INFORMATION

PRODUCT No. : X1A000091001900

MODEL : FC-13A

INFO. No. : Q13-265-1B

DATE : Feb. 13. 2014

SEIKO EPSON 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.

1) This product complies with RoHS Directive.
2) This Product supplied (and any technical information furnished, if any) by Seiko Epson 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.
3) 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 systems, and medical equipment, the functional purpose of which is to keep extra high reliability, such as satellite, rocket and other space life.

This FC-13A is authorized for Use of meter for automobile only.

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[1] Absolute maximum ratings

No.	Item	Symbol	Rating value			Unit	Note
			Min.	Typ.	Max.		
1	Storage temperature range	T_stg	- 55		+ 125	°C	Suppose to be within CI STD at + 25 °C ± 3 °C.
2	Maximum level of drive	GL			1.0	μW	

[2] Operating range

No.	Item	Symbol	Rating value			Unit	Note
			Min.	Typ.	Max.		
1	Operating temperature range	T_use	- 40		+ 125	°C	
2	Level of drive	DL	0.01	0.1	1.0	μW	
3	Vibration mode		Fundamental				

[3] Static characteristics

No.	Item		Symbol	Value	Unit	Conditions
1	Nominal Frequency		f_nom	32.768	kHz	
2	Frequency tolerance		f_tol	± 10	$\times 10^{-6}$	CL = 7 pF Ta = + 25 ± 3°C Level of drive : 0.1 μW Not include aging
3	Motional resistance		R1	70 Max.	kΩ	CI meter : HP4294A Level of drive : 0.5 μW
4	Motional capacitance		C1	3.2 Typ.	fF	
5	Shunt capacitance		C0	0.9 Typ.	pF	
6	Frequency temperature characteristics	Turnover temperature	Ti	+ 25 ± 5	°C	Values are calculated by The frequencies at + 10, + 25, + 40 °C with C-MOS circuit.
		Parabolic coefficient	B	- 0.04 Max.	$\times 10^{-6}/°C^2$	
7	Isolation resistance		IR	500 Min.	MΩ	DC 100V± 15, 60 seconds Between terminal # 1 and terminal # 2
8	Frequency Aging		f_age	± 3	$\times 10^{-6}$/year	Ta = + 25 °C ± 3 °C Level of drive : 0.1 μW

[4] Environmental and Mechanical characteristics

No.	Items	Value*1*2 $\Delta f/f$ [1×10^{-6}]	Conditions
1	Shock resistance	*3 ± 10	Free drop from 1 000 mm height on a hard wooden board for 3 times (Board is thickness more than 30 mm)
2	Vibration resistance	*3 ± 5	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)
3	Soldering heat resistance	± 5	For convention reflow soldering furnace (3 times)
4	High temperature storage	*3 ± 20	+ 125 °C × 1 000 h
5	Low temperature storage	*3 ± 10	- 55 °C × 1 000 h
6	High temperature and humidity	*3 ± 10	+ 85°C × 85%RH × 1 000 h
7	High Temperature bias	*3 ± 20	+ 125 °C × 1 000 h (Bias , Drive level ; 0.5 μW)
8	Low Temperature bias	*3 ± 15	- 40 °C × 1 000 h (Bias , Drive level ; 0.5 μW)
9	Temperature humidity storage bias	*3 ± 15	+ 85°C × 85 %RH × 1 000 h (Bias , Drive level ; 0.5 μW)
10	Temperature cycle	*3 ± 15	- 40 °C ↔ + 125 °C 30 minutes at each temperature × 1 000 cycles
11	Sealing	*3 1×10^{-8} hPa·l / s Max.	For He leak detector
12	Shear	No peeling-off at a soldered part	20 N press for 10 ± 1 s. Ref. IEC 60068-2-21
13	Pull - off	No peeling-off at a soldered part	20 N press for 10 ± 1 s. Ref. IEC 60068-2-21
14	Substrate bending	No peeling-off at a soldered part	Bend width reaches 4 mm and hold for 20 s ± 1 s × 1 time Ref. IEC 60068-2-21
15	Solderability	More than 95 % covered by solder	Dip into methyl alcohol solution of rosin for 5 sec. at + 235 ± 5 °C

< Notes >

*1 Each test done independently.

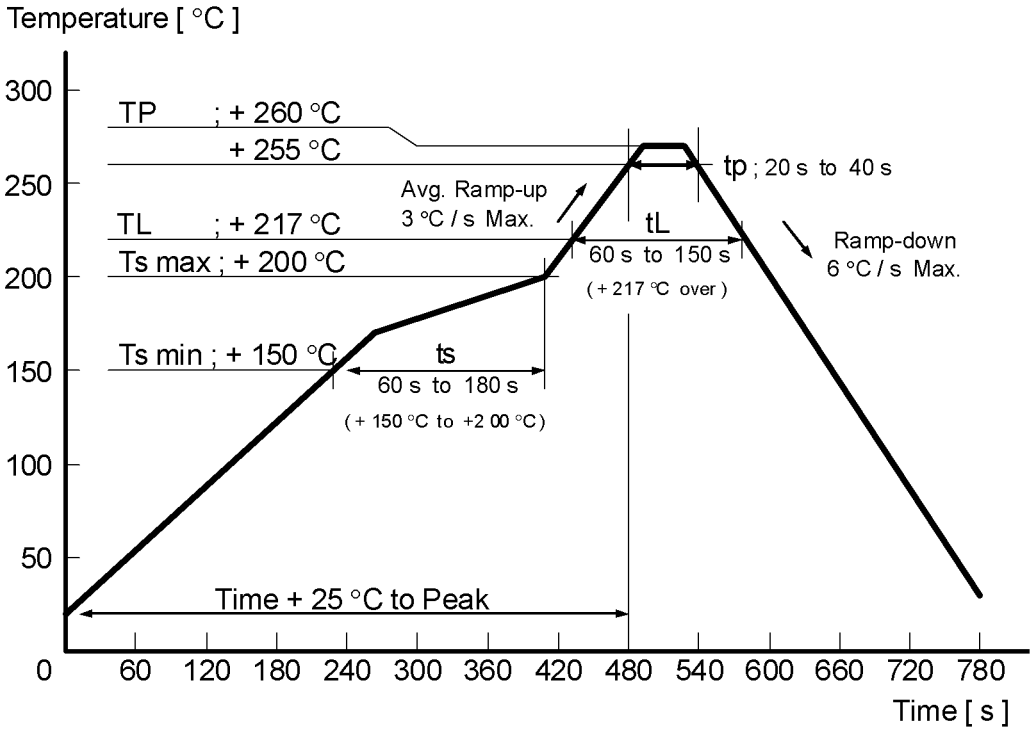
*2 Measuring 2 h to 24 h later leaving in room temperature after each test. Drive level : 0.5 μW

