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• **Domestic Distributors**

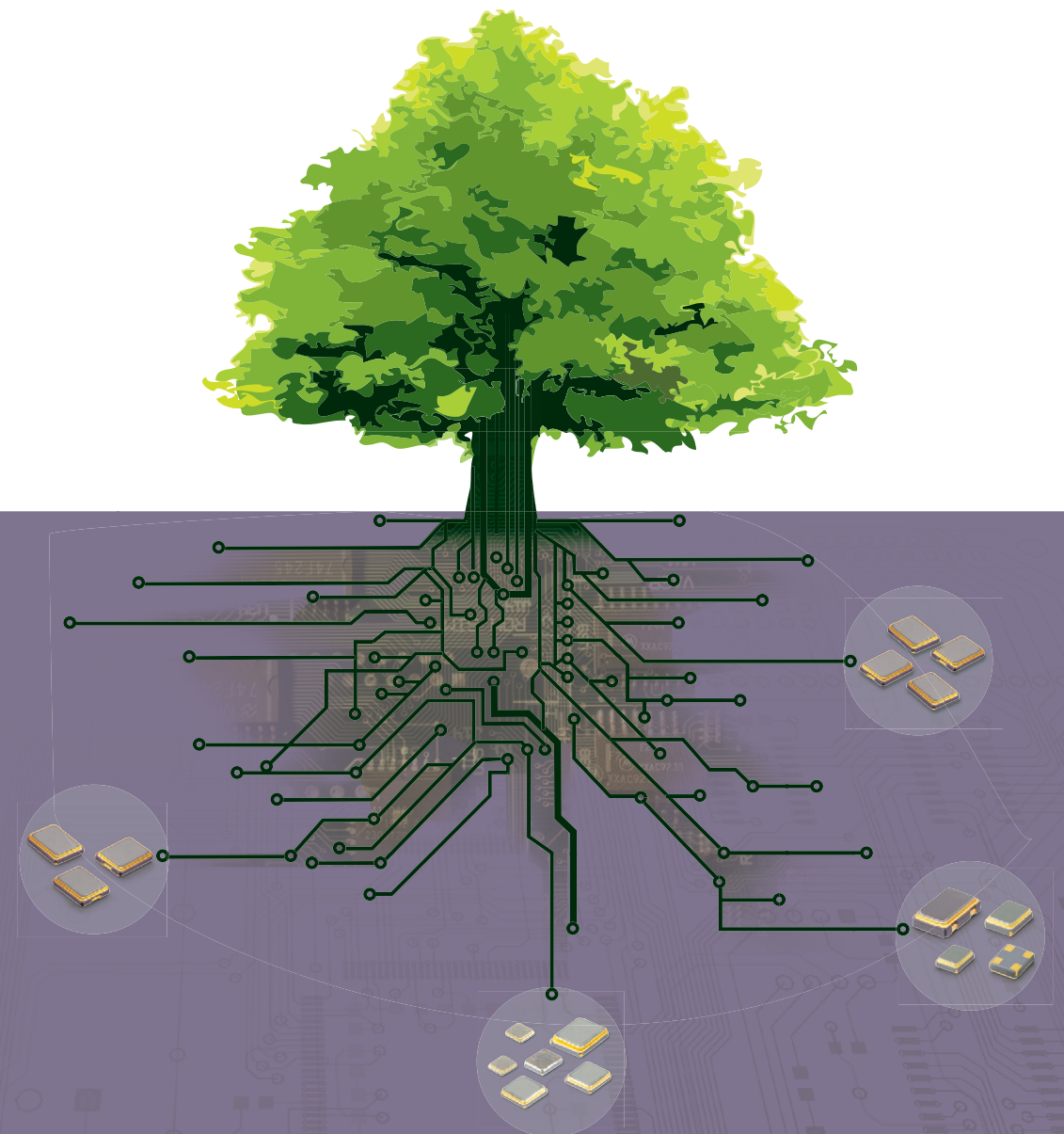
Korchip Corporation  
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# QUARTZ CRYSTAL UNIT AND OSCILLATOR





**We declare that all our Quartz crystal unit and oscillators are produced in accordance with EU ROHS and REACH Directive.**

**1. RoHS Compliance and restriction of Br**

The following restricted materials are not used in packaging materials as well as products in compliance with the law and restriction.

- Cd, Pb, Hg, Cr+6, As, Br and the compounds, PCB, asbestos
- Bromic materials : PBBs, PBBOs, PBDO, PBDE, PBB

**2. No use of materials breaking Ozone layer**

The following ODS materials are not used in our fabrication process.

- ODS material : Freon, Haron, 1-1-1 TCE, CCl4, HCFC

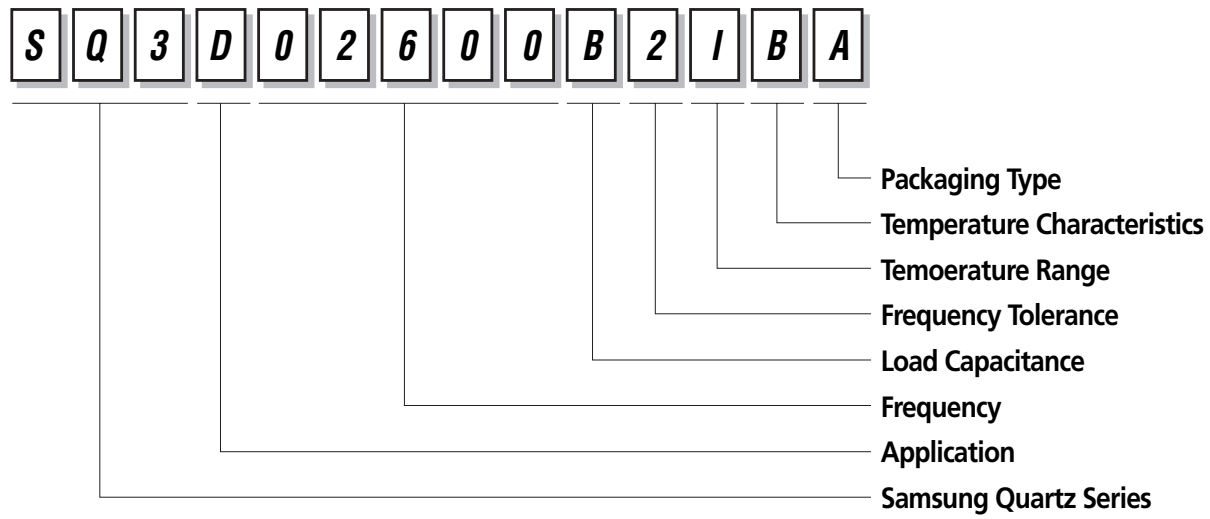
If you want more detailed Information, Please Visit Samsung Electro-mechanics Website  
[\[http://www.sem1cr.com\]](http://www.sem1cr.com)

Please, see the last page of this catalog for our environmental certification list.

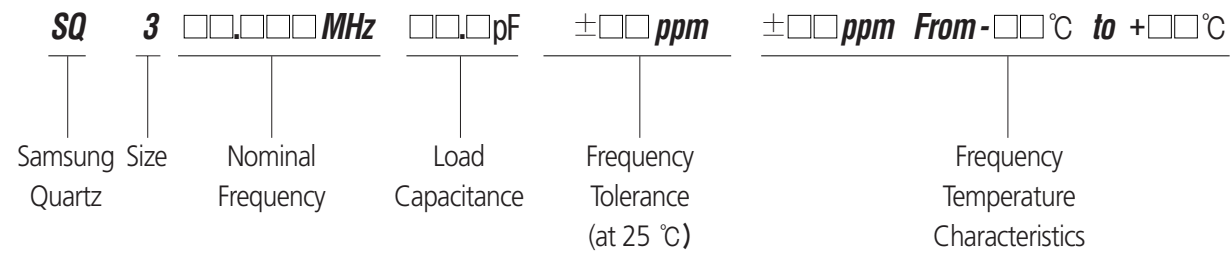
**CONTENTS**

	Crystal unit .....	<b>4</b> Crystal unit
	Crystal Oscillator .....	<b>14</b> Crystal Oscillator
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	Packaging Specification .....	<b>20</b> Packaging Specification
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Part Numbering System

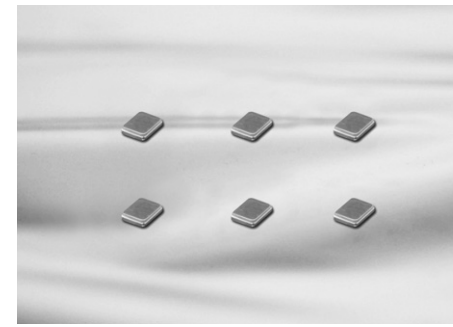


How to order



3 Size code	
Index	Size(mm)
C	1612
B	2016
2	2520
3	3225
5	5032 4Pad
A	5032 2Pad

※ For the more details, Please contact sales department.



