SIGLENT TECHNOLOGIES CO LTD

RECIPIENT

SPECIFICATIONS

Product No. : Q3614CA00125500

MODEL : VG-4231VA

SPEC. No. : A15-418-1B

DATE: May. 26. 2015

SEIKO EPSON CORPORATION

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Emi Oguchi

SPECIFICATIONS

1. Application

This document is applicable to the crystal oscillator that are delivered to SIGLENT TECHNOLOGIES CO LTD from Seiko Epson Corp.

This product complies 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 Q3614CA00125500.
The model is VG-4231CA GRCT.

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

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[1] Absolute maximum ratings

Parameter	Symbol	Value	Unit	Note
Supply voltage	V_{DD}-GND	-0.3 to +7.0	V	
Storage temperature	T_{STG}	-40 to +125	°C	Stored as bare product after unpacking.
Output current	I_{OUT}	30	mA	
Input voltage	V_{IN}	-0.3 to V_{DD}+0.3	V	Vc,OE terminal

[2] Operating range

Parameter		Symbol	Value			Unit	Note
			Min.	Typ.	Max.		
Supply voltage		V_{DD}	3.0	3.3	3.6	V	V_{DD}=3.3 V±0.3 V
Supply voltage		GND	0.0		0.0	V	
Operatable temperature range		T_{OPA}	-40		+85	°C	V_{DD}=3.3 V±0.3 V
Operating temperature range		T_{OPR}	-40		+85	°C	V_{DD}=3.3 V±0.3 V
Input voltage		Vc	0.15	1.65	3.15	V	V_{DD}≥3.0 V
		V_{OE}	GND		V_{DD}	V	OE terminal
Output load	C-MOS	CL			15	pF	

•By-pass capacitor (0.01 μF to 0.1 μF) is placed closely between V_{DD} and GND.

[3] Frequency characteristics

1) Output frequency ..... 40 MHz
2) Frequency characteristic

(V_{DD}=3.3 V±0.3 V, Vc=1.65 V, GND=0.0 V, CL=15 pF)

Parameter	Symbol	Value	Unit	Note
Design Code	-	GRC	-	
Operating temperature	T_{OPR}	-40 ~ +85	°C	
Supply voltage	V_{DD}	3.3±0.3	V	
Control voltage	Vc	1.65±1.5	V	
Frequency stability *[1×10^{-6}]	Δ f/fo	±50 Max.	-	
Aging	Δ fa	±10.0 Max.	-	T_{OPR}=+25 °C 10 years

* This includes initial frequency tolerance, temperature characteristics, voltage characteristics, load characteristics and reflow soldering drift but exclude aging.

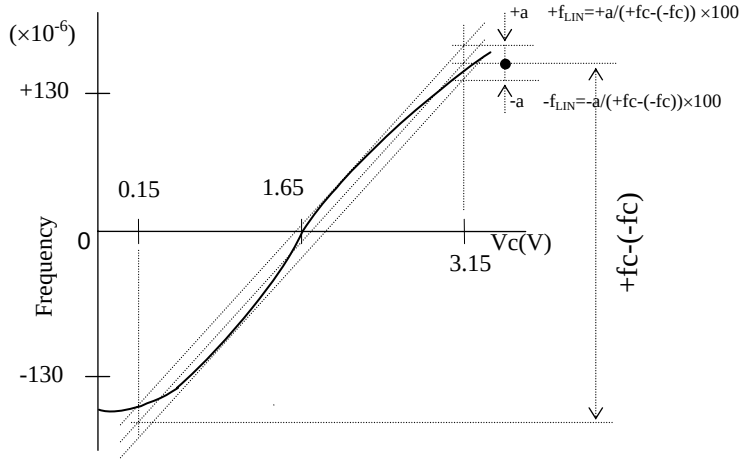
3) Frequency control characteristic

(V_{DD}=3.3 V±0.3 V, GND=0.0 V, Vc=1.65 V±1.5 V,CL=15 pF,T_{OPR})

Parameter	Symbol	Value			Unit	Note
		Min.	Typ.	Max.		
Pull range	Δfc	$\pm130\times10^{-6}$			-	
Absolute pull range *1	APR	$\pm65\times10^{-6}$				
Input resistance	Zin	50			kΩ	D.C Level
Vc lined deviation *2	f_{LIN}			±10	%	
Modulation characteristics	BW	15	20		kHz	±3 dB at 1 kHz
Frequency change polarity	-	Positive polarity			-	

*1 Absolute pull range is the minimum guaranteed frequency shift from fo over variations in Frequency stability (df/fo), aging, drop, and vibration.

*2 Deviation from best linear fit.



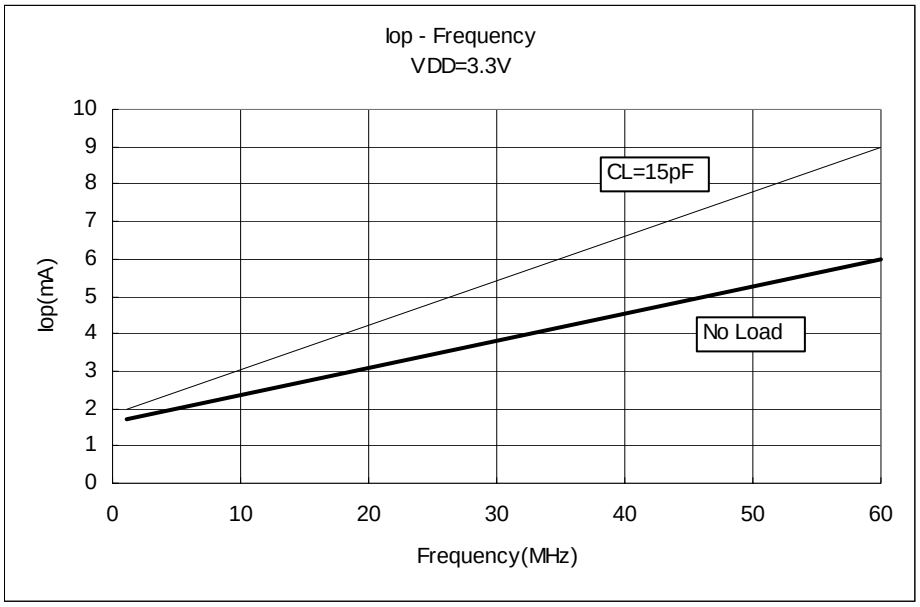
Example of frequency control characteristic

