INFORMATION

PRODUCT No. : **Q13MC1461000300**

MODEL : **MC-146**

32.768 kHz 7 pF ± 10

INFO. No. : **Q05-331-11B**

DATE : **Jan. 12. 2006**

EPSON TOYOCOM CORPORATION

8548 Naka-minowa
Minowa-machi Kamiina-gun
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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.

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

Contents

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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	TOPR	-40 °C		+85 °C
Drive level	DL	0.01 μW	0.1 μW	0.5μW
Vibration mode		Fundamental		

[3] Static characteristics

Item	Symbol	Value	Note
Frequency	fi	32.768 kHz	
Frequency tolerance	Δ f/f	± 10 × 10^{-6}	CL = 7 pF Ta = +25 ± 3 °C, Drive level : 0.1 μW Not include aging
Series resistance	R1	Max. 65 kΩ	CI meter : Sanders 140B Drive level : 0.5 μW
Motional capacitance	C1	Typ. 1.9 fF	
Shunt capacitance	C0	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

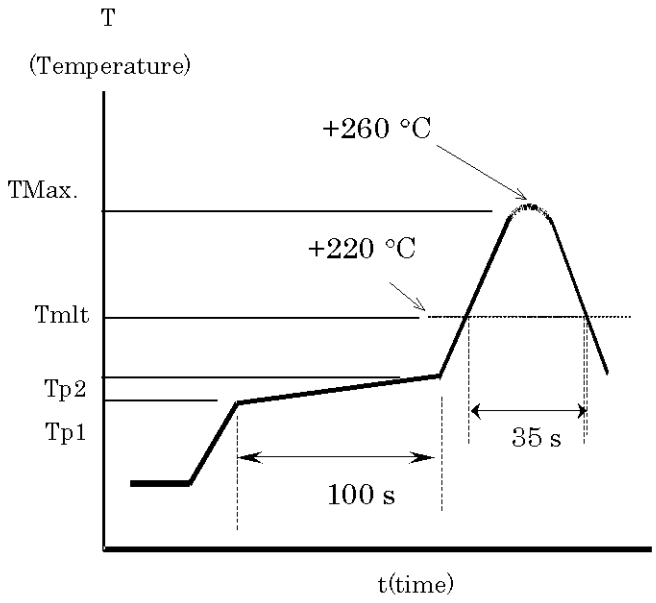
[4] Environmental and Mechanical characteristics

No.	Items	Value *1*2 $\Delta f/f$ [1×10^{-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

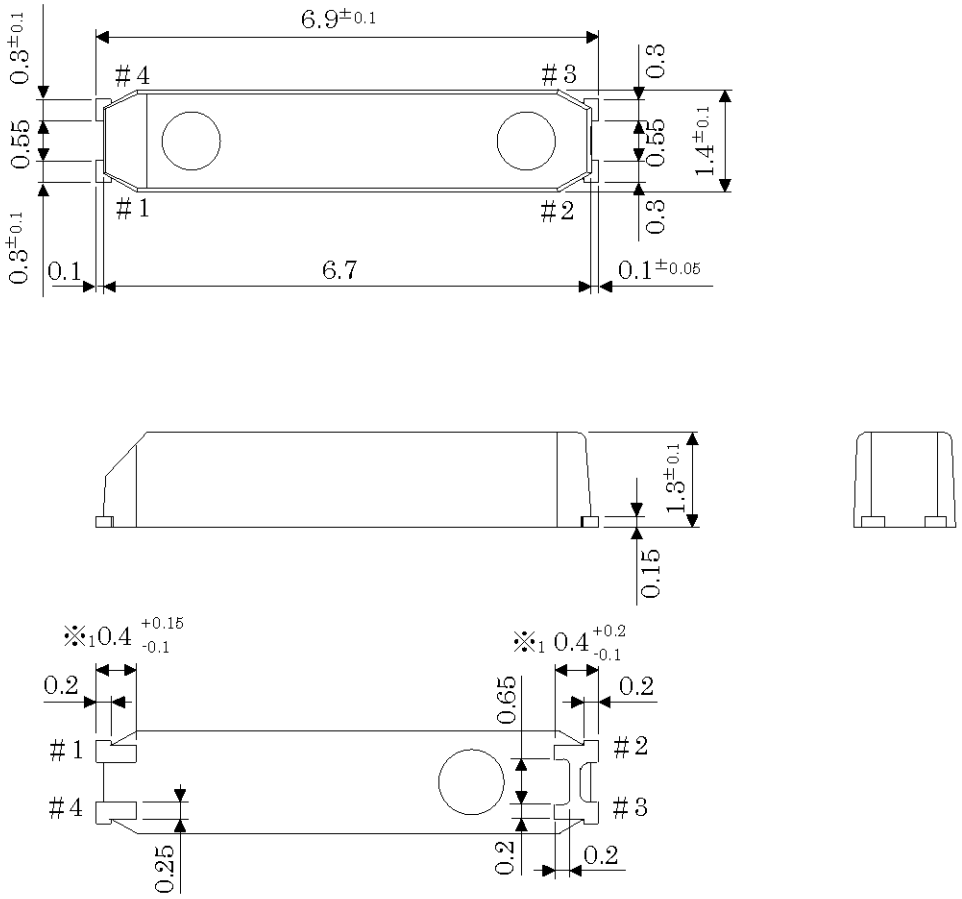
♦Air- reflow

Pre heating temperature : Tp1～Tp2 = +170 ℃
Peak temperature must not exceed +260 ℃ and the duration of over +220 ℃ should be 35 s



