COMBA TELECOM SYSTEMS (CHINA) LTD.

RECIPIENT

SPECIFICATIONS

MODEL : **VG-4232CA**

VG-4232CA 61.440000 MHz GGC-T

SPEC. No. : **A13-724-0A**

DATE: **Nov. 5. 2013**

SEIKO EPSON CORPORATION

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

CHECKED _____ / TD･CS Quality Assurance Department Manager
Yasushi HIraizumi

PREPARED _____ / TD･CS Quality Assurance Department Staff
Emi Oguchi

SPECIFICATIONS

1. Application

1) This document is applicable to the voltage controlled crystal oscillator that are delivered to COMBA TELECOM SYSTEMS (CHINA) LTD. from Seiko Epson Corp.

2) This product is compliant with 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 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 model is VG-4232CA GGC-T.

3. Packing

It is subject to the packing standard of Seiko Epson Corp.

4. Warranty

Defective parts which are originated by us are replaced free of charge in case defects are found within 12 months after delivery.

5. Amendment and abolishment

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

6. Contents

Item No.	Item	Page
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[1] Absolute maximum ratings

Parameter	Symbol	Value	Unit	Note
Supply voltage	Vcc-GND	-0.5 to +7.0	V	
Storage temperature range *	t_stg	-55 to +125	°C	Stored as bare product after unpacking.
Input voltage	V_{IN}	-0.5 to V_{CC}+0.5	V	Vc Terminal

[2] Operating range

Parameter	Symbol	Value			Unit	Note
		Min.	Typ.	Max.		
Supply voltage	Vcc	3.135	3.3	3.465	V	
Supply voltage	GND	0.0	0.0	0.0	V	
Control voltage	V_c	0.0	1.65	3.3	V	
Operating temperature range	t_use	-40	+25	+85	°C	
Output load condition	L_CMOS	-	-	15	pF	

Start up time (Vcc=0V→90%Vcc)of power source should be more than 150us.
By-pass capacitor (approx. 0.01 μF to 0.1 μF) should be placed closely between Vcc and GND.

[3] Frequency characteristics

1) Output frequency (fo) ..... 61.44 MHz

2) Frequency characteristics

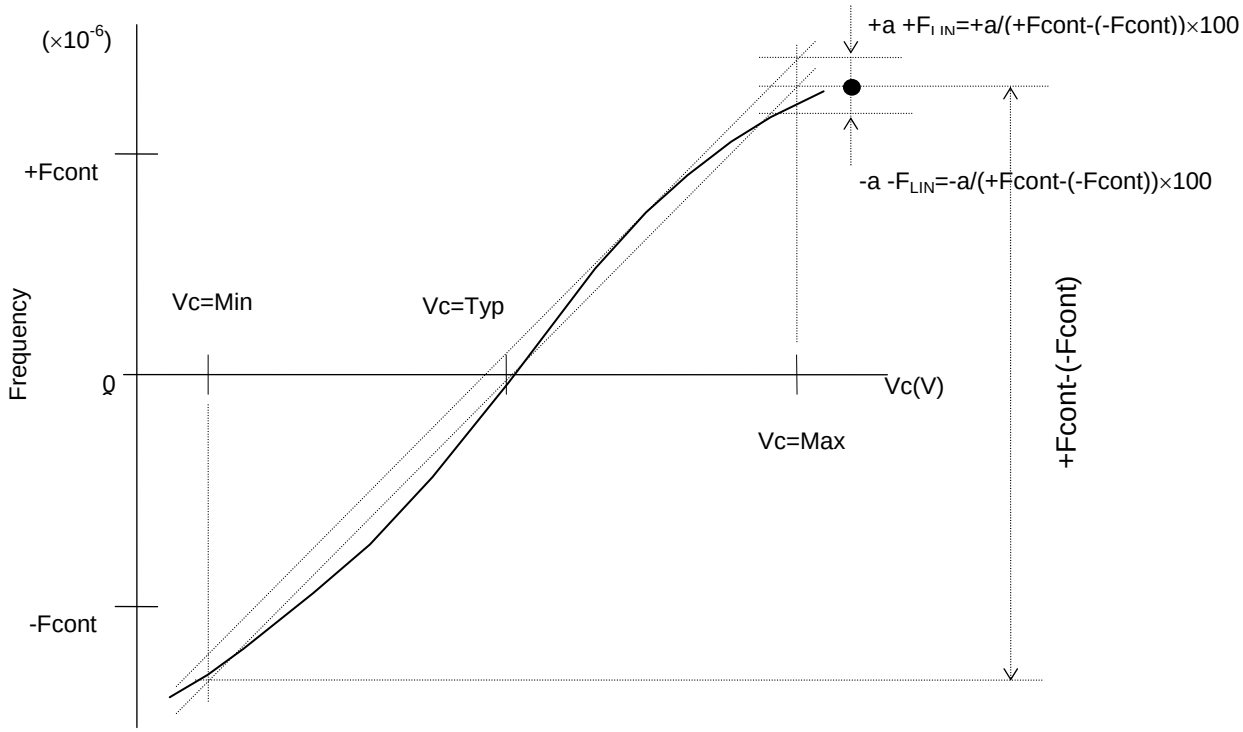
[Vc=1.65V]

Parameter	Symbol	Value [10^{-6}]	Note
Frequency tolerance*	f_tol (OSC)	+/-50	t_use = -40 °C ~ +85 °C

*This includes initial frequency tolerance, temperature characteristics, Supply voltage characteristics,load Characteristics, and 10 years aging(Ta=+25℃) characteristics.

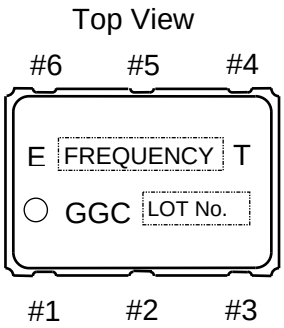
3) Output Frequency characteristics

Parameter	Symbol	Value			Unit	Note
		Min.	Typ.	Max.		
Absolute Pull Range	APR	$\pm 50\times10^{-6}$	-	-	-	
Input resistance	Rin	80	-	-	KΩ	Vc terminal
Frequency tuning linearity	f_{LIN}	-	-	±10	%	
Modulation band width	BW	5	-		kHz	±3dB
Frequency change polarity	-	Positive polarity			-	



Exsample of controling freaquency characteristics

[4] Terminal assignment



Name	No.	Terminal description
Vc	#1	Vc terminal
OE	#2	OE terminal
GND	#3	GND terminal
OUT	#4	Clock output terminal
DNC	#5	DNC terminal(*)
Vcc	#6	Vcc terminal

(*) Please do not connect DNC terminal(#5) to other pattern of VCC or GND etc.

