INFORMATION

PRODUCT No. : **Q22MA5061004600**

MODEL : **MA-506**

INFO. No. : **A13-804-2B**

DATE : **Nov. 26. 2013**

SEIKO EPSON CORPORATION

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INTRODUCTION

1. The contents is subject to change without notice.
   Please exchange the specification sheets regarding
   the product's warranty.

2. This sheet is not intended to guarantee or provide
   an approval of implementation of industrial patents.

3. We have prepared this sheet as carefully as possible.
   If you find it incomplete or unsatisfactory in any
   respect, We would welcome your comments.

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This product complies with RoHS Directive.

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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.

Production No. / Model

This crystal resonator's production code is

Q22MA5061004600 / MA-506.

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MSL

MSL level 1

[1] Absolute maximum ratings

Item	Symbol	Rating value
Storage temperature	TSTG	-55 °C to +125 °C
Maximum drive level	GL	2 mW

[2] Operating range

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

[3] Electrical characteristics

Item	Symbol	Value	Note
Frequency	f_1	6.144 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	80 Ω Max.	π circuit Drive level : 100 μW Ta = -20°C to +70 °C
Shunt capacitance	C_0	5 pF Max.	π circuit
Frequency temperature characteristics	Top	$\pm 30 \times 10^{-6}$	-20 °C to +70 °C(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	Δfa/f	$\pm 5 \times 10^{-6}$/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 *2 (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)　*2
3	High temperature storage	(1)　a) ± 50 b) ± 10	a) +125 °C × 1 000 h b) +85 °C × 1 000 h　*1
4	Low temperature storage	(1)　± 10	-55 °C×1 000 h　*1
5	Temperature cycle	(1)　± 10	-55 °C ⇔ +125 °C 30 min. at each temp. 100 cycles　*1
6	Temperature humidity storage	(1)　± 20	+85 °C × 85 %RH × 1 000 h　*1
7	Resistance to soldering heat	± 5	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)

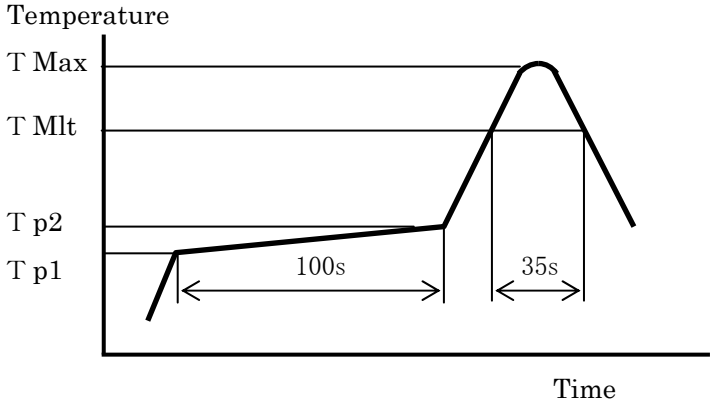
1. Item No.1 to No.7 resistance at before above tests should be less than ±20 % or less than under mentioned values.
2. *1 Each test done independently.
3. *2 Measuring 2 h to 24 h later leaving in room temperature after each test.
   (1) Measuring 24 h later leaving in room temperature after each test.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