[5] Dimensions and Marking layout

1. Dimensions

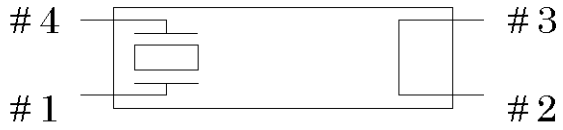


♣1 : Available area for soldering

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

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

2. Internal Connection

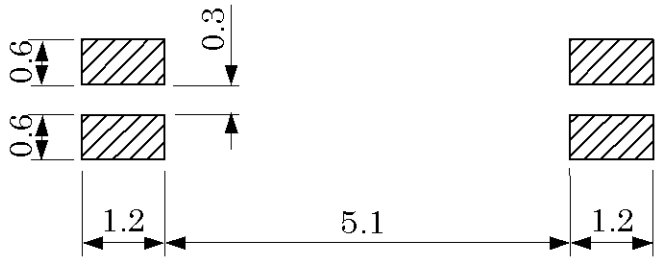


Do not connect 2# and 3# terminals to any external circuits (including GND).

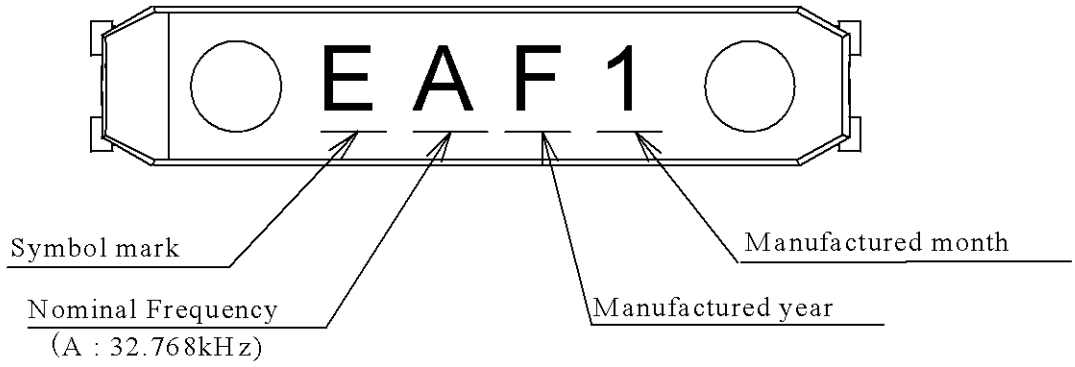
Type	MC-146	Unit	1 = 1 mm

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

[6] Notes

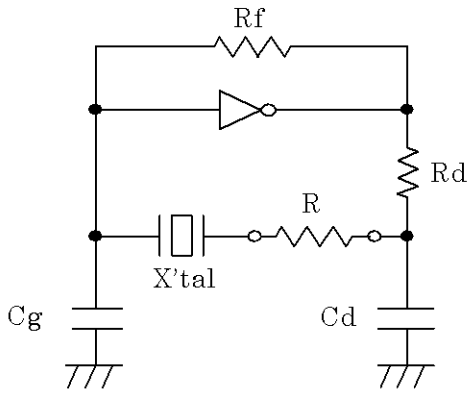
1. Max two (2) times reflow is allowed. Once miss soldering is happened, hand work soldering by soldering iron is recommended. (+350°C × within 5 sec.)

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
[1]	Taping specification	1 to 2
[2]	Inner carton	3
[3]	Shipping carton	
[4]	Marking	4
[5]	Quantity	
[6]	Storage environment	
[7]	Handling	

