

# PRODUCT CATALOG

Arkh. series

Crystal resonators

Crystal oscillators

Monolithic crystal filters

MEMS oscillators

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Global Quality  
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## Arkh.Series

## Crystal Resonators

## Crystal Oscillators

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## For Automotive

## Monolithic Crystal Filters

## MEMS Oscillators

## Taping Forms, etc.

# Quartz Devices

## Handling Instructions

### Soldering

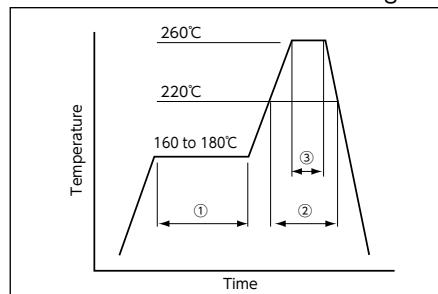
Our products are designed so they may withstand the same standard reflow soldering temperatures as most other electronics components. However, if the reflow temperature is higher than our specification allows, the performance may be affected. Avoid soldering the product at temperatures higher than specified.

For the reflow temperature profile of SMD products, refer to the figure below.

(1)	Preheat	160 to 180°C	120sec.
(2)	Primary heat	220°C	60sec
(3)	Peak	260°C	10sec. max.

\* The reflow temperature profile may vary depending on the product model, specifications and frequency range.  
Refer to the individual product specifications for details.

Reflow Temperature Profile  
(Available for lead free soldering)



### Cleaning

- ◎ General cleaning solutions or ultrasonic cleaning may be used to clean our crystal products, but verification tests are recommended prior to use.
- ◎ Tuning fork crystals resonate at frequency bands that are close to the washing frequency of ultrasonic cleaning machines and this may cause resonance deterioration in the crystal. Therefore the use of ultrasonic cleaning machines to clean tuning fork crystals should be avoided. After applying ultrasonic cleaning, the functionality of crystals should be verified by testing the performance of the end product.

### Shock

Crystal products are designed to resist shock, but if the products receive excessive shocks or are dropped on the ground, be sure to check for any damages before using.

### Mounting

#### (SMD crystal products)

Surface mount crystals are designed to be compatible with most automatic mounting processes, but some processes may exert excessive shock which may damage the crystal. Therefore test mounting of the crystal prior to mass production is necessary. If there is a possibility that PCB may be warped, make sure the warping is not to such a degree that the crystal products' operating characteristics or soldering conditions will be negatively affected. Avoid mounting and processing by Ultrasonic welding because this method has a possibility of an excessive vibration spreading inside the crystal products and becoming the cause of characteristic deterioration and not oscillating.

#### (Lead type)

When bending, forming, or mounting leaded crystal products be careful not to put too much pressure on the glassed part of the base, as it may crack and negatively affect the crystals' performance.

### Storage

Storing crystal products at high temperatures or high humidity may deteriorate the soldering condition of pins. Do not store in direct sunlight or damp environments.

### Others

#### (Crystal Resonators)

- ◎ When excessive voltage is applied to crystal resonators, their performance may be affected or the crystal blank may be damaged. When handling the product, use the product within the specifications provided.
- ◎ Negative resistance determines the tolerance margin of a circuit that oscillates the resonator. We recommend that the negative resistance be at least five times the standard series resistance for standard applications, and at least ten times the standard series resistance for automotive and safety applications.

#### (Crystal Oscillators)

- ◎ C-MOS is used for internal circuit of crystal oscillators. To prevent latch-up phenomena or static electricity, take careful note.
- ◎ Some crystal oscillators do not have internally connected bypass capacitors. When using the product, use a capacitor with a good high frequency characteristic of  $0.01\mu F$  between Vcc and GND (e.g. Ceramic chip capacitor) and connect it at the shortest possible distance. For details, refer to the specifications of each individual product.

#### (Monolithic Crystal Filters)

- ◎ Take care so that the input pin and the output pin do not close on the PCB.
- ◎ If the floating capacity of a PCB (on which a crystal filter is to be mounted) is too large, circuit tuning may be required to cancel out the excess floating capacity.
- ◎ When excessive voltage is applied to crystal filters, their performance may be affected or the crystal blank may be damaged. When handling the product, use at its input level equal to or less than -10dBm.

# RoHS/ELV Compliant Lead-free and Halogen-free products from KDS.

KDS is fully committed to environmental protection and has been proactively working to comply with the major environmental regulations such as RoHS Directive (Directive of the Restriction of the use of certain Hazardous Substances : 2011/65/EU and (EU) 2015/863), ELV Directive (End-of-Life Vehicles Directive : 2000/53/EC) and Halogen-free activities etc. The below spreadsheet provide the current status of the product compliance in each environmental regulations. Please visit our website for the latest information.(<https://www.kds.info>)

As of sept.30.2022

	Type	RoHS/ELV Compliant	Halogen-free	Pb-free	Materials of pin	Note
Crystal Resonators/ MHz Band Crystal Resonators	DX1008JS	○	○	○	Ni/Au	
	DSX1210A	○	○	○	Ni/Au	
	DSX1612S	○	○	○	Ni/Au	
	DSX211S, DSX211SH	○	○	○	Ni/Au	
	DSX221SH	○	○	○	Ni/Au	
	DSX321SH	○	○	○	Ni/Au	
	DSX210GE	○	○	Pb in sealing-glass	Ni/Au	Pb in sealing-glass is exempted from RoHS/ELV Directive. <sup>(*)</sup>
	DSX320GE	○	○	Pb in sealing-glass	Ni/Au	Pb in sealing-glass is exempted from RoHS/ELV Directive. <sup>(*)</sup>
	DSX211G	○	○	Pb in sealing-glass	Ni/Au	Pb in sealing-glass is exempted from RoHS/ELV Directive. <sup>(*)</sup>
	DSX321G, DSX321GK	○	○	Pb in sealing-glass	Ni/Au	Pb in sealing-glass is exempted from RoHS/ELV Directive. <sup>(*)</sup>
Tuning Fork Crystal Resonators/ kHz Band Crystal Resonators	DSX530GA	○	○	Pb in sealing-glass	Ni/Au	Pb in sealing-glass is exempted from RoHS/ELV Directive. <sup>(*)</sup>
	SMD-49	○	○	○	Sn-Cu	
	DT-26, DT-261	○	○	○	Sn	
	DT-38, DT-381	○	○	○	Sn	
	DMX-26S	○	○	High temperature solder	Sn	High temperature solder used inside the product is exempted from RoHS/ELV Directive. <sup>(*)</sup>
	DST1210A	○	○	○	Ni/Au	
	DST1610A, DST1610AL	○	○	○	Ni/Au	
Crystal Resonators with dedicated temperature sensor/ MHz Band Crystal Resonators	DST210AC	○	○	○	Ni/Au	
	DST311S, DST310S	○	○	○	Ni/Au	
	DSR1210ATH	○	○	○	Ni/Au	
	DSR1612ATH, DSR1612STH	○	○	○	Ni/Au	
Temperature Compensated Crystal Oscillators (TCXO)	DSR211STH	○	○	○	Ni/Au	
	DSR221STH	○	○	○	Ni/Au	
	DSA/DSB1612 SERIES	○	○	○	Ni/Au	
	DSA/DSB211 SERIES	○	○	○	Ni/Au	
	DSA/DSB221 SERIES	○	○	○	Ni/Au	
	DSA/DSB321 SERIES	○	○	○	Ni/Au	
	DSA/DSB535SGA	○	○	○	Ni/Au	
Real Time Clock Module (RTC)	DSK1612ATD	○	○	○	Ni/Au	
	DSK321STD	○	○	○	Ni/Au	
Simple Packaged Crystal Oscillators (SPXO)	DD3225TS, DD3225TR	○	○	○	Ni/Au	
	DS1008J SERIES	○	○	○	Ni/Au	
	DSO1612AR	○	○	○	Ni/Au	
	DS2016KS	○	○	○	Ni/Au	
	DSO211S SERIES	○	○	○	Ni/Au	
	DSO221S SERIES	○	○	○	Ni/Au	
	DSO223S SERIES	○	○	○	Ni/Au	
	DSO321S SERIES	○	○	○	Ni/Au	
	DSO323S SERIES	○	○	○	Ni/Au	
	DSO531S SERIES	○	○	○	Ni/Au	
	DSO533 SERIES	○	○	○	Ni/Au	
	DLO555MBA	○	○	○	Sn	
	DSO751S SERIES	○	○	○	Ni/Au	
Voltage Controlled Crystal Oscillators (VCXO)	DSO753S SERIES	○	○	○	Ni/Au	
	DSV221SV	○	○	○	Ni/Au	
	DSV321S	○	○	○	Ni/Au	
	OCXO	○	Halogenated compounds in print wiring boards	Pb in chip resistor	Ni/Au	Pb in chip resistor is exempted from RoHS/ELV Directive. <sup>(*)</sup>
Monolithic Crystal Filters	DC5032AS	○				
	DSF334 SERIES	○	○	○	Ni/Au	
	DSF633 SERIES	○	○	○	Ni/Au	
	DSF753 SERIES	○	○	○	Ni/Au	

\* RoHS Directive and ELV Directive exemptions are granted for high temperature solder, lead content in low-melting glass of DSX-G Series and lead in chip resistors of DC5032AS.

# How a quartz crystal device is made

## The piezoelectric effect

In 1880, the Curie brothers, both physicists of France (the wife of Pierre, the younger Curie, was Madame Curie (Marie), famed for her discovery of radium), discovered the phenomenon of electric polarization as a result of applying mechanical strain to a plate of quartz crystal. This effect, referred to as the "piezoelectric effect," is an important phenomenon used in quartz crystal devices.

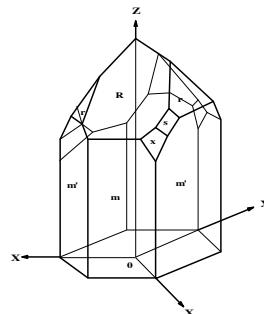


Fig. 1. Typical appearance of a quartz crystal

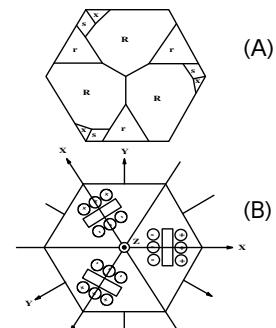


Fig. 2. (A) Typical crystallogram as obtained by viewing Fig. 1 from above  
(B) Illustration of piezoelectricity

## Growth of artificial quartz crystal

A quartz crystal device is produced from artificial quartz crystal; the reason for this is that artificial quartz crystal of high purity can be obtained on an industrial and stable basis, and that artificial quartz crystal can be processed into shapes suitable for further processing. Quartz crystal is grown in a special-steel oven, called an autoclave (shown in Fig. 3), under high-temperature and high-pressure conditions; this process takes several months. The natural quartz crystal that is recrystallized by means of hydrothermal synthesis is artificial quartz crystal.



Artificial quartz crystal drawn from an autoclave



Various artificial quartz crystals

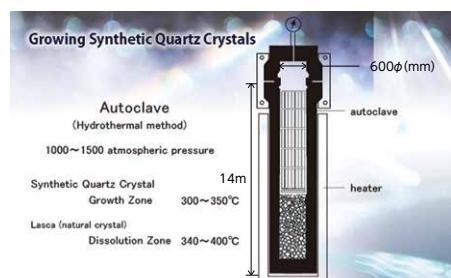


Fig. 3. Autoclave

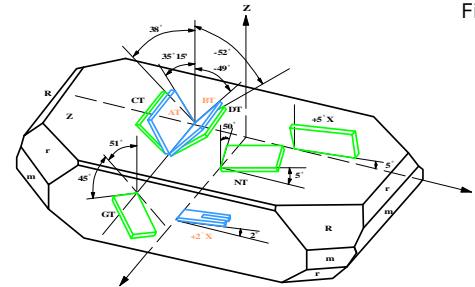
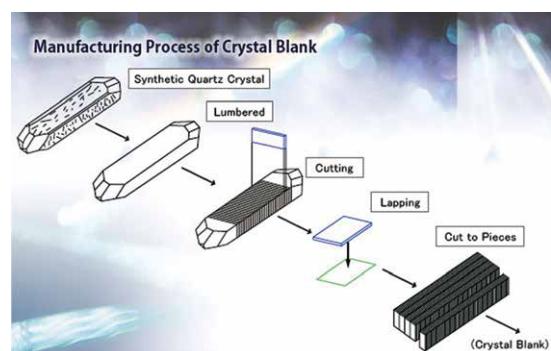


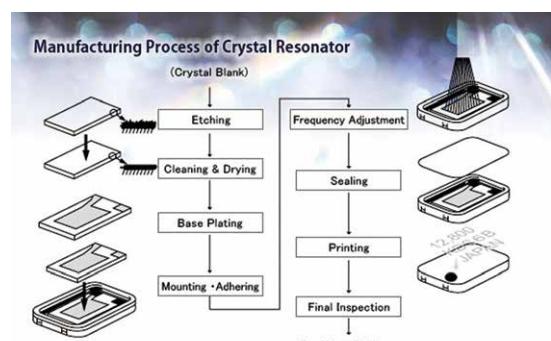
Fig. 4. Designations of cuts from a piece of artificial quartz crystal

## Process of manufacturing quartz crystal devices

A finished artificial quartz crystal is cut at an angle suited to its application; repeated grinding and cutting then turn it into a quartz crystal piece (a small plate-like chip of quartz crystal, it is usually called "Crystal blank"). The manufacture of a crystal blank is so important a process as to allow this crystal blank to practically determine the characteristic of a quartz crystal.



Several months after artificial crystal growth begins, the assembly process finally occurs. After the crystal surface has been cleaned, metal thin film is created on it to obtain a conductive surface, and the package is connected to the crystal blank. The crystal blank then undergoes final frequency adjustment and is packaged in a vacuum or in a nitrogen atmosphere to protect it from oxygen, moisture, and similar substances, which can affect it adversely. When all these steps have been completed, the crystal blank undergoes shipping inspection, is marked and then shipped.



Refer to "Handbook of Quartz Crystal Device, 5th ed. (QIAJ)" for each figure.

# “Slim × Small × Smart” Crystal (Triple-S Crystal)



Mobile devices such as smartphones are demanded to be more powerful and multifunctional to enhance user convenience, requiring their component to be downsized and low-profiled. Inevitably, the sizes, shapes, and specifications of wearable devices and smart cards under development also require parts mounted on them to be downsized and low-profiled.

“Slim×Small×Smart” Crystal (Triple-S Crystal) forms a below-2016-size crystal device group expanding design possibilities under these circumstances.

New aspects such as newly-designed crystal chips, the mounting of crystal chips by a new process, and an optimized package design have enabled realization of a product of the world's smallest and thinnest class, that comes with similar or better performance than currently running products. In addition to downsized and low-profile products, we will continue to realize products that respond to various specifications including high functionality, high-frequency performance, high reliability and low power consumption, thereby contributing to the downsizing and the enhancement of functionality in various devices.

## Symbols



A logo representing Arkh.Series

A logo representing “Slim×Small×Smart” Crystal (Triple-S Crystal) used for below-2016-size crystal devices



As of sept.30.2022

No lead content.  
Lead-free mounting is possible.

RoHS “2011/65/EU and  
(EU) 2015/863” Compliant

RoHS “2011/65/EU and  
(EU) 2015/863”  
ELV “2000/53/EC” Compliant

## Environment

### ISO14001

Daishinku's domestic and international production sites have acquired ISO14001, an environmental management system, as one of the approaches to protect the environment.

### ISO9001, IATF16949

In order to meet customer's needs with “reliance” and “reassurance”, Daishinku has achieved ISO9001, IATF16949 certification in domestic and international production sites \*.

\*Except for Kanzaki Plant

#### ● Use this Catalog with the following points in mind.

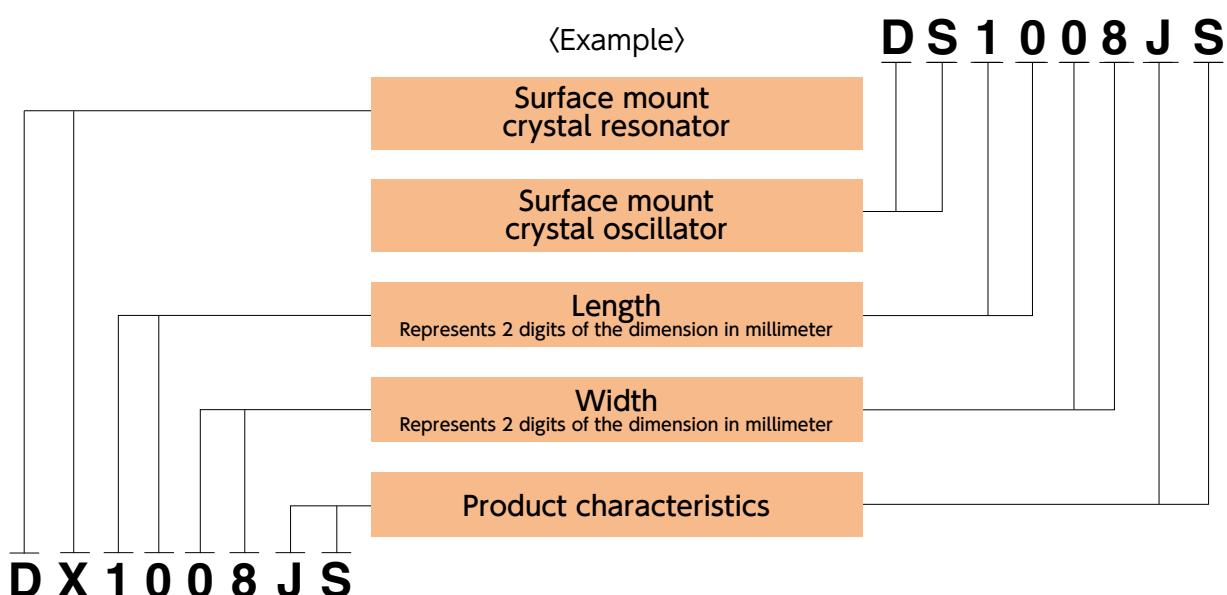
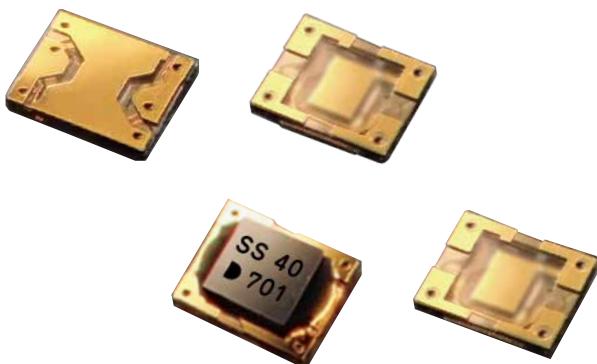
- The contents of this Catalog are subject to change without notice.
- It is strictly forbidden to reprint or reproduce this Catalog, either wholly or in part, without the permission of the manufacturer.
- The application circuits, methods and drawings included in this Catalog are provided strictly for the purposes of reference. Verify before using. The manufacturer is not liable if any third party has its rights infringed or incurs losses in connection with the information presented in this Catalog. Permission is neither given nor implied to exercise the industrial property rights of the manufacturer or any third party.

#### ● Handle products carefully.

The products listed in this Catalog are intended for use with ordinary electronic devices. When a product is required to have especially high reliability in a given application, consult our sales representative.

# Quartz Devices

## Arkh.Series



# Arkh.3G SERIES

## About Arkh.Series



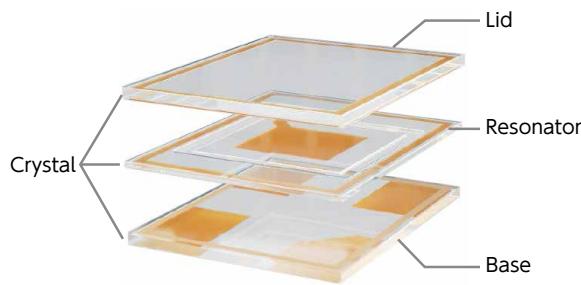
**Arkh.Series**

The Arkh Series is a device with an unprecedented new structure developed as the third generation following the lead type and the surface-mount type.

The brand name "Arkh" is taken from the ancient Greek word "Arkhitekton", which is the origin of the English word "Architecture". It is not just a structure, but contains the desire to emphasize that it is the origin of crystal devices with a completely new structure.

## About the Structure of the Arkh Series

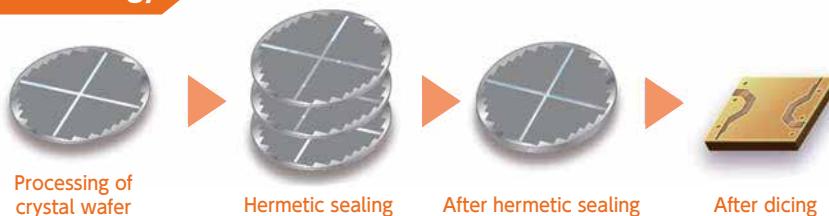
### <Arkh.3G>



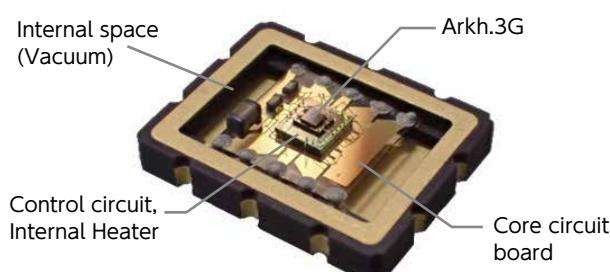
The Arkh.3G is an ultra-compact and thin device realized by WLP (Wafer Level Package) technology and is arranged in a three-layer structure consisting of a lid, resonator, and base, the host of which is quartz crystal. With the outlines of the resonator and other parts having been formed by a photolithographic process, three quartz crystal wafers are bonded and diced into a waferlevel package. Thus the holder and resonator parts are formed into an integrated structure without the use of a conductive adhesive.

This design has solved the challenges that the conventional structure needed to meet for product size reduction, namely, improved accuracy in conductive adhesive application and the provision of a margin for ensuring a quartz crystal element mounting location. Additionally, it is possible to reduce quality risks by carrying out processes ranging from wafer cleaning to bonding in a vacuum environment.

### WLP technology



### <Arkh.5G>



The Arkh.5G is an ultra-compact and low-power OCXO by embedding the ultra-small Arkh.3G oscillator in its core. The core of the conventional product is generally under atmospheric pressure. But the new core structure is maintained in a vacuum, which eliminates the effects of thermal convection. The conventional products are unsuitable for mass production due to their complicated structures and large numbers of components, but the design of Arkh.5G facilitates assembling on a fully automatic production line, which will enable us to supply in large numbers.

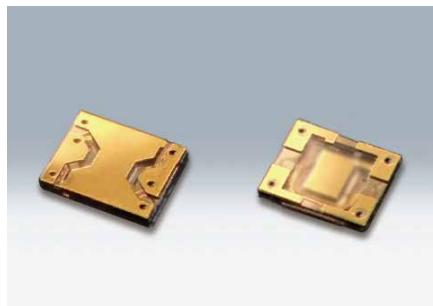
## About Mounting and Usage of the Arkh.Series

The Arkh.Series can be soldered to circuit boards with a pick-and-place machine in the conventional manner. The Arkh.3G can also be built into an IC package or used for wire bonding or molding.

\*Note that, as with conventional products, the Arkh.3G is subject to resonance fracture or damage, depending on conditions such as ultrasonic cleaning and molding pressure. Therefore, it is necessary to check the Arkh.3G in advance under your particular operating conditions.

# SMD Crystal Resonators / MHz Band Crystal Resonators

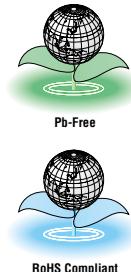
## DX1008JS



Actual size □

### ■ Features

- 1008 size, height 0.12mm  
Unprecedented extremely low-profile package using a novel structure
- Composed only of quartz crystal plates and metallic films without the use of a ceramic base
- Long-term high resistance to aging, due to avoiding the use of an organic conductive adhesive
- Reduced risk of the inclusion of foreign matter due to assembly in a vacuum environment



### ■ Applications

- Mobile communications and short-range wireless modules
- Wearable devices
- Automotive millimeter-wave radar

### ■ Standard Specification

Item	Type	DX1008JS		
Frequency Range	48 to 52MHz	52 to 96MHz	96 to 120MHz	
Overtone Order		Fundamental		
Load Capacitance		8pF, 10pF, 12pF		
Drive Level		10µW (100µW max.)		
Frequency Tolerance		±20×10 <sup>-6</sup> (at 25°C)	±100×10 <sup>-6</sup> (at 25°C)	
Series Resistance	100Ω max.	60Ω max.	40Ω max.	
Frequency Characteristics over Temperature		±30×10 <sup>-6</sup> / -30 to +85°C (Ref.To 25°C)		
Storage Temperature Range		-40 to +85°C		
Packing Unit (1)		3000pcs./reel (φ 180)		

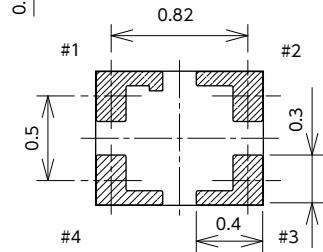
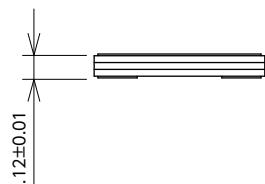
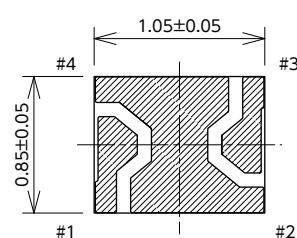
(1) Moisture prevention packing is unnecessary.

Moisture Sensitivity Level: LEVEL1 (IPC/JEDEC J-STD-033)

Consult our sales representative for other specifications

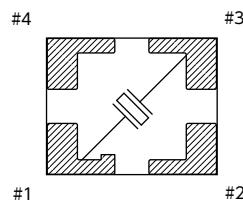
[mm]

### ■ Dimensions



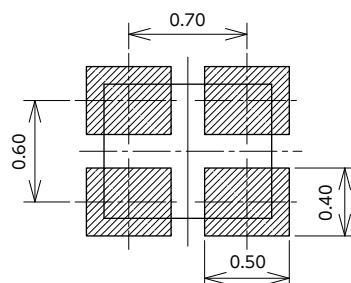
### ■ Internal Connections

⟨Top View⟩



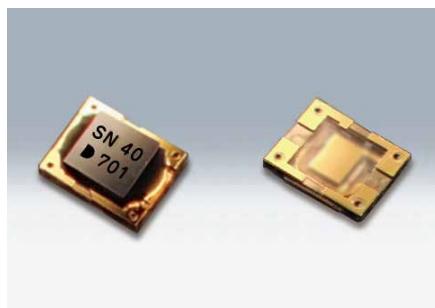
### ■ Recommended Land Pattern

⟨Top View⟩



# SMD Crystal Oscillators

## DS1008JN



Actual size □

### ■ Features

- 1008 size, height 0.22mm  
Unprecedented extremely low-profile package using a novel structure
- Available frequency range : 1 to 100MHz
- Low Supply Voltage : 0.9V/ 1.2V/ 1.3V/ 1.5V typ.
- 3-state function
- Available up to 100MHz by using AT cut fundamental resonator.  
Low jitter provides for high performance.



### ■ Applications

- Medical camera
- Wearable devices
- IoT devices
- Automotive multimedia device

[Function Code]

DS1008JN EA

E : 1.5V	A : $\pm 100 \times 10^{-6}$
F : 1.3V	B : $\pm 50 \times 10^{-6}$
G : 1.2V	C : $\pm 30 \times 10^{-6}$
H : 0.9V	E : $\pm 20 \times 10^{-6}$

### ■ Standard Specification

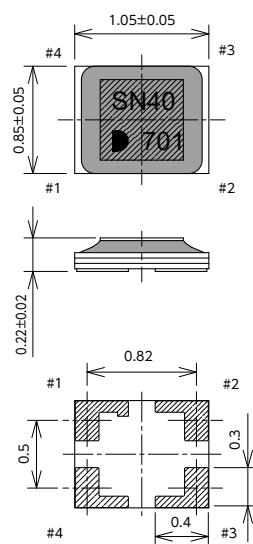
Item	Type	Function Code		Output Frequency Range (MHz)	Legend	Spec.			Condition
		Supply Voltage	Frequency Tolerance			min.	typ.	max.	
Supply Voltage	E	*	1 $\leq f_0 \leq 100$	Vcc	f_tol	1.4	1.5	1.6	V
	F					1.2	1.3	1.4	
	G					1.1	1.2	1.3	
	H					0.8	0.9	1.0	
Frequency Tolerance (Includes frequency tolerance at room temperature.)	A	*	*			—	—	$\pm 100$	ppm
	B					—	—	$\pm 50$	
	C					—	—	$\pm 30$	
	E					—	—	$\pm 20$	
Current Consumption	E	*	80 $\leq f_0 \leq 100$	lcc		—	—	3.1	mA
			50 $\leq f_0 < 80$			—	—	2.7	
			1 $\leq f_0 < 50$			—	—	2.2	
	F	*	80 $\leq f_0 \leq 100$			—	—	2.8	
			50 $\leq f_0 < 80$			—	—	2.5	
			1 $\leq f_0 < 50$			—	—	2.1	
	G	*	80 $\leq f_0 \leq 100$			—	—	2.7	
			50 $\leq f_0 < 80$			—	—	2.4	
			1 $\leq f_0 < 50$			—	—	2.0	
	H	*	80 $\leq f_0 \leq 100$			—	—	2.3	
			50 $\leq f_0 < 80$			—	—	2.1	
			1 $\leq f_0 < 50$			—	—	1.8	
Stand-by Current (#1 pin "L" Level)	*	*	*	L_std		—	—	0.02	mA
Load Condition	*	*	*	L_CMOS		—	—	15	pF
Symmetry	*	*	*	SYM	40	50	60	%	at 50%
Rise and Fall Time	*	*	*	tr, tf		—	—	5.5	ns
Output Enable Time	*	*	*	tPZL		—	—	2	ms
Output Disable Time	*	*	*	tPLZ		—	—	200	ns
OE Pin 1 Level Input Voltage	*	*	*	VIH	Vcc $\times 0.8$	—	—	V	
OE Pin 0 Level Input Voltage	*	*	*	VIL	—	—	Vcc $\times 0.2$	V	
Packing Unit (1)	3000pcs./reel(Φ 180)								

(1) Moisture prevention packing

Consult our sales representative for other specifications

[mm]

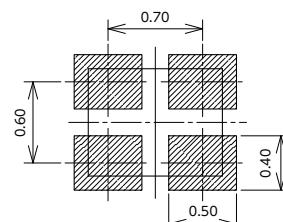
### ■ Dimensions



Pin Connection	
Pin No.	Connection
#1	OE (Output Enable)
#2	GND
#3	Output
#4	Vcc
Function	
#1 input	#3 Output condition
H	Oscillation out
Open	Oscillation out
L	High Z

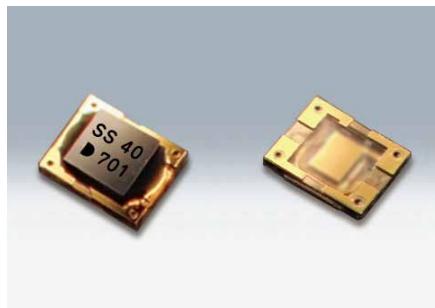
### ■ Recommended Land Pattern

&lt;Top View&gt;



# SMD Crystal Oscillators

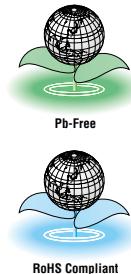
## DS1008JS



Actual size □

### ■ Features

- 1008 size, height 0.22mm  
Unprecedented extremely low-profile package using a novel structure
- Available frequency range : 1 to 100MHz
- Supply Voltage : +1.8V to +3.3V
- 3-state function
- Available up to 100MHz by using AT cut fundamental resonator.  
Low jitter provides for high performance.



### ■ Applications

- Mobile communications and short-range wireless modules
- Wearable devices
- Automotive multimedia device

[Function Code]  
DS1008JS A A

A : 3.3V	A : $\pm 100 \times 10^{-6}$
B : 2.8V	B : $\pm 50 \times 10^{-6}$
C : 2.5V	C : $\pm 30 \times 10^{-6}$
D : 1.8V	E : $\pm 20 \times 10^{-6}$

### ■ Standard Specification

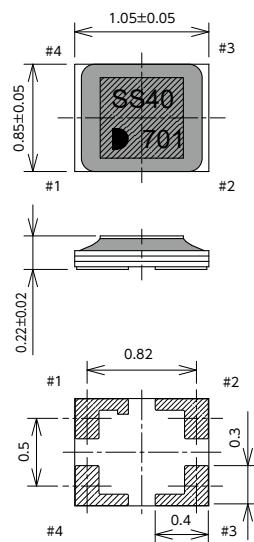
Item	Type	Function Code		Output Frequency Range (MHz)	Legend	Spec			Condition
		Frequency Tolerance	Frequency Tolerance			min.	typ.	max.	
Supply Voltage	A	*	1 $\leq f_0 \leq 100$	Vcc		3.0	3.3	3.6	V
	B					2.6	2.8	3.0	
	C					2.25	2.5	2.75	
	D					1.6	1.8	2.0	
Frequency Tolerance (Includes frequency tolerance at room temperature.)	A	*	*	f_tol		—	—	$\pm 100$	ppm
	B					—	—	$\pm 50$	
	C					—	—	$\pm 30$	
	E					—	—	$\pm 20$	
	A		80 $\leq f_0 \leq 100$ 48 $\leq f_0 < 80$ 1 $\leq f_0 < 48$	Icc		—	—	4.9	mA
Current Consumption	B					—	—	4.2	
	C					—	—	3.1	
	B					—	—	4.2	
	B					—	—	3.7	
	C					—	—	2.7	
	C					—	—	3.9	
	C					—	—	3.4	
	D					—	—	2.6	
	D					—	—	3.1	
Stand-by Current (#1 pin "L" Level)	*	*	*	L_std		—	—	0.01	mA
	Load Condition	*	*	L_CMOS		—	—	15	pF
Symmetry	*	*	*	SYM	45	50	55	%	at 50% Vcc $f_0 < 60$ MHz
Rise and Fall Time	*	*	*	tr, tf	—	—	5	ns	10 to 90% Vcc Level
Output Enable Time	*	*	*	tPZL	—	—	2	ms	
Output Disable Time	*	*	*	tPLZ	—	—	200	ns	
OE Pin 1 Level Input Voltage	*	*	*	VIH	$V_{cc} \times 0.8$	—	—	V	
OE Pin 0 Level Input Voltage	*	*	*	VIL	—	—	$V_{cc} \times 0.2$	V	
Packing Unit (1)	3000pcs./reel(Φ 180)								

(1) Moisture prevention packing

Consult our sales representative for other specifications

[mm]

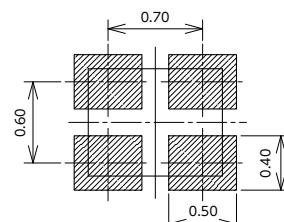
### ■ Dimensions



Pin Connection	
Pin No.	Connection
#1	OE (Output Enable)
#2	GND
#3	Output
#4	Vcc
Function	
#1 input	#3 Output condition
H	Oscillation out
Open	Oscillation out
L	High Z

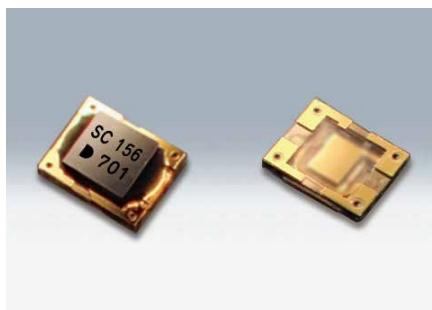
### ■ Recommended Land Pattern

&lt;Top View&gt;



# SMD Differential Output Crystal Oscillators

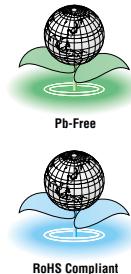
## DS1008JC/DS1008JK/DS1008JJ



Actual size □

### ■ Features

- 1008 size, height 0.24mm  
Unprecedented extremely low-profile package using a novel structure
- Available frequency range : 156.25MHz
- HD-LVDS output (DS1008JC)
- LV-PECL out put (DS1008JK)
- LVDS output (DS1008JJ)
- By using AT cut fundamental resonator, low jitter provides for high performance.



### ■ Applications

- Optical transmission device

### ■ Standard Specification

Item	Type	Legend	DS1008JC	DS1008JK	DS1008JJ	Condition
Output Specification	—	HD-LVDS	LV-PECL	LVDS		
Output Frequency Range	f <sub>0</sub>			156.25MHz		
Supply Voltage	V <sub>CC</sub>	+3.3V±0.165V	+2.5V±0.125V / +3.3V±0.165V			
Frequency Tolerance (Includes frequency tolerance at room temperature.)	f <sub>tol</sub>		±100×10 <sup>-6</sup> max.			-40 to +85°C
Current Consumption	I <sub>CC</sub>	30mA max.	45mA max.	20mA max.		
Load Condition	Load-R	100Ω (Output-OutputN, DC Cut)	50Ω to V <sub>CC</sub> -2.0V	100Ω (Output-OutputN)		
Symmetry	SYM		45 to 55%			at outputs cross point
0 Level Output Voltage	V <sub>OL</sub>	—	V <sub>CC</sub> -1.81 to V <sub>CC</sub> -1.62	—		
1 Level Output Voltage	V <sub>OH</sub>	—	V <sub>CC</sub> -1.025 to V <sub>CC</sub> -0.88	—		
Rise and Fall Time	t <sub>r</sub> , t <sub>f</sub>	0.4ns max	0.5ns max	0.4ns max		20 to 80% Output-OutputN
Differential Output Voltage	V <sub>OD1</sub> , V <sub>OD2</sub>	0.500 to 1.000V	—	0.247 to 0.454V		
Change to V <sub>OD</sub>	ΔV <sub>OD</sub>	—	—	50mV		ΔV <sub>OD</sub> =ABS(V <sub>OD1</sub> -V <sub>OD2</sub> )
Offset Voltage	V <sub>OS</sub>	—	—	1.125 to 1.375V		Output, OutputN Offset Voltage
Offset to V <sub>OS</sub>	ΔV <sub>OS</sub>	—	—	50mV		Magnitude Change V <sub>OS</sub>
Start Up Time	T <sub>ST</sub>		2ms			
Period Jitter (1)	t <sub>RM</sub>		2.5ps typ.			
	t <sub>p-p</sub>		22ps typ.			Peak to peak
Phase Jitter (2)	t <sub>pj</sub>		0.1ps max.	0.12ps max.		f <sub>0</sub> offset: 12kHz to 20MHz @ +25°C
Packing Unit (3)			3000pcs./reel (φ 180)			

(1) Measured WAVECREST DTS-2075

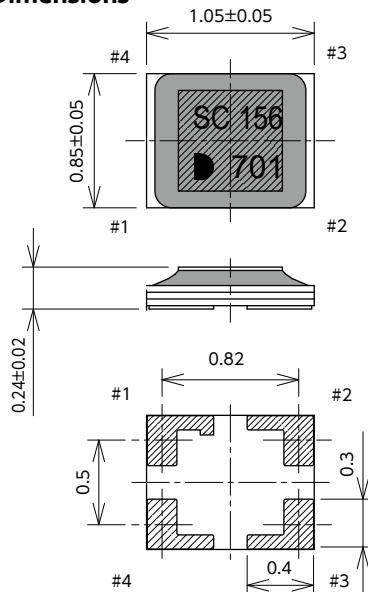
(2) Measured Keysight Technologies E5052B

(3) Moisture prevention packing

Consult our sales representative for other specifications

[mm]

### ■ Dimensions

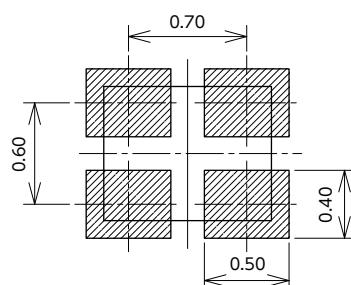


### Pin Connection

Pin No.	Connection
#1	GND
#2	OutputN
#3	Output
#4	V <sub>CC</sub>

### ■ Recommended Land Pattern

&lt;Top View&gt;



# Oven Controlled Crystal Oscillators

## DC5032AS

Under Development

**NEW**



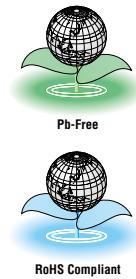
Actual size

### ■ Features

- 5032 size, 2.5mm height  
Embedded Arkh.3G serise of KDS unique technology
- Frequency stability:  $\pm 30 \times 10^{-9}$  (-40 to +85°C)
- Low power consumption : 250mW typ. (Ta=+25°C)
- 2 Output are available

### ■ Application

- 5G RRHs, Small cells, Stratum3, etc



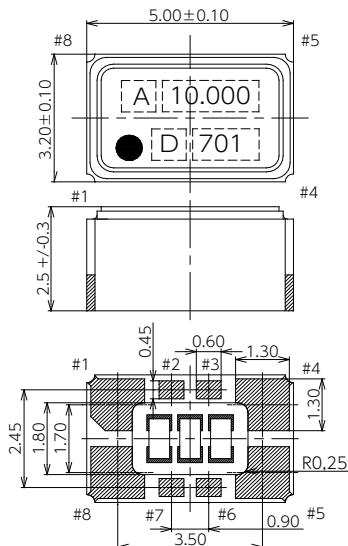
### ■ Standard Specification

Item	Type	DC5032AS
Output Frequency Range		5 to 100MHz
Standard Frequency		10, 20, 30.72MHz
Supply Voltage		+3.3V±0.165V
Frequency Control Voltage		+1.65V±1.00V
Operating Temperature Range		-40 to +85°C
Frequency Stability		$\pm 500 \times 10^{-9}$ max. [Initial accuracy at +25°C]
Tolerance		$\pm 30 \times 10^{-9}$ max. [-40 to +85°C *Reference to (Fmax. +Fmin.) /2]
vs. Temperature		$\pm 20 \times 10^{-9}$ max. [+3.3±0.165V]
vs. Supply Voltage		$\pm 1000 \times 10^{-9}$ max./year [after 30days of operation]
vs. Aging		$\pm 5.0 \times 10^{-6}$ typ. [Positive Slope]
Frequency Adjustment Range		1000mW max. [Warm up]
Power Consumption		250mW typ. 400mW max. [Steady state in still air at +25°C]
Output Load		15pF±10%
Symmetry		45 to 55 % [50% Vcc Level]
0 Level Output Voltage		Vcc×0.1 max.
1 Level Output Voltage		Vcc×0.9 min.
Rise and Fall Time		5.5 ns max.
Phase Noise		10MHz
Offset 10Hz		-75dBc/Hz max.
Offset 100Hz		-110dBc/Hz max.
Offset 1kHz		-135dBc/Hz max.
Offset 10kHz		-140dBc/Hz max.

Consult our sales representative for other specifications.

[mm]

### ■ Dimensions

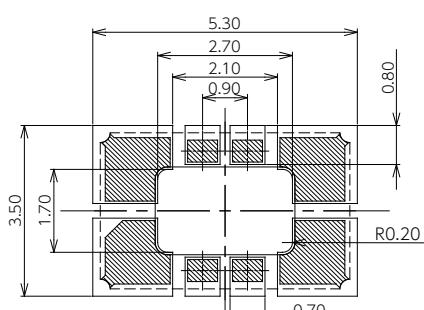


### Pin Connections

Pin No.	Connection
#1	VCONT
#2	No Connection
#3	No Connection
#4	GND
#5	Output
#6	Output2/ No Connection
#7	No Connection
#8	Vcc

### ■ Recommended Land Pattern

#### ⟨Top View⟩



# MEMO

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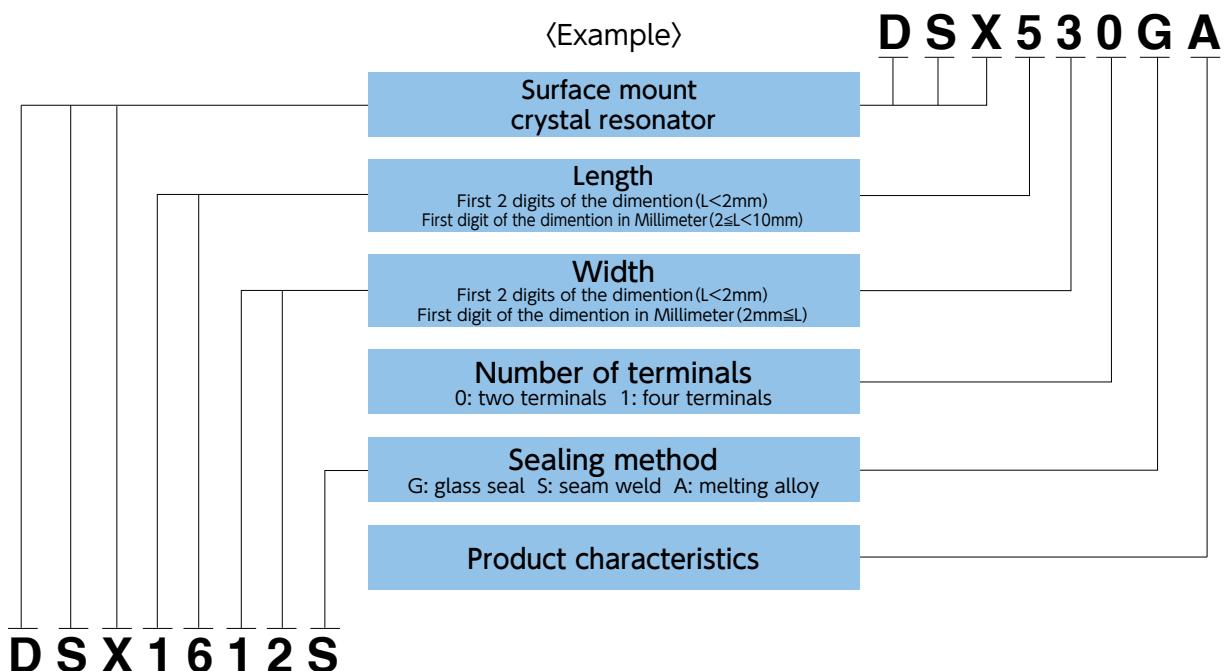
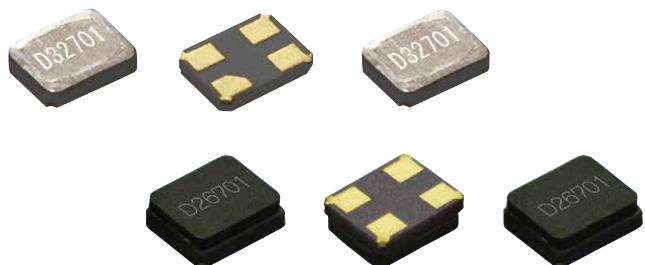
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# Quartz Devices

## Crystal resonators



# Crystal Resonators

## Description

### ●MHz Band Crystal Resonators

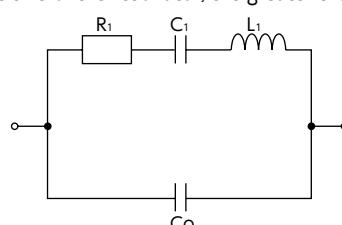
A resonator using thickness-sheer mode and has high stability during temperature variations. There are many packages and sizes available for various applications.

### ●kHz Band Crystal Resonators(Tuning Fork Crystal Resonators)

A resonator with low power consumption and a tuning fork shaped crystal blank. Common application includes watches and mobile phones.

## Terminology

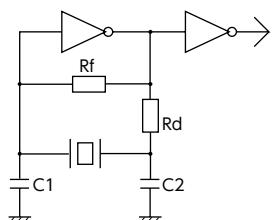
<b>Fundamental Crystal Resonators</b>	Crystal resonator designed to oscillate in the lowest-order (fundamental) oscillation mode.
<b>Overtone Crystal Resonators</b>	Crystal resonator designed to oscillate in the overtone oscillation mode (third, fifth, and seventh).
<b>Overtone Order</b>	Desired order of vibration mode, (odd) integer multiples of the fundamental mode.
<b>Vibration Mode</b>	One factor which determines the mechanical vibration behavior of a crystal blank is cutting angle. Examples of such vibration behaviors are thickness-sheer mode and flexure mode.
<b>Nominal Frequency</b>	The specified center frequency of the crystal.
<b>Load Capacitance</b>	The effective external capacitance that determines the resonance frequency of a crystal resonator. When this capacitance is small, the crystal resonator is vulnerable to changes in the circuit characteristics, thus deteriorating the frequency stability.
<b>Drive Level</b>	Loading condition of crystal resonator, which is determined by electric current or power applied to the crystal blank. Electric power P is determined by the following equation: $P = I^2 \cdot R_1$ , where I represents electric current and R1 represents series resistance.
<b>Series Resistance</b>	The resistance of the crystal at the series resonance frequency, also called the equivalent series resistance (ESR).
<b>Frequency Tolerance (Crystal Resonators)</b>	Allowable deviation from nominal at room temperature (25 deg.C), indicated in parts per million ( $\times 10^6$ ).
<b>Frequency Characteristics over Temperature (Crystal Resonators)</b>	Allowable deviation of frequency at room temperature, in parts per million ( $\times 10^6$ ). This is the maximum value within the operating temperature range.
<b>Aging</b>	The frequency change of the crystal operated at specific conditions for a certain period of time.
<b>Operating Temperature Range</b>	Temperature range over which the crystal resonator can be operated within allowable deviation range.
<b>Storage Temperature Range</b>	Temperature range, which crystal resonator can be stored at without any deterioration or damage independently.
<b>Turnover Temperature</b>	The temperature at the peak of the parabolic curve that a crystal in kHz shows with temperature. It is expected that the crystal will have a steady oscillation if the peak temperature is within the working temperature range.
<b>Parabolic Coefficient</b>	The temperature co-efficient of a parabolic curve shown in frequency vs. temperature.
<b>Plastic-encapsulated (SMD) type</b>	Crystal resonators encapsulated with resin.
<b>Cylindrical type</b>	Crystal resonators in cylindrical constructions, which are generally in kHz frequency range.
<b>Equivalent Circuit to Crystal Resonator</b>	An equivalent circuit near the resonance point of the crystal resonator is shown below. It consists of a series circuit including series motional inductance (L1), series capacitance (C1) and series resistance (R1), with the resonator's terminal-to-terminal capacitance (shunt capacitance: C0) connected in parallel with the series circuit. The smaller the size of the resonator, the greater the average values of R1 and L1.



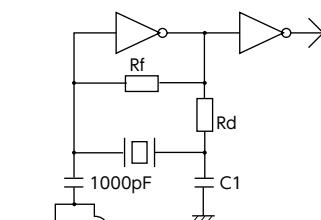
# Oscillation Circuit

## Oscillation Circuit of Crystal Resonator

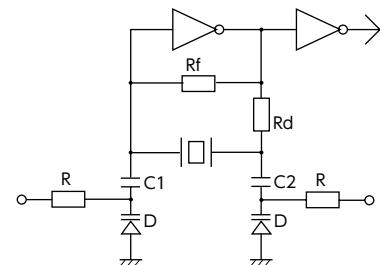
**Oscillation Circuit of Fundamental Mode**



**Oscillation Circuit of Overtone Mode**



**VCXO Circuit**



### Oscillation Circuit of Fundamental Mode :

A circuit that allows the crystal resonator to oscillate in the fundamental mode.

### Oscillation Circuit of Overtone Mode :

A circuit that allows the crystal resonator to oscillate in a high-order oscillation mode (overtone mode). (However, the circuit can be used at the composition of oscillation circuit of fundamental mode.)

### VCXO Circuit :

An oscillation circuit with a frequency control function that utilizes the load capacitance characteristic of the crystal resonator.

## Tips for Circuit Design

### [IC Selection]

Selecting an IC according to the oscillation frequency.

⟨Example⟩ 4069UB : From the kHz range to around 8 MHz

7WU04 : 4 to 30MHz

7WHU04 : 20 to 60MHz

### [Feedback Resistance]

The feedback resistance for DC bias is necessary to continue the oscillation of a resonator. Generally, a resistance of 10 MΩ and above is used for oscillation in the kHz range, and a resistance of 1 MΩ and above is used for oscillation in the MHz range.

For overtone oscillation, a resistance of 1 kΩ may be used.

### [Control Resistance]

Limits the current that flows into resonator, adjusts the negative resistance and drive level, prevents abnormal oscillation of resonator and suppresses frequency fluctuations.

### [Capacitor C1, C2]

Adjusts the negative resistance and drive level, prevents abnormal oscillation of resonator.

### [Bypass Capacitor]

This component is required to lower the impedance of the power-supply system inserted between the power-supply pin and ground pin of the IC. Mount as closely as possible to the IC, using a bypass capacitor with a capacitance suitable for the oscillation frequency.

⟨Example⟩ kHz range : 10 to 100 μF  
MHz range : 0.01 to 0.1 μF

### [Line Pattern]

Mount parts of a oscillation circuit as closely as possible to the IC and don't put signal line of the oscillator circuit closely or cross another signal line.

# Oscillation Circuit

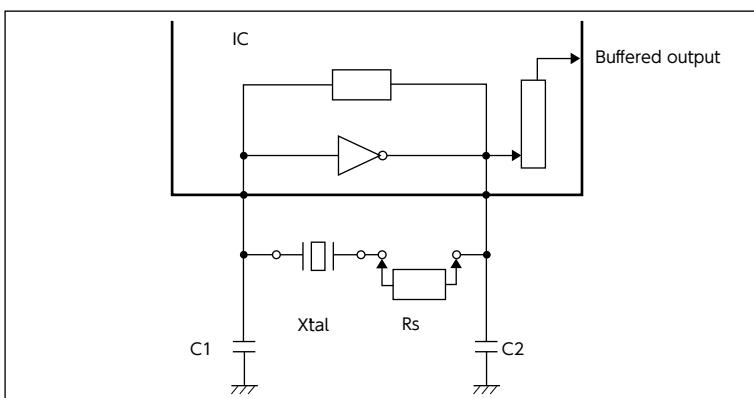
## Confirmation on Operation of Oscillation Circuit

### [Negative Resistance]

As the figure shows, raise one end of the crystal resonator from the oscillation circuit and insert a resistor ( $R_s$ ). Change the value of the inserted resistor ( $R_s$ ). The value at which oscillation stops represents negative resistance. KDS measures the value not only at room temperature but also at low temperature, at high temperature and regards the lowest value as the negative resistance.

The negative resistance value of the circuit should generally be at least five times the standard series resistance.

It is recommended to provide a negative resistance that is at least ten times the standard series resistance for automotive applications and safety equipment.



Measurement Circuit for Negative Resistance

### [Load Capacitance]

Minimize the difference of the oscillation frequency by making the load capacitance of a oscillation circuit and that of a resonator equal.

### [Drive Level]

Absolute Maximum Value ; See "Drive Level" in the table of each page.

The adequate drive level differs according to the crystal resonator type and overtone order.

MHz Band Crystal Resonators

Fundamental Mode:  $300\mu\text{W}$  max.,  $200\mu\text{W}$  max.,  $100\mu\text{W}$  max. Overtone Mode:  $1\text{mW}$  max.,  $500\mu\text{W}$  max.

Tuning Fork Crystal Resonators

$2\mu\text{W}$  max.,  $1\mu\text{W}$  max.

The smaller a resonator becomes, the tighter its specification becomes.

### (Measurement Method)

Calculation based on the measured amperage flowing through a resonator and the resistance of that with a high-frequency current probe.

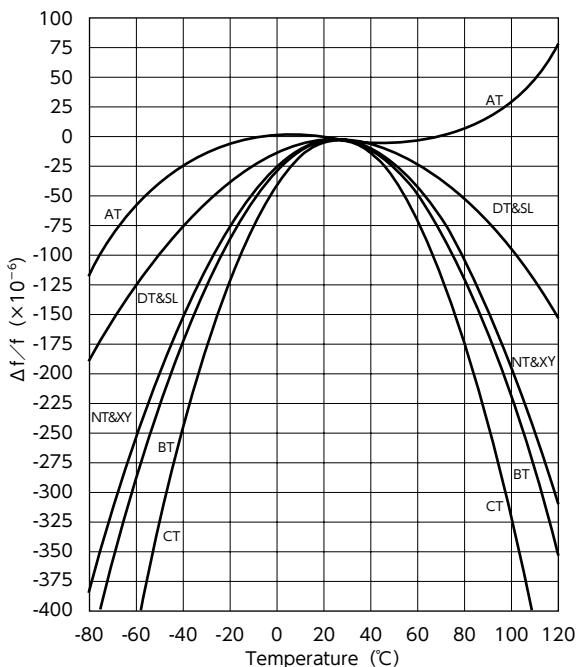
$$\text{Drive Level } P = (I/2\sqrt{2})^2 \cdot R$$

### [Inquiry About The Oscillation Circuit]

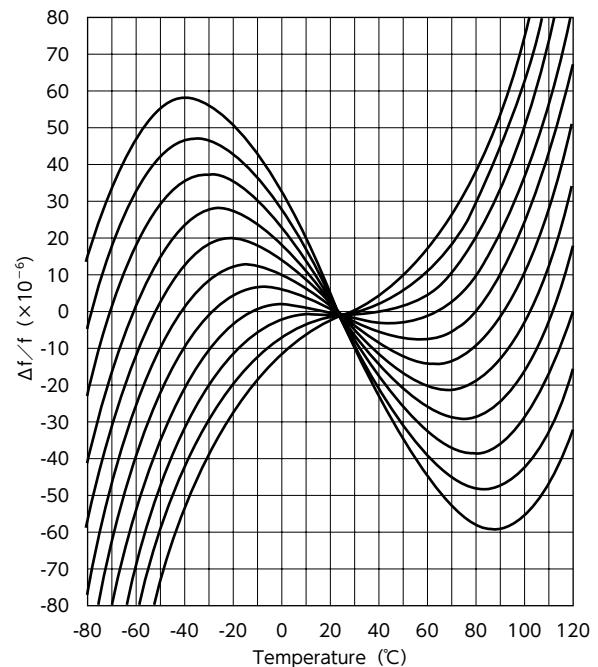
Regarding inquiries concerning oscillation circuit and its matching with the ICs you are using, please directly contact our sales department or leave us an e-mail from our website(click "CONTACT US" from the top page → select "TECHNICAL SUPPORT").

# Cut Angle and Frequency Characteristics over Temperature

Temperature Characteristics for Various Cuts

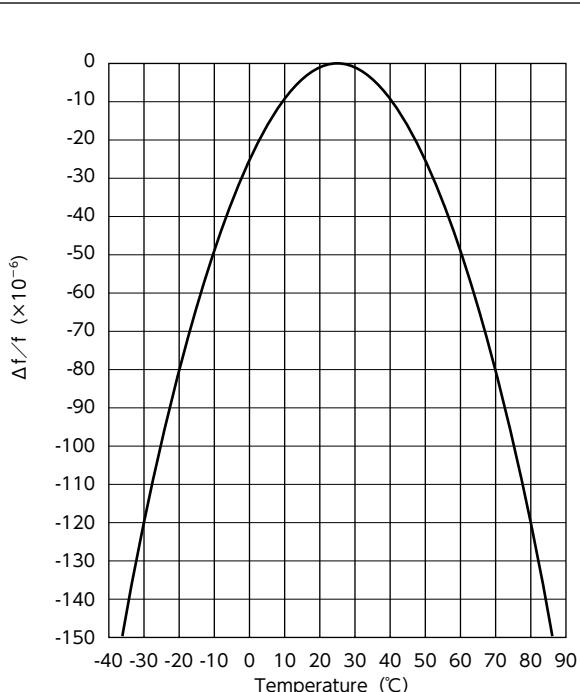


Temperature Characteristics for AT Cuts

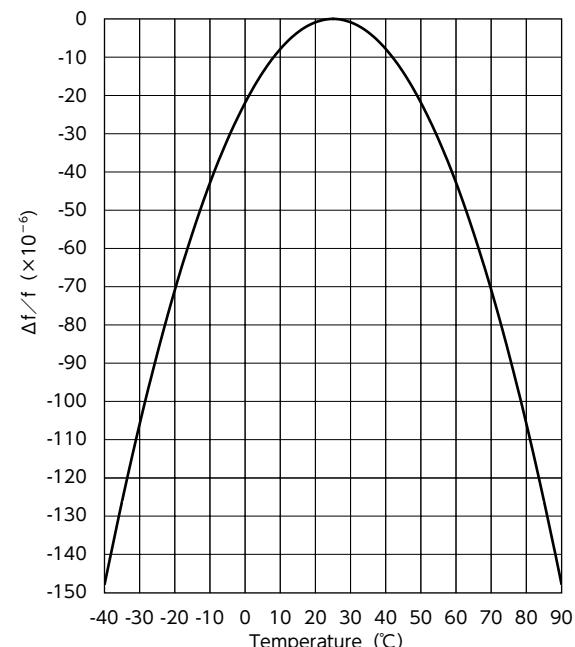


Difference of cutting angle between each temperature curve is 2'.

Temperature Characteristics for BT Cuts



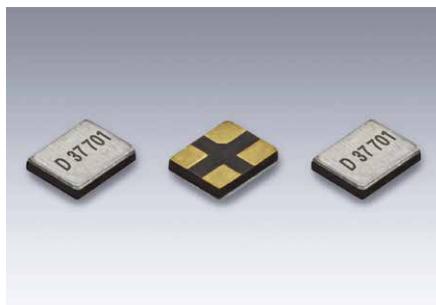
Temperature Characteristics for Tuning Fork Crystal Resonator





# SMD Crystal Resonators / MHz Band Crystal Resonators

## DSX1210A



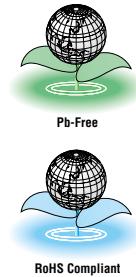
Actual size □

### ■ Features

- 1210 size ultra miniature and lightweight SMD crystal resonator with a low profile of 0.28mm
- High precision and high reliability  
(Frequency aging specification of  $\pm 1 \times 10^{-6}/1$  year or  $\pm 3 \times 10^{-6}/5$  years is available for cell phone or wireless communication systems etc.)
- Allowing for high density surface mounting.