Features

- High density surface mounting type with ultra small & thin size.
- Excellent heat resistance and environmental characteristics.
- Excellent electric performance.
- Suitable product for lead free soldering.

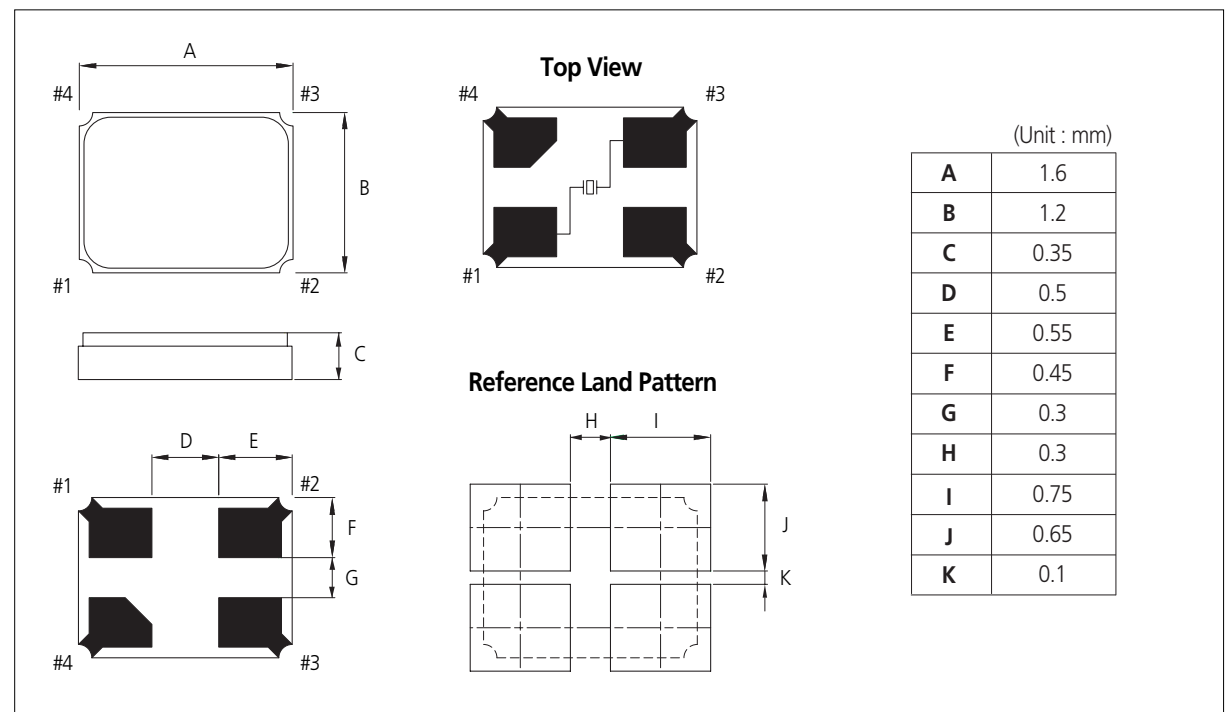
Applications

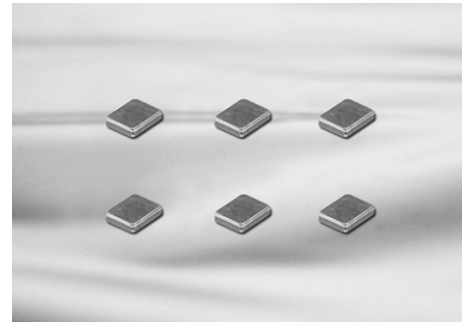
- Application Process, Bluetooth / W-LAN
- Mobile TV, MP3
- GPS (Global Positioning System)

Specifications

Item	Type	Specifications
Mode of Oscillation		Fundamental
Frequency Range	MHz	24.0 ~ 50.0
Frequency Tolerance (25±2 °C)	ppm	±10.0 ~ ±50.0
Temperature Characteristics (in reference to+25 °C)	ppm	±10.0 ~ ±50.0
Equivalent Series Resistance (ESR)	Ω	60 / 80 max
Drive Level	μW	Typ. 50 (Max. 200)
Standard Load Capacitance	pF	8.0, 10.0, 12.0 etc (specified by customer)
Operating Temperature Range	°C	-20 ~ +75 / -30 ~ +85
Storage Temperature Range	°C	-40 ~ +85

Dimensions





**Features**

- High density surface mounting type with ultra small & thin size.
- Excellent heat resistance and environmental characteristics.
- Excellent electric performance.
- Suitable product for lead free soldering.

**Applications**

- Application Process, Bluetooth / W-LAN
- Mobile TV, MP3, NFC
- GPS (Global Positioning System)

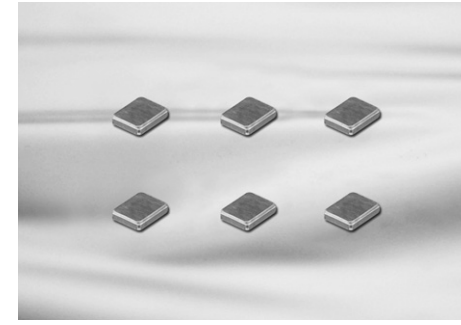
**Specifications**

Item	Type	Specifications
Mode of Oscillation		Fundamental
Frequency Range	MHz	19.2 ~ 52.0
Frequency Tolerance (25±2℃)	ppm	±10.0 ~ ±50.0
Temperature Characteristics (in reference to+25℃)	ppm	±10.0 ~ ±50.0
Operating Temperature Range	℃	-20 ~ +75 / -30 ~ +85
Equivalent Series Resistance (ESR)	Ω	60 / 80 max
Drive Level	μW	Typ. 50 (Max. 200)
Standard Load Capacitance	pF	8.0, 10.0, 12.0 etc (specified by customer)
Operating Temperature Range	℃	-20 ~ +75 / -30 ~ +85
Storage Temperature Range	℃	-40 ~ +85

**Dimensions**

(Unit : mm)

A	2.0
B	1.6
C	0.45
D	0.7
E	0.65
F	0.55
G	0.5
H	0.6
I	0.75
J	0.65
K	0.4



**Feature**

- Reference frequency for telecommunication systems.
- High density surface mounting type with small size.
- Excellent electric performance.
- Excellent heat resistance and environmental characteristics.

**Application**

- Mobile Communications
- GPS (Global Positioning System)

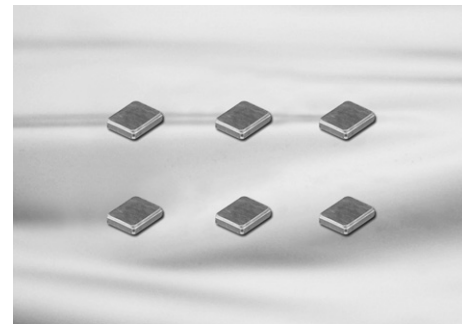
**Specifications**

Item	Type	Specifications
Mode of Oscillation		Fundamental
Frequency Range	MHz	19.2 ~ 52.0
Frequency Tolerance (30±3℃)	ppm	±10.0
Temperature Characteristics (in reference to+30℃)	ppm	±12.0 (-30 ~ +85℃)
Equivalent Series Resistance (ESR)	Ω	80 max
Drive Level	μW	Typ. 50 (Max. 200)
Standard Load Capacitance	pF	Series (7.0 etc)
Residual Frequency Stability Slope (GPS Quality)	ppb/℃	±50 Max. (Ta=-30 ... +85)
5℃ Small Orbit Hysteresis 1 (GPS Quality)	ppb/℃	±50 Max. (Ta=-30 ... +85)
5℃ Small Orbit Hysteresis 2 (GPS Quality)	ppb pk-pk	100 (Magnitude) (Ta=-30 ... +85)
Operating Temperature Range	℃	-30 ~ +105
Storage Temperature Range	℃	-40 ~ +105

**Dimensions**

(Unit : mm)

A	2.0
B	1.6
C	0.6
D	0.7
E	0.65
F	0.65
G	0.3
H	0.7
I	0.75
J	0.75
K	0.3



**Features**

- High density surface mounting type with ultra small & thin size.
- Good heat resistance and environmental characteristics.
- Good electric performance.
- Suitable product for lead free soldering.