*3 Pre conditionings

1. + 125 °C × 24 h → +85 °C × 85 %RH × 168 h ± 1 h → reflow 3 times
2. Initial value shall be after 24 h at room temperature.

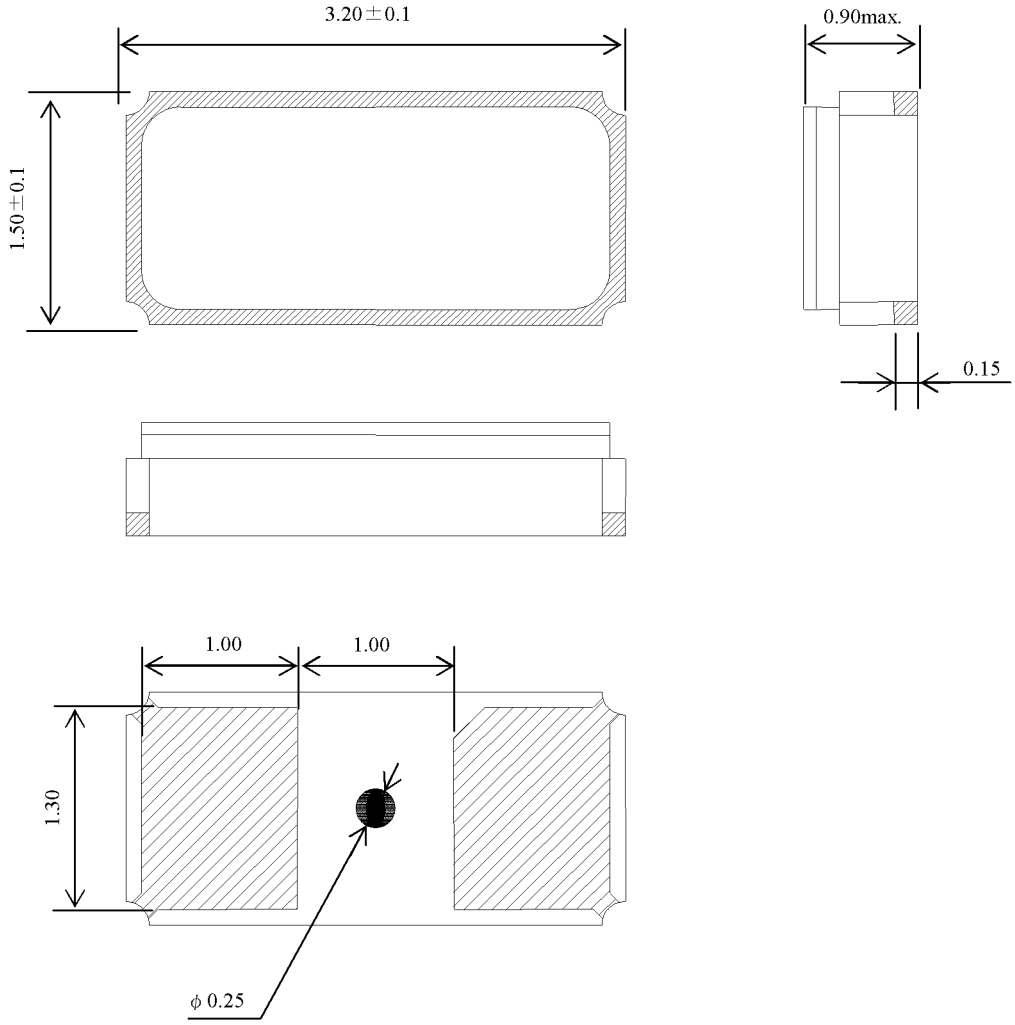
Shift of series resistance at before and after the test should be less than ± 30 kΩ.

♦ Reflow condition (follow to IPC / JEDEC J-STD-020C)



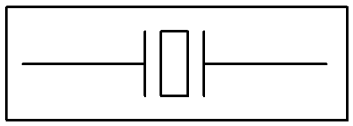
[5] Dimensions and Internal Connection

1. Dimensions



2. Internal Connection

(Top View)



1 # 2

PKG	Ceramic
Electrode	Au-P 0.5 μm Min.
Lid	Kovar (**)
PKG color	Grey

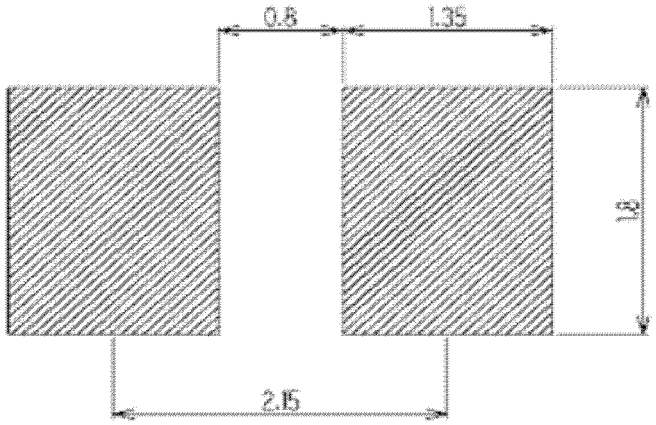
(**) Lid does not connect with # 1 and # 2

