

RECIPIENT

## SPECIFICATIONS

**Product No. : Q24FA20H0074800**

**MODEL : FA-20H**

**SPEC. No. : D0110487**

**DATE: Dec. 27. 2018**

**SEIKO EPSON CORPORATION**

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# SPECIFICATIONS

## 1. Application

- 1) This document is applicable to the crystal unit that are delivered to user 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.

## 2. Product No. / Model

The product No. of this crystal unit is Q24FA20H0074800.  
The model is FA-20H.

## 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	-40	-	+125	°C	Depends on the Environmental characteristics specifications.

[ 2 ] Operating range

No.	Item	Symbol	Rating value			Unit	Note
			Min.	Typ.	Max.		
1	Operating temperature range	T_use	-40	-	+85	°C	
2	Level of drive	DL	1	-	100	μW	

[ 3 ] Static characteristics

No.	Item	Symbol	Value	Unit	Conditions
1	Nominal Frequency	f_nom	27.120000	MHz	Fundamental
2	Frequency tolerance	f_tol	±10	× 10 <sup>-6</sup>	CL = 10 pF Ta = +25 ±3°C DL = 100 μW Not include aging
3	Motional resistance	R1	150 Max.(12 ≤ f_nom < 16 MHz) 80 Max.(16 ≤ f_nom ≤ 25 MHz) 60 Max.(25 < f_nom ≤ 30 MHz) 50 Max.(30 < f_nom ≤ 35 MHz) 40 Max.(35 < f_nom ≤ 48 MHz)	Ω	π circuit IEC 60444-2 Ta = Operating temperature range DL = 100 μW
4	Shunt capacitance	C0	2.0 Max.	pF	π circuit and N.A.
5	Frequency temperature characteristics	f_tem	±18	× 10 <sup>-6</sup>	Ta = Operating temperature range (Ref. at Ta = +25 °C ±3 °C) DL = 100 μW
6	Isolation resistance	IR	500 Min.	MΩ	DC 100 V ±15, 60 seconds Between terminal #1 and terminal #3
7	Frequency Aging	f_age	±1 (12 < f_nom ≤ 40 MHz) ±3 (40 < f_nom ≤ 48 MHz)	× 10 <sup>-6</sup> /year	Ta = +25 °C ±3 °C

[ 4 ] Environmental and mechanical characteristics

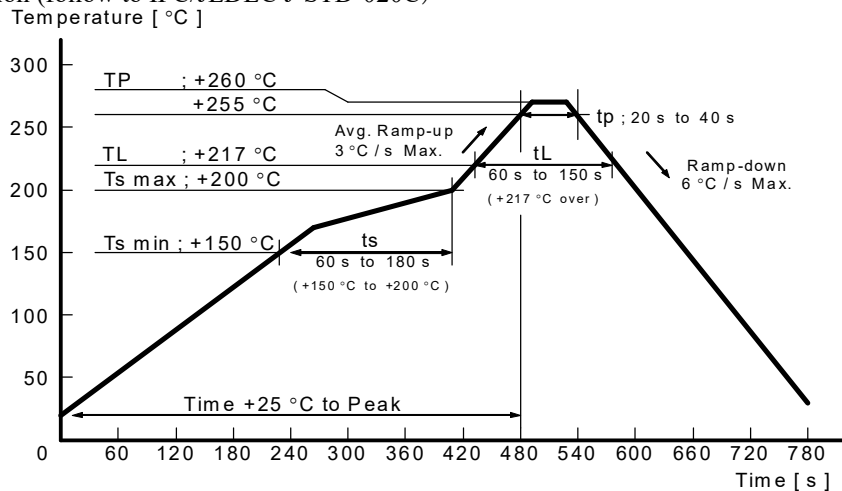
(The company evaluation condition : We evaluate it by the following examination item and examination condition.)

