

RECIPIENT

SPECIFICATIONS

PRODUCT

No.: X1A000091000100

MODEL : FC-13A

SPEC. No. : Q17-028-1B

DATE: Jun. 26. 2017

SEIKO EPSON CORPORATION

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SPECIFICATIONS

1. Application

- 1) This document is applicable to the crystal unit that are delivered to Foryou Group Co.,Ltd from Seiko Epson Corp.
- 2) This product complies with RoHS Directive.
- 3) 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.
- 4) 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 navigation system for automobile only.

2. Product No. / Model

The product No. of this crystal unit is X1A000091000100.
The model is FC-13A.

3. Packing

It is subject to the packing standard of Seiko Epson Corp.

4. Warranty

Defective parts which originate with us are replaced free of charge in the case of defects being found with 12 months after delivery.

5. Amendment and/or termination

Amendment and/or termination of this specification is subject to the agreement between the two parties.

6. Contents

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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		0.5		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	0.5	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	± 20	× 10 ⁻⁶	CL = 12.5 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.	× 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	× 10 ⁻⁶ /year	Ta = + 25 °C ± 3 °C Level of drive : 0.1 μW	

[4] Environmental and Mechanical characteristics

No.	Items	Value*1*2		Conditions
		$\Delta f/f [1 \times 10^{-6}]$		
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