Type	FC-13A	Unit	1 = 1 mm

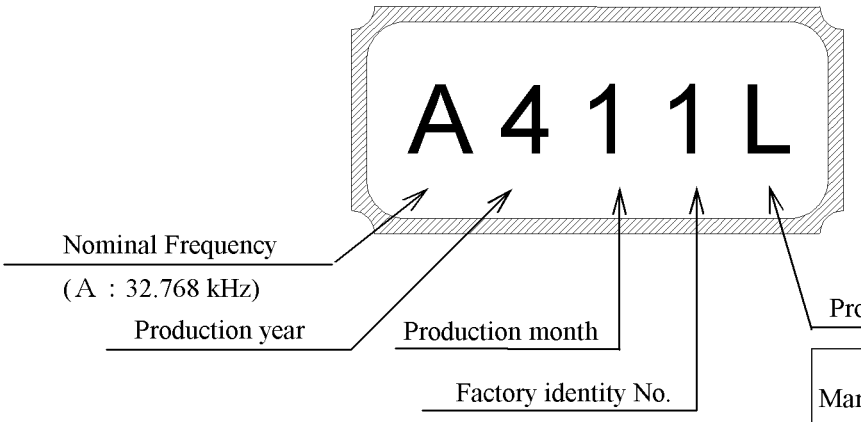
[6] Recommended soldering pattern and Marking layout

3. Recommended soldering pattern

Unit : 1 = 1 mm



4. Marking layout



Marking	Product Factory Name	Country
J	INA	Japan
L	EPMY	Malaysia

Symbol of Manufacturing month

Month digit	1	2	3	4	5	6	7	8	9	10	11	12
Marking	1	2	3	4	5	6	7	8	9	X	Y	Z

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

Type	FC-13A	Unit	1 = 1 mm

[7] Notes

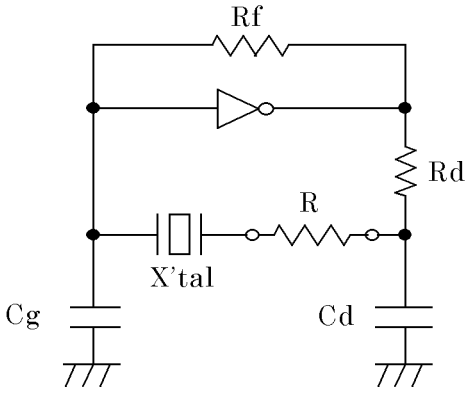
1. Max three (3) times reflow is allowed. Once miss soldering is happened, hand work soldering by soldering iron is recommended. (+ 350 °C × within 5 s)

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

7. 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.

8. 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.

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

PACKING SPECIFICATION

1. APPLICATION

This document is applicable to FC-13A.

2. CONTENTS

Item No.	Item	Page
[1]	Taping specification	1 to 2
[2]	Inner carton	3
[3]	Shipping carton	
[4]	Label Marking	4
[5]	Quantity	
[6]	Expected shipping and storage conditions	
[7]	Handling	

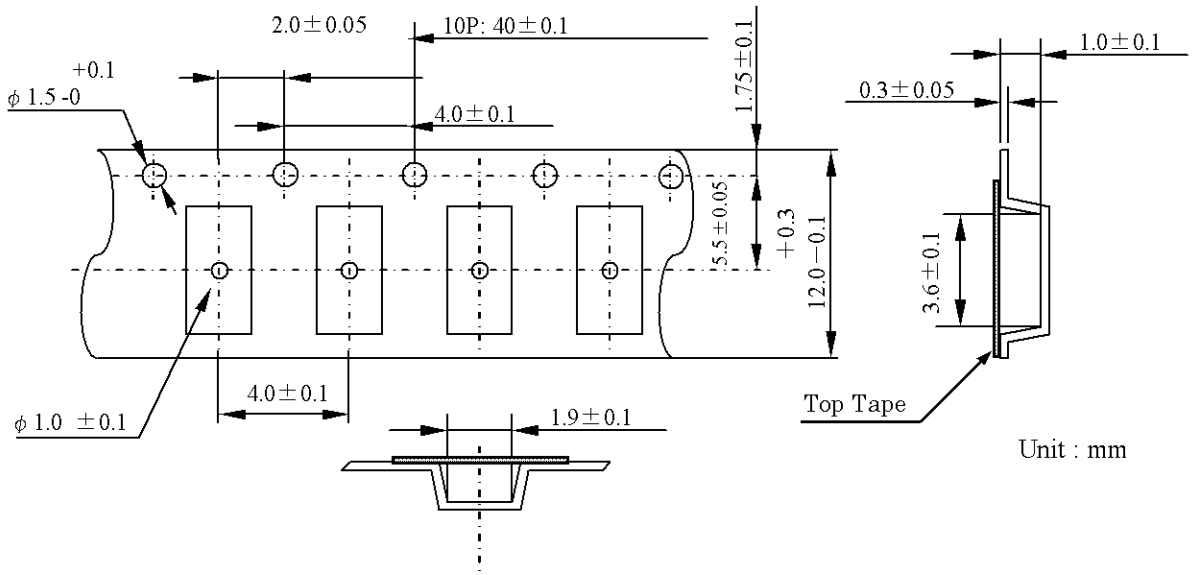
[1] Taping specification

Subject to EIA-481 , JIS C0806.

