

INFORMATION

PRODUCT No. : Q13MC3062000600

MODEL : MC-306

INFO. No. : A14-067-9A

DATE : Jun. 17. 2014

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.

SPECIFICATIONS

1) RoHS compliant

MC-306 contains lead in high melting type solder which is exempted in RoHS directive.

2) 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.

3) 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.

Product No. / Model

The product No. of this crystal unit is Q13MC3062000600.

The model is MC-306.

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[1] Absolute maximum ratings

No.	Item	Symbol	Rating value			Unit	Note
			Min.	Typ.	Max.		
1	Storage temperature range	T_stg	- 55		+ 125	°C	
2	Maximum level of drive	GL		1.0		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		0.1		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 = 6 pF Ta = + 25 ± 3 °C Not include aging	
3	Quality factor	Q	5.0Min.	× 10 ⁴	Decay method	
4	Motional resistance	R1	50 Max.	kΩ	CI meter : Saunders 140B Level of drive : 1.0 μW	
5	Motional capacitance	C1	1.8 Typ.	fF		
6	Shunt capacitance	C0	0.9 Typ.	pF		
7	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	
8	Isolation resistance	IR	500 Min.	MΩ	DC 100 V ± 15, 60 seconds Between terminal # 1 and terminal # 4	
9	Frequency Aging	f_age	± 3	× 10 ⁻⁶ /year	Ta = + 25 °C ± 3 °C	

[4] Environmental and mechanical characteristic

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

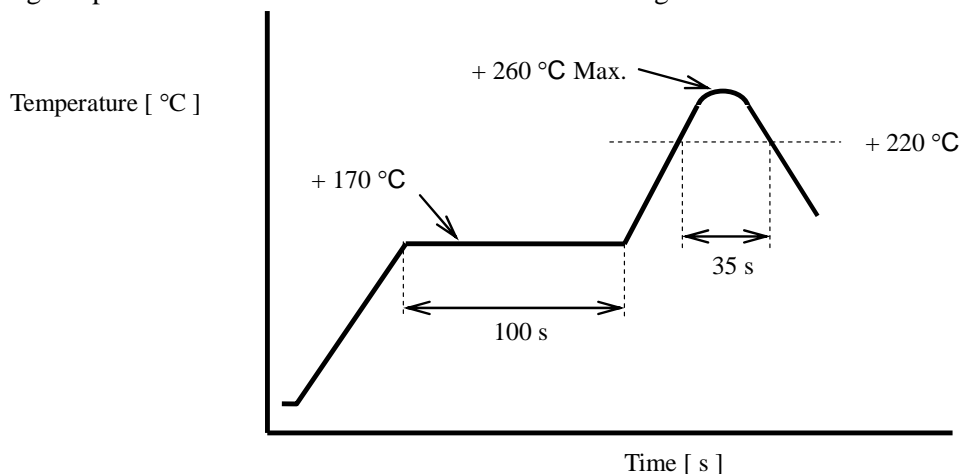
No.	Items	Value*1*2		Conditions
		$\Delta f/f [1 \times 10^{-6}]$		
1	Drop	± 5		Free drop from 750 mm height on a hard wooden board for 3 times (Board is thickness more than 30 mm)
2	Vibration resistance	± 3		10 Hz to 55 Hz amplitude 0.75 mm 55 Hz to 500 Hz acceleration 98 m/s ² 10 Hz → 500 Hz → 10 Hz 15 min./cycle 6 h (2 hours , 3 directions)
3	High temperature storage	*3 a) ± 20 *3 b) ± 10		a) + 125 °C × 1 000 h b) + 85 °C × 1 000 h
4	Low temperature storage	*3	± 20	- 55 °C × 1 000 h
5	Temperature cycle	*3	± 20	- 55 °C ↔ + 125 °C 30 min. at each temp. 100 cycles
6	High temperature and humidity	*3	± 20	+ 85 °C × 8 5%RH × 1 000 h
7	Soldering heat resistance	± 5		For convention reflow soldering furnace (2 times)
8	Shear	No peeling-off at a soldered part		20 N press the side for 10 ± 1 s Ref. IEC 60068-2-21
9	Pull - off	No peeling-off at a soldered part		10 N press the side for 10 ± 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 95 % covered with fresh solder		Dip termination into solder bath at + 235 °C ± 5 °C for 3 s (Using Rosin Flux)

< 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
 1. + 125 °C × 24 h to + 85 °C × 85 %RH × 48 h ± 1 h → reflow 2 times
 2. Initial value shall be after 24 h at room temperature.
4. Shift series resistance at after above tests should be less than 60 kΩ