### ■ Applications

- Small mobile devices for next generation such as mobile communications, short-range wireless modules, digital AV equipment and PC.
- Wearable devices



### ■ Standard Specification

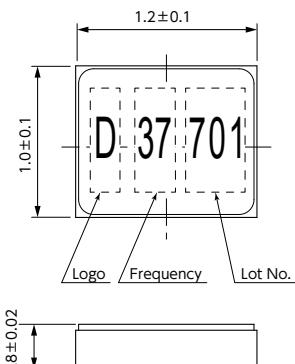
Item	Type	DSX1210A			
Frequency Range	32MHz	37.4MHz / 38.4MHz / 40MHz	48MHz/52MHz	76.8MHz/80MHz/96MHz	
Overtone Order	Fundamental				
Load Capacitance	8pF, 10pF, 12pF				
Drive Level	10μW (100μW max.)				
Frequency Tolerance	$\pm 10 \times 10^{-6}$ , $\pm 20 \times 10^{-6}$ (at 25°C)				
Series Resistance	100Ω max.	60Ω max.	40Ω max.	30Ω max.	
Frequency Characteristics over Temperature	$\pm 12 \times 10^{-6}$ , $\pm 30 \times 10^{-6}$ / -30 to +85°C (Ref. To 25°C)				
Storage Temperature Range	-40 to +85°C				
Packing Unit (1)	3000pcs./reel (φ180)				

(1) Moisture prevention packing is unnecessary.  
Moisture Sensitivity Level: LEVEL1 (IPC/JEDEC J-STD-033)

Consult our sales representative for other specifications.

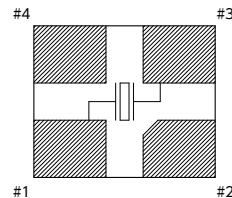
[mm]

### ■ Dimensions



### ■ Internal Connections

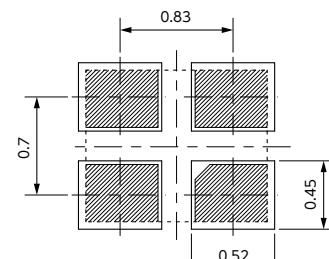
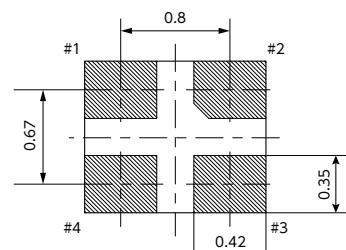
<Top View>



# 1 & # 3 connected to quartz element  
# 2 & # 4 connected to the cover

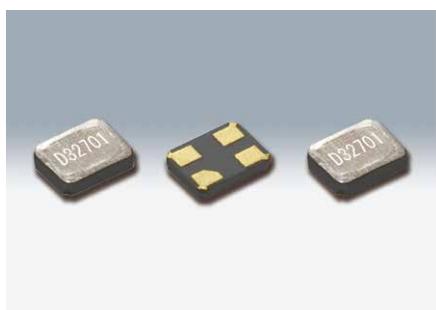
### ■ Recommended Land Pattern

<Top View>



# SMD Crystal Resonators / MHz Band Crystal Resonators

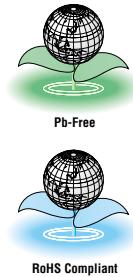
## DSX1612S



Actual size □

### ■ Features

- 1612 size ultra miniature and lightweight SMD crystal resonator with a low profile of 0.35 mm.
- High precision and high reliability  
(Frequency aging specification of  $\pm 1 \times 10^{-6}$ /1 year or  $\pm 3 \times 10^{-6}$ /5 years is available for cell phone or wireless communication systems etc.)
- Allowing for high density surface mounting.



### ■ Applications

- Small mobile devices for next generation such as mobile communications, short-range wireless modules, digital AV equipment and PC.
- Wearable devices

### ■ Standard Specification

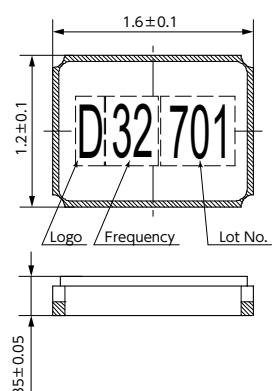
Item	Type	DSX1612S			
Frequency Range		24 to 32MHz	32 to 40MHz	40 to 54MHz	
Overtone Order		Fundamental			
Load Capacitance		8pF, 10pF, 12pF			
Drive Level		10 $\mu$ W (100 $\mu$ W max.)			
Frequency Tolerance		$\pm 10 \times 10^{-6}$ , $\pm 20 \times 10^{-6}$ (at 25°C)			
Series Resistance		100 $\Omega$ max.	50 $\Omega$ max.		
Frequency Characteristics over Temperature		$\pm 15 \times 10^{-6}$ , $\pm 30 \times 10^{-6}$ / -30 to +85°C (Ref. To 25°C)			
Storage Temperature Range		-40 to +85°C			
Packing Unit (1)		3000pcs./reel ( $\phi$ 180)			

(1) Moisture prevention packing is unnecessary.  
Moisture Sensitivity Level: LEVEL1 (IPC/JEDEC J-STD-033)

Consult our sales representative for other specifications.

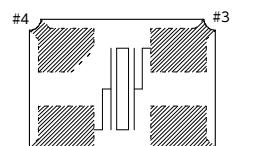
[mm]

### ■ Dimensions



### ■ Internal Connections

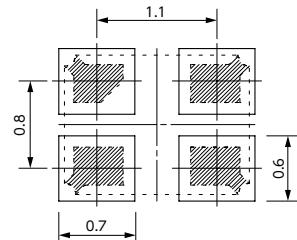
〈Top View〉



#1 & #3 connected to quartz element  
#2 connected to the cover  
#4 open (unconnected)  
#2 & #4 recommended GND connection

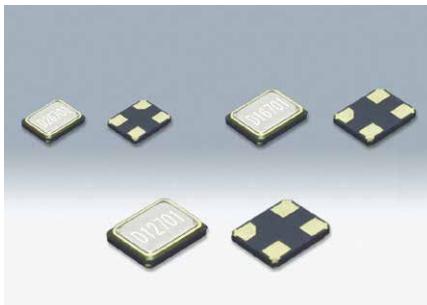
### ■ Recommended Land Pattern

〈Top View〉



# SMD Crystal Resonators / MHz Band Crystal Resonators

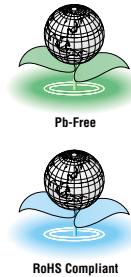
## DSX211S/DSX211SH/DSX221SH/DSX321SH



Actual size DSX211S/SH □ DSX221SH □  
DSX321SH □

### ■ Features

- Miniature and lightweight SMD crystal resonator  
DSX211S/SH : 2016 size 0.45mm height  
DSX221SH : 2520 size 0.45mm height  
DSX321SH : 3225 size 0.65mm height
- Excellent heat resistance, High precision and high reliability
- Offers a wide range of frequencies  
DSX211S : 76.8MHz, 80MHz, 96MHz  
DSX211SH : 16MHz to 60MHz  
DSX221SH : 16MHz to 54MHz  
DSX321SH : 12MHz to 50MHz
- AEC-Q200 Compliant (except for DSX211S)
- Frequency Characteristics over Temperature  
 $\pm 50 \times 10^{-6}$  / -40 to +105°C is available for Industrial Equipment.



### ■ Applications

- Telecommunication products, short-range wireless modules and other small devices such as DVC, DSC, PC.
- Automotive applications such as multimedia devices (AEC-Q200 Compliant).
- Industrial equipment

### ■ Standard Specification

Item	Type	DSX211SH	DSX211S	DSX221SH		DSX321SH		
Frequency Range		16 to 30MHz	30 to 60MHz	76.8MHz/80MHz/96MHz	12 to 24MHz	24 to 30MHz	30 to 54MHz	12 to 20MHz
Overtone Order		Fundamental						
Load Capacitance		8pF, 10pF, 12pF						
Drive Level		10μW (100μW max.)	10μW (400μW max.)				10μW (200μW max.)	
Frequency Tolerance				$\pm 20 \times 10^{-6}$ (at 25°C)				
Series Resistance		100Ω max.	50Ω max.	30Ω max.	120Ω max.	50Ω max.	40Ω max.	80Ω max.
Frequency Characteristics over Temperature				$\pm 30 \times 10^{-6}$ / -30 to +85°C (Ref. to 25°C)				
Storage Temperature Range				-40 to +85°C				
Packing Unit (1)				3000pcs./reel(Φ180)				

(1) Moisture prevention packing is unnecessary.

Moisture Sensitivity Level: LEVEL1 (IPC/JEDEC J-STD-033)

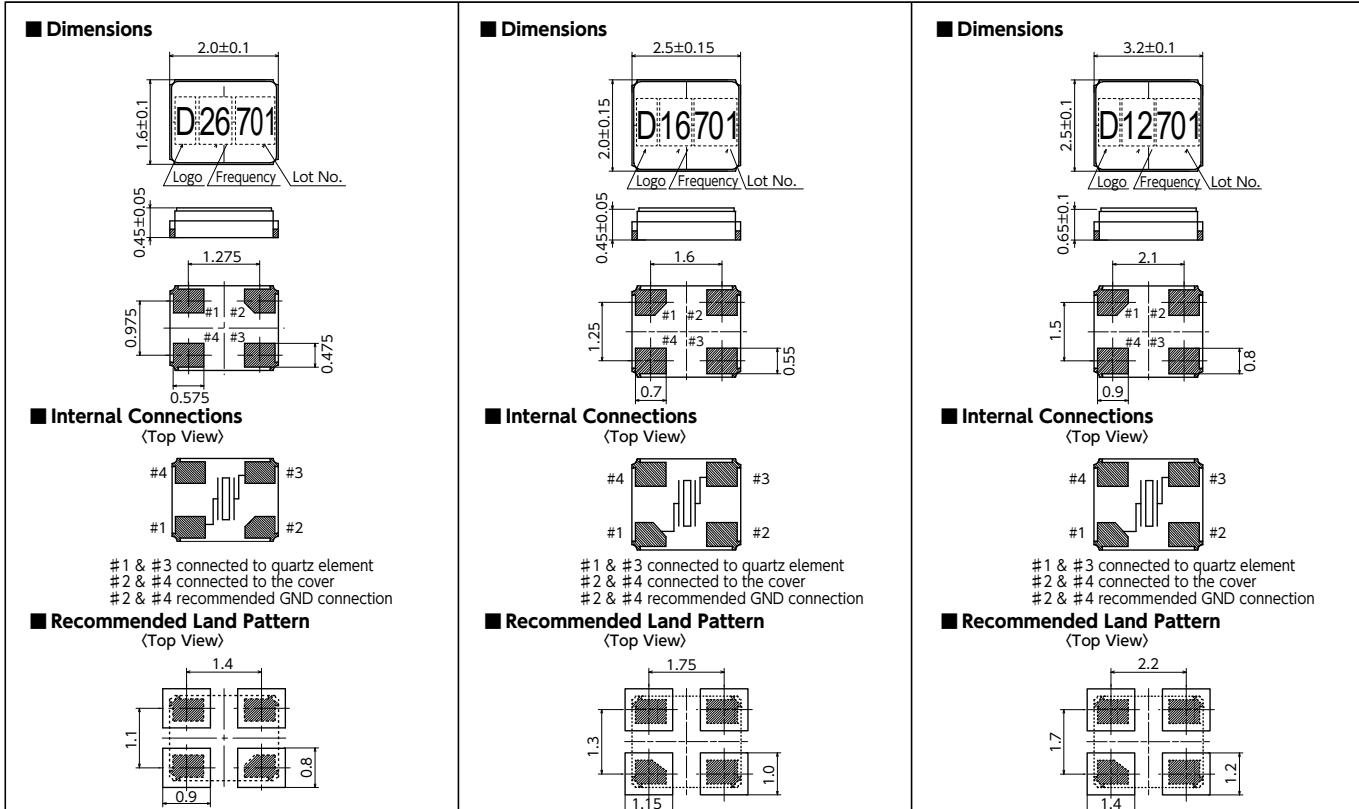
Consult our sales representative for other specifications.

### ■ DSX211S/DSX211SH [mm]

### ■ DSX221SH [mm]

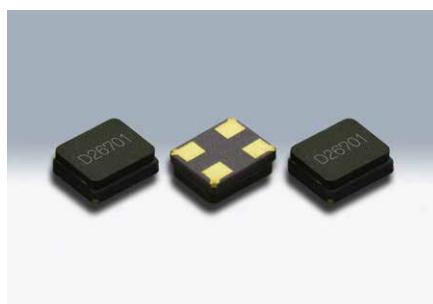
### ■ DSX321SH [mm]

### ■ DSX321SH [mm]



# SMD Crystal Resonators / MHz Band Crystal Resonators

## DSX211G



Actual size □

### ■ Features

- 2016 size miniature and lightweight SMD crystal resonator with a low profile of 0.65mm.
- High precision and high reliability
- Offers a wide range of frequencies from 20MHz up to 64MHz.
- AEC-Q200 Compliant
- Frequency Characteristics over Temperature  $\pm 50 \times 10^{-6}$  / -40 to +105°C is available for Industrial Equipment.



### ■ Applications

- Telecommunication products and other small devices such as DVC, DSC, PC, USB.
- Automotive applications such as multimedia devices (AEC-Q200 Compliant)
- Industrial equipment

### ■ Standard Specification

Item	Type	DSX211G			
Frequency Range		20 to 24MHz	24 to 30MHz	30 to 36MHz	36 to 64MHz
Overtone Order		Fundamental			
Load Capacitance		8pF, 10pF, 12pF			
Drive Level		10μW (100μW max.)			
Frequency Tolerance		$\pm 20 \times 10^{-6}$ (at 25°C)			
Series Resistance		200Ω max.	150Ω max.	120Ω max.	80Ω max.
Frequency Characteristics over Temperature		$\pm 30 \times 10^{-6}$ / -30 to +85°C (Ref. to 25°C)			
Storage Temperature Range		-40 to +85°C			
Packing Unit (1)		3000pcs./reel (φ180)			

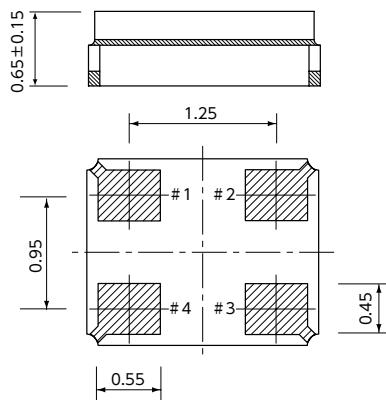
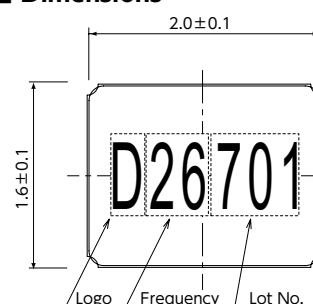
(1) Moisture prevention packing is unnecessary.

Moisture Sensitivity Level: LEVEL1 (IPC/JEDEC J-STD-033)

Consult our sales representative for other specifications.

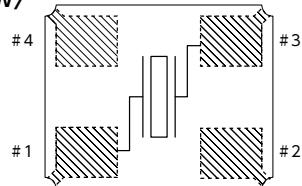
[mm]

### ■ Dimensions



### ■ Internal Connections

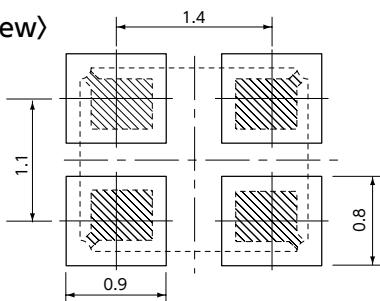
#### ⟨Top View⟩



#1 & #3 connected to quartz element  
#2 & #4 GND connected or N.C. available

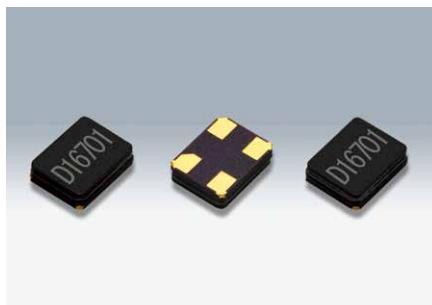
### ■ Recommended Land Pattern

#### ⟨Top View⟩



# SMD Crystal Resonators / MHz Band Crystal Resonators

## DSX321G



Actual size

### ■ Features

- 3225 size miniature and lightweight SMD crystal resonator.  
Height DSX321G (over 12MHz): 0.75mm  
DSX321G (12MHz or under): 0.85mm
- Excellent heat resistance, High precision and high reliability  
(Frequency aging specification of  $\pm 1 \times 10^{-6} / 1$  year or  $\pm 3 \times 10^{-6} / 5$  years is available for cell phone or wireless communication systems etc.)
- Offers a wide range of frequencies from 7.9MHz up to 64MHz.
- AEC-Q200 Compliant
- Frequency Characteristics over Temperature  
 $\pm 50 \times 10^{-6} / -40$  to  $+105^\circ\text{C}$  is available for Industrial Equipment.



RoHS Compliant

### ■ Applications

- Telecommunication products, short-range wireless modules and other small devices such as DVC, DSC, PC.
- Automotive applications such as Bluetooth, wireless LAN, GPS/GNSS, RKE (Remote Keyless Entry), safety controls and multimedia devices (AEC-Q200 Compliant)
- Industrial equipment

### ■ Standard Specification

Item	Type	DSX321G						
Frequency Range		7.9 to 9MHz   9 to 9.8MHz   9.8 to 11MHz   11 to 12MHz   12 to 20MHz   20 to 27MHz   27 to 64MHz						
Overtone Order		Fundamental						
Load Capacitance		8pF, 10pF, 12pF						
Drive Level		10μW (200μW max.)						
Frequency Tolerance		$\pm 20 \times 10^{-6}$ (at 25°C)						
Series Resistance		400Ω max.	300Ω max.	150Ω max.	100Ω max.	80Ω max.	60Ω max.	50Ω max.
Frequency Characteristics over Temperature		$\pm 30 \times 10^{-6} / -30$ to $+85^\circ\text{C}$ (Ref. to 25°C)						
Storage Temperature Range		$-40$ to $+85^\circ\text{C}$						
Packing Unit (1)		3000pcs./reel ( $\phi 180$ )						

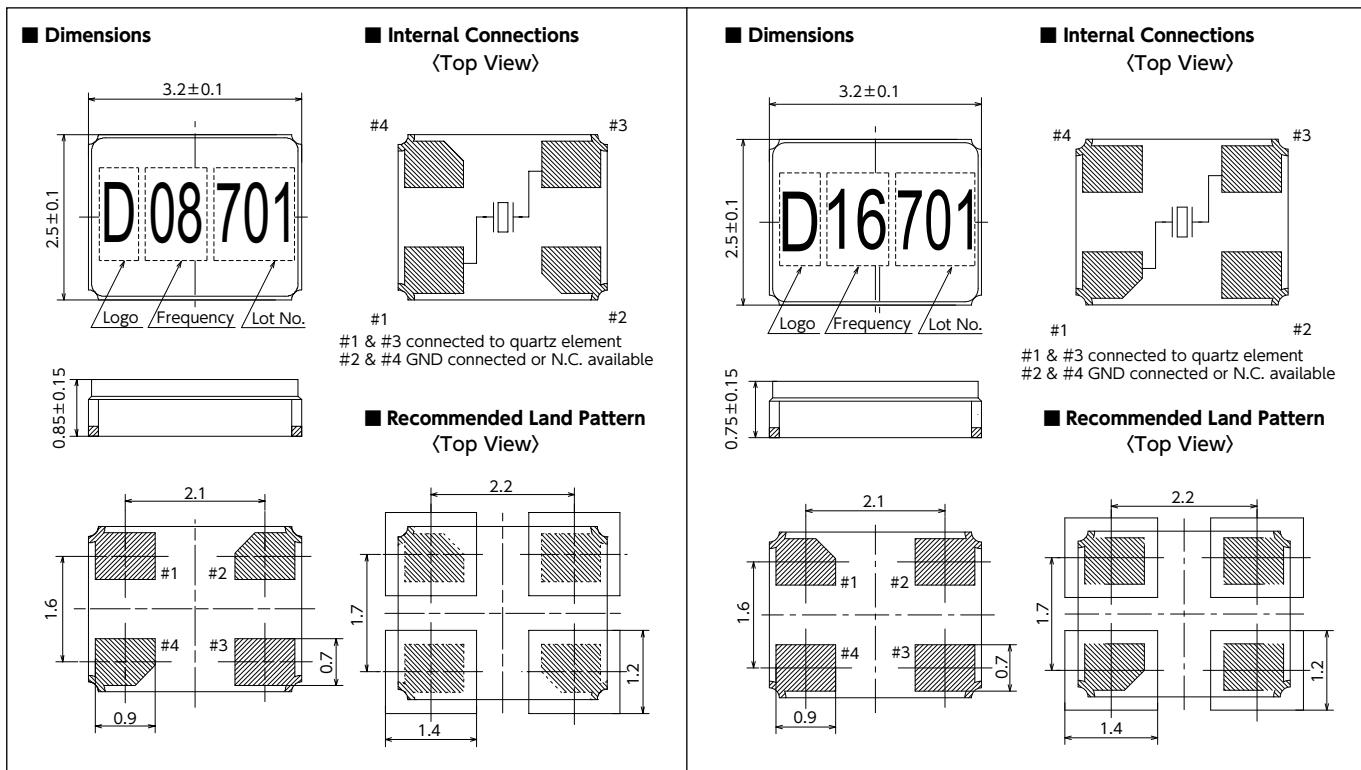
(1) Moisture prevention packing is unnecessary.

Moisture Sensitivity Level: LEVEL1 (IPC/JEDEC J-STD-033)

Consult our sales representative for other specifications.

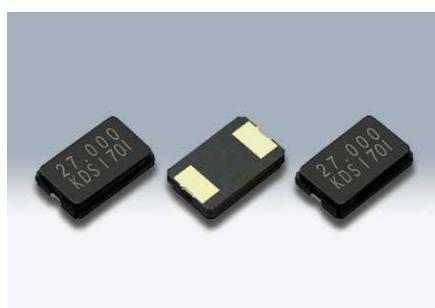
### ■ DSX321G (12MHz or under)

### ■ DSX321G (over 12MHz)



# SMD Crystal Resonators / MHz Band Crystal Resonators

## DSX530GA



Actual size 



### ■ Features

- 5032 size miniature SMD crystal resonator with a low profile of 1.0mm.
- Excellent heat resistance, high precision, and high reliability.
- Offers a wide range of frequencies from 7MHz up to 80MHz.
- AEC-Q200 Compliant

### ■ Applications

- Suitable for car navigation systems, digital AV equipment as well as many other applications.

### ■ Standard Specification

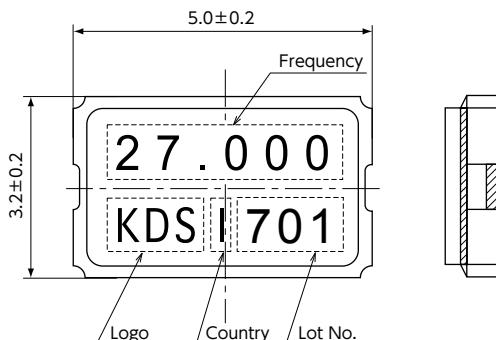
Item	Type	DSX530GA				
Frequency Range		7 to 9MHz	9 to 12MHz	12 to 40MHz		
Overtone Order	Fundamental					
Load Capacitance	8pF, 10pF, 12pF					
Drive Level	10μW (300μW max.)					
Frequency Tolerance	±30×10 <sup>-6</sup> (at 25°C)					
Series Resistance	150Ω max.	100Ω max.	50Ω max.			
Frequency Characteristics over Temperature	±50×10 <sup>-6</sup> / -30 to +85°C (Ref. to 25°C)					
Storage Temperature Range	-40 to +85°C					
Packing Unit (1)	1000pcs./reel (φ180)					

(1) Moisture prevention packing is unnecessary.  
Moisture Sensitivity Level: LEVEL1 (IPC/JEDEC J-STD-033)

Consult our sales representative for other specifications.

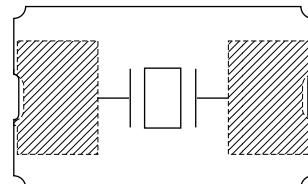
[mm]

### ■ Dimensions

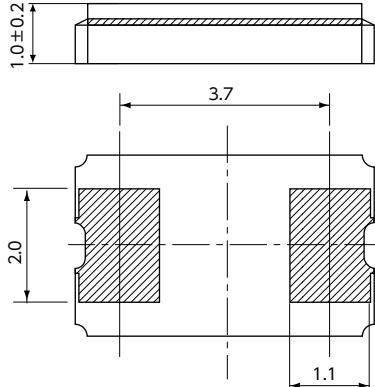


### ■ Internal Connections

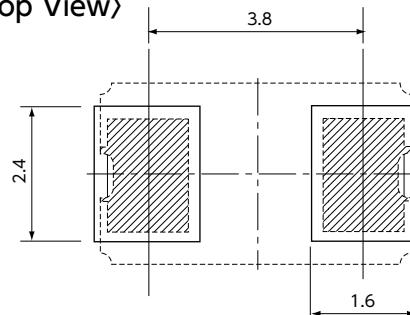
⟨Top View⟩



### ■ Recommended Land Pattern

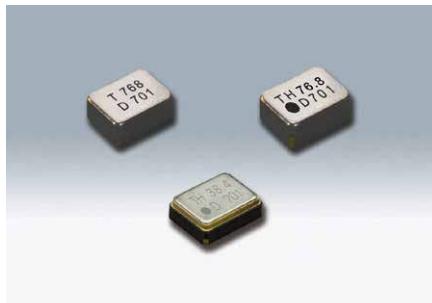


⟨Top View⟩



# SMD Crystal Resonators with dedicated temperature sensor / MHz Band Crystal Resonators

## DSR1210ATH/DSR1612ATH/DSR1612STH

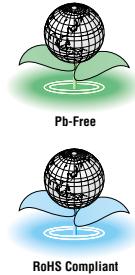


### ■ Features

- DSR1210ATH: 1210size, height 0.45mm
- DSR1612ATH: 1612size, height 0.55mm
- DSR1612STH: 1612size, height 0.6mm
- Built-in NTC thermistor

### ■ Applications

- Mobile phones
- GPS/GNSS
- Wearable devices



Actual size DSR1210ATH □ DSR1612ATH □  
DSR1612STH □

### ■ Standard Specification

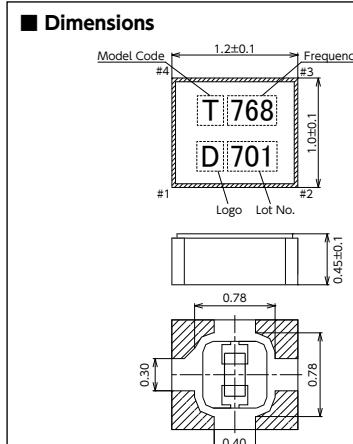
Item	Type	DSR1210ATH	DSR1612ATH	DSR1612STH
Frequency Range		76.8MHz	38.4MHz / 52MHz / 76.8MHz	38.4MHz
Overtone Order			Fundamental	
Load Capacitance			6pF, 7pF, 8pF	
Drive Level			10μW (100μW max.)	
Frequency Tolerance			±10×10 <sup>-6</sup> (at 25°C)	
Series Resistance			80Ω max.	
Frequency Characteristics over Temperature			±12×10 <sup>-6</sup> / -30 to +85 °C	
Storage Temperature Range			-40 to +125 °C	
Thermistor Resistance		100kΩ (at +25°C)	22kΩ / 100kΩ(at +25°C )	
Thermistor B-constant		4250K (+25°C to +50°C)	3380K / 4250K(+25°C to +50°C )	
Packing Unit (1)			3000pcs./reel (φ 180)	

(1) Moisture prevention packing is unnecessary.

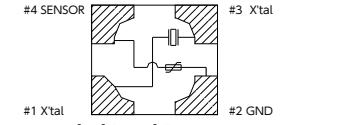
Moisture Sensitivity Level : LEVEL 1(IPC/JEDEC J-STD-033)

Consult our sales representative for other specifications.

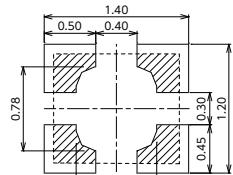
### ■ DSR1210ATH [mm]



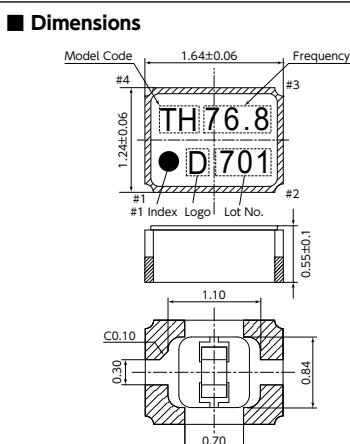
#### ■ Internal Connections



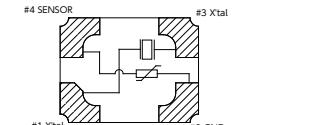
#### ■ Recommended Land Pattern



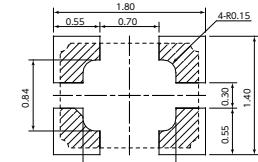
### ■ DSR1612ATH [mm]



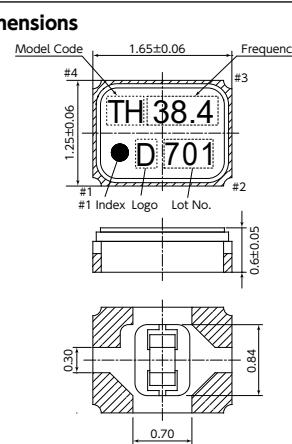
#### ■ Internal Connections



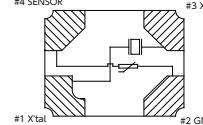
#### ■ Recommended Land Pattern



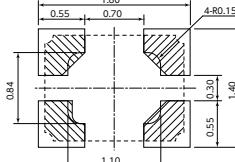
### ■ DSR1612STH [mm]



#### ■ Internal Connections

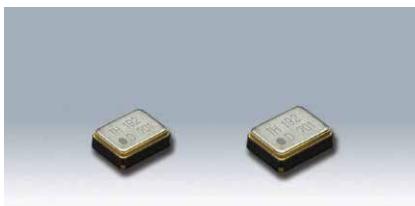


#### ■ Recommended Land Pattern



# SMD Crystal Resonators with dedicated temperature sensor / MHz Band Crystal Resonators

## DSR211STH/DSR221STH



Actual size DSR211STH □ DSR221STH □

### ■ Features

- DSR211STH: 2016size, height 0.7mm (19.2MHz / 26MHz)  
0.6mm (38.4MHz)
- DSR221STH: 2520size height 0.9mm
- Built-in NTC thermistor

### ■ Applications

- Mobile phones
- GPS/GNSS
- Wearable devices
- UWB



### ■ Standard Specification

Item	Type	DSR211STH	DSR221STH
Frequency Range		19.2MHz / 26MHz / 38.4MHz / 55.2MHz	19.2MHz/26MHz
Overtone Order			Fundamental
Load Capacitance			6pF, 7pF, 8pF
Drive Level			10μW (100μW max.)
Frequency Tolerance			±10×10 <sup>-6</sup> (at 25°C)
Series Resistance			80Ω max.
Frequency Characteristics over Temperature			±12×10 <sup>-6</sup> / -30 to +85 °C
Storage Temperature Range			-40 to +125 °C
Thermistor Resistance			10kΩ / 22kΩ / 100kΩ (at +25°C)
Thermistor B-constant			3435K (+25 to +85°C) / 3380K / 4250K (+25 to +50°C)
Packing Unit (1)			3000pcs./reel (φ180)

(1) Moisture prevention packing is unnecessary.

Moisture Sensitivity Level : LEVEL 1(IPC/JEDEC J-STD-033)

Consult our sales representative for other specifications.

### ■ DSR211STH

[mm]

### ■ DSR221STH

[mm]

#### ■ Dimensions

**DSR211STH Dimensions:**  
 Top View: Model Code (2.0±0.1), Frequency (1.6±0.1), #1 Index (1.6±0.1), Logo (1.6±0.1), Lot No. (1.6±0.1). Bottom View: 0.475, 0.475, 0.975, 1.375, 0.475, 0.475.  
**DSR221STH Dimensions:**  
 Top View: Model Code (2.5±0.15), Frequency (2.0±0.15), #1 Index (2.0±0.15), Logo (2.0±0.15), Lot No. (2.0±0.15). Bottom View: 0.65, 0.65, 1.25, 1.65, 0.65, 0.65.

#### ■ Internal Connections

<Top View>

#4 SENSOR, #3 Xtal, #2 GND, #1 Xtal.

#### ■ Recommended Land Pattern

<Top View>

0.75, 0.46, 0.46, 0.75, 2.20, 180, R0.20.

#### ■ Dimensions

**DSR221STH Dimensions:**  
 Top View: Model Code (2.5±0.15), Frequency (2.0±0.15), #1 Index (2.0±0.15), Logo (2.0±0.15), Lot No. (2.0±0.15). Bottom View: 0.65, 0.65, 1.25, 1.65, 0.65, 0.65.

#### ■ Internal Connections

<Top View>

#4 SENSOR, #3 Xtal, #2 GND, #1 Xtal.

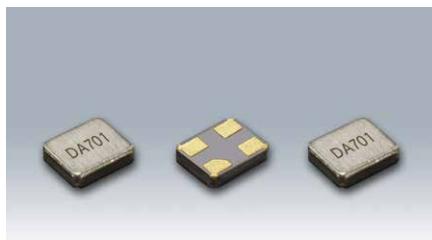
#### ■ Recommended Land Pattern

<Top View>

0.85, 1.95, 0.95, 1.55, 2.20.

# SMD Tuning Fork Crystal Resonators / kHz Band Crystal Resonators

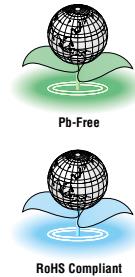
## DST1210A



Actual size □

### ■ Features

- 1210 size ultra miniature SMD tuning fork crystal resonator with a low profile of 0.3mm
- A ceramic package with a metal lid providing high precision and reliability.
- Suitable for mobile communications and consumer devices.
- Metal lid connected to GND terminal to reduce EMI.



### ■ Applications

- Mobile communications and consumer devices, etc.
- Smart card and Wearable devices

### ■ Standard Specification

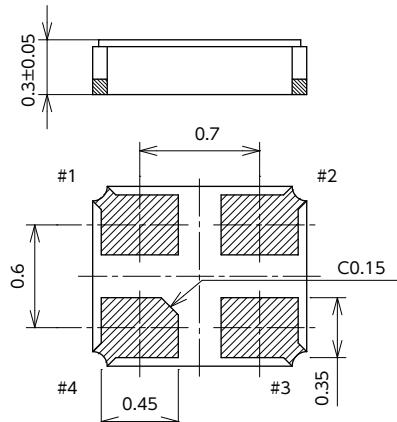
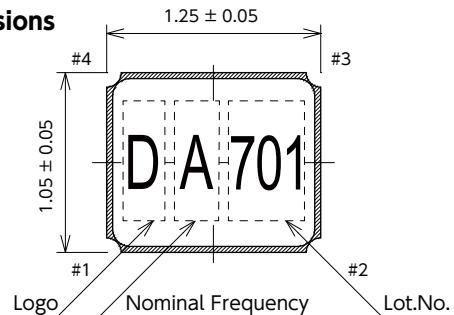
Item	Type	DST1210A
Frequency Range		32.768kHz
Load Capacitance		7pF, 9pF, 12.5pF
Drive Level		0.1 $\mu$ W (0.2 $\mu$ W max.)
Frequency Tolerance		$\pm 20 \times 10^{-6}$ (at 25°C)
Series Resistance		80k $\Omega$ max.
Turnover Temperature		+25°C ± 5°C
Parabolic Coefficient		-0.04×10 <sup>-6</sup> /°C <sup>2</sup> max.
Operating Temperature Range		-40 to +85°C
Storage Temperature Range		-40 to +85°C
Shunt Capacitance		1.0pF typ.
Packing Unit (1)		3000pcs/reel ( $\phi$ 180)

(1) Moisture prevention packing is unnecessary.  
Moisture Sensitivity Level : LEVEL 1(IPC/JEDEC J-STD-033)

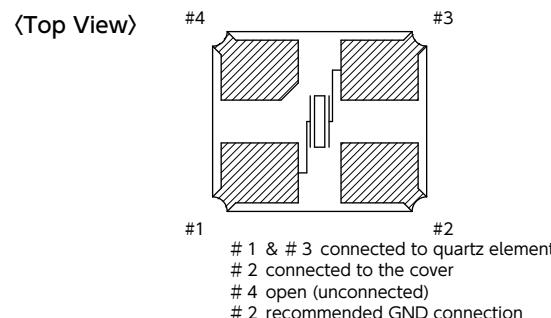
Consult our sales representative for other specifications.

[mm]

### ■ Dimensions



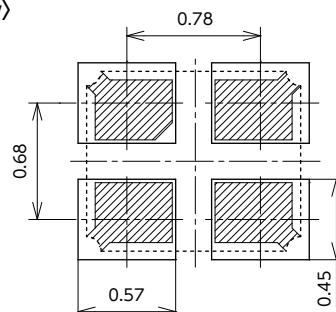
### ■ Internal Connections



#1 & #3 connected to quartz element  
#2 connected to the cover  
#4 open (unconnected)  
#2 recommended GND connection

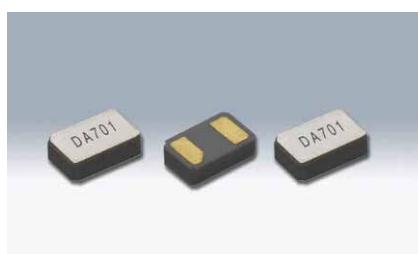
### ■ Recommended Land Pattern

Top View

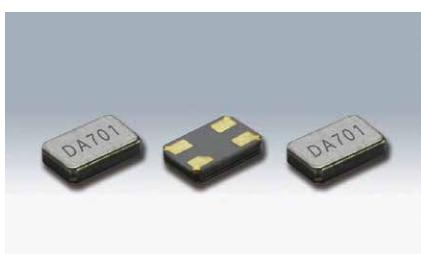


# SMD Tuning Fork Crystal Resonators / kHz Band Crystal Resonators

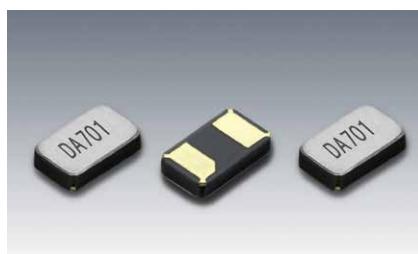
## DST1610A/DST1610AL/DST210AC



DST1610A



Actual size □ DST1610AL

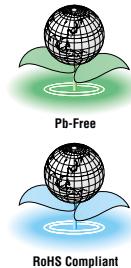


DST210AC

Actual size □

### ■ Features

- Ultra miniature SMD tuning fork crystal resonator
- DST1610A: 1610size height 0.45mm
- DST1610AL: 1610size height 0.3mm
- DST210AC: 2012size height 0.5mm
- A ceramic package with a metal lid providing high precision and reliability.
- Series Resistance 50kΩ max. available (DST1610A).
- Metal lid connected to GND terminal to reduce EMI (DST1610AL).
- Suitable for mobile communications and consumer devices.
- AEC-Q200 Compliant (DST210AC)



### ■ Applications

- Mobile communications and consumer devices, etc.
- Smart card and Wearable devices (DST1610AL).

### ■ Standard Specification

Item	Type	DST1610A	DST1610AL	DST210AC
Frequency Range			32.768kHz	
Load Capacitance			4pF, 6pF, 7pF, 9pF, 12.5pF	
Drive Level			0.1 μW (0.5 μW max.)	
Frequency Tolerance			±20×10 <sup>-6</sup> (at 25°C)	
Series Resistance	50kΩ max.		80kΩ max.	
Turnover Temperature			+25°C±5°C	
Parabolic Coefficient			-0.04×10 <sup>-6</sup> /°C <sup>2</sup> max.	
Operating Temperature Range			-40 to +85°C	
Storage Temperature Range			-40 to +85°C	
Shunt Capacitance	1.6pF typ.	1.3pF typ.	1.2pF typ.	1.3pF typ.
Packing Unit (1)			3000pcs/reel (φ 180)	

(1) Moisture prevention packing is unnecessary.

Moisture Sensitivity Level : LEVEL 1(IPC/JEDEC J-STD-033)

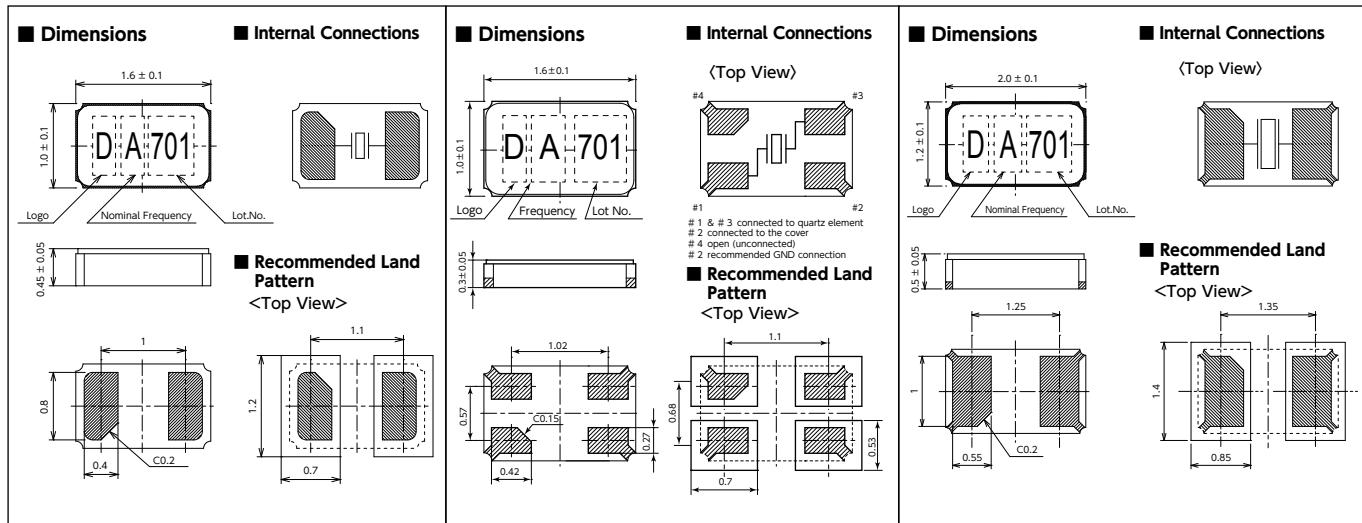
Consult our sales representative for other specifications.

### ■ DST1610A

[mm] ■ DST1610AL

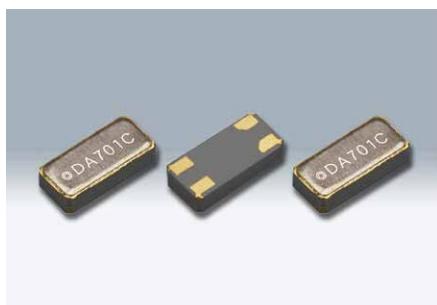
[mm] ■ DST210AC

[mm]



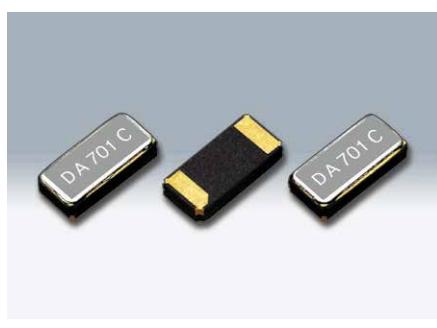
# SMD Tuning Fork Crystal Resonators / kHz Band Crystal Resonators

## DST311S/DST310S



DST311S

Actual size

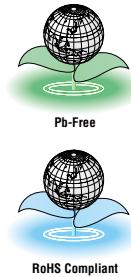


DST310S

Actual size

### ■ Features

- 3215 size miniature and lightweight SMD tuning fork crystal resonator with a low profile of 0.75mm.
- A ceramic package with a metal lid providing high precision and reliability.
- Metal lid connected to GND terminal to reduce EMI (DST311S).
- Noise sensitive applications (smart meter etc.) (DST311S).
- Series Resistance 50kΩ max. available.
- AEC-Q200 Compliant (DST310S)



### ■ Applications

- Mobile communications, radio-controlled clock, digital home appliances.
- Automotive applications such as multimedia devices (AEC-Q200 Compliant).

### ■ Standard Specification

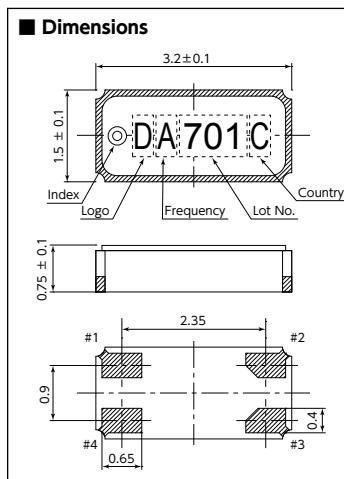
Item	Type	DST311S	DST310S
Frequency Range		32.768kHz	
Load Capacitance		7pF, 9pF, 12.5pF	
Drive Level		0.2μW (1.0μW max.)	
Frequency Tolerance		±20×10 <sup>-6</sup> (at 25°C)	
Series Resistance		50kΩ max.	
Turnover Temperature		+25°C±5°C	
Parabolic Coefficient		-0.04×10 <sup>-6</sup> /°C <sup>2</sup> max.	
Operating Temperature Range		-40 to +85°C	
Storage Temperature Range		-40 to +85°C	
Shunt Capacitance		0.9pF typ.	1.3pF typ.
Packing Unit (1)		3000pcs./reel (φ180)	

(1) Moisture prevention packing is unnecessary.

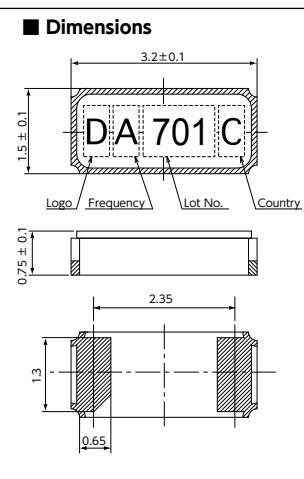
Moisture Sensitivity Level : LEVEL 1(IPC/JEDEC J-STD-033)

Consult our sales representative for other specifications.

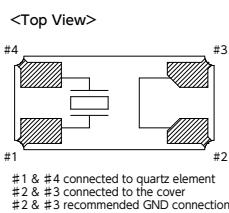
### ■ DST311S



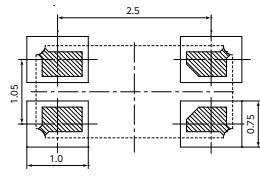
### ■ DST310S



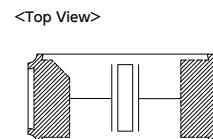
#### ■ Internal Connections



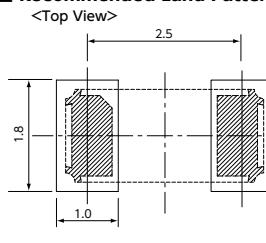
#### ■ Recommended Land Pattern



#### ■ Internal Connections



#### ■ Recommended Land Pattern



# SMD Tuning Fork Crystal Resonators / kHz Band Crystal Resonators

## DMX-26S



Actual size 

### ■ Features

- Plastic molded SMD tuning fork crystal of heat-resistance DT-26 and DT-261
- Automatic mounting and reflow soldering applicable.
- Suitable for digital AV equipment, PC, gaming equipment as well as many other applications.
- AEC-Q200 Compliant



### ■ Standard Specification

Item	Type	DMX-26S
Frequency Range		32.768kHz (30 to 90kHz)
Load Capacitance		7pF, 9pF, 12.5pF
Drive Level		1.0 $\mu$ W (2.0 $\mu$ W max.)
Frequency Tolerance		$\pm 20 \times 10^{-6}$ (at 25°C)
Series Resistance		50k $\Omega$ max. (1)
Turnover Temperature		+25°C±5°C (1)
Parabolic Coefficient		-0.04×10 <sup>-6</sup> /°C <sup>2</sup> max.
Operating Temperature Range		-40 to +85°C
Storage Temperature Range		-40 to +85°C
Shunt Capacitance		1.25pF typ. (1)
Packing Unit (2)		2500pcs./reel ( $\phi$ 330)

(1) custom specification will be provided for the frequency other than 32.768kHz.

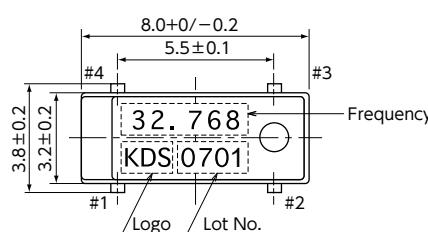
(2) Moisture prevention packing is unnecessary.

Moisture Sensitivity Level : LEVEL 1(IPC/JEDEC J-STD-033)

Consult our sales representative for other specifications.

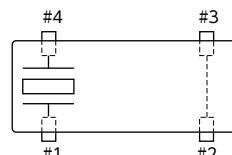
[mm]

### ■ Dimensions



### ■ Internal Connections

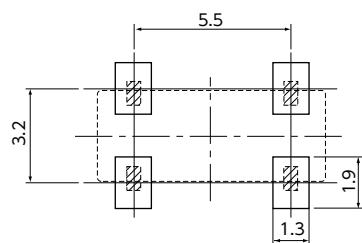
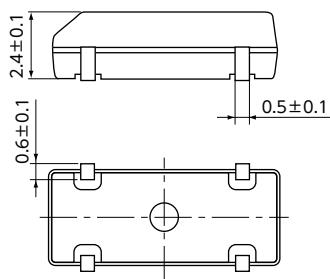
<Top View>



#2 & #3 open (unconnected)

### ■ Recommended Land Pattern

<Top View>

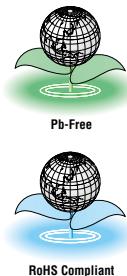


# Tuning Fork Crystal Resonators / kHz Band Crystal Resonators

## DT-38, DT-381/DT-26, DT-261



Low power consuming tuning fork crystal resonators are suitable not only for wristwatches but also for a wide range of other applications from industrial equipment to the clock functions in consumer and household electronics.



### ■ Features

- A cylindrical type tuning fork crystal resonator

### ■ Standard Specification

Item	Type	DT-38	DT-381	DT-26	DT-261
Frequency Range		32.768kHz	20 to 90kHz	32.768kHz	28 to 90kHz
Load Capacitance			12.5pF (1)		
Drive Level				1.0μW (2.0μW max.)	
Frequency Tolerance					±20×10 <sup>-6</sup> (at 25°C)
Series Resistance		30kΩ max. (2)			40kΩ max. (2)
Turnover Temperature				+25°C±5°C	
Parabolic Coefficient					-0.04×10 <sup>-6</sup> /C <sup>2</sup> max.
Operating Temperature Range					-10 to +60°C
Storage Temperature Range					-20 to +70°C
Shunt Capacitance		1.3pF typ.	(2)	1.1pF typ.	(2)

(1) Other capacitance value is available upon your request.

(2) Upon customer request.

(3) Moisture prevention packing is unnecessary.

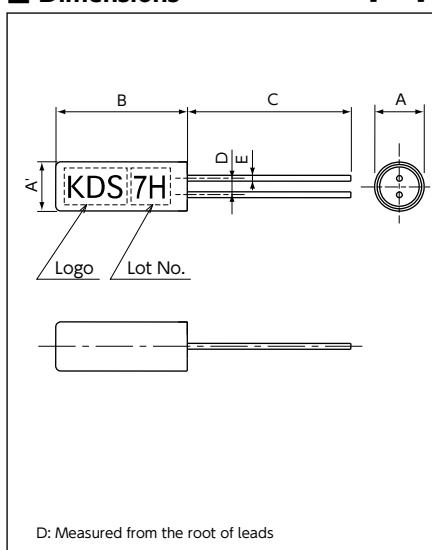
Moisture Sensitivity Level : LEVEL 1(IPC/JEDEC J-STD-033)

Consult our sales representative for other specifications.

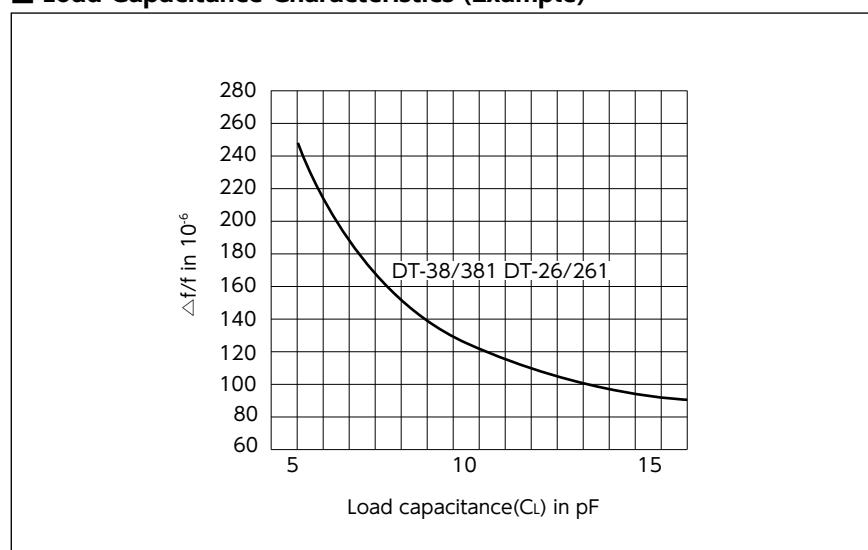
### ■ Dimensions[mm]

Type	A'	A	B	C	D	E
DT-38, DT-381	φ3.0	φ3.0 <sup>+0.1</sup> <sub>-0.2</sub>	8.0 <sup>+0.3</sup> <sub>-0.2</sub>	10.0±1.0	1.1±0.2	φ0.35±0.07
DT-26, DT-261	φ2.0	φ2.0 <sup>+0</sup> <sub>-0.2</sub>	6.0 <sup>+0.1</sup> <sub>-0.2</sub>	7.5±1.0	0.7±0.2	φ0.28±0.05

### ■ Dimensions



### ■ Load Capacitance Characteristics (Example)



# MEMO

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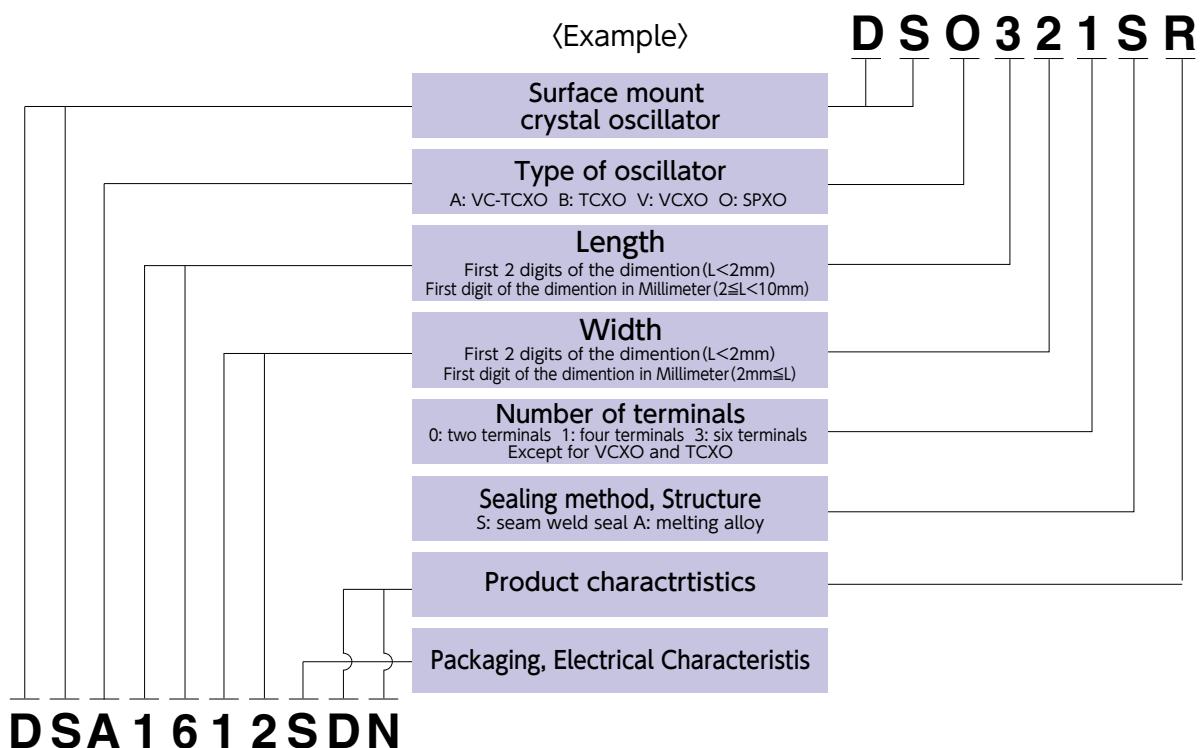
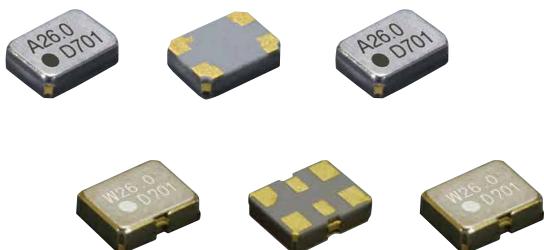
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# Quartz Devices

## Crystal oscillators



# Selection Guide



Scan the QR code to check the table of contents page of our web site "Crystal Oscillators" (URL: <https://www.kds.info/class/2-l-co/>).