(1) Tape dimensions

Material of the Carrier Tape : PS

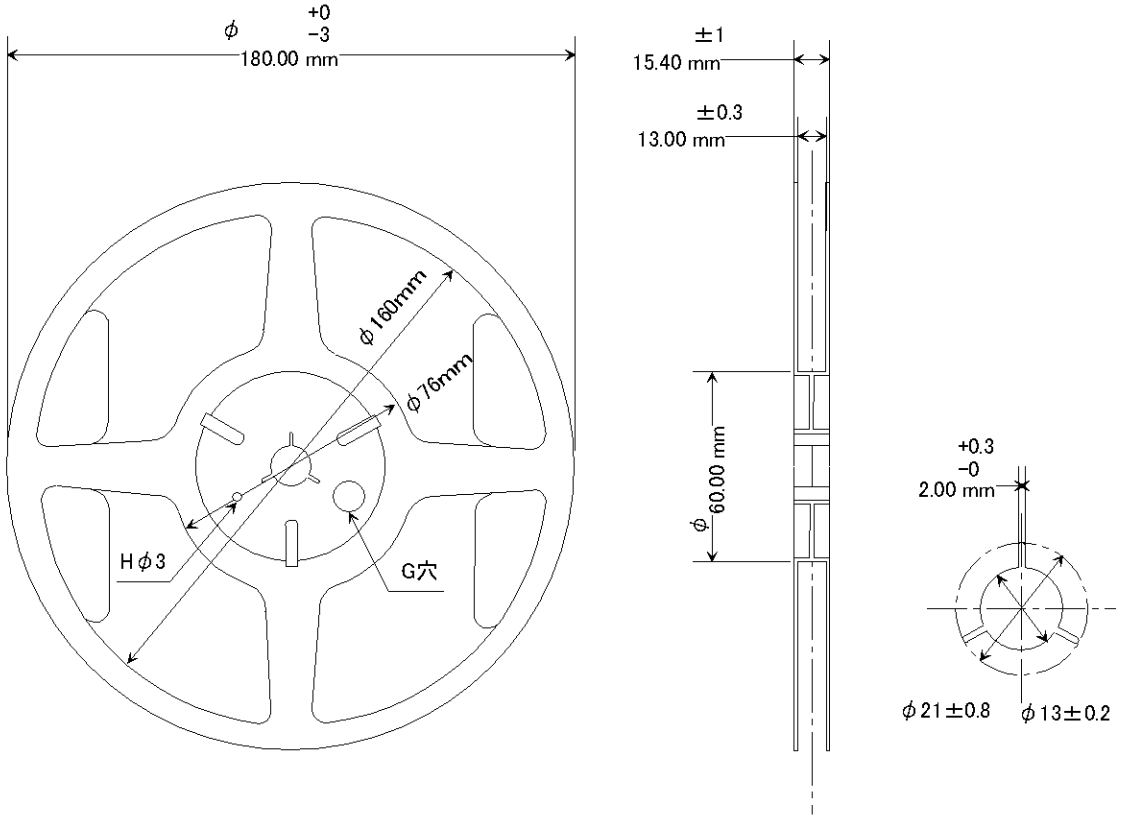
Material of the Top Tape : PET+PE



Unit : mm

(2) Reel dimensions EIAJRRM φ 180 Tape width : 12 mm

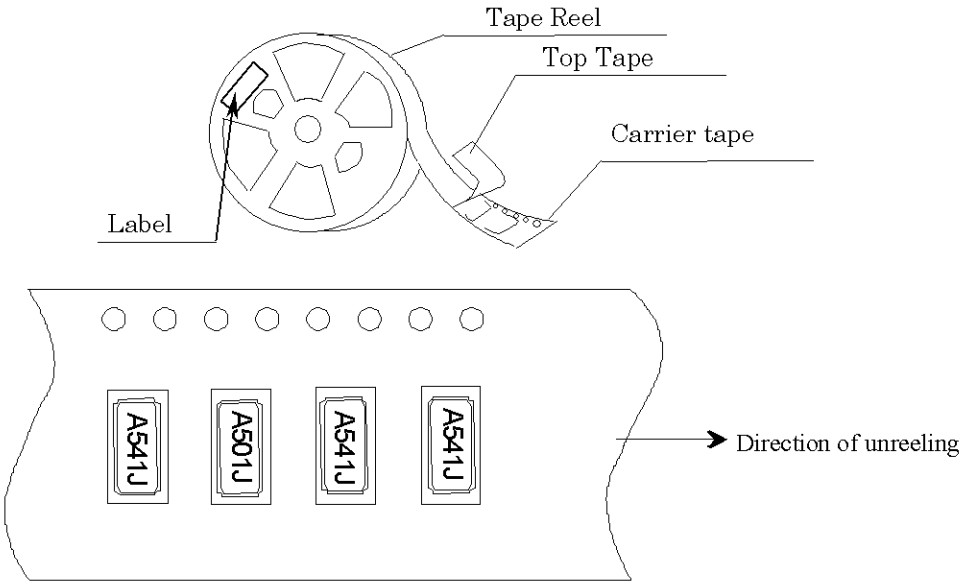
Material of the Reel: PS



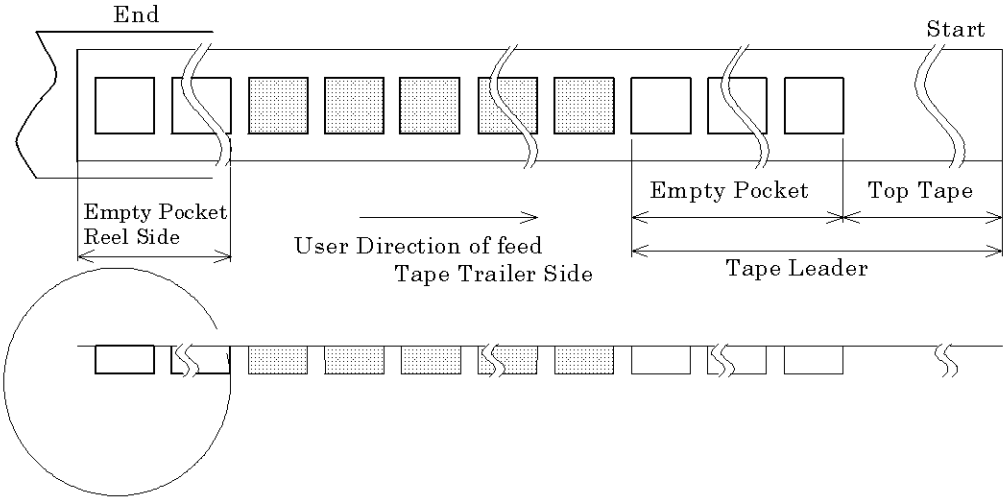
Form and Size of reel window shows are one of the example

(3) Packing

(a) Tape & Reel