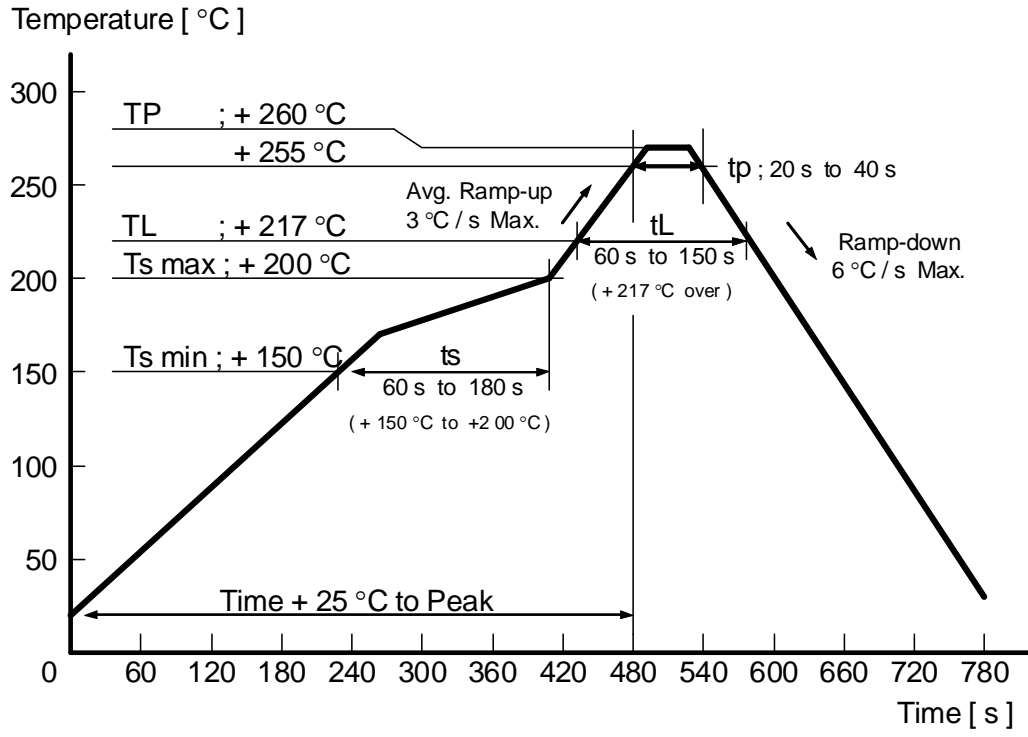
*3 Pre conditionings

1. + 125 °C × 24 h → +85 °C × 85 %RH × 168 h ± 1 h → reflow 3 times

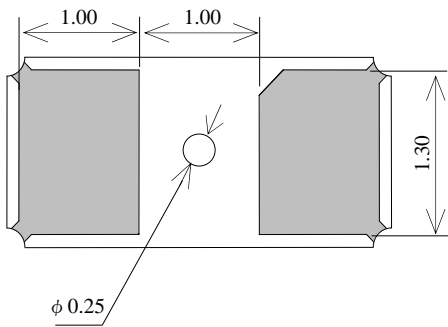
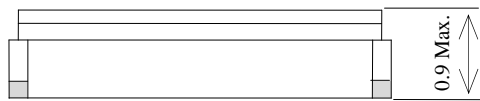
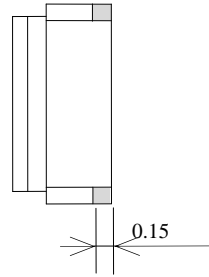
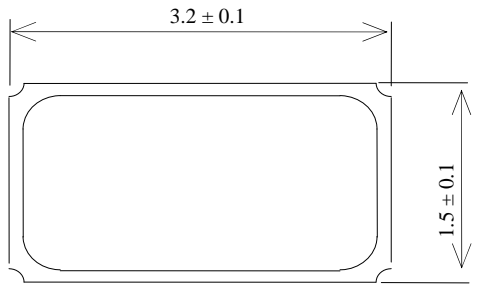
2. Initial value shall be after 24 h at room temperature.

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)

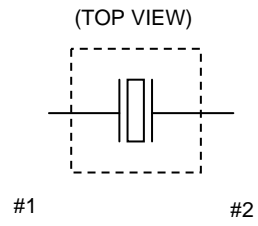


[5] Dimensions and Internal Connection
 Dimension (Unit : mm)



Internal Connection

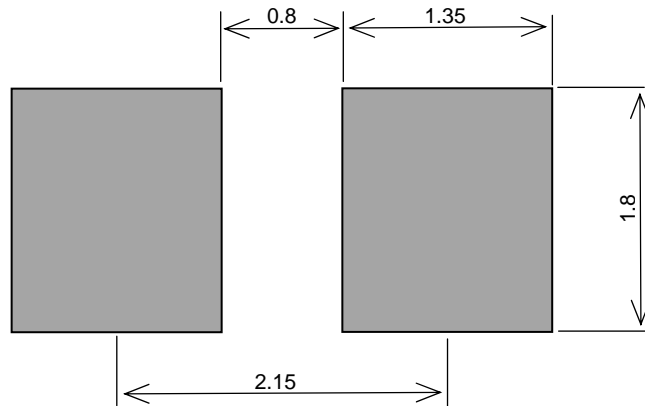
(**) Lid does not connect with # 1 and # 2



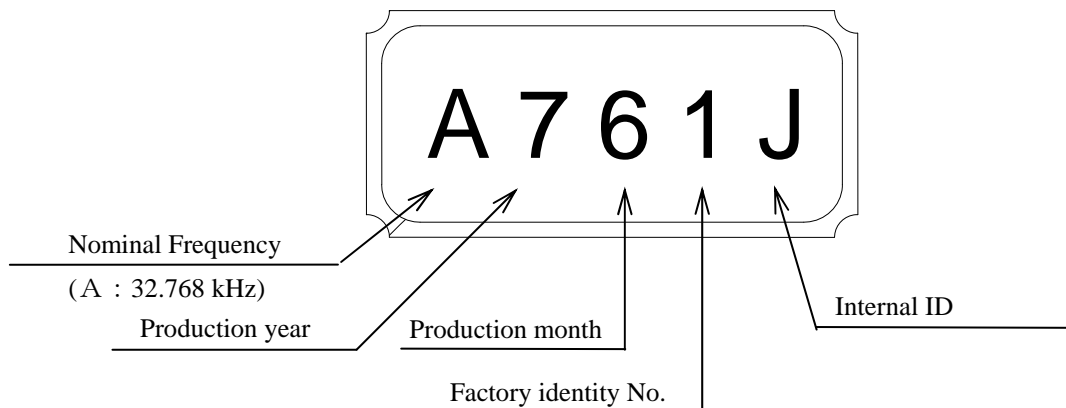
Terminal : Au plating

[6] Recommended soldering pattern and Marking layout

Recommended soldering pattern (Unit : mm)



Marking layout



Symbol of Manufacturing month

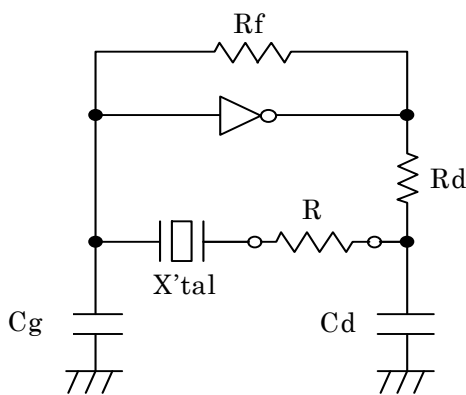
Month digit	1	2	3	4	5	6	7	8	9	10	11	12
Marking	1	2	3	4	5	6	7	8	9	X	Y	Z

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

[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.