Icons

**VC** Voltage Control Function **Stb** Stand-by Function

**CE** Consumer Equipment **IE** Industrial Equipment **TC** Mobile Phone, Wireless Communication **AE** Automotive Electronics

## Temperature Compensated Crystal Oscillators (TCXO/VC-TCXO)

Type	Actual Size	Size (mm)			Output	Frequency Range (MHz)	Frequency Characteristics over Temperature ( $\times 10^{-6}$ )	Operating Temperature Range (°C)	Supply Voltage (V)	Function	Recommended Application	Catalog Page
		L	W	H (max.)								
DSA1612SDN	□	1.6	1.2	0.55	CS	16 to 60	$\pm 1.0$ $\pm 0.5$	-40 to +85	+1.68 to +3.5	VC	IE TC	38, 39
DSB1612SDN				0.45		26, 38.4, 52	$\pm 0.5$				AE	76, 77
DSB1612WA				0.55		24 to 104					IE TC	37
DSB1612WEB						12.288 to 52	$\pm 1.0$ $\pm 0.5$		+1.68 to +3.63	Stb	TC	40
DSA211SDN		2.0	1.6	0.8		9.6 to 52	$\pm 0.5$		+1.68 to +3.5	VC	IE TC	38, 39
DSB211SDN		2.5	2.0	0.9			$\pm 1.0$ $\pm 0.5$			VC	AE	76, 77
DSA221SDN	■	2.5	2.0	1.0			$\pm 0.5$			VC	IE TC	38, 39
DSB221SDN						13 to 52	$\pm 1.0$ $\pm 0.5$		+1.68 to +3.5	VC	AE	76, 77
DSA321SDN						12.288 to 52	$\pm 0.5$			VC	IE TC AE	42, 79
DSB321SDN		3.2	2.5	1.0		10 to 52	$\pm 0.5$			VC	IE TC	42
DSB211JA		2.0	1.6	0.8	CMOS	13 to 52	$\pm 5.0$	-40 to +105	+1.7 to +3.6	Stb	IE TC AE	42, 79
DSB221JA		2.5	2.0	0.9	CMOS	13 to 52	$\pm 5.0$	-40 to +105	+1.7 to +3.6	Stb	IE TC	42
DSA211SP	□	2.0	1.6	0.7	CS	12.288 to 52	$\pm 1.0$ $\pm 0.5$	-40 to +105	+1.68 to +3.5	VC	AE	78
DSB211SP										Stb	IE TC	41
DSA535SGA	■	5.0	3.2	1.5	CS or CMOS	10 to 52	$\pm 0.1$	-40 to +85	+2.3 to +3.63	VC Stb	IE TC	41
DSB535SGA										Stb	IE TC	

## Clock Oscillators (SPXO)

Type	Actual Size	Size (mm)			Output	Frequency Range (MHz)	Frequency Tolerance ( $\times 10^{-6}$ ) (Includes frequency tolerance at room temperature.)	Operating Temperature Range (°C)	Supply Voltage (V)	Current Consumption (mA)	Recommended Application	Catalog Page
		L	W	H (max.)								
DS1008JN	□	1.05	0.85	0.24	CMOS	1.0 to 100	$\pm 50$	-40 to +125	+0.8 to +1.6	1.9	CE TC	8
DS1008JS	□	1.05	0.85	0.24	CMOS	1.0 to 100	$\pm 50$	-40 to +125	+1.6 to +3.3	1.8	CE TC	9
DSO1612AR	□	1.6	1.2	0.58	CMOS	0.584375 to 80	$\pm 50$ $\pm 100$	-40 to +85 -40 to +125	+1.6 to +3.6	1.4 to 3.7	CE TC AE	49, 70
DS2016KS	□	2.0	1.6	0.7	CMOS	1 to 100	$\pm 50$	-40 to +125	+1.6 to +3.6	2.1 to 4.9	CE IE	48
DSO221SR	□	2.5	2.0	0.895	CMOS	0.2 to 167	$\pm 50$ $\pm 100$	-40 to +85 -40 to +125	+1.6 to +3.6	1.0 to 8.0 2.5 to 8.0	CE TC AE	50, 51 71
DSO321SR	□	3.2	2.5	1.2								
DSO531SR	■	5.0	3.2	1.2								
DSO751SR	■	7.3	4.9	1.7								
DSO221SBM	□	2.5	2.0	0.895		3.25 to 52	$\pm 50$	-40 to +85 -40 to +125	+5.0	8.0	CE IE	52
DSO321SBM	□	3.2	2.5	1.2						4.0 to 8.0		
DSO531SBM	■	5.0	3.2	1.2						5.0		
DSO751SBM	■	7.3	4.9	1.7						5.0		
DSO211SX	□	2.0	1.6	0.8	CMOS	1.0 to 125	$\pm 50$	-40 to +125	+1.6 to +3.6	1.7 to 10.0	AE	72
DSO221SX	□	2.5	2.0	0.9	CMOS	1.0 to 125	$\pm 50$	-40 to +125	+1.6 to +3.6	1.7 to 10.0	CE TC	53
DSO211SXF	□	2.0	1.6	0.8	CMOS	1.0 to 125	$\pm 50$	-40 to +125	+1.6 to +3.6	1.7 to 10.0	CE TC	53
DSO221SXF	□	2.5	2.0	0.9	CMOS	1.0 to 125	$\pm 50$	-40 to +125	+1.6 to +3.6	1.7 to 10.0	CE TC	55, 74
DSO221SY	□	2.5	2.0	0.895	CMOS	1.049 to 8.5	$\pm 35$ $\pm 50$	-40 to +85	+1.6 to +3.6	0.7	CE TC AE	55, 74
DSO321SY	□	3.2	2.5	1.2	CMOS	1.049 to 8.5	$\pm 50$	-40 to +85	+1.6 to +3.6	0.7	CE TC AE	55, 74
DLO555MBA	—	5.0	4.0	5.0	CMOS	0.75 to 54	$\pm 50$ , $\pm 100$	-10 to +85	+1.6 to +5.5	8.0	IE	59

## Low Phase Noise Crystal Oscillators (SPXO)

Type	Actual Size	Size (mm)			Output	Frequency Range (MHz)	Frequency Tolerance ( $\times 10^{-6}$ ) (Includes frequency tolerance at room temperature.)	Operating Temperature Range (°C)	Supply Voltage (V)	Current Consumption (mA)	Recommended Application	Catalog Page
		L	W	H (max.)								
DSO221SH	□	2.5	2.0	0.895	CMOS	3.5 to 52	$\pm 50$	-40 to +85	+1.6 to +3.6	2.3 to 4.2	CE TC	46
DSO321SH	□	3.2	2.5	1.2	CMOS	20 to 50	$\pm 50$	-40 to +85	+1.62 to +3.6	2.9 to 7.7	CE TC	47
DSO531SHH	■	5.0	3.2	1.2	CMOS	20 to 50	$\pm 50$	-40 to +85	+1.62 to +3.6	2.9 to 7.7	CE TC	47

### Differential Output Crystal Oscillators (SPXO)

Type	Actual Size	Size (mm)			Output	Frequency Range (MHz)	Frequency Tolerance ( $\times 10^{-3}$ ) (Includes frequency tolerance at room temperature.)	Operating Temperature Range (°C)	Supply Voltage (V)	Current Consumption (mA)	Recommended Application	Catalog Page
		L	W	H (max.)								
DS1008JC		1.05	0.85	0.26	HD-LVDS	156.25	$\pm 100$	-40 to +85	+3.3	30		10
DS1008JK					LV-PECL				+2.5, +3.3	45		
DS1008JJ					LVDS					20		
DSO223SD		2.5	2.0	0.95	HCSL	13.5 to 167	$\pm 50$	-40 to +85 -40 to +105	+2.5, +3.3	30		56
DSO223SJ					LVDS					20		
DSO223SK					LV-PECL					45		
DSO323SD		3.2	2.5	1.2	HCSL	13.5 to 212.5 13.5 to 167	$\pm 80$	-40 to +85 -40 to +105	+2.5, +3.3	35		75
DSO323SJ					LVDS					30		
DSO323SK					LV-PECL					50		
DSO533SJ		5.0	3.2	1.2	LVDS	13.5 to 212.5	$\pm 50$	-40 to +85	+2.5, +3.3	20		57
DSO533SK					LV-PECL					50		
DSO753SD		7.3	4.9	1.7	HCSL	13.5 to 212.5	$\pm 50$	-40 to +85	+2.5, +3.3	35		58
DSO753SJ					LVDS					20		
DSO753SK					LV-PECL					50		

### Voltage Controlled Crystal Oscillators (VCXO)

Type	Actual Size	Size (mm)			Output	Frequency Range (MHz)	Frequency Tolerance ( $\times 10^{-3}$ ) (Includes frequency tolerance at room temperature.)	Operating Temperature Range (°C)	Frequency Adjustment Range (MHz)	Supply Voltage (V)	Current Consumption (mA)	Recommended Application	Catalog Page
		L	W	H (max.)									
DSV221SV		2.5	2.0	0.9	CMOS	30.72	$\pm 40$	-30 to +85	$\pm 100$	+3.3	7.0		60
DSV321SV		3.2	2.5	1.2	CMOS	6.75 to 125	$\pm 40$	-30 to +85	$\pm 100$	+2.8, +3.3	3.0 to 12		60

### Oven Controlled Crystal Oscillators (OCXO)

Type	Actual Size	Size (mm)			Output	Frequency Range (MHz)	Frequency Characteristics over Temperature ( $\times 10^{-3}$ )	Operating Temperature Range (°C)	Supply Voltage (V)	Current Consumption (mA)	Tolerance ( $\times 10^{-3}$ )	Aging ( $\times 10^{-3}$ )	Function	Recommended Application	Catalog Page
		L	W	H (max.)											
DC5032AS		5.0	3.2	2.8	CMOS	5 to 100	$\pm 30$	-40 to +85	3.3	400 (Equilibrium)	$\pm 500$	$\pm 1000$			11

### Real Time Clock Module (RTC)/kHz Band TCXO

Type	Actual Size	Size (mm)			Output	Frequency Range (MHz)	Frequency Tolerance ( $\times 10^{-3}$ )	Operating Temperature Range (°C)	Supply Voltage (V)	Current Consumption ( $\mu$ A)	Temperature Compensated Type	Recommended Application	Catalog Page
		L	W	H (max.)									
DD3225TS		3.2	2.5	1.0	CMOS	32.768	$\pm 7.0$	-40 to +105	+1.3 to 5.5	2.9, 4.0	Digital		44, 82
DD3225TR		3.2	2.5	1.0	CMOS	32.768	$\pm 11.5$	-40 to +85	+1.3 to 5.5	2.9, 4.0	Analog		45
DSK1612ATD		1.6	1.2	0.65	CMOS	32.768	$\pm 5.0$	-40 to +85	+1.5 to +3.63	3.2 to 3.5	Digital		43, 80
DSK321STD		3.2	2.5	1.0	CMOS	32.768	$\pm 5.0$	-40 to +85	+1.5 to 3.63	3.2, 3.5	Digital		81

### kHz Band SPXO

Type	Actual Size	Size (mm)			Output	Frequency Range (MHz)	Frequency Tolerance ( $\times 10^{-3}$ ) (Includes frequency tolerance at room temperature.)	Operating Temperature Range (°C)	Supply Voltage (V)	Current Consumption ( $\mu$ A)	Recommended Application	Catalog Page
		L	W	H (max.)								
DSO1612AR (kHz)		1.6	1.2	0.6	CMOS	32.768	$\pm 100$	-40 to +125	+1.6 to +3.6	32		54
DSO221SR (kHz)		2.5	2.0	0.895	CMOS	32.768 to 50	$\pm 100$	-40 to +125	+1.6 to +5.5	65 to 120		73
DSO321SR (kHz)		3.2	2.5	1.2								
DSO221SY (kHz)		2.5	2.0	0.895	CMOS	32.768	$\pm 35$ $\pm 50$	-40 to +85	+1.6 to +3.6	18	 	55
DSO321SY (kHz)		3.2	2.5	1.2								

# Crystal Oscillators

## Description

### ● Simple Packaged Crystal Oscillators (SPXO)

SPXO is an oscillator for clock, which uses crystal resonance to create an electrical signal with a more precise frequency and are suitable for clock signal generators.

### ● Voltage Controlled Crystal Oscillators (VCXO)

These crystal oscillators have a variable-capacitance diode inserted into a SPXO oscillation loop, and enables the oscillation frequency to change by varying the voltage of the external power supply. The temperature characteristic of these oscillators are equivalent to those of the SPXO loop and takes advantage of the good attributes of crystal resonators.

### ● Temperature Compensated Crystal Oscillators (TCXO)

These high-precision crystal oscillators have a built-in circuit that corrects frequency variations resulting from temperature variations of the crystal resonator. It is optimal for applications where small frequency tolerance is required across a wide temperature.

### ● Oven Controlled Crystal Oscillator (OCXO)

OCXO is a super high-precision crystal oscillator with very small frequency variations by a built-in thermostatic bath, to maintain a constant temperature of the crystal resonator.

Available to the frequency reference, such as instruments and infrastructure base stations.

### ● Real Time Clock Module (RTC)

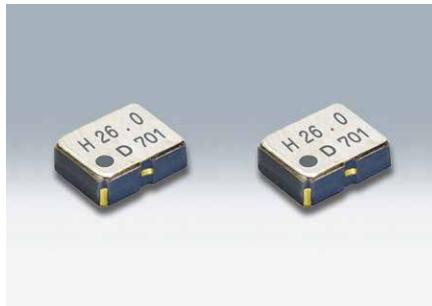
RTC is a high-precision crystal application product with built-in tuning-fork crystal oscillator, has an interrupt function and data provide function necessary for calendar clock function, such as year, month, day, hour, minute and second.

## Terminology

<b>Output Frequency</b>	Nominal value of output frequency of a crystal controlled oscillator.
<b>Frequency Tolerance (Crystal Oscillators)</b>	The maximum permissible deviation of the oscillator frequency from a specified nominal value, when operating under specified condition.
<b>Frequency Characteristics over Temperature (Crystal Oscillators)</b>	Deviation from the frequency at the specified reference temperature due to operation over the specified temperature range, when other conditions remain constant.
<b>Frequency Stability vs. Supply Voltage</b>	Deviation from the frequency at the specified supply voltage due to operation over the specified range, when other conditions remain constant.
<b>Frequency Stability vs. Load Variation</b>	Deviation from the frequency at the specified load conditions due to changes in load impedance over the specified range, when other conditions remain constant.
<b>Frequency Stability vs. Aging</b>	The rate of output frequency change when an oscillator is operated under a specified condition and operating time.
<b>Operating Temperature Range</b>	Temperature range over which the crystal oscillator can be operated within allowable deviation range.
<b>Supply Voltage</b>	The DC input voltage necessary for oscillator operation.
<b>Current Consumption</b>	Operating current consumption.
<b>Stand-by Current</b>	The current consumption, when the oscillator stops oscillating by the control voltage applied to the control pin of an oscillator having the output control function.
<b>Start up Time</b>	The duration from the oscillation start until it reaches the specified output amplitude after power was applied.
<b>Load Condition</b>	Types or the number (capacity) of loads that can be connected to the oscillator.
<b>Output Level</b>	Amplitude of output waveform.
<b>Rise Time</b>	The time interval required for the leading edge of a waveform to change between two defined levels.
<b>Fall Time</b>	The time interval required for the trailing edge of a waveform to change between two defined levels.
<b>Symmetry</b>	The ratio between the time, in which the output voltage is above a specified level, and time in which the output voltage is below the specified level, in percent of the duration of the full signal period.
<b>Output Disable Time</b>	Time lag between control-signal input and oscillation output, where oscillation output is on. Specified for models with output control function.
<b>Output Enable Time</b>	Time lag between control-signal input and oscillation output, with oscillation output switched off (no output load). Specified for models with output control function.
<b>3-state</b>	The situation that the output goes to a high impedance when an oscillator stops oscillating by the standby function.
<b>Phase Noise</b>	The generic designation of the unwanted emission of energy around the nominal frequency generated by an oscillator.
<b>Phase Jitter</b>	The phenomenon when the phase of the pulse wave of the output signal of an oscillator moves back and forth in time from its ideal position. It is called jitter when the frequency fluctuations of the phase in time is over 10Hz.
<b>Harmonics</b>	Unwanted frequency component, which is higher than the desired output frequency of an oscillator.
<b>Frequency Adjustment Range</b>	The output frequency range which can be shifted by the control voltage from outside to VCXOs.
<b>Frequency Control Voltage</b>	The range of input voltage from outside to shift the frequency of VCXOs.

# High-precision SMD TCXO

## DSB1612WA



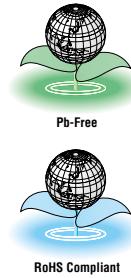
Actual size □

### ■ Features

- H structure
- Low voltage operation
- Low phase noise

### ■ Applications

- Mobile phones
- GPS/GNSS and Industrial radio communications



### ■ Standard Specification

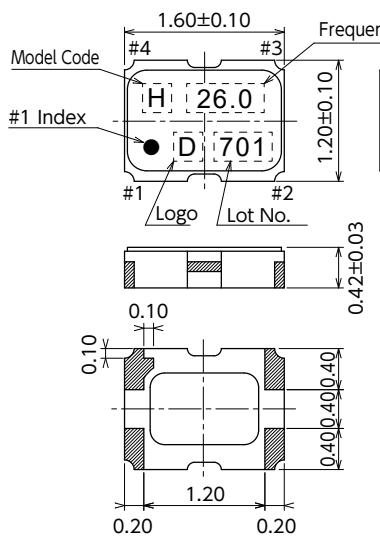
Item	Type	DSB1612WA	
Frequency Range		26MHz/38.4MHz/52MHz	
Standard Frequency		26MHz / 38.4MHz	
Supply Voltage Range		+1.68 to +3.5V	
Supply Voltage (Vcc)		+1.8V/+2.6V/+2.8V/+3.0V/+3.3V	
Current Consumption		+1.5mA max. ( $f \leq 26\text{MHz}$ ) /+2.0mA max. ( $26 < f \leq 52\text{MHz}$ ) /+2.5mA max. ( $f \leq 60\text{MHz}$ )	
Output Level		0.8Vp-p min. ( $f \leq 52\text{MHz}$ ) (Clipped Sinewave/DC-coupled)	
Output Load		10kΩ//10pF	
Frequency Stability			
Tolerance		$\pm 1.5 \times 10^{-6}$ max. (After 2 reflows)	
vs. Temperature		$\pm 0.5 \times 10^{-6}, \pm 2.5 \times 10^{-6}$ max./-30 to +85°C $\pm 0.5 \times 10^{-6}, \pm 2.5 \times 10^{-6}$ max./-40 to +85°C (Option)	
vs. Supply Voltage		$\pm 0.2 \times 10^{-6}$ max. ( $V_{cc} \pm 5\%$ )	
vs. Load Variation		$\pm 0.2 \times 10^{-6}$ max. (10kΩ//10pF±10%)	
vs. Aging		$\pm 1.0 \times 10^{-6}$ max./year	
Start up Time		2.0ms max.	
Phase Noise	[ $f \leq 26\text{MHz}$ ]	[ $26\text{MHz} < f \leq 40\text{MHz}$ ]	[ $40\text{MHz} < f \leq 52\text{MHz}$ ]
Offset 100Hz	-115dBc/Hz	-110dBc/Hz	-105dBc/Hz
Offset 1kHz	-130dBc/Hz	-130dBc/Hz	-125dBc/Hz
Offset 10kHz	-150dBc/Hz	-150dBc/Hz	-145dBc/Hz
Offset 100kHz	-155dBc/Hz	-155dBc/Hz	-150dBc/Hz
Packing Unit (1)		3000pcs./reel (φ180)	

(1) Moisture prevention packing

Consult our sales representative for other specifications.

[mm]

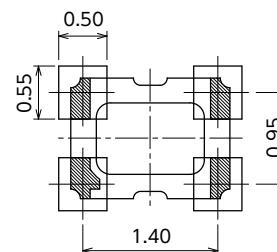
### ■ Dimensions



Pin No.	Connection
#1	GND
#2	GND
#3	Output
#4	Vcc

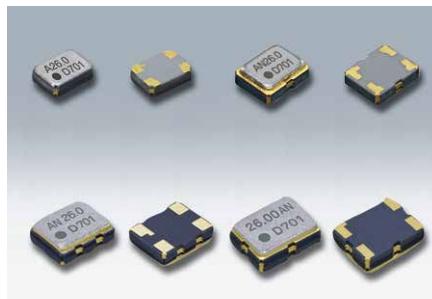
### ■ Recommended Land Pattern

<Top View>



# High-precision SMD VC-TCXO/TCXO

DSA1612SDN/DSA211SDN/DSA221SDN/DSA321SDN, DSB1612SDN/DSB211SDN/DSB221SDN/DSB321SDN



Actual size DSA1612SDN □ DSA211SDN □  
DSA221SDN □ DSA321SDN □

## ■ Features

- Low voltage operation
- Low phase noise
- Single package structure

## ■ Applications

- Mobile phones
- GPS/GNSS and Industrial radio communications



[Type]

VC-TCXO	TCXO	Size
DSA1612SDN	DSB1612SDN	1612 size
DSA211SDN	DSB211SDN	2016 size
DSA221SDN	DSB221SDN	2520 size
DSA321SDN	DSB321SDN	3225 size

## ■ Standard Specification

Item	VC-TCXO				TCXO			
	DSA1612SDN	DSA211SDN	DSA221SDN	DSA321SDN	DSB1612SDN	DSB211SDN	DSB221SDN	DSB321SDN
Frequency Range	16 to 60MHz	12.288 to 52MHz	9.6 to 52MHz		16 to 60MHz	12.288 to 52MHz	9.6 to 52MHz	
Standard Frequency	19.2MHz/26MHz/38.4MHz/40MHz/52MHz				16.3676MHz/16.367667MHz/16.368MHz/16.369MHz/16.8MHz/26MHz/33.6MHz			
Supply Voltage Range					+1.68 to +3.5V			
Supply Voltage (Vcc)					+1.8V/+2.6V/+2.8V/+3.0V/+3.3V			
Current Consumption					+1.5mA max. ( $f \leq 26\text{MHz}$ ) /+2.0mA max. ( $26 < f \leq 52\text{MHz}$ ) /+2.5mA max. ( $f \leq 60\text{MHz}$ )			
Output Level					0.8Vp-p min. ( $f \leq 52\text{MHz}$ ) (Clipped Sinewave/DC-coupled)			
Output Load					10kΩ//10pF			
Frequency Stability Tolerance					$\pm 1.5 \times 10^{-6}$ max. (After 2 reflows)			
vs. Temperature	$\pm 1.0 \times 10^{-6}, \pm 2.5 \times 10^{-6}$ max./-30 to +85°C $\pm 1.0 \times 10^{-6}, \pm 2.5 \times 10^{-6}$ max./-40 to +85°C (Option)				$\pm 0.5 \times 10^{-6}, \pm 2.5 \times 10^{-6}$ max./-30 to +85°C $\pm 0.5 \times 10^{-6}, \pm 2.5 \times 10^{-6}$ max./-40 to +85°C (Option)			
vs. Supply Voltage					$\pm 0.2 \times 10^{-6}$ max. ( $V_{cc} \pm 5\%$ )			
vs. Load Variation					$\pm 0.2 \times 10^{-6}$ max. (10kΩ//10pF±10%)			
vs. Aging					$\pm 1.0 \times 10^{-6}$ max./year			
Frequency Control Control Sensitivity	$\pm 3.0 \times 10^{-6}$ to $\pm 5.0 \times 10^{-6}$ /Vcont=+1.4V±1V @ $V_{cc} \geq +2.6V$ $\pm 3.0 \times 10^{-6}$ to $\pm 5.0 \times 10^{-6}$ /Vcont=+0.9V±0.6V @ $V_{cc} = +1.8V$							-
Response Slope					Positive			-
Start up Time					2.0ms max.			
Phase Noise Offset 100Hz	[ $f \leq 26\text{MHz}$ ] -115dBc/Hz				[ $26\text{MHz} < f \leq 40\text{MHz}$ ] -110dBc/Hz			[ $40\text{MHz} < f \leq 52\text{MHz}$ ] -105dBc/Hz
Offset 1kHz	-130dBc/Hz				-130dBc/Hz			-125dBc/Hz
Offset 10kHz	-150dBc/Hz				-150dBc/Hz			-145dBc/Hz
Offset 100kHz	-155dBc/Hz				-155dBc/Hz			-150dBc/Hz
Packing Unit (1)	DSA1612SDN/DSA211SDN/DSA221SDN, DSB1612SDN/DSB211SDN/DSB221SDN : 3000pcs./reel (φ180) DSA321SDN, DSB321SDN : 2000pcs./reel (φ180)							

(1) Moisture prevention packing is unnecessary.

Moisture Sensitivity Level : LEVEL 1 (IPC/JEDEC J-STD-033)

Consult our sales representative for other specifications.

# High-precision SMD VC-TCXO/TCXO

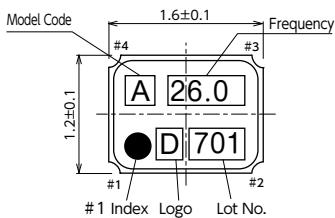
For Mobile communications/Industrial system/GPS/GNSS

## ■ Dimensions [mm]

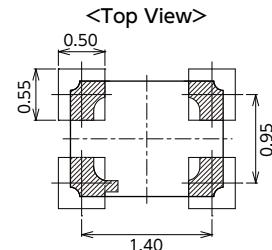
### ■ DSA1612SDN/DSB1612SDN

Model Code  
A:VC-TCXO(DSA1612SDN)  
B:TCXO(DSB1612SDN)

Pin Connections	
Pin No.	Connection
#1	Vcont(VC-TCXO)/GND(TCXO)
#2	GND
#3	Output
#4	Vcc



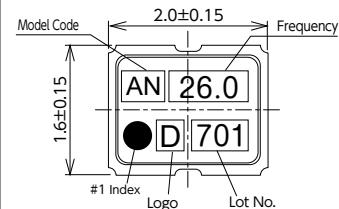
### ■ Recommended Land Pattern <Top View>



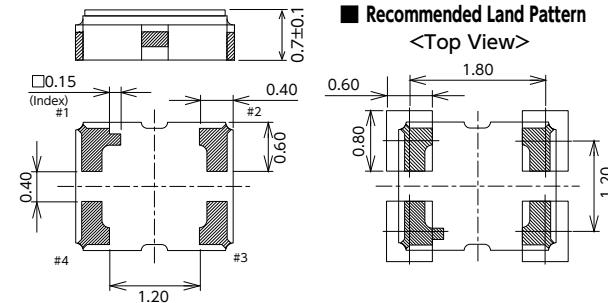
### ■ DSA211SDN/DSB211SDN

Model Code  
AN : VC-TCXO (DSA211SDN)  
BN : TCXO (DSB211SDN)

Pin Connections	
Pin No.	Connection
#1	Vcont(VC-TCXO)/GND(TCXO)
#2	GND
#3	Output
#4	Vcc



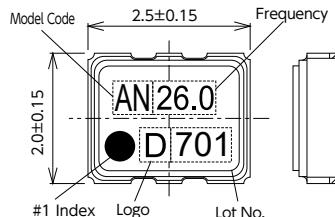
### ■ Recommended Land Pattern <Top View>



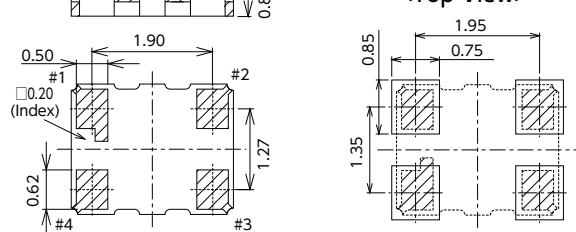
### ■ DSA221SDN/DSB221SDN

Model Code  
AN : VC-TCXO (DSA221SDN)  
BN : TCXO (DSB221SDN)

Pin Connections	
Pin No.	Connection
#1	Vcont(VC-TCXO)/GND(TCXO)
#2	GND
#3	Output
#4	Vcc



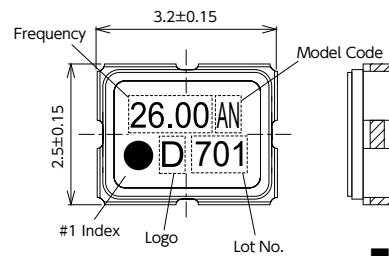
### ■ Recommended Land Pattern <Top View>



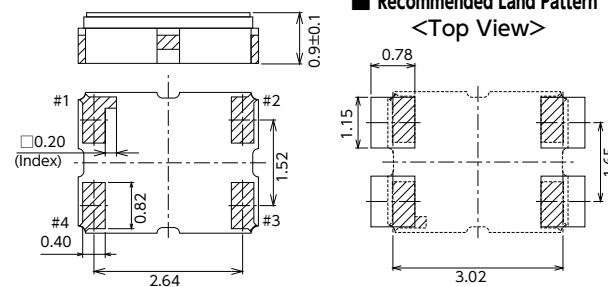
### ■ DSA321SDN/DSB321SDN

Model Code  
AN : VC-TCXO (DSA321SDN)  
BN : TCXO (DSB321SDN)

Pin Connections	
Pin No.	Connection
#1	Vcont(VC-TCXO)/GND(TCXO)
#2	GND
#3	Output
#4	Vcc

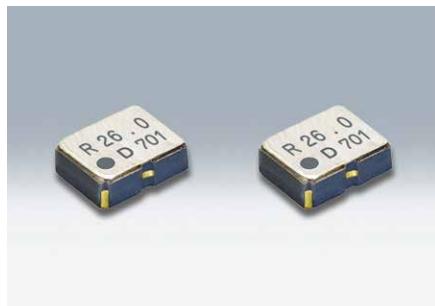


### ■ Recommended Land Pattern <Top View>



# High-precision SMD TCXO

## DSB1612WEB



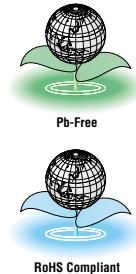
Actual size □

### ■ Features

- Low voltage operation
- Capable of operating over a wide temperature range, from -40 up to +105°C

### ■ Applications

- Mobile communications, GPS/GNSS, 5G, WiFi6(IEEE802.11ax), IoT



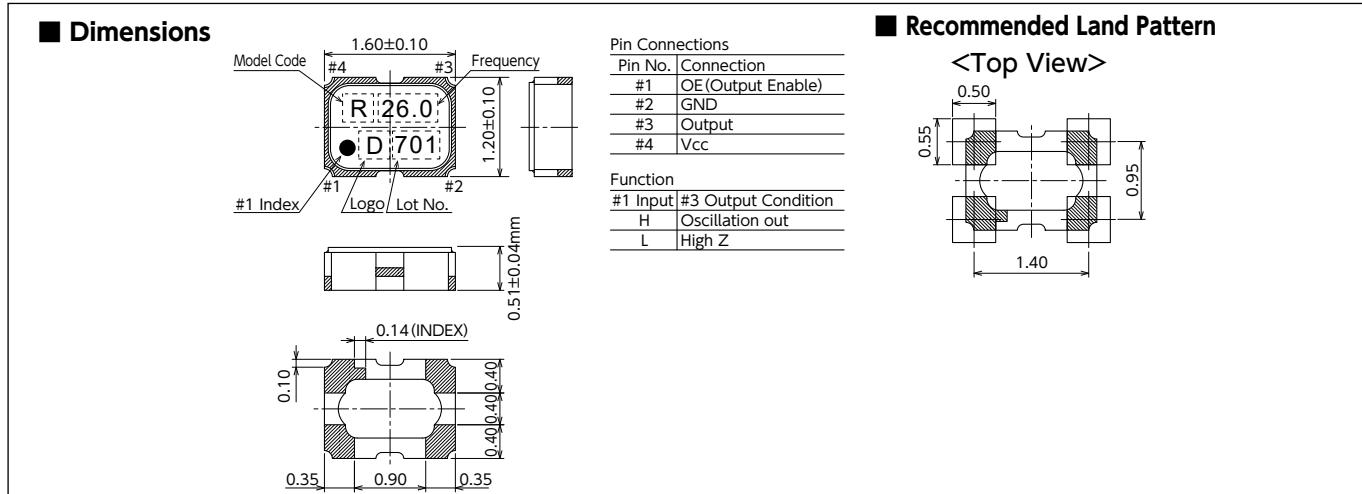
### ■ Standard Specification

Item	Type	DSB1612WEB
Frequency Range		24 to 104MHz
Standard Frequency		52MHz/ 76.8MHz
Supply Voltage Range		+1.68 to +3.63V
Supply Voltage (Vcc)		+1.8V/ +2.5V/ +2.8V/ +3.3V
Current Consumption		+3.0mA max. (52MHz) +4.0mA max. (76.8MHz)
Stand-by Current (#1 pin "L" Level)		+6.0μA max.
Output Level		0.8Vp-p min. (Clipped Sinewave/DC-coupled)
Output Load		10kΩ//10pF
Frequency Stability		$\pm 1.5 \times 10^{-6}$ max. (After 2 reflows)
Tolerance		$\pm 0.5 \times 10^{-6}$ max./-30 to +85°C $\pm 0.5 \times 10^{-6}$ max./-40 to +85°C (option) $\pm 5.0 \times 10^{-6}$ max./-40 to +105°C (option)
vs. Temperature		$\pm 0.1 \times 10^{-6}$ max. (Vcc ±5%)
vs. Supply Voltage		$\pm 0.1 \times 10^{-6}$ max. (10kΩ//10pF±10%)
vs. Load Variation		$\pm 2.0 \times 10^{-6}$ max./year
vs. Aging		
OE Pin 0 Level Input Voltage		Vcc×0.2 max.
OE Pin 1 Level Input Voltage		Vcc×0.8 min.
Start Up Time		2.0ms max.
Phase Noise		76.8MHz (typ.)
Offset 100Hz		-109dBc/Hz
Offset 1kHz		-132dBc/Hz
Offset 10kHz		-149dBc/Hz
Offset 100kHz		-159dBc/Hz
Packing Unit (1)		3000pcs./reel (φ180)

(1) Moisture prevention packing

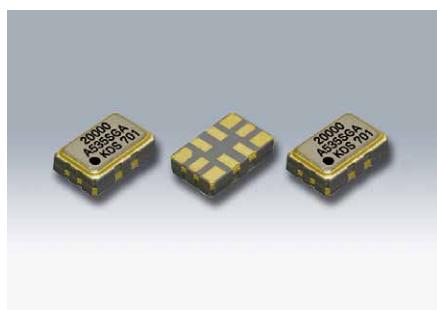
Consult our sales representative for other specifications.

[mm]



# Ultra High-precision SMD VC-TCXO/TCXO

## DSA535SGA/DSB535SGA for Stratum3/ Femtocell



Actual size

### ■ Features

- 5032 size, 1.35mm height. Ultra high precision SMD (VC-) TCXO
- Clipped-sine wave or CMOS level output
- Low phase noise
- Single packaged structure

### ■ Applications

- Stratum3, 5G, Networking, Base station



### ■ Standard Specification

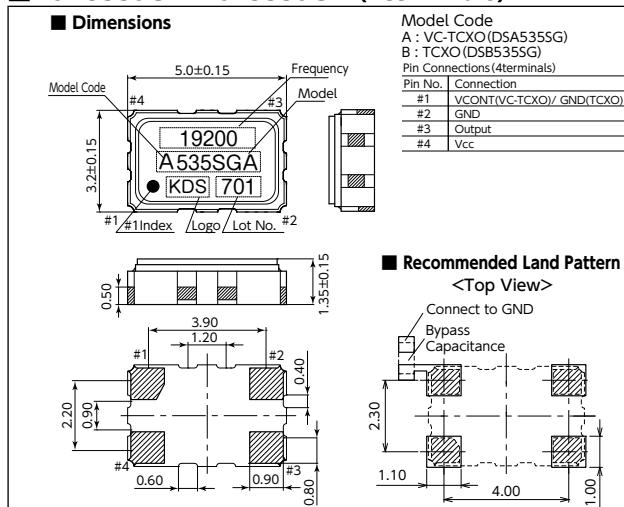
Item	DSA535SGA (VC-TCXO)		DSB535SGA (TCXO)			
Output Frequency Range	10 to 52MHz					
Standard Frequency	10MHz/ 19.2MHz/ 20MHz/ 38.88MHz					
Supply Voltage (Range)	+2.3 to +3.63V					
Supply Voltage (Vcc)	+2.8V/ +3.0V/ +3.3V					
Current Consumption	+4.0mA max. (Clipped sine wave)/ +8.0mA max. (CMOS)					
Output Level	Clipped sine wave 0.8Vp-p min. (DC-coupled)	CMOS '0'level 0.1×Vcc V max. '1'level 0.9×Vcc V min.	Clipped sine wave 0.8Vp-p min. (DC-coupled)	CMOS '0'level 0.1×Vcc V max. '1'level 0.9×Vcc V min.		
Output Load	10kΩ//10pF	15pF	10kΩ//10pF	15pF		
Frequency Stability Tolerance	$\pm 1.5 \times 10^{-6}$ max. (After 2 reflows)					
vs. Temperature	$\pm 0.10 \times 10^{-6}$ max./ -40 to +85°C					
vs. Hysteresis	$\pm 0.20 \times 10^{-6}$ max./ -40 to +105°C					
vs. Supply Voltage	$\pm 0.1 \times 10^{-6}$ max. (Vcc±5%)					
vs. Load Variation	$\pm 0.20 \times 10^{-6}$ max. (10kΩ//10pF±10% / 15pF ±10%)					
vs. Aging	$\pm 1.0 \times 10^{-6}$ max./year					
Total Frequency Tolerance	$\pm 4.6 \times 10^{-6}$ max. (Inclusive of variations over operating temperature, initial tolerance, supply voltage, load variation, aging)					
Frequency Control Control Sensitivity	$\pm 3.0$ to $\pm 5.0 \times 10^{-6}$ /Vcont=+1.5±1V		—			
Response Slope	Positive					
Phase Noise	20MHz (typ.)					
Offset 100Hz	-118dBc/Hz					
Offset 1kHz	-139dBc/Hz					
Offset 10kHz	-155dBc/Hz					
Offset 100kHz	-158dBc/Hz					
Packing Unit (1)	1000pcs./reel (φ180), 4000pcs./reel (φ330)					

(1) Moisture prevention packing is unnecessary.

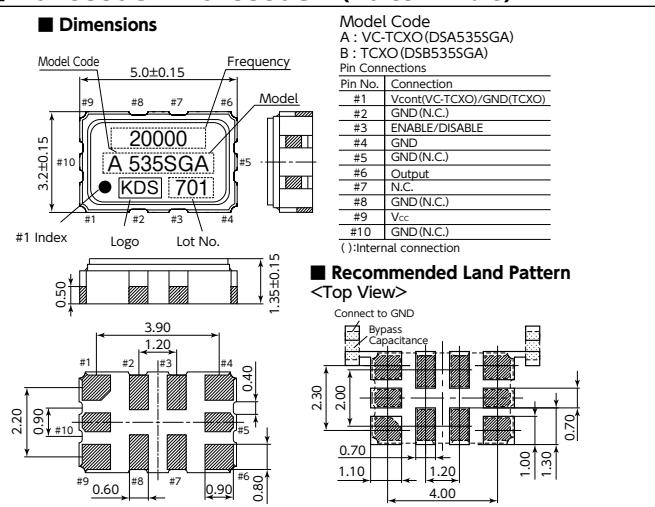
Moisture Sensitivity Level: LEVEL 1 (IPC/JEDEC J-STD-033)

Consult our sales representative for other specifications.

### ■ DSA535SGA/DSB535SGA (4terminals)



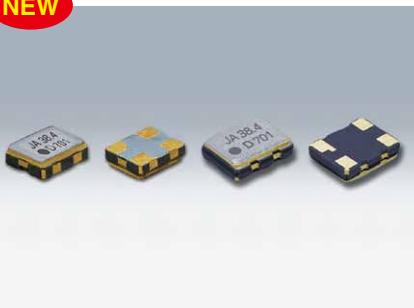
### ■ DSA535SGA/DSB535SGA (10 terminals)



# SMD TCXO

## DSB211SJA/DSB221SJA

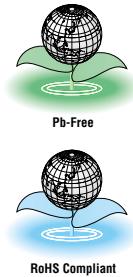
**NEW**



Actual size DSB211SJA DSB221SJA

### ■ Features

- Capable of operating over a wide temperature range, from -40 to +105°C
- Supply voltage from +1.7 up to +3.6V
- CMOS Level Output
- Low phase noise
- Single package structure
- AEC-Q100/AEC-Q200 Compliant



### ■ Applications

- WLAN, WiMAX, Smart Grid, visual applications and industrial radio communications

### ■ Standard Specification

Item	Type	DSB211SJA/DSB221SJA
Frequency Range		13 to 52MHz
Standard Frequency		19.2MHz/ 25MHz/ 26MHz/ 32MHz/ 38.4MHz/ 40MHz/ 48MHz/ 52MHz
Supply Voltage (Vcc)		+1.8V/ +2.5V/ +2.8V/ +3.3V
Current Consumption		5.0mA max. [No Load]
Stand-by Current (#1 pin "L" Level)		+10µA max.
Frequency Stability		
Tolerance		±1.5×10 <sup>-6</sup> max.(After 2 reflows)
vs. Temperature		±2.5×10 <sup>-6</sup> max./ -40 to +85°C ±5.0×10 <sup>-6</sup> max./ -40 to +105°C ±20×10 <sup>-6</sup> max./ -40 to +125°C(Option)
vs. Aging		±1.0×10 <sup>-6</sup> max./year
Symmetry		45 to 55% (50% Vcc Level)
0 Level Output Voltage		Vcc×0.1V max.
1 Level Output Voltage		Vcc×0.9V min.
Output Load		15pF
Rise and Fall Time		5ns max.(10% to 90% Vcc Level)
OE Pin 0 Level Input Voltage		Vcc×0.2V max.
OE Pin 1 Level Input Voltage		Vcc×0.8V min.
Start Up Time		3.0ms max.
Output Enable Time		3.0ms max.
Output Disable Time		150ns max.
Start Up Time	[f≤26MHz]	[26MHz<f≤52MHz]
Offset 1kHz	-145dBc/Hz	-141dBc/Hz
Offset 100kHz	-158dBc/Hz	-157dBc/Hz
Packing Unit (1)		3000pcs./reel (φ 180)

(1) Moisture prevention packing is unnecessary.

Consult our sales representative for other specifications.

Moisture Sensitivity Level : LEVEL 1 (IPC/JEDEC J-STD-033)

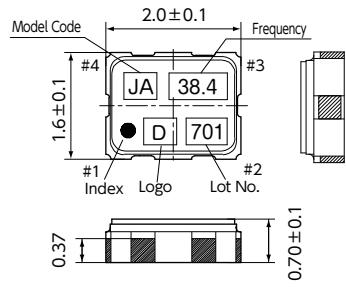
### ■ DSB211SJA

[mm]

### ■ DSB221SJA

[mm]

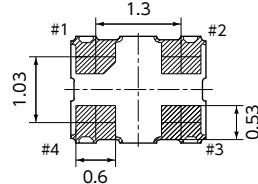
#### ■ Dimensions



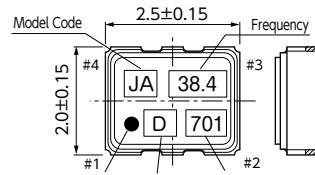
Pin Connections	
Pin No.	Connection
#1	OE (Output Enable)
#2	GND
#3	Output
#4	Vcc

Function	
#1 Input	#3 Output condition
H	Oscillation out
L	High Z

#### ■ Recommended Land Pattern <Top View>



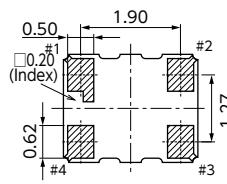
#### ■ Dimensions



Pin Connections	
Pin No.	Connection
#1	OE (Output Enable)
#2	GND
#3	Output
#4	Vcc

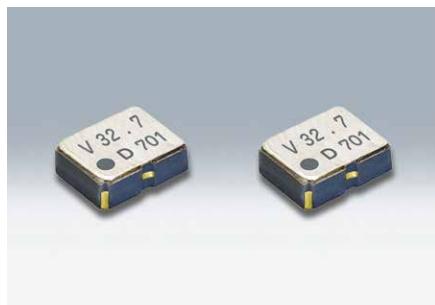
Function	
#1 Input	#3 Output condition
H	Oscillation out
L	High Z

#### ■ Recommended Land Pattern <Top View>



# SMD TCXO

## DSK1612ATD



Actual size 

### ■ Features

- Digital temperature compensated type
- High precision:  $\pm 5.0 \times 10^{-6}$  (-40 to +85°C)
- Low current consumption

### ■ Applications

- High precision clock source
- High precision clock source for RTC



Pb-Free



RoHS Compliant

### ■ Standard Specification

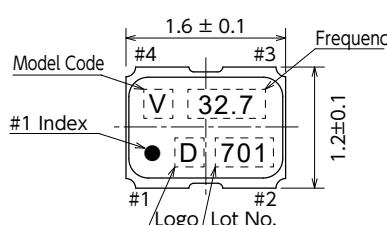
Item	Legend	Spec.				Condition
		min.	typ.	max.	Unit	
Output Frequency	f <sub>0</sub>	—	32.768	—	kHz	
Supply Voltage Range	V <sub>cc</sub>	+1.5	—	+3.63	V	(Temperature Compensated Operating)
Frequency Tolerance	f <sub>_tol</sub>	-5.0	—	+5.0	$\times 10^{-6}$	-40 to +85°C
Current Consumption	I <sub>cc</sub>	—	—	+3.5	$\mu$ A	V <sub>cc</sub> =+1.8V or +3.3V, Temperature Compensation Interval:0.5s, No Load
		—	—	+3.2		V <sub>cc</sub> =+1.8V or +3.3V, Temperature Compensation Interval:2.0s, No Load
Symmetry	SYM	40	50	60	%	at 50% V <sub>cc</sub>
0 Level Output Voltage	V <sub>OL</sub>	—	—	V <sub>cc</sub> ×0.1	V	
1 Level Output Voltage	V <sub>OH</sub>	V <sub>cc</sub> ×0.9	—	—		
Rise and Fall Time	t <sub>r</sub> , t <sub>f</sub>	—	—	50	ns	V <sub>cc</sub> =+1.5 to +3.63V, 10 to 90% V <sub>cc</sub> Level
Load Condition	L <sub>CMOS</sub>	—	—	15	pF	
Start Up Time	T <sub>start</sub>	—	—	1.0	s	
Packing Unit (1)						3000pcs./reel ( $\phi$ 180)

(1) Moisture prevention packing

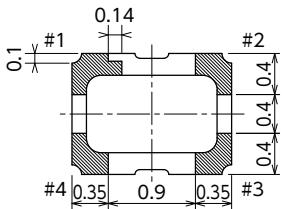
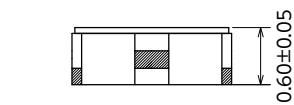
Consult our sales representative for other specifications.

[mm]

### ■ Dimensions

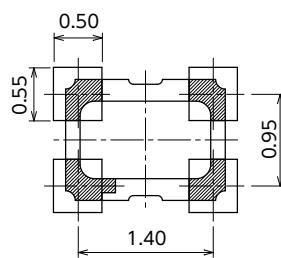


Pin No.	Connection
#1	GND
#2	Output
#3	V <sub>cc</sub>
#4	GND



### ■ Recommended Land Pattern

<Top View>



# SMD Real Time Clock Module

## DD3225TS

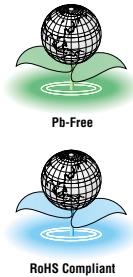
Under Development



**NEW**

### ■ Features

- Digital temperature compensated type
- High precision :  $\pm 5.0 \times 10^{-6}$  (-40 to +85°C),  $\pm 7.0 \times 10^{-6}$  (-40 to +105°C)
- Low current consumption
- Low voltage operation : +1.3 to +5.5V (Temperature Compensated Operating), +1.3 to +5.5V (Clock Timing Operating)
- I<sup>2</sup>C-BUS serial interface : 400kHz fast-mode compatible
- Clock function : hour·minute·second, Calendar function with auto leap year adjustment : year·month·day·day of week
- Alarm interrupt function : day·day of week·hour·minute
- Fixed-cycle timer interrupt function : 244μs to 255min
- Time update interrupt function : minute·second
- Clock output function : 32.768kHz, 1024Hz, 32Hz, 1Hz
- Supply voltage detection function:  
+1.5V temperature compensation operating voltage detection  
+1.3V supply voltage under voltage detection
- AEC-Q100/AEC-Q200 compliant
- \* "I<sup>2</sup>C-BUS" is a trademark of NXP semiconductors.



### ■ Applications

- High precision clock source
- Car navigation, Smart meter, Data logger

### ■ Standard Specification

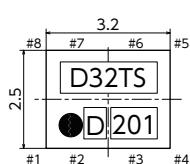
Item	Legend	Spec.				Condition
		min.	typ.	max.	unit	
Output Frequency	f <sub>0</sub>	—	32.768	—	kHz	
Supply Voltage Range	V <sub>cc</sub>	+1.3	—	+5.5		(Clock Timing Operating)
	V <sub>tem</sub>	+1.5	—	+5.5		(Temperature Compensated Operating)
	V <sub>int</sub>	+1.5	—	+5.5		(Interface Operation) I <sup>2</sup> C-BUS
Frequency Tolerance	f <sub>_tol</sub>	-5	—	+5		$\times 10^{-6}$
		-7	—	+7		-40 to +85°C
Current Consumption	I <sub>cc1</sub>	—	0.30	2.10		V <sub>cc</sub> = +3.0V
		—	0.42	2.90		V <sub>cc</sub> = +5.0V
	I <sub>cc2</sub>	—	0.90	2.80		V <sub>cc</sub> = +3.0V
		—	1.30	4.00		V <sub>cc</sub> = +5.0V
Load Condition	L <sub>CMOS</sub>	—	—	15	pF	
Symmetry	SYM	40	—	60	%	50%V <sub>cc</sub>
1 level Output Voltage	V <sub>OH</sub>	0.8xV <sub>cc</sub>	—	—	V	I <sub>OH</sub> =-1mA
0 level Output Voltage	V <sub>OL</sub>	—	—	0.2xV <sub>cc</sub>	V	I <sub>OL</sub> =1mA
Rise / Fall Time	Tr/Tf	—	—	100	ns	20 to 80%V <sub>cc</sub>
OE Pin 1 level Input Voltage	V <sub>IH</sub>	0.8xV <sub>cc</sub>	—	V <sub>cc</sub>	V	
OE Pin 0 level Input Voltage	V <sub>IL</sub>	0	—	0.2xV <sub>cc</sub>	V	
Start Up Time	Tstart	—	—	1	s	Ta = +25°C , V <sub>cc</sub> = +1.3V
Packing Unit (1)				2000pcs./reel (φ 180)		

(1) Moisture prevention packing

Consult our sales representative for other specifications.

[mm]

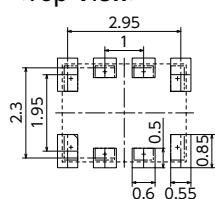
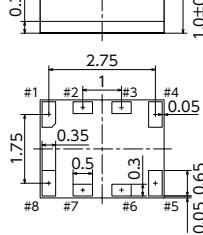
### ■ Dimensions



Function	
#1 Input	#5 Output Condition
H	Oscillation out
L	High Z
Marking	
(1) Type	D32TS
(2) Logo	D
(3) Date code	Year(1digit) + Week(2digits) e.g.2022/1/1 → 201

No.	Name	I/O	Description
#1	OE	I	Output control enable input (L:High impedance, H:Clock output)
#2	INTN	0	1Hz signal, alarm interrupt signal, fixed-cycle timer interrupt signal, and time update interrupt signal, Nch open-drain output.
#3	N.C.	-	None connection
#4	GND	-	Ground connection.
#5	Output	0	Clock output connection.
#6	SCL	I	I <sup>2</sup> C-BUS serial interface clock input connection.
#7	SDA	I/O	I <sup>2</sup> C-BUS serial interface data input/output connection.
#8	V <sub>cc</sub>	-	Supply Voltage

### ■ Recommended Land Pattern <Top View>



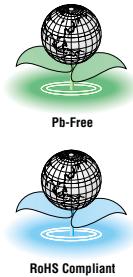
# SMD Real Time Clock Oscillator

## DD3225TR

Under Development

**NEW****■ Features**

- Precision :  $\pm 11.5 \times 10^{-6}$  (30 seconds per month),  
 $\pm 23.0 \times 10^{-6}$  (60 seconds per month)
  - Low current consumption
  - Low voltage operation : +1.5 to +5.5V, +1.3 to +5.5V (Clock Timing Operating)
  - I<sup>2</sup>C-BUS serial interface : 400kHz fast-mode compatible
  - Clock function : hour·minute·second, Calendar function with auto leap year adjustment : year·month·day·day of week
  - Alarm interrupt function : day·day of week·hour·minute
  - Fixed-cycle timer interrupt function : 244μs to 255min
  - Time update interrupt function : minute·second
  - Clock output function : 32.768kHz, 1024Hz, 32Hz, 1Hz
  - Supply voltage detection function : +1.5V temperature compensation operating voltage detection
- \* "I<sup>2</sup>C-BUS" is a trademark of NXP semiconductors.

**■ Applications**

- Calendar, Timer, Alarm, Standard for watches
- Remote control with calendar, Data logger, Wireless sensor, Amusement device

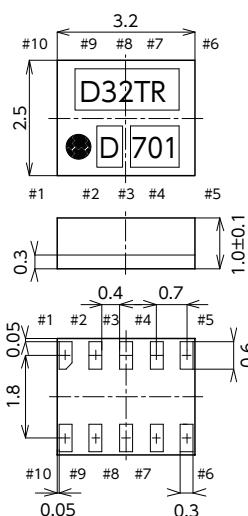
**■ Standard Specification**

Item	Legend	Spec.				Condition
		min.	typ.	max.	unit	
Output Frequency	f <sub>0</sub>	—	32.768	—	kHz	
Supply Voltage Range	V <sub>CC</sub>	+1.3	—	+5.5	V	(Clock Timing Operating)
	V <sub>int</sub>	+1.5	—	+5.5		(Interface Operation) I <sup>2</sup> C-BUS
Frequency Tolerance	f <sub>tol</sub>	-11.5	—	+11.5	× 10 <sup>-6</sup>	Ta = 25°C , V <sub>CC</sub> = +3.0V (30 seconds per month)
		-23	—	+23		Ta = 25°C , V <sub>CC</sub> = +3.0V (60 seconds per month)
Operating temperature range	T <sub>a</sub>	-40	—	+85	°C	
Current Consumption	I <sub>CC1</sub>	—	0.29	2.10	μA	V <sub>CC</sub> = +3.0V
		—	0.41	2.90		V <sub>CC</sub> = +5.0V
	I <sub>CC2</sub>	—	0.89	2.80		V <sub>CC</sub> = +3.0V
		—	1.29	4.00		V <sub>CC</sub> = +5.0V
Load Condition	L <sub>CMOS</sub>	—	—	15	pF	SCL = SDA = INTN = V <sub>CC</sub> , OE = GND
Symmetry	SYM	40	—	60	%	(Output Off)
1 level Output Voltage	V <sub>OH</sub>	0.8xV <sub>CC</sub>	—	—	V	I <sub>OH</sub> =1mA
0 level Output Voltage	V <sub>OL</sub>	—	—	0.2xV <sub>CC</sub>	V	I <sub>OL</sub> =1mA
Rise / Fall Time	T <sub>r/T<sub>f</sub></sub>	—	—	100	ns	20 to 80%V <sub>CC</sub>
OE Pin 1 level Input Voltage	V <sub>IH</sub>	0.8xV <sub>CC</sub>	—	V <sub>CC</sub>	V	
OE Pin 0 level Input Voltage	V <sub>IL</sub>	0	—	0.2xV <sub>CC</sub>	V	
Start Up Time	T <sub>start</sub>	—	—	1	s	Ta = +25°C , V <sub>CC</sub> = +1.3V
Packing Unit (1)				2000pcs./reel		(φ 180)

(1) Moisture prevention packing

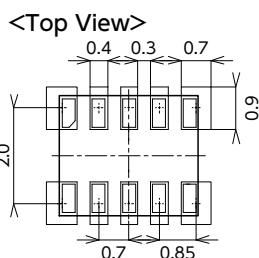
Consult our sales representative for other specifications.

[mm]

**■ Dimensions**

Function		
#2 Input	#4 Output Condition	
H	Oscillation out	
L	High Z	

Marking		
(1) Type	D32TR	
(2) Logo	D	
(3) Date code	Year(1digit) + Week(2digits) e.g. 2022/1/1 → 201	

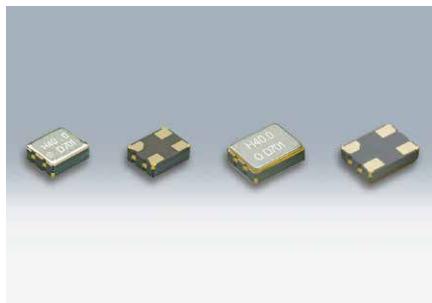
**■ Recommended Land Pattern**

## Pin Function

No.	Name	I/O	Function
#1	V <sub>CC</sub>	-	Supply Voltage
#2	OE	I	Output control enable input (L:High impedance, H:Clock output)
#3	N.C.	-	
#4	Output	0	Clock output connection
#5	SCL	I	I <sup>2</sup> C-BUS serial interface clock input connection.
#6	EVENT	I	Trigger input for Time stamp request. Internal pull-up resistor can be selected. Input polarity can be selected.
#7	SDA	I/O	I <sup>2</sup> C-BUS serial interface data input/output connection.
#8	N.C.	-	
#9	GND	-	Ground connection.
#10	INTN	0	1Hz signal, alarm interrupt signal, fixed-cycle timer interrupt signal, and time update interrupt signal. Nch open-drain output.

# SMD Low Phase Noise Crystal Oscillators

## DSO221SH/DSO321SH



### ■ Features

- Supply Voltage : 1.8V/2.5V/2.8V/3.0V/3.3V
- Low phase noise :  $f_{out} \pm 1\text{kHz}$   $-145 \text{ dBc/Hz}(\text{Typ.})$   
 $f_{out} \pm 100\text{kHz}$   $-158 \text{ dBc/Hz}(\text{Typ.})$
- Low profile : 0.815mm(DSO221SH), 1.1mm(DSO321SH)
- AEC-Q200 Compliant (Option: Equivalent to AEC-Q100)
- 3-state function



### ■ Applications

- WiLAN, WiMAX, Bluetooth
- DVC, HDTV, Blu-ray
- PC, gaming equipment, audio equipment
- Automotive multimedia device

[Function Code]

DSO****H	A	A
M	$\pm 100 \times 10^{-6}$	$\pm 100 \times 10^{-6}$
B	$\pm 50 \times 10^{-6}$	$\pm 50 \times 10^{-6}$
C	$\pm 30 \times 10^{-6}$	$\pm 30 \times 10^{-6}$
D	$\pm 25 \times 10^{-6}$	$\pm 25 \times 10^{-6}$
E	$\pm 20 \times 10^{-6}$	$\pm 20 \times 10^{-6}$

When requesting the product, please select the model and function code of your request.

[Type]	DSO221SH	2520 size
	DSO321SH	3225 size

### ■ Standard Specification

Item	Function Code		Output Frequency Range (MHz)	Legend	Spec.				Condition
	Supply Voltage	Frequency tolerance			min.	typ.	max.	Unit	
Supply Voltage	A	*	3.5 $\leq f_0 \leq 52$	V <sub>CC</sub>	+3.0	+3.3	+3.6	V	
	M				+2.7	+3.0	+3.3		
	B				+2.6	+2.8	+3.0		
	C				+2.25	+2.5	+2.75		
	D				+1.6	+1.8	+2.0		
Frequency Tolerance (Includes frequency tolerance at room temperature.)	A	*	3.5 $\leq f_0 \leq 52$	f <sub>tol</sub>	-100	-	+100	$\times 10^{-6}$	-40 to +85°C
	B				-50	-	+50		-20 to +70°C
	C				-30	-	+30		-10 to +70°C
	D				-25	-	+25		(Standard Operating Temperature Range)
	E				-20	-	+20		
Current Consumption	A,M	*	3.5 $\leq f_0 \leq 52$	I <sub>CC</sub>	-	-	4.2	mA	No Load
	B	*			-	-	2.3		
	C	*			-	-	-		
	D	*			-	-	-		
Stand-by Current (#1 pin "L" Level)	*	*	*	I <sub>STD</sub>	-	-	10	$\mu\text{A}$	
Load Condition	*	*	*	L <sub>CMOS</sub>	-	-	15	pF	
Symmetry	A,M,B,C	*	*	SYM	45	50	55	%	at 50% V <sub>CC</sub>
	D	*	*		40	50	60		
0 Level Output Voltage	*	*	*	V <sub>OL</sub>	-	-	$V_{CC} \times 0.1$	V	
1 Level Output Voltage	*	*	*	V <sub>OH</sub>	$V_{CC} \times 0.9$	-	-		
Rise and Fall Time	A,M,B	*	*	tr, tf	-	-	4.0	ns	10 to 90% V <sub>CC</sub> Level
	C,D	*	*		-	-	6.5		
OE Pin 0 Level Input Voltage	*	*	*	V <sub>IL</sub>	-	-	$V_{CC} \times 0.2$	V	
OE Pin 1 Level Input Voltage	*	*	*	V <sub>IH</sub>	$V_{CC} \times 0.8$	-	-		
Output Disable Time	*	*	*	t <sub>PLZ</sub>	-	-	100	ns	
Output Enable Time	*	*	*	t <sub>PZL</sub>	-	-	2.0	ms	
Phase Noise	*	*	*		-	-140	-	dBc/Hz	Offset 1kHz
					-	-153	-		Offset 100kHz
Period Jitter (1)	*	*	*	t <sub> RMS</sub>	-	2.4	-	ps	$\sigma$
				t <sub>tp-p</sub>	-	23	-		Peak to peak
Total Jitter (1)	*	*	*	t <sub>TL</sub>	-	34	-	ps	t <sub>DJ</sub> +n <sub>x</sub> t <sub>RJ</sub> n=14.1(BER=1 $\times 10^{-12}$ ) (2)
Phase Jitter	*	*	40 $\leq f_0 \leq 52$	t <sub>PJ</sub>	-	-	1	ps	f <sub>0</sub> offset: 12kHz to 20MHz
			10 $\leq f_0 < 40$						f <sub>0</sub> offset: 12kHz to 5MHz
Packing Unit (3)					2000pcs./reel(Φ180)				

(1) Measured WAVECREST DTS-2075

Consult our sales representative for other specifications.

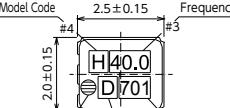
(2) t<sub>DJ</sub>: Deterministic jitter t<sub>RJ</sub>: Random jitter

(3) Moisture prevention packing is unnecessary.

Moisture Sensitivity Level: Level 1 (IPC/JEDEC J-STD-033)

### ■ DSO221SH

#### ■ Dimensions

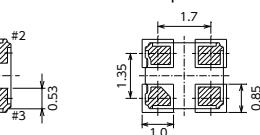


Pin Connections	
#1	OE (Output Enable)
#2	GND
#3	Output
#4	V <sub>CC</sub>

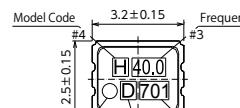
Function	
#1 Input	#3 Output condition
H	Oscillation out
Open	Oscillation out
L	High Z

#### ■ Recommended Land Pattern <Top View>



### ■ DSO321SH

#### ■ Dimensions

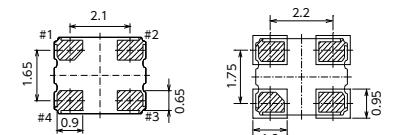


Pin Connections	
#1	OE (Output Enable)
#2	GND
#3	Output
#4	V <sub>CC</sub>

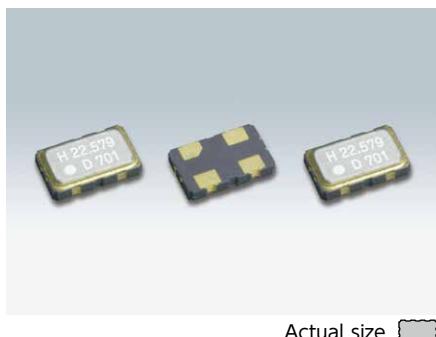
Function	
#1 Input	#3 Output condition
H	Oscillation out
Open	Oscillation out
L	High Z

#### ■ Recommended Land Pattern <Top View>



# SMD Low Phase Noise Crystal Oscillators

## DSO531SHH



### ■ Features

- Supply Voltage: 1.8V/2.5V/2.8V/3.3V
- Ultra low phase noise:  $f_{out} \pm 1\text{kHz} -160 \text{ dBc/Hz(Typ.)}$   
 $f_{out} \pm 100\text{kHz} -172 \text{ dBc/Hz(Typ.)}$
- Available frequency range: 20 to 50MHz
- Low profile: 1.1 mm
- 3-state function

### ■ Applications

- High quality audio equipment,  
Communication equipment and  
visual applications

[Function Code]  
DSO531SHH A A

A : 3.3V	A : $\pm 100 \times 10^{-6}$
B : 2.8V	B : $\pm 50 \times 10^{-6}$
C : 2.5V	C : $\pm 30 \times 10^{-6}$
D : 1.8V	D : $\pm 25 \times 10^{-6}$



When requesting the product, please select the model and function code of your request.

### ■ Standard Specification

Item	Function Code		Output Frequency Range (MHz)	Legend	Spec.				Condition
	Supply Voltage	Frequency tolerance			min.	typ.	max.	Unit	
Supply Voltage	A	*	20 $\leq f_0 \leq 50$	Vcc	+3.0	+3.3	+3.6	V	
	B				+2.6	+2.8	+3.0		
	C				+2.25	+2.5	+2.75		
	D				+1.62	+1.8	+2.0		
Frequency Tolerance (Includes frequency tolerance at room temperature.)	A	*	*	f_tol	-100	—	+100	$\times 10^{-6}$	$-40 \text{ to } +85^\circ\text{C}$ $-20 \text{ to } +70^\circ\text{C}$ $-10 \text{ to } +70^\circ\text{C}$ (Standard Operating Temperature Range)
	B				-50	—	+50		
	C				-30	—	+30		
	D				-25	—	+25		
Current Consumption	A	*	20 $\leq f_0 \leq 50$	Icc	—	—	7.7	mA	No Load
	B				—	—	5.5		
	C				—	—	4.8		
	D				—	—	2.9		
Stand-by Current (#1 pin "L" Level)	A	*	20 $\leq f_0 \leq 50$	I_std	—	—	35	$\mu\text{A}$	
	B				—	—	32		
	C				—	—	30		
	D				—	—	25		
Symmetry	*	*	*	SYM	45	50	55	%	50% Vcc Level
0 Level Output Voltage	*	*	*	VOL	—	—	$\text{Vcc} \times 0.1$	V	
1 Level Output Voltage	*	*	*	VOH	$\text{Vcc} \times 0.9$	—	—		
Rise and Fall Time	A	*	*	tr,tf	—	—	2.1	ns	10 to 90% Vcc Level
	B				—	—	2.5		
	C				—	—	2.7		
	D				—	—	4.7		
Load Condition	*	*	*	L_CMOS	—	—	15	pF	
OE Pin 0 Level Input Voltage	*	*	*	VIL	—	—	$\text{Vcc} \times 0.3$	V	
OE Pin 1 Level Input Voltage	*	*	*	VIH	$\text{Vcc} \times 0.7$	—	—		
Output Enable Time	*	*	*	tPZL	—	—	1	ms	
Output Disable Time	*	*	*	tPLZ	—	—	10	$\mu\text{s}$	
Phase Noise	A	*	20 $\leq f_0 \leq 50$	—	—	-160	—	dBc/Hz	Offset 1kHz
	D				—	-158	—		
	A				—	-172	—		Offset 100kHz
	D				—	-166	—		
Packing Unit (1)	1000pcs./reel( $\phi 180$ )								

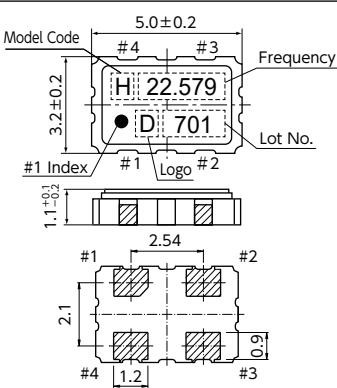
(1) Moisture prevention packing is unnecessary.

