RECIPIENT

SPECIFICATIONS

Product No. : X1G004691003500

MODEL : TG2016SBN 40.000000 MHz TCNNNA

SPEC. No. : A15-1173-0B

DATE : Jan. 14. 2016

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SPECIFICATIONS

1. Application

This document is applicable to the temperature compensated crystal oscillator (TCXO) that is delivered to **Chongqing Pinsheng Technology Co., Ltd.** from SEIKO EPSON Corp.

This product is compliant with RoHS Directive.

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.

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 extra high reliability, such as satellite, rocket and other space systems, and medical equipment, the functional purpose of which is to keep life.

2. Product No. / Model

The product No. of this crystal oscillator unit is **X1G00469100350**.
The model is **TG2016SBN 40.000000 MHz TCNNNA** (TCXO)

3. Packing

It is subject to the packing standard of SEIKO EPSON Corp.

4. Amendment and abolishment

Amendment and/or abolishment of this specification are subject to the agreement of both parties.

5. Contents

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[1] Characteristics

- Lead Free Reflowable and ultra small SMD(2.0 × 1.6 × 0.73 mm Typ.).
- Using the heat-resisting type AT cut quartz crystal allows almost the same temperature soldering as universal SMD IC.
- Clipped-sinewave output.

[2] Absolute maximum ratings

Parameter	Symbol	Value	Unit	Note
Supply voltage	V_{CC}-GND	-0.3 to 4.0	V	
Storage temperature range	$T_{_STG}$	-40 to +90	°C	

[3] Operating range

Parameter		Symbol	Value			Unit	Note
			Min.	Typ.	Max.		
Supply voltage		V_{CC}	1.7		3.63	V	
		GND	0.0		0.0		
Operating temperature range		T_use	-30	+25	+85	°C	
Output load		Load_R	9	10	11	kΩ	
		Load_C	9	10	11	pF	
	DC-cut capacitor	C_C	0.01			μF	

DC-cut capacitor is not included in this TCXO.
Please attach an external DC-cut capacitor (0.01 μF Min.) to the out pin.

[4] Frequency characteristics

1) Output frequency 40.000000 MHz

2) Frequency characteristics

(Condition : V_{CC} = 1.8 V, 2.8 V, 3.0 V or 3.3 V, GND = 0.0V, Load 10kΩ//10pF(DC cut), T_use =+25°C)

Parameter	Symbol	Value			Unit	Note
		Min.	Typ.	Max.		
Frequency tolerance	f_tol(osc)	-1.0	-	+1.0	$\times 10^{-6}$	T_use = +25°C ±2°C Before Reflow soldering
	f_tol *1	-2.0	-	+2.0	$\times 10^{-6}$	T_use = +25°C ±2°C After reflow : 2 times *2
Frequency / Temperature characteristics	fo-Tc	-0.5	-	+0.5	$\times 10^{-6}$	T_use = -30°C to +85°C (Based on frequency at +25°C)
Frequency / Load coefficient	fo-Load	-0.2	-	+0.2	$\times 10^{-6}$	Load :10kΩ // 10pF ±10 % each
Frequency / Voltage coefficient	fo-V_{CC}	-0.2	-	+0.2	$\times 10^{-6}$	V_{CC} ±5% *3
Frequency aging	f_age	-1.0	-	+1.0	$\times 10^{-6}$	First year T_use =+25°C

*1 Include initial frequency tolerance and frequency deviation after reflow cycles.

*2 Measurement of frequency deviation is made 24h after reflow soldering.

*3 V_{CC} ± 5% must be in operating supply voltage range. (1.7V to 3.63V)

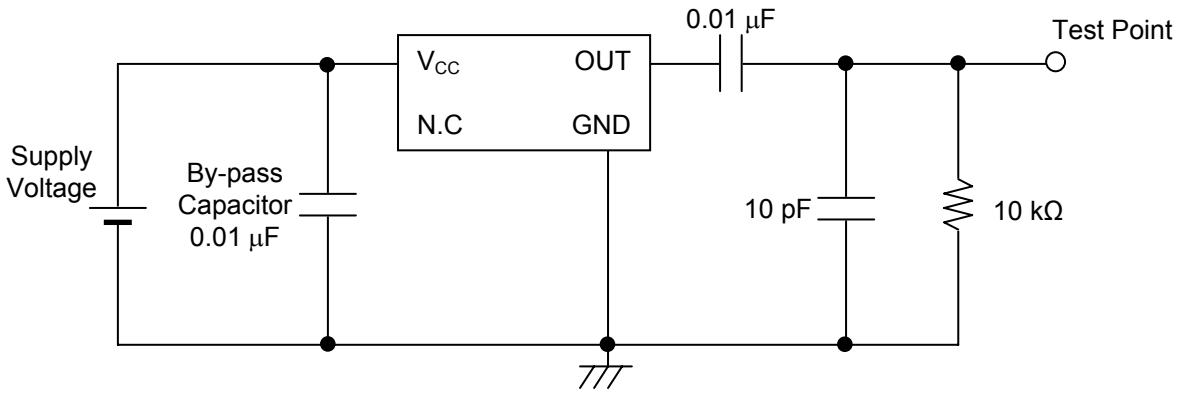
[5] Electrical characteristics

(Condition : V_{CC} = 1.8 V, 2.8 V, 3.0 V or 3.3 V, GND = 0.0V, Load 10kΩ//10pF(DC cut), T_use =+25°C)