[5] Electrical characteristics

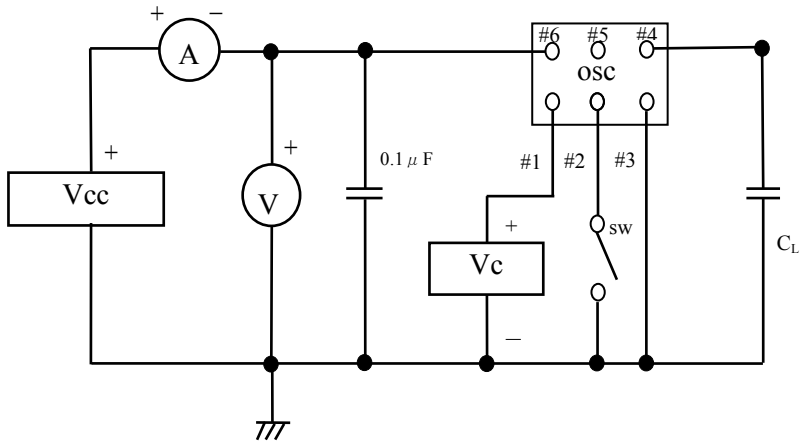
(Please see page 2 [2] Operating range)

Parameter	Symbol	Value		Unit	Note
		Min.	Max.		
Oscillation start up time	T_str	-	10	ms	0sec at 90 % Vcc
Current consumption	I_{cc}	-	35	mA	No load
Disable current	I_dis	-	25	mA	OE=GND
Rise time	tr	-	5	ns	20 %V_{CC} → 80 %Vcc
Fall time	tf	-	5	ns	80 %V_{CC} → 20 %Vcc
Symmetry	SYM	45	55	%	50 %V_{CC} Level
High level output voltage	V_{OH}	0.9Vcc	-	V	I_{OH}= -4mA
Low level output voltage	V_{OL}	-	0.1Vcc	V	I_{OL}= 4mA
High level input voltage	V_{IH}	0.7Vcc	-	V	OE terminal
Low level input voltage	V_{IL}	-	0.3Vcc	V	
Disable time	tpxz	-	100	ns	OE terminal HIGH → LOW
Enable time	tpzx	-	100	ns	OE terminal LOW → HIGH

Please see [6] Test circuit and [7]timing chart.

[6] Test circuit

1) Waveform observation



2) Condition

(1) Oscilloscope

- Bandwidth should be minimum 5 times higher (wider) than measurement frequency.
- Probe ground should be placed closely from test point and lead length should be as short as possible.

(2) L_CMOS includes probe capacitance.

(3) By-pass capacitor (0.01 μF～0.1 μF) should be placed closely between Vcc and GND.

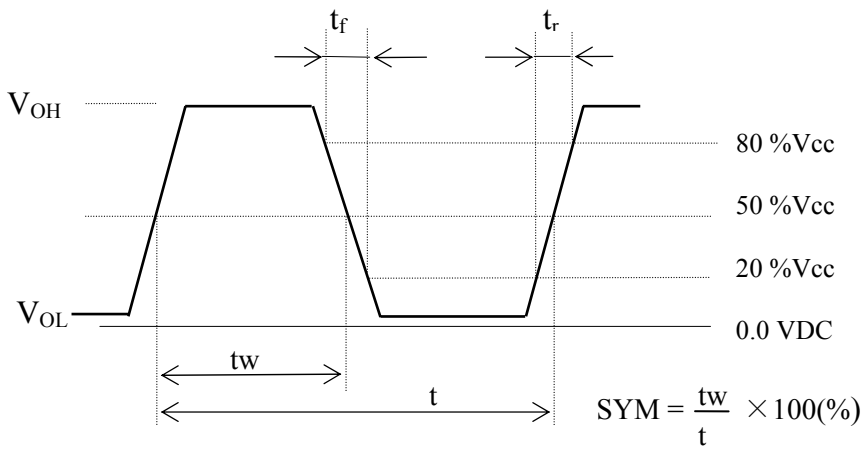
(4) Use the current meter whose internal impedance value is small.

(5) Power supply

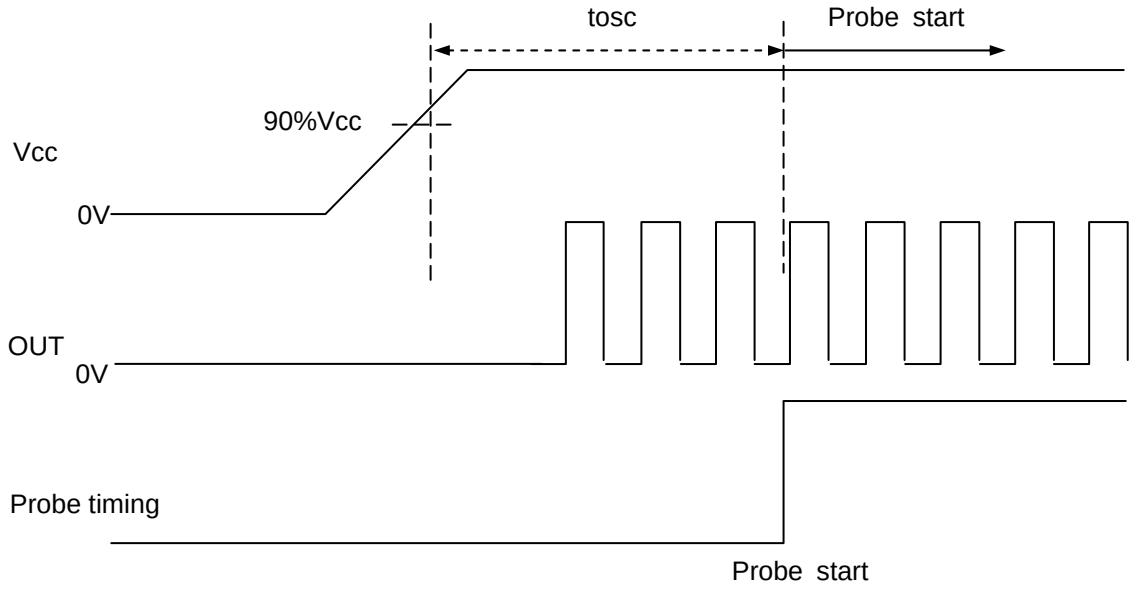
- Impedance of power supply should be as low as possible.