[4] Electrical characteristics

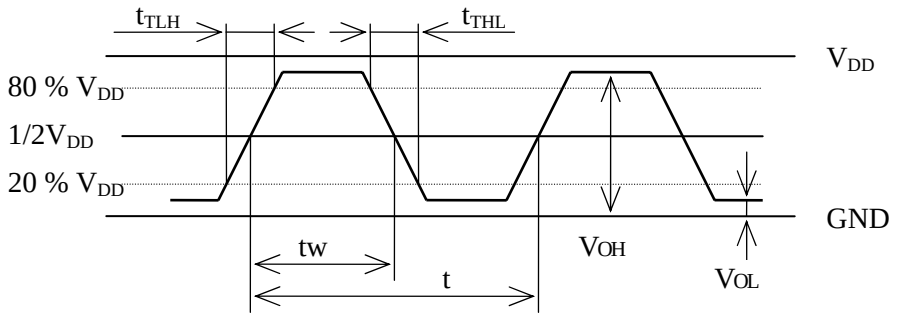
(V_{DD}=3.3 V±0.3 V,GND=0.0 V,Vc=1.65 V±1.5 V,CL=15 pF, T_{OPR})

Parameter	Symbol	Value		Unit	Note
		Min.	Max.		
Start up time	t_{OSC}		10	ms	time point of 90 %V_{DD} is consider as t=0
Current consumption	I_{OP}		10	mA	No load
Disable current	I_{OE}		7.0	mA	OE=GND
Output rise time	t_{TLH}		4.0	ns	C-MOS load:20 %V_{DD}→80 %V_{DD} Level
Output fall time	t_{THL}		4.0	ns	C-MOS load:80 %V_{DD}→20 %V_{DD} Level
Output duty	tw/t	40	60	%	C-MOS load:1/2 V_{DD} Level
High level output voltage	V_{OH}	V_{DD}-0.4		V	I_{OH}= -0.8 mA
Low level output voltage	V_{OL}		0.4	V	I_{OL}= 3.2 mA
High level input voltage	V_{IH}	0.7 V_{DD}		V	OE terminal
Low level input voltage	V_{IL}		0.3 V_{DD}	V	OE terminal
Output disable time	t_{PXZ}		25	ns	OE terminal High → Low
Output enable time	t_{PZX}		25	ns	OE terminal Low → High

◆Reference : Current consumption Typ. value

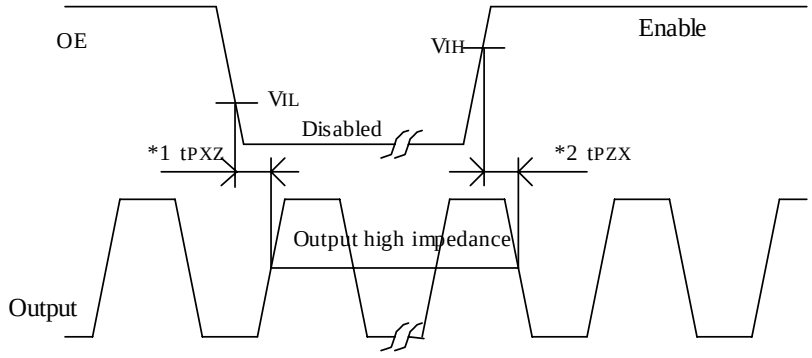


◆Timing chart（C-MOS Level）　　Duty=t w/t×100 (%)



◆OE function and timing

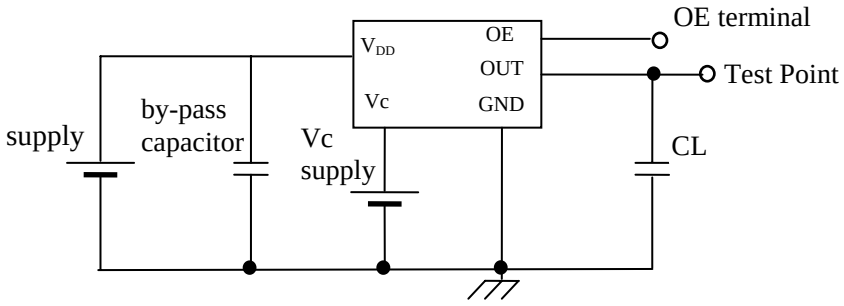
OE function	Osc. circuit	Output
High or Open	Enable	Specified frequency is output : Enable
Low	Enable	Output becomes high impedance : Disable



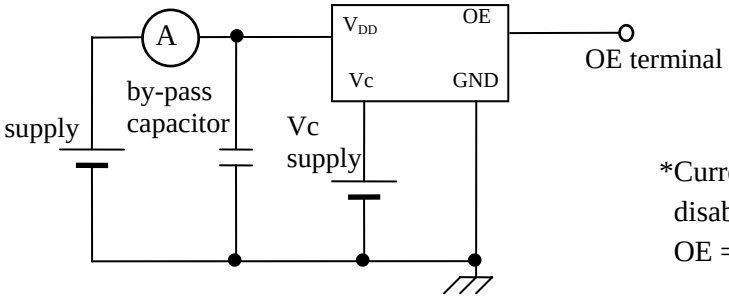
*1　The time taken from OE=VIL to out put = Disable (high impedance)
*2　The time taken from OE=VIH to out put = Enable

[5] Test circuit

1) C-MOS load CL=15 pF



2) Current consumption



*Current consumption under the disable function should be OE = GND.

3) Condition

1. Oscilloscope :Impedance Min. 1 MΩ
   Input capacitance Max. 15 pF
   Band width Min. 400 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. CL includes probe capacitance.
3. By-pass capacitor (0.01 μF to 0.1 μF) is placed closely between V_{DD} and GND.
4. Use the current meter whose internal impedance value is small.
5. Power Supply
   ・Start up time (0 %V_{DD}→90 %V_{DD}) of power source should be more than 150 μs.
   ・Impedance of power supply should be as lowest as possible.
6. One point earth of test cirouit is required.

[6] 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 storage	*3 ±20	Satisfy Item [4] after test.	+125 °C × 1 000 h
2	Low temperature storage	*3 ±10		-40 °C × 1 000 h
3	High temperature bias	*3 ±7		+85 °C × 3.6 V × 1 000 h
4	Low temperature bias	*3 ±7		-40 °C × 3.6 V × 1 000 h
5	Temperature humidity bias	*3 ±10		+85 °C × 85 %RH × 3.6 V × 1 000 h
6	Temperature cycle	*3 ±10		-40 °C ↔ +125 °C 30 min. at each temperature 100 cycles
7	Resistance to soldering heat	±2		Convection reflow soldering furnace (2 time)
8	Drop	±2		Free drop from 750 mm height on a hard wooden board for 3 times. (Board is thickness more than 30 mm)
9	Vibration	±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)
10	Seal	1×10^{-9} Pa·m^3/ s		He leakage detector
11	Solderability	Termination must be 95 % covered with fresh solder		Dip termination into solder bath at +235 °C ± 5 °C for 5 s. (Using Rosin Flux)
12	Pull - off	No peeling-off at a solder part		10 N press for 10 s ± 1 s Ref. EIAJ ED-4702
13	Solvent resistance	The marking shall be legible		Ref. JIS C 0052 or IEC 60068-2-45

< Notes >

*1 Each test done independently.

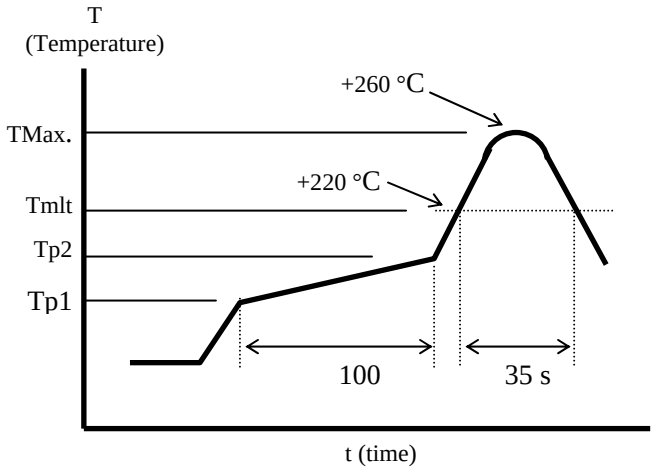
*2 Measuring 2 h to 24 h later leaving in room temperature after each test.

*3 Initial value shall be measured after 24 h storage at room temperature after pre-conditioning.

Convection reflow soldering furnace

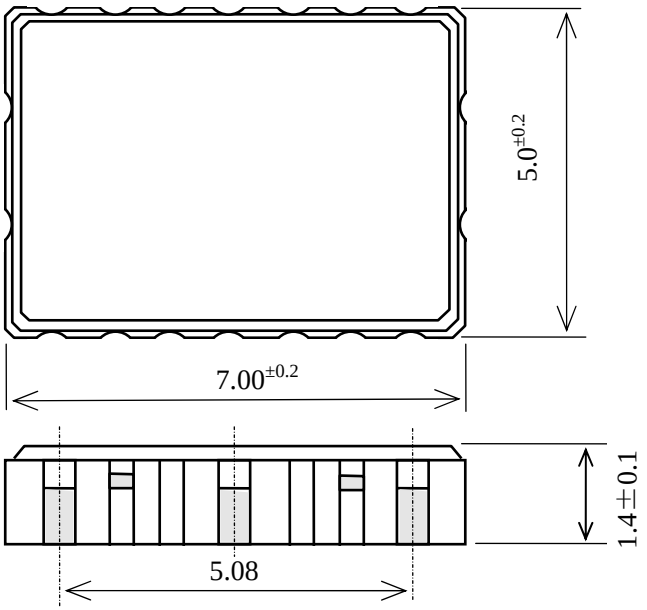
1.Pre heating temperature : Tp1 ~ Tp2 = +170 °C

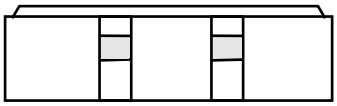
2.Peak temperature must not exceed +260 °C and the duration of over +220 °C should be 35 s.

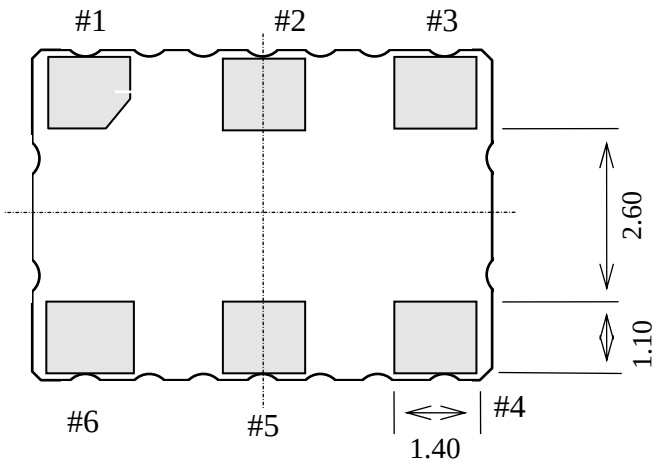


[7] Dimensions and marking layout

1) Dimensions







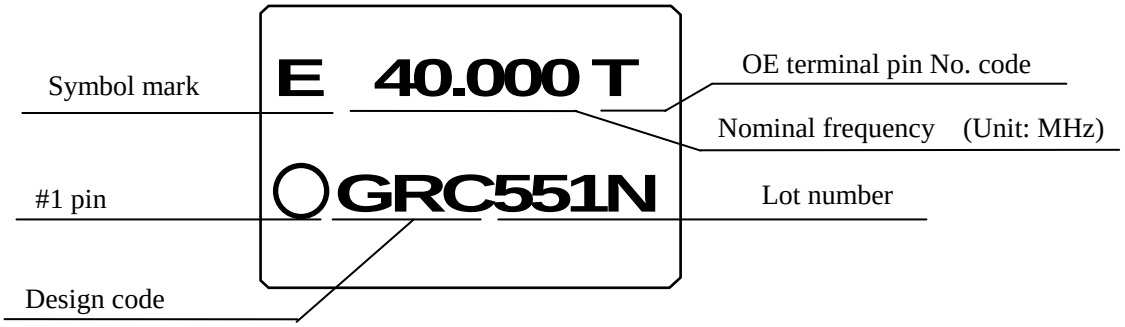
端子説明

Pin. No.	Name
#1	Vc
#2	OE
#3	GND
#4	OUT
#5	NC
#6	VDD

Terminal treatment : Au plating

Unit : mm

2) Marking layout



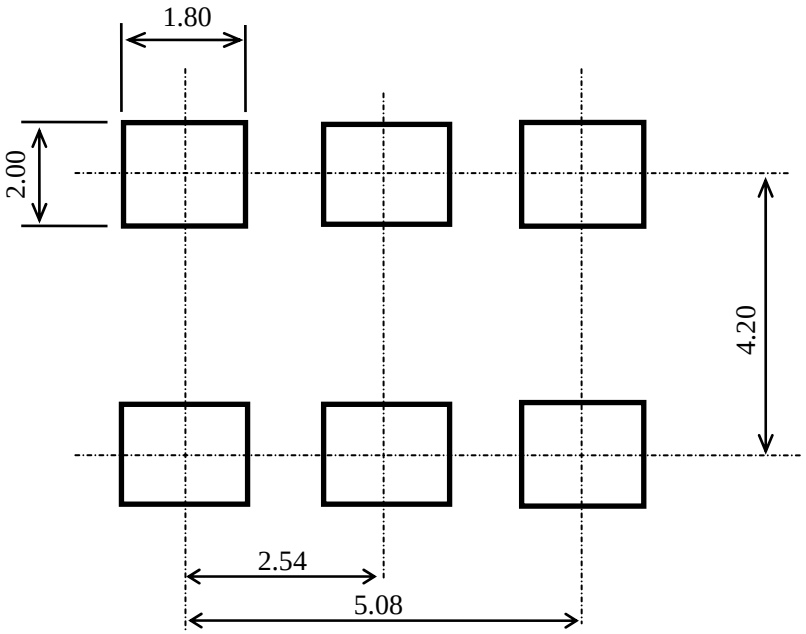
♦ Marking layout shows only marking contents and their approximate position, it doesn't show for font, size and exact position.

♦ Output frequency shall indicate by 3 digits below decimal point, if the value under decimal point over 3 digits, the least significant digits will be omitted.

[8] Recommendable patterning

The soldering pad sample indicated as like following:

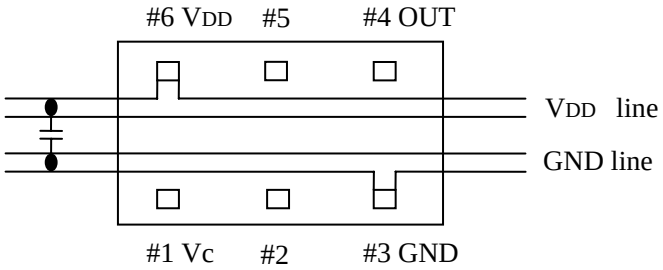
Soldering position (Unit : mm)



[9] 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 recommend placing a 0.01 μF to 0.1 μF capacitor closely between V_{DD} and GND to obtain stable operation and protect against power line ripple.



   V_{DD} and GND pattern shall be as large as possible so that high frequency impedance shall be small.

3) 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.

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

5) Power ripple : 200 mV P-P max. Start up time(0 %V_{DD}→90 %V_{DD}) of power source should be more than 150 μs.

6) A long output line may cause irregular output, so try to make the output line as short as possible, and also keep high-level signal source away from this device.

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

8) 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.

9) 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.

10) Ultrasonic cleaning can be used on the VG-4231CA, however, since the oscillator might be damaged under some conditions, please exercise in advance.

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

12) When don't intend to use OE pin, please connect the pin to V_{DD}.
   Seiko Epson recommends to install a resistor in between to mitigate effect by electrical surge etc.

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 sleeve	3
〔3〕	Shipping carton	
〔4〕	Marking	4
〔5〕	Quantity	
〔6〕	Storage environment	
〔7〕	Handling	

