RECIPIENT

YF INTERNATIONAL LIMITED

SPECIFICATIONS

Product No. : X1G003821000600

Model : TG-5021CE-06G

SPEC. No. : A11-440-0B

DATE : Oct. 24. 2011

EPSON TOYOCOM CORPORATION
421-8 Hino, Hino-shi Tokyo 191-8501, Japan

CHECKED

M. Kaneko : CS Quality Assurance Department

SPECIFICATIONS

1. Application

This document is applicable to the temperature compensated crystal oscillator (TCXO) that is delivered to **YF INTERNATIONAL LIMITED** from Epson Toyocom Corp.

This product is compliant with RoHS Directive.

This Product supplied (and any technical information furnished, if any) by Epson Toyocom 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. Model / Product No.

The model is TG-5021CE-06G / X1G003821000600

3 Amendment and abolishment

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

4 Contents

[1] Characteristics

- Reflowable and high density mounting type ultra small size SMD (3.2×2.5×0.9 mm).
- Using the heat-resisting type AT cut quartz crystal
  allows almost the same temperature soldering as universal SMD IC.
- Operating supply voltage : 3.0 V.

[2] Absolute maximum ratings

Item	Symbol	Min.	Max.	Unit	Condition
Maximum supply voltage	V_{CC}-GND	-0.3	4.5	V	
Storage temperature range	T_stg	-40	+85	°C	

[3] Operating range

Item		Symbol	Min.	Typ.	Max.	Unit	Condition
Supply voltage		V_{CC}	2.85	3.00	3.15	V	V_{CC}=3.0V ± 5 %
Operating temperature range		T_use	-30	+25	+ 85	°C	
Output load		Load_R	9	10	11	KΩ	C_L // R_L (DC cut capacitor = 0.01 μF)
		Load_C	9	10	11	pF	
	DC-cut capacitor	Cc	0.01			μF	

DC-cut capacitor is not included in our TCXO. Please insert DC-cut capacitor in output line

[4] Frequency characteristics

1) Output frequency 16.367667 MHz

2) Frequency characteristics (V_{CC}=3.0 V, Load 10 kΩ // 10pF(DC cut), Ta =+25 °C)

Item	Symbol	Spec.	Condition
Frequency tolerance	f_tol(OSC)	± 2.0×10^{-6} Max.	Ta =+25 °C ± 2 °C Reflow cycle : 2 times *1
Frequency / temperature characteristics	fo-Tc	± 2.5×10^{-6} Max.	-30 °C to + 85 °C (Based on frequency at +25 °C)
Frequency slope vs. Temp.	-	± 0.15×10^{-6} /°C Max.	T_use=-10 °C to +60 °C
		± 0.30×10^{-6} /°C Max.	T_use=-30 °C to -10 °C, +60 °C to +85 °C
Frequency drift	-	± 10×10^{-9} /sec Max.	T_use=-10 °C to +60 °C *2 *3
		± 20×10^{-9} /sec Max.	T_use=-30 °C to -10 °C, +60 °C to +85 °C *2 *3
Frequency / load coefficient	fo-Load	± 0.2×10^{-6} Max.	10 k**Ω** // 10 pF ± 10%
Frequency / voltage coefficient	fo-Vcc	± 0.2×10^{-6} Max.	3.0 V ± 0.15 V
Frequency ageing	f_age	± 1.0×10^{-6} Max.	T_use=+25 °C, first year

*1 Measurement of frequency deviation is made 1h after reflow soldering.

*2 measured from stabilization.

*3 Temperature slope is below 2 °C/min

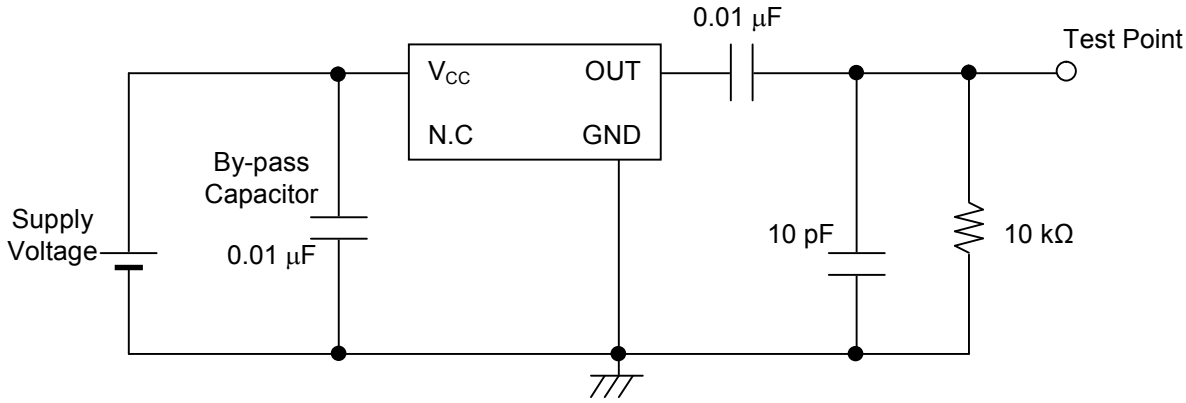
[5] Electrical characteristics

(V_{CC}=3.0 V, Load 10 kΩ // 10pF(DC cut), Ta =+25 °C)

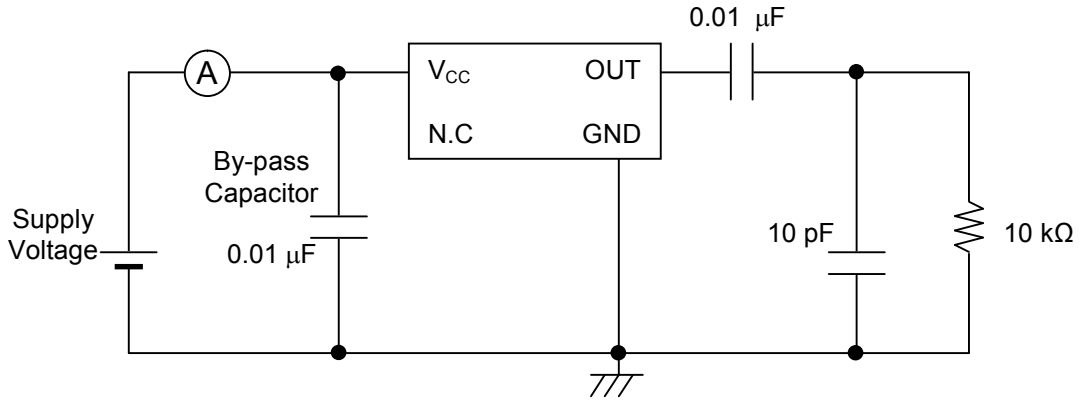
Item	Symbol	Min.	Typ.	Max.	Unit	Condition
Output level	Vpp	0.8	-	-	V	Peak to peak Clipped sine wave
Current consumption	I_{CC}	-	-	2.0	mA	
Start-up time	t_str	-	-	2.0	ms	To 90% of final amplitude.
Short term stability	-	-	-	± 1.0	×10^{-9}	τ=1s , 10s
SSB Phase noise	L(f)	-	-	-50	dBc/Hz	Offset : 1Hz
		-	-	-80		Offset : 10Hz
		-	-	-100		Offset : 100Hz
		-	-	-130		Offset : 1kHz
		-	-	-140		Offset : 10kHz

[6] Test circuit

1) Output Load : 10 kΩ//10 pF



2) Current consumption



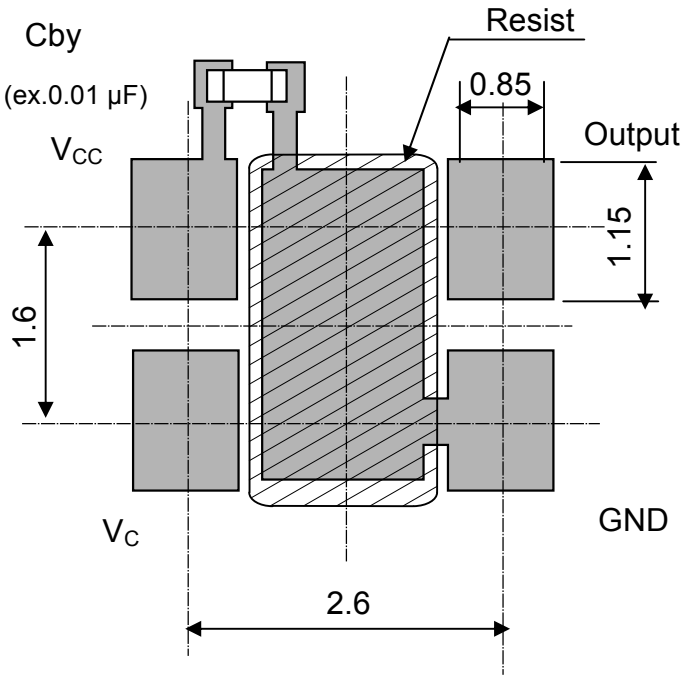
3) Conditions

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 lowest as possible.
6. GND should apply one point earth.

[7] Recommendation Foot pattern



※ Please connect Cby(bypass capacitor) quite near by ”Vcc” terminal.

※ It is desirable to draw GND pattern under TCXO.

[8] Environmental and mechanical characteristics

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

No.	Item	Value *1		Test method
		Freq. Tolerance [1×10^{-6}] *2	Electrical characteristics	
1	High temp. storage *3	± 2.0	Satisfy Output level after test	+85 °C × 1 000 h
2	Low temp. storage *3	± 2.0		-40 °C × 1 000 h
3	Temp. cycle *3	± 2.0		-40 °C to +85 °C (30 min × 1 000 cycle/each)
4	Resistance to Soldering heat (Reflow characteristics)	± 1.0		Reflow furnace with the condition 3 times
5	Drop	± 2.0		Free drop from 1.5 m height on a concrete floor for 3 times.
6	Vibration (variable frequency)	± 1.0		10 Hz to 55 Hz 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)
7	Solderability	Terminals must be 95 % covered with fresh solder		Dip termination into solder bath at +235 °C for 5 s (Using Rosin Flux)

Notes

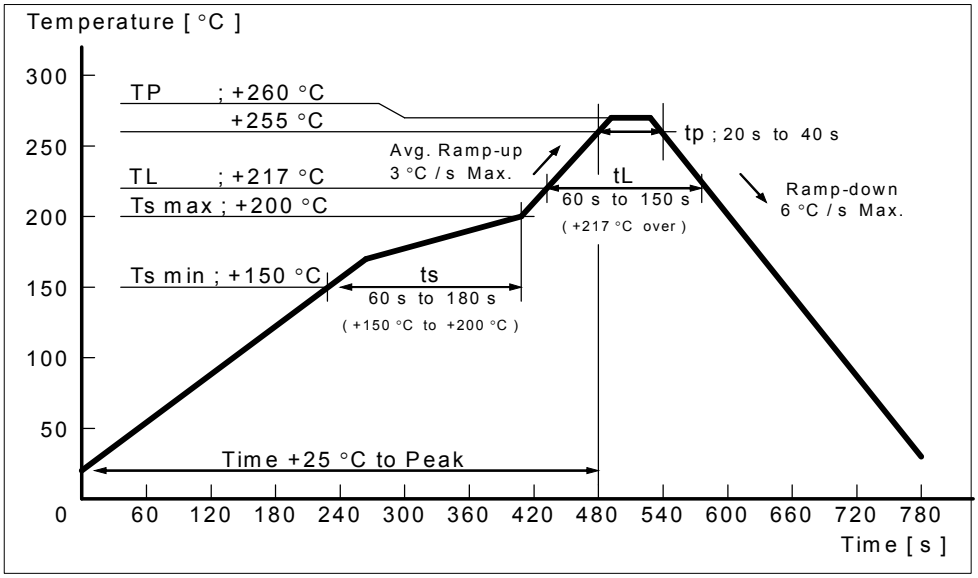
1.*1 each test is independent.

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

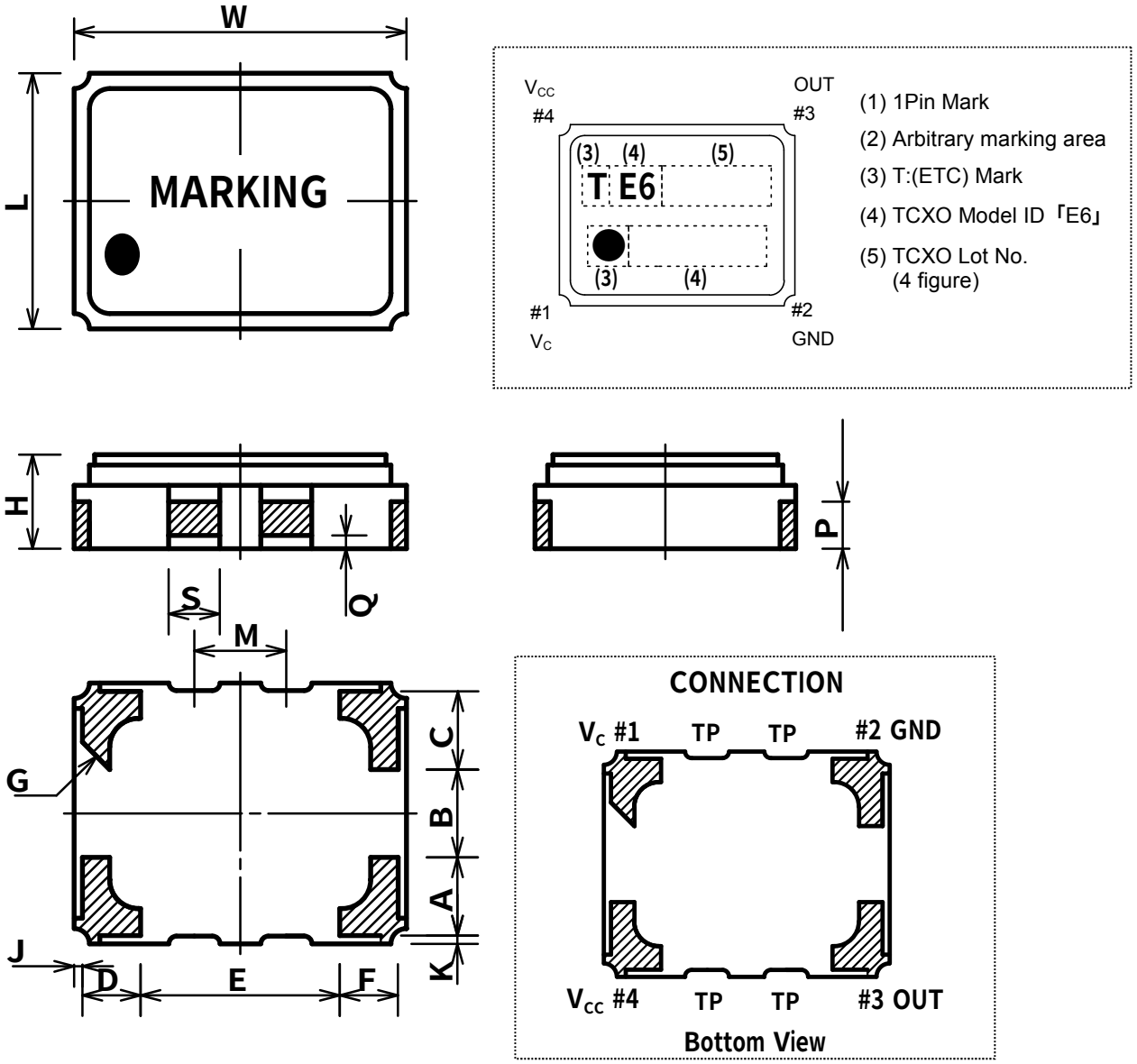
3.*3 Pre conditionings

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

• REFLOW SOLDERING PROFILE (Reference to JEDEC J-STD-020C)



[9] OUTLINE DRAWING



(unit : mm)

Dim.	Min.	Typ.	Max.	Dim.	Min.	Typ.	Max.
W	3.05	3.20	3.35	F	—	0.57	—
L	2.35	2.50	2.65	G	—	C 0.27	—
H	0.80	0.90	1.00	J	—	0.08	—
A	—	0.765	—	K	—	0.08	—
B	0.76	0.86	0.96	M	0.80	0.90	1.00
C	—	0.765	—	P	0.41	0.46	0.51
D	—	0.57	—	Q	—	0.13	—
E	1.85	1.95	2.05	S	0.40	0.50	0.60

Material
Base : Ceramics
Terminal : W-Ni-Au
Lid : Fe-Ni-Co

[10] Attention

※ Please keep at normal temperature and humidity (+25℃±10℃ and 45% to 75%RH).

※ Please use within a week after opening the package .

※ Please keep the reel in moisture-proof bag with desiccant after opening the package .

※ Please don't scratch IC with tweezers etc. because there is a possibility of breakdown .

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※ When this product is used under high humidity condition, it is possible for this product to fail beause of dew condensation. As other standard IC, Give consideration about dew condensation prevetion.

※ Do not deal mechanichal shock and vibration.

※ Exposure to X-ray can cause deterioration in performance, so avoid irradiation.

※ When water or brane attaches to this product, the metal cap, terminal or electrode may have some corrosions and this product may fail. Give consideration about how to use water and brane.

※ excessive levels of static electricity may damage the IC. Choose conductive materials for containers and packing material. Use a soldering gun and a measuring circuit free from high-voltage leakage and provide grounding connection when working with them.

※ Do not use or store the product in a pH range that may cause corrosion or dissolution of the materials or packaging.

※ It may cause peeling off portions of soldering or package cracks by mechanical stress . Particularly, in the case of cutting boards after soldering these products, please be sure to layout the crystal on a less stressed location and use less stressed cutting method.

※ In the case of soldering ceramic package products on a different expansion-coefficient board (ex.Epoxy Glass), soldering crack at the foot pattern would be expected under repeated temperature changes for a long period. Under these conditions, be sure to check the solder ability in advance.

※ This small and thin product is sensitive regarding product strength. Give consideration to choose tools and to decide how to operate such as reworking.

※ Plating of this product is for Pb free solder, so do not use Pb solder because of maintaining joint strength.

※ It can be cleaned by ultrasonic. But under some conditions, the crystal characteristics may be affected and internal wiring may be damaged. Please be sure to check the suitability of your system in advance.

※ With washable products, avoid the use of cleaners or solvents that may negatively affect the product.

※ Use flux which meets IEC 60068-2-20. Clean and dry thoroughly because residue of flux melts easily and affects the reliablity. Furthermore sufficient rinsing and drying are needed to avoid the migration.

登録 REGIST.	
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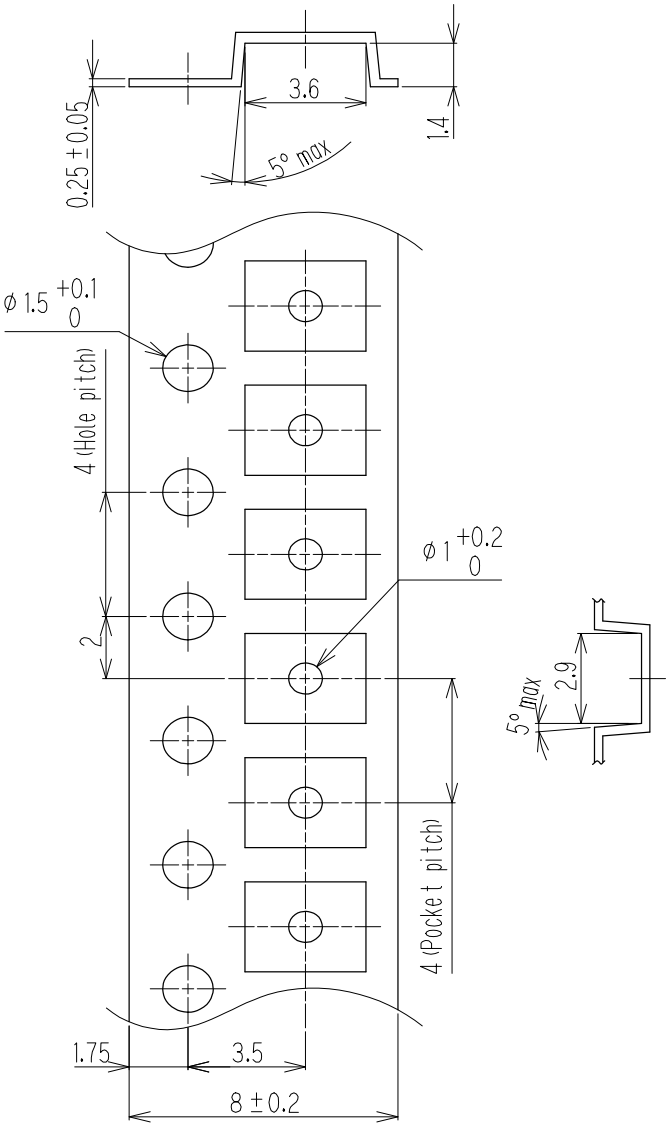
Packing Specification		名称 TITLE	仕番 SPEC. NO.
		Packing Standard ③	TN4-24998
作成部門 SECTION 49833	作成年月日 DATE '07.02.07	MODEL TCO-587x・TCO-586x・TG-50xxCE	頁 P. 1 / 6

1. TAPE & REEL PACKAGING SPECIFICATION

1.1. Embossed tape dimension & Outline drawings



[Size in mm]

※ The radius of each corner is 0.3mm max.

※ 10 feeding hole pitches cumulative tolerance on tape is ±0.2mm max.

※ The material is polystyrene.

※ Tolerance for all measurements are ±0.1mm unless otherwise stated.

承認 APP.	照査 CHK'D	照査 CHK'D	作成 DRAW
H.TAKANASHI	H.KANNO		A.KAKUMAE

改版記事 DESCRIPTION

② '10.05.10 Draw N.Y App Y.S
1.4 Marking
Changed reel label

③ '11.04.22 Draw N.Y App Y.S
Title Changed
TG-5005CE ⇒ TG-50xxCE

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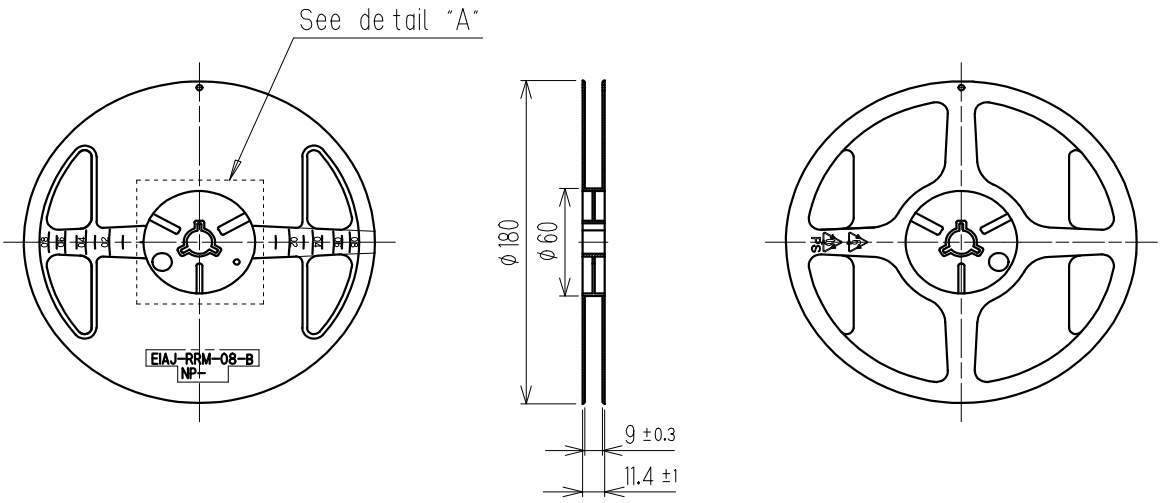
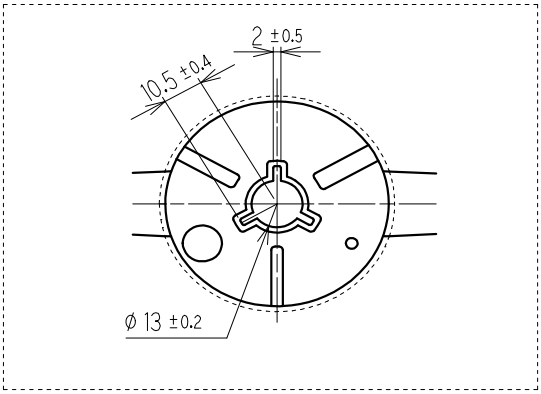
1.2. Reel dimension & Outline drawing



Detail "A"



Material

PS(REEL)

[Size in mm]

※ Tolerance for all measurements are +/-0.1mm unless otherwise stated.

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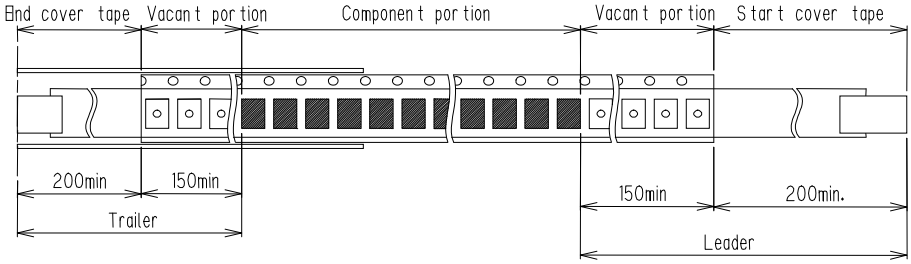
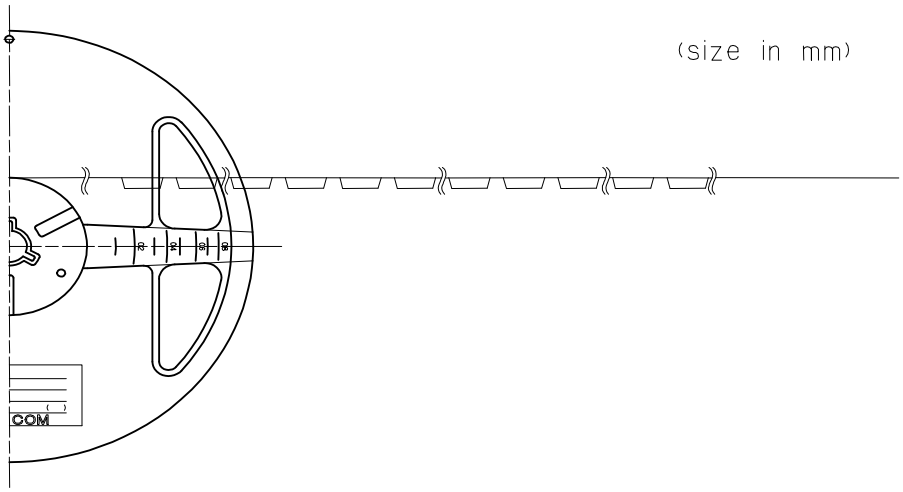
H.TAKANASHI	H.KANNO		A.KAKUMAE

改版記事 DESCRIPTION

EPSON TOYOCOM CORPORATION エプソントヨコム株式会社

1.3. Taping package





※ Direction of taking up reel is clock-wise as above. There are sprocket holes on the right hand side of the tape when it is pulled out as shown above.