Moisture Sensitivity Level : Level 1 (IPC/JEDEC J-STD-033)

Consult our sales representative for other specifications.

[mm]

### ■ Dimensions



### Pin Connections

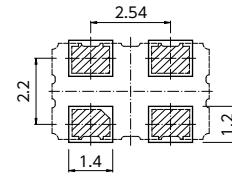
Pin No.	Connection
#1	OE(Output Enable)
#2	GND
#3	Output
#4	Vcc

### Function

#1Input	#3 Output condition
H	Oscillation out
Open	Oscillation out
L	High Z

### ■ Recommended Land Pattern

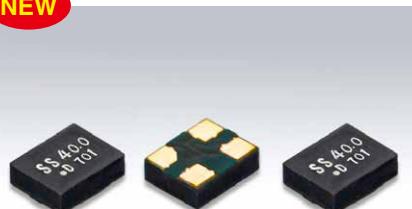
#### <Top View>



# SMD Crystal Oscillators

## DS2016KS

**NEW**



Actual size □

### ■ Features

- Resonator and IC are integrated in a mold package
- Supply Voltage : 1.8V/2.5V/2.8V/3.3V
- Available frequency range : 1 to 100MHz
- Low profile : 0.6mm
- CMOS Level Output
- Capable of operating over a wide temperature range, from -40 to +125°C



### ■ Applications

- Visual applications, Server, SSD
- Industrial equipment

[Function Code]  
DS2016KS AA

A : 3.3V	A : $\pm 100 \times 10^{-6}$
B : 2.8V	B : $\pm 50 \times 10^{-6}$
C : 2.5V	C : $\pm 30 \times 10^{-6}$
D : 1.8V	E : $\pm 20 \times 10^{-6}$

### ■ Standard Specification

Item	Function Code		Output Frequency Range (MHz)	Legend	Spec.				Condition
	Supply Voltage	Frequency tolerance			min.	typ.	max.	Unit	
Supply Voltage	A	*	$1 \leq f_0 \leq 100$	Vcc	+3.0	+3.3	+3.6		V
	B				+2.6	+2.8	+3.0		
	C				+2.25	+2.5	+2.75		
	D				+1.6	+1.8	+2.0		
Frequency Tolerance (Includes frequency tolerance at room temperature)	A	*	*	f_tol	-100	-	+100		$\times 10^{-6}$
	B				-50	-	+50		
	C				-30	-	+30		
	E				-20	-	+20		
	A				80 $\leq f_0 \leq 100$	-	-	4.9	
Current Consumption	A	*	*	Icc	48 $\leq f_0 < 80$	-	-	4.2	mA
	B				1 $\leq f_0 < 48$	-	-	3.1	
	C				80 $\leq f_0 \leq 100$	-	-	4.2	
	B				48 $\leq f_0 < 80$	-	-	3.7	
	C				80 $\leq f_0 \leq 100$	-	-	3.9	
	B				48 $\leq f_0 < 80$	-	-	3.4	
	C				1 $\leq f_0 < 48$	-	-	2.6	
	D				80 $\leq f_0 \leq 100$	-	-	3.1	
	D				48 $\leq f_0 < 80$	-	-	2.8	
	D				1 $\leq f_0 < 48$	-	-	2.1	
Stand-by Current (#1 pin "L" Level)	*	*	*	I_std	-	-	10	$\mu A$	
Load Condition	*	*	*	I_L_Cmos	-	-	15	pF	
Symmetry	*	*	*	SYM	45	50	55	%	50% Vcc Level
0 Level Output Voltage	*	*	*	V <sub>OL</sub>	-	-	$V_{CC} \times 0.1$	V	
1 Level Output Voltage	*	*	*	V <sub>OH</sub>	$V_{CC} \times 0.9$	-	-		
Rise and Fall Time	A,B,C,D	*	*	t <sub>r,tf</sub>	-	-	5	ns	10 to 90% Vcc Level
OE Pin 0 Level Input Voltage	*	*	*	V <sub>IL</sub>	-	-	$V_{CC} \times 0.3$	V	
OE Pin 1 Level Input Voltage	*	*	*	V <sub>IH</sub>	$V_{CC} \times 0.7$	-	-		
Output Disable Time	*	*	*	t <sub>PLZ</sub>	-	-	200	ns	
Output Enable Time	*	*	*	t <sub>PZL</sub>	-	-	2	ms	
Packing Unit (1)					3000pcs./reel ( $\phi 180$ )				

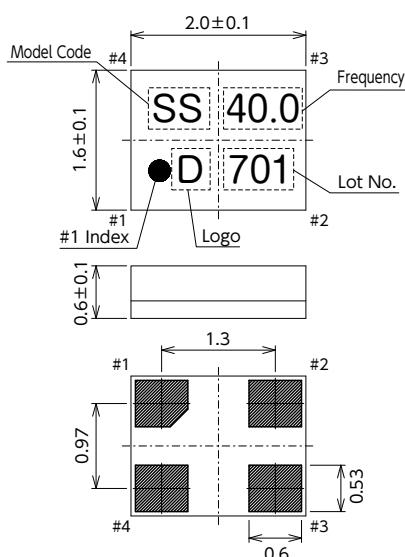
(1) Moisture prevention packing

Consult our sales representative for other specifications.

Moisture Sensitivity Level : Level2 (IPC/JEDEC J-STD-033)

[mm]

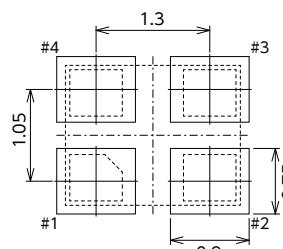
### ■ Dimensions



Pin Connections	
Pin No.	Connection
#1	OE(Output Enable)
#2	GND
#3	Output
#4	Vcc
Function	
#1 Input	#3 Output condition
H	Oscillation out
Open	Oscillation out
L	High Z

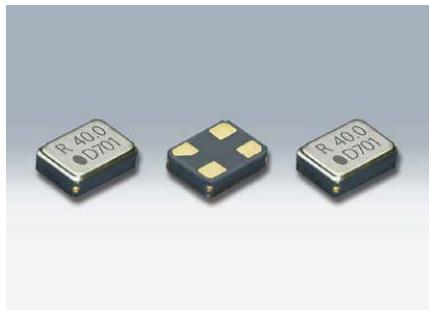
### ■ Recommended Land Pattern

<Top View>



# SMD Crystal Oscillators

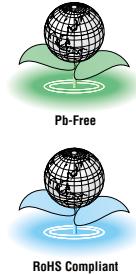
## DSO1612AR



Actual size DSO1612AR

### ■ Features

- 1612 size, 0.5 mm height. Ultra miniature and lightweight SMD SPXO
- 3-state function
- AEC-Q200 Compliant (Option: Equivalent to AEC-Q100)
- Supply Voltage : 1.8V/2.5V/2.8V/3.0V/3.3V
- Available frequency range : 0.584375 to 80MHz
- Available up to 80MHz by using AT cut fundamental resonator. Low jitter provides for high performance.



### ■ Applications

- PC, DSC, DVD, DVC, HDD
- Smartphone, WLAN, WiMAX, Bluetooth
- Gaming equipment
- Automotive multimedia device
- Wearable devices

[Function Code]

DSO1612AR AA

A : 3.3V	A : $\pm 100 \times 10^{-6}$
M : 3.0V	B : $\pm 50 \times 10^{-6}$
B : 2.8V	C : $\pm 30 \times 10^{-6}$
C : 2.5V	D : $\pm 25 \times 10^{-6}$
D : 1.8V	E : $\pm 20 \times 10^{-6}$

When requesting the product, please select the model and function code of your request.

### ■ Standard Specification

Item	Function Code		Output Frequency Range (MHz)	Legend	Spec.			Unit	Condition
	Supply Voltage	Frequency tolerance			min.	typ.	max.		
Supply Voltage	A	*	0.584375 $\leq f_0 \leq$ 80	Vcc	+3.0	+3.3	+3.6	V	
	M				+2.7	+3.0	+3.3		
	B				+2.6	+2.8	+3.0		
	C				+2.25	+2.5	+2.75		
	D				+1.6	+1.8	+2.0		
Frequency Tolerance (includes frequency tolerance at room temperature)	A	*	0.584375 $\leq f_0 \leq$ 80	f_tol	-100	-	+100	$\times 10^{-6}$	$-40 \text{ to } +85^\circ\text{C}$ $-20 \text{ to } +70^\circ\text{C}$ $-10 \text{ to } +70^\circ\text{C}$ (Standard Operating Temperature Range)
	B				-50	-	+50		
	C				-30	-	+30		
	D				-25	-	+25		
	E				-20	-	+20		
Current Consumption	A,M	*	0.584375 $\leq f_0 <$ 40 40 $\leq f_0 \leq$ 80 0.584375 $\leq f_0 <$ 40 40 $\leq f_0 \leq$ 80 0.584375 $\leq f_0 <$ 40 40 $\leq f_0 \leq$ 80 0.584375 $\leq f_0 <$ 40 40 $\leq f_0 <$ 60 60 $\leq f_0 \leq$ 80	I_cc	-	-	3.0	mA	No Load
	B				-	-	4.2		
	C				-	-	2.4		
	D				-	-	3.7		
	A,M,B,C	*	0.584375 $\leq f_0 \leq$ 80	I_std	-	-	2.0		
	D				-	-	3.4		
	OE Pin 0 Level Input Voltage	*	*	V <sub>IL</sub>	-	-	1.4		
	OE Pin 1 Level Input Voltage	*	*	V <sub>IH</sub>	$V_{cc} \times 0.8$	-	1.6		
Rise and Fall Time		A,M,B,C	0.584375 $\leq f_0 \leq$ 80	tPLZ	-	-	1.9	ns	10 to 90% Vcc Level
Output Enable Time				tPZL	-	-	5.0		
Period Jitter (1)		*	*	tRMS	-	2.2	-	ps	$\sigma$ Peak to peak
Total Jitter (1)		*	*	tp-p	-	20	-		
Phase Jitter		*	*	tTL	-	31	-	ps	tDJ+n $\times$ tRJ n=14.1 (BER=1 $\times$ 10 $^{-12}$ ) (2) fo offset:12kHz to 20MHz fo offset:12kHz to 5MHz
Packing Unit (3)		*	40 $\leq f_0 \leq$ 80	tpJ	-	-	1		
				3000pcs./reel ( $\phi$ 180)					

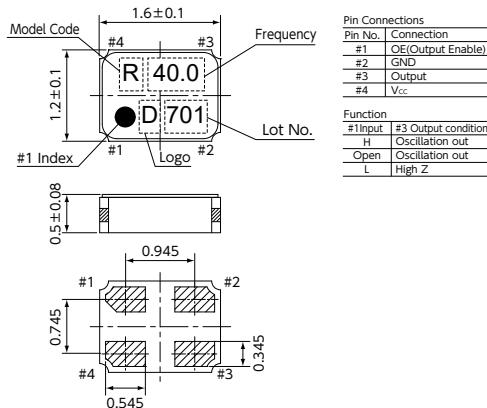
(1) Measured WAVECREST DTS-2075

Consult our sales representative for other specifications.

(2) tDJ : Deterministic jitter tRJ : Random jitter

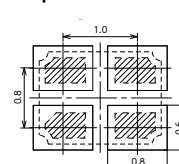
(3) Moisture prevention packing is unnecessary. Moisture Sensitivity Level : Level 1 (IPC/JEDEC J-STD-033)

### ■ Dimensions



### ■ Recommended Land Pattern

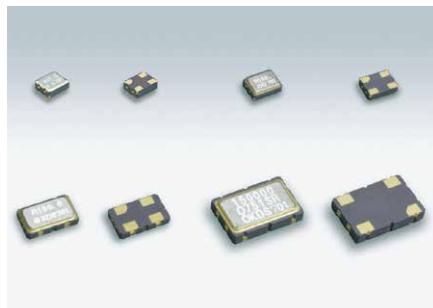
<Top View>



[mm]

# SMD Crystal Oscillators

DSO221SR/DSO321SR/DSO531SR/DSO751SR



Actual size DSO221SR DSO321SR  
DSO531SR DSO751SR

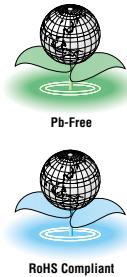
## ■ Features

- Low current consumption: 8mA max (167MHz, 3.3V)
- Supply Voltage: 1.8V/2.5V/2.8V/3.0V/3.3V
- Offers Narrow deviation:  $\pm 20 \times 10^{-6} / \pm 30 \times 10^{-6} / \pm 50 \times 10^{-6} / \pm 100 \times 10^{-6}$
- Available up to 167MHz by using AT cut fundamental resonator.
- Low jitter provides for high performance.
- Low profile: 0.815mm(DSO221SR),  
1.1mm(DSO321SR/DSO531SR),  
1.5mm(DSO751SR)
- AEC-Q200 Compliant  
(Option: Equivalent to AEC-Q100)

[Type]	DSO221SR	2520 size
	DSO321SR	3225 size
	DSO531SR	5032 size
	DSO751SR	7349 size

### [Function Code]

DSO***SR	A A
A : 3.3V	A : $\pm 100 \times 10^{-6}$
M : 3.0V	B : $\pm 50 \times 10^{-6}$
B : 2.8V	C : $\pm 30 \times 10^{-6}$
C : 2.5V	D : $\pm 25 \times 10^{-6}$
D : 1.8V	E : $\pm 20 \times 10^{-6}$



## ■ Standard Specification

When requesting the product, please select the model and function code of your request.

Item	Function Code		Output Frequency Range (MHz)	Legend	Spec.				Condition
	Supply Voltage	Frequency tolerance			min.	typ.	max.	Unit	
Supply Voltage	A	*	0.2 $\leq$ fo $\leq$ 167	VCC	+3.0	+3.3	+3.6	V	
			0.2 $\leq$ fo $\leq$ 167		+2.7	+3.0	+3.3		
			0.2 $\leq$ fo $\leq$ 157		+2.6	+2.8	+3.0		
			0.2 $\leq$ fo $\leq$ 157		+2.25	+2.5	+2.75		
			0.2 $\leq$ fo $\leq$ 80		+1.6	+1.8	+2.0		
Frequency Tolerance (Includes frequency tolerance at room temperature.)	A	*	0.2 $\leq$ fo $\leq$ 167	f_tol	-100	-	+100	$\times 10^{-6}$	$-40 \text{ to } +85^\circ\text{C}$ $-20 \text{ to } +70^\circ\text{C}$ $-10 \text{ to } +70^\circ\text{C}$ (Standard Operating Temperature Range)
			0.2 $\leq$ fo $\leq$ 125		-50	-	+50		
			0.2 $\leq$ fo $\leq$ 80		-30	-	+30		
			0.2 $\leq$ fo $\leq$ 80		-25	-	+25		
			0.2 $\leq$ fo $\leq$ 50		-20	-	+20		
Current Consumption	A,M	*	0.2 $\leq$ fo $<$ 32	Icc	-	-	1.8	mA	No Load
			32 $\leq$ fo $<$ 54		-	-	2.5		
			54 $\leq$ fo $<$ 80		-	-	5.0		
			80 $\leq$ fo $<$ 125		-	-	6.0		
			125 $\leq$ fo $\leq$ 167		-	-	8.0		
	B	*	0.2 $\leq$ fo $<$ 32		-	-	1.8		
			32 $\leq$ fo $<$ 54		-	-	2.5		
			54 $\leq$ fo $<$ 125		-	-	5.0		
			125 $\leq$ fo $\leq$ 157		-	-	7.0		
	C	*	0.2 $\leq$ fo $<$ 32	Icc	-	-	1.5	mA	No Load
			32 $\leq$ fo $<$ 54		-	-	2.0		
			54 $\leq$ fo $<$ 125		-	-	4.0		
	D	*	0.2 $\leq$ fo $<$ 32		-	-	6.0		
			32 $\leq$ fo $<$ 54		-	-	1.0		
			54 $\leq$ fo $\leq$ 80		-	-	3.0		
Stand-by Current (#1 pin "L" Level)	*	*	*	I_std	-	-	10	$\mu\text{A}$	
Load Condition	*	*	*	L_CMOS	-	-	15	pF	
	A,M	*	0.2 $\leq$ fo $\leq$ 80	L_CMOS	-	-	30		
Symmetry	*	*	fo $<$ 50	SYM	45	50	55	% 50% Vcc Level	
	*	*	fo $\geq$ 50	40	50	60			
0 Level Output Voltage	*	*	*	VOL	-	-	$\text{Vcc} \times 0.1$	V	
	*	*	*	V <sub>OH</sub>	$\text{Vcc} \times 0.9$	-	-		
Rise and Fall Time	A,M,B,C	*	0.2 $\leq$ fo $\leq$ 54	tr, tf	-	-	5(4)	ns	$L_{\text{CMOS}}: 15\text{pF}$ 10 to 90% Vcc Level $(20$ to 80% Vcc Level)
			0.2 $\leq$ fo $\leq$ 54		-	-	7(6)		
			54 $<$ fo $<$ 100		-	-	4(3)		
			100 $\leq$ fo $\leq$ 167		-	-	3(2.5)		
			0.2 $\leq$ fo $\leq$ 54		-	-	10		
	A,M	*	54 $<$ fo $\leq$ 80		-	-	6		$L_{\text{CMOS}}: 30\text{pF}$ 10 to 90% Vcc Level
			-		-	-	-		
OE Pin 0 Level Input Voltage	*	*	*	V <sub>IL</sub>	-	-	$\text{Vcc} \times 0.2$	V	
OE Pin 1 Level Input Voltage	*	*	*	V <sub>IH</sub>	$\text{Vcc} \times 0.8$	-	-		
Output Disable Time	*	*	*	tPLZ	-	-	150	ns	
Output Enable Time	*	*	*	tPZL	-	-	1	ms	
Period Jitter (1)	*	*	*	tRMS	-	2.2	-	ps	$\sigma$ Peak to peak
	*	*	*	tp-p	-	20	-		
Total Jitter (1)	*	*	*	tTL	-	31	-	ps	$tDJ+n \times tRJ = n=14.1$ (BER=1x10 <sup>-12</sup> ) (2)
Phase Jitter	*	*	40 $\leq$ fo $\leq$ 167	tpj	-	-	1	ps	$f_0$ offset: 12kHz to 20MHz $f_0$ offset: 12kHz to 5MHz
Packing Unit (3)	DSO221SR, DSO321SR: 2000pcs./reel ( $\phi$ 180) , DSO531SR: 1000pcs./reel ( $\phi$ 180) , DSO751SR: 1000pcs./reel ( $\phi$ 254)								

(1) Measured WAVECREST DTS-2075

(2) tDJ : Deterministic jitter tRJ : Random jitter

(3) Moisture prevention packing is unnecessary.

Moisture Sensitivity Level : Level 1 (IPC/JEDEC J-STD-033)

Consult our sales representative for other specifications.

# SMD Crystal Oscillators

**DSO221SR/DSO321SR/DSO531SR/DSO751SR**

## ■ Applications

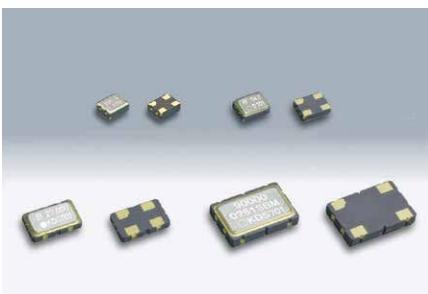
- PC, gaming equipment
- DSC, DVD, Blu-ray, HDTV, DVC, HDD
- WiMAX
- Camera module
- GbEthernet
- Automotive multimedia device

## ■ Dimensions [mm]

DSO221SR		DSO321SR		DSO531SR		DSO751SR	
<b>Pin Connections</b>							
Pin No. Connection #1 OE(Output Enable) #2 GND #3 Output #4 Vcc	Pin No. Connection #1 OE(Output Enable) #2 GND #3 Output #4 Vcc	Pin No. Connection #1 OE(Output Enable) #2 GND #3 Output #4 Vcc	Pin No. Connection #1 OE(Output Enable) #2 GND #3 Output #4 Vcc	Pin No. Connection #1 OE(Output Enable) #2 GND #3 Output #4 Vcc	Pin No. Connection #1 OE(Output Enable) #2 GND #3 Output #4 Vcc	Pin No. Connection #1 OE(Output Enable) #2 GND #3 Output #4 Vcc	Pin No. Connection #1 OE(Output Enable) #2 GND #3 Output #4 Vcc
Function #1Input #3 Output condition H Oscillation out Open Oscillation out L High Z	Function #1Input #3 Output condition H Oscillation out Open Oscillation out L High Z	Function #1Input #3 Output condition H Oscillation out Open Oscillation out L High Z	Function #1Input #3 Output condition H Oscillation out Open Oscillation out L High Z	Function #1Input #3 Output condition H Oscillation out Open Oscillation out L High Z	Function #1Input #3 Output condition H Oscillation out Open Oscillation out L High Z	Function #1Input #3 Output condition H Oscillation out Open Oscillation out L High Z	Function #1Input #3 Output condition H Oscillation out Open Oscillation out L High Z
<b>Recommended Land Pattern</b> (Top View)							

# SMD Crystal Oscillators

## DSO221SBM/DSO321SBM/DSO531SBM/DSO751SBM



Actual size DSO221SBM DSO321SBM  
DSO531SBM DSO751SBM

### ■ Features

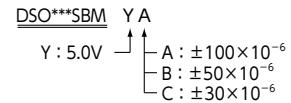
- Low current consumption
- 3-state function
- General purpose +5.0V HCMOS oscillator

### ■ Applications

- PC, visual and FA equipment applications



### [Function Code]



When requesting the product, please select the model and function code of your request.

[Type]	DSO221SBM	2520 size
	DSO321SBM	3225 size
	DSO531SBM	5032 size
	DSO751SBM	7349 size

### ■ Standard Specification

Item	Legend	Function Code			DSO221SBM				DSO221, 321, 531, 751 SBM				Condition		
		Supply Voltage	Frequency tolerance	Range (MHz)	Spec.			Range (MHz)	Spec.			Unit			
					min.	typ.	max.		min.	Typ.	max.				
Supply Voltage	V <sub>CC</sub>	*	*	3.25 ≤ f <sub>0</sub> ≤ 52	+4.5	+5.0	0.7 ≤ f <sub>0</sub> ≤ 90	+4.5	+5.0	+5.5	+5.5	V			
Frequency Tolerance (Includes frequency tolerance at room temperature.)	f <sub>TOL</sub>	*	A	3.25 ≤ f <sub>0</sub> ≤ 52	-100	-	+100	-100	-	+100	-	X10 <sup>-6</sup>	-40 to +85°C -20 to +70°C (Standard Operating Temperature Range)		
B			B	3.25 ≤ f <sub>0</sub> ≤ 52	-50	-	+50	0.7 ≤ f <sub>0</sub> ≤ 90	-50	-	+50	-			
C			C	3.25 ≤ f <sub>0</sub> ≤ 52	-30	-	+30	0.7 ≤ f <sub>0</sub> ≤ 54	-30	-	+30	-			
Current Consumption	I <sub>CC</sub>	*	*	3.25 ≤ f <sub>0</sub> ≤ 52	-	-	8.0	0.7 ≤ f <sub>0</sub> < 32	-	-	4.0	-			
								32 ≤ f <sub>0</sub> < 54	-	-	6.0	-			
								54 ≤ f <sub>0</sub> < 90	-	-	8.0	-			
Stand-by Current (#1 pin "L" Level)	I <sub>STD</sub>	*	*	*	-	-	10	*	-	-	50	μA			
Load Condition	L <sub>CMOS</sub>	*	*	*	-	-	15	*	-	-	30	pF			
Symmetry	SYM	*	*	*	45	50	55	f <sub>0</sub> < 26	45	50	55	%	50% V <sub>CC</sub> Level		
0 Level Output Voltage	V <sub>OL</sub>	*	*	*	-	-	V <sub>CC</sub> × 0.1	*	-	-	V <sub>CC</sub> × 0.1	-	V		
1 Level Output Voltage	V <sub>OH</sub>	*	*	*	V <sub>CC</sub> × 0.9	-	-	*	V <sub>CC</sub> × 0.9	-	-	-			
Rise and Fall Time	t <sub>RF</sub> , t <sub>TF</sub>	*	*	3.25 ≤ f <sub>0</sub> ≤ 52	-	-	4.0	0.7 ≤ f <sub>0</sub> ≤ 54	-	-	7 (6)	ns	L <sub>CMOS</sub> : 30pF 10 to 90% V <sub>CC</sub> Level (20 to 80% V <sub>CC</sub> Level)		
								54 < f <sub>0</sub> < 90	-	-	5 (4)	-			
OE Pin 0 Level Input Voltage	V <sub>IL</sub>	*	*	*	-	-	V <sub>CC</sub> × 0.2	*	-	-	V <sub>CC</sub> × 0.2	-	V		
OE Pin 1 Level Input Voltage	V <sub>IH</sub>	*	*	*	V <sub>CC</sub> × 0.8	-	-	*	V <sub>CC</sub> × 0.8	-	-	-			
Output Disable Time	t <sub>PLZ</sub>	*	*	*	-	-	100	*	-	-	150	ns			
Output Enable Time	t <sub>PZL</sub>	*	*	*	-	-	2.0	*	-	-	1	rms			
Period Jitter (1)	t <sub>RMS</sub>	*	*	*	-	2.5	-	*	-	2.5	-	ps	σ Peak to peak		
	t <sub>PP</sub>	*	*	*	-	20	-	*	-	20	-	-			
Total Jitter (1)	t <sub>TJL</sub>	*	*	*	-	35	-	*	-	35	-	ps	t <sub>DJ</sub> +n × t <sub>RJ</sub> n=14.1 (BER=1 × 10 <sup>-12</sup> ) (2)		
Phase Jitter	t <sub>PJ</sub>	*	*	40 ≤ f <sub>0</sub> ≤ 52	-	-	1	40 ≤ f <sub>0</sub> ≤ 90	-	-	1	ps	f <sub>0</sub> offset: 12kHz to 20MHz		
				10 ≤ f <sub>0</sub> < 40				10 ≤ f <sub>0</sub> < 40					f <sub>0</sub> offset: 12kHz to 5MHz		
Packing Unit (3)				DSO221SBM, DSO321SBM: 2000pcs./reel (φ180), DSO531SBM: 1000pcs./reel (φ180), DSO751SBM: 1000pcs./reel (φ254)											

(1) Measured WAVECREST DTS-2075

Consult our sales representative for other specifications.

(2) tDJ: Deterministic jitter tRJ: Random jitter

(3) Moisture prevention packing is unnecessary.

Moisture Sensitivity Level: Level 1 (IPC/JEDEC J-STD-033)

### ■ DSO221SBM

[mm]

### ■ DSO321SBM

[mm]

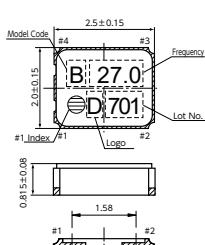
### ■ DSO531SBM

[mm]

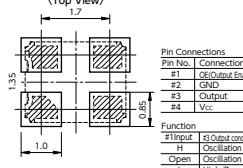
### ■ DSO751SBM

[mm]

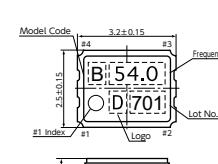
#### ■ Dimensions



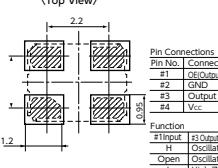
■ Recommended Land Pattern  
(Top View)



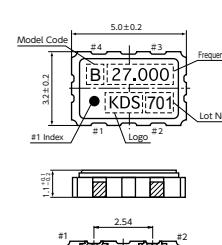
#### ■ Dimensions



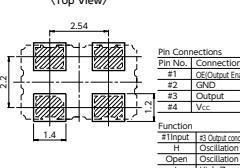
■ Recommended Land Pattern  
(Top View)



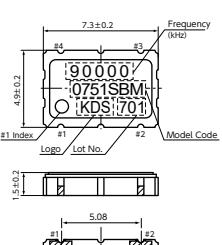
#### ■ Dimensions



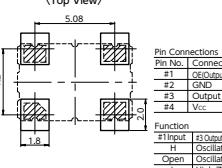
■ Recommended Land Pattern  
(Top View)



#### ■ Dimensions

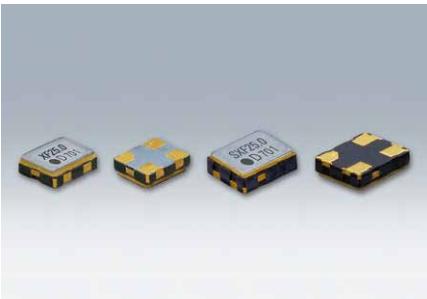


■ Recommended Land Pattern  
(Top View)



# SMD Crystal Oscillators

## DSO211SXF/DSO221SXF



Actual size DSO211SXF DSO221SXF

### ■ Features

- Supply Voltage: 1.8V/2.5V/2.8V/3.3V
- Available frequency range: 1 to 125MHz
- Low profile: 0.7mm (DSO211SXF), 0.8mm (DSO221SXF)
- CMOS Level Output
- Capable of operating over a wide temperature range, from -40 to 125°C .
- 3-state function



### ■ Applications

- Audio equipment, communication equipment, visual equipment, FA equipment, PC, gaming equipment and WLAN

#### [Function Code]

DSO***SXF	A Z
A : 3.3V	Z : $\pm 80 \times 10^{-6}$
B : 2.8V	B : $\pm 50 \times 10^{-6}$
C : 2.5V	C : $\pm 30 \times 10^{-6}$
D : 1.8V	D : $\pm 25 \times 10^{-6}$
E	E : $\pm 20 \times 10^{-6}$

When requesting the product, please select the model and function code of your request.

#### [Type]

DSO211SXF	2016 size
DSO221SXF	2520 size

### ■ Standard Specification

Item	Function Code		Output Frequency Range (MHz)	Legend	Spec.			Condition	
	Supply Voltage	Frequency tolerance			min.	typ.	max.		
Supply Voltage	A	*	1≤f <sub>0</sub> ≤125	V <sub>CC</sub>	+3.0	+3.3	+3.6	V	
	B				+2.6	+2.8	+3.0		
	C		1≤f <sub>0</sub> ≤100		+2.25	+2.5	+2.75		
	D				+1.6	+1.8	+2.0		
Frequency Tolerance (includes frequency tolerance at room temperature)	Z	*	* 1≤f <sub>0</sub> ≤100	f <sub>TOL</sub>	—	—	±80	×10 <sup>-6</sup> -40 to +125°C -40 to +85°C -20 to +70°C (-10 to +70°C (Standard Operating Temperature Range))	
	B				—	—	±50		
	C				—	—	±50		
	D				—	—	±30		
	E				—	—	±25		
Current Consumption	A	*	100≤f <sub>0</sub> ≤125 40≤f <sub>0</sub> <100 1≤f <sub>0</sub> <40	I <sub>CC</sub>	—	—	10.0	mA No Load	
	B				—	—	4.2		
	C				—	—	2.4		
	D				—	—	9.0		
	A		100≤f <sub>0</sub> ≤125 40≤f <sub>0</sub> <100 1≤f <sub>0</sub> <40		—	—	3.7		
	B				—	—	2.2		
	C				—	—	8.0		
	D				—	—	3.4		
	A				—	—	2.0		
	B				—	—	2.7		
Stand-by Current (#1 pin "L"Level)	*	*	*	I <sub>STANDBY</sub>	—	—	1.7	μA	
	*	*	*	I <sub>STANDBY</sub>	—	—	10		
Load Condition	*	*	*	L <sub>C</sub>	—	—	15	pF	
	*	*	*	L <sub>C</sub>	—	—	55		
Symmetry	*	*	*	SYMMETRY	45	50	55	%	
	*	*	*	V <sub>OHL</sub>	—	—	V <sub>CC</sub> ×0.1		
0 Level Output Voltage	*	*	*	V <sub>OHL</sub>	V <sub>CC</sub> ×0.9	—	—	V	
	*	*	*	V <sub>OHL</sub>	V <sub>CC</sub> ×0.9	—	—		
1 Level Output Voltage	*	*	*	V <sub>OVL</sub>	—	—	—	V	
	*	*	*	V <sub>OVL</sub>	—	—	—		
Rise and Fall Time	A, B, C	*	tr, tf	tr, tf	—	—	3	ns	
	D				—	—	5		
OE Pin 0 Level Input Voltage	*	*	*	V <sub>IOL</sub>	—	—	V <sub>CC</sub> ×0.3	ns	
	*	*	*	V <sub>IOL</sub>	V <sub>CC</sub> ×0.7	—	—		
OE Pin 1 Level Input Voltage	*	*	*	V <sub>IIL</sub>	—	—	—	ns	
	*	*	*	V <sub>IIL</sub>	V <sub>CC</sub> ×0.7	—	—		
Output Disable Time	*	*	*	t <sub>PLZ</sub>	—	—	200	ms	
	*	*	*	t <sub>PLZ</sub>	—	—	2		
Output Enable Time	*	*	*	t <sub>RMS</sub>	—	2.4	—	ms	
	*	*	*	t <sub>RMS</sub>	—	23	—		
Period Jitter (1)	*	*	*	t <sub>JITTER</sub>	—	32	—	ps	
	*	*	*	t <sub>JITTER</sub>	—	—	—		
Total Jitter (1)	*	*	*	t <sub>JITTER</sub>	—	—	—	ps	
	*	*	40≤f <sub>0</sub> ≤125 10≤f <sub>0</sub> <40	t <sub>JITTER</sub>	—	—	1		
Phase Jitter	*	*	40≤f <sub>0</sub> ≤125 10≤f <sub>0</sub> <40	t <sub>JITTER</sub>	—	—	1	ps	
	*	*	10≤f <sub>0</sub> <40	t <sub>JITTER</sub>	—	—	—		
Packing Unit (3)					3000pcs./reel (Ø 180)				

(1) Measured WAVECREST DTS-2075

Consult our sales representative for other specifications.

(2) tDJ:Deterministic jitter tRJ:Random jitter

(3) Moisture prevention packing is unnecessary. Moisture Sensitivity Level : Level1 (IPC/JEDEC J-STD-033)

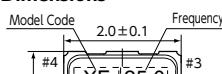
### ■ DSO211SXF

[mm]

### ■ DSO221SXF

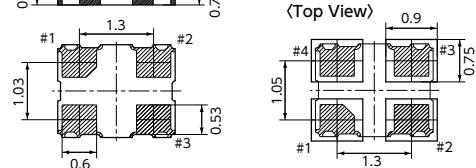
[mm]

#### ■ Dimensions



Pin Connections	
Pin No.	Connection
#1	OE(Output Enable)
#2	GND
#3	Output
#4	V <sub>CC</sub>

#### ■ Recommended Land Pattern (Top View)

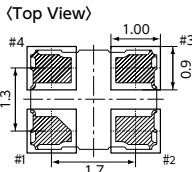


#### ■ Dimensions



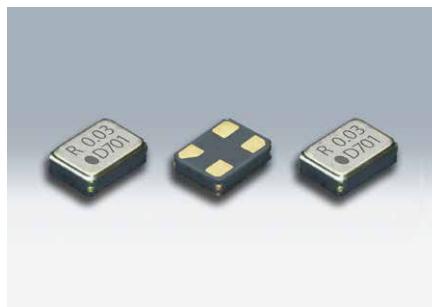
Pin Connections	
Pin No.	Connection
#1	OE(Output Enable)
#2	GND
#3	Output
#4	V <sub>CC</sub>

#### ■ Recommended Land Pattern



# SMD Crystal Oscillators

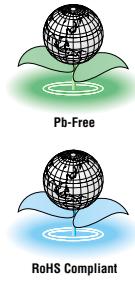
## DSO1612AR (kHz)



Actual size □

### ■ Features

- 1612 size, 0.5mm height, ultra miniature and lightweight
- Output Frequency : 32.768kHz
- Supply Voltage : 1.8V/2.5V/2.8V/3.0V/3.3V
- Low current consumption: 18µA typ
- Stable frequency variation realized by adopting an At cut resonator
- Capable of operating over a wide temperature range, from -40 to +125°C
- CMOS Level Output
- 3-state function



[Function Code]  
DSO1612AR AA

A : 3.3V	A,Y : $\pm 100 \times 10^{-6}$
M : 3.0V	Z : $\pm 80 \times 10^{-6}$
B : 2.8V	B : $\pm 50 \times 10^{-6}$
C : 2.5V	C : $\pm 30 \times 10^{-6}$
D : 1.8V	D : $\pm 25 \times 10^{-6}$
E	E : $\pm 20 \times 10^{-6}$

When requesting the product, please select  
the model and function code of your request.

### ■ Standard Specification

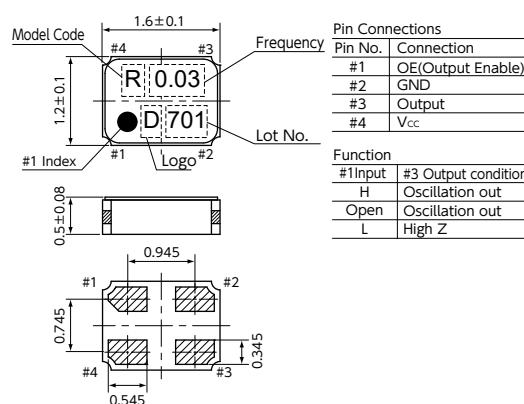
Item	Function Code		Output Frequency (kHz)	Legend	Spec.			Unit	Condition
	Supply Voltage	Frequency tolerance			min.	typ.	max.		
Supply Voltage	A	*	*	Vcc	+3.0	+3.3	+3.6	V	
	M				+2.7	+3.0	+3.3		
	B				+2.6	+2.8	+3.0		
	C				+2.25	+2.5	+2.75		
	D				+1.6	+1.8	+2.0		
Frequency Tolerance (includes frequency tolerance at room temperature)	*	Y	*	f_tol	—	—	±100	$\times 10^{-6}$	-40 to +125°C
	*	Z			—	—	±80		-40 to +110°C
	*	A			—	—	±100		-40 to +85°C
	*	B			—	—	±50		-20 to +70°C
	*	C			—	—	±30		-10 to +70°C
	*	D			—	—	±25		
	*	E			—	—	±20		
Current Consumption	*	*	*	I <sub>cc</sub>	—	18	32	µA	No Load
Stand-by Current (#1 pin "L" Level)	*	*	*	I <sub>std</sub>	—	—	5	µA	
Load Condition	*	*	*	L <sub>CMOS</sub>	—	—	15	pF	
Symmetry	*	*	*	SYM	45	50	55	%	50% Vcc Level
0 Level Output Voltage	*	*	*	V <sub>OL</sub>	—	—	V <sub>cc</sub> × 0.1	V	
1 Level Output Voltage	*	*	*	V <sub>OH</sub>	V <sub>cc</sub> × 0.9	—	—		
Rise and Fall Time	*	*	*	t <sub>rf</sub>	—	—	50	ns	10 to 90% Vcc Level
OE Pin 0 Level Input Voltage	*	*	*	V <sub>IL</sub>	—	—	V <sub>cc</sub> × 0.3	V	
OE Pin 1 Level Input Voltage	*	*	*	V <sub>IH</sub>	V <sub>cc</sub> × 0.7	—	—		
Output Disable Time	*	*	*	t <sub>PZ</sub>	—	—	1	µs	
Output Enable Time	*	*	*	t <sub>PL</sub>	—	—	10	ms	
Packing Unit (1)	3000pcs./reel (φ180)								

- (1) Moisture prevention packing is unnecessary.  
Moisture Sensitivity Level : Level1 (IPC/JEDEC J-STD-033)

Consult our sales representative for other specifications.

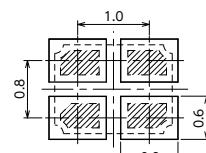
[mm]

### ■ Dimensions



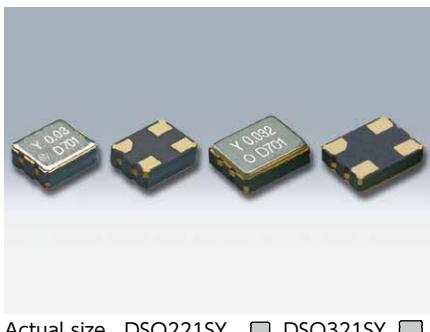
### ■ Recommended Land Pattern

&lt;Top View&gt;



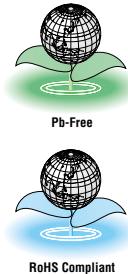
# SMD Crystal Oscillators

## DSO221SY/DSO321SY



### ■ Features

- Available frequency range : 32.768kHz, 1.049 to 8.5MHz
- Supply Voltage: 1.8V/2.5V/2.8V/3.3V
- 3-state function
- Low current consumption: 10µA typ.(32.768kHz)
- CMOS Level Output
- Stable frequency variation realized by adopting an At cut resonator
- AEC-Q200 Compliant (Option: Equivalent to AEC-Q100)



### ■ Applications

- Timer module, Industrial measuring equipment, Consumer Product

[Type]	DSO221SY	2520 size
	DSO321SY	3225 size

[Function Code]  
DSO\*\*\*SY AA

A : 3.3V	A : $\pm 100 \times 10^{-6}$
B : 2.8V	B : $\pm 50 \times 10^{-6}$
C : 2.5V	N : $\pm 35 \times 10^{-6}$
D : 1.8V	C : $\pm 30 \times 10^{-6}$
	D : $\pm 25 \times 10^{-6}$

When requesting the product, please select the model and function code of your request.

### ■ Standard Specification

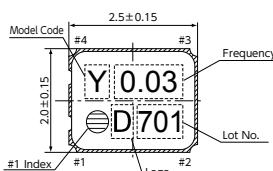
Item	Function Code		Output Frequency Range	Legend	Spec.				Condition
	Supply Voltage	Frequency tolerance			min.	typ.	max.	Unit	
Supply Voltage	A	*	32.768kHz 1.049≤f <sub>0</sub> ≤8.5MHz	Vcc	+3.0	+3.3	+3.6		V
	B				+2.6	+2.8	+3.0		
	C				+2.25	+2.5	+2.75		
	D				+1.6	+1.8	+2.0		
Frequency Tolerance (includes frequency tolerance at room temperature)	A	*	32.768kHz 1.049≤f <sub>0</sub> ≤8.5MHz	f <sub>tol</sub>	-100	-	+100		×10 <sup>-6</sup>
	B				-50	-	+50		
	N				-35	-	+35		
	C				-30	-	+30		
	D				-25	-	+25		
Current Consumption	*	*	32.768kHz 1.049≤f <sub>0</sub> ≤8.5MHz	I <sub>CC</sub>	—	—	18	µA	No Load
Stand-by Current (#1 pin "L" Level)	*	*	*	I <sub>std</sub>	—	—	700	µA	—40 to +85°C
Load Condition	*	*	*	L <sub>CMOS</sub>	—	—	3	µA	—40 to +85°C
Symmetry	*	*	32.768kHz 1.049≤f <sub>0</sub> ≤8.5MHz	SYM	45 40	50 50	55 60	%	—10 to +70°C (Standard Operating Temperature Range)
0 Level Output Voltage	*	*	*	V <sub>OL</sub>	—	—	V <sub>CC</sub> ×0.1	V	
1 Level Output Voltage	*	*	*	V <sub>OH</sub>	V <sub>CC</sub> ×0.9	—	—	V	
Rise and Fall Time	*	*	*	t <sub>r</sub> , t <sub>f</sub>	—	—	15	ns	10 to 90% V <sub>CC</sub> Level
OE Pin 0 Level Input Voltage	*	*	*	V <sub>IL</sub>	—	—	V <sub>CC</sub> ×0.2	V	
OE Pin 1 Level Input Voltage	*	*	*	V <sub>IH</sub>	V <sub>CC</sub> ×0.8	—	—	V	
Output Disable Time	*	*	*	t <sub>PLZ</sub>	—	—	100	ns	
Output Enable Time	*	*	*	t <sub>PZL</sub>	—	—	20	ms	
Packing Unit (1)	2000pcs./reel (φ180)								

(1) Moisture prevention packing is unnecessary.  
Moisture Sensitivity Level: Level 1 (IPC/JEDEC J-STD-033)

Consult our sales representative for other specifications.

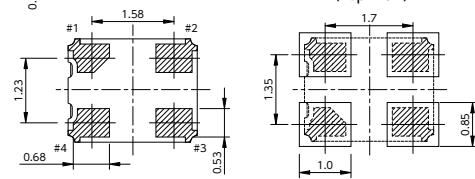
### ■ DSO221SY

#### ■ Dimensions



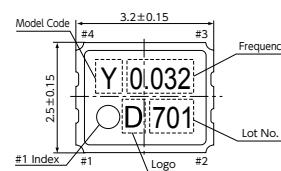
Function	
#1 Input	#3 Output condition
H	Oscillation out
Open	Oscillation out
L	High Z

■ Recommended Land Pattern  
(Top View)



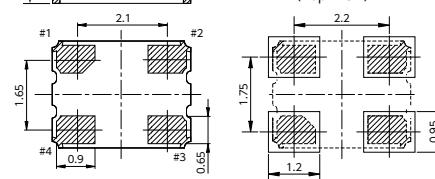
### ■ DSO321SY

#### ■ Dimensions



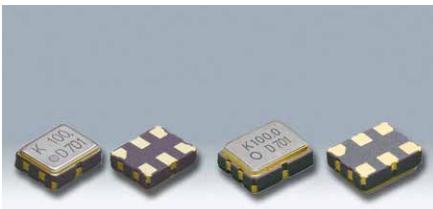
Function	
#1 Input	#3 Output condition
H	Oscillation out
Open	Oscillation out
L	High Z

■ Recommended Land Pattern  
(Top View)



# SMD Differential Output Crystal Oscillators

DSO223SK/DSO323SK/DSO223SJ/DSO323SJ/DSO223SD/DSO323SD



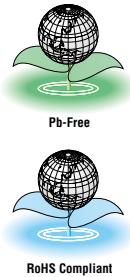
Actual size DSO223S ■ DSO323S ■

## ■ Features

- 2.5V/3.3V operating voltage, High speed type
- 3-state function
- LV-PECL output (DSO223/323SK)
- LVDS output (DSO223/323SJ)
- HCSL output (DSO223/323SD)
- AEC Standard

DSO223SK/SJ/SD: AEC-Q200 Compliant

DSO323SK/SJ/SD: AEC-Q200 Compliant (Option: Equivalent to AEC-Q100)



## ■ Applications

- Server, Optical transmission device, Communication base station and Automotive multimedia device

### [Type]

DSO223S SERIES	2520 size
DSO323S SERIES	3225 size

### [Function Code]

Model Code	K : LVECL J : LVDS D : HCSL
Supply Voltage	A : 3.3V C : 2.5V

Operating Temperature Range	A : -10 to +70°C C : 40 to +85°C
Frequency Tolerance	A : $\pm 100 \times 10^{-6}$ B : $\pm 50 \times 10^{-6}$

When requesting the product, please select the model and function code of your request.

## ■ Standard Specification

Item	Type	Legend	DSO223SK DSO323SK	DSO223SJ DSO323SJ	DSO223SD DSO323SD
Output Specification	—	LV-PECL	LVDS	HCSL	
Output Frequency Range	f <sub>o</sub>		13.5 to 167MHz (DSO223S SERIES) / 13.5 to 212.5MHz (DSO323S SERIES)		
Supply Voltage	V <sub>CC</sub>		+2.5V±0.125V/+3.3V±0.165V		
Frequency Tolerance (Includes frequency tolerance at room temperature.)	f <sub>TOL</sub>		$\pm 50 \times 10^{-6}$ max., $\pm 100 \times 10^{-6}$ max.		
Storage Temperature Range	T <sub>STG</sub>		-40 to +85°C		
Operating Temperature Range	T <sub>USE</sub>		-10 to +70°C, -40 to +85°C		
Current Consumption	I <sub>CC</sub>	45mA max. ( $f_0 \leq 170$ MHz), 50mA max. (170MHz < $f_0 \leq 212.5$ MHz)	20mA max.	30mA max. ( $f_0 \leq 170$ MHz), 35mA max. (170MHz < $f_0 \leq 212.5$ MHz)	
Stand-by Current (#1 pin "L" Level)	I <sub>STD</sub>		10 μA max.		
Load Condition	Load-R	50Ω to V <sub>CC</sub> -2V	100Ω (Output-OutputN)		50Ω
Symmetry	SYM		45 to 55% [at outputs cross point]		
0 Level Output Voltage	V <sub>OLO</sub>	V <sub>CC</sub> -1.81 to V <sub>CC</sub> -1.62V	—		-0.15 to 0.15V
1 Level Output Voltage	V <sub>OHI</sub>	V <sub>CC</sub> -1.025 to V <sub>CC</sub> -0.88V	—		0.58 to 0.85V
Rise and Fall Time	tr, tf	0.5ns max. [20 to 80% Output, OutputN]	0.4ns max. [20 to 80% Output-OutputN]		0.5ns max. [0.175 to 0.525V Level]
Differential Output Voltage	V <sub>OD1</sub> , V <sub>OD2</sub>	—	0.247 to 0.454V		—
Change to V <sub>DD</sub>	ΔV <sub>OD</sub>	—	50mV [ΔV <sub>OD</sub> =  V <sub>OD1</sub> -V <sub>OD2</sub>   ]		—
Offset Voltage	V <sub>OS</sub>	—	1.125 to 1.375V		—
Offset to V <sub>DD</sub>	ΔV <sub>OS</sub>	—	50mV		—
Crossing Point Voltage	V <sub>CR</sub>	—	—		250 to 550mV
OE Pin 0 Level Input Voltage	V <sub>ILO</sub>		V <sub>CC</sub> ×0.3 max.		
OE Pin 1 Level Input Voltage	V <sub>IHI</sub>		V <sub>CC</sub> ×0.7 min.		
Output Disable Time	t <sub>PLZ</sub>		200ns		
Output Enable Time	t <sub>PZL</sub>		2ms		
Period Jitter (1)	t <sub>RMS</sub> tp-p	5ps typ. (13.5MHz≤f <sub>0</sub> <27MHz) / 2.5ps typ. (27MHz≤f <sub>0</sub> ≤212.5MHz) (σ) 33ps typ. (13.5MHz≤f <sub>0</sub> <27MHz) / 22ps typ. (27MHz≤f <sub>0</sub> ≤212.5MHz) (Peak to peak)			
Total Jitter (1)	t <sub>TL</sub>	50ps typ. (13.5MHz≤f <sub>0</sub> <27MHz) / 35ps typ. (27MHz≤f <sub>0</sub> ≤212.5MHz) [t <sub>DJ</sub> + n <sub>x</sub> t <sub>RJ</sub> n=14.1(BER=1×10 <sup>-12</sup> ) (2)]			
Phase Jitter	t <sub>pj</sub>	1.5ps max. (13.5MHz≤f <sub>0</sub> <27MHz) / 1ps max. (27MHz≤f <sub>0</sub> ≤212.5MHz) [13.5MHz≤f <sub>0</sub> <40MHz, f <sub>0</sub> offset:12kHz to 5MHz, f <sub>0</sub> ≥40MHz, f <sub>0</sub> offset:12kHz to 20MHz]			
Packing Unit (3)	—	—	2000pcs./reel (φ180)		

(1) Measured WAVECREST DTS-2075

Consult our sales representative for other specifications.

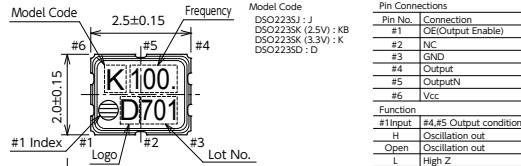
(2) t<sub>DJ</sub> : Deterministic jitter      t<sub>RJ</sub> : Random jitter

(3) Moisture prevention packing is unnecessary.

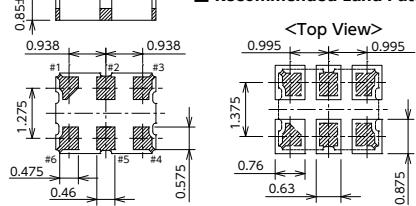
Moisture Sensitivity Level : Level 1 (IPC/JEDEC J-STD-033)

## ■ DSO223S SERIES

### ■ Dimensions



### ■ Recommended Land Pattern

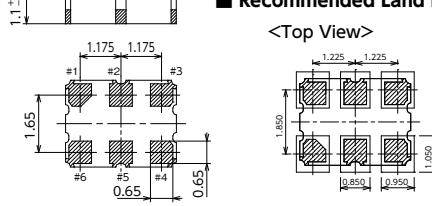


## ■ DSO323S SERIES

### ■ Dimensions

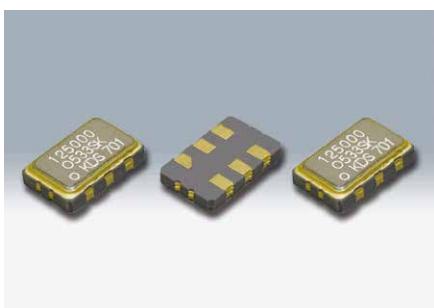


### ■ Recommended Land Pattern



# SMD Differential Output Crystal Oscillators

## DSO533SK/DSO533SJ

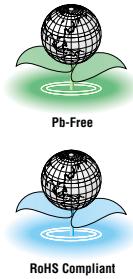


### ■ Features

- 5032 size, 1.1mm height
- 2.5V/3.3V operating voltage,
- High speed type(13.5 to 212.5MHz)
- 3-state function
- LV-PECL output(DSO533SK)
- LVDS output(DSO533SJ)

### ■ Applications

- Sever, SONET/SDH, PC



### ■ Standard Specification

Item	Type	Legend	DSO533SK	DSO533SJ
Output Specification		—	LV-PECL	LVDS
Output Frequency Range	f <sub>0</sub>		13.5 to 212.5MHz	
Supply Voltage	V <sub>CC</sub>		+2.5V±0.125V/+3.3V±0.165V	
Frequency Tolerance (Includes frequency tolerance at room temperature.)	f <sub>TOL</sub>		±50 × 10 <sup>-6</sup> max., ±100 × 10 <sup>-6</sup> max.	
Storage Temperature Range	T <sub>STG</sub>		−40 to +85°C	
Operating Temperature Range	T <sub>USE</sub>		−10 to +70°C, −40 to +85°C	
Current Consumption	I <sub>CC</sub>	45mA max. (f <sub>0</sub> ≤170MHz), 50mA max. (170MHz< f <sub>0</sub> ≤212.5MHz)		20mA max.
Stand-by Current (#1 pin "L" Level)	I <sub>STD</sub>		10μA max.	
Load Condition	Load-R	50Ω to V <sub>CC</sub> −2V		100Ω (Output-OutputN)
Symmetry	SYM		45 to 55% [at outputs cross point]	
0 Level Output Voltage	V <sub>OLO</sub>	V <sub>CC</sub> −1.81 to V <sub>CC</sub> −1.62V		—
1 Level Output Voltage	V <sub>OHI</sub>	V <sub>CC</sub> −1.025 to V <sub>CC</sub> −0.88V		—
Rise and Fall Time	tr, tf	0.5ns max. [20 to 80% Output, OutputN]	0.4ns max. [20 to 80% Output-OutputN]	
Differential Output Voltage	V <sub>OD1</sub> , V <sub>OD2</sub>	—	0.247 to 0.454V	
Change to V <sub>OD</sub>	ΔV <sub>OD</sub>	—	50mV [ΔV <sub>OD</sub> =   V <sub>OD1</sub> −V <sub>OD2</sub>   ]	
Offset Voltage	V <sub>OS</sub>	—	1.125 to 1.375V	
Offset to V <sub>OS</sub>	ΔV <sub>OS</sub>	—	50mV	
OE Pin 0 Level Input Voltage	V <sub>ILO</sub>	V <sub>CC</sub> ×0.3 max.		
OE Pin 1 Level Input Voltage	V <sub>IHI</sub>	V <sub>CC</sub> ×0.7 min.		
Output Disable Time	t <sub>PLZ</sub>	200ns		
Output Enable Time	t <sub>PZL</sub>	2ms		
Period Jitter (1)	t <sub>RMS</sub>	5ps typ. (13.5MHz≤f <sub>0</sub> <27MHz) / 2.5ps typ. (27MHz≤f <sub>0</sub> ≤212.5MHz) (σ)		
tp-p		33ps typ. (13.5MHz≤f <sub>0</sub> <27MHz) / 22ps typ. (27MHz≤f <sub>0</sub> ≤212.5MHz) (Peak to peak)		
Total Jitter (1)	t <sub>TL</sub>	50ps typ. (13.5MHz≤f <sub>0</sub> <27MHz) / 35ps typ. (27MHz≤f <sub>0</sub> ≤212.5MHz) [t <sub>DJ</sub> + n×t <sub>RJ</sub> n=14.1(BER=1×10 <sup>−12</sup> ) (2)]		
Phase Jitter	tpj	1.5ps max. (13.5MHz≤f <sub>0</sub> <27MHz) / 1ps max. (27MHz≤f <sub>0</sub> ≤212.5MHz) [13.5MHz≤f <sub>0</sub> <40MHz, fo offset:12kHz to 5MHz fo≥40MHz, fo offset:12kHz to 20MHz]		
Packing Unit (3)	—	1000pcs./reel (φ 180)		

(1) Measured WAVECREST DTS-2075

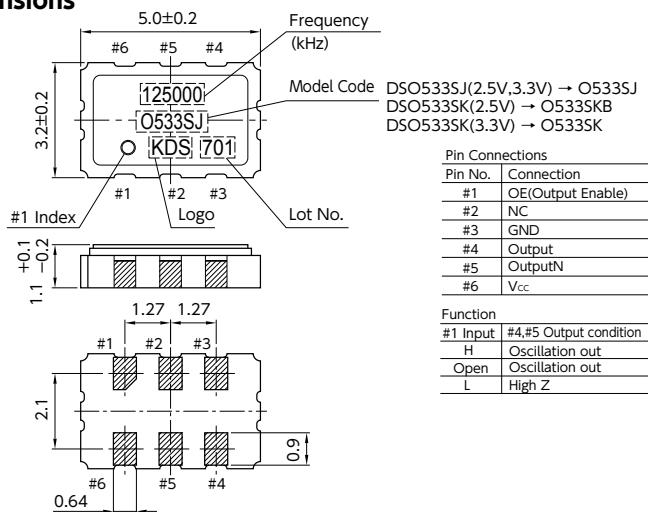
Consult our sales representative for other specifications.

(2) tDJ : Deterministic jitter      tRJ : Random jitter

(3) Moisture prevention packing is unnecessary.

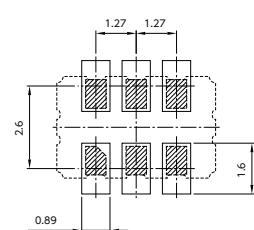
Moisture Sensitivity Level : Level 1 (IPC/JEDEC J-STD-033)

### ■ Dimensions



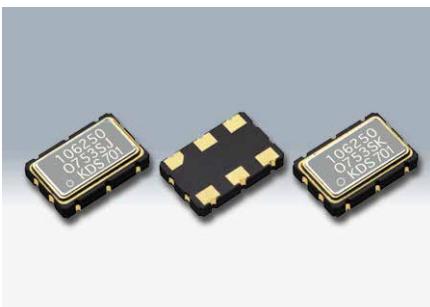
### ■ Recommended Land Pattern

#### <Top View>



# SMD Differential Output Crystal Oscillators

## DSO753SK/DSO753SJ/DSO753SD



Actual size

### ■ Features

- Package size : 7.3×4.9×1.5mm
- 2.5V/3.3V operating voltage,
- High speed type (13.5 to 212.5MHz)
- 3-state function
- LV-PECL output (DSO753SK)
- LVDS output (DSO753SJ)
- HCSL output(DSO753SD)



### ■ Applications

- Server, FC-HBA

### ■ Standard Specification

Item	Type	Legend	DSO753SK	DSO753SJ	DSO753SD
Output Specification		-	LV-PECL	LVDS	HCSL
Output Frequency Range	f <sub>0</sub>			13.5 to 212.5MHz	
Supply Voltage	V <sub>CC</sub>			+2.5V±0.125V/+3.3V±0.165V	
Frequency Tolerance (Includes frequency tolerance at room temperature.)	f <sub>tol</sub>			±50×10 <sup>-6</sup> max., ±100×10 <sup>-6</sup> max.	
Storage Temperature Range	T <sub>stg</sub>			-40 to +85°C	
Operating Temperature Range	T <sub>use</sub>			-10 to +70°C, -40 to +85°C	
Current Consumption	I <sub>CC</sub>	45mA max. (f <sub>0</sub> ≤170MHz), 50mA max. (170MHz<f <sub>0</sub> ≤212.5MHz)		20mA max.	30mA max. (f <sub>0</sub> ≤170MHz), 35mA max. (170MHz<f <sub>0</sub> ≤212.5MHz)
Stand-by Current (#1 pin "L" Level)	I <sub>std</sub>			10μA max.	
Load Condition	Load-R	50Ω to V <sub>CC</sub> -2V		100Ω (Output-OutputN)	50Ω
Symmetry	SYM			45 to 55% [at outputs cross point]	
0 Level Output Voltage	V <sub>OL</sub>	V <sub>CC</sub> -1.81 to V <sub>CC</sub> -1.62V		-	-0.15 to 0.15V
1 Level Output Voltage	V <sub>OH</sub>	V <sub>CC</sub> -1.025 to V <sub>CC</sub> -0.88V		-	0.58 to 0.85V
Rise and Fall Time	tr, tf	0.5ns max. [20 to 80% Output,OutputN]		0.4ns max. [20 to 80% Output-OutputN]	0.5ns max. [0.175 to 0.525V Level]
Differential Output Voltage	V <sub>OD1</sub> , V <sub>OD2</sub>	-		0.247 to 0.454V	-
Change to V <sub>OD</sub>	ΔV <sub>OD</sub>	-		50mV [ΔV <sub>OD</sub> =   V <sub>OD1</sub> -V <sub>OD2</sub>   ]	-
Offset Voltage	V <sub>OS</sub>	-		1.125 to 1.375V	-
Offset to V <sub>OS</sub>	ΔV <sub>OS</sub>	-		50mV	-
Crossing Point Voltage	V <sub>CR</sub>	-		-	250 to 550mV
OE Pin 0 Level Input Voltage	V <sub>IL</sub>			V <sub>CC</sub> ×0.3 max.	
OE Pin 1 Level Input Voltage	V <sub>IH</sub>			V <sub>CC</sub> ×0.7 min.	
Output Disable Time	t <sub>PLZ</sub>			200ns	
Output Enable Time	t <sub>PZL</sub>			2ms	
Period Jitter (1)	t <sub>RMS</sub>	5ps typ. (13.5MHz≤f <sub>0</sub> <27MHz) / 2.5ps typ. (27MHz≤f <sub>0</sub> ≤212.5MHz) (σ)			
	t <sub>p-p</sub>	33ps typ. (13.5MHz≤f <sub>0</sub> <27MHz) / 22ps typ. (27MHz≤f <sub>0</sub> ≤212.5MHz) (Peak to peak)			
Total Jitter (1)	t <sub>TL</sub>	50ps typ. (13.5MHz≤f <sub>0</sub> <27MHz) / 35ps typ. (27MHz≤f <sub>0</sub> ≤212.5MHz) [t <sub>DJ</sub> +nxtRJ n=14.1(BER=1×10 <sup>-12</sup> ) (2)]			
Phase Jitter	t <sub>pj</sub>	1.5ps max. (13.5MHz≤f <sub>0</sub> <27MHz) / 1ps max. (27MHz≤f <sub>0</sub> ≤212.5MHz) [13.5MHz≤f <sub>0</sub> <40MHz, f <sub>0</sub> offset:12kHz to 5MHz f <sub>0</sub> ≥40MHz, f <sub>0</sub> offset:12kHz to 20MHz]			
Packing Unit (3)	-			1000pcs./reel (φ254)	

(1) Measured WAVECREST DTS-2075

(2) t<sub>DJ</sub>: Deterministic jitter t<sub>RJ</sub>: Random

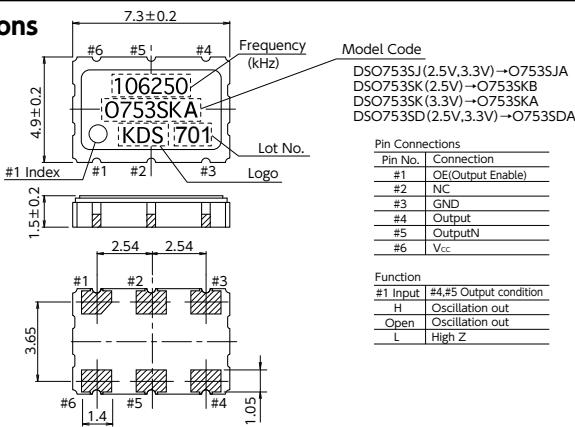
(3) Moisture prevention packing is unnecessary.

