KDS
DAISHINKU CORP.

2017~2018
PRODUCT CATALOG

PRODUCT CATALOG

- Crystal resonators
- Crystal oscillators
- Monolithic crystal filters
- Optical products
- MEMS oscillators

Global Quality

株式会社 大真空

INDEX

Handling Instructions

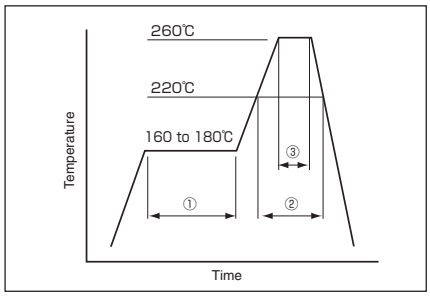
■ Soldering

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℃	120sec.
②	Primary heat	220℃	60sec
③	Peak	260℃	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 0.01μ F between Vdd 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.

〈Optical Products〉
◎Our products are manufactured in a dust-free environment. To keep them clean and dust free, keep them in a clean environment after they are unpacked.

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 the Hazardous Substances) , ELV Directive (End of Life Vehicles Directive) 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.(http://www.kds.info)

As of sept.30.2017

	Type	RoHS/ELV Compliant	Halogen-free	Pb-free	Materials of pin	Note
Crystal Resonators /MHz Band Crystal Resonators	DSX1210A	○	○	○	Ni/Au	
	DSX1612S, DSX1612SL	○	○	○	Ni/Au	
	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. (*)
	DSX320G, DSX320GE	○	○	Pb in sealing-glass	Ni/Au	Pb in sealing-glass is exempted from RoHS/ELV Directive. (*)
	DSX211G	○	○	Pb in sealing-glass	Ni/Au	Pb in sealing-glass is exempted from RoHS/ELV Directive. (*)
	DSX221G	○	○	Pb in sealing-glass	Ni/Au	Pb in sealing-glass is exempted from RoHS/ELV Directive. (*)
	DSX321G, DSX321GK	○	○	Pb in sealing-glass	Ni/Au	Pb in sealing-glass is exempted from RoHS/ELV Directive. (*)
	DSX530GA, DSX530GK	○	○	Pb in sealing-glass	Ni/Au	Pb in sealing-glass is exempted from RoHS/ELV Directive. (*)
	SMD-49	○	○	○	Sn-Cu	
Tuning Fork Crystal Resonators /kHz Band Crystal Resonators	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.(*)
	DST1210A	○	○	○	Ni/Au	
	DST1610A, DST1610AL	○	○	○	Ni/Au	
	DST210AC	○	○	○	Ni/Au	
	DST311S, DST310S	○	○	○	Ni/Au	
Crystal Resonators with dedicated temperature sensor/MHz Band Crystal Resonators	DSR1612ATH	○	○	○	Ni/Au	
	DSR211ATH, DSR211STH	○	○	○	Ni/Au	
	DSR221STH	○	○	○	Ni/Au	
Temperature Compensated Crystal Oscillators (TCXO)	DSA/DSB1612 SERIES	○	○	○	Ni/Au	
	DSA/DSB211 SERIES	○	○	○	Ni/Au	
	DSA/DSB221 SERIES	○	○	○	Ni/Au	
	DSA/DSB222 SERIES	○	○	○	Ni/Au	
	DSA/DSB321 SERIES	○	○	○	Ni/Au	
	DSA/DSB535 SERIES	○	○	○	Ni/Au	
	DSK321STD	○	○	○	Ni/Au	
Real Time Clock Module (RTC)	DSK324SR	○	○	○	Ni/Au	
Simple Packaged Crystal Oscillators (SPXO)	DSO1612AR	○	○	○	Ni/Au	
	DSO211A 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	
	DLO555MB	○	○	○	Sn	
	DSO751S SERIES	○	○	○	Ni/Au	
	DSO753H SERIES	○	Halogenated compounds in solder	Pb in chip resistor	Ni/Au	Pb in chip resistor is exempted from RoHS/ELV Directive.(*)
	DSO753S SERIES	○	○	○	Ni/Au	
Voltage Controlled Crystal Oscillators (VCXO)	DSV211A SERIES	○	○	○	Ni/Au	
	DSV221S SERIES	○	○	○	Ni/Au	
	DSV321S SERIES	○	○	○	Ni/Au	
	DSV323S SERIES	○	○	○	Ni/Au	
	DSV531S/DSV532S SERIES	○	○	○	Ni/Au	
	DSV753C SERIES	○	Halogenated compounds in solder	Pb in chip resistor	Ni/Au	Pb in chip resistor is exempted from RoHS/ELV Directive.(*)
	DSV753S SERIES	○	○	○	Ni/Au	
	DSV753H SERIES	○	Halogenated compounds in solder	Pb in chip resistor	Ni/Au	Pb in chip resistor is exempted from RoHS/ELV Directive.(*)
Oven Controlled Crystal Oscillator (OCXO)	DLC117	○	Halogenated compounds in print wiring boards	Pb in chip resistor	Ni	Pb in chip resistor is exempted from RoHS/ELV Directive.(*)
Monolithic Crystal Filters	DSF334 SERIES	○	○	○	Ni/Au	
	DSF444 SERIES	○	○	○	Ni/Au	
	DSF633 SERIES	○	○	○	Ni/Au	
	DSF753 SERIES	○	○	○	Ni/Au	

*RoHS Directive (Directive of the Restriction of the use of the Hazardous Substances) and ELV Directive (End of Life Vehicles Directive) exemptions are granted for high temperature solder, Lead content in low-melting glass of DSX-G Series, Lead in chip resistor of DSO / DSV 753H series, DSV753C series and DLC117.

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.

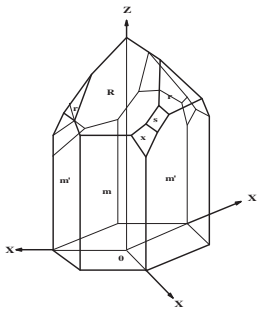


Fig. 1. Typical appearance of a quartz crystal

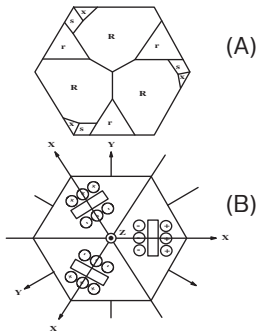


Fig. 2. (A) Typical crystallogram as obtained by viewing Fig. 1 from above
(B) Illustration of piezoelectricity

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.

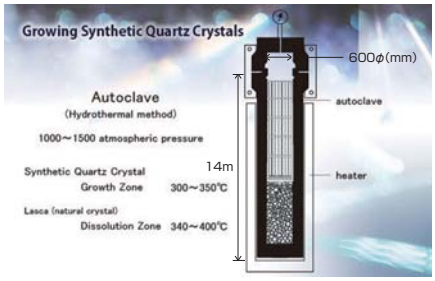


Fig.3. Autoclave

Artificial quartz crystal drawn from an autoclave

Various artificial quartz crystals

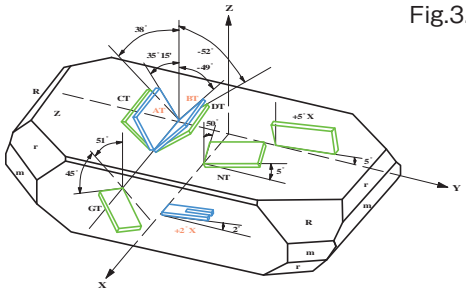
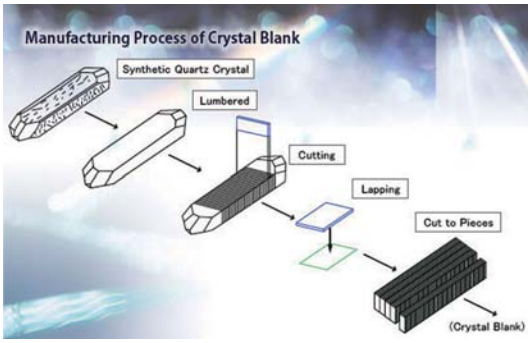


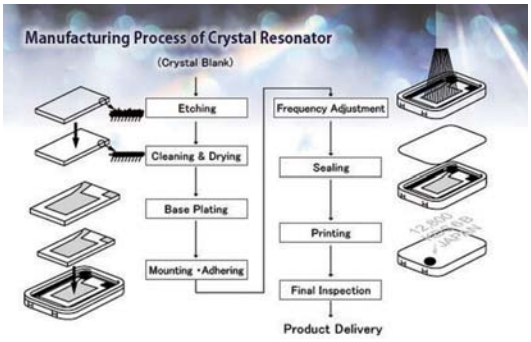
Fig.4. Designations of cuts from a piece of artificial quartz crystal

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

As of sept.30.2017

A logo representing “Slim×Small×Smart” Crystal (Triple-S Crystal) used for below-2016-size crystal devices	RoHS “2011/65/EU” Compliant
No lead content. Lead-free mounting is possible.	RoHS “2011/65/EU” ELV “2000/53/EC” Compliant

Pb-Free

RoHS Compliant

RoHS/ELV 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, ISO/TS16949

In order to meet customer’s needs with “reliance” and “reassurance” , Daishinku has achieved ISO9001,ISO/TS16949 certification in domestic and international production sites *.

*except for Kanzaki plant

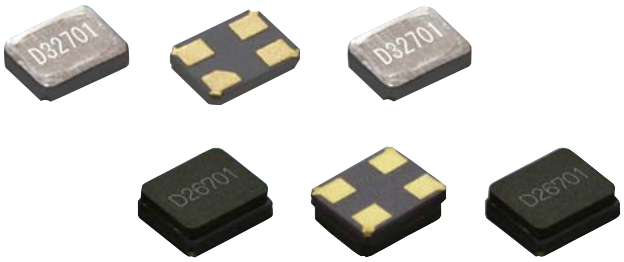
●Use this Catalog with the following points in mind.

- 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
Crystal resonators



〈Example〉 **D S X 5 3 0 G A**

Surface mount crystal resonator

Length
First 2 digits of the dimention (L<2mm)
First digit of the dimention in Millimeter (2≤L<10mm)
"1" (L≥10mm)

Width
First 2 digits of the dimention (L<2mm)
First digit of the dimention in Millimeter (2mm≤L)

Number of terminals
0: two terminals 1: four terminals

Sealing method
G: glass seal S: seam weld A: melting alloy

Product characteristics

D S X 1 6 1 2 S

KDS DAISHINKU CORP.

Crystal Resonators

Description

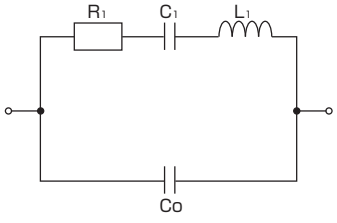
●MHz Band Crystal Resonators

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.

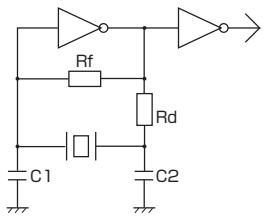
Terminology

Fundamental Crystal Resonators	Crystal resonator designed to oscillate in the lowest-order (fundamental) oscillation mode.
Overtone Crystal Resonators	Crystal resonator designed to oscillate in the overtone oscillation mode (third, fifth, and seventh).
Overtone Order	Desired order of vibration mode, (odd) integer multiples of the fundamental mode.
Vibration Mode	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.
Nominal Frequency	The specified center frequency of the crystal.
Load Capacitance	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.
Drive Level	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.
Series Resistance	The resistance of the crystal at the series resonance frequency, also called the equivalent series resistance (ESR).
Frequency Tolerance (Crystal Resonators)	Allowable deviation from nominal at room temperature (25 deg.C), indicated in parts per million ($\times 10^{-6}$).
Frequency Characteristics over Temperature (Crystal Resonators)	Allowable deviation of frequency at room temperature, in parts per million ($\times 10^{-6}$). This is the maximum value within the operating temperature range.
Aging	The frequency change of the crystal operated at specific conditions for a certain period of time.
Operating Temperature Range	Temperature range over which the crystal resonator can be operated within allowable deviation range.
Storage Temperature Range	Temperature range, which crystal resonator can be stored at without any deterioration or damage independently.
Turnover Temperature	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.
Parabolic Coefficient	The temperature co-efficient of a parabolic curve shown in frequency vs. temperature.
Plastic-encapsulated (SMD) type	Crystal resonators encapsulated with resin.
Cylindrical type	Crystal resonators in cylindrical constructions, which are generally in kHz frequency range.
Equivalent Circuit to Crystal Resonator	An equivalent circuit near the resonance point of the crystal resonator is shown below. It consists of a series circuit including series motional inductance (L_1), series capacitance (C_1) and series resistance (R_1), with the resonator's terminal-to-terminal capacitance (shunt capacitance: C_0) connected in parallel with the series circuit. The smaller the size of the resonator, the greater the average values of R1 and L1. 

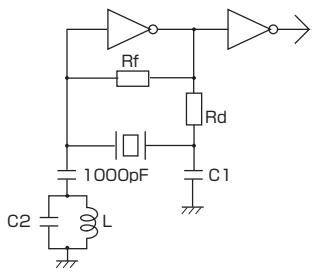
Oscillation Circuit

Oscillation Circuit of Crystal Resonator

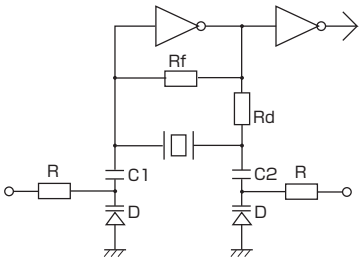
Oscillation Circuit of Fundamental Mode



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
74HCU04 : 4 to 30MHz
74VHCU04 : 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

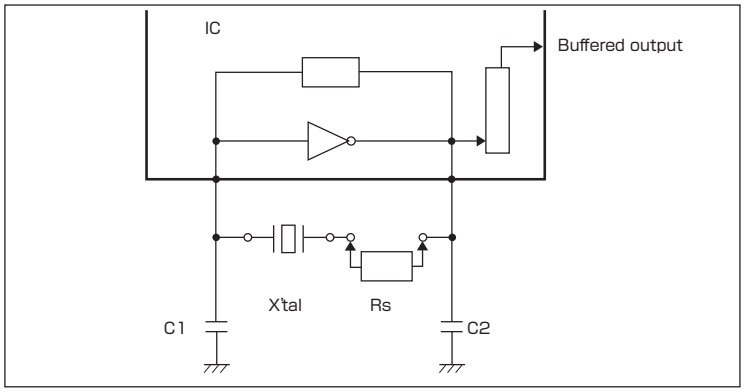
[Line Pattern]
Mount parts of a oscillation circuit as closely as possible to the IC and don't put signal line of the oscillator circuit closely or cross another signal line.

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(Rs). Change the value of the inserted resistor(Rs). 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: 300μW max., 200μW max., 100μW max. Overtone Mode: 1mW max., 500μW max.

Tuning Fork Crystal Resonators
2μW max., 1μW 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.

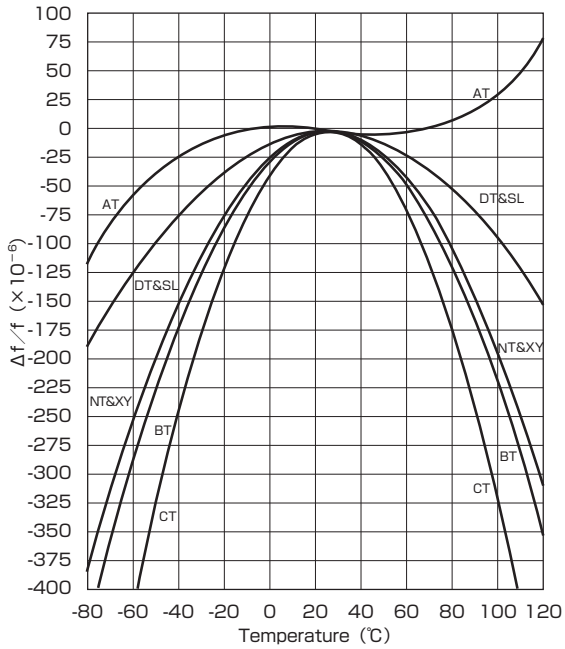
Drive Level $P = (I/2\sqrt{2})^2 \cdot R$

【Inquiry About The Oscillation Circuit】

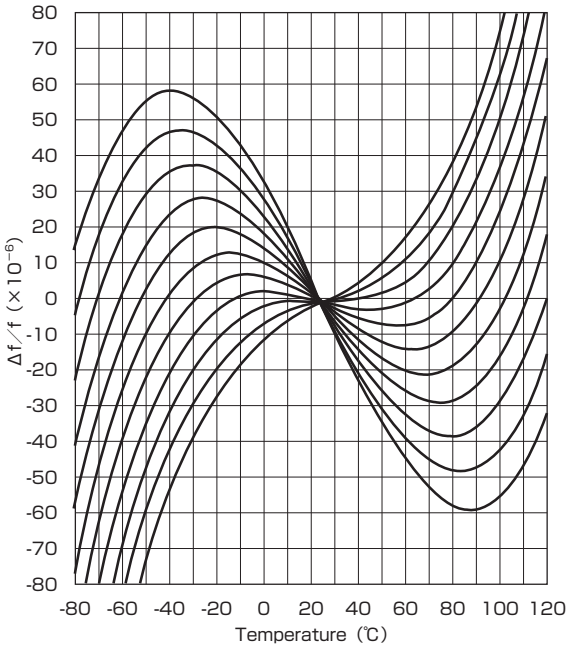
Regarding inquiries concerning oscillation circuit and its matching with the ICs you are using, please directly contact our sales department or leave us an e-mail from our website(click “CONTACT US” from the top page → select “TECHNICAL SUPPORT”).

Cut Angle and Frequency Characteristics over Temperature

Temperature Characteristics for Various Cuts

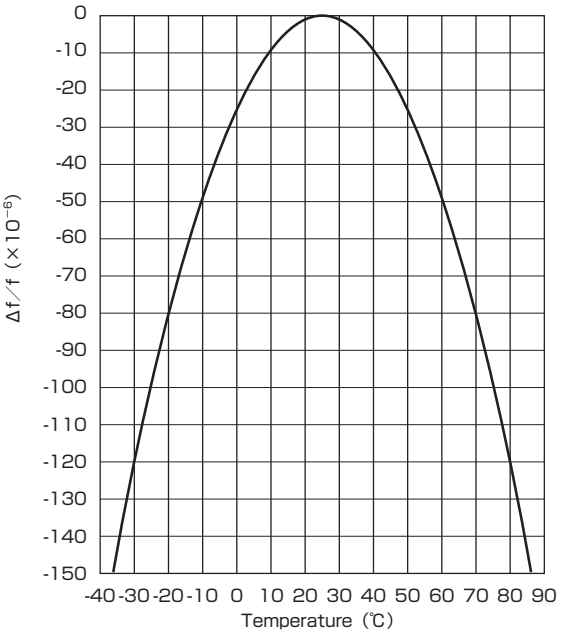


Temperature Characteristics for AT Cuts

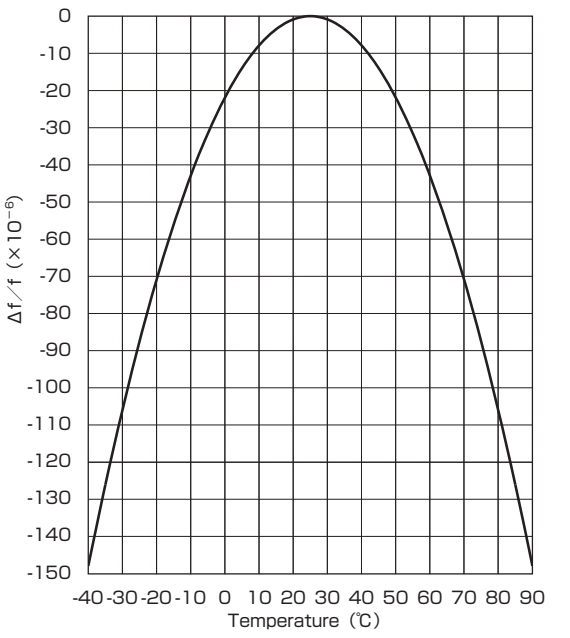


Difference of cutting angle between each temperature curve is 2'.

Temperature Characteristics for BT Cuts



Temperature Characteristics for Tuning Fork Crystal Resonator



Selection Guide

Scan the QR code to check the table of contents page of our web site "Crystal Resonators" (URL: http: //www.kds.info/class/1-l-qr/).

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

SMD Crystal Resonators / MHz Band Crystal Resonators

Type	Actual Size	Size (mm) L	W	H (max.)	Frequency Range (MHz)	Frequency Tolerance (×10⁻⁶) @+25℃	Frequency Characteristics over Temperature (×10⁻⁶)	Operating Temperature Range (℃)	Load Capacitance (pF)	Drive Level (μw)	Lid	Recommended Application	Catalog Page
DSX1210A		1.2	1.0	0.3	32 to 52	±20	±30	-30 to +85℃	8, 10 ,12	10	Metal	CE TC	11
DSX1612S		1.6	1.2	0.4	24 to 54	±20	±30	-30 to +85℃	8, 10 ,12	10	Metal	CE TC	12
DSX1612SL		1.6	1.2	0.33	32 to 52								
DSX211SH		2.05	1.65	0.5	24 to 50	±20 ±30	±30 ±100	-30 to +85℃ -40 to +125℃	8, 10 ,12	10	Metal	CE IE TC AE	13・72
DSX221SH		2.5	2.0	0.5	12 to 54								
DSX321SH		3.2	2.5	0.75	12 to 50								
DSX210GE		2.2	1.6	1.0	16 to 64	±30	±100	-40 to +125℃	8, 10 ,12	10	Ceramic	AE	68
DSX211G		2.0	1.6	0.8	20 to 64	±20 ±30	±30 ±100	-30 to +85℃ -40 to +125℃	8, 10 ,12	10	Ceramic	CE IE TC AE	14・68
DSX221G		2.5	2.0	0.9	12 to 64	±20 ±30	±30 ±100	-30 to +85℃ -40 to +125℃	8, 10 ,12	10	Ceramic	CE IE TC AE	15・69
DSX320G		3.2	2.5	1.0	12 to 64	±30	±100	-40 to +125℃	8, 10 ,12	10	Ceramic	AE	70
		3.2	2.5	1.1	7.9 to 12								
DSX320GE		3.2	2.5	1.1	7.9 to 64	±30	±100	-40 to +125℃	8, 10 ,12	10	Ceramic	AE	70
DSX321G		3.2	2.5	0.9	12 to 64	±20 ±30	±30 ±100	-30 to +85℃ -40 to +125℃	8, 10 ,12	10	Ceramic	CE IE TC AE	16・70
		3.2	2.5	1.0	7.9 to 12								
DSX321GK		3.2	2.5	1.0	9.8 to 40	±30	±100	-40 to +125℃	8, 10 ,12	10	Ceramic	AE	70
DSX530GA		5.0	3.2	1.2	7 to 70 7 to 54	±30	±50 ±100	-30 to +85℃ -40 to +125℃	8, 10 ,12	10	Ceramic	CE IE AE	17・71
DSX530GK		5.0	3.2	1.2	8 to 54	±30	±100	-40 to +125℃	8, 10 ,12	10	Ceramic	AE	71
SMD-49		11.0	4.6	4.5	4, 8	±30	±100	-40 to +125℃	8, 10 ,12	10	Metal	AE	74

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

Type	Actual Size	Size (mm) L	W	H (max.)	Frequency Range (MHz)	Frequency Tolerance (×10⁻⁶) @+25℃	Frequency Characteristics over Temperature (×10⁻⁶)	Operating Temperature Range (℃)	Load Capacitance (pF)	Drive Level (μw)	Lid	Recommended Application	Catalog Page
DSR1612ATH		1.64	1.24	0.65	38.4	±10	±12	-30 to +85℃	7, 8	10	Metal	TC	18
DSR211ATH		2.0	1.6	0.65	19.2, 26, 38.4 19.2	±10	±12 ±30	-30 to +85℃ -40 to +105℃	7, 8	10	Metal	TC AE	18・73
DSR211STH		2.0	1.6	0.8 (0.65)	19.2, 26, (38.4) 19.2, (38.4)	±10	±12 ±30	-30 to +85℃ -40 to +105℃	7, 8	10	Metal	TC AE	
DSR221STH		2.5	2.0	1.0	19.2, 26 19.2	±10	±12 ±20	-30 to +85℃ -40 to +105℃	7, 8	10	Metal	TC AE	

SMD Tuning Fork Crystal Resonators / kHz Band Crystal Resonators

Type	Actual Size	Size (mm) L	W	H (max.)	Frequency Range (kHz)	Frequency Tolerance (×10⁻⁶) @+25℃	Series resistance (kΩ max.)	Operating Temperature Range (℃)	Load Capacitance (pF)	Drive Level (μw)	Package	Recommended Application	Catalog Page
DST1210A		1.2	1.0	0.35	32.768	±20	80	-40 to +85℃	7, 9, 12.5	0.1	Ceramic	CE TC	19
DST1610A		1.6	1.0	0.5	32.768	±20	80	-40 to +85℃	7, 9, 12.5	0.1	Ceramic	CE TC	20
DST1610AL		1.6	1.0	0.35									
DST210AC		2.0	1.2	0.55									
DST310S		3.2	1.5	0.85	32.768	±20	50, 80 80, 120	-40 to +85℃ -40 to +125℃	7, 9, 12.5	0.2	Ceramic	CE IE TC AE	21・75
DST311S							50, 80	-40 to +85℃				CE IE TC	21
DMX-26S		8.0	3.8	2.5	30 to 90	±20	50 50, 80	-40 to +85℃ -40 to +125℃	7, 9, 12.5	1.0	Plastic	CE AE	22・75

