

RECIPIENT

SPECIFICATIONS

MODEL : FC-13M

SPEC. No. : Q12-209-14B

DATE: Jan. 23. 2013

SEIKO EPSON CORPORATION

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

CHECKED T. Kuwahara / TD Production Engineering Department Manager
Takuo Kuwahara

CHECKED T. Usui / TD Production Engineering Department Staff
Takeshi Usui

CHECKED K. Matsumoto / TD-CS Quality Assurance Department Manager
Kazuki Matsumoto

PREPARED T. Kurumizawa / TD-CS Quality Assurance Department Senior Staff
Takashi kurumizawa

SPECIFICATIONS

1. Application

- 1) This document is applicable to the crystal unit that are delivered to ARIMA COMMUNICATION CORP. 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 clock oscillator's is X1A000031000100.
The model is FC-13M.

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 to 4
[5]	Dimensions and Marking layout	5 to 6
[6]	Notes	7

[1] Absolute maximum ratings

No.	Item	Symbol	Rating value			Unit	Note
			Min.	Typ.	Max.		
1	Storage temperature range	T_stg	- 55		+ 125	°C	Suppose to be within CI STD at + 25 °C ± 3 °C.
2	Maximum level of drive	GL		0.5		μW	

[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	0.01	0.1	0.5	μW	
3	Vibration mode		Fundamental				

[3] Static characteristics

No.	Item	Symbol	Value	Unit	Conditions	
1	Nominal Frequency	f_nom	32.768	kHz		
2	Frequency tolerance	f_tol	± 20	× 10 ⁻⁶	CL = 9 pF Ta = + 25 ± 3°C Level of drive : 0.1 μW Not include aging	
3	Motional resistance	R1	70 Max.	kΩ	CI meter : Saunders 140B Level of drive : 0.5 μW	
4	Motional capacitance	C1	3.4 Typ.	fF		
5	Shunt capacitance	C0	1.1 Typ.	pF		
6	Frequency temperature characteristics	Turnover temperature	Ti	+ 25 ± 5	°C	Values are calculated by The frequencies at + 10, + 25, + 40 °C with C-MOS circuit.
		Parabolic coefficient	B	- 0.04 Max.	× 10 ⁻⁶ /°C ²	
7	Isolation resistance	IR	500 Min.	MΩ	DC 100V± 15, 60 seconds Between terminal # 1 and terminal # 2	
8	Frequency Aging	f_age	± 3	× 10 ⁻⁶ /year	Ta = + 25 °C ± 3 °C Level of drive : 0.1 μW	

[4] Environmental and Mechanical characteristics

No.	Items	Value [$\times 10^{-6}$] *1 *2	Conditions
1	Shock resistance	*3 $\Delta f/f$: ± 15	100 g dummy(Epson Toyocom Standard), Natural drop from 1500 mm height on to the concrete. 3 directions \times 10 times
2	Vibration resistance	*3 $\Delta f/f$: ± 3	10 Hz to 55 Hz amplitude 0.75 mm 55 Hz to 500 Hz acceleration 98 m/s ² 10 Hz \rightarrow 500 Hz \rightarrow 10 Hz 15 min./cycle 6 h (2 hours , 3 directions)
3	Soldering heat resistance	$\Delta f/f$: ± 8	For convention reflow soldering furnace (3 times)
4	High temperature storage	*3 $\Delta f/f$: ± 10	+ 125 °C \times 1 000 h
		*3 $\Delta f/f$: ± 7	+ 85 °C \times 1 000 h
5	Low temperature storage	*3 $\Delta f/f$: ± 15	- 55 °C \times 1 000 h
6	High temperature and humidity	*3 $\Delta f/f$: ± 10	+ 85°C \times 85%RH \times 1 000 h
7	Temperature cycle	*3 $\Delta f/f$: ± 10	- 55 °C \leftrightarrow + 125 °C 30 minutes at each temperature \times 100 cycles
8	Sealing	*3 1×10^{-8} hPa \cdot 1 / s Max.	For He leak detector
9	Shear	No peeling-off at a soldered part	20 N press for 10 \pm 1 s. Ref. IEC 60068-2-21
10	Pull - off	No peeling-off at a soldered part	20 N press for 10 \pm 1 s. Ref. IEC 60068-2-21
11	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
12	Solderability	More than 95 % covered by solder	Dip into methyl alcohol solution of rosin for 5 sec. at + 235 \pm 5 °C

< Notes >

*1 Each test done independently.

*2 Measuring 2 h to 24 h later leaving in room temperature after each test. Drive level : 0.5 μ W

*3 Pre conditionings

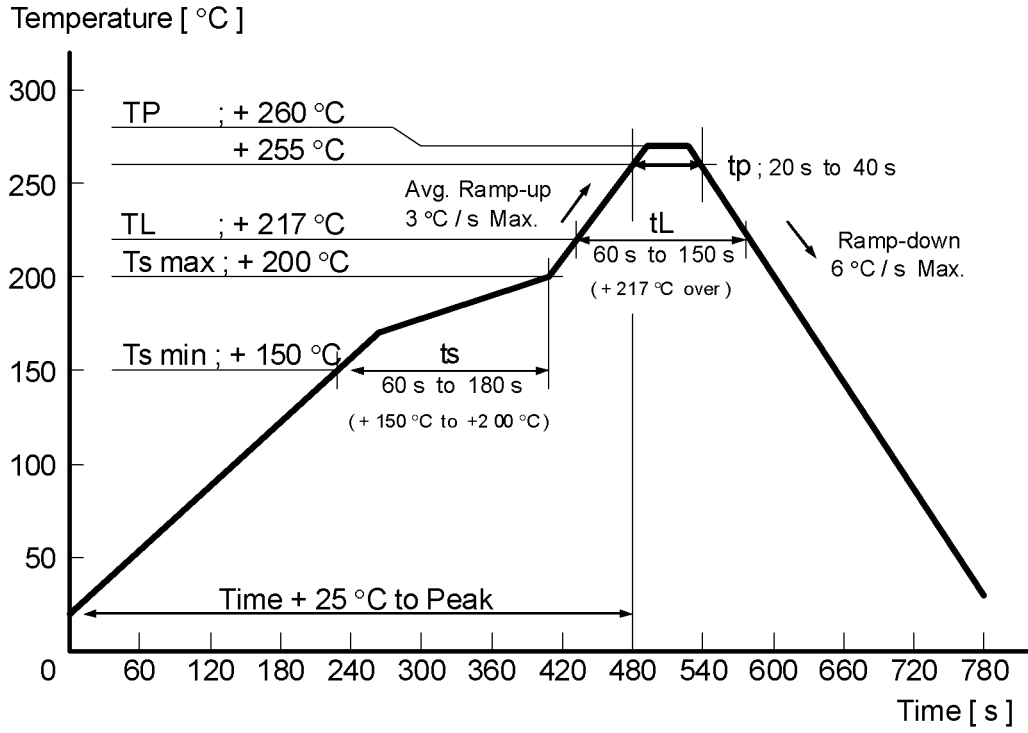
1. + 125 °C \times 24 h to +85 °C \times 85 %RH \times 168 h \pm 1 h \rightarrow reflow 3 times