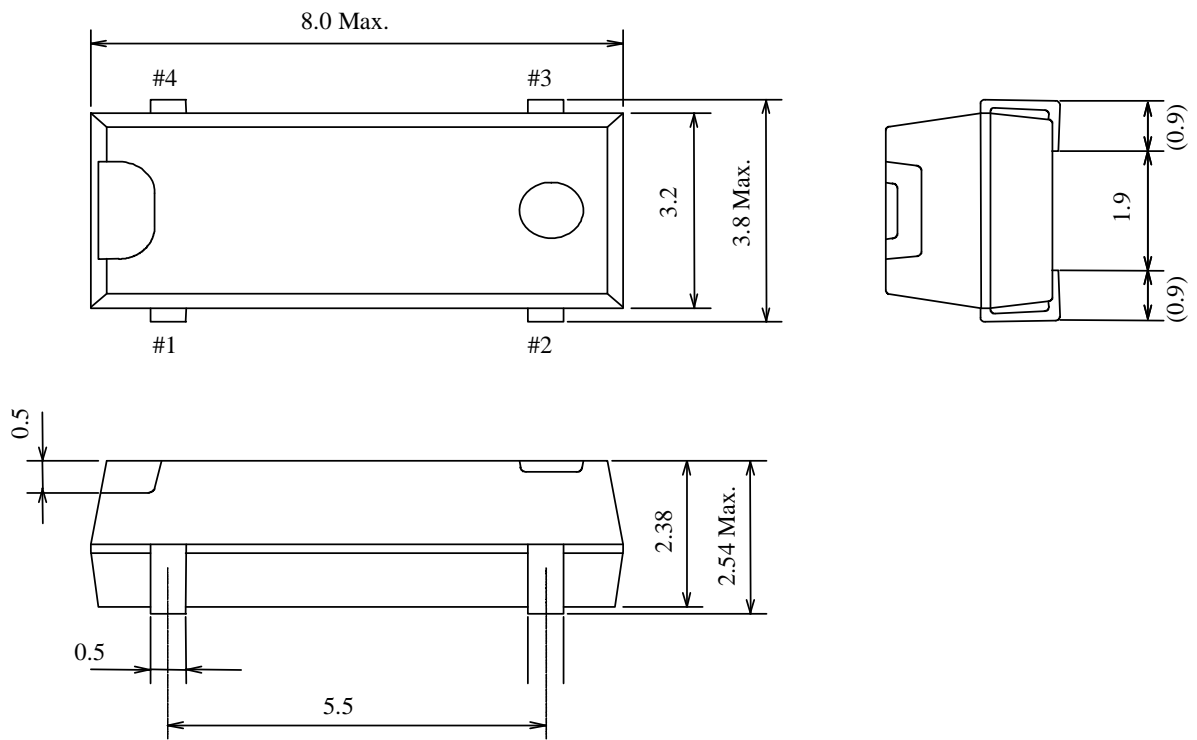
◆ Air-reflow

Pre heating temperature : + 170 °C Pre heating time : 100 s
 Heating temperature : + 220 °C Heating time : 35 s



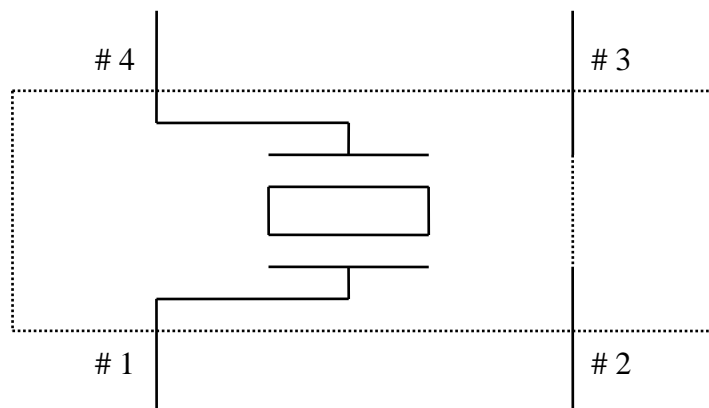
[5] Dimensions and marking layout

1. Dimensions



Metal may be exposed on the top or bottom of this product.
This will not affect any quality, reliability or electrical spec.

2. Circuit location

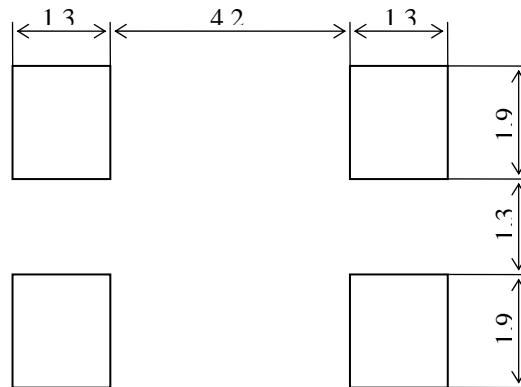


Do not connect # 2 and # 3 terminals to any external terminals.

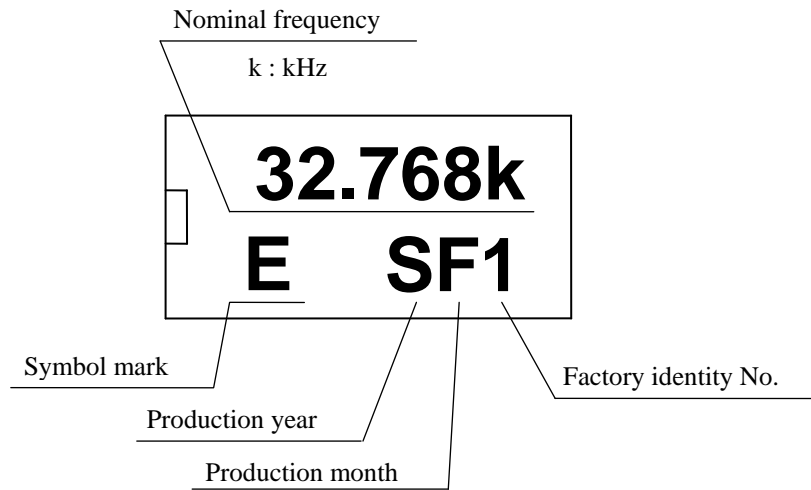
Type	MC-306	Terminal treatment	Pb Free Solder plate	Unit	1 = 1 mm
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3. Recommendable patterning

Unit : 1 = 1 mm



4. Marking layout



Symbol of Manufacturing year

Year digit	1	2	3	4	5	6	7	8	9	0
Marking Sn plating	M	N	R	S	T	U	V	W	X	Z

Year digit(1st) of the Production

Symbol of Manufacturing month

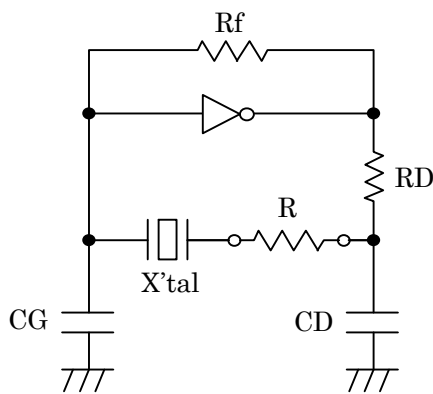
Month digit	1	2	3	4	5	6	7	8	9	10	11	12
Marking (Halide free)	A	B	C	D	E	F	G	H	J	K	L	M

- ◆ Nominal frequency is only example.
- ◆ The above marking layout shows only marking contents and their approximate position and it is not for font, size and exact position.

