

INFORMATION

PRODUCT No. : **Q13MC1461000200**

MODEL : **MC-146**
32.768 kHz 12.5 pF ± 20

INFO. No. : **Q05-327-11A**

DATE : **Jan. 12. 2006**

EPSON TOYOCOM CORPORATION

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

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.

This product is not authorized for use as critical components in life support device or systems.

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[1] Absolute maximum ratings

Item	Symbol	Rating value
Storage temperature	TSTG	-55°C to +125°C
Maximum drive level	DL	1.0 μW

[2] Operating range

Item	Symbol	Value		
		Min.	Typ.	Max.
Operating temperature range	T _{OPR}	-40 °C		+85 °C
Drive level	DL	0.01 μW	0.1 μW	0.5 μW
Vibration mode		Fundamental		

[3] Static characteristics

Item	Symbol	Value	Note
Frequency	f _i	32.768 kHz	
Frequency tolerance	Δ f/f	± 20 × 10 ⁻⁶	CL = 12.5 pF Ta = +25 ± 3 °C, Drive level : 0.1 μW Not include aging
Series resistance	R ₁	Max. 65 kΩ	CI meter : Sanders 140B Drive level : 0.5 μW
Motional capacitance	C ₁	Typ. 1.9 fF	
Shunt capacitance	C ₀	Typ. 0.8 pF	
Turnover temperature	0T	+25 ± 5°C	Values are calculated by the frequencies at +10, +25, +40°C with C-MOS circuit.
Temperature coefficient	a	Max. -4.0 × 10 ⁻⁸ /°C ²	
Isolation resistance	IR	Min. 500 MΩ	DC 100V, 60 seconds Between terminal #1 and terminal #4
Aging	fa	± 3 × 10 ⁶ /year	Ta = +25°C ± 3°C Drive level : 0.1 μW

[4] Environmental and Mechanical characteristics

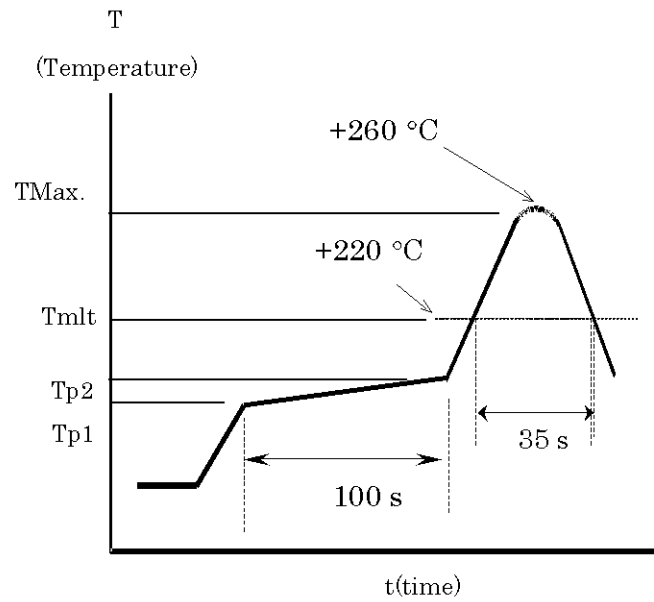
No.	Items	Value *1*2 $\Delta f/f [1 \times 10^{-6}]$	Conditions
1	Shock	*3 ± 5	100g dummy (SEIKO EPSON Standard) drop from 1500 mm height on to the concrete 3 directions 10 times
2	Vibration	*3 ± 3	10 Hz to 55 Hz amplitude 0.75 mm 55 Hz to 500 Hz acceleration 98 m/s ² 10 Hz → 500 Hz → 10 Hz 15 min./cycle 6 h (2 hours , 3 directions)
3	Resistance to soldering heat (Reflow characteristics)	*3 ± 5	Treat the Reflow 2 times by the following profile in the next page
4	High temperature storage	*3 a) ± 20 b) ± 10	a) +125 °C × 1 000 h b) +85 °C × 1 000 h
5	Low temperature storage	*3 ± 10	-55°C × 1 000 h
6	Temperature humidity storage	*3 ± 10	+85°C × 85%RH × 1000 h
7	Temperature cycle	*3 ± 10	-55°C ↔ +125°C 30 minutes at each temperature 100 cycles
8	Shear	No peeling-off at a soldered part	10 N press the side for 10 s ± 1 s. Ref. IEC 60068-2-21
10	Pull-off	No peeling-off at a soldered part	10 N press the side for 10 s ± 1 s. Ref. IEC 60068-2-21
11	Substrate bending	No peeling-off at a soldered part	Bending width reaches 3mm and hold for 5 s ± 1 s × 1 time Ref. IEC 60068-2-21
12	Solderability	Termination must be 95% covered with fresh solder	Dip termination into solder bath at 235 ± 5°C for 3 s (Using rosin flux)
13	Solvent resistance	The marking shall be legible	Ref. JIS C 0052 or IEC 60068-2-45