TAPING SPECIFICATION

テープ梱包基準書

1. APPLICATION 適用範囲

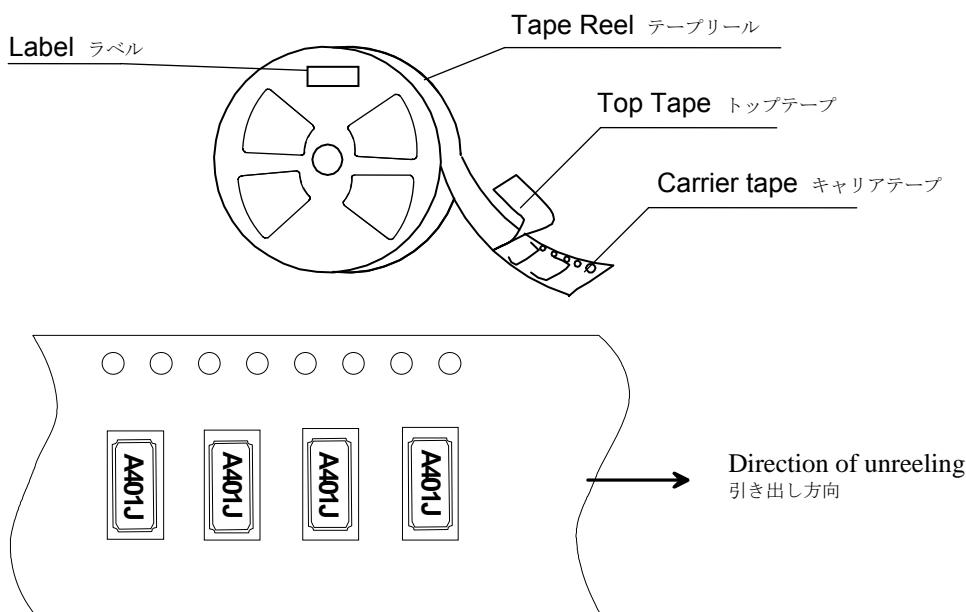
This document is applicable to FC-13A.

本基準書は、FC-13A のテーピング梱包について規定する。

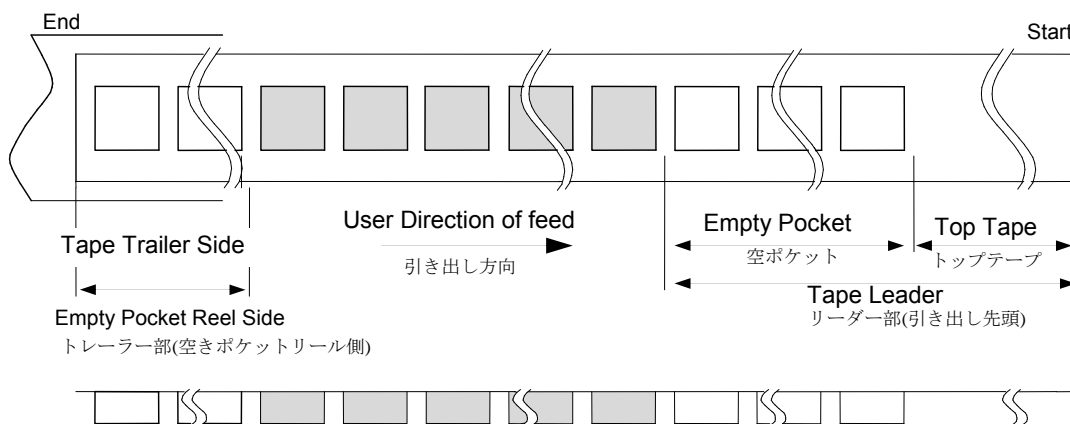
2. CONTENTS 目次

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[2]	Shipping carton 外装箱への収納	4
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(3) Packing 収納形態
 (a) Tape & Reel デバイス収納方法