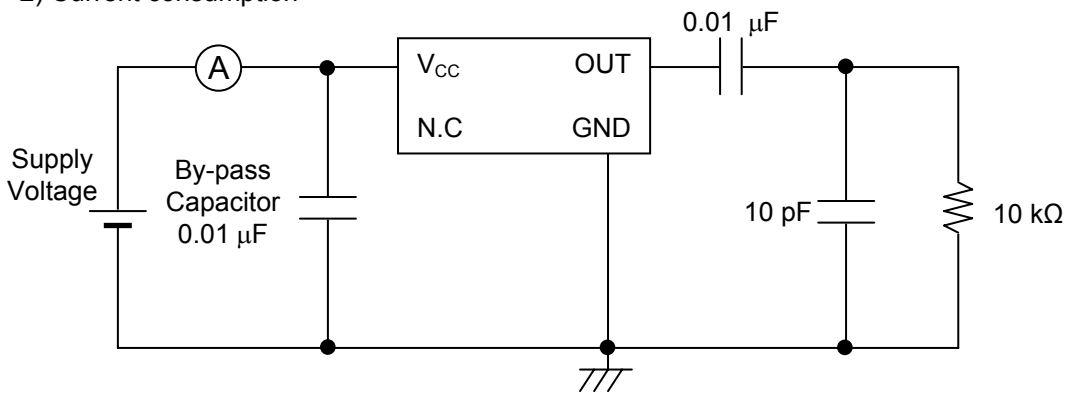
Parameter	Symbol	Value			Value	Note
		Min.	Typ.	Max.		
Current consumption	I_{CC}	-	-	2.0	mA	
Output level	V_{PP}	0.8	-	-	V	Peak to peak voltage Clipped sine wave
Symmetry	SYM	40	-	60	%	GND Level
Start up time	t_str	-	-	2.0	ms	Until frequency has been reached within ±1 × 10^{-6} of final frequency.
		-	-	2.0		Until output signal has been reached min 90 % of final amp.
SSB Phase noise	L(f)	-	-87	-	dBc /Hz	Offset : 10 Hz
		-	-114	-		Offset : 100 Hz
		-	-135	-		Offset : 1 kHz
		-	-149	-		Offset : 10 kHz
		-	-152	-		Offset : 100 kHz
		-	-153	-		Offset : 1 MHz

[6] Test circuit

1) Output Load : 10 kΩ//10 pF



2) Current consumption



3) Conditions

1. Oscilloscope: Impedance Min. 1 MΩ
   Input capacitance Max. 10 pF
   Band width Min. 300 MHz
   Impossible to measure both frequency and wave form at the same time.(In case of using oscilloscope's amplifier output, possible to measure both at the same time.)
2. Load_C includes probe capacitance.
3. A capacitor (By-pass:0.01 μF) is placed between V_{CC} and GND,and closely to TCXO.
4. Use the current meter whose internal impedance value is small.
5. Power Supply
   Impedance of power supply should be as low as possible.
6. GND pin should be connected to low impedance GND

[7] Environmental and mechanical characteristics

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

No.	Item	Value *1 Freq. Tolerance [1×10^{-6}] *2 Electrical characteristics	Test method
1	High temp. storage *3	±2.0	+85 °C × 1000 h
2	Low temp. storage *3	± 2.0	-40 °C × 1000 h
3	High temp. with humidity	±2.0	+85 °C × 85%RH × 1000 h
4	Temp. cycle *3	±2.0	-40 °C to +85 °C (30 min × 100 cycle/each)
5	Resistance to Soldering heat (Reflow characteristics)	±1.0	Reflow furnace with the condition 3 times
6	Drop	±2.0	150g dummy jig (SEIKO EPSON Standard) drop from 1500 mm height on the concrete 6 directions 3 times.
7	Vibration	±2.0	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)
8	Solderability	Terminals must be 95 % covered with fresh solder	Dip termination into solder bath at +235 °C for 5 s (Using Rosin Flux)

Notes

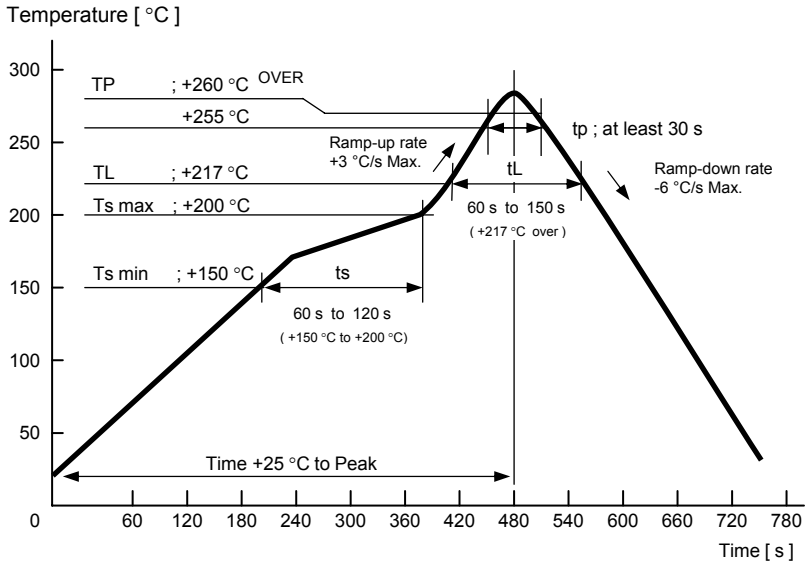
1.*1 each test is independent.

2.*2 measuring 2 h to 24 h later leaving in room temperature after each test.

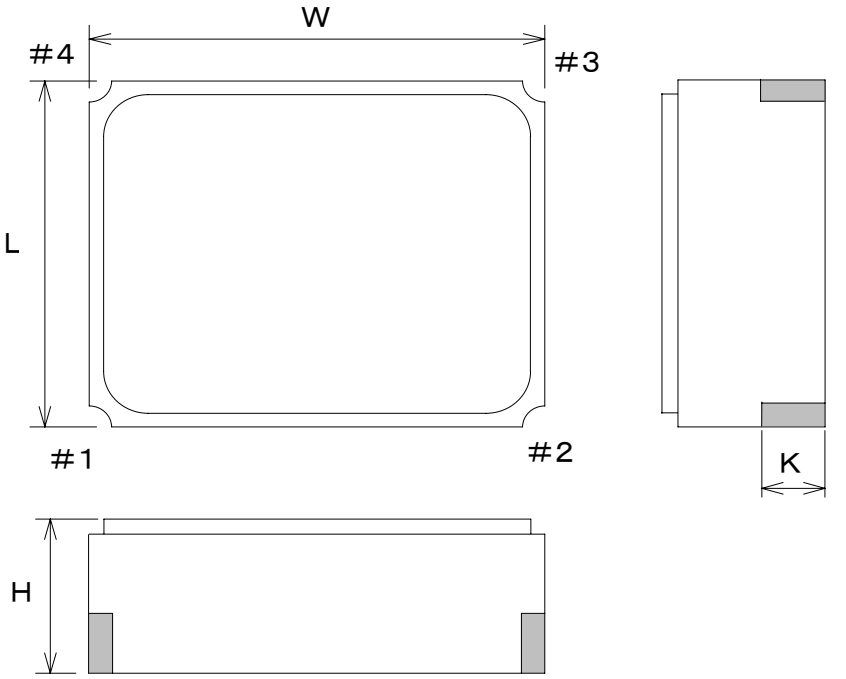
3.*3 Pre conditionings

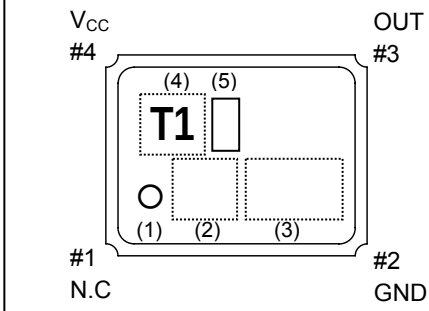
1. reflow 2 times
2. Initial value shall be after 24 h at room temperature.

Reflow condition (follow to IPC / JEDEC J-STD-020D.1)



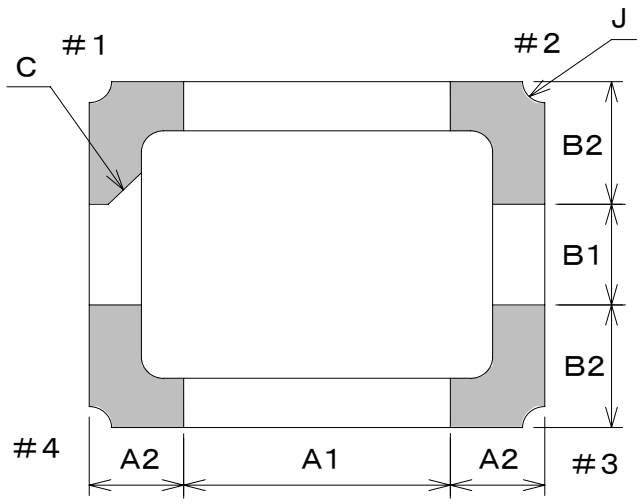
[8] Dimensions and marking layout





Marking

(1) 1Pin Mark
(2) Arbitrary marking area (2digits)
(3) TCXO LOT NO. (3digits)
(4) TCXO Model ID (T1)
(5) Image recognition mark



Connection

Pin No.	Terminal
# 1	N.C.
# 2	GND
# 3	OUT
# 4	V_{CC}

Material

Base : Ceramics
Terminal : Au plated nickel

(unit : mm)

DIM.	MIN.	TYP.	MAX.
W	1.85	2.00	2.15
L	1.45	1.60	1.75
H	0.66	0.73	0.80
J	---	R0.10	---
K	---	0.27	---

Co-planarity : 0.05mm

DIM.	TYP.
A1	1.20
A2	0.4
B1	0.4
B2	0.6
C	C0.15

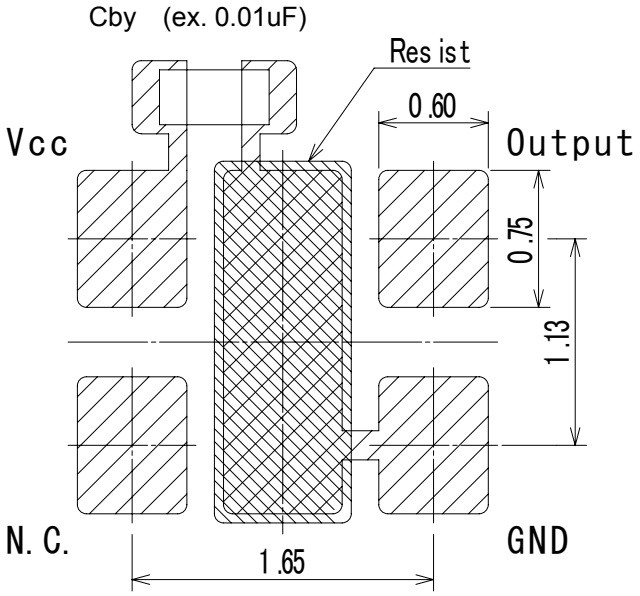
[9] Recommendable patterning

For actual design work, please consider optimum condition together with mounting density, reliability of soldering and mount ability etc.

Please connect Cby(bypass capacitor) quite near by ”Vcc” terminal.
Do not design any patterns except GND on the shaded area.

Soldering position

Unit: mm



[10] Handling precautions

Prior to using this product, please carefully read the section entitled “Precautions” on our Web site (http://www5.epsondevice.com/en/quartz/tech/precaution/) for instructions on how to handle and use the product properly to ensure optimal performance of the product in your equipment. Before using the product under any conditions other than those specified therein, please consult with us to verify and confirm that the performance of the product will not be negatively affected by use under such conditions.

In addition to the foregoing precautions, in order to avoid the deteriorating performance of the product, we strongly recommend that you DO NOT use the product under ANY of the following conditions:

(1) Mounting the product on a board using water-soluble solder flux and using the product without removing the residue of the flux completely from the board. The residue of such flux that is soluble in water or water-soluble cleaning agent, especially the residues which contains active halogens, will negatively affect the performance and reliability of the product.
(2) Using the product in any manner that will result in any shock or impact to the product.
(3) Using the product in places where the product is exposed to water, chemicals, organic solvent, sunlight, dust, corrosive gasses, or other materials.
(4) Using the product in places where the product is exposed to static electricity or electromagnetic waves.
(5) Applying ultrasonic cleaning without advance verification and confirmation that the product will not be affected by such a cleaning process, because it may damage the crystal, IC and/or metal line of the product.
(6) Touching the IC surface with tweezers or other hard materials directly.
(7) Using the product under any other conditions that may negatively affect the performance and/or reliability of the product.
(8) Using the product with power line ripple exceeding 50 mV(p-p) level.