Tuning Fork Crystal Resonators / kHz Band Crystal Resonators

Type	Actual Size	Size (mm) L	W	H (max.)	Frequency Range (kHz)	Frequency Tolerance (×10⁻⁶) @+25℃	Series resistance (kΩ max.)	Operating Temperature Range (℃)	Load Capacitance (pF)	Drive Level (μw)	Package	Recommended Application	Catalog Page
DT-26		φ2.0	φ2.0	6.0	32.768	±20 (GRADE A) ±30 (GRADE B)	40	-10 to +60℃	12.5	1.0	Cylinder	CE IE	23
DT-261					28 to 90								
DT-38		φ3.0	φ3.0	8.0	32.768		30						
DT-381					20 to 90								

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 0.3mm max.
- High precision and high reliability
  (Frequency aging specification of $\pm1\times10^{-6}$/1 year or $\pm3\times10^{-6}$/5 years is available for cell phone or wireless communication systems etc.)
- Allowing for high density surface mounting.
- Moisture prevention packing is unnecessary.
  Moisture Sensitivity Level:LEVEL1 (IPC/JEDEC J-STD-033)

Pb-Free

RoHS Compliant

■ Applications

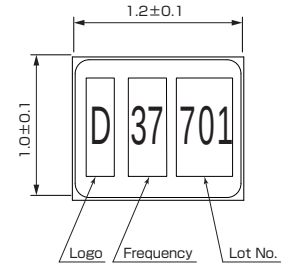
- Small mobile devices for next generation such as mobile communications, short-range wireless modules, digital AV equipment and PC.
- Wearable devices

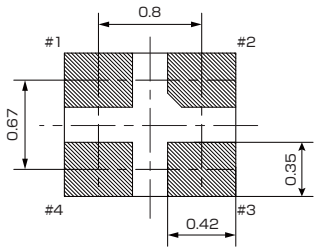
■ Standard Specification

Item \ Type	DSX1210A			
Frequency Range	32MHz	37.4MHz / 38.4MHz / 40MHz	48MHz	52MHz
Overtone Order	Fundamental			
Load Capacitance	8pF, 10pF, 12pF			
Drive Level	10μW (100μW max.)			
Frequency Tolerance	$\pm20\times10^{-6}$ (at 25℃)			
Series Resistance	150Ω max.	60Ω max.	40Ω max.	
Frequency Characteristics over Temperature	$\pm30\times10^{-6}$ / −30 to +85℃ (Ref. To 25℃)			
Storage Temperature Range	−40 to +85℃			
Packing Unit	3000pcs./reel (φ180)			

[mm]

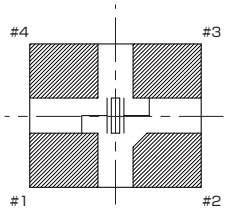
■ Dimensions





■ Internal Connections

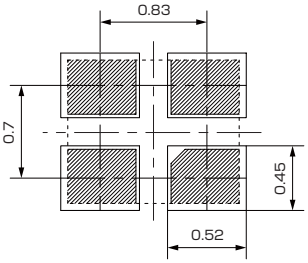
〈Top View〉



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

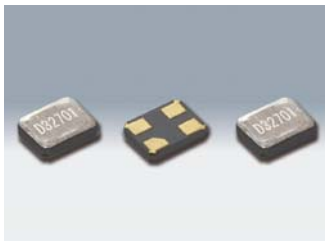
■ Recommended Land Pattern

〈Top View〉

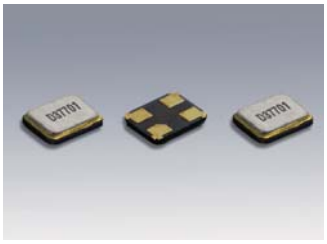


SMD Crystal Resonators / MHz Band Crystal Resonators

DSX1612S/DSX1612SL



DSX1612S Actual size



DSX1612SL Actual size

■ Features

- 1612 size ultra miniature and lightweight SMD crystal resonator.
  Height DSX1612S : 0.35mm
  DSX1612SL : 0.33mm max.
- High precision and high reliability
  (Frequency aging specification of $\pm1\times10^{-6}$/1 year or $\pm3\times10^{-6}$/5 years is available for cell phone or wireless communication systems etc.)
- Allowing for high density surface mounting.
- Moisture prevention packing is unnecessary.
  Moisture Sensitivity Level:LEVEL1 (IPC/JEDEC J-STD-033)

Pb-Free

RoHS Compliant

■ Applications

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

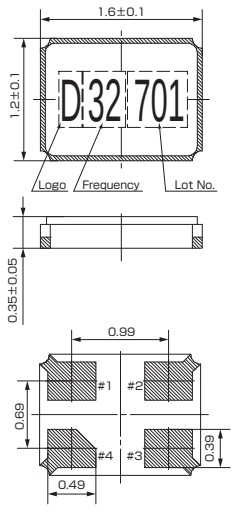
■ Standard Specification

Item \ Type	DSX1612S			DSX1612SL			
Frequency Range	24 to 32MHz	32 to 40MHz	40 to 54MHz	32MHz	37.4MHz / 38.4MHz / 40MHz	48MHz	52MHz
Overtone Order	Fundamental						
Load Capacitance	8pF, 10pF, 12pF						
Drive Level	10μW (100μW max.)						
Frequency Tolerance	$\pm20\times10^{-6}$ (at 25℃)						
Series Resistance	200Ω max.	150Ω max.	100Ω max.	120Ω max.	60Ω max.	30Ω max.	50Ω max.
Frequency Characteristics over Temperature	$\pm30\times10^{-6}$ / −30 to +85℃ (Ref. To 25℃)						
Storage Temperature Range	−40 to +85℃						
Packing Unit	3000pcs./reel (φ180)						

Consult our sales representative for other specifications.

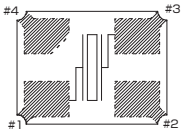
■DSX1612S [mm]

■ Dimensions



■ Internal Connections

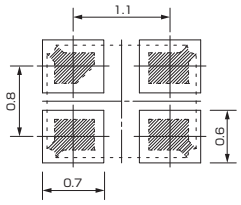
〈Top View〉



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

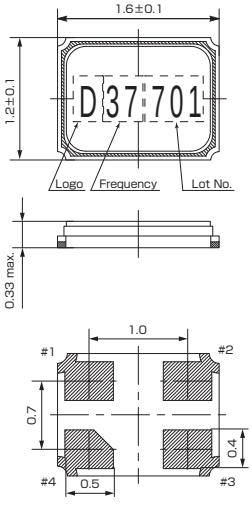
■ Recommended Land Pattern

〈Top View〉



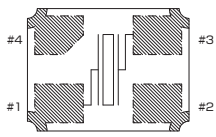
■ DSX1612SL [mm]

■ Dimensions



■ Internal Connections

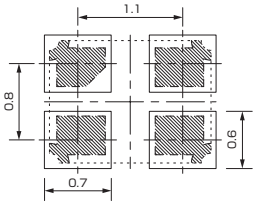
〈Top View〉



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

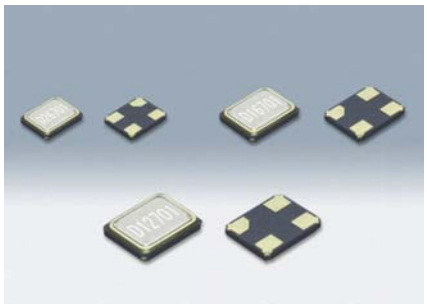
■ Recommended Land Pattern

〈Top View〉



SMD Crystal Resonators / MHz Band Crystal Resonators

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 : 24MHz to 50MHz
  - DSX221SH : 16MHz to 54MHz
  - DSX321SH : 12MHz to 50MHz
- Moisture prevention packing is unnecessary.
  Moisture Sensitivity Level:LEVEL1 (IPC/JEDEC J-STD-033)
- AEC-Q200 Compliant
- Frequency Characteristics over Temperature
  $\pm 50\times10^{-6}$/ −40 to +105℃ is available for Industrial Equipment.

Pb-Free

RoHS Compliant

■ 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

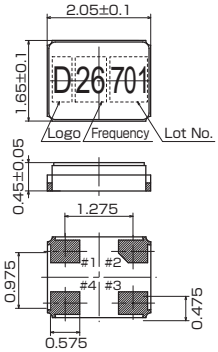
■ Standard Specification

Item \ Type	DSX211SH		DSX221SH				DSX321SH		
Frequency Range	24 to 30MHz	30 to 50MHz	12 to 16MHz	16 to 24MHz	24 to 30MHz	30 to 54MHz	12 to 20MHz	20 to 28MHz	28 to 50MHz
Overtone Order	Fundamental								
Load Capacitance	8pF, 10pF, 12pF								
Drive Level	10μW (100μW max.)		10μW (200μW max.)						
Frequency Tolerance	$\pm 20\times10^{-6}$(at 25℃)								
Series Resistance	100Ω max.	80Ω max.	200Ω max.	150Ω max.	100Ω max.	60Ω max.	80Ω max.	60Ω max.	50Ω max.
Frequency Characteristics over Temperature	$\pm 30\times10^{-6}$ / −30 to +85℃ (Ref. to 25℃)								
Storage Temperature Range	−40 to +85℃								
Packing Unit	3000pcs./reel(φ180)								

Consult our sales representative for other specifications.

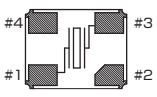
■ DSX211SH [mm]

■ Dimensions



■ Internal Connections

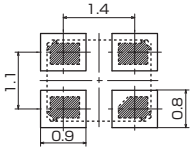
〈Top View〉



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

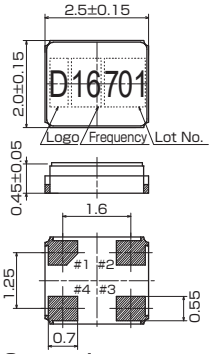
■ Recommended Land Pattern

〈Top View〉



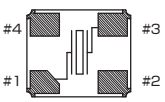
■ DSX221SH [mm]

■ Dimensions



■ Internal Connections

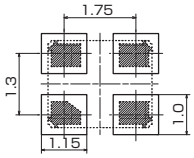
〈Top View〉



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

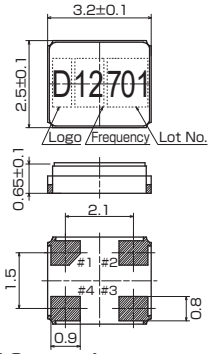
■ Recommended Land Pattern

〈Top View〉



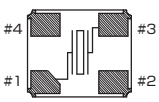
■ DSX321SH [mm]

■ Dimensions



■ Internal Connections

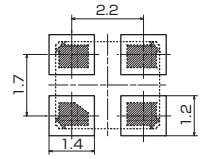
〈Top View〉



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

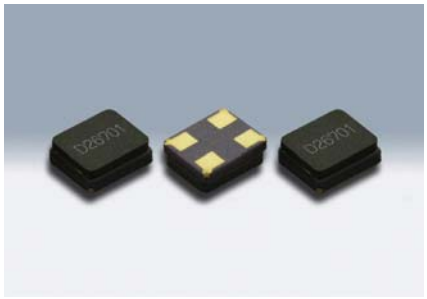
■ Recommended Land Pattern

〈Top View〉



SMD Crystal Resonators / MHz Band Crystal Resonators

DSX211G



Actual size

RoHS Compliant

■ 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.
- Utilizing vacuum glass sealing, lower ESR equivalent to that in alloy/seam weld sealing is optionally available.
- Moisture prevention packing is unnecessary. Moisture Sensitivity Level:LEVEL1 (IPC/JEDEC J-STD-033)
- AEC-Q200 Compliant
- Frequency Characteristics over Temperature $\pm 50\times10^{-6}$/ −40 to +105℃ 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

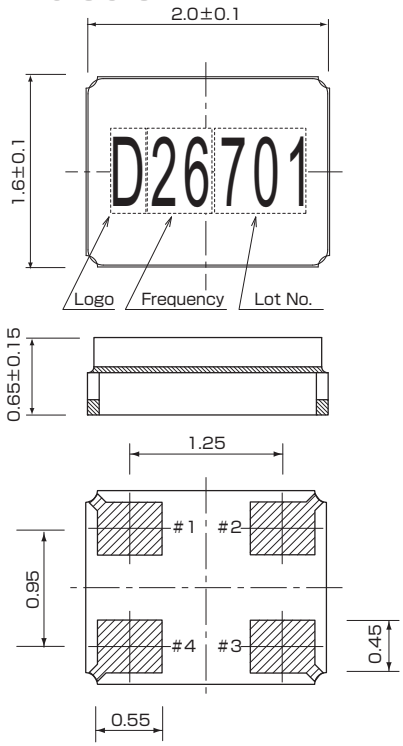
■ Standard Specification

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	$\pm 20\times10^{-6}$ (at 25℃)			
Series Resistance(Inside Atmosphere:nitrogen)	200Ω max.	150Ω max.	120Ω max.	80Ω max.
Series Resistance(Inside Atmosphere:vacuum)	150Ω max.	100Ω max.		60Ω max.
Frequency Characteristics over Temperature	$\pm 30\times10^{-6}$ / −30 to +85℃ (Ref. to 25℃)			
Storage Temperature Range	−40 to +85℃			
Packing Unit	3000pcs./reel (φ180)			

Consult our sales representative for other specifications.

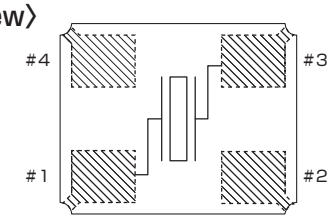
[mm]

■ Dimensions



■ Internal Connections

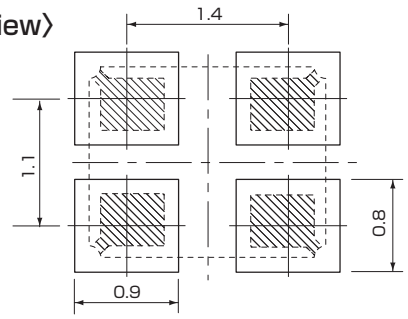
〈Top View〉



#1 & #3 connected to quartz element
#2 & #4 open (unconnected)

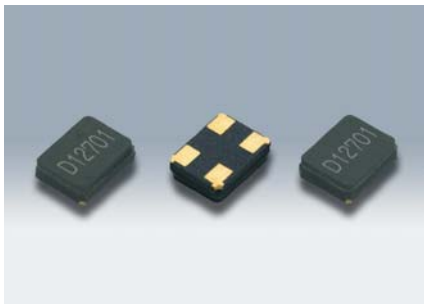
■ Recommended Land Pattern

〈Top View〉



SMD Crystal Resonators / MHz Band Crystal Resonators

DSX221G



Actual size

RoHS Compliant

■ Features

- 2520 size miniature and lightweight SMD crystal resonator with a low profile of 0.75mm.
- Excellent heat resistance, High precision and high reliability (Frequency aging specification of $\pm1\times10^{-6}$/1 year or $\pm3\times10^{-6}$/5 years is available for cell phone or wireless communication systems etc.)
- Offers a wide range of frequencies from 12MHz up to 64MHz. Moisture prevention packing is unnecessary.
- Moisture Sensitivity Level:LEVEL1 (IPC/JEDEC J-STD-033)
- AEC-Q200 Compliant
- Frequency Characteristics over Temperature $\pm50\times10^{-6}$/ −40 to +105℃ is available for Industrial Equipment.

■ Applications

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

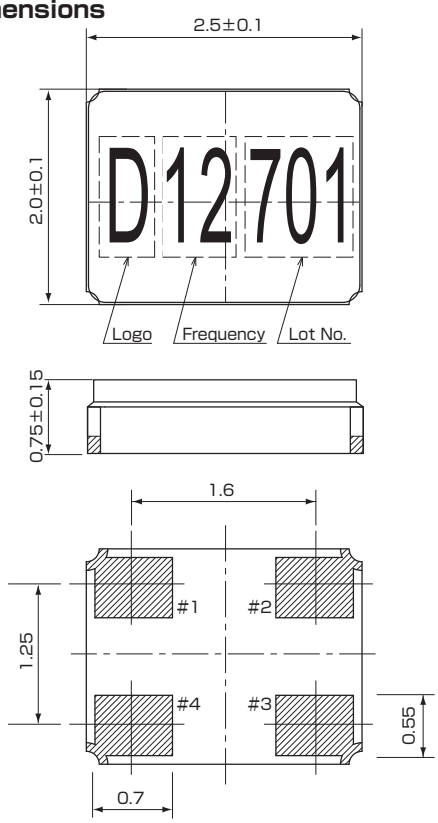
■ Standard Specification

Item \ Type	DSX221G				
Frequency Range	12 to 13MHz	13 to 16MHz	16 to 20MHz	20 to 27MHz	27 to 64MHz
Overtone Order	Fundamental				
Load Capacitance	8pF, 10pF, 12pF				
Drive Level	10μW (200μW max.)				
Frequency Tolerance	$\pm20\times10^{-6}$ (at 25℃)				
Series Resistance	250Ω max.	150Ω max.	100Ω max.	80Ω max.	60Ω max.
Frequency Characteristics over Temperature	$\pm30\times10^{-6}$ / −30 to +85℃ (Ref. to 25℃)				
Storage Temperature Range	−40 to +85℃				
Packing Unit	3000pcs./reel (φ180)				

Consult our sales representative for other specifications.

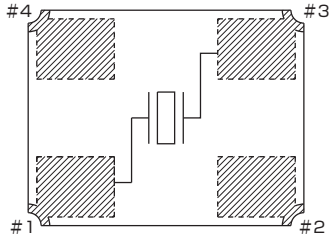
[mm]

■ Dimensions



■ Internal Connections

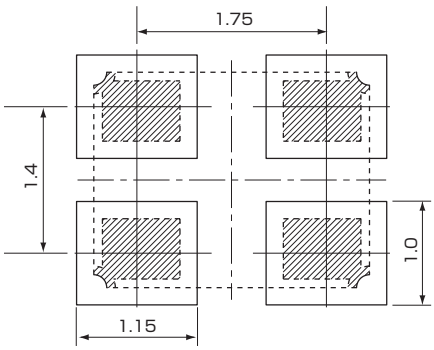
〈Top View〉



#1 & #3 connected to quartz element
#2 & #4 open (unconnected)

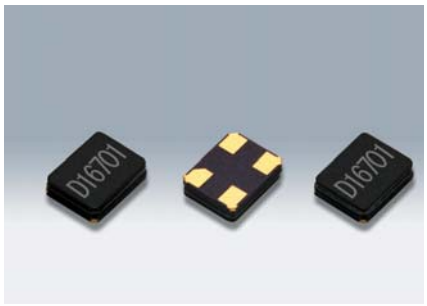
■ Recommended Land Pattern

〈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 (under 12MHz): 0.85mm
- Excellent heat resistance, High precision and high reliability (Frequency aging specification of $\pm1\times10^{-6}$/1 year or $\pm3\times10^{-6}$/5 years is available for cell phone or wireless communication systems etc.)
- Offers a wide range of frequencies from 7.9MHz up to 64MHz.
- Moisture prevention packing is unnecessary.
  Moisture Sensitivity Level:LEVEL1 (IPC/JEDEC J-STD-033)
- AEC-Q200 Compliant
- Fully lead free option available.
- Frequency Characteristics over Temperature
  $\pm50\times10^{-6}$/ −40 to +105℃ 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

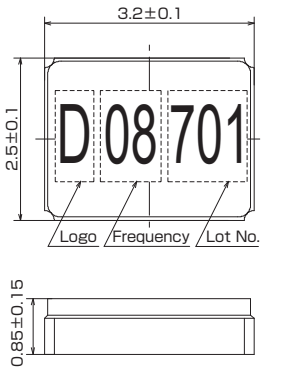
■ Standard Specification

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	$\pm20\times10^{-6}$ (at 25℃)						
Series Resistance	400Ω max.	300Ω max.	150Ω max.	100Ω max.	80Ω max.	60Ω max.	50Ω max.
Frequency Characteristics over Temperature	$\pm30\times10^{-6}$ / −30 to +85℃ (Ref. to 25℃)						
Storage Temperature Range	−40 to +85℃						
Packing Unit	3000pcs./reel (φ180)						

Consult our sales representative for other specifications.

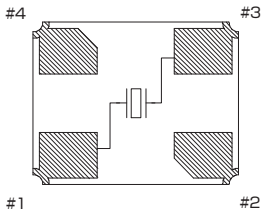
■ DSX321G (under 12MHz) [mm]

■ Dimensions



■ Internal Connections

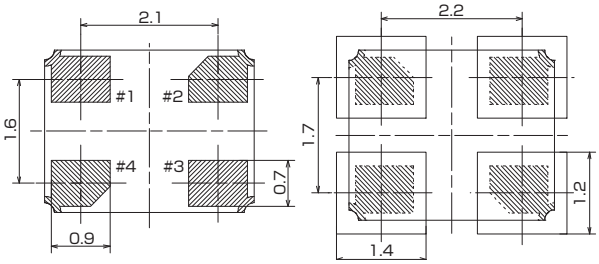
〈Top View〉



#1 & #3 connected to quartz element
#2 & #4 open (unconnected)

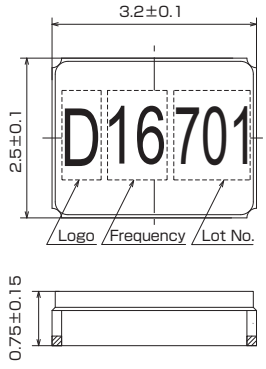
■ Recommended Land Pattern

〈Top View〉



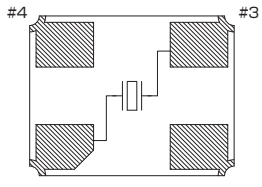
■ DSX321G (over 12MHz) [mm]

■ Dimensions



■ Internal Connections

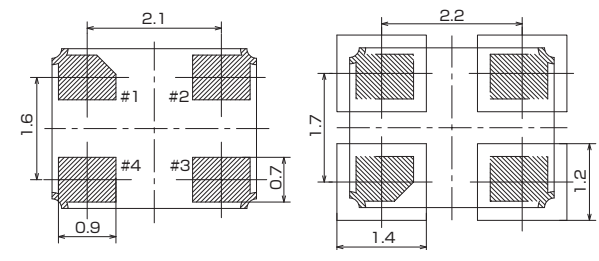
〈Top View〉



#1 & #3 connected to quartz element
#2 & #4 open (unconnected)

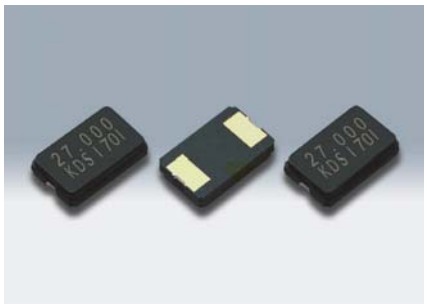
■ Recommended Land Pattern

〈Top View〉



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 70MHz. Moisture prevention packing is unnecessary.
- Moisture Sensitivity Level:LEVEL1 (IPC/JEDEC J-STD-033) AEC-Q200 Compliant
- Suitable for car navigation systems, digital AV equipment as well as many other applications.

RoHS Compliant

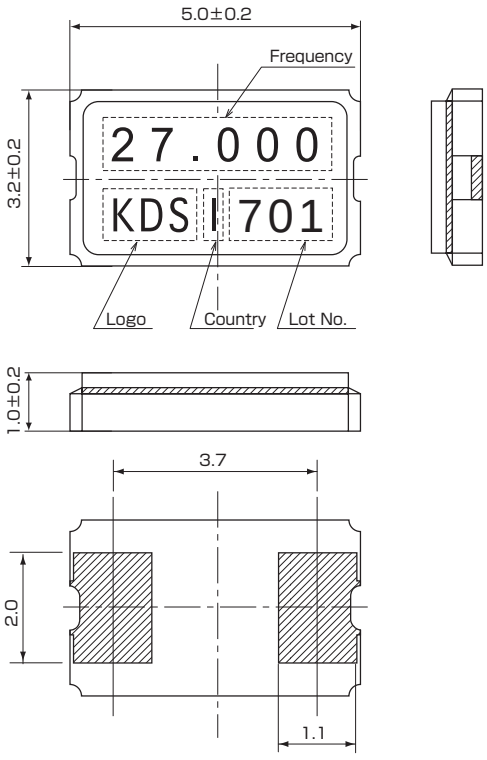
■ Standard Specification

Item \ Type	DSX530GA				
Frequency Range	7 to 9MHz	9 to 12MHz	12 to 40MHz	40 to 54MHz	45 to 70MHz
Overtone Order	Fundamental				3rd overtone
Load Capacitance	8pF, 10pF, 12pF				Series
Drive Level	10μW (300μW max.)				10μW (500μW max.)
Frequency Tolerance	±30×10^{-6} (at 25℃)				
Series Resistance	150Ω max.	100Ω max.	50Ω max.		100Ω max.
Frequency Characteristics over Temperature	±50×10^{-6} / −30 to +85℃ (Ref. to 25℃)				
Storage Temperature Range	−40 to +85℃				
Packing Unit	1000pcs./reel (φ180)				

Consult our sales representative for other specifications.

