

RECIPIENT

## SPECIFICATIONS

**Product No. : X1E000381A01400**


**MODEL : FA2016AA**


**SPEC. No. : A15-030-0B**


**DATE: Apr. 15. 2015**

### SEIKO EPSON CORPORATION

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

CHECKED  / TD Production Engineering Department Manager  
Kenji Komine

CHECKED  / TD • CS Quality Assurance Department Manager  
Hiroaki Ohashi

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

# SPECIFICATIONS

## 1. Application

- 1) This document is applicable to the crystal unit FA2016AA that are delivered.  
to from Seiko Epson Corp.
- 2) This product is compliant with RoHS Directive.  
This FA2016AA is authorized for Use of Storage for Car DVR usage 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 extra high reliability, such as satellite, rocket and other space systems, and medical equipment, the functional purpose of which is to keep life.

## 2. Product No. / Model

X1E000381A01400 / FA2016AA

## 3. Packing

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

## 4. Warranty

- 1) 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

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

## 6. Contents

No.	Item	Page
[1]	Absolute maximum ratings	2
[2]	Operating range	2
[3]	Electrical 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

Parameter	Symbol	Rating value			Unit	Note
		Min	Typ.	Max.		
Storage temperature	T <sub>stg</sub>	-40	–	+125	°C	Suppose to be within CI std. at +25 °C - 3 °C

## [ 2 ] Operating range

Parameter	Symbol	Value			Unit	Note
		Min	Typ.	Max.		
Operating temperature	T <sub>use</sub>	-40	–	+125	°C	meet the requirement of CI and Temp. Characteristics.
Drive level	DL	10	100	200	uW	

## [ 3 ] Electrical characteristics

Parameter	Symbol	Standard	Unit	Conditions
Nominal frequency	f	24	MHz	Fundamental
Frequency tolerance	f <sub>tol</sub>	±15	1×10 <sup>-6</sup>	CL=10 pF T <sub>use</sub> = +25 °C ± 3 °C DL=100 uW Not include aging
Motional resistance	R <sub>1</sub>	80 Ω Max.	Ω	π circuit JIS C6701 DL=100uW T <sub>use</sub> = -40°C ~ +125 °C
Shunt capacitance	C <sub>0</sub>	3 and less	pF	
Frequency versus temperature characteristics	f <sub>tem</sub>	±50	1×10 <sup>-6</sup>	T <sub>use</sub> = -40°C ~ +125 °C Ref. at +25 °C±3 °C DL=100 uW
Isolation resistance	IR	500 and above	MΩ	DC 100V × 60 sec. Between each terminals
Aging	Δfa/f	±1/year	1×10 <sup>-6</sup>	Ta=+25°C±3°C DL=100 uW

#### [4]Environmental and mechanical characteristics

Item No.3 to No.6 shall be tested after following pre conditioning.

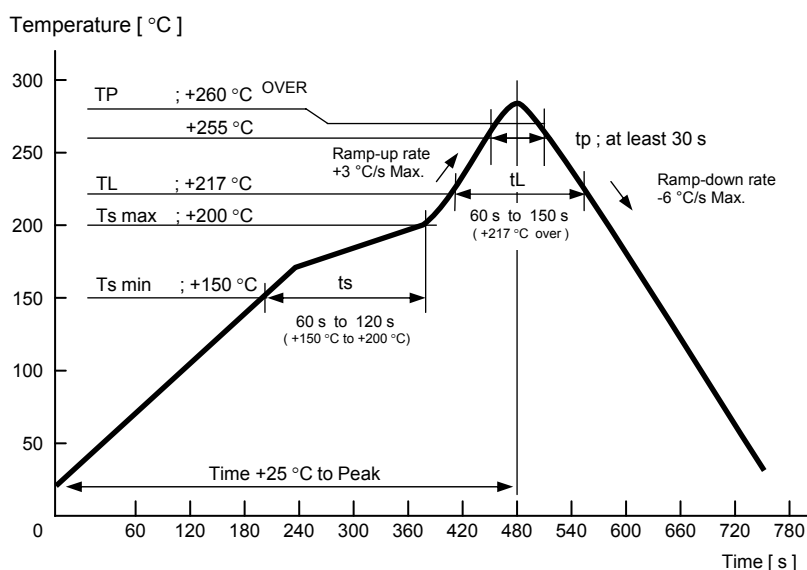
Pre conditioning : Test crystal must be leaving in room temperature for 24h after reflow  $\times 3$ .

(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	Drop	*3	$\pm 3$	150 g dummy Jig (Epson Toyocom Standard) drop from 1500 mm height on the Concrete 6 directions 10 times
2	Vibration	*3	$\pm 3$	10Hz~40Hz 1.5mm 40Hz~2000Hz 5G (1cycle = 20min) $\times$ 12cycle $\times$ 3direction.
3	High temperature storage	*3	$\pm 5$	+125 °C $\times$ 1 000 h
4	Low temperature storage	*3	$\pm 3$	-40 °C $\times$ 1 000 h
5	Temperature cycle	*3	$\pm 3$	-40 °C $\leftrightarrow$ +125 °C 30 minutes at each temp. 1000 cycle
6	Temperature humidity storage	*3	$\pm 3$	+85 °C $\times$ 85 %RH $\times$ 1 000 h
7	Resistance to soldering heat		$\pm 3$	For convention reflow soldering furnace (3times)
8	Substrate bending	No peeling-off at a soldered part		Bend width reaches 3 mm and hold for 5 s $\pm$ 1 s $\times$ 1 time Ref. IEC 60068-2-21
9	Shear	No peeling-off at a soldered part		10 N press for 10 s $\pm$ 1 s Ref. IEC 60068-2-21
10	Pull – off	No peeling-off at a soldered part		10 N press for 10 s $\pm$ 1 s Ref. IEC 60068-2-21
11	Solder ability	Terminals must be 95 % covered With fresh solder.		Dip termination into solder bath at +235 °C $\pm$ 10 °C for 5 s (Using Rosin Flux)

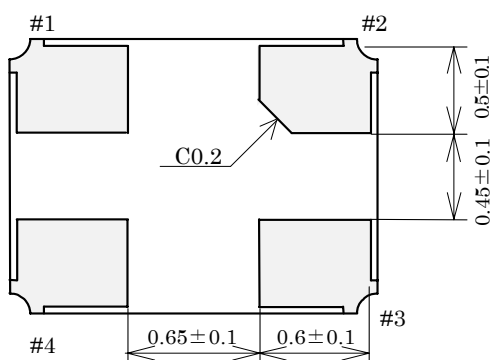
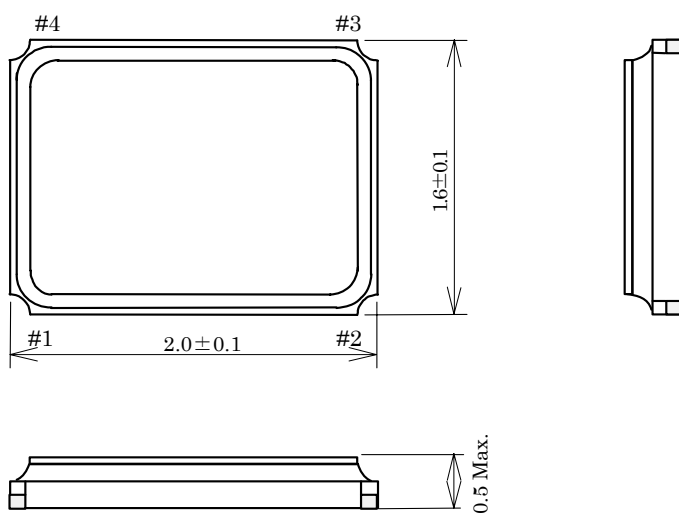
< Notes >

- \*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.
- Item No.1 to No.11 resistance at before above tests should be less than  $\pm 20$  % or less than  $\pm 10 \Omega$ .
- Pre conditioning : Test crystal must be leaving in room temperature for 24h after reflow  $\times 3$



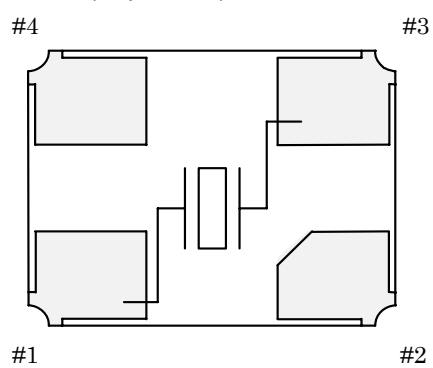
[ 5 ] Dimensions and Circuit

1. Dimension



2. Circuit

(Top View)



Pin connection

# 1, # 3 : X'tal

# 2, # 4 : GND

Type : FA2016AA

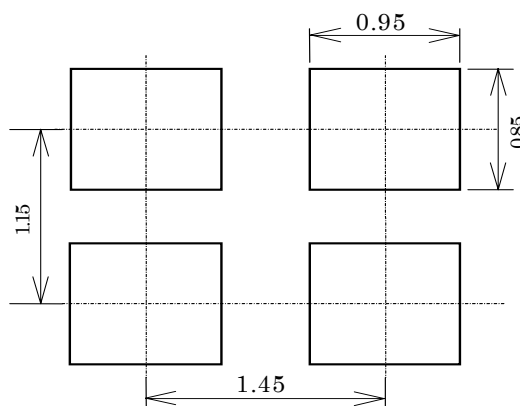
Terminal treatment : Au Plate

Unit : 1=1 mm

[ 6 ] Recommended soldering pattern and Marking layout

1. Recommended soldering pattern

Unit : mm



2. Marking layout.

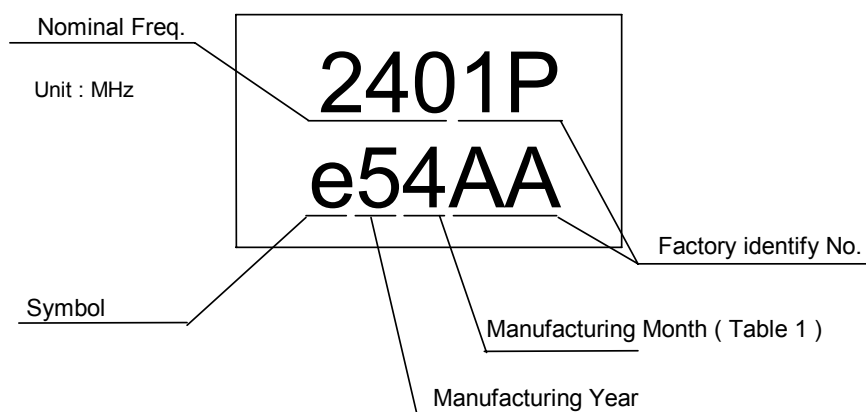


Table.1 Production month

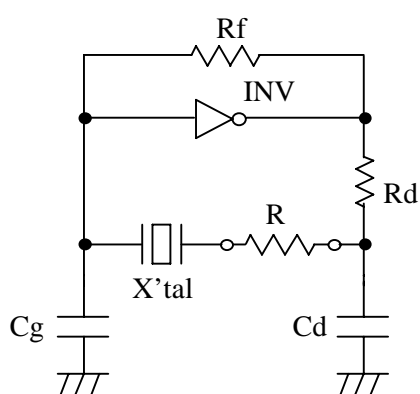
Production Month	Jan.	Feb.	Mar.	...	Oct.	Nov.	Dec.
Marking	1	2	3	...	X	Y	Z

- \* Nominal frequency is only one example.
- \* Nominal frequency is display to the first decimal place.  
ex) 24 MHz ..... [240]
- \* 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 × within 5 seconds)
2. Patterning on a board should follow our company recommended pattern.
3. Applying excessive excitation force to the crystal unit may cause deterioration damage.
4. 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  $-R=R+Cl$  value.
- (5) Recommended  $-R$   
 $[-R]>Cl \times 10$

5. It is recommended to do patterning to the oscillator as short as possible. Abnormal oscillation may happened if the line is too long.
6. To avoid malfunction, no pattern across or near the crystal unit is allowed.
7. 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.
8. 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.
9. 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.
10. Condensation may occur when used/stored under high humidity condition.  
 Please take precautions to prevent condensation.
11. Please refer to packing specification for the storage method and packing standard.

# TAPING SPECIFICATION

## 1. APPLICATION

This document is applicable to FA2016AA

## 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

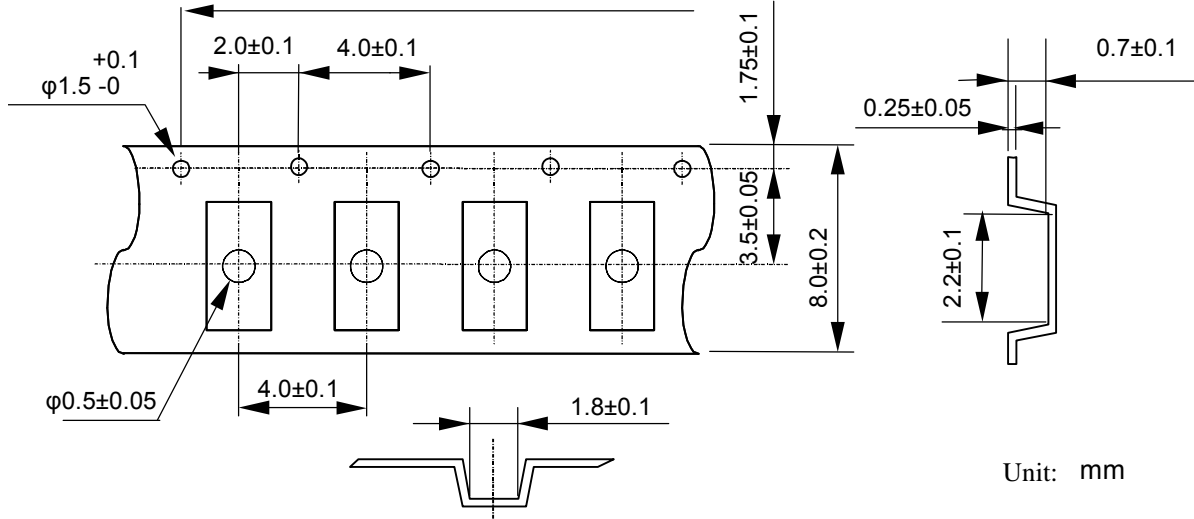
Subject to EIA-481 & IEC-60286

(1) Tape dimensions TE0804L

Material of the Carrier Tape : PS

Material of the Top Tape : PET+PE

10P :  $40 \pm 0.15$

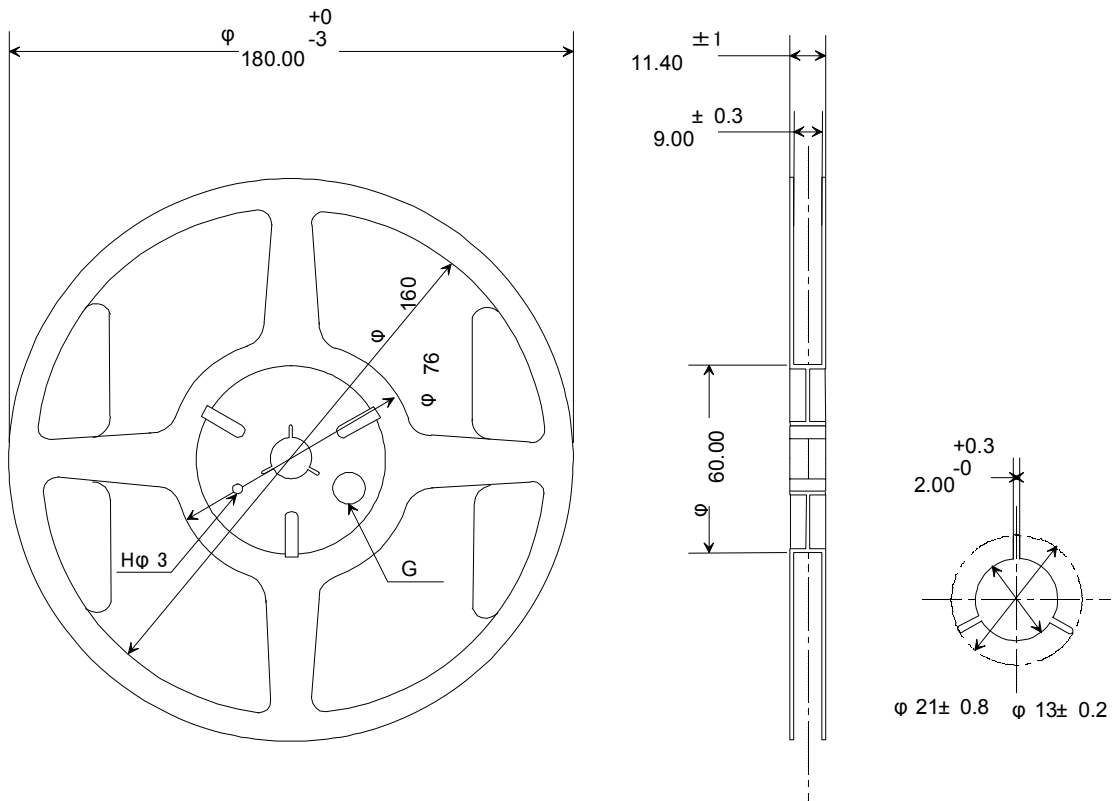


Unit: mm

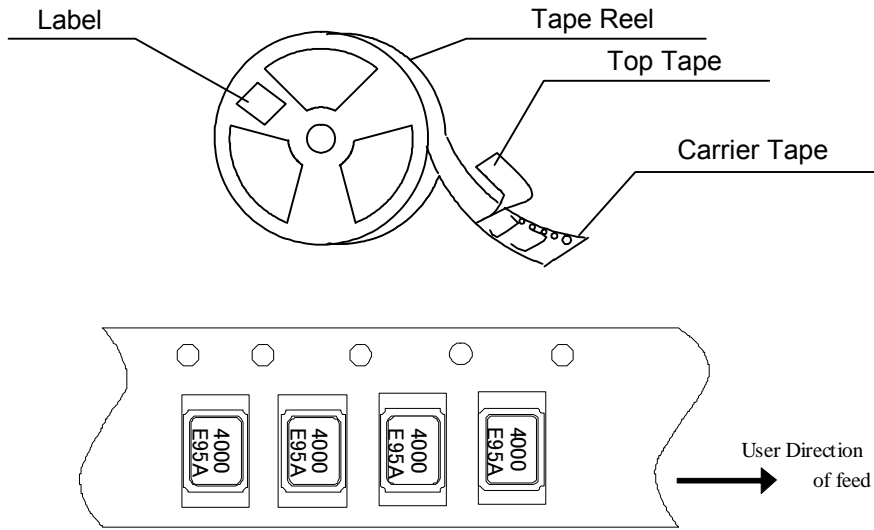
(2) Reel dimensions

(a) Center material : PS

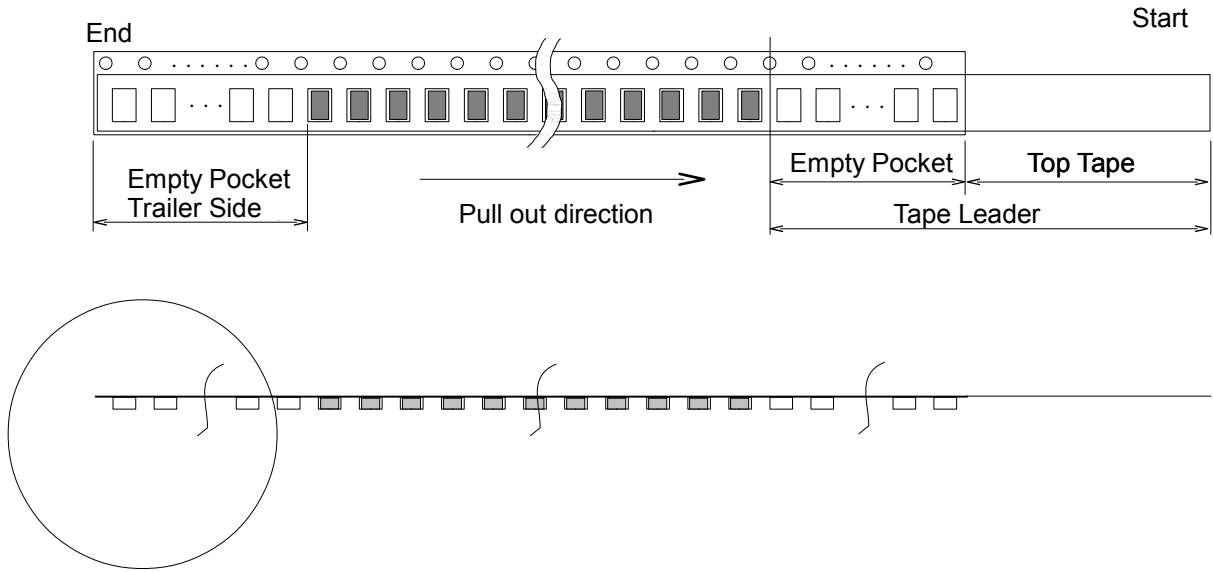
(b) Material of the Reel : PS



(3) Packing  
(a) Tape & Reel



(b) Start & End Point



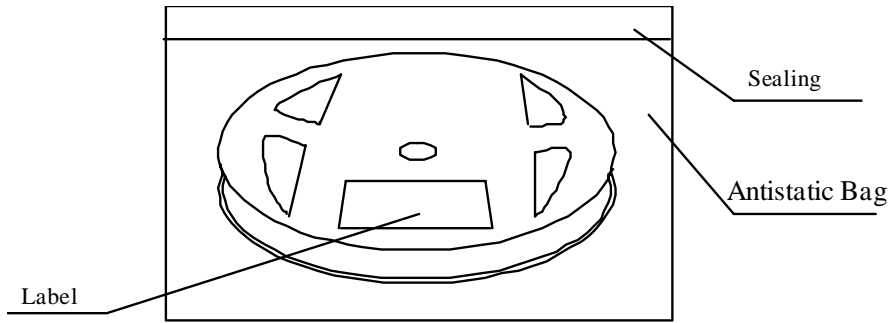
Item		Empty Space
Tape Leader	Top Tape	Min. 1 000 mm
	Carrier Tape	Min. 100 mm
Tape Trailer	Top Tape	Min. 0 mm
	Carrier Tape	Min. 160 mm

(4) Peel force of the cover tape

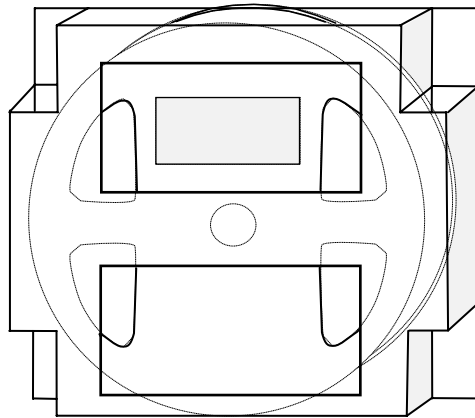
- (a) angle : cover tape during peel off and the direction of unreeling shall be 165° to 180°.
- (b) peel speed : 300 mm / min.
- (c) strength : 0.1 to 1 N.

### [ 2 ] Inner Sleeve

a) Packing to antistatic bag

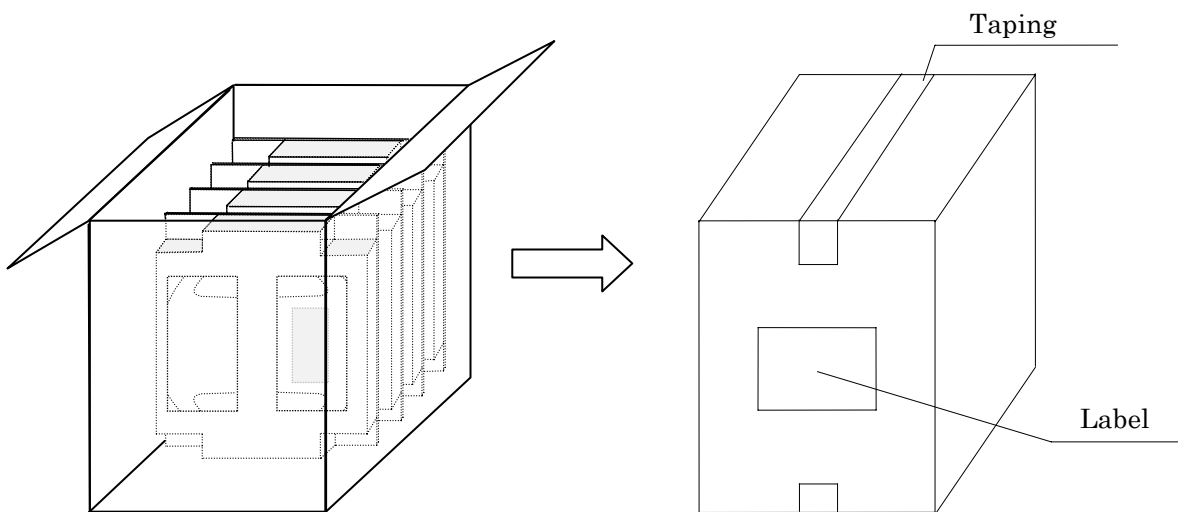


b) Packing to inner sleeve



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

### [ 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.

**SMD TYPE AT STRIP CRYSTAL : FA2016AA**

No. A-1301-01-AIE-1

FA2016AA\_Q\_0001

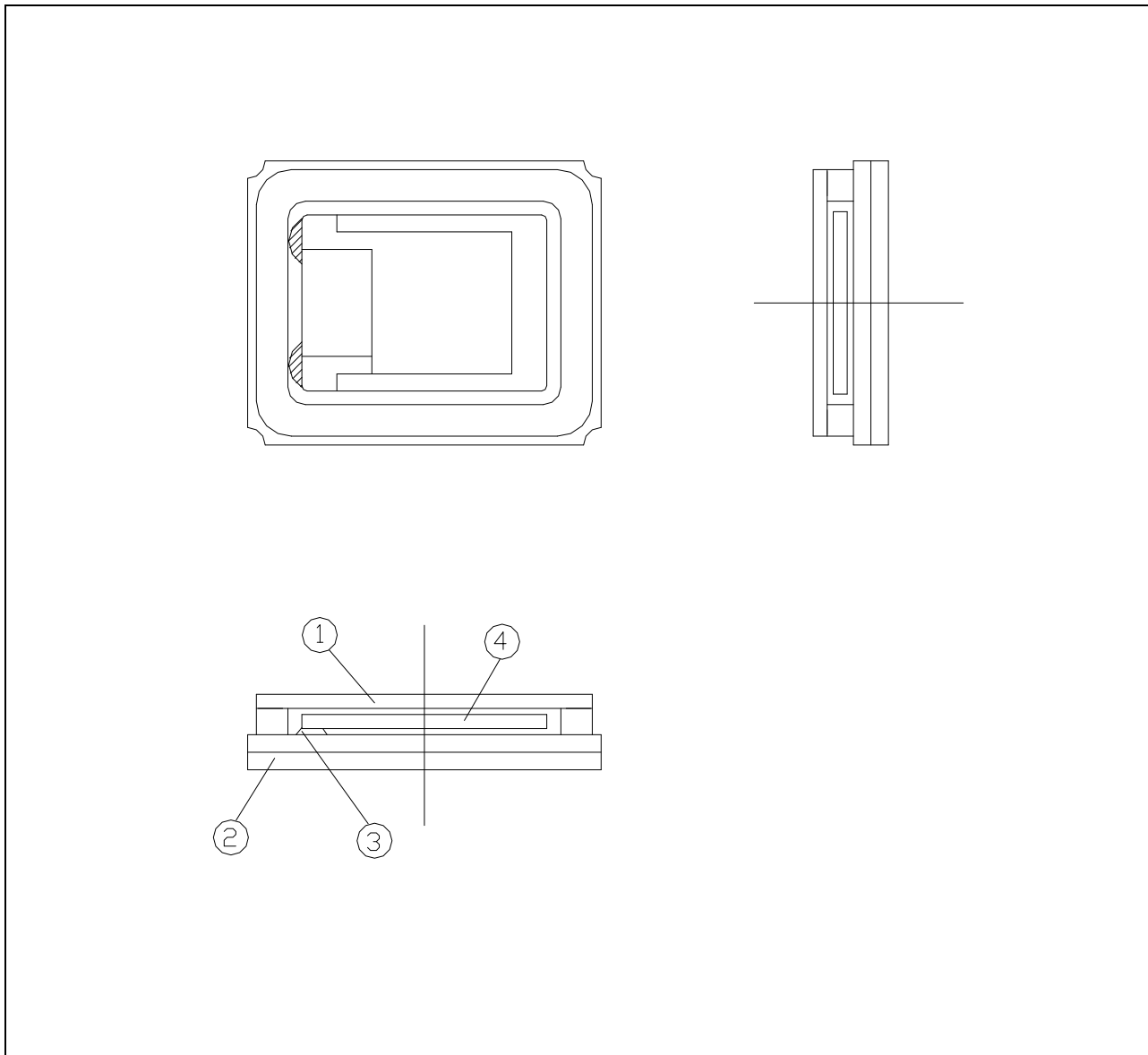
2015.03.09

Manufacturing process chart		No.	Section	Standard	Inspection Control items	Inspection method	Instrument	Record
	1	Quality Control section	Purchasing specification	Size.	Sampling.	Comparator.	In-coming inspection data sheet	
	Quality Control section	Incoming inspection standard	Outer appearance.	Visual inspection.				
	Manufacturing section	Manufacturing instruction	Outer appearance.	100%	Micro scope	Lot process record		
	2	Quality Control section	Purchasing specification	Size.	Sampling.	Comparator.	In-coming inspection data sheet	
	Quality Control section	Incoming inspection standard	Outer appearance.	Visual inspection.				
	Manufacturing section	Manufacturing instruction	Outer appearance.	Sampling.	Micro scope	Lot process record		
	3	Manufacturing section	Manufacturing instruction	Outer appearance.	100%	Micro scope	Lot process record	
	4	Manufacturing section	Manufacturing instruction	Frequency	Sampling.	Network analyzer	Lot process record	
	Manufacturing section	Manufacturing instruction	Outer appearance.	Micro scope				
	5	Quality Control section	Purchasing specification	Size.	Sampling.	Comparator.	In-coming inspection data sheet	
	Quality Control section	Incoming inspection standard	Outer appearance.	Visual inspection.				
	Manufacturing section	Manufacturing instruction	Leak test	100%	Inspection MC	Lot process record		
	6	Manufacturing section	Manufacturing instruction	Temp. profile	-	Temp. recorder	Record sheet	
	7	Manufacturing section	Manufacturing instruction	Outer appearance.	Sampling.	Micro scope	Lot process record	
8	Manufacturing section	Manufacturing instruction	Crystal impedance	100%	Inspection MC	Lot process record		
Manufacturing section	Manufacturing instruction	Frequency						
Manufacturing section	Manufacturing instruction	Insulation resistance						
9	Manufacturing section	Manufacturing instruction	Temperature characteristic	Sampling.	Inspection MC	Lot process record		
Manufacturing section	Manufacturing instruction	Shock resistance	Drop shock jig					
Manufacturing section	Manufacturing instruction	Outer appearance.	Micro scope					
10	Quality Control section	Outgoing inspection standard	Crystal impedance	Sampling.	Inspection jig	Out-going inspection data sheet		
Quality Control section	Outgoing inspection standard	Frequency						
Quality Control section	Outgoing inspection standard	Insulation resistance						
Manufacturing section	Manufacturing instruction	Outer appearance.	Sampling.	Micro scope	Lot process record			
11	Quality Control section	Outgoing inspection standard	Outer appearance.	Sampling.	Micro scope	Out-going inspection data sheet		
12	Product control section.	Manufacturing instruction	Receiver's address	-	-	Lot process record		
Product control section.	Packing Instruction	Quantity						
13	Out-going inspection							
14	Packing							
Shipment								

# Structure Diagram 構造図

Unit : mm

Model 型式	FA2016AA	
Document No. 管理No.	A-1301-A-1	FA2016AA_D_0001



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

## RELIABILITY TEST DATA

### Product Name : FA-2016AA

The Company evaluation condition

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

No. F-A-1301-02-001E

No.	ITEM	TEST CONDITIONS	VALUE *1 *2	TEST	FAIL
			$\Delta f / f$ [1 × 10 <sup>-6</sup> ]	Qty [ n ]	Qty [ n ]
1	Drop	150g dummy Jig (Epsontoyocom Standard) drop from 1500 mm height on the Concrete 3 directions 10 times	*3 ± 3	22	0
2	Vibration	10 to 2000Hz , 5g's , 20minutes/cycles 12 cycles × 3directions	*3 ± 3	22	0
3	High temperature storage	+125 °C × 1 000 h	*3 ± 5	22	0
4	Low temperature storage	-40 °C × 1 000 h	*3 ± 3	22	0
5	Temperature cycle	-40 °C ⇔ + 125 °C 30 min at each temp. 100 cycles	*3 ± 3	22	0
6	Temperature humidity storage	+85 °C × 85 %RH × 1 000 h	*3 ± 3	22	0
7	Resistance to soldering heat	For convention reflow soldering furnace (3 times)	± 3	22	0
8	Substrate bending	Bend width reaches 2.0 mm and hold for 60 s ± 1 s × 1 time Ref.AEC-Q200-005	No peeling - off at a solder part	11	0
9	Shear	1.8kgf press for 60 s ± 1 s Ref. AEC-Q200-006	No peeling - off at a solder part	11	0
10	Pull - off	1.8kgf press for 60 s ± 1 s Ref.AEC-Q200-006	No peeling - off at a solder part	11	0
11	Solderability	Dip termination into solder bath at +260°C ± 105 °C for 10 s (Using Rosin Flux)	Termination must be 95 % covered with fresh solder	11	0

#### Notes

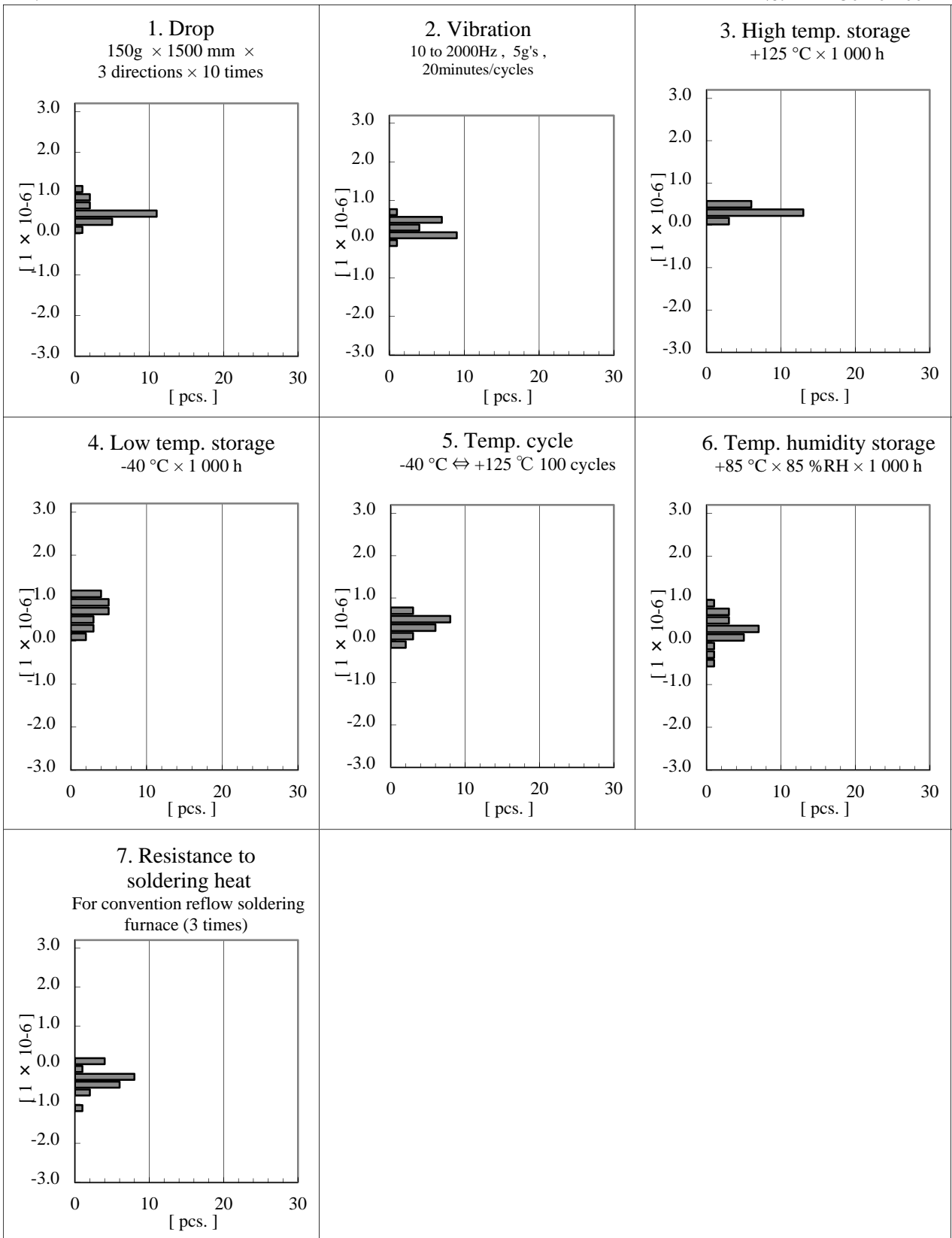
1. \*1 Each test done independently.
2. \*2 Measuring 2 h to 24 h later leaving in room temperature after each test.
3. \*3 Measuring 24 h later leaving in room temperature after each test.
  1. Reflow 3 times
  2. Initial value shall be after 24h at room temperature.
4. Shift series resistance at before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

#### Qualification Data

**Product Name : FA-2016AA**

$\Delta f / f$

**No. F-A-1301-02-002E**





**Product Name : FA-2016AA**

$\Delta$  CI

**No. F-A-1301-02-003E**