Should any customer use the product in any manner contrary to the precautions and/or advice herein, such use shall be done at the customer’s own risk.

TAPING SPECIFICATION
テープ梱包基準書

1. APPLICATION 適用範囲

This document is applicable to 2.0 x 1.6 SMD package.

本基準書は、2.0 x 1.6 セラミックパッケージのテーピング梱包について規定する。

2. CONTENTS 目次

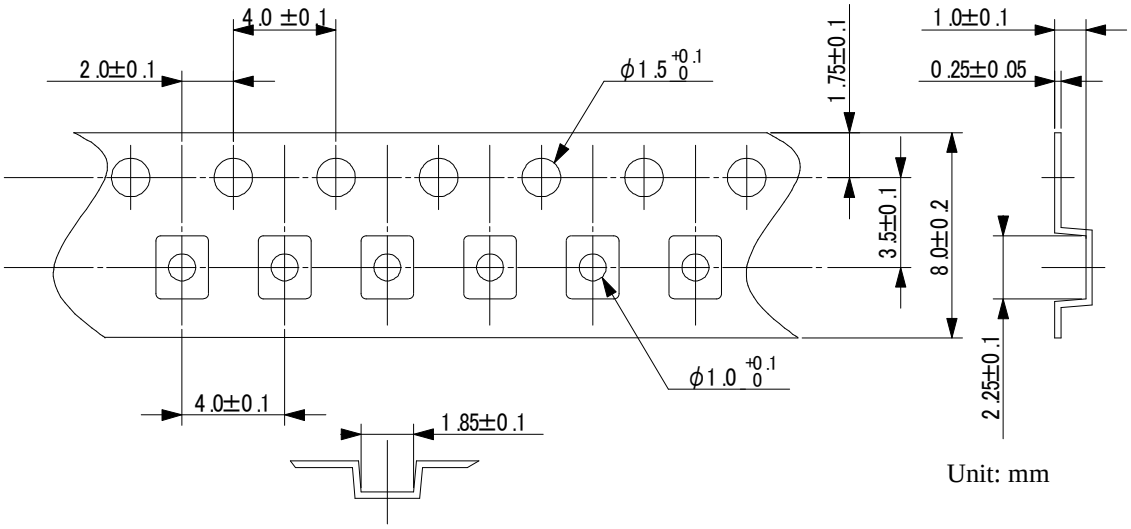
Item No.	Item	Page
[1]	**Taping specification** テーピング仕様	1 to 2
[2]	**Inner Sleeve** スリーブへの収納	3
[3]	**Shipping carton** 外装箱への収納	
[4]	**Marking** 表示	4
[5]	**Quantity** 収納数量	
[6]	**Storage environment** 保管環境	
[7]	**Handling** リール取扱い	

[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 TE0804L

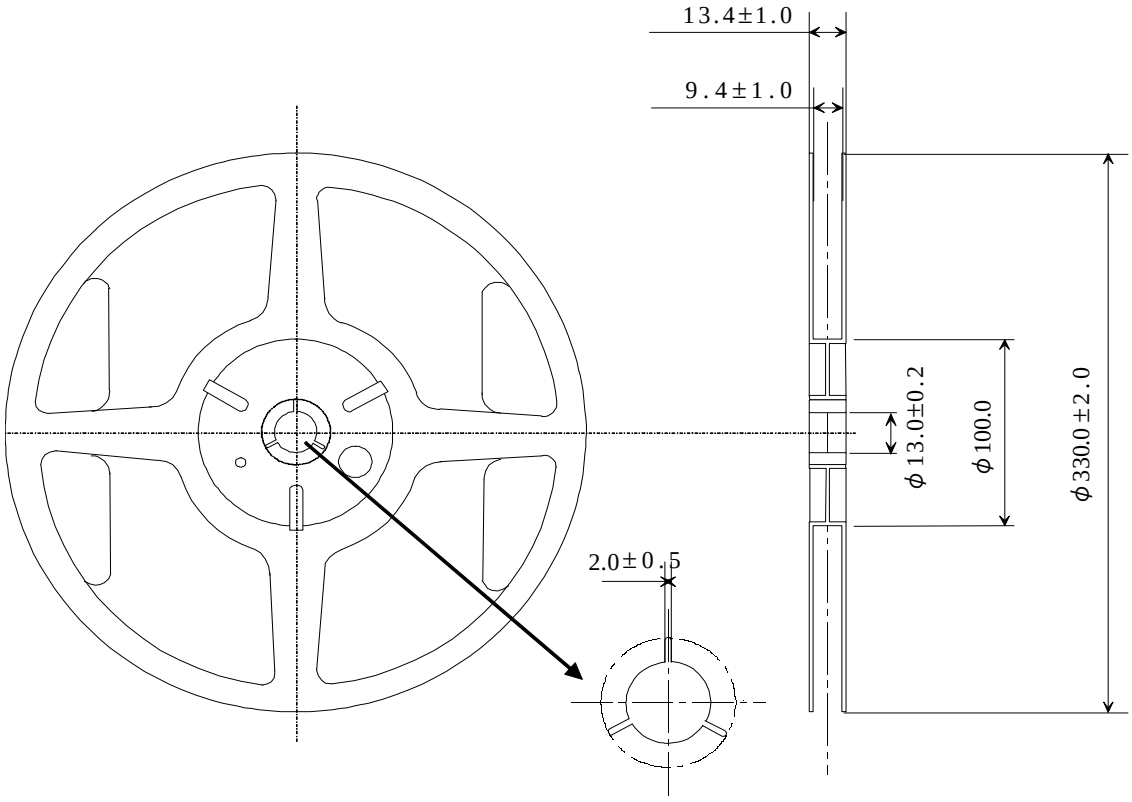
Material of the Carrier Tape キャリアテープ材質: PS (Black / Conductive 黒/導電性)
Material of the Top Tape トップテープ材質 : PET+PE