[6] Notes

1. Max two (2) times reflow is allowed. Once miss soldering is happen, hand work soldering by soldering iron is recommended. (+ 350 °C × 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 no 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
 $|-R| > CI \times (5 \sim 10)$

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.
Please check your condition in advance to maintain shock level to be smallest.
9. Depending on the conditions, ultrasonic cleaning cloud cause resonance damage of the internal crystal unit. Since we are unable to determine the usage conditions (type of cleaning unit, power, time, conditions inside the bath, etc.) at our company, we cannot guarantee the safety of this unit when it is cleaned in an ultrasonic cleaner.
10. Ink marking is some kind of solvent may damage marking ink; please take precautions when choosing solvent.
11. Please refer to packing specification regarding how to storage the products in the pack.

TAPING SPECIFICATION

1. APPLICATION

This document is applicable to MC-306 and MC-30A.

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	

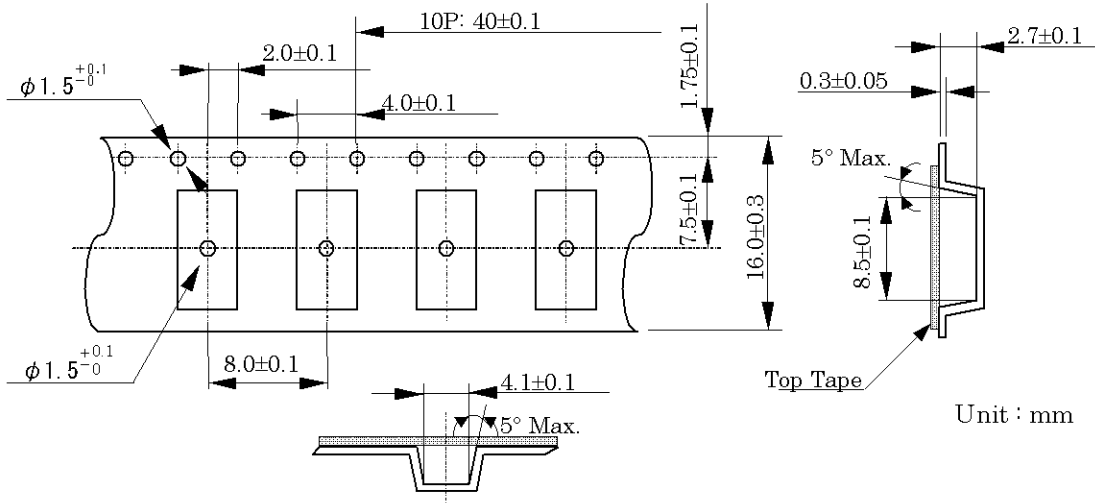
[1] Taping specification

Subject to EIA-481 and IEC 60286.