**Applications**

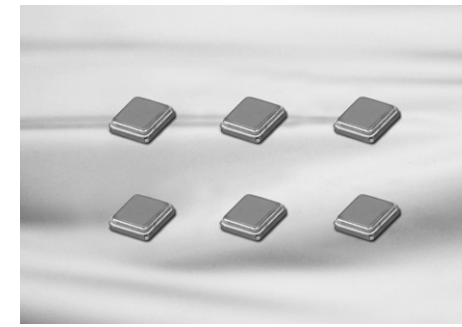
- PC / Visual Equipment / Small Portable Equipment.
- HDD / SSD (Available for S-ATA interface)
- USB Flash Drive / Mobile Phone etc. (USB2.0 / 3.0)

**Specifications**

Item	Type	Specifications
Mode of Oscillation		Fundamental
Frequency Range	MHz	20.0 ~ 48.0
Frequency Tolerance (25±2℃)	ppm	±30.0 ~ ±50.0
Temperature Characteristics (in reference to+25℃)	ppm	±20.0 ~ ±50.0
Equivalent Series Resistance (ESR)	Ω	60 / 80 max
Drive Level	μW	Typ. 50 (Max. 300)
Standard Load Capacitance	pF	8.0, 10.0, 12.0 etc (specified by customer)
Operating Temperature Range	℃	-20 ~ +75 / -30 ~ +85
Storage Temperature Range	℃	-40 ~ +85

**Dimensions**

(Unit : mm)	
A	2.0
B	1.6
C	0.65
D	0.8
E	0.6
F	0.6
G	0.4
H	0.6
I	0.75
J	0.7
K	0.3



**Features**

- High density surface mounting type with small & thin size.
- Excellent heat resistance and environmental characteristics.
- Excellent electric performance.
- Suitable product for lead free soldering.

**Applications**

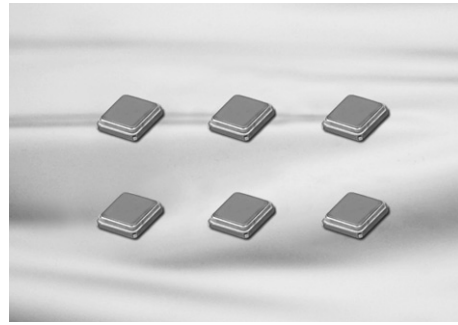
- Mobile Communication
- Application Process, Bluetooth / W-LAN
- Mobile TV, MP3, NFC
- GPS (Global Positioning System)

**Specifications**

Item	Type	Specifications
Mode of Oscillation		Fundamental
Frequency Range	MHz	16.0 ~ 60.0
Frequency Tolerance (25±2℃)	ppm	±10.0 ~ ±50.0
Temperature Characteristics (in reference to+25℃)	ppm	±10.0 ~ ±50.0
Equivalent Series Resistance (ESR)	Ω	60 / 80 max
Drive Level	μW	Typ. 50 (Max. 200)
Standard Load Capacitance	pF	8.0, 10.0, 12.0 etc (specified by customer)
Operating Temperature Range	℃	-20 ~ +75 / -30 ~ +85
Storage Temperature Range	℃	-40 ~ +85

**Dimensions**

(Unit : mm)	
A	2.5
B	2.0
C	0.5
D	0.9
E	0.8
F	0.65
G	0.7
H	0.8
I	1.0
J	0.8
K	0.6



**Features**

- Reference frequency for telecommunication systems.
- High density surface mounting type with small size. (With thermistor)
- Excellent electric performance.
- Excellent heat resistance and environmental characteristics.

**Applications**

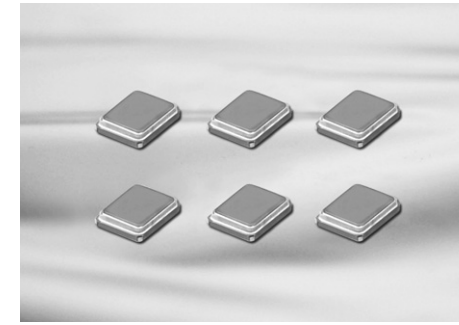
- Mobile Communication
- GPS (Global Positioning System)

**Specifications**

Item	Type	Specifications
Mode of Oscillation		Fundamental
Frequency Range	MHz	19.2 ~ 52.0
Frequency Tolerance (30±3℃)	ppm	±10.0
Temperature Characteristics (in reference to +30℃)	ppm	±12.0
Equivalent Series Resistance (ESR)	Ω	80 max
Drive Level	μW	Typ. 50 (Max. 200)
Standard Load Capacitance	pF	Series (7.0 etc)
Residual Frequency Stability Slope (GPS Quality)	ppb/℃	±50 Max. (Ta=-30 ... +85)
5℃ Small Orbit Hysteresis 1 (GPS Quality)	ppb/℃	±50 Max. (Ta=-30 ... +85)
5℃ Small Orbit Hysteresis 2 (GPS Quality)	ppb pk-pk	100 (Magnitude) (Ta=-30 ... +85)
Operating Temperature Range	℃	-30 ~ +105
Storage Temperature Range	℃	-40 ~ +105

**Dimensions**

(Unit : mm)	
A	2.5
B	2.0
C	0.9
D	1.0
E	0.75
F	0.65
G	0.7
H	1.0
I	0.95
J	0.85
K	0.7



**Feature**

- High density surface mounting type with small & thin size.
- Excellent heat resistance and environmental characteristics.
- Excellent electric performance.
- Suitable product for lead free soldering.

**Application**

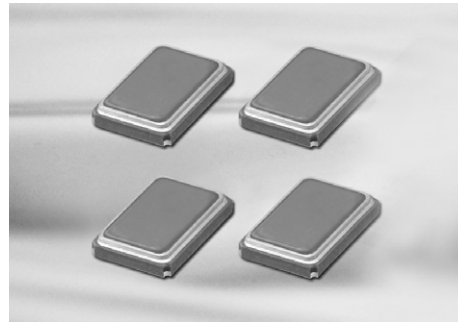
- Mobile Communication
- MP3
- Bluetooth / W-LAN
- GPS etc.

**Specifications**

Item	Type	Specifications
Mode of Oscillation		Fundamental
Frequency Range	MHz	12.0 ~ 50.0
Frequency Tolerance (25±2℃)	ppm	±10.0 ~ ±50.0
Temperature Characteristics (in reference to +25℃)	ppm	±10.0 ~ ±50.0
Equivalent Series Resistance (ESR)	Ω	30 / 80 max
Drive Level	μW	Typ. 50 (Max. 200)
Standard Load Capacitance	pF	8.0, 10.0, 12.0 etc (specified by customer)
Operating Temperature Range	℃	-20 ~ +75 / -30 ~ +85
Storage Temperature Range	℃	-40 ~ +85

**Dimensions**

(Unit : mm)	
A	3.2
B	2.5
C	0.7
D	1.2
E	1.0
F	0.9
G	0.7
H	0.8
I	1.4
J	1.2
K	0.4



### Feature

- High density surface mounting type.
- Excellent heat resistance and environmental characteristics.
- Excellent electric performance.
- Suitable product for lead free soldering.

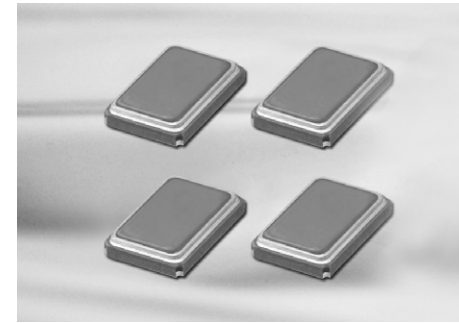
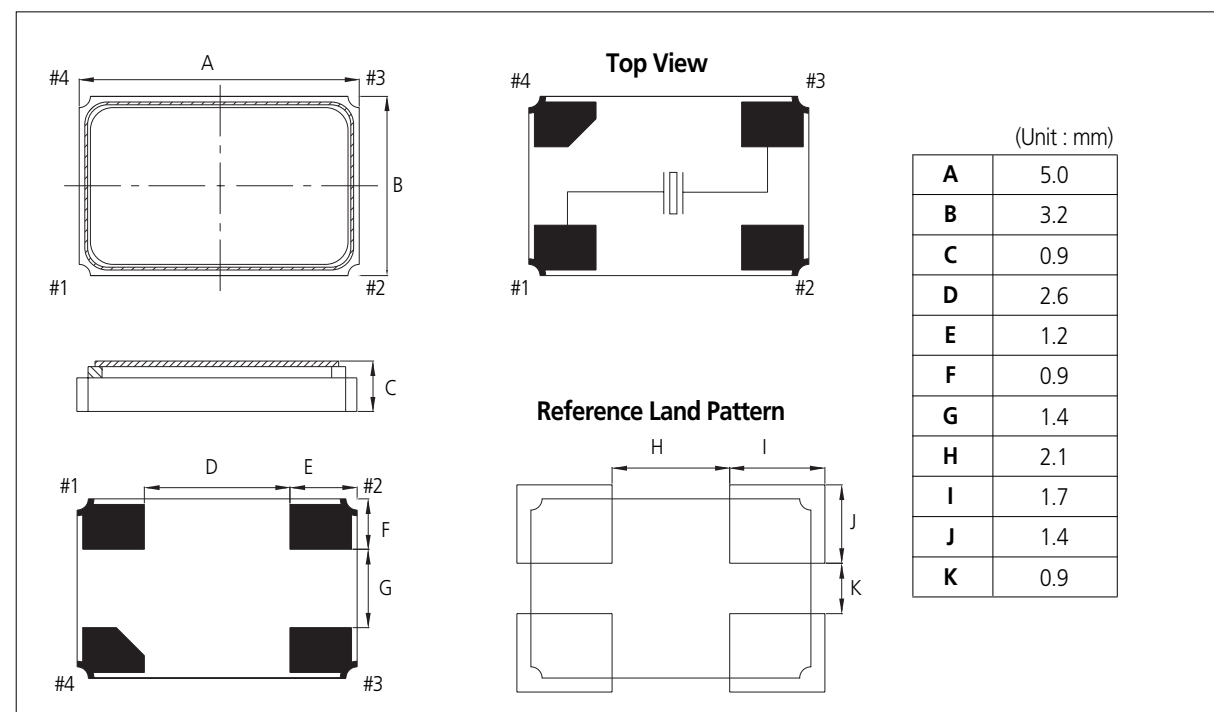
### Application

- Mobile Communication
- MP3
- Bluetooth / W-LAN
- GPS etc.

### Specifications

Item	Type	Specifications
Mode of Oscillation		Fundamental / 3rd overtone
Frequency Range	MHz	10.0 ~ 50.0
Frequency Tolerance (25±2℃)	ppm	±10.0 ~ ±50.0
Temperature Characteristics (in reference to+25℃)	ppm	±10.0 ~ ±50.0
Equivalent Series Resistance (ESR)	Ω	30 / 60 / 80 max
Drive Level	μW	Typ. 50 (Max. 200)
Standard Load Capacitance	pF	8.0, 10.0, 12.0 etc (specified by customer)
Operating Temperature Range	℃	-20 ~ +75 / -30 ~ +85
Storage Temperature Range	℃	-40 ~ +85

### Dimensions



### Feature

- High density surface mounting type.
- Excellent heat resistance and environmental characteristics.
- Excellent electric performance.
- Suitable product for lead free soldering.

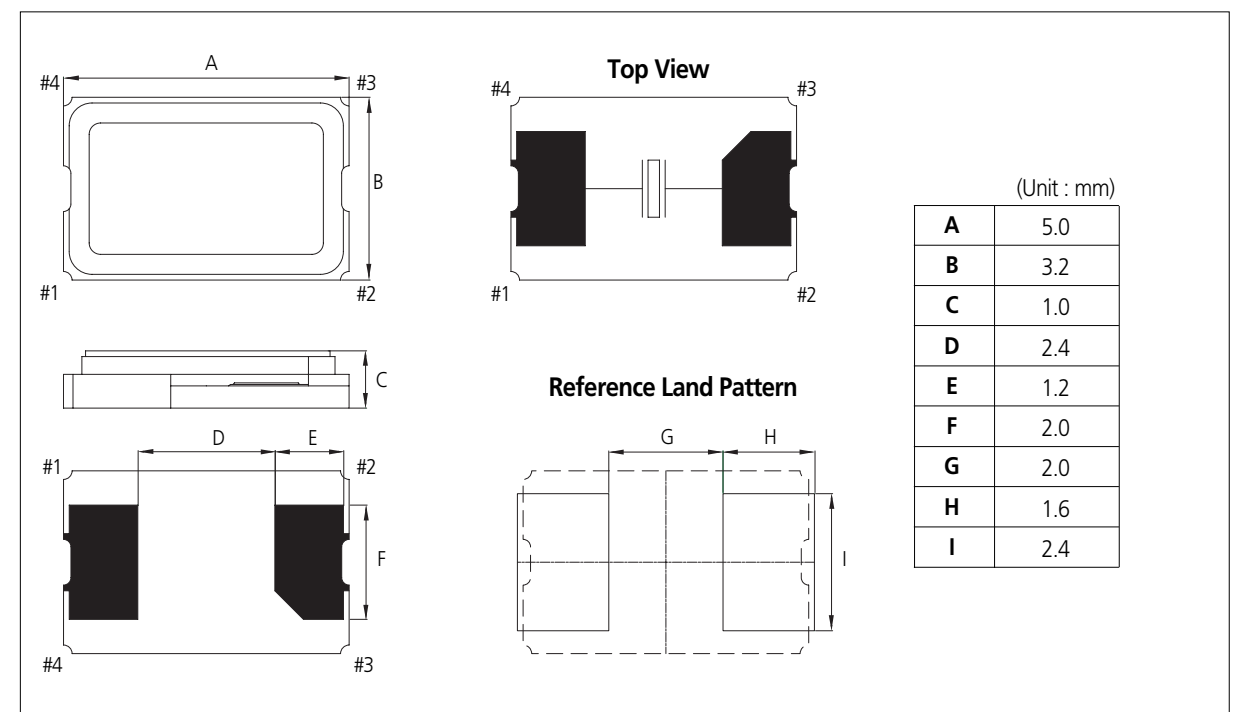
### Application

- Note PC
- HDD / SSD
- MP3
- OA, AV, etc.

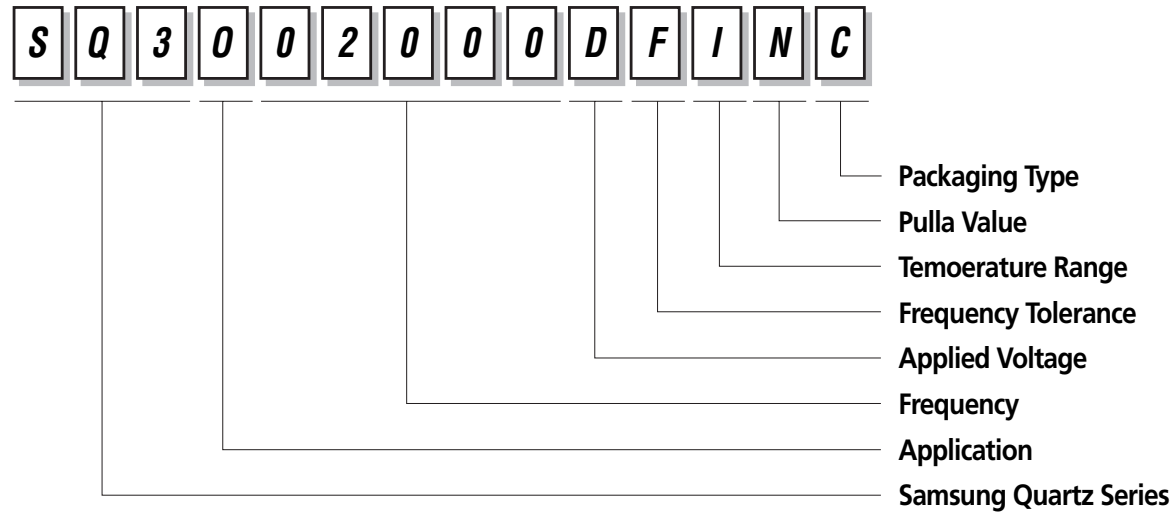
### Specifications

Item	Type	Specifications
Mode of Oscillation		Fundamental
Frequency Range	MHz	10.0 ~ 50.0
Frequency Tolerance (25±2℃)	ppm	±10.0 ~ ±50.0
Temperature Characteristics (in reference to+25℃)	ppm	±10.0 ~ ±50.0
Equivalent Series Resistance (ESR)	Ω	30 / 60 / 80 max
Drive Level	μW	Typ. 50 (Max. 200)
Standard Load Capacitance	pF	8.0, 10.0, 12.0 etc (specified by customer)
Operating Temperature Range	℃	-20 ~ +75 / -30 ~ +85
Storage Temperature Range	℃	-40 ~ +85