[7] Timing chart

1) Output wave form and measurement level

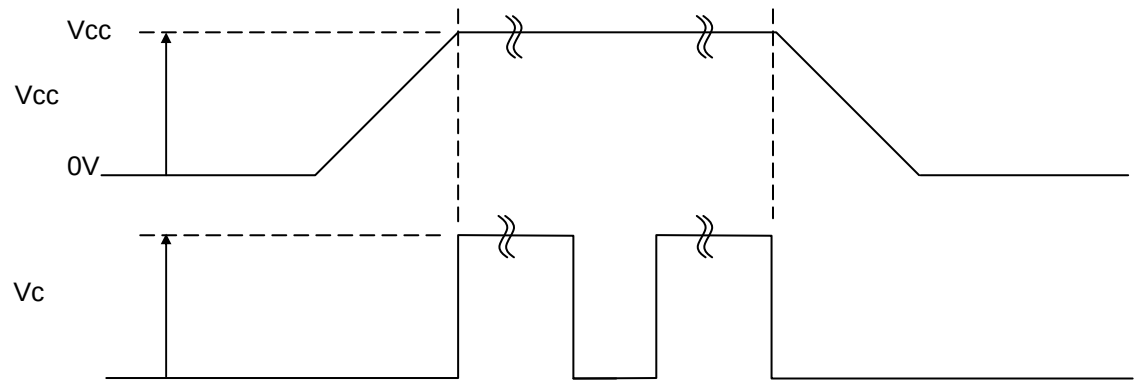


2) Measurement timing of output wave



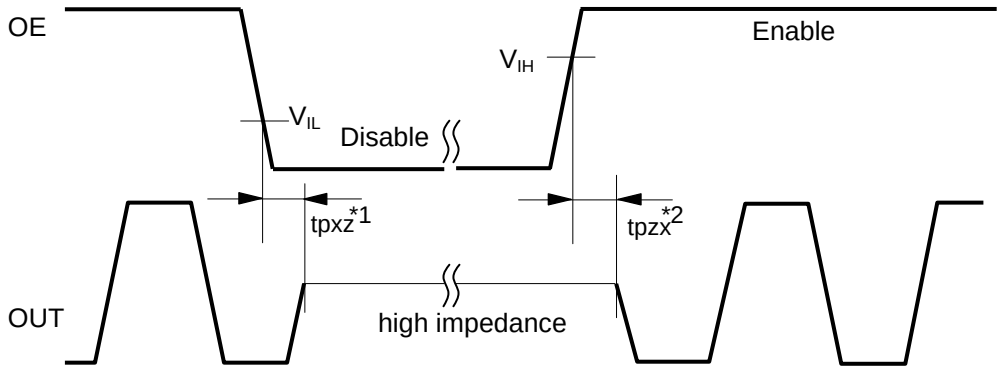
3) Vc control timing

∗ Please rise up the Vc voltage after the Vcc voltage rises up.



4) OE function and timing

OE input level	Oscillation circuit	Output
High or Open	Oscillation	Enable : Specified frequency is output
Low	Oscillation stop	Disable : high impedance



*1 The time taken from OE=V_{IL} to Output=Disable (high impedance).

*2 The time taken from OE=V_{IH} to Output=Enable.

[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 Conditions
		Δ f / f *2 [1×10^{-6}]	Electrical Characteristics	
1	High temperature bias *3	± 15	Satisfy Item [5] after test.	+85 °C × Vcc/Vc Max. ×1 000 h
2	Low temperature storage *3	± 10		-55 ℃×1 000 h
3	Temperature humidity *3	± 10		+85 °C ×85 %RH×1 000 h
4	Temperature cycle *3	± 10		-55 °C ⇔+125 °C 30 min at each temperature ×100 cycles
5	Resistance to soldering heat (Reflow characteristics)	± 10		reflow furnace with the condition 3times IPC/JEDEC J-STD-020D.1
6	Vibration	± 5		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)
7	Drop	± 5		Free drop from 750 mm height on a hard wooden board for 3 times.
8	Air tight	Under 1×10^{-9} Pa・m^3/s		He

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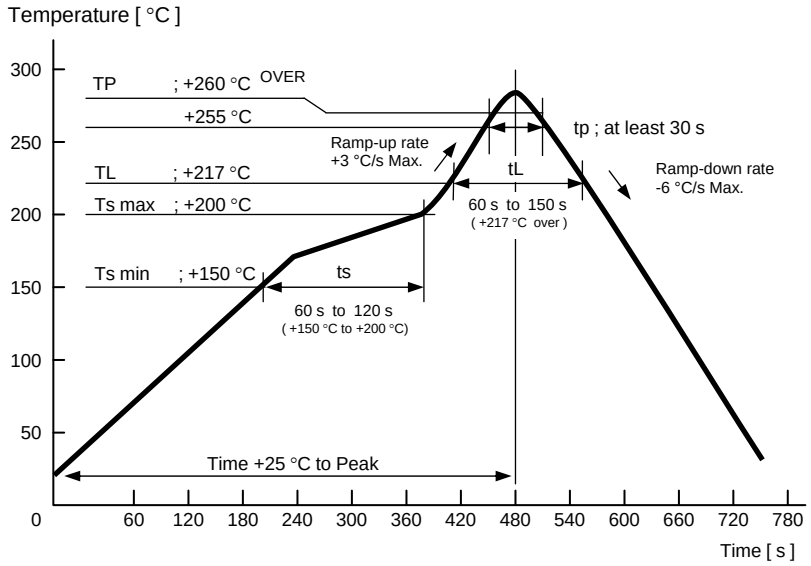
*1 Each test done independently.

*2 Measuring 1 h to 24 h later leaving in room temperature after each test.

*3 Initial values shall be measured after 24 h storage at room temperature after Pre-treatment.

Pre-treatment: Reflow (3 times)

♦ Convection reflow conditions (Ref. IPC/JEDEC J-STD-020D.1)