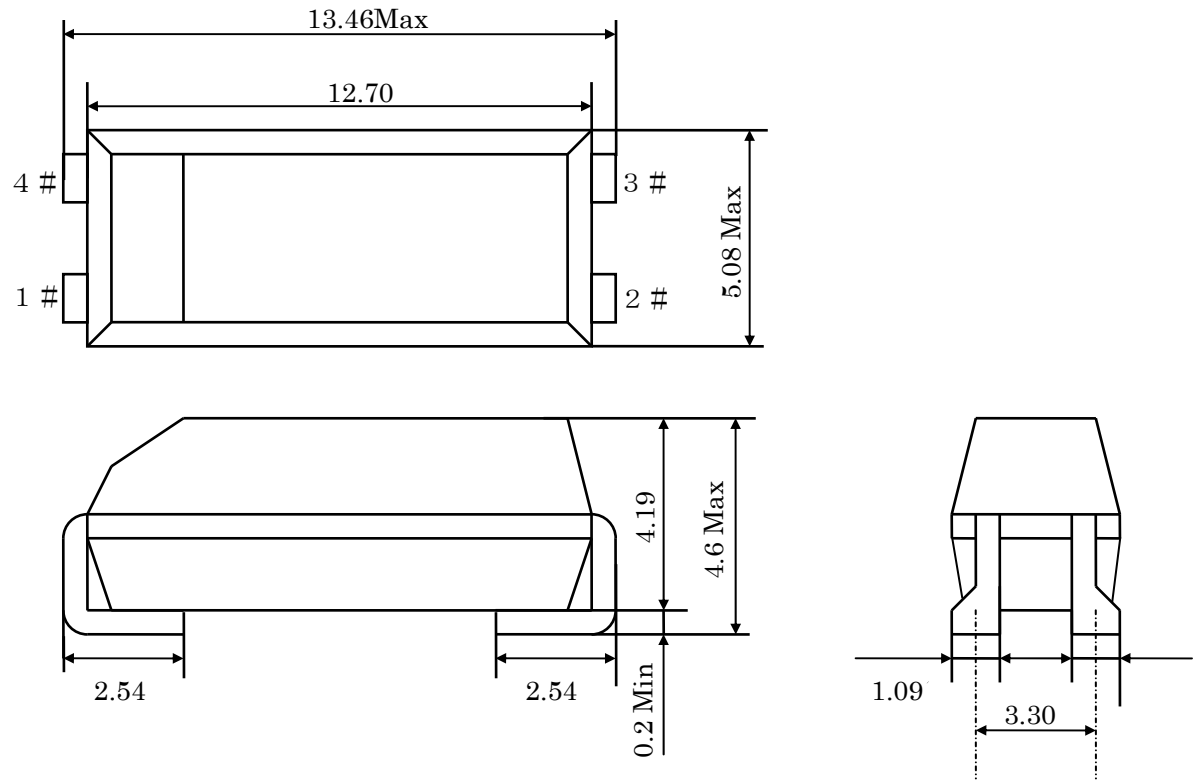
Pre Heating Temperature
　T p1～T p2 ＝ +170 °C
Heating Temperature
　T Mlt ＝ +220 °C
Peek Temperature
　T Max ＝ +260 °C

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

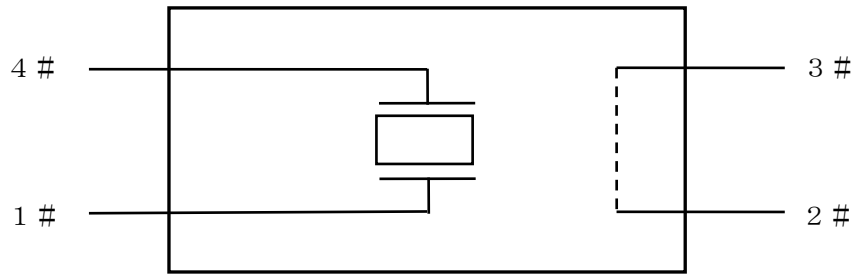


[5] Dimensions and marking layout

Dimensions



Circuit location



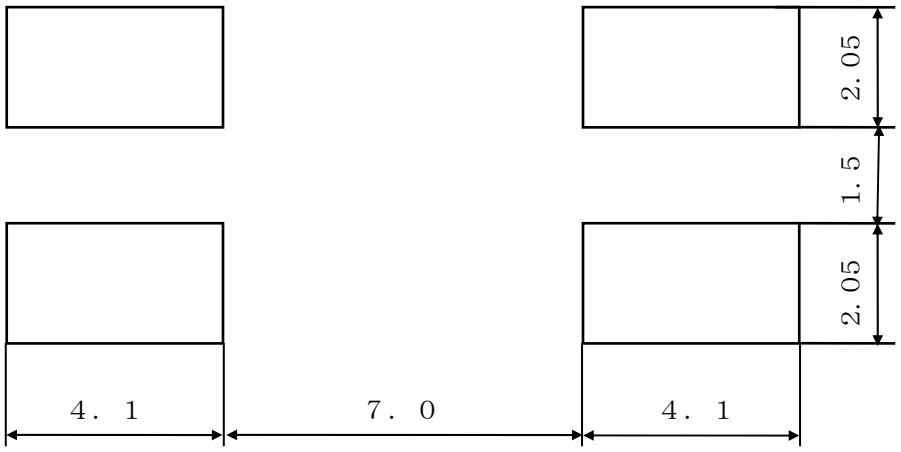
* Do not connect 2# and 3# terminals to any external terminals.

