RECIPIENT

SPECIFICATIONS

Product No. : Q22MA4061001000

MODEL : MA-406

SPEC. No. : A13-780-2A

DATE: Nov. 20. 2013

SEIKO EPSON CORPORATION

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SPECIFICATIONS

1. Application

This document is applicable to the crystal units that are delivered to . from Seiko Epson Corp.

This product complies with RoHS Directive.

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.

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

The product No. of this crystal unit is Q22MA4061001000.

The model is MA-406.

3. Packing

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

4. Warranty

Defective parts which are originated by us are replaced free of charge in case defects are found within 12 months after delivery.

5. Amendment and abolishment

Amendment and/or abolishment of this specification are subject to the agreement of both parties.

6. Contents

Item No.	Item	Page
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[1] Absolute maximum ratings

Item	Symbol	Rating value
Storage temperature	T_{STG}	-55 °C to +125 °C
Maximum drive level	GL	2 mW

[2] Operating range

Item	Symbol	Value		
		Min.	Typ.	Max.
Operating temperature	T_{OPR}	-20 °C		+70 °C
Drive level	DL		100 μW	

[3] Electrical characteristics

Item	Symbol	Value	Note
Frequency	f_1	4 MHz	
Frequency tolerance	ΔF/F	$\pm 50 \times 10^{-6}$	CL = 20 pF Ta= +25 °C±3 °C Drive level : 100 μW not include aging
Series resistance	R_1	150 Ω Max.	π circuit Drive level : 100 μW Ta = -20°C to +70 °C
Shunt capacitance	C_0	5 pF Max.	
Frequency temperature characteristics	Top	$\pm 50 \times 10^{-6}$	Ta = -20°C to +70 °C (0×10^{-6}at +25 °C ± 3 °C) Drive level : 100 μW
Isolation resistance	IR	500 MΩ Min.	DC 100V, 60 sec. between terminals or terminal and case
Aging	fa	$\pm 5 \times 10^{-6}$/year	Ta = +25 °C ± 3 °C Drive level : 100 μW

[4] Environmental and mechanical characteristics

Item No.3 to No.6 shall be tested after following pre conditioning
+85 ± 2 °C × 85 ± 5 %RH × 24 ± 1 h after 24 h at room temperature

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

No.	Items	Value*1*2	Conditions
		Δ f/f [1 × 10^{-6}]	
1	Drop	(2) ± 10	Free drop from 750 mm height on a hard wooden board for 3 times (Board is thickness more than 30 mm)
2	Vibration	(2) ± 10	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	(1) a) ± 50 b) ± 10	a) +125 °C × 1 000 h b) +85 °C × 1 000 h
4	Low temperature storage	(1) ± 10	-55 °C × 1 000 h
5	Temperature cycle	(1) ± 10	-55 °C ⇔ +125 °C 30 min. at each temp. 100 cycles
6	Temperature humidity storage	(1) ± 20	+85 °C × 85 %RH × 1 000 h
7	Resistance to soldering heat	± 8	For convention reflow soldering furnace (2 times)
8	Shear	No peeling-off at a soldered part	20 N press the side for 10 s ± 1 s Ref. IEC 60068-2-21
9	Pull - off	No peeling-off at a soldered part	10 N press the side for 10 s ± 1 s. Ref. IEC 60068-2-21
10	Solvent resistance	The marking shall be legible	Ref. JIS C 0052 or IEC 60068-2-45
11	Solderability	Termination must be 90 % covered with fresh solder	Dip termination into solder bath at +230 °C ± 10 °C for 3 s (Using Rosin Flux)

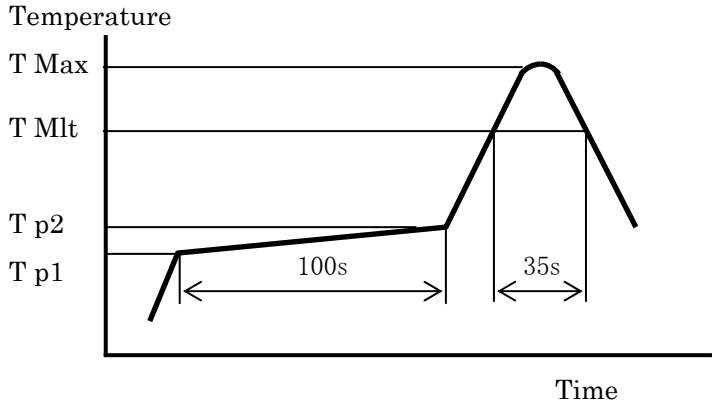
1. Item No.1 to No.7 resistance at before above tests should be less than ±20 % or less than under mentioned values.
2. *1 Each test done independently.
3. *2 Measuring 2 h to 24 h later leaving in room temperature after each test.
   (1) Measuring 24 h later leaving in room temperature after each test.
   (2) Measuring 2 h later leaving in room temperature after each test.