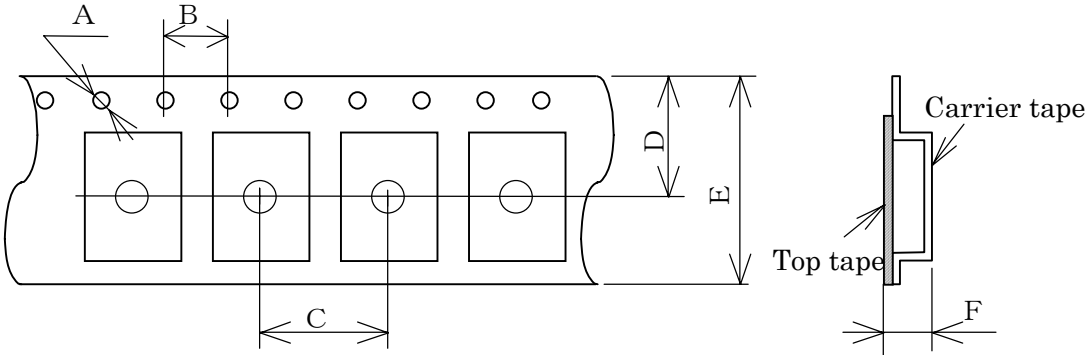
〔1〕 Taping specification

Subject to「EIA-481」and「IEC-60286」

(1) Tape dimensions TE-1612L

Material of the carrier tape : PS

Material of the top tape : PET

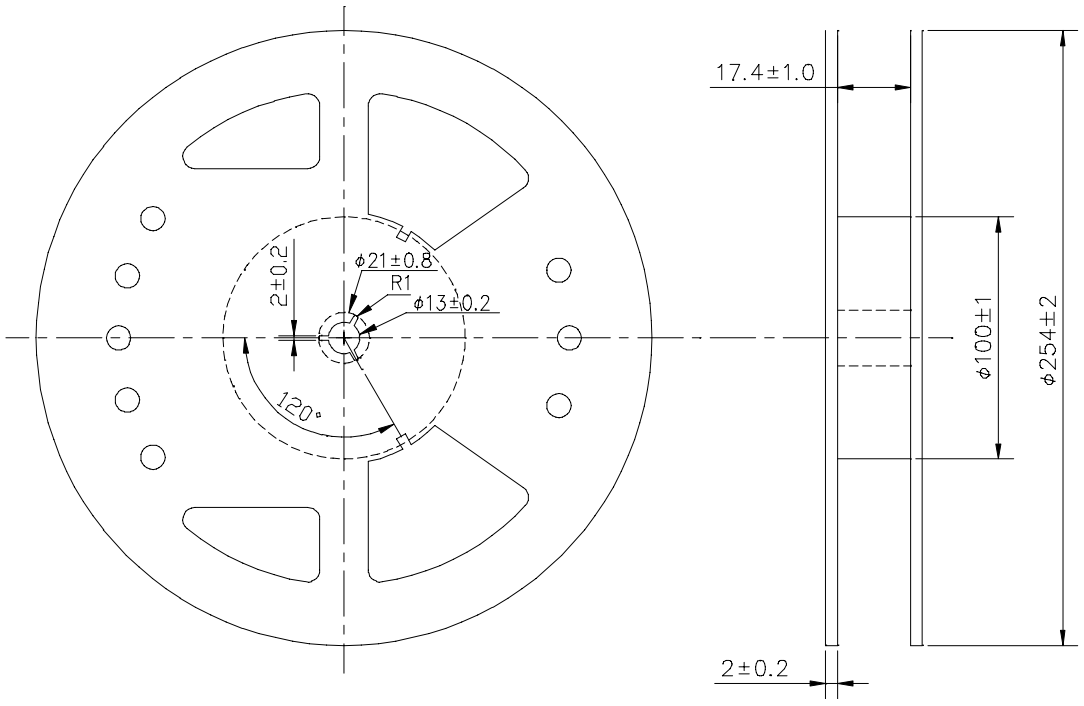


Symbol	A	B	C	D	E	F
Value	ϕ 1.5	4.0	8.0	9.25	16.0	2.3

Unit : mm

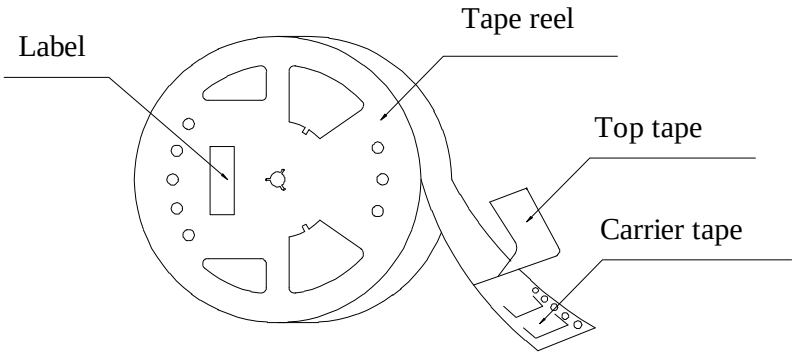
(2) Reel dimensions

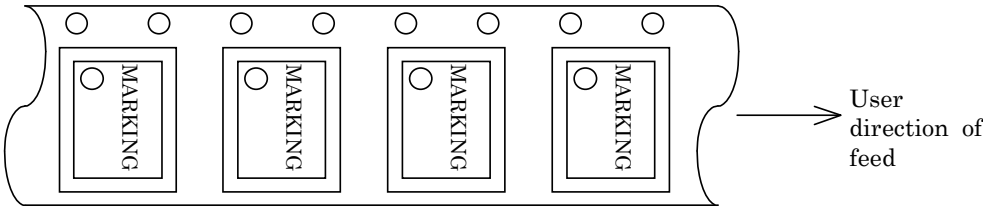
Material of the reel : Conductive polystyrene



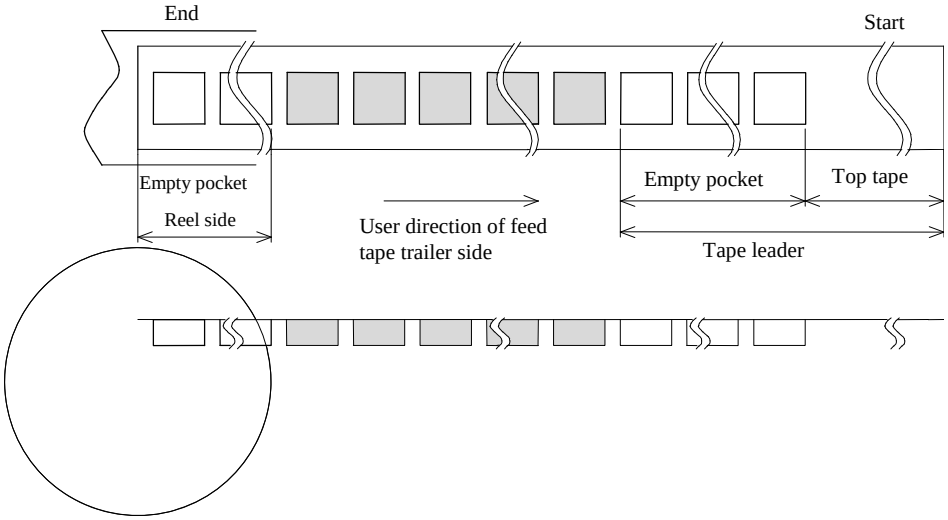
(3) Packing

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

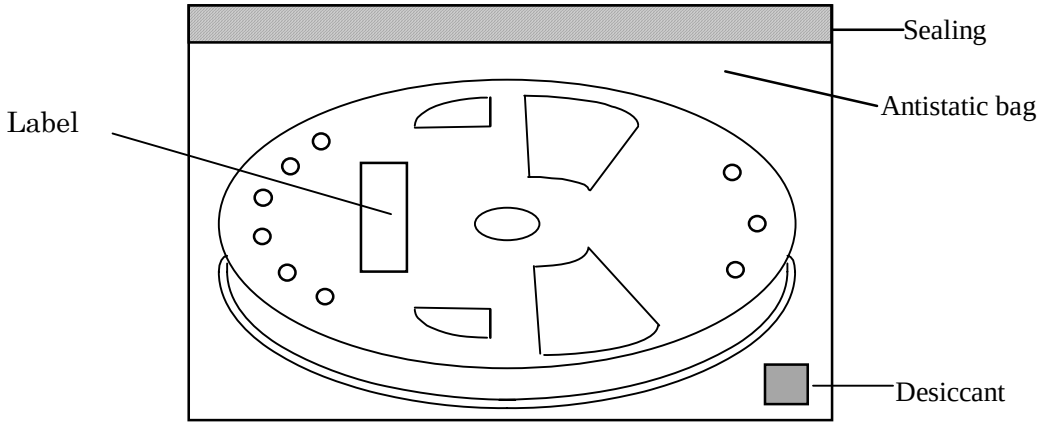
(4) Peel force of the cover tape

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

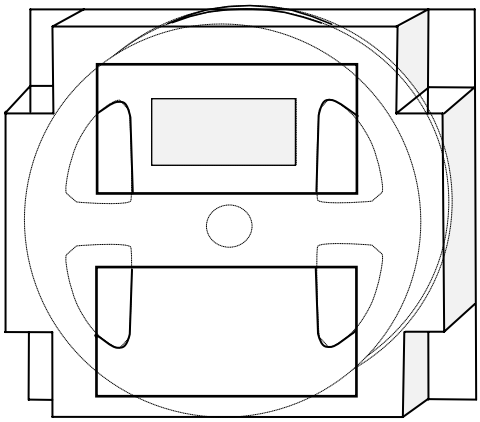
② peel speed : 300 mm / min.