Type	MA-506	Terminal treatment	Pb Free solder plate	Unit	1 = 1 mm

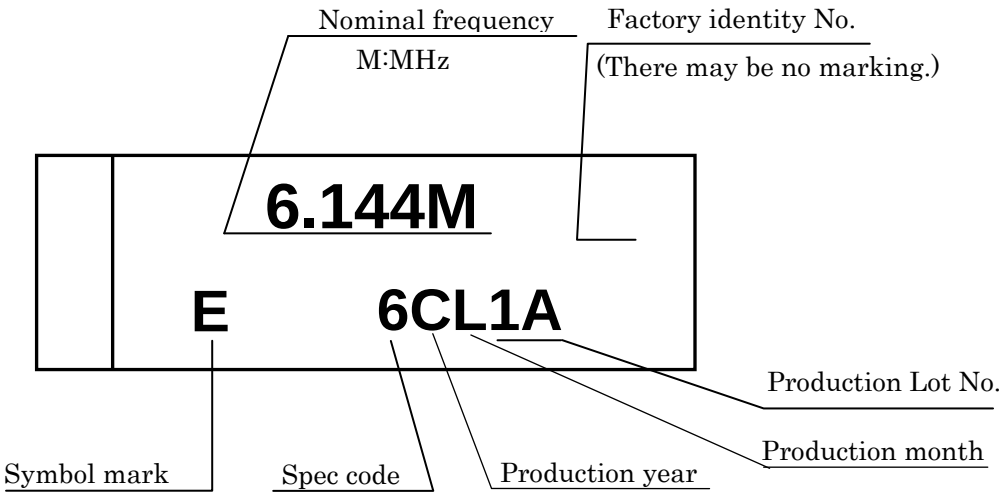
[6] Recommendable patterning and marking layout

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

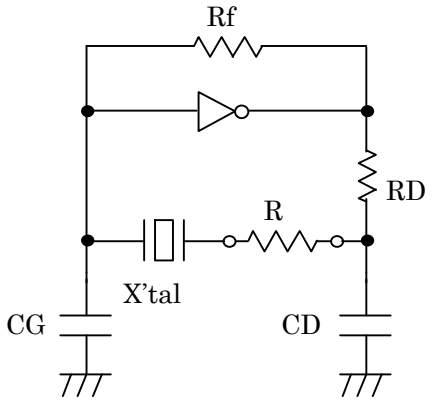
1. Max. two (2) times reflow is allowed. Once miss soldering is happen, hand work soldering by soldering iron is recommended. (+350 °C Max. × within 5 sec.)

2. Patterning should be followed by our recommended one.

3. Applying excessive excitation force to the crystal 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 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 × (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-506.