Frequency	Vib. mode	ΔCI
4.0 MHz ≤ f < 5.0 MHz	Fundamental	50Ω
5.5 MHz ≤ f < 12.0 MHz		10Ω
12.0 MHz ≤ f ≤ 30.0 MHz		5Ω
26.0 MHz ≤ f ≤ 64.0 MHz	3rd overtone	10Ω

◆Reflow

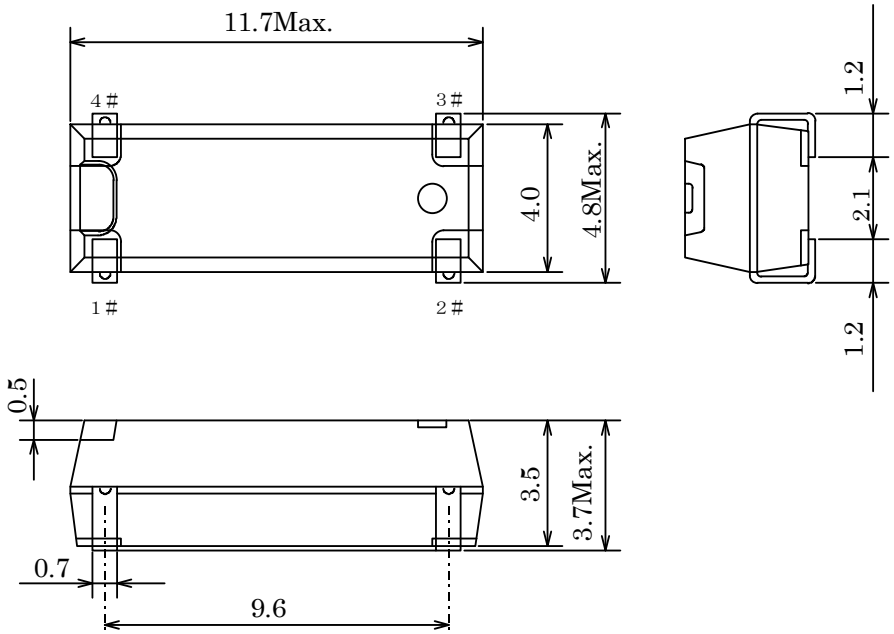
Pre Heating Temperature
T p1~T p2 = +170 °C
Heating Temperature
T Mlt = +220 °C
Peek Temperature
T Max = +260 °C

Point of measuring
In case of Solderability
Terminal.
In case of Resistance to soldering heat
Surface.

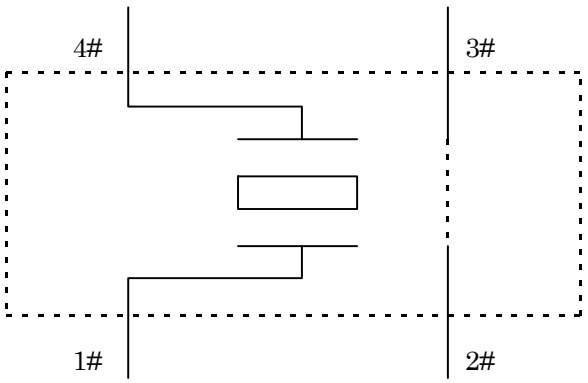


[5] Dimensions and marking layout

Dimensions



Circuit location



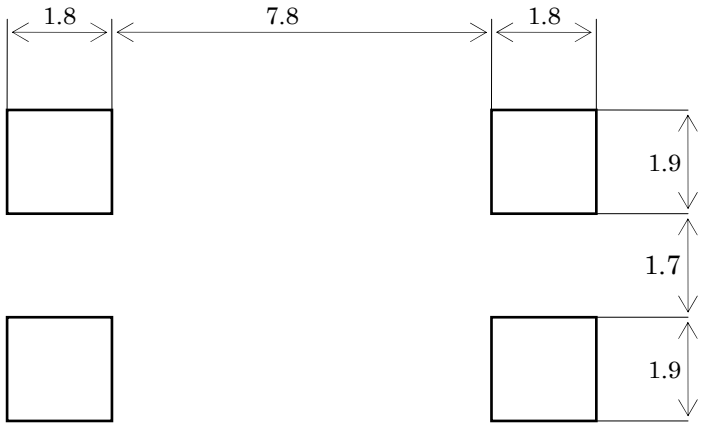
* Do not connect 2# and 3# terminals to any external terminals.

Type	MA-406	Terminal treatment	Pb Free solder plate	Unit	1 = 1 mm

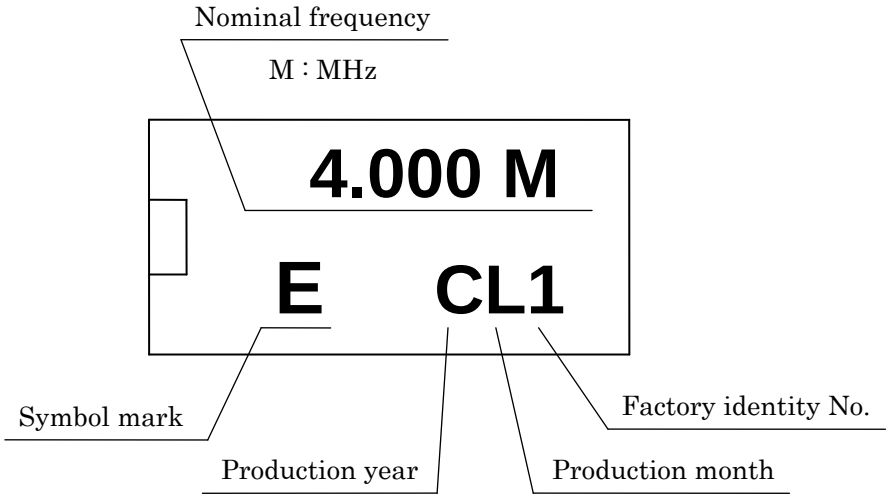
[6] Recommendable patterning and marking layout

Recommendable patterning

Unit : mm



Marking layout



Marking table for Production year with the last one digit of Anno Domini

The last one digit of A.D	1	2	3	4	5	6	7	8	9	0
Production year of marking	A	B	C	D	E	F	G	H	J	K

Marking table for Production month with the marking number

Production month	Jan.	Feb.	·····	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.
Production month of marking	A	B	·····	G	H	J	K	L	M

- ♦ Nominal frequency is only example.
- ♦ Nominal frequency omits the figure below the forth place of decimals.
- ♦ The above marking layout shows only marking contents and their approximate position and it is not for font, size and exact position.