- Note
1. *1 Each test done independently.
 2. *2 Measuring 1 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 % × 48 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 ± 15 % or less than ± 5 kΩ
In case Resistance to soldering heat, high temperature storage (± 125 °C × 1 000 h) shift series resistance
at after above tests should be less than ± 20 % or ± 10 kΩ

◆ Air- reflow

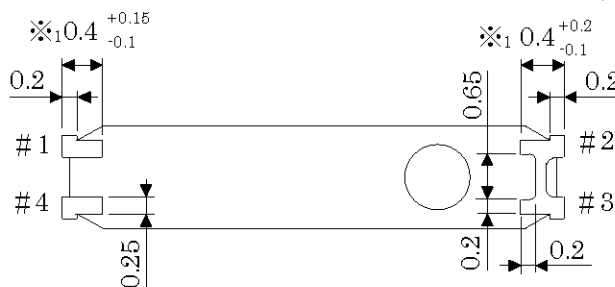
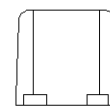
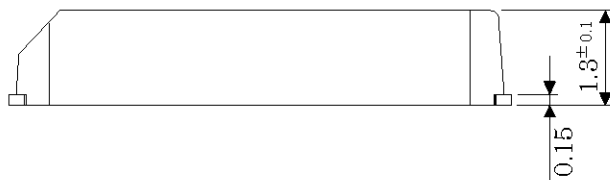
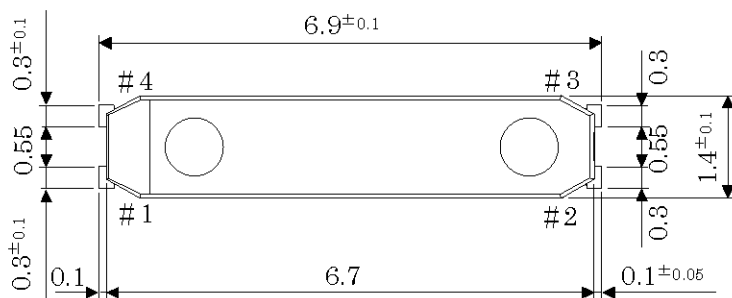
Pre heating temperature : $T_{p1} \sim T_{p2} = +170 \text{ }^\circ\text{C}$

Peak temperature must not exceed $+260 \text{ }^\circ\text{C}$ and the duration of over $+220 \text{ }^\circ\text{C}$ should be 35 s



[5] Dimensions and Marking layout

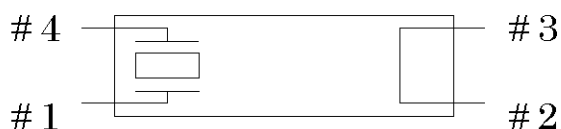
1. Dimensions



♣₁ : Available area for soldering

There are some cases that a part of the case of quartz resonator expose on the surface of the molding material

2. Internal Connection



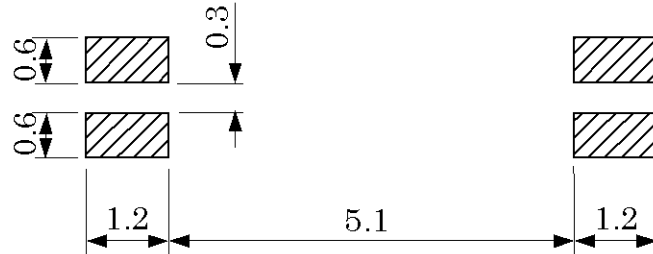
Terminal thickness	0.15mm
Lead Frame	42Alloy
Terminal treatment	Pb Free Solder plate 15 ± 10 μm
Molding	Epoxy Compound
Compound color	Black

Do not connect 2# and 3# terminals to any external circuits (including GND).

