RECIPIENT

SPECIFICATIONS

Product No. : **Q13FC1350004900**

MODEL : **FC-135**

SPEC. No. : **ECC2015-0056**

DATE: **Aug. 1. 2015**

SEIKO EPSON CORPORATION

ECCSH

CHECKED Kiang /

PREPARED Jarry /

SPECIFICATIONS

1. Application

1) This document is applicable to the crystal unit that are delivered to customer from Seiko Epson Corp.
2) RoHS compliant
   FC-135 contains lead in Low melting type solder which is exempted in 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 unit is Q13FC1350004900.
The model is FC-135.

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

[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	$\times 10^{-6}$	CL =6 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	1.2 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.	$\times 10^{-6}/°C^2$	
7	Isolation resistance		IR	500 Min.	MΩ	DC 100 V ± 15, 60 seconds Between terminal # 1 and terminal # 2
8	Frequency Aging		f_age	± 3	$\times 10^{-6}$/year	Ta = + 25 °C ± 3 °C Level of drive : 0.1 μW

[4] Environmental and Mechanical characteristics

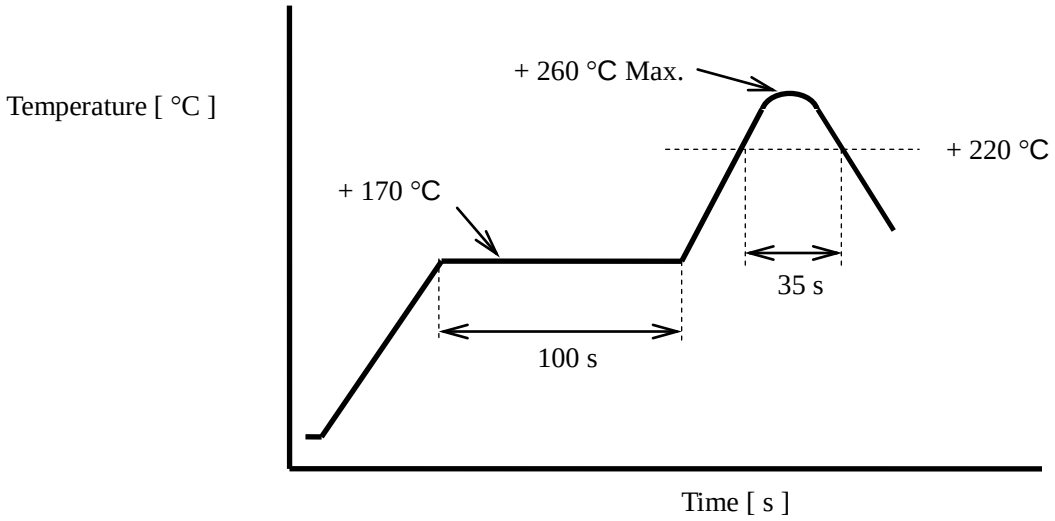
No.	Items	Value	Conditions
1	Shock resistance	*3Δ f/f : ± 8 × 10^{-6}	100 g dummy(EPSON Standard), Natural drop from 1 500 mm height on to the concrete. 3 directions × 10 times *2
2	Vibration resistance	*3Δ f/f : ± 3 × 10^{-6}	10 Hz to 55 Hz amplitude 0.75 mm 55 Hz to 500 Hz acceleration 98 m/s^2 10 Hz → 500 Hz → 10 Hz 15 min./cycle 6 h (2 hours , 3 directions) *2
3	Soldering heat resistance	Δ f/f : ± 5 × 10^{-6}	For convention reflow soldering furnace (2 times)
4	High temperature storage	*3Δ f/f : ± 10 × 10^{-6}	+ 125 °C × 1 000 h *1
		*3Δ f/f : ± 7 × 10^{-6}	+ 85 °C × 1 000 h *1
5	Low temperature storage	*3Δ f/f : ± 10 × 10^{-6}	- 55 °C × 1 000 h *1
6	High temperature and humidity	*3Δ f/f : ± 10 × 10^{-6}	+ 85 °C × 85 %RH × 1000 h *1
7	Temperature cycle	*3Δ f/f : ± 10 × 10^{-6}	- 55 °C ↔ + 125 °C 30 minutes at each temperature × 100 cycles *1
8	Sealing	*3 1 × 10^{-8} hPa･l / s Max.	For He leak detector
9	Shear	No peeling-off at a soldered part	20 N press for 10 ± 1 s. Ref. IEC 60068-2-21
10	Pull - off	No peeling-off at a soldered part	20 N press for 10 ± 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 ± 1 s × 1 time Ref. IEC 60068-2-21
12	Solvent resistance	The marking shall be legible	Ref. JIS C 0052 or IEC 60068-2-45

< Notes >

1. *1 Each test done independently.
2. *2 Measuring 2 h to 24 h later leaving in room temperature after each test. Drive level : 0.5 μW
3. *3 Pre conditionings(Treat the Reflow 2 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 ±20 % or less than ±15kΩ.
   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 ± 30 % or ± 20 kΩ.