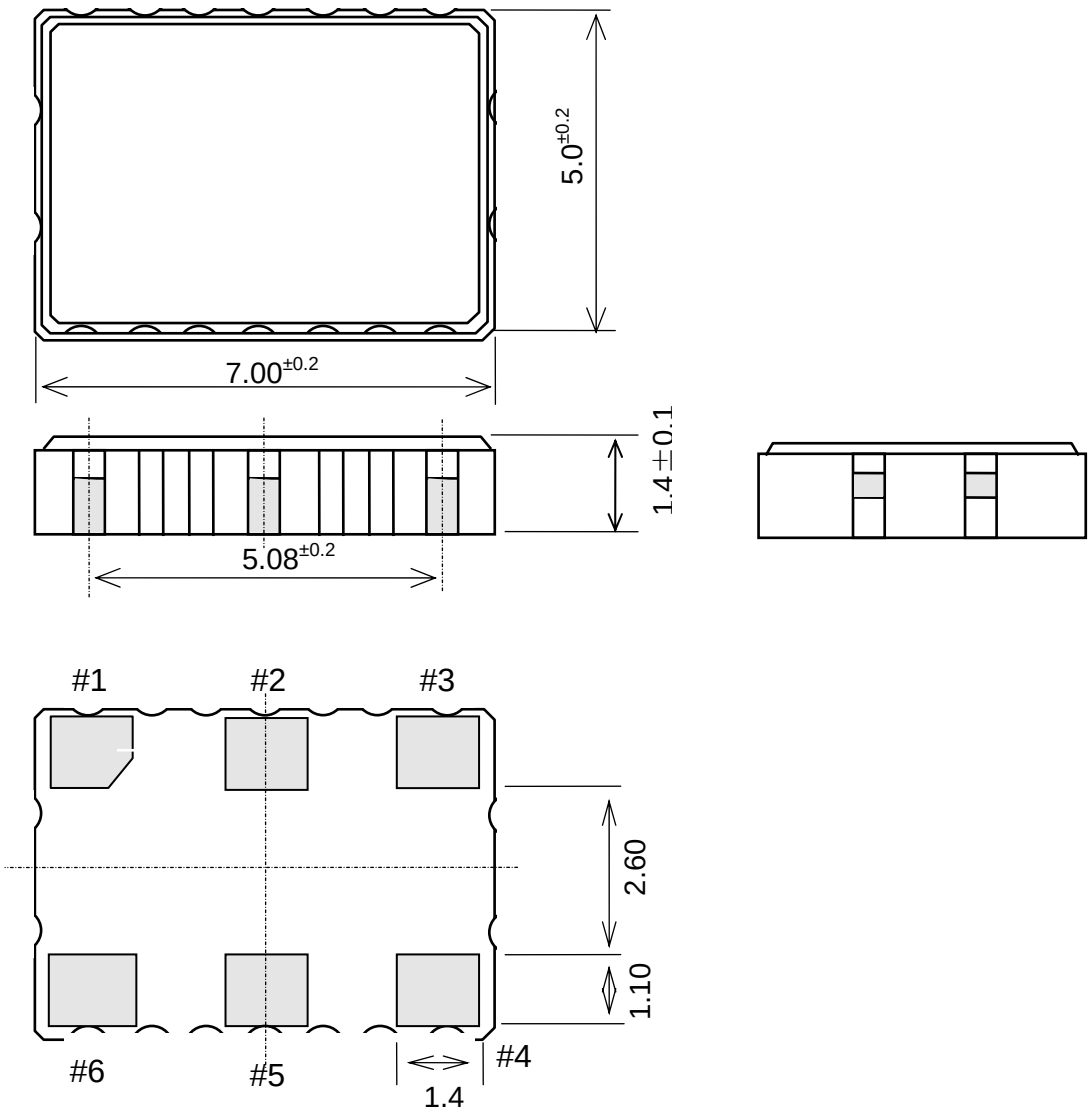
[9] ESD sensitivity

・Electrostatic discharge (ESD)

Item	Value	Test procedure
Human Body Model (HBM)	2 000 V Min.	EIAJ ED-4701-1 C111A, 100 pF, 1.5 kΩ, 3times
Machine Model (MM)	200 V Min.	EIAJ ED-4701-1 C111, 200 pF, 0 Ω, 1time

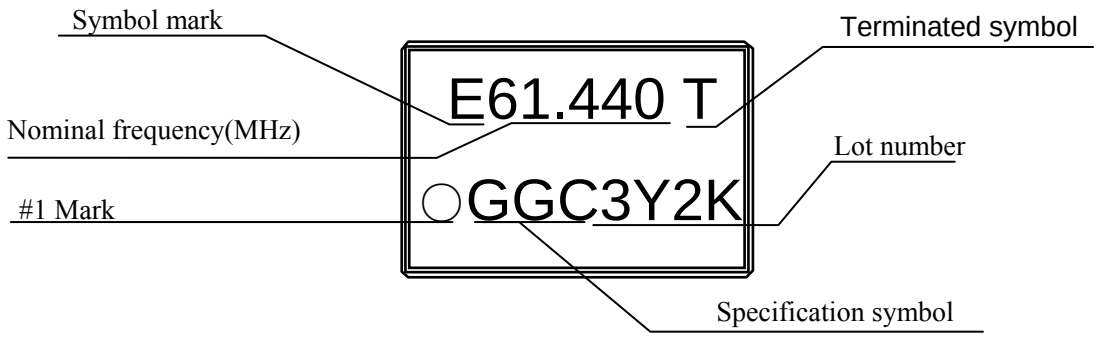
[10] Dimensions and marking layout

1) Dimensions



Terminal treatment : Au plating
Unit : mm

2) Marking layout



- The above marking layout shows only marking contents and their approximate position and it is not for font, size and exact position.
- We show output frequency to the third decimal place and round down the forth decimal place.

[11] Notes

1) This device is made with C-MOS IC.
Please take necessary precautions to prevent damage due to electrical static discharge.

2) Seiko Epson recommends placing a 0.01μF to 0.1μF capacitor closely between Vcc and GND to obtain stable operation and protect against power line ripple. (see [12])

3) Vcc and GND pattern shall be as large as possible so that high frequency impedance shall be small.

4) Seiko Epson cannot recommend to put filtering element into power line so as to reduce noise. Oscillator might be unstable oscillation because high frequency impedance of power line become higher. When use filtering element, please verify electrical construction and or element's spec.

5) Seiko Epson doesn't recommend to power on from intermediate electric voltage or extreme fast power on. Those powering conditions may cause no oscillation or abnormal oscillation.

6) Power ripple: 200 mV P-P max. Start up time (0 %Vcc→90 %Vcc) of power source should be more than 150 μs.

7) A long output line may cause irregular output, so try to make the output line as short as possible.

8) Other high-level signal lines may cause incorrect operation, so please do not place high level signal line close to this device.

9) This device contains a crystal resonator, so please don't expose excessive shock or vibration.
Seiko Epson recommends store device under normal temperature and humidity to keep the specification.

10) An automatic insertion is available, however, the internal crystal resonator might be damaged in case that too much shock or vibration is applied by machine condition.
Be sure to check your machine condition in advance.

11) Ultrasonic cleaning can be used on the VG-4232CA, however, since the oscillator might be damaged under some conditions, please check in advance.

12) Seiko Epson recommends to use and store under room temperature and normal humidity to secure frequency accuracy and prevent moisture.

13) Metal cap of this product is connected to GND. Please don't apply electrical voltage.

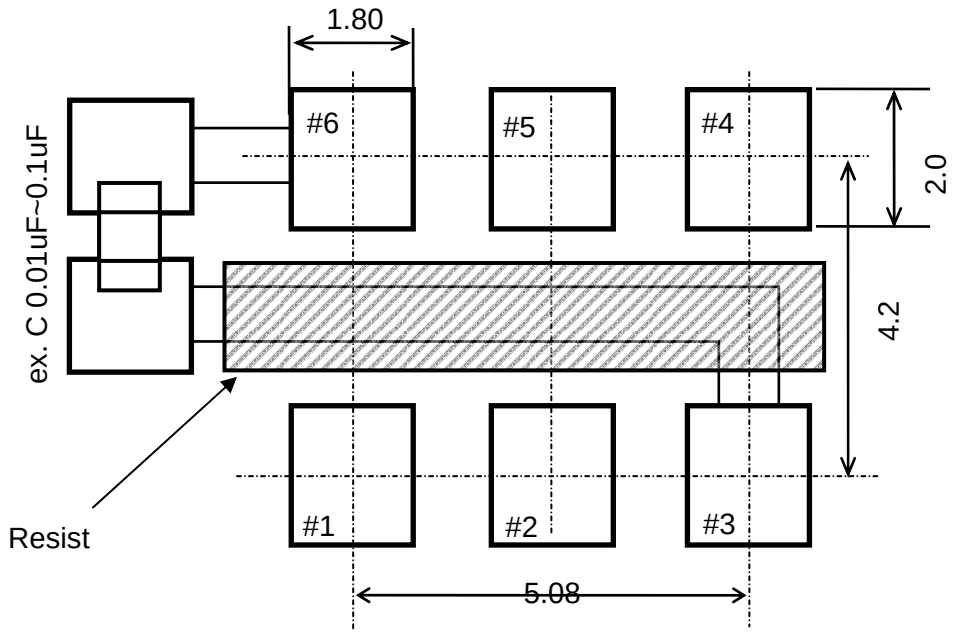
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[12] Recommendable patterning

The soldering pad sample indicated as like following.