(b) Start & End Point



(c) Peel force of the cover tape

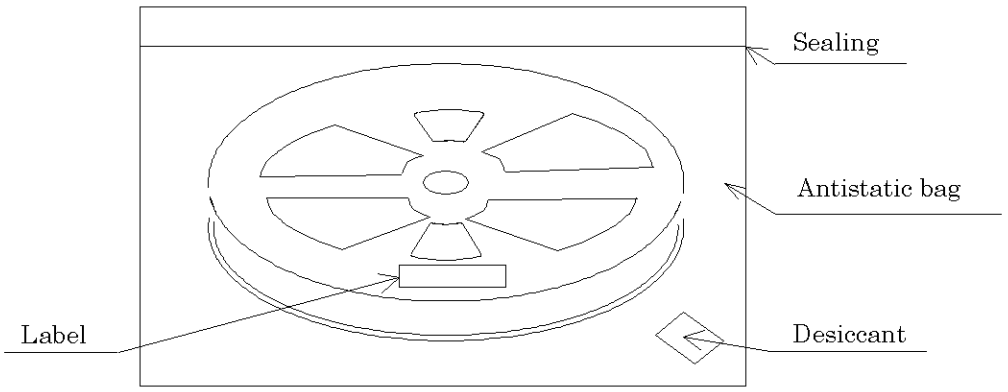
(1) angle : cover tape during peel off and the direction of unreeling shall be 165° to 180°.

(2) peel speed : 5 mm/s.

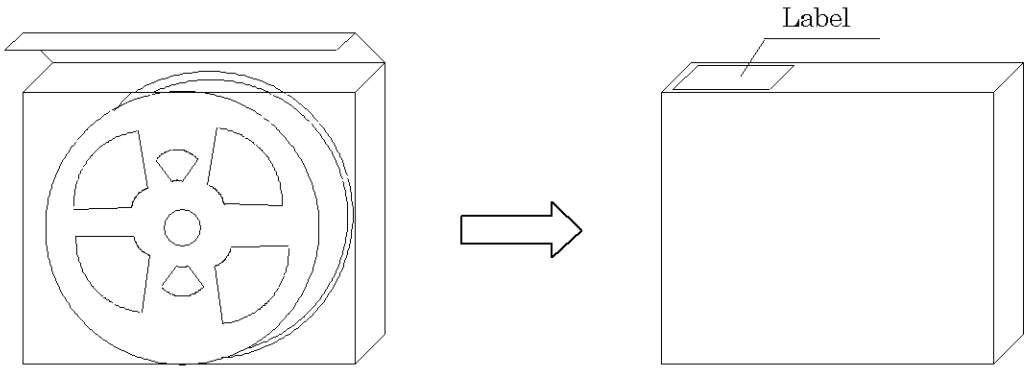
Item		Empty Space
Tape Leader	Top Tape	1 000 mm Min.
	Carrier Tape	160 mm Min.
Tape Trailer	Top Tape	0 mm Min.
	Carrier Tape	160 mm Min.