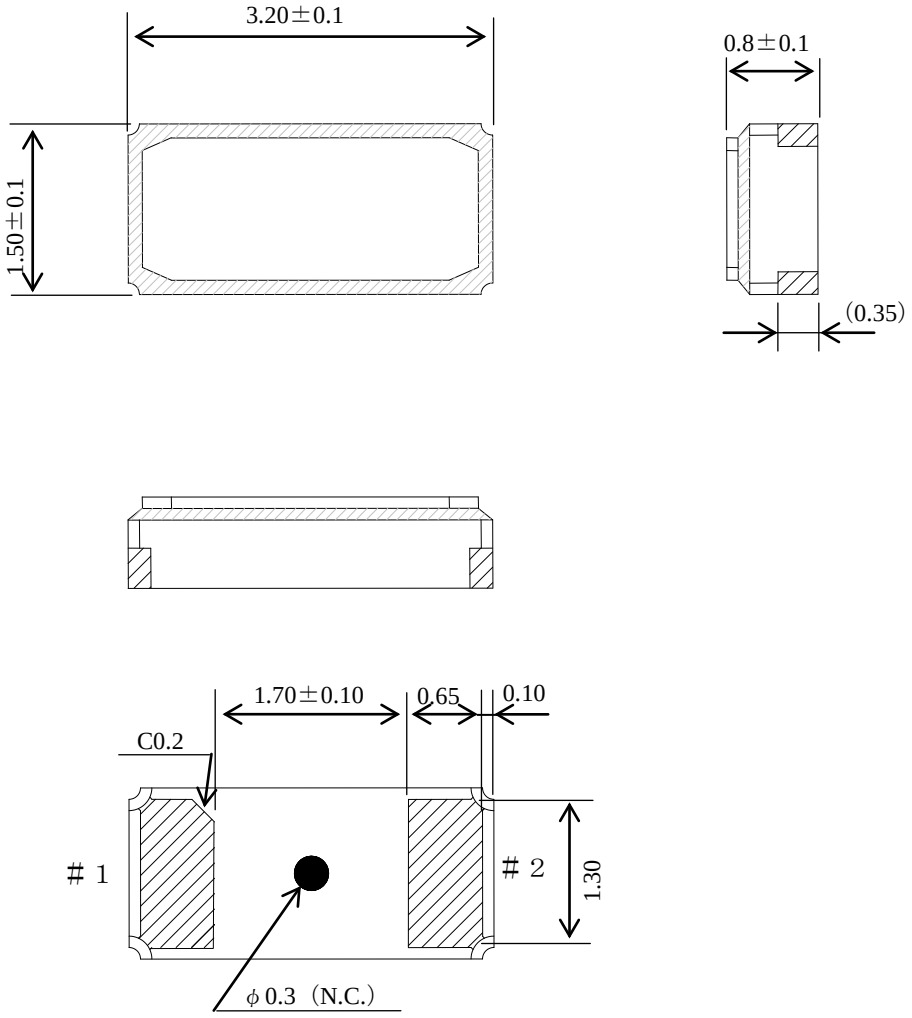
♦ Conditions of hot air convection reflow