[7] Notes

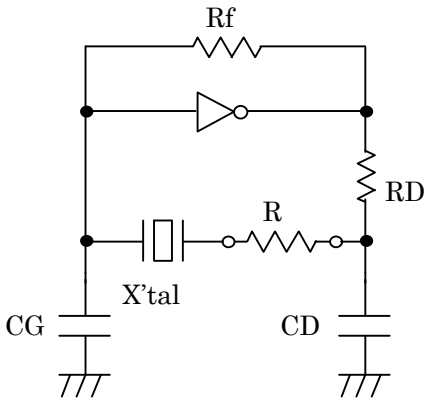
1. Max. two (2) times reflow is allowed. Once miss soldering is happen, hand work soldering by soldering iron is recommended. (+350 °C Max. × within 5 sec.)

2. Patterning should be followed by our recommended one.

3. Applying excessive excitation force to the crystal unit may cause deterioration damage.

4. Unless adequate negative resistance is allocated in the oscillation circuit, start up time of oscillation may be increased, or oscillation may occur.

   How to check the negative resistance



1) Connect the resistance (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 × (5 ~ 10)

5. The shortest line patterning on board is recommendable.
   Too long line on board may cause of abnormal oscillation.

6. To avoid malfunction, no pattern under or near the X'tal is allowed.
   Solder paste should be more than 150 μm thickness.

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

8. 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.

9. Don't storage or use in the environment that temperature may change rapidly to avoid the condition.

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

TAPING SPECIFICATION

Ⅰ. Application

This standard will apply to MA-406.

Ⅱ. Contents

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

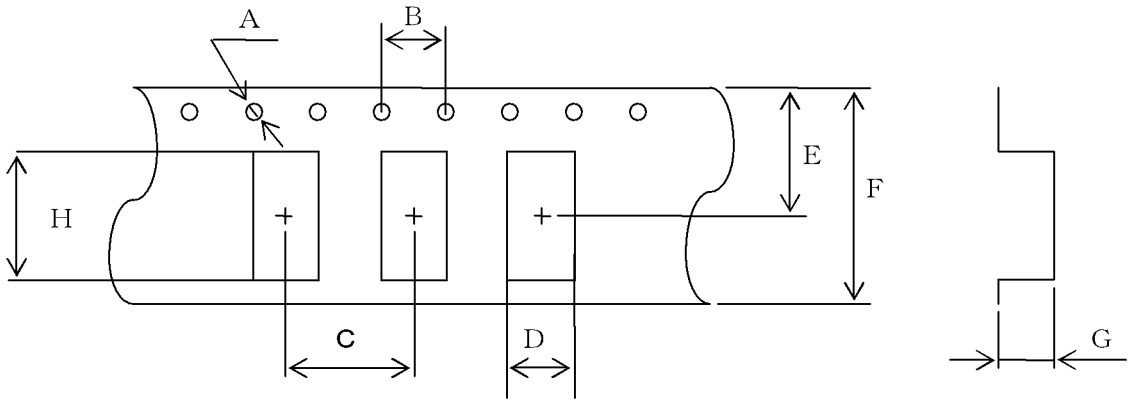
〔1〕 Taping specification

Subject to EIA-481 & IEC-60286

(1) Tape dimensions TE-2412L

Material of the carrier tape : Polystyrene

Material of the top tape : PET

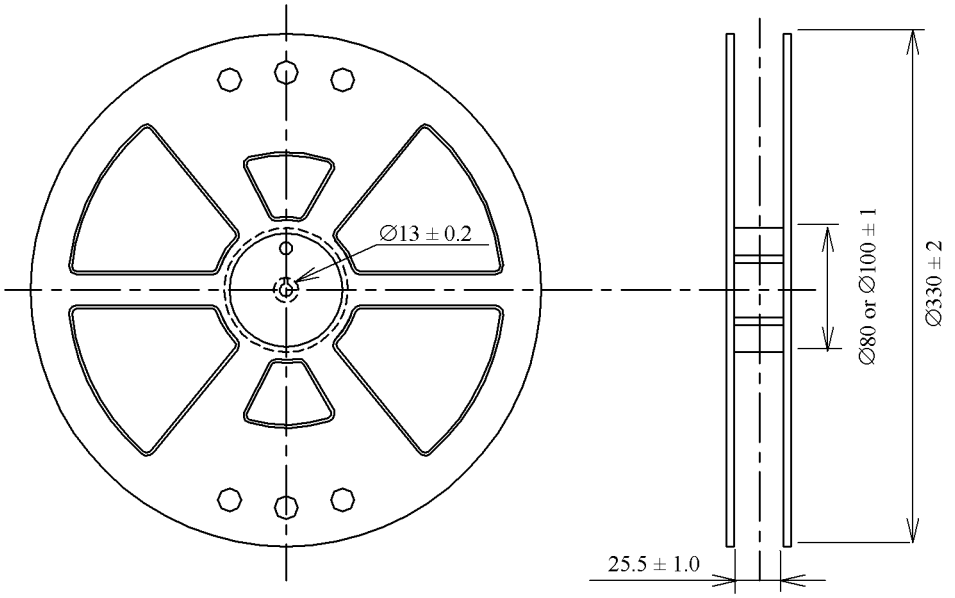


Symbol	A	B	C	D	E	F	G	H
Value	ϕ 1.5 ±0.1/-0	4.0 ±0.1	12.0 ±0.1	4.9 ±0.1	11.5 ±0.1	24.0 ±0.2	4.0 ±0.1	11.9 ±0.1