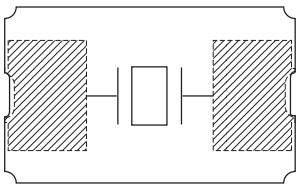
[mm]

■ Dimensions



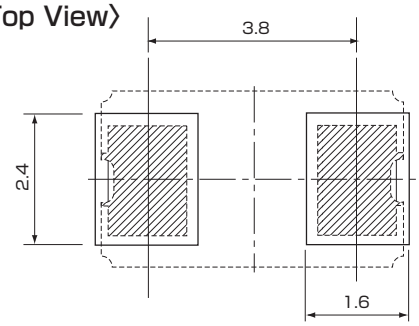
■ Internal Connections

〈Top View〉



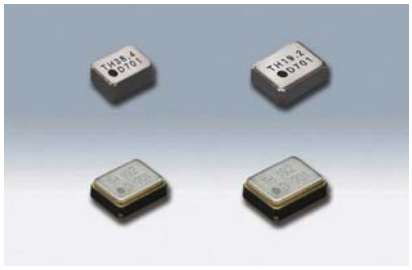
■ Recommended Land Pattern

〈Top View〉



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

DSR1612ATH/DSR211ATH/DSR211STH/DSR221STH



Actual size DSR1612ATH DSR211ATH DSR211STH DSR221STH

Pb-Free

RoHS Compliant

■ Features

- DSR1612ATH: 1612size, height 0.65mm max.
  DSR211ATH: 2016size, height 0.65mm max.
  DSR211STH: 2016size,
  height 0.8mm max. (19.2MHz / 26MHz)
  0.65mm max. (38.4MHz)
  DSR221STH: 2520size height 1.0mm max.
- Built-in NTC thermistor
- Moisture prevention packing is unnecessary.
  Moisture Sensitivity Level : LEVEL 1(IPC/JEDEC J-STD-033)

■ Applications

- Mobile phones
- GPS/GNSS
- Wearable devices

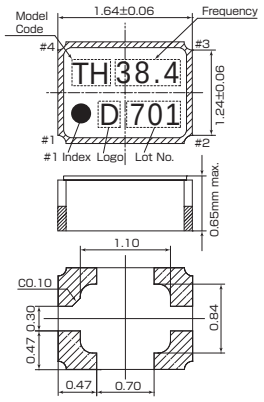
■ Standard Specification

Item \ Type	DSR1612ATH	DSR211ATH	DSR211STH	DSR221STH
Frequency Range	38.4MHz	19.2MHz/26MHz/38.4MHz		19.2MHz/26MHz
Overtone Order	Fundamental			
Load Capacitance	7pF, 8pF			
Drive Level	10μW (100μW max.)			
Frequency Tolerance	±10×10^{-6} (at 25℃)			
Series Resistance	80Ω max.			
Frequency Characteristics over Temperature	±12×10^{-6} / −30 to +85 ℃			
Storage Temperature Range	−40 to +125 ℃			
Thermistor Resistance	100kΩ (at +25℃)			
Thermistor B-constant	4250K (+25℃ to +50℃)			
Packing Unit	3000pcs./reel (φ180)			

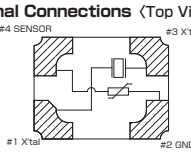
Consult our sales representative for other specifications.

■DSR1612ATH [mm]

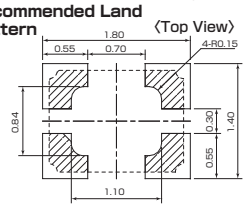
■ Dimensions



■ Internal Connections 〈Top View〉

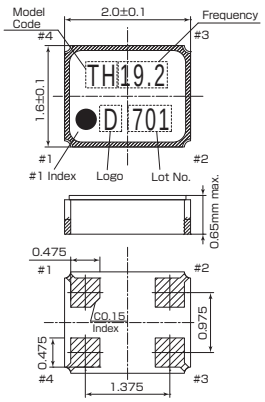


■ Recommended Land Pattern 〈Top View〉

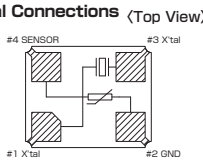


■DSR211ATH [mm]

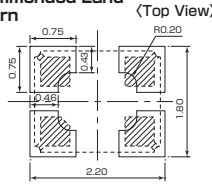
■ Dimensions



■ Internal Connections 〈Top View〉

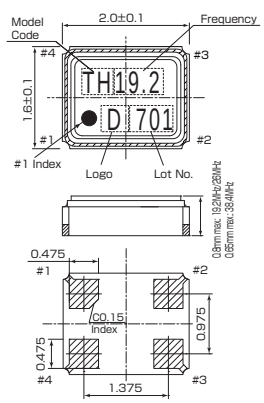


■ Recommended Land Pattern 〈Top View〉

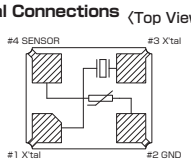


■DSR211STH [mm]

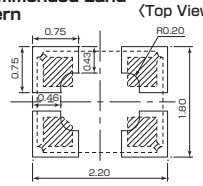
■ Dimensions



■ Internal Connections 〈Top View〉

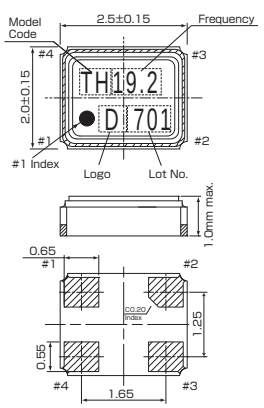


■ Recommended Land Pattern 〈Top View〉

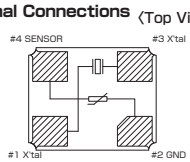


■DSR221STH [mm]

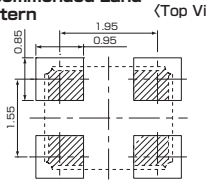
■ Dimensions



■ Internal Connections 〈Top View〉

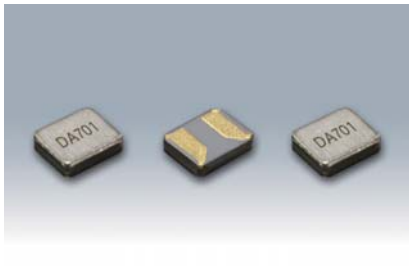


■ Recommended Land Pattern 〈Top View〉



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 0.35mm max.
- A ceramic package with a metal lid providing high precision and reliability.
- Suitable for mobile communications and consumer devices.

Pb-Free

RoHS Compliant

■ Applications

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

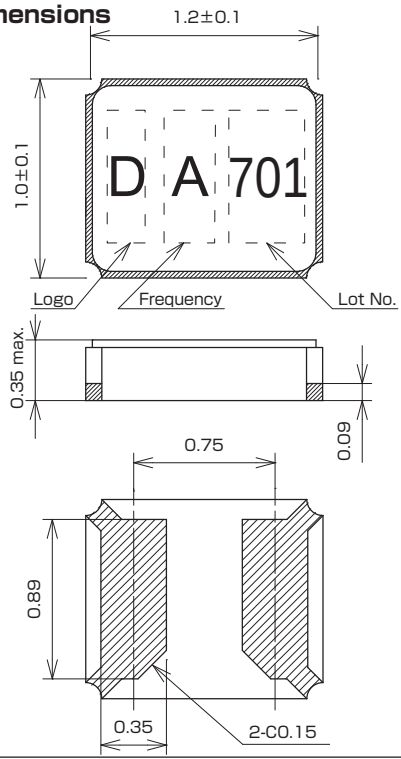
■ Standard Specification

Item \ Type	DST1210A
Frequency Range	32.768kHz
Load Capacitance	7pF, 9pF, 12.5pF
Drive Level	0.1μW (0.2μW max.)
Frequency Tolerance	±20×10^{-6}(at 25℃)
Series Resistance	80kΩ max.
Turnover Temperature	+25℃±5℃
Parabolic Coefficient	−0.04×10^{-6}/℃^{2} max.
Operating Temperature Range	−40 to +85℃
Storage Temperature Range	−40 to +85℃
Shunt Capacitance	1.1pF typ.
Packing Unit	3,000pcs/reel (φ180)

Consult our sales representative for other specifications.

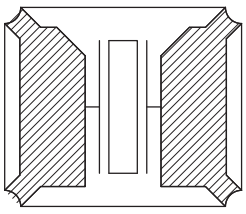
[mm]

■ Dimensions



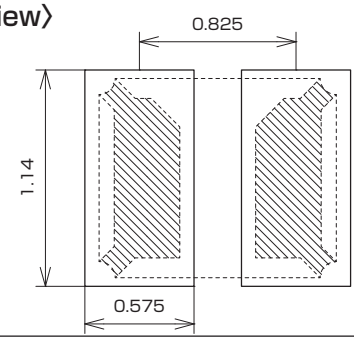
■ Internal Connections

〈Top View〉



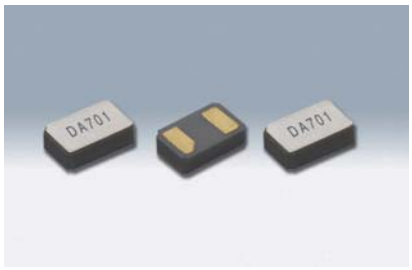
■ Recommended Land Pattern

〈Top View〉

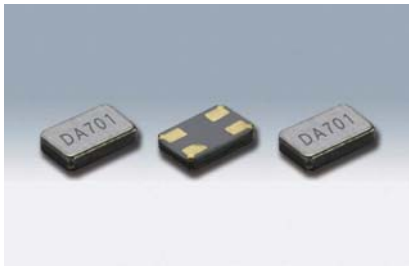


SMD Tuning Fork Crystal Resonators / kHz Band Crystal Resonators

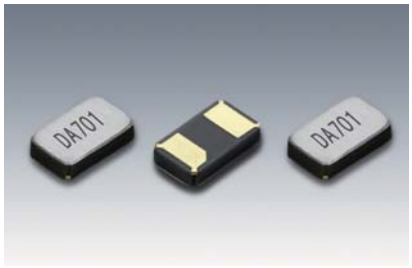
DST1610A/DST1610AL/DST210AC



DST1610A Actual size



DST1610AL Actual size



DST210AC Actual size

■ Features

- Ultra miniature SMD tuning fork crystal resonator
  DST1610A: 1610size height 0.5mm max.
  DST1610AL: 1610size height 0.35mm max.
  DST210AC: 2012size height 0.55mm max.
- A ceramic package with a metal lid providing high precision and reliability.
- Metal lid connected to GND terminal to reduce EMI (DST1610AL).
- Suitable for mobile communications and consumer devices.
- AEC-Q200 Compliant (DST210AC)

Pb-Free

RoHS Compliant

■ Applications

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

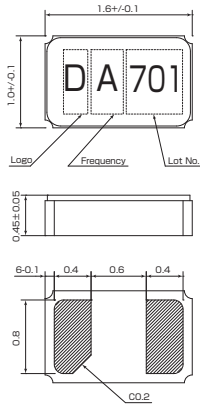
■ Standard Specification

Item \ Type	DST1610A	DST1610AL	DST210AC
Frequency Range	32.768kHz		
Load Capacitance	7pF, 9pF, 12.5pF		
Drive Level	0.1μW (0.5μW max.)		
Frequency Tolerance	±20×10^{-6}(at 25℃)		
Series Resistance	80kΩ max.		
Turnover Temperature	+25℃±5℃		
Parabolic Coefficient	−0.04×10^{-6}/℃^{2} max.		
Operating Temperature Range	−40 to +85℃		
Storage Temperature Range	−40 to +85℃		
Shunt Capacitance	1.3pF typ.	1.2pF typ.	1.3pF typ.
Packing Unit	3,000pcs/reel (φ180)		

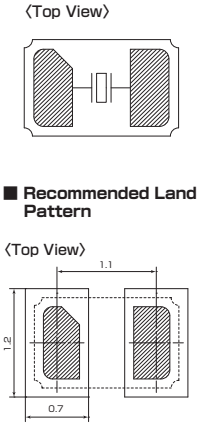
Consult our sales representative for other specifications.

■DST1610A [mm]

■ Dimensions

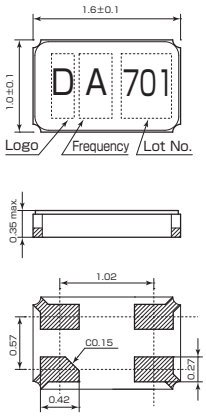


■ Internal Connections

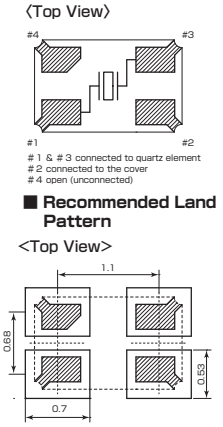


■DST1610AL [mm]

■ Dimensions

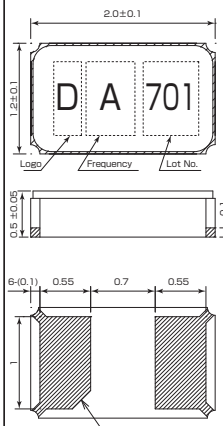


■ Internal Connections

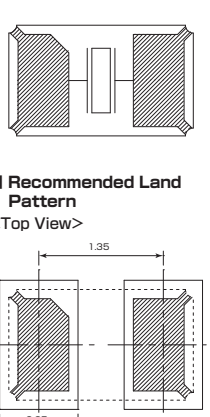


■ DST210AC [mm]

■ Dimensions

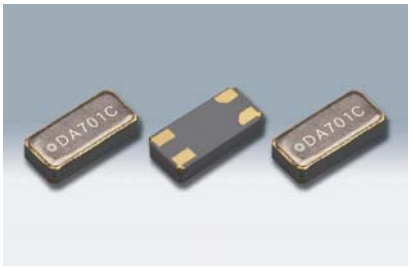


■ Internal Connections
〈Top View〉



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).

Pb-Free

RoHS Compliant

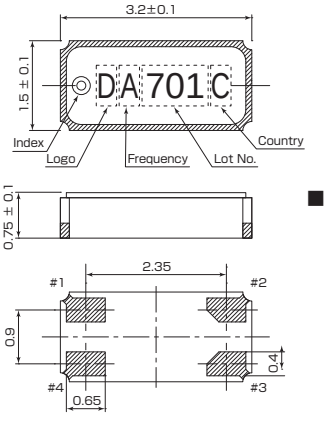
■ Standard Specification

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^{-6} (at 25℃)	
Series Resistance	50kΩ max./80kΩ max.	
Turnover Temperature	+25℃±5℃	
Parabolic Coefficient	−0.04×10^{-6}/℃^{2} max.	
Operating Temperature Range	−40 to +85℃	
Storage Temperature Range	−40 to +85℃	
Shunt Capacitance	0.9pF typ.	1.3pF typ.
Packing Unit	3000pcs./reel (φ180)	

Consult our sales representative for other specifications.

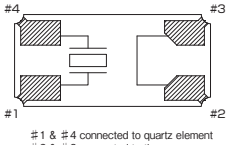
■ DST311S [mm]

■ Dimensions



■ Internal Connections

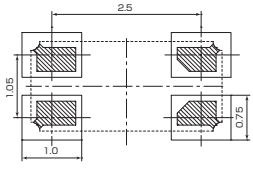
<Top View>



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

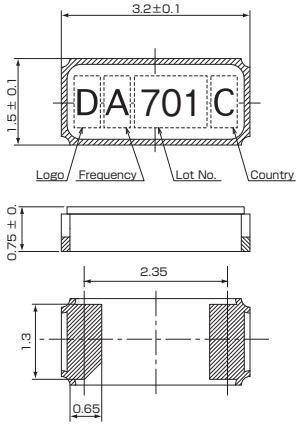
■ Recommended Land Pattern

<Top View>



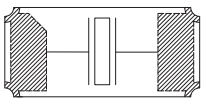
■ DST310S [mm]

■ Dimensions



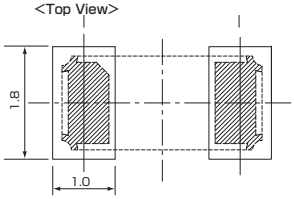
■ Internal Connections

<Top View>



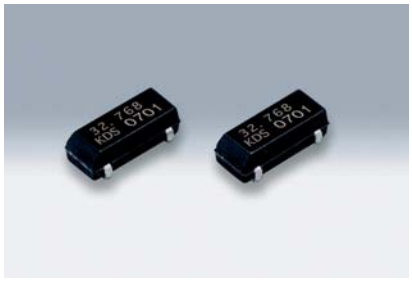
■ Recommended Land Pattern

<Top View>



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

RoHS Compliant

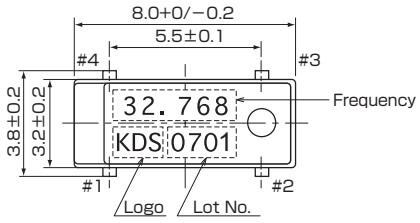
■ Standard Specification

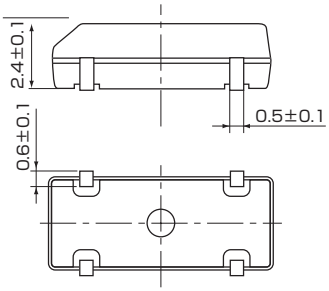
Item \ Type	DMX-26S
Frequency Range	32.768kHz (30 to 90kHz)
Load Capacitance	7pF, 9pF, 12.5pF
Drive Level	1.0μW (2.0μW max.)
Frequency Tolerance	±20×10^{-6}(at 25℃)
Series Resistance	50kΩ max. ※
Turnover Temperature	+25℃±5℃ ※
Parabolic Coefficient	−0.04×10^{-6}/℃^{2} max.
Operating Temperature Range	−40 to +85℃
Storage Temperature Range	−40 to +85℃
Shunt Capacitance	1.25pF typ. ※
Packing Unit	2500pcs./reel (φ330)

※A custom specification will be provided for the frequency other than 32.768kHz. Consult our sales representative for other specifications.

[mm]

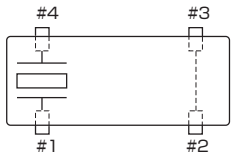
■ Dimensions





■ Internal Connections

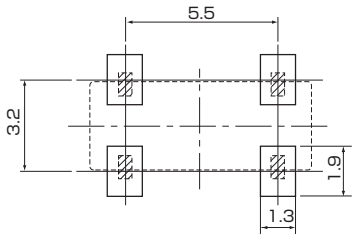
〈Top View〉



#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.

Pb-Free

RoHS Compliant

■ Features

- A cylindrical type tuning fork crystal resonator

■ Standard Specification

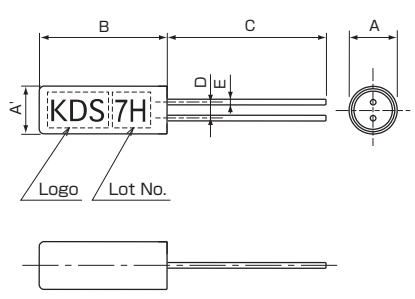
Item \ Type	DT-38	DT-381	DT-26	DT-261
Frequency Range	32.768kHz	20 to 90kHz	32.768kHz	28 to 90kHz
Load Capacitance	12.5pF ※1			
Drive Level	1.0μW (2.0μW max.)			
Frequency Tolerance	GRADE A±20×10^{-6} (at 25℃) GRADE B±30×10^{-6} (at 25℃)			
Series Resistance	30kΩ max. ※2		40kΩ max. ※2	
Turnover Temperature	+25℃±5℃			
Parabolic Coefficient	−0.04×10^{-6}/℃^{2} max.			
Operating Temperature Range	−10 to +60℃			
Storage Temperature Range	−20 to +70℃			
Shunt Capacitance	1.3pF typ.	※2	1.1pF typ.	※2

※1: Other capacitance value is available upon your request. ※2: Upon customer request.
Consult our sales representative for other specifications.

■ Dimensions[mm]

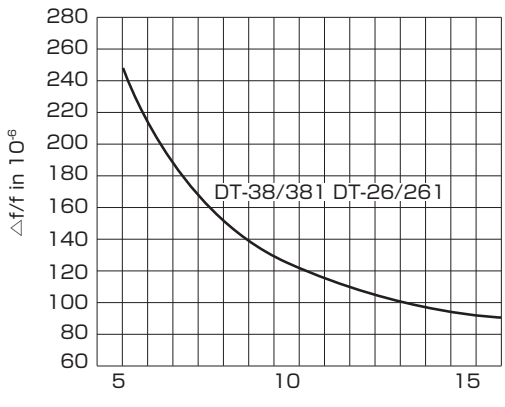
Type	A'	A	B	C	D	E
DT-38, DT-381	φ3.0	$\phi 3.0^{+0.1}_{-0.2}$	$8.0^{+0.3}_{-0.2}$	10.0±1.0	1.1±0.2	φ0.35±0.07
DT-26, DT-261	φ2.0	$\phi 2.0^{+0}_{-0.2}$	$6.0^{+0.1}_{-0.2}$	7.5±1.0	0.7±0.2	φ0.28±0.05

■ Dimensions [mm]



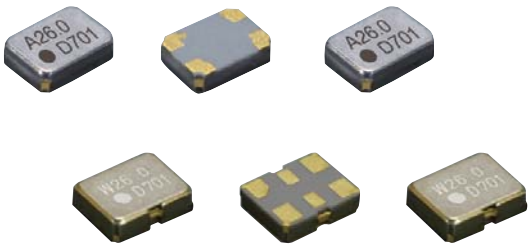
D: Measured from the root of leads

■ Load Capacitance Characteristics (Example)



MEMO

Quartz Devices
Crystal oscillators



〈Example〉

D S O 3 2 1 S R

Surface mount crystal oscillator	
Type of oscillator	A: VC-TCXO B: TCXO V: VCXO O: SPXO
Length	First 2 digits of the dimention (L<2mm) First digit of the dimention in Millimeter (2≦L<10mm) "1" (L≧10mm)
Width	First 2 digits of the dimention (L<2mm) First digit of the dimention in Millimeter (2mm≦L)
Number of terminals	0: two terminals 1: four terminals 3: six terminals Except for VCXO and TCXO
Sealing method,Structure	S: seam weld seal A: melting alloy H: Hybrid
Product charactrtistics	
Packaging,Electrical Characteristis	S: Single Package M: Multi-function

D S A 1 6 1 2 S D N

KDS DAISHINKU CORP.

Selection Guide

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

Icons: VC Voltage Control Function, Stb Stand-by Function, 2OP Two Output 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) L	W	H (max.)	Output	Frequency Range (MHz)	Frequency Characteristics over Temperature (×10⁻⁶)	Operating Temperature Range (℃)	Supply Voltage (V)	Function	Recommended Application	Catalog Page
DSA1612SDN		1.6	1.2	0.55	CS	16 to 60	±1.0 ±0.5	-40 to +85℃	+1.68 to +3.5	VC	IE TC AE	30・31 84・85
DSB1612SDN							±0.5					
DSB1612SDNB										Stb		
DSA211SDN		2.0	1.6	0.8		12.288 to 52	±1.0 ±0.5			VC		
DSB211SDN							±0.5					
DSB211SDNB										Stb		
DSA221SDN		2.5	2.0	0.9		9.6 to 52	±1.0 ±0.5			VC		
DSB221SDN							±0.5					
DSB221SDNB										Stb		
DSA321SDN		3.2	2.5	1.0			±1.0 ±0.5			VC		
DSB321SDN							±0.5					
DSB321SDNB										Stb		
DSA211SP		2.0	1.6	0.7	CS	12.288 to 52	±1.0	-40 to+105℃	+1.68 to +3.5	VC	AE	83
DSB211SP							±0.5					
DSA221SP		2.5	2.0	0.9		9.6 to 52	±1.0			VC		
DSB221SP							±0.5					
DSB211SJA		2.0	1.6	0.8	CMOS	13 to 26, 32 to 52	±5.0	-40 to+105℃	+1.7 to +3.6	Stb	IE TC AE	36・86
DSB211SLB		2.0	1.6	0.7	CS	12.288 to 40	±0.5	-40 to +85℃	+1.1 to +1.4	Stb	TC	29
DSB221SLB		2.5	2.0	0.9		9.6 to 40						
DSB321SLB		3.2	2.5	1.0								
DSA222MAA		2.5	2.0	0.8	CS/CS	13 to 52	±2.0	-30 to +85℃	+2.3 to +3.63	VC Stb 2OP	TC	32・33
DSB222MAA										2OP		
DSA222MAB					CS/CMOS	13 to 40				VC 2OP		
DSB222MAB										2OP		
DSA535SC		5.0	3.2	1.5	CS	10 to 30	±2.5	-30 to +85℃	+2.3 to +5.5	VC	TC	34
DSB535SC												
DSA535SD		5.0	3.2	1.2		9.6 to 40	±1.0	-40 to +85℃		VC	IE TC	
DSB535SD							±0.5					
DSA535SG		5.0	3.2	1.5	CS or CMOS	10 to 40	±0.28	-40 to +85℃	+2.7 to +5.5	VC Stb	IE TC	35
DSB535SG										Stb		

Clock Oscillators (SPXO)

Type	Actual Size	Size (mm) L	W	H (max.)	Output	Frequency Range (MHz)	FrequencyTolerance (×10⁻⁶) (Includes frequency tolerance at room temperature.)	Operating Temperature Range (℃)	Supply Voltage (V)	Current Consumption (mA)	Recommended Application	Catalog Page
DSO1612AR		1.6	1.2	0.58	CMOS	0.584375 to 80	±50 ±100	-40 to +85℃ -40 to +125℃	+1.6 to +3.6	1.4 to 3.8	CE TC AE	44・78
DSO211AR		2.0	1.6	0.8	CMOS	0.4 to 80	±50 ±100	-40 to +85℃ -40 to +125℃	+1.6 to +3.6	1.0 to 5.0 2.5 to 6.0	CE TC AE	45・78
DSO221SR		2.5	2.0	0.895	CMOS	0.2 to 167	±50 ±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	46・47 79
DSO321SR		3.2	2.5	1.2								
DSO531SR		5.0	3.2	1.2								
DSO751SR		7.3	4.9	1.7								
DSO211AN		2.0	1.6	0.8	CMOS	9.6 to 80	±50	-40 to +85℃	+0.8 to +1.6	1.2 to 6.8	CE TC	42
DSO221SN		2.5	2.0	0.895		1.5625 to 100						
DSO321SN		3.2	2.5	1.2								
DSO221SY		2.5	2.0	0.895	CMOS	1.049 to 8.5	±35 ±50	-40 to +85℃	+1.6 to +3.6	0.7	CE TC AE	49・81
DSO321SY		3.2	2.5	1.2								
DSO211AB		2.0	1.6	0.8	CMOS	3.25 to 52	±50	-40 to +85℃	+5.0	8.0	CE IE	43
DSO221SBM		2.5	2.0	0.895								
DSO321SBM		3.2	2.5	1.2		0.7 to 90				4.0 to 8.0		
DSO321SBN												
DSO321SVN									+3.3	2.0 to 6.0		
DSO531SBM		5.0	3.2	1.2					+5.0	4.0 to 8.0		
DSO531SBN												
DSO531SVN									+3.3	2.0 to 6.0		
DSO751SBM		7.3	4.9	1.7					+5.0	4.0 to 8.0		
DSO751SBN												
DSO751SVN									+3.3	2.0 to 6.0		
DSO753HV		7.0	5.0	2.2	CMOS	170 to 230	±50	-20 to +70℃	+3.3	70	IE TC	53
DLO555MB	—	5.0	4.0	5.0	CMOS	0.75 to 54	±50, ±100	-10 to +85℃	+1.6 to +5.5	8.0	CE IE	54