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

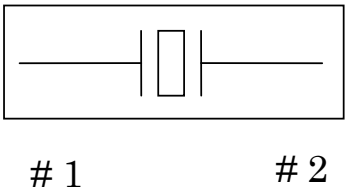


[5] Dimensions and Marking layout

1. Dimensions



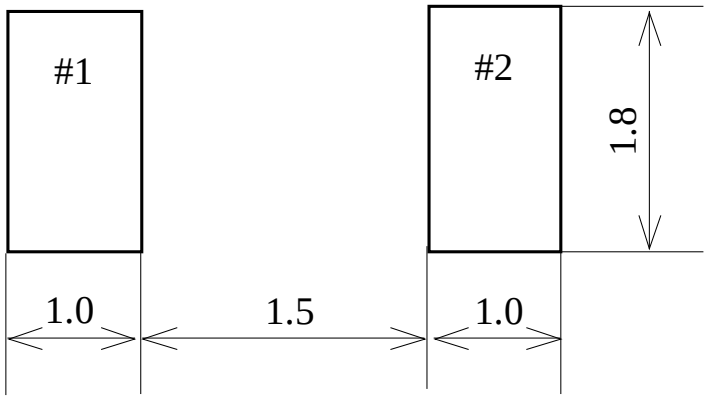
2. Internal Connection



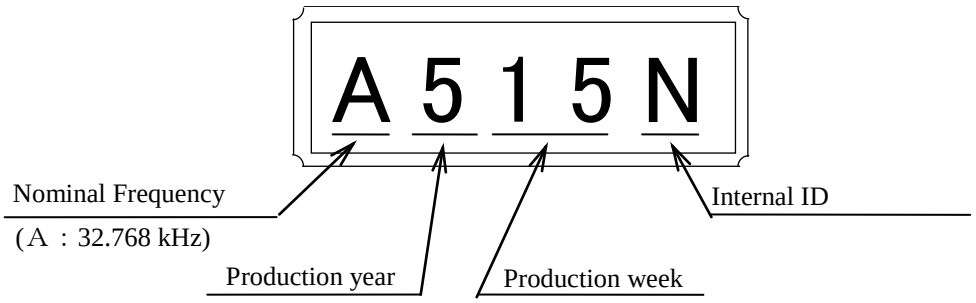
Type	FC-135	Terminal treatment	Au plating	Unit	1 = 1 mm

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-135	Unit	1 = 1 mm

[6] Notes

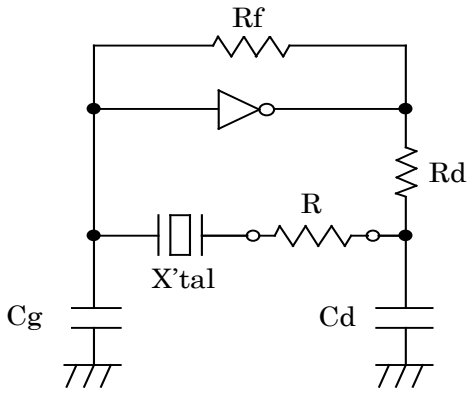
1. Max two (2) times reflow is allowed. Once miss soldering is happened, hand work soldering by soldering iron is recommended. (+ 350 °C × within 5 s)

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 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.

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 unit. 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.