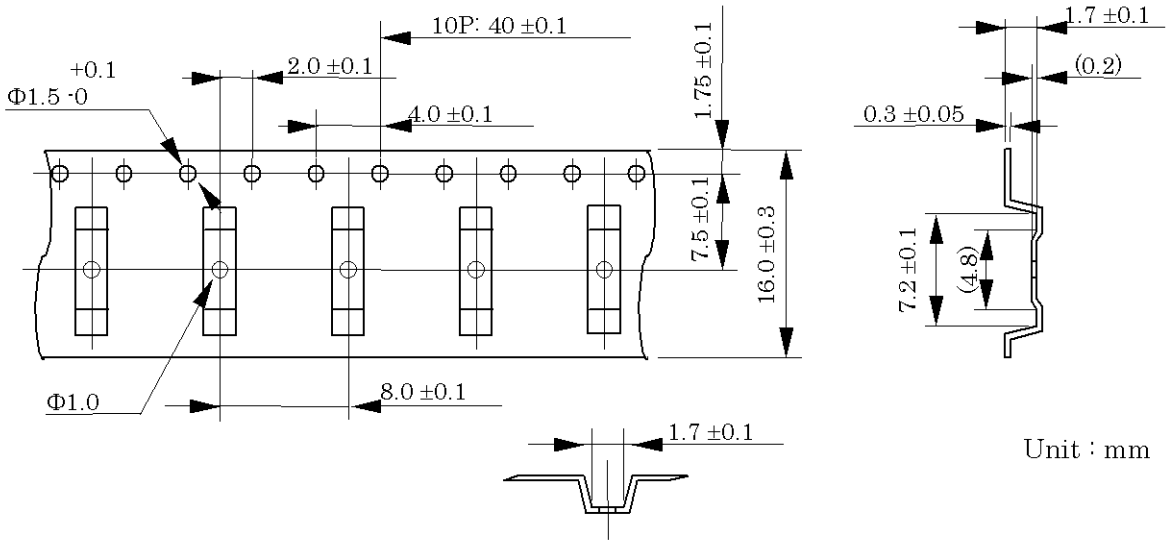
[1] Taping specification

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

(1) Tape dimensions TE1604L

Material of the Carrier Tape : PS

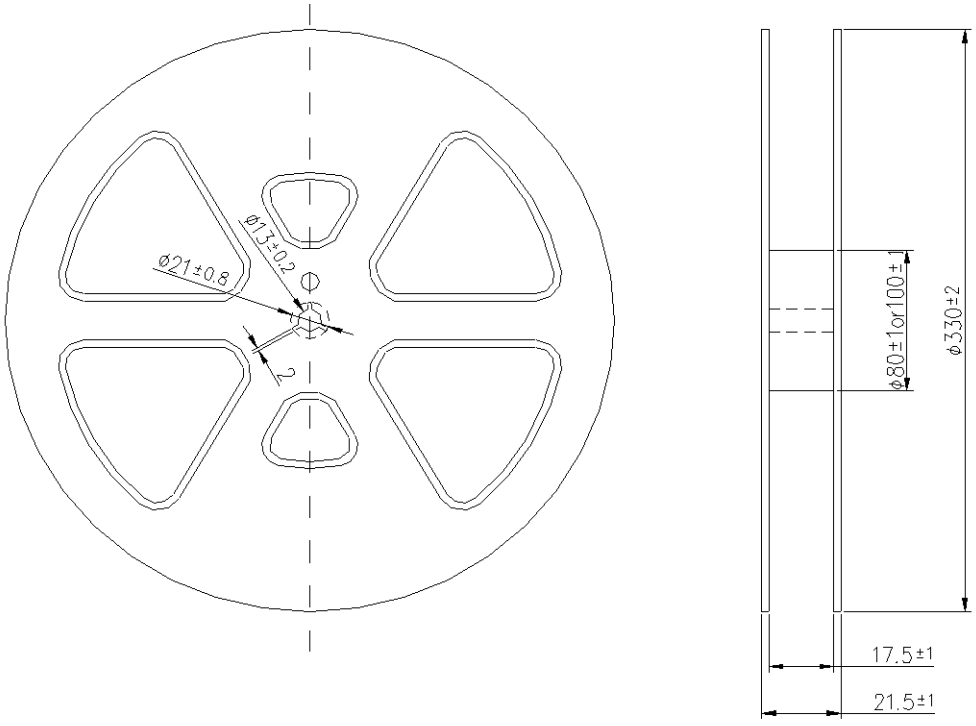
Material of the Top Tape : PET+PE



Unit : mm

(2) Reel dimensions

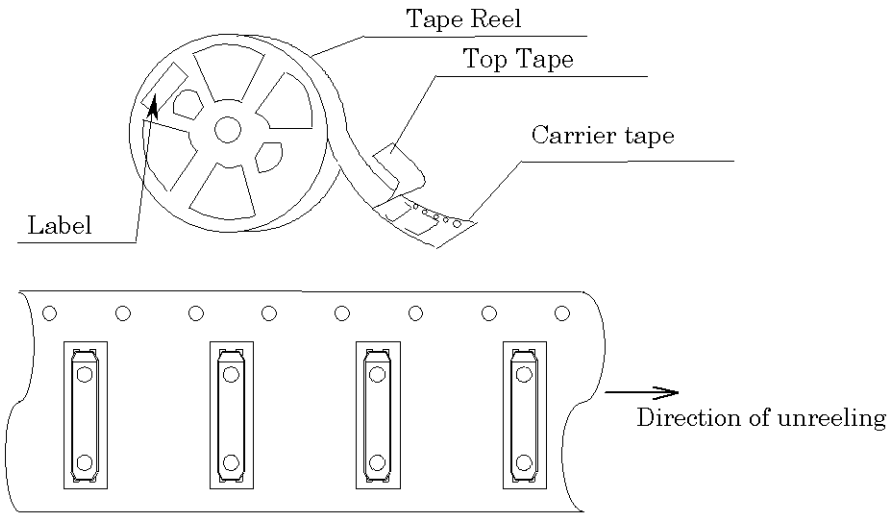
Material of the Reel : PS



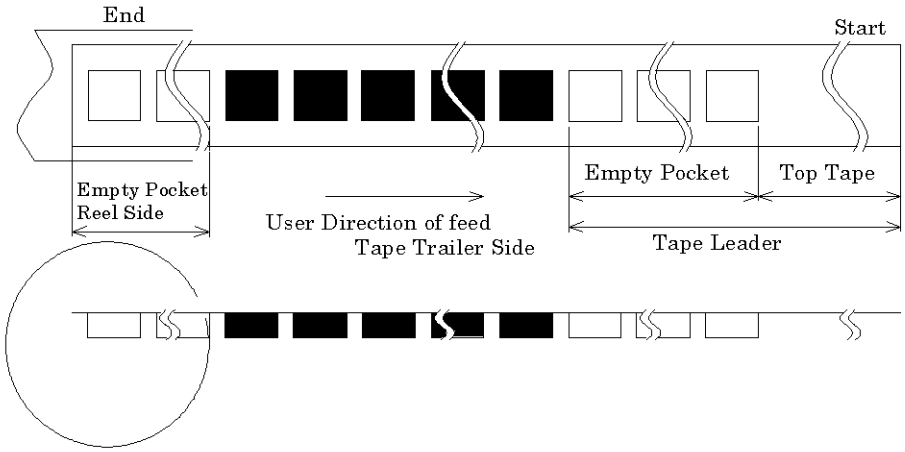
Form and Size of reel window shows are one of the example