No.	Item	Value * 1 * 2	Test Conditions
		$\Delta f / f [1 \times 10^{-6}]$	
1	Shock	* 3 $\pm 2$ ( $12 < f_{nom} \leq 40$ MHz) $\pm 5$ ( $40 < f_{nom} \leq 48$ MHz)	150 g dummy Jig (ETC Standard) drop from 1 500 mm height on the Concrete 3 directions 10 times
2	Vibration	* 3 $\pm 2$ ( $12 < f_{nom} \leq 40$ MHz) $\pm 5$ ( $40 < f_{nom} \leq 48$ MHz)	10 Hz to 55 Hz amplitude 0.75 mm 55 Hz to 500 Hz acceleration 98 m/s <sup>2</sup> 10 Hz → 500 Hz → 10 Hz 15 min./cycle 6 h (2 hours , 3 directions)
3	High temperature storage	* 3 $\pm 2$ ( $12 < f_{nom} \leq 40$ MHz) $\pm 5$ ( $40 < f_{nom} \leq 48$ MHz)	+85 °C × 1 000 h
4	Low temperature storage	* 3 $\pm 2$ ( $12 < f_{nom} \leq 40$ MHz) $\pm 5$ ( $40 < f_{nom} \leq 48$ MHz)	- 40 °C × 1 000 h
5	Temperature cycle	* 3 $\pm 2$ ( $12 < f_{nom} \leq 40$ MHz) $\pm 5$ ( $40 < f_{nom} \leq 48$ MHz)	- 40 °C ↔ + 85 °C 30 minutes at each temp. 100 cycle
6	Temperature humidity storage	* 3 $\pm 2$ ( $12 < f_{nom} \leq 40$ MHz) $\pm 5$ ( $40 < f_{nom} \leq 48$ MHz)	+85 °C × 85 %RH × 1 000 h
7	Resistance to soldering heat	$\pm 2$ ( $12 < f_{nom} \leq 40$ MHz) $\pm 5$ ( $40 < f_{nom} \leq 48$ MHz)	For convention reflow soldering furnace (3 times)
8	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
9	Shear	No peeling-off at a soldered part	10 N press for 10 s ± 1 s Ref. IEC 60068-2-21
10	Pull – off	No peeling-off at a soldered part	10 N press for 10 s ± 1 s Ref. IEC 60068-2-21
11	Solderability	Terminals must be 95 % covered with fresh solder.	Dip termination into solder bath at +235 °C ± 5 °C for 5 s (Using Rosin Flux)

< Notes >

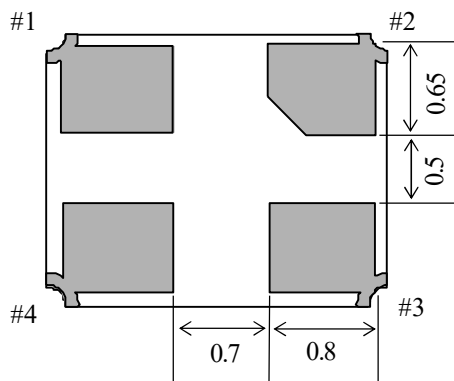
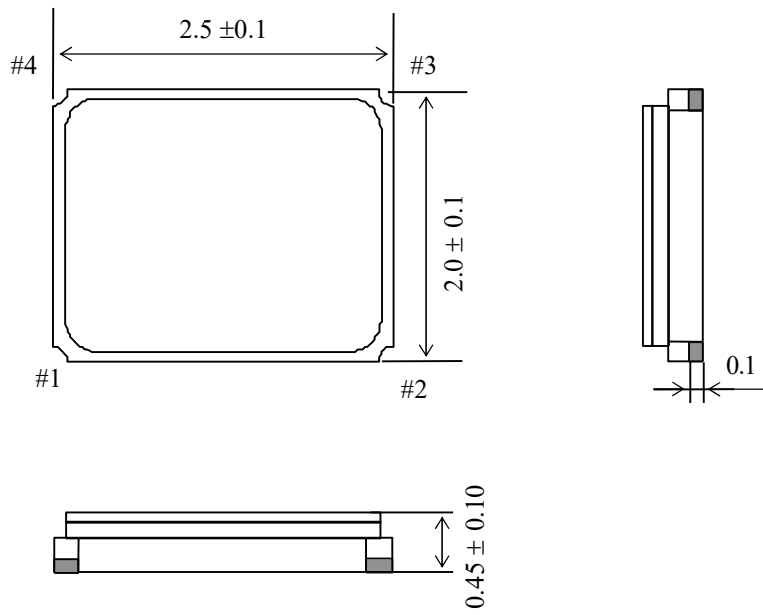
- \* 1 Each test done independently.
- \* 2 Measuring 2 h to 24 h later leaving in room temperature after each test.
- \* 3 Item No.1 to No.6 shall be tested after following pre conditioning.  
Measuring 24 h later leaving in room temperature after Pre conditioning.  
Pre conditioning : Reflow 3 times.
- Item No.1 to No.7, Shift motional resistance at after above tests should be less than 20 % or less than 10 Ω.