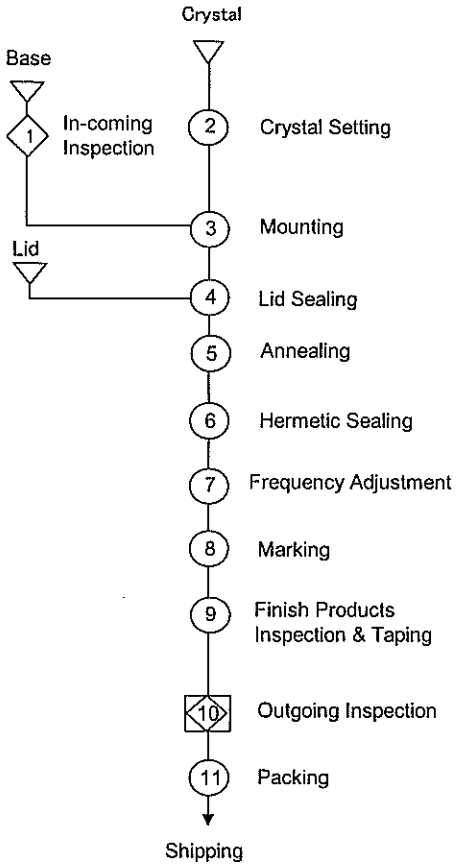
PROCESS QUALITY CONTROL

FC-135

No.C-0102-AGE-1

2015.03.10
FC135_Q_0001

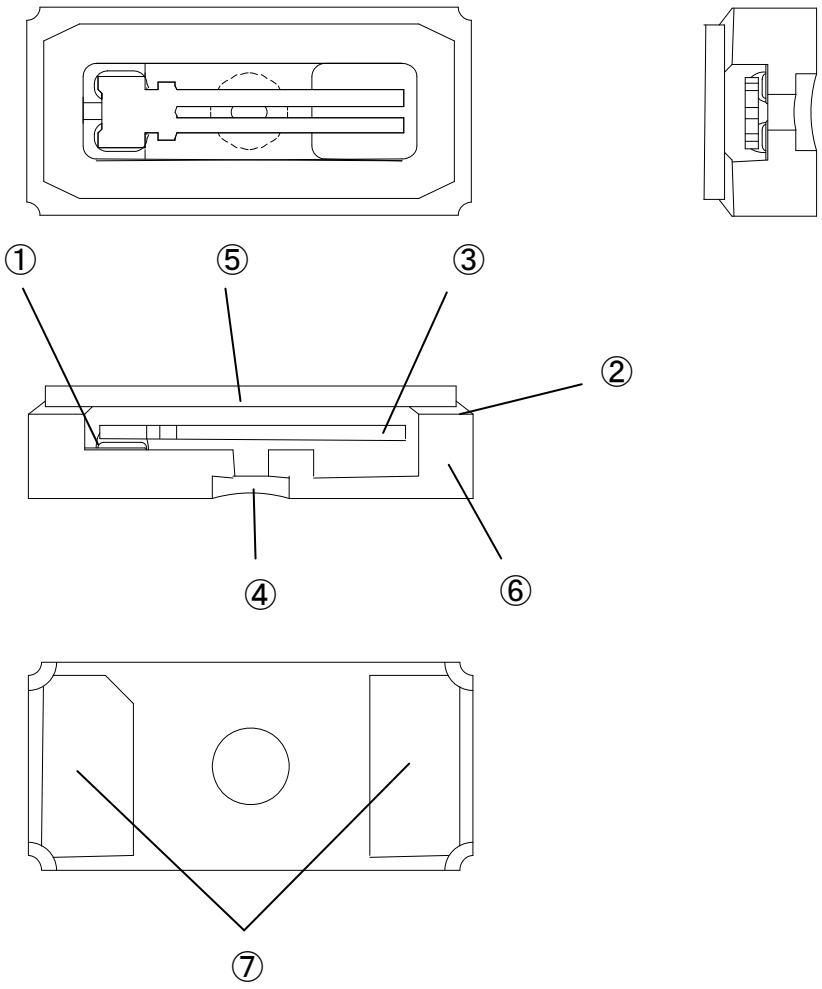
Manufacturing process chart



No.	Section In Charge	Standards	Inspection Control Item	Inspection Methods	Instruments	Record
1	Inspection Section	Purchasing Specification	Appearance	Sampling	Visual Inspection	In-coming Inspection
		Incoming Inspection Standard	Dimension	Sampling	Tool Microscope	Data Sheet
2	SUB-CONTRACTOR	Manufacturing Instruction Sheet	Appearance	100% Inspection	Microscope	Process Data Sheet
3	SUB-CONTRACTOR	Manufacturing Instruction Sheet	Appearance	100% Inspection	Microscope	Process Data Sheet
4	SUB-CONTRACTOR	Manufacturing Instruction Sheet	Appearance	100% Inspection	Microscope	Process Data Sheet
			Height Measure	Sampling	Inspection Jig	
5	SUB-CONTRACTOR	Manufacturing Instruction Sheet	Appearance	100% Inspection	Microscope	Process Data Sheet
6	SUB-CONTRACTOR	Manufacturing Instruction Sheet	Appearance	100% Inspection	Microscope	Process Data Sheet
7	SUB-CONTRACTOR	Manufacturing Instruction Sheet	Frequency	100% Inspection	Frequency Adjust-ment Machine	Data Sheet
8	SUB-CONTRACTOR	Manufacturing Instruction Sheet	Appearance	100% Inspection	Microscope	Process Data Sheet
			Marking Strength	Sampling	Rubbing Test	Data Sheet
9	SUB-CONTRACTOR	Manufacturing Instruction Sheet	Frequency	100% Inspection	Characteristics In-spection Machine	Process Data Sheet
			Crystal Inpedance	100% Inspection		
			Appearance	100% Inspection	Microscope	
10	SUB-CONTRACTOR	Specification	Electrical Characteristics	Sampling	Measuring Equipment	Outgoing Inspection
		Outgoing Inspection Standard	Appearance	Sampling	Microscope	Data Sheet
			Dimension	Sampling	Tool Microscope	
11	SUB-CONTRACTOR	Packing Instruction	Customers	———	———	Shipment List
		Daily Shipping List	Type	———	———	
			Quantity	———	———	

Structure Diagram 構造図

Model 型式	**FC-135**	
Document No. 管理№	-	FC135_D_0001



No.	Name of Part 部品名
⑦	Terminal 端子 (外部電極)
⑥	Package パッケージ
⑤	Lid キャップ
④	Sealing 封止材
③	Crystal chip 水晶片
②	Sealing 封止材
①	Crystal Adhesive 水晶接着