Please design implementation density and the soldering reliability after confirmation.

Soldering position (Unit : mm)



TAPING SPECIFICATION

Ⅰ. Application

This standard will apply to 7×5 Ceramic package.

Spec：CA package

Ⅱ. 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	

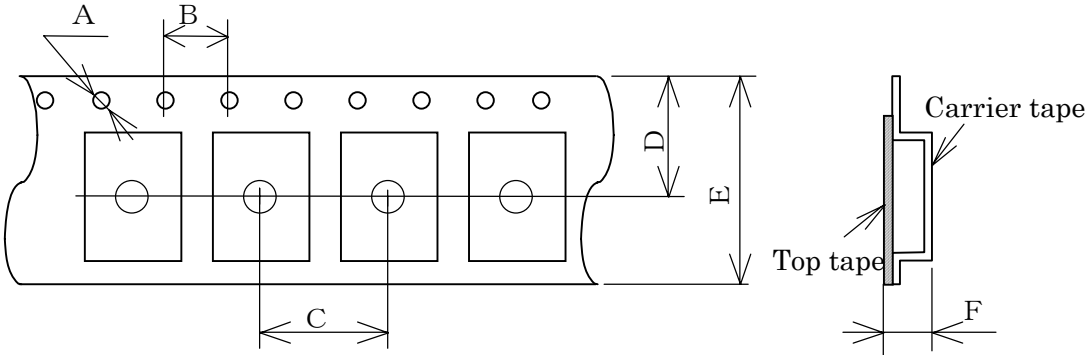
〔1〕 Taping specification

Subject to「EIA-481」and「IEC-60286」

(1) Tape dimensions TE-1612L

Material of the carrier tape : PS

Material of the top tape : PET

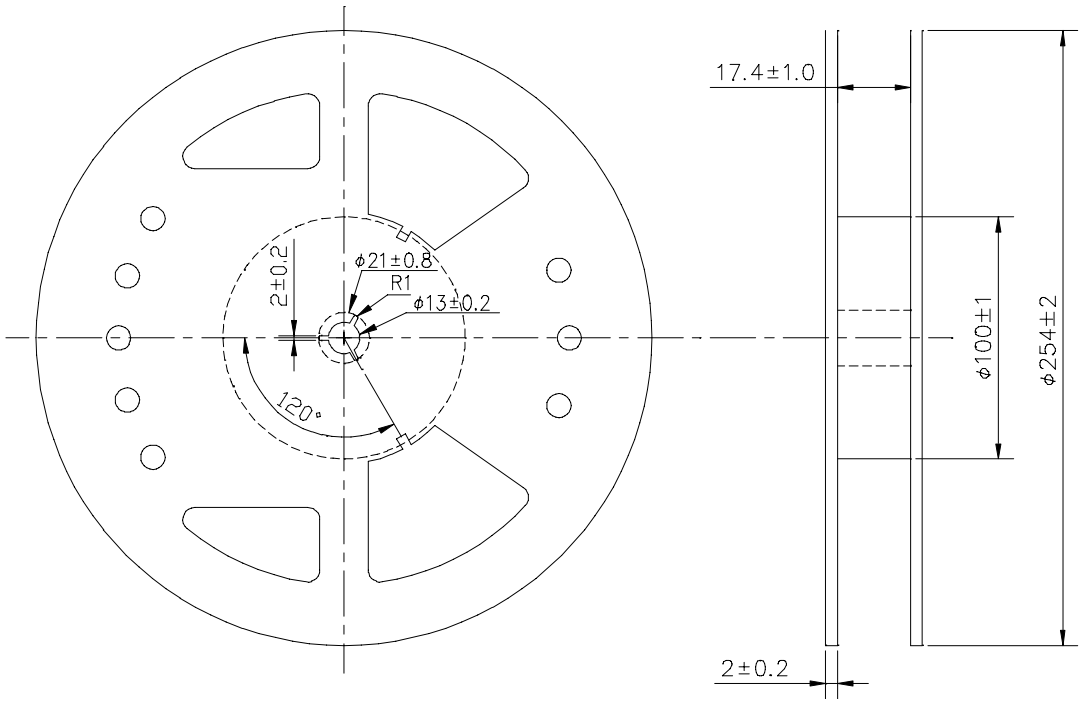


Symbol	A	B	C	D	E	F
Value	ϕ 1.5	4.0	8.0	9.25	16.0	2.3

Unit : mm

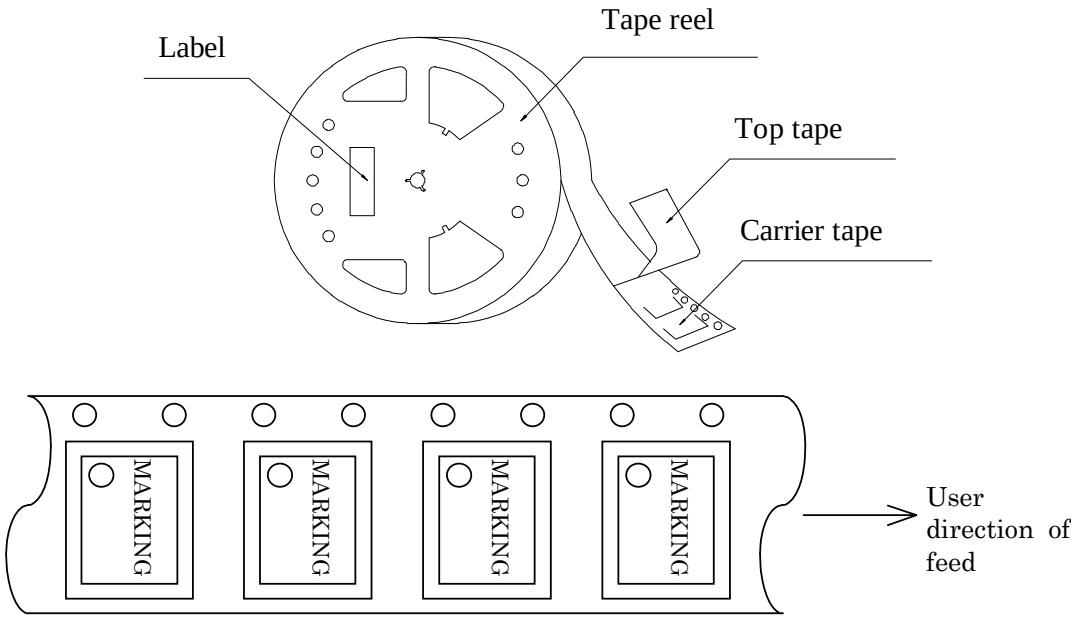
(2) Reel dimensions

Material of the reel : Conductive polystyrene