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

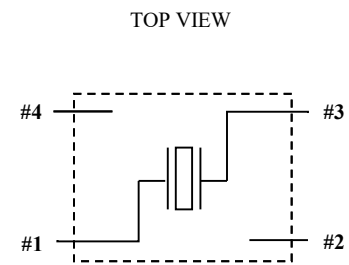


## [ 5 ] Dimensions and Circuit

### 1) Dimension (Unit : mm)



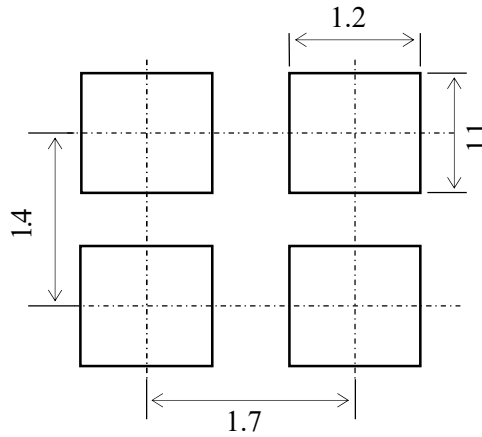
### Internal connection



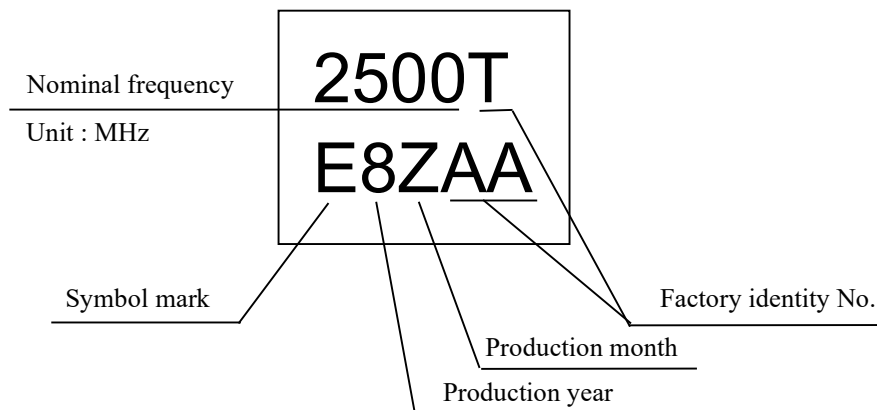
Terminal #2, #4 are connected to the LID  
(Please connect GND)  
Terminal Plating : Au plating

[ 6 ] Recommended soldering pattern and Marking layout

1) Recommended soldering pattern (Unit : mm)



2) Marking layout



Production month

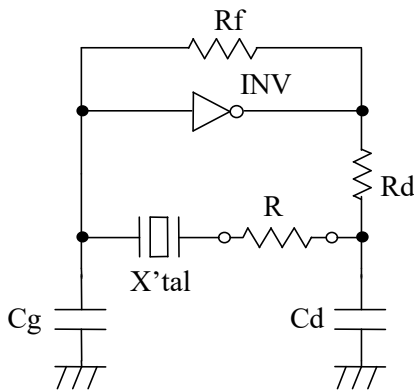
January	February	.....	October	November	December
1	2	.....	X	Y	Z

- Nominal frequency is only one example.
- Nominal frequency omits the figure below the second place of decimals.  
ex) 25 MHz ..... [2500]
- 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 re-flow is allowed. Its recommended to manually solder when not enough/no solder detected.( Using soldering iron at +350 °C Max × within 5 seconds)
2. Patterning on a board should follow our company recommended pattern.
3. Too much exciting shock or vibration may cause deterioration on damage.  
The product may damage depends on the condition such as a shock in assembly machinery.  
Please check your process condition in advance to minimize and maintain the shock level.
4. It is recommended to do patterning to the oscillator as short as possible. Abnormal oscillation may happened if the line is too long.
5. Condensation may occur when products are used/stored under remarkable temperature change.
6. This product may be affected to ultrasonic cleaning. It is depends on the cleaning conditions (Cleaning machine type/power/time/content/position etc.). The warranty will not cover any damage due to this type of usage. Check conditions prior to use.
7. When the substrate of oscillation become dewy, the crystal frequency is changed or stopped. Please use under without the dewfall.
8. Applying excessive excitation Drive Level to the crystal Unit may cause deterioration damage.
9. Few data or readings taken at user side may be different from our company's data. Confirmation of the different value is necessary before application.
10. To avoid malfunction, no pattern across or near the crystal is allowed.
11. Start up time of oscillation may be increased or no oscillation may occur unless adequate negative resistance is allocated in the oscillation circuit In order to avoid this, please provide enough negative resistance to the circuit design.

How to check the negative resistance



- (1) Connect the resistor(R) to the circuit in series with the crystal Unit.
- (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  
 $[-R] > CI \times 5$