Low Phase Noise Crystal Oscillators (SPXO)

Type	Actual Size	Size (mm) L	W	H (max.)	Output	Frequency Range (MHz)	Frequency Tolerance (×10⁻⁶) (Includes frequency tolerance at room temperature.)	Operating Temperature Range (℃)	Supply Voltage (V)	Current Consumption (mA)	Recommended Application	Catalog Page
DSO211AH		2.0	1.6	0.8	CMOS	1.2 to 80	±50 ±80	-40 to +85℃ -40 to +105℃	+1.6 to +3.6	2.8 to 5.0	CE TC AE	40・76
DSO221SH		2.5	2.0	0.895	CMOS	3.5 to 52	±50	-40 to +85℃	+1.6 to +3.6	2.8 to 5.0	CE TC	40
DSO321SH		3.2	2.5	1.2								
DSO221SHF		2.5	2.0	0.9	CMOS	1.5 to 80	±50 ±100	-40 to +85℃ -40 to +125℃	+1.6 to +5.5 +1.6 to +3.6	2.8 to 9.1 3.7 to 9.1	CE TC AE	41・77

Differential Output Crystal Oscillators (SPXO)

Type	Actual Size	Size (mm) L	W	H (max.)	Output	Frequency Range (MHz)	Frequency Tolerance (×10⁻⁶) (Includes frequency tolerance at room temperature.)	Operating Temperature Range (℃)	Supply Voltage (V)	Current Consumption (mA)	Recommended Application	Catalog Page
DSO223SD		2.5	2.0	0.895	HCSL	13.5 to 167	±50 ±80	-40 to +85℃ -40 to +105℃	+2.5, +3.3	35 30	CE IE TC AE	50・82
DSO223SJ					LVDS					20		
DSO223SK					LV-PECL					50 45		
DSO323SD		3.2	2.5	1.2	HCSL	13.5 to 212.5 13.5 to 167				35 30		
DSO323SJ					LVDS					20		
DSO323SK					LV-PECL					50 45		
DSO533SJ		5.0	3.2	1.2	LVDS	13.5 to 212.5	±50	-40 to +85℃	+2.5, +3.3	20	CE IE TC	51
DSO533SK					LV-PECL					50		
DSO753SD		7.3	4.9	1.7	HCSL					35	CE IE	52
DSO753SJ					LVDS					20		
DSO753SK					LV-PECL					50		
DSO753HJ		7.0	5.0	2.2	LVDS	212.5 to 350	±50	-20 to +70℃	+2.5, +3.3	70	IE TC	53
DSO753HK					LV-PECL					90		

Voltage Controlled Crystal Oscillators (VCXO)

Type	Actual Size	Size (mm) L	W	H (max.)	Output	Frequency Range (MHz)	Frequency Tolerance (×10⁻⁶) (Includes frequency tolerance at room temperature.)	Operating Temperature Range (℃)	Frequency Adjustment Range (×10⁻⁶)	Supply Voltage (V)	Current Consumption (mA)	Recommended Application	Catalog Page
DSV211AR		2.0	1.6	0.8	CMOS	19.2 to 60	±40	-30 to +85℃	±80	+1.8	2.9	CE	55
DSV211AV						12 to 80			±100	+2.8, +3.3	9.4, 13.6		
DSV221SR		2.5	2.0	0.895	CMOS	7.5 to 60	±40	-30 to +85℃	±100	+1.8	2.0, 3.0	CE	56
DSV221SV						6.75 to 90			±125	+2.8, +3.3	3.0 to 13.5		
DSV321SR		3.2	2.5	1.2	CMOS	13.5 to 54	±40	-30 to +85℃	±100	+1.8	2.0, 3.0	CE	57
DSV321SV						6.75 to 90			±125	+2.8, +3.3	3.0 to 12		
DSV323SV		3.2	2.5	1.2	CMOS	6.75 to 170	±50	-40 to +85℃	±100	+3.3	12, 25	CE TC	59
DSV531SB		5.0	3.2	1.4	CMOS	5.0 to 50	±50	-10 to +70℃	±100	+5.0	15	CE	58
DSV532SB		5.0	3.2	1.2									
DSV531SV		5.0	3.2	1.4		1.25 to 80				+3.3	10, 15		
DSV532SV		5.0	3.2	1.2									
DSV753SB		7.3	4.9	1.7	CMOS	4.0 to 50	±50	-40 to +85℃	±100	+5.0	15	CE	60
DSV753SV						2.0 to 170				+3.3	12, 25		
DSV753HV		7.0	5.0	2.2	CMOS	170 to 230	±50	-20 to +70℃	±100	+3.3	70	CE TC	61

Differential Output Voltage Controlled Crystal Oscillators (VCXO)

Type	Actual Size	Size (mm) L	W	H (max.)	Output	Frequency Range (MHz)	Frequency Tolerance (×10⁻⁶) (Includes frequency tolerance at room temperature.)	Operating Temperature Range (℃)	Frequency Adjustment Range (×10⁻⁶)	Supply Voltage (V)	Current Consumption (mA)	Recommended Application	Catalog Page
DSV323SD		3.2	2.5	1.2	HCSL	80 to 170	±50	-40 to +85℃	±100	+3.3	40	CE TC	59
DSV323SJ					LVDS						30		
DSV323SK					LV-PECL	40 to 170					50		
DSV753SD		7.3	4.9	1.7	HCSL	80 to 170	±50	-40 to +85℃	±100	+3.3	40	CE	60
DSV753SJ					LVDS						30		
DSV753SK					LV-PECL	40 to 170					50		
DSV753HJ		7.0	5.0	2.2	LVDS	170 to 350	±50	-20 to +70℃	±100	+3.3	70	CE TC	61
DSV753HK					LV-PECL						90		
DSV753CJ		7.0	5.0	2.2	LVDS	350 to 700	±50	-20 to +70℃	±100	+3.3	60	CE TC	62
DSV753CK					LV-PECL						80		

Oven Controlled Crystal Oscillator (OCXO)

Type	Actual Size	Size (mm) L	W	H (max.)	Output	Frequency Range (MHz)	Frequency Characteristics over Temperature (×10⁻⁹)	Operating Temperature Range (℃)	Supply Voltage (V)	Power Consumption (W)	Tolerance (×10⁻⁹)	vs. Aging (×10⁻⁹)	Function	Recommended Application	Catalog Page
DLC117	–	25.4	25.4	13.5	CMOS	10 to 20	±20	-20 to +70℃	+3.3, +5.0	1.0 (equilibrium)	±100	±100	VC	CE IE	39

Real Time Clock Module (RTC) / kHz Band TCXO

Type	Actual Size	Size (mm) L	W	H (max.)	Output	Frequency Range (kHz)	Frequency Tolerance (×10⁻⁶) (Includes frequency tolerance at room temperature.)	Operating Temperature Range (℃)	Supply Voltage (V)	Current Consumption (μA)	Temperature Compensated Type	Recommended Application	Catalog Page
DSK324SR		3.2	2.5	1.0	CMOS	32.768	±5.0	-40 to +85℃	+1.3 to +5.5	2.0, 4.0	Digital	CE IE AE	38・88
DSK321STD		3.2	2.5	1.0	CMOS	32.768	±5.0	-40 to +85℃	+1.3 to +5.5	2.0 to 3.2	Digital	CE IE AE	37・87

kHz Band SPXO

Type	Actual Size	Size (mm) L	W	H (max.)	Output	Frequency Range (MHz)	Frequency Tolerance (×10⁻⁶) (Includes frequency tolerance at room temperature.)	Operating Temperature Range (℃)	Supply Voltage (V)	Current Consumption (μA)	Recommended Application	Catalog Page
DSO221SR (kHz)		2.5	2.0	0.895	CMOS	32.768 to 50	±35 ±100	-40 to +85℃ -40 to +125℃	+1.6 to +5.5	50 to 100 65 to 120	CE TC AE	48・80
DSO321SR (kHz)		3.2	2.5	1.2								
DSO221SY (kHz)		2.5	2.0	0.895	CMOS	32.768	±35 ±50	-40 to +85℃	+1.6 to +3.6	18	CE TC AE	49・81
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)

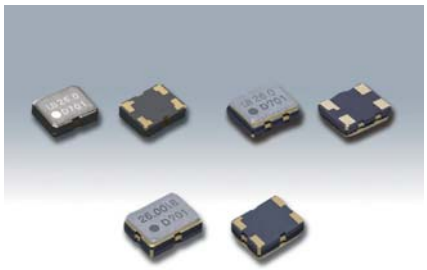
RTC is a high-precision crystal application product with built-in tuning-fork crystal oscillator, has an interrupt function and data provide function necessary for calendar clock function, such as year, month, day, hour, minute and second.

Terminology

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

High-precision SMD TCXO

DSB211SLB/DSB221SLB/DSB321SLB



Actual size DSB211SLB DSB221SLB DSB321SLB

■Features

- Low voltage operation (Supply Voltage Range:+1.1 to +1.4V)
- Low phase noise
- Single packaged structure
- Moisture prevention packing is unnecessary. Moisture Sensitivity Level : LEVEL 1 (IPC/JEDEC J-STD-033)

Pb-Free

RoHS Compliant

■Applications

- GPS/GNSS
- Industrial radio communications

[Type]

TCXO	Size
DSB211SLB	2016 size
DSB221SLB	2520 size
DSB321SLB	3225 size

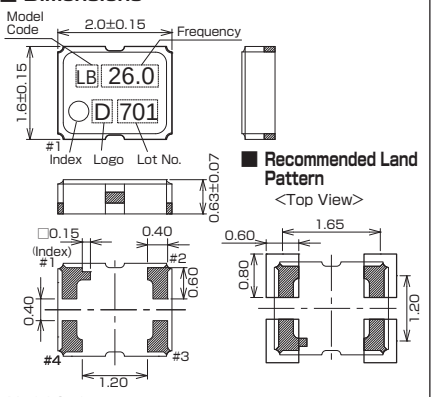
■ Standard Specification

Item \ Type	TCXO		
	DSB211SLB	DSB221SLB	DSB321SLB
Frequency Range	12.288 to 40MHz	9.6 to 40MHz	
Standard Frequency	16.3676MHz/ 16.367667MHz/ 16.368MHz/ 16.369MHz/ 16.8MHz/ 26MHz/ 33.6MHz		
Supply Voltage Range	+1.1 to +1.4V		
Supply Voltage(Vcc)	+1.2V		
Current Consumption	+1.7mA max. (f≦26MHz) +2.2mA max. (f>26MHz)		
Stand-by Current	+3.0μA max.		
Output Level	0.8Vp-p min. (Clipped sine wave / DC-coupled)		
Output Load	10kΩ//10pF		
Frequency Stability Tolerance	±1.5×10^{-6} max.(After 2 reflows)		
vs. Temperature	±0.5×10^{-6} max. / −30 to +85℃		
	±0.5×10^{-6} max. / −40 to +85℃ (Option)		
vs. Supply Voltage	±0.1×10^{-6} max. (Vcc±5%)		
vs. Load	±0.1×10^{-6} max. (10kΩ//10pF ±10%)		
vs. Aging	±1.0×10^{-6} max. /year		
Start up time	2.0msec. max.		
Phase Noise Offset 100Hz Offset 1kHz Offset 10kHz Offset 100kHz	[f≦15MHz] −115dBc/Hz −135dBc/Hz −145dBc/Hz −145dBc/Hz	[15MHz<f≦26MHz] −110dBc/Hz −130dBc/Hz −140dBc/Hz −145dBc/Hz	[26MHz<f≦40MHz] −105dBc/Hz −125dBc/Hz −135dBc/Hz −145dBc/Hz
Packing Unit	3000pcs./reel (φ180)		2000pcs./reel (φ180)

Consult our sales representative for other specifications.

■ DSB211SLB [mm]

■ Dimensions



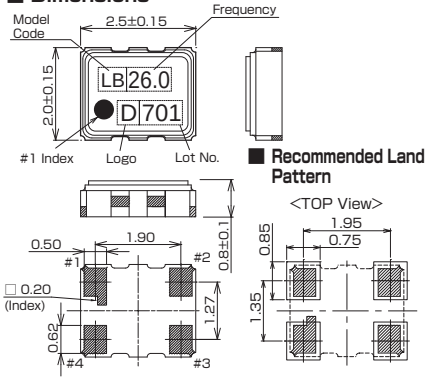
Model Code

Pin Connections

Pin No.	Connection
#1	ENABLE/DISABLE(Stand-by Function)
#2	GND
#3	Output
#4	Vcc

■ DSB221SLB [mm]

■ Dimensions



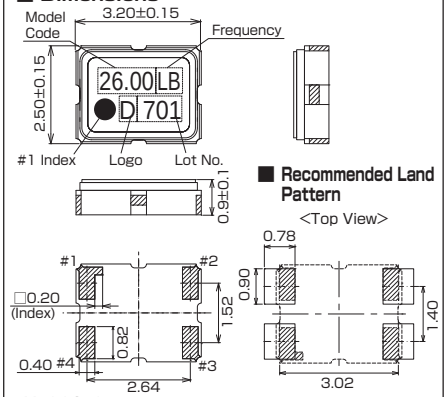
Model Code

Pin Connections

Pin No.	Connection
#1	ENABLE/DISABLE(Stand-by Function)
#2	GND
#3	Output
#4	Vcc

■ DSB321SLB [mm]

■ Dimensions



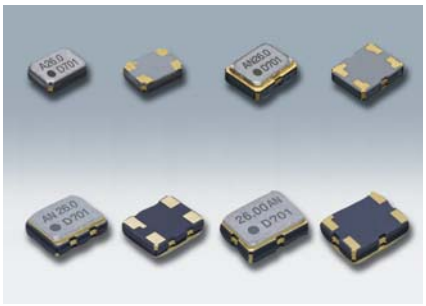
Model Code

Pin Connections

Pin No.	Connection
#1	ENABLE/DISABLE(Stand-by Function)
#2	GND
#3	Output
#4	Vcc

High-precision SMD VC-TCXO/TCXO

DSA1612SDN/DSA211SDN/DSA221SDN/DSA321SDN
DSB1612SDN/DSB211SDN/DSB221SDN/DSB321SDN/DSB1612SDNB/DSB211SDNB/DSB221SDNB/DSB321SDNB



Actual size DSA1612SDN DSA211SDN
DSA221SDN DSA321SDN

■ Features

- Low voltage operation
- Low phase noise
- Single package structure
- Moisture prevention packing is unnecessary.
  Moisture Sensitivity Level : LEVEL 1
  (IPC/JEDEC J-STD-033)

Pb-Free

RoHS Compliant

■ Applications

- Mobile phones
- GPS/GNSS and Industrial radio communications

[Type]

VC-TCXO	TCXO	TCXO(Stand-by Function)	Size
DSA1612SDN	DSB1612SDN	DSB1612SDNB	1612 size
DSA211SDN	DSB211SDN	DSB211SDNB	2016 size
DSA221SDN	DSB221SDN	DSB221SDNB	2520 size
DSA321SDN	DSB321SDN	DSB321SDNB	3225 size

■ Standard Specification

Item \ Type	VC-TCXO				TCXO							
	DSA1612SDN	DSA211SDN	DSA221SDN	DSA321SDN	DSB1612SDN	DSB211SDN	DSB221SDN	DSB321SDN	DSB1612SDNB (Stand-by Function)	DSB211SDNB (Stand-by Function)	DSB221SDNB (Stand-by Function)	DSB321SDNB (Stand-by Function)
Frequency Range	16 to 60MHz	12.288 to 52MHz	9.6 to 52MHz		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.(26<f≦52MHz)/+2.5mA max.(f≦60MHz)											
Stand-by Current	–								+3μA max.			
Output Level	0.8Vp-p min.(f≦52MHz)(Clipped Sinewave/DC-coupled)											
Output Load	10kΩ//10pF											
Frequency Stability Tolerance	±1.5×10^{-6} max.(After 2 reflows)											
vs. Temperature	±1.0×10^{-6},±2.5×10^{-6} max./-30 to +85℃ ±1.0×10^{-6},±2.5×10^{-6} max./-40 to +85℃(Option)				±0.5×10^{-6},±2.5×10^{-6} max./-30 to +85℃ ±0.5×10^{-6},±2.5×10^{-6} max./-40 to +85℃(Option)							
vs. Supply Voltage	±0.2×10^{-6} max.(Vcc ±5%)											
vs. Load Variation	±0.2×10^{-6} max.(10kΩ//10pF±10%)											
vs. Aging	±1.0×10^{-6} max./year											
Frequency Control Control Sensitivity	±3.0×10^{-6} to ±5.0×10^{-6}/Vcont=+1.4V±1V @Vcc≧+2.6V ±3.0×10^{-6} to ±5.0×10^{-6}/Vcont=+0.9V±0.6V @Vcc=+1.8V				–							
Response Slope	Positive				–							
Start up Time	2.0ms max.											
Output Enable Time	–								2.0ms max.			
Phase Noise Offset 100Hz Offset 1kHz Offset 10kHz Offset 100kHz	[f≦26MHz] -115dBc/Hz -130dBc/Hz -150dBc/Hz -155dBc/Hz				[26MHz<f≦40MHz] -110dBc/Hz -130dBc/Hz -150dBc/Hz -155dBc/Hz				[40MHz<f≦52MHz] -105dBc/Hz -125dBc/Hz -145dBc/Hz -150dBc/Hz			
Packing Unit	DSA1612SDN/DSA211SDN/DSA221SDN, DSB1612SDN/DSB211SDN/DSB221SDN, DSB1612SDNB/DSB211SDNB/DSB221SDNB: 3000pcs./reel(φ180) DSA321SDN, DSB321SDN, DSB321SDNB: 2000pcs./reel(φ180)											

Consult our sales representative for other specifications.

High-precision SMD VC-TCXO/TCXO

For Mobile communications/Industrial system/GPS/GNSS

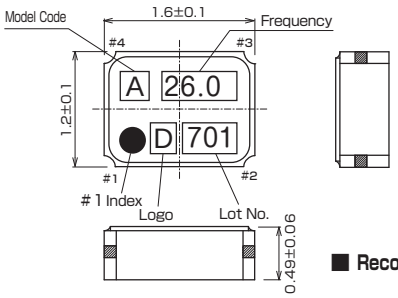
■ Dimensions

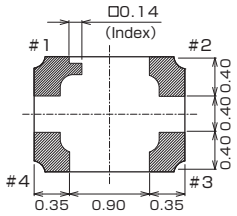
[mm]

■ DSA1612SDN/DSB1612SDNB

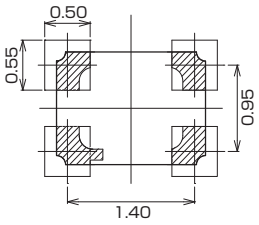
Model Code
A:VC-TCXO(DSA1612SDN)
B:TCXO(DSB1612SDN)
C:TCXO(DSB1612SDNB Stand-by Function)

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





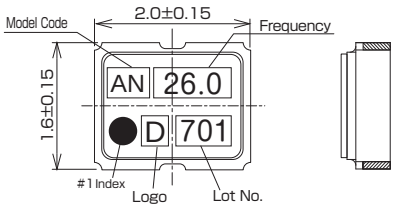
■ Recommended Land Pattern
<Top View>

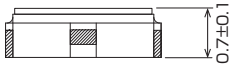


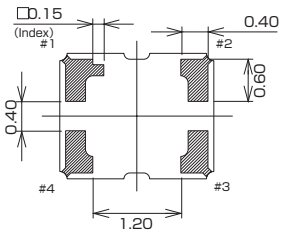
■ DSA211SDN/DSB211SDN/DSB211SDNB

Model Code
AN : VC-TCXO (DSA211SDN)
BN : TCXO (DSB211SDN)
CN : TCXO (DSB211SDNB Stand-by Function)

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







■ Recommended Land Pattern
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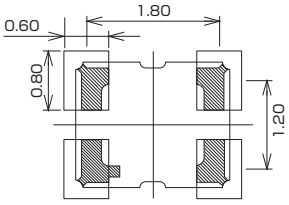
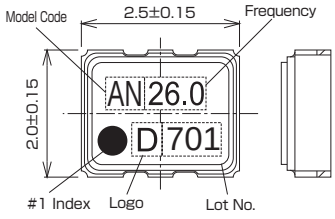
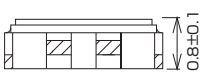


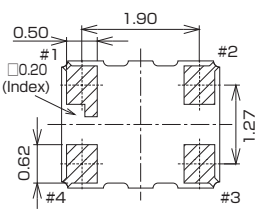
■ DSA221SDN/DSB221SDN/DSB221SDNB

Model Code
AN : VC-TCXO (DSA221SDN)
BN : TCXO (DSB221SDN)
CN : TCXO (DSB221SDNB Stand-by Function)

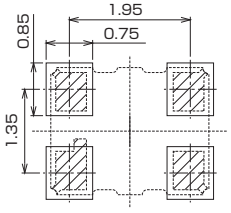
Pin Connections	
Pin No.	Connection
#1	Vcont(VC-TCXO)/GND(TCXO) ENABLE/DISABLE (Stand-by Function)
#2	GND
#3	Output
#4	Vcc







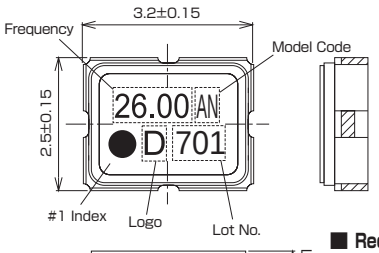
■ Recommended Land Pattern
<Top View>

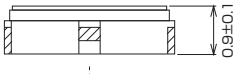


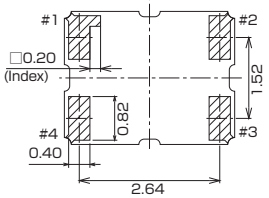
■ DSA321SDN/DSB321SDN/DSB321SDNB

Model Code
AN : VC-TCXO (DSA321SDN)
BN : TCXO (DSB321SDN)
CN : TCXO (DSB321SDNB Stand-by Function)

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







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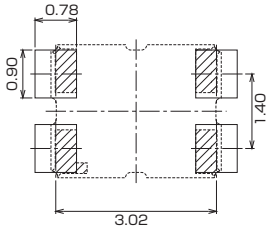
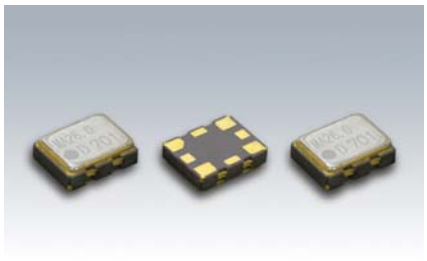


SMD VC-TCXO/TCXO Module

DSA222MAA/DSB222MAA/DSA222MAB/DSB222MAB for Mobile communications



Actual size

■ Features

- 2520size, 0.7mm height. Ultra miniature and lightweight SMD (VC-)TCXO Module(0.0045cc・0.02g)
- 2 output are available :
  Output1 is Clipped Sine wave with ENABLE/DISABLE or CMOS level.
  CMOS level output is related by independent supply.
  Output 2 is a Clipped Sine wave output.
- Temperature sensor output
- Moisture prevention packing is unnecessary.
  Moisture Sensitivity Level : LEVEL 1(IPC/JEDEC J-STD-033)

Pb-Free

RoHS Compliant

■ Applications

- Mobile phones

■ Standard Specification

Item \ Type	DSA222MAA	DSB222MAA	DSA222MAB	DSB222MAB
Output Frequency Range	13 to 52MHz		13 to 40MHz	
Supply Voltage Range(Vcc1)	13MHz/ 19.2MHz/ 26MHz/ 38.4MHz			
Supply Voltage(Vcc1)	+2.3 to +3.63V			
Supply Voltage for buffer(Vcc2)	+2.6V/ +2.8V/ +3.0V/ +3.3V			
Current Consumption	—		+1.6 to +3.63VDC	
Current Consumption Icc1 (Output1 :'ENABLE') Icc1 (Output1 :'DISABLE') Icc2	 2.0mA max.(f≦26MHz)/3.0mA max.(26MHz<f≦52MHz) 1.5mA max.(f≦26MHz)/2.5mA max.(26MHz<f≦52MHz) —		 1.5mA max.(f≦26MHz)/2.0mA max.(26MHz<f≦40MHz) 1.5mA max.(f≦26MHz)/2.0mA max.(26MHz<f≦40MHz) 2.5mA max.(f≦26MHz)/3.5mA max.(26MHz<f≦40MHz)	
Output Level Output1	Clipped Sinewave/ DC-coupled 0.8Vp-p min. ENABLE/DISABLE CONTROL		CMOS '0'Level Vcc2×0.2V max. '1'Level Vcc2×0.8V min.	
Output2	Clipped Sinewave/ DC-coupled 0.8Vp-p min.		Clipped Sinewave/ DC-coupled 0.8Vp-p min.	
Output Load	10kΩ//10pF(Clipped Sinewave),15pF(CMOS)			
Frequency Stability Tolerance	±1.5×10^{-6} max.(After 2 reflows)			
vs. Temperature	±2.0×10^{-6} max./ −30 to +85℃			
vs. Supply Voltage	±0.2×10^{-6} max.(Vcc1±5%)			
vs. Load Variation	±0.2×10^{-6} max.(10kΩ//10pF±10%)			
vs. Aging	±1.0×10^{-6} max./year			
Frequency Control Control Sensitivity	± 9 to ±15×10^{-6} (Vcont=+1.5±1V)	—	± 9 to ±15×10^{-6} (Vcont=+1.5±1V)	—
Response Slope	Positive	—	Positive	—
Start up Time	2.0ms max.			
Phase Noise Offset 100Hz Offset 1kHz Offset 10kHz Offset 100kHz	[13MHz≦f≦26MHz] −110dBc/Hz −130dBc/Hz −140dBc/Hz −145dBc/Hz		[26MHz<f≦52MHz] −105dBc/Hz −125dBc/Hz −135dBc/Hz −145dBc/Hz	
Temp. Sensor Output	+1.474V typ.(Ta=+30℃) −8.20mV/℃ typ.			
Packing Unit	3000pcs./reel(φ180)			

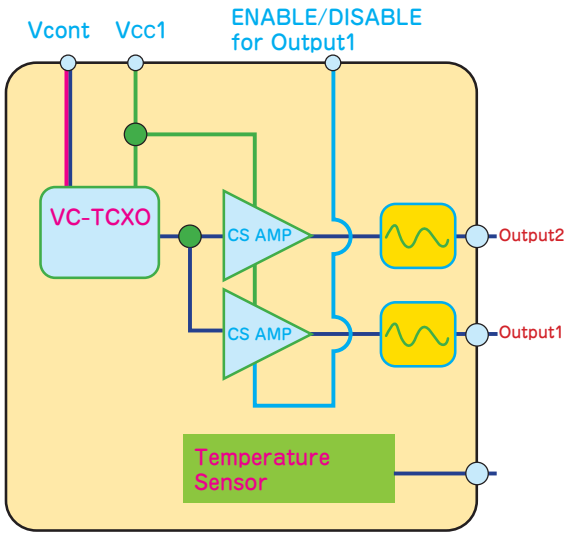
Consult our sales representative for other specifications.