〔2〕 Inner sleeve

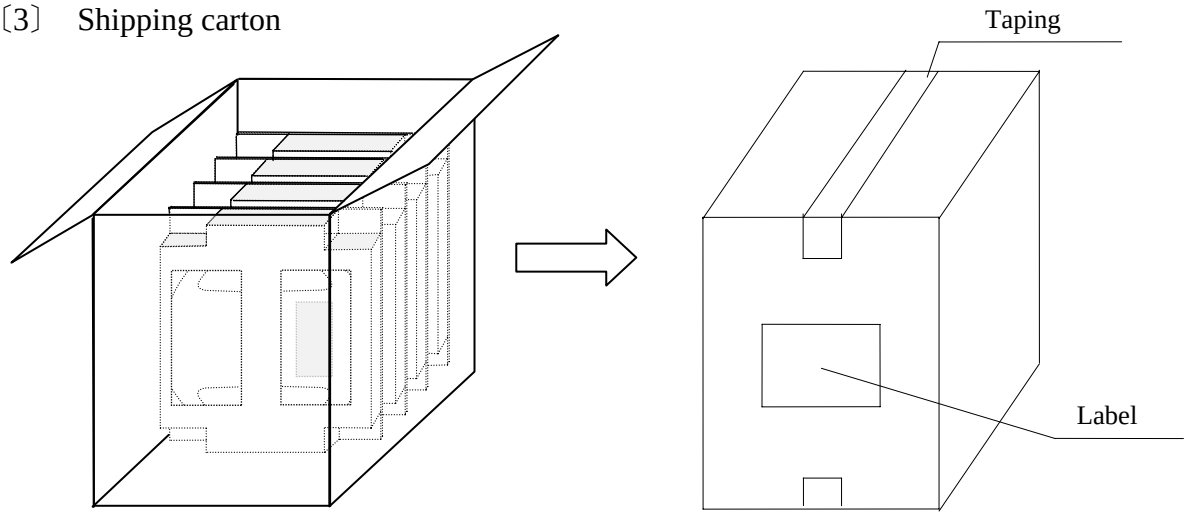
a) Packing to antistatic bag



b) Packing to inner sleeve



〔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) Shipping carton marking

・Shipping carton marking shall consist of :

1) Parts name
2) Quantity

〔5〕 Quantity

・1 000 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.