12. Please refer to packing specification for the storage method and packing standard.

# TAPING SPECIFICATION

## 1. APPLICATION

This document is applicable to FA-20H / FA-206

## 2. CONTENTS

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



[ 1 ] Taping specification

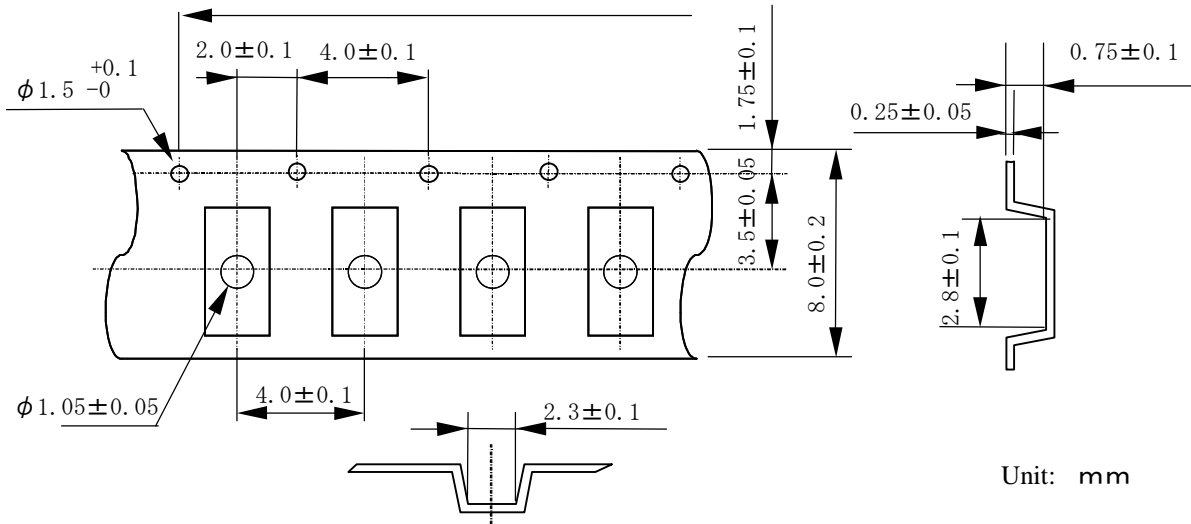
Subject to EIA-481 & IEC-60286

(1) Tape dimensions TE0804L

Material of the Carrier Tape : PS (Electrically conductive)

Material of the Top Tape : PET+PE

10P :  $40 \pm 0.1$

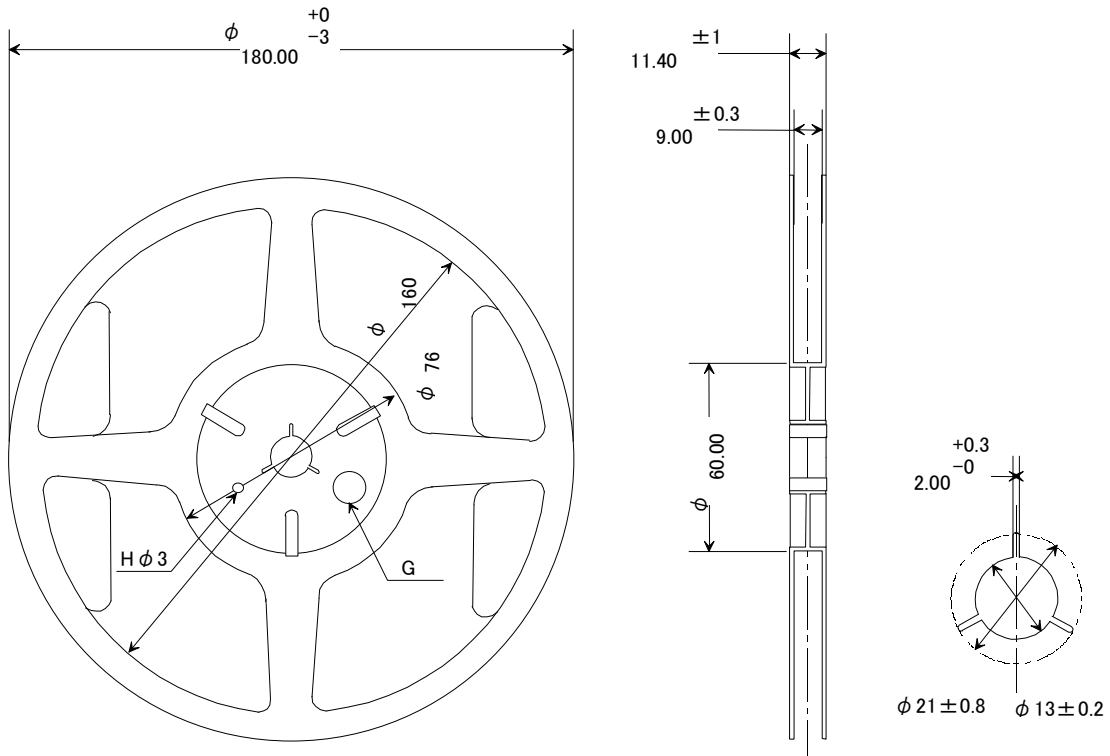


Unit: mm

(2) Reel dimensions

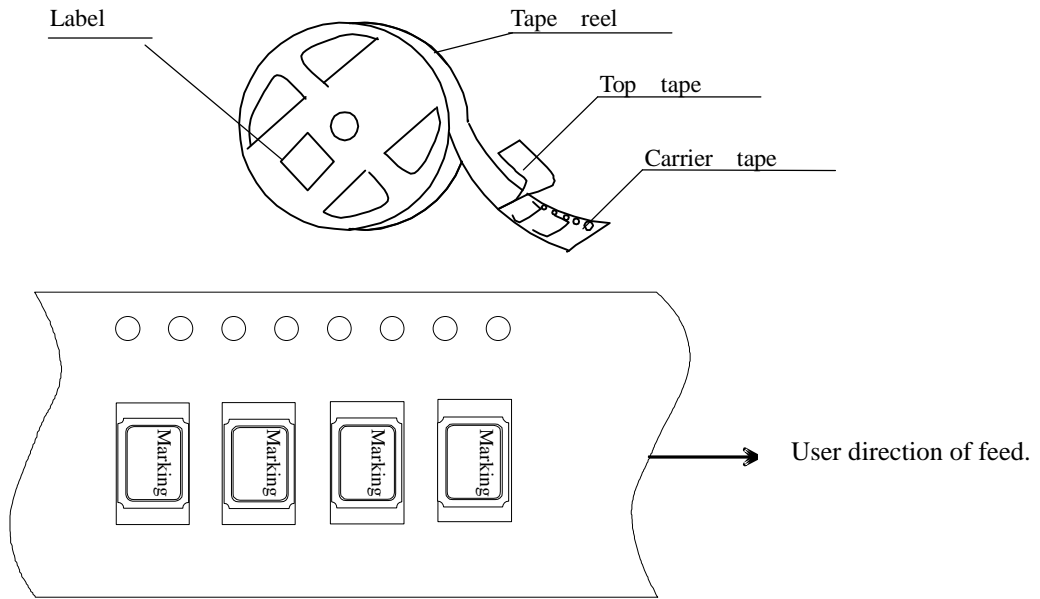
(a) Center material : PS

(b) Material of the Reel : PS

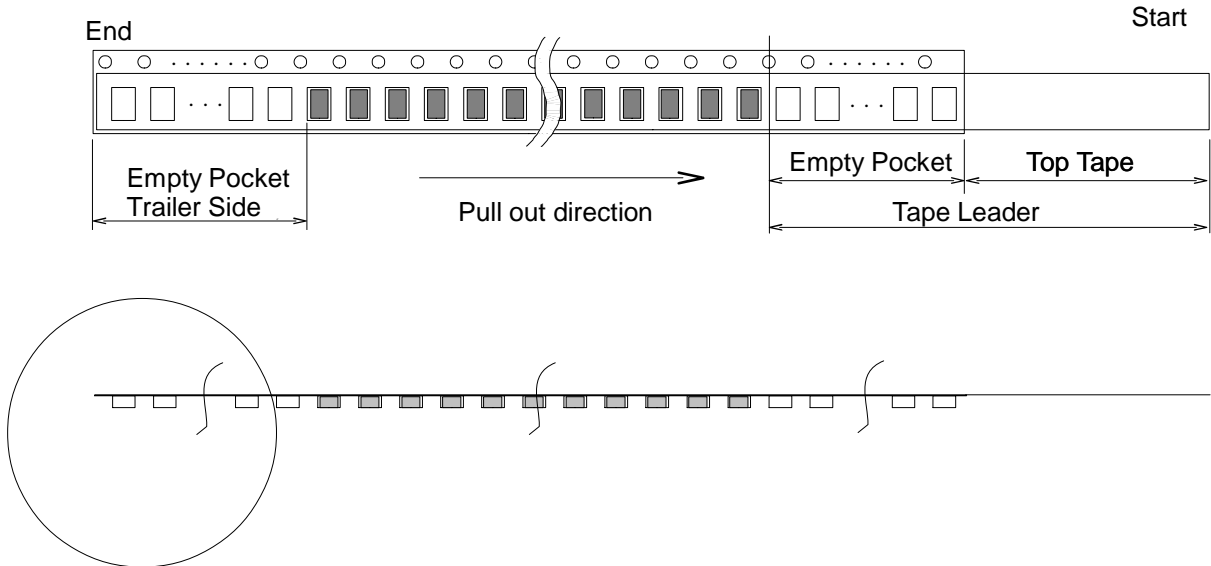


(3) Packing

(a) Tape & Reel



(b) Start & End Point



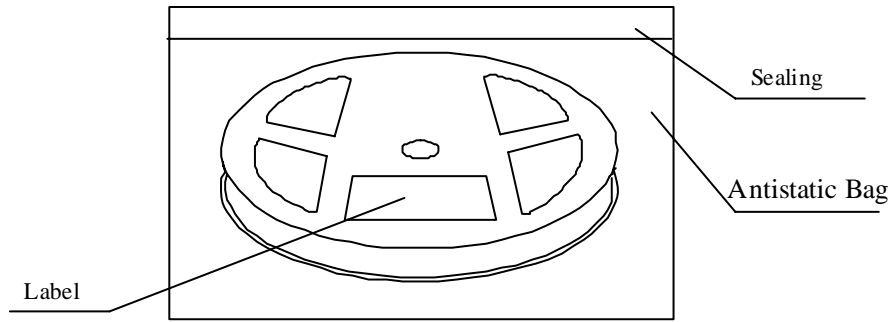
Item		Empty Space
Tape Leader	Top Tape	Min. 1 000 mm
	Carrier Tape	Min. 100 mm
Tape Trailer	Top Tape	Min. 0 mm
	Carrier Tape	Min. 160 mm