[2] Inner Carton

a) Packing to antistatic bag

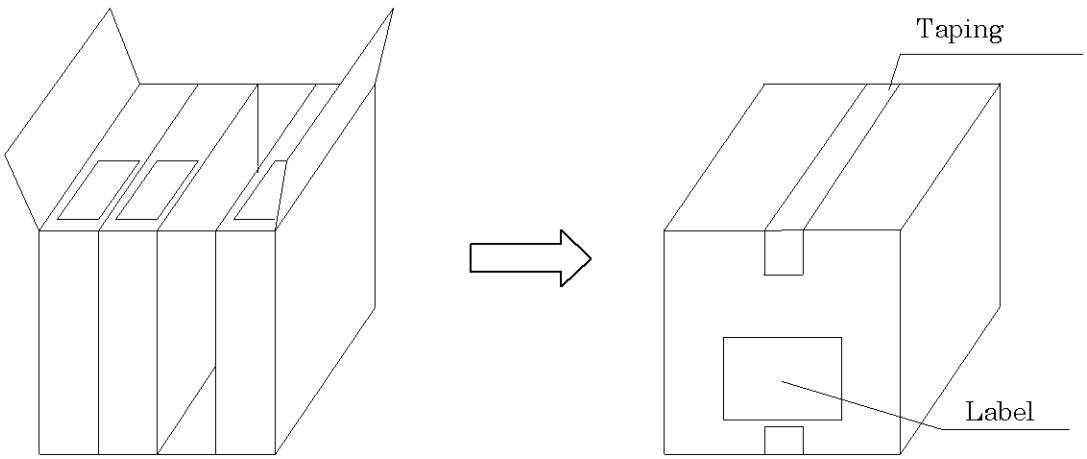


b) Packing to innercarton



[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

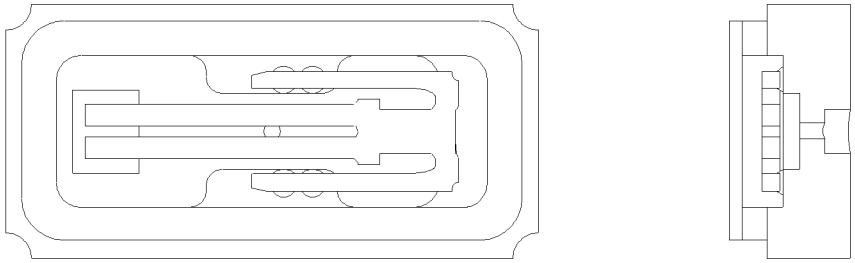
[6] Storage environment

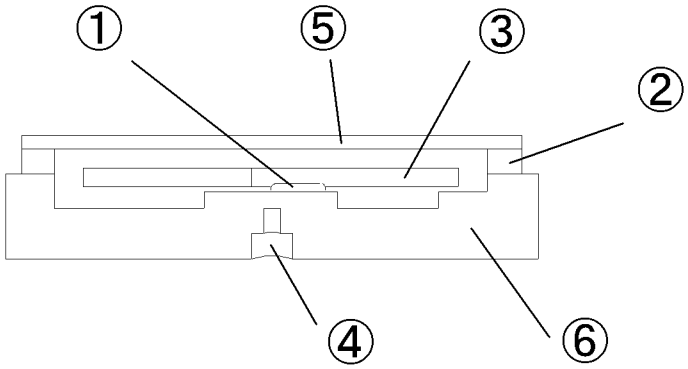
(1) Before open the packing, we recommend to keep less than +30 °C and 85 %RH of Humidity,and to use it less than 6 months after delivery.
(2) We recommend to open Package in immediately before use. After open Package, We recommend to keeps less than 6 month. No need dry air before soldering work if it is less than temperature +30 °C, 85 humidity %RH.
(3) Not to storage with some erosive chemicals.
(4) Nothing is allowed to put on the reel or carton to prevent mechanical damage.

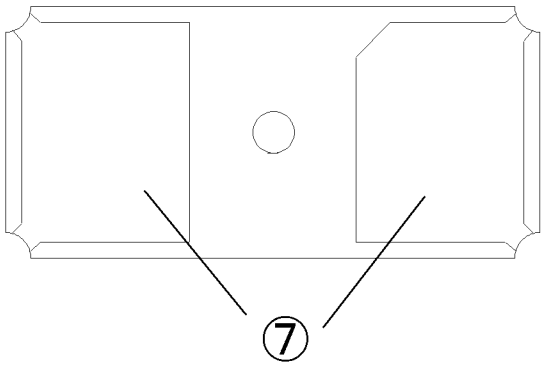
[7] Handling

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

Structure diagram FC-13A







LIST		
Name of part		Material
①	Crystal Adhesive	Ag Paste
②	Sealing	Seal ring
③	Chip	tuning fork
④	Sealing	Au/Ge
⑤	Lid	Kovar
⑥	Package	Ceramic(Al2O3)
⑦	Terminal	Mo Metalization + Ni-P + Au-P

RELIABILITY TEST DATA

Product Name : FC-13A

The Company evaluation condition

We evaluate environmental and mechanical characteristics by the following test condition . **No. F-020C-C-0901-01-001E**

No.	ITEM	TEST CONDITIONS	VALUE *1 *2 Δ f / f [1 × 10^{-6}]	TEST Qty [n]	FAIL Qty [n]
1	Shock resistance	Free drop from 1 000 mm height on a hard wooden board for 3 times (Board is thickness more than 30 mm)	*3 ± 10	22	0
2	Vibration resistance	10 Hz to 55 Hz amplitude 0.75 mm 55 Hz to 500 Hz acceleration 98 m/s2 10 Hz →500 Hz →10 Hz 15 min./cycle 6 h (2 hours . 3 directions)	*3 ± 5	22	0
3	Soldering heat resistance	IPC/JEDEC J-STD-020C Reflow (3 times)	± 5	22	0
4	High temperature storage	+125℃ × 1 000 h	*3 ± 20	22	0
5	Low temperature storage	-55 ℃ × 1 000 h	*3 ± 15	22	0
6	Temperature humidity storage	+85 ℃ × 85 %RH × 1 000 h	*3 ± 10	22	0
7	High temperature bias	+125℃ × 1 000 h (Bias , Drive level ; 0.5 μW)	*3 ± 20	22	0
8	Low temperature bias	-40 ℃ × 1 000 h (Bias , Drive level ; 0.5 μW)	*3 ± 15	22	0
9	Temperature humidity storage bias	+ 85°C × 85 %RH × 1 000 h (Bias , Drive level ; 0.5 μW)	*3 ± 15	22	0
10	Temperature cycle	-40 ℃ ⇔ +125 ℃ 30 min at each temp. 1 000 cycles	*3 ± 15	22	0
11	Sealing	For He leak detector	*3 1× 10^{-8} hPa·l / s Max.	11	0
12	Shear	20 N press for 10 s ± 1 Ref. IEC 60068-2-21	No peeling - off at a solder part	11	0
13	Pull - off	20 N press for 10 s ± 1 Ref. IEC 60068-2-21	No peeling - off at a solder part	11	0
14	Substrate bending	Bend width reaches 4 mm and hold for 20 s ± 1 s × 1 time Ref. IEC 60068-2-21	No peeling - off at a solder part	11	0
15	Solderability	Dip termination into solder bath at +235 ℃ ± 10 ℃ for 3 s (Using Rosin Flux)	Termination must be 95 % covered with fresh solder	11	0

Notes

*1 Each test shall be done independently.

*2 Measuring 2 h to 24 h later leaving in room temperature after each test. Drive level : 0.5 μw

*3 Pre conditionings

1. +125 °C × 24 h to +85 °C × 85 % × 168 h ± 1 h → reflow 3 times
2. Initial value shall be after 24 h at room temperature.

Shift of series resistance at before and after the test should be less than ±30 kΩ.

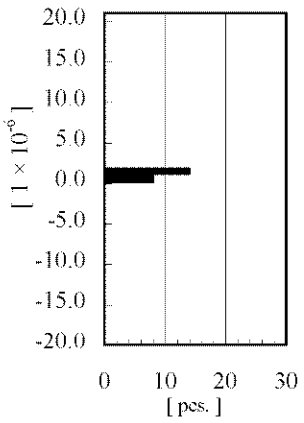
Qualification Data

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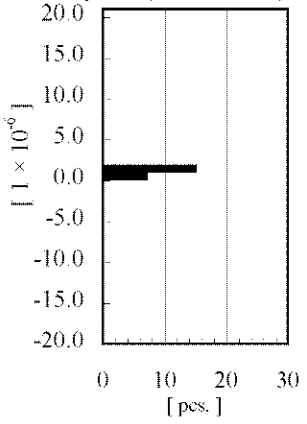
Δ f / f

No. F-020C-C-0901-01-002E

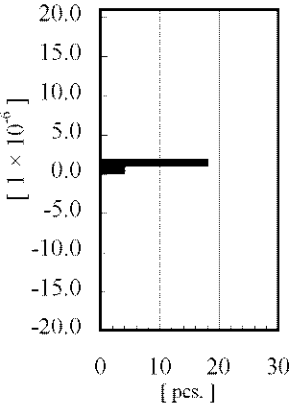
1. Shock resistance
1 000 mm × 3 times



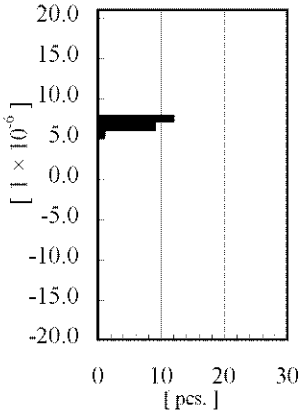
2. Vibration
10 Hz to 55 Hz amplitude 0.75 mm
55 Hz to 500 Hz acceleration 98 m/s²
15 min / cycle 6 h (2 h × 3 directions)



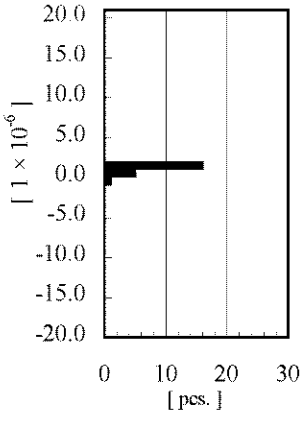
3. Resistance to soldering heat
For convention reflow furnace (3 times)



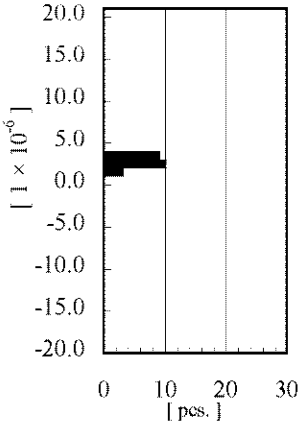
4. High temp. storage
+125 ℃ 1 000 h



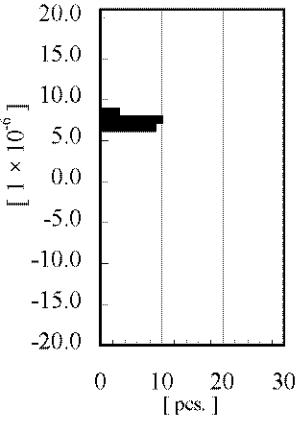
5. Low temp. storage
-55 ℃ × 1 000 h



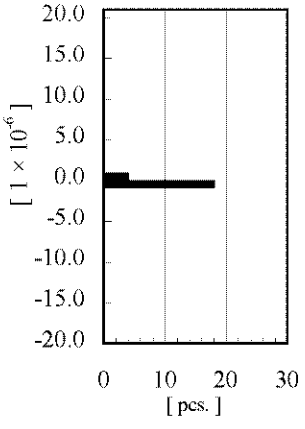
6. Temp. humidity storage
+85 ℃ 85 %RH 1 000 h



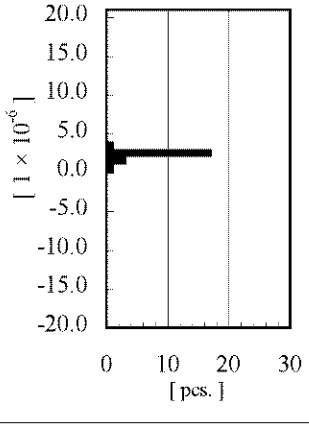
7. High temp. bias
+125 ℃ 1 000 h
× 0.5 μW



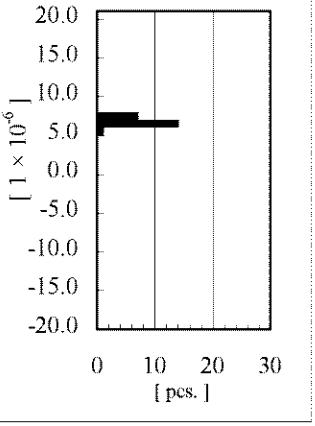
8. Low temp. bias
-55 ℃ × 1000 h
× 0.5 μW