Moisture Sensitivity Level: Level 1 (IPC/JEDEC J-STD-033)

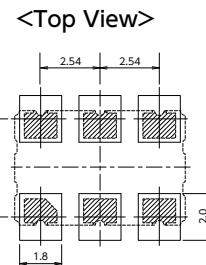
Consult our sales representative for other specifications.

[mm]

### ■ Dimensions

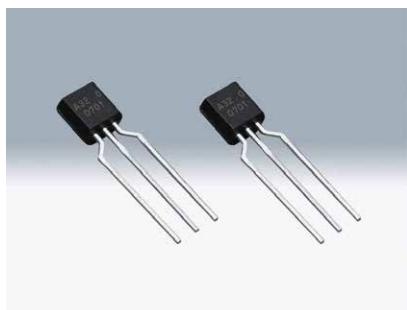


### ■ Recommended Land Pattern



# Crystal Oscillators

## DLO555MBA



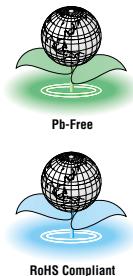
### ■ Features

- Small crystal oscillator in TO92 package
- Built-in bypass capacitor to improve noise resistance
- No PLL, No multiplier in oscillation circuit  
(The divider circuit, some cases be used)
- High-speed oscillation start up time(1ms)

### ■ Type

D L O 5 5 5 M B A  
 ① ② ③ ④ ⑤ ⑥ ⑦ ⑧ ⑨

- ① D : Corporate name (Daishinku)
- ② L : Lead type
- ③ O : SPXO
- ④, ⑤ 5 : Dimensions
- ⑥ 5 : 3 terminals
- ⑦ M : Mold type
- ⑧ B : Vcc : 5V, CMOS Level Output
- ⑨ A : Improved impact electric field resistance



### ■ Applications

- Gaming equipment
- Industrial equipment

### ■ Absolute Maximum Ratings

Item	Legend	Spec.	Unit
Supply Voltage	Vcc	-0.5 to +6.0	V
Output Pin Voltage	Vout	-0.5 to Vcc+0.5	V
Output Pin Current	Iout	10	mA
Storage Temperature Range	T_str	-40 to +105	°C

### ■ Recommended Operating Conditions

Item	Legend	min.	typ.	max.	Unit
Supply Voltage	Vcc	3.0	5.0	5.5	V
Load Condition	L_CMOS	—	—	15	pF
				30	
Operating Temperature Range	T_opr	-10	—	+85	°C

### ■ Standard Specification

Item	Legend	Spec.			Unit	Condition
		min.	typ.	max.		
Output Frequency Range	f <sub>0</sub>	1.5	—	54	MHz	L_CMOS : 30pF
Frequency Tolerance	f <sub>tol</sub>	-100 -50	—	+100 +50	×10 <sup>-6</sup>	T_opr= -10 to +85°C Vcc= +3.0 to +5.5V
Aging	—	—	—	±5	×10 <sup>-6</sup> /year	
Current Consumption	I <sub>cc</sub>	—	—	8	mA	No load
Symmetry	SYM	45	—	55	%	50% Vcc level
0 Level Output Voltage	V <sub>OL</sub>	—	—	V <sub>CC</sub> ×0.1	V	
1 Level Output Voltage	V <sub>OH</sub>	V <sub>CC</sub> ×0.9	—	—	V	
Rise and Fall Time	t <sub>r,tf</sub>	—	—	7.5	ns	L_CMOS : 30pF 20 to 80% Vcc level
Start Up Time	T <sub>start</sub>	—	—	1	ms	t=0 at 90% Vcc
Phase Noise	—	—	-139 -156	—	dBc/Hz	Offset 1kHz Offset 100kHz
Period Jitter (1)	t <sub>RMS</sub>	—	2.4	—	σ	
	t <sub>p-p</sub>	—	20	—	ps	Peak to peak
Total Jitter (1)	t <sub>TL</sub>	—	34	—		t <sub>DJ</sub> +n×t <sub>RJ</sub> n=14.1(BER=1×10 <sup>-12</sup> ) (2)
Phase Jitter (3)	t <sub>pj</sub>	—	—	1		10MHz≤f <sub>0</sub> <54MHz f <sub>0</sub> offset 12kHz to 5MHz 40MHz≤f <sub>0</sub> ≤60MHz f <sub>0</sub> offset 12kHz to 20MHz
Built-in Bypass Capacitors Capacitance	C <sub>bp</sub>	—	0.1	—	μF	Vcc to GND capacitance

(1) Measured WAVECREST DTS-2075

Consult our sales representative for other specifications.

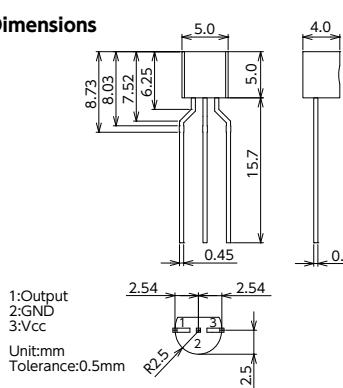
(2) t<sub>DJ</sub>: Deterministic jitter t<sub>RJ</sub>: Random jitter

(3) Measured Keysight Technologies E5052B

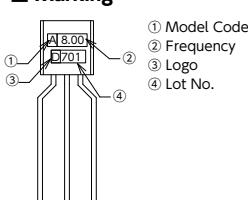
\*Moisture prevention packing is unnecessary. Moisture Sensitivity Level : Level 1 (IPC/JEDEC J-STD-033)

### ■ Dimensions

#### ■ Dimensions



#### ■ Marking



- ① Model Code
- ② Frequency
- ③ Logo
- ④ Lot No.

# SMD Voltage Controlled Crystal Oscillators

## DSV221SV/DSV321SV

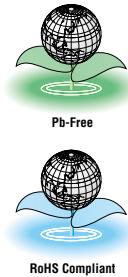


### ■ Features

- DSV221SV: 2520 size, 0.8 mm height  
DSV321SV: 3225 size, 1.1mm height
- The product is an analog VCXO which ensures good variable frequency and a linear changing frequency.
- Low current consumption

### ■ Applications

- DVD, Digital TV, STB, backbone transmission equipment



Actual size DSV221SV ■ DSV321SV ■

### ■ Standard Specification

Item	Type	Legend	DSV221SV	DSV321SV
Output Frequency Range		f <sub>0</sub>	30.72MHz	6.75 to 125MHz
Supply Voltage		V <sub>cc</sub>	+3.3V±0.33V	
Frequency Control Voltage		V <sub>cont</sub>	+1.65V±1.65V	
Storage Temperature Range		T <sub>stg</sub>	-40 to +85°C	
Operating Temperature Range		T <sub>use</sub>	-30 to +85°C	-10 to +70°C / -30 to +85°C
Frequency Tolerance (Includes frequency tolerance at room temperature.)		f <sub>tol</sub>	±40×10 <sup>-6</sup> max.	
Frequency Adjustment Range		f <sub>cont</sub>	±100×10 <sup>-6</sup> min. [Positive Slope]	
Current Consumption	I <sub>cc</sub>		7mA max. [No Load] 17mA max. (40MHz<f <sub>0</sub> ≤70MHz) 27mA max. (54MHz<f <sub>0</sub> ≤125MHz) [No Load]	7mA max. (6.75MHz≤f <sub>0</sub> ≤36MHz) 17mA max. (40MHz<f <sub>0</sub> ≤70MHz) 27mA max. (54MHz<f <sub>0</sub> ≤125MHz) [No Load]
Load Condition	L <sub>Cmos</sub>		15pF	
Symmetry	SYM		40 to 60% [50% V <sub>cc</sub> Level]	
0 Level Output Voltage	V <sub>OL</sub>		V <sub>cc</sub> ×0.1 max.	
1 Level Output Voltage	V <sub>OH</sub>		V <sub>cc</sub> ×0.9 min.	
Rise and Fall Time	tr, tf		5ns max. [10 to 90% V <sub>cc</sub> Level]	5ns max. (6.75MHz≤f <sub>0</sub> ≤90MHz) 3ns max. (90MHz<f <sub>0</sub> ≤125MHz) [10 to 90% V <sub>cc</sub> Level]
Period Jitter (1)	t <sub>RMS</sub>		2.4ps typ. (σ)	
	t <sub>p-p</sub>		22ps typ. (Peak to peak)	
Total Jitter (1)	t <sub>TL</sub>		33ps typ. [t <sub>DJ</sub> + n×t <sub>RJ</sub> n=14.1(BER=1×10 <sup>-12</sup> )(2)]	
Phase Jitter	t <sub>pj</sub>		1ps max. (10MHz≤f <sub>0</sub> <40MHz, f <sub>0</sub> offset : 12kHz to 5MHz, f <sub>0</sub> ≥40MHz, f <sub>0</sub> offset : 12kHz to 20MHz)	
Packing Unit (3)	—		2000pcs./reel (φ180)	

(1) Measured WAVECREST DTS-2075

Consult our sales representative for other specifications.

(2) tDJ : Deterministic jitter tRJ : Random jitter

(3) Moisture prevention packing is unnecessary.

Moisture Sensitivity Level : Level 1 (IPC/JEDEC J-STD-033)

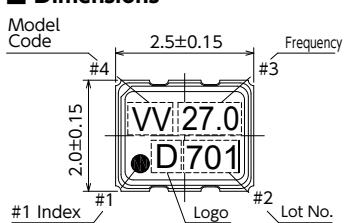
### ■ DSV221SV

[mm]

### ■ DSV321SV

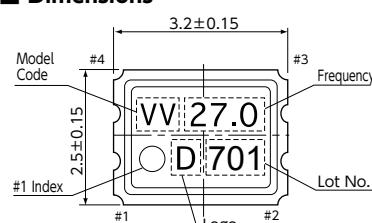
[mm]

#### ■ Dimensions



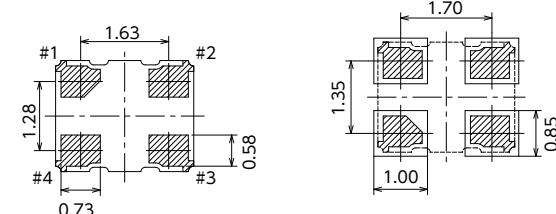
Pin Connections	
Pin No.	Connection
#1	V <sub>cont</sub>
#2	GND
#3	Output
#4	V <sub>cc</sub>

#### ■ Dimensions

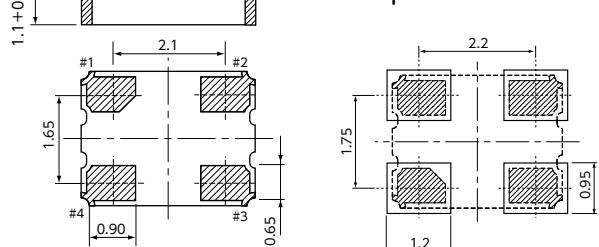


Pin Connections	
Pin No.	Connection
#1	V <sub>cont</sub>
#2	GND
#3	Output
#4	V <sub>cc</sub>

#### ■ Recommended Land Pattern <Top View>



#### ■ Recommended Land Pattern <Top View>



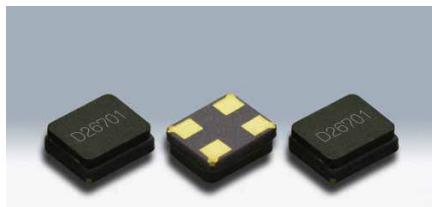
# Quartz Devices For Automotive



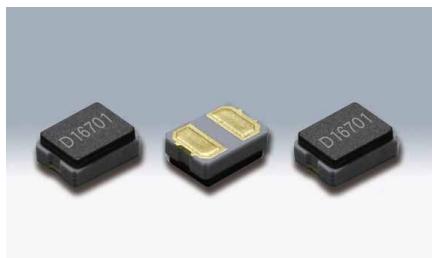
**KDS**   
DAISHINKU CORP.

# SMD Crystal Resonators / MHz Band Crystal Resonators <For Automotive>

## DSX211G/DSX210GE



DSX211G



DSX210GE

Actual size □

### ■ Features

- Miniature and lightweight SMD crystal resonator (height DSX211G 0.65mm / DSX210GE 0.85mm)
- Excellent heat resistance, High precision and high reliability
- Offers a wide range of frequencies from 16MHz to 64MHz
- Enhanced durability of solder joint for thermal cycles : after 3000 Thermal cycle tests "-40, +125°C (DSX210GE)
- AEC-Q200 Compliant

### ■ Applications

- Automotive radio applications such as Bluetooth, wireless LAN, GPS/GNSS, multimedia devices and automotive camera
- ECU (engine, body work control), safety relations, car body controls, ABS, EPS (DSX210GE)

### ■ Standard Specification

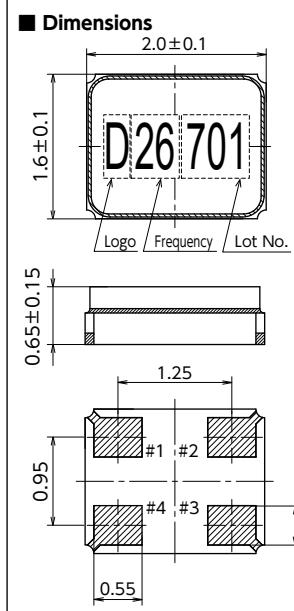
Item	Type	DSX210GE				
		DSX211G				
Frequency Range		16 to 20MHz	20 to 24MHz	24 to 30MHz	30 to 36MHz	36 to 64MHz
Overtone Order		Fundamental				
Load Capacitance		8pF, 10pF, 12pF				
Drive Level		10μW (100μW max.)				
Frequency Tolerance		±30×10 <sup>-6</sup> (at 25°C)				
Series Resistance		400Ω max.	200Ω max.	150Ω max.	120Ω max.	80Ω max.
Frequency Characteristics over Temperature		±100×10 <sup>-6</sup> /-40 to +125°C (Ref. to 25°C)				
Storage Temperature Range		-40 to +150°C				
Reliability		AEC-Q200				
Packing Unit (1)		3000pcs./reel(Φ180)				

(1) Moisture prevention packing is unnecessary.  
Moisture Sensitivity Level: LEVEL1 (IPC/JEDEC J-STD-033)

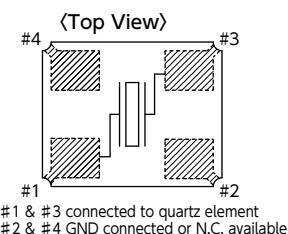
Consult our sales representative for other specifications.

### ■ DSX211G

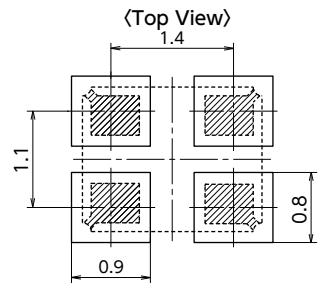
[mm]



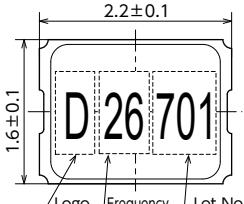
### ■ Internal Connections



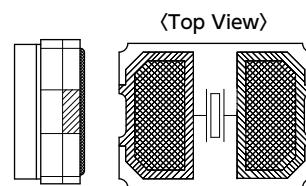
### ■ Recommended Land Pattern



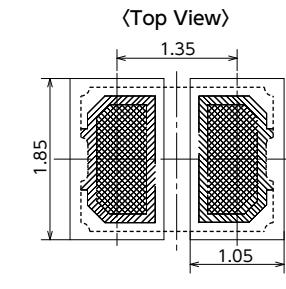
### ■ Dimensions



### ■ Internal Connections

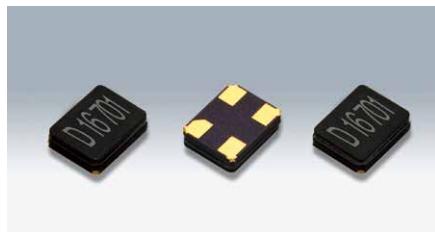


### ■ Recommended Land Pattern



# SMD Crystal Resonators / MHz Band Crystal Resonators<For Automotive>

## DSX321G/DSX321GK/DSX320GE



DSX321G/DSX321GK



DSX320GE

Actual size

### ■ Features

- Miniature and lightweight SMD crystal resonator height DSX321G (over 12MHz): 0.75mm (12MHz or under): 0.85mm  
DSX321GK: 0.85mm  
DSX320GE: 0.95mm
- Excellent heat resistance, High precision and high reliability
- Offers a wide range of frequencies  
DSX321G/DSX320GE: 7.9 to 64MHz  
DSX321GK: 9.8 to 40MHz
- Enhanced durability of solder joint for thermal cycles : after 3000 thermal cycle tests "-40, +125°C " (DSX320GE)
- AEC-Q200 Compliant



### ■ Applications

- RKE (Remote Keyless Entry), TPMS and safety controls (DSX321GK)
- Multimedia devices such as car navigation systems and car audio (DSX321G)
- ECU (engine, body work control), safety relations, car body controls, ABS, EPS (DSX320GE)

### ■ Standard Specification

Item	Type	DSX321G/DSX320GE				
		DSX321GK				
Frequency Range	7.9 to 9.8MHz	9.8 to 11MHz	11 to 12MHz	12 to 27MHz	27 to 40MHz	40 to 64MHz
Overtone Order	Fundamental					
Load Capacitance	8pF, 10pF, 12pF					
Drive Level	10μW(200μW max.)					
Frequency Tolerance	±30×10 <sup>-6</sup> (at 25°C)					
Series Resistance	400Ω max.	200Ω max.	150Ω max.	120Ω max.	100Ω max.	
Frequency Characteristics over Temperature	±100×10 <sup>-6</sup> /-40 to +125°C(Ref. to 25°C)					
Storage Temperature Range	-40 to +150°C					
Reliability	AEC-Q200					
Packing Unit (1)	3000pcs./reel(φ180)					

(1) Moisture prevention packing is unnecessary.  
Moisture Sensitivity Level:LEVEL1 (IPC/JEDEC J-STD-033)

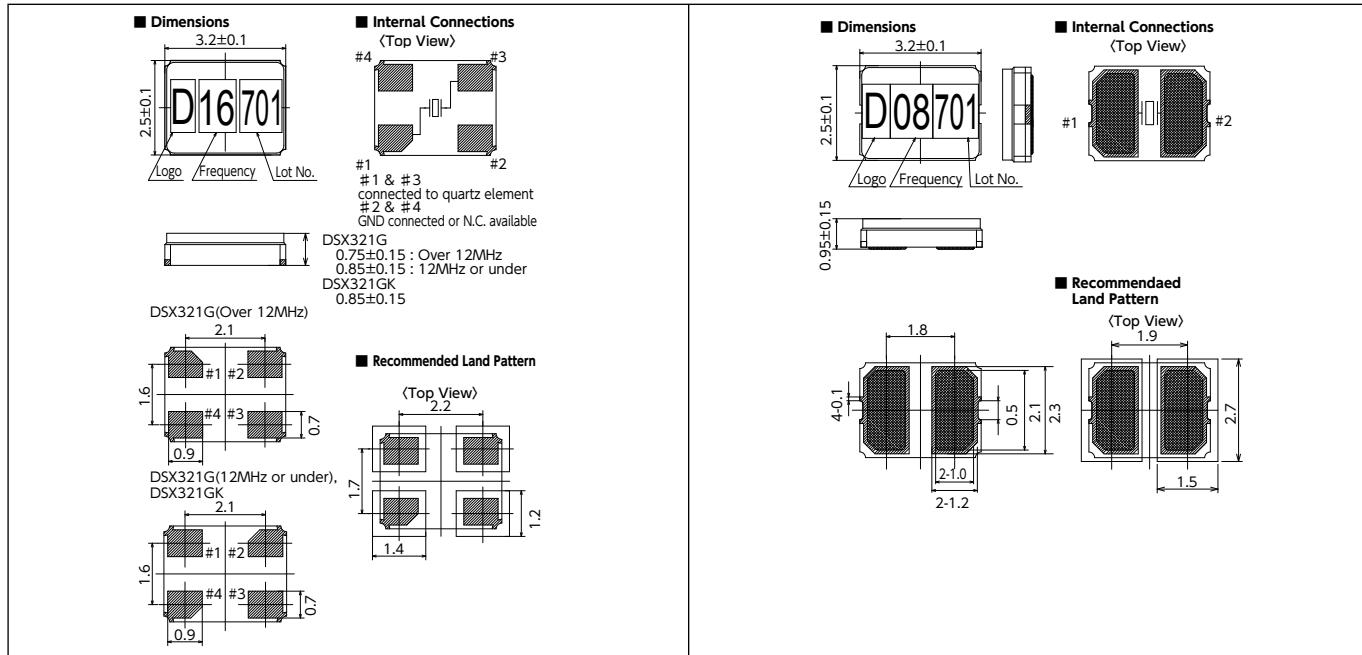
Consult our sales representative for other specifications.

### ■ DSX321G/DSX321GK

[mm]

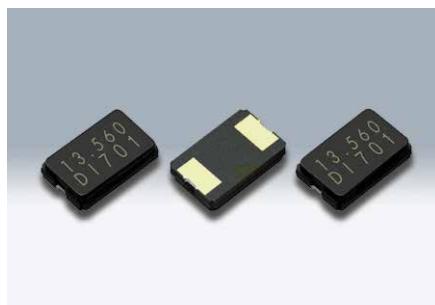
### ■ DSX320GE

[mm]



# SMD Crystal Resonators / MHz Band Crystal Resonators<For Automotive>

## DSX530GA



Actual size

### ■ Features

- Miniature and low profile SMD crystal resonator (height 1.0mm)
- Excellent heat resistance, High reliability.
- AEC-Q200 Compliant



### ■ Applications

- Multimedia devices such as car navigation systems and car audio

### ■ Standard Specification

Item	Type	DSX530GA
Frequency Range		7 to 8MHz
Overtone Order		Fundamental
Load Capacitance		8pF, 10pF, 12pF
Drive Level		10μW (300μW max.)
Frequency Tolerance		±30×10 <sup>-6</sup> (at 25°C)
Series Resistance		200Ω max.
Frequency Characteristics over Temperature		±100×10 <sup>-6</sup> / -40 to +125°C (Ref. to 25°C)
Storage Temperature Range		-40 to +150°C
Reliability		AEC-Q200
Packing Unit (1)		1000pcs./reel (φ180)

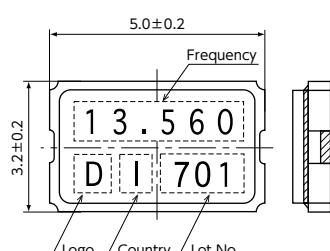
(1) Moisture prevention packing is unnecessary.  
Moisture Sensitivity Level: LEVEL1 (IPC/JEDEC J-STD-033)

Consult our sales representative for other specifications.

### ■ DSX530GK/DSX530GA

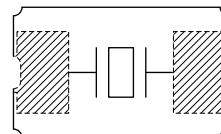
[mm]

#### ■ Dimensions



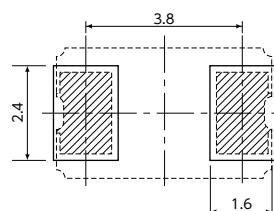
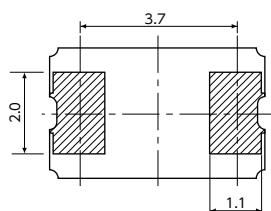
#### ■ Internal Connections

⟨Top View⟩



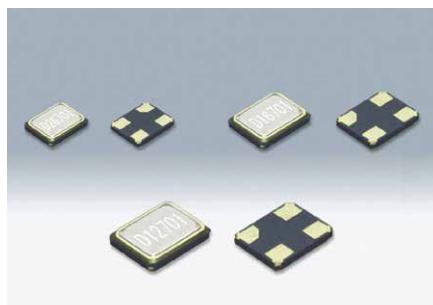
#### ■ Recommended Land Pattern

⟨Top View⟩



# SMD Crystal Resonators / MHz Band Crystal Resonators<For Automotive>

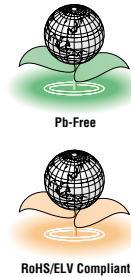
## DSX211SH/DSX221SH/DSX321SH



Actual size DSX211SH DSX221SH DSX321SH

### ■ Features

- Miniature and lightweight SMD crystal resonator  
DSX211SH : 2016 size 0.45mm height  
DSX221SH : 2520 size 0.45mm height  
DSX321SH : 3225 size 0.65mm height
- Excellent heat resistance, High precision and high reliability
- Offers a wide range of frequencies  
DSX211SH : 16MHz to 60MHz  
DSX221SH : 12MHz to 54MHz  
DSX321SH : 12MHz to 50MHz
- AEC-Q200 Compliant



### ■ Applications

- Automotive radio applications such as Bluetooth, wireless LAN and GPS/GNSS and multimedia devices, etc.

### ■ Standard Specification

Item	Type	DSX211SH		DSX221SH			DSX321SH		
Frequency Range		16 to 30MHz	30 to 60MHz	12 to 24MHz	24 to 30MHz	30 to 54MHz	12 to 20MHz	20 to 32MHz	32 to 50MHz
Overtone Order				Fundamental					
Load Capacitance				8pF, 10pF, 12pF					
Drive Level		10μW (100μW max.)					10μW (200μW max.)		
Frequency Tolerance				$\pm 30 \times 10^{-6}$ (at 25°C)					
Series Resistance		100Ω max.	50Ω max.	120Ω max.	50Ω max.	40Ω max.	80Ω max.	50Ω max.	40Ω max.
Frequency Characteristics over Temperature				$\pm 100 \times 10^{-6}$ / -40 to +125°C (Ref. to 25°C)					
Storage Temperature Range				-40 to +150°C					
Reliability				AEC-Q200					
Packing Unit (1)				3000pcs./reel(Φ180)					

(1) Moisture prevention packing is unnecessary.

Moisture Sensitivity Level:LEVEL1 (IPC/JEDEC J-STD-033)

Consult our sales representative for other specifications.

### ■ DSX211SH

[mm]

### ■ DSX221SH

[mm]

### ■ DSX321SH

[mm]

■ Dimensions	■ Dimensions	■ Dimensions
<p>2.0±0.1 1.6±0.1 0.45±0.05 0.975 0.575 Logo Frequency Lot No.</p>	<p>2.5±0.15 2.0±0.15 0.45±0.05 1.6 1.25 0.7 #1 #2 #4 #3 #1 #2 #4 #3 Logo Frequency Lot No.</p>	<p>3.2±0.1 2.5±0.1 2.1 1.5 0.9 0.8 Logo Frequency Lot No.</p>
■ Internal Connections (Top View)	■ Internal Connections (Top View)	■ Internal Connections (Top View)
<p>#1 &amp; #3 connected to quartz element #2 &amp; #4 connected to the cover #2 &amp; #4 recommended GND connection</p>	<p>#1 &amp; #3 connected to quartz element #2 &amp; #4 connected to the cover #2 &amp; #4 recommended GND connection</p>	<p>#1 &amp; #3 connected to quartz element #2 &amp; #4 connected to the cover #2 &amp; #4 recommended GND connection</p>
■ Recommended Land Pattern (Top View)	■ Recommended Land Pattern (Top View)	■ Recommended Land Pattern (Top View)
<p>1.1 0.9 1.4 0.8</p>	<p>1.3 1.15 1.75 1.0</p>	<p>2.2 1.7 1.4 1.2</p>

# SMD Crystal Resonators with dedicated temperature sensor / MHz Band Crystal Resonators (For Automotive)

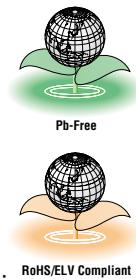
## DSR1612ATH/DSR211STH/DSR221STH



Actual size DSR1612ATH □ DSR211STH □  
DSR221STH □

### ■ Features

- DSR1612ATH: 1612size, height 0.55mm  
DSR211STH: 2016size, height 0.7mm (19.2MHz)  
0.6mm (38.4MHz / 55.2MHz)
- DSR221STH: 2520size, height 0.9mm
- Built-in NTC thermistor
- AEC-Q200 Compliant



### ■ Applications

- Multimedia devices such as car navigation systems and car audio
- GPS/GNSS
- UWB

### ■ Standard Specification

Item	Type	DSR1612ATH	DSR211STH	DSR221STH
Frequency Range		38.4Mhz	19.2MHz / 38.4MHz / 55.2MHz	19.2MHz
Overtone Order			Fundamental	
Load Capacitance			7pF, 8pF	
Drive Level			10μW (100μW max.)	
Frequency Tolerance			±10×10 <sup>-6</sup> (at 25°C)	
Series Resistance			80Ω max.	
Frequency Characteristics over Temperature		±30×10 <sup>-6</sup> / -40 to +105 °C (±12×10 <sup>-6</sup> / -30 to +85 °C)	±30×10 <sup>-6</sup> / -40 to +105 °C (±12×10 <sup>-6</sup> / -30 to +85 °C)	±20×10 <sup>-6</sup> / -40 to +105 °C
Storage Temperature Range			-40 to +125 °C	
Thermistor Resistance			10kΩ / 100kΩ (at +25°C)	
Thermistor B-constant			3435K (+25 to +85°C) / 3380K / 4250K (+25 to +50°C)	
Reliability			AEC-Q200	
Packing Unit (1)			3000pcs./reel (φ180)	

(1) Moisture prevention packing is unnecessary.

Moisture Sensitivity Level : LEVEL 1(IPC/JEDEC J-STD-033)

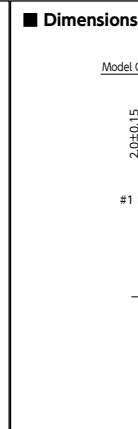
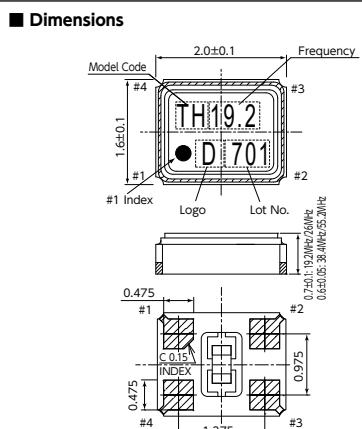
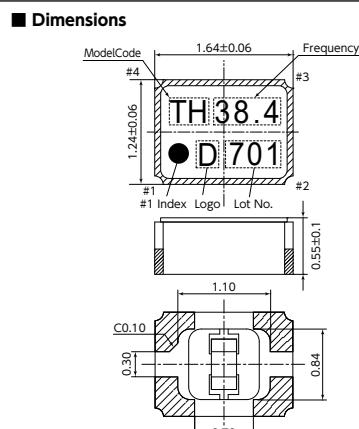
Consult our sales representative for other specifications.

### ■ DSR1612ATH [mm]

### ■ DSR211STH [mm]

### ■ DSR221STH [mm]

[mm]



# SMD Crystal Resonators / MHz Band Crystal Resonators <For Automotive>

## SMD-49

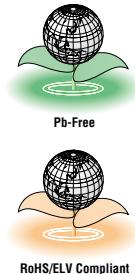


Actual size



### ■ Features

- Capable of operating over a wide temperature range, from -40 to +125°C.
- Offers high reliability such as excellent shock and vibration resistance as well as excellent frequency stability.
- Automatic mounting and reflow soldering applicable.
- AEC-Q200 Compliant
- Pb free
- RoHS/ELV Compliant



### ■ Standard Specification

Item	Type	SMD-49			
Frequency Range		4MHz	8MHz		
Overtone Order	Fundamental				
Load Capacitance	8pF, 10pF, 12pF				
Drive Level	10μW (300μW max.)				
Frequency Tolerance	$\pm 30 \times 10^{-6}$ (at 25°C)				
Series Resistance	120Ω max.	60Ω max.			
Frequency Characteristics over Temperature	$\pm 100 \times 10^{-6}$ / -40 to +125°C				
Storage Temperature Range	-40 to +150°C				
Reliability	AEC-Q200				
Packing Unit (1)	1000pcs./reel (φ330)				

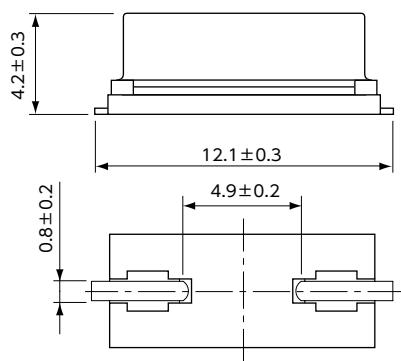
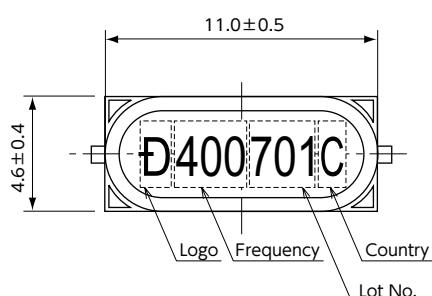
(1) Moisture prevention packing is unnecessary.

Moisture Sensitivity Level:Level 1 (IPC/JEDEC J-STD-033)

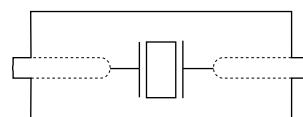
Consult our sales representative for other specifications.

[mm]

### ■ Dimensions

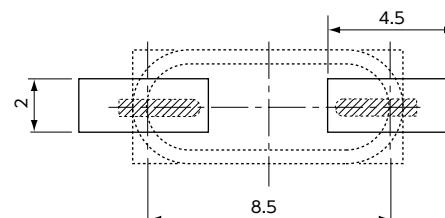


### ■ Internal Connections <Top View>



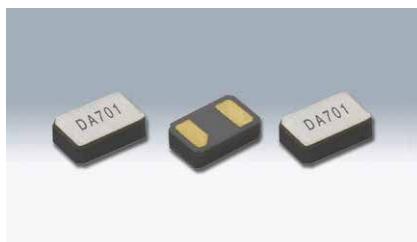
### ■ Recommended Land Pattern

#### <Top View>

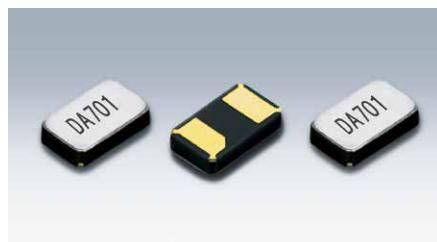


# SMD Tuning Fork Crystal Resonators / kHz Band Crystal Resonators (For Automotive)

## DST1610A/DST210AC/DST310S



DST1610A



Actual size □ DST210AC

Actual size □



DST310S

Actual size □

**■ Features**

- AEC-Q200 Compliant
- Pb free
- RoHS/ELV Compliant



Pb-Free

**■ Applications**

- Automotive multimedia devices



RoHS/ELV Compliant

**■ Standard Specification**

Item	Type	DST1610A	DST210AC	DST310S
Frequency Range		32.768kHz		
Load Capacitance			7pF, 9pF, 12.5pF	
Drive Level		0.1μW(0.5μW max.)		0.2μW(1.0μW max.)
Frequency Tolerance			±20×10 <sup>-6</sup> (at 25°C)	
Series Resistance		80kΩ max. (-40 to +85°C) 120kΩ max. (-40 to +125°C)		50kΩ max. (-40 to +85°C) 80kΩ max. (-40 to +125°C)
Turnover Temperature			+25°C±5°C	
Parabolic Coefficient			-0.04×10 <sup>-6</sup> / °C <sup>2</sup> max.	
Operating Temperature Range			-40 to +85°C / -40 to +125°C	
Storage Temperature Range			-40 to +125°C	
Shunt Capacitance			1.3pF typ.	
Reliability			AEC-Q200	
Packing Unit (1)			3000pcs./reel(Φ180)	

(1) Moisture prevention packing is unnecessary.

Moisture Sensitivity Level:Level 1 (IPC/JEDEC J-STD-033)

Consult our sales representative for other specifications.

**■ DST1610A**

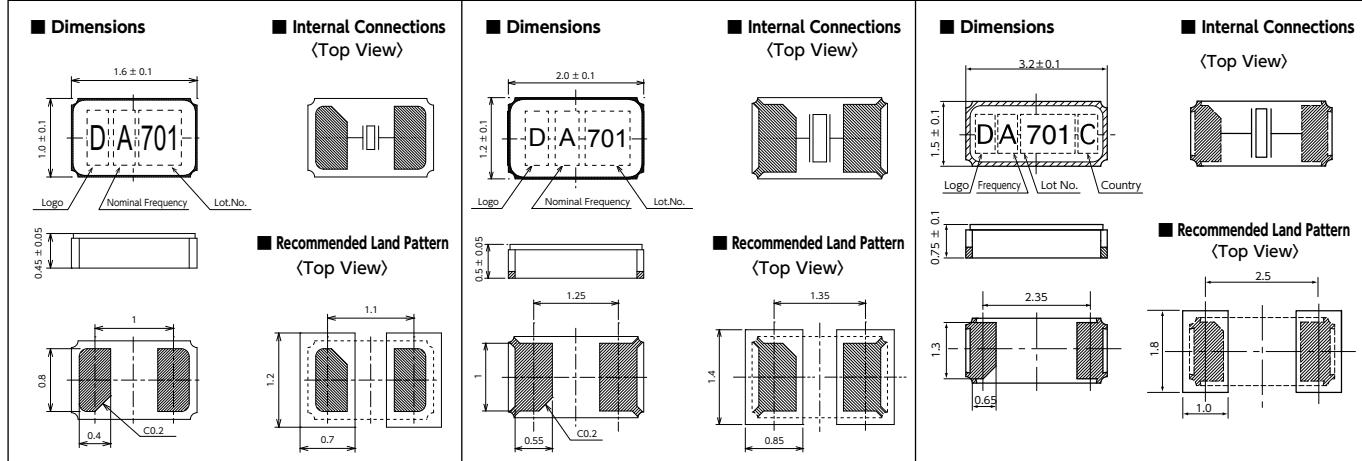
[mm]

**■ DST210AC**

[mm]

**■ DST310S**

[mm]



# SMD Tuning Fork Crystal Resonators / kHz Band Crystal Resonators (For Automotive)

## DMX-26S



Actual size

### ■ Features

- AEC-Q200 Compliant
- RoHS/ELV Compliant

### ■ Applications

- Automotive multimedia devices



RoHS/ELV Compliant

### ■ Standard Specification

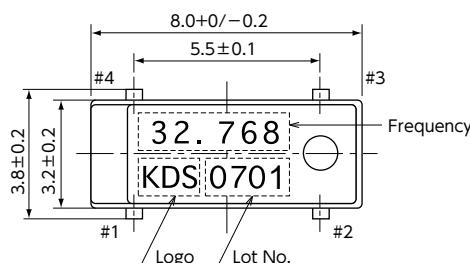
Item	Type	DMX-26S
Frequency Range		32.768kHz(30 to 90kHz)
Load Capacitance		7pF, 9pF, 12.5pF
Drive Level		1.0μW(2.0μW max.)
Frequency Tolerance		±20×10 <sup>-6</sup> (at 25°C)
Series Resistance		50kΩ max. (-40 to +85°C) 80kΩ max. (-40 to +125°C)
Turnover Temperature		+25°C±5°C
Parabolic Coefficient		-0.04×10 <sup>-6</sup> / °C <sup>2</sup> max.
Operating Temperature Range		-40 to +85°C / -40 to +125°C
Storage Temperature Range		-40 to +125°C
Shunt Capacitance		1.25pF typ.
Reliability		AEC-Q200
Packing Unit (1)		2500pcs./reel(Φ330)

(1) Moisture prevention packing is unnecessary.  
Moisture Sensitivity Level:Level 1 (IPC/JEDEC J-STD-033)

Consult our sales representative for other specifications.

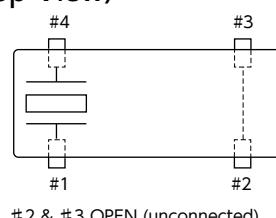
[mm]

### ■ Dimensions



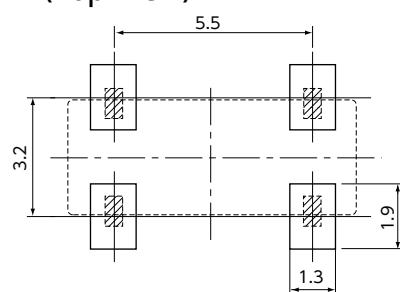
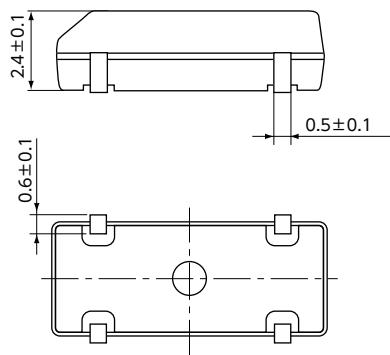
### ■ Internal Connections

#### ⟨Top View⟩



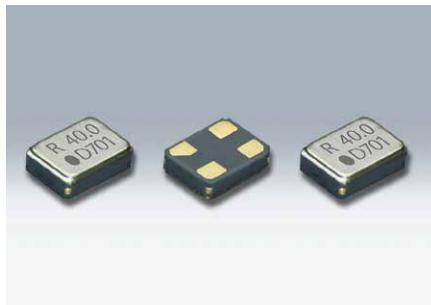
### ■ Recommended Land Pattern

#### ⟨Top View⟩



# SMD Crystal Oscillators<For Automotive>

## DSO1612AR



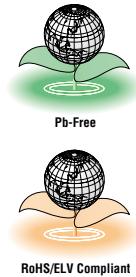
Actual size □

### ■ Features

- 3-state function
- Capable of operating over a wide temperature range, from  $-40$  to  $+125^{\circ}\text{C}$ .
- AEC-Q200 Compliant (Option: Equivalent to AEC-Q100)

### ■ Applications

- Multimedia devices such as car navigation systems and car audio
- Automotive camera



#### [Function Code]

DSO1612AR	A	Y
A : 3.3V		$Y : \pm 100 \times 10^{-6}$
M : 3.0V		$Z : \pm 80 \times 10^{-6}$
B : 2.8V		$B : \pm 50 \times 10^{-6}$
C : 2.5V		
D : 1.8V		

When requesting the product, please select the model and function code of your request.

### ■ Standard Specification

Item	Function Code		Legend	Output Frequency Range (MHz)	Spec.			Condition
	Supply Voltage	Frequency tolerance			min.	typ.	max.	
Supply Voltage	A	*	Vcc	$0.584375 \leq f_0 \leq 80$	+3.0	+3.3	+3.6	
	M				+2.7	+3.0	+3.3	
	B				+2.6	+2.8	+3.0	
	C				+2.25	+2.5	+2.75	
	D				+1.6	+1.8	+2.0	
Frequency Tolerance (Includes frequency tolerance at room temperature.)	Y	f_tol		$0.584375 \leq f_0 \leq 80$	-100	—	+100	-40 to +125°C
	Z				-80	—	+80	
	B				-50	—	+50	
Current Consumption	A,M	*	Icc	0.584375 $\leq f_0 < 40$	—	—	+3.0	No Load
	M				—	—	+4.2	
	B			0.584375 $\leq f_0 < 40$	—	—	+2.4	
	C				—	—	+3.7	
	C			0.584375 $\leq f_0 < 40$	—	—	+2.0	
	D				—	—	+3.4	
	D			0.584375 $\leq f_0 < 40$	—	—	+1.4	
	D				—	—	+1.6	
	A,M,B,C			40 $\leq f_0 < 80$	—	—	+1.9	
	D				—	—	—	
Stand-by Current (#1 pin "L"level)	*	*	I_std	*	—	—	+20	
Load Condition	*	*	L_cmos	*	—	—	15	
Symmetry	*	*	SYM	*	40	50	60	at 50% Vcc
0 Level Output Voltage	*	*	V <sub>OL</sub>	*	—	—	V <sub>cc</sub> × 0.1	
1 Level Output Voltage	*	*	V <sub>OH</sub>	*	V <sub>cc</sub> × 0.9	—	—	
Rise and Fall Time	A,M,B,C	*	tr, tf	*	—	—	3.0	10 to 90% Vcc Level
	D				—	—	5	
OE Pin 0 Level Input Voltage	*	*	V <sub>IL</sub>	*	—	—	V <sub>cc</sub> × 0.2	
OE Pin 1 Level Input Voltage	*	*	V <sub>IH</sub>	*	V <sub>cc</sub> × 0.8	—	—	
Output Disable Time	*	*	t <sub>PZ</sub>	*	—	—	200	
Output Enable Time	*	*	t <sub>PZL</sub>	*	—	—	2	
Period Jitter (1)	*	*	t <sub>RM</sub>	*	—	2.2	—	$\sigma$
			t <sub>p-p</sub>	*	—	20	—	Peak to peak
Total Jitter (1)	*	*	t <sub>TL</sub>	*	—	31	—	$t\Delta J + n \times tRJ \approx 14.1(BER=1 \times 10^{-12})$ (2)
Phase Jitter	*	*	tpj	40 $\leq f_0 \leq 80$	—	—	1	f <sub>0</sub> offset: 12kHz to 20MHz
				10 $\leq f_0 < 40$	—	—		f <sub>0</sub> offset: 12kHz to 5MHz
Reliability				AEC-Q100/AEC-Q200				
Packing Unit (3)				3000pcs./reel(Φ180)				

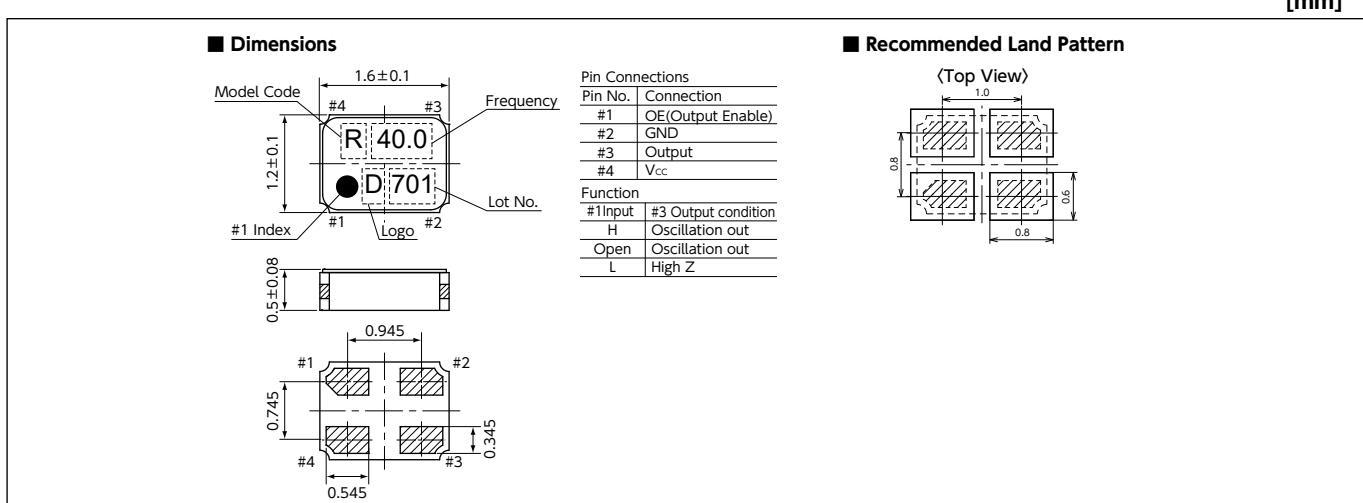
(1) Measured WAVECREST DTS-2075

(2) tDJ:Deterministic jitter tRJ:Random jitter

(3) Moisture prevention packing is unnecessary.

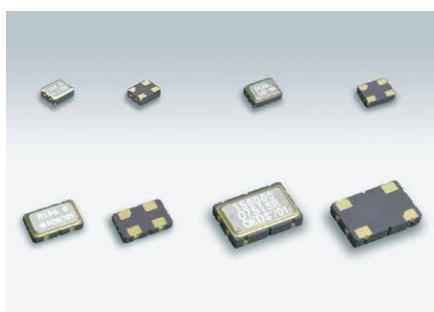
Moisture Sensitivity Level:Level 1 (IPC/JEDEC J-STD-033)

Consult our sales representative for other specifications.



# SMD Crystal Oscillators<For Automotive>

## DSO221SR/DSO321SR/DSO531SR/DSO751SR



Actual size DSO221SR DSO321SR DSO531SR DSO751SR

### ■ Features

- 3-state function
- Capable of operating over a wide temperature range, from  $-40$  to  $+125^{\circ}\text{C}$ .
- AEC-Q200 Compliant (Option: Equivalent to AEC-Q100)

### ■ Applications

- Multimedia devices such as car navigation systems and car audio
- Automotive camera

#### [Type]

DSO221SR	2520 size
DSO321SR	3225 size
DSO531SR	5032 size
DSO751SR	7349 size



Pb-Free



RoHS/ELV Compliant

#### [Function Code]

DSO\*\*\*SR A A

A : 3.3V	A,Y : $\pm 100 \times 10^{-6}$
M : 3.0V	Z : $\pm 80 \times 10^{-6}$
B : 2.8V	B : $\pm 50 \times 10^{-6}$
C : 2.5V	
D : 1.8V	

When requesting the product, please select the model and function code of your request.

### ■ Standard Specification

Item	Function Code		Output Frequency Range (MHz)	Legend	Spec.				Condition
	Supply Voltage	Frequency tolerance			min.	typ.	max.	Unit	
Supply Voltage	A		0.2 $\leq$ fo $\leq$ 125	VCC	+3.0	+3.3	+3.6		
	M		0.2 $\leq$ fo $\leq$ 125		+2.7	+3.0	+3.3		
	B	*	0.2 $\leq$ fo $\leq$ 100		+2.6	+2.8	+3.0		
	C		0.2 $\leq$ fo $\leq$ 100		+2.25	+2.5	+2.75		
	D		0.2 $\leq$ fo $\leq$ 80		+1.6	+1.8	+2.0		
Frequency Tolerance (Includes frequency tolerance at room temperature.)	Y	0.2 $\leq$ fo $\leq$ 100		f_tol	-100	—	+100		$\times 10^{-6}$ $-40$ to $+125^{\circ}\text{C}$ $-40$ to $+110^{\circ}\text{C}$ $-40$ to $+85^{\circ}\text{C}$
		0.2 $\leq$ fo $\leq$ 100			-80	—	+80		
		100 $\leq$ fo $\leq$ 125			-100	—	+100		
		0.2 $\leq$ fo $\leq$ 100			-50	—	+50		
Current Consumption	A,M	*	0.2 $\leq$ fo $<$ 54	I <sub>CC</sub>	—	—	+4.0		mA No Load
			54 $\leq$ fo $<$ 80		—	—	+6.0		
			80 $\leq$ fo $\leq$ 125		—	—	+8.0		
			0.2 $\leq$ fo $<$ 54		—	—	+3.5		
	B	*	54 $\leq$ fo $<$ 80		—	—	+5.5		
			80 $\leq$ fo $\leq$ 100		—	—	+7.5		
			0.2 $\leq$ fo $<$ 54		—	—	+3.0		
			54 $\leq$ fo $<$ 80		—	—	+5.0		
Stand-by Current (#1 pin "L" level)	*	*	*	I_std	—	—	+10	$\mu\text{A}$	
	*	*	*	L_CMOS	—	—	15	pF	
Symmetry	*	*	*	SYM	40	50	60	%	50% V <sub>CC</sub> Level
0 Level Output Voltage	*	*	*	V <sub>O L</sub>	—	—	V <sub>CC</sub> $\times$ 0.1	V	
1 Level Output Voltage	*	*	*	V <sub>O H</sub>	V <sub>CC</sub> $\times$ 0.9	—	—		
Rise and Fall Time	*	*	0.2 $\leq$ fo $\leq$ 54	tr,tf	—	—	8		ns 10 to 90% V <sub>CC</sub> Level
			54 $\leq$ fo $<$ 100		—	—	4		
			100 $\leq$ fo $\leq$ 125		—	—	3		
OE Pin 0 Level Input Voltage	*	*	*	V <sub>I L</sub>	—	—	V <sub>CC</sub> $\times$ 0.2	V	
OE Pin 1 Level Input Voltage	*	*	*	V <sub>I H</sub>	V <sub>CC</sub> $\times$ 0.8	—	—		
Output Disable Time	*	*	*	t <sub>PLZ</sub>	—	—	150	ns	
Output Enable Time	*	*	*	t <sub>PZL</sub>	—	—	5	ms	
Period Jitter (1)	*	*	*	t <sub>RMS</sub>	—	2.2	—	ps	$\sigma$ Peak to peak
Total Jitter (1)	*	*	*	t <sub>T L</sub>	—	31	—	ps	t <sub>DJ</sub> +n <sub>x</sub> t <sub>RJ</sub> n=14.1 (BER=1 $\times$ 10 <sup>-12</sup> ) (2)
Phase Jitter	*	*	40 $\leq$ fo $\leq$ 125	tpj	—	—	1	ps	fo offset: 12kHz to 20MHz fo offset: 12kHz to 5MHz
Reliability					AEC-Q100/AEC-Q200				
Packing Unit (3)					DSO221SR, DSO321SR : 2000pcs./reel(180 $\phi$ ), DSO531SR : 1000pcs./reel(180 $\phi$ ), DSO751SR : 1000pcs./reel(254 $\phi$ )				

(1) Measured WAVECREST DTS-2075

(2) tDJ:Deterministic jitter tRJ:Random jitter

(3) Moisture prevention packing is unnecessary.

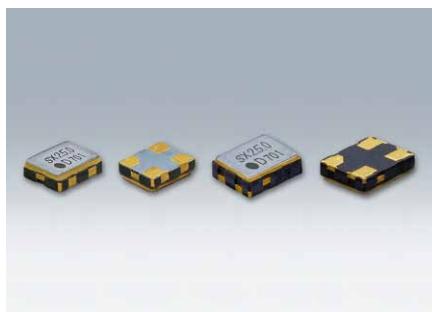
Moisture Sensitivity Level:Level 1 (IPC/JEDEC J-STD-033)

Consult our sales representative for other specifications.

■ DSO221SR	■ DSO321SR	■ DSO531SR	■ DSO751SR
<b>■ Dimensions</b>			
<b>■ Dimensions</b>	<b>■ Dimensions</b>	<b>■ Dimensions</b>	<b>■ Dimensions</b>

# SMD Crystal Oscillators<For Automotive>

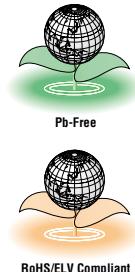
## DSO211SX/DSO221SX



Actual size DSO211SX □ DSO221SX □

### ■ Features

- Supply Voltage: 1.8V/2.5V/2.8V/3.3V
- Available frequency range: 1 to 125MHz
- Low profile: 0.7mm (DSO211SX), 0.8mm (DSO221SX)
- CMOS Level Output
- Capable of operating over a wide temperature range, from -40 to 125°C.
- 3-state function
- Conforms to Autonomous Driving Level II
- AEC-Q100/AEC-Q200 Compliant



### ■ Applications

- In-vehicle driving safety applications  
(millimeter-wave radar, sensing cameras, etc.)

### [Type]

DSO211SX	2016 size
DSO221SX	2520 size

### [Function Code]

DSO\*\*\*SX A Z

A : 3.3V	Z : ±80 × 10 <sup>-6</sup>
B : 2.8V	B : ±50 × 10 <sup>-6</sup>
C : 2.5V	C : ±30 × 10 <sup>-6</sup>
D : 1.8V	

When requesting the product, please select the model and function code of your request.

### ■ Standard Specification

Item	Function Code		Output Frequency Range (MHz)	Legend	Spec.				Condition	
	Supply Voltage	Frequency tolerance			min.	typ.	max.	Unit		
Supply Voltage	A	*	1 ≤ fo ≤ 125	VCC	+3.0	+3.3	+3.6	V		
	B				+2.6	+2.8	+3.0			
	C		1 ≤ fo ≤ 100		+2.25	+2.5	+2.75			
	D				+1.6	+1.8	+2.0			
Frequency Tolerance (includes frequency tolerance at room temperature)	Z	*	*	f_tol	—	—	±80	×10 <sup>-6</sup>	-40 to +125°C	
	B				—	—	±50			
	C				—	—	±50			
Current Consumption	A	*	100 ≤ fo ≤ 125	ICC	—	—	10.0	mA	No Load	
	40 ≤ fo < 100				—	—	4.2			
	1 ≤ fo < 40				—	—	2.4			
	100 ≤ fo ≤ 125				—	—	9.0			
	40 ≤ fo < 100				—	—	3.7			
	100 ≤ fo ≤ 125				—	—	8.0			
	40 ≤ fo < 100				—	—	3.4			
	1 ≤ fo < 40				—	—	2.0			
	40 ≤ fo ≤ 100				—	—	2.7			
Stand-by Current (#1 pin "L" level)	*	*	*	I_std	—	—	10	μA		
Load Condition	*	*	*	L_CMOs	—	—	15	pF		
Symmetry	*	*	*	SYM	45	50	55	%	50% Vcc Level	
0 Level Output Voltage	*	*	*	VOL	—	—	Vcc × 0.1	V		
1 Level Output Voltage	*	*	*	VOH	Vcc × 0.9	—	—			
Rise and Fall Time	A,B,C	*	*	tr, tf	—	—	3	ns	10 to 90% Vcc Level	
	D	*	*	tr, tf	—	—	5			
OE Pin 0 Level Input Voltage	*	*	*	VIL	—	—	Vcc × 0.3	V		
OE Pin 1 Level Input Voltage	*	*	*	VIH	Vcc × 0.7	—	—			
Output Disable Time	*	*	*	tPLZ	—	—	200	ns		
Output Enable Time	*	*	*	tPZL	—	—	2	ms		
Period Jitter (1)	*	*	*	tRMS	—	2.4	—	ps	σ Peak to peak	
Total Jitter (1)	*	*	*	tTL	—	32	—	ps	tDJ+n×tRJ n=14.1(BER=1×10 <sup>-12</sup> ) (2)	
Phase Jitter	*	*	40 ≤ fo ≤ 125	tpj	—	—	1	ps	f0 offset: 1.2kHz to 20MHz f0 offset: 1.2kHz to 5MHz	
Reliability					AEC-Q100/AEC-Q200					
Packing Unit (3)					3000pcs./reel (φ180)					

(1) Measured WAVECREST DTS-2075

Consult our sales representative for other specifications.

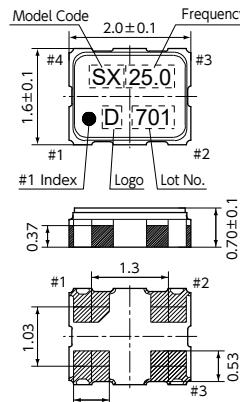
(2) tDJ:Deterministic jitter tRJ:Random jitter

(3) Moisture prevention packing is unnecessary. Moisture Sensitivity Level:Level1 (IPC/JEDEC J-STD-033)

### ■ DSO211SX

[mm]

#### ■ Dimensions

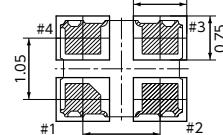


Pin No.	Connection
#1	OE(Output Enable)
#2	GND
#3	Output
#4	V <sub>cc</sub>

Function

#1 Input	#3 Output condition
H	Oscillation out
L	High Z

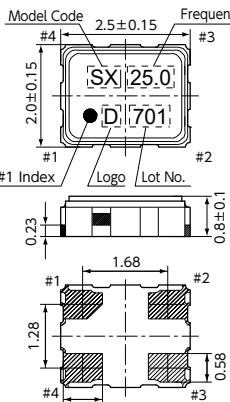
#### ■ Recommended Land Pattern (Top View)



### ■ DSO221SX

[mm]

#### ■ Dimensions

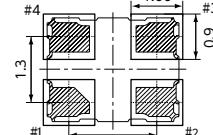


Pin No.	Connection
#1	OE(Output Enable)
#2	GND
#3	Output
#4	V <sub>cc</sub>

Function

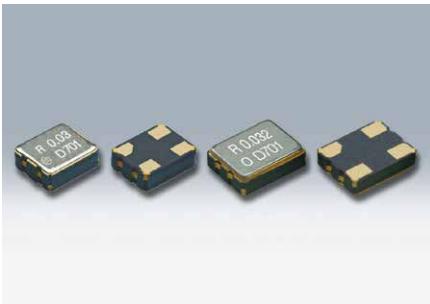
#1 Input	#3 Output condition
H	Oscillation out
L	High Z

#### ■ Recommended Land Pattern (Top View)



# SMD Crystal Oscillators<For Automotive>

## DSO221SR/DSO321SR (kHz)



Actual size DSO221SR □ DSO321SR □

### ■ Features

- Supply Voltage: 1.8V/2.5V/2.8V/3.0V/3.3V/5.0V
- 3-state function
- Low current consumption
- CMOS Level Output
- High speed start-up: 2ms max. until frequency output after power on
- Stable frequency variation realized by adopting an At cut resonator
- AEC-Q200 Compliant (Option: Equivalent to AEC-Q100)



### ■ Applications

- Multimedia devices such as car navigation systems and car audio

#### [Type]

DSO221SR	2520 size
DSO321SR	3225 size

[Function Code]  
DSO\*\*\*SR A Y

A : 3.3V	Y : $\pm 100 \times 10^{-6}$
M : 3.0V	Z : $\pm 80 \times 10^{-6}$
B : 2.8V	B,W : $\pm 50 \times 10^{-6}$
C : 2.5V	
D : 1.8V	
Y : 5.0V	

### ■ Standard Specification

When requesting the product, please select the model and function code of your request.