SMD VC-TCXO/TCXO Module

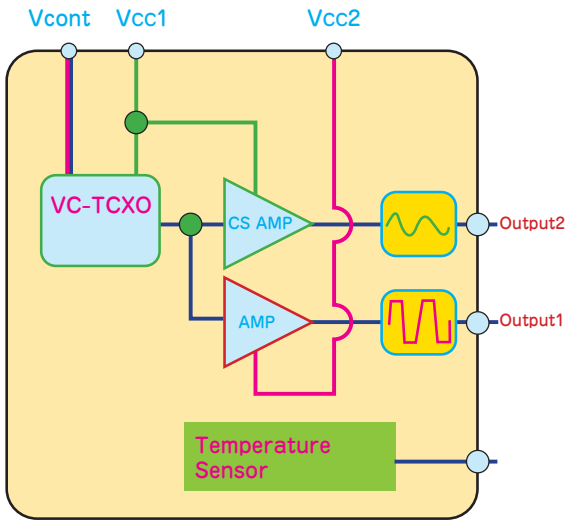
DSA222MAA/DSB222MAA/DSA222MAB/DSB222MAB for Mobile communications

■Block Diagram

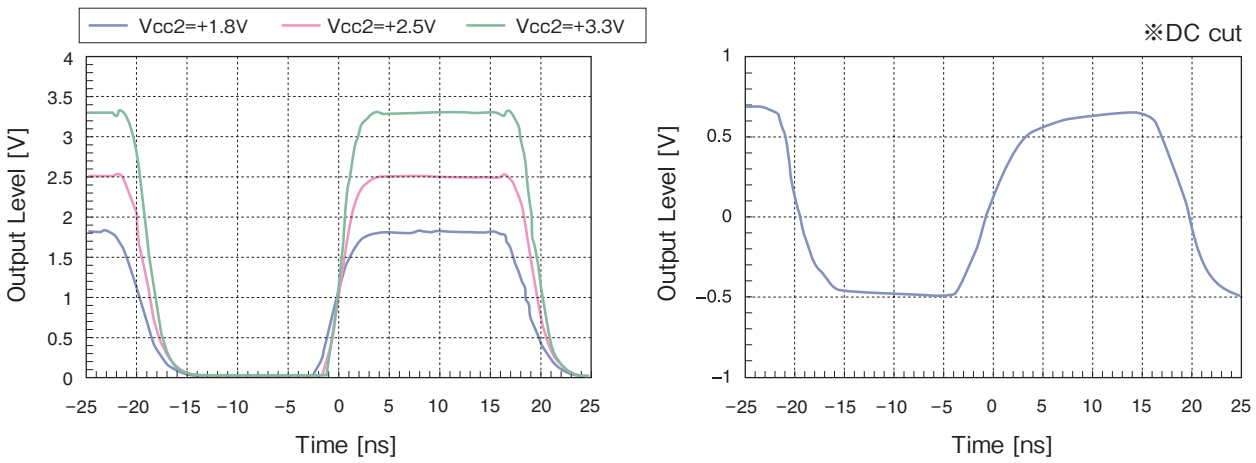
DSA222MAA



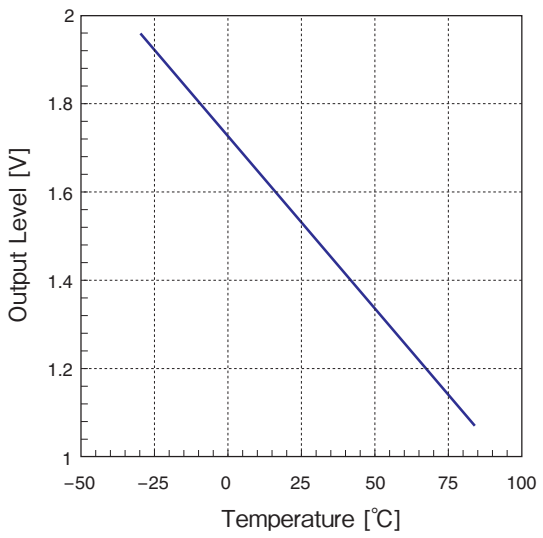
DSA222MAB



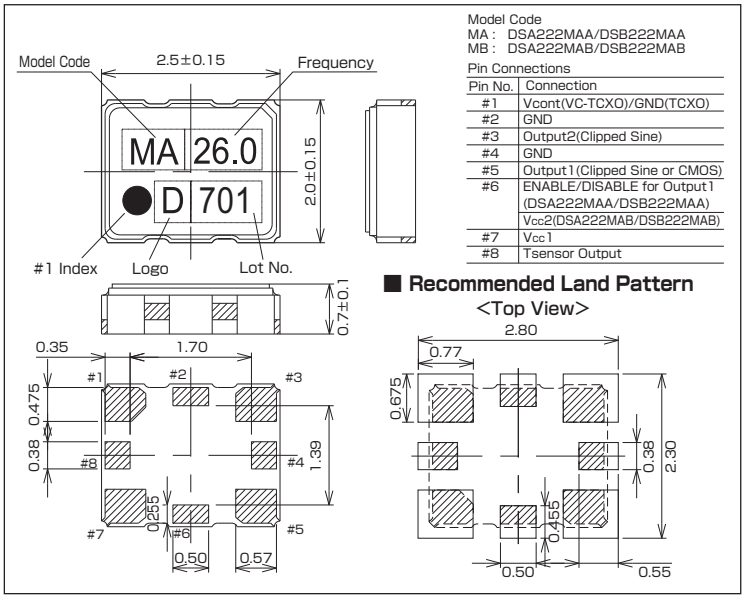
■DSA222MAB 26MHz Output Waveform



■DSA_DSB222MAA/MAB Temp. Sensor Output

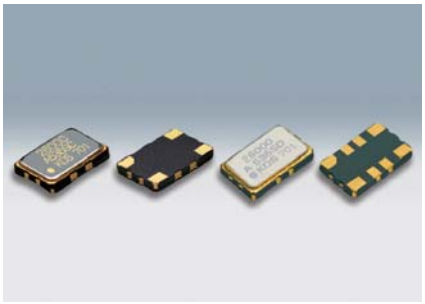


■Dimensions [mm]



High-precision SMD VC-TCXO / TCXO

DSA535SC/DSA535SD/DSB535SC/DSB535SD



Actual size

■ Features

- 5032 size
- Low phase noise
- Single package structure
- Moisture prevention packing is unnecessary.
  Moisture Sensitivity Level : LEVEL 1
  (IPC/JEDEC J-STD-033)

Pb-Free

RoHS Compliant

■ Applications

- Mobile phone
- Other wireless radio communications
- GPS/GNSS
- Industrial radio communications

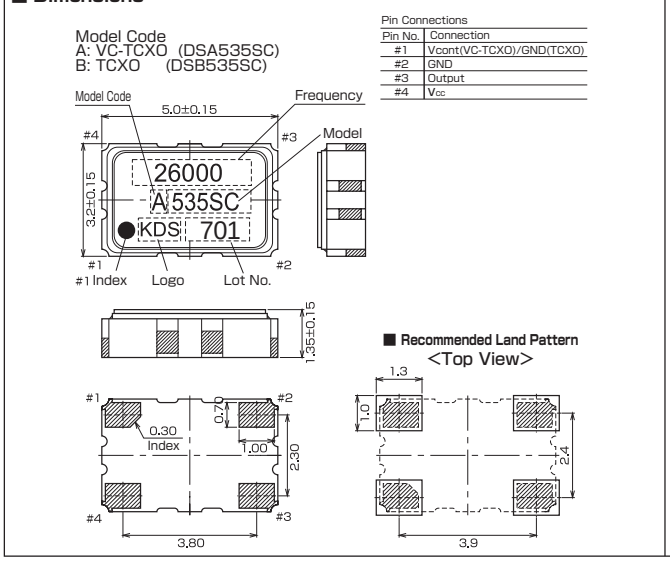
■ Standard Specification

Item	VC-TCXO DSA535SC	TCXO DSB535SC	VC-TCXO DSA535SD	TCXO DSB535SD
Frequency Range	10 to 30MHz		9.6 to 40MHz	
Standard Frequency	13MHz/ 19.2MHz/ 26MHz			16.3676MHz/ 16.367667MHz/ 16.368MHz/ 16.369MHz/ 16.8MHz/ 26MHz
Supply Voltage Range	+2.3 to +5.5V			
Supply Voltage(Vcc)	+2.6V/ +2.8V/ +3.0V / +3.3V			
Current Consumption	+1.1mA max. (f≦15MHz)/+1.3mA max. (f>15MHz)		+1.5mA max. (f≦26MHz)/+2.0mA max. (f>26MHz)	
Output Level	0.8Vp-p min. (Clipped Sinewave / DC-coupled)			
Output Load	10kΩ//10pF			
Frequency Stability Tolerance	±1.5×10^{-6} max.(After 2 reflows)			
vs. Temperature	±2.5×10^{-6} max. / −30 to +85℃		±1.0×10^{-6} max. / −30 to +85℃	±0.5×10^{-6} max. / −30 to +85℃
			±1.0×10^{-6} max. / −40 to +85℃ (Option)	±0.5×10^{-6} max. / −40 to +85℃ (Option)
vs. Supply Voltage	±0.2×10^{-6} max. (Vcc±5%)			
vs. Load Variation	±0.2×10^{-6} max.			
vs. Aging	±1.0×10^{-6} max. /year			
Start up Time	2.0ms max.			
Frequency Control Control Sensitivity	±9.0×10^{-6} to ±15×10^{-6} / Vcont=+1.5V±1V	—	±3.0×10^{-6} to ±5.0×10^{-6} / Vcont=+1.4V±1V	—
Response Slope	Positive	—	Positive	—
Phase Noise	[f≦15MHz]	[15MHz<f]	[f≦15MHz]	[15MHz<f≦26MHz] [26MHz<f≦40MHz]
Offset 100Hz	−110dBc/Hz	−105dBc/Hz	−115dBc/Hz	−110dBc/Hz −105dBc/Hz
Offset 1kHz	−130dBc/Hz	−125dBc/Hz	−135dBc/Hz	−130dBc/Hz −125dBc/Hz
Offset 10kHz	−145dBc/Hz	−140dBc/Hz	−145dBc/Hz	−140dBc/Hz −135dBc/Hz
Offset 100kHz	−145dBc/Hz	−145dBc/Hz	−145dBc/Hz	−145dBc/Hz −145dBc/Hz
Packing Unit	4000pcs./reel(φ330)			

Consult our sales representative for other specifications.

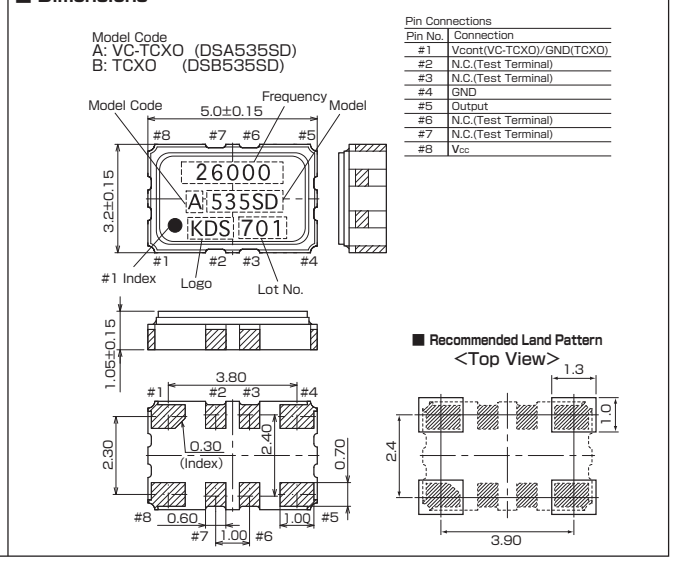
■DSA535SC/DSB535SC [mm]

■ Dimensions



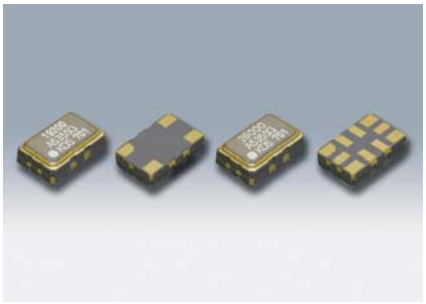
■ DSA535SD/DSB535SD [mm]

■ Dimensions



Ultra High-precision SMD VC-TCXO/TCXO

DSA535SG/DSB535SG for Stratum3/ Femtocell



Actual size

■Features

- 5032 size. 1.35mm height. Miniature (VC-) TCXO (0.024cc・0.08g)
- Wide voltage range. Supply voltage up to +2.7 to +5.5V
- Clipped-sine wave or CMOS level output
- Low phase noise
- Single packaged structure
- Moisture prevention packing is unnecessary.
  Moisture Sensitivity Level: LEVEL 1 (IPC/JEDEC J-STD-033)
- 10 terminals or 4terminals

Pb-Free

RoHS Compliant

■Applications

- Stratum3/ Femtocell/ Industrial radio communications

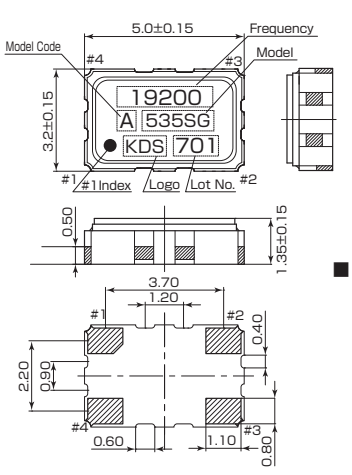
■ Standard Specification

Item	DSA535SG(VC-TCXO)		DSB535SG(TCXO)	
Output Frequency Range	10 to 40MHz			
Standard Frequency	10MHz/ 12.8MHz/ 19.2MHz/ 19.44MHz/ 20MHz/ 38.88MHz			
Supply Voltage(Vcc)	+3.0V/ +3.3V/ +5.0V			
Current Consumption 10≦F≦20MHz	+2.0mA max.	+3.5mA max.	+2.0mA max.	+3.5mA max.
20<F≦40MHz	+2.5mA max.	+5.0mA max.	+2.5mA max.	+5.0mA max.
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 max.	Clipped sine wave 0.8Vp-p min. (DC-coupled)	CMOS '0'level 0.1×Vcc V max. '1'level 0.9×Vcc V max.
Output Load	10kΩ//10pF	15pF	10kΩ//10pF	15pF
Frequency Stability Tolerance	±1.5×10^{-6} max.(After 2 reflows)			
vs. Temperature	±0.28×10^{-6} max./ −40 to +85℃			
	±0.10×10^{-6} max./ −10 to +70℃(Option)			
vs. Hysteresis	±0.10×10^{-6} max.			
vs. Supply Votage	±0.20×10^{-6} max.(Vcc±5%)			
vs. Load Variation	±0.20×10^{-6} max.(10kΩ//10pF±10%)			
vs. Aging	±1.0×10^{-6} max. /year			
Frequency Control Control Sensitivity	± 3.0×10^{-6} to ±5.0×10^{-6} / Vcont=+1.5V±1V ± 3.0×10^{-6} to ±5.0×10^{-6} / Vcont=+2.5V±2V(O.P.Vcc=5V)		—	
Response Slope	Positive		—	
Phase Noise	[10MHz≦f≦20MHz]		[20MHz<f≦40MHz]	
Offset 100Hz	−118dBc/Hz		−110dBc/Hz	
Offset 1kHz	−138dBc/Hz		−132dBc/Hz	
Offset 10kHz	−150dBc/Hz		−148dBc/Hz	
Offset 100kHz	−152dBc/Hz		−150dBc/Hz	
Packing Unit	1000pcs./reel(φ180), 4000pcs./reel(φ330)			

Consult our sales representative for other specifications.

■DSA535SG/DSB535SG(4 terminals) [mm]

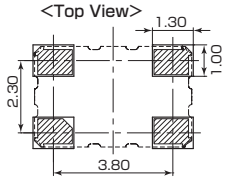
■ Dimensions



Model Code
A : VC-TCXO(DSA535SG)
B : TCXO(DSB535SG)
Pin Connections(4terminals)

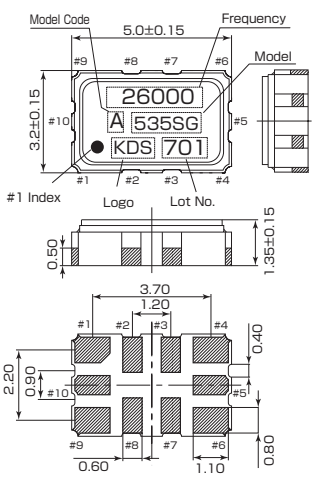
Pin No.	Connection
#1	VCONT(VC-TCXO)/ GND(TCXO)
#2	GND
#3	Output
#4	Vcc

■ Recommended Land Pattern
<Top View>



■ DSA535SG/DSB535SG(10 terminals) [mm]

■ Dimensions

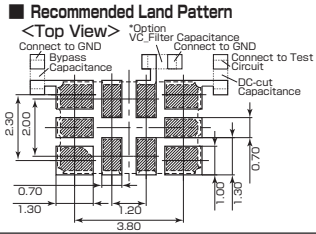


Model Code
A : VC-TCXO(DSA535SG)
B : TCXO(DSB535SG)
Pin Connections(10terminals)

Pin No.	Connection
#1	Vcont(VC-TCXO)/GND(TCXO)
#2	GND(N.C.)
#3	ENABLE/DISABLE
#4	GND
#5	GND(N.C.)
#6	Output
#7	N.C./ VC_FILTER*
#8	GND(N.C.)
#9	Vcc
#10	GND(N.C.)

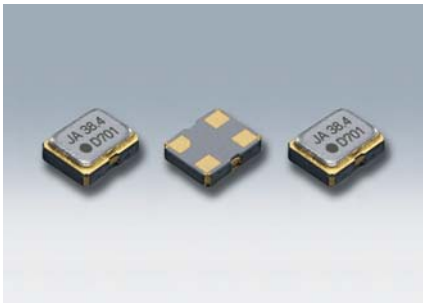
():Internal connection
*extra low phase noise mode with external VC_FILTER(Cvc=0.033μF)

■ Recommended Land Pattern
<Top View>



SMD TCXO

DSB211SJA



Actual size

■Features

- Capable of operating over a wide temperature range, from -40 to +105℃
- Supply voltage up to +1.7 to +3.6V
- CMOS Level Output
- Low phase noise
- Single package structure
- Moisture prevention packing is unnecessary.
  Moisture Sensitivity Level: LEVEL 1 (IPC/JEDEC J-STD-033)
- AEC-Q100 Compliant

Pb-Free

RoHS Compliant

■Applications

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

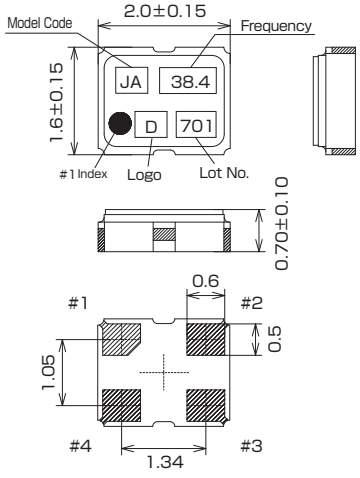
■ Standard Specification

Item \ Type	DSB211SJA (TCXO)	
Frequency Range	13 to 26, 32 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	+10μA max.	
Frequency Stability Tolerance	±1.5×10^{-6} max.(After 2 reflows)	
vs. Temperature	±2.5×10^{-6} max./ -40 to +85℃ ±5.0×10^{-6} max./ -40 to +105℃ ±20×10^{-6} max./ -40 to +125℃(Option)	
vs. Aging	±1.0×10^{-6} max./year	
Symmetry	45 to 55% (50% Vcc Level)	
0 Level Output Voltage	Vcc×0.1V	
1 Level Output Voltage	Vcc×0.9V	
Output Load	15pF	
Rise and Fall Time	5ns max.(10% to 90% Vcc Level)	
OE Pin 0 Level Input Voltage	Vcc×0.2V	
OE Pin 1 Level Input Voltage	Vcc×0.8V	
Start Up Time	3.0ms max.	
Output Enable Time	3.0ms max.	
Output Disable Time	150ns max.	
Start Up Time	[f≦26MHz]	[32MHz<f≦52MHz]
Offset 1kHz	-145dBc/Hz	-141dBc/Hz
Offset 100kHz	-158dBc/Hz	-157dBc/Hz
Packing Unit	3000pcs./reel (φ180)	

Consult our sales representative for other specifications.

[mm]

■ Dimensions



Pin Connections

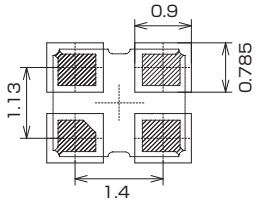
Pin No.	Connection
#1	OE (Output Enable)
#2	GND
#3	Output
#4	Vcc

Function

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

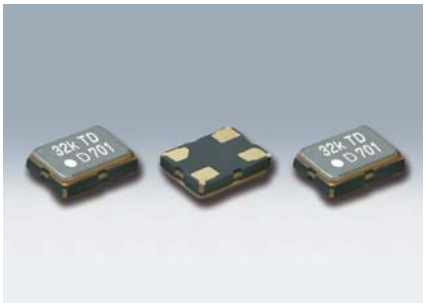
■ Recommended Land Pattern

<Top View>



SMD TCXO

DSK321STD



Actual size

■Features

- Digital temperature compensated type
- High precision:±5.0×10^{-6} (−40 to +85℃)
  ±3.8×10^{-6} (−10 to +60℃)
- Low current consumption
- Moisture prevention packing is unnecessary.
  Moisture Sensitivity Level: Level 1 (IPC/JEDEC J-STD-033)
- AEC-Q 100 compliant

Pb-Free

RoHS Compliant

■Applications

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

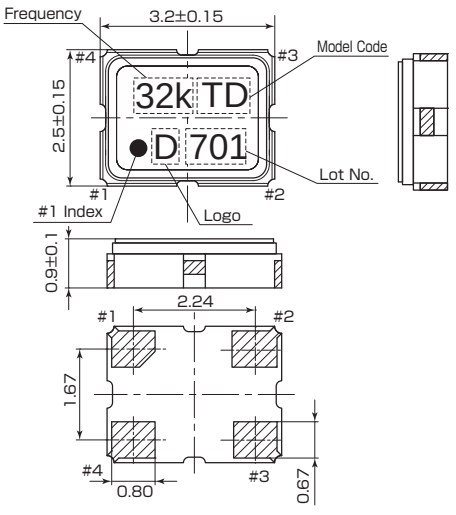
■ Standard Specification

Item	Legend	Spec.				Condition
		min.	typ.	max.	Unit	
Output Frequency	fo	–	32.768	–	kHz	
Supply Voltage Range	Vcc	+2.0	–	+5.5	V	(Temperature Compensated Operating)
		+1.3	–	+5.5		(Clock Timing Operating)
Frequency Tolerance	f_tol	−5.0	–	+5.0	×10^{-6}	−40 to +85℃
		−3.8	–	+3.8		−10 to +60℃
Current Consumption	Icc	–	+1.2	+2.5	μA	Vcc=+3.3V, Temperature Compensation Interval:0.5s, No Load
		–	+1.7	+3.2		Vcc=+5.0V, Temperature Compensation Interval:0.5s, No Load
		–	+1.0	+2.0		Vcc=+3.3V, Temperature Compensation Interval:2.0s, No Load
		–	+1.5	+3.0		Vcc=+5.0V, Temperature Compensation Interval:2.0s, No Load
Symmetry	SYM	40	50	60	%	at 50% Vcc
0 Level Output Voltage	VOL	–	–	+0.4	V	
1 Level Output Voltage	VOH	Vcc-0.4	–	–		
Rise and Fall Time	tr, tf	–	–	50	ns	Vcc=+2.0 to +5.5V, 10 to 90% Vcc Level
		–	–	200		Vcc=+1.3 to +5.5V, 10 to 90% Vcc Level
Load Condition	L_CMOS	–	–	15	pF	
Start Up Time	Tstart	–	–	3.0	s	
Packing Unit	2000pcs./reel (φ180)					

Consult our sales representative for other specifications.

