Manufacturing Instruction Sheet	Appearance	100% Inspection	Microscope	Process Data Sheet
	4	Production Section	Manufacturing Instruction Sheet	Appearance	100% Inspection	Microscope	Process Data Sheet
	5	Production Section	Manufacturing Instruction Sheet	Appearance	100% Inspection	Microscope	Process Data Sheet
	6	Production Section	Manufacturing Instruction Sheet	Frequency	100% Inspection	Frequency Adjust-ment Machine	Data Sheet
	7	Production Section	Manufacturing Instruction Sheet	Appearance Marking Strength	100% Inspection Sampling	Microscope Rubbing Test	Process Data Sheet Data Sheet
	8	Production Section	Manufacturing Instruction Sheet	Frequency Crystal Inpedance Appearance	100% Inspection 100% Inspection 100% Inspection	Characteristics In-spection Machine Microscope	Process Data Sheet
	9	Inspection Section	Specification Outgoing Inspection Standard	Electrical Characteristics Appearance Dimension	Sampling Sampling Sampling	Measuring Equipment Microscope Tool Microscope	Outgoing Inspection Data Sheet
	10	Production Control Section	Packing Instruction Daily Shipping List	Customers Information Production Type Quantity	- - -	- - -	Shipment List

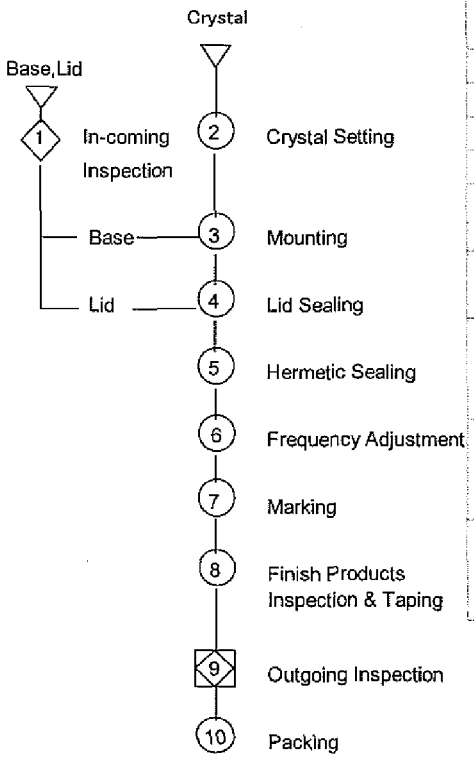
PROCESS QUALITY CONTROL

FC-145
No.C-0101-AIE-1

2005/4/1

EPSON TOYOCOM CORP.
INA PLANT QZ BU

PREPARED	CHECKED	APPROVED

Manufacturing process chart	No.	Section In Charge	Standards	Inspection Control Item	Inspection Methods	Instruments	Record
	1	Inspection Section (INA Plant QA)	Purchasing Specification Incoming Inspection Standard	Appearance Dimension	Sampling Sampling	Visual Inspection Tool Microscope	In-coming Inspection Data Sheet
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	4	Production Section	Manufacturing Instruction Sheet	Appearance	100% Inspection	Microscope	Process Data Sheet
	5	Production Section	Manufacturing Instruction Sheet	Appearance	100% Inspection	Microscope	Process Data Sheet
	6	Production Section	Manufacturing Instruction Sheet	Frequency	100% Inspection	Frequency Adjustment Machine	Data Sheet
	7	Production Section	Manufacturing Instruction Sheet	Appearance Marking Strength	100% Inspection Sampling	Microscope Rubbing Test	Process Data Sheet Data Sheet
	8	Production Section	Manufacturing Instruction Sheet	Frequency Crystal Inpedance Appearance	100% Inspection 100% Inspection 100% Inspection	Characteristics Inspection Machine Microscope	Process Data Sheet
	9	Inspection Section	Specification Outgoing Inspection Standard	Electrical Characteristics Appearance Dimension	Sampling Sampling Sampling	Measuring Equipment Microscope Tool Microscope	Outgoing Inspection Data Sheet
	10	Production Control Section	Packing Instruction Daily Shipping List	Customers Information Production Type Quantity	---	---	Shipment List