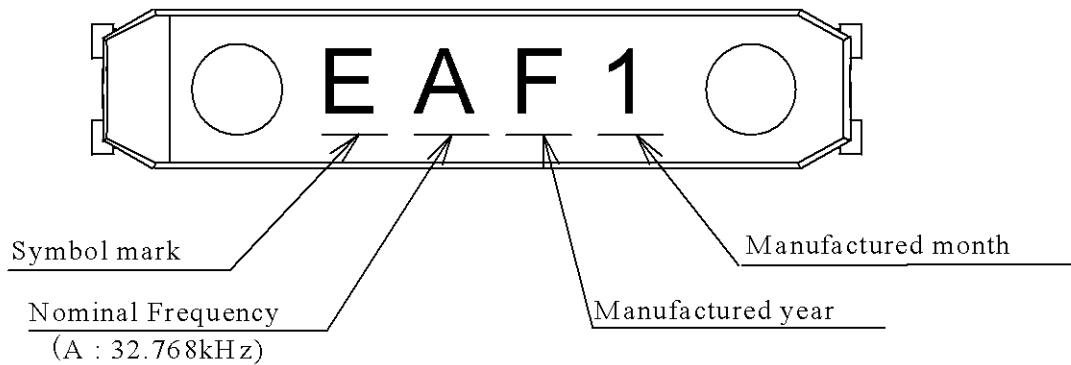
Type	MC-146	Unit	1 = 1 mm
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3. Recommended soldering pattern

Unit : 1 = 1 mm



4. Marking layout



Symbol of Manufacturing year

Year digit	1	2	3	4	5	6	7	8	9	0
Marking	A	B	C	D	E	F	G	H	J	K

Year digit(1st) of the Production

Symbol of Manufacturing month

Jan.	Feb.	Oct.	Nov.	Dec.
1	2	X	Y	Z

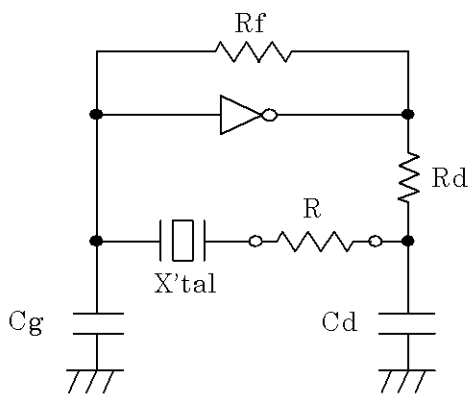
- ◆ The above marking layout shows only marking contents and their approximate position and it is not for font, size and exact position.

Type	MC-146	Unit	1=1 mm
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[6] Notes

1. Max two (2) times reflow is allowed. Once miss soldering is happened, 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 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. To avoid mull function, no pattern under or near the crystal 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 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.
10. Ink marking may be damaged by some kind of solvent, please take precautions when choosing solvent by your selves.
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-146.

2. CONTENTS

Item No.	Item	Page
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[6]	Storage environment	
[7]	Handling	

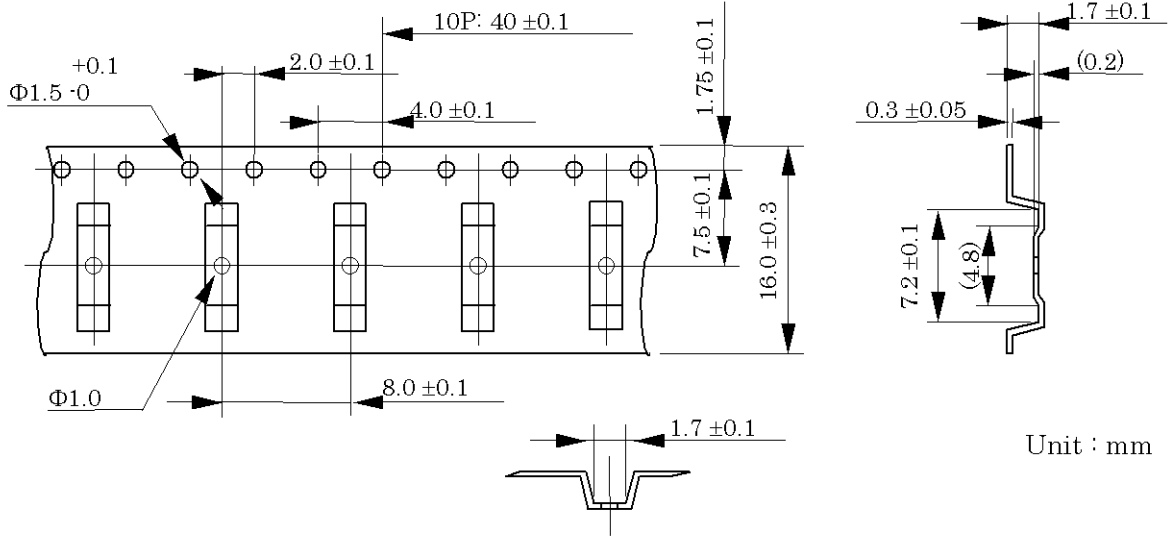
[1] Taping specification

Subject to EIA-481 , EIAJ EDX7602 , IEC 60286 , and JIS C0806.

(1) Tape dimensions TE1604L

Material of the Carrier Tape : PS

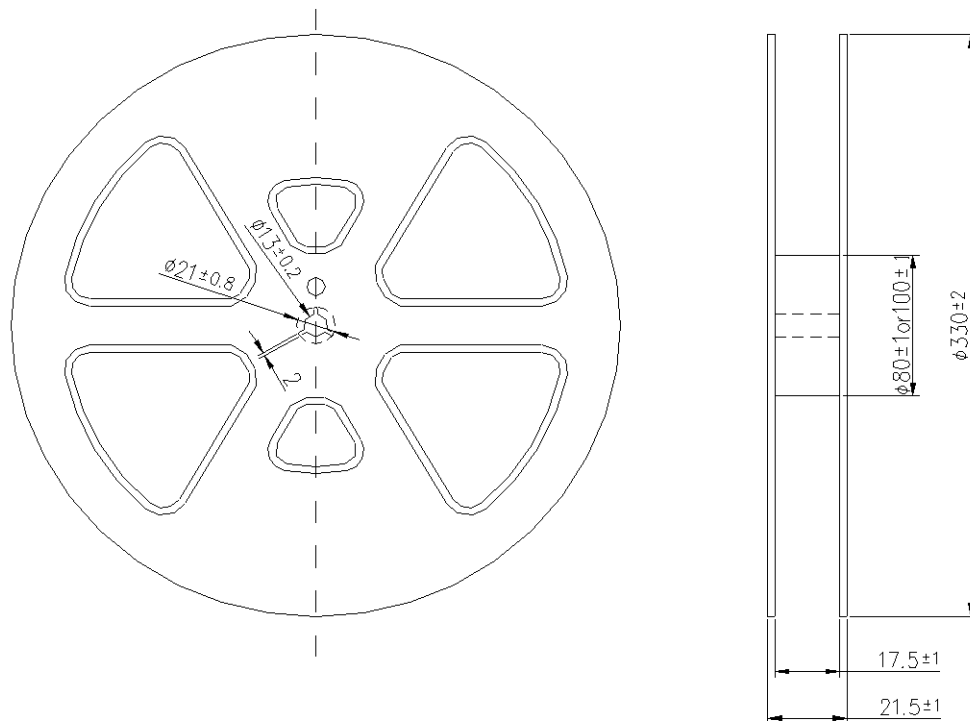
Material of the Top Tape : PET+PE



Unit : mm

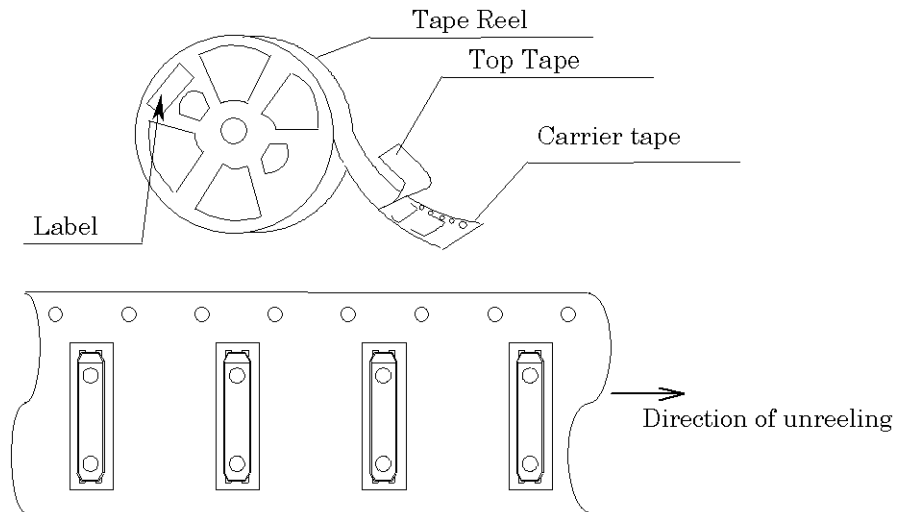
(2) Reel dimensions

Material of the Reel : PS

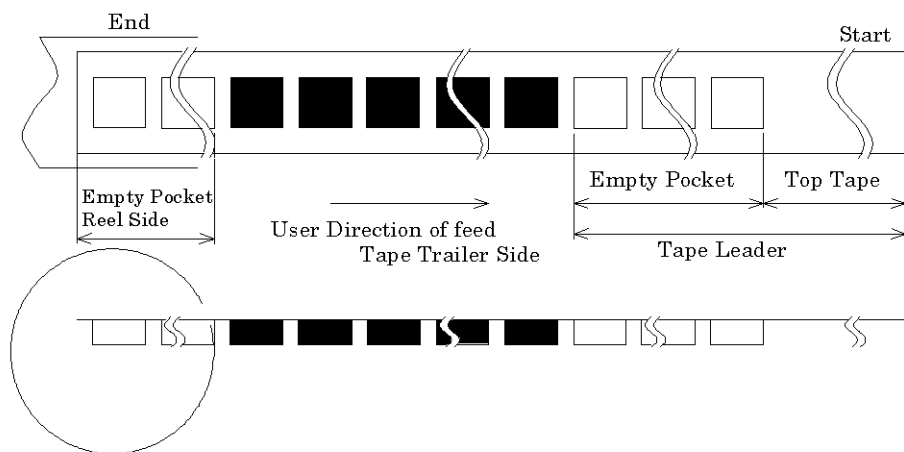


Form and Size of reel window shows are one of the example

(3) Packing
 (a) Tape & Reel



(b) Start & End Point



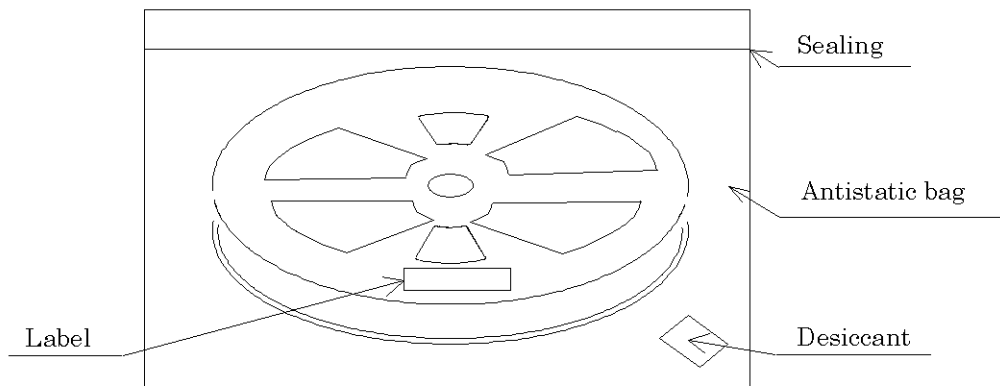
(c) Peel force of the cover tape

- (1) angle : cover tape during peel off and the direction of unreeling shall be 165° to 180° .
- (2) peel speed : 5 mm/s.

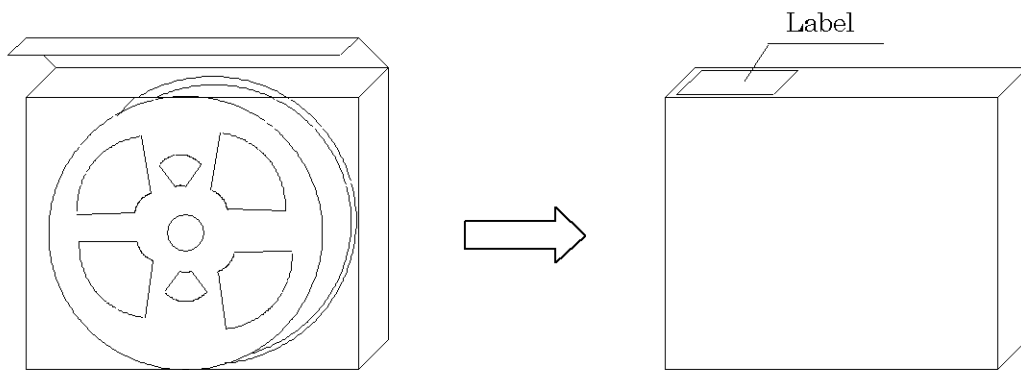
Item		Empty Space
Tape Leader	Top Tape	Min. 1 000 mm
	Carrier Tape	Min. 40 pockets
Tape Trailer	Top Tape	Min. 0 mm
	Carrier Tape	Min. 40 pockets

[2] Inner Carton

a) Packing to antistatic bag

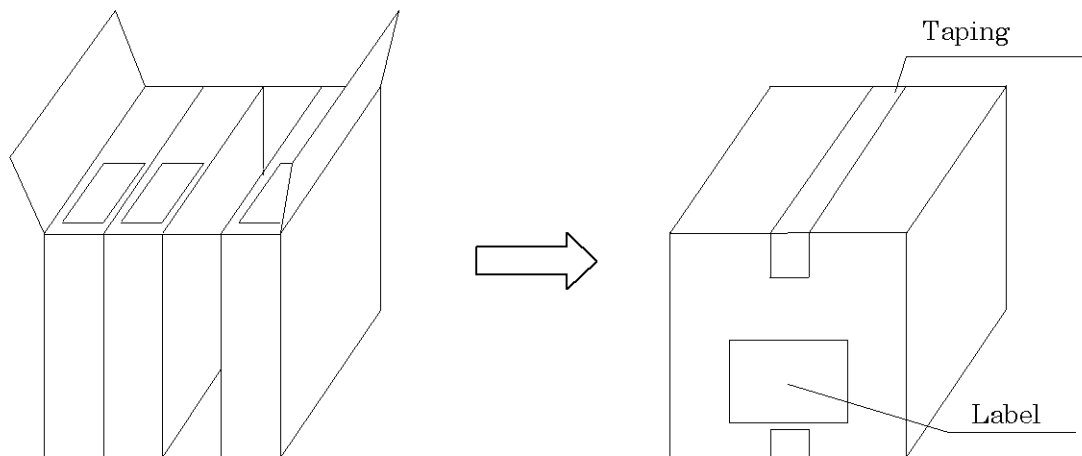


b) Packing to innercarton



[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 -

1999.09.14

CODE : MC-146

Control No : M-9803-AEE-1

SURFACE MOUNTING TYPE CRYSTAL

MC-146

EPSON TOYOCOM CORP.
INA PLANT QZ BU

PREPARED	CHECKED	APPROVED
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[Handwritten signatures and initials]

MANUFACTURING PROCESS 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 1st PRESSING</p> <p>5 SOLDER PLATING</p> <p>6 MARKING</p> <p>7 2nd PRESS</p> <p>8 FINAL INSPECTION AND TAPING</p> <p>9 OUTGOING INSPECTION</p> <p>10 PACKING</p> <p>EXPORT</p>	1'	MALAYSIA PIANT	PURCHASING SPECIFICATION INCOMING INSPECTION STD.	APPEARANCE DIMENSION	SAMPLING	PIUG GAUGES MICROSCOPE	IN-COMMING INSPECTION DATA SHEET
	2	MALAYSIA PIANT	MANUFACTURING INSTRUCTION SHEET MANUFACTURING INSTRUCTION SHEET MANUFACTURING INSTRUCTION SHEET	APPEARANCE DIMENSION STRENGTH	100% INSPECTION SAMPLING SAMPLING	MICROSCOPE T.M.S PUSH&PULL GAUGE	PROCESS DATA SHEET PROCESS DATA SHEET PROCESS DATA SHEET
	3	MALAYSIA PIANT	MANUFACTURING INSTRUCTION SHEET	APPEARANCE	100% INSPECTION SAMPLING	MICROSCOPE X-RAY	PROCESS DATA SHEET PROCESS DATA SHEET
	4	MALAYSIA PIANT	MANUFACTURING INSTRUCTION SHEET	APPEARANCE	SAMPLING	MICROSCOPE	PROCESS DATA SHEET
	5	MALAYSIA PIANT SUB-CONTRACTOR	SOLDER PLATING SPECIFICATION SHEET	S.P THICKNESS APPEARANCE	SAMPLING SAMPLING	FLUOROSCOPY VISUAL INSPECTION	PROCESS DATA SHEET PROCESS DATA SHEET
	6	MALAYSIA PIANT	MANUFACTURING INSTRUCTION SHEET	APPEARANCE	SAMPLING	VISUAL INSPECTION	PROCESS DATA SHEET
	7	MALAYSIA PIANT	MANUFACTURING INSTRUCTION	APPEARANCE DIMENSION	SAMPLING SAMPLING	MICROSCOPE INSPECTION JIG	PROCESS DATA SHEET PROCESS DATA SHEET
	8	MALAYSIA PIANT	MANUFACTURING INSTRUCTION SHEET MANUFACTURING INSTRUCTION SHEET QUALITY STD.	ELECTRICAL CHARACTERISTIC TAPING STRENGTH ELECTRICAL CHARACTERISTIC	100% INSPECTION SAMPLING SAMPLING	FO CHECKING By m/c STRENGTH TESTER TO&CI CHECKER	PROCESS DATA SHEET PROCESS DATA SHEET OGI INSP.SHEET
	9	MALAYSIA PIANT	QUALITY STD.	APPEARANCE	SAMPLING	MICROSCOPE	OGI INSP.SHEET
	10	MALAYSIA PIANT	MANUFACTURING INSTRUCTION SHEET DAILY SHIPPING LIST	EXPORT CUSTOMER LIST FREQUENCY QUANTITY			EXPORT DOCUMENTS