Unit : mm

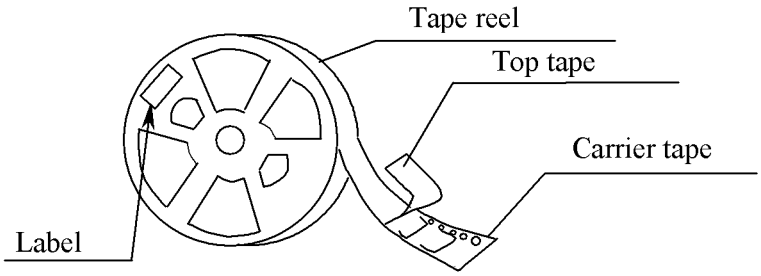
(2) Reel dimensions

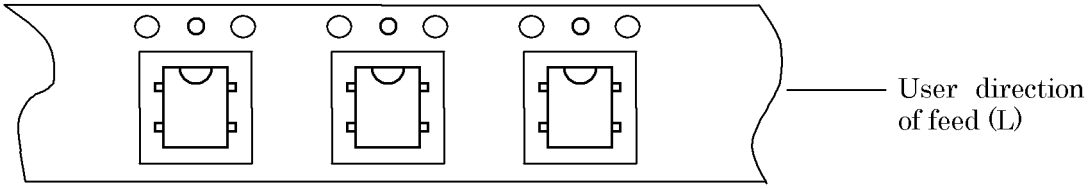
Material of the reel : Polystyrene



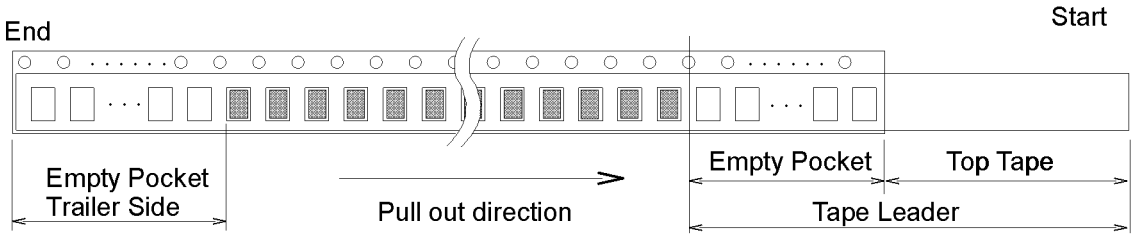
(3) Packing

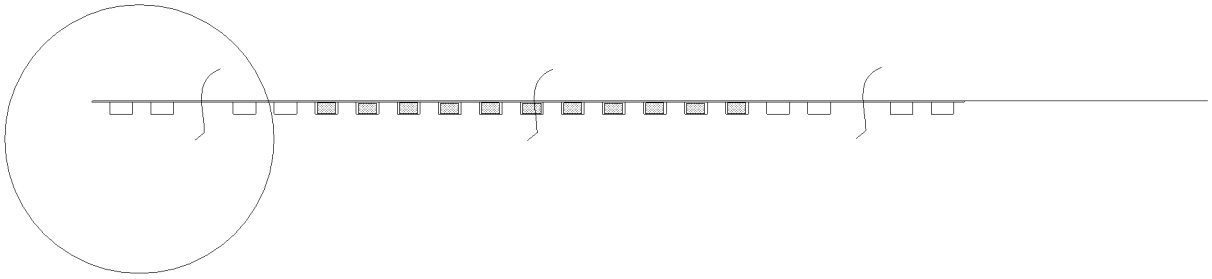
①Tape & reel





②Start & end point

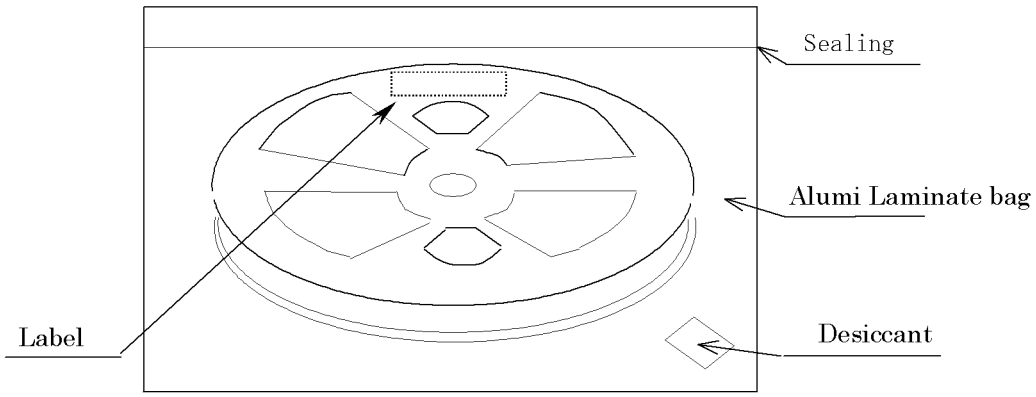




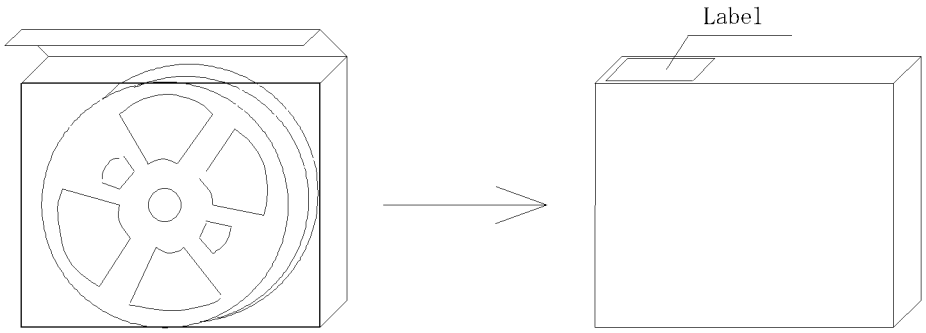
Item		Empty space
Tape leader	Top tape	Min. 1 000 mm
	Carrier tape	Min. 100 mm
Tape trailer	Top tape	Min. 0 mm
	Carrier tape	Min. 160 mm

〔2〕 Inner carton

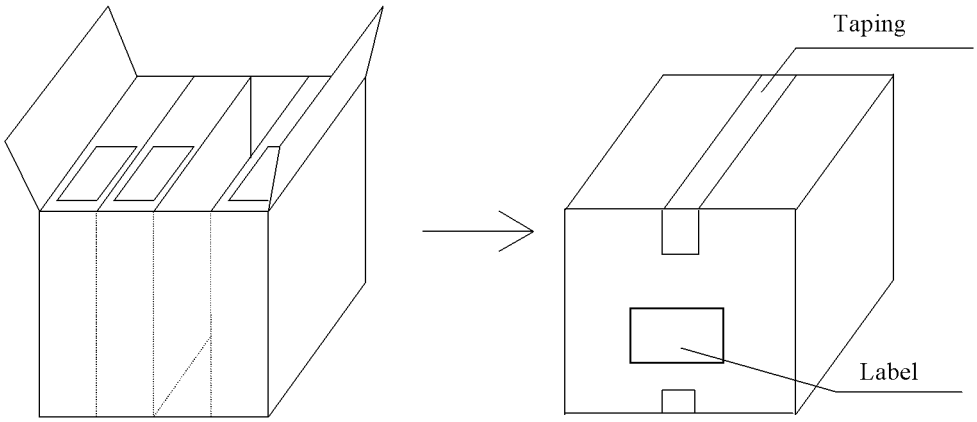
a) Packing to antistatic bag



b) Packing to inner carton



〔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 name 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

・1 000 pcs./reel

〔6〕 Storage environment

(1) To storage the reel at 15 °C to 35 °C, 25 %RH to 85 %RH of humidity.
(2) To open the packing just before using.
(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.