(4) Peel force of the cover tape

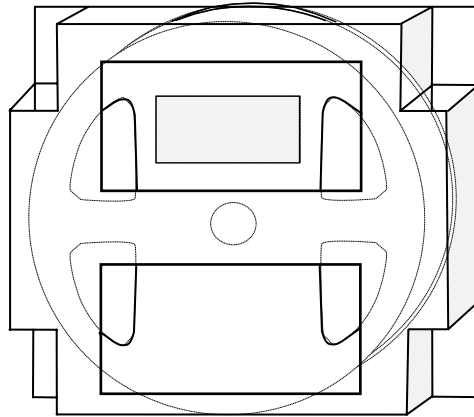
- ① angle : cover tape during peel off and the direction of unreeling shall be 165° to 180°.
- ② peel speed : 300 mm / min.
- ③ strength : 0.1 to 1 N.

### [ 2 ] Inner Sleeve

a) Packing to antistatic bag

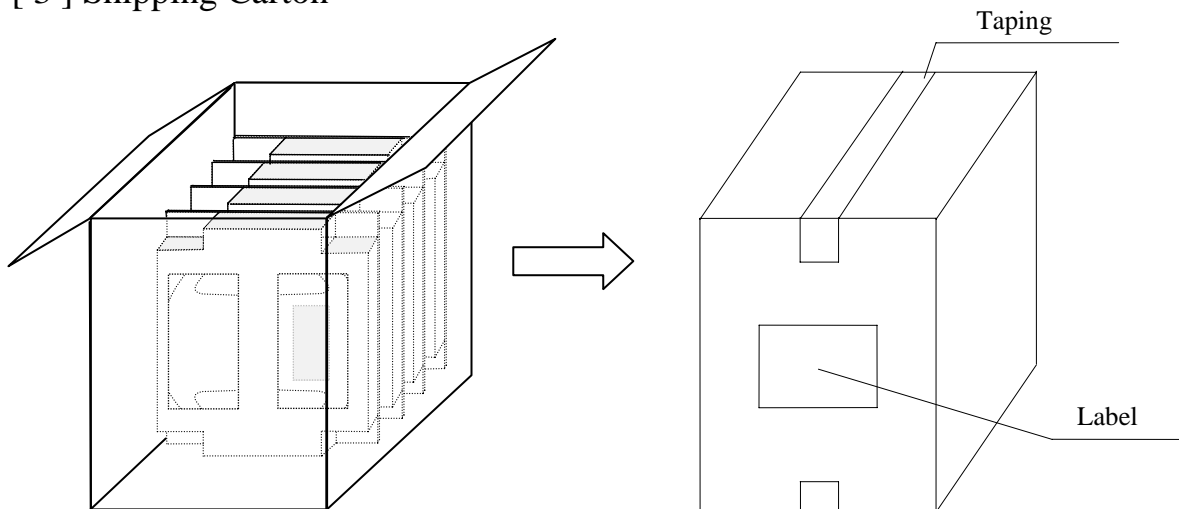


b) Packing to inner sleeve



\* There is also a case to put the two reels.

### [ 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) 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 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 構造図

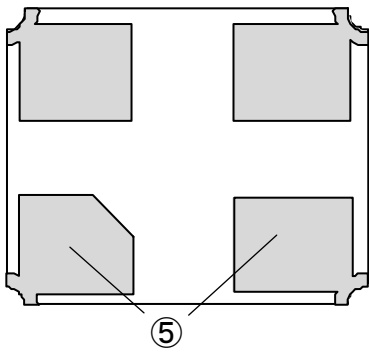
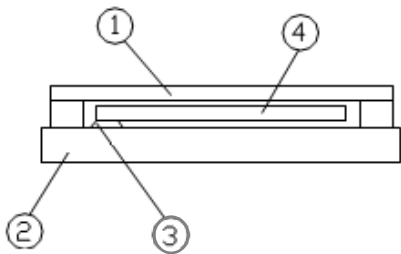
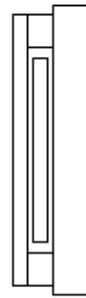
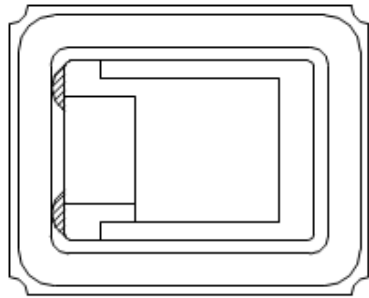
Rev.5

Model  
型式

FA-20H

Document No.  
管理№

FA-20H\_D\_0001



No.	Name of Part 部品名
①	Lid リッド
②	Package パッケージ
③	Crystal Adhesive 水晶接着
④	Crystal chip 水晶片
⑤	Terminal 端子