Item	Function Code		Output Frequency Range (KHz)	Legend	Spec.				Condition	
	Supply Voltage	Frequency tolerance			min.	typ.	max.	Unit		
Supply Voltage	A	*	$32.768 \leq f_0 \leq 50$	Vcc	+3.0	+3.3	+3.6	V		
	M				+2.7	+3.0	+3.3			
	B				+2.6	+2.8	+3.0			
	C				+2.25	+2.5	+2.75			
	D				+1.6	+1.8	+2.0			
	Y				+4.5	+5.0	+5.5			
Frequency Tolerance (includes frequency tolerance at room temperature)	*	Y	$32.768 \leq f_0 \leq 50$	f_tol	-100	-	+100	$\times 10^{-6}$	-40 to +125°C	
	*	Z			-80	-	+80		-40 to +110°C	
	*	W			-50	-	+50		-40 to +105°C	
	*	B			-50	-	+50		-40 to +85°C	
Current Consumption	A,M,B, C,D	*	$f_0=32.768$ $32.768 < f_0 \leq 50$ $f_0=32.768$ $32.768 < f_0 \leq 50$	Icc	-	-	65	$\mu A$	No Load	
					-	-	100			
					-	-	80			
					-	-	120			
Stand-by Current (#1 pin "L" Level)	*	*	$32.768 \leq f_0 \leq 50$	I_std	-	-	3	$\mu A$	-40 to +125°C	
Load Condition	*	*	$32.768 \leq f_0 \leq 50$	I_CMOS	-	-	15	pF		
Symmetry	*	*	$32.768 \leq f_0 \leq 50$	SYM	45	50	55	%	at 50% Vcc	
0 Level Output Voltage	*	*	*	V <sub>OL</sub>	-	-	$V_{cc} \times 0.1$	V		
1 Level Output Voltage	*	*	*	V <sub>OH</sub>	$V_{cc} \times 0.9$	-	-			
Rise and Fall Time	*	*	$32.768 \leq f_0 \leq 50$	tr, tf	-	-	20	ns	10 to 90% Vcc Level	
OE Pin 0 Level Input Voltage	*	*	*	V <sub>IL</sub>	-	-	$V_{cc} \times 0.2$	V		
OE Pin 1 Level Input Voltage	*	*	*	V <sub>IH</sub>	$V_{cc} \times 0.8$	-	-			
Output Disable Time	*	*	*	tPLZ	-	-	150	ns		
Output Enable Time	*	*	*	tPZL	-	-	2	ms		
Period Jitter (1)	*	*	*	tRMS	-	15	-	$\sigma$	Peak to peak	
Total Jitter (1)	*	*	*	tp-p	-	150	-	ps		
Reliability				tTL	-	220	-	ps	$tDJ + n \times tRJ \ n=14.1 \ (BER=1 \times 10^{-12}) \ (2)$	
Packing Unit (3)					AEC-Q100/AEC-Q200				2000pcs./reel(Φ 180)	

(1) Measured WAVECREST DTS-2075

Consult our sales representative for other specifications.

(2) tDJ:Deterministic jitter tRJ:Random jitter

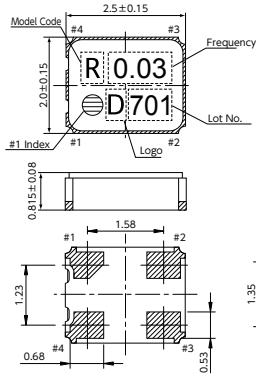
(3) Moisture prevention packing is unnecessary.

Moisture Sensitivity Level:Level 1 (IPC/JEDEC J-STD-033)

### ■ DSO221SR(kHz)

[mm]

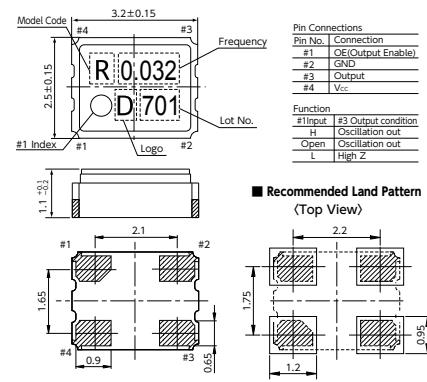
#### ■ Dimensions



### ■ DSO321SR(kHz)

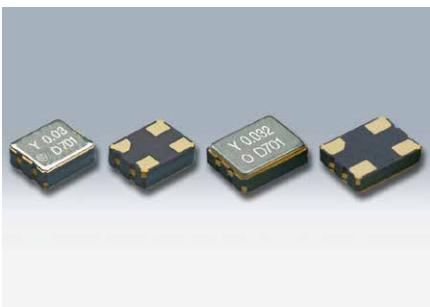
[mm]

#### ■ Dimensions



# SMD Crystal Oscillators<For Automotive>

## DSO221SY/DSO321SY



Actual size DSO221SY DSO321SY

### ■ Features

- Available frequency range : 32.768kHz, 1.049 to 8.5MHz
- Supply Voltage: 1.8V/2.5V/2.8V/3.3V
- 3-state function
- Low current consumption: 10µA typ.(32.768kHz)
- CMOS Level Output
- Stable frequency variation realized by adopting an At cut resonator
- AEC-Q200 Compliant (Option: Equivalent to AEC-Q100)



### ■ Applications

- Multimedia devices such as car navigation systems and car audio

#### [Type]

DSO221SY	2520 size
DSO321SY	3225 size

[Function Code]  
DSO\*\*\*SY AA

A : 3.3V	A : $\pm 100 \times 10^{-6}$
B : 2.8V	B : $\pm 50 \times 10^{-6}$
C : 2.5V	
D : 1.8V	

When requesting the product, please select the model and function code of your request.

### ■ Standard Specification

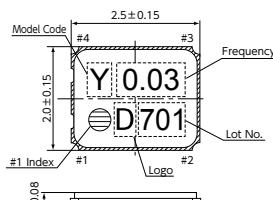
Item	Function Code		Output Frequency Range	Legend	Spec.				Condition
	Supply Voltage	Frequency tolerance			min.	typ.	max.	Unit	
Supply Voltage	A	*	32.768kHz 1.049≤f <sub>0</sub> ≤8.5MHz	Vcc	+3.0	+3.3	+3.6		V
	B				+2.6	+2.8	+3.0		
	C				+2.25	+2.5	+2.75		
	D				+1.6	+1.8	+2.0		
Frequency Tolerance (includes frequency tolerance at room temperature)	*	A	32.768kHz 1.049≤f <sub>0</sub> ≤8.5MHz	f <sub>tol</sub>	-100	-	+100		×10 <sup>-6</sup> -40 to +85°C
	*	B			-50	-	+50		
Current Consumption	*	*	32.768kHz 1.049≤f <sub>0</sub> ≤8.5MHz	I <sub>CC</sub>	-	-	18	μA	No Load
Stand-by Current (#1 pin "L" Level)	*	*	*	I <sub>std</sub>	-	-	3	μA	
Load Condition	*	*	*	L <sub>CMOS</sub>	-	-	15	pF	
Symmetry	*	*	32.768kHz 1.049≤f <sub>0</sub> ≤8.5MHz	SYM	45 40	50 50	55 60	%	at 50% Vcc
0 Level Output Voltage	*	*	*	V <sub>OL</sub>	-	-	Vcc×0.1		
1 Level Output Voltage	*	*	*	V <sub>OH</sub>	Vcc×0.9	-	-	V	
Rise and Fall Time	*	*	*	tr, tf	-	-	15	ns	10 to 90% Vcc Level
OE Pin 0 Level Input Voltage	*	*	*	V <sub>IL</sub>	-	-	Vcc×0.2		
OE Pin 1 Level Input Voltage	*	*	*	V <sub>IH</sub>	Vcc×0.8	-	-	V	
Output Disable Time	*	*	*	t <sub>PZL</sub>	-	-	100	ns	
Output Enable Time	*	*	*	t <sub>PZL</sub>	-	-	20	ms	
Reliability					AEC-Q100/AEC-Q200				
Packing Unit (1)					2000pcs./reel(Φ180)				

(1) Moisture prevention packing is unnecessary.  
Moisture Sensitivity Level:Level 1 (IPC/JEDEC J-STD-033)

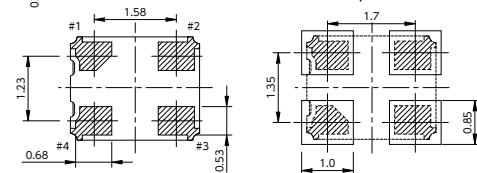
Consult our sales representative for other specifications.

### ■ DSO221SY

#### ■ Dimensions

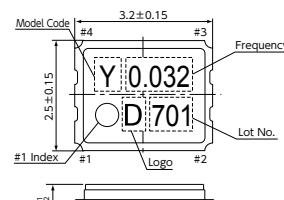


#### ■ Recommended Land Pattern (Top View)

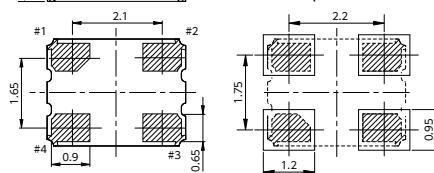


### ■ DSO321SY

#### ■ Dimensions

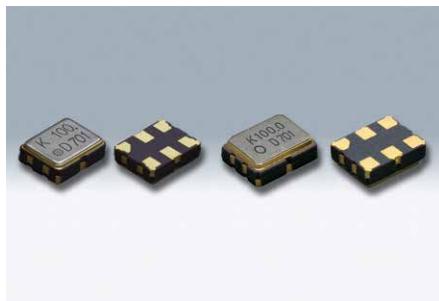


#### ■ Recommended Land Pattern (Top View)



# SMD Differential Output Crystal Oscillators<For Automotive>

## DSO223SK/DSO323SK/DSO223SJ/DSO323SJ/DSO223SD/DSO323SD



Actual size DSO223S ■ DSO323S ■

### ■ Features

- 2.5V/3.3V operating voltage, High speed type
- 3-state function
- LV-PECL output (DSO223/323SK)
- LVDS output (DSO223/323SJ)
- HCSL output (DSO223/323SD)
- AEC Standard

DSO223SK/SJ/SD: AEC-Q200 Compliant

DSO323SK/SJ/SD: AEC-Q200 Compliant  
(Option: Equivalent to AEC-Q100)

### ■ Applications

- Multimedia devices such as car navigation systems and car audio

[Type]

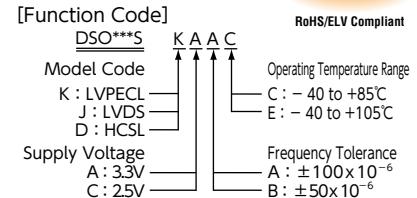
DSO223S SERIES	2520 size
DSO323S SERIES	3225 size



Pb-Free



RoHS/ELV Compliant



When requesting the product, please select the model and function code of your request.

### ■ Standard Specification

Item	Type	Legend	DSO223SK DSO323SK	DSO223SJ DSO323SJ	DSO223SD DSO323SD
Output Specification	—		LV-PECL	LVDS	HCSL
Output Frequency Range	f <sub>o</sub>			13.5 to 167MHz	
Supply Voltage	V <sub>cc</sub>			+2.5V±0.125V/+3.3V±0.165V	
Frequency Tolerance (Includes frequency tolerance at room temperature.)	f <sub>tol</sub>			±50×10 <sup>-6</sup> max., ±80×10 <sup>-6</sup> max. / ±100×10 <sup>-6</sup> max.	
Storage Temperature Range	T <sub>stg</sub>				-40 to +105°C
Operating Temperature Range	T <sub>use</sub>				-40 to +85°C, -40 to +105°C
Current Consumption	I <sub>cc</sub>		45mA max.	20mA max.	30mA max.
Stand-by Current (#1 pin "L" Level)	I <sub>std</sub>			10μA max.	
Load Resistance	Load-R		50Ω to V <sub>cc</sub> -2V	100Ω (Output-OutputN)	50Ω
Symmetry	SYM			45 to 55% [at outputs cross point]	
0 Level Output Voltage	V <sub>OL</sub>		V <sub>cc</sub> -1.81 to V <sub>cc</sub> -1.62V	—	-0.15 to 0.15V
1 Level Output Voltage	V <sub>OH</sub>		V <sub>cc</sub> -1.025 to V <sub>cc</sub> -0.88V	—	0.58 to 0.85V
Rise and Fall Time	tr, tf		0.5ns max. [20 to 80% Output, OutputN]	0.4ns max. [20 to 80% Output-OutputN]	0.5ns max. [0.175 to 0.525V Level]
Differential Output Voltage	V <sub>OD1</sub> , V <sub>OD2</sub>		—	0.247 to 0.454V	—
Change to V <sub>OD</sub>	ΔV <sub>OD</sub>		—	50mV [ΔV <sub>OD</sub> =   V <sub>OD1</sub> -V <sub>OD2</sub>   ]	—
Offset Voltage	V <sub>os</sub>		—	1.125 to 1.375V	—
Offset to V <sub>os</sub>	ΔV <sub>os</sub>		—	50mV	—
Crossing Point Voltage	V <sub>cr</sub>		—	—	250 to 550mV
OE Pin 0 Level Input Voltage	V <sub>IL</sub>		V <sub>cc</sub> ×0.3 max.		
OE Pin 1 Level Input Voltage	V <sub>IH</sub>		V <sub>cc</sub> ×0.7 min.		
Output Disable Time	t <sub>PLZ</sub>			200ns	
Output Enable Time	t <sub>PZL</sub>			2ms	
Period Jitter(1)	t <sub>RMS</sub>		5ps typ. (13.5MHz≤f <sub>o</sub> <27MHz) / 2.5ps typ. (27MHz≤f <sub>o</sub> ≤167MHz) (σ)		
	t <sub>p-p</sub>		33ps typ. (13.5MHz≤f <sub>o</sub> <27MHz) / 22ps typ. (27MHz≤f <sub>o</sub> ≤167MHz) (Peak to peak)		
Total Jitter(1)	t <sub>TL</sub>		50ps typ. (13.5MHz≤f <sub>o</sub> <27MHz) / 35ps typ. (27MHz≤f <sub>o</sub> ≤167MHz) [t <sub>DJ</sub> +n×t <sub>RJ</sub> n=14.1(BER=1×10 <sup>-12</sup> ) (2)]		
Phase Jitter	t <sub>pj</sub>		1.5ps max. (13.5MHz≤f <sub>o</sub> <27MHz) / 1ps max. (27MHz≤f <sub>o</sub> ≤167MHz) [13.5MHz≤f <sub>o</sub> <40MHz, f <sub>o</sub> offset:12kHz to 5MHz f <sub>o</sub> ≥40MHz, f <sub>o</sub> offset:12kHz to 20MHz]		
Reliability			AEC-Q200(DSO223 SERIES), AEC-Q100/AEC-Q200(DSO323 SERIES)		
Packing Unit (3)			2000pcs./reel(Φ180)		

(1) Measured WAVECREST DTS-2075

Consult our sales representative for other specifications.

(2) t<sub>DJ</sub>:Deterministic jitter t<sub>RJ</sub>:Random jitter

(3) Moisture prevention packing is unnecessary.

Moisture Sensitivity Level: LEVEL 1 (IPC/JEDEC J-STD-033)

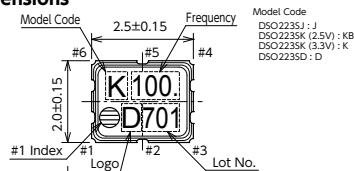
### ■ DSO223S SERIES

[mm]

### ■ DSO323S SERIES

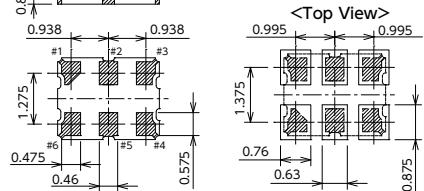
[mm]

#### ■ Dimensions

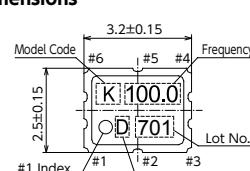


Pin Connections	
Pin No.	Connection
#1	OE(Output Enable)
#2	NC
#3	GND
#4	Output
#5	OutputN
#6	V <sub>cc</sub>
Function	
#1 Input	#4#5 Output condition
H	Oscillation out
Open	Oscillation out
L	High Z

#### ■ Recommended Land Pattern

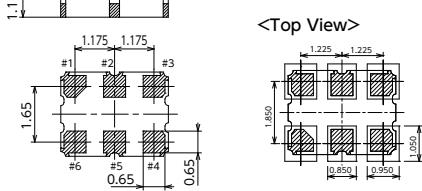


#### ■ Dimensions



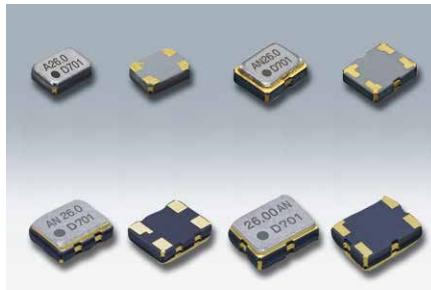
Pin Connections	
Pin No.	Connection
#1	OE(Output Enable)
#2	NC
#3	GND
#4	Output
#5	OutputN
#6	V <sub>cc</sub>
Function	
#1 Input	#4#5 Output condition
H	Oscillation out
Open	Oscillation out
L	High Z

#### ■ Recommended Land Pattern



# High-precision SMD VC-TCXO/TCXO<For Automotive>

DSA1612SDN/DSA211SDN/DSA221SDN/DSA321SDN, DSB1612SDN/DSB211SDN/DSB221SDN/DSB321SDN



Actual size DSA1612SDN DSA211SDN  
DSA221SDN DSA321SDN

## ■ Features

- Low voltage operation
- Low phase noise
- Single packaged structure
- AEC-Q200 Compliant (Option: Equivalent to AEC-Q100)

## ■ Applications

- Telematics, Satellite radio



[Type]

	VC-TCXO	TCXO	Size
DSA1612SDN	DSB1612SDN	1612 size	
DSA211SDN	DSB211SDN	2016 size	
DSA221SDN	DSB221SDN	2520 size	
DSA321SDN	DSB321SDN	3225 size	

## ■ Standard Specification

Item	VC-TCXO				TCXO			
	DSA1612SDN	DSA211SDN	DSA221SDN	DSA321SDN	DSB1612SDN	DSB211SDN	DSB221SDN	DSB321SDN
Frequency Range	16 to 60MHz	12.288 to 52MHz	9.6 to 52MHz		16 to 60MHz	12.288 to 52MHz	9.6 to 52MHz	
Standard Frequency		19.2MHz/26MHz/38.4MHz/40MHz/52MHz			16.3676MHz/16.367667MHz/16.368MHz/16.369MHz/16.8MHz/26MHz/33.6MHz			
Supply Voltage Range					+1.68 to +3.5V			
Supply Voltage(Vcc)					+1.8V/+2.6V/+2.8V/+3.0V/+3.3V			
Current Consumption					+1.5mA max.(f≤26MHz) /+2.0mA max.(26MHz<f≤52MHz) /+2.5mA max.(f≤60MHz)			
Output Level					0.8Vp-p min.(f≤52MHz) (Clipped Sinewave/DC-coupled)			
Output Load					10kΩ//10pF			
Frequency Stability					±1.5×10 <sup>-6</sup> max.(After 2 reflows)			
Tolerance					±1.0×10 <sup>-6</sup> , ±2.5×10 <sup>-6</sup> max./-40 to +85°C	±0.5×10 <sup>-6</sup> , ±2.5×10 <sup>-6</sup> max./-40 to +85°C		
vs. Temperature								
vs. Supply Voltage					±0.2×10 <sup>-6</sup> max.(Vcc ±5%)			
vs. Load Variation					±0.2×10 <sup>-6</sup> max.(10kΩ//10pF±10%)			
vs. Aging					±1.0×10 <sup>-6</sup> max./year			
Frequency Control	±3.0×10 <sup>-6</sup> to ±5.0×10 <sup>-6</sup> /Vcont=+1.4V±1V @Vcc≥+2.6V							—
Control Sensitivity	±3.0×10 <sup>-6</sup> to ±5.0×10 <sup>-6</sup> /Vcont=+0.9V±0.6V @Vcc=+1.8V							
Response Slope		Positive						—
Start up Time					2.0ms max.			
Phase Noise	[f≤26MHz]		[26MHz<f≤40MHz]			[40MHz<f≤52MHz]		
Offset 100Hz	-115dBc/Hz		-110dBc/Hz			-105dBc/Hz		
Offset 1kHz	-130dBc/Hz		-130dBc/Hz			-125dBc/Hz		
Offset 10kHz	-150dBc/Hz		-150dBc/Hz			-145dBc/Hz		
Offset 100kHz	-155dBc/Hz		-155dBc/Hz			-150dBc/Hz		
Reliability			AEC-Q100/AEC-Q200					
Packing Unit (1)		DSA1612SDN/DSA211SDN/DSA221SDN, DSB1612SDN/DSB211SDN/DSB221SDN: 3000pcs./reel(Φ180)						
		DSA321SDN, DSB321SDN: 2000pcs./reel(Φ180)						

(1) Moisture prevention packing is unnecessary.  
Moisture Sensitivity Level: LEVEL 1 (IPC/JEDEC J-STD-033)

Consult our sales representative for other specifications.

# High-precision SMD VC-TCXO/TCXO<For Automotive>

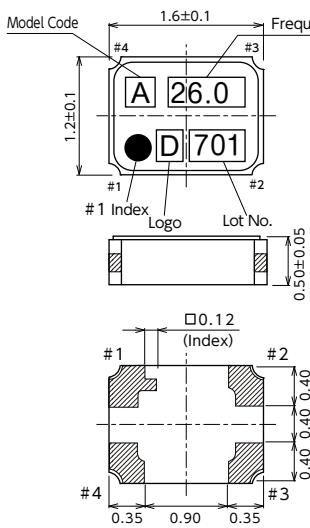
## For Automotive Applications

### ■ Dimensions [mm]

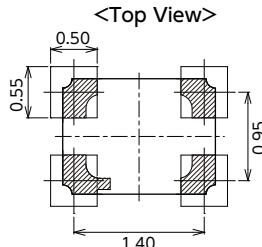
#### ■ DSA1612SDN/DSB1612SDN

Model Code  
A:VC-TCXO(DSA1612SDN)  
B:TCXO(DSB1612SDN)

Pin Connections	
Pin No.	Connection
#1	Vcont(VC-TCXO)/GND(TCXO)
#2	GND
#3	Output
#4	Vcc



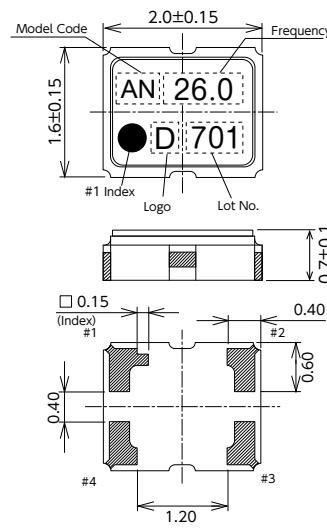
#### ■ Recommended Land Pattern <Top View>



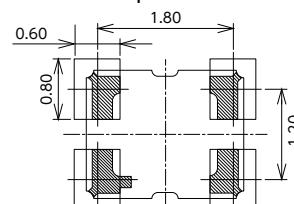
#### ■ DSA211SDN/DSB211SDN

Model Code  
AN : VC-TCXO (DSA211SDN)  
BN : TCXO (DSB211SDN)

Pin Connections	
Pin No.	Connection
#1	Vcont(VC-TCXO)/GND(TCXO)
#2	GND
#3	Output
#4	Vcc



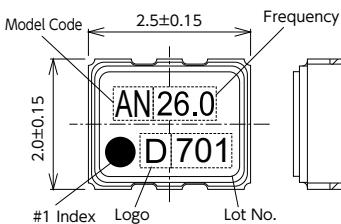
#### ■ Recommended Land Pattern <Top View>



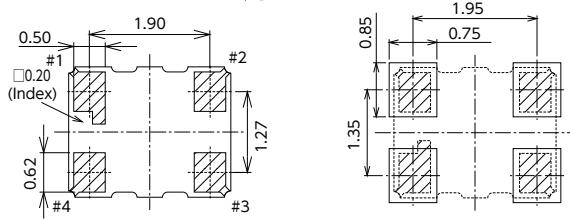
#### ■ DSA221SDN/DSB221SDN

Model Code  
AN : VC-TCXO (DSA221SDN)  
BN : TCXO (DSB221SDN)

Pin Connections	
Pin No.	Connection
#1	Vcont(VC-TCXO)/GND(TCXO)
#2	GND
#3	Output
#4	Vcc



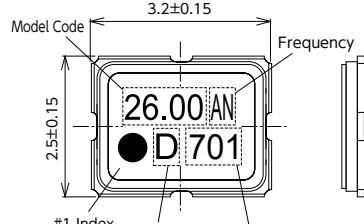
#### ■ Recommended Land Pattern <Top View>



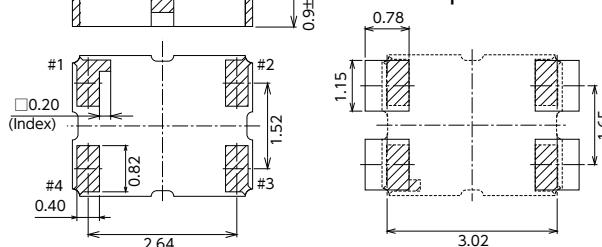
#### ■ DSA321SDN/DSB321SDN

Model Code  
AN : VC-TCXO (DSA321SDN)  
BN : TCXO (DSB321SDN)

Pin Connections	
Pin No.	Connection
#1	Vcont(VC-TCXO)/GND(TCXO)
#2	GND
#3	Output
#4	Vcc

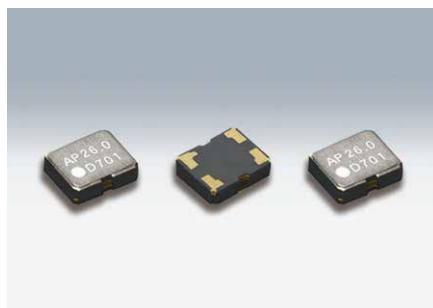


#### ■ Recommended Land Pattern <Top View>



# High-precision SMD VC-TCXO/TCXO (For Automotive)

## DSA211SP/DSB211SP



Actual size

### ■ Features

- Capable of operating over a wide temperature range, from -40 to +105°C
- Low voltage operation
- Low phase noise
- Single packaged structure
- AEC-Q100/AEC-Q200 compliant



### ■ Applications

- GPS / GNSS
- Telematics, Satellite radio

### ■ Standard Specification

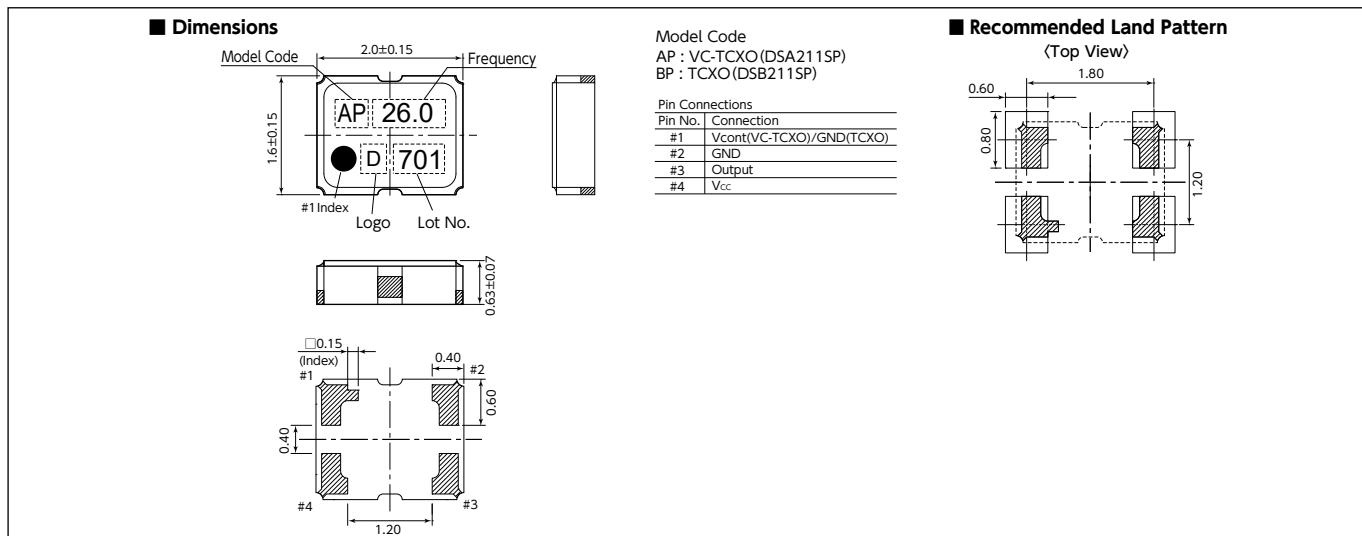
Item	Type	DSA211SP(VC-TCXO)	DSB211SP(TCXO)
Output Frequency Range		12.288 to 52 MHz	12.288 to 52 MHz
Standard Frequency		16.3676 / 16.367667 / 16.368 / 16.369 / 16.8 / 26 / 38.4 MHz	
Supply Voltage Range		+1.68 to +3.5V	
Supply Voltage (Vcc)		+1.8V / +2.8 V / +3.0V / +3.3V	
Current Consumption		+1.7 mA max. (f≤26MHz) / +2.2 mA max. (f>26MHz)	
Output Level		0.8 Vp-p min. (Clipped Sine Wave / DC-coupled)	
Output Load		10 kΩ//10 pF	
Frequency Stability Tolerance		±1.5×10 <sup>-6</sup> max. (After 2 reflows)	
vs. Temperature		±1.0×10 <sup>-6</sup> max. / -40 to +105°C	±0.5×10 <sup>-6</sup> max. / -40 to +105°C
vs. Supply Voltage		±0.2×10 <sup>-6</sup> max. (Vcc±5%)	
vs. Load Variation		±0.2×10 <sup>-6</sup> max.	
vs. Aging		±1.0×10 <sup>-6</sup> max. / year	
Start up Time		2.0ms max.	
Frequency Control Control Sensitivity		±3.0×10 <sup>-6</sup> to ±5.0×10 <sup>-6</sup> / Vcont=+1.4V±1V @Vcc≥+2.6V ±3.0×10 <sup>-6</sup> to ±5.0×10 <sup>-6</sup> / Vcont=+0.9V±0.6V @Vcc=+1.8V	—
Response Slope		Positive	—
SSB Phase Noise		[f≤15MHz]	[f>26MHz]
Offset 100Hz		-115 dBc/Hz	-110 dBc/Hz
Offset 1kHz		-135 dBc/Hz	-130 dBc/Hz
Offset 10kHz		-145 dBc/Hz	-140 dBc/Hz
Offset 100kHz		-145 dBc/Hz	-145 dBc/Hz
Reliability		AEC-Q100/AEC-Q200	
Packing Unit (1)		3000pcs./reel (φ180)	

(1) Prevention of moisture packing is unnecessary

Moisture Sensitivity Level : LEVEL 1 (IPC/JEDEC J-STD-033)

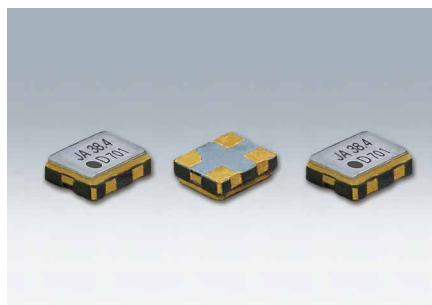
Consult our sales representative for other specifications.

[mm]



# SMD TCXO (For Automotive)

## DSB211SJA



Actual size □

### ■ Features

- Capable of operating over a wide temperature range, from -40 to +105°C
- Supply voltage from +1.7 up to +3.6V
- CMOS Level Output
- Low phase noise
- Single package structure
- AEC-Q100/AEC-Q200 Compliant



### ■ Applications

- Automotive multimedia device, WLAN and visual applications such as automotive camera

### ■ Standard Specification

Item	Type	DSB211SJA
Frequency Range		13 to 52MHz
Standard Frequency		19.2MHz/ 25MHz/ 26MHz/ 32MHz/ 38.4MHz/ 40MHz/ 48MHz/ 52MHz
Supply Voltage (Vcc)		+1.8V/ +2.5V/ +2.8V/ +3.3V
Current Consumption		5.0mA max. [No Load]
Stand-by Current (#1 pin "L" Level)		+10μA max.
Frequency Stability Tolerance		±1.5×10 <sup>-6</sup> max. (After 2 reflows)
vs. Temperature		±2.5×10 <sup>-6</sup> max./ -40 to +85°C ±5.0×10 <sup>-6</sup> max./ -40 to +105°C ±20×10 <sup>-6</sup> max./ -40 to +125°C (Option)
vs. Aging		±1.0×10 <sup>-6</sup> max./year
Symmetry		45 to 55% (50% Vcc Level)
0 Level Output Voltage		Vcc×0.1V max.
1 Level Output Voltage		Vcc×0.9V min.
Output Load		15pF
Rise and Fall Time		5ns max. (10% to 90% Vcc Level)
OE Pin 0 Level Input Voltage		Vcc×0.2V max.
OE Pin 1 Level Input Voltage		Vcc×0.8V min.
Start Up Time		3.0ms max.
Output Enable Time		3.0ms max.
Output Disable Time		150ns max.
Phase Noise	[f≤26MHz]	[26MHz<f≤52MHz]
Offset 1kHz	-145dBc/Hz	-141dBc/Hz
Offset 100kHz	-158dBc/Hz	-157dBc/Hz
Reliability		AEC-Q100/AEC-Q200
Packing Unit (1)		3000pcs./reel (φ180)

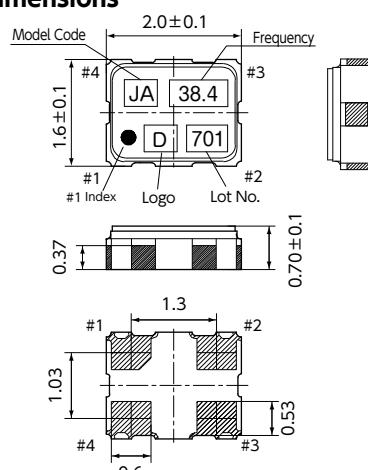
(1) Moisture prevention packing is unnecessary.

Moisture Sensitivity Level: LEVEL 1 (IPC/JEDEC J-STD-033)

Consult our sales representative for other specifications.

[mm]

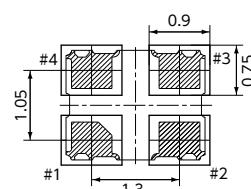
### ■ Dimensions



Pin Connections	
Pin No.	Connection
#1	OE (Output Enable)
#2	GND
#3	Output
#4	Vcc
Function	
#1 Input	#3 Output condition
H	Oscillation out
L	High Z

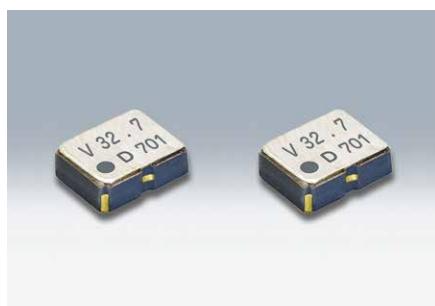
### ■ Recommended Land Pattern

<Top View>



# SMD TCXO (For Automotive)

## DSK1612ATD



Actual size

### ■ Features

- Digital temperature compensated type
- High precision:  $\pm 5.0 \times 10^{-6}$  (-40 to +85°C)
- Low current consumption
- AEC-Q200 Compliant

### ■ Applications

- High precision clock source
- High precision clock source for RTC



Pb-Free



RoHS/ELV Compliant

### ■ Standard Specification

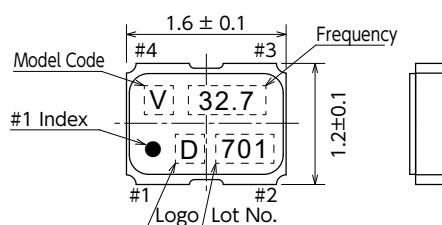
Item	Legend	Spec.				Condition
		min.	typ.	max.	Unit	
Output Frequency	f <sub>0</sub>	—	32.768	—	kHz	
Supply Voltage Range	V <sub>cc</sub>	+1.5	—	+3.63	V	(Temperature Compensated Operating)
Frequency Tolerance	f <sub>_tol</sub>	-5.0	—	+5.0	$\times 10^{-6}$	-40 to +85°C
Current Consumption	I <sub>cc</sub>	—	—	+3.5	$\mu$ A	V <sub>cc</sub> =+1.8V or +3.3V, Temperature Compensation Interval:0.5s, No Load
		—	—	+3.2		V <sub>cc</sub> =+1.8V or +3.3V, Temperature Compensation Interval:2.0s, No Load
Symmetry	SYM	40	50	60	%	at 50% V <sub>cc</sub>
0 Level Output Voltage	V <sub>OL</sub>	—	—	V <sub>cc</sub> ×0.1	V	
1 Level Output Voltage	V <sub>OH</sub>	V <sub>cc</sub> ×0.9	—	—		
Rise and Fall Time	t <sub>r</sub> , t <sub>f</sub>	—	—	50	ns	V <sub>cc</sub> =+1.5 to +3.63V, 10 to 90% V <sub>cc</sub> Level
Load Condition	L <sub>CMOS</sub>	—	—	15	pF	
Start Up Time	T <sub>start</sub>	—	—	1.0	s	
Reliability						AEC-Q200
Packing Unit (1)						3000pcs./reel ( $\phi$ 180)

(1) Moisture prevention packing

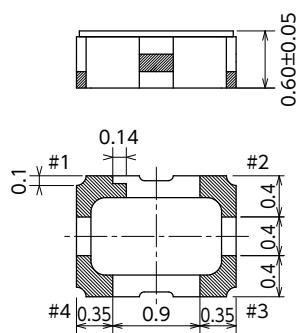
Consult our sales representative for other specifications.

[mm]

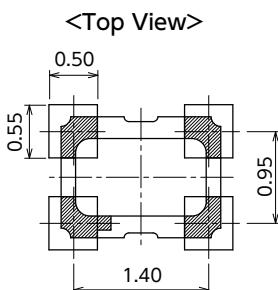
### ■ Dimensions



Pin No.	Connection
#1	GND
#2	Output
#3	V <sub>cc</sub>
#4	GND



### ■ Recommended Land Pattern



# SMD TCXO (For Automotive)

## DSK321STD



Actual size

### ■ Standard Specification

Item	Legend	Spec.				Condition
		min.	typ.	max.	Unit	
Output Frequency	f <sub>0</sub>	—	32.768	—	kHz	
Supply Voltage Range	V <sub>cc</sub>	+1.5	—	+3.63	V	(Temperature Compensated Operating)
Frequency Tolerance (Includes frequency tolerance at room temperature.)	f <sub>_tol</sub>	-5.0	—	+5.0	$\times 10^{-6}$	-40 to +85°C
Current Consumption	I <sub>cc</sub>	—	—	+3.5	$\mu$ A	V <sub>cc</sub> =+1.8V or +3.3V, Temperature Compensation Interval:0.5s, No Load
		—	—	+3.2		V <sub>cc</sub> =+1.8V or +3.3V, Temperature Compensation Interval:2.0s, No Load
Symmetry	SYM	40	50	60	%	at 50% V <sub>cc</sub>
0 Level Output Voltage	V <sub>OL</sub>	—	—	V <sub>cc</sub> ×0.1	V	
1 Level Output Voltage	V <sub>OH</sub>	V <sub>cc</sub> ×0.9	—	—		
Rise and Fall Time	t <sub>r, tf</sub>	—	—	50	ns	V <sub>cc</sub> =+1.5 to +3.63V, 10 to 90% V <sub>cc</sub> Level
Load Condition	L <sub>_CMOS</sub>	—	—	15	pF	
Start Up Time	T <sub>start</sub>	—	—	1.0	s	
Reliability	AEC-Q200					
Packing Unit (1)	3000pcs./reel ( $\phi$ 180)					

(1) Moisture prevention packing is unnecessary.

Moisture Sensitivity Level:Level 1 (IPC/JEDEC J-STD-033

Consult our sales representative for other specifications.

### ■ Features

- Digital temperature compensated type
- High precision:  $\pm 5.0 \times 10^{-6}$  (-40 to +85°C)
- Low current consumption
- AEC-Q200 Compliant

### ■ Applications

- High precision clock source
- High precision clock source for RTC



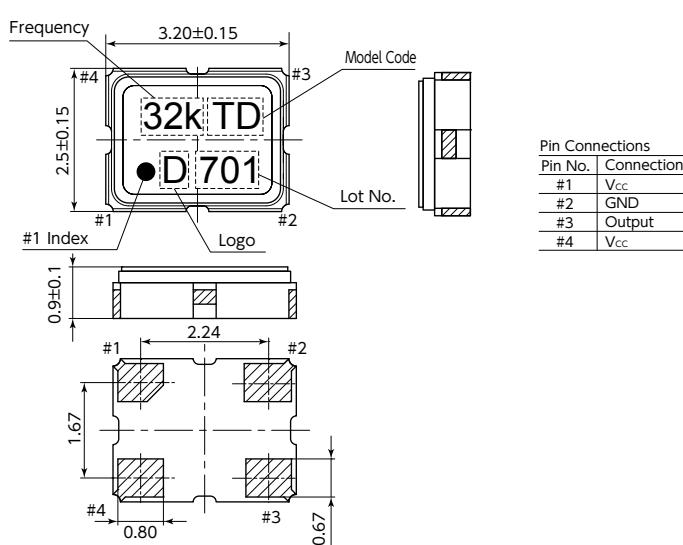
Pb-Free



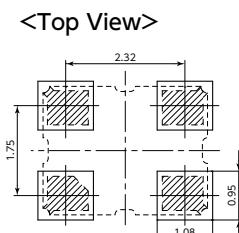
RoHS/ELV Compliant

[mm]

### ■ Dimensions



### ■ Recommended Land Pattern

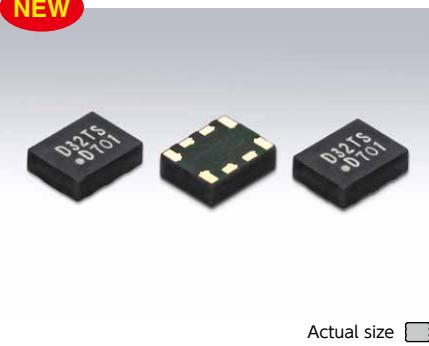


# SMD Real Time Clock Module

## DD3225TS

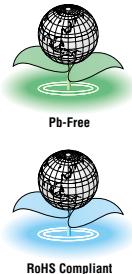
Under Development

NEW



### ■ Features

- Digital temperature compensated type
  - High precision :  $\pm 5.0 \times 10^{-6}$  (-40 to +85°C),  $\pm 7.0 \times 10^{-6}$  (-40 to +105°C)
  - Low current consumption
  - Low voltage operation : +1.3 to +5.5V (Temperature Compensated Operating), +1.3 to +5.5V (Clock Timing Operating)
  - I<sup>2</sup>C-BUS serial interface:400kHz fast-mode compatible
  - Clock function:hour·minute·second, Calendar function with auto leap year adjustment:year·month·day·day of week
  - Alarm interrupt function:day·day of week·hour·minute
  - Fixed-cycle timer interrupt function:244μs to 255min
  - Time update interrupt function:minute·second
  - Clock output function:32.768kHz, 1024Hz, 32Hz, 1Hz
  - Supply voltage detection function:  
+1.5V temperature compensation operating voltage detection  
+1.3V supply voltage under voltage detection
  - AEC-Q100/AEC-Q200 compliant
- \* "I<sup>2</sup>C-BUS" is a trademark of NXP semiconductors.



### ■ Applications

- High precision clock source
- Car navigation, Smart meter, Data logger

### ■ Standard Specification

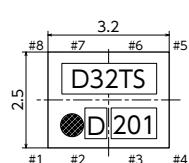
Item	Legend	Spec.				Condition
		min.	typ.	max.	unit	
Output Frequency	f <sub>0</sub>	—	32.768	—	kHz	
Supply Voltage Range	V <sub>cc</sub>	+1.3	—	+5.5		(Clock Timing Operating)
	V <sub>tem</sub>	+1.5	—	+5.5		(Temperature Compensated Operating)
	V <sub>int</sub>	+1.5	—	+5.5		(Interface Operation) I <sup>2</sup> C-BUS
Frequency Tolerance	f <sub>_tol</sub>	-5	—	+5		$\times 10^{-6}$
		-7	—	+7		-40 to +85°C
Current Consumption	I <sub>CC1</sub>	—	0.30	2.10		V <sub>cc</sub> = +3.0V
		—	0.42	2.90		V <sub>cc</sub> = +5.0V
	I <sub>CC2</sub>	—	0.90	2.80		V <sub>cc</sub> = +3.0V
		—	1.30	4.00		V <sub>cc</sub> = +5.0V
Load Condition	L <sub>CMOS</sub>	—	—	15	pF	
Symmetry	SYM	40	—	60	%	50%V <sub>cc</sub>
1 level Output Voltage	V <sub>OH</sub>	0.8xV <sub>cc</sub>	—	—	V	I <sub>OH</sub> =-1mA
0 level Output Voltage	V <sub>OL</sub>	—	—	0.2xV <sub>cc</sub>	V	I <sub>OL</sub> =1mA
Rise / Fall Time	Tr/Tf	—	—	100	ns	20 to 80%V <sub>cc</sub>
OE Pin 1 level Input Voltage	V <sub>IH</sub>	0.8xV <sub>cc</sub>	—	V <sub>cc</sub>	V	
OE Pin 0 level Input Voltage	V <sub>IL</sub>	0	—	0.2xV <sub>cc</sub>	V	
Start Up Time	Tstart	—	—	1	s	T <sub>a</sub> = +25°C , V <sub>cc</sub> = +1.3V
Packing Unit (1)				2000pcs./reel (φ 180)		

(1) Moisture prevention packing

Consult our sales representative for other specifications.

[mm]

### ■ Dimensions



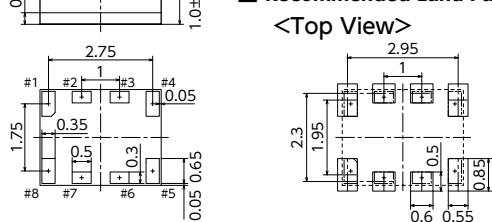
Function		Pin Function		
#1 Input	#5 Output Condition	No.	Name	I/O
H	Oscillation out	#1	OE	I
L	High Z	#2	INTN	0
		#3	N.C.	-
		#4	GND	-
		#5	Output	0
		#6	SCL	I
		#7	SDA	I/O
		#8	Vcc	-

Pin Function Description

- #1 OE I Output control enable input (L:High impedance, H:Clock output)
- #2 INTN 0 1Hz signal, alarm interrupt signal, fixed-cycle timer interrupt signal, and time update interrupt signal, Nch open-drain output.
- #3 N.C. - None connection
- #4 GND - Ground connection.
- #5 Output 0 Clock output connection.
- #6 SCL I I<sup>2</sup>C-BUS serial interface clock input connection.
- #7 SDA I/O I<sup>2</sup>C-BUS serial interface data input/output connection.
- #8 Vcc - Supply Voltage

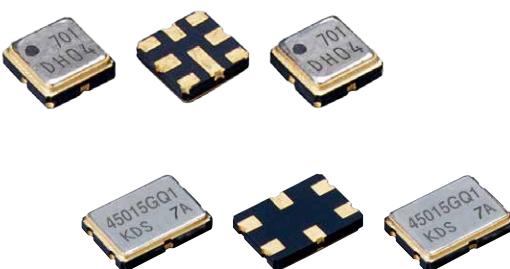
### ■ Recommended Land Pattern

<Top View>



# Quartz Devices

## Monolithic crystal filters



⟨Example⟩

Surface mount  
monolithic crystal filter

D S F 3 3 4 S A F

Length  
Represents first digit of the dimension in millimeter

Width  
Represents first digit of the dimension in millimeter

Number of terminals  
3: six terminals 4: eight terminals

Sealing method  
S: seam weld seal

Product characteristics  
A: 2pole B,D: 4pole C: 3pole

Product characteristics  
F: Fundamental O: Overtone

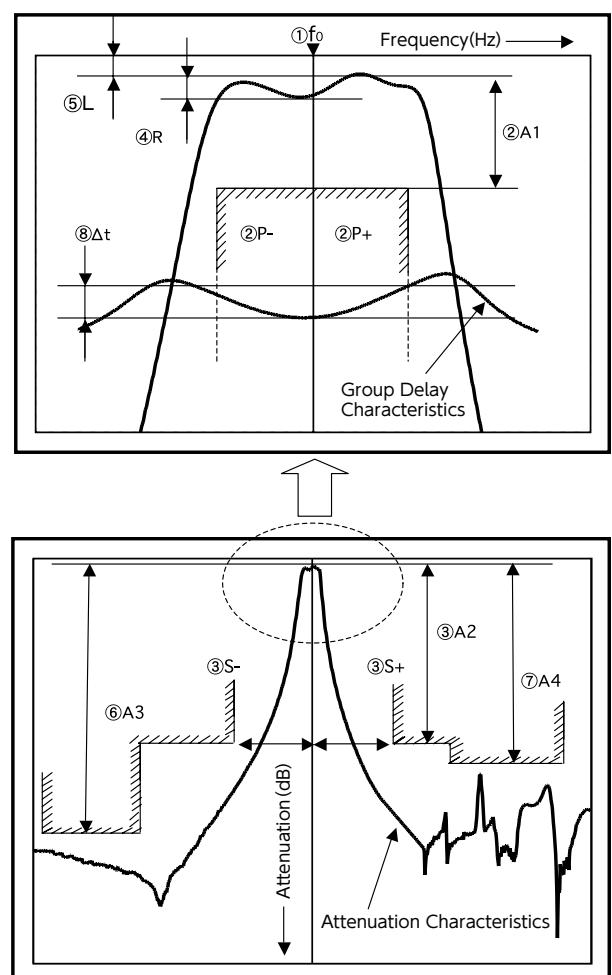
# Monolithic Crystal Filters

## Description

A monolithic crystal filter is a device that has a frequency screening function. From a wide frequency range, it passes a specific frequency and attenuates unnecessary ones. It plays the role of extracting desired frequency in radio communication equipment. With the high Q factor of the crystal, these filters feature low loss, steep attenuation characteristics and high stability, as well as good temperature drifting characteristics.

## Terminology

①	<b>Nominal Frequency</b> $f_0$ (MHz)	Nominal value of center frequency.
②	<b>Pass Bandwidth</b> $P \pm$ (kHz), $A_1$ (dB)	Frequency interval at which relative attenuation is guaranteed to be equal to or less than a given value, $A_1$ .
③	<b>Stop Bandwidth</b> $S \pm$ (kHz), $A_2$ (dB)	Frequency interval at which relative attenuation is guaranteed to be equal to or more than a given value, $A_2$ .
④	<b>Ripple</b> $R$ (dB)	The maximum difference between the minimum attenuation and the minimum loss within the pass band.
⑤	<b>Insertion Loss</b> $L$ (dB)	Difference in attenuation when filter is inserted and not inserted. Can be either of the following. Minimum loss: Minimum value of insertion loss. Insertion loss at $f_0$ : Insertion loss at nominal frequency.
⑥	<b>Guaranteed Attenuation</b> $A_3$ (dB)	Relative attenuation guaranteed in a specific range within the stop band.
⑦	<b>Spurious</b> $A_4$ (dB)	Relative attenuation produced as a result of spurious frequencies in a specific range within the stop band.
⑧	<b>Tolerance in Group Delay Time</b> $\Delta t$ ( $\mu$ s)	Difference between the maximum value and minimum value of the group delay time within the pass band.
<b>Terminating Impedance</b> $R_t//C_t$ ( $\Omega//\text{pF}$ )		Signal-source impedance or loading impedance as viewed from the filter side. Expressed as resistance and parallel capacitance including floating capacitance.
<b>Coupling Capacitance</b> $C_c$ ( $\text{pF}$ )		Capacitance of the connection between elements for 4pole filter.
<b>Operating Temperature Range</b>		Temperature range over which the monolithic crystal filter can be operated within allowable deviation range.



# Selection Guide



Scan the QR code to check the table of contents page of our web site "Monolithic Crystal Filters" (URL: <https://www.kds.info/class/3-l-cf/>).

Icons

IE

Industrial Equipment

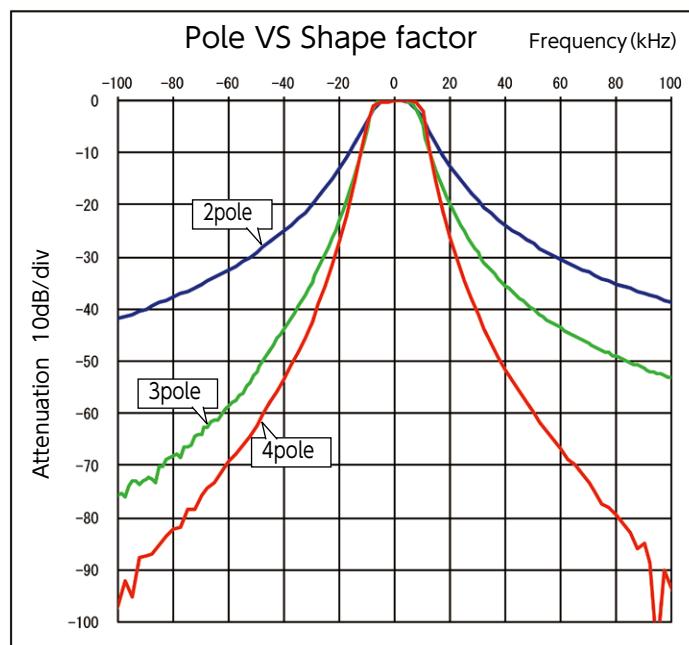
TC

Mobile Phone, Wireless Communication

## Monolithic Crystal Filters

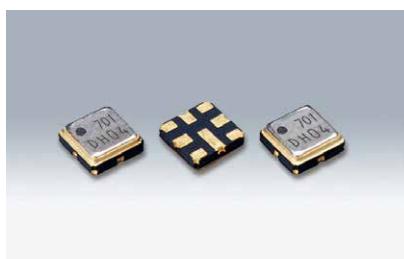
Type	Actual Size	Size (mm)			Frequency Range (MHz)	Operating Temperature Range (°C)	Overtone Order	Pole	Pass Bandwidth (kHz min./3dB)	Recommended Application	Catalog Page			
		L	W	H (max.)										
DSF334SAF		3.0	3.0	1.1	45 to 130	-20 to +70	Fundamental	2	±3.5, ±7.5, ±15		86			
DSF334SAO					100 to 160		3rd							
DSF334SCF					60 to 130		Fundamental	3						
DSF633SAF		6.0	3.5	1.3	20 to 160	-20 to +70	Fundamental	4	±3.5, ±7.5, ±15		87			
DSF633SDF					37 to 130		Fundamental							
DSF633SDO					60 to 160		3rd							
DSF753SAF		7.0	5.0	1.5	16 to 90	-20 to +70	Fundamental	2	±3.5, ±7.5, ±15		88			
DSF753SAO					60 to 160		3rd							
DSF753SCF					20 to 130		Fundamental	3						
DSF753SCO					90 to 160		3rd							
DSF753SBF					30 to 70		Fundamental	4						
DSF753SDF					20 to 130		3rd							
DSF753SDO					60 to 160		3rd							

## Pole VS Shape factor



# SMD Monolithic Crystal Filters

## DSF334S 2POLE/DSF334S 3POLE



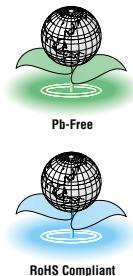
Actual size

### ■ Features

- 3030 size, lightweight (0.03g) and miniature SMD crystal filter. Just 0.9mm height.
- Excellent shock and vibration resistance.
- Low spurious

### ■ Applications

- Radio communications



### ■ Standard Specification

Type	DSF334SAF	DSF334SAF	DSF334SCF	
Model	D50003AM	D50015AM	DA6115FM	DA6270FM
Pole	2	2	3	3
Overtone Order	Fundamental	Fundamental	Fundamental	Fundamental
Nominal Frequency	50.000 MHz	50.000 MHz	161.950 MHz	162.000 MHz
Pass Bandwidth	$\pm 1.5\text{kHz}$ min./3dB	$\pm 7.5\text{kHz}$ min./3dB	$\pm 7.5\text{kHz}$ min./3dB	$\pm 35\text{kHz}$ min./3dB
Stop Bandwidth	$\pm 18\text{kHz}$ max./15dB	$\pm 25\text{kHz}$ max./13dB	$\pm 20\text{dB}$ min./50kHz	$\pm 10\text{dB}$ min./125kHz
Ripple	1dB max.	1dB max.	1dB max.	1dB max.
Insertion Loss	40dB max.	3.5dB max.	5dB max.	5dB max.
Guaranteed Attenuation	60dB min.	60dB min.	70dB min.	50dB min.
Terminating Impedance	$400\Omega//9\text{pF}$	$750\Omega//3\text{pF}$	$120\Omega//-0.8\text{pF}$	$320\Omega//-0.4\text{pF}$
Operating Temperature Range	$-20$ to $+70^\circ\text{C}$			
Packing Unit (1)	2000pcs./reel( $\phi 180$ )			

1) Moisture prevention packing is unnecessary.

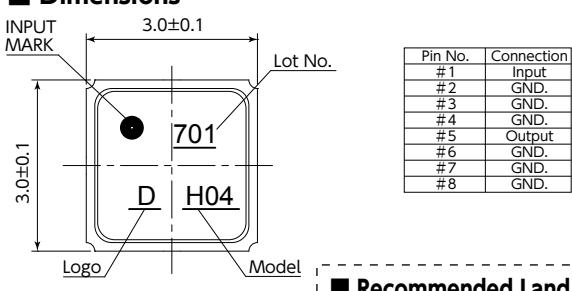
Moisture Sensitivity Level: LEVEL 1 (IPC/JEDEC J-STD-03)

Consult our sales representative for other specifications.

### ■ DSF334S

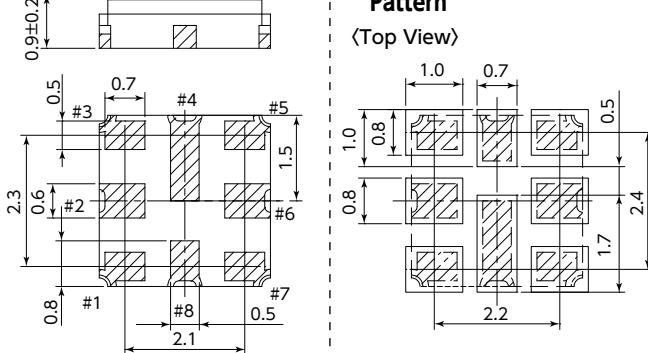
[mm] ■ Improved phase noise characteristics

#### ■ Dimensions

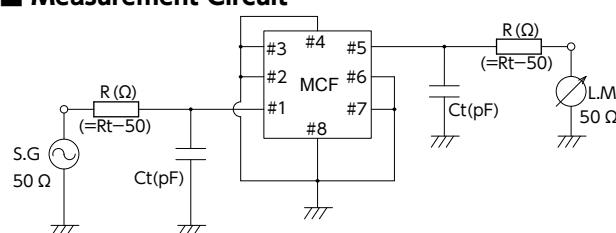


#### ■ Recommended Land Pattern

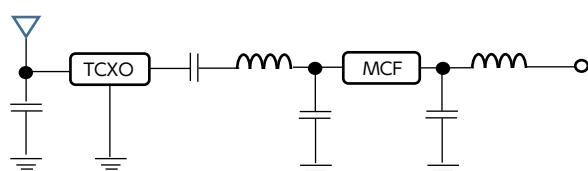
<Top View>



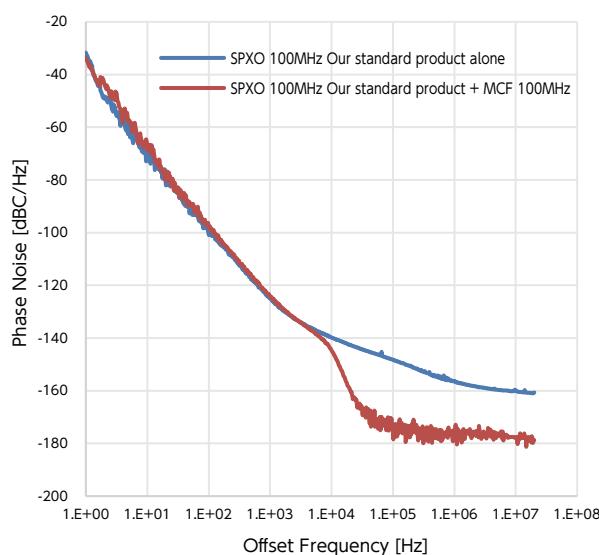
#### ■ Measurement Circuit



#### MCF Measurement Configuration

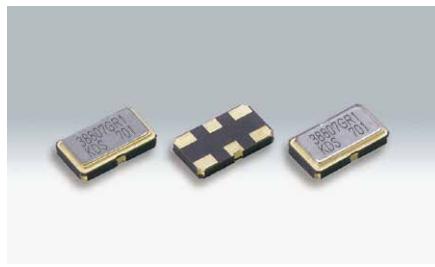


※TCXO or Oscillator (SPXO)



# SMD Monolithic Crystal Filters

## DSF633S 2POLE/DSF633S 4POLE



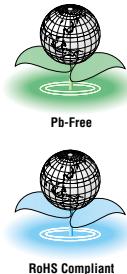
Actual size

### ■ Features

- 6035 size, lightweight (0.072g) and miniature SMD crystal filter. Just 1.1mm height.
- 4 pole function in a single package.
- Excellent guaranteed attenuation.
- Excellent shock and vibration resistance.