- PROCESS QUALITY CONTROL -

2000.04.26

PREPARED	CHECKED	APPROVED
<i>M. Nagai</i>	<i>M. Nagai</i>	<i>[Signature]</i>

CODE : MC-146

EPSON TOYOCOM CORP.
INA PLANT QZ BU

Control No : M-9803-ASE-1

MANUFACTURING PROCESS CHART	No	RESPONSIBLE SECTION	STANDARD AND SPECIFICATIONS	INSPECTION AND CONTROL ITEMS	INSPECTION METHOD	MEASURING INSTRUMENTS	DATA COLLECTION
	1'	CHINA PIANT	PURCHASING SPECIFICATION INCOMING INSPECTION STD.	APPEARANCE DIMENSION	SAMPLING	PIUG GAUGES MICROSCOPE	IN-COMMING INSPECTION DATA SHEET
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	5	CHINA PIANT SUB-CONTRACTOR	SOLDER PLATING SPECIFICAT ION SHEET	S.P THICKNESS APPEARANCE	SAMPLING SAMPLING	FLUOROSCOPY VISUAL INSPECTION	PROCESS DATA SHEET PROCESS DATA SHEET
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	9	CHINA PIANT	QUALITY STD.	APPEARANCE	SAMPLING	MICROSCOPE	OGI INSP.SHEET
	10	CHINA PIANT	MANUFACTURING INSTRUCTION SHEET DAILY SHIPPING LIST	EXPORT CUSTOMER LIST FREQUENCY QUANTITY			EXPORT DOCUMENTS

- PROCESS QUALITY CONTROL -

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CODE : MC-146

Control No : M-9803-ANE-1

EPSON TOYOCOM CORP.
INA PLANT QZ BU

PREPARED	CHECKED	APPROVED
<i>M. Nagai</i>	<i>M. Nagai</i>	<i>S. Saito</i>

MANUFACTURING PROCESS 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 1st PRESSING</p> <p>5 SOLDER PLATING</p> <p>6 MARKING</p> <p>7 2nd PRESS</p> <p>8 FINAL INSPECTION AND TAPING</p> <p>9 OUTGOING INSPECTION</p> <p>10 PACKING</p> <p>EXPORT</p>	1'	SUB-CONTRACTOR	PURCHASING SPECIFICATION INCOMING INSPECTION STD.	APPEARANCE DIMENSION	SAMPLING	PIUG GAUGES MICROSCOPE	IN-COMMING INSPECTION DATA SHEET
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- PROCESS QUALITY CONTROL -