- Process Quality Control -

No. IA-0601-01-AIE-4

**SMD TYPE AT STRIP CRYSTAL : FA-20H / 206**

FA20H\_Q\_0001

12.09.14

Manufacturing process chart	No.	Section	Standard	Inspection, Control items	Inspection method	Instrument	Record
Crystal block ▽	1	Inspecting section.	Purchasing specification Incoming inspection standard	Size. Outer appearance. Inner appearance.	Sampling. " "	Measure. Visual inspection. Visual inspection.	In-coming inspection data sheet.
④ In-coming inspection	1'	Inspecting section.	"	Size. Outer appearance.	Sampling. "	Comparator. Micro scope.	"
② Wafer cutting	2	Inspecting section.	Manufacturing instruction sheet	Cut angle. Wafer thickness.	Sampling. "	X-ray radio graphic. Comparator.	Process data sheet.
③ Wafer lapping	3	Producing section.	"	Frequency. Wafer thickness.	Sampling. "	Frequency counter. Comparator.	"
Ceramic base ④ Chip cutting	4	Producing section.	"	Size.	Sampling.	Comparator.	"
⑤ Etching	5	Producing section.	"	Frequency. Outer appearance.	Sampling. "	Comparator. Micro scope.	"
①' In-coming inspection ⑥ Deposition	6	Producing section.	"	Frequency. Outer appearance.	Sampling. "	Comparator. Micro scope.	"
⑦ Mounting	7	Producing section.	"	Outer appearance.	All insprcion.	Micro scope.	"
Lid ⑧ In-coming inspection ⑧ Frequency adjustment	8	Producing section.	"	Frequency.	Sampling.	Frequency counter.	"
⑨ Welding	9	Producing section.	"	Outer appearance.	Sampling.	Micro scope.	"
⑩ Leak test	10	Producing section.	"	Airtightness check.	All insprcion.	Leak tester.	"
⑪ Marking	11	Producing section.	"	Outer appearance.	Sampling.	Micro scope.	"
⑫ Characteristic inspection	12	Producing section.	"	Crystal impedance. Frequency. Insulation resistance. Temp. characteristic.	All insprcion. " " Sampling.	Inspectional machine. " " "	"
⑬ Out-going inspection	13	Inspecting section.	Out-going inspection standard	Crystal impedance. Frequency. Insulation resistance. Outer appearance.	Sampling. " " "	Inspection M/C. " " Micro scope.	Out-going inspection data sheet.
⑭ Taping	14	Producing section.	Manufacturing instruction sheet	Tape-peel strength.	Sampling.	Peelinf force tester.	Process data sheet.
⑮ Packing	15	Product control section.	Manufacturing instruction sheet Packing instruction sheet	Address. Quantity.	—	—	Delivery slip.

RELIABILITY TEST DATA 信頼性試験結果

**Product Name : FA-20H**

The Company evaluation condition 弊社評価条件

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

弊社では環境特性及び機械的特性を下記試験条件により評価しています。

No.CS-Q-20-013

No.	ITEM 試験項目	TEST CONDITIONS 条件	VALUE *1 *2	TEST Qty 試料数 [ n ]	FAIL Qty 故障数 [ n ]
			判定規格 $\Delta f / f$ 周波数変化率 [ $1 \times 10^{-6}$ ]		
1	Shock 治具落下試験	150 g dummy Jig (SEIKO EPSON Standard) drop from 1 500 mm height on the Concrete 3 directions 10 times	* 3  ±2	22	0
2	Vibration 振動試験	10 Hz to 55 Hz amplitude 0.75 mm 55 Hz to 500 Hz acceleration 98 m/s <sup>2</sup> 10 Hz → 500 Hz → 10 Hz 15 min / cycle 6 h ( 2 h × 3 directions )	* 3  ±2	22	0
3	High temperature storage 高温保存試験	+ 125 °C × 1 000 h	* 3  ±3	22	0
4	Low temperature storage 低温保存試験	- 40 °C × 1 000 h	* 3  ±2	22	0
5	Temperature cycle 温度サイクル試験	- 40 °C ⇔ + 85 °C 30 min at each temp. 100 cycles	* 3  ±2	22	0
6	Temperature humidity storage 高温高湿保存試験	+ 85 °C × 85 %RH × 1 000 h	* 3  ±2	22	0
7	Resistance to soldering heat はんだ耐熱性試験	For convention reflow soldering furnace (3 times)	±2	22	0
8	Substrate bending 耐基板曲げ性試験	Bend width reaches 3.0 mm and hold for 5 s ±1 s × 1 time Ref. IEC 60068-2-21	No peeling - off at a solder part はんだ付け部の剥離のないこと	11	0
9	Shear 固着性試験	10 N press for 10 s ±1 s Ref. IEC 60068-2-21	No peeling - off at a solder part はんだ付け部の剥離のないこと	11	0
10	Pull - off 引き剥がし強度試験	10 N press for 10 s ±1 s Ref. IEC 60068-2-21	No peeling - off at a solder part はんだ付け部の剥離のないこと	11	0
11	Solderability はんだ付け性試験	Dip termination into solder bath at + 235 °C ±5 °C for 5 s (Using Rosin Flux)	Termination must be 95 % covered with fresh solder 浸漬面の 95 % 以上が新しい はんだで覆われること	11	0