[mm]

■ Dimensions

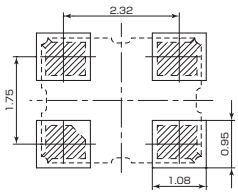


Pin Connections

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

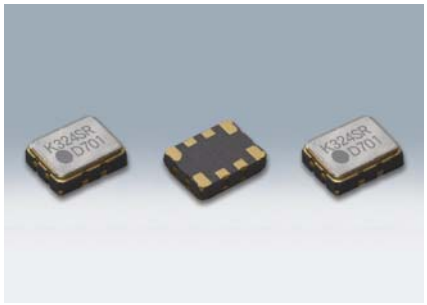
■ Recommended Land Pattern

<Top View>



SMD Real Time Clock Module

DSK324SR



Actual size

■Features

- Digital temperature compensated type
- High precision:±5.0×10^{-6} (−40 to +85℃)
  ±3.8×10^{-6} (−10 to +60℃)
- Low current consumption
- Low voltage operation:+2.0 to +5.5V(Temperature Compensated Operating)
  +1.3 to +5.5V(Clock Timing Operating)
- I^{2}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:
  +2.0V temperature compensation operating voltage detection
  +1.5V supply voltage undervoltage detection
- AEC-Q 100 compliant

Pb-Free

RoHS Compliant

■Applications

- High precision clock source

"I^{2}C-BUS" is a registered trademark of NXP Semiconductor

■ Standard Specification

Item	Legend	Spec. min.	Spec. typ.	Spec. max.	Unit	Condition
Output Frequency	fo	–	32.768	–	kHz	
Supply Voltage Range	Vcc	+1.3	–	+5.5	V	(Clock Timing Operating)
	Vtem	+2.0	–	+5.5		(Temperature Compensated Operating)
	Vint	+1.5	–	+5.5		(Interface Operation) I^{2}C-BUS
Frequency Tolerance	f_tol	−5.0	–	+5.0	×10^{-6}	−40 to +85℃
		−3.8	–	+3.8		−10 to +60℃
Current Consumption	Icc1	–	+0.6	+2.0	μA	Vcc=+3.0V, Temperature Compensation Interval:30s, SCL=SDA=INTN=Vcc,CLKOE=GND(Output Off)
	Icc2	–	+1.5	+4.0	μA	Vcc=+3.0V, Temperature Compensation Interval:30, No Load, SCL=SDA=INTN=CLKOE=Vcc(Output On)
Load Condition	L_CMOS	–	–	15	pF	
Start Up Time	Tstart	–	–	1.0	s	Ta=+25℃, Vcc=+1.3V
		–	–	3.0		Ta=−40 to +85℃, Vcc=+1.3 to +5.5V
Power Supply Detection Voltage	V_{DET1}*1	+1.8	+1.9	+2.0	V	Temperature Compensated Operation Detection Voltage
	V_{DET2}*2	+1.3	+1.4	+1.5		Power Supply Undervoltage Detection
Packing Unit	2000pcs./reel (φ180)					

*1:When Vcc falls below V_{DET1}, the internal detection circuit operates, and the intermittent temperature compensating stops. At the same time, the current temperature compensating data value is retained. When Vcc rises above V_{DET1} again, the intermittent temperature compensating is enabled.
*2:The Detection circuit operates at the temperature compensation interval.

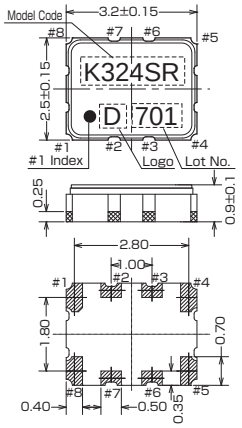
Consult our sales representative for other specifications.

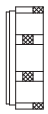
Description

Pin No.	Name	I/O	Function
#1	OE	I	Output control enable input (L:High impedance, H:Clock output)
#2	INTN	O	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	O	Clock output connection.
#6	SCL	I	I^{2}C-BUS serial interface clock input connection.
#7	SDA	I/O	I^{2}C-BUS serial interface data input/output connection.
#8	Vcc	–	Supply Voltage

[mm]

■ Dimensions





Pin Connections

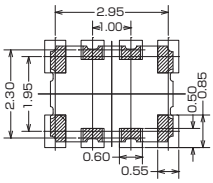
Pin No.	Connection
#1	OE(Output Enable)
#2	INTN
#3	N.C.
#4	GND
#5	Output
#6	SCL
#7	SDA
#8	Vcc

Function

#1 Input	#5 Output condition
H	Oscillation out
L	High Z

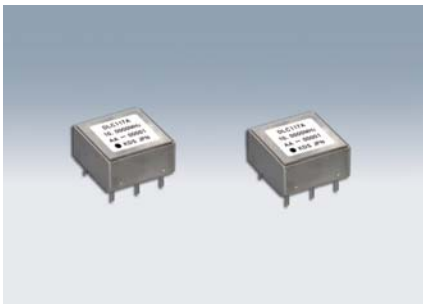
■ Recommended Land Pattern

<Top View>

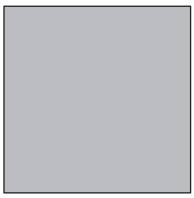


Oven Controlled Crystal Oscillator

DLC117



Actual size



■Features

- Small size OCXO
  25.4(L)×25.4(W)×13.2(H)mm
- Low phase noise
- Extra long-term stability
- Adopt SC-Cut resonator

RoHS Compliant

■Applications

- Base station, Measuring equipment

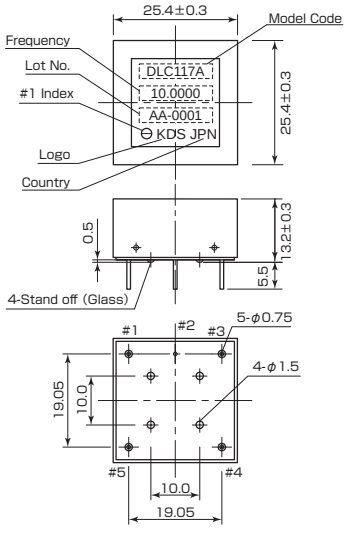
■ Standard Specification

Item \ Type	Legend	DLC117
Output Specification	—	C-MOS
Output Frequency Range	f_0	10 to 20MHz （10.000MHz Standard Specification）
Supply Voltage	Vcc	+3.3V±0.165V/+5.0V±0.25V
Frequency Control Voltage	Vcont	+1.65V±1.65V/+2.5V±2.5V
Operating Temperature Range	T_{use}	−20 to +70 ℃
Frequency Stability	—	
Tolerance		±100×10^{-9} max.
vs. Temperature	fo-Tc	±20×10^{-9} max. [−20 to +70℃]
vs. Supply Votage	fo-Vcc	±5×10^{-9} max. [+3.3V±5%/+5.0V±5%]
vs. Aging	f_{age}	±100×10^{-9} max./year
Frequency Adjustment Range	f_{cont}	±0.5×10^{-6}min. [+1.65±1.65V/+2.5±2.5V]
Power Consumption	—	3W max. [Warm-up]
		1W max. [Steady States]
Output Load	L_{CMOS}	15pF±10%
Symmetry	SYM	45 to 55% [50% Vcc Level]
0 Level Output Voltage	V_{OL}	Vcc×0.1 max.
1 Level Output Voltage	V_{OH}	Vcc×0.9 min.
Rise and Fall Time	tr, tf	15ns max.
Phase Noise		
Offset 10Hz	—	−130dBc/Hz typ.
Offset 100Hz		−142dBc/Hz typ.
Offset 1kHz		−148dBc/Hz typ.
Offset 10kHz		−152dBc/Hz typ.

Consult our sales representative for other specifications.

[mm]

■ Dimensions

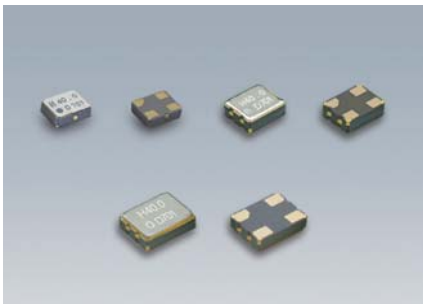


Pin Connections

Pin No.	Connection
#1	Output
#2	GND
#3	V_{cont}
#4	NC
#5	Vcc

SMD Crystal Oscillators

DSO211AH/DSO221SH/DSO321SH



Actual size DSO211AH DSO221SH DSO321SH

■Features

- Supply Voltage: 1.8V/2.5V/2.8V/3.0V/3.3V
- Low phase noise: fout ±1kHz −145 dBc/Hz(Typ.)
  fout ±100kHz −158 dBc/Hz(Typ.)
- Low profile: 0.72mm(DSO211AH), 0.815mm(DSO221SH), 1.1mm(DSO321SH)
- AEC-Q100 Compliant
- 3-state function

Pb-Free

RoHS Compliant

■ Applications

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

[Type]

DSO211AH	2016 size
DSO221SH	2520 size
DSO321SH	3225 size

[Function Code]

DSO****H A A

A : 3.3V
M : 3.0V
B : 2.8V
C : 2.5V
D : 1.8V

A : ±100×10^{-6}
B : ±50×10^{-6}
C : ±30×10^{-6}
D : ±25×10^{-6}
E : ±20×10^{-6}

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

■ Standard Specification

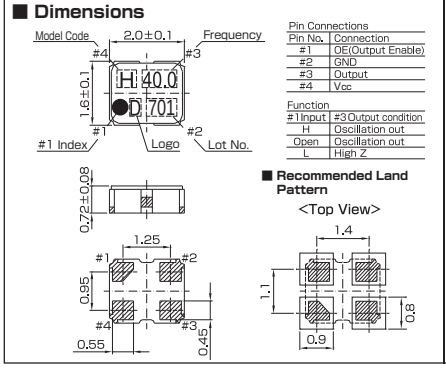
Item	Function Code: Supply Voltage	Function Code: Frequency tolerance	Output Frequency Range (MHz)	Legend	Spec.: min.	Spec.: typ.	Spec.: max.	Spec.: Unit	Condition	
Supply Voltage	A	*	DSO211AH 1.2≦fo≦80 DSO221/321SH 3.5≦fo≦52	Vcc	+3.0	+3.3	+3.6	V		
	M				+2.7	+3.0	+3.3			
	B				+2.6	+2.8	+3.0			
	C				+2.25	+2.5	+2.75			
	D				+1.6	+1.8	+2.0			
Frequency Tolerance (Includes frequency tolerance at room temperature.)	*	A	DSO211AH 1.2≦fo≦80 DSO221/321SH 3.5≦fo≦52	f_tol	−100	−	+100	×10^{-6}	−40 to +85℃	−10 to +70℃ (Standard Operating Temperature Range)
		B			−50	−	+50			
		C			−30	−	+30		−20 to +70℃	
		D			−25	−	+25			
		E			−20	−	+20		−10 to +70℃	
Current Consumption	A,M	*	1.2≦fo≦60	Icc	−	−	4.0	mA	No Load	
			60<fo≦80		−	−	5.0			
	B	*	1.2≦fo≦60		−	−	3.6			
			60<fo≦80		−	−	4.5			
	C	*	1.2≦fo≦60		−	−	3.4			
			60<fo≦80		−	−	4.0			
	D	*	1.2≦fo≦60		−	−	2.8			
			60<fo≦80		−	−	3.5			
Stand-by Current(#1 pin "L" Level)	*	*	*	I_std	−	−	10	μA		
Load Condition	*	*	*	L_CMOS	−	−	15	pF		
Symmetry	*	*	*	SYM	45	50	55	%	at 50% Vcc	
0 Level Output Voltage	*	*	*	VOL	−	−	Vcc×0.1	V		
1 Level Output Voltage	*	*	*	VOH	Vcc×0.9	−	−			
Rise and Fall Time	*	*	*	tr, tf	−	−	6 (5)	ns	10 to 90% Vcc Level (20 to 80% Vcc Level)	
					−	−				
OE Pin 0 Level Input Voltage	*	*	*	VIL	−	−	Vcc×0.2	V		
OE Pin 1 Level Input Voltage	*	*	*	VIH	Vcc×0.8	−	−			
Output Disable Time	*	*	*	tPLZ	−	−	150	ns		
Output Enable Time	*	*	*	tPZL	−	−	5	ms		
Phase Noise	A,M,B,C	*	1.2≦fo≦60	−	−	−145	−	dBc/Hz	Offset 1kHz	
	D				−	−140	−			
	A,M,B,C		60<fo≦80		−	−135	−			
	D				−	−135	−			
	A,M,B,C		1.2≦fo≦60		−	−158	−		Offset 100kHz	
	D				−	−152	−			
	A,M,B,C		60<fo≦80		−	−155	−			
	D				−	−150	−			
Period Jitter (1)	*	*	*	tRMS	−	2.4	−	ps	σ	
				tp-p	−	23	−		Peak to peak	
Total Jitter (1)	*	*	*	tTL	−	34	−	ps	tDJ+n×tRJ n=14.1(BER=1×10^{-12}) (2)	
Phase Jitter	*	*	40≦fo≦80	tpj	−	−	1	ps	fo offset:12kHz to 20MHz	
			10≦fo<40						fo offset:12kHz to 5MHz	
Packing Unit	DSO211AH: 3000pcs./reel(φ180), DSO221SH/DSO321SH: 2000pcs./reel(φ180)									

(1) Measured WAVECREST DTS-2075
(2) tDJ:Deterministic jitter tRJ:Random jitter

Consult our sales representative for other specifications.

■ DSO211AH [mm]

■ Dimensions



Pin Connections

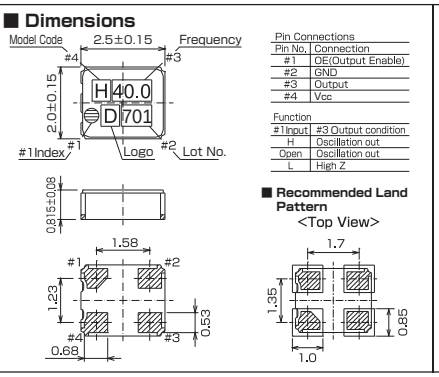
Pin No.	Connection
#1	OE(Output Enable)
#2	GND
#3	Output
#4	Vcc

Function

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

■ DSO221SH [mm]

■ Dimensions



Pin Connections

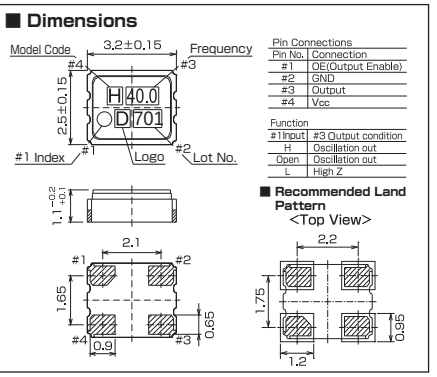
Pin No.	Connection
#1	OE(Output Enable)
#2	GND
#3	Output
#4	Vcc

Function

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

■ DSO321SH [mm]

■ Dimensions



Pin Connections

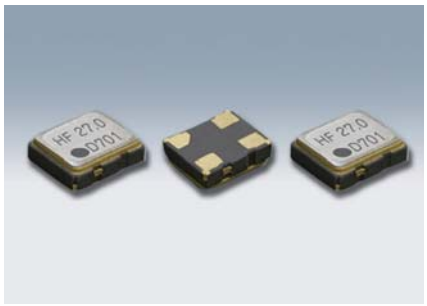
Pin No.	Connection
#1	OE(Output Enable)
#2	GND
#3	Output
#4	Vcc

Function

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

SMD Crystal Oscillators

DSO221SHF



Actual size

■Features

- Supply Voltage: 1.8V/2.5V/2.8V/3.0V/3.3V/5.0V
- Low phase noise: fout ±1kHz −145 dBc/Hz(Typ.)
  fout ±100kHz −158 dBc/Hz(Typ.)
- Low profile: 0.8mm
- 3-state function
- AEC-Q100 compliant

■Applications

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

Pb-Free

RoHS Compliant

[Function Code]

DSO221SHF Y A

Y : 5.0V
A : 3.3V
M : 3.0V
B : 2.8V
C : 2.5V
D : 1.8V

A : ±100×10⁻⁶
B : ±50×10⁻⁶
C : ±30×10⁻⁶
D : ±25×10⁻⁶
E : ±20×10⁻⁶

■ Standard Specification

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

Item	Function Code: Supply Voltage	Function Code: Frequency tolerance	Output Frequency Range (MHz)	Legend	Spec.: min.	typ.	max.	Unit	Condition	
Supply Voltage	Y	*	1.5≦fo≦【48】80 【 】→Supply Voltage:Y	Vcc	+4.5	+5.0	+5.5	V		
	A				+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.)	*	A		f_tol	−100	−	+100	×10⁻⁶	−40 to +85℃	−10 to +70℃ (Standard Operating Temperature Range)
		B			−50	−	+50			
		C			−30	−	+30		−20 to +70℃	
		D			−25	−	+25			
		E			−20	−	+20		−10 to +70℃	
Current Consumption	Y	*	1.5≦fo≦48	Icc	−	−	8.0	mA	No Load	
	A·M		1.5≦fo≦60		−	−	4.0			
			60<fo≦80		−	−	9.1			
	B		1.5≦fo≦60		−	−	3.6			
			60<fo≦80		−	−	8.1			
	C		1.5≦fo≦60		−	−	3.4			
			60<fo≦80		−	−	7.6			
	D		1.5≦fo≦60		−	−	2.8			
			60<fo≦80		−	−	6.2			
Stand-by Current(#1 pin "L" Level)	*	*	*	I_std	−	−	10	μA		
Load Condition	Y·A	*	1.5≦fo≦48	L_CMOS	−	−	30	pF		
	A·M·B·C·D		1.5≦fo≦80		−	−	15			
Symmetry	*	*	*	SYM	45	50	55	%	at 50% Vcc	
0 Level Output Voltage	*	*	*	VOL	−	−	Vcc×0.1	V		
1 Level Output Voltage	*	*	*	VOH	Vcc×0.9	−	−			
Rise and Fall Time	Y·A	*	1.5≦fo≦48	tr,rf	−	−	10(8)	ns	10 to 90% Vcc Level (20 to 80% Vcc Level)	L_CMOS=30pF
	Y·A·M·B·C		1.5≦fo≦【48】60 【 】→Supply Voltage:Y		−	−	5(4)			L_CMOS=15pF
	D				−	−	6(5)			
	A·M·B·C·D		60<fo≦80		−	−	6		10 to 90% Vcc Level	
OE Pin 0 Level Input Voltage	*	*	*	VIL	−	−	Vcc×0.2	V		
OE Pin 1 Level Input Voltage	*	*	*	VIH	Vcc×0.8	−	−			
Output Disable Time	*	*	*	tPLZ	−	−	150	ns		
Output Enable Time	*	*	1.5≦fo≦【48】60 【 】→Supply Voltage:Y	tPZL	−	−	1	ms		
	A·M·B·C·D		60<fo≦80				3			
Phase Noise	Y·A·M·B·C	*	1.5≦fo≦【48】60 【 】→Supply Voltage:Y	−	−	−145	−	dBc/Hz	Offset 1kHz	
	D				−	−140	−			
	A·M·B·C·D		60<fo≦80		−	−135	−			
	Y·A·M·B·C		1.5≦fo≦【48】60 【 】→Supply Voltage:Y		−	−158	−		Offset 100kHz	
	D				−	−152	−			
	A·M·B·C		60<fo≦80		−	−156	−			
	D				−	−150	−			
Period Jitter (1)	*	*	*	tRMS	−	2.4	−	ps	σ	
				tp-p	−	23	−		Peak to peak	
Total Jitter (1)	*	*	*	tTL	−	34	−	ps	tDJ+n×tRJ n=14.1(BER=1×10⁻¹²) (2)	
Phase Jitter	*	*	40≦fo≦60	tpj	−	−	1	ps	fo offset:12kHz to 20MHz	
			10≦fo<40						fo offset:12kHz to 5MHz	
Packing Unit	3000pcs./reel (φ180)									

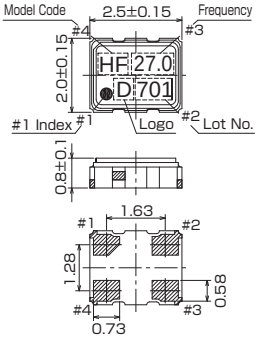
(1)Measured WAVECREST DTS-2075
(2)tDJ:Deterministic jitter tRJ:Random jitter

Consult our sales representative for other specifications.

[mm]

■ Dimensions

Model Code
HF: 1.5 ≦ fo ≦ 60
HFA: 60 < fo ≦ 80



Pin Connections

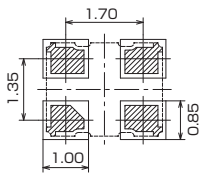
Pin No.	Connection
#1	OE(Output Enable)
#2	GND
#3	Output
#4	Vcc

Function

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

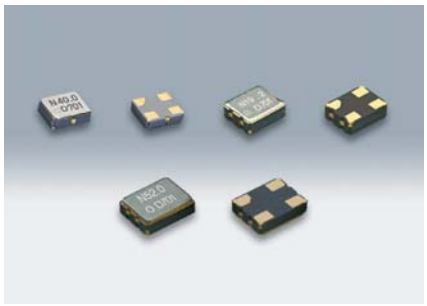
■ Recommended Land Pattern

<Top View>



SMD Crystal Oscillators

DSO211AN/DSO221SN/DSO321SN



Actual size DSO211AN DSO221SN DSO321SN

■Features

- Supply Voltage: 0.9V/1.3V/1.5V typ.
- Available frequency range : 1.5625 to 100MHz
- Low profile: 0.72mm(DSO211AN), 0.815mm(DSO221SN), 1.1mm(DSO321SN)

■Applications

- PC, Memory module, USB
- DSC, DVC
- WiMAX, Bluetooth, Wireless-LAN
- Mobile phones, Silicon audio player

Pb-Free

RoHS Compliant

[Function Code]

DSO****N E A

E : 1.5V
F : 1.3V
G : 0.9V

A : ±100×10^{-6}
B : ± 50×10^{-6}
C : ± 30×10^{-6}
D : ± 25×10^{-6}
E : ± 20×10^{-6}

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

[Type]

DSO211AN	2016 size
DSO221SN	2520 size
DSO321SN	3225 size

■ Standard Specification

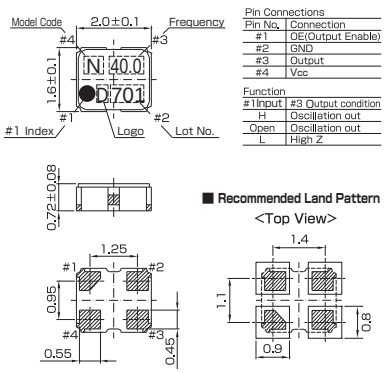
Item	Function Code		Output Frequency Range (MHz)	Legend	Spec.				Condition
	Supply Voltage	Frequency tolerance			min.	typ.	max.	Unit	
Supply Voltage	E	*	DSO211AN 9.6≦fo≦80 DSO221SN/321SN 1.5625≦fo≦100	Vcc	+1.4	+1.5	+1.6	V	
	F				+1.2	+1.3	+1.4		
	G				+0.8	+0.9	+1.0		
Frequency Tolerance (Includes frequency tolerance at room temperature.)	*	A	*	f_tol	−100	−	+100	×10^{-6}	−40 to +85℃ / −10 to +70℃ (Standard Operating Temperature Range)
		B			−50	−	+50		
		C			−30	−	+30		−20 to +70℃
		D			−25	−	+25		−10 to +70℃
		E			−20	−	+20		
Current Consumption	E, F	*	1.5625≦fo≦50	Icc	−	−	2.0	mA	No Load
			50<fo≦100		−	−	6.8		
	G		1.5625≦fo≦50		−	−	1.2	mA	
			50<fo≦100		−	−	3.2		
Stand-by Current(#1 pin "L" Level)	*	*	*	I_std	−	−	20	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	E,F	*	*	tr, tf	−	−	4	ns	10 to 90% Vcc Level
	G				−	−	8		
OE Pin 0 Level Input Voltage	*	*	*	VIL	−	−	Vcc×0.2	V	
OE Pin 1 Level Input Voltage	*	*	*	VIH	Vcc×0.8	−	−		
Output Disable Time	*	*	*	tPLZ	−	−	10	μs	
Output Enable Time	*	*	*	tPZL	−	−	2	ms	
Period Jitter (1)	E,F	*	*	tRMS	−	5	−	ps	σ
	G		*		−	7	−		
	E,F		*	tp-p	−	40	−	ps	Peak to peak
	G		*		−	60	−		
Total Jitter (1)	E,F	*	*	tTL	−	70	−	ps	tDJ + n×tRJ n=14.1(BER=1×10^{-12}) (2)
	G		*		−	98	−		
Phase Jitter	E,F	*	10≦fo<40	tpj	−	−	2	ps	fo offset:12kHz to 5MHz
			40≦fo≦100						fo offset:12kHz to 20MHz
	G		10≦fo<40		−	−	4		fo offset:12kHz to 5MHz
			40≦fo≦100						fo offset:12kHz to 20MHz
Packing Unit	DSO211AN/DSO221SN: 3000pcs./reel(φ180), DSO321SN: 2000pcs./reel(φ180)								

(1) Measured WAVECREST DTS-2075
(2) tDJ:Deterministic jitter tRJ:Random jitter

Consult our sales representative for other specifications.