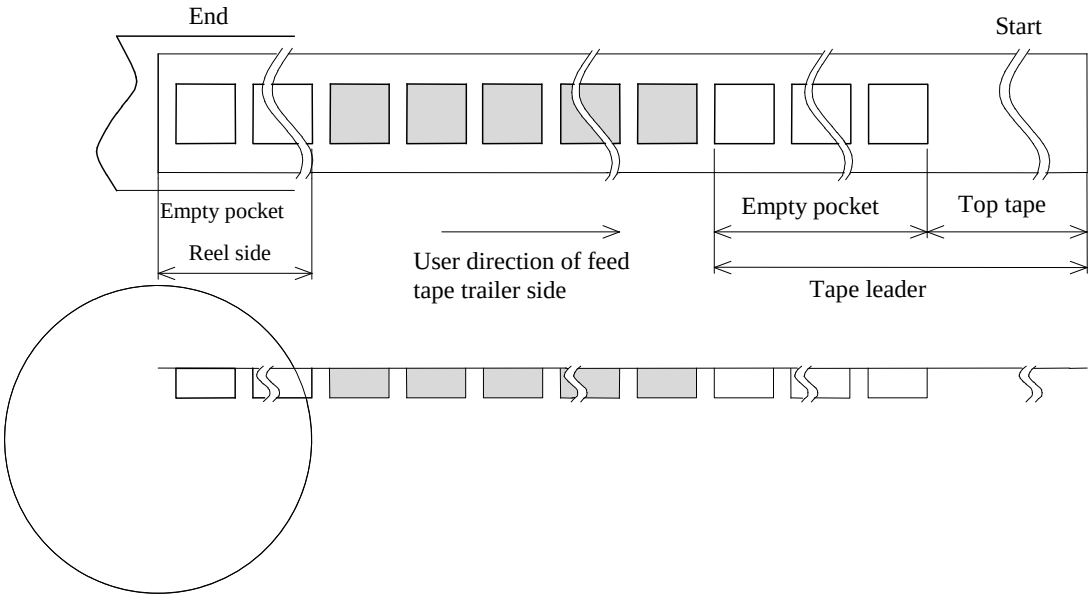


(3) Packing

①Tape & reel



②Start & end point



Item		Empty space
Tape leader	Top tape	Min. 1 000 mm
	Carrier tape	Min. 160 mm
Tape trailer	Top tape	Min. 0 mm
	Carrier tape	Min. 160 mm

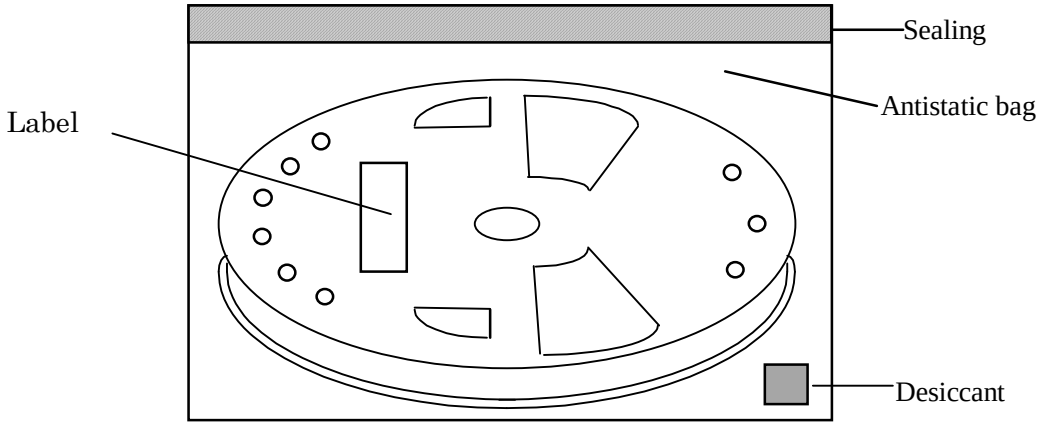
(4) Peel force of the cover tape

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

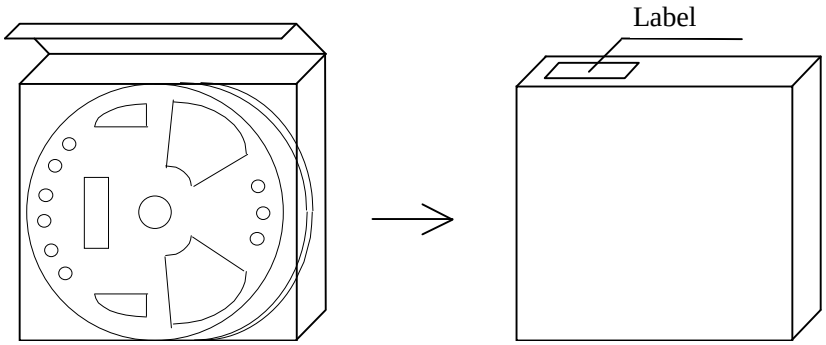
② peel speed : 300 mm / min.

〔2〕 Inner carton

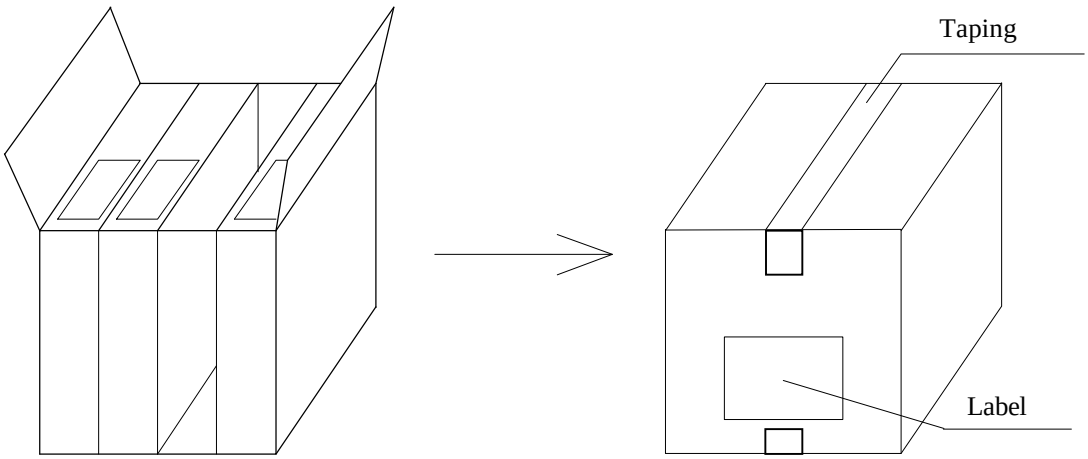
a) Packing to antistatic bag



b) Packing to inner carton



〔3〕 Shipping carton



〔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

・1 000 pcs./reel

〔6〕 Storage environment

(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.

(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.

(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.

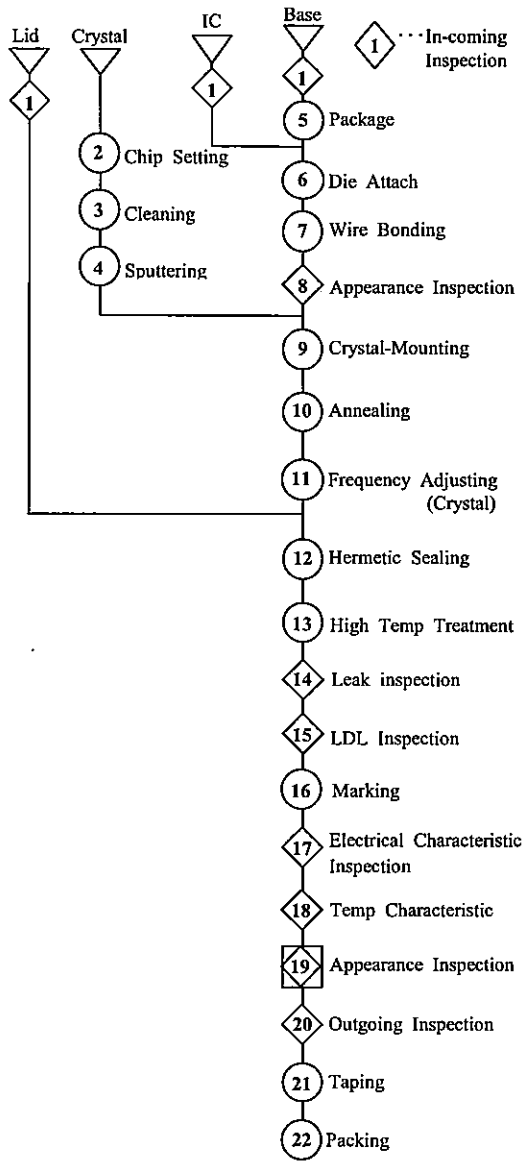
〔7〕 Handling

・To handle with care to prevent the damage of tape, reel and products.

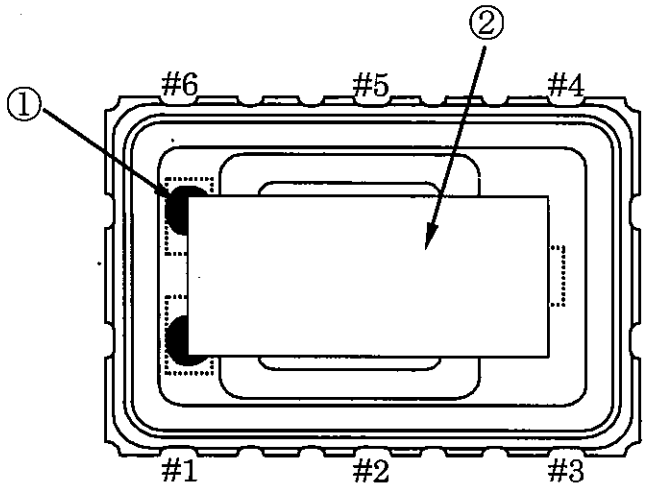
- PROCESS QUALITY CONTROL -

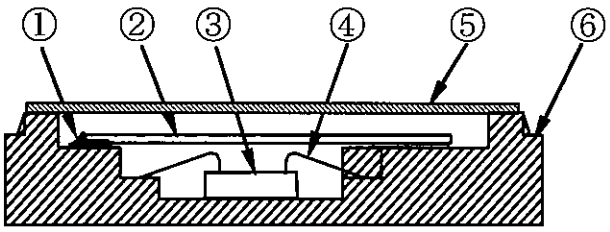
No. VG-4232CA - 00 - ASE – 1 CRYSTAL OSCILLATOR : VG−4232CA

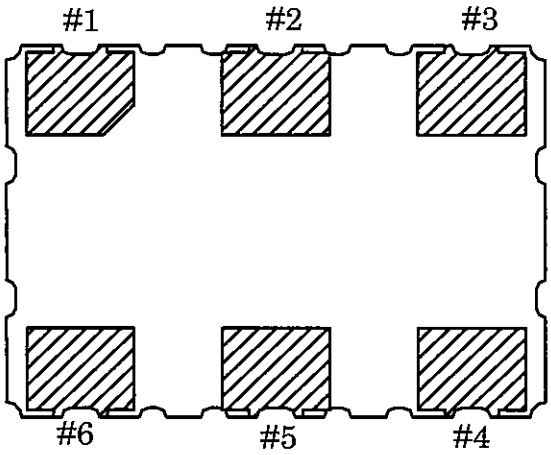
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Manufacturing process chart	No.	Section In Charge	Standards	Inspection, Control Item	Instruments	Inspection Methods	Record
	1	Inspection Section	Purchasing Specification Incoming Inspection Standard	Appearance Dimension	Microscope	Sampling	Data sheet
	2	China plant	Manufacturing Instruction Sheet	Appearance	Microscope	100% Inspection	Data sheet
	3	China plant	Manufacturing Instruction Sheet	Appearance	Microscope	Sampling	Data sheet
	4	China plant	Manufacturing Instruction Sheet	Appearance Frequency	Microscope	Sampling	Data sheet
	5	China plant	Manufacturing Instruction Sheet	Appearance	Microscope	Sampling	Data sheet
	6	China plant	Manufacturing Instruction Sheet	Appearance	Microscope	Sampling	Data sheet
	7	China plant	Manufacturing Instruction Sheet	Bonding strength Appearance	Pull tester/Gauge Microscope	Sampling 100% Inspection	Data sheet
	8	China plant	Manufacturing Instruction Sheet	Appearance	Microscope	100% Inspection	Data sheet
	9	China plant	Manufacturing Instruction Sheet	Mounting strength Appearance	Pull tester Microscope	Sampling 100% Inspection	Data sheet
	10	China plant	Manufacturing Instruction Sheet	Appearance	Microscope	Sampling	—
	11	China plant	Manufacturing Instruction Sheet	Frequency	Counter	Sampling	Data sheet
	12	China plant	Manufacturing Instruction Sheet	Appearance Frequency	Microscope Counter	Sampling	Data sheet
	13	China plant	Manufacturing Instruction Sheet	—	—	—	—
	14	China plant	Manufacturing Instruction Sheet	Leakage inspection	Measuring equipment	100% Inspection	Data sheet
	15	China plant	Manufacturing Instruction Sheet	Characteristic inspection	Measuring equipment	100% Inspection	Data sheet
	16	China plant	Manufacturing Instruction Sheet	Appearance	Visual Inspection	Sampling	Data sheet
	17	China plant	Delivery Specifications Outgoing Inspection Standard	Electrical characteristic Master check	Measuring equipment	100% Inspection	Data sheet
	18	China plant	Manufacturing Instruction Sheet	Temp characteristic Inspection	Measuring equipment	100% Inspection	Data sheet
	19	China plant	Manufacturing Instruction Sheet	Appearance	Microscope	Sampling	Data sheet
	20	China plant	Delivery Specifications Outgoing Inspection Standard	Electrical characteristic Appearance Master check	Measuring equipment Microscope	Sampling	Data sheet
	21	China plant	Manufacturing Instruction Sheet	Tape peeling strength Frequency check function	Peeling strength test machine	Sampling	Data sheet
	22	China plant	Manufacturing Instruction Sheet Daily Shipping List	Customers Type Quantity	—	—	Delivery Slip