2000.04.26

PREPARED	CHECKED	APPROVED
<i>M. Angai</i>	<i>M. Angai</i>	<i>[Signature]</i>

CODE : MC-146

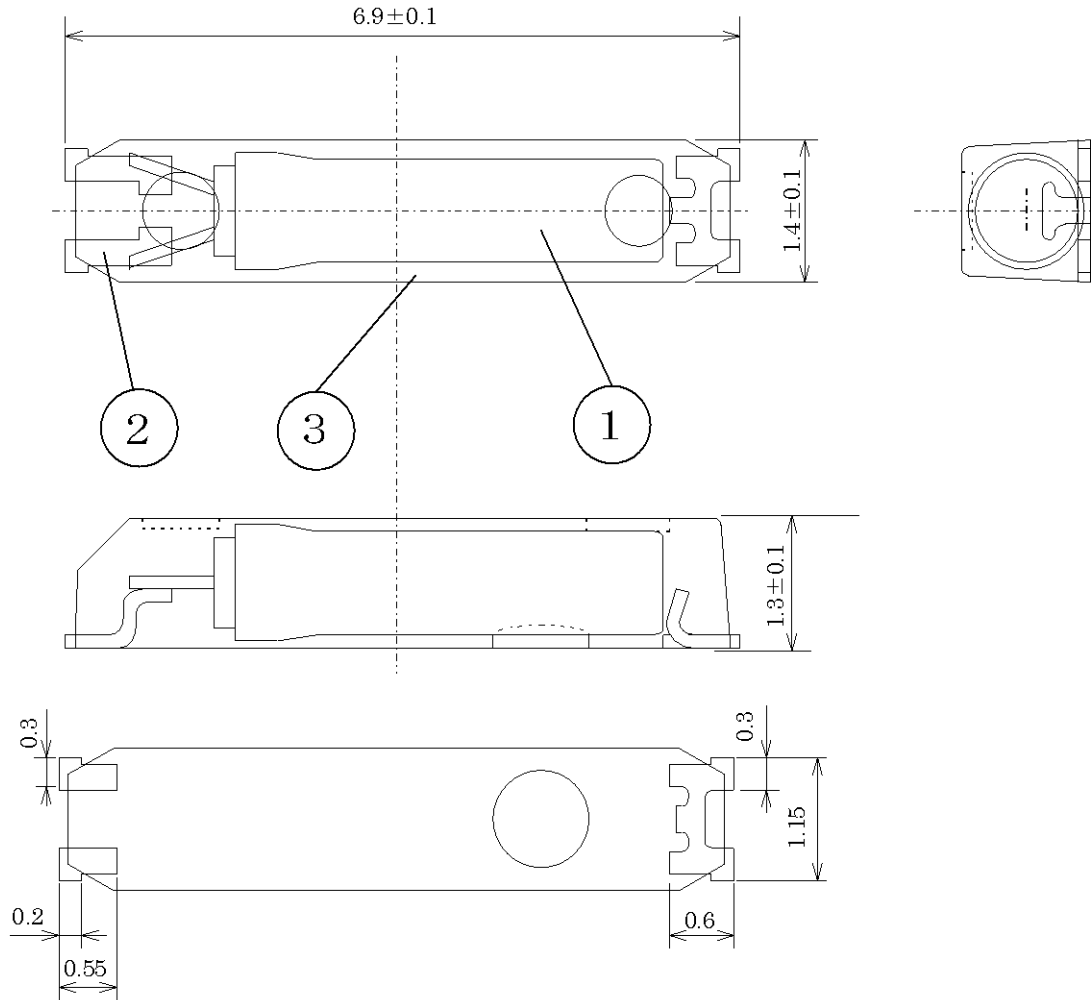
EPSON TOYOCOM CORP.
INA PLANT QZ BU

Control No : M-9803-AKE-1

MANUFACTURING PROCESS CHART	No	RESPONSIBLE SECTION	STANDARD AND SPECIFICATIONS	INSPECTION AND CONTROL ITEMS	INSPECTION METHOD	MEASURING INSTRUMENTS	DATA COLLECTION
<p>The process chart shows a vertical flow starting with 'LEAD FRAME' and 'CRYSTAL (SiO2 COATING)'. It includes an 'INCOMING INSPECTION' diamond (1'), followed by steps 2 through 10: 'CRYSTAL WELDING', 'TRANSFER MOULDING', '1st PRESSING', 'SOLDER PLATING', 'MARKING', '2nd PRESS', 'FINAL INSPECTION AND TAPING' (diamond 8), 'OUTGOING INSPECTION' (diamond 9), and 'PACKING' (10). The process ends with 'EXPORT'.</p>	1'	SUB-CONTRACTOR	PURCHASING SPECIFICATION INCOMING INSPECTION STD.	APPEARANCE DIMENSION	SAMPLING	PIUG GAUGES MICROSCOPE	IN-COMMING INSPECTION DATA SHEET
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	10	SUB-CONTRACTOR	MANUFACTURING INSTRUCTION SHEET DAILY SHIPPING LIST	EXPORT CUSTOMER LIST FREQUENCY QUANTITY			EXPORT DOCUMENTS

MC - 1 4 6 Structure diagram

Unit : mm



③	Molding	Epoxy Compound	_____
②	Lead	4 2 Alloy	Solder Plating (Pb free)
①	Crystal C-5SH	_____	_____
No.	Name of Part	Material	Remarks