< Notes 注記 >

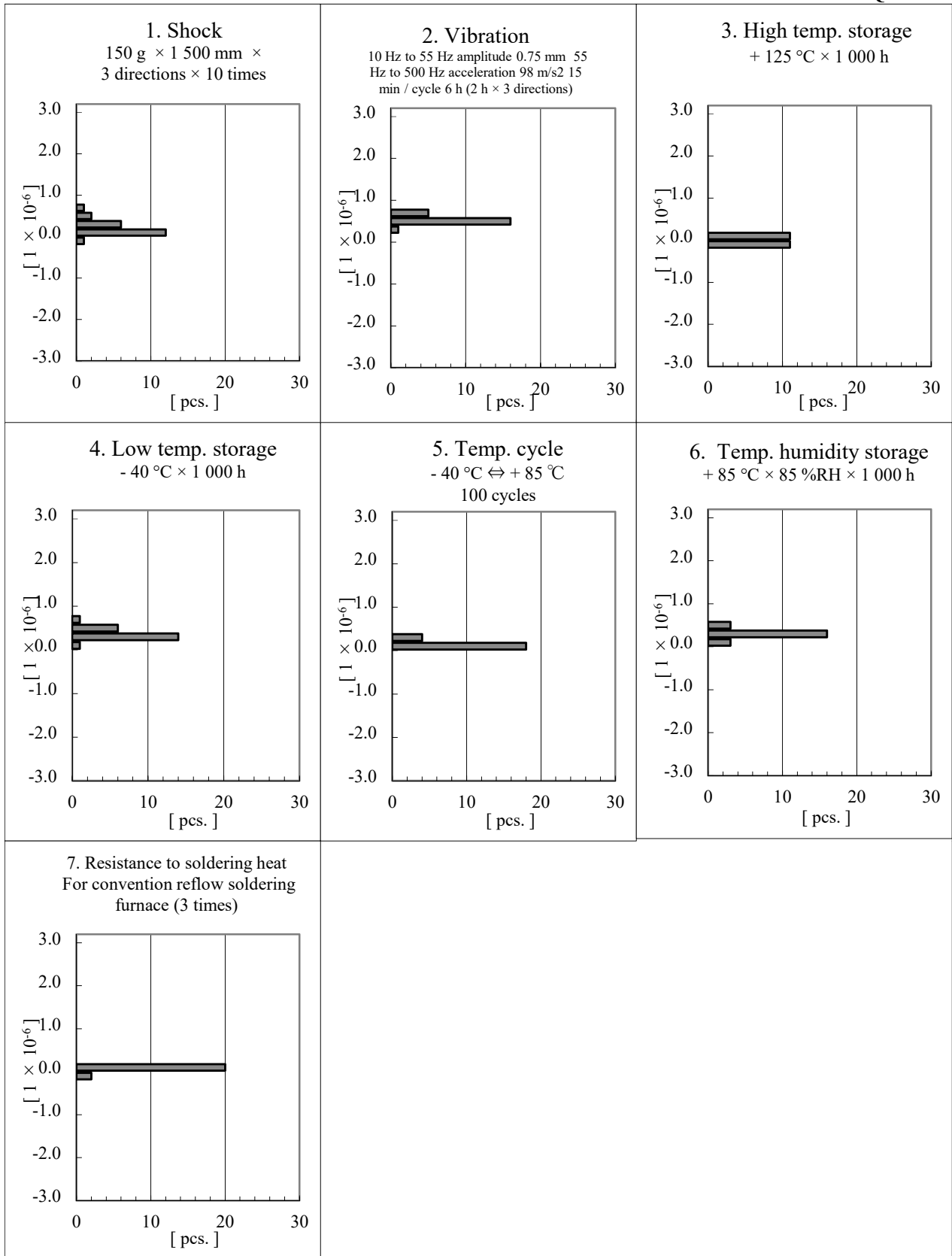
- \*1 Each test done independently.  
各項目を独立して試験した場合の規格値とする。
- \*2 measuring 2 h to 24 h later leaving in room temperature after each test.  
各試験終了後、常温放置 2 ~ 24 h 後に測定した値とする。
- \* 3 Item No.1 to No.6 shall be tested after following pre conditioning.  
Measuring 24 h later leaving in room temperature after Pre conditioning.  
Pre conditioning : Reflow 3 times.  
No.1 ~ No.6 は試験前に、前処理を行ない、常温放置 24 h 後の測定値を初期値とする。  
前処理 : エアーリフロー 3 回
- Item No.1 to No.7, Shift motional resistance at after above tests should be less than 20 % or less than 10 Ω.  
各試験 No.1 ~ No.7 における CI 値の変化量が 20 % 又は 10 Ω のいずれか大きい方以下であること。

**Qualification Data**

**Product Name : FA-20H**

$\Delta f / f$

**No.CS-Q-20-013**





**Product Name : FA-20H**

Δ CI

No.CS-Q-20-013