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	

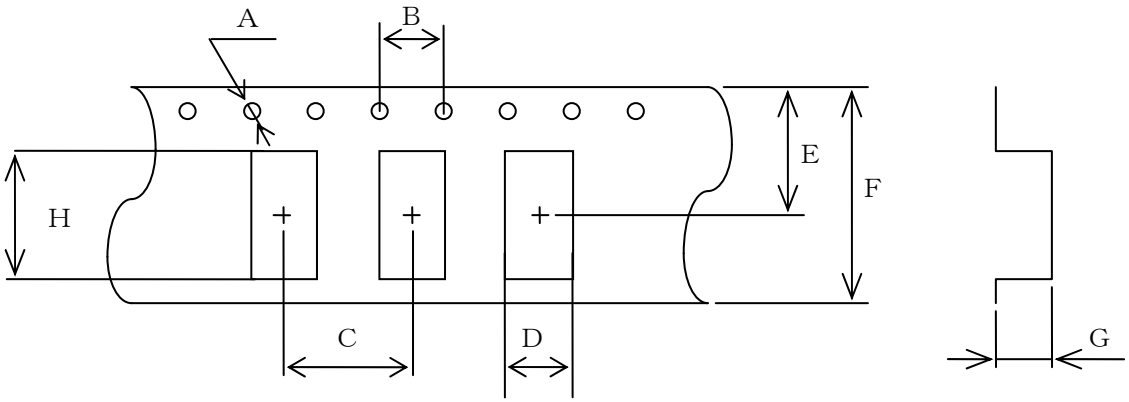
[1] Taping specification

Subject to EIA-481 & IEC-60286

(1) Tape dimensions TE-2412L

Material of the carrier tape : Polystyrene

Material of the top tape : PET

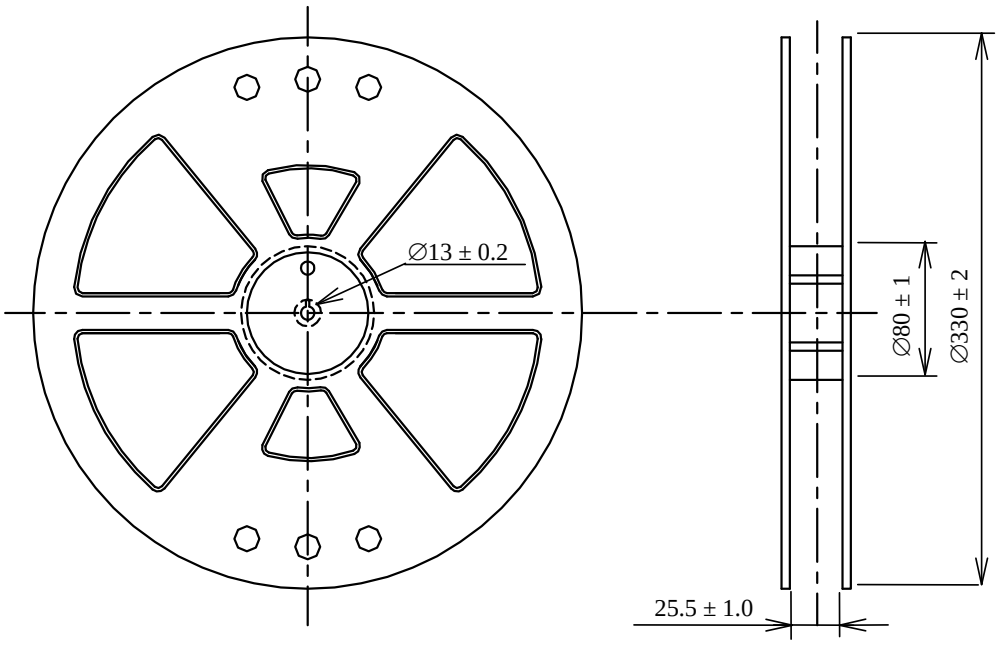


Symbol	A	B	C	D	E	F	G	H
Value	ϕ 1.5 ±0.1/-0	4.0 ±0.1	12.0 ±0.1	5.5 ±0.1	11.5 ±0.1	24.0 ±0.2	4.8 ±0.1	13.8 ±0.1