2. Initial value shall be after 24 h at room temperature.

Shift of series resistance at before and after the test should be less than ± 30 % or less than ± 20 k Ω .

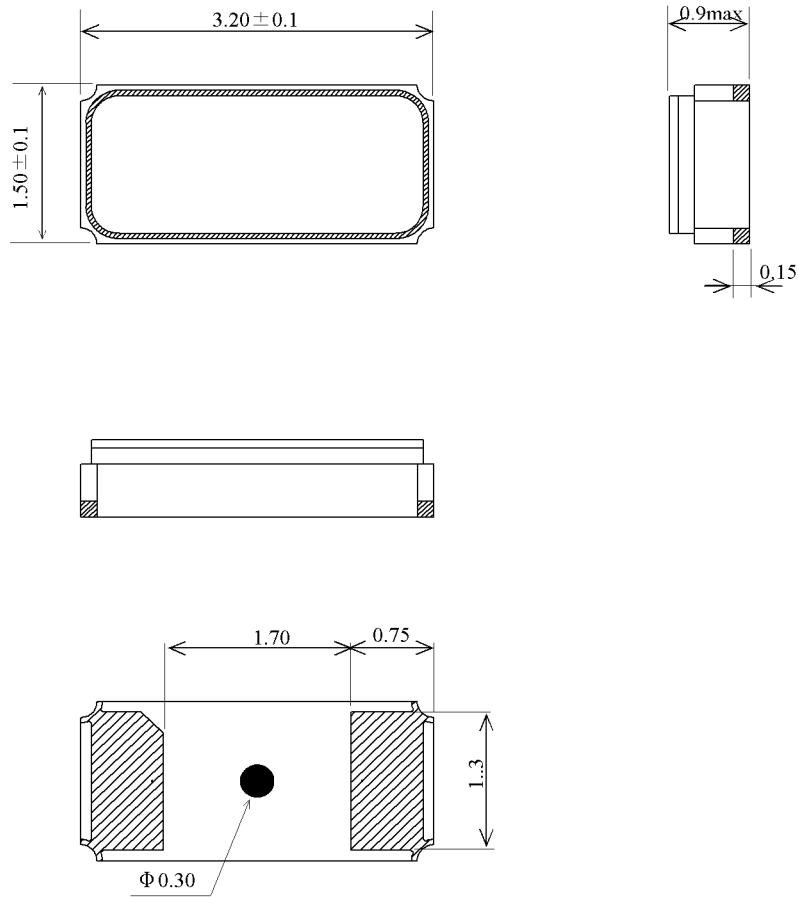
In case high temperature storage(+ 125 °C \times 1 000 h), Soldering heat resistance, shift of series resistance at before and after the test should be less than ± 40 % or ± 30 k Ω .