(b) Start & End Point 引き出し先頭側及びリール側の処理



Item		Empty Space 空きスペース	Note 備考
Tape Leader (引き出し先頭側)	Top Tape	Min. 1 000 mm	Feeding in the Top tape, the tip is fixed with tape. トップテープ単独で繰り出し、先端はテープにより固定。 Winding method is a diagram of the above リールへの巻き取り方法は、上図の通り。
	Carrier Tape	Min. 160 mm	
Tape Trailer (リール側)	Top Tape	Min. 0 mm	Tip is fixed to the reel. 先端はリールに固定。
	Carrier Tape	Min. 160 mm	

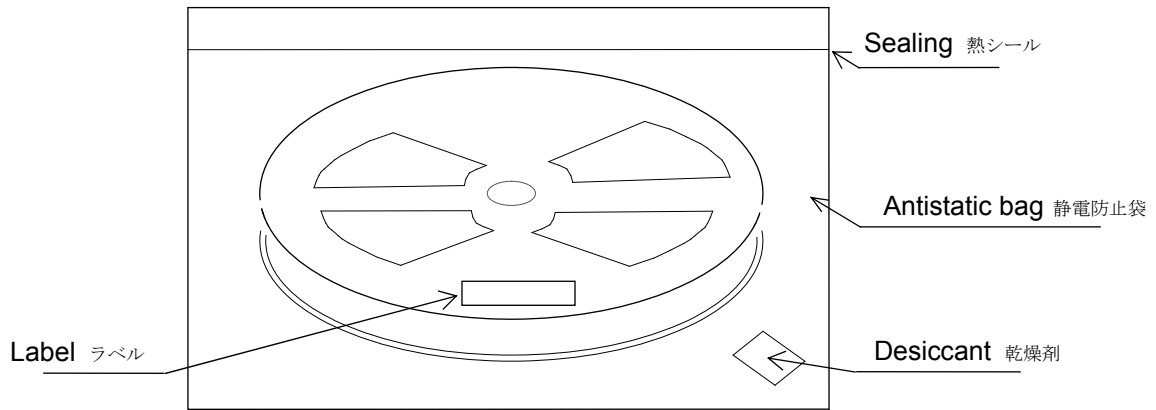
(4) Peel force of the cover tape トップテープの剥離強度

(a) angle : cover tape during peel off and the direction of unreeling shall be 165° to 180°.
 剥離角度: テープの接着面に対し 165~180 度とする。

(b) peel speed : 300 mm/min
 剥離速度: 300 mm/min とする。

[2] Shipping Carton 外装箱への収納

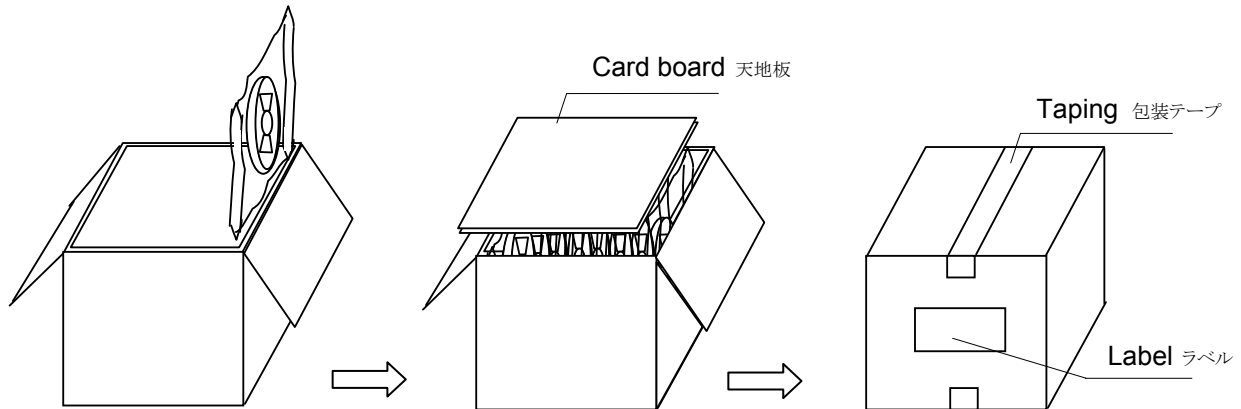
a) Packing to antistatic bag 袋への収納



b) Packing to shipping carton 外装箱への収納

If there is space in the outer box, material is put in a shock absorbing together.