EPSON TOYOCOM

RELIABILITY TEST DATA

Product Name : FC-145

The Company evaluation condition

We evaluate environmental and mechanical characteristics by the following test condition . **F-C-0101-01-001E**

No.	ITEM	TEST CONDITIONS	VALUE *1 *2 Δ f / f [1 × 10^{-6}]	TEST Qty [n]	FAIL Qty [n]
1	Shock	100 g dummy (SEIKO EPSON Standard) drop from 1 500 mm height on to the concrete 3 directions 10 times	*3 ± 8	22	0
2	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)	*3 ± 3	22	0
3	Resistance to soldering heat	For convention reflow soldering furnace (2 times) 260℃ Max.	± 5	22	0
4	High temperature storage	a) +125℃ × 1 000 h b) +85 ℃ × 1 000 h	*3 a) ± 20 *3 b) ± 10	a) 22 b) 22	a) 0 b) 0
5	Low temperature storage	-55 ℃ × 1 000 h	*3 ± 10	22	0
6	Temperature humidity storage	+85 ℃ × 85 %RH × 1 000 h	*3 ± 10	22	0
7	Temperature cycle	-55 ℃ ⇔ +125 ℃ 30 min at each temp. 100 cycles	*3 ± 10	22	0
8	Sealing	For He leak detector	1 × 10^{-8} hPa · l / s Max.	11	0
9	Shear	10 N press for 10 s ± 1 s Ref. IEC 60068-2-21	No peeling - off at a solder part	11	0
10	Pull - off	10 N press for 10 s ± 1 s Ref. IEC 60068-2-21	No peeling - off at a solder part	11	0
11	Substrate bending	Bend width reaches 3 mm and hold for 5 s ± 1 s × 1 time Ref. IEC 60068-2-21	No peeling - off at a solder part	11	0
12	Solvent resistance	Ref. JIS C 0052 or IEC 60068-2-45	The marking shall be legible	11	0

Notes

1. *1 Each test done independently.
2. *2 Measuring 2 h to 24 h later leaving in room temperature after each test. DL : 0.5 μW
3. *3 Pre conditionings Initial value shall be after 24 h at room temperature.
4. Shift series resistance at before above tests should be less than ±20 % or less than ±15 kΩ.
   In case Resistace to solder heat and High temperature storage (+125 ℃ × 1 000 h) shift series resistance at before above tests should be less than ±30 % or less than ±20 kΩ.