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

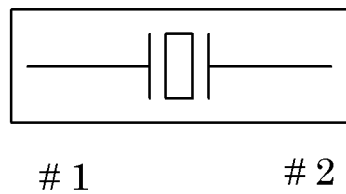


[5] Dimensions and Marking layout

1. Dimensions



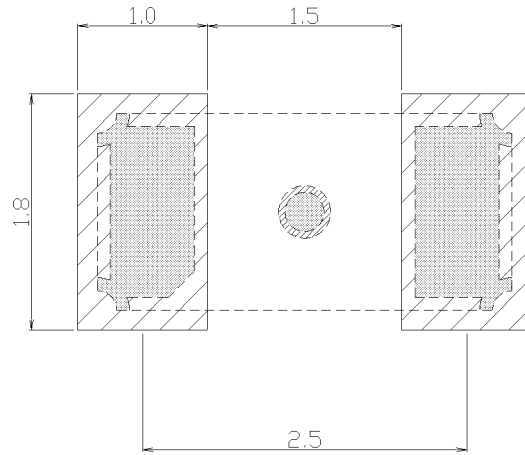
2. Internal Connection



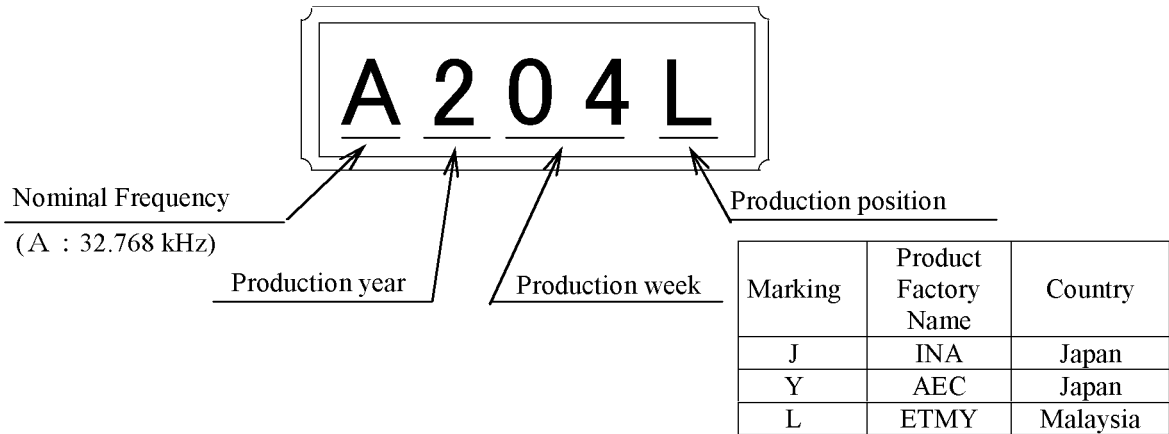
Type	FC-13M	Terminal treatment	Au plating	Unit	1 = 1 mm
------	--------	--------------------	------------	------	----------

3. Recommended soldering pattern

Unit : 1 = 1 mm



4. Marking layout



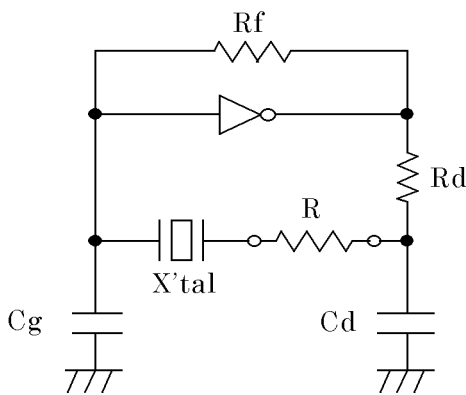
* The above marking layout shows only marking contents and their approximate position and it is not for font, size and exact position.

Type	FC-13M	Unit	1 = 1 mm
------	--------	------	----------

[6] Notes

1. Max three (3) times reflow is allowed. Once miss soldering is happened, hand work soldering by soldering iron is recommended. (+ 350 °C × within 5 s)
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 no 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
 $|-R| > CI \times (5 \sim 10)$

5. The shortest patterning line on board is recommendable.
Too long line on board may cause of abnormal oscillation.
6. This device must be stored at the normal temperature and humidity conditions before mounting on a board.
7. 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.
Please check your condition in advance to maintain shock level to be smallest.
8. Depending on the conditions, ultrasonic cleaning may cause resonant damage of the internal crystal resonator. Since we are unable to determine the conditions (type of cleaning unit, power, time, conditions inside the bath, etc.) to be used in your company, we cannot guarantee the safety of this unit when it is cleaned in an ultrasonic cleaner.
9. Please refer to packing specification regarding how to storage the products in the pack.

TAPING SPECIFICATION

1. APPLICATION

This document is applicable to FC-13M.