■ DSO211AN [mm]

■ Dimensions



Pin Connections

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

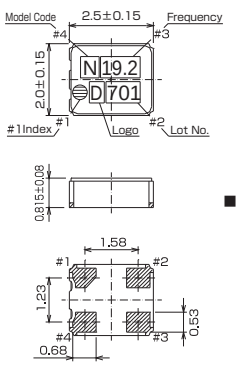
Function

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

■ Recommended Land Pattern
<Top View>

■ DSO221SN [mm]

■ Dimensions



Pin Connections

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

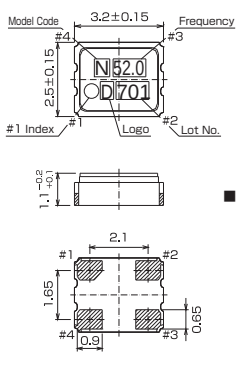
Function

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

■ Recommended Land Pattern
<Top View>

■ DSO321SN [mm]

■ Dimensions



Pin Connections

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

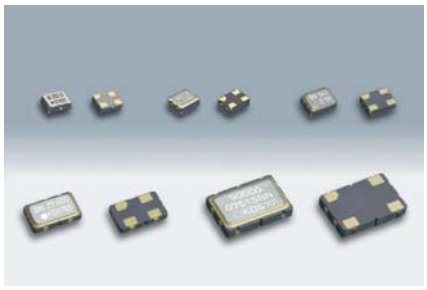
Function

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

■ Recommended Land Pattern
<Top View>

SMD Crystal Oscillators

DSO211AB/DSO221SBM,DSO321SBM/SBN/SVN,DSO531SBM/SBN/SVN,DSO751SBM/SBN/SVN



Actual size DSO211AB DSO221SBM DSO321SBM/SBN DSO531SBM/SBN DSO751SBM/SBN

■ Features

- Low current consumption(5V type DSO211AB, DSO***SBM/SBN)
  (3.3V type DSO***SVN)
- 3-state function
- DSO211AB, DSO***SBM:General purpose +5.0V HCMOS oscillator
- DSO***SBN/SVN:Optimized characteristic for single gate drive/lower loading conditions

■ Applications

- PC, visual and FA equipment applications

[Type]

DSO211AB	2016 size
DSO221SBM	2520 size
DSO321SBM/SBN/SVN	3225 size
DSO531SBM/SBN/SVN	5032 size
DSO751SBM/SBN/SVN	7349 size

Pb-Free RoHS Compliant

[Function Code]

DSO211AB,DSO***SBM/SBN Y A

Y : 5.0V
- A : ±100×10⁻⁶
- B : ±50×10⁻⁶
- C : ±30×10⁻⁶

DSO***SVN A A

A : 3.3V
- A : ±100×10⁻⁶
- B : ±50×10⁻⁶
- C : ±30×10⁻⁶

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

■ Standard Specification

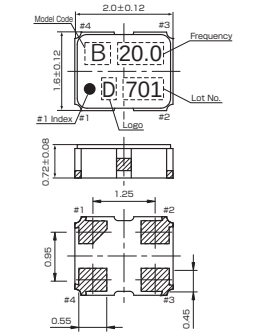
Item	Legend	Function Code: Supply Voltage	Function Code: Frequency tolerance	DSO211AB/DSO221SBM: Output Frequency Range (MHz)	DSO211AB/DSO221SBM: Spec. min.	DSO211AB/DSO221SBM: Spec. typ.	DSO211AB/DSO221SBM: Spec. max.	DSO321, 531, 751 SBM/ SBN/ SVN: Output Frequency Range (MHz)	DSO321, 531, 751 SBM/ SBN/ SVN: Spec. min.	Typ.	max.	Unit	Condition
Supply Voltage	V_{CC}	Y	*	3.25≦fo≦52	+4.5	+5.0	+5.5	0.7≦fo≦90	+4.5	+5.0	+5.5	V	DSO＊＊＊SBM/SBN
		A		–	–	–	–		+3.0	+3.3	+3.6	V	DSO＊＊＊SVN
Frequency Tolerance (Includes frequency tolerance at room temperature.)	f_tol	*	A	3.25≦fo≦52	−100	–	+100	0.7≦fo≦90	−100	–	+100	X10⁻⁶	−40 to +85℃ / −10 to +70℃ (Standard Operating Temperature Range)
			B	3.25≦fo≦52	−50	–	+50	0.7≦fo≦90	−50	–	+50		
			C	3.25≦fo≦52	−30	–	+30	0.7≦fo≦54	−30	–	+30		−20 to +70℃
Current Consumption	I_{CC}	Y	*	3.25≦fo≦52	–	–	8.0	0.7≦fo<32	–	–	4.0	mA	DSO＊＊＊SBM/SBN No Load
								32≦fo<54	–	–	6.0		
								54≦fo<90	–	–	8.0		
		A		–	–	–	–	0.7≦fo<32	–	–	2.0	mA	DSO＊＊＊SVN No Load
								32≦fo<54	–	–	3.0		
								54≦fo<90	–	–	6.0		
Stand-by Current(#1 pin "L" Level)	I_std	*	*	*	–	–	50	*	–	–	50	μA	
Load Condition	L_{CMOS}	*	*	*	–	–	30	*	–	–	30	pF	DSO＊＊＊SBM
					–	–	–	*	–	–	15		DSO＊＊＊SBN/SVN
Symmetry	SYM	*	*	fo<26	45	50	55	fo<26	45	50	55	%	50% V_{CC} Level
				fo≧26	40	50	60	fo≧26	40	50	60		
0 Level Output Voltage	V_{OL}	*	*	*	–	–	V_{CC}×0.1	*	–	–	V_{CC}×0.1	V	
1 Level Output Voltage	V_{OH}	*	*	*	V_{CC}×0.9	–	–	*	V_{CC}×0.9	–	–		
Rise and Fall Time	tr, tf	*	*	3.25≦fo≦52	–	–	10	0.7≦fo≦54	–	–	7 (6)	ns	DSO＊＊＊SBM(20 to 80% V_{CC} Level) L_{CMOS}:30pF 10 to 90% V_{CC} Level
								54<fo≦90	–	–	5 (4)		
				–	–	–	–	0.7≦fo≦54	–	–	8 (7)		DSO＊＊＊SBN/SVN(20 to 80% V_{CC} Level) L_{CMOS}:15pF 10 to 90% V_{CC} Level
				–	–	–	–	54<fo≦90	–	–	5 (4)		
OE Pin 0 Level Input Voltage	V_{IL}	*	*	*	–	–	V_{CC}×0.2	*	–	–	V_{CC}×0.2	V	
OE Pin 1 Level Input Voltage	V_{IH}	*	*	*	V_{CC}×0.8	–	–	*	V_{CC}×0.8	–	–		
Output Disable Time	tPLZ	*	*	*	–	–	150	*	–	–	150	ns	
Output Enable Time	tPZL	*	*	*	–	–	5	*	–	–	1	ms	
Period Jitter (1)	tRMS	*	*	*	–	2.5	–	*	–	2.5	–	ps	σ
	tp-p			*	–	20	–	*	–	20	–		Peak to peak
Total Jitter (1)	tTL	*	*	*	–	35	–	*	–	35	–	ps	tDJ+n×tRJ n=14.1(BER=1×10⁻¹²) (2)
Phase Jitter	tpj	*	*	40≦fo≦52	–	–	1	40≦fo≦90	–	–	1	ps	fo offset:12kHz to 20MHz
				10≦fo<40				10≦fo<40					fo offset:12kHz to 5MHz
Packing Unit	DSO211AB: 3000pcs./reel(φ180), DSO221SBM, DSO321SBM/SBN/SVN: 2000pcs./reel(φ180), DSO531SBM/SBN/SVN: 1000pcs./reel(φ180), DSO751SBM/SBN/SVN: 1000pcs./reel(φ254)												

(1)Measured WAVECREST DTS-2075
(2)tDJ:Deterministic jitter tRJ:Random jitter

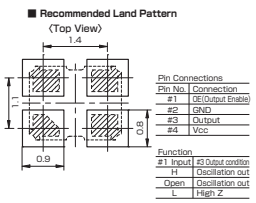
Consult our sales representative for other specifications.

■ DSO211AB [mm] ■ DSO221SBM [mm] ■ DSO321SBM/SBN/SVN [mm] ■ DSO531SBM/SBN/SVN [mm] ■ DSO751SBM/SBN/SVN [mm]

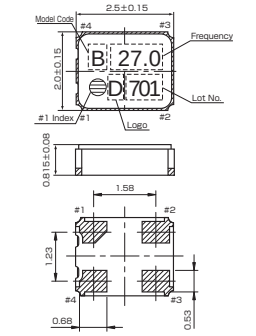
■ Dimensions



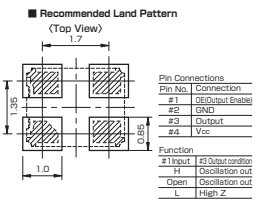
■ Recommended Land Pattern



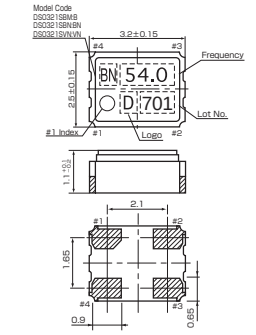
■ Dimensions



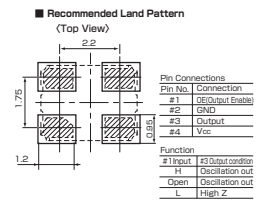
■ Recommended Land Pattern



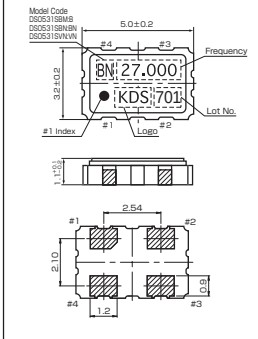
■ Dimensions



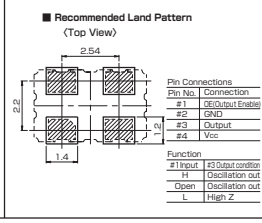
■ Recommended Land Pattern



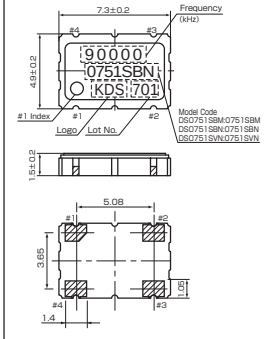
■ Dimensions



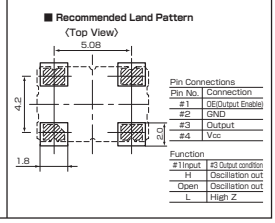
■ Recommended Land Pattern



■ Dimensions

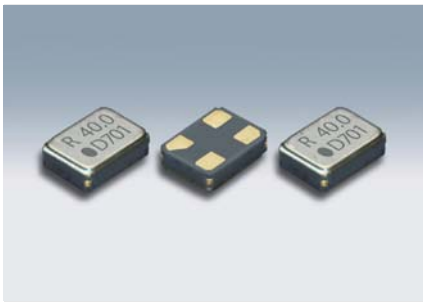


■ Recommended Land Pattern



SMD Crystal Oscillators

DSO1612AR



Actual size DSO1612AR

■Features

- 1612 size, 0.5 mm height. Ultra miniature and lightweight SMD SPXO
- 3-state function
- AEC-Q100 compliant
- 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.

Pb-Free

RoHS Compliant

■Applications

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

[Function Code]

DSO1612AR A A

A :3.3V — A:±100×10^{-6}
M :3.0V — B:±50×10^{-6}
B :2.8V — C:±30×10^{-6}
C :2.5V — D:±25×10^{-6}
D :1.8V — E:±20×10^{-6}

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

■ Standard Specification

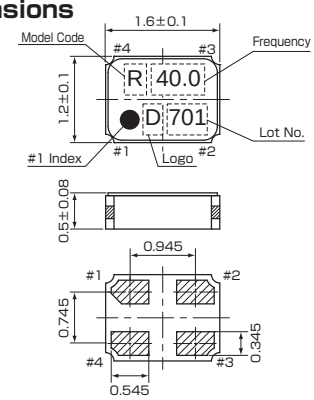
Item	Function Code: Supply Voltage	Function Code: Frequency tolerance	Output Frequency Range (MHz)	Legend	Spec. min.	Spec. typ.	Spec. max.	Unit	Condition
Supply Voltage	A	*	0.584375≦fo<80	Vcc	+3.0	+3.3	+3.6	V	
	M				+2.7	+3.0	+3.3		
	B				+2.6	+2.8	+3.0		
	C				+2.25	+2.5	+2.75		
	D				+1.6	+1.8	+2.0		
Frequency Tolerance (includes frequency tolerance at room temperature)	*	A	0.584375≦fo<80	f_tol	−100	−	+100	×10^{-6}	−40 to +85℃ / −10 to +70℃ (Standard Operating Temperature Range)
		B			−50	−	+50		
		C			−30	−	+30		−20 to +70℃ / −10 to +70℃ (Standard Operating Temperature Range)
		D	0.584375≦fo<50		−25	−	+25		
		E			−20	−	+20		
Current Consumption	A,M	*	0.584375≦fo<40	Icc	−	−	3.0	mA	No Load
			40≦fo<60		−	−	3.4		
			60≦fo≦80		−	−	3.8		
	B		0.584375≦fo<40		−	−	2.4		
			40≦fo<60		−	−	2.8		
			60≦fo≦80		−	−	3.1		
	C		0.584375≦fo<40		−	−	2.0		
			40≦fo<60		−	−	2.4		
			60≦fo≦80		−	−	2.7		
	D		0.584375≦fo<40		−	−	1.4		
			40≦fo<60		−	−	1.6		
			60≦fo≦80		−	−	1.9		
Stand-by Current(#1 pin "L" Level)	*	*	*	I_std	−	−	10	μA	−40 to +85℃
Load Condition	*	*	0.584375≦fo<80	L_CMOS	−	−	15	pF	
Symmetry	*	*	0.584375≦fo<80	SYM	45	50	55	%	at 50% Vcc
0 Level Input Voltage	*	*	*	VOL	−	−	Vcc×0.1	V	
1 Level Input Voltage	*	*	*	VOH	Vcc×0.9	−	−		
Rise and Fall Time	A,M,B,C	*	0.584375≦fo<80	tr, tf	−	−	3.5	ns	10 to 90% Vcc Level
	D				−	−	5.0		
OE Pin 0 Level Input Voltage	*	*	*	VIL	−	−	Vcc×0.2	V	
OE Pin 1 Level Input Voltage	*	*	*	VIH	Vcc×0.8	−	−		
Output Disable Time	*	*	*	tPLZ	−	−	200	ns	
Output Enable Time	*	*	*	tPZL	−	−	1	ms	
Period Jitter (1)	*	*	*	tRMS	−	2.2	−	ps	σ
			*	tp-p	−	20	−		Peak to peak
Total Jitter (1)	*	*	*	tTL	−	31	−	ps	tDJ+n×tRJ n=14.1 (BER=1×10^{-12}) (2)
Phase Jitter	*	*	40≦fo≦80	tpj	−	−	1	ps	fo offset:12kHz to 20MHz
			10≦fo<40						fo offset:12kHz to 5MHz
Packing Unit	3000pcs./reel(φ180)								

(1) Measured WAVECREST DTS-2075
(2) tDJ:Deterministic jitter tRJ:Random jitter

Consult our sales representative for other specifications.

[mm]

■ Dimensions



Pin Connections

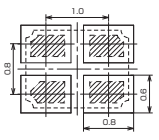
Pin No.	Connection
#1	OE(Output Enable)
#2	GND
#3	Output
#4	Vcc

Function

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

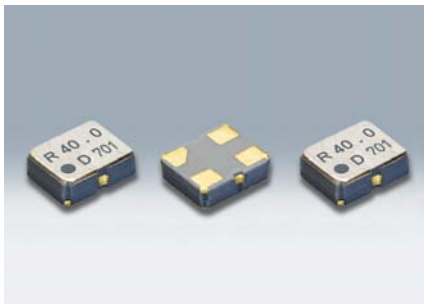
■ Recommended Land Pattern

<Top View>



SMD Crystal Oscillators

DSO211AR



Actual size

■Features

- 2016 size, 0.72 mm height.
- Available frequency range : 0.4 to 80MHz
- The electronic specification is compatible with that of SR series(DSO221SR/ DSO321SR/ DSO531SR/ DSO751SR)
- Available up to 80MHz by using AT cut fundamental resonator. Low jitter provides for high performance.
- AEC-Q100 compliant

■Applications

- PC, USB
- DSC, DVD, Blu-ray, HDTV, DVC, HDD
- WiMAX, Bluetooth, Wireless LAN
- Camera module
- Automotive multimedia device

Pb-Free

RoHS Compliant

[Function Code]

DSO211AR A A

A : 3.3V
M : 3.0V
B : 2.8V
C : 2.5V
D : 1.8V

A : ±100×10^{-6}
B : ±50×10^{-6}
C : ±30×10^{-6}
D : ±25×10^{-6}
E : ±20×10^{-6}

■ Standard Specification

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

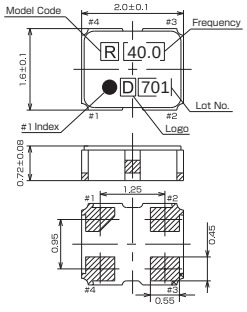
Item	Function Code: Supply Voltage	Function Code: Frequency tolerance	Output Frequency Range (MHz)	Legend	Spec.: min.	Spec.: typ.	Spec.: max.	Spec.: Unit	Condition	
Supply Voltage	A	*	0.4≦fo≦80	Vcc	+3.0	+3.3	+3.6	V		
	M				+2.7	+3.0	+3.3			
	B				+2.6	+2.8	+3.0			
	C				+2.25	+2.5	+2.75			
	D				+1.6	+1.8	+2.0			
Frequency Tolerance (Includes frequency tolerance at room temperature.)	*	A	0.4≦fo≦80	f_tol	−100	−	+100	×10^{-6}	−40 to +85℃	−10 to +70℃ (Standard Operating Temperature Range)
		B			−50	−	+50			
		C			−30	−	+30		−20 to +70℃	
		D	0.4≦fo≦50		−25	−	+25		−10 to +70℃	
		E			−20	−	+20			
Current Consumption	A,M	*	0.4≦fo<32	Icc	−	−	1.8	mA	No Load	
			32≦fo<54		−	−	2.5			
			54≦fo≦80		−	−	5.0			
	B	*	0.4≦fo<32		−	−	1.8			
			32≦fo<54		−	−	2.5			
			54≦fo≦80		−	−	5.0			
	C	*	0.4≦fo<32		−	−	1.5			
			32≦fo<54		−	−	2.0			
			54≦fo≦80		−	−	4.0			
	D	*	0.4≦fo<32		−	−	1.0			
			32≦fo<54		−	−	1.4			
			54≦fo≦80		−	−	3.0			
Stand-by Current(#1 pin "L" Level)	*	*	*	I_std	−	−	10	μA		
Load Condition	*	*	0.4≦fo≦80	L_CMOS	−	−	15	pF		
	A,M				−	−	30			
Symmetry	*	*	fo<50	SYM	45	50	55	%	50% Vcc Level	
			fo≧50		40	50	60			
0 Level Output Voltage	*	*	*	VOL	−	−	Vcc×0.1	V		
1 Level Output Voltage	*	*	*	VOH	Vcc×0.9	−	−			
Rise and Fall Time	A,M,B,C	*	0.4≦fo<54	tr, tf	−	−	5(4)	ns	L_CMOS:15pF 10 to 90% Vcc Level (20 to 80% Vcc Level)	
	D		0.4≦fo<54		−	−	7(6)			
	*		54≦fo≦80		−	−	4(3)			
	A,M		0.4≦fo<54		−	−	10		L_CMOS:30pF 10 to 90% Vcc Level	
	A,M		54≦fo≦80		−	−	6			
OE Pin 0 Level Input Voltage	*	*	*	VIL	−	−	Vcc×0.2	V		
OE Pin 1 Level Input Voltage	*	*	*	VIH	Vcc×0.8	−	−			
Output Disable Time	*	*	*	tPLZ	−	−	150	ns		
Output Enable Time	*	*	*	tPZL	−	−	1	ms		
Period Jitter (1)	*	*	*	tRMS	−	2.2	−	ps	σ	
				tp-p	−	20	−		Peak to peak	
Total Jitter (1)	*	*	*	tTL	−	31	−	ps	tDJ+n×tRJ n=14.1(BER=1×10^{-12}) (2)	
Phase Jitter	*	*	40≦fo≦80	tpj	−	−	1	ps	fo offset:12kHz to 20MHz	
			10≦fo<40						fo offset:12kHz to 5MHz	
Packing Unit	3000pcs./reel(φ180)									

(1) Measured WAVECREST DTS-2075
(2) tDJ:Deterministic jitter tRJ:Random jitter

Consult our sales representative for other specifications.

[mm]

■ Dimensions



Pin Connections

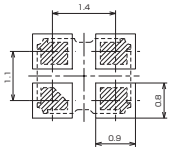
Pin No.	Connection
#1	OE(Output Enable)
#2	GND
#3	Output
#4	Vcc

Function

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

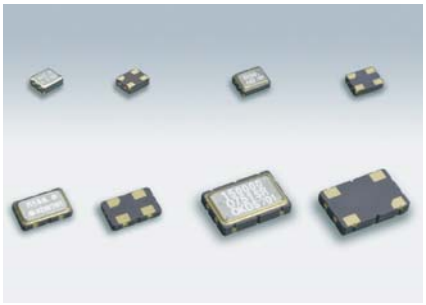
■ Recommended Land Pattern

<Top View>



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: $\pm 20\times10^{-6}/\pm 30\times10^{-6}/\pm 50\times10^{-6}/\pm 100\times10^{-6}$
- 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-Q100 compliant

Pb-Free

RoHS Compliant

[Type]

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

[Function Code]

DSO***SR A A

A : 3.3V
M : 3.0V
B : 2.8V
C : 2.5V
D : 1.8V

A : $\pm 100\times10^{-6}$
B : $\pm 50\times10^{-6}$
C : $\pm 30\times10^{-6}$
D : $\pm 25\times10^{-6}$
E : $\pm 20\times10^{-6}$

■ 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≦fo≦167	Vcc	+3.0	+3.3	+3.6	V		
	M		0.2≦fo≦167		+2.7	+3.0	+3.3			
	B		0.2≦fo≦157		+2.6	+2.8	+3.0			
	C		0.2≦fo≦157		+2.25	+2.5	+2.75			
	D		0.2≦fo≦80		+1.6	+1.8	+2.0			
Frequency Tolerance (Includes frequency tolerance at room temperature.)	*	A	0.2≦fo≦167	f_tol	−100	−	+100	×10⁻⁶	−40 to +85℃	−10 to +70℃ (Standard Operating Temperature Range)
		B	0.2≦fo≦125		−50	−	+50			
		C	0.2≦fo≦80		−30	−	+30		−20 to +70℃	
		D	0.2≦fo≦80		−25	−	+25			
		E	0.2≦fo≦50		−20	−	+20		−10 to +70℃	
Current Consumption	A,M	*	0.2≦fo<32	Icc	−	−	1.8	mA	No Load	
			32≦fo<54		−	−	2.5			
			54≦fo<80		−	−	5.0			
			80≦fo<125		−	−	6.0			
			125≦fo≦167		−	−	8.0			
	B	*	0.2≦fo<32		−	−	1.8			
			32≦fo<54		−	−	2.5			
			54≦fo<125		−	−	5.0			
			125≦fo≦157		−	−	7.0			
	C	*	0.2≦fo<32		−	−	1.5			
			32≦fo<54		−	−	2.0			
			54≦fo<125		−	−	4.0			
			125≦fo≦157		−	−	6.0			
	D	*	0.2≦fo<32		−	−	1.0			
			32≦fo<54		−	−	1.4			
			54≦fo≦80		−	−	3.0			
Stand-by Current(#1 pin "L" Level)	*	*	*	I_std	−	−	10	μA		
Load Condition	*	*	*	L_CMOS	−	−	15	pF		
	A,M		0.2≦fo≦80		−	−	30			
Symmetry	*	*	fo<50	SYM	45	50	55	%	50% Vcc Level	
			fo≧50		40	50	60			
0 Level Output Voltage	*	*	*	VOL	−	−	Vcc×0.1	V		
1 Level Output Voltage	*	*	*	VOH	Vcc×0.9	−	−			
Rise and Fall Time	A,M,B,C	*	0.2≦fo≦54	tr, tf	−	−	5(4)	ns	L_CMOS:15pF 10 to 90% Vcc Level (20 to 80% Vcc Level)	
	D		0.2≦fo≦54		−	−	7(6)			
	*		54<fo<100		−	−	4(3)			
	*		100≦fo≦167		−	−	3(2.5)			
	A,M		0.2≦fo≦54		−	−	10		L_CMOS:30pF 10 to 90% Vcc Level	
	A,M		54<fo≦80		−	−	6			
OE Pin 0 Level Input Voltage	*	*	*	VIL	−	−	Vcc×0.2	V		
OE Pin 1 Level Input Voltage	*	*	*	VIH	Vcc×0.8	−	−			
Output Disable Time	*	*	*	tPLZ	−	−	150	ns		
Output Enable Time	*	*	*	tPZL	−	−	1	ms		
Period Jitter (1)	*	*	*	tRMS	−	2.2	−	ps	σ	
				tp-p	−	20	−		Peak to peak	
Total Jitter (1)	*	*	*	tTL	−	31	−	ps	tDJ+n×tRJ n=14.1(BER=1×10⁻¹²) (2)	
Phase Jitter	*	*	40≦fo≦167	tpj	−	−	1	ps	fo offset:12kHz to 20MHz	
			10≦fo<40						fo offset:12kHz to 5MHz	
Packing Unit	DSO221SR, DSO321SR: 2000pcs./reel (φ180) , DSO531SR: 1000pcs./reel (φ180) , DSO751SR: 1000pcs./reel (φ254)									

(1)Measured WAVECREST DTS-2075
(2)tDJ:Deterministic jitter tRJ:Random jitter

Consult our sales representative for other specifications.