(1) Tape dimensions TE1608L

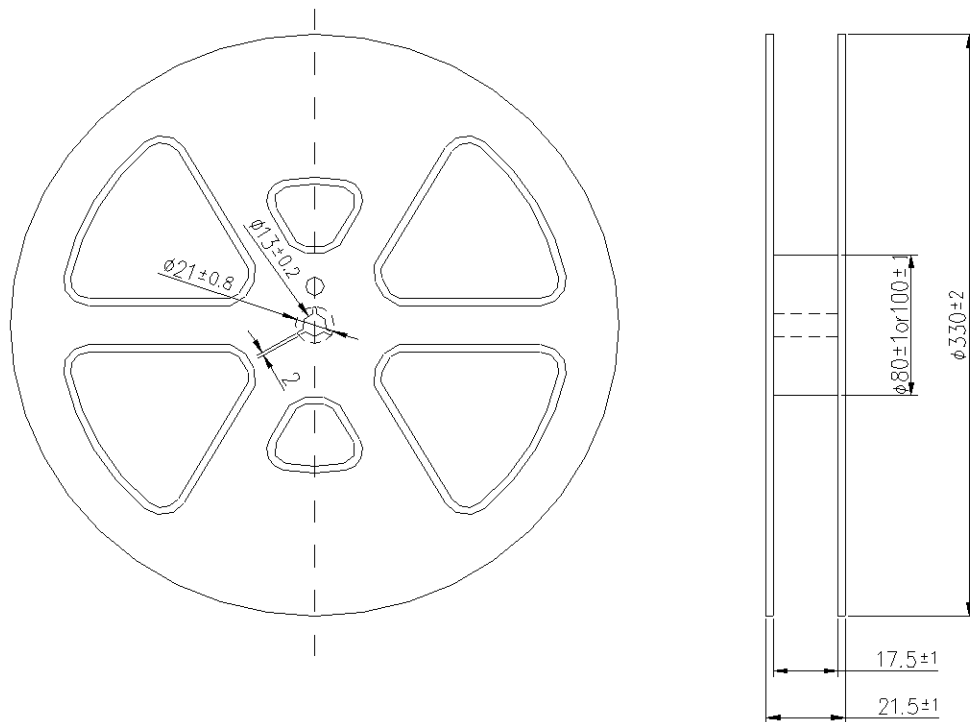
Material of the Carrier Tape : PS

Material of the Top Tape : PET+PE



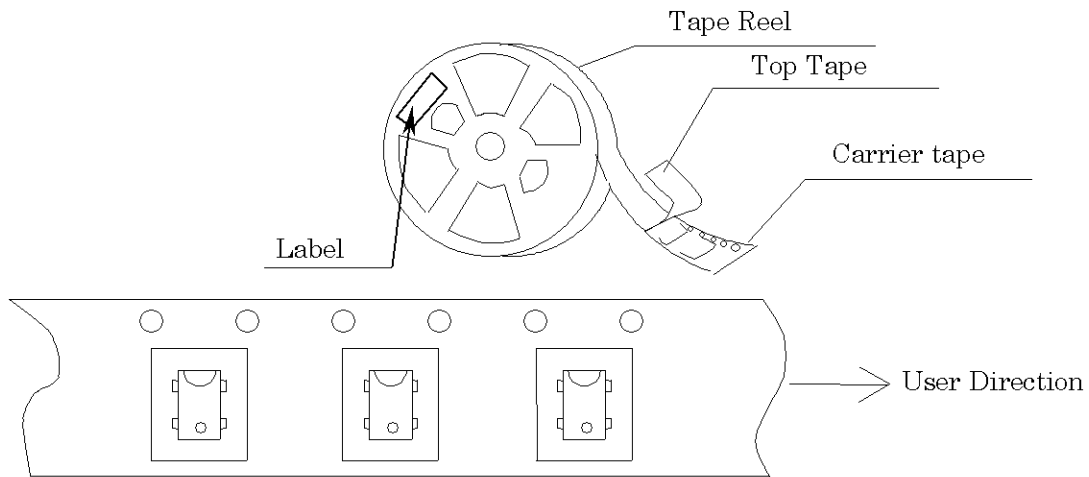
(2) Reel dimensions

Material of the Reel : PS

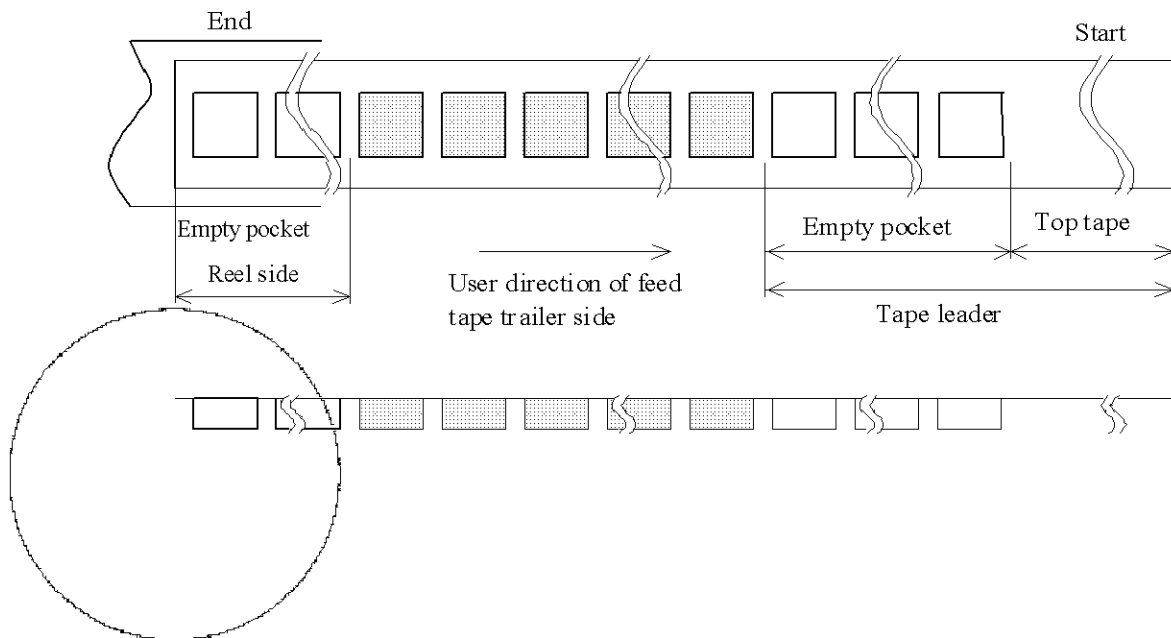


Form and Size of reel window shows are one of the example

(3) Packing
 (a) Tape & Reel



(b) Start & End Point



(c) Peel force of the cover tape

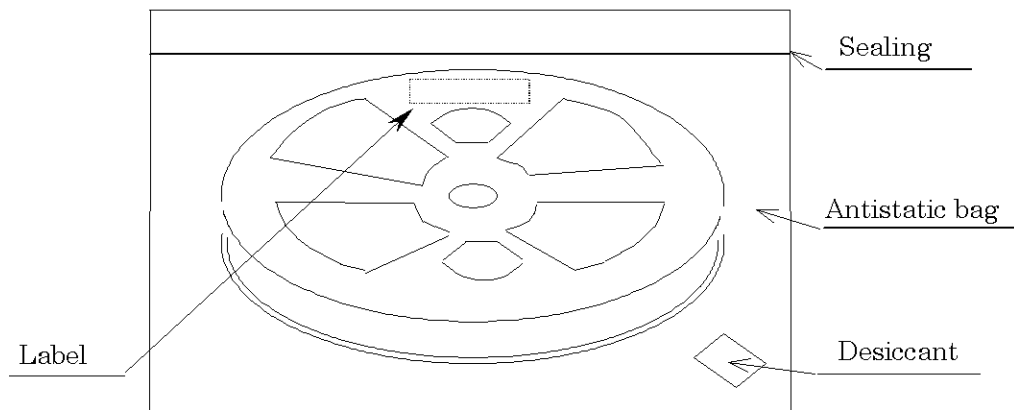
(1) angle : cover tape during peel off and the direction of unreeling shall be 165° to 180°.