QZ Business Unit

Qualification Data

Signature Itaru Nagai

EPSON TOYOCOM

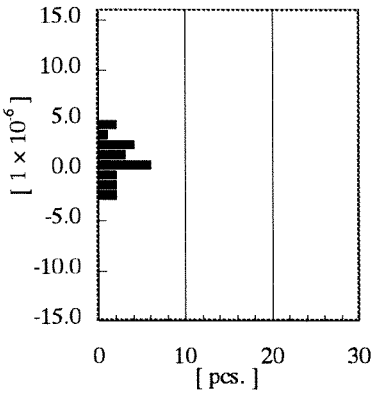
Product Name : FC−145

Δ f / f

F-C-0101-01-002E

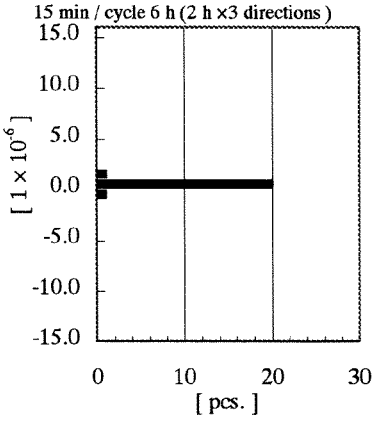
1. Shock

1 500 mm × 3 directions × 100 g × 10 times



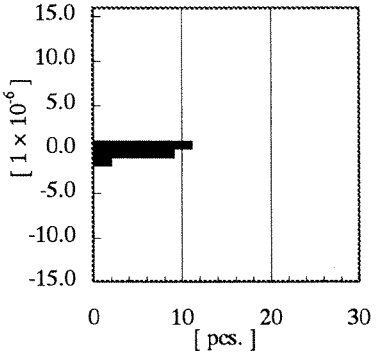
2. Vibration

10 Hz to 55 Hz amplitude 0.75 mm
55 Hz to 500 Hz acceleration 98 m/s²
15 min / cycle 6 h (2 h ×3 directions)



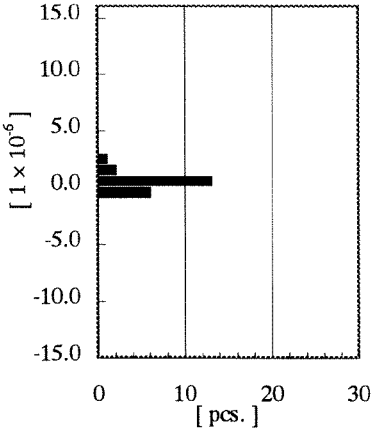
3.Resistance to soldering heat

For convention reflow soldering furnace (2 times)
260℃ Max



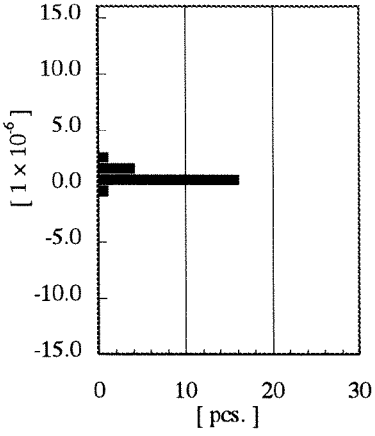
4. High temp. storage

a) +125 ℃ × 1 000 h



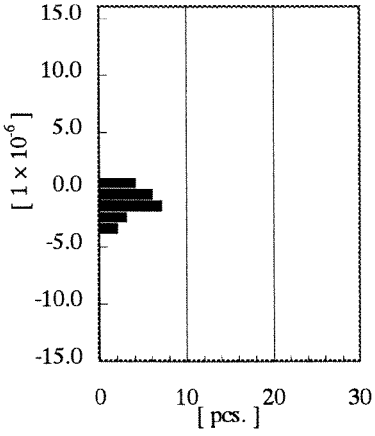
4. High temp. storage

b) +85 ℃ × 1 000 h



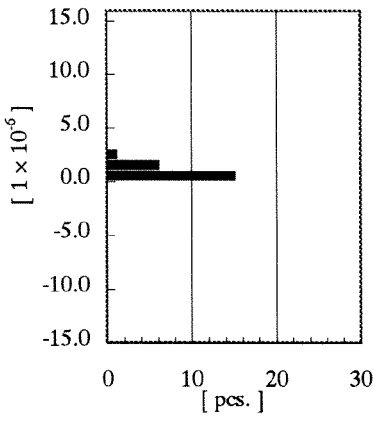
5. Low temp. storage

-55 ℃ × 1 000 h



6. Temp. humidity storage

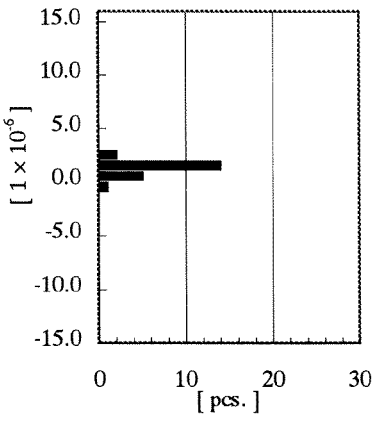
+85 ℃ × 85 %RH × 1 000 h



7. Temp. cycle

-55 ℃ ⇔ +125 ℃