※ The end of leader is fixed on the tape with adhesive tape as shown above.

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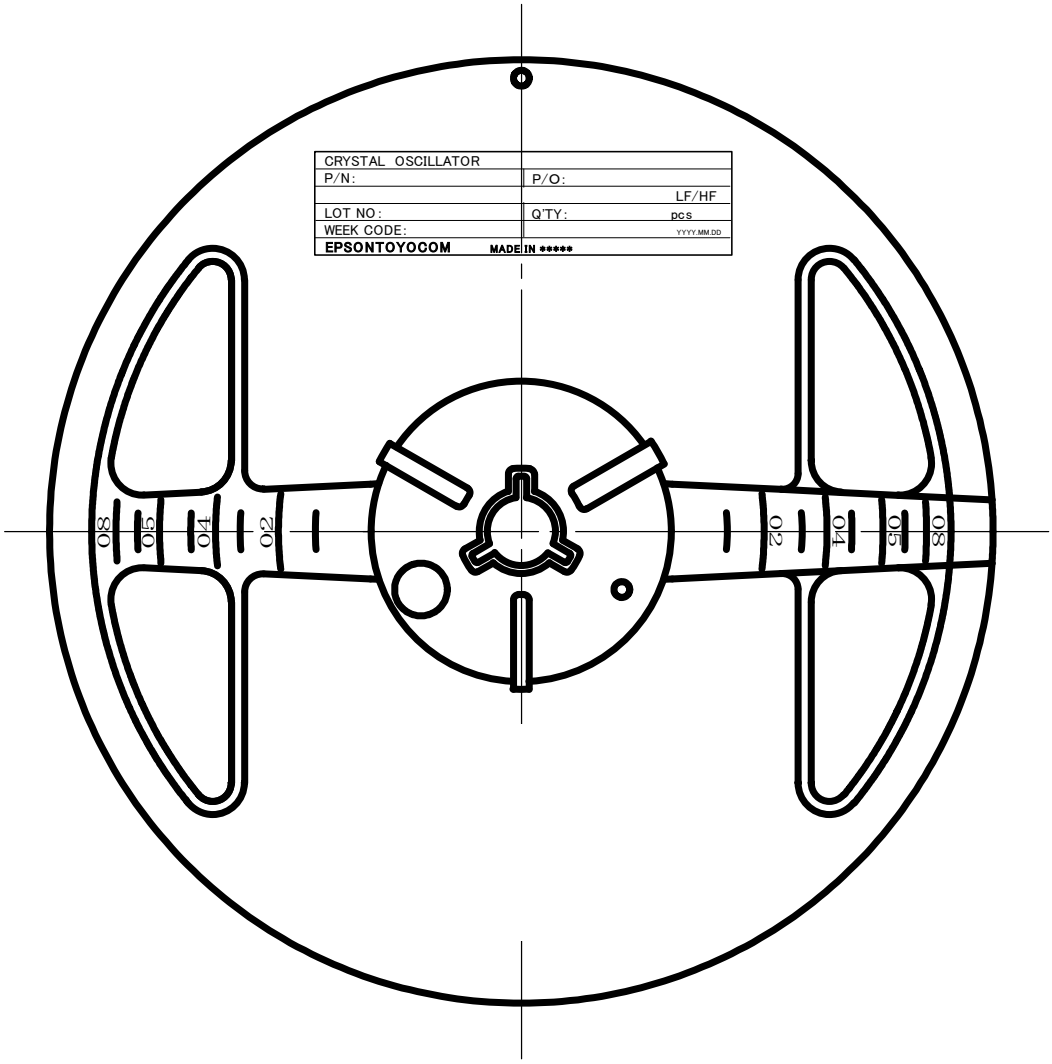
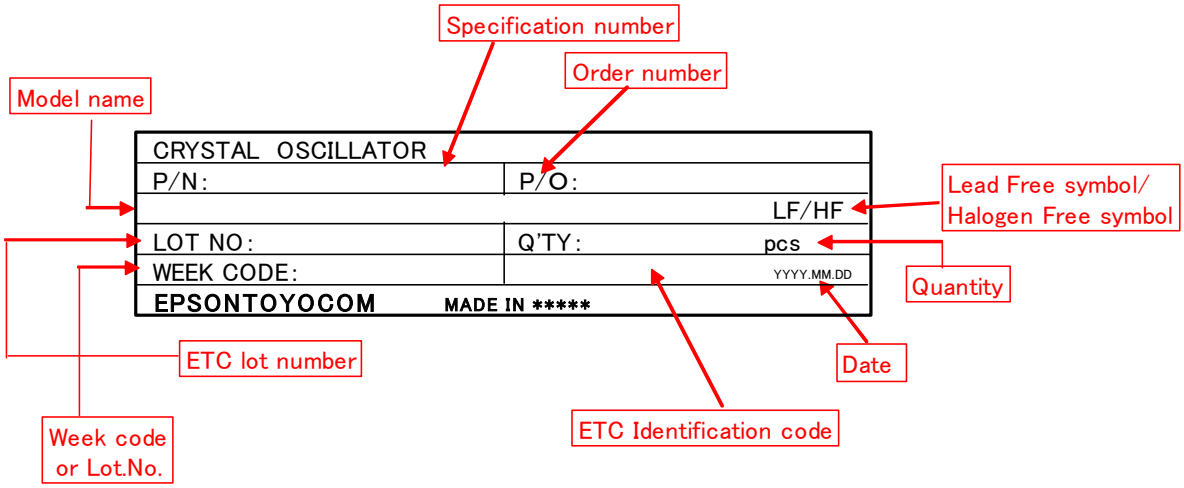
REV.NO.

1.4. Marking

△2



Marking Label



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改版記事 DESCRIPTION

1.5. Cover tape peeling-off strength

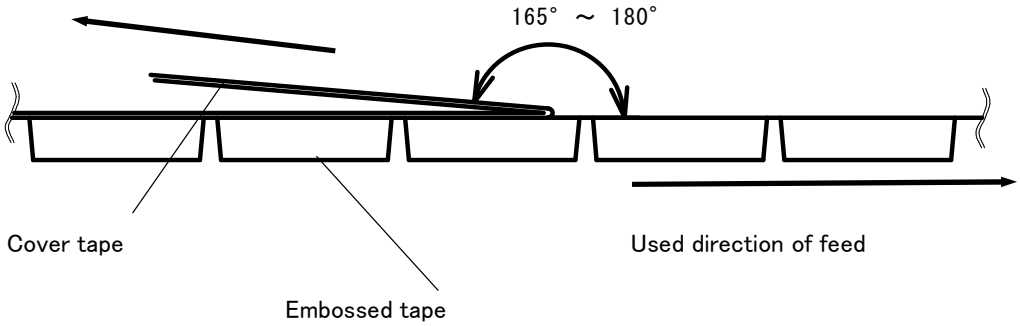
※ Angle :165° ～180° from feeding direction

※ Speed :5mm/sec.

※ Force :0.2N～0.7N

※ Others :There shall be no split or breakage of the carrier tape and the cover tape when peeling away the fixing tape.

Pulling direction of cover tape

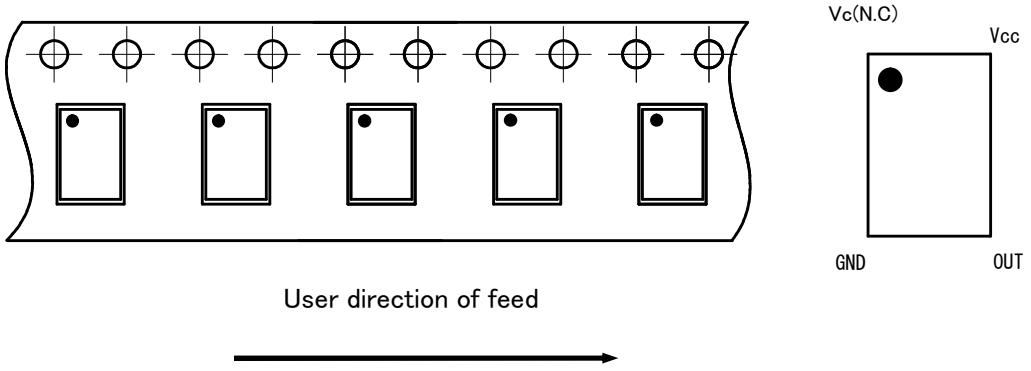


1.6. Quantity of components

2000pcs／reel(MAX.)
500pcs／reel(MIN.)

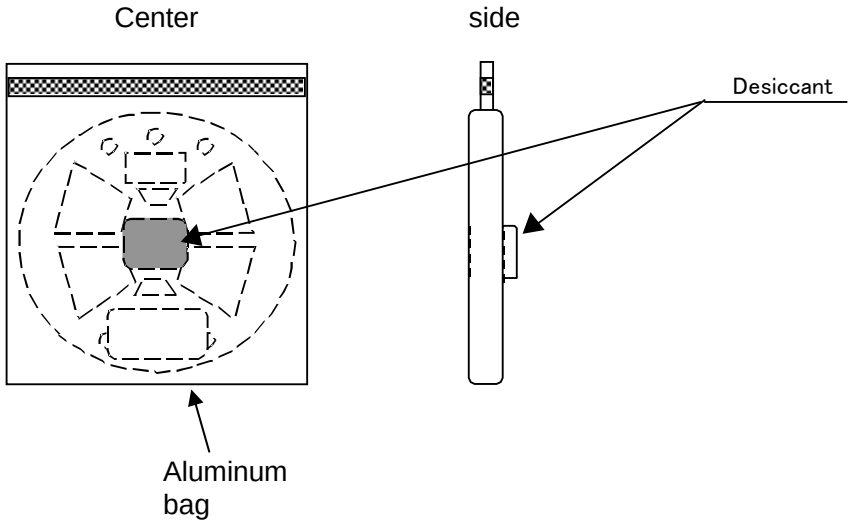
※ The above quantity is our standard packing size.
In case of an odd sum as per the purchased quantity, the packing quantity might be below our standard minimum packing size.

1.7. Oscillator orientation : TOP VIEW

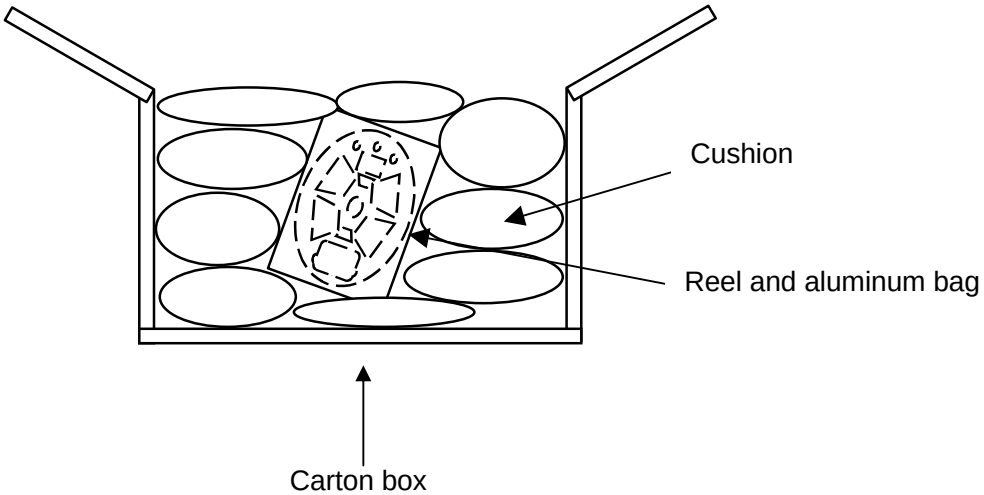


1.8. .Packaging

Reel is in aluminum bag. (vacuum-packed)

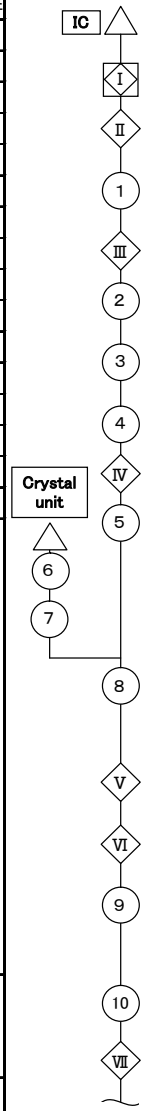


This reel is in carton box with cushion.



承認 APP.	照査 CHK'D	照査 CHK'D	作成 DRAW
H.TAKANASHI	H.KANNO		A.KAKUMAE

改版記事 DESCRIPTION

登録 REGIST		Flow chart	Process	Control item	Check item	Inspection item	Operation						Disposal of defected parts		Remarks
版	年月日 DATE						Procedure	Operator	Lot	Sampling rate	Equipment	Record	In process	Defected parts	
1	11.04.22		**Electrical and Mechanical parts**												
			Incoming inspection			Part name	nspection procedure	Quality assurance div.	Delivered lot	100%	Visual	Incoming inspection record	—	Return to vender/ Issue a Notice of defective	
						Quantity									
			IC appearance inspection			Appearance of IC wafer	IC-001	Producion div.	Wafer	N=10chip	Microscope ×40	Travel sheet	—	Return to vender/ Issue a Notice of defective	
			Bump bonding	Number of tool shots			IC-002	Producion div.	Wafer	100%	Built-in counter	Tool change check	changed capillary	Isolation the Product/ Issue a Notice of defective	
					Stage temperature					Daily	Thermometer	Daily check sheet	Production halt/ Process investigation		
			Test of bump shear strength			Bump dimension	IC-002	Producion div.	Wafer	N=4bump at changed capillary	Measuring Microscope	Travel sheet	Process investigation	Isolation the Product/ Issue a Notice of defective	
						Shear strength					Bond tester	Xber-R Chart			
			To paste Tape on IC wafer		Number of cutter shots		IC-003	Producion div.	Wafer	Daily	Built-in counter	Daily check sheet	Change cutter/ Work guidance	—	
			Dicing	Abrasion loss of Blade			IC-004	Producion div.	Wafer	Wafer	Built-in measure	Tool change check	Change blade	Isolation the Product/ Issue a Notice of defective	
					Resistivity of cutting water					Daily	Built-in measure	Travel sheet	Production halt/ Process investigation		
			To clean IC wafer		Resistivity of cleaning water		IC-006	Producion div.	Wafer	Daily	Built-in measure	Daily check sheet	Production halt/ Process investigation	Isolation the Product/ Issue a Notice of defective	
			Appearance inspection			Bonding condition	IC-002	Producion div.	Wafer	N=10chip	Microscope ×40	Travel sheet	Production halt/ Process investigation	Isolation the Product/ Issue a Notice of defective	
						Dicing condition	IC-004								
			UV irradiation		UV intensity		IC-007	Producion div.	Wafer	Daily	UV radiometer	Daily check sheet	Change Metal halide lamp	Isolation the Product/ Issue a Notice of defective	
			Blow & Vacuum		Blow,Vacuum motion		IC-010	Producion div.	Product lot	Daily	Visual	Daily check sheet	Production halt/ Process investigation	Isolation the Product/ Issue a Notice of defective	
			Plasma etching		Flow of Argon		IC-011	Producion div.	Product lot	Daily	Built-in flowmeter	Daily check sheet	Production halt/ Process investigation	Isolation the Product/ Issue a Notice of defective	
					Flow of oxygen										
			Flip chip bonding	Number of tool shots			IC-016	Producion div.	Product lot	100%	Built-in counter	Tool change check	Clean the bonding too	Isolation the Product/ Issue a Notice of defective	
					Stage temperature					Daily	Thermometer	Daily check sheet	Production halt/ Process investigation		
						Bonding impedance				100%	Built-in measure	Travel sheet	(Process investigation	Scrap	
			Inspection of die share strength			Bump dimension	IC-016	Producion div.	Product lot	N=6bump	Measuring Microscope	Travel sheet	Production halt/ Process investigation	Isolation the Product/ Issue a Notice of defective	
						Shear strength				N=2pcs	Bond tester	Xber-R Chart			
			Appearance inspection			Flipchip bonding condition	IC-016	Producion div.	Product lot	N=2pcs	Microscope ×15	Travel sheet	Process investigation /Alignment	Scrap	
			Under fill filling	Chip coat storage temperature			IC-020	Producion div.	Product lot	Daily	Thermometer	Daily check sheet	Scrap the resin	—	
				Pot life time						100%	Built-in measure	Tool change check	Change resin	Isolation the Product/ Issue a Notice of defective	
					Stage temperature					Daily	Thermometer	Daily check sheet	Production halt/ Process investigation		
			Curing	Curing time			IC-022	Producion div.	Product lot	Product lot	Timer	Travel sheet	Work guidance	Scrap	
					Chamber temperature					Daily	Thermometer	Daily check sheet	Production halt/ Process investigation		
			Appearance inspection			Under fill condition	IC-020	Producion div.	Product lot	100%	Microscope ×15	Travel sheet	Process investigation	Scrap	
						Defective rate				100%	PC	P Chart		Issue a Notice of defective	

承認 APP.

照査 CHK'D

作成 DRAW

改版記事 DESCRIPTION

TiTle	QC Process Chart of TG-5021CE Series			
Date	22nd. Apr. 2011	Document No.	TG5021CE-00-AFE	1/2

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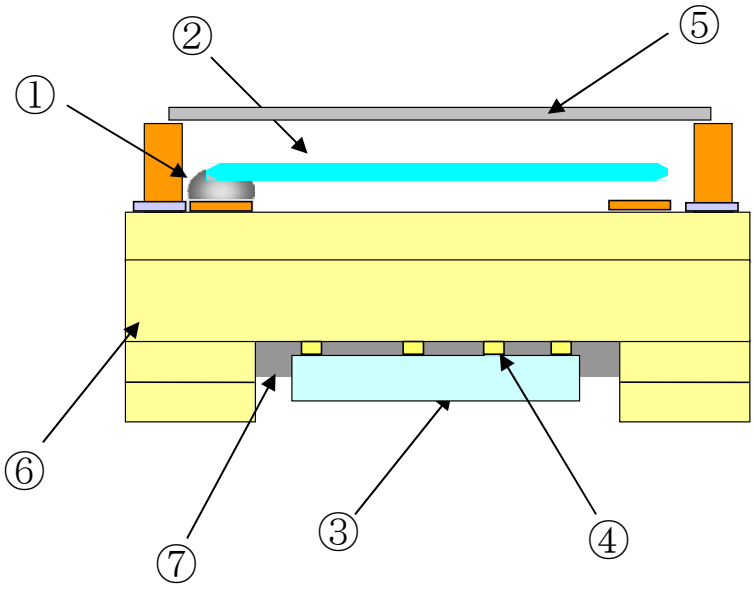
Flow chart	Process	Control item	Check item	Inspection item	Operation						Disposal of defected parts		Remarks
					Procedure	Operator	Lot	Sampling rate	Equipment	Record	In process	Defected parts	
11	Reflow		Temperature profile		IC-031	Producion div.	Product lot	Daily	Thermometer	Daily check sheet	Production halt/ Process investigation	Isolation the Product/ Issue a Notice of defective	
Ⅷ	Frequency inspection at high temperature		Stage temperature		IC-032	Producion div.	Product lot	Daily	Thermometer	Daily check sheet	Production halt/ Process investigation	Isolation the Product/ Issue a Notice of defective	
				Frequency at high temperature				N=306pcs	Frequency counter	Tool change check sheet	Process investigation		
Ⅸ	Temperature characteristics adjustmet and inspection		Stage temperature		IC-054	Producion div.	Product lot	Daily	Thermometer	Daily check sheet	Production halt/ Process investigation	Isolation the Product/ Issue a Notice of defective	
				Temperature characteristics				100%	Temperature characteristic measurement	Travel sheet	(Process investigation	Re-work	
				Defective rate				Product lot	PC	P Chart	Production halt/ Process investigation	Isolation the Product/ Issue a Notice of defective	
Ⅹ	Final inspection			Dimension	IC-045	Quality assurance div.	Product lot	N=3pcs	Calipers	Inspection record Travel sheet	Process investigation	Return to Production div./ Issue a Notice of defective	
				Appearance				AQL 1.0%	Amplifier				
				Part name, Quantity				N=3pcs	Amplifier				
				Frequency tolerance				AQL 0.4%	Frequency counter				
				DC supply current				AQL 0.4%	Multimeter				
				Temperature characteristics				AQL 0.4%	Inspection record				
Ⅺ	electrical characteristics inspection			Frequency tolerance	IC-043	Producion div.	Product lot	100%	Frequency counter	Travel sheet	Process investigation	Issue a Notice of defective	
				RF output					Oscilloscope				
				Duty cycle									
				DC supply current					Multimeter				
				Frequency control range					Frequency counter				
				Circuit frequency stabilityvs. supply voltage									
12	Marking			Marking contents	IC-043	Producion div.	Product lot	Product lot	Built-in word recongnition system	Travel sheet	Production halt/ Process investigation	Isolation the Product/ Issue a Notice of defective	
13	Taping		Peeling strength		IC-043	Producion div.	Packing lot	Daily	Peeling tester	Daily check sheet	Process investigation /Adjust the heater	Isolation the Product/ Issue a Notice of defective	
Ⅻ	Taping inspection			Direction	IC-043	Quality assurance div.	Packing lot	N=3pcs	Amplifier	Inspection record	Production halt/ Process investigation	Return to Production div./ Issue a Notice of defective	
				Marking contents									
	Packing and shipping			Quantity	Packing Instruction	Production control div.	Shipping lot	100%	Visual	Shipping record	—	Return to Production div.	

改版記事 DESCRIPTION

TiTle	QC Process Chart of TG-5021CE Series			
Date	22nd. Apr. 2011	Document No.	TG5021CE-00-AFE	2/2

TG-5021CE　Structure

Section



material Table		
material		Specification
①	Adhesives	Adhesives
②	XTAL blank	ATCut
③	IC	CMOS
④	FC bump	Au bump wire
⑤	Lid	Kovar
⑥	PKG	Ceramic
⑦	UF	Potting resin

T-1004-01-01		
MGR.	CHK.	ENG.
Y.Shishido	T.Matsuda	N.Yoshida

EPSON TOYOCOM

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RELIABILITY TEST DATA

Product Name : TG-5021CE series

The Company evaluation condition
We evaluate it by the following examination item and examination condition. No. TCE11-CO-001-1E

No.	ITEM	TEST CONDITIONS	Value *1		TEST Qty	FAIL Qty
			Freq. Tolerance D f / f *2 [1×10^{-6}]	Electrical characteristics	[n]	[n]
1	High temp. storage	+85±2℃ × 1000h *3	± 2.0	Satisfy Output level after test	20	0
2	Low temp. storage	-40±2℃ × 1000h *3	± 2.0		20	0
3	Temperature cycle	-40⇔+85℃ (30 min at each temp.1000 cycles) *3	± 2.0		20	0
4	Resistance to soldering heat	Reflow furnace with the condition 3 times	± 1.0		20	0
5	Drop Test	Free drop from 1.5 m height on a for 3 times.(against concrete floor)	± 2.0		20	0
6	Vibration	10 Hz to 55 Hz 0.75 mm 55 Hz to 500 Hz acceleration 98 m/s2 10 Hz → 500 Hz → 10 Hz 15 min./cycle 6 h(2 h × 3 directions) *3	± 1.0		20	0
7	Solderability	Dip termination into solder bath at +235℃ for 5s(Using Rosin Flux)	Terminals must be 95% covered with fresh solder		20	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 after pre-conditioning .
   Pre-conditioning: Reflow (3 time)

Production Engineering Department

signature T. Shishido

Qualification Data

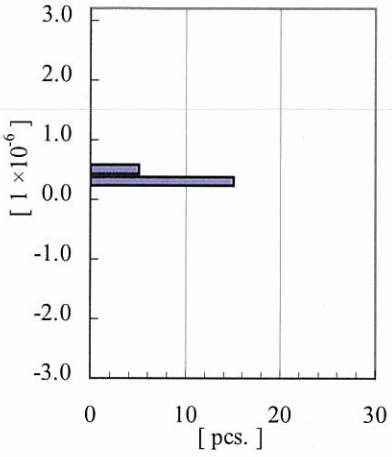
EPSON TOYOCOM

Product Name : TG-5021CE series

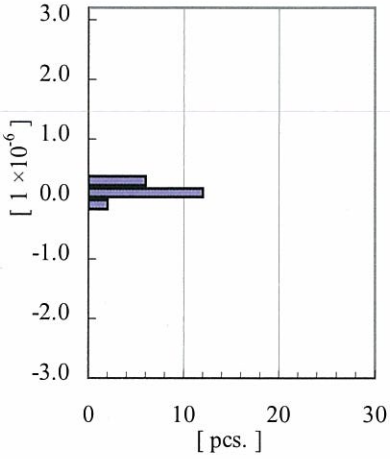
Δ f / f

No. TCE11-CO-001-1E

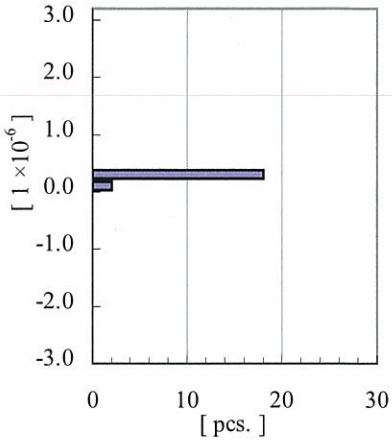
1. High temp. storage
+85℃ × 1 000 h



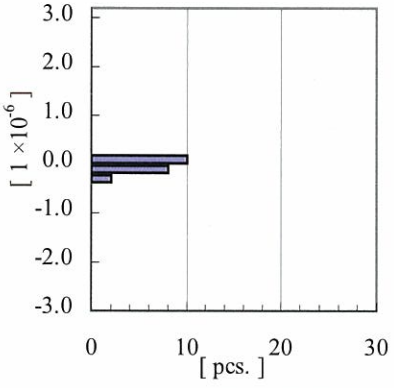
2. Low temp. storage
-40 ℃ × 1 000 h



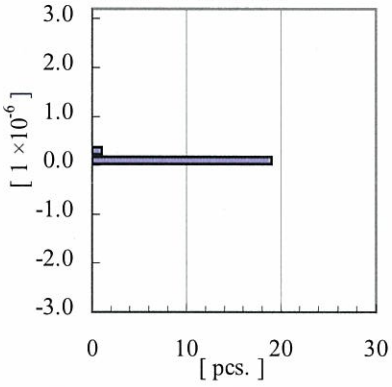
3. Temp. cycle
-40 ℃ ⇔ +85 ℃ 100 cycles



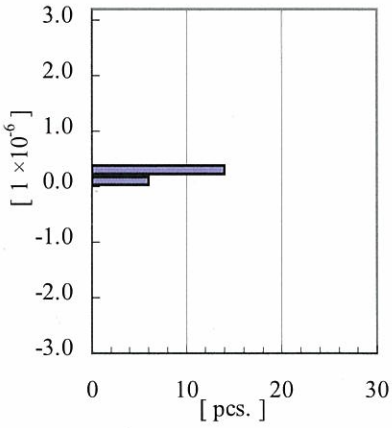
4. Resistance to soldering heat
For convention reflow soldering furnace (3 times)



5. 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)



6. Shock
150g jig 1.5m height × 6 directions 3 times



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Qualification Data