(2) peel speed :300 mm/min

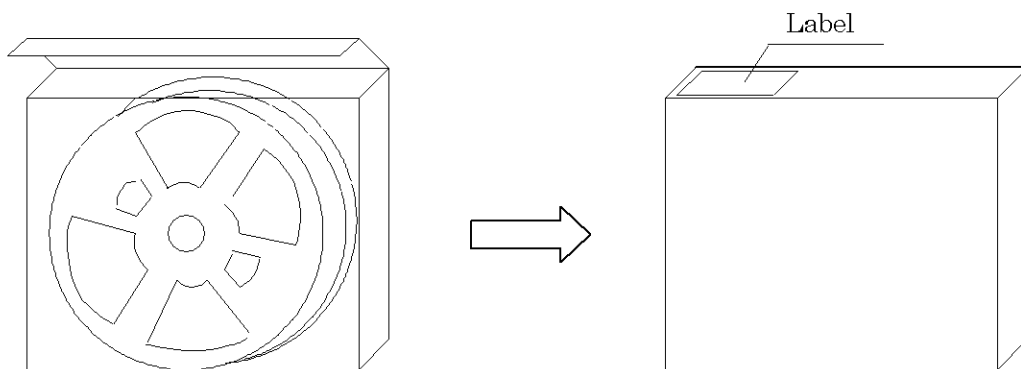
Item		Empty Space
Tape Leader	Top Tape	Min. 1 000 mm
	Carrier Tape	Min. 80 mm
Tape Trailer	Top Tape	Min. 0 mm
	Carrier Tape	Min. 80 mm

[2] Inner Carton

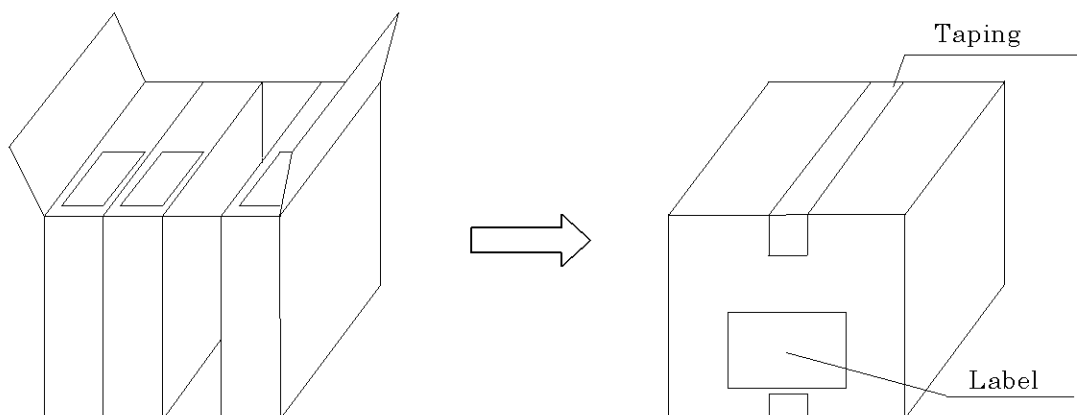
a) Packing to antistatic bag



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 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.

QC PROCESS FLOW SHEET

CODE : MC-306

Control No : 45-00-03-ANE-1

26-Apr-00

MANUFACTURING PROCESS FLOW CHART		No	RESPONSIBLE SECTION	STANDARD AND SPECIFICATIONS	INSPECTION AND CONTROL ITEMS	INSPECTION METHOD	MEASURING INSTRUMENTS	DATA COLLECTION
<p>CRYSTAL (SiO2 COATING)</p> <p>LEAD FRAME</p> <p>① INCOMING INSPECTION</p> <p>② CRYSTAL WELDING</p> <p>③ TRANSFER MOULDING</p> <p>④ SOLDER PLATING</p> <p>⑤ MARKING</p> <p>⑥ PRESS</p> <p>⑦ FINAL INSPECTION</p> <p>⑧ OUTGOING INSPECTION</p> <p>⑨ TAPING</p> <p>⑩ PACKING</p> <p>EXPORT</p>	1	SUB-CONTRACTOR	PURCHASE SPECIFICATION INCOMING INSPECTION STD.	APPEARANCE DIMENSION	SAMPLING	MS SCALE SCOPE	INSPECTION DATA	
	2	SUB-CONTRACTOR	MANUFACTURING INSTRUCTION	APPEARANCE DIMENSION STRENGTH	100% INSPECTION SAMPLING SAMPLING	MICROSCOPE SCALE MICRO PUSH&PULL GAUGE	DATA INPUT TO PC RECORD SHEET RECORD SHEET	
	3	SUB-CONTRACTOR	MANUFACTURING INSTRUCTION	APPEARANCE	100% INSPECTION SAMPLING	MICROSCOPE X-RAY	RECORD SHEET RECORD SHEET	
	4	SUB-CONTRACTOR	SOLDER PLATING SPECIFICATION SHEET	S.P THICKNESS APPEARANCE	SAMPLING SAMPLING	FLUOROSCOPY VISUAL INSPECTION	RECORD SHEET RECORD SHEET	
	5	SUB-CONTRACTOR	MANUFACTURING INSTRUCTION	APPEARANCE	SAMPLING	VISUAL INSPECTION	RECORD SHEET	
	6	SUB-CONTRACTOR	MANUFACTURING INSTRUCTION	APPEARANCE DIMENSION	SAMPLING SAMPLING	MICROSCOPE INSPECTION JIG	RECORD SHEET RECORD SHEET	
	7	SUB-CONTRACTOR	MANUFACTURING INSTRUCTION	ELECTRICAL CHARACTERISTIC	100% INSPECTION	F0 CHECKING By m/c	RECORD SHEET	
	8	SUB-CONTRACTOR	QUALITY STD.	APPEARANCE ELECTRICAL CHARACTERISTIC DIMENSION	SAMPLING SAMPLING SAMPLING	MICROSCOPE TO&CI CHECKER INSPECTION JIG	OGI INSP SHEET OGI INSP SHEET RECORD SHEET	
	9	SUB-CONTRACTOR	MANUFACTURING INSTRUCTION	TAPING STRENGTH	SAMPLING	STRENGTH TESTER	RECORD SHEET	
	10	SUB-CONTRACTOR	MANUFACTURING INSTRUCTION	PACKING INSTRUCTION THE LIST OF EXPORT DAILY BASE	EXPORT CUSTOMER LIST FREQUENCY QUANTITY			EXPORT DOCUMENTS