100 cycles



Qualification Data

EPSON TOYOCOM

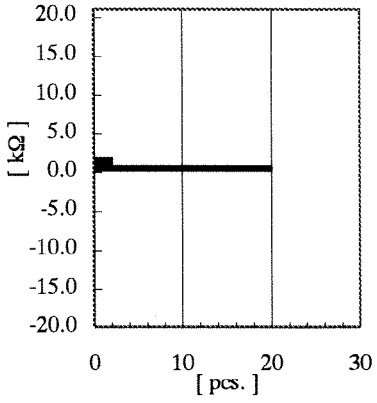
Product Name : FC−145

Δ CI

F-C-0101-01-003E

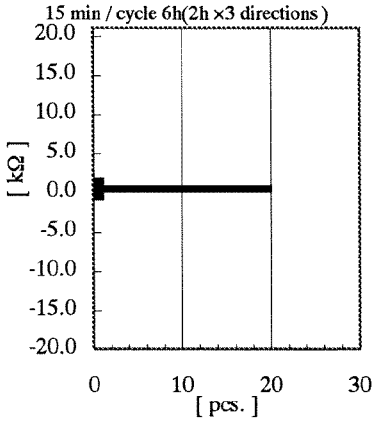
1. Shock

1 500 mm x 3 directions x 100 g
x 10 times



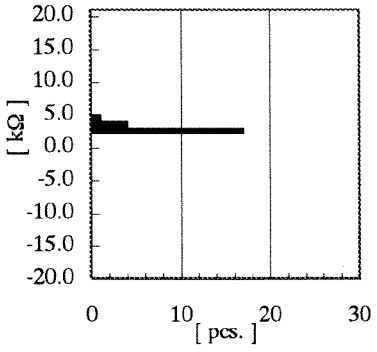
2. Vibration

10 Hz to 55 Hz amplitude 0.75 mm
55 Hz to 500 Hz acceleration 98 m/s^2
15 min / cycle 6h(2h x3 directions)



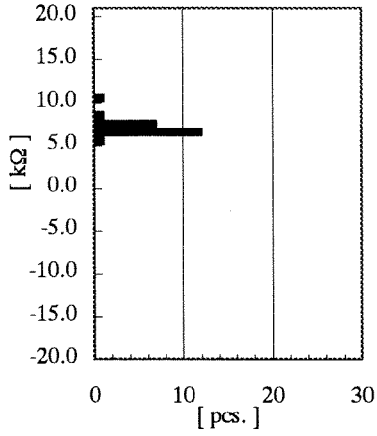
3. Resistance to soldering heat

For convention reflow
soldering furnace (2 times)
260℃ Max.



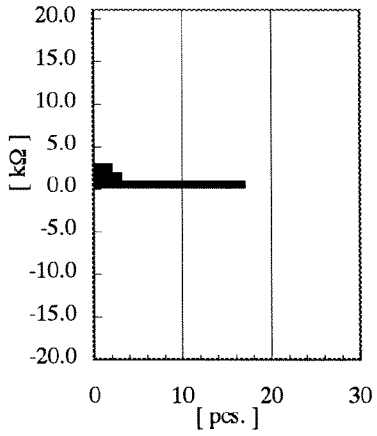
4. High temp. storage

a) +125 ℃ x 1 000 h



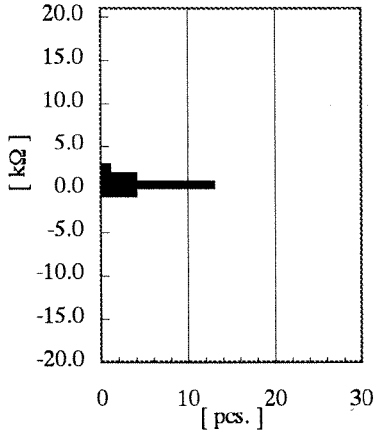
4. High temp. storage

b) +85℃ x 1 000 h



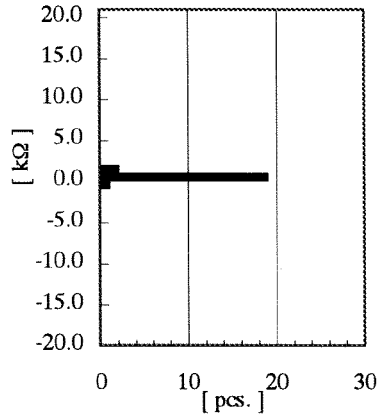
5. Low temp. storage

-55 ℃ x 1 000 h



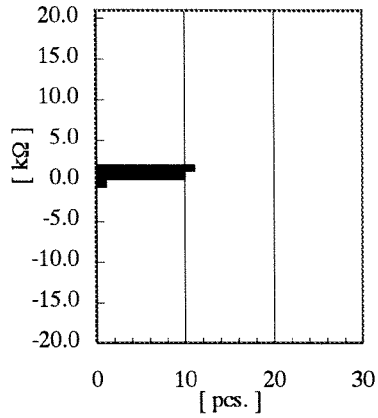
6. Temp. humidity storage

+85 ℃ x 85 %RH x 1 000 h



7. Temp. cycle

-55 ℃ ⇔ +125 ℃
100 cycles



Qualification Data