SMD Crystal Oscillators

DSO221SR/DSO321SR/DSO531SR/DSO751SR

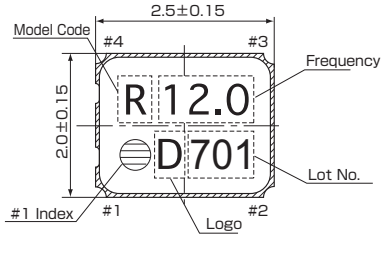
■Applications

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

■ Dimensions

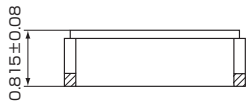
[mm]

DSO221SR

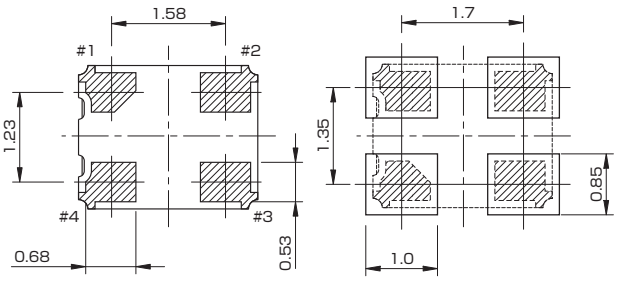


Pin Connections	
Pin No.	Connection
#1	OE(Output Enable)
#2	GND
#3	Output
#4	Vcc

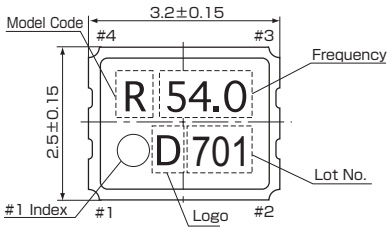
Function	
#1Input	#3 Output condition
H	Oscillation out
Open	Oscillation out
L	High Z



■ Recommended Land Pattern
〈Top View〉

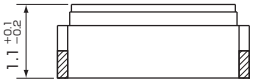


DSO321SR

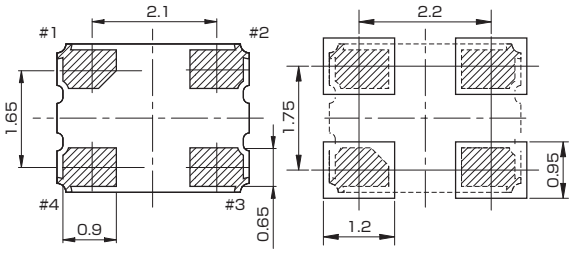


Pin Connections	
Pin No.	Connection
#1	OE(Output Enable)
#2	GND
#3	Output
#4	Vcc

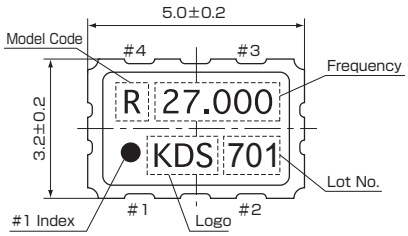
Function	
#1Input	#3 Output condition
H	Oscillation out
Open	Oscillation out
L	High Z



■ Recommended Land Pattern
〈Top View〉

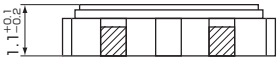


DSO531SR

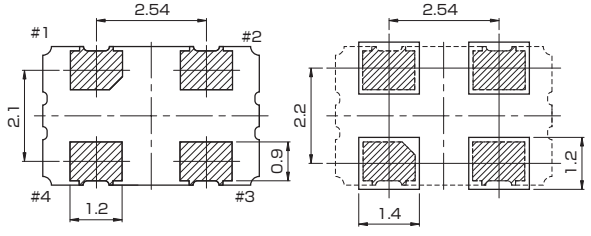


Pin Connections	
Pin No.	Connection
#1	OE(Output Enable)
#2	GND
#3	Output
#4	Vcc

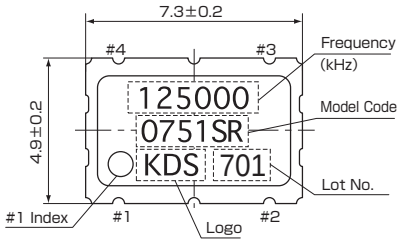
Function	
#1Input	#3 Output condition
H	Oscillation out
Open	Oscillation out
L	High Z



■ Recommended Land Pattern
〈Top View〉

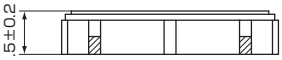


DSO751SR

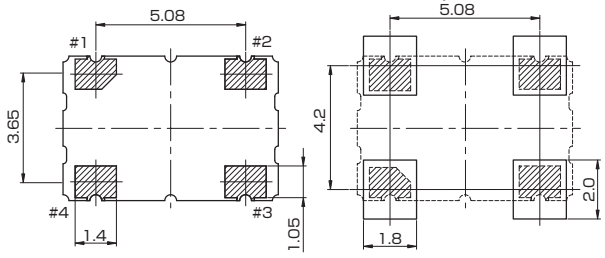


Pin Connections	
Pin No.	Connection
#1	OE(Output Enable)
#2	GND
#3	Output
#4	Vcc

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

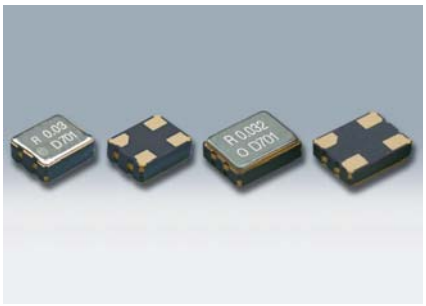


■ Recommended Land Pattern
〈Top View〉



SMD Crystal Oscillators

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-Q 100 compliant

Pb-Free

RoHS Compliant

■Applications

- Timer module, Industrial measuring equipment, Consumer Product, Clock source for RTC, automotive multimedia device

[Type]

DSO221SR	2520 size
DSO321SR	3225 size

[Function Code]

DSO***SR A A

- A :3.3V
- M :3.0V
- B :2.8V
- C :2.5V
- D :1.8V
- Y :5.0V

- A:±100×10^{-6}
- B:±50×10^{-6}
- N:±35×10^{-6}
- C:±30×10^{-6}
- D:±25×10^{-6}

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

■ Standard Specification

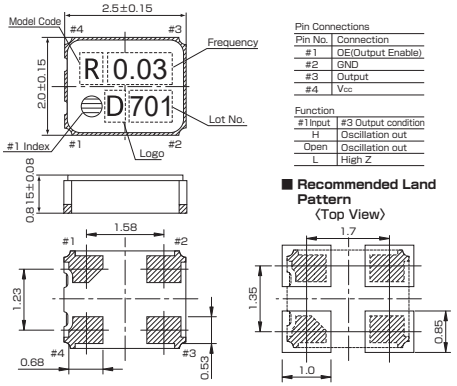
Item	Function Code: Supply Voltage	Function Code: Frequency tolerance	Output Frequency Range (KHz)	Legend	Spec. min.	Spec. typ.	Spec. max.	Spec. Unit	Condition	
Supply Voltage	A	*	32.768≦fo≦50	Vcc	+3.0	+3.3	+3.6	V		
	M				+2.7	+3.0	+3.3			
	B				+2.6	+2.8	+3.0			
	C				+2.25	+2.5	+2.75			
	D				+1.6	+1.8	+2.0			
	Y				+4.5	+5.0	+5.5			
Frequency Tolerance (includes frequency tolerance at room temperature)	*	A	32.768≦fo≦50	f_tol	−100	−	+100	×10^{-6}	−40 to +85℃	−10 to +70℃ (Standard Operating Temperature Range)
		B			−50	−	+50			
		N			−35	−	+35			
		C			−30	−	+30		−20 to +70℃	
		D			−25	−	+25		−10 to +70℃	
Current Consumption	A,M,B, C,D	*	fo=32.768	Icc	−	−	50	μA	No Load	
			32.768<fo≦50		−	−	82			
	Y		fo=32.768		−	−	60			
			32.768<fo≦50		−	−	100			
Stand-by Current(#1 pin "L" Level)	*	*	32.768≦fo≦50	I_std	−	−	1.5	μA	−40 to +85℃	
Load Condition	*	*	32.768≦fo≦50	L_CMOS	−	−	15	pF		
Symmetry	*	*	32.768≦fo≦50	SYM	45	50	55	%	at 50% Vcc	
0 Level Input Voltage	*	*	*	VOL	−	−	Vcc×0.1	V		
1 Level Input Voltage	*	*	*	VOH	Vcc×0.9	−	−			
Rise and Fall Time	*	*	32.768≦fo≦50	tr, tf	−	−	20	ns	10 to 90% Vcc Level	
OE Pin 0 Level Input Voltage	*	*	*	VIL	−	−	Vcc×0.2	V		
OE Pin 1 Level Input Voltage	*	*	*	VIH	Vcc×0.8	−	−			
Output Disable Time	*	*	*	tPLZ	−	−	150	ns		
Output Enable Time	*	*	*	tPZL	−	−	2	ms		
Period Jitter (1)	*	*	*	tRMS	−	15	−	ps	σ	
				tp-p	−	150	−		Peak to peak	
Total Jitter (1)	*	*	*	tTL	−	220	−	ps	tDJ+n×tRJ n=14.1 (BER=1×10^{-12}) (2)	
Packing Unit	2000pcs./reel(φ180)									

(1) Measured WAVECREST DTS-2075
(2) tDJ:Deterministic jitter tRJ:Random jitter

Consult our sales representative for other specifications.

■ DSO221SR(kHz) [mm]

■ Dimensions



Pin Connections

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

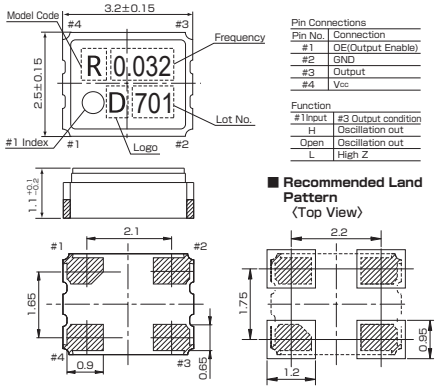
Function

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

■ Recommended Land Pattern
〈Top View〉

■ DSO321SR(kHz) [mm]

■ Dimensions



Pin Connections

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

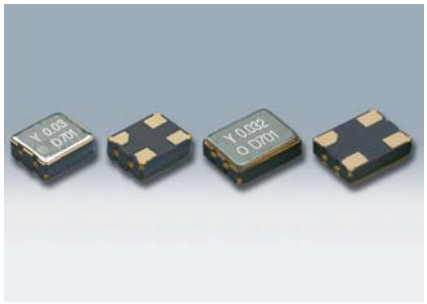
Function

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

■ Recommended Land Pattern
〈Top View〉

SMD Crystal Oscillators

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-Q 100 compliant

Pb-Free

RoHS Compliant

■Applications

- Timer module, Industrial measuring equipment, Consumer Product

[Type]

DSO221SY	2520 size
DSO321SY	3225 size

[Function Code]

DSO***SY A A

A :3.3V
B :2.8V
C :2.5V
D :1.8V

A:±100×10^{-6}
B:±50×10^{-6}
N:±35×10^{-6}
C:±30×10^{-6}
D:±25×10^{-6}

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

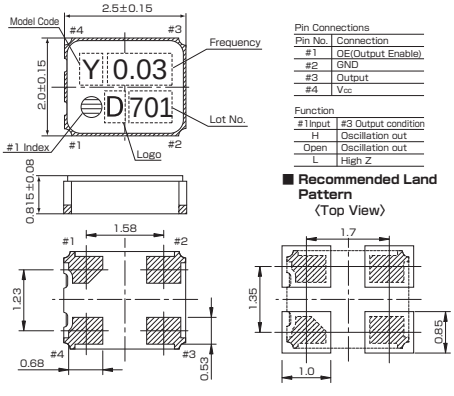
■ Standard Specification

Item	Function Code		Output Frequency Range	Legend	Spec.				Condition	
	Supply Voltage	Frequency tolerance			min.	typ.	max.	Unit		
Supply Voltage	A	*	32.768kHz 1.049≦fo≦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≦fo≦8.5MHz	f_tol	−100	−	+100	×10^{-6}	−40 to +85℃	−10 to +70℃ (Standard Operating Temperature Range)
		B			−50	−	+50			
		N			−35	−	+35			
		C			−30	−	+30		−20 to +70℃	
		D			−25	−	+25		−10 to +70℃	
Current Consumption	*	*	32.768kHz	Icc	−	−	18	μA	No Load	
			1.049≦fo≦8.5MHz		−	−	700			
Stand-by Current(#1 pin "L" Level)	*	*	*	I_std	−	−	3	μA	−40 to +85℃	
Load Condition	*	*	*	L_CMOS	−	−	15	pF		
Symmetry	*	*	32.768kHz	SYM	45	50	55	%	at 50% Vcc	
			1.049≦fo≦8.5MHz		40	50	60			
0 Level Input Voltage	*	*	*	V_{OL}	−	−	Vcc×0.1	V		
1 Level Input Voltage	*	*	*	V_{OH}	Vcc×0.9	−	−			
Rise and Fall Time	*	*	*	tr, tf	−	−	15	ns	10 to 90% Vcc Level	
OE Pin 0 Level Input Voltage	*	*	*	V_{IL}	−	−	Vcc×0.2	V		
OE Pin 1 Level Input Voltage	*	*	*	V_{IH}	Vcc×0.8	−	−			
Output Disable Time	*	*	*	tPLZ	−	−	100	ns		
Output Enable Time	*	*	*	tPZL	−	−	20	ms		
Packing Unit	2000pcs./reel(φ180)									

Consult our sales representative for other specifications.

■ DSO221SY [mm]

■ Dimensions



Pin Connections

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

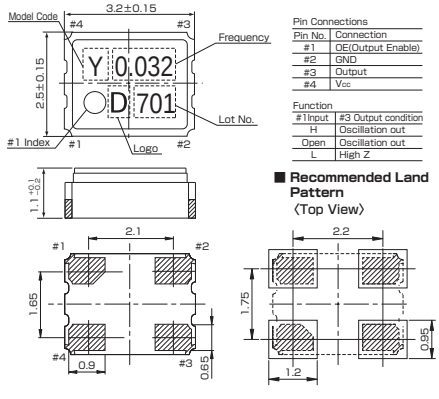
Function

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

■ Recommended Land Pattern
〈Top View〉

■ DSO321SY [mm]

■ Dimensions



Pin Connections

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

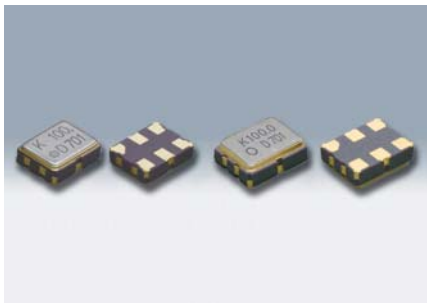
Function

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

■ Recommended Land Pattern
〈Top View〉

SMD Crystal Oscillators

DSO223S/DSO323S SERIES



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-Q100 Compliant

Pb-Free

RoHS Compliant

■ Applications

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

[Type]

DSO223S SERIES	2520 size
DSO323S SERIES	3225 size

[Function Code]

DSO***S K A A A

Model Code
K : LVPECL
J : LVDS
D : HCSL

Operating Temperature Range
A : − 10 to +70℃
C : − 40 to +85℃

Supply Voltage
A : 3.3V
C : 2.5V

Frequency Tolerance
A : ±100×10^{-6}
B : ±50×10^{-6}

■ Standard Specification

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

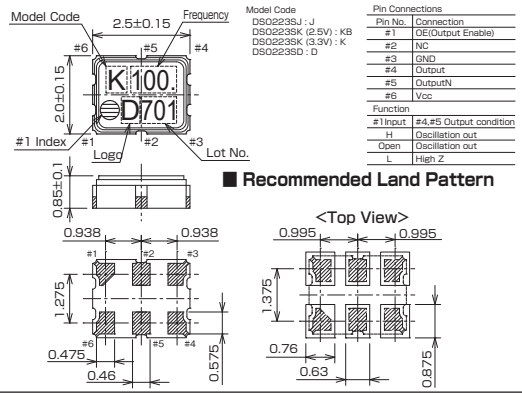
Item \ Type	Legend	DSO223SK DSO323SK	DSO223SJ DSO323SJ	DSO223SD DSO323SD
Output Specification	−	LV-PECL	LVDS	HCSL
Output Frequency Range	fo	13.5 to 167MHz(DSO223S SERIES)/13.5 to 212.5MHz(DSO323S SERIES)		
Supply Voltage	Vcc	+2.5V±0.125V/+3.3V±0.165V		
Frequency Tolerance (Includes frequency tolerance at room temperature.)	f_tol	±50×10^{-6} max., ±100×10^{-6} max.		
Storage Temperature Range	T_stg	−40 to +85℃		
Operating Temperature Range	T_use	−10 to +70℃ ,−40 to +85℃		
Current Consumption	Icc	45mA max. (fo≦170MHz), 50mA max. (170MHz<fo≦212.5MHz)	20mA max.	30mA max. (fo≦170MHz), 35mA max. (170MHz<fo≦212.5MHz)
Stand-by Current(#1 pin "L" Level)	I_std	10μA max.		
Load Condition	Load-R	50Ω to Vcc−2V	100Ω (Output−OutputN)	50Ω
Symmetry	SYM	45 to 55% [at outputs cross point]		
0 Level Output Voltage	VOL	Vcc−1.81 to Vcc−1.62V	−	−0.15 to 0.15V
1 Level Output Voltage	VOH	Vcc−1.025 to Vcc−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	VOD1, VOD2	−	0.247 to 0.454V	−
Change to VOD	⊿VOD	−	50mV [⊿VOD= | VOD1−VOD2 |]	−
Offset Voltage	VOS	−	1.125 to 1.375V	−
Offset to VOS	⊿VOS	−	50mV	−
Crossing Point Voltage	Vcr	−	−	250 to 550mV
OE Pin 0 Level Input Voltage	VIL	Vcc×0.3 max.		
OE Pin 1 Level Input Voltage	VIH	Vcc×0.7 min.		
Output Disable Time	tPLZ	200ns		
Output Enable Time	tPZL	2ms		
Period Jitter (1)	tRMS	5ps typ. (13.5MHz≦fo<27MHz) / 2.5ps typ. (27MHz≦fo<212.5MHz) (σ)		
	tp-p	33ps typ. (13.5MHz≦fo<27MHz) / 22ps typ. (27MHz≦fo<212.5MHz) (Peak to peak)		
Total Jitter (1)	tTL	50ps typ. (13.5MHz≦fo<27MHz) / 35ps typ. (27MHz≦fo<212.5MHz) [tDJ + n×tRJ n=14.1(BER=1×10^{-12}) (2)]		
Phase Jitter	tpj	1.5ps max. (13.5MHz≦fo<27MHz) / 1ps max. (27MHz≦fo<212.5MHz) [13.5MHz≦fo<40MHz,fo offset:12kHz to 5MHz fo≧40MHz,fo offset:12kHz to 20MHz]		
Packing Unit	−	2000pcs./reel(φ180)		

(1)Measured WAVECREST DTS-2075
(2)tDJ:Deterministic jitter tRJ:Random jitter

Consult our sales representative for other specifications.

■ DSO223S SERIES [mm]

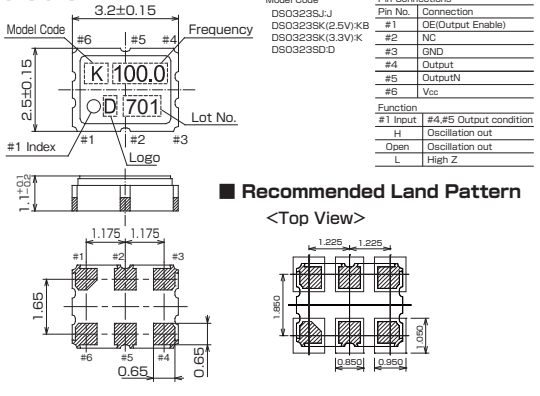
■ Dimensions



■ Recommended Land Pattern

■ DSO323S SERIES [mm]

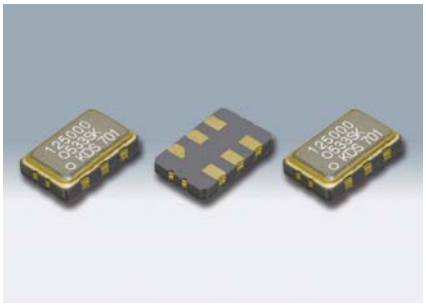
■ Dimensions



■ Recommended Land Pattern

SMD Crystal Oscillators

DSO533S SERIES



Actual size

■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

Pb-Free

RoHS Compliant

■ Standard Specification

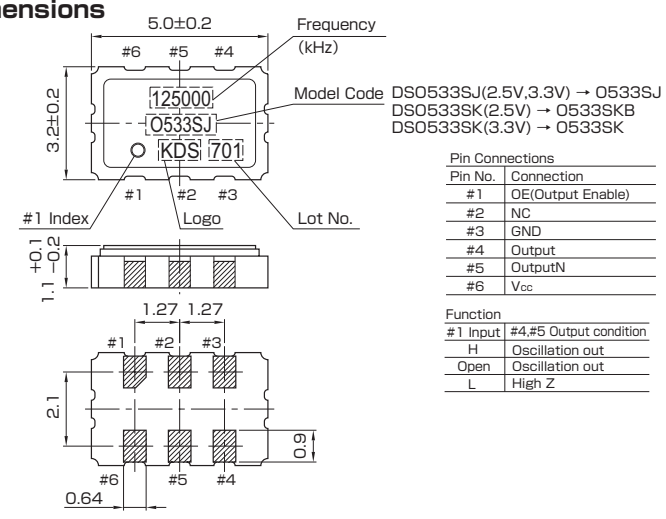
Item \ Type	Legend	DSO533SK	DSO533SJ
Output Specification	–	LV-PECL	LVDS
Output Frequency Range	fo	13.5 to 212.5MHz	
Supply Voltage	Vcc	+2.5V±0.125V/+3.3V±0.165V	
Frequency Tolerance (Includes frequency tolerance at room temperature.)	f_tol	$\pm 50 \times 10^{-6}$ max., $\pm 100 \times 10^{-6}$ max.	
Storage Temperature Range	T_stg	−40 to +85℃	
Operating Temperature Range	T_use	−10 to +70℃ , −40 to +85℃	
Current Consumption	Icc	45mA max. (fo≦170MHz), 50mA max. (170MHz<fo≦212.5MHz)	20mA max.
Stand-by Current(#1 pin "L" Level)	I_std	10μA max.	
Load Condition	Load-R	50Ω to Vcc−2V	100Ω (Output-OutputN)
Symmetry	SYM	45 to 55% [at outputs cross point]	
0 Level Output Voltage	VOL	Vcc−1.81 to Vcc−1.62V	–
1 Level Output Voltage	VOH	Vcc−1.025 to Vcc−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	VOD1, VOD2	–	0.247 to 0.454V
Change to V_{OD}	⊿VOD	–	50mV [⊿VOD= | VOD1−VOD2 |]
Offset Voltage	Vos	–	1.125 to 1.375V
Offset to V_{OS}	⊿Vos	–	50mV
OE Pin 0 Level Input Voltage	VIL	Vcc×0.3 max.	
OE Pin 1 Level Input Voltage	VIH	Vcc×0.7 min.	
Output Disable Time	tPLZ	200ns	
Output Enable Time	tPZL	2ms	
Period Jitter (1)	tRMS	5ps typ. (13.5MHz≦fo<27MHz) / 2.5ps typ. (27MHz≦fo<212.5MHz) (σ)	
	tp-p	33ps typ. (13.5MHz≦fo<27MHz) / 22ps typ. (27MHz≦fo<212.5MHz) (Peak to peak)	
Total Jitter (1)	tTL	50ps typ. (13.5MHz≦fo<27MHz) / 35ps typ. (27MHz≦fo<212.5MHz) [tDJ + n×tRJ n=14.1(BER=1×10^{-12}) (2)]	
Phase Jitter	tpj	1.5ps max. (13.5MHz≦fo<27MHz) / 1ps max. (27MHz≦fo<212.5MHz) [13.5MHz≦fo<40MHz,fo offset:12kHz to 5MHz fo≧40MHz,fo offset:12kHz to 20MHz]	
Packing Unit	–	1000pcs./reel (φ 180)	

(1)Measured WAVECREST DTS-2075
(2)tDJ:Deterministic jitter tRJ:Random jitter

Consult our sales representative for other specifications.

[mm]

■ Dimensions



Pin Connections

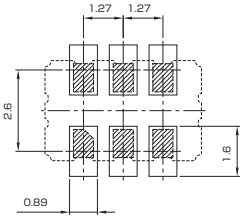
Pin No.	Connection
#1	OE(Output Enable)
#2	NC
#3	GND
#4	Output
#5	OutputN
#6	Vcc

Function

#1 Input	#4,#5 Output condition
H	Oscillation out
Open	Oscillation out
L	High Z

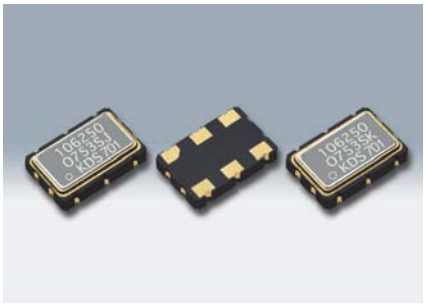
■ Recommended Land Pattern

<Top View>



SMD Crystal Oscillators

DSO753S SERIES



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

- Sever, FC-HBA

Pb-Free

RoHS Compliant

■ Standard Specification

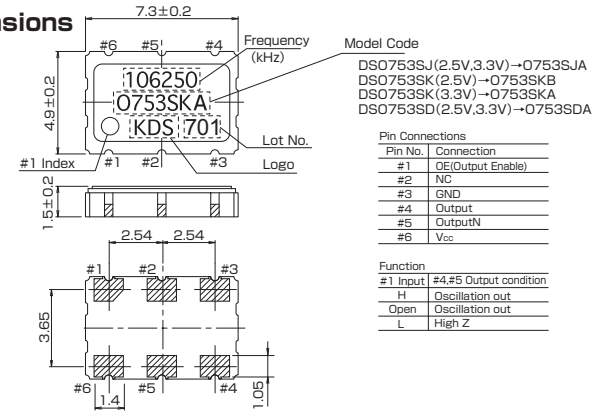
Item \ Type	Legend	DSO753SK	DSO753SJ	DSO753SD
Output Specification	–	LV-PECL	LVDS	HCSL
Output Frequency Range	fo	13.5 to 212.5MHz		
Supply Voltage	Vcc	+2.5V±0.125V/+3.3V±0.165V		
Frequency Tolerance (Includes frequency tolerance at room temperature.)	f_tol	±50×10^{-6} max., ±100×10^{-6} max.		
Storage Temperature Range	T_stg	−40 to +85℃		
Operating Temperature Range	T_use	−10 to +70℃ , −40 to +85℃		
Current Consumption	Icc	45mA max. (fo≦170MHz), 50mA max. (170MHz<fo≦212.5MHz)	20mA max.	30mA max. (fo≦170MHz), 35mA max. (170MHz<fo≦212.5MHz)
Stand-by Current(#1 pin "L" Level)	I_std	10μA max.		
Load Condition	Load-R	50Ω to Vcc−2V	100Ω (Output−OