

RECIPIENT

SPECIFICATIONS

MODEL : FA-20H

SPEC. No. : A15-972-4B

DATE: Oct. 27. 2015

SEIKO EPSON CORPORATION

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

CHECKED T. Kuwahara / TD Engineering Department Manager
Takuo Kuwahara

CHECKED M. Shirotori / TD Production Engineering Department Senior Staff
Masashi Shirotori

CHECKED H. Ohashi / TD • CS Quality Assurance Department Manager
Hiroaki Ohashi

PREPARED E. Oguchi / TD • CS Quality Assurance Department Senior Staff
Emi Oguchi

SPECIFICATIONS

1. Application

- 1) This document is applicable to the crystal unit that are delivered to Shenzhen Digiengine Technology Co., Ltd from Seiko Epson Corp.
- 2) This product complies with RoHS Directive.
This FA-20H is authorized for Use of Core Navi Board for automobile only.
- 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. Model

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

| Item No. | Item | Page |
|----------|--|------|
| [1] | Absolute maximum ratings | 2 |
| [2] | Operating range | 2 |
| [3] | Static characteristics | 2 |
| [4] | Environmental and mechanical characteristics | 3 |
| [5] | Dimensions and circuit | 4 |
| [6] | Recommended soldering pattern and marking layout | 5 |
| [7] | Notes | 6 |

[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 | -20 | | +85 | °C | |
| 2 | Level of drive | DL | | 100 | 200 | μW | Recommended : 100 μW |

[3] Static characteristics

| No. | Item | Symbol | Value | Unit | Conditions |
|-----|---------------------------------------|--------|----------|--------------------------|--|
| 1 | Nominal Frequency | f_nom | 26 | MHz | Fundamental |
| 2 | Frequency tolerance | f_tol | ±7 | × 10 ⁻⁶ | CL = 11.3 pF Ta = +25 ±3°C DL = 100 μW Not include aging |
| 3 | Motional resistance | R1 | 60 Max. | 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 | ±10 | × 10 ⁻⁶ | 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 | × 10 ⁻⁶ /year | Ta = +25 °C ±3 °C |

[4] Environmental and mechanical characteristics

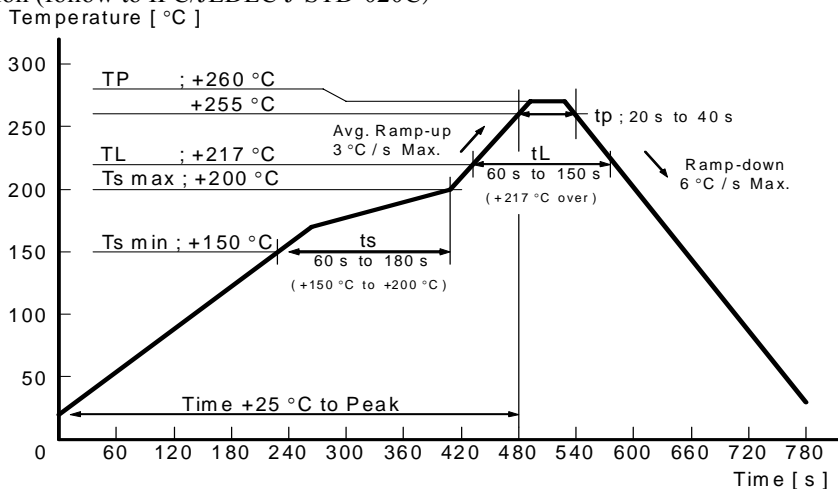
(The company evaluation condition : We evaluate it by the following examination item and examination condition.)

| No. | Item | Value * 1 * 2 | | Test Conditions |
|-----|------------------------------|---|---------|--|
| | | $\Delta f / f [1 \times 10^{-6}]$ | | |
| 1 | Shock | * 3 | ± 2 | 150 g dummy Jig (ETC Standard) drop from 1 500 mm height on the Concrete 3 directions 10 times |
| 2 | Vibration | * 3 | ± 2 | 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 | High temperature storage | * 3 | ± 2 | + 85 °C × 1 000 h |
| 4 | Low temperature storage | * 3 | ± 2 | - 40 °C × 1 000 h |
| 5 | Temperature cycle | * 3 | ± 2 | - 40 °C ↔ + 85 °C 30 minutes at each temp. 100 cycle |
| 6 | Temperature humidity storage | * 3 | ± 2 | + 85 °C × 85 %RH × 1 000 h |
| 7 | Resistance to soldering heat | | ± 2 | 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 >

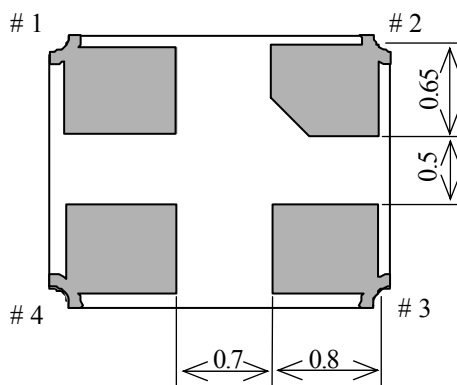
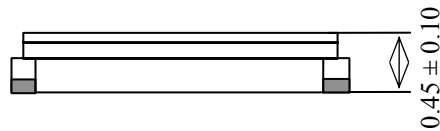
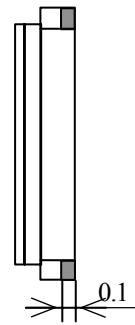
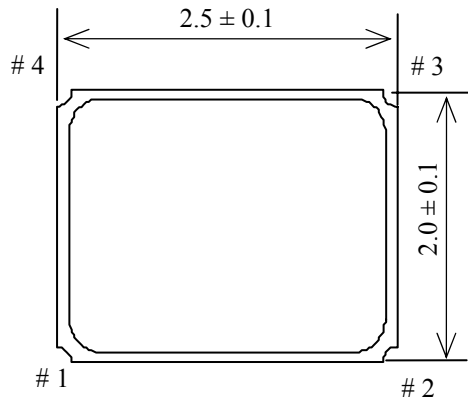
- * 1 Each test done independently.
- * 2 Measuring 2 h to 24 h later leaving in room temperature after each test.
- * 3 Item No.1 to No.6 shall be tested after following pre conditioning.
Measuring 24 h later leaving in room temperature after Pre conditioning.
Pre conditioning : Reflow 3 times.
- Item 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)



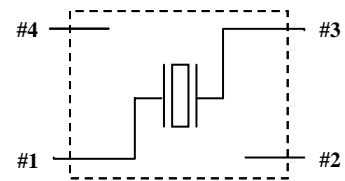
[5] Dimensions and Circuit

1) Dimension



Pin connection

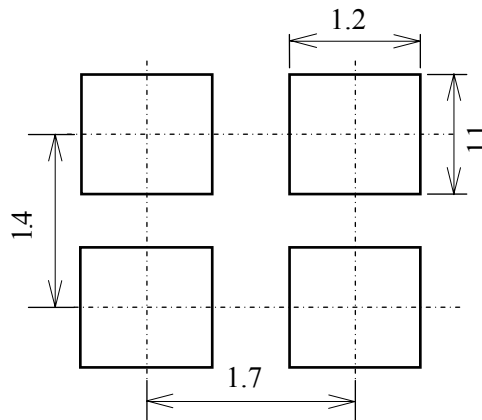
TOP VIEW



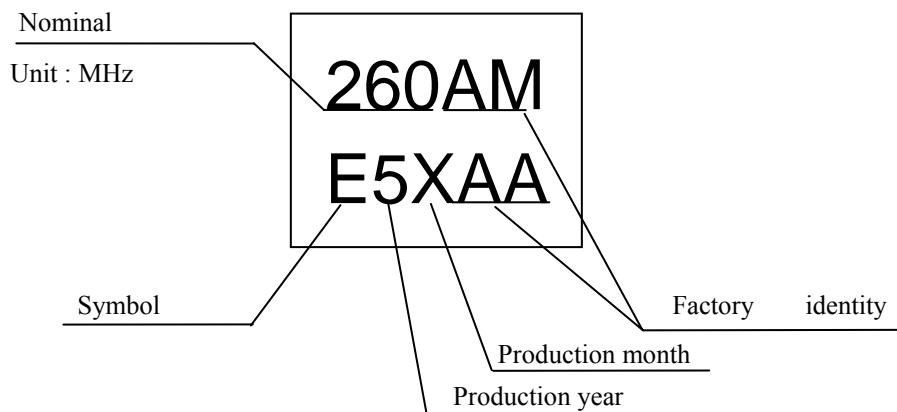
Terminal #1, #3 : Xtal
 Terminal #2, #4 : GND
 Terminal treatment : Au plate

[6] Recommended soldering pattern and Marking layout

1) Recommended soldering pattern



2) Marking layout



Production month

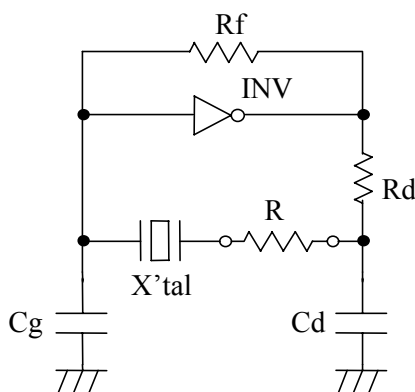
| | | | | | |
|---------|----------|-------|---------|----------|----------|
| January | February | | October | November | December |
| 1 | 2 | | X | Y | Z |

- Nominal frequency is only one example.
- Nominal frequency omits the figure below the first place of decimals.
ex) 26 MHz [260]
- 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

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

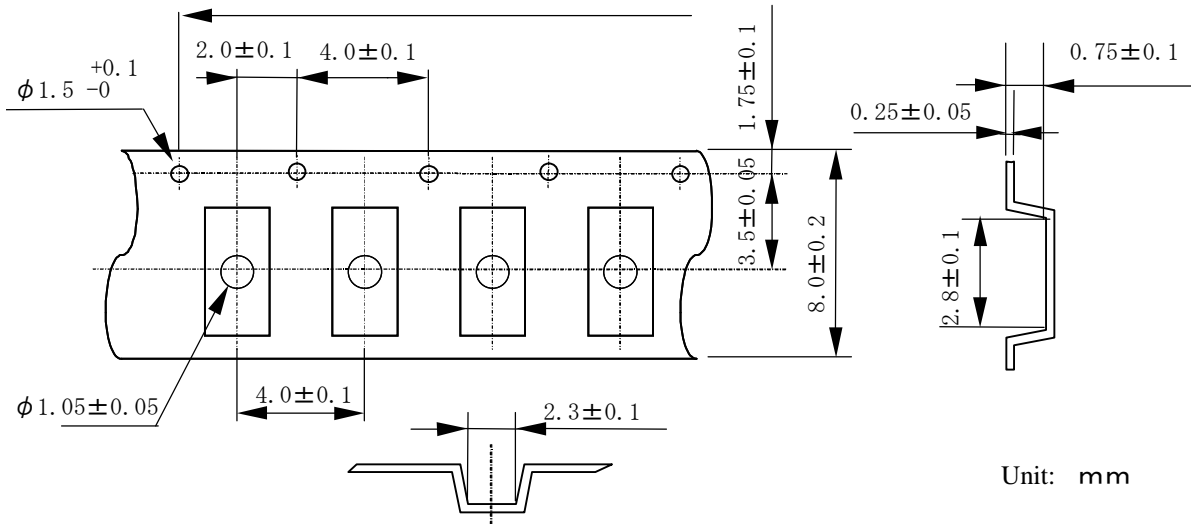
Subject to EIA-481 & IEC-60286

(1) Tape dimensions TE0804L

Material of the Carrier Tape : PS (Electrically conductive)