(3) Packing

(a) Tape & Reel



(b) Start & End Point



(c) Peel force of the cover tape

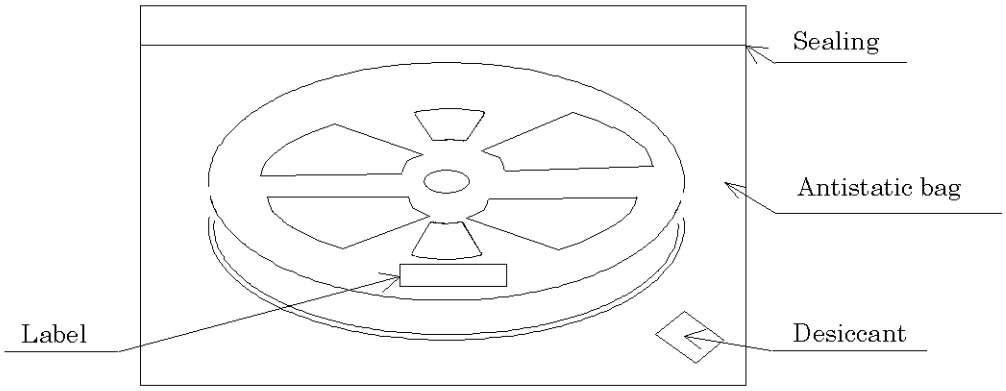
(1) angle : cover tape during peel off and the direction of unreeling shall be 165° to 180°.

(2) peel speed : 5 mm/s.

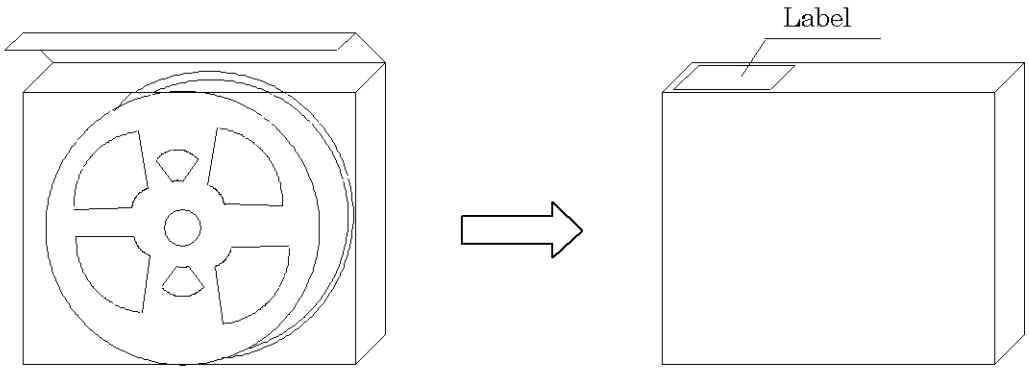
Item		Empty Space
Tape Leader	Top Tape	Min. 1 000 mm
	Carrier Tape	Min. 40 pockets
Tape Trailer	Top Tape	Min. 0 mm
	Carrier Tape	Min. 40 pockets