Unit: mm

(2) Reel dimensions

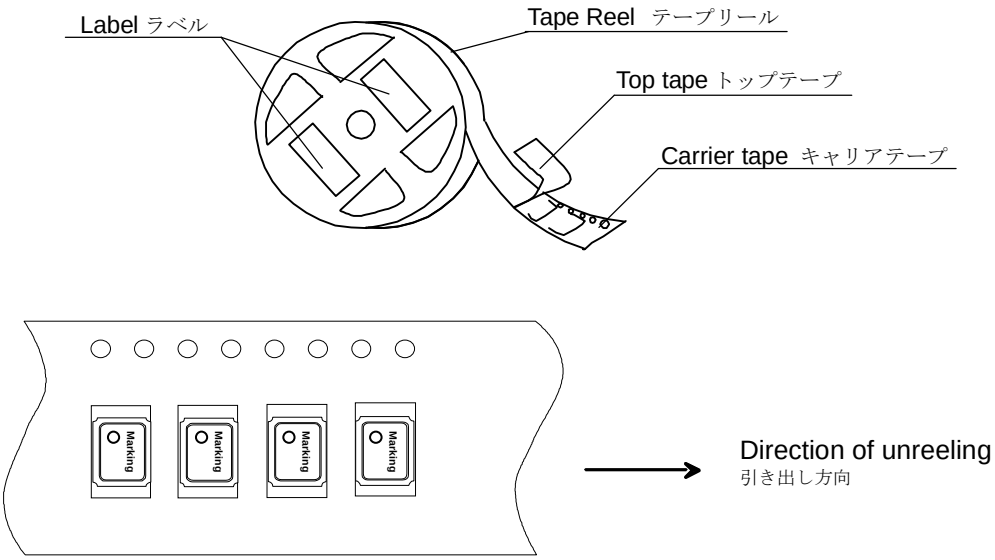
Material of the Reel リール材質: PS (Black / Conductive 黒/導電性)



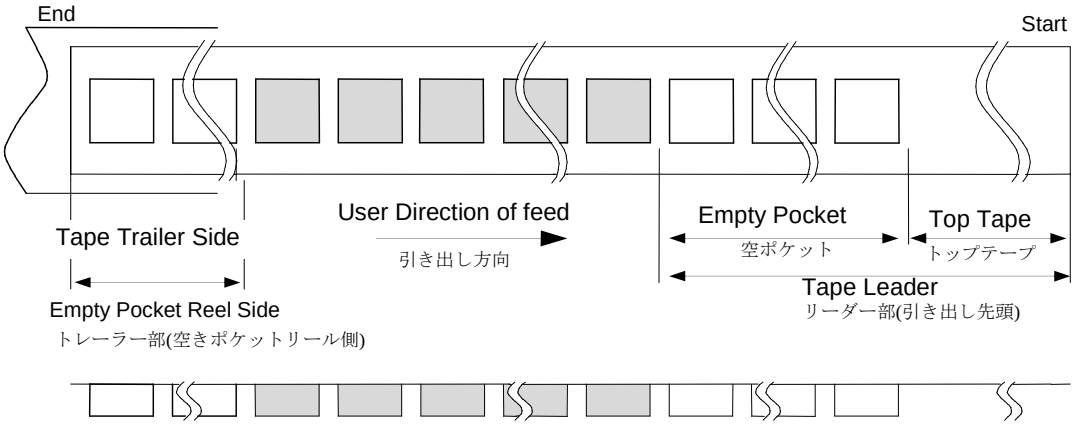
Form and Size of reel window shows are one of the example
リールの窓の形状は代表例を掲載。

(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 項目		Empty Space 空きスペース	Note 備考
Tape Leader (引き出し先頭側)	Top Tape	Min. 200 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。
	Carrier Tape	Min. 150 mm	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。
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. 150 mm	

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

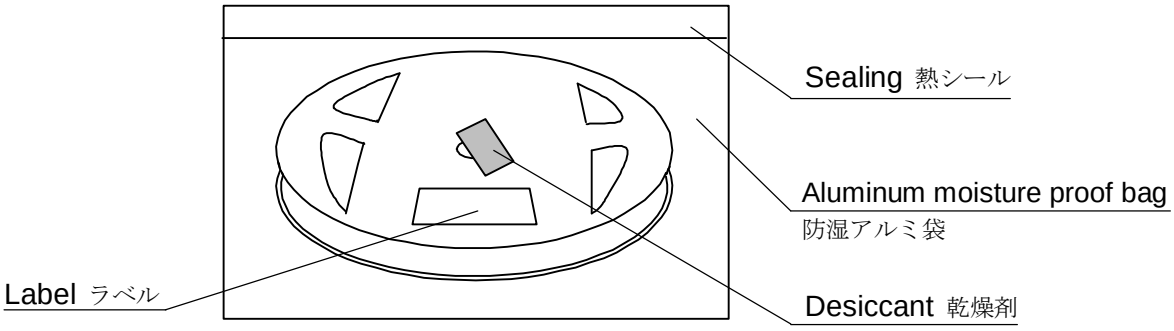
(a) Angle: cover tape during peel off and the direction of unreeling shall be 165° to 180°.
剥離角度:テープの接着面に対し 165～180 度とする。

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

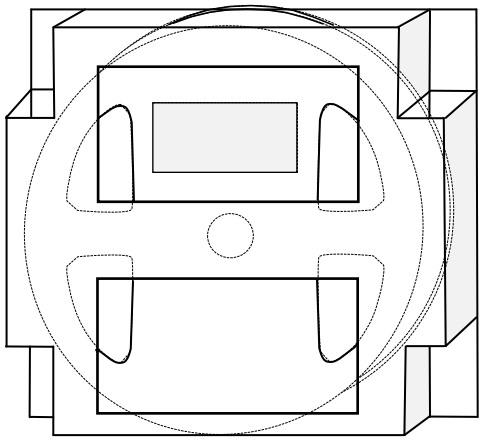
(c) Peel strength: 0.1 ~ 1.0 N.
剥離強度:0.1～1.0 N

[2] Inner sleeve

a) Packing to antistatic bag 袋への収納

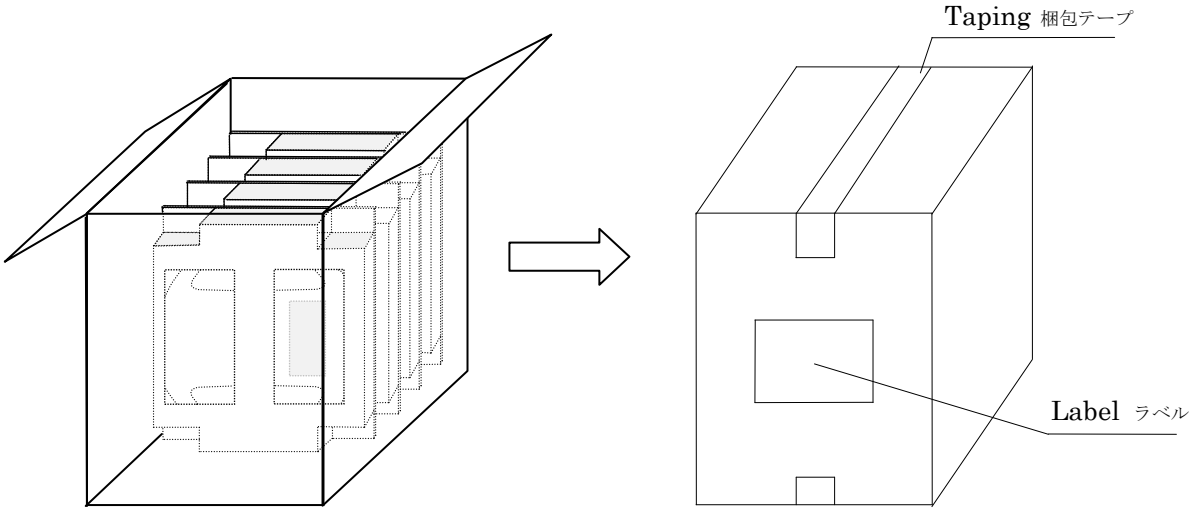


b) Packing to inner sleeve スリーブへの収納



[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 is space 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

- Maximum 12 000 pcs./reel 最大 12,000 個/リール
- Minimum 500 pcs./reel 最小 500 個/リール

[6] Storage environment 保管環境

(1) Before open the packing, we recommend to keep less th an +30 °C and 60 %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 60 %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 4 weeks. No need dry air before soldering work if it is less than temperature +30 °C, 60 humidity %RH. When keeping 4 weeks are exceeded after the opening, it is recommended to be used after soldering is confirmed.

使用直前まで開梱せず、袋開封後は 4 週間以内の実装を推奨します。
温度 +30 °C、湿度 60 %RH 以下では、はんだ付け作業前に乾燥不要です。
開封後保管 4 週間を超えた場合は半田付け性を確認の上使用されることを推奨します。

(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。

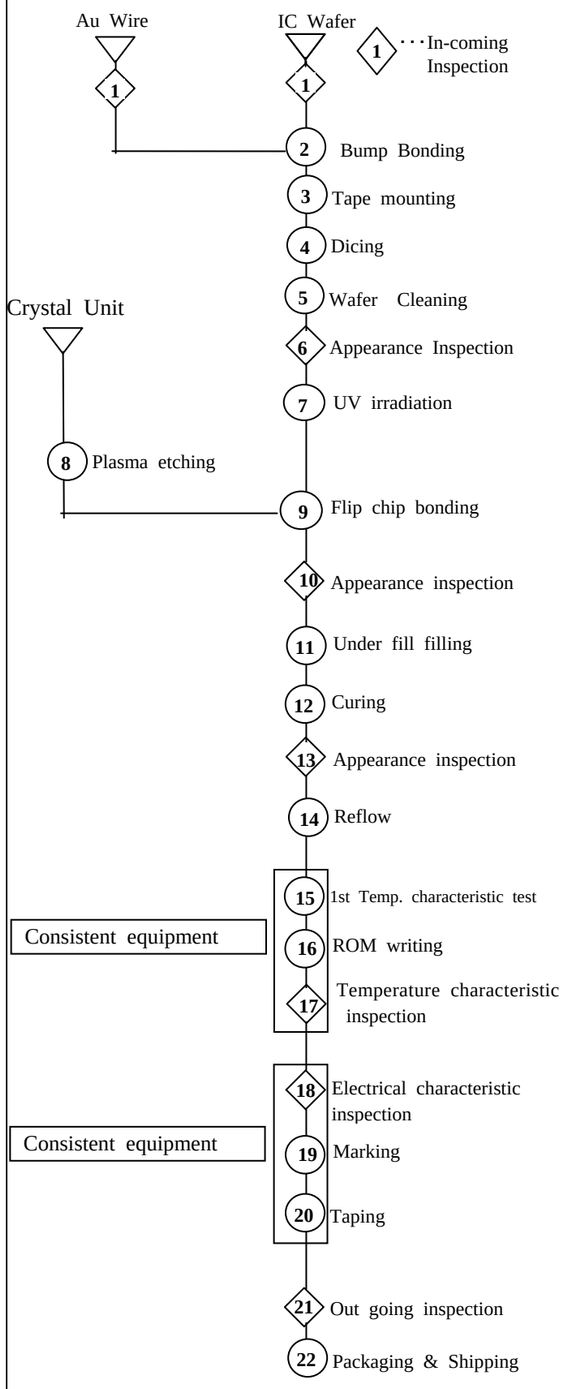
[7] Handling リール取扱い

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。

- PROCESS QUALITY CONTROL -

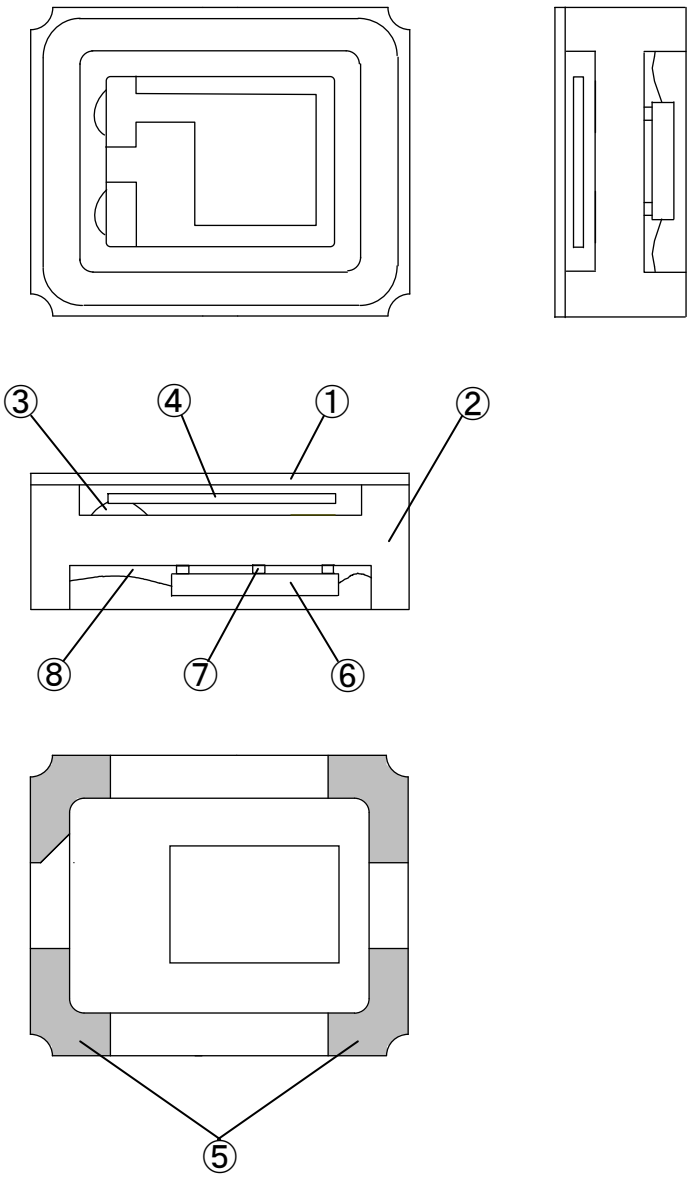
No. TG50xxCx_Q_0001 CRYSTAL OSCILLATOR : TG2016 series

2015.03.26
TG2016_Q_0001



No.	Section In Charge	Standards	Inspection, Control Item	Instruments	Inspection Methods	Record
1	Inspection Section	Purchase specification Delivery card	Appearance	Visual inspection	Every lot	Data sheet
2	Production Section	Specification (Work standard)	Heater temperature Bump dimension Shear strength	Thermometer Microscope Bond tester	Daily Sampling Sampling	Daily check sheet Data sheet Data sheet
3	Production Section	Specification (Work standard)	Cutting condition Appearance	Visual inspection	Daily	Daily check sheet
4	Production Section	Specification (Work standard)	Abrasion loss of Blade	Built-in gauge	Every batch	Tool change check sheet
5	Production Section	Specification (Work standard)	Water resistance	Built-in meter	Daily	Daily check sheet
6	Production Section	Specification (Work standard)	Dicing condition	Microscope	Sampling	Data sheet
7	Production Section	Specification (Work standard)	UV condition	UV intensity meter	Daily	Daily check sheet
8	Production Section	Specification (Work standard)	Flow rate of O2 and Ar	Built-in meter	Daily	Daily check sheet
9	Production Section	Specification (Work standard)	Number of US tool shots Number of ejector needle shot. Heater temperature Bump dimension Shear strength	Built-in counter Built-in counter Thermometer Microscope Bond tester	100% 100% Daily Sampling Sampling	Tool change check sheet Daily check sheet Data sheet Data sheet
10	Production Section	Specification (Work standard)	Flipchip bonding Condition	Microscope	Sampling	Data sheet
11	Production Section	Specification (Work standard)	Chip coat storage temp. Pot lifetime	Thermometer Built-in timer	Daily 100%	Daily check sheet Tool change check sheet
12	Production Section	Specification (Work standard)	Curing time Oven temperature	Timer Thermometer	Every batch Daily	Data sheet Daily check sheet
13	Production Section	Specification (Work standard)	Appearance (FC & Under fill condition)	Microscope	100% Inspection	Data sheet
14	Production Section	Specification (Work standard)	Reflow profile	Thermometer	Daily	Daily check sheet
15	Production Section	Specification (Work standard)	Stage temperature	Thermometer	Daily	Daily check sheet
16	Production Section	Specification (Work standard)	Stage temperature	Thermometer	Daily	Daily check sheet
17	Production Section	Specification (Work standard)	Stage temperature Temperature characteristic	Thermometer Measuring equepment	Daily 100% Inspection	Daily check sheet Data sheet
18	Production Section	Specification (Work standard)	Electrical charactoristics Master cofirmation	Measuring equepment	100% Inspection	Data sheet
19	Production Section	Specification (Work standard)	Appearance Marking	CCD camera	100% Inspection	Data sheet
20	Production Section	Specification (Work standard)	Peeling off strength Direction	Peel back tester Visual inspection	Daily Sampling Delivery lot	Daily check sheet Data sheet
21	Inspection Section	Specification (Work standard)	Electrical characteristics Appearance	Measuring equipment Visual inspection	Sampling	Data sheet
22	Production Control Section	Specification (Work standard)	Quantity	Visual inspection	Sampling Delivery lot	Data sheet Delivery record

Structure Diagram 構造図	Rev.04
Model 型式	TG2016SBN
Document No. 管理№	TG2016_D_0001



No.	Name of Part 部品名	No.	Name of Part 部品名
①	Lid リッド	⑤	Terminal 端子
②	Package パッケージ	⑥	IC IC
③	Crystal adhesive 接着材	⑦	FC bump FC バンプ
④	Crystal chip 水晶片	⑧	Underfill アンダーフィル

EPSON
EXCEED YOUR VISION

RELIABILITY TEST DATA

Product Name : TG2016SBN

The Company evaluation condition
We evaluate environmental and mechanical characteristics by the following test condition . **DTA-1508_E**