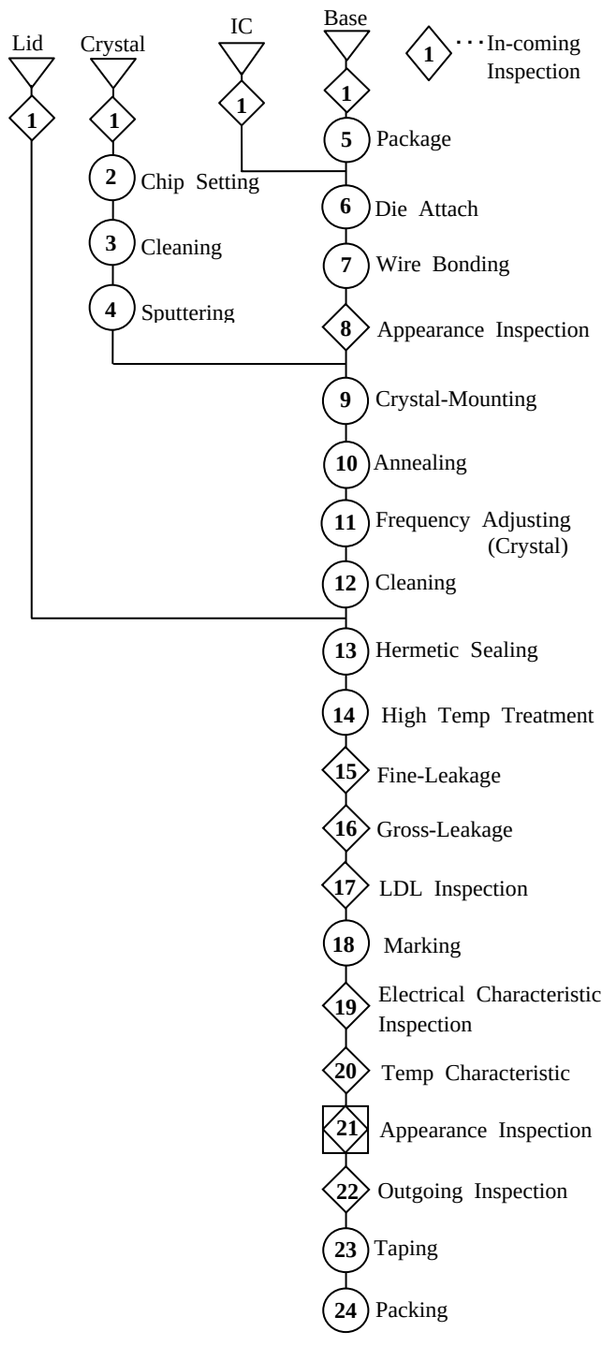
〔7〕 Handling

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

- PROCESS QUALITY CONTROL -

No. VG-4231CA - 00 - AME – 3　　CRYSTAL OSCILLATOR : VG−4231CA

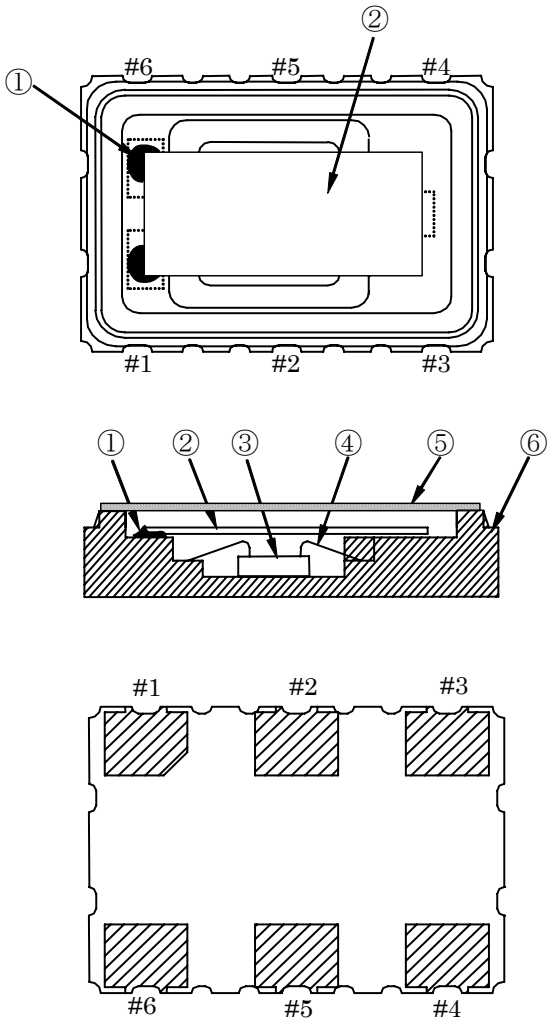
VG4231CA_Q_0001
2015.03.03



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	Production Section	Manufacturing Instruction Sheet	Appearance	Microscope	100% Inspection	Data sheet
3	Production Section	Manufacturing Instruction Sheet	Appearance	Microscope	Sampling	Data sheet
4	Production Section	Manufacturing Instruction Sheet	Appearance Frequency	Microscope	Sampling	Data sheet
5	Production Section	Manufacturing Instruction Sheet	Appearance	Microscope	Sampling	Data sheet
6	Production Section	Manufacturing Instruction Sheet	Appearance	Microscope	Sampling	Data sheet
7	Production Section	Manufacturing Instruction Sheet	Bonding strength Appearance	Pull tester／Gauge Microscope	Sampling 100% Inspection	Data sheet
8	Production Section	Manufacturing Instruction Sheet	Appearance	Microscope	100% Inspection	Data sheet
9	Production Section	Manufacturing Instruction Sheet	Mounting strength Appearance	Pull tester Microscope	Sampling 100% Inspection	Data sheet
10	Production Section	Manufacturing Instruction Sheet	Appearance	Microscope	Sampling	—
11	Production Section	Manufacturing Instruction Sheet	Frequency	Counter	Sampling	Data sheet
12	Production Section	Manufacturing Instruction Sheet	Appearance	Microscope	Sampling	Data sheet
13	Production Section	Manufacturing Instruction Sheet	Appearance Frequency	Microscope Counter	Sampling	Data sheet
14	Production Section	Manufacturing Instruction Sheet	—	—	—	—
15	Production Section	Manufacturing Instruction Sheet	Leakage inspection	Measuring equipment	100% Inspection	Data sheet
16	Production Section	Manufacturing Instruction Sheet	Leakage inspection	Measuring equipment	100% Inspection	Data sheet
17	Production Section	Manufacturing Instruction Sheet	Characteristic inspection	Measuring equipment	100% Inspection	Data sheet
18	Production Section	Manufacturing Instruction Sheet	Appearance	Visual Inspection	Sampling	Data sheet
19	Production Section	Delivery Specifications Outgoing Inspection Standard	Electrical characteristic Master Check	Measuring equipment	100% Inspection	Data sheet
20	Production Section	Manufacturing Instruction Sheet	Temp characteristic Inspection	Measuring equipment	100% Inspection	Data sheet
21	Production Section	Manufacturing Instruction Sheet	Appearance Master Check	Microscope	Sampling	Data sheet
22	Inspection Section	Delivery Specifications Outgoing Inspection Standard	Electrical characteristic Appearance	Measuring equipment Microscope	Sampling	Data sheet
23	Production Section	Manufacturing Instruction Sheet	Tape peeling strength Frequency check function	Peeling strength test machine	Sampling	Data sheet
24	Production Control Section	Manufacturing Instruction Sheet Daily Shipping List	Customers Type Quantity	—	—	Delivery Slip

Structure Diagram 構造図

Model 型式	**VG-4231CA**	
Document No. 管理№	IG-0601-01-1	VG4231CA_D_0001



⑥	Package ﾊﾟｯｹｰｼﾞ
⑤	Lid ﾘｯﾄﾞ
④	Bonding Wire ﾎﾞﾝﾃﾞｨﾝｸﾞﾜｲﾔｰ
③	IC IC
	IC Conductive Adhesive IC ﾏｳﾝﾄ材
②	Crystal Chip 水晶振動子
①	Crystal adhesive 水晶振動子ﾏｳﾝﾄ材
No.	Name of Part 部品名

RELIABILITY TEST DATA

Product Name : VG-4231CA series (From 1.0 MHz to 50.0 MHz)

The Company evaluation condition

We evaluate environmental and mechanical characteristics by the following test condition . **No. F-G0110E-02-005E**

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	+125 °C × 1 000 h	*3 ± 20	Satisfy specification after test	22	0
2	Low temperature storage	-40 °C × 1 000 h	*3 ± 10		22	0
3	High temperature bias	+85 °C × spec. bias × 1 000 h	*3 ± 7		22	0
4	Low temperature bias	-40 °C × spec. bias × 1 000 h	*3 ± 7		22	0
5	Temperature humidity bias	+85 °C × 85 %RH × spec. bias × 1 000 h	*3 ± 10		22	0
6	Temperature cycle	-40 °C ⇔ +125 °C 30 min at each temp. 100 cycles	*3 ± 10		22	0
7	Resistance to soldering heat	Reflow furnace with the condition 2 times	± 2		22	0
8	Drop	Free drop from 750 mm height on a hard wooden board for 3 times (Board is thickness more than 30 mm)	± 2		22	0
9	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)	± 3		22	0
10	Sealing	For He leak detector	1 × 10^{-9} Pa·m^3/s Max.		11	0
11	Solderability	Dip termination into solder bath at +235 °C ± 5 °C for 5 s (Using Rosin Flux)	Termination must be 95 % covered with fresh solder		11	0
12	Pull - off	10 N press for 10 s ± 1 s Ref. EIAJ ED-4702	No peeling - off at a solder part		11	0
13	Solvent resistance	Ref. JIS C 0052 or IEC 60068-2-45	The marking shall be legible		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 Pre conditionings Initial value shall be after 24 h at room temperature.

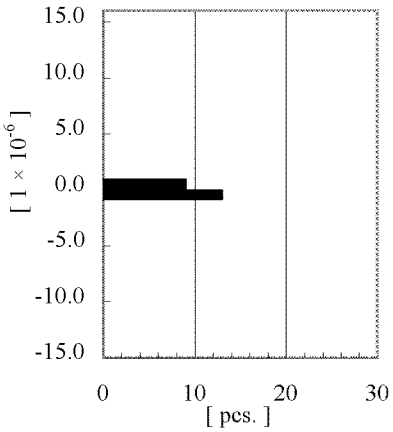
Qualification Data

Product Name : VG-4231CA series (From 1.0 MHz to 50.0 MHz)

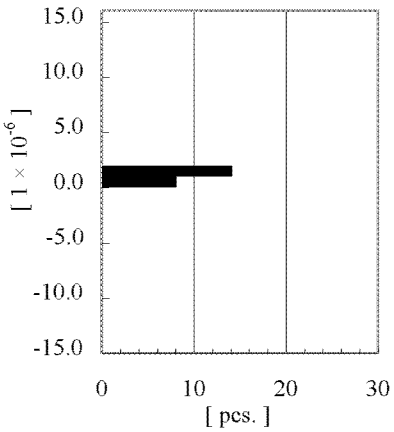
Δf / f

No. F-G0110E-02-005E

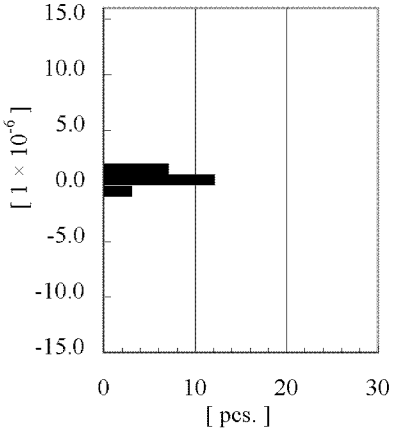
1. High temp. storage
+125 °C × 1 000 h



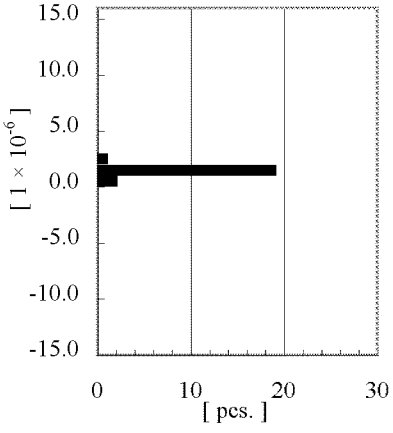
2. Low temp. storage
-40 °C × 1 000 h



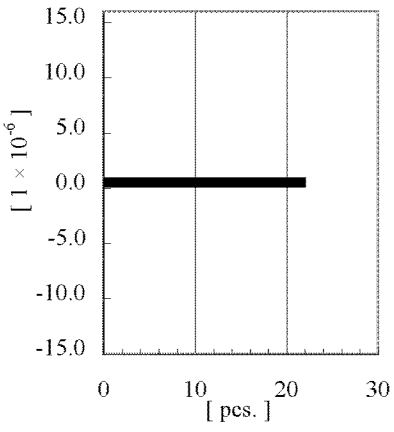
3. High temp. bias
+85 °C × spec. bias × 1 000 h



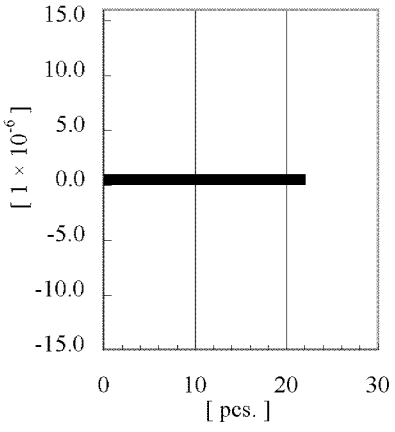
4. Low temp. bias
-40 °C × spec. bias × 1 000 h



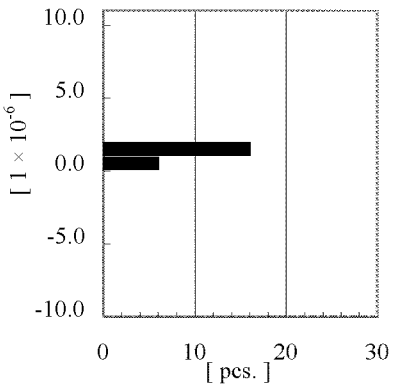
5. Temp. humidity bias
+85 °C × 85 %RH × spec. bias
× 1 000 h



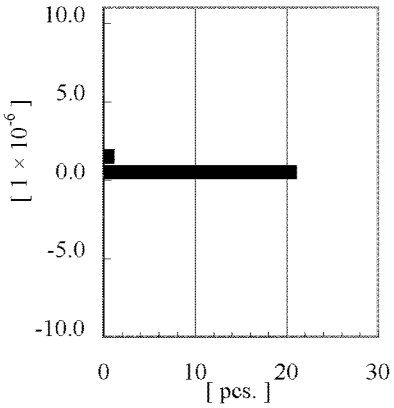
6. Temp. cycle
-40 °C ⇔ +125 °C
100 cycles



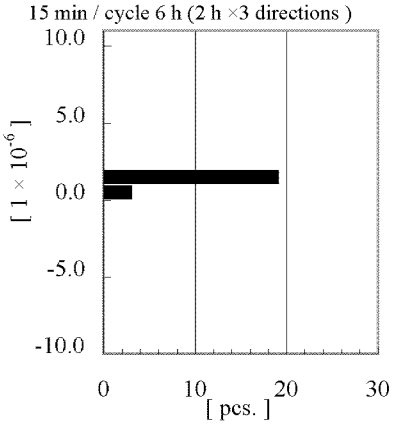
7. Resistance to soldering heat
Reflow furnace with the condition 2 times



8. Drop
750 mm × 3 times



9. 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)



・ Though these data show about 5V spec. , guarantee 3V,for both spec. have same crystal.

Qualification Data

Phase noise

Product : VG-4231CA GRCT

f_{out} = 40MHz
Vcc = 3.3V, Vc=1.65V
Ta = 25°C
Out put load = 15pF

<measurement tool>
Signal Source Analyer E5052A

Phase noise data

Product	Offset freq [Hz]					
	10	100	1k	10k	100k	1M
VG-4231CA	-76.6	-111.9	-131.4	-146.4	-155.9	-161.5

Unit : [dBc/Hz]