QC PROCESS FLOW SHEET

CODE : MC-306

Control No : 45-00-03-AKE-1

26-Apr-00

MANUFACTURING PROCESS FLOW CHART	No	RESPONSIBLE SECTION	STANDARD AND SPECIFICATIONS	INSPECTION AND CONTROL ITEMS	INSPECTION METHOD	MEASURING INSTRUMENTS	DATA COLLECTION
<p>CRYSTAL (SiO2 COATING)</p> <p>LEAD FRAME</p> <p>1 INCOMING INSPECTION</p> <p>2 CRYSTAL WELDING</p> <p>3 TRANSFER MOULDING</p> <p>4 SOLDER PLATING</p> <p>5 MARKING</p> <p>6 PRESS</p> <p>7 FINAL INSPECTION</p> <p>8 OUTGOING INSPECTION</p> <p>9 TAPING</p> <p>10 PACKING</p> <p>EXPORT</p>	1	SUB-CONTRACTOR	PURCHASE SPECIFICATION INCOMING INSPECTION STD.	APPEARANCE DIMENSION	SAMPLING	MS SCALE SCOPE	INSPECTION DATA
	2	SUB-CONTRACTOR	MANUFACTURING INSTRUCTION	APPEARANCE DIMENSION STRENGTH	100% INSPECTION SAMPLING SAMPLING	MICROSCOPE SCALE MICRO PUSH&PULL GAUGE	DATA INPUT TO PC RECORD SHEET RECORD SHEET
	3	SUB-CONTRACTOR	MANUFACTURING INSTRUCTION	APPEARANCE	100% INSPECTION SAMPLING	MICROSCOPE X-RAY	RECORD SHEET RECORD SHEET
	4	SUB-CONTRACTOR	SOLDER PLATING SPECIFICATION SHEET	S.P THICKNESS APPEARANCE	SAMPLING SAMPLING	FLUOROSCOPY VISUAL INSPECTION	RECORD SHEET RECORD SHEET
	5	SUB-CONTRACTOR	MANUFACTURING INSTRUCTION	APPEARANCE	SAMPLING	VISUAL INSPECTION	RECORD SHEET
	6	SUB-CONTRACTOR	MANUFACTURING INSTRUCTION	APPEARANCE DIMENSION	SAMPLING SAMPLING	MICROSCOPE INSPECTION JIG	RECORD SHEET RECORD SHEET
	7	SUB-CONTRACTOR	MANUFACTURING INSTRUCTION	ELECTRICAL CHARACTERISTIC	100% INSPECTION	F0 CHECKING By m/c	RECORD SHEET
	8	SUB-CONTRACTOR	QUALITY STD.	APPEARANCE ELECTRICAL CHARACTERISTIC DIMENSION	SAMPLING SAMPLING SAMPLING	MICROSCOPE T0&C1 CHECKER INSPECTION JIG	OGI INSP SHEET OGI INSP SHEET RECORD SHEET
	9	SUB-CONTRACTOR	MANUFACTURING INSTRUCTION	TAPING STRENGTH	SAMPLING	STRENGTH TESTER	RECORD SHEET
	10	SUB-CONTRACTOR	MANUFACTURING INSTRUCTION	EXPORT CUSTOMER LIST PACKING INSTRUCTION THE LIST OF EXPORT DAILY BASE QUANTITY	FREQUENCY		EXPORT DOCUMENTS

QC PROCESS FLOW SHEET

CODE : MC-306

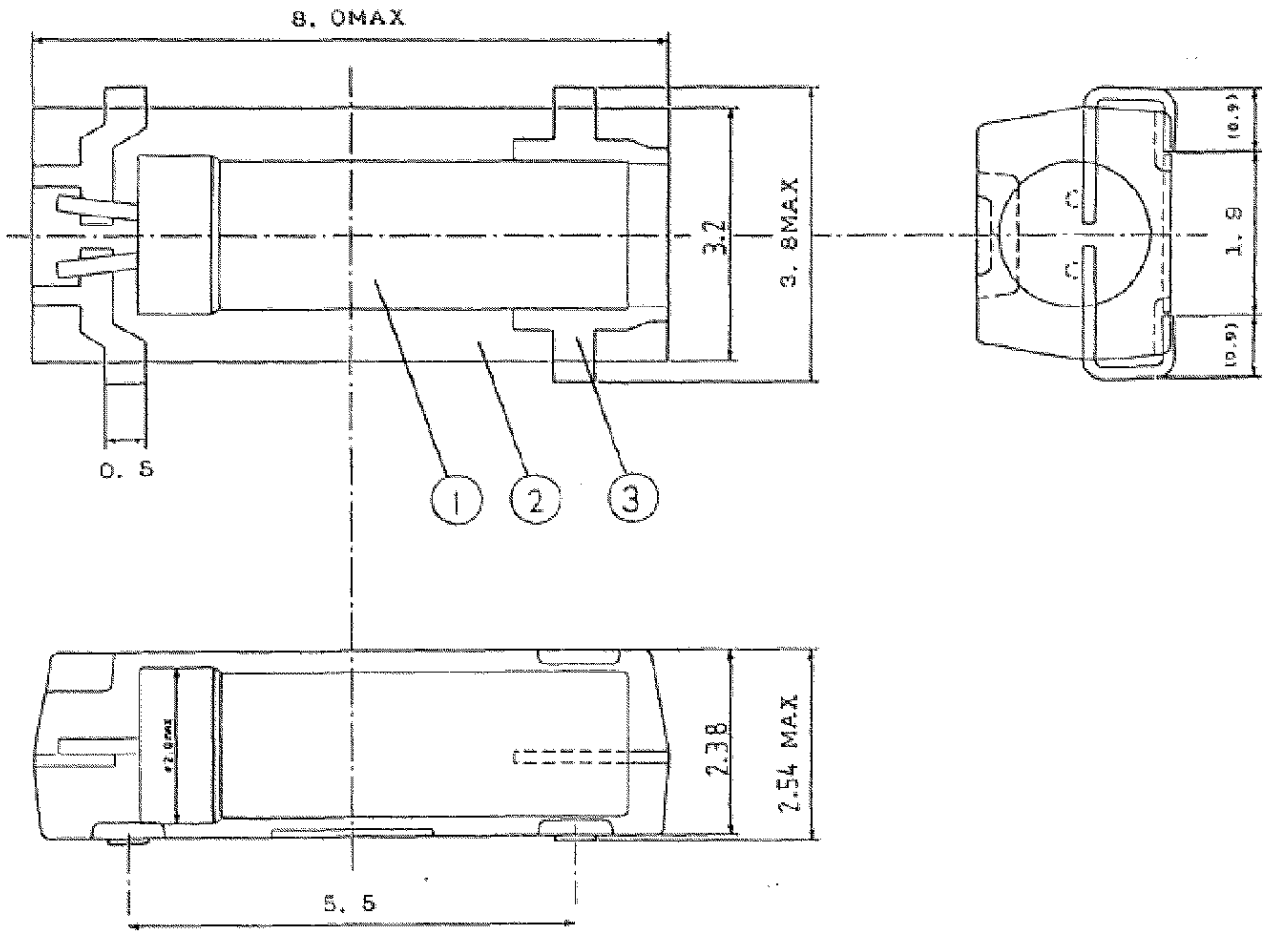
Control No. : 45-00-03-AGE-3

25-May-05

MANUFACTURING PROCESS FLOW CHART	No.	RESPONSIBLE SECTION	STANDARD AND SPECIFICATIONS	INSPECTION AND CONTROL ITEMS	INSPECTION METHOD	MEASURING INSTRUMENTS	DATA COLLECTION
<pre> graph TD A[LEAD FRAME] --> B((1)) B --> C[CRYSTAL (SiO2 COATING)] C --> D((2)) D --> E((3)) E --> F((4)) F --> G((5)) G --> H((6)) H --> I((7)) I --> J((8)) J --> K((9)) K --> L((10)) L --> M((11-1)) M --> N((11-2)) N --> O[EXPORT] </pre> <p>CRYSTAL (SiO₂ COATING)</p> <p>LEAD FRAME</p> <p>INCOMING INSPECTION</p> <p>CRYSTAL WELDING</p> <p>TRANSFER MOULDING</p> <p>SOLDER PLATING</p> <p>MARKING</p> <p>PRESS</p> <p>FINAL INSPECTION</p> <p>OUTGOING INSPECTION</p> <p>TAPING</p> <p>OUTGOING INSPECTION</p> <p>Pre-PACKING</p> <p>PACKING</p> <p>EXPORT</p>	1	MALAYSIA PLANT (Sub-Contractor)	PURCHASE SPECIFICATION INCOMING INSPECTION STD.	APPEARANCE DIMENSION	SAMPLING SAMPLING	MICROSCOPE MS SCALE SCOPE	INSPECTION DATA
	2	MALAYSIA PLANT (Sub-Contractor)	MANUFACTURING INSTRUCTION	APPEARANCE	SAMPLING	MICROSCOPE	RECORD SHEET
	3	MALAYSIA PLANT (Sub-Contractor)	MANUFACTURING INSTRUCTION	APPEARANCE	SAMPLING SAMPLING	MICROSCOPE VISUAL INSPECTION	RECORD SHEET RECORD SHEET
	4	MALAYSIA PLANT (Sub-Contractor)	SOLDER PLATING SPECIFICATION SHEET	S.P THICKNESS S.P ORGANIZATION APPEARANCE	SAMPLING DATA SAMPLING DATA	FLUOROSCOPY MICROSCOPE	RECORD SHEET RECORD SHEET RECORD SHEET
	5	MALAYSIA PLANT (Sub-Contractor)	MANUFACTURING INSTRUCTION	APPEARANCE	SAMPLING	VISUAL INSPECTION	RECORD SHEET
	6	MALAYSIA PLANT (Sub-Contractor)	MANUFACTURING INSTRUCTION	APPEARANCE DIMENSION	SAMPLING SAMPLING	MICROSCOPE INSPECTION JIG	RECORD SHEET RECORD SHEET
	7	MALAYSIA PLANT (Sub-Contractor)	MANUFACTURING INSTRUCTION	ELECTRICAL CHARACTERISTIC	100% INSPECTION	F0 CHECKING By m/c	RECORD SHEET
	8	MALAYSIA PLANT (Sub-Contractor)	QUALITY STD.	APPEARANCE ELECTRICAL CHARACTERISTIC DIMENSION	SAMPLING SAMPLING SAMPLING	MICROSCOPE T0&C1 CHECKER INSPECTION JIG	OGI INSP.SHEET OGI INSP.SHEET RECORD SHEET
	9	MALAYSIA PLANT (Sub-Contractor)	MANUFACTURING INSTRUCTION	TAPING STRENGTH	SAMPLING	STRENGTH TESTER	RECORD SHEET
	10	MALAYSIA PLANT (Sub-Contractor)	QUALITY STD.	APPEARANCE	100% INSPECTION	MICROSCOPE	OGI INSP.SHEET
	11-1	MALAYSIA PLANT (Sub-Contractor)	MANUFACTURING INSTRUCTION PACKING INSTRUCTION THE LIST OF EXPORT DAILY BASE	EXPORT CUSTOMER LIST FREQUENCY QUANTITY	---	---	EXPORT DOCUMENTS
	11-2	MALAYSIA PLANT	MANUFACTURING INSTRUCTION PACKING INSTRUCTION THE LIST OF EXPORT DAILY BASE	EXPORT CUSTOMER LIST FREQUENCY QUANTITY	---	---	EXPORT DOCUMENTS

MC-306 Structure diagram

Unit : mm



③	Lead	42Alloy	Sn plating
②	Molding	Epoxy Compound (Halide free)	_____
①	Crystal C-002SH	_____	_____
No.	Name of Part	Material	Remarks

RELIABILITY TEST DATA

Product Name : MC-306 (Halide free mold)

The Company evaluation condition

We evaluate environmental and mechanical characteristics by the following test condition . **No.F-45-0001-02-007EH**