TAPING SPECIFICATION
テープ梱包基準書

1. APPLICATION 適用範囲

This document is applicable to FC-135 series.
本基準書は、FC-135 シリーズのテーピング梱包について規定する。

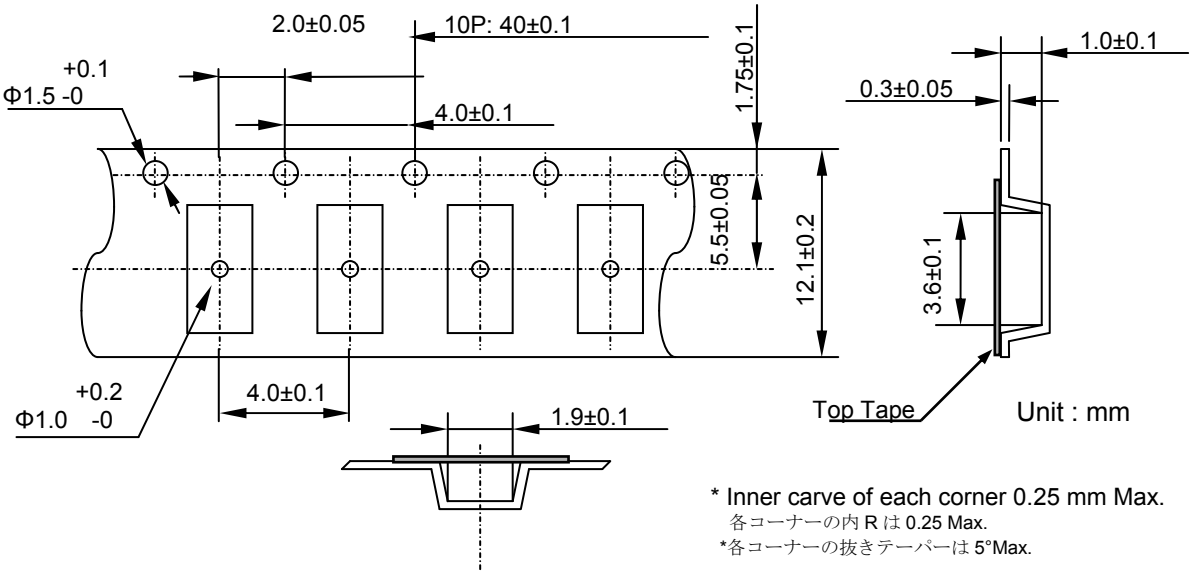
2. CONTENTS 目次

[1] Taping specification テーピング仕様

Subject to EIA-481 , IEC 60286.
「EIA-481」「IEC 60286」に準拠する。

(1) Tape dimensions TE1204L

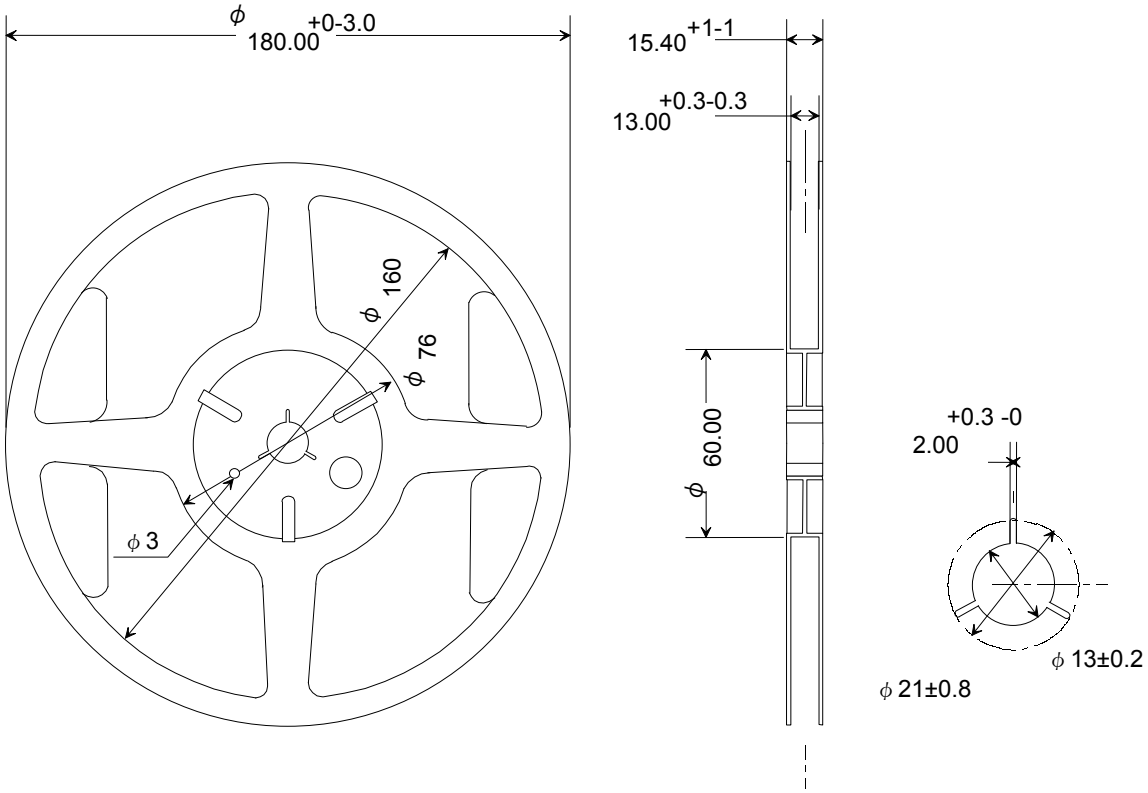
Material of the Carrier Tape キャリアテープ材質: PS (Electrically conductive)
Material of the Top Tape トップテープ材質 : PET+PE