### ■ Applications

- Radio communications



### ■ Standard Specification

Type	DSF633SDF				
Model	D38807GR	D49903GR	D58010GR	D73312GR	DA3050GR
Pole	4	4	4	4	4
Overtone Order	Fundamental	Fundamental	Fundamental	Fundamental	Fundamental
Nominal Frequency	38.850 MHz	49.950 MHz	58.050 MHz	73.350MHz	130.000MHz
Pass Bandwidth	±3.75kHz min./3dB	±1.75kHz min./3dB	±5.0kHz min./3dB	±6.0kHz min./3dB	±25.0kHz min./3dB
Stop Bandwidth	±15.0kHz min./35dB	±6.25kHz max./20dB	±12.5kHz max./25dB	±25kHz max./40dB	±100kHz max./35dB
Ripple	1dB max.	1dB max.	1dB max.	1dB max.	1dB max.
Insertion Loss	6dB max.	6dB max.	5dB max.	5dB max.	5dB max.
Guaranteed Attenuation	76dB min.	76dB min.	80dB min.	80dB min.	70dB min.
Terminating Impedance	710Ω//4pF Cc=12.5pF	150Ω//11pF Cc=33pF	450Ω//4.5pF Cc=9.5pF	380Ω//5pF Cc=11pF	560Ω//0.2pF Cc=3.5pF
Operating Temperature Range	-20 to +70°C				
Packing Unit (1)	1000pcs./reel(Φ180)				

(1) Moisture prevention packing is unnecessary.

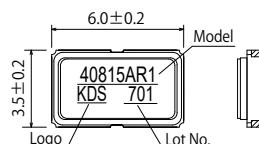
Moisture Sensitivity Level: LEVEL 1 (IPC/JEDEC J-STD-033)

Consult our sales representative for other specifications.

### ■ DSF633SA

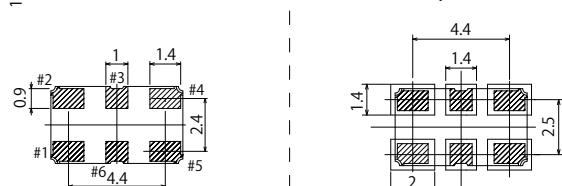
[mm]

#### ■ Dimensions

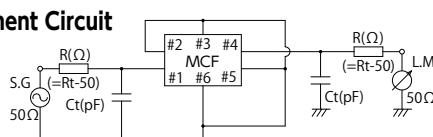


Pin No.	Connection
#1	INPUT
#2	GND.
#3	GND.
#4	OUTPUT
#5	GND.
#6	GND.

#### ■ Recommended Land Pattern <Top View>



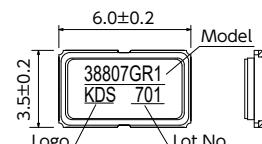
#### ■ Measurement Circuit



### ■ DSF633SD

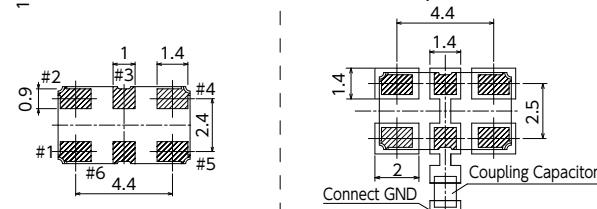
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#### ■ Dimensions

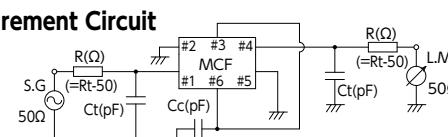


Pin No.	Connection
#1	INPUT
#2	GND.
#3	Connect with #6
#4	OUTPUT
#5	GND.
#6	Connect with #3

#### ■ Recommended Land Pattern <Top View>



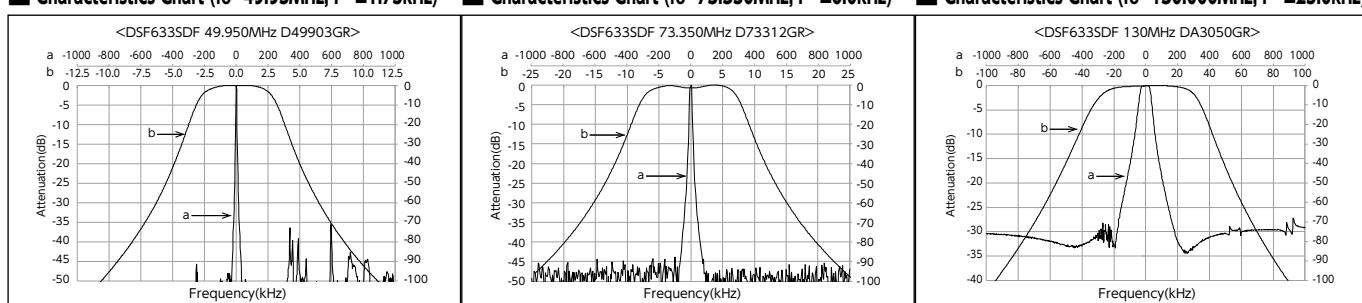
#### ■ Measurement Circuit



### ■ Characteristics Chart (fo=49.95MHz, P=±1.75kHz)

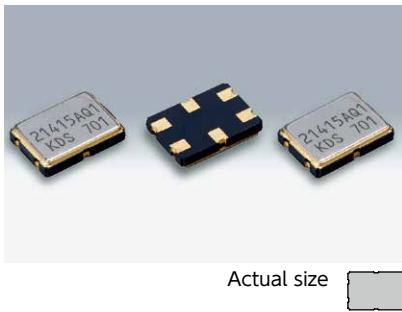
### ■ Characteristics Chart (fo=73.350MHz, P=±6.0kHz)

### ■ Characteristics Chart (fo=130.000MHz, P=±25.0kHz)



# SMD Monolithic Crystal Filters

## DSF753S 2POLE/DSF753S 3POLE/DSF753S 4POLE

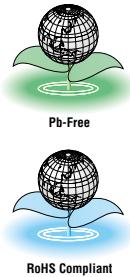


### ■ Features

- 7050 size, lightweight (0.15g) and miniature SMD crystal filter. Just 1.3mm height.
- Excellent shock and vibration resistance

### ■ Applications

- Radio communications



Actual size

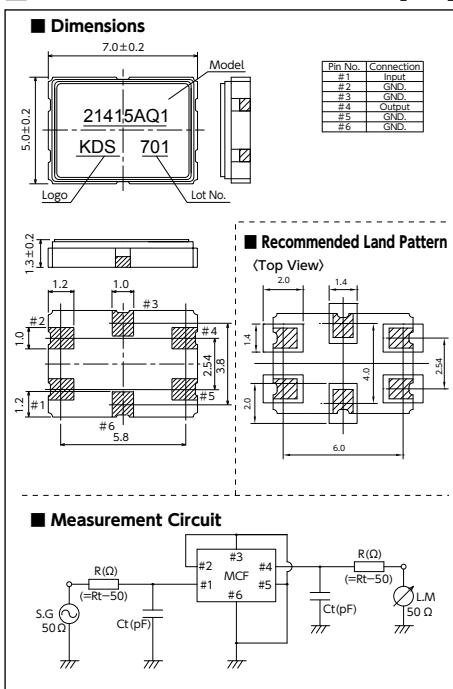
### ■ Standard Specification

Type	DSF753SAF	DSF753SCF	DSF753SBF/DSF753SDF			DSF753SDO
Model	D21415AQ	D45015FQ	D46307GQ	D50810GQ	D73312GQ	DA4917GQ
Pole	2	3	4	4	4	4
Overtone Order	Fundamental	Fundamental	Fundamental	Fundamental	Fundamental	3rd overtone
Nominal Frequency	21.400 MHz	45.000 MHz	46.350MHz	50.850MHz	73.350MHz	149.9725 MHz
Pass Bandwidth	±7.5kHz min./3dB	±7.5kHz min./3dB	±3.5kHz min./3dB	±5.0kHz min./3dB	±6.0kHz min./3dB	±8.68kHz min./3dB
Stop Bandwidth	±25kHz max./18dB	±50kHz max./30dB	±18kHz max./40dB	±20kHz max./40dB	±25kHz max./40dB	±15dB min./30kHz
Ripple	1dB max.	1dB max.	1dB max.	1dB max.	1dB max.	1dB max.
Insertion Loss	2dB max.	3dB max.	5dB max.	5dB max.	5dB max.	6dB max.
Guaranteed Attenuation	70dB min.	70dB min.	80dB min.	80dB min.	80dB min.	60dB min.
Terminating Impedance	1500Ω//2.5pF	700Ω//−1pF	400Ω//4pF Cc=17.5pF	560Ω//4pF Cc=9.7pF	450Ω//4pF Cc=9.2pF	800Ω//−0.2pF Cc=0.6pF
Operating Temperature Range	−20 to +70°C					
Packing Unit (1)	1000pcs./reel(Φ180)					

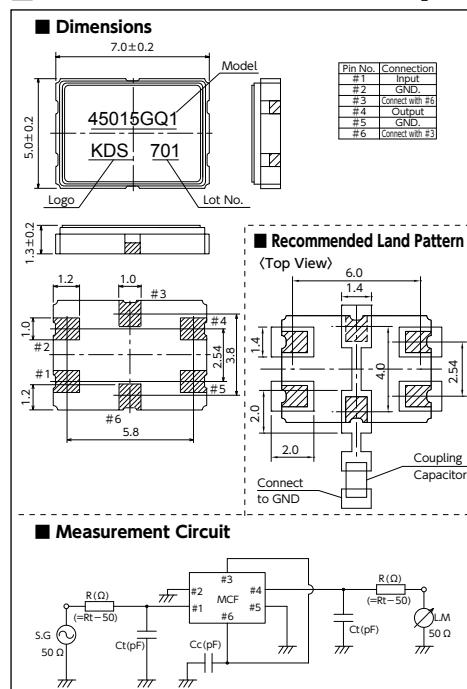
- (1) Moisture prevention packing is unnecessary.  
Moisture Sensitivity Level: LEVEL 1 (IPC/JEDEC J-STD-033)

Consult our sales representative for other specifications.

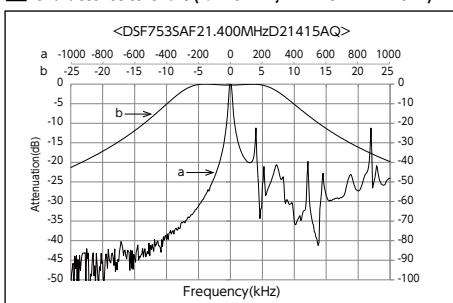
### ■ DSF753SA/DSF753SC [mm]



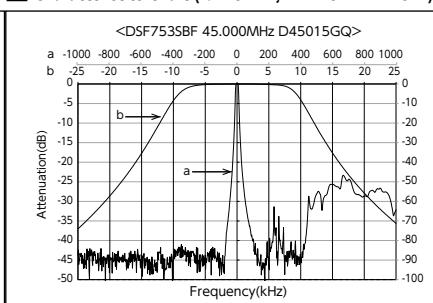
### ■ DSF753SB/DSF753SD [mm]



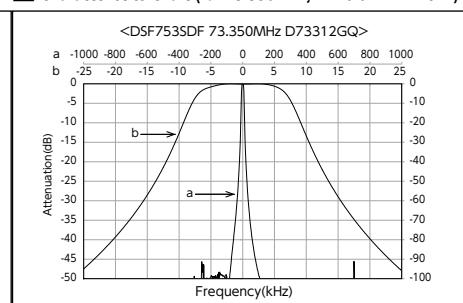
### ■ Characteristics Chart (f0=45MHz, P=±7.5kHz 2POLE)



### ■ Characteristics Chart (f0=45MHz, P=±7.5kHz 4POLE)

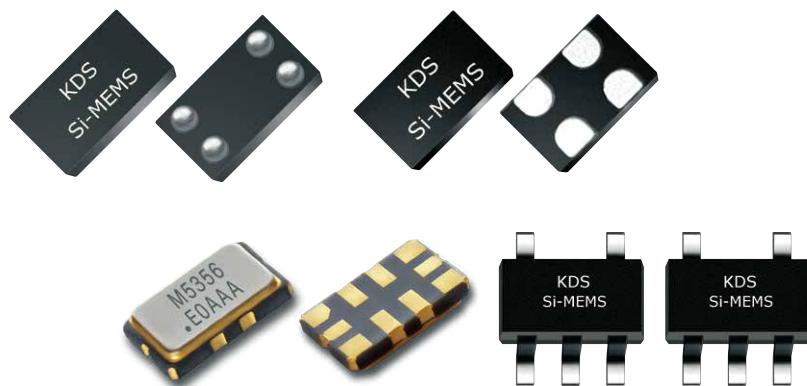


### ■ Characteristics Chart (f0=73.35MHz, P=±6.0kHz 4POLE)



# Silicon Timing Devices

## MEMS oscillators



# Selection Guide



Scan the QR code to check the table of contents page of our web site "MEMS Oscillators" (URL: <https://www.kds.info/class/4-l-mems/>).

Icons CE Consumer Equipment IE Industrial Equipment TC Mobile Phone, Wireless Communication

## KHz Band MEMS Oscillator

Type	Actual Size	Size (mm)			Output	Frequency Range (kHz)	Frequency Characteristics over Temperature ( $\times 10^{-6}$ )	Operating Temperature Range (°C)	Supply Voltage (V)	Current Consumption ( $\mu A$ typ.)	Recommended Application	Catalog Page
		L	W	H (max.)								
MO1532	■	1.5	0.8	0.6	NanoDrive™LVC MOS	32.768	$\pm 100$	-40 to +85	+1.2 to +3.63	+0.90	CE TC	91
MO1534	■	1.5	0.8	0.6	NanoDrive™LVC MOS	0.001 to 32.768	$\pm 100$	-40 to +85	+1.2 to +3.63	+0.90	CE TC	92
	■	2.0	1.2	0.6								
MO1569	■	1.5	0.8	0.6	LVC MOS	0.001 to 462	$\pm 50$	-40 to +85	+1.62 to +3.63	+2.0 $\mu A$ (100kHz)	CE TC	91
MO1630	■	2.0	1.2	0.6	LVC MOS	16.384, 32.768	$\pm 150$	-40 to +105	+1.5 to +3.63	+1.00	CE TC	91

## KHz Band Temperature Compensated MEMS Oscillators

Type	Actual Size	Size (mm)			Output	Frequency Range (kHz)	Frequency Characteristics over Temperature ( $\times 10^{-6}$ )	Operating Temperature Range (°C)	Supply Voltage (V)	Current Consumption ( $\mu A$ typ.)	Recommended Application	Catalog Page			
		L	W	H (max.)											
MO1552	■	1.5	0.8	0.6	NanoDrive™LVC MOS	32.768	$\pm 5/\pm 10/\pm 20$ over temp.	-40 to +85	+1.5 to +3.63	+0.99	CE TC	91			
MO1566	■	1.5	0.8	0.6	LVC MOS		$\pm 3$ all inclusive		+1.8	+4.5					
MO1568	■						$\pm 5$ all inclusive After Overmold/ Underfill								
MO1576	■	1.5	0.8	0.6	LVC MOS	0.001 to 2000	$\pm 5$ all inclusive	-40 to +85	+1.62 to +3.63	+8.0 $\mu A$ (100kHz)	CE TC	92			

## Low Power MEMS Oscillators

Type	Actual Size	Size (mm)			Output	Frequency Range (MHz)	Frequency Tolerance ( $\times 10^{-6}$ ) (Includes frequency tolerance at room temperature.)	Operating Temperature Range (°C)	Supply Voltage (V)	Current Consumption (mA typ.)	Recommended Application	Catalog Page
		L	W	H (max.)								
MO8021	■	1.5	0.8	0.6	LVC MOS	1.0 to 26	$\pm 100$	-40 to +85	+1.62 to +1.98, +2.25 to +3.63	+0.006 to +0.34 (+0.9 $\mu A$ stby)	CE TC	92

## Low Phase Jitter MEMS Oscillators

Type	Actual Size	Size (mm)			Output	Frequency Range (MHz)	Frequency Tolerance ( $\times 10^{-6}$ ) (Includes frequency tolerance at room temperature.)	Operating Temperature Range (°C)	Supply Voltage (V)	Current Consumption (mA typ.)	Recommended Application	Catalog Page
		L	W	H (max.)								
MO8208	■	2.7	2.4	0.8	LVC MOS	1.0 to 80	$\pm 10, \pm 20, \pm 25, \pm 50$	-40 to +85	+2.25 to +3.63	+29 to +36 (+10 $\mu A$ stby)	CE IE	94
		3.2	2.5	0.8		80 to 220						
MO8209	■	5.0	3.2	0.8	LVPECL LVDS	25 to 212.5	$\pm 10, \pm 20, \pm 25, \pm 50$	-40 to +85	+2.25 to +3.63	+54 to +69	CE IE	94
		7.0	5.0	1.0		1.0 to 220						
MO9120	■	3.2	2.5	0.8	LVPECL LVDS	220 to 625	$\pm 10, \pm 20, \pm 25, \pm 50$	-40 to +85	+2.25 to +3.63	+76 to +84	CE IE	93
		5.0	3.2	0.8		32 Standard Frequencies						
MO9365	■	3.2	2.5	0.8	LVPECL LVDS HCSL	1.0 to 220	$\pm 10, \pm 20, \pm 25, \pm 50$	-40 to +105	+2.25 to +3.63	+76 to +84	CE IE	93
		5.0	3.2	0.8		220 to 725						

## Temperature Compensated MEMS Oscillators

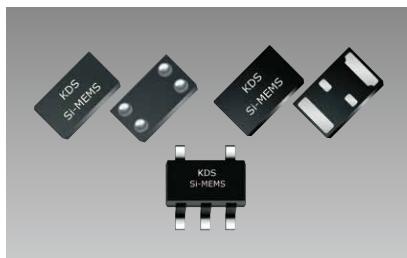
Type	Actual Size	Size (mm)			Output	Frequency Range (MHz)	Frequency Characteristics over Temperature ( $\times 10^{-6}$ )	Operating Temperature Range (°C)	Supply Voltage (V)	Current Consumption (mA typ.)	Recommended Application	Catalog Page					
		L	W	H (max.)													
MO5155	■	5.0	3.2	1.0	Clipped Sinewave (1 to 60 MHz) LVC MOS	10 std. GNSS Freq.	$\pm 0.5, \pm 1.0, \pm 2.5$	-40 to +105°C	+2.25 to +3.63	+40 to +50	CE IE	95					
MO5156	■					1.0 to 60											
MO5157	■					60 to 220	$\pm 0.1, \pm 0.2, \pm 0.25$										
MO5356	■					1.0 to 60											
MO5357	■					60 to 220	$\pm 0.05$	0 to +70°C									
MO5358	■					1.0 to 60											
MO5358	■					60 to 189, 200 to 220											
MO5359	■					LVC MOS											

## MEMS Oscillators with Spread Spectrum Function

Type	Actual Size	Size (mm)			Output	Frequency Range (MHz)	Frequency Tolerance ( $\times 10^{-6}$ ) (Includes frequency tolerance at room temperature.)	Operating Temperature Range (°C)	Supply Voltage (V)	Current Consumption (mA typ.)	Recommended Application	Catalog Page
		L	W	H (max.)								
MO9002	■	5.0	3.2	0.8	LVPECL LVDS CML HCSL	1.0 to 220	$\pm 25, \pm 50$	-40 to +85	+48 to +75	+1.71 to +1.89, +2.25 to +3.63	CE IE	96
		7.0	5.0	1.0		1.0 to 110						
MO9003	■	2.5	2.0	0.8	LVC MOS	1.0 to 110	$\pm 50, \pm 100$	0 to +70°C	+3.2 to +4.1 (+0.4 to +4.3 $\mu A$ stby)	+5.0 to +6.5 (+0.4 to +4.3 $\mu A$ stby)	CE IE	96
		3.2	2.5	0.8		1.0 to 141						
MO9005	■	5.0	3.2	0.8	LVPECL LVDS CML HCSL	1.0 to 141	$\pm 20, \pm 25, \pm 50$	0 to +70°C	+1.62 to +1.98, +2.25 to +3.63	+5.0 to +6.5 (+0.4 to +4.3 $\mu A$ stby)	CE IE	96
		7.0	5.0	1.0		1.0 to 141						

# 32 kHz MEMS Oscillators / 32 kHz TC-MO - μPower

## MO1532/MO1552/MO1630/MO1566/MO1568



### ■ Features

- Fixed 32.768 kHz
- Ultra-low power
- Internal filtering eliminates external Vdd bypass cap

### ■ Applications

- Mobile Phones, Tablets
- Health and wellness monitors, Fitness Watches
- Pulse-per-second timekeeping, RTC reference clock
- Battery Management Timekeeping



Model	Output Frequency (kHz)	Frequency Tolerance ( $\times 10^{-6}$ )	Supply Voltage (V)	Current Consumption ( $\mu\text{A}$ Typ.)	Size (mm)	Output
MO1532	32.768	$\pm 10$ room; 75, 100 over temp.	+1.2 to +3.63	+0.90	1.5×0.8×0.6 (CSP)	NanoDrive™ LVCMOS
MO1552 TC-MO		$\pm 5, \pm 10, \pm 20$ over temp.	+1.5 to +3.63	+0.99		
MO1566 Super TC-MO		$\pm 3, 5$ all inclusive	+1.8	+4.5		LVCMOS
MO1568 Super TC-MO		$\pm 5$ all inclusive After Overmold/Underfill		1.5×0.8×0.6 (CSP)		
MO1630 -40 to +105°C	16.384, 32.768	$\pm 20$ room; $\pm 75, 100, 150$ over temp.	+1.5 to +3.63	+1.00	2.0×1.2×0.6 (QFN) 2.9×2.8×1.3 (SOT23-5)	LVCMOS

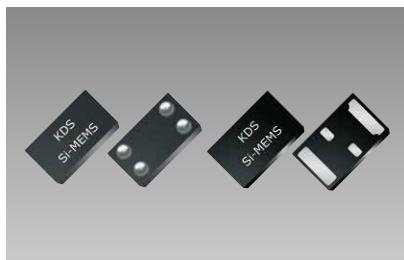
### ■ Standard Specification (MO1532)

Item	Legend	Min.	Typ.	Max.	Unit	Condition
Output Frequency Range	Fout	32.768			kHz	
Supply Voltage	Vdd	+1.2	-	+3.63	V	$T_A = -10^\circ\text{C}$ to $+70^\circ\text{C}$
		+1.5	-	+3.63		$T_A = -40^\circ\text{C}$ to $+85^\circ\text{C}$
Operating Temperature Range	T_use	$-10$ to $+70$ / $-40$ to $+85$			°C	
Frequency Stability [1]	F_stab	-	-	+75	$\times 10^{-6}$	$T_A = -10^\circ\text{C}$ to $+70^\circ\text{C}$ , Vdd: +1.5V to +3.63V
		-	-	+100		$T_A = -40^\circ\text{C}$ to $+85^\circ\text{C}$ , Vdd: +1.5V to +3.63V
		-	-	+250		$T_A = -10^\circ\text{C}$ to $+70^\circ\text{C}$ , Vdd: +1.2V to +1.5V
Frequency Tolerance [2]	F_tol	-	-	+10	$\times 10^{-6}$	$T_A = +25^\circ\text{C}$ , post reflow, Vdd: +1.5V to +3.63V
		-	-	+20		$T_A = +25^\circ\text{C}$ , post reflow with board-level underfill, Vdd: +1.5V to +3.63V
First Year Aging	F_aging1	-1.0	-	+1.0	$\times 10^{-6}$	$T_A = +25^\circ\text{C}$
Core Operating Current [3]	Idd	-	+0.9	-	$\mu\text{A}$	$T_A = +25^\circ\text{C}$ , Vdd: +1.8V. No load
		-	-	+1.3		$T_A = -10^\circ\text{C}$ to $+70^\circ\text{C}$ , Vdd max: +3.63V. No load
		-	-	+1.4		$T_A = -40^\circ\text{C}$ to $+85^\circ\text{C}$ , Vdd max: +3.63V. No load
Start-up Time [4]	T_start	-	180	300	ms	$T_A = -40^\circ\text{C} \leq T_A \leq +50^\circ\text{C}$ , valid output
		-	-	450		$T_A = +50^\circ\text{C} < T_A \leq +85^\circ\text{C}$ , valid output
LVCMOS Output Option, $T_A = -40^\circ\text{C}$ to $+85^\circ\text{C}$ , typical values are at $T_A = +25^\circ\text{C}$						
Duty Cycle	DC	48	-	52	%	
Output Low Voltage	V <sub>OL</sub>	-	-	$\text{Vdd} \times 0.1$	V	Vdd: +1.5V to +3.63V, I <sub>OL</sub> = +10 $\mu\text{A}$ , 15 pF
Output High Voltage	V <sub>OH</sub>	$\text{Vdd} \times 0.9$	-	-	V	Vdd: +1.5V to +3.63V, I <sub>OH</sub> = -10 $\mu\text{A}$ , 15 pF
Rise and Fall Time	Tr, Tf	-	100	200	ns	10 to 90% (Vdd), 15 pF load, Vdd = +1.5V to +3.63V
		-	-	50		10 to 90% (Vdd), 5 pF load, Vdd $\geq$ +1.62V
Packing Unit	1000pcs./reel ( $\phi 180$ ) or 3000pcs./reel ( $\phi 180$ )					

- [1]. Measured peak-to-peak. Inclusive of initial tolerance at  $+25^\circ\text{C}$ , and variations over operating temperature, rated power supply voltage and load. Stability is specified for two operating voltage ranges. Stability progressively degrades with supply voltage below +1.5V.
- [2]. Measured peak-to-peak. Tested with Keysight 53132A frequency counter. Due to the low operating frequency, the gate time must be  $\geq 100$  ms to ensure an accurate frequency measurement.
- [3]. Core operating current does not include output driver operating current or load current. To derive total operating current (no load), add core operating current +  $(+0.065 \mu\text{A}/\text{V}) \times (\text{output voltage swing})$ .
- [4]. Measured from the time Vdd reaches +1.5V.

# MEMS Oscillators / TC-MO - μPower

## MO1534/MO1569/MO1576/MO8021



### ■ Features

- Ultra-low power
- Internal filtering eliminates external Vdd bypass cap

### ■ Applications

- Tablets, Wearable, Portable audio
- Health and wellness monitors, Fitness bands
- IoT devices
- Input devices



Model	Output Frequency (kHz)	Frequency Tolerance ( $\times 10^{-6}$ )	Supply Voltage (V)	Current Consumption ( $\mu\text{A}$ Typ.)	Size (mm)	Output
MO1534	1 Hz to 32.768 kHz	$\pm 20$ room; $\pm 75,100,150$ over temp	+1.2 to +3.63	+0.90	1.5×0.8×0.6 (CSP) 2.0×1.2×0.6 (QFN)	NanoDrive™ LVCMOS
MO1569	1 Hz to 462 kHz	$\pm 50$		+2.0 (100 kHz)		
MO1576 Super TC-MO	1 Hz to 2 MHz	$\pm 5$ all inclusive	+1.62 to +3.63	+8.0 (100 kHz)	1.5×0.8×0.6 (CSP)	LVCMOS
MO8021	1 Hz to 26 MHz	$\pm 100$	+1.62 to +1.98, +2.25 to +3.63	+6 to +340 (0.9 $\mu\text{A}$ stby)		

### ■ Standard Specification (MO8021)

Item	Legend	Min.	Typ.	Max.	Unit	Condition
Output Frequency Range	f	1	-	26	MHz	
Operating Supply Voltage	Vdd	+1.62	+1.8	+1.98	V	
		+2.25	-	+3.63		Any voltage from +2.25 to +3.63V
Operating Temperature Range	T_use	-20	-	+70	°C	Extended Commercial
		-40	-	+85		Industrial
Frequency Stability	F_tol	-15	-	+15	$\times 10^{-6}$	Frequency offset at +25°C post reflow
Frequency Tolerance	F_stab	-100	-	+100	$\times 10^{-6}$	Inclusive of initial tolerance, and variations over operating temperature, rated power supply voltage and output load.
First Year Aging	F_aging1	-3.0	-	+3.0	$\times 10^{-6}$	T <sub>A</sub> = +25°C
Current Consumption [1]	Idd	-	+60	-	$\mu\text{A}$	f = 3.072 MHz, Vdd = +1.8V, no load
		-	+110	+130		f = 6.144 MHz, Vdd = +1.8V, no load
		-	+230	+270		f = 6.144 MHz, Vdd = +1.8V, 10 pF load
		-	+160	-		f = 12 MHz, Vdd = +1.8V, no load
		-	-	+160		f = 6.144 MHz, Vdd = +2.25V to +3.63V, no load
Standby Current	I_std	-	+0.7	+1.3	$\mu\text{A}$	Vdd = +1.8V, ST pin = HIGH, output is weakly pulled down
		-	-	+1.5		Vdd = +2.25V to +3.63V, ST pin = HIGH, output is weakly pulleddown
Duty Cycle	DC	45	-	55	%	
Output Low Voltage	V <sub>OL</sub>	-	-	Vdd × 0.1	V	I <sub>OL</sub> = +0.5 mA
Output High Voltage	V <sub>OH</sub>	Vdd × 0.9	-	-	V	I <sub>OH</sub> = -0.5 mA
Rise and Fall Time	Tr, Tf	-	+4.0	+8.0	ns	20% to 80%
Input Low Voltage	V <sub>IL</sub>	-	-	Vdd × 0.2	V	
Input High Voltage	V <sub>IH</sub>	Vdd × 0.8	-	-	V	
Start-up Time	T_start	-	75	150	ms	Measured from the time Vdd reaches 90% of its final value
Standby Time	T_stdby	-	-	20	$\mu\text{s}$	Measured from the time ST pin crosses 50% threshold
Resume Time	T_resume	-	2.0	3.0	ms	Measured from the time ST pin crosses 50% threshold
RMS Period Jitter	T_jitt	-	75	110	ps	f = 6.144 MHz, Vdd = +1.8V
		-	-	110		f = 6.144 MHz, Vdd = +2.25V to +3.63V
RMS Phase Jitter (random)	T_phj	-	0.8	2.5	ns	f = 6.144 MHz, Integration bandwidth = 100 Hz to 40 kHz
		-	-	2.5		Vdd = +1.8V, Note [2]
		-	-	2.5		f = 6.144 MHz, Integration bandwidth = 100 Hz ~ 40 kHz
Packing Unit						Vdd = +2.25V to +3.63V, Note [2]
						1000pcs./reel ( $\phi 180$ ) or 3000pcs./reel ( $\phi 180$ )

[1]. Supply current with load is a function of the output frequency and output load.

For any given output frequency, the capacitive loading will increase supply current equal to  $C_{load} \times Vdd \times f(\text{MHz})$ .

[2]. Max spec inclusive of +25 mV peak-to-peak sinusoidal noise on Vdd. Noise frequency 100 Hz to 20 MHz.

# MEMS Oscillators - Super Low Jitter

## MO9365/MO9366/MO9367

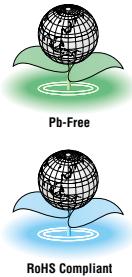


### ■ Features

- Industry-Standard packages: 3.2×2.5 mm, 5.0×3.2 mm, 7.0×5.0 mm
- Output signaling types: LVPECL, LVDS, HCSL
- Frequency tolerance as low as  $\pm 10 \times 10^{-6}$
- 0.1 ps RMS phase jitter (random) for Ethernet applications

### ■ Applications

- 10/40GB Ethernet, SONET, SATA, SAS, Fibre Channel
- Telecom, networking, instrumentation, storage, servers



Model	Output Frequency (MHz)	Frequency Tolerance ( $\times 10^{-6}$ )	Supply Voltage (V)	Current Consumption (mA Typ.)	Size (mm)	Output
MO9365	32 Standard Frequencies	$\pm 10, \pm 20, \pm 25, \pm 50$	+2.25 to +3.63	+76 to +84	3.2×2.5×0.8, 5.0×3.2×0.8, 7.0×5.0×1.0 (QFN)	LVPECL LVDS HCSL
MO9366	1 to 220					
MO9367	220 to 725					

### ■ Standard Specification (MO9366)

Item	Legend	Min.	Typ.	Max.	Unit	Condition
Output Frequency Range	f	1	-	220	MHz	Accurate to 6 decimal places
Supply Voltage	Vdd	+2.25	+2.50	+2.75	V	
		+2.52	+2.80	+3.08		
		+2.70	+3.00	+3.30		
		+2.97	+3.30	+3.63		
Operating Temperature Range	T_use	-20	-	+70	°C	Extended Commercial
		-40	-	+85		Industrial
		-40	-	+95		
		-40	-	+105		Extended Industrial
Frequency Tolerance	F_stab	-10	-	+10	$\times 10^{-6}$	Inclusive of initial tolerance, and variations over operating temperature, rated power supply voltage and output load.
		-20	-	+20		
		-25	-	+25		
		-50	-	+50		
First Year Aging	F_aging1	-	$\pm 1$	-	$\times 10^{-6}$	T <sub>A</sub> = +25°C
Duty Cycle	DC	45	-	55	%	
OE Disable Supply Current	I_oe	-	-	+58	mA	OE = Low
Input Low Voltage	V <sub>IL</sub>	-	-	Vdd×0.3	V	Pin 1, OE
Input High Voltage	V <sub>IH</sub>	Vdd×0.7	-	-	V	Pin 1, OE
Start-up Time	T_start	-	-	3.0	ms	Measured from the time Vdd reaches its rated minimum value
Enable and Disable Time	T_oe	-	-	3.8	μs	f = 156.25 MHz
RMS Phase Jitter [1]	T_jitt	-	1	1.6	ps	f = 100, 156.25 or 212.5 MHz, Vdd = 3.3 or 2.5 V
LVPECL output						
Current Consumption	Idd	-	-	+89	mA	Excluding Load Termination Current, Vdd = +3.3V or +2.5V
Output Low Voltage	V <sub>OL</sub>	Vdd - 1.9	-	Vdd - 1.5	V	
Output High Voltage	V <sub>OH</sub>	Vdd - 1.1	-	Vdd - 0.7	V	
Differential Output Voltage	V_Swing	1.2	1.6	2.0	V	
Rise and Fall Time	Tr, Tf	-	225	290	ps	20% to 80%
RMS Phase Jitter [random]	T_phj	-	0.225	0.275	ps	Note [2]
LVDS output						
Current Consumption	Idd	-	-	+79	mA	Excluding Load Termination Current, Vdd = +3.3V or +2.5V
Differential Output Voltage	V <sub>OD</sub>	+250	-	+450	mV	
V <sub>OD</sub> Magnitude Change	ΔV <sub>OD</sub>	-	-	+50	mV	
Offset Voltage	V <sub>OS</sub>	+1.125	-	+1.375	V	
V <sub>OS</sub> Magnitude Change	ΔV <sub>OS</sub>	-	-	+50	mV	
Rise and Fall Time	Tr, Tf	-	400	470	ps	Measured with 2 pF capacitive loading to GND, 20% to 80%
RMS Phase Jitter [random]	T_phj	-	0.235	0.275	ps	Note [2]
HCSL output						
Current Consumption	Idd	-	-	+89	mA	Excluding Load Termination Current, Vdd = +3.3V or +2.5V
Output Voltage Low	V <sub>OL</sub>	-0.05	-	+0.08	V	
Output Voltage High	V <sub>OH</sub>	0.6	-	+0.9	V	
Differential Output Voltage	V_Swing	1.0	1.4	1.8	V	
Rise and Fall Time	Tr, Tf	-	360	465	ps	Measured with 2 pF capacitive loading to GND, 20% to 80%
RMS Phase Jitter [random]	T_phj	-	0.225	0.275	ps	Note [2]

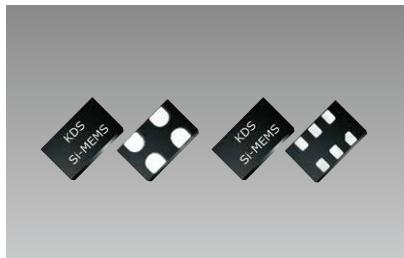
Packing Unit 1000pcs./reel (φ180) or 3000pcs./reel (φ180: 3225 package)

[1]. Measured according to JESD65B

[2]. 5.0×3.2 and 3.2×2.5 mm package, f = 156.25 MHz, Integration bandwidth = 12 kHz to 20 MHz, all Vdd levels, includes spurs. Temperature ranges -20 to +70°C and -40 to +85°C

# MEMS Oscillators - Low Jitter

**MO9120/MO9121/MO9122/MO8208/MO8209**



## ■ Features

- Frequency tolerance as low as  $\pm 10 \times 10^{-6}$
- Ultra-Low phase Jitter

## ■ Applications

- Computing, storage, networking
- Telecom, industrial control
- SATA, SAS, Ethernet, PCI Express, video, WiFi



RoHS Compliant

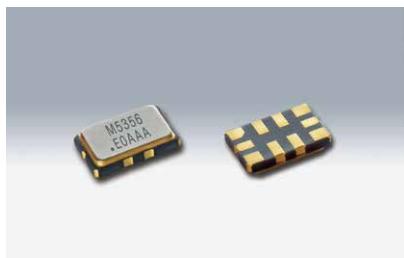
Model	Output Frequency (MHz)	Frequency Tolerance ( $\times 10^{-6}$ )	Supply Voltage (V)	Current Consumption (mA Typ.)	Size (mm)	Output	
MO9120	25 to 212.5	$\pm 10, \pm 20, \pm 25, \pm 50$	+2.25 to +3.63	+54 to +69	$3.2 \times 2.5 \times 0.8, 5.0 \times 3.2 \times 0.8, 7.0 \times 5.0 \times 1.0$ (QFN)	LVPECL LVDS	
MO9121	1 to 220						
MO9122	220 to 625			+29 to +36 (+10 $\mu$ A stby)	$2.7 \times 2.4 \times 0.8, 3.2 \times 2.5 \times 0.8, 5.0 \times 3.2 \times 0.8, 7.0 \times 5.0 \times 1.0$ (QFN)		
MO8208	1 to 80					LVC MOS	
MO8209	80 to 220						

## ■ Standard Specification (MO9121)

Item	Legend	Min.	Typ.	Max.	Unit	Condition
Output Frequency Range	f	1	-	220	MHz	Refer to datasheet for exact list of supported frequencies
Supply Voltage	Vdd	+2.97	+3.3	+3.63	V	
		+2.25	+2.5	+2.75		
		+2.25	-	+3.63		
Operating Temperature Range	T_use	-20	-	+70	°C	Extended Commercial
		-40	-	+85		Industrial
Frequency Tolerance	F_stab	-10	-	+10	$\times 10^{-6}$	Inclusive of initial tolerance, and variations over operating temperature, rated power supply voltage and output load.
		-20	-	+20		
		-25	-	+25		
		-50	-	+50		
		-	-	-		
First Year Aging	F_agng1	-2.0	-	+2.0	$\times 10^{-6}$	T <sub>A</sub> = +25°C
10-year Aging	F_agng10	-5.0	-	+5.0		T <sub>A</sub> = +25°C
Duty Cycle	DC	45	-	55	%	
Input Low Voltage	V <sub>IL</sub>	-	-	Vdd × 0.3	V	Pin 1, OE or ST
Input High Voltage	V <sub>IH</sub>	Vdd × 0.7	-	-	V	Pin 1, OE or ST
Start-up Time	T_start	-	6.0	10	ms	Measured from the time Vdd reaches its rated minimum value.
Resume Time	T_resume	-	6.0	10	ms	In Standby mode, measured from the time ST pin crosses 50% threshold.
LVPECL, DC and AC Characteristics						
Current Consumption	I <sub>dd</sub>	-	+61	+69	mA	Excluding Load Termination Current, Vdd = +3.3V or +2.5V
OE Disable Supply Current	I <sub>oe</sub>	-	-	+35	mA	OE = Low
Standby Current	I <sub>std</sub>	-	-	+100	μA	ST = Low, for all Vdds
Output Low Voltage	V <sub>OL</sub>	Vdd - 1.9	-	Vdd - 1.5	V	
Output High Voltage	V <sub>OH</sub>	Vdd - 1.1	-	Vdd - 0.7	V	
Rise and Fall Time	Tr, Tf	-	300	700	ps	20% to 80%
Enable and Disable Time	T <sub>oe</sub>	-	-	115	ns	f = 212.5 MHz - For other frequencies, T <sub>oe</sub> = 100ns + 3 period
RMS Period Jitter	T <sub>jitt</sub>	-	1.2	1.7	ps	f = 100 MHz, Vdd = +3.3V or +2.5V
		-	1.2	1.7		f = 156.25 MHz, Vdd = +3.3V or +2.5V
		-	1.2	1.7		f = 212.5 MHz, Vdd = +3.3V or +2.5V
RMS Phase Jitter (random)	T <sub>phj</sub>	-	0.6	0.85	ps	f = 156.25 MHz, Integration bandwidth = 12 kHz to 20 MHz, all Vdds
LVDS, DC and AC Characteristics						
Current Consumption	I <sub>dd</sub>	-	+47	+55	mA	Excluding Load Termination Current, Vdd = +3.3V or +2.5V
OE Disable Supply Current	I <sub>oe</sub>	-	-	+35	mA	OE = Low
Standby Current	I <sub>std</sub>	-	-	+100	μA	ST = Low, for all Vdds
Rise and Fall Time	Tr, Tf	-	495	700	ps	20% to 80%
Differential Output Voltage	V <sub>OD</sub>	+250	+350	+450	mV	
V <sub>OD</sub> Magnitude Change	ΔV <sub>OD</sub>	-	-	+50	mV	
Offset Voltage	V <sub>os</sub>	+1.125	+1.2	+1.375	V	
V <sub>os</sub> Magnitude Change	ΔV <sub>os</sub>	-	-	+50	mV	
Enable and Disable Time	T <sub>oe</sub>	-	-	115	ns	f = 212.5 MHz - For other frequencies, T <sub>oe</sub> = 100ns + 3 period
RMS Period Jitter	T <sub>jitt</sub>	-	1.2	1.7	ps	f = 100 MHz, Vdd = +3.3V or +2.5V
		-	1.2	1.7		f = 156.25 MHz, Vdd = +3.3V or +2.5V
		-	1.2	1.7		f = 212.5 MHz, Vdd = +3.3V or +2.5V
RMS Phase Jitter (random)	T <sub>phj</sub>	-	0.6	0.85	ps	f = 156.25 MHz, Integration bandwidth = 12 kHz to 20 MHz, all Vdds
Packing Unit				1000pcs./reel (φ180) or 3000pcs./reel (φ180: 3225 package)		

# TC-MO / VC TC-MO - Super Low Jitter

MO5155/MO5156/MO5157/MO5356/MO5357/MO5358/MO5359



## ■ Features

- 5.0×3.2 mm Ceramic package
- LVC MOS or Clipped Sinewave output

## ■ Applications

- Synchronous Ethernet
- Small cell
- Optical transport-SONET/SDH, OTN
- IEEE1588
- Test and measurement



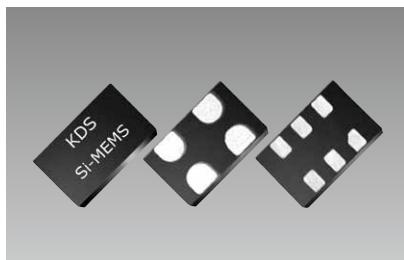
Model	Output Frequency (MHz)	Frequency Tolerance ( $\times 10^{-6}$ )	Supply Voltage (V)	Current Consumption (mA Typ.)	Size (mm)	Output		
MO5155	10 std. GNSS Freq.	$\pm 0.5, \pm 1.0, \pm 2.5$	+2.25 to +3.63	+40 to +50	5.0×3.2×0.95 (Ceramic)	Clipped Sinewave (1 to 60 MHz) LVC MOS		
MO5156	1 to 60							
MO5157	60 to 220							
MO5356	1 to 60							
MO5357	60 to 220							
MO5358	1.0 to 60		$\pm 0.05$			Clipped sinewave, LVC MOS		
MO5359	60 to 189, 200 to 220							

## ■ Standard Specification (MO5356)

Item	Legend	Min.	Typ.	Max.	Unit	Condition
Output Frequency Range	f	1	-	60	MHz	
Supply Voltage	Vdd	+2.25	+2.50	+2.75	V	
		+2.52	+2.80	+3.08		
		+2.70	+3.00	+3.30		
		+2.97	+3.30	+3.63		
Operating Temperature Range	T_use	-20	-	+70	°C	Extended commercial
		-40	-	+85		Industrial
		-40	-	+105		Extended Industrial, ambient temperature
Initial Tolerance	F_init	-1.0	-	+1.0	$\times 10^{-6}$	Inclusive of solder-down shift at 48 hours after 2 reflows at +25°C
Frequency Stability over temperature	F_stab	-0.10	-	+0.10	$\times 10^{-6}$	Referenced to (fmas + fmin)/2 over the specified temperature range
		-0.20	-	+0.20		
		-0.25	-	+0.25		
First Year Aging	F_aging1	-	$\pm 1.0$	-	$\times 10^{-6}$	$T_A = +25^\circ\text{C}$
Pull Range	PR	$\pm 6.25$			$\times 10^{-6}$	VC TC-MO mode. Contact KDS for $\pm 12.5, \pm 25$
		$\pm 6.25, \pm 10, \pm 12.5, \pm 25, \pm 50, \pm 80, \pm 100, \pm 125, \pm 150, \pm 200, \pm 400, \pm 600, \pm 800, \pm 1200, \pm 1600, \pm 3200$			$\times 10^{-6}$	DC TC-MO mode.
Upper Control Voltage	VC_U	Vdd×0.9	-	-	V	
Control Voltage Range	VC_L	-	-	Vdd×0.1	V	
Control Voltage Input Impedance	VC_Z	8	-	-	MΩ	
Control Voltage Input Bandwidth	VC_C	-	10	-	kHz	
Frequency Change Polarity	-	Positive Slope			-	
Current Consumption	Idd	-	+44	+53	mA	No load condition, f = 19.2 MHz, TC-MO and DC TC-MO mode.
		-	+48	+57		No load condition, f = 19.2 MHz, VC TC-MO mode.
OE Disable Current	I_od	-	+43	+51	mA	OE = GND, output is weakly pull down, TC-MO and DC TC-MO mode.
		-	+47	+55		OE = GND, output is weakly pull down, VC TC-MO mode.
Input Low Voltage	V_il	-	-	Vdd×0.3	V	For OE pin
Input High Voltage	V_ih	Vdd×0.7	-	-	V	For OE pin
Start-up Time	T_start	-	2.5	3.5	ms	Time to first pulse, Measured from the time Vdd reaches its rated minimum value.
RMS Period Jitter	T_jitt	-	0.8	1.1	ps	f = 10 MHz
LVC MOS Output						
Duty Cycle	DC	45	-	55	%	
Output Low Voltage	V_ol	-	-	Vdd×0.1	V	$I_{OL} = -3\text{mA}$
Output High Voltage	V_oh	Vdd×0.9	-	-	V	$I_{OH} = +3\text{mA}$
Rise and Fall Time	Tr, Tf	0.8	1.2	1.9	ns	10% to 90% Vdd.
RMS Phase Jitter (random)	T_phj	-	0.31	0.48	ps	f = 50 MHz, Integration bandwidth = 12 kHz to 20 MHz, -40 to +85 °C
Clipped Sinewave Output						
Output Voltage Level	Vout	+0.8	-	+1.2	%	$10\text{k}\Omega \parallel 10\text{pF} \pm 10\%$
Rise and Fall Time	Tr, Tf	-	3.5	4.6	V	20% to 80% Vdd, 19.2MHz
RMS Phase Jitter (random)	T_phj	-	0.31	0.48	ps	f = 60 MHz, Integration bandwidth = 12 kHz to 20 MHz, -40 to +85 °C
Packing Unit	1000pcs./reel (φ 180)					

# MEMS Oscillators with Spread Spectrum Function (SSCG)

## MO9002/MO9003/MO9005



### ■ Features

- Spread options  
Center Spread:  $\pm 0.5\%$ ,  $\pm 0.25\%$   
Down Spread:  $-1\%$ ,  $-0.5\%$
- Standby, output enable or spread disable mode
- $<30$  ps cycle-to-cycle jitter

### ■ Applications

- Printers
- Flat panel drivers
- PCI
- Microprocessors

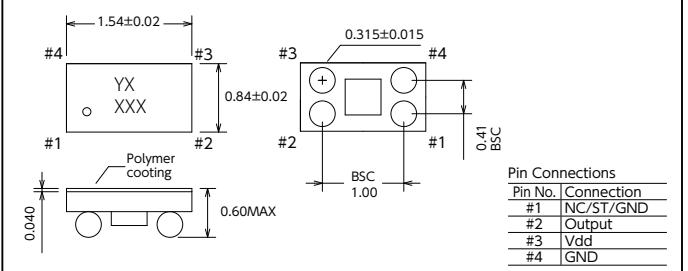
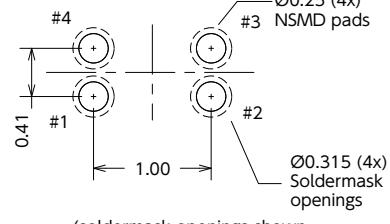
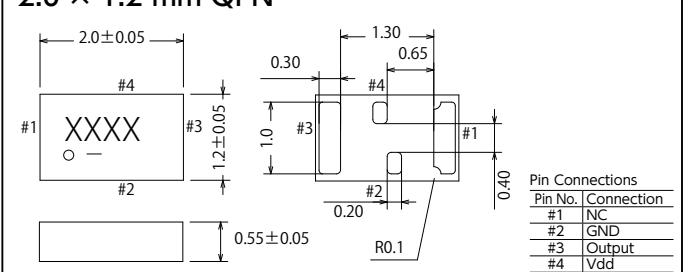
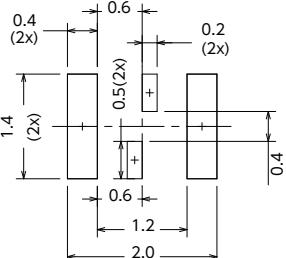
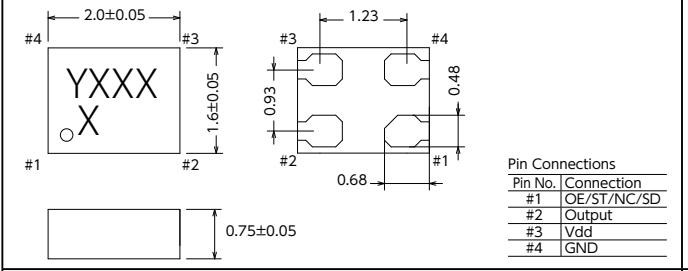
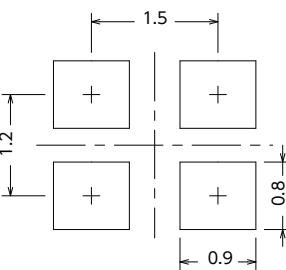
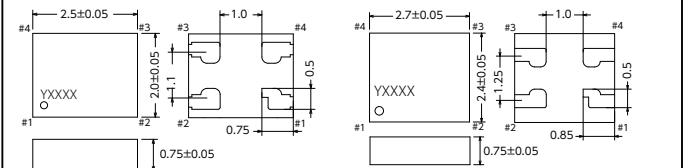
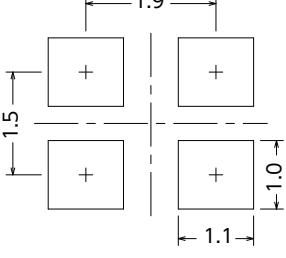
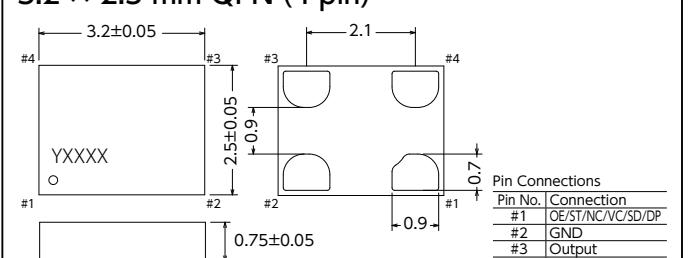
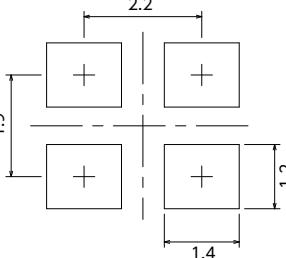
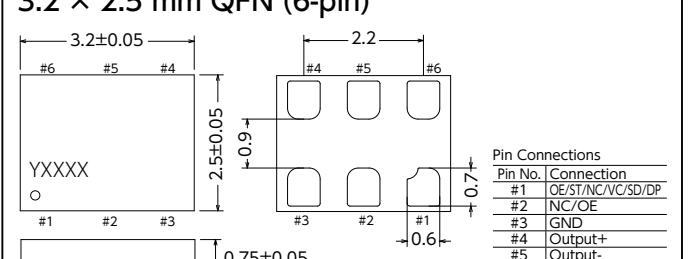
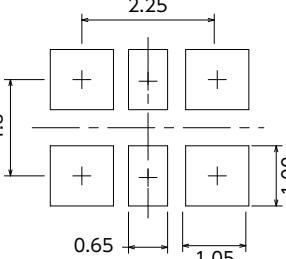


Model	Output Frequency (MHz)	Frequency Tolerance ( $\times 10^{-6}$ )	Supply Voltage (V)	Current Consumption (mA Typ.)	Size (mm)	Output
MO9002	1 to 220	$\pm 25, \pm 50$	$+1.71$ to $+1.89$ , $+2.25$ to $+3.63$	+48 to +75	$5.0 \times 3.2 \times 0.8$ , $7.0 \times 5.0 \times 1.0$ (QFN)	LVPECL CML LVDS HCSL
MO9003	1 to 110	$\pm 50, \pm 100$		+3.2 to +4.1 (+0.4 to +4.3 $\mu$ A stby)	$2.5 \times 2.0 \times 0.8$ , $3.2 \times 2.5 \times 0.8$ , $5.0 \times 3.2 \times 0.8$ , $7.0 \times 5.0 \times 1.0$ (QFN)	
MO9005	1 to 141	$\pm 20, \pm 25, \pm 50$	+1.62 to +1.98, +2.25 to +3.63	5.0 to 6.5 (0.4 to 4.3 $\mu$ A stby)	$2.0 \times 1.6 \times 0.8$ , $2.5 \times 2.0 \times 0.8$ , $3.2 \times 2.5 \times 0.8$ (QFN)	LVC MOS

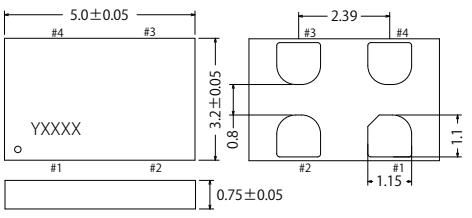
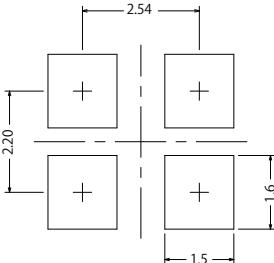
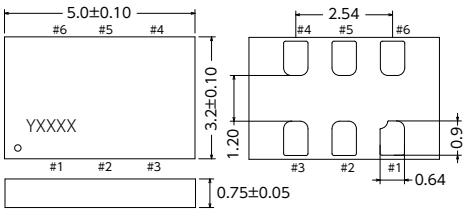
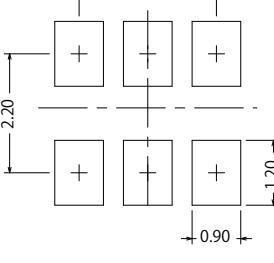
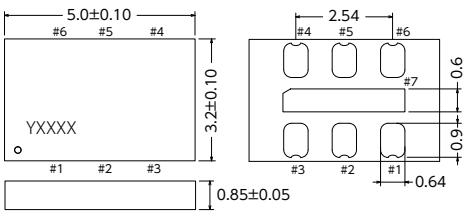
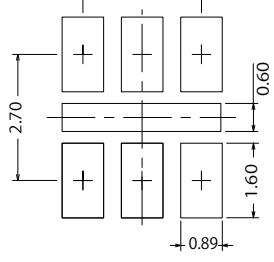
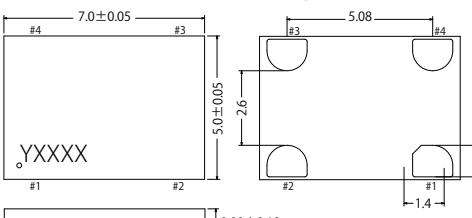
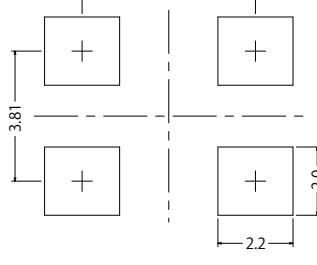
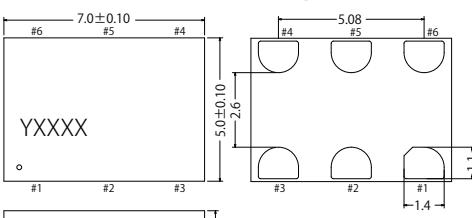
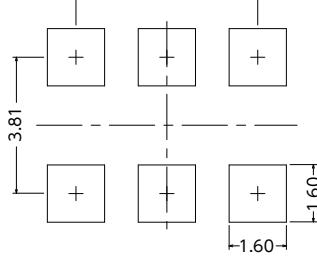
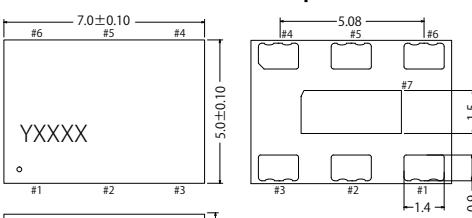
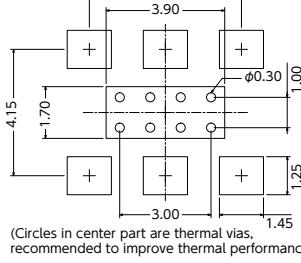
### ■ Standard Specification (MO9005)

Item	Legend	Min.	Typ.	Max.	Unit	Condition
Output Frequency Range	f	1	-	141	MHz	
Supply Voltage	Vdd	+1.62	+1.8	+1.98	V	
		+2.25	+2.5	+2.75		
		+2.52	+2.8	+3.08		
		+2.7	+3.0	+3.3		
		+2.97	+3.3	+3.63		
		+2.25	-	+3.63		
Operating Temperature Range	T_use	-20	-	+70	°C	Extended Commercial
		-40	-	+85		Industrial
Frequency Tolerance	F_tol	-20	-	+20	$\times 10^6$	Inclusive of initial tolerance at $+25^\circ\text{C}$ , 1st year aging at $+25^\circ\text{C}$ , and variations over operating temperature, rated power supply voltage.
		-25	-	+25		
		-50	-	+50		
Current Consumption	Idd	-	+5.6	+6.5	mA	No load condition, f = 40 MHz, Vdd = +2.5V to +3.3V
		-	+5.0	+5.5		No load condition, f = 40 MHz, Vdd = +1.8V
Standby Current	I_std	-	+2.1	+4.3	$\mu\text{A}$	$\overline{\text{ST}} = \text{GND}$ , Vdd = +2.5V to +3.3V, Output is weakly pulled down
		-	+0.4	+1.5		$\overline{\text{ST}} = \text{GND}$ , Vdd = +1.8V, Output is weakly pulled down
Spread Spectrum	-	$\pm 0.125$ to $\pm 2.060$			%	Center Spread
		-4.28 to -0.25				Down Spread
Duty Cycle	DC	45	-	55	%	
Output Low Voltage	V <sub>OL</sub>	90%	-	-	Vdd	I <sub>OL</sub> = -4 mA (Vdd = +3.0V or +3.3V) I <sub>OL</sub> = -3 mA (Vdd = +2.8V and Vdd = +2.5V) I <sub>OL</sub> = -2 mA (Vdd = +1.8V)
Output High Voltage	V <sub>OH</sub>	-	-	10%	Vdd	I <sub>OL</sub> = +4 mA (Vdd = +3.0V or +3.3V) I <sub>OL</sub> = +3 mA (Vdd = +2.8V and Vdd = +2.5V) I <sub>OL</sub> = +2 mA (Vdd = +1.8V)
Rise and Fall Time	Tr, Tf	-	1	2	ns	Vdd = +2.5V, +2.8V, +3.0V or +3.3V, 20% to 80%, default derive strength
		-	1.3	2.5		Vdd = +1.8V, 20% to 80%, default derive strength
		-	-	2.0		Vdd = +2.25V to +3.63V, 20% to 80%, default derive strength
Input Low Voltage	V <sub>IL</sub>	-	-	Vdd $\times$ 0.3	V	Pin 1, OE or $\overline{\text{ST}}$
Input High Voltage	V <sub>IH</sub>	Vdd $\times$ 0.7	-	-	V	Pin 1, OE or $\overline{\text{ST}}$
OE Disable Current	I <sub>oe</sub>	-	+5.0	+6.5	mA	f = 40 MHz, Vdd = +2.5V to +3.3V, OE = GND, Output in high-Z state
		-	+4.6	+5.2		f = 40 MHz, Vdd = +1.8V, OE = GND, Output in high-Z state
Enable/Disable Time	T <sub>oe</sub>	-	-	180	ns	f = 40 MHz - For other frequencies, T <sub>oe</sub> = 100ns + 3 period
Packing Unit						1000pcs./reel(Φ180)

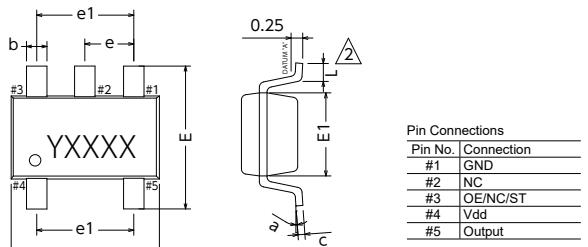
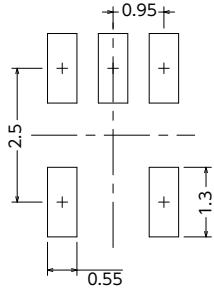
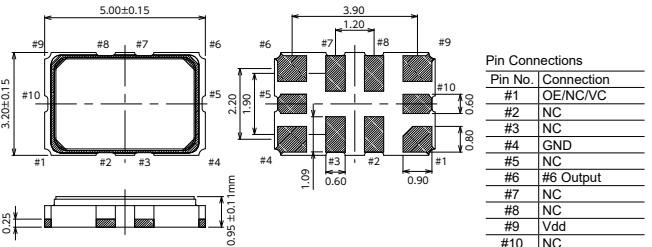
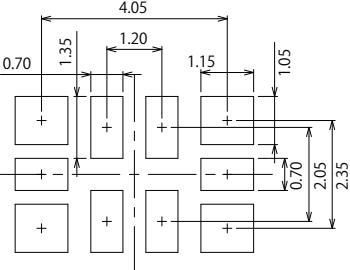
# Dimensions and Land Pattern

Package Size - Dimensions (unit:mm)	Recommended Land Pattern (unit:mm)														
<p><b>1.55 × 0.85 mm CSP</b></p>  <p>Pin Connections</p> <table border="1"> <tr><td>Pin No.</td><td>Connection</td></tr> <tr><td>#1</td><td>NC/ST/GND</td></tr> <tr><td>#2</td><td>Output</td></tr> <tr><td>#3</td><td>Vdd</td></tr> <tr><td>#4</td><td>GND</td></tr> </table>	Pin No.	Connection	#1	NC/ST/GND	#2	Output	#3	Vdd	#4	GND	 <p>(soldermask openings shown with heavy dashed line)</p>				
Pin No.	Connection														
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<p><b>2.5 × 2.0 mm QFN</b></p>  <p>Pin Connections</p> <table border="1"> <tr><td>Pin No.</td><td>Connection</td></tr> <tr><td>#1</td><td>OE/ST/NC/VC/SD</td></tr> <tr><td>#2</td><td>GND</td></tr> <tr><td>#3</td><td>Output</td></tr> <tr><td>#4</td><td>Vdd</td></tr> </table>	Pin No.	Connection	#1	OE/ST/NC/VC/SD	#2	GND	#3	Output	#4	Vdd					
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<p><b>2.9 × 2.8 mm (SOT23-5)</b></p>  <table border="1"> <thead> <tr> <th>Symbol</th><th>Min.</th><th>Nom.</th><th>Max.</th></tr> </thead> <tbody> <tr> <td>A</td><td>0.9</td><td>1.25</td><td>1.45</td></tr> <tr> <td>A1</td><td>0</td><td>0.05</td><td>0.15</td></tr> <tr> <td>A2</td><td>0.9</td><td>1.1</td><td>1.3</td></tr> <tr> <td>b</td><td>0.35</td><td>0.4</td><td>0.5</td></tr> <tr> <td>c</td><td>0.08</td><td>0.15</td><td>0.2</td></tr> <tr> <td>D</td><td>2.8</td><td>2.9</td><td>3</td></tr> <tr> <td>E</td><td>2.6</td><td>2.8</td><td>3</td></tr> <tr> <td>E1</td><td>1.5</td><td>1.625</td><td>1.75</td></tr> <tr> <td>L</td><td>0.35</td><td>0.45</td><td>0.6</td></tr> <tr> <td>L1</td><td colspan="3">0.60 REF</td></tr> <tr> <td>e</td><td colspan="3">0.95 BSC.</td></tr> <tr> <td>e1</td><td colspan="3">1.90 BSC.</td></tr> <tr> <td>α</td><td>0°</td><td>2.5°</td><td>8°</td></tr> </tbody> </table>	Symbol	Min.	Nom.	Max.	A	0.9	1.25	1.45	A1	0	0.05	0.15	A2	0.9	1.1	1.3	b	0.35	0.4	0.5	c	0.08	0.15	0.2	D	2.8	2.9	3	E	2.6	2.8	3	E1	1.5	1.625	1.75	L	0.35	0.45	0.6	L1	0.60 REF			e	0.95 BSC.			e1	1.90 BSC.			α	0°	2.5°	8°	
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# MEMO

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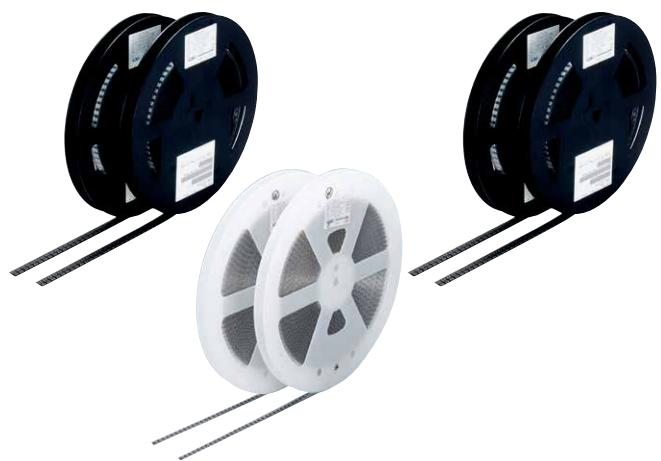
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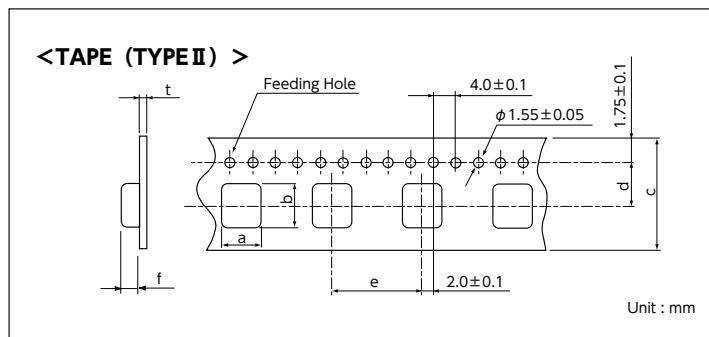
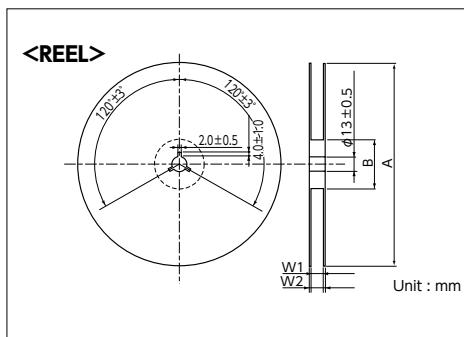
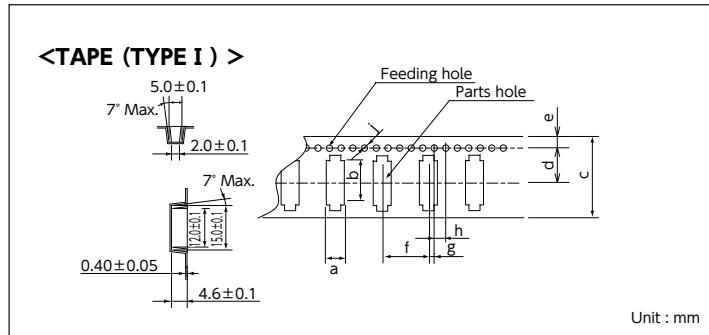
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# Taping Forms, etc.