– P R O C E S S Q U A L I T Y C O N T R O L –

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No.68-00-1-AEE-1

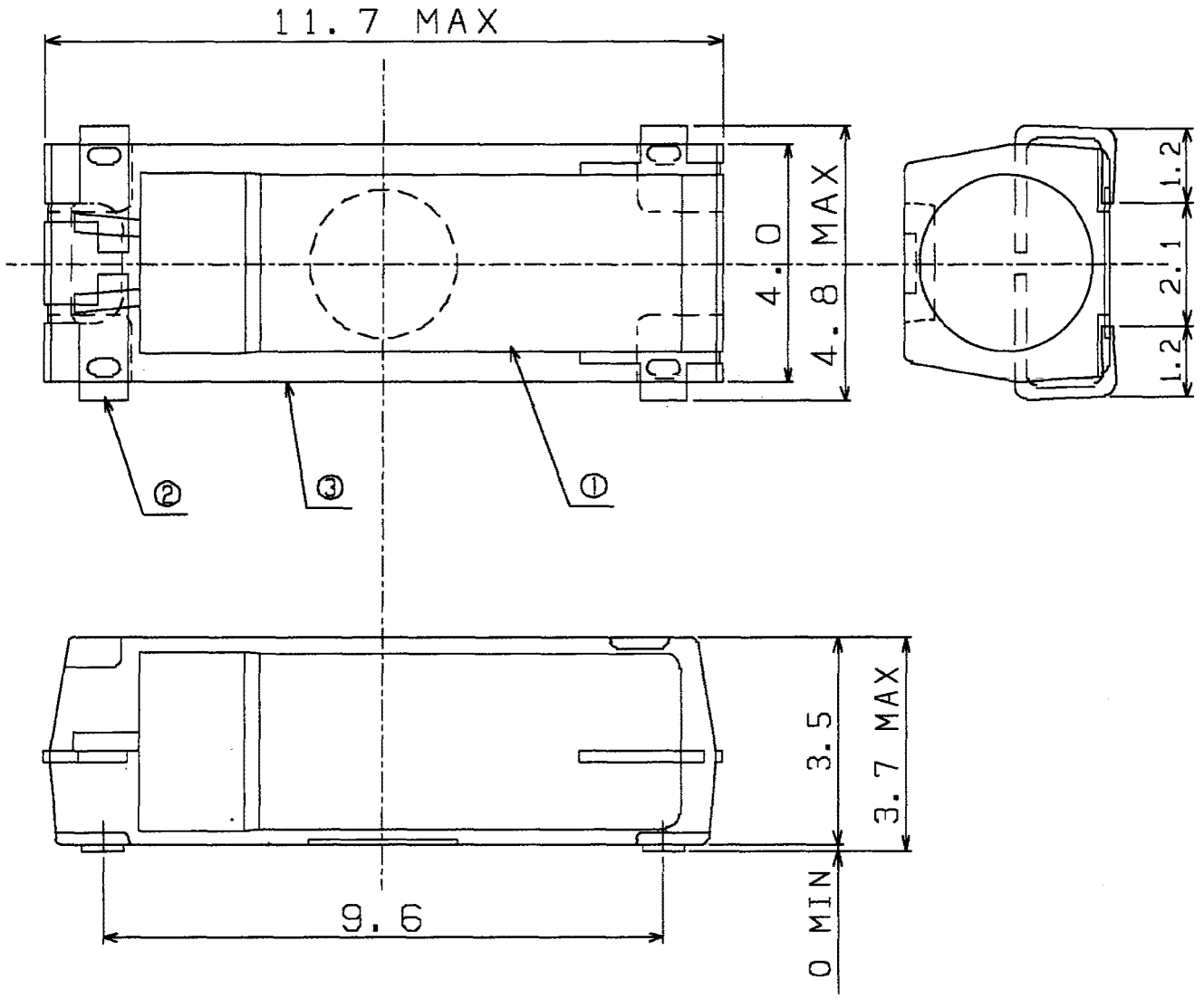
MOLD TYPE AT STRIP CRYSTAL M A – 4 0 6

Manufacturing process chart	No.	Section In Charge	Standards	Inspection,Control Item	Inspection Methods	Instruments	Record
CA-303 Crystal Lead Frame 1' In-coming Inspection	1'	Inspection Section	Purchasing Specification,In-coming Inspection Standard	Shape Appearance	Sampling 〃	Visual Inspection Microscope	In-coming Data Sheet
	2	Malaysia Plant Subcontractive Co.	Manufacturing Instruction Sheet	Appearance	100% Inspection	Microscope	Process Data Sheet
	3	〃	〃	Appearance	〃	Visual Inspection	〃
	4	〃	Solder Plating Specification	Plating Thickness Appearance	Sampling 100% Inspection	Fluorescent X-ray Visual Inspection	〃
② Crystal Welding	5	〃	Manufacturing Instruction Sheet	Appearance	100% Inspection	Visual Inspection	〃
③ Transfer Mold	6	〃	〃	Appearance Shape	Sampling 〃	Microscope Dial Gauge Caliper	〃
④ Solder Plating	7	〃	〃	Crystal Impedance Frequency	100% Inspection 〃	Characteristics Inspection Machine	〃
⑤ Marking ⑥ Press	8	〃	Specification Outgoing Inspection Standard	Crystal Impedance Frequency Isolation Resistance Appearance	Sampling 〃 〃 〃	CI Meter Frequency Counter I.R Tester Microscope	Outgoing Inspection Data Sheet
7 Finish Products Inspection	9	〃	Manufacturing Instruction Sheet	Tape Peeling Force	Sampling	Peeling Force Tester	Process Data Sheet
8 Outgoing Inspection	10	〃	Manufacturing Instruction Sheet Daily Shipping List	Destination Quantity			Delivery Slip
⑨ Taping ⑩ Packing							

Construction of MA Type Quartz Crystals(MA-406)

No. : M-990201-AE-4

unit : mm



No	Name of Part	Material	Remarks
①	Crystal CA-303		
②	Lead	42 Alloy	Pb Free Solder plate
③	Molding	Epoxy Compound (Halide free)	

RELIABILITY TEST DATA

Product Name : MA-406

The Company evaluation condition

We evaluate environmental and mechanical characteristics by the following test condition . **No. M-990202-01-001E**

No.	ITEM	TEST CONDITIONS	VALUE *1 *2 Δ f / f [1 × 10^{-6}]	TEST Qty [n]	FAIL Qty [n]
1	Drop	Free drop from 750 mm height on a hard wooden board for 3 times (Board is thickness more than 30 mm)	± 10	11	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)	± 10	22	0
3	High temperature storage	a) +125°C × 1 000 h b) +85 °C × 1 000 h	*3 a) ± 50 *3 b) ± 10	a) 22 b) 22	a) 0 b) 0
4	Low temperature storage	-55 °C × 1 000 h	*3 ± 10	22	0
5	Temperature cycle	-55 °C <=> +125 °C 30 min at each temp. 100 cycles	*3 ± 10	22	0
6	Temperature humidity storage	+85 °C × 85 %RH × 1 000 h	*3 ± 20	22	0
7	Resistance to soldering heat	Reflow furnace with the condition 2 times	± 8	22	0
8	Shear	20 N press for 10 s ± 1 s Ref. IEC 60068-2-21	No peeling - off at a solder part	11	0
9	Pull - off	10 N press for 10 s ± 1 s Ref. IEC 60068-2-21	No peeling - off at a solder part	11	0
10	Solvent resistance	Ref. JIS C 0052 or IEC 60068-2-45	The marking shall be legible	5	0
11	Solderability	Dip termination into solder bath at +230 °C ± 10 °C for 3 s (Using Rosin Flux)	Termination must be 90 % 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 Pre conditionings Initial value shall be after 24 h at room temperature.
4. Shift series resistance at before above tests should be less than 20 % or less than under mentioned values.