* Inner carve of each corner 0.25 mm Max.
各コーナーの内 R は 0.25 Max.
*各コーナーの抜きテーパーは 5°Max.

(2) Reel dimensions : EIAJRRM Φ180 mm Tape Wide 12 mm

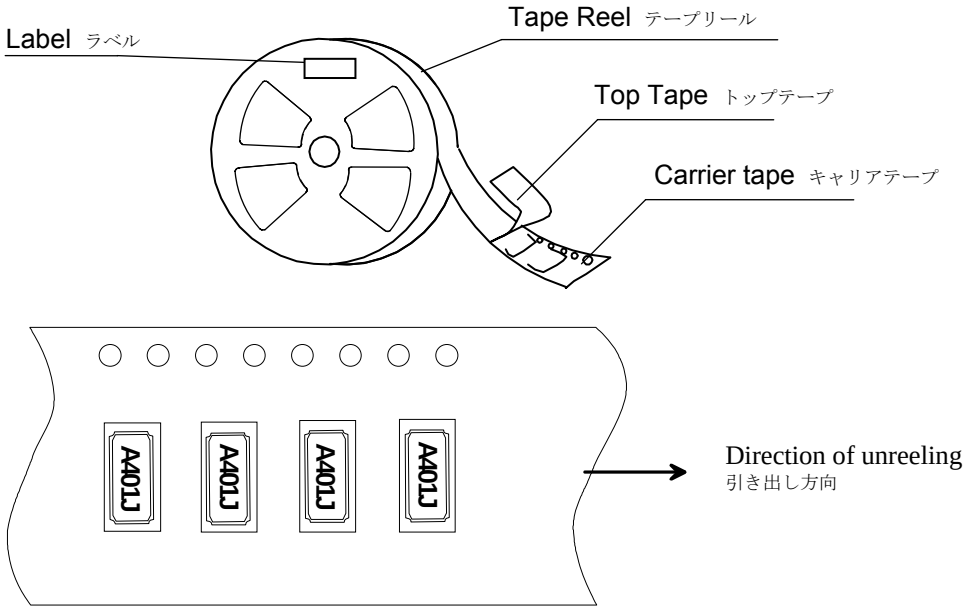
Material of the Reel リール材質: PS



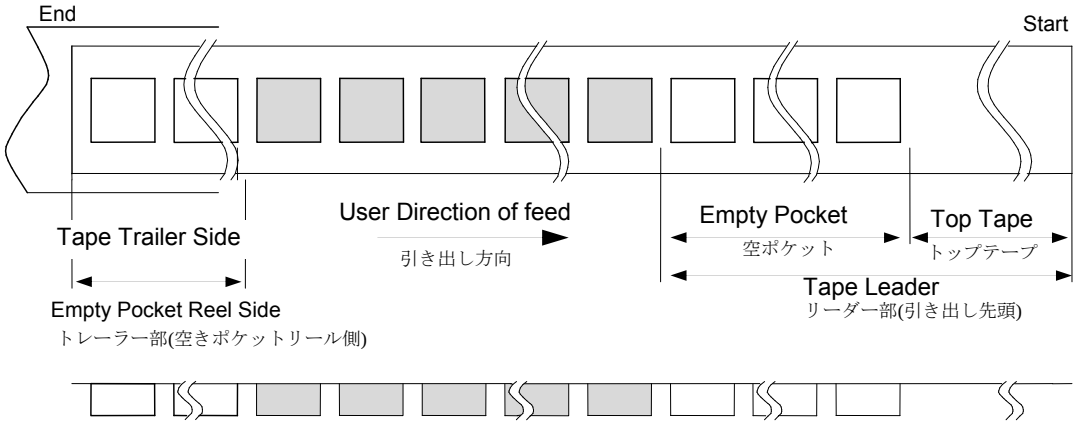
Form and Size of reel window shows are one of the example
リールの窓の形状は代表例を掲載。

(3) Packing 収納形態

(a) Tape & Reel デバイス収納方法



(b) Start & End Point 引き出し先頭側及びリール側の処理



Item		Empty Space 空きスペース	Note 備考
Tape Leader (引き出し先頭側)	Top Tape	Min. 1 000 mm	**Feeding in the Top tape, the tip is fixed with tape.