2. 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	

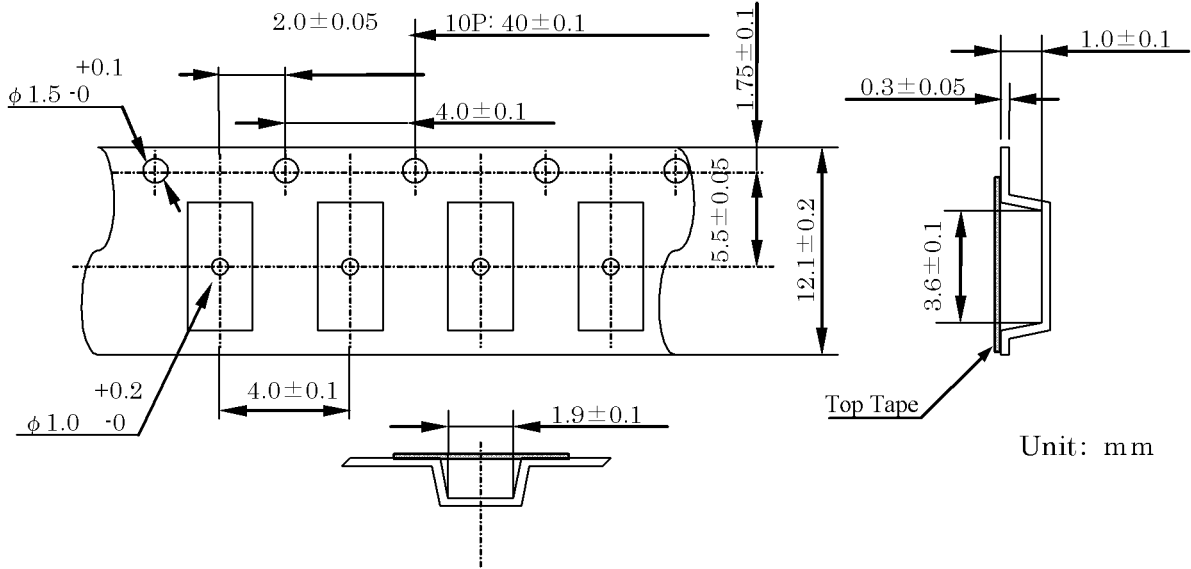
[1] Taping specification

Subject to EIA-481 and IEC 60286

(1) Tape dimensions TE1204L

Material of the Carrier Tape : PS

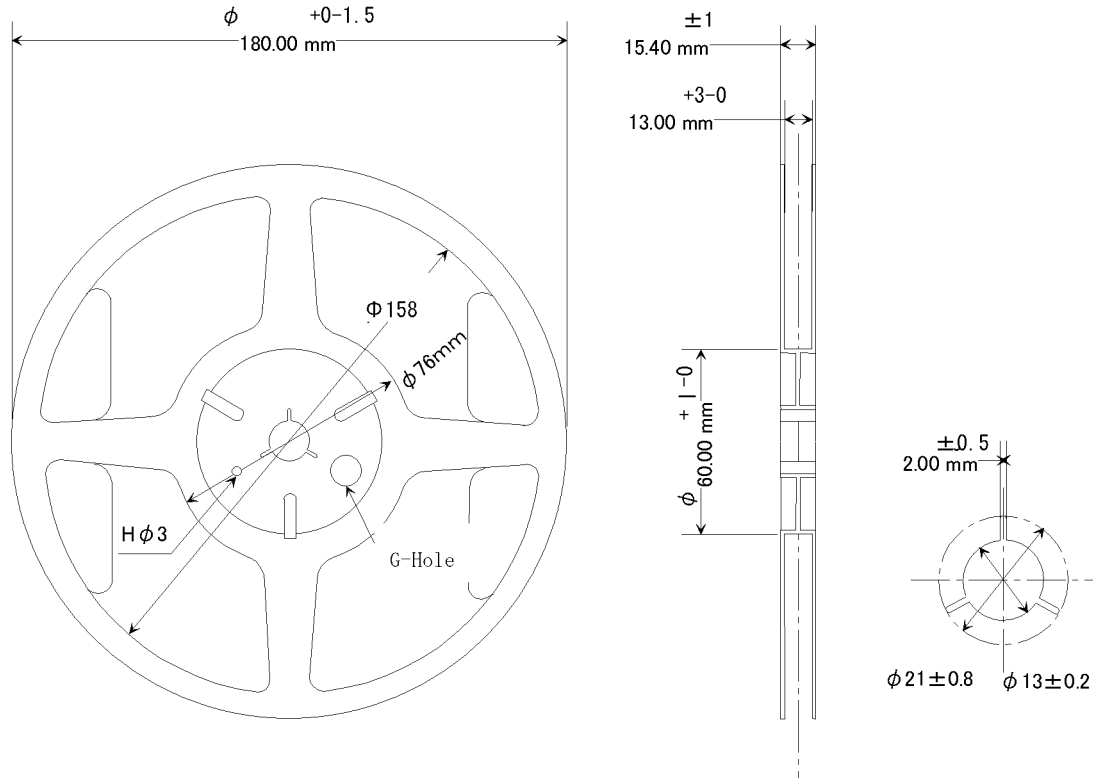
Material of the Top Tape : PET+PE



Unit: mm

(2) Reel dimensions

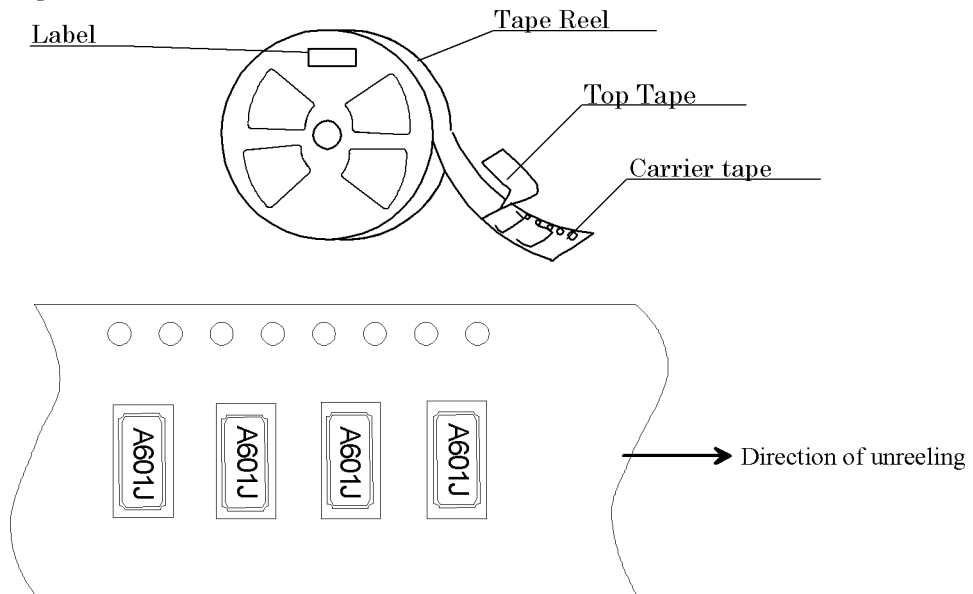
Material of the Reel : PS



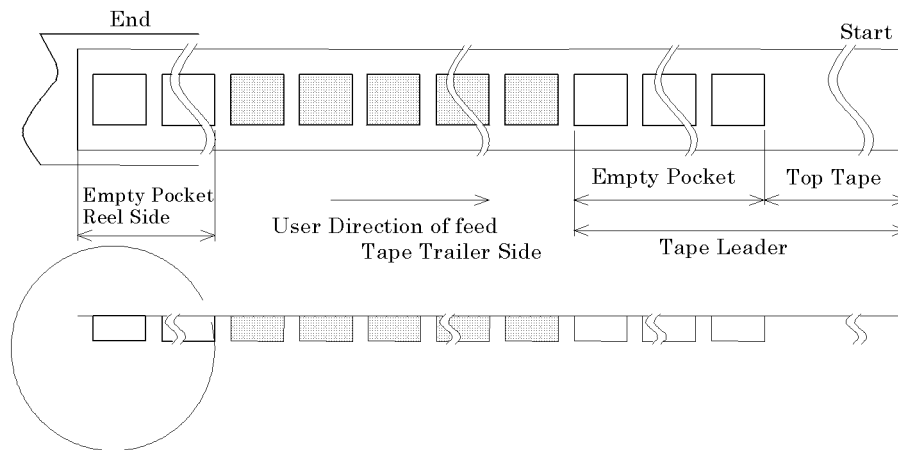
Form and Size of reel window shows are one of the example

(3) Packing

(a) Tape & Reel



(b) Start & End Point



Item		Empty Space
Tape Leader	Top Tape	Min. 1 000 mm
	Carrier Tape	Min. 80 mm
Tape Trailer	Top Tape	Min. 0 mm
	Carrier Tape	Min. 80 mm

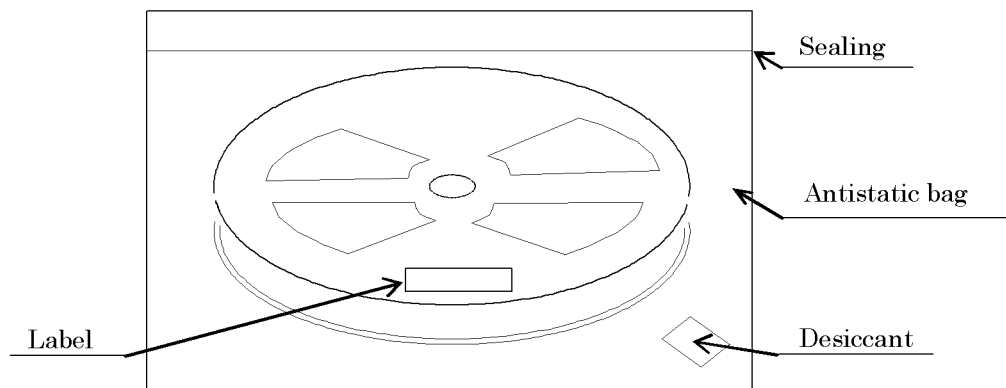
(4) Peel force of the cover tape

(a) angle : cover tape during peel off and the direction of unreeling shall be 165° to 180°.

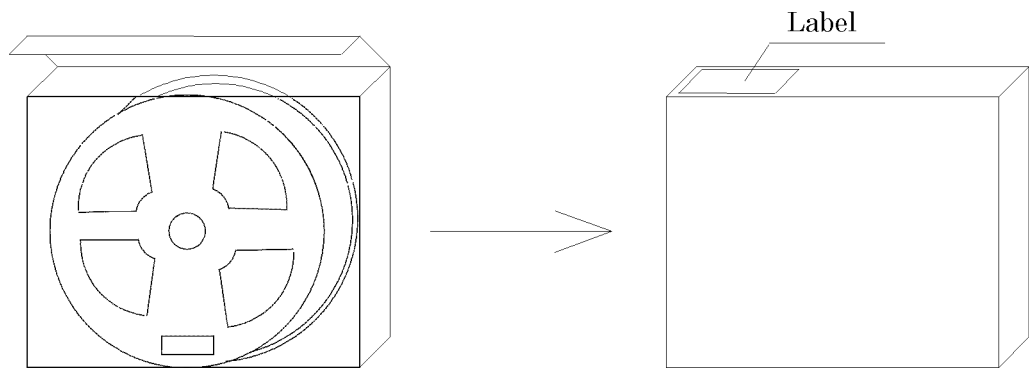
(b) peel speed : 300 mm/min

[2] Inner Carton

a) Packing to antistatic bag

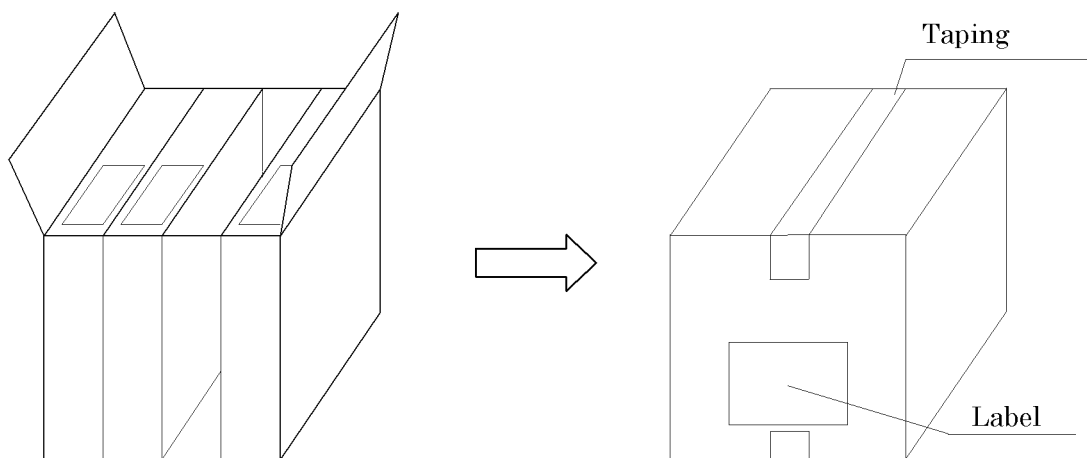


b) Packing to innercarton



[3] Shipping Carton

- Put inner boxes into an outer box.
- If there are room in the outer box, material is put in a shock absorbing together.



[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) Inner carton marking
 - Same as Reel marking.
- (3) Shipping carton marking
 - Shipping carton marking shall consist of :
 - 1) Parts name
 - 2) Quantity

[5] Quantity

- 3 000 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.

PROCESS QUALITY CONTROL

FC-13M

No. C-0701-AIE-2

2009/3/9

Manufacturing process chart		No.	Section In Charge	Standard	Inspection Control Item	Inspection Methods	Instruments	Record
	1	Inspection Section (INA Plant QA)	Purchasing Specification Incoming Inspection Standard	Appearance Dimension	Sampling Sampling	Microscope Tool Microscope	In-coming Inspection Data Sheet	
	2	INA Plant	Manufacturing Instruction Sheet	Appearance	100% Inspection	Microscope	Process Data Sheet	
	3	INA Plant	Manufacturing Instruction Sheet	Appearance	100% Inspection	Microscope	Process Data Sheet	
	4	INA Plant	Manufacturing Instruction Sheet	—	—	—	—	
	5	INA Plant	Manufacturing Instruction Sheet	—	—	—	—	
	6	INA Plant	Manufacturing Instruction Sheet	Frequency	100% Inspection	Frequency Adjustment Machine	Data Sheet	
	7	INA Plant	Manufacturing Instruction Sheet	Appearance	100% Inspection	Microscope	Process Data Sheet	
	8	INA Plant	Manufacturing Instruction Sheet	Appearance	100% Inspection	Microscope	Process Data Sheet	
	9	INA Plant	Manufacturing Instruction Sheet	Appearance	100% Inspection	Microscope	Process Data Sheet	
	10	INA Plant	Manufacturing Instruction Sheet	Frequency Crystal Impedance	100% Inspection 100% Inspection	Characteristics In- spection Machine	Process Data Sheet	
	11	INA Plant	Specification Outgoing Inspection Standard	Electrical Characteristics Appearance Dimension	Sampling Sampling Sampling	Measuring Equipment Microscope Tool Microscope	Outgoing Inspection Data Sheet	
	12	INA Plant	Packing Instruction Daily Shipping List	Customers Type Quantity	— — —	— — —	Shipping List	

PROCESS QUALITY CONTROL

FC-13M

No. C-0701-AAE-1

2009/3/9

Manufacturing process chart		No.	Section In Charge	Standard	Inspection Control Item	Inspection Methods	Instruments	Record
	1	Inspection Section (INA Plant QA)	Purchasing Specification Incoming Inspection Standard	Appearance Dimension	Sampling Sampling	Microscope Tool Microscope	In-coming Inspection Data Sheet	
	2	AKITA Plant	Manufacturing Instruction Sheet	Appearance	100% Inspection	Microscope	Process Data Sheet	
	3	AKITA Plant	Manufacturing Instruction Sheet	Appearance	100% Inspection	Microscope	Process Data Sheet	
	4	AKITA Plant	Manufacturing Instruction Sheet	—	—	—	—	
	5	AKITA Plant	Manufacturing Instruction Sheet	—	—	—	—	
	6	AKITA Plant	Manufacturing Instruction Sheet	Frequency	100% Inspection	Frequency Adjustment Machine	Data Sheet	
	7	AKITA Plant	Manufacturing Instruction Sheet	Appearance	100% Inspection	Microscope	Process Data Sheet	
	8	AKITA Plant	Manufacturing Instruction Sheet	Appearance	100% Inspection	Microscope	Process Data Sheet	
	9	AKITA Plant	Manufacturing Instruction Sheet	Appearance	100% Inspection	Microscope	Process Data Sheet	
	10	AKITA Plant	Manufacturing Instruction Sheet	Frequency Crystal Impedance	100% Inspection 100% Inspection	Characteristics In- spection Machine	Process Data Sheet	
	11	AKITA Plant	Specification Outgoing Inspection Standard	Electrical Characteristics Appearance Dimension	Sampling Sampling Sampling	Measuring Equipment Microscope Tool Microscope	Outgoing Inspection Data Sheet	
	12	AKITA Plant	Packing Instruction Daily Shipping List	Customers Type Quantity	— — —	— — —	Shipping List	

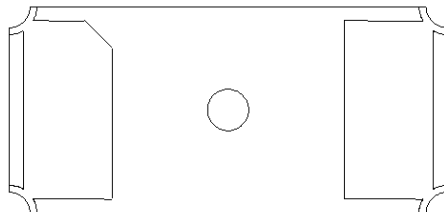
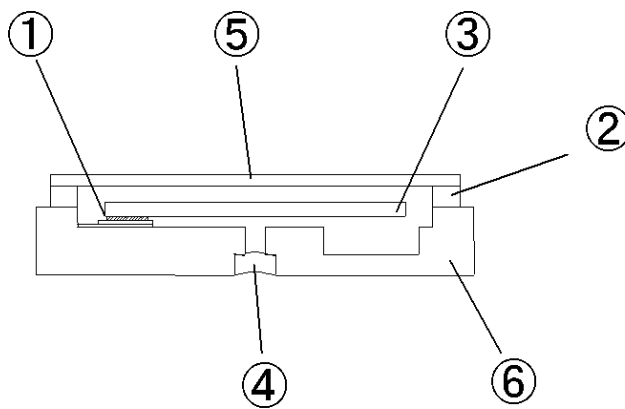
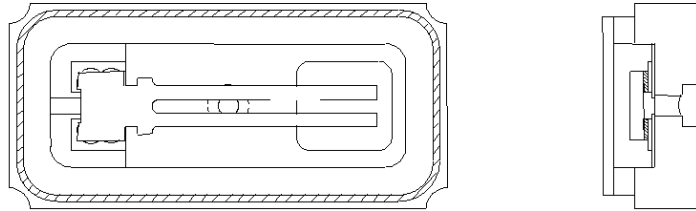
PROCESS QUALITY CONTROL

FC-13M
No. C-0701-AME-1

2009/3/9

Manufacturing process chart		No.	Section In Charge	Standard	Inspection Control Item	Inspection Methods	Instruments	Record
	1	Inspection Section (INA Plant QA)	Purchasing Specification Incoming Inspection Standard	Appearance Dimension	Sampling Sampling	Microscope Tool Microscope	In-coming Inspection Data Sheet	
	2	MALAYSIA Plant	Manufacturing Instruction Sheet	Appearance	100% Inspection	Microscope	Process Data Sheet	
	3	MALAYSIA Plant	Manufacturing Instruction Sheet	Appearance	100% Inspection	Microscope	Process Data Sheet	
	4	MALAYSIA Plant	Manufacturing Instruction Sheet	—	—	—	—	
	5	MALAYSIA Plant	Manufacturing Instruction Sheet	—	—	—	—	
	6	MALAYSIA Plant	Manufacturing Instruction Sheet	Frequency	100% Inspection	Frequency Adjustment Machine	Data Sheet	
	7	MALAYSIA Plant	Manufacturing Instruction Sheet	Appearance	100% Inspection	Microscope	Process Data Sheet	
	8	MALAYSIA Plant	Manufacturing Instruction Sheet	Appearance	100% Inspection	Microscope	Process Data Sheet	
	9	MALAYSIA Plant	Manufacturing Instruction Sheet	Appearance	100% Inspection	Microscope	Process Data Sheet	
	10	MALAYSIA Plant	Manufacturing Instruction Sheet	Frequency Crystal Impedance Appearance	100% Inspection 100% Inspection 100% Inspection	Characteristics In- spection Machine Microscope	Process Data Sheet	
	11	MALAYSIA Plant	Specification Outgoing Inspection Standard	Electrical Characteristics Appearance Dimension	Sampling Sampling Sampling	Measuring Equipment Microscope Tool Microscope	Outgoing Inspection Data Sheet	
	12	MALAYSIA Plant	Packing Instruction Daily Shipping List	Customers Type Quantity	— — —	— — —	Shipping List	

Structure diagram FC-13M



LIST		
	Name of part	Material
①	Crystal Adhesive	Ag Paste
②	Sealing	Seal ring
③	Chip	Crystal
④	Sealing	Au/Ge
⑤	Lid	Kovar
⑥	Package	Ceramic (Al ₂ O ₃)

RELIABILITY TEST DATA

Product Name : FC-13M J-STD-020C

The Company evaluation condition

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

F-C-0701-01-001J

No.	ITEM	TEST CONDITIONS	VALUE *1 *2		TEST Qty [n]	FAIL Qty [n]
			$\Delta f / f$ [1×10^{-6}]			
1	Shock	100 g dummy (Epson Toyocom Standard) drop from 1 500 mm height on to the concrete 3 directions 10 times	*3	± 15	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	± 3	22	0
3	Resistance to soldering heat	For air reflow soldering furnace (3 times) Ref. J-STD-020C		± 8	22	0
4	High temperature storage	a) +125°C × 1 000 h	*3	a) ± 10	a) 22	a) 0
		b) +85 °C × 1 000 h	*3	b) ± 7	b) 22	b) 0
5	Low temperature storage	-55 °C × 1 000 h	*3	± 15	22	0
6	Temperature humidity storage	+85 °C × 85 %RH × 1 000 h	*3	± 10	22	0
7	Temperature cycle	-55 °C ⇔ +125 °C 30 min at each temp. 100 cycles	*3	± 10	22	0
8	Sealing	For He leak detector	*3	1×10^{-8} hPa · 1 / s Max.	11	0
9	Shear	20 N press for 10 s ± 1 s Ref. IEC 60068-2-21		No peeling - off at a solder part	11	0
10	Pull - off	20 N press for 10 s ± 1 s Ref. IEC 60068-2-21		No peeling - off at a solder part	11	0
11	Substrate bending	Bend width reaches 3 mm and hold for 5 s ± 1 s × 1 time Ref. IEC 60068-2-21		No peeling - off at a solder part	11	0
12	Solvent resistance	Ref. JIS C 0052 or IEC 60068-2-45		The marking shall be legible	11	0

Notes

*1 Each test done independently.

*2 Measuring 2 h to 24 h later leaving in room temperature after each test. DL : 0.5 μW

*3 Pre conditionings(Treat the Reflow 3 times with the following profile) Initial value shall be after 24 h at room temperature. Shift of series resistance at before and after the test should be less than ±30 % or less than ±20 kΩ.

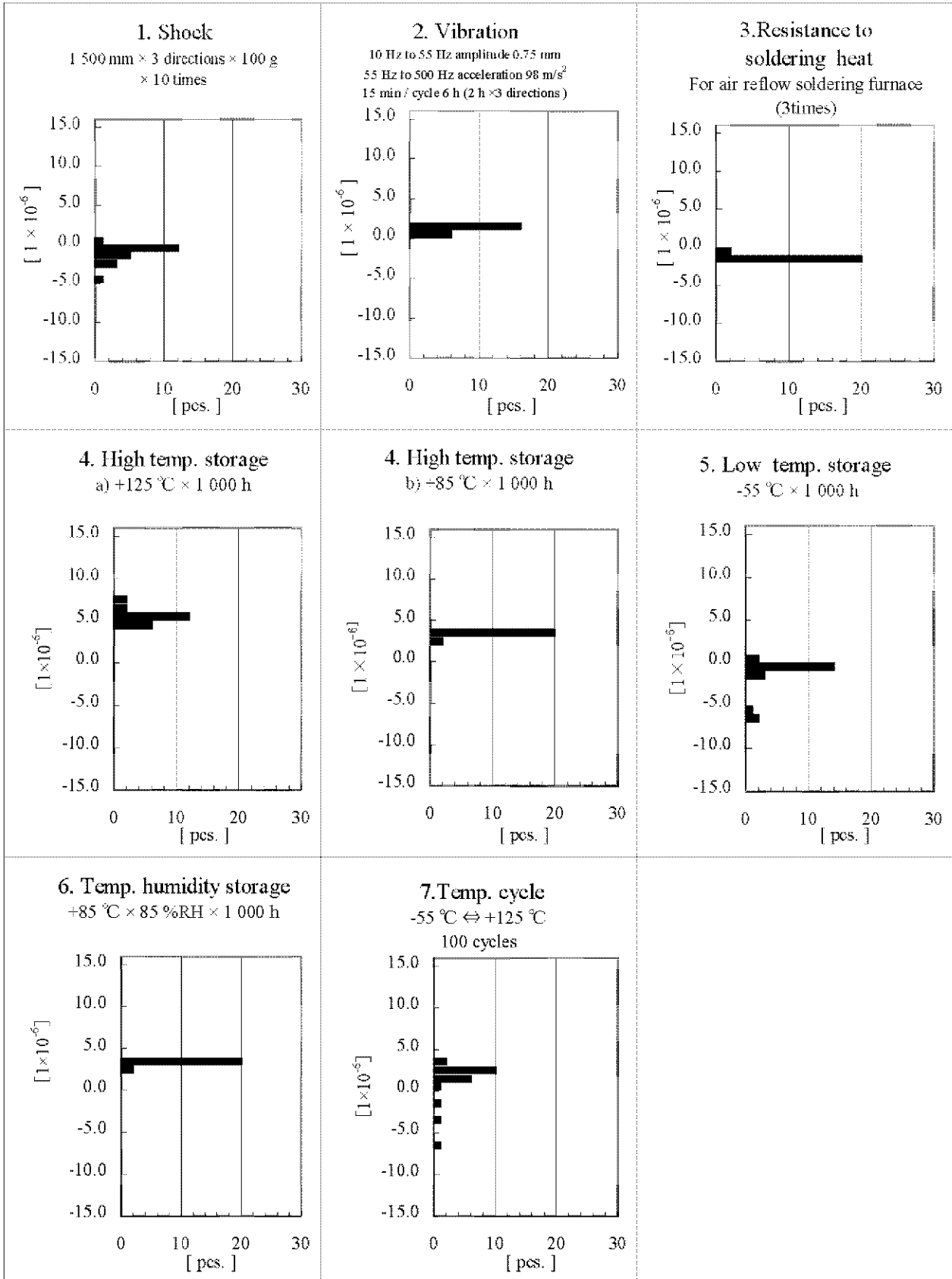
In case high temperature storage(+125 °C × 1 000 h), Soldering heat resistance, shift of series resistance at before and after the test should be less than ±40 % or ±30 kΩ.