Material of the Top Tape : PET+PE

10P : 40 ± 0.1

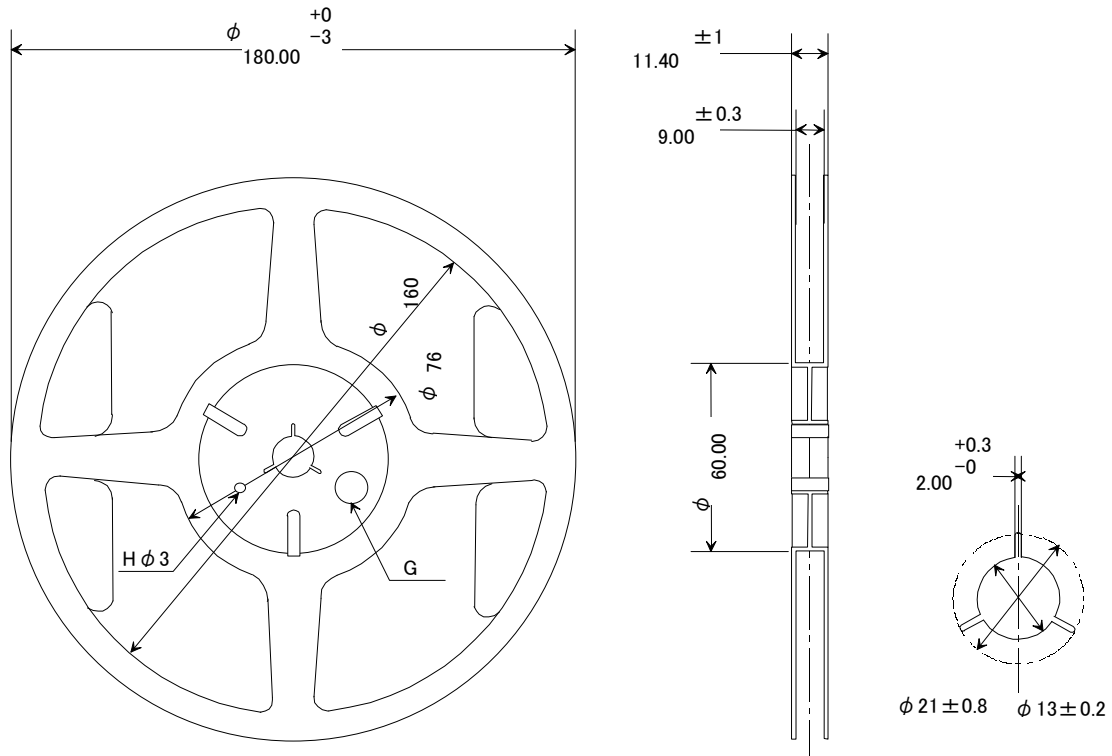


Unit: mm

(2) Reel dimensions

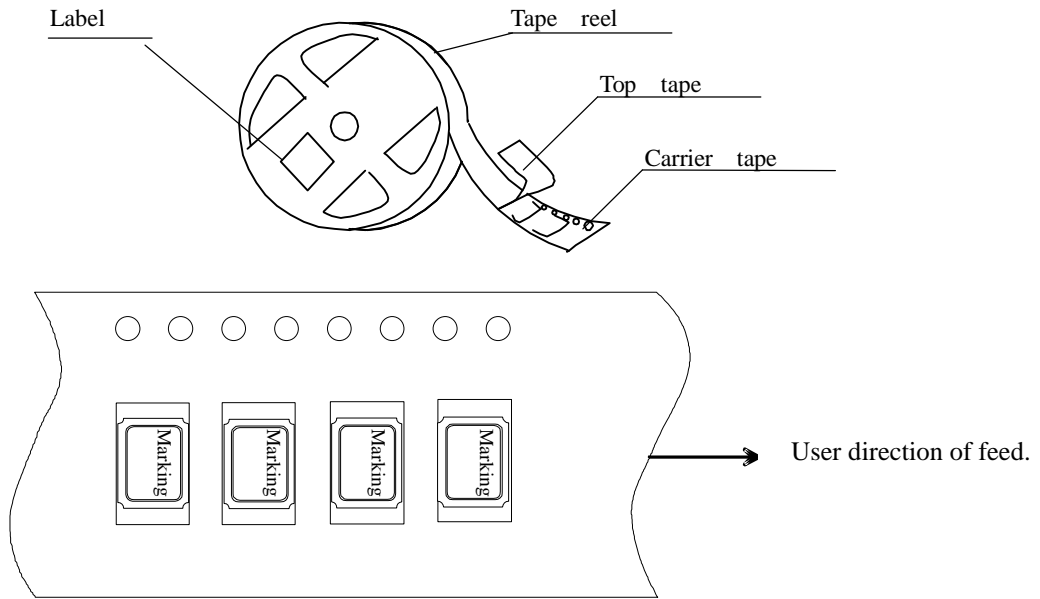
(a) Center material : PS

(b) Material of the Reel : PS

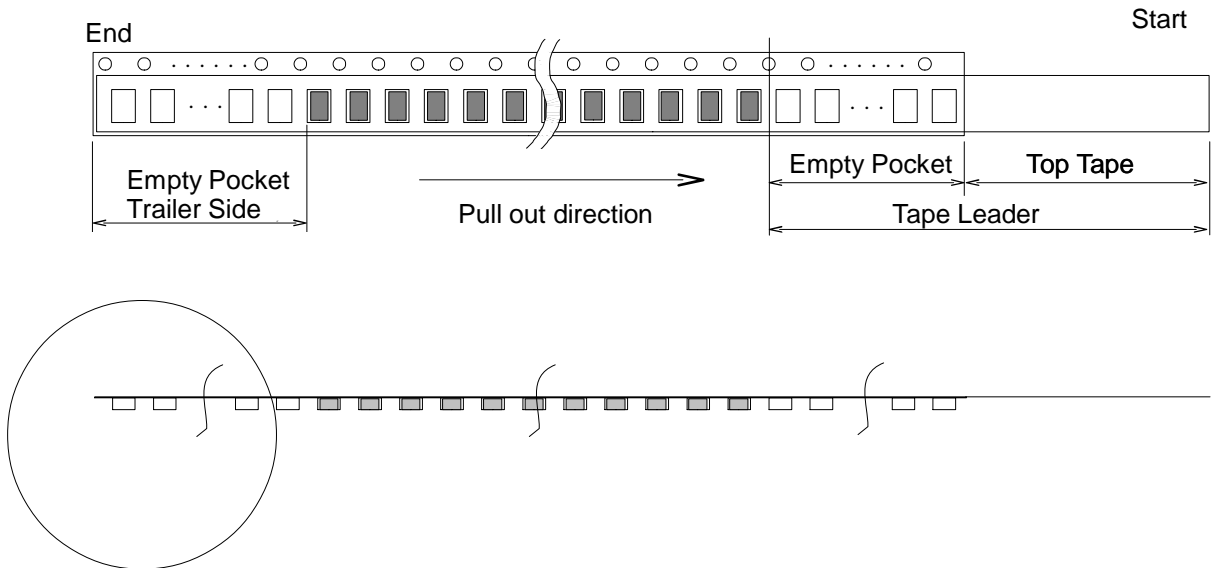


(3) Packing

(a) Tape & Reel



(b) Start & End Point



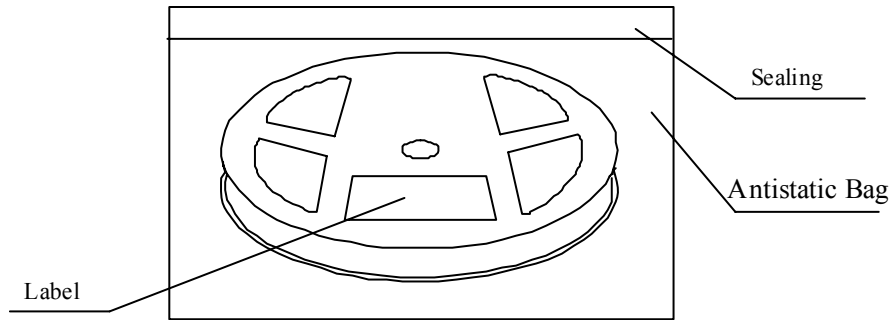
| Item | | Empty Space |
|--------------|--------------|---------------|
| Tape Leader | Top Tape | Min. 1 000 mm |
| | Carrier Tape | Min. 100 mm |
| Tape Trailer | Top Tape | Min. 0 mm |
| | Carrier Tape | Min. 160 mm |

(4) Peel force of the cover tape

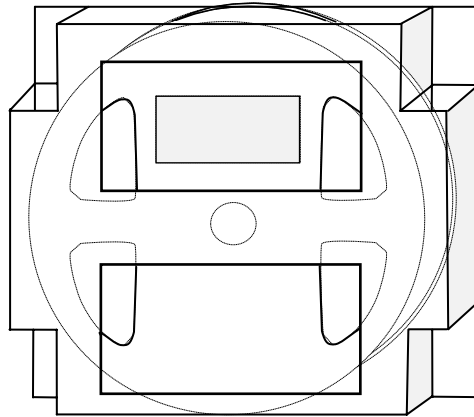
- ① angle : cover tape during peel off and the direction of unreeling shall be 165° to 180°.
- ② peel speed : 300 mm / min.
- ③ strength : 0.1 to 1 N.

[2] Inner Sleeve

a) Packing to antistatic bag

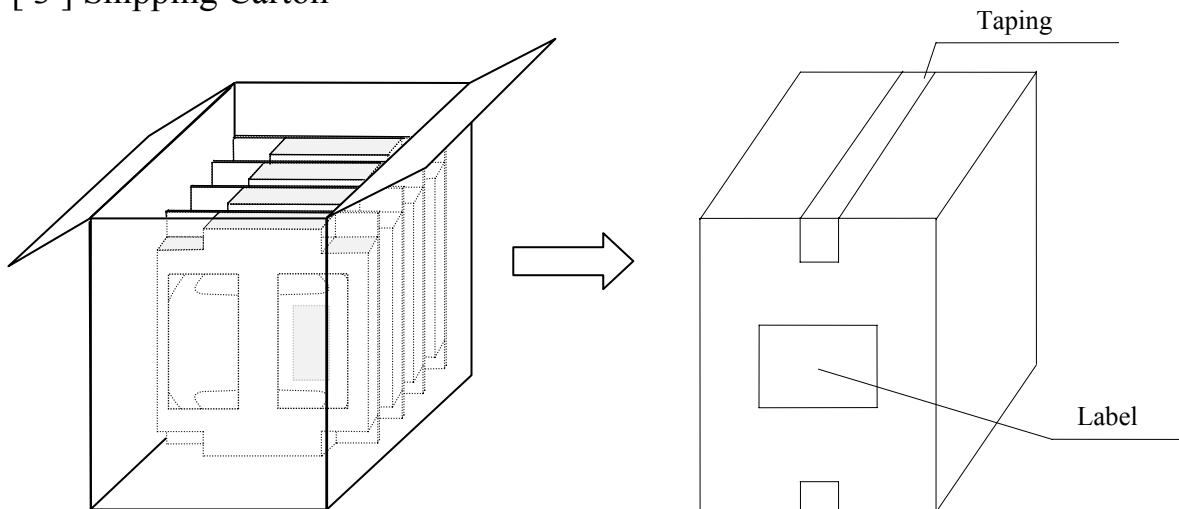


b) Packing to inner sleeve



* 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.

- 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 | Producing section. | " | Frequency. Outer appearance. | Sampling. " | Comparator. Micro scope. | " |
| ⑥ Deposition | 6 | Producing section. | " | Frequency. Outer appearance. | Sampling. " | Comparator. Micro scope. | " |
| Lid ⑦ Mounting | 7 | Producing section. | " | Outer appearance. | All insprcion. | Micro scope. | " |
| ⑧ Frequency adjustment | 8 | Producing section. | " | Frequency. | Sampling. | Frequency counter. | " |
| ①' In-coming inspection | 9 | Producing section. | " | Outer appearance. | Sampling. | Micro scope. | " |
| 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. |

Structure Diagram 構造図

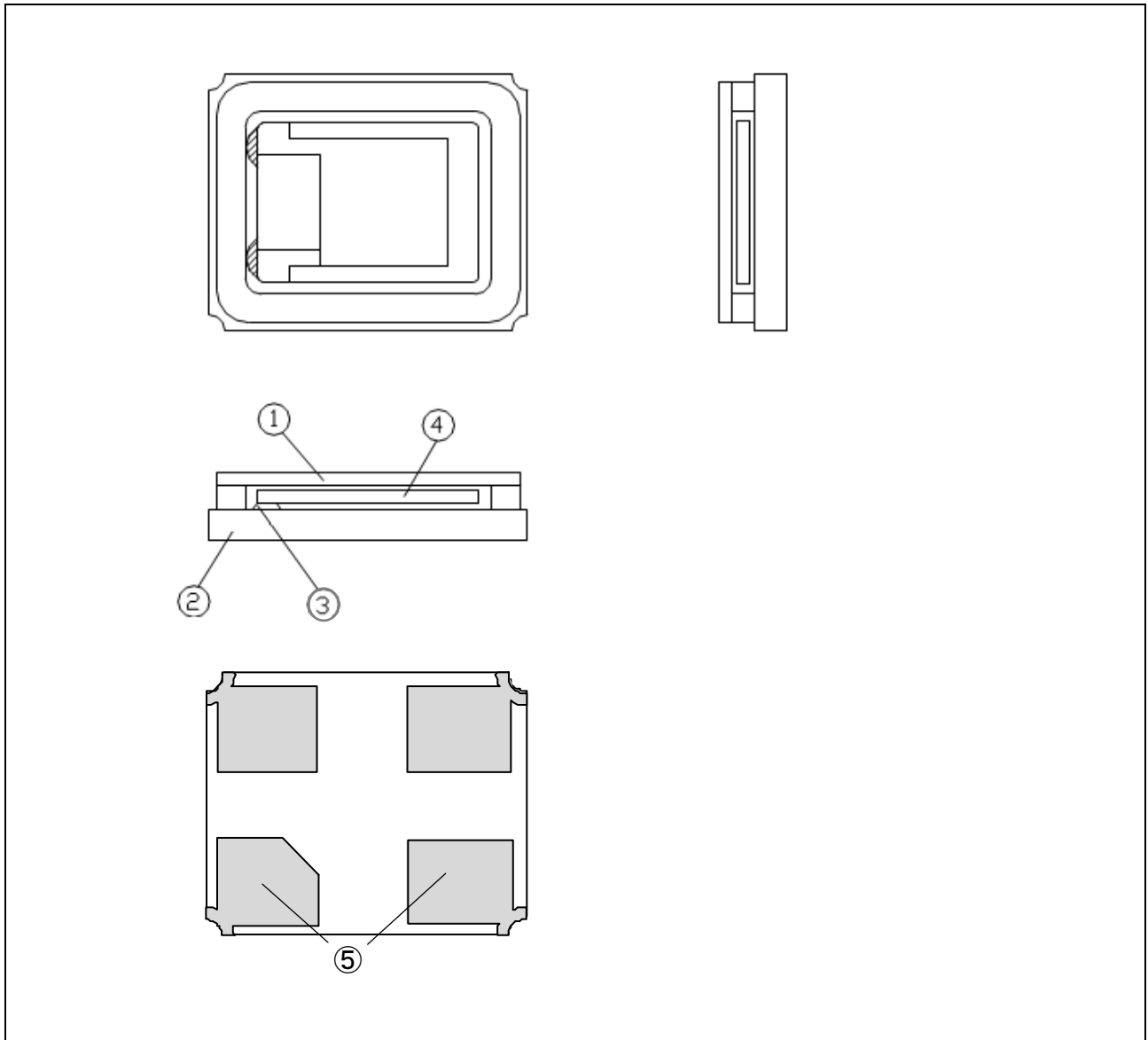
Rev.4

Model
型式

FA-20H / TSX-3225

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 |

RELIABILITY TEST DATA

Product Name : FA-20H

The Company evaluation condition

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

No.A-06014-1-001E

| No. | ITEM | TEST CONDITIONS | VALUE *1 *2 | TEST | FAIL |
|-----|------------------------------|---|--|--------------|--------------|
| | | | $\Delta f / f$ [1×10^{-6}] | Qty [n] | Qty [n] |
| 1 | Shock | 150g dummy Jig (EPSON TOYOCOM Standard) drop from 1500 mm height on the Concrete | *3 ± 2 | 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 ± 2 | 22 | 0 |
| 3 | High temperature storage | +85 °C × 1 000 h | *3 ± 2 | 22 | 0 |
| 4 | Low temperature storage | -40 °C × 1 000 h | *3 ± 2 | 22 | 0 |
| 5 | Temperature humidity storage | +85 °C × 85 %RH × 1 000 h | *3 ± 2 | 22 | 0 |
| 6 | Temperature cycle | -40 °C ⇔ + 85 °C 30 min at each temp. 100 cycles | *3 ± 2 | 22 | 0 |
| 7 | Resistance to soldering heat | For convention reflow soldering furnace (3 times) | ± 2 | 22 | 0 |
| 8 | Substrate bending | 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 | 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 | Solderability | Dip termination into solder bath at +235 °C ± 10 °C for 5 s (Using Rosin Flux) | Termination must be 95 % covered with fresh solder | 11 | 0 |

Notes

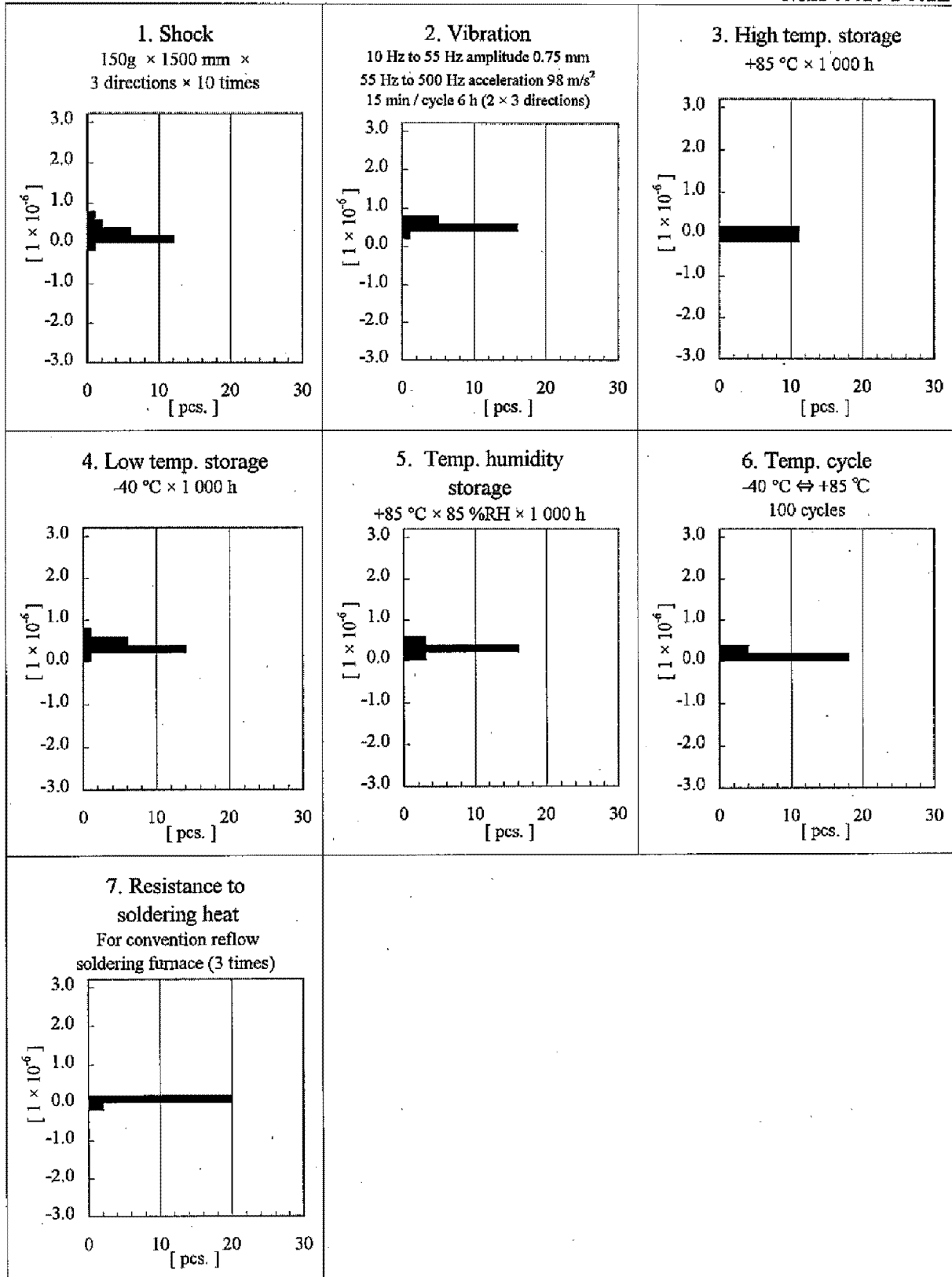
1. *1 Each test done independently.
2. *2 Measuring 2 h to 24 h later leaving in room temperature after each test.
3. *3 Measuring 24 h later leaving in room temperature after each test.
 1. Reflow 3 times
 2. Initial value shall be after 24h at room temperature.
4. Shift series resistance at before above tests should be less than ±20 % or less than ±10 Ω.

Qualification Data

Product Name : FA-20H

$\Delta f/f$

No.A-06014-1-002E



Product Name : FA-20H

Δ CI

No.A-06014-1-003E