Unit : mm

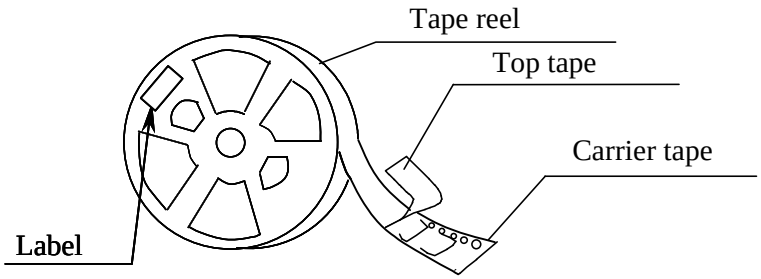
(2) Reel dimensions

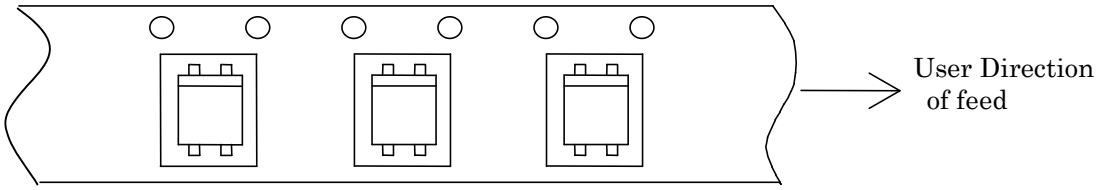
Material of the reel : Polystyrene



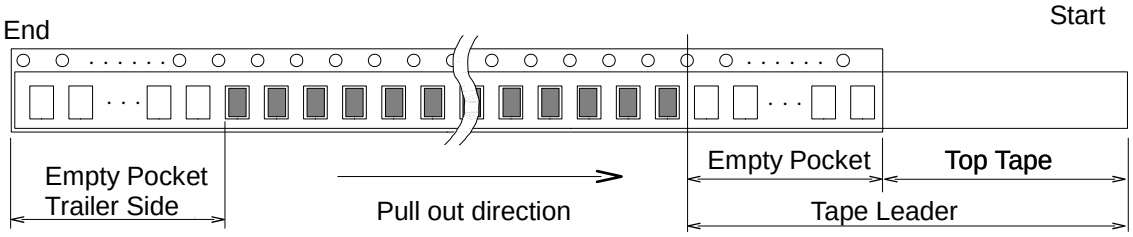
(3) Packing

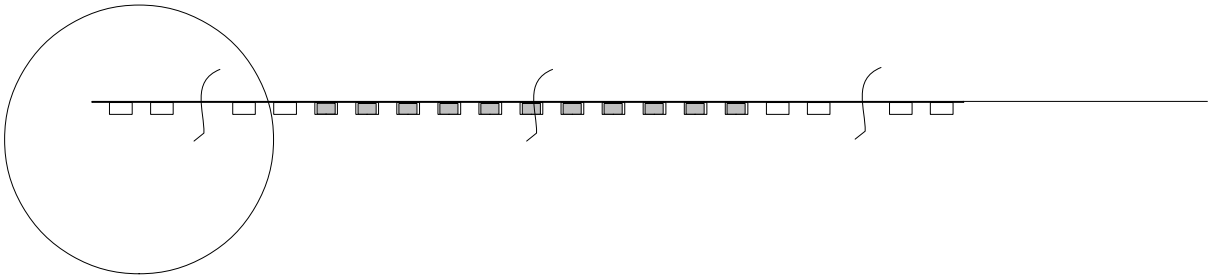
①Tape & reel　　Tape type : L





②Start & end point





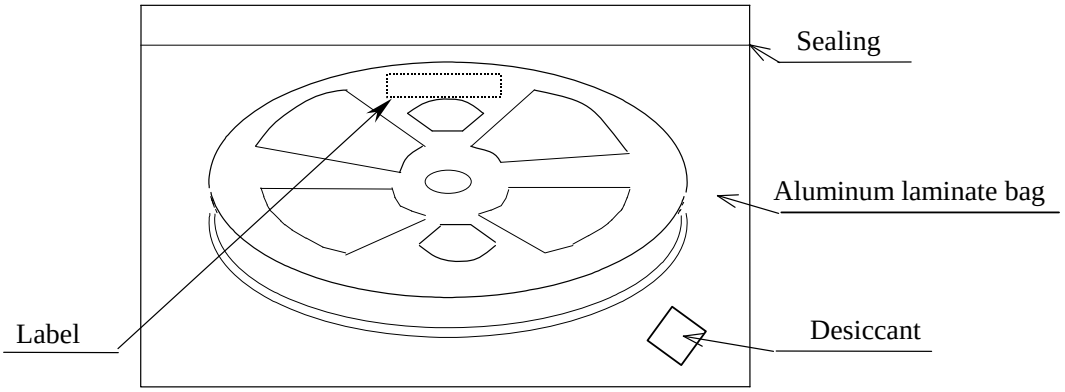
Item		Empty space
Tape leader	Top tape	Min. 1 000 mm
	Carrier tape	Min. 100 mm
Tape trailer	Top tape	Min. 0 mm
	Carrier tape	Min. 160 mm

(4) Peel force of the cover tape

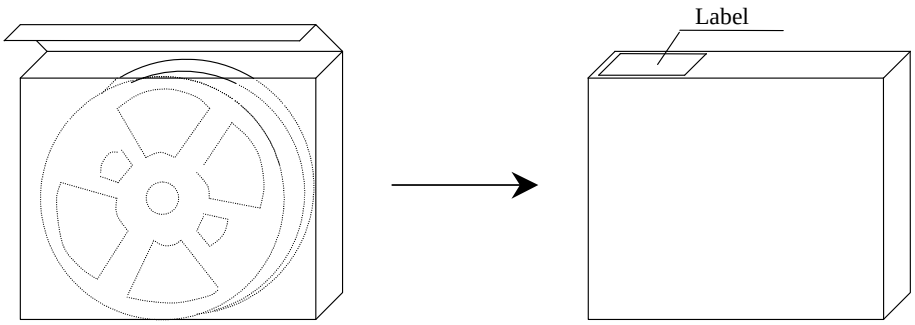
① angle : cover tape during peel off and the direction of unreeling shall be 165° to 180°.
② peel speed : 300 mm / min.
③ strength : 0.1 to 1 N.

[2] Inner carton

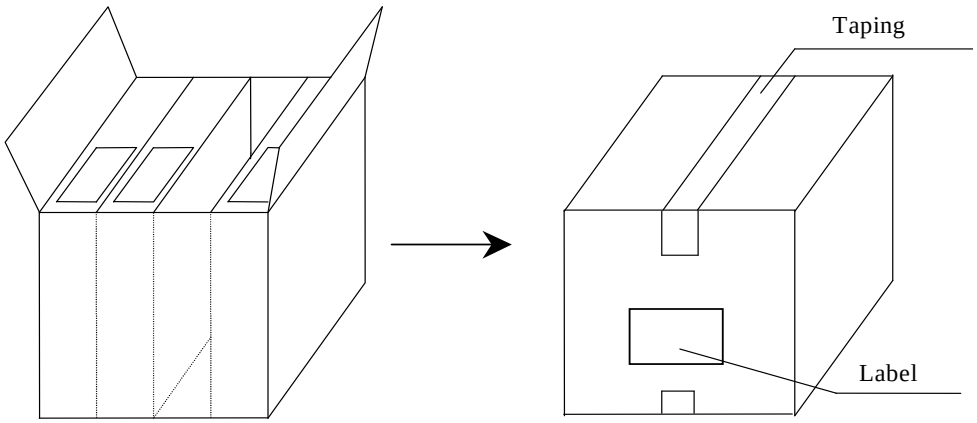
a) Packing to antistatic bag



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.

No.22-00-1-AEE-3　　MOLD TYPE AT STRIP CRYSTAL　MA－５０５／５０６　　'13.11.20

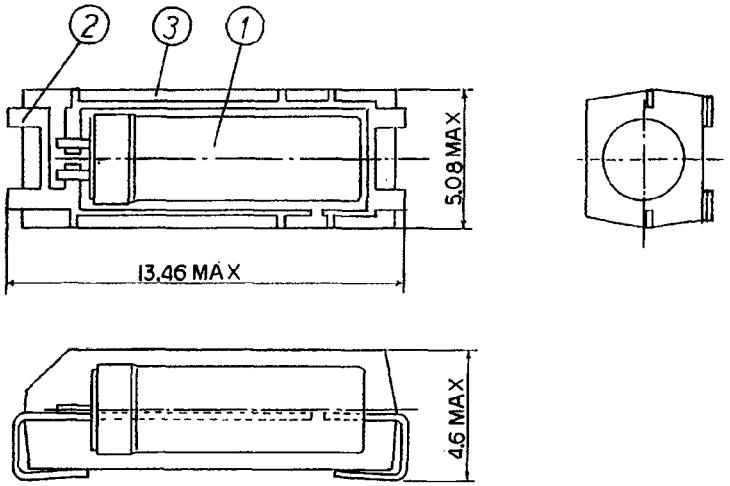
Manufacturing process chart	No.	Section In Charge	Standards	Inspection,Control Item	Inspection Methods	Instruments	Record
CA-303 Crystal ▽ Lead Frame ▽ 1' In-coming Inspection	1'	Inspection Section	Purchasing Specification,In-coming Inspection Standard	Dimension Appearance	Sampling 〃	Length Gauge Microscope	In-coming Data Sheet
	2	Malaysia Plant	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	Marking Permanence Appearance	Sampling 100% Inspection	CellophaneTape Visual Inspection	〃
③ Transfer Mold	6	〃	〃	Appearance Shape	Sampling 〃	Microscope Dial Gauge	〃
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 Marking Permanence Dimension	Sampling 〃 〃 〃 〃 〃	CI Meter Frequency Counter I.R Tester Microscope CellophaneTape T.M.S	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-505, MA-506)

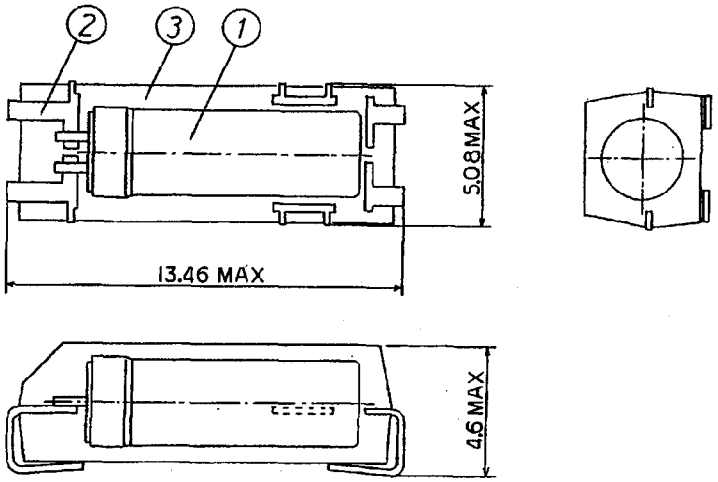
No. : M-990301-AE-2

unit : mm

MA-505



MA-506



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-505/6

The Company evaluation condition

We evaluate environmental and mechanical characteristics by the following test condition . **No. M-990401-03-001E**

No.	ITEM	TEST CONDITIONS	VALUE *1 *2 $\Delta f / f$ $[1 \times 10^{-6}]$	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	± 5	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

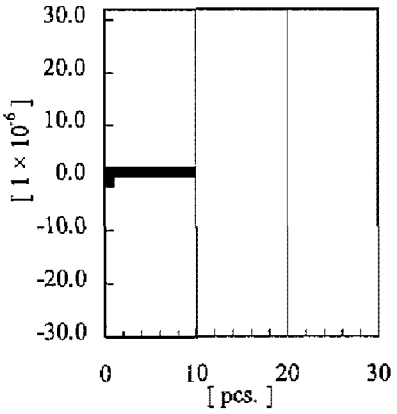
Qualification Data

Product Name : MA-505/6

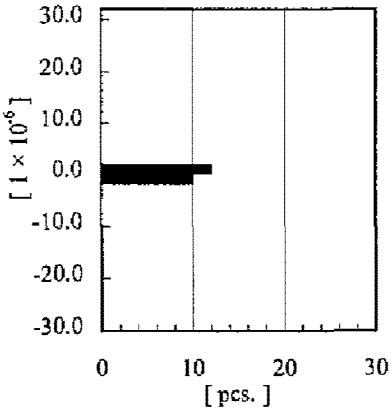
Δ f / f

No. M-990401-03-002E

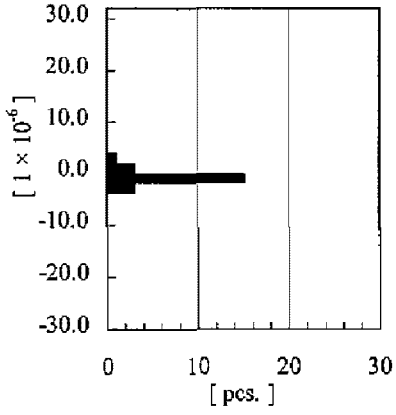
1. Drop
750 mm × 3 times



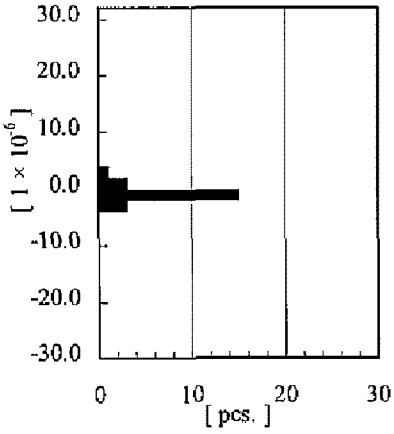
2. Vibration
10 Hz to 55 Hz amplitude 0.75 mm
55 Hz to 500 Hz acceleration 98 m/s²
15 min / cycle 6 h (2 h × 3 directions)



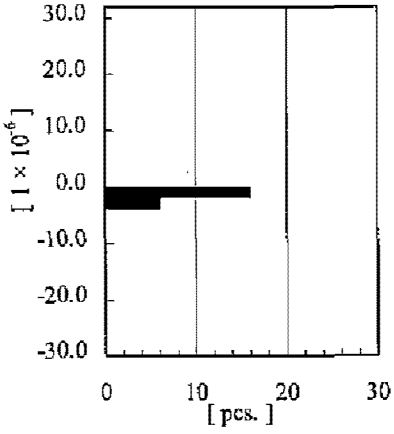
3. High temp. storage
a) +125 °C × 1 000 h



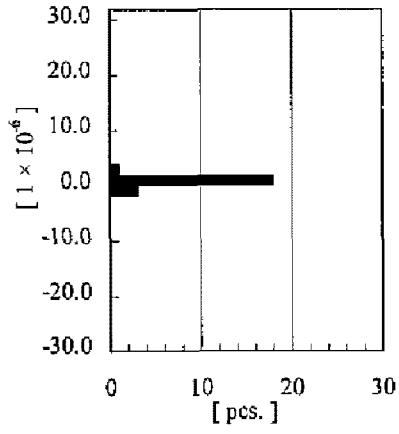
3. High temp. storage
b) +85 °C × 1 000 h



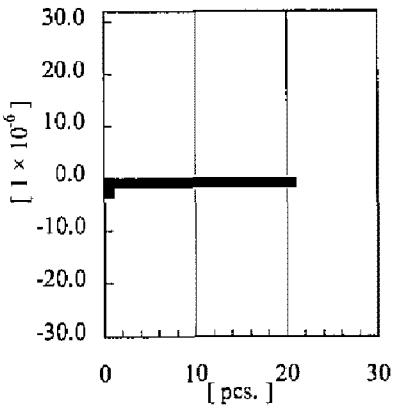
4. Low temp. storage
-55 °C × 1 000 h



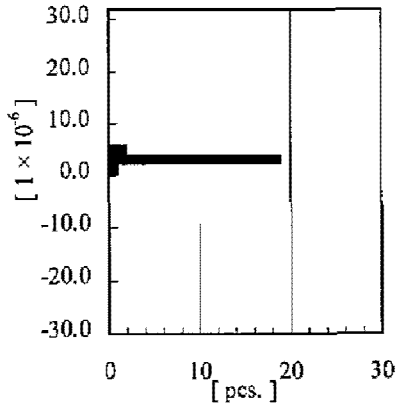
5. Temp. cycle
-55 °C ⇔ +125 °C
100 cycles