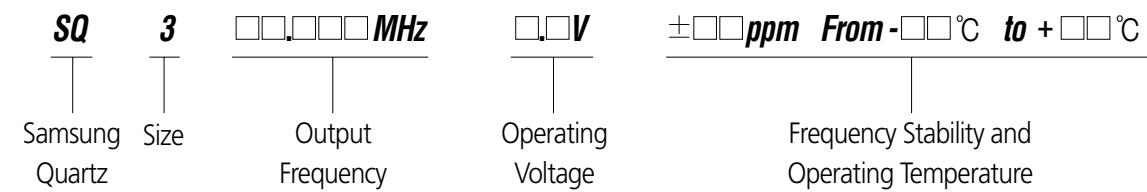
### Dimensions



Part Numbering System



How to order

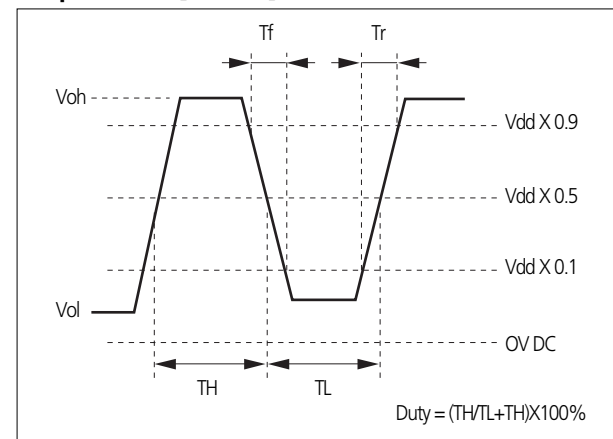


3 Size code	
Index	Size(mm)
C	1612
B	2016
2	2520
3	3225
5	5032 4Pad
A	5032 2Pad

※ For the more details, Please contact sales department

Wave Form and Pin Description

Output Wave [C-MOS]

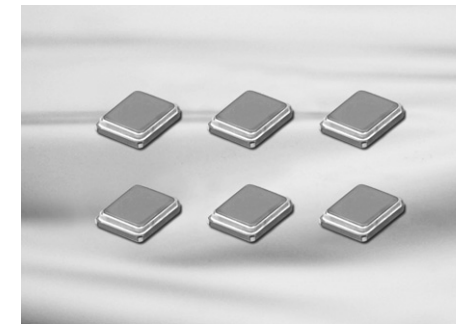


Stand-by Function [Tri-state]

# 1 pin input	# 3 pin input
H level or open	oscillation
L level	High Impedance

Oscillator Pin Description

Pad No.	Connection	Pad No.	Connection
#1	Stand- By	#3	Output
#2	GND	#4	VDD



Feature

- Height compatible with slim IC package.
- Small size and volume. Also Ultra light weight.
- The best choice for portable PC, PDA and PC card.
- Directly drives C-MOS IC.
- Embossed carrier tape and IR reflow are possible.

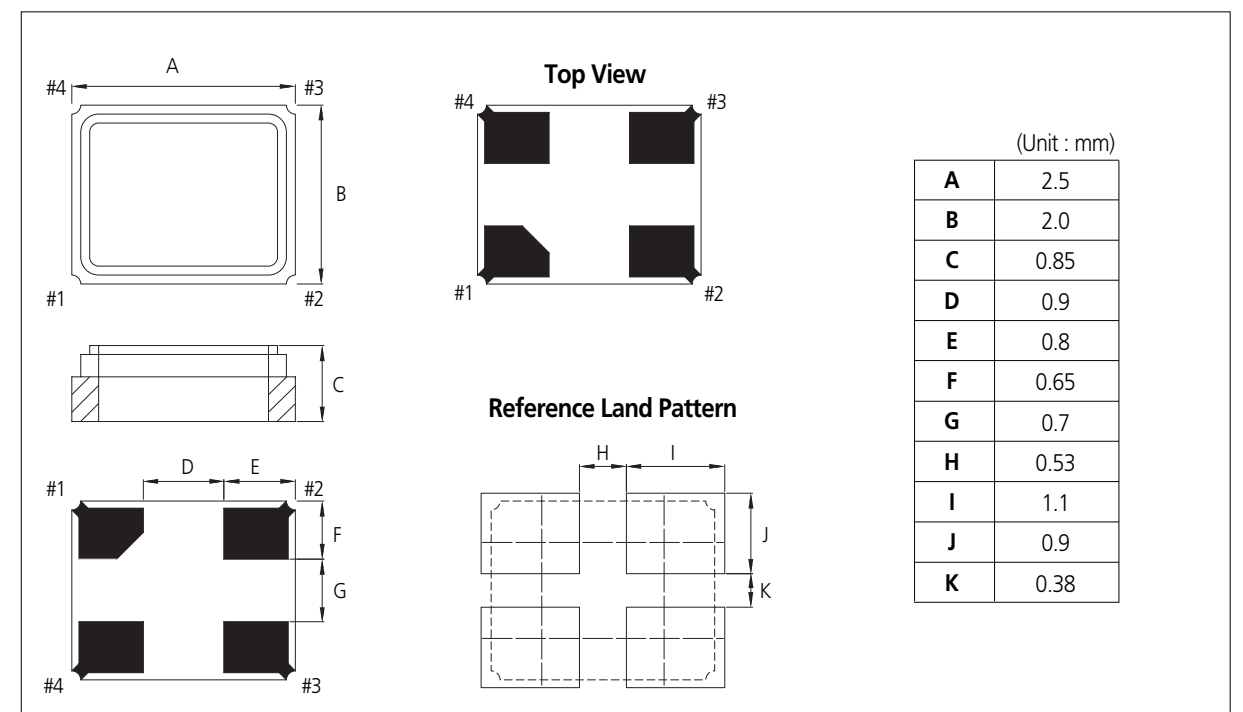
Application

- PC / PDA / MP3 / WiFi / Modem etc

Specifications

Item	Type	Specifications
Output Level		C-MOS
Frequency Range	MHz	4.0 ~ 125.0
Frequency Stability	ppm	±20.0 ~ ±100.0
Supply Voltage	V	1.6 ~ 5.5
Current Consumption	mA	7 max.
Output Rise/Fall Time	nS	10 max.
Duty Cycle	%	40 ~ 60 / 45 ~ 55 (at 1/2 VDD)
CL	CL (pF)	15 (standard)
Stand-by Function	Tri-sate	Yes
Operating Temperature Range	°C	- 20 ~ +75 / -30 ~ +85
Storage Temperature Range	°C	- 40 ~ +85

Dimensions



Crystal unit

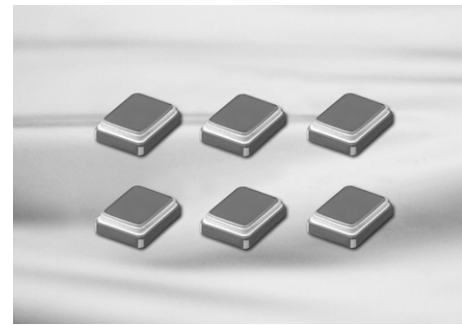
Crystal Oscillator

Reliability Test Condition

Packaging Specification

Application Guide





**Feature**

- Height compatible with slim IC package.
- Small size and volume. Also Ultra light weight.
- The best choice for portable PC, PDA and PC card.
- Directly drives C-MOS IC.
- Embossed carrier tape and IR reflow are possible.

**Application**

- PC / PDA / MP3 / WiFi / Modem etc

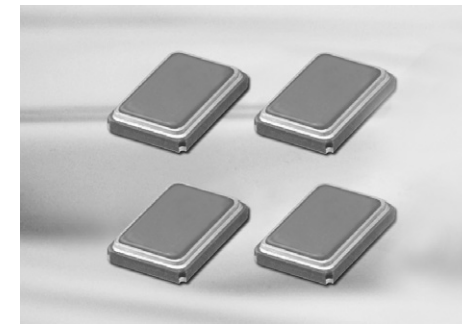
**Specifications**

Item	Type	Specifications
Output Level		C-MOS
Frequency Range	MHz	4.0 ~ 125.0
Frequency Stability	ppm	±20.0 ~ ±100.0
Supply Voltage	V	1.6 ~ 5.5
Current Consumption	mA	7 max.
Output Rise/Fall Time	nS	10 max.
Duty Cycle	%	40 ~ 60 / 45 ~ 55 (at 1/2 VDD)
CL	CL (pF)	15 (standard)
Stand-by Function	Tri-state	Yes
Operating Temperature Range	°C	-20 ~ +75 / -30 ~ +85
Storage Temperature Range	°C	-40 ~ +85

**Dimensions**

(Unit : mm)

A	3.2
B	2.5
C	0.95
D	1.2
E	1.0
F	0.75
G	1.0
H	0.8
I	1.4
J	1.2
K	0.55



**Feature**

- Height compatible with slim IC package.
- The best choice for portable PC, PDA and PC card.
- Directly drives C-MOS IC.
- Embossed carrier tape and IR reflow are possible.

**Application**

- PC / PDA / MP3 / WiFi / Modem etc

**Specifications**

Item	Type	Specifications
Output Level		C-MOS
Frequency Range	MHz	4.0 ~ 125.0
Frequency Stability	ppm	±20.0 ~ ±100.0
Supply Voltage	V	2.7 ~ 5.5
Current Consumption	mA	25 max.
Output Rise/Fall Time	nS	10 max.
Duty Cycle	%	40 ~ 60 / 45 ~ 55 (at 1/2 VDD)
CL	CL (pF)	15 (standard)
Stand-by Function	Tri-state	Yes
Operating Temperature Range	°C	-20 ~ +75 / -30 ~ +85
Storage Temperature Range	°C	-40 ~ +85

**Dimensions**

(Unit : mm)

A	5.0
B	3.2
C	1.2
D	1.34
E	1.2
F	0.63
G	1.0
H	1.2
I	0.84
J	1.7
K	1.4
L	0.7

Crystal unit

Crystal Oscillator

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Crystal Unit

NO.	Item	Test Condition
1	SHOCK RESISTANCE (RANDOM DROP)	2 cycle drop it onto a concrete for six directions(x, y, z) and one corner. The height is 152cm. Dummy is 120g weight.
2	VIBRATION RESISTANCE	Frequency : 10 ~ 55Hz Amplitude : 1.5 m Period : 1 min Test time : x,y,z each direction 2h According to IEC 1178-1.4.8.7
3	SOLDER ABILITY	Temperature of bath : 235±5℃ solder bath Dipping time : 5 ±1.0 sec According to IEC 1178-1.4.8.3
4	HIGH TEMPERATURE STORAGE	Temperature : 85 ±3℃ in atmosphere. Time : For 240 hours According to IEC 1178-1.4.8.11
5	LOW TEMPERATURE STORAGE	Temperature : -40 ±3℃ in atmosphere. Time : For 240 hours According to IEC 1178-1.4.8.13
6	HUMIDITY	Temperature : 40±2℃ Humidity : 90 ~ 95% Time : For 240 hours According to IEC 1178-1.4.8.15
7	THERMAL SHOCK	100 cycles of temperature -40℃ and 85℃, Keeping time is 30 min. at each temperature. According to IEC 1178-1.4.8.4
8	REFLOW	Peak Temperature : +260℃ According to JEDEC J-STD-020C
9	LEAKAGE	AIR LEAK TEST Helium leak detector According to IEC 1178-1.4.8.2

Crystal Oscillator

NO.	Item	Test Condition
1	SHOCK RESISTANCE (RANDOM DROP)	2 cycle drop it onto a concrete for six directions(x, y, z) and one corner. The height is 152cm. Dummy is 120g weight.
2	VIBRATION RESISTANCE	Frequency : 10 ~ 55Hz Amplitude : 1.5 m Period : 1 min Test time : x,y,z each direction 2h According to IEC 1178-1.4.8.7
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4	HIGH TEMPERATURE STORAGE	Temperature : 85 ±3℃ in atmosphere. Time : For 240 hours According to IEC 1178-1.4.8.11
5	HIGH TEMPERATURE OPERATING	Temperature : 85 ±3℃ in atmosphere. Time : For 240 hours Rated Voltage : Applied
6	LOW TEMPERATURE STORAGE	Temperature : -40±3℃ in atmosphere. Time : For 240 hours
7	LOW TEMPERATURE OPERATING	Temperature : -40±3℃ in atmosphere. Time : For 240 hours Rated Voltage : Applied
8	HUMIDITY	Temperature : 40±2℃ Humidity : 90 ~ 95% Time : For 240 hours According to IEC 1178-1.4.8.15
9	THERMAL SHOCK	100 cycles of temperature -40℃ and 85℃, Keeping time is 30 min. at each temperature. According to IEC 1178-1.4.8.4
10	REFLOW	Peak Temperature : +260℃ According to JEDEC J-STD-020C
11	LEAKAGE	AIR LEAK TEST Helium leak detector According to IEC 1178-1.4.8.2