[2] Inner Carton

a) Packing to antistatic bag

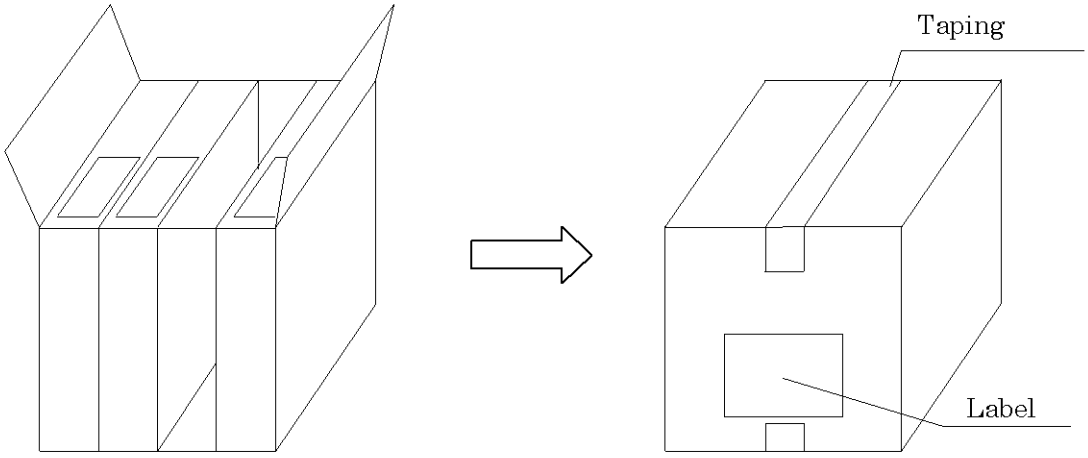


b) Packing to innercarton



[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 —

CODE : MC-146

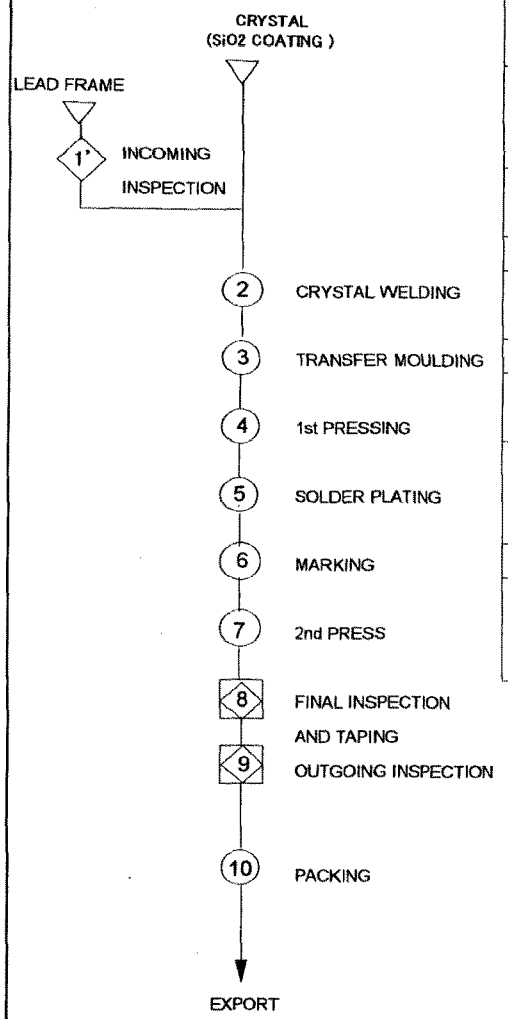
Control No : M-9803-AEE-1

SURFACE MOUNTING TYPE CRYSTAL MC-146

1999.09.14

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INA PLANT QZ BU

PREPARED	CHECKED	APPROVED
	T.Ozawa	M.Taniguchi



No	RESPONSIBLE SECTION	STANDARD AND SPECIFICATIONS	INSPECTION AND CONTROL ITEMS	INSPECTION METHORD	MEASURING INSTRUMENTS	DATA COLLECTION
1'	MALAYSIA PIANT	PURCHASING SPECIFICATION	APPEARANCE	SAMPLING	PIUG GAUGES	IN-COMMING INSPECTION
		INCOMING INSPECTION STD.	DIMENSION		MICROSCOPE	DATA SHEET
2	MALAYSIA PIANT	MANUFACTURING INSTRUCTION SHEET	APPEARANCE	100% INSPECTION	MICROSCOPE	PROCESS DATA SHEET
		MANUFACTURING INSTRUCTION SHEET	DIMENSION	SAMPLING	T.M.S	PROCESS DATA SHEET
		MANUFACTURING INSTRUCTION SHEET	STRENGTH	SAMPLING	PUSH&PULL GAUGE	PROCESS DATA SHEET
3	MALAYSIA PIANT	MANUFACTURING INSTRUCTION SHEET	APPEARANCE	100% INSPECTION	MICROSCOPE	PROCESS DATA SHEET
				SAMPLING	X-RAY	PROCESS DATA SHEET
4	MALAYSIA PIANT	MANUFACTURING INSTRUCTION SHEET	APPEARANCE	SAMPLING	MICROSCOPE	PROCESS DATA SHEET
5	MALAYSIA PIANT	SOLDER PLATING	S.P THICKNESS	SAMPLING	FLUOROSCOPY	PROCESS DATA SHEET
	SUB-CONTRACTOR	SPECIFICATION SHEET	APPEARANCE	SAMPLING	VISUAL INSPECTION	PROCESS DATA SHEET
6	MALAYSIA PIANT	MANUFACTURING INSTRUCTION SHEET	APPEARANCE	SAMPLING	VISUAL INSPECTION	PROCESS DATA SHEET
7	MALAYSIA PIANT	MANUFACTURING INSTRUCTION	APPEARANCE	SAMPLING	MICROSCOPE	PROCESS DATA SHEET
			DIMENSION	SAMPLING	INSPECTION JIG	PROCESS DATA SHEET
8	MALAYSIA PIANT	MANUFACTURING INSTRUCTION SHEET	ELECTRICAL CHARACTERISTIC	100% INSPECTION	FO CHECKING By m/c	PROCESS DATA SHEET
		MANUFACTURING INSTRUCTION SHEET	TAPING STRENGTH	SAMPLING	STRENGTH TESTER	PROCESS DATA SHEET
		QUALITY STD.	ELECTRICAL CHARACTERISTIC	SAMPLING	TO&CI CHECKER	OGI INSP.SHEET
9	MALAYSIA PIANT	QUALITY STD.	APPEARANCE	SAMPLING	MICROSCOPE	OGI INSP.SHEET
10	MALAYSIA PIANT	MANUFACTURING INSTRUCTION SHEET	EXPORT CUSTOMER LIST			EXPORT DOCUMENTS
		DAILY SHIPPING LIST	FREQUENCY			
			QUANTITY			

— PROCESS QUALITY CONTROL —

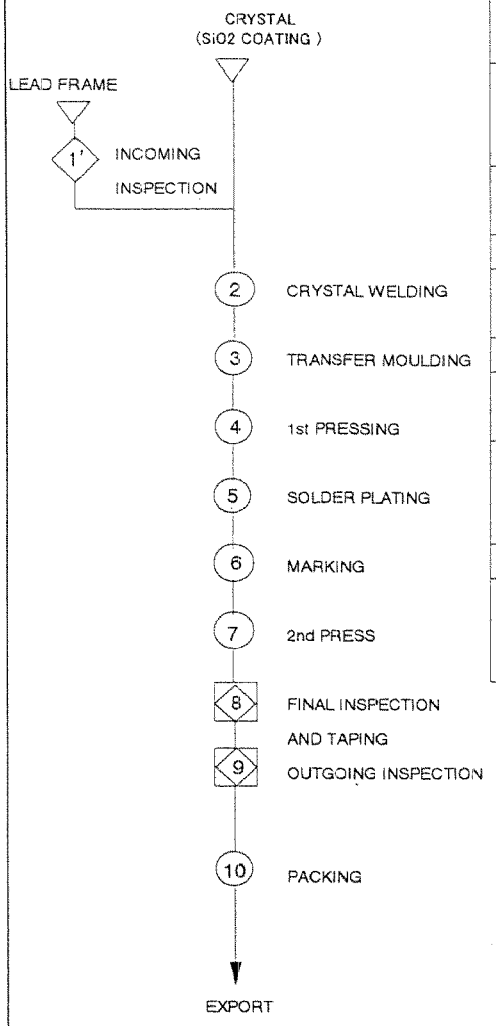
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CODE : MC-146

Control No : M-9803-ASE-1

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INA PLANT QZ BU



No	RESPONSIBLE SECTION	STANDARD AND SPECIFICATIONS	INSPECTION AND CONTROL ITEMS	INSPECTION METHORD	MEASURING INSTRUMENTS	DATA COLLECTION
1'	CHINA PIANT	PURCHASING SPECIFICATION	APPEARANCE	SAMPLING	PIUG GAUGES	IN-COMMING INSPECTION
		INCOMING INSPECTION STD.	DIMENSION		MICROSCOPE	DATA SHEET
2	CHINA PIANT	MANUFACTURING INSTRUCTION SHEET	APPEARANCE	100% INSPECTION	MICROSCOPE	PROCESS DATA SHEET
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		MANUFACTURING INSTRUCTION SHEET	TAPING STRENGTH	SAMPLING	STRENGTH TESTER	PROCESS DATA SHEET
		QUALITY STD.	ELECTRICAL CHARACTERISTIC	SAMPLING	T0&CI CHECKER	OGI INSP.SHEET
9	CHINA PIANT	QUALITY STD.	APPEARANCE	SAMPLING	MICROSCOPE	OGI INSP.SHEET
10	CHINA PIANT	MANUFACTURING INSTRUCTION SHEET	EXPORT CUSTOMER LIST			EXPORT DOCUMENTS
		DAILY SHIPPING LIST	FREQUENCY			
			QUANTITY			

— PROCESS QUALITY CONTROL —

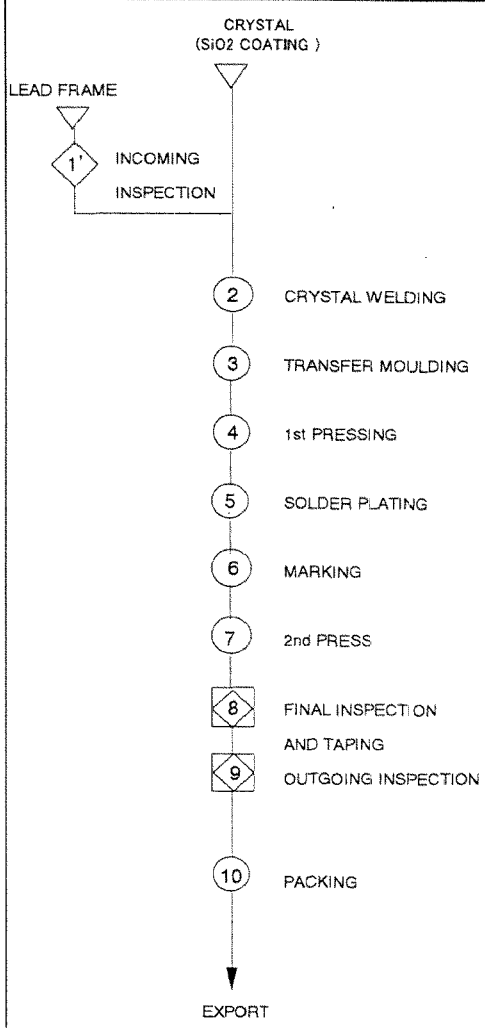
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M.Nagai	M.Nagai	

CODE : MC-146

Control No : M-9803-ANE-1

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No	RESPONSIBLE SECTION	STANDARD AND SPECIFICATIONS	INSPECTION AND CONTROL ITEMS	INSPECTION METHORD	MEASURING INSTRUMENTS	DATA COLLECTION
1'	SUB-CONTRACTOR	PURCHASING SPECIFICATION	APPEARANCE	SAMPLING	PIUG GAUGES	IN-COMMING INSPECTION
		INCOMING INSPECTION STD.	DIMENSION		MICROSCOPE	DATA SHEET
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		DAILY SHIPPING LIST	FREQUENCY			
			QUANTITY			

— PROCESS QUALITY CONTROL —

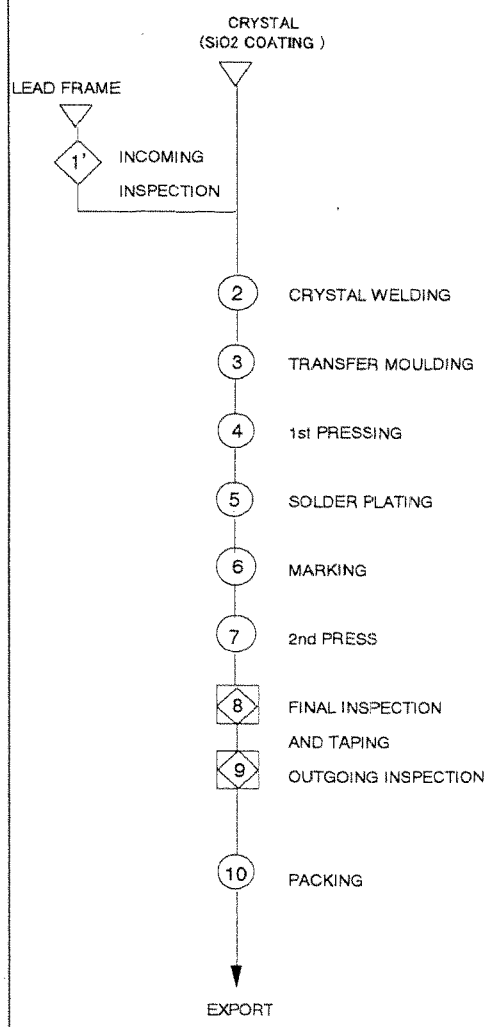
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CODE : MC-146