** トップテープ単独で繰り出し、先端はテープにより固定。 **Winding method is a diagram of the above** リールへの巻き取り方法は、上図の通り。
	Carrier Tape	Min. 80 mm	
Tape Trailer (リール側)	Top Tape	Min. 0 mm	**Tip is fixed to the reel.** 先端はリールに固定。
	Carrier Tape	Min. 80 mm	

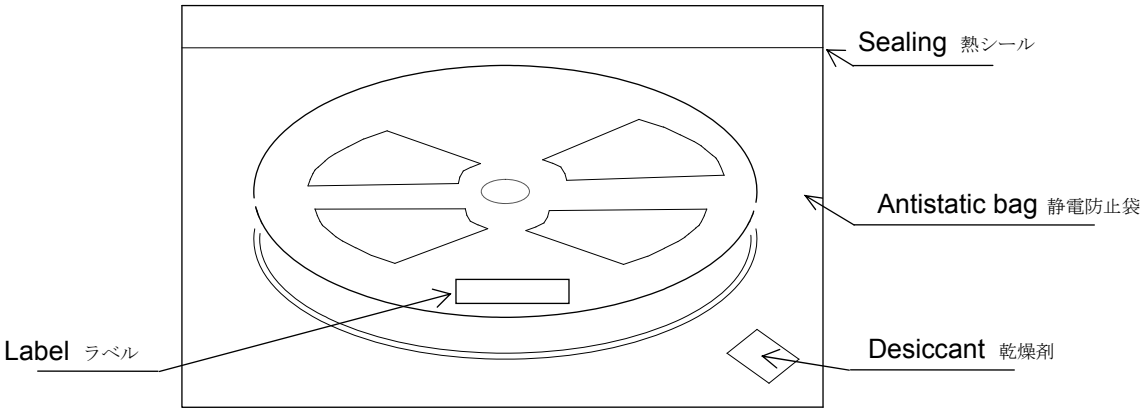
(4) Peel force of the cover tape トップテープの剥離強度

(a) angle : cover tape during peel off and the direction of unreeling shall be 165° to 180°.
剥離角度:テープの接着面に対し 165～180 度とする。

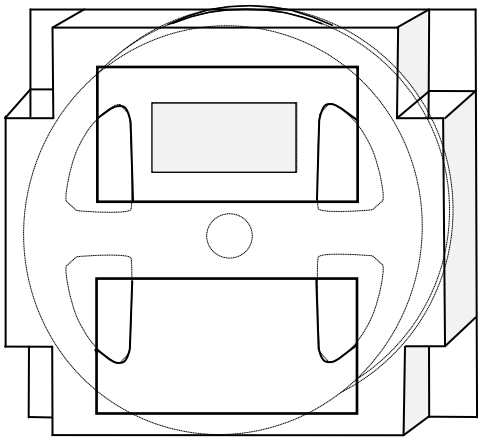
(b) peel speed : 300 mm/min
剥離速度:300 mm/min とする。