空間ができた時は、クッション材を入れる。



[3] Marking 表示

(1) Reel marking リールへの表示

● Reel marking shall consist of

下記内容をリール表面に表示できるラベルを貼る。:

- 1) Parts name 製品名称
- 2) Quantity 製品数量
- 3) Manufacturing Date or symbol 製品の製造年月又はこれを示す記号
- 4) Manufacturer's Date or symbol 製品の製造業者又はその略号
- 5) Others (if necessary) その他必要事項

(2) Shipping carton marking 外装箱への表示

● Shipping carton marking shall consist of :

下記内容を外装箱表面に表示できるラベルを貼る。:

- 1) Parts name 製品名称
- 2) Quantity 製品数量

[4] Quantity 収納数量

- 3 000 pcs./reel (Standard)

However it is not the limit, in case that the order quantity does not fill with 3000 pieces.

Packing quantity is defined by 14th and 15th digit of product number.

但し、注文数量が 3 000 pcs に満たない場合は、その限りではない。

収納数量は、製品型番の 14 桁、15 桁による。

14th and 15th digit of product number. 製品型番の 14 桁、15 桁	Quantity
00	3 000 pcs
01	Vinyl Bag(Tape cut)
11	Any Quantity
12	250 pcs
13	500 pcs
14	1 000 pcs
15	2 000 pcs

[5] Storage environment 保管環境

- (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.

開梱前の製品は、温度 +30 °C、湿度 85 %RH 以下での保管をして下さい。

貴社納入後、袋未開封で 6 ヶ月以内の実装を推奨します。

- (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.

使用直前まで開梱せず、袋開封後は 6 ヶ月以内の実装を推奨します。

温度 +30 °C、湿度 85 %RH 以下では、はんだ付け作業前に乾燥不要です。

- (3) Not to storage with some erosive chemicals.

化学薬品類との同居を避ける。

- (4) Nothing is allowed to put on the reel or carton to prevent mechanical damage

外装箱がゆがまないようまた、外圧がかかからないように保管して下さい。

[6] Handling リール取扱い

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

リールの取扱いについては、中のテープ・製品を変形させないようにして下さい。

PROCESS QUALITY CONTROL

FC-13A
No. C-0901-02-AME

2015.03.09
FC13A_Q_0001

Manufacturing process chart	No.	Section In Charge	Standard	Inspection Control Item	Inspection Methods	Instruments	Record
<p>The manufacturing process chart is a vertical flow diagram. It starts with 'Base' (diamond 1-2) and 'Crystal' (diamond 1-1). The process continues through: 'Tuning fork setting' (circle 2), 'Mounting' (circle 3), 'Ag paste cure' (circle 4), 'US cleaning' (circle 5), 'Annealing' (circle 6), 'Frequency adjustment' (circle 7), 'Outer appearance inspection' (diamond 8), 'Spot welding' (circle 9), 'Seam welding' (circle 10), 'Ball setting' (circle 11), 'Hermetic sealing' (circle 12), 'Outer appearance inspection' (diamond 13), 'Marking' (circle 14), 'Outer appearance inspection' (diamond 15), 'Electrical characteristic inspection & taping' (diamond 16), 'Outer appearance inspection' (diamond 17), 'Outgoing inspection' (diamond 18), and finally 'Packing' (circle 19) and 'Shipping' (circle 20). Additional inputs include 'Ag paste' (diamond 1-3) and 'Lid' (diamond 1-4). A 'Ball' input (diamond 1-5) is shown at the bottom left.</p>	1	Inspection Section	Purchasing Specification Incoming Inspection Standard	Appearance Dimension	Sampling Sampling	Microscope Tool Microscope	Incoming Inspection Data sheet
	2	Production Section	Manufacturing Instruction	Appearance	100% Inspection	Microscope	Process data sheet
	3	Production Section	Manufacturing Instruction	Appearance	100% Inspection	Microscope	Process data sheet
	4	Production Section	Manufacturing Instruction	Appearance	100% Inspection	Microscope	Process data sheet
	5	Production Section	Manufacturing Instruction	-	-	-	-
	6	Production Section	Manufacturing Instruction	-	-	-	-
	7	Production Section	Manufacturing Instruction	Frequency	100% Inspection	Frequency adjustment Machine	Data sheet
	8	Production Section	Manufacturing Instruction	Appearance	100% Inspection	Microscope	Process data sheet
	9	Production Section	Manufacturing Instruction	Appearance	100% Inspection	Spot welding machine	Process data sheet
	10	Production Section	Manufacturing Instruction	Appearance	100% Inspection	Microscope	Process data sheet
	11	Production Section	Manufacturing Instruction	-	-	-	-
	12	Production Section	Manufacturing Instruction	-	-	-	-
	13	Production Section	Manufacturing Instruction	Appearance	100% Inspection	Microscope	Process data sheet
	14	Production Section	Manufacturing Instruction	Appearance	100% Inspection	Microscope	Process data sheet
	15	Production Section	Manufacturing Instruction	Appearance	100% Inspection	Microscope	Process data sheet
	16	Production Section	Manufacturing Instruction	Frequency Crystal Impedance Appearance	100% Inspection 100% Inspection 100% Inspection	Characteristic Inspection machine Microscope	Process data sheet
	17	Production Section	Manufacturing Instruction	Appearance	100% Inspection	Microscope	Process data sheet
	18	Production Section	Specification Outgoing Inspection Standard	Electrical Characteristic Appearance Dimension	Sampling Sampling Sampling	Measuremente equipment Microscope Tool Microscope	Outgoing Inspection data sheet
	19	Production Section	Packing Instruction Daily Shipping List	Customer Type Quantity	- - -	- - -	Shipping List