9. Temp. humidity bias
+85 ℃× 85 %RH
× 1 000 h × 0.5 μW



10. Temp. cycle
-40 ℃ ⇔ +125 ℃
1 000 cycles



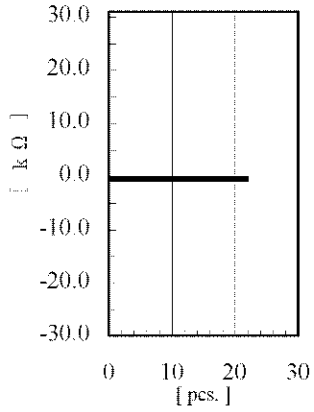
Qualification Data

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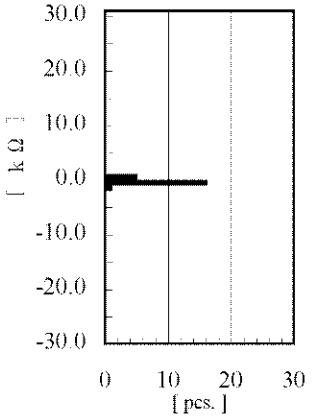
Δ CI

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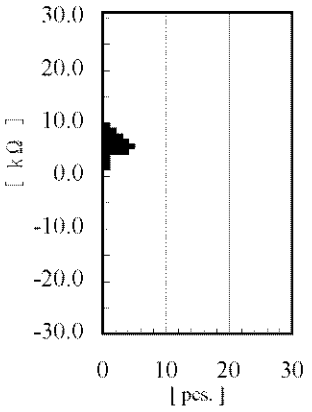
1. Shock
1 000 mm × 3 times



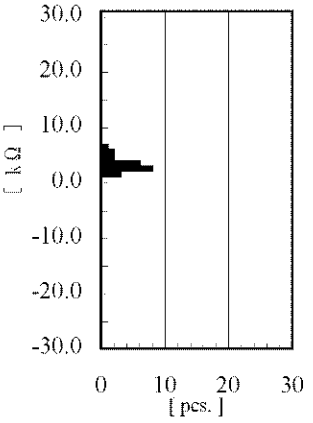
2. Vibration
10 Hz to 55 Hz amplitude 0.75 mm
55 Hz to 500 Hz acceleration 98 m/s²
15 min / cyc. 6 h (2 h × 3 directions)



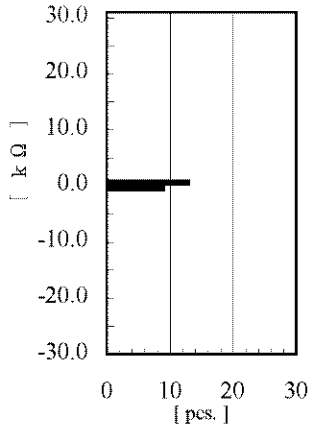
3. Resistance to soldering heat
For convention reflow soldering furnace (3 times)



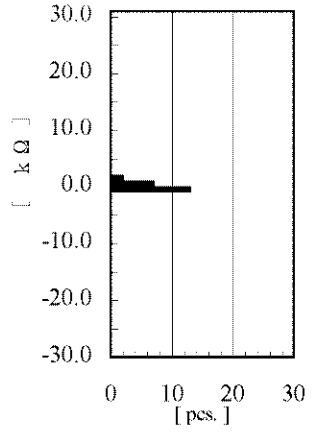
4. High temp. storage
+125 ℃ × 1 000 h



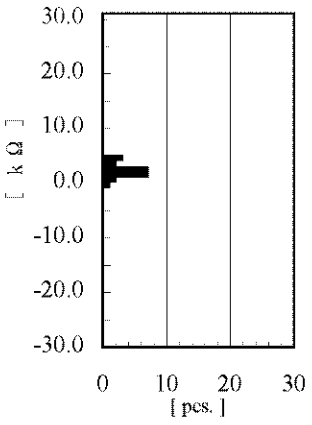
5. Low temp. storage
-55 ℃ × 1 000 h



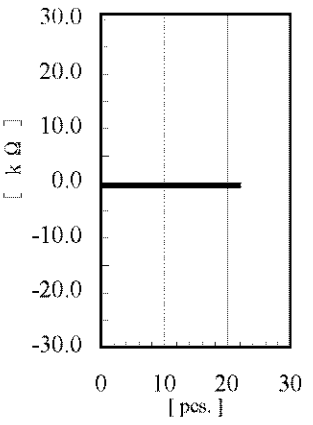
6. Temp. humidity storage
+85 ℃ × 85 %RH × 1 000 h



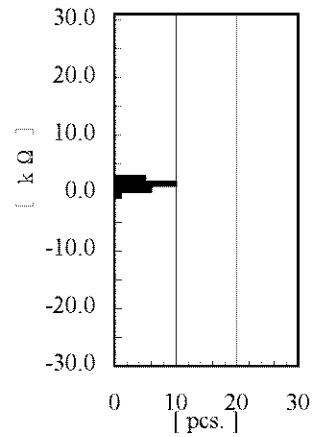
7. High temp. bias
+125 ℃ × 1 000 h
0.5 μW



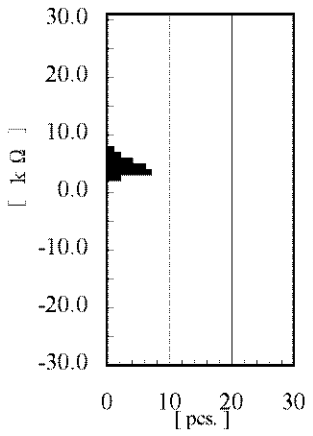
8. Low temp. bias
-40 ℃ × 1 000 h
0.5 μW



9. Temp. humidity bias
+85 ℃ × 85 %RH
× 1 000 h × 0.5 μW



10. Temp. cycle
-40 ℃ ⇔ +125 ℃
1 000 cycles



Qualification Data