No.	ITEM	TEST CONDITIONS	VALUE *1 *2	TEST	FAIL
			$\Delta f / f$ [1×10^{-6}]	Qty [n]	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)	± 5	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 \rightarrow 500 Hz \rightarrow 10 Hz 15 min / cycle 6 h (2 h \times 3 directions)	± 3	22	0
3	High temperature storage	a) $+125^\circ\text{C} \times 1\,000 \text{ h}$	*3 a) ± 20	a) 22	a) 0
		b) $+85^\circ\text{C} \times 1\,000 \text{ h}$	*3 b) ± 10	b) 22	b) 0
4	Low temperature storage	$-55^\circ\text{C} \times 1\,000 \text{ h}$	*3 ± 20	22	0
5	Temperature cycle	$-55^\circ\text{C} \Leftrightarrow +125^\circ\text{C}$ 30 min at each temp. 100 cycles	*3 ± 20	22	0
6	Temperature humidity storage	$+85^\circ\text{C} \times 85\% \text{RH} \times 1\,000 \text{ h}$	*3 ± 20	22	0
7	Resistance to soldering heat	For convention reflow soldering furnace (2 times)	± 5	22	0
8	Shear	20 N press for $10 \pm 1 \text{ s}$ Ref. IEC 60068-2-21	No peeling - off at a solder part	11	0
9	Pull - off	10 N press for $10 \pm 1 \text{ s}$ 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	11	0
11	Solderability	Dip termination into solder bath at $+235^\circ\text{C} \pm 5^\circ\text{C}$ for 3 s (Using Rosin Flux)	Termination must be 95 % covered with fresh solder	11	0

Notes

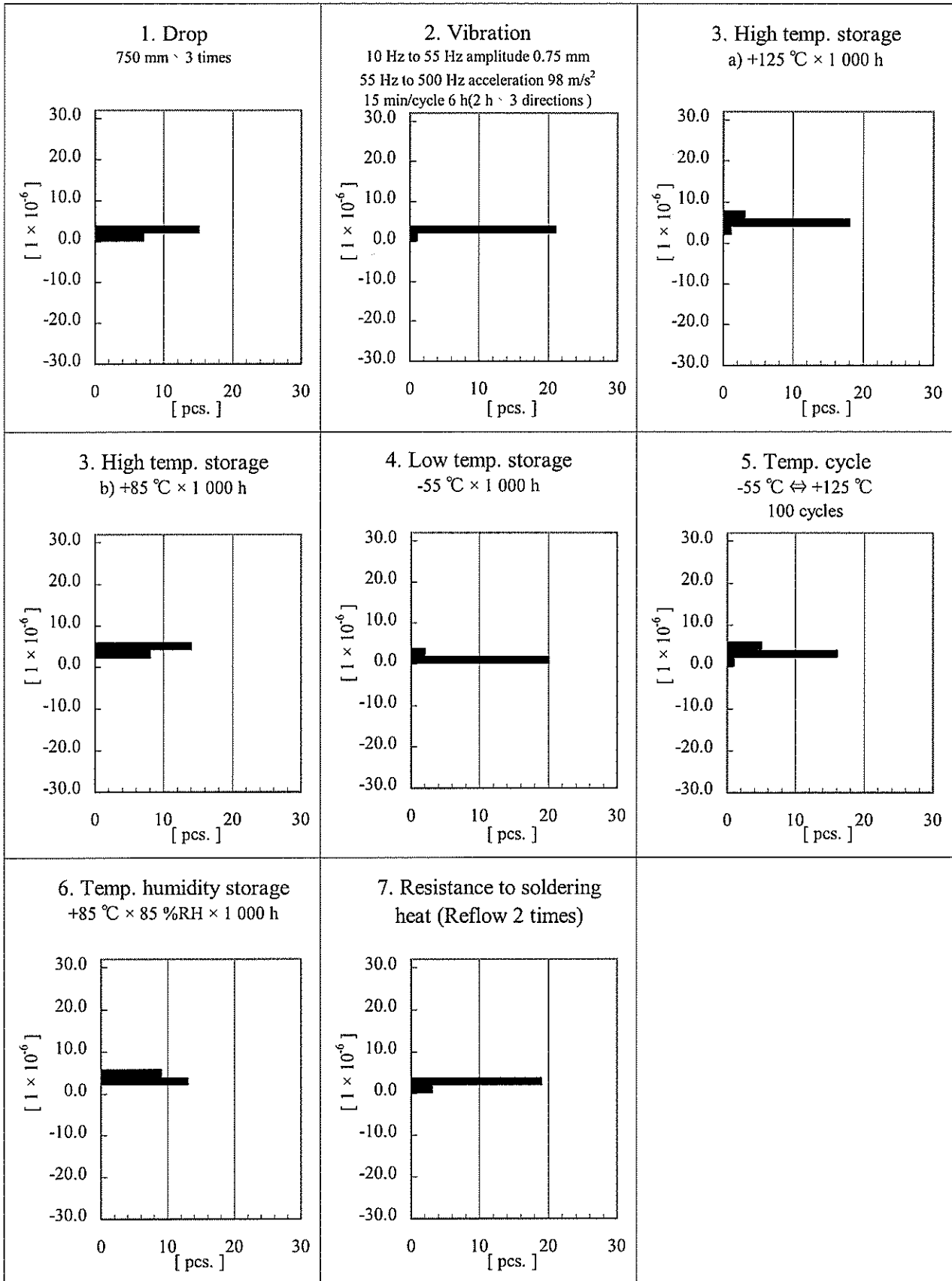
1. *1 Each test done independently.
2. *2 Measuring 2 h to 24 h later leaving in room temperature after each test.
3. *3 Pre conditionings Initial value shall be after 24 h at room temperature.
4. Shift series resistance at before above tests should be less than 60 k Ω .

Qualification Data

Product Name : MC-306 (Halide free mold)

$\Delta f / f$

No.F-45-0001-02-008EH



Product Name : MC-306 (Halide free mold)

CI

No.F-45-0001-02-009EH