Qualification Data

Product Name : FC-13M J-STD-020C

$\Delta f/f$

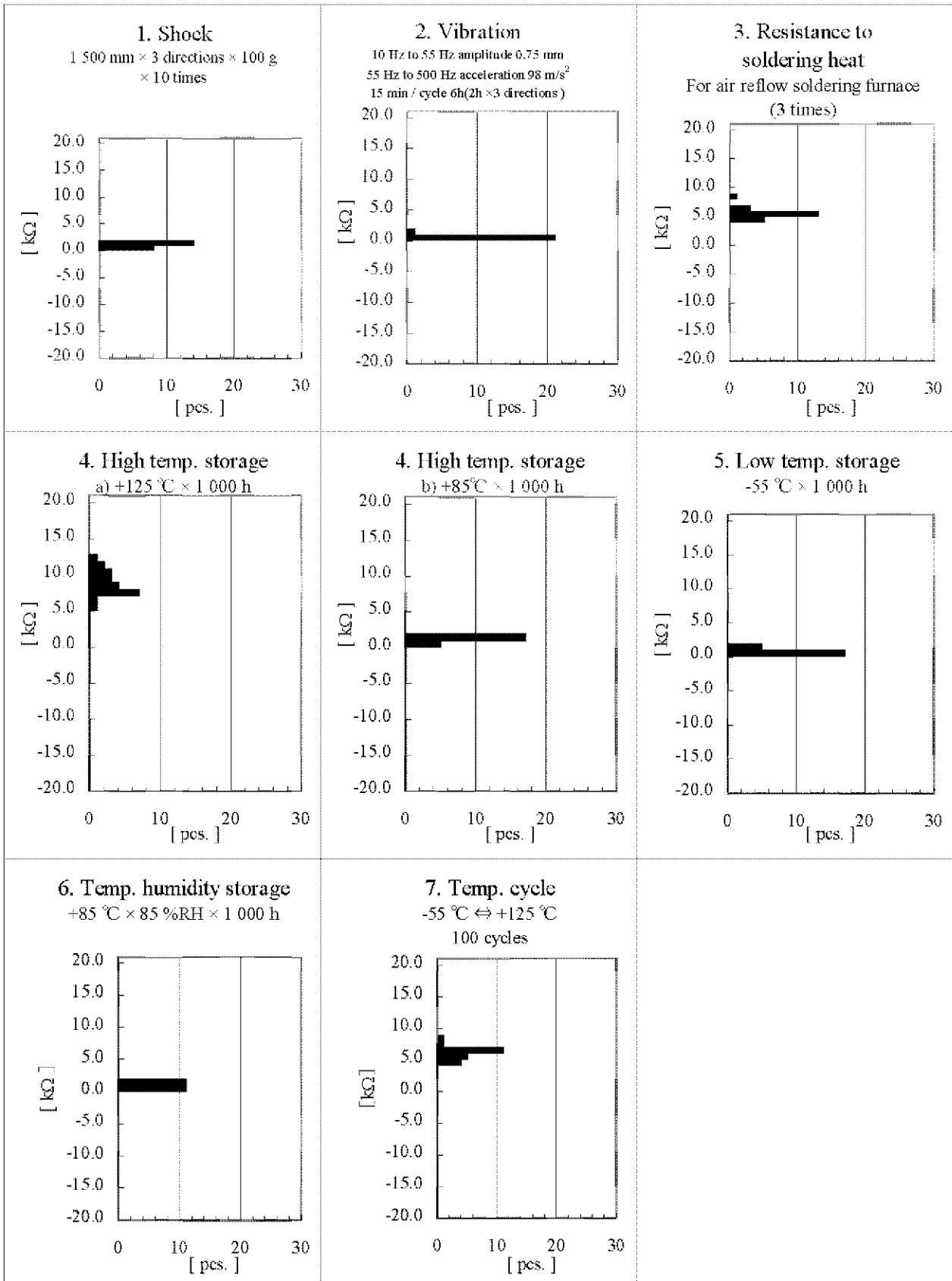
F-C-0701-01-002E



Product Name : FC-13M J-STD-020C

Δ CI

F-C-0701-01-003E



To: ARIMA COMMUNICATION CORP.

No.ST12-514
Jan.23.2013

SEIKO EPSON CORPORATION
TD•CS Quality Assurance Dept.

Product Name: FC-13M
Subject: ESD and MSL

Thank you for choosing Seiko Epson Corp. as your Timing Device supplier.
We would like to report our reply about above issue as below.

- 1) E.S.D
 - Machine Model
(C=200 pF;R=0 Ω) : > ±300 Volt
 - Human Body Model
(C=100 pF;R=1 500 Ω) : > ±1000 Volt

- 2) MSL
FC-13M: MSL Level 1
-