Vib. mode	Frequency	Δ CI
Fundamental	4.0 MHz ≦ f < 5.0 MHz	50 Ω
	5.5 MHz ≦ f < 12.0 MHz	10 Ω
	12.0 MHz ≦ f < 30.0 MHz	5 Ω
3rd overtone	26.0 MHz ≦ f ≦ 64.0 MHz	10 Ω

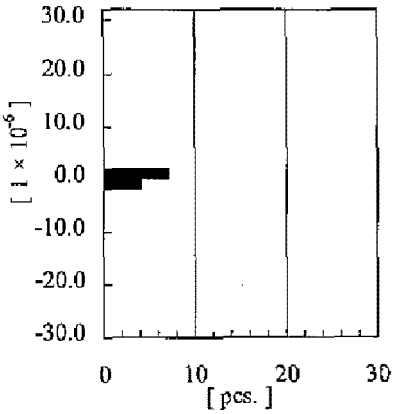
Qualification Data

Product Name : MA-406

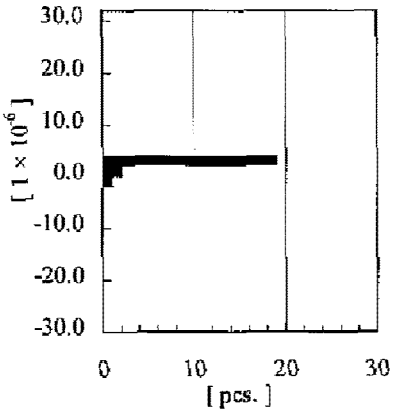
Δ f / f

No. M-990202-01-002E

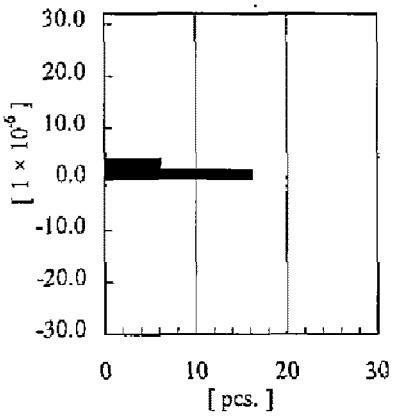
1. Drop
750 mm × 3 times



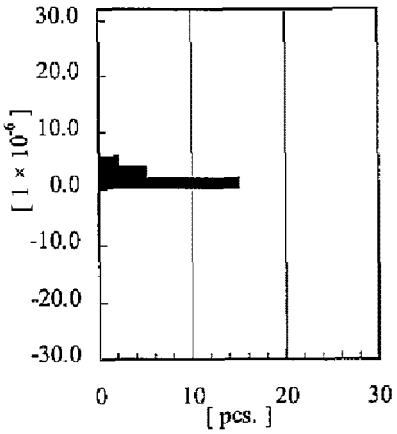
2. Vibration
10 Hz to 55 Hz amplitude 0.75 mm
55 Hz to 500 Hz acceleration 98 m/s²
15 min / cycle 6 h (2 h × 3 directions)



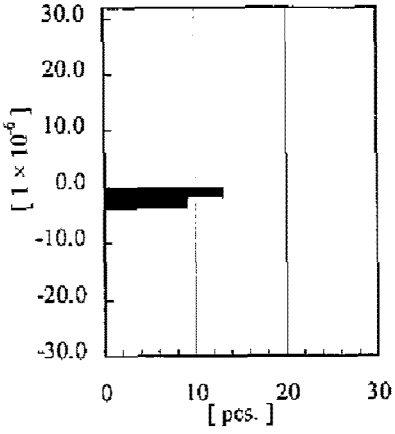
3. High temp. storage
a) +125 °C × 1 000 h



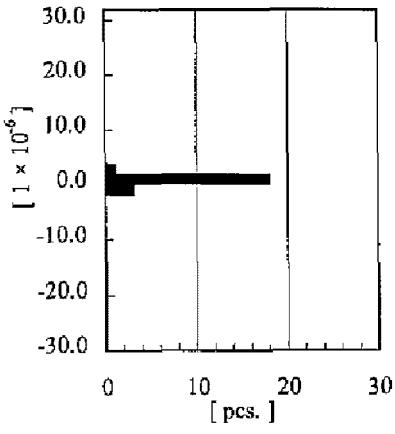
3. High temp. storage
b) +85 °C × 1 000 h



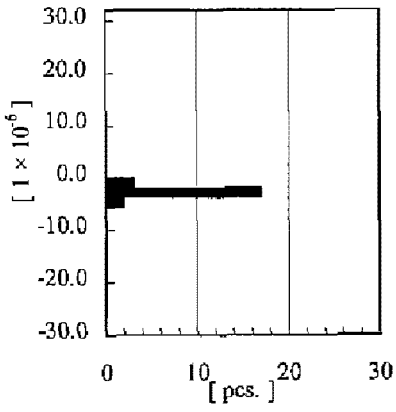
4. Low temp. storage
-55 °C × 1 000 h



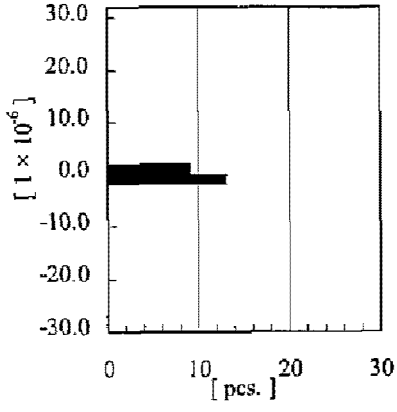
5. Temp. cycle
-55 °C ⇔ +125 °C
100 cycles



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



7. Resistance to soldering heat (Reflow characteristics)
Reflow furnace with the condition
2 times



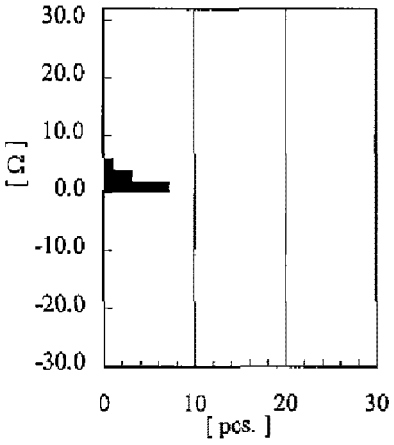
Qualification Data

Product Name : MA-406

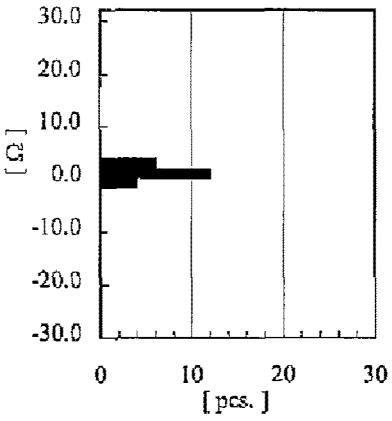
Δ CI

No. M-990202-01-003E

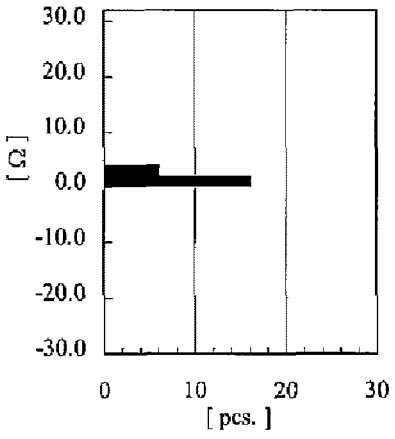
1. Drop
750 mm × 3 times



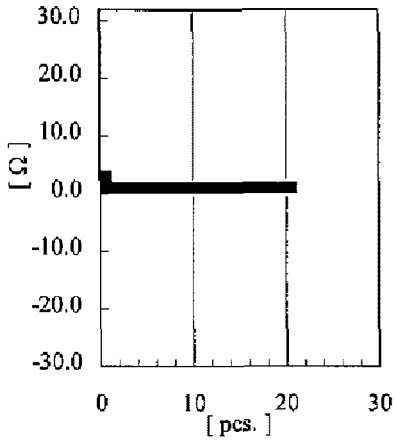
2. Vibration



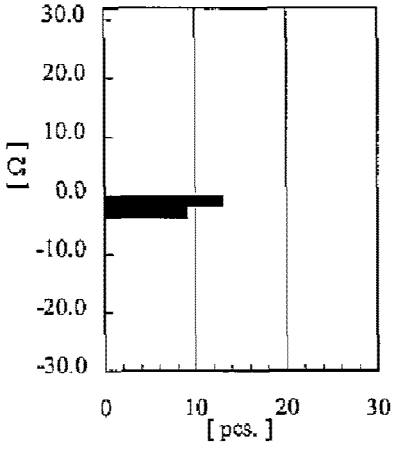
3. High temp. storage
a) +125 °C × 1 000 h



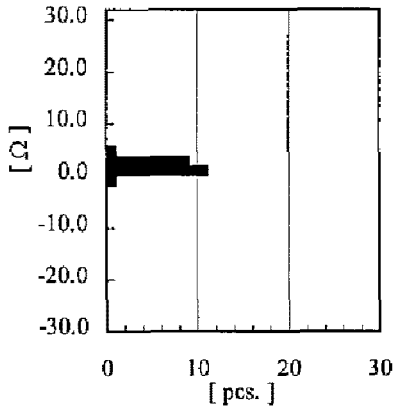
3. High temp. storage
b) +85 °C × 1 000 h



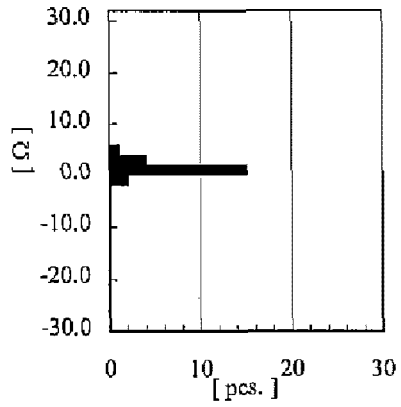
4. Low temp. storage
-55 °C × 1 000 h



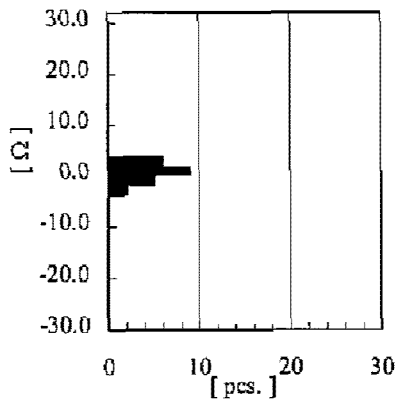
5. Temp. cycle
-55 °C ⇔ +125 °C
100 cycles



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



7. Resistance to soldering heat (Reflow characteristics)
Reflow furnace with the condition
2 times



Qualification Data