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



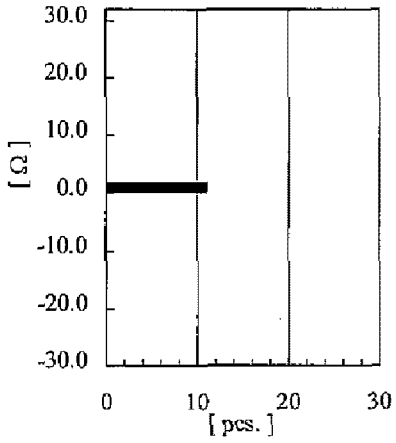
Qualification Data

Product Name : MA-505/6

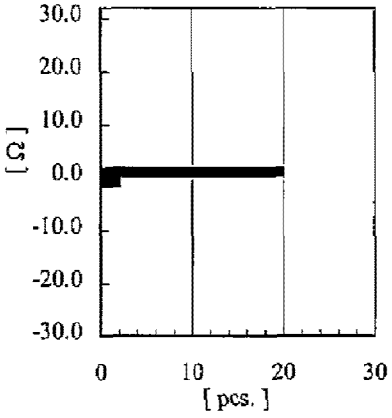
Δ CI

No. M-990401-03-003E

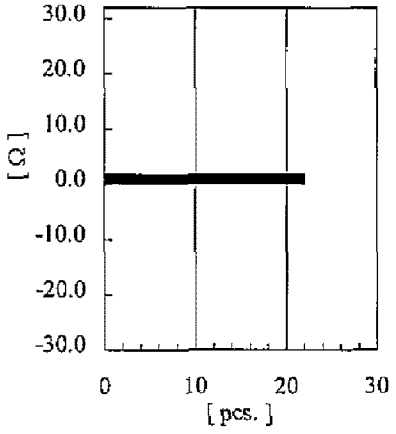
1. Drop
750 mm × 3 times



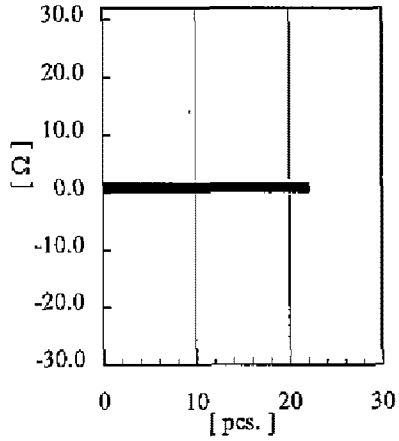
2. Vibration
10 Hz to 55 Hz amplitude 0.75 mm
55 Hz to 500 Hz acceleration 98 m/s^2
15 min / cycle 6 h (2 h × 3 directions)



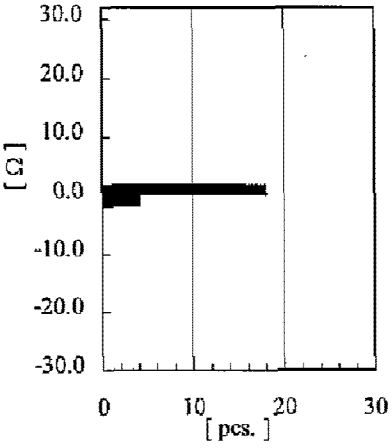
3. High temp. storage
a) +125 °C × 1 000 h



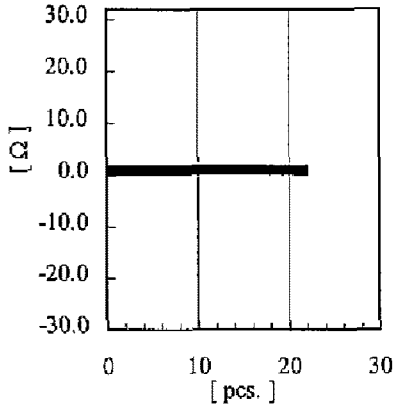
3. High temp. storage
b) +85 °C × 1 000 h



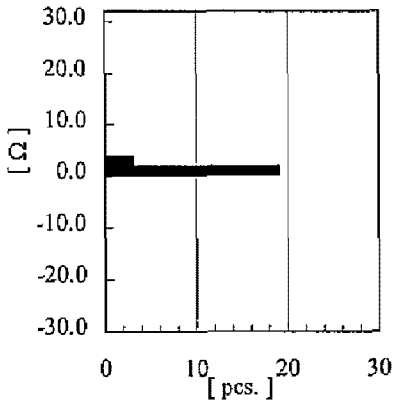
4. Low temp. storage
-55 °C × 1 000 h



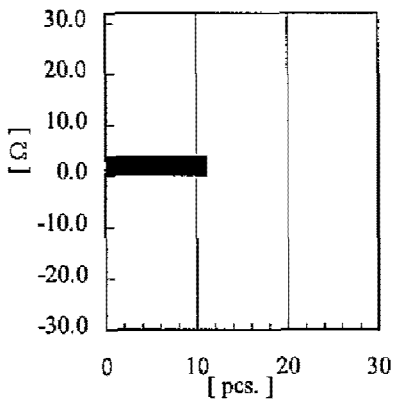
5. Temp. cycle
-55 °C ⇔ +125 °C
100 cycles



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

ATTN :Kafa Technology Co., Ltd

Quality and reliability data

No.ST13-403
Nov., 28, 2013
SEIKO EPSON CORP.
TD・CS QUALITY ASSURANCE DEPARTMENT

MODEL:MA-506

1.Machine Model

EIAJ-4701 C-111-A
(C = 200 pF ; R = 0Ω) : > ±2 000 Volt

2.Human Body Model

MIL-STD-883C , Method 3015.7
(C = 100 pF ; R = 1 500 Ω) : > ±4 000 Volt

Criterion: Frequency change rate exceeded $\pm 50 \times 10^{-6}$