Control No : M-9803-AKE-1

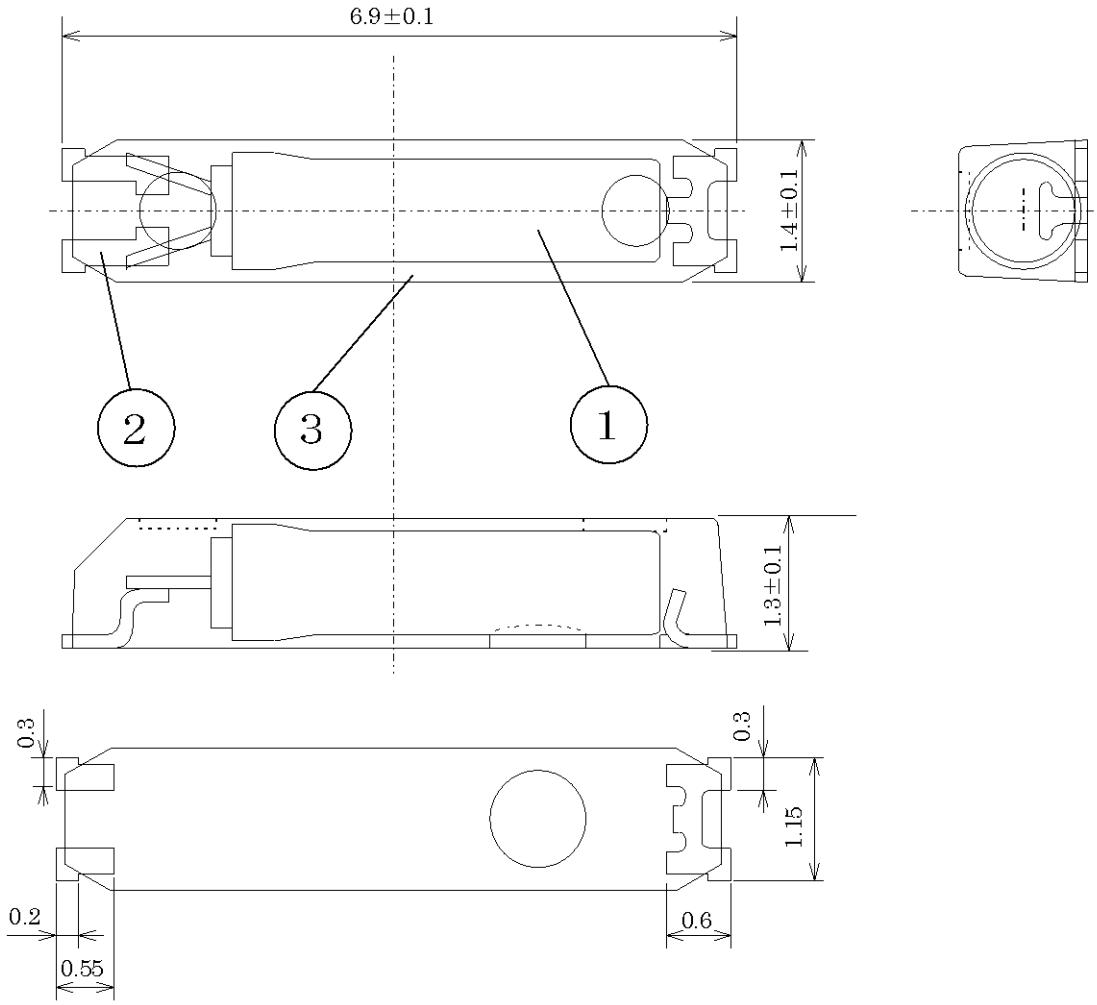
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4	SUB-CONTRACTOR	MANUFACTURING INSTRUCTION SHEET	APPEARANCE	SAMPLING	MICROSCOPE	PROCESS DATA SHEET
5	SUB-CONTRACTOR	SOLDER PLATING	S.P THICKNESS	SAMPLING	FLUOROSCOPY	PROCESS DATA SHEET
	SUB-CONTRACTOR	SPECIFICATION SHEET	APPEARANCE	SAMPLING	VISUAL INSPECTION	PROCESS DATA SHEET
6	SUB-CONTRACTOR	MANUFACTURING INSTRUCTION SHEET	APPEARANCE	SAMPLING	VISUAL INSPECTION	PROCESS DATA SHEET
7	SUB-CONTRACTOR	MANUFACTURING INSTRUCTION	APPEARANCE	SAMPLING	MICROSCOPE	PROCESS DATA SHEET
			DIMENSION	SAMPLING	INSPECTION JIG	PROCESS DATA SHEET
8	SUB-CONTRACTOR	MANUFACTURING INSTRUCTION SHEET	ELECTRICAL CHARACTERISTIC	100% INSPECTION	F0 CHECKING By m/c	PROCESS DATA SHEET
		MANUFACTURING INSTRUCTION SHEET	TAPING STRENGTH	SAMPLING	STRENGTH TESTER	PROCESS DATA SHEET
		QUALITY STD.	ELECTRICAL CHARACTERISTIC	SAMPLING	T0&CI CHECKER	OGI INSP.SHEET
9	SUB-CONTRACTOR	QUALITY STD.	APPEARANCE	SAMPLING	MICROSCOPE	OGI INSP.SHEET
10	SUB-CONTRACTOR	MANUFACTURING INSTRUCTION SHEET	EXPORT CUSTOMER LIST			EXPORT DOCUMENTS
		DAILY SHIPPING LIST	FREQUENCY			
			QUANTITY			

MC－146 Structure diagram

Unit：mm



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