Crystal unit

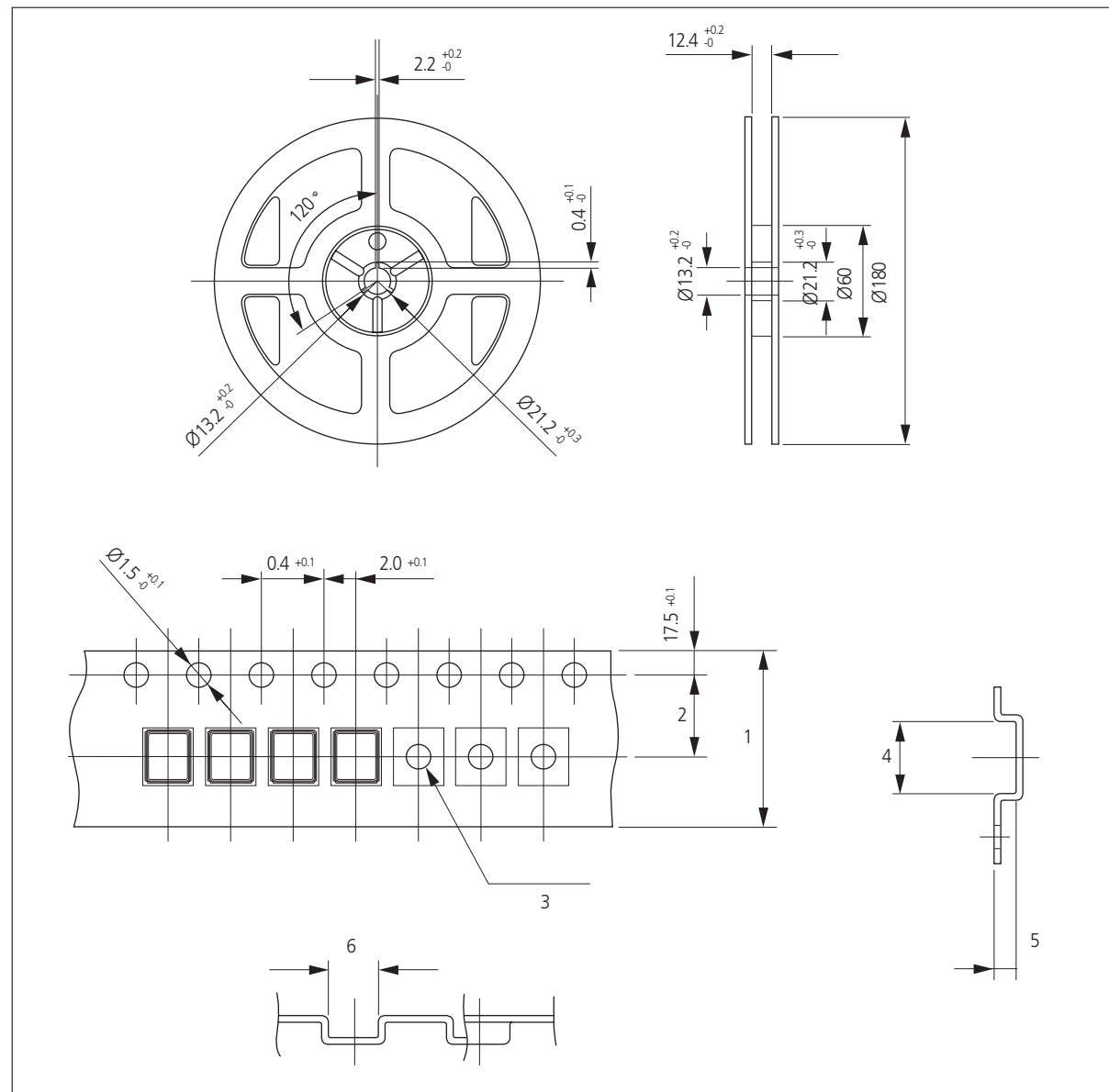
Crystal Oscillator

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Reel Dimensions



Class	Size	1	2	3	4	5	6	Packing Quantity		
								Reel	Inner Box	Outer Box
Crystal	5032	12	5.5	$\varnothing 1.5$	5.35	1.2	3.5	1,500 pcs	7,500 pcs	30,000 pcs
	3225	12	5.5	$\varnothing 1.5$	3.5	1.0	2.8	3,000 pcs	15,000 pcs	60,000 pcs
	2520	8	3.5	$\varnothing 1.0$	2.8	0.75	2.3	3,000 pcs	15,000 pcs	60,000 pcs
	2016	8	3.5	$\varnothing 1.0$	2.3	0.75	1.95	3,000 pcs	15,000 pcs	60,000 pcs
	1612	8	3.5	$\varnothing 0.8$	1.9	0.6	1.5	3,000 pcs	15,000 pcs	60,000 pcs
OSC	5032	12	5.5	$\varnothing 1.5$	5.35	1.2	3.5	1,500 pcs	7,500 pcs	30,000 pcs
	3225	12	5.5	$\varnothing 1.5$	3.6	1.5	2.9	3,000 pcs	15,000 pcs	60,000 pcs
	2520	8	3.5	$\varnothing 1.0$	2.77	1.05	2.19	3,000 pcs	15,000 pcs	60,000 pcs

Application Guide

1. Equivalent Circuit

Vibration of a crystal unit is actually mechanical vibration. However, the crystal unit can be expressed by a two-terminal network if its behavior is electrically converted. The series circuit consisting of L1, C1, and R1 is related to elastic vibration, while the element C0 connected in parallel to the series arm as a capacitance attributable to the dielectric body of a quartz crystal plate. The resistance R1 is a resonance resistance of the crystal unit at the series resonance frequency. (See Fig. 1.)

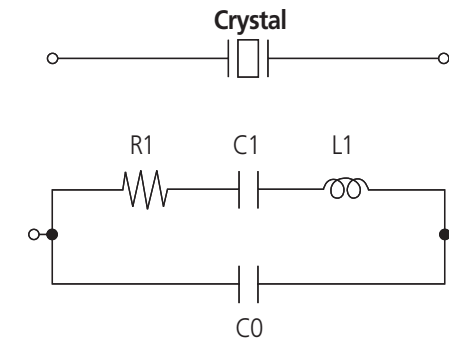


Fig.1 Equivalent Circuit of Crystal Unit

2. Frequency-Temperature Characteristics of an AT-cut

The frequency-temperature characteristics of an AT-cut crystal unit most generally used at present are expressed by cubic curves. (See Fig.2.) A crystal plate is cut at an angle at which a required frequency tolerance is obtained in the given operating temperature range. Actually, however there can be some dispersion in apparent cutting angle due to the result of cutting and polishing accuracy in the successive processes. Therefore, it is necessary to raise processing accuracy.

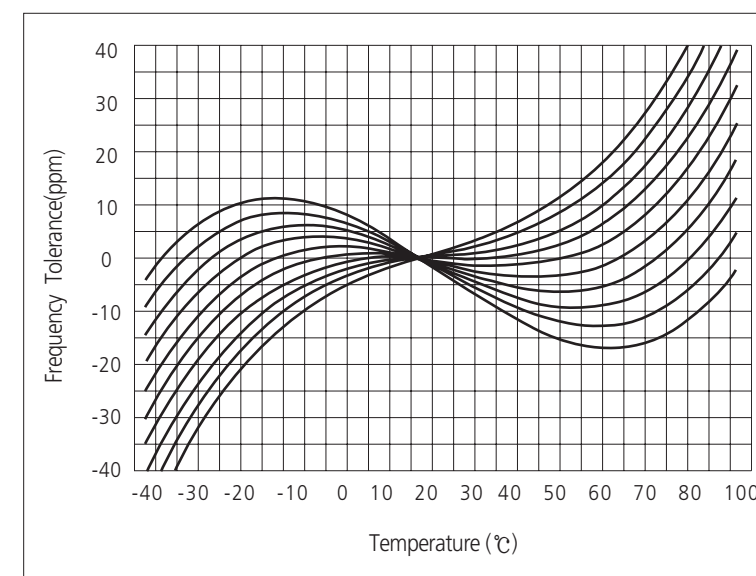


Fig.2 Frequency vs. Temperature Characteristics of AT-cut Crystal Unit

Crystal unit

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### 3. Level of Drive

Since a crystal unit performs mechanical vibration, too much vibration may lead to unstable oscillation frequency, and finally to destruction in the worst case. When designing an oscillation circuit, the level of drive should be examined so as to use an oscillator below the level specified by our company. Fig.3 shows an example method of confirming a level of drive. The method employs a current probe to measure the crystal oscillator current. In this case the level of drive is as follows :

$$\text{Level of drive(P)} = I_q^2 R_e$$

$$R_e = R_1(1+C_0/CL)^2$$

here, R1 is series resonance resistance, C0 is shunt capacitance, CL is load capacitance.  
If level of drive exceed the specified level, oscillation frequency will shift or crystal unit will malfunction.

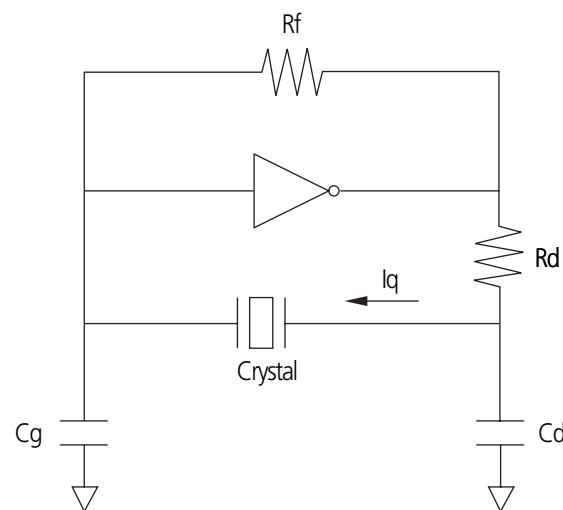


Fig.3 Example Method of Confirming a Drive Level

### 4. Load Capacitance

The load capacitance CL is a factor for determining the "conditions" of a crystal unit when used in the oscillation circuit. In an ordinary oscillation circuit, the crystal unit is used in a range where it functions as an inductive reactance. In such usage, the oscillation circuit operates as a capacitive reactance. In other words, when the oscillation circuit is seen from both terminals of the crystal unit, the oscillation circuit can be expressed as a series circuit of a negative resistance -R and a capacitance CL. At that time this capacitance is called the load capacitance. The relationship between load capacitance and oscillation frequency is not linear. When the load capacitance is small, the amount of frequency vibration is large, and when the load capacitance is lessened in the oscillation circuit to secure a large allowance for the oscillation frequency, the frequency stability will be greatly influenced even by a small change in the circuit. The load capacitance can be chosen from standard values specified in the catalog.

### 5. Equivalent Circuit of Crystal Oscillation Circuit

When a crystal unit is actuated as an inductive reactance in an oscillation circuit, the relationship between crystal unit and oscillation circuit is shown in Fig. 4. To improve the starting conditions of the oscillation circuit, it is preferable to increase the circuit. The starting conditions will become worse if a circuit without much allowance in negative resistance (less negative resistance) is combined with a crystal unit having a larger resonance resistance. The oscillation circuit should be designed to a goal such that the value of negative resistance is 5 to 10 times the resonance resistance. It is also necessary that the center value of load capacitance (to determine the absolute value of oscillation frequency) and the variable range (fine adjustment range of oscillation frequency) are maintained at the optimum values in the oscillation circuit.