Structure Diagram 構造図

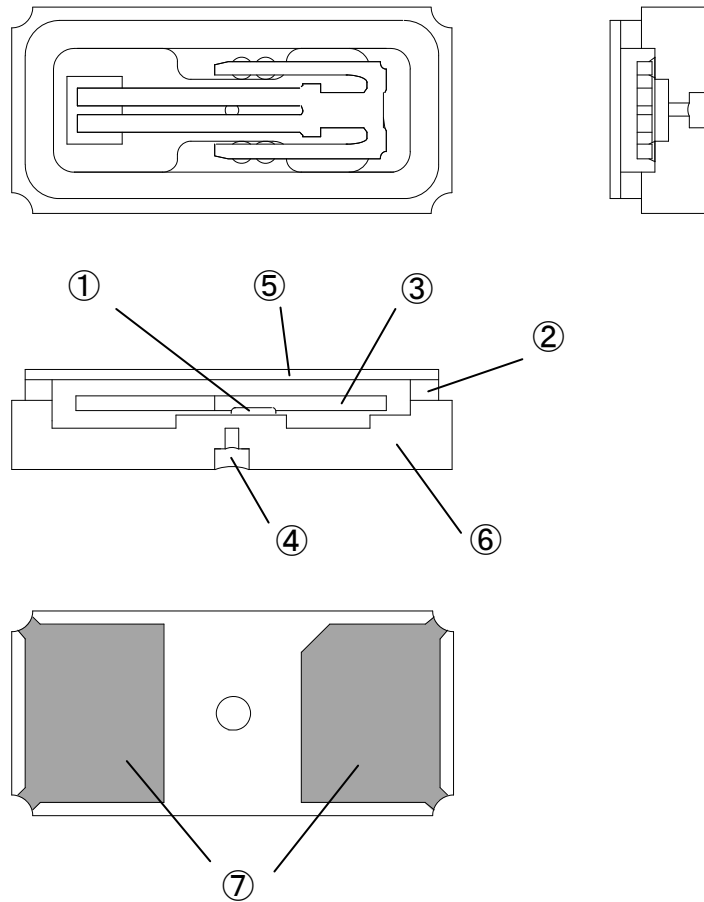
Rev.01

Model
型式

FC-13A

Document No.
管理No.