No.	ITEM	TEST CONDITIONS	VALUE *1		TEST Qty [n]	FAIL Qty [n]
			Δ f / f *2 [1 × 10^{-6}]	Electrical characteristics		
1	High temperature storage	+85 °C × 1 000 h	*3 ± 2.0	Satisfy output level after test	22	0
2	Low temperature storage	-40 °C × 1 000 h	*3 ± 2.0		22	0
3	High Temperature with Humidity	+85 °C × 85 %RH × 1 000 h	*3 ± 2.0		22	0
4	Temperature cycle	-40 °C ⇔ +85 °C 30 min at each temp. 100 cycles	*3 ± 2.0		22	0
5	Resistance to soldering heat	Convection reflow soldering furnace (3 times)	± 1.0		22	0
6	Drop	150g dummy jig (SEIKO EPSON Standard) drop from 1500 mm height on the concrete 6 directions 3 times.	± 2.0		22	0
7	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)	± 2.0		22	0
8	Solderability	Dip termination into solder bath at +235 °C ± 5 °C for 5 s	Termination must be covered with fresh solder more than 95 % of dip area.		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 Initial value shall be measured after 24 h storage at room temperature Pre-treatment
   Pre-treatment : Bake (+125 ℃ × 24 h) →Moisture soak (+85 ℃ × 85 % × 168 h) →reflow (3 times)

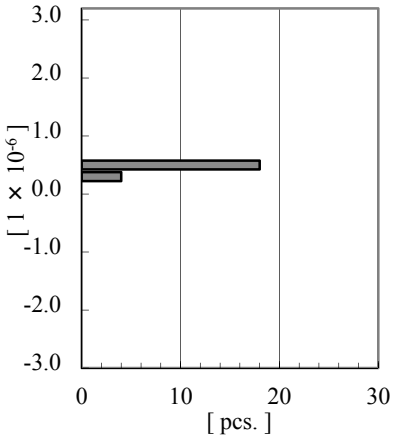
Qualification Data

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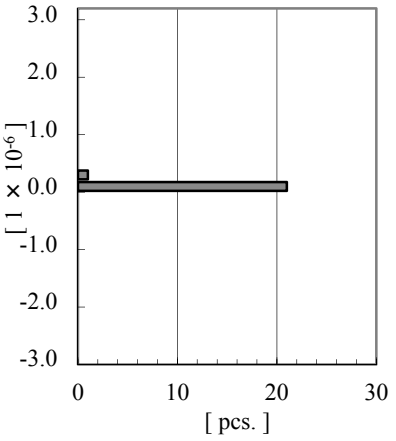
Product Name : TG2016SBN

df / f

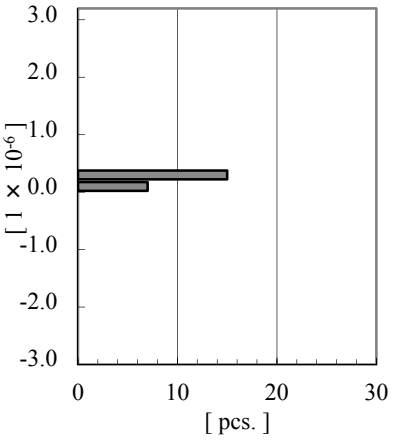
1. High temp. storage
+85 °C × 1 000 h



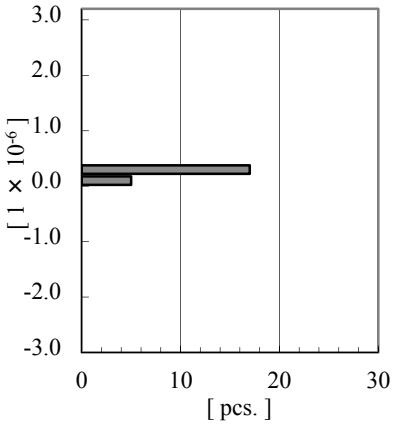
2. Low temp. storage
-40 °C × 1 000 h



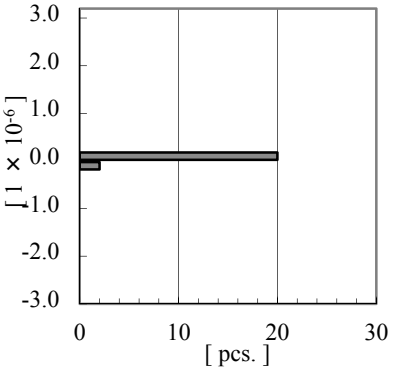
3. Temp. humidity storage
+85 °C × 85 %RH × 1 000 h



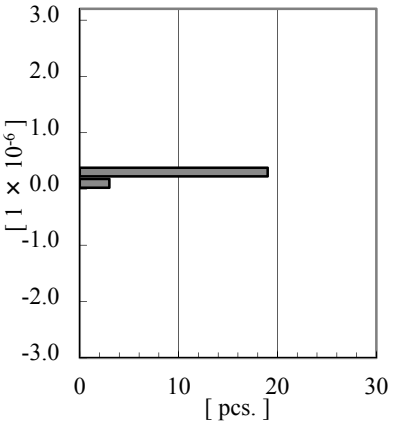
4. Temp. cycle
-40 °C ⇔ +85 °C
100 cycles



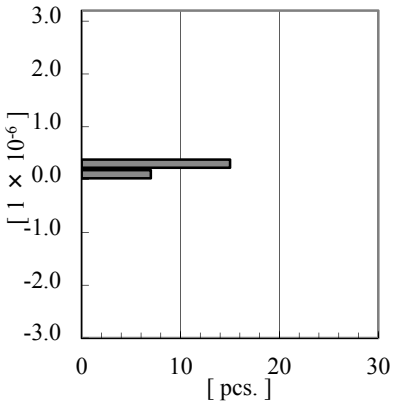
5. Resistance to soldering heat
For convention reflow soldering furnace (3 times)



6. Drop
1500 mm 6 directions 3 times



7. Vibration
10 Hz to 55 Hz amplitude 0.75 mm
55 Hz to 500 Hz acceleration 98 m/s^2
15 min / cycle 6 h (2 h × 3 directions)



Qualification Data