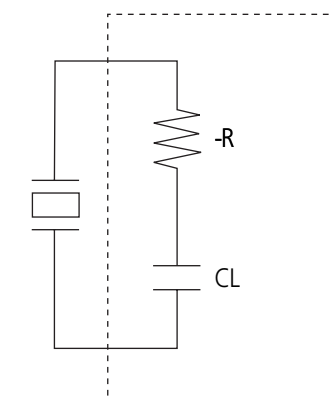


Fig.4 Equivalent Circuit of Crystal Oscillation Circuit

### 6. Oscillation Circuit

A typical oscillation circuit composed of a crystal unit is introduced below. Element constants used are for example.

- (1) Crystal units are designed to have lower limitable level of drive, of 100uW and below. Prior to use, the crystal current should be examined in an actually mounting circuit. (See Fig.3)
- (2) The negative resistance of a circuit must be checked. Confirmation of negative resistance is possible according to Fig. 5. A goal of negative resistance is designed to 5 or more times of the resonance resistance.
- (3) The Rd in the circuit diagram is indispensable when used in a C-MOS oscillation circuit. (See Fig. 5.) If this Rd is attached, the level of drive is kept within the specified value and stable oscillation frequency can be obtained.
- (4) Cg and Cd should be used within the range of 10 ~ 30pF. If Cg and Cd are used below 10pF or above 30pF, oscillation may be easily affected by circuit performance, level of drive may increase, of negative resistance may decrease, thus failing in maintaining stable oscillation.
- (5) The layout for crystal oscillation circuits should be arranged as short as possible. The stray capacitance between circuits and ground patterns should be reduced. Crossing of crystal oscillation circuits patterns over other circuit patterns should be avoided.
- (6) If the circuits used, IC types, and IC manufactures are different, frequency, level of drive, and negative resistance should be confirmed.

\* Overtone oscillation circuits need additional consultation.

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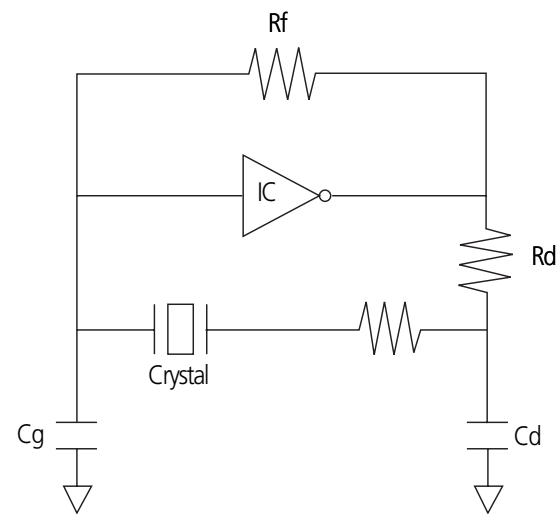


Fig.5 Example Method of Negative Resistance Measurement

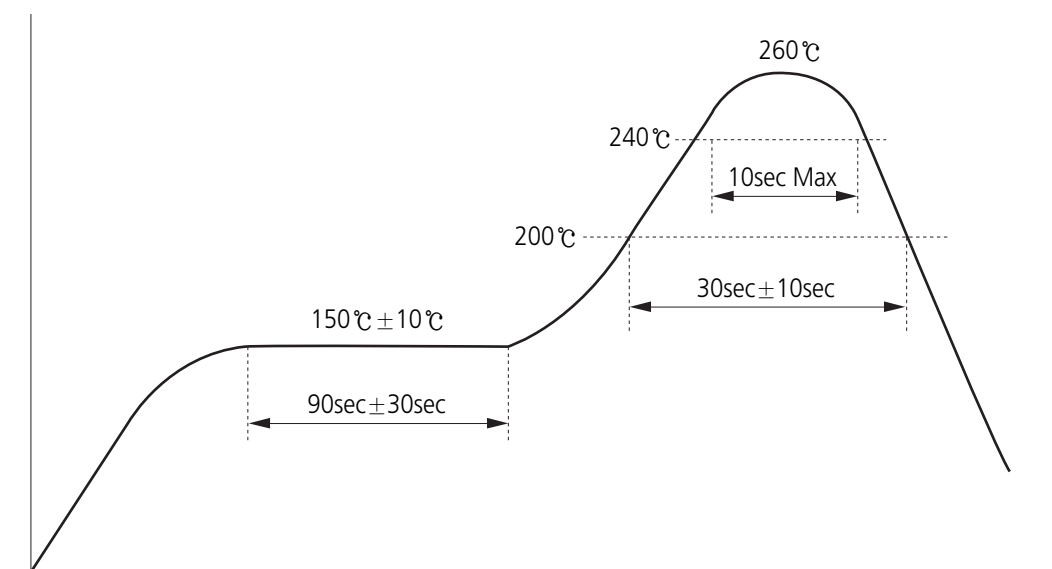
## \*\*\* Procedures of Negative Resistance Measurement

1. Open either end of the crystal unit in the main circuit used, and insert a variable resistor in series to the crystal unit, as shown in Fig. 6. Change the resistance value to examine the limits of oscillation and resistance in ohms observed at that time. In this case the power circuit must be turned on and off, without fail.
2. Negative resistance (-R) in the circuit is the sum of the value obtained by 1 above and the resonance resistance R1 of the crystal.  
\*\*\* This measurement should be carried out at both the upper and lower limits of the operating temperature range.

## Notes for Crystal Unit Applications

- (1) It has the possibility that a crystal element fractures when an excessive shock and vibration more than the regulation are added at the time of the conveyance or circuit board mounting. Be sure to do characteristic confirmation when a shock more than the regulation, a vibration are added.
- (2) Ultrasonic-wave cleaning may cause deterioration of crystal units, which printed in the catalog.
- (3) Leave it and bend 0.5 or more mm from the foundation of the lead in the case of lead type.
- (4) The deformation of the extreme circuit board sometimes brings about a pattern comes off, a terminal and electrode comes off, a crack in the solder. Be careful when you install it in the position where the curve of the circuit board appears greatly when you divide a circuit board appears greatly when you divide a circuit board after you mount it specially.
- (5) Select the model whose shock is small as much as possible, and use it after confirmation in advance when you use an automatic loading machine.

## Reflow Profile(Reference)



- Pre heating temperature :  $150^{\circ}\text{C} \pm 10^{\circ}\text{C}$  - Pre heating time :  $90\text{sec} \pm 30\text{sec}$
- Heating temperature :  $260^{\circ}\text{C} \pm 5^{\circ}\text{C}$  - Heating time : 10sec Max.
- Peak temperature must not exceed  $+265^{\circ}\text{C}$  and the duration of over  $+200^{\circ}\text{C}$  should be  $30\text{sec} \pm 10\text{sec}$

## Storage environment

- 1) Recommended storage condition :  $+15^{\circ}\text{C} \sim +35^{\circ}\text{C}$ , RH 85%  
(MSL : LEVEL 1,  $+30^{\circ}\text{C}/85\% \text{RH}$  Unlimited)
- 2) Please open the package just before using.
- 3) Please keep the products out of the direct rays of the sun.
- 4) Please keep the products away from any corrosive chemicals.
- 5) Please do not put other materials but the product in the reel or package box.  
(Otherwise, the products might be affected by other materials.)

## &lt;Caution&gt;

Please keep the products not to be shocked directly.

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  - Aerospace/Aviation equipment
  - Transportation equipment (vehicles, trains, ships, etc)
  - Medical equipment
  - Military equipment
  - Disaster prevention/crime prevention equipment
  - Any other applications with the same as or similar complexity or reliability to the applications set forth above.



**Quality System Certification List**

Table 1: Certification list of Samsung Factory

Certification	Section	PHILIPPINES
ISO / TS 16949	Authority	BSI
	Number	TS 91430-005
	Date	2012 - 08 - 03
	Validity	2015 - 08 - 02
ISO 14001	Authority	BSI
	Number	EMS 77354
	Date	2003 - 08 - 14
	Validity	2015 - 07 - 12
OSHAS18001	Authority	BSI
	Number	OHS 568723
	Date	2010 - 12 - 21
	Validity	2013 - 12 - 20
QC080000	Authority	UL
	Number	PI-HSPM-1001
	Date	2013 - 06 - 27
	Validity	2016 - 07 - 04