FC135_D_0001



No.	Name of Part 部品名
①	Crystal adhesive 水晶接着
②	Sealing 封止材(シールリング)
③	Crystal chip 水晶片
④	Sealing 封止材
⑤	Lid リッド
⑥	Package パッケージ
⑦	Terminal 端子

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	TEST Qty [n]	FAIL Qty [n]
			$\Delta f / f$ [1×10^{-6}]		
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/s ² 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°C × 1 000 h	*3 ± 20	22	0
5	Low temperature storage	-55 °C × 1 000 h	*3 ± 15	22	0
6	Temperature humidity storage	+85 °C × 85 %RH × 1 000 h	*3 ± 10	22	0
7	High temperature bias	+125°C × 1 000 h (Bias , Drive level ; 0.5 μW)	*3 ± 20	22	0
8	Low temperature bias	-40 °C × 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 °C ⇔ +125 °C 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 °C ± 10 °C 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.

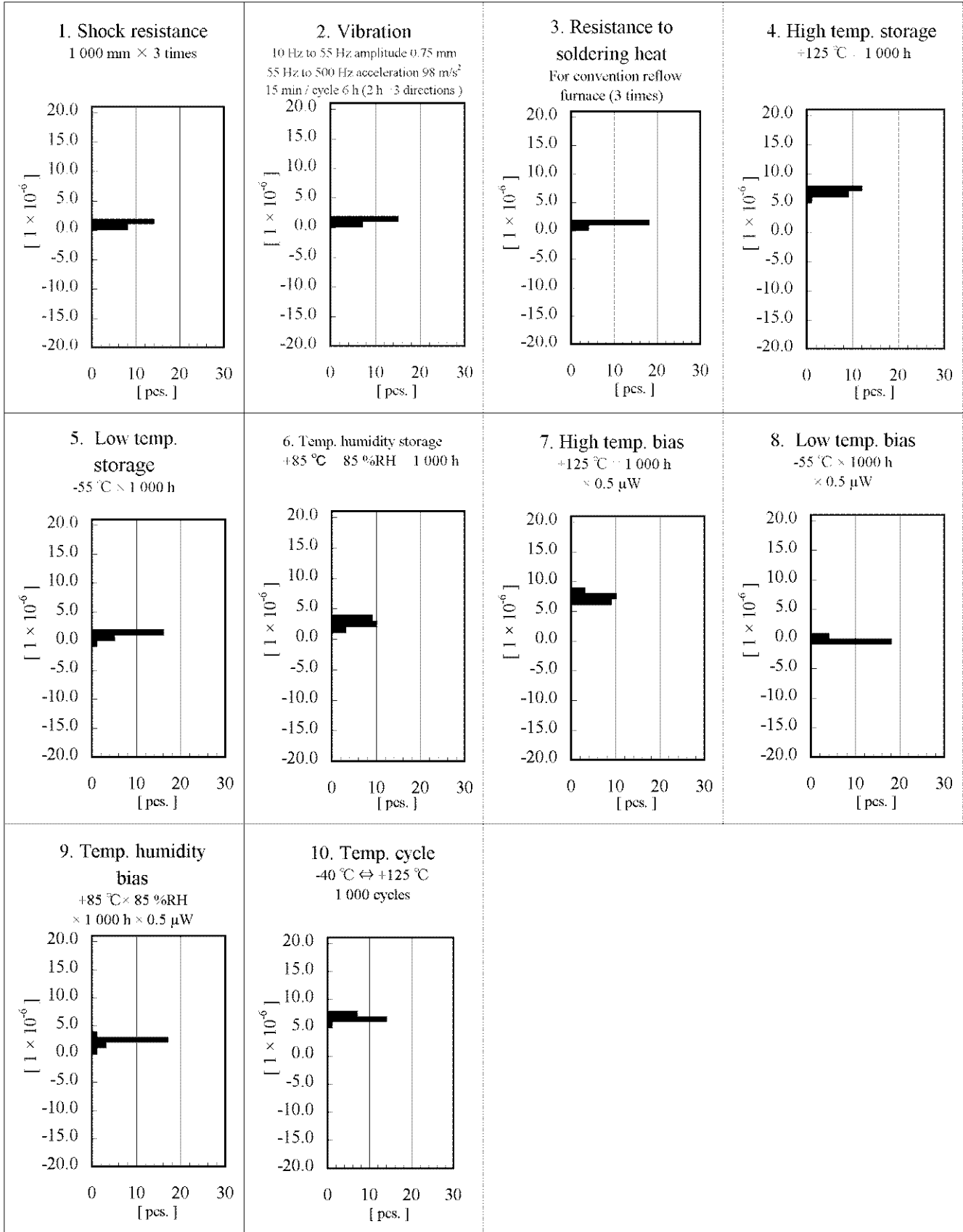
Shift of series resistance at before and after the test should be less than ±30 kΩ.