Structure diagram VG-4232CA







LIST		
	Name of part	Material
①	Crystal Adhesive	Ag Paste
②	Crystal chip	AT cut
③	IC	C-MOS
	IC conductive adhesive	Ag Paste
④	Bonding wire	Au
⑤	Cap	Kovar
⑥	Package	Ceramic(Al_2O_2)

RELIABILITY TEST DATA

Product Name : VG-4232CA series

The Company evaluation condition

We evaluate environmental and mechanical characteristics by the following test condition . **No.DTA-1203E**

No.	ITEM	TEST CONDITIONS	VALUE *1		TEST Qty [n]	FAIL Qty [n]
			Δ f / f *2 [1 × 10^{-6}]	Electrical characteristics		
1	High temperature bias	+85 ℃ × (Vcc/Vc Max.) bias × 1 000 h	*3 ± 15	Satisfy specification after test	22	0
2	Low temperature storage	-55 ℃ × 1 000 h	*3 ± 10		22	0
3	Temperature humidity	+85 ℃ × 85 %RH × 1 000 h	*3 ± 10		22	0
4	Temperature cycle	-55 ℃ ⇔ +125 ℃ 30 min at each temp. 100 cycles	*3 ± 10		22	0
5	Resistance to soldering heat	For convention reflow soldering furnace (3 times) IPC/JEDEC J-STD-020D.1	± 10		22	0
6	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)	± 5		22	0
7	Drop	Free dorop from 750 mm height on a hard Wooden board for 3 times	± 5		22	0
8	Air tight	He leakage detector	1 × 10^{-9} Pa･m^3/s Max.		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 after pre-conditioning.(Reflow 3 times)

Qualification Data

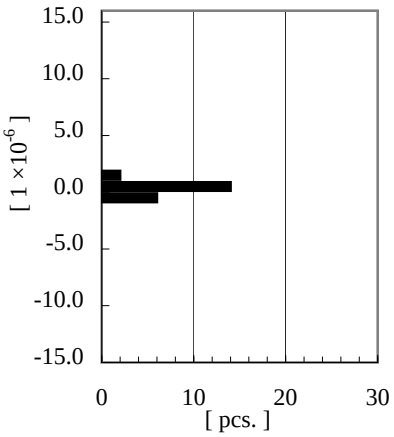
Product Name : VG-4232CA series

Δ f / f

No.DTA-1203E

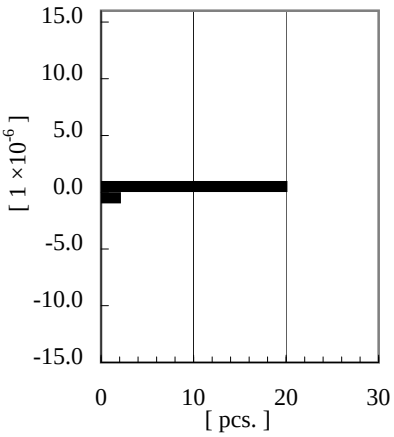
1. High temp. bias

+85 ℃ ×(Vcc/Vc Max.)×1 000 h



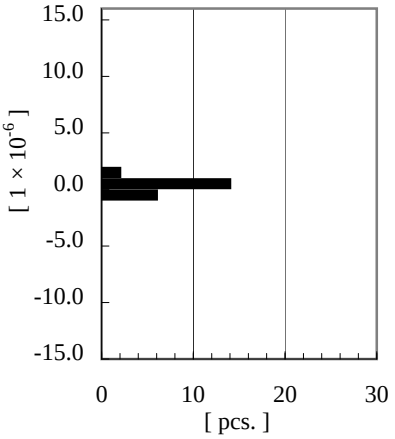
2. Low temp. storage

-55℃ × 1 000 h



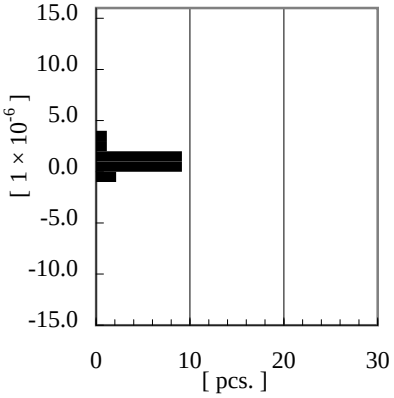
3. Temp. humidity

+85 ℃ × 85 %RH × 1 000 h



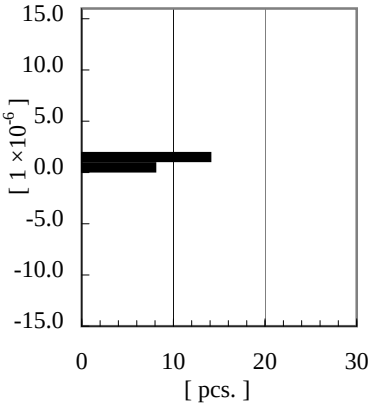
4. Temp. cycle

-55 ℃ ⇔ +125 ℃ 100 cycles



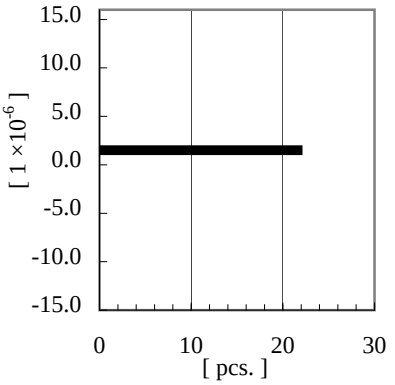
5.Resistance to soldering heat

For convention reflow soldering furnace
(3 times)



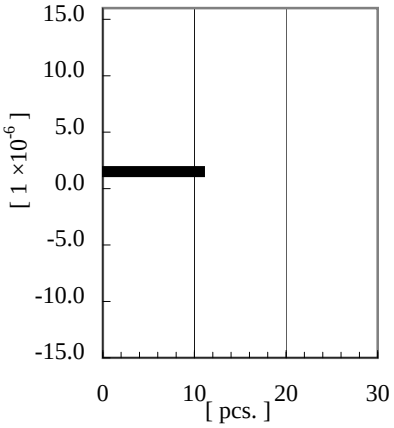
6. Vibration

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)



7. Drop

750mm × 3 times Free drop



Qualification Data