[2] Inner sleeve

a) Packing to antistatic bag 袋への収納

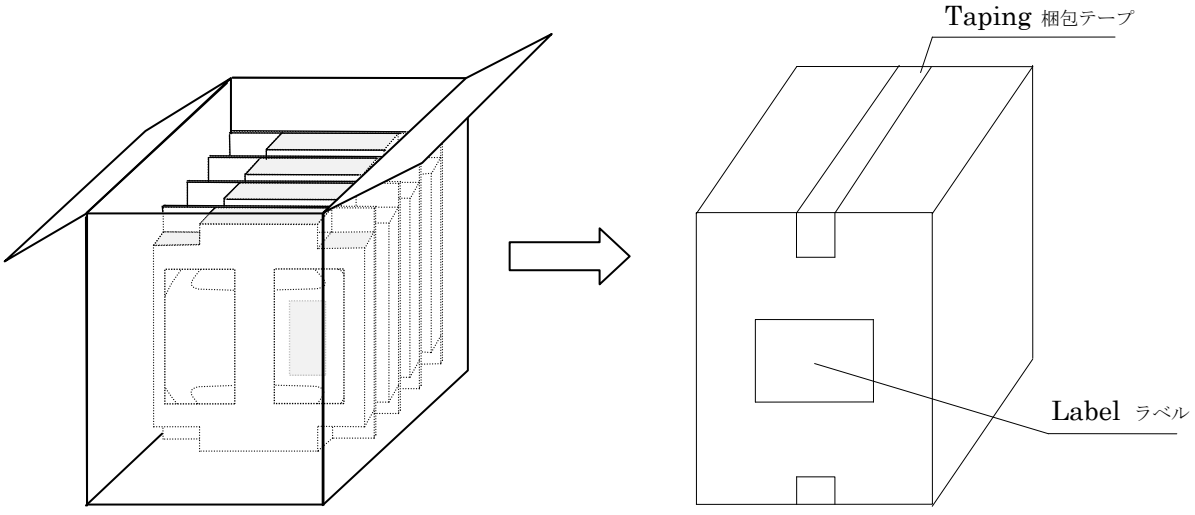


b) Packing to inner sleeve スリーブへの収納



[3] Shipping Carton 外装箱への収納

- Put inner sleeve into an outer box.
  外装箱の中へ、スリーブを収納する。
- If there are room in the outer box, material is put in a shock absorbing together.
  空間ができた時は、クッション材を入れる。



[4] Marking 表示

(1) Reel marking リールへの表示

- Reel marking shall consist of

下記内容をリール表面に表示できるラベルを貼る。:

1) Parts name 製品名称
2) Quantity 製品数量
3) Manufacturing Date or symbol 製品の製造年月又はこれを示す記号
4) Manufacturer's Date or symbol 製品の製造業者又はその略号
5) Others (if necessary) その他必要事項

(2) Shipping carton marking 外装箱への表示

- Shipping carton marking shall consist of :

下記内容を外装箱表面に表示できるラベルを貼る。:

1) Parts name 製品名称
2) Quantity 製品数量

[5] Quantity 収納数量

- 3 000 pcs./reel (Standard)

However it is not the limit, in case that the order quantity does not fill with 3000 pieces.
Packing quantity is defined by 14th and 15th digit of product number.
但し、注文数量が 3 000 pcs に満たない場合は、その限りではない。
収納数量は、製品型番の 14 桁、15 桁による。

14th and 15th digit of product number. 製品型番の 14 桁、15 桁	Quantity
00	3 000 pcs
01	Vinyl Bag(Bulk)
11	Any Quantity
12	250 pcs
13	250 pcs
14	1 000 pcs
15	2 000 pcs

[6] Storage environment 保管環境

(1) Before open the packing, we recommend to keep less than +30 °C and 85 %RH of Humidity, and to use it less than 6 months after delivery.
開梱前の製品は、温度 +30 °C、湿度 85 %RH 以下での保管をして下さい。
貴社納入後、袋未開封で 6 ヶ月以内の実装を推奨します。

(2) We recommend to open Package in immediately before use. After open Package, We recommend to keeps less than 6 month. No need dry air before soldering work if it is less than temperature +30 °C, 85 humidity %RH.
使用直前まで開梱せず、袋開封後は 6 ヶ月以内の実装を推奨します。
温度 +30 °C、湿度 85 %RH 以下では、はんだ付け作業前に乾燥不要です。

(3) Not to storage with some erosive chemicals.
化学薬品類との同居を避ける。

(4) Nothing is allowed to put on the reel or carton to prevent mechanical damage
内・外装箱がゆがまないようまた、外圧がかからないように保管して下さい。

[7] Handling リール取扱い

To handle with care to prevent the damage of tape, reel and products.
リールの取扱いについては、中のテープ・製品を変形させないようにして下さい。