Qualification Data

Product Name : FC-13A

$\Delta f / f$

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

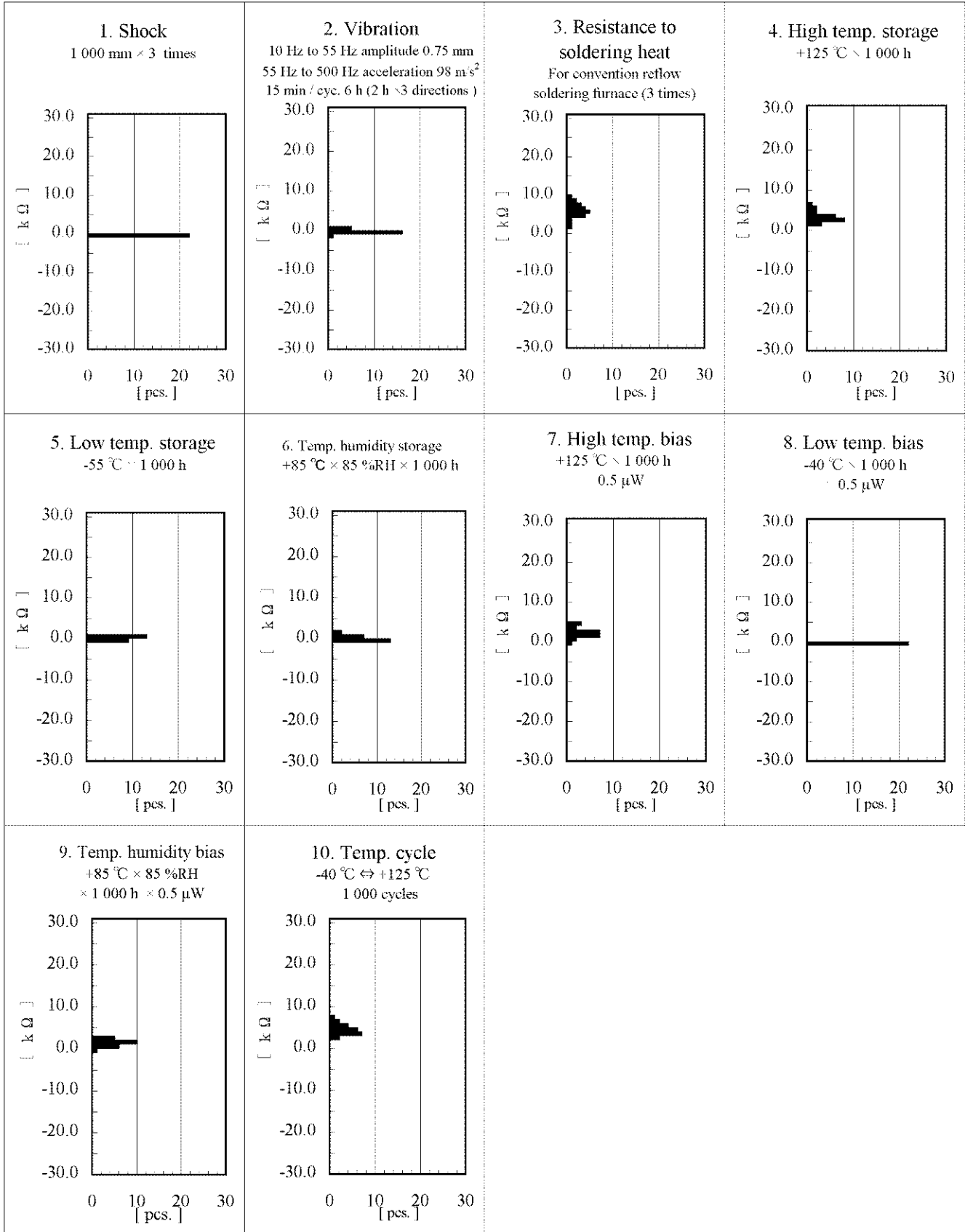


Qualification Data

Product Name : FC-13A

Δ CI

No. F-020C-C-0901-01-003E



Qualification Data