# Emboss Carrier Tape (SMD Crystal Resonators)



## ■ Standard Specification

TYPE I	a	b	c	d	e	f	g	h	j	A	B	W1	W2
SMD-49	5.0 ± 0.1	12.0 ± 0.1	24.0 ± 0.3	11.5 ± 0.1	1.75 ± 0.10	8.0 ± 0.1	2.0 ± 0.1	4.0 ± 0.1	+0.1/-0	φ330 ± 2	φ80 ± 1	25.5 ± 1.0	29.5 ± 1.0

### MHz Band Crystal Resonators / Crystal Resonators with dedicated temperature sensor

TYPE II	a	b	c	d	e	f	t	A	B	W1	W2
DSX530GA/GK	3.6 ± 0.1	5.45 ± 0.10	12.0 ± 0.2	5.50 ± 0.10	8.0 ± 0.1	1.55 ± 0.10	0.30 ± 0.05	φ180 +0/-3	φ60 +1/-0	13.0 ± 0.3	15.4 ± 1.0
DSX321G/GK DSX320GE	2.8 ± 0.1	3.5 ± 0.1	8.0 ± 0.2	3.50 ± 0.05	4.0 ± 0.1	1.0 ± 0.1	0.25 ± 0.05	φ180 +0/-3	φ60 +1/-0	9.0 ± 0.3	11.4 ± 1.0
DSX321SH	2.7 ± 0.1	3.4 ± 0.1	8.0 ± 0.2	3.50 ± 0.05	4.0 ± 0.1	1.4 ± 0.1	0.25 ± 0.05	φ180 +0/-3	φ60.0 +1/-0	9.0 ± 0.3	11.4 ± 1.0
DSX221SH	2.25 ± 0.1	2.7 ± 0.1	8.0 ± 0.2	3.50 ± 0.05	4.0 ± 0.1	0.8 ± 0.05	0.25 ± 0.05	φ180 +0/-3	φ60.0 +1/-0	9.0 ± 0.3	11.4 ± 1.0
DSX211S/SH	1.9 ± 0.1	2.3 ± 0.1	8.0 ± 0.2	3.50 ± 0.05	4.0 ± 0.1	0.65 ± 0.10	0.25 ± 0.05	φ180 +0/-3	φ60.0 +1/-0	9.0 ± 0.3	11.4 ± 1.0
DSX211G	1.85 ± 0.10	2.25 ± 0.10	8.0 ± 0.2	3.50 ± 0.05	4.0 ± 0.1	0.95 ± 0.10	0.25 ± 0.05	φ180 +0/-3	φ60 +1/-0	9.0 ± 0.3	11.4 ± 1.0
DSX210GE	2.0 ± 0.1	2.4 ± 0.1	8.0 ± 0.2	3.50 ± 0.05	4.0 ± 0.1	0.95 ± 0.1	0.25 ± 0.05	φ180 +0/-3	φ60 +1/-0	9.0 ± 0.3	11.4 ± 1.0
DSX1612S	1.45 ± 0.15	1.85 ± 0.15	8.0 ± 0.2	3.50 ± 0.05	4.0 ± 0.1	0.45 ± 0.15	0.25 ± 0.05	φ180 +0/-3	φ60 +1/-0	9.0 ± 0.3	11.4 ± 1.0
DSX1210A	1.17 ± 0.05	1.42 ± 0.05	8.0 +0.3/-0.1	3.50 ± 0.05	4.0 ± 0.1	0.48 ± 0.05	0.20 ± 0.05	φ180 +0/-3	φ60 +1/-0	9.0 ± 0.3	11.4 ± 1.0
DX1008JS	1.0 ± 0.05	1.2 ± 0.05	8.0 ± 0.2	3.50 ± 0.05	4.0 ± 0.1	0.45 ± 0.05	0.20 ± 0.05	φ180 +0/-3	φ60 +1/-0	9.0 ± 0.3	11.4 ± 1.0
DSR221STH	2.25 ± 0.1	2.7 ± 0.1	8.0 ± 0.2	3.50 ± 0.05	4.0 ± 0.1	1.15 ± 0.10	0.25 ± 0.05	φ180 +0/-3	φ60 +1/-0	9.0 ± 0.3	11.4 ± 1.0
DSR211STH	1.85 ± 0.1	2.25 ± 0.1	8.0 ± 0.2	3.50 ± 0.05	4.0 ± 0.1	0.95 ± 0.10	0.25 ± 0.05	φ180 +0/-3	φ60 +1/-0	9.0 ± 0.3	11.4 ± 1.0
DSR1612ATH/STH	1.40 ± 0.1	1.80 ± 0.1	8.0 ± 0.2	3.50 ± 0.05	4.0 ± 0.1	0.70 ± 0.10	0.25 ± 0.05	φ180 +0/-3	φ60 +1/-0	9.0 ± 0.3	11.4 ± 1.0
DSR1210ATH	1.3 ± 0.1	1.5 ± 0.1	8.0 ± 0.2	3.5 ± 0.05	4.0 ± 0.1	0.4 ± 0.15	0.25 ± 0.05	φ180 +0/-3	φ60 +1/-0	9.0 ± 0.3	11.4 ± 1.0

### KHz Band Crystal Resonators

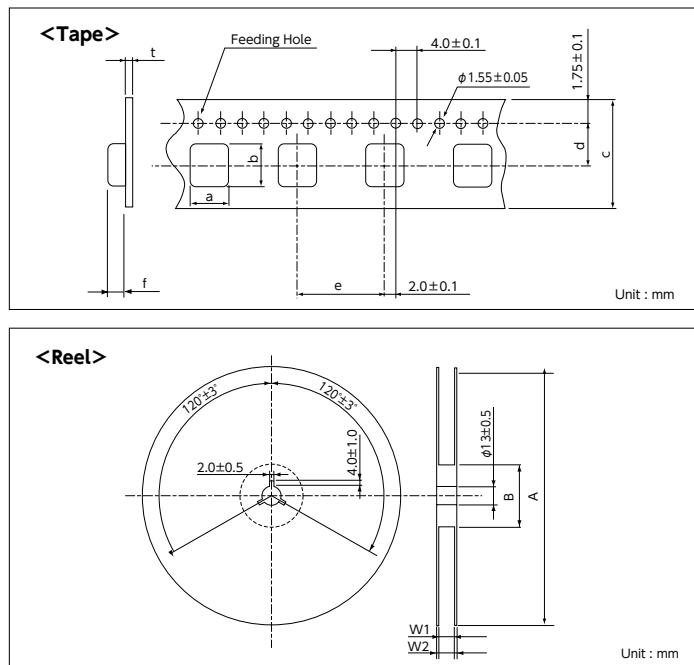
DMX-26S	4.1 ± 0.1	8.5 ± 0.1	16.0 ± 0.3	7.5 ± 0.1	8.0 ± 0.1	2.7 ± 0.1	0.30 ± 0.05	φ330 ± 2	φ80 ± 1	17.5 ± 1.0	21.5 ± 1.0
DST310S DST311S	1.70 ± 0.05	3.40 ± 0.05	12.0 ± 0.2	5.50 ± 0.05	4.0 ± 0.1	0.95 ± 0.05	0.25 ± 0.05	φ180 +0/-3	φ60 +1/-0	13.0 ± 0.3	15.5 ± 1.0
DST210AC	1.45 ± 0.1	2.3 ± 0.1	8.0 ± 0.2	3.50 ± 0.05	4.0 ± 0.1	0.65 ± 0.10	0.20 ± 0.05	φ180 +0/-3	φ60 +1/-0	9.0 ± 0.3	11.4 ± 1.0
DST1610A	1.28 ± 0.05	1.79 ± 0.05	8.0 ± 0.2	3.50 ± 0.05	4.0 ± 0.1	0.65 ± 0.10	0.20 ± 0.05	φ180 +0/-3	φ60 +1/-0	9.0 ± 0.3	11.4 ± 1.0
DST1610AL	1.35 ± 0.05	1.85 ± 0.05	8.0 ± 0.2	3.50 ± 0.05	4.0 ± 0.1	0.4 ± 0.10	0.20 ± 0.05	φ180 +0/-3	φ60 +1/-0	9.0 ± 0.3	11.4 ± 1.0
DST1210A	1.17 ± 0.05	1.42 ± 0.05	8.0 +0.3/-0.1	3.50 ± 0.05	4.0 ± 0.1	0.48 ± 0.05	0.20 ± 0.05	φ180 +0/-3	φ60 +1/-0	9.0 ± 0.3	11.4 ± 1.0

※1: To indicate product name and other information, place those information on a label, and affix the label on one side of the flange.

2: For DSX321G, DSX1612S pin No.1 is located on the sprocket-hole side of the tape.

3: For other models, the insertion direction is not specified.

# Emboss Carrier Tape (SMD Crystal Oscillators)



## ■ Standard Specification

VC-TCXO/TCXO

TYPE	a	b	c	d	e	f	t	A	B	W1	W2
DSA/DSB535SGA	3.5 ±0.1	5.4 ±0.1	12.0 ±0.2	5.50 ±0.1	8.0 ±0.1	1.7 ±0.1	0.30 ±0.05	φ330 ±2	φ100 ±1	13.5 ±1.0	18.5 max.
DSK321STD	2.8 ±0.1	3.5 ±0.1	8.0 ±0.2	3.50 ±0.05	4.0 ±0.1	1.5 ±0.1	0.25 ±0.05	φ180 +0/-3	φ60 +1/-0	9.0 ±0.3	11.4 ±1.0
DSA/DSB221SDN	2.3 ±0.1	2.8 ±0.1	8.0 ±0.2	3.50 ±0.05	4.0 ±0.1	1.15 ±0.1	0.30 ±0.05	φ180 +0/-3	φ60 +1/-0	9.0 ±0.3	11.4 ±1.0
DSB221SJA											
DSA/DSB211SDN/SP	1.95 ±0.10	2.35 ±0.10	8.0 ±0.2	3.50 ±0.05	4.0 ±0.1	0.85 ±0.1	0.20 ±0.05	φ180 +0/-3	φ60 +1/-0	9.0 ±0.3	11.4 ±1.0
DSB211SJA											
DSA/DSB1612SDN	1.4 ±0.10	1.8 ±0.10	8.0 ±0.2	3.50 ±0.05	4.0 ±0.1	0.7 ±0.1	0.25 ±0.05	φ180 +0/-3	φ60 +1/-0	9.0 ±0.3	11.4 ±1.0
DSB1612WA/WEB											
DSK1612ATD											

SPXO/VCXO/RTC/OCXO

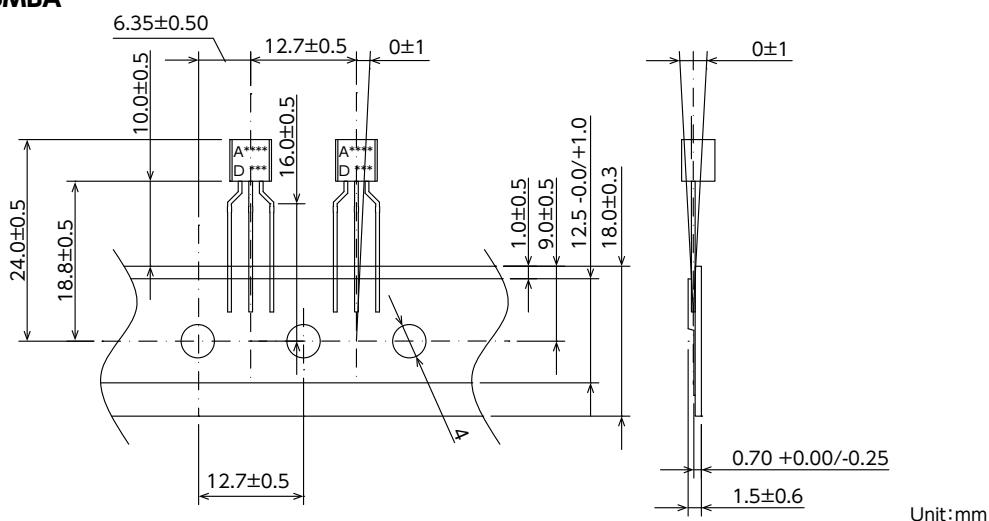
TYPE	a	b	c	d	e	f	t	A	B	W1	W2
DSO751SR DSO751SBM DSO753SK/SJ/SD	5.5 ±0.1	7.9 ±0.1	16.0 ±0.3	7.5 ±0.1	8.0 ±0.1	2.4 ±0.1	0.30 ±0.05	φ254 ±2	φ80 ±0.5	17.0 ±0.5	21.0 ±1.0
DC5032AS	3.5 ±0.1	5.3 ±0.1	12.0 ±0.3	5.5 ±0.1	8.0 ±0.1	2.9 ±0.1	0.30 ±0.05	φ180 +0/-3	φ60 +1/-0	9.0 ±0.3	11.4 ±0.1
DD3225TS DD3225TR DSO531SR DSO531SHH DSO531SBM DSO533SK/SJ	3.6 ±0.1	5.45 ±0.1	12.0 ±0.2	5.50 ±0.05	8.0 ±0.1	1.55 ±0.10	0.30 ±0.05	φ180 +0/-3	φ60 +1/-0	13.0 ±0.3	15.4 ±1.0
DSO323SK/SJ/SD DSO321SR/SH/SY DSO321SBM DSV321SV	2.8 ±0.1	3.5 ±0.1	8.0 ±0.2	3.50 ±0.05	4.0 ±0.1	1.5 ±0.1	0.25 ±0.05	φ180 +0/-3	φ60 +1/-0	9.0 ±0.3	11.4 ±1.0
DSO221SR/SH/SY/SX/SXF DSO221SBM DSO223SK/SJ/SD DSV221SV	2.3 ±0.1	2.8 ±0.1	8.0 ±0.2	3.50 ±0.05	4.0 ±0.1	1.15 ±0.10	0.30 ±0.05	φ180 +0/-3	φ60 +1/-0	9.0 ±0.3	11.4 ±1.0
DS2016KS DSO211SX/SXF	1.85 ±0.10	2.25 ±0.10	8.0 ±0.2	3.50 ±0.05	4.0 ±0.1	0.95 ±0.10	0.25 ±0.05	φ180 +0/-3	φ60 +1/-0	9.0 ±0.3	11.4 ±1.0
DSO1612AR	1.4 ±0.1	1.8 ±0.1	8.0 ±0.2	3.50 ±0.05	4.0 ±0.1	0.7 ±0.1	0.25 ±0.05	φ180 +0/-3	φ60 +1/-0	9.0 ±0.3	11.4 ±1.0
DS1008JS/JN/JC/JK/JJ	1.0 ±0.05	1.2 ±0.05	8.0 ±0.2	3.50 ±0.05	4.0 ±0.1	0.45 ±0.05	0.20 ±0.05	φ180 +0/-3	φ60 +1/-0	9.0 ±0.3	11.4 ±1.0

※ 1: To indicate product name and other information, place those information on a label, and affix the label on one side of the flange.

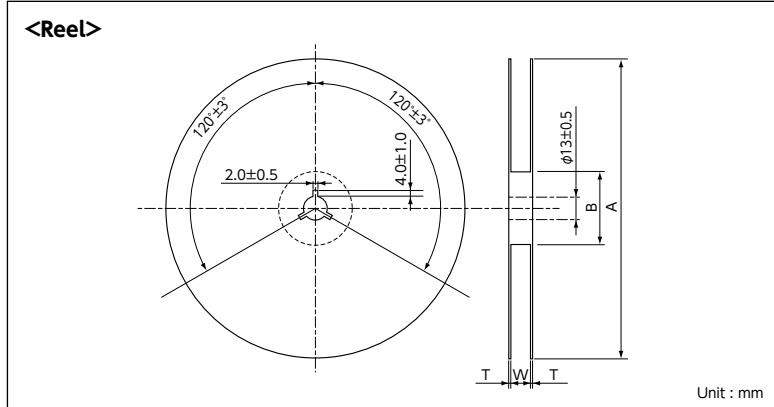
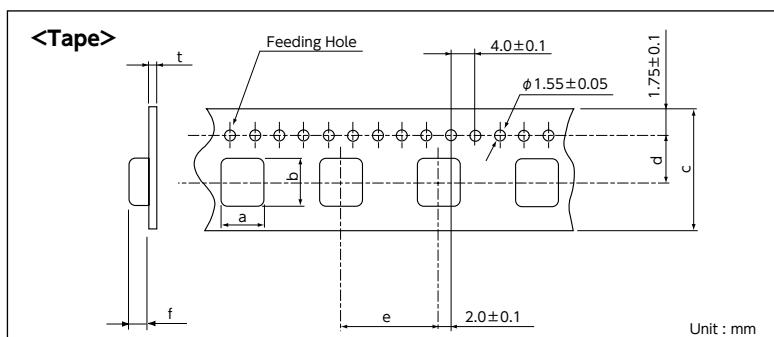
2: DSA/DSB535SGA reel φ180 available.

## Radial Tape (Crystal Oscillators)

DLO555MBA



## Emboss Carrier Tape (SMD Monolithic Crystal Filters)



### ■ Standard Specification

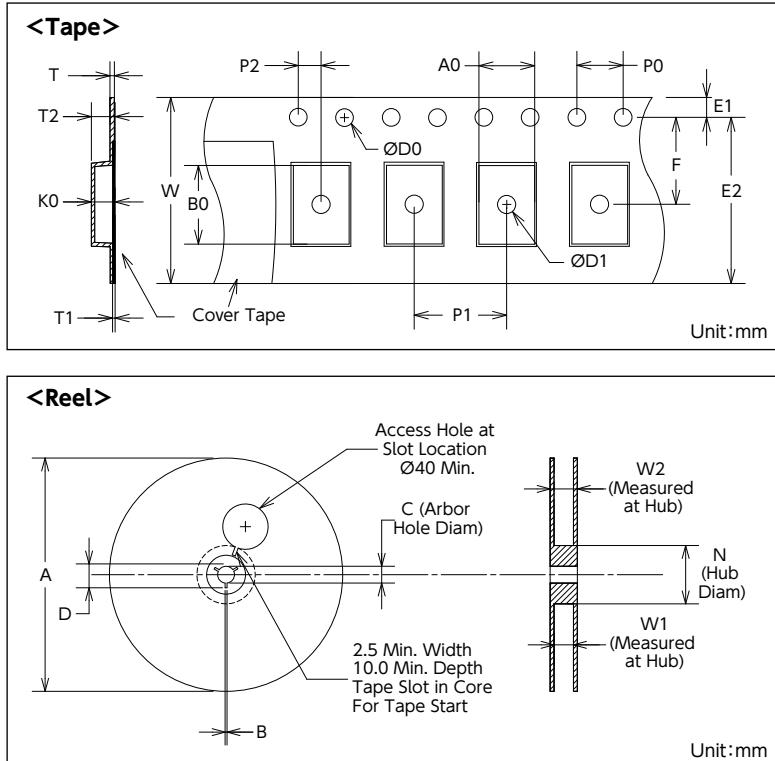
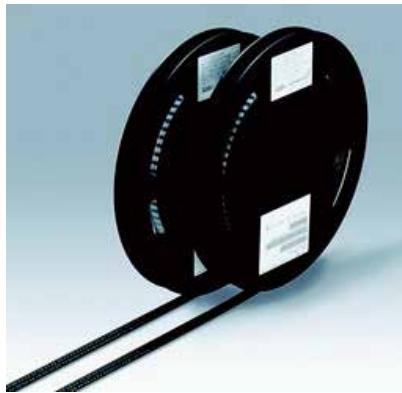
TYPE	a	b	c	d	e	f	t	A	B	T	W
DSF753S SERIES	5.6 ±0.1	7.6 ±0.1	16.0 ±0.3	7.5 ±0.1	8.0 ±0.1	1.7 ±0.1	0.30 ±0.05	φ178 ±2	φ60 +1/-0	1.2 ±0.5	17.0 ±0.3
DSF633S SERIES	4.0 ±0.1	6.5 ±0.1	12.0 ±0.2	5.5 ±0.05	8.0 ±0.1	1.7 ±0.1	0.30 ±0.05	φ178 ±2	φ60 +1/-0	1.2 ±0.5	13.0 ±0.3
DSF334S SERIES	3.2 ±0.1	3.2 ±0.1	8.0 ±0.2	3.5 ±0.05	4.0 ±0.1	1.5 ±0.1	0.25 ±0.05	φ178 ±2	φ60 +1/-0	1.2 ±0.5	9.0 ±0.3

\* 1: To indicate product name and other information, place those information on a label, and affix the label on one side of the flange.

2: The taping dimensions should be as per JIS C 0806. 1,000 units should be packaged per reel.

3: The standard packaged quantity per reel is 2,000 units for DSF334S.

# Emboss Carrier Tape (MEMS Oscillators)



## ■ Reel Standard Specification

Tape Size	A Max.	B Min.	C	D Min.	N	W1	W2 Max.
8	180	1.5	13.0 +0.6/-0.2	20.2	60 +0.5/-0.5	8.4 +1.5/-0	14.4
8	330	1.5	13.0 +0.2/-0.2	20.2	100 +0.5/-0.5	8.4 +1.5/-0	14.4
12	330	1.5	13.0 +0.2/-0.2	20.2	100 +0.5/-0.5	12.4 +2.0/-0	18.4
12	180	1.5	13.0 +0.2/-0.2	20.2	60 +0.5/-0.5	12.4 +2.0/-0	18.4
16	330	1.5	13.0 +0.2/-0.2	20.2	100 +0.5/-0.5	16.4 +2.0/-0	22.4
16	180	1.5	13.0 +0.2/-0.2	20.2	60 +0.5/-0.5	16.4 +2.0/-0	22.4

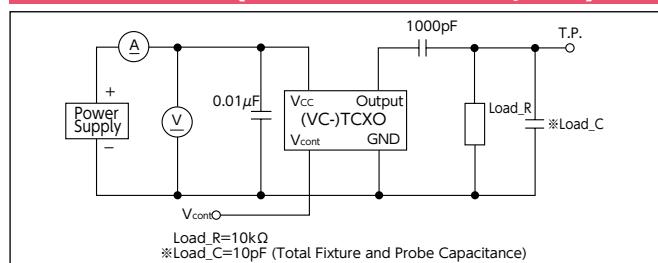
## ■ Carrier Tape Standard Specification

Package Outline Drawing	Package Size	Tape Size	D0	D1 Min.	E1	E2 Min.	F	P0	P1	P2	T	T1 Max.	T2 Max.	W Max.	A0	B0	K0
POD-1	2.5×2.0×0.75	12	1.5 +0.1/-0.0	1.5	1.75 ±0.1	10.25 ±0.05	5.5 ±0.1	4.0 ±0.1	4.0 ±0.1	2.0 ±0.05	0.6	0.1	1.65	12.3	2.3 ±0.10	2.8 ±0.10	1.10 ±0.10
POD-1	2.5×2.0×0.75	8	1.55 ±0.05	1.0	1.75 ±0.1	5.85	3.5 ±0.05	4.0 ±0.1	4.0 ±0.1	2.0 ±0.05	0.3 ±0.05	0.1	1.65	8.3	2.25 ±0.05	2.8 ±0.05	1.10 ±0.10
POD-23	2.7×2.4×0.75	12	1.55 ±0.05	1.0	1.75 ±0.1	9.85	5.5 ±0.05	4.0 ±0.1	4.0 ±0.1	2.0 ±0.05	0.3 ±0.05	0.1	1.55	12.3	2.65 ±0.10	2.95 ±0.10	1.00 ±0.10
POD-23	2.7×2.4×0.75	8	1.55 ±0.05	1.0	1.75 ±0.1	5.85	3.5 ±0.05	4.0 ±0.1	4.0 ±0.1	2.0 ±0.05	0.3 ±0.05	0.1	1.55	8.3	2.65 ±0.10	2.95 ±0.10	1.00 ±0.10
POD-2	3.2×2.5×0.75	12	1.5 +0.1/-0.0	1.5	1.75 ±0.1	10.25	5.5 ±0.05	4.0 ±0.1	4.0 ±0.1	2.0 ±0.05	0.6	0.1	1.65	12.3	2.8 ±0.10	3.4 ±0.10	1.15 ±0.10
POD-2	3.2×2.5×0.75	8	1.5 +0.1/-0.0	1.0	1.75 ±0.1	5.95	3.5 ±0.05	4.0 ±0.1	4.0 ±0.1	2.0 ±0.05	0.2 ±0.05	0.1	1.65	8.2	2.7 ±0.10	3.4 ±0.10	1.15 ±0.10
POD-3	5.0×3.2×0.75	12	1.5 +0.1/-0.0	1.5	1.75 ±0.1	10.25	5.5 ±0.05	4.0 ±0.1	8.0 ±0.1	2.0 ±0.05	0.6	0.1	1.65	12.3	3.5 ±0.10	5.3 ±0.10	1.10 ±0.10
POD-4	7.0×5.0×0.90	16	1.5 +0.1/-0.0	1.5	1.75 ±0.1	14.25	7.5 ±0.10	4.0 ±0.1	8.0 ±0.1	2.0 ±0.10	0.6	0.1	1.80	16.3	5.4 ±0.10	7.4 ±0.10	1.3 ±0.10
POD-9	3.5×3.0×0.30	12	1.5 +0.1/-0.0	1.5	1.75 ±0.1	10.25	5.5 ±0.05	4.0 ±0.1	8.0 ±0.1	2.0 ±0.05	0.6	0.1	1.65	12.3	3.3 ±0.10	3.8 ±0.10	0.65 ±0.10
POD-26	2.0×1.6×0.75	8	1.55 ±0.05	0.9	1.75 ±0.1	6.05	3.5 ±0.05	4.0 ±0.1	4.0 ±0.1	2.0 ±0.05	0.3 ±0.05	0.1	1.55	8.3	1.9 ±0.05	2.3 ±0.05	1.00 ±0.10
POD-29	2.0×1.2×0.60	8	1.55 ±0.05	1.0	1.75 ±0.1	6.05	3.5 ±0.05	4.0 ±0.1	4.0 ±0.1	2.0 ±0.05	0.25 ±0.05	0.1	1.55	8.3	1.9 ±0.05	2.3 ±0.05	1.00 ±0.10
POD-32	1.5×0.8×0.60	8	1.55 ±0.05	0.18	1.75 ±0.1	6.05	3.5 ±0.05	4.0 ±0.1	4.0 ±0.1	2.0 ±0.05	0.25 ±0.02	0.1	1.55	8.3	0.96 ±0.03	1.66 ±0.03	0.63 ±0.03
SOT-23	2.8×1.6×1.45	8	1.55 ±0.05	1.0	1.75 ±0.1	6.05	3.5 ±0.05	4.0 ±0.1	4.0 ±0.1	2.0 ±0.05	0.25 ±0.02	0.1	1.62	8.3	3.23 ±0.10	3.17 ±0.10	1.37 ±0.10

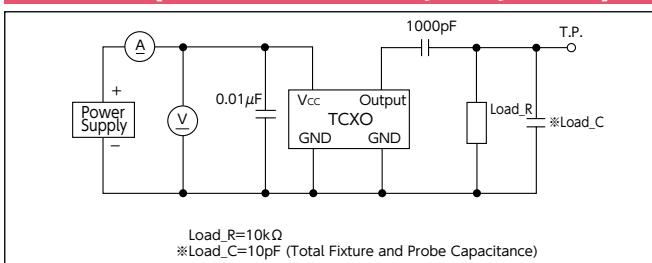
Refer to datasheet for details of emboss carrier tape specifications.

## Measurement Circuit (Crystal Oscillators)

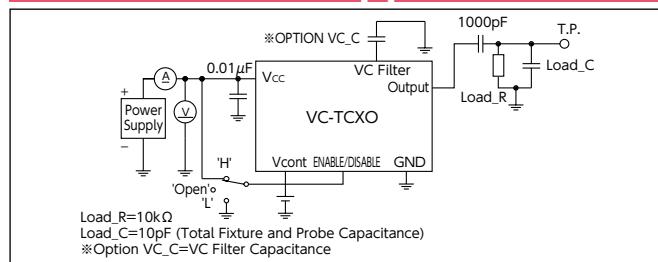
## **VC-TCXO (DSA\*\*\*SDN, SP)**



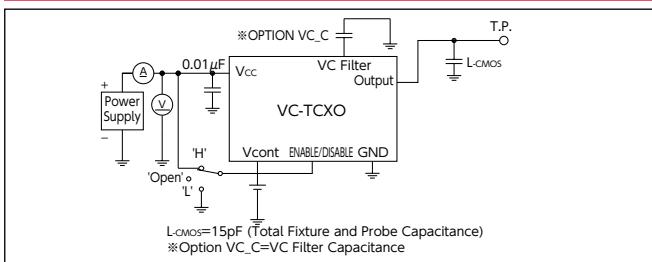
**TCXO (DSB\*\*\*SDN, SP, WA)**



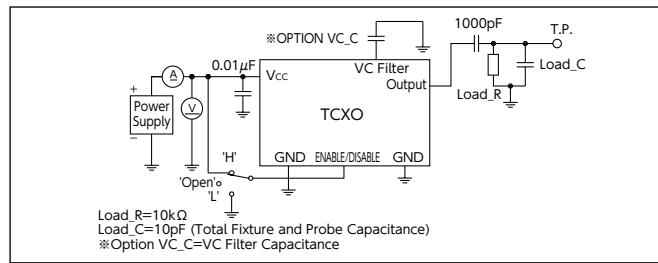
## DSA535SGA (Clipped Sine)



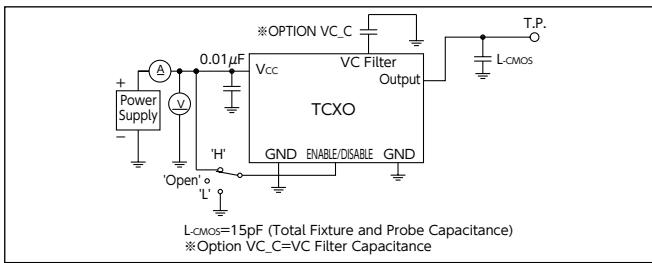
# DSA535SGA (CMOS)



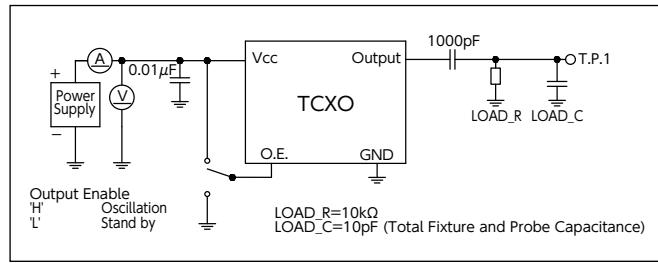
## **DSB535SGA (Clipped Sine)**



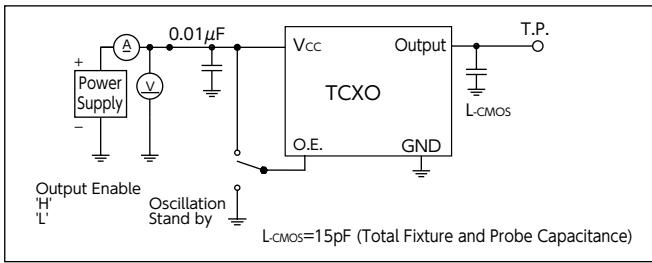
# DSB535SGA (CMOS)



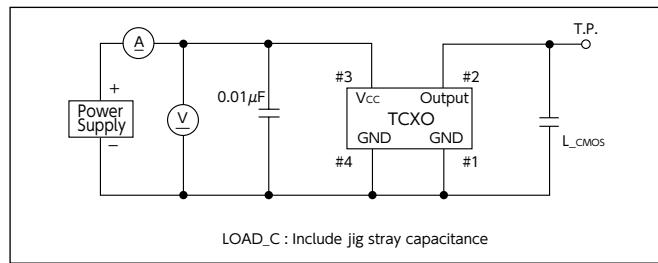
# TCXO (DSB\*\*\*, WEB)



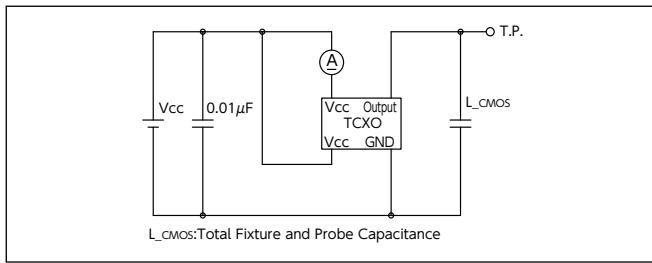
**DSB211SJA, 221SJA**



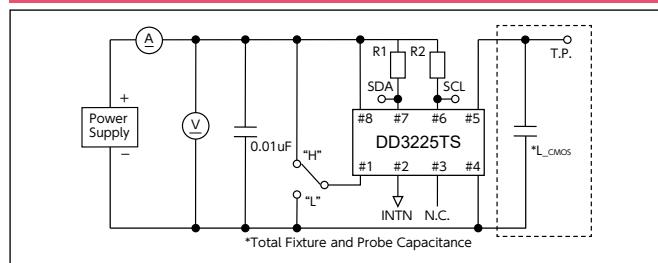
# DSK1612ATD



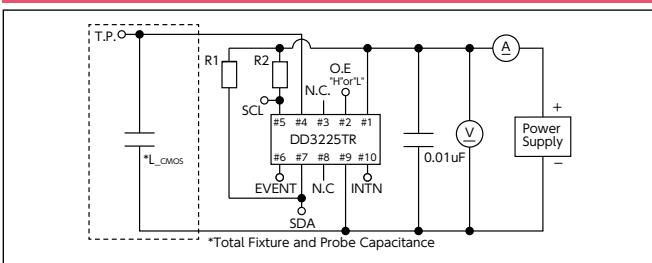
# DSK321STD



**DD3225TS**

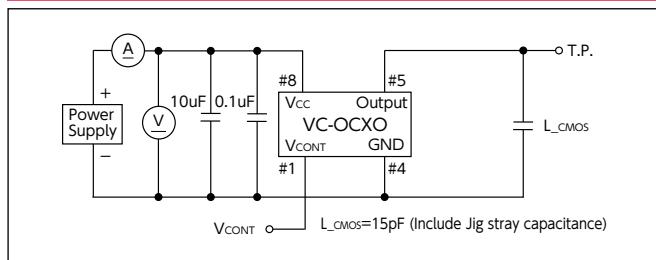


**DD3225TR**

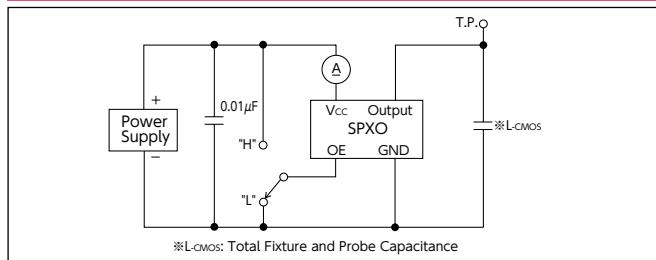


## Measurement Circuit (Crystal Oscillators)

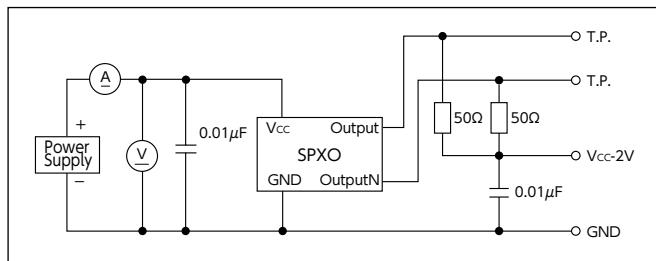
### DC5032AS



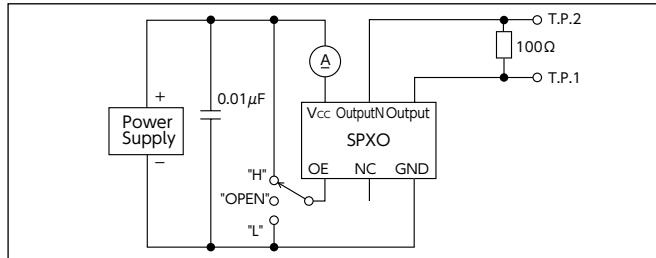
### DSO\*\*\*SX, SXF



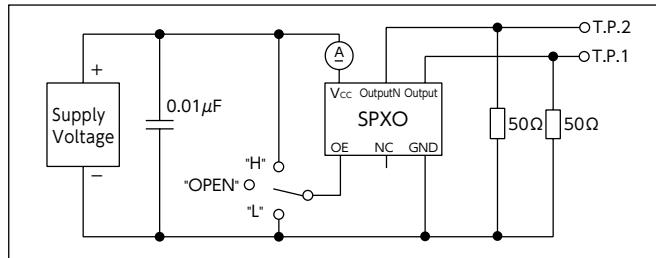
### DS1008JK



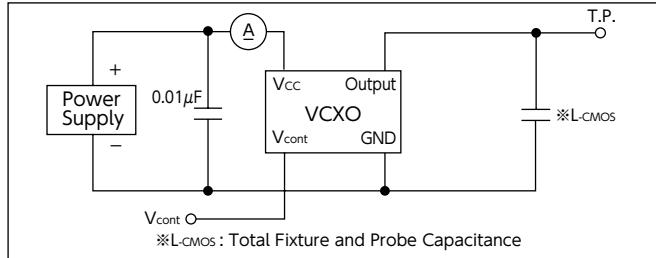
### DSO223SJ, DSO323SJ, DSO533SJ, DSO753SJ



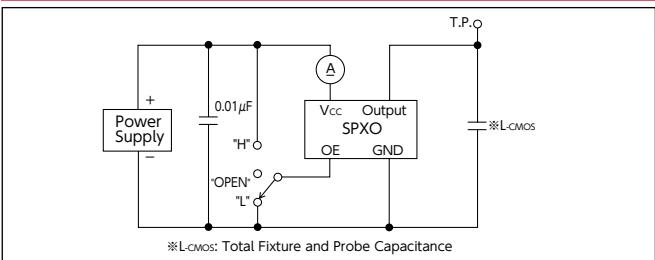
### DSO223SD, DSO323SD, DSO753SD



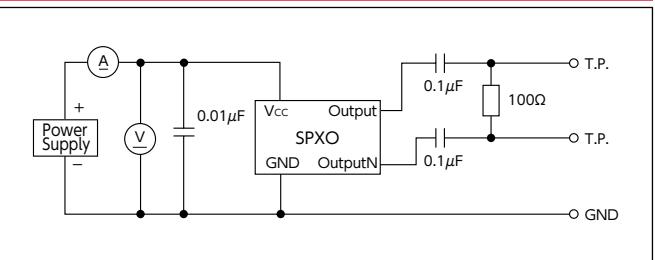
### DSV221SV, 321SV



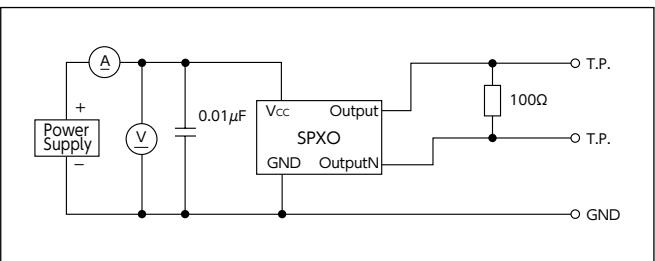
### DS1008JS, JN, DS2016KS, DSO\*\*\*AR, SR, SH, SY, SHH, SBM



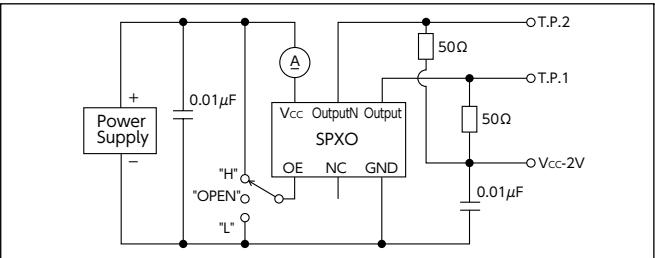
### DS1008JC



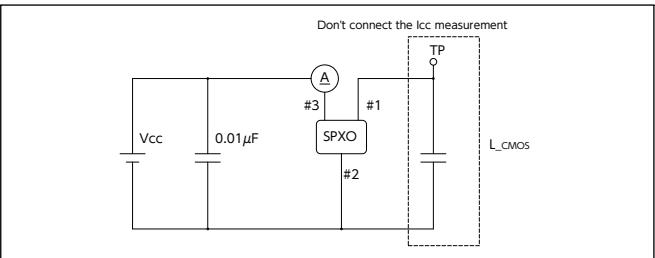
### DS1008JJ



### DSO223SK, DSO323SK, DSO533SK, DSO753SK

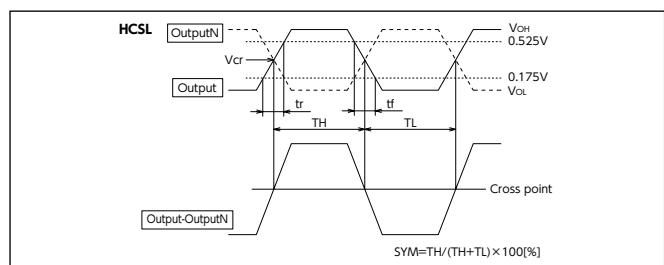
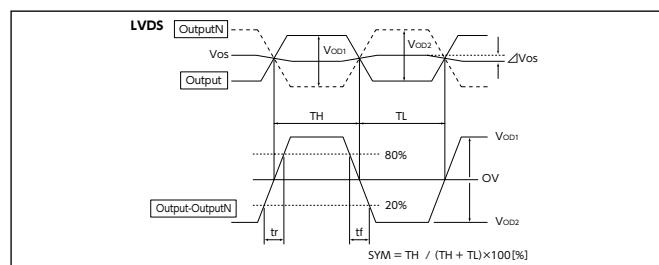
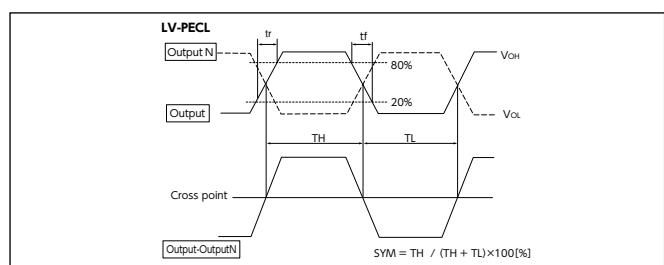
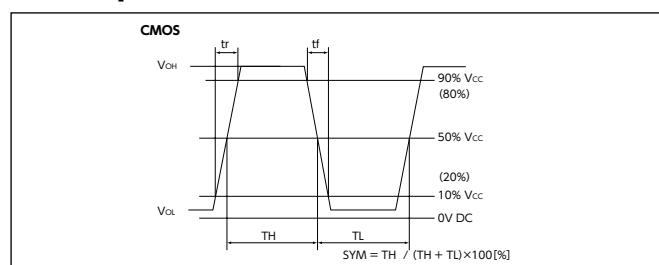


### DLO555MBA

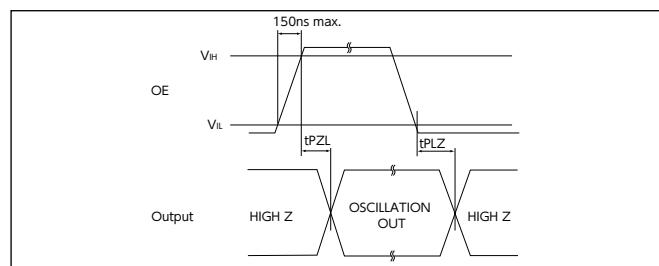


# Measurement Circuit

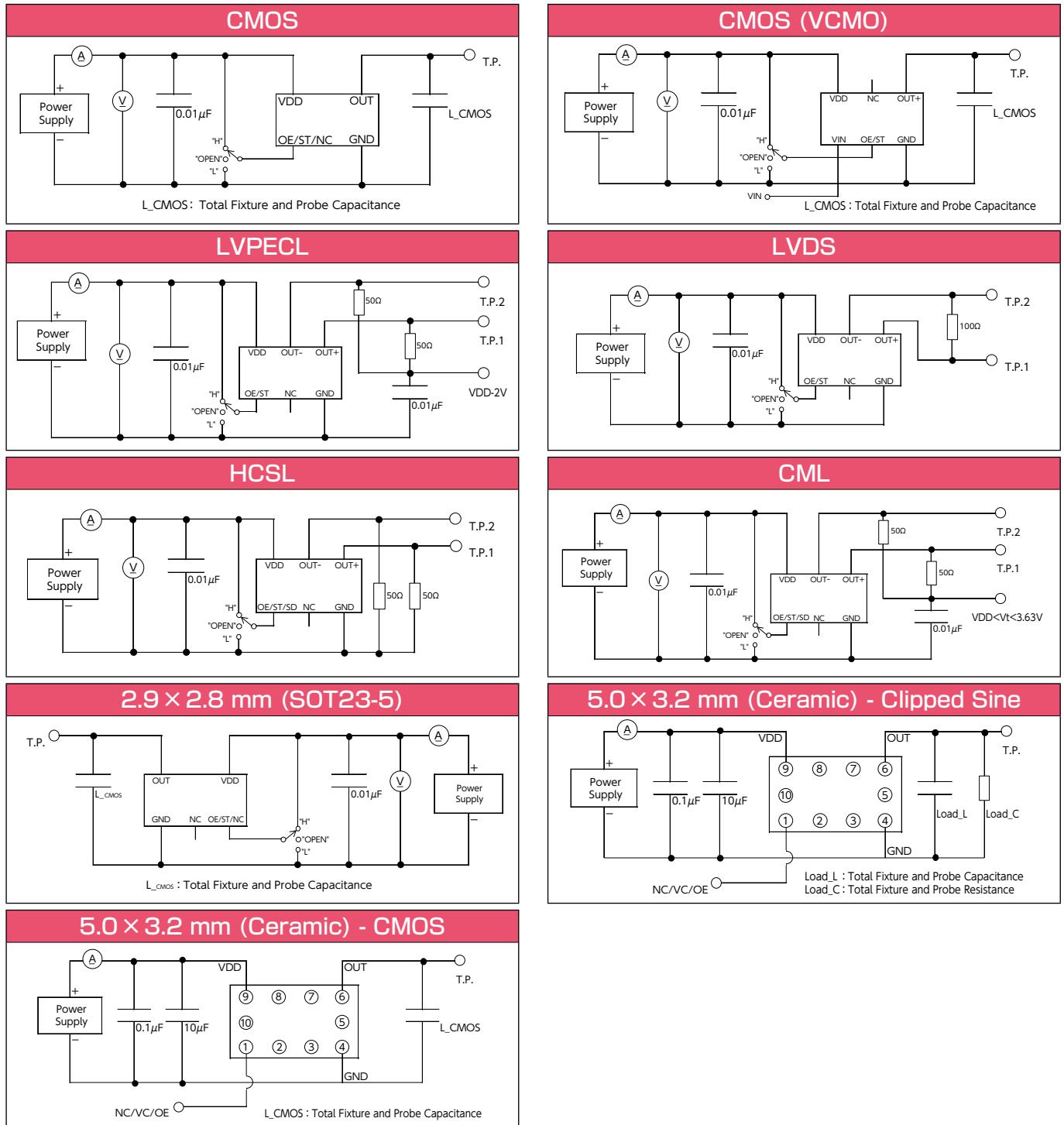
## ■ Output Wave Form



## ■ Input and Output Conditions



# Measurement Circuit (MEMS Oscillators)



# Substitution Products

Please contact our sales representative for further assistance.

You may also visit our web site (<https://www.kds.info>) to obtain standard specification.



SMD Crystal Resonators	
Type	Substitution Products
DSX1008A	DX1008JS

SMD Crystal Resonators with dedicated temperature sensor	
Type	Substitution Products
DSR211ATH	DST211STH

Voltage Controlled Crystal Oscillators	
Type	Substitution Products
DSV531SV	DSV321SV
DSV323SV/SK/SJ/SD	—
DSV753SV/SK/SJ/SD	—

SMD Crystal Resonators <For Automotive>	
Type	Substitution Products
DSX320G	DSX320GE
DSX530GK	DSX530GA

SMD Crystal Resonators with dedicated temperature sensor <For Automotive>	
Type	Substitution Products
DSR211ATH	DST211STH

High-precision SMD TCXO <For Automotive>	
Type	Substitution Products
DSB211SPX	DSB211SP

SMD Monolithic Crystal Filters	
Type	Substitution Products
DSF444SAF	DSF334S
DSF444SCF	DSF633S

# Product introduction on the Web

## Sending products information through Internet

DAISHINKU has been supplying the latest products information through Internet. Please use this service.

DAISHINKU Web site: <https://www.kds.info>



## Contact us

The following link can be used to submit any inquiries to us about KDS products including technical support or ordering products etc.

You may also contact us directly by e-mail.  
e-mail address: [kouhou602@kds.info](mailto:kouhou602@kds.info)

**Broadband  
Technology**  
2000

For UK & Ireland  
**Contact us:**  
**01189 324600**  
**sales@bt2000.co.uk**

# MEMO

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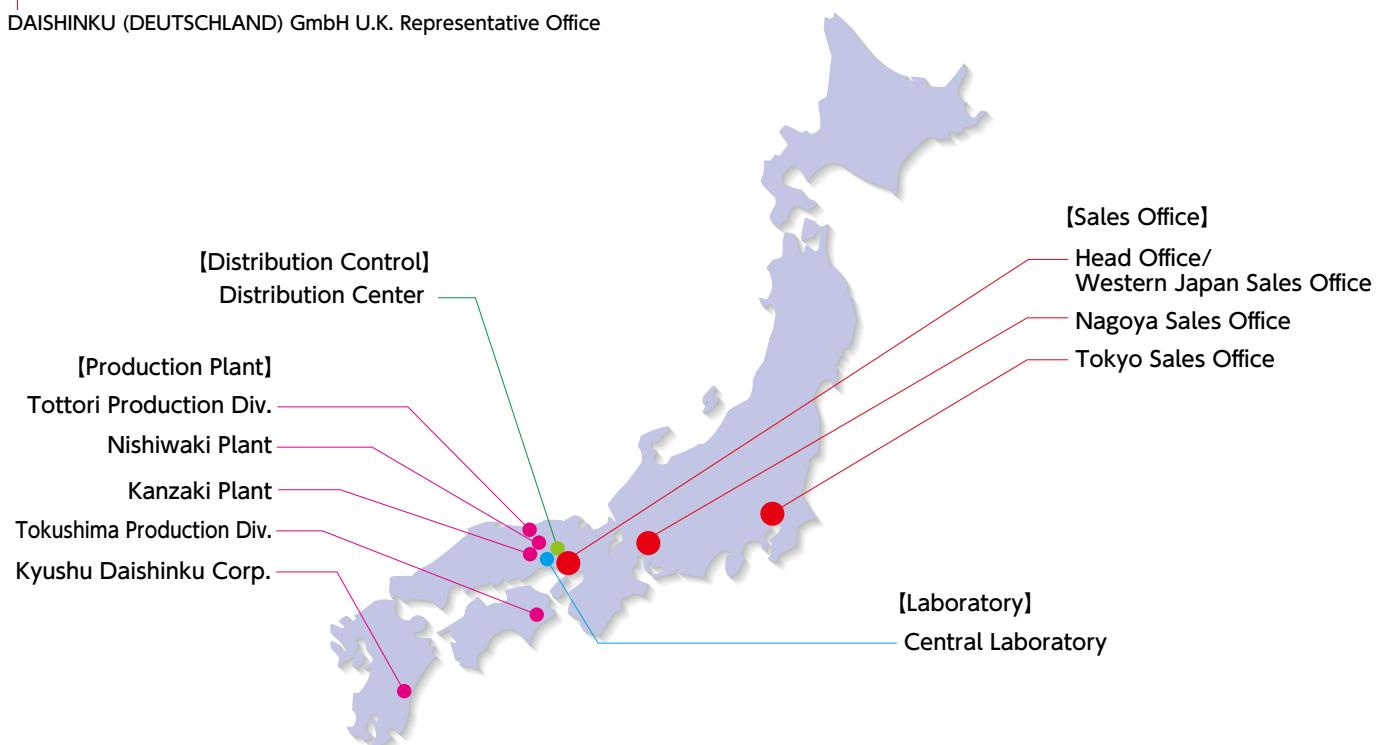
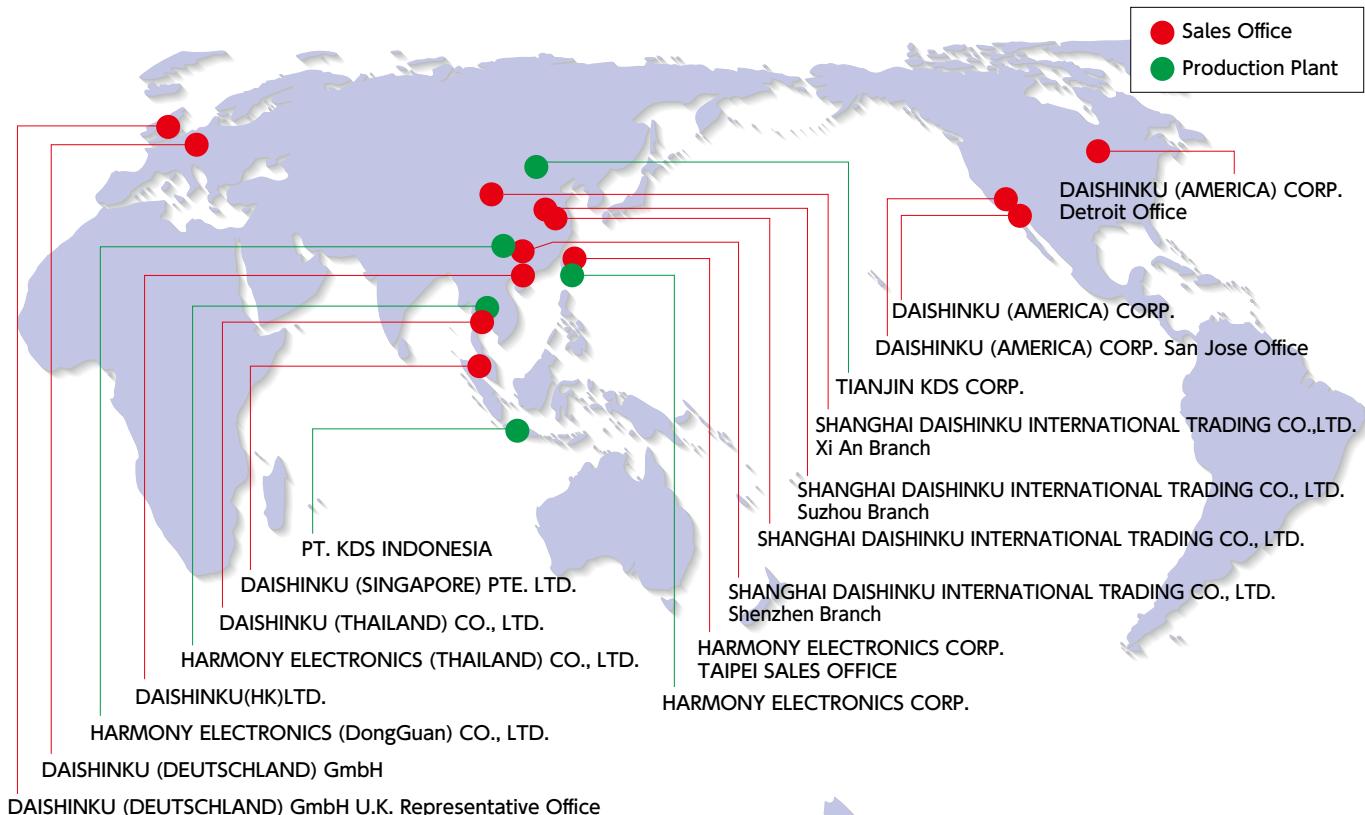
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# KDS Global Network

## Our global network accelerates our business.

All KDS business bases are connected through a global network via host computers. This network allows for online and real-time networking, thus maximizing time efficiency and ensures our promptness. This network maintains our quality standards through the control of production at our plants, product transport from/to the distribution center, and our sales information. In the best interest of our customers we continuously aim to deliver our quality services to the world market.





General Manufacturer of Quartz Devices

株式会社 大真空  
DAISHINKU CORP.

<https://www.kds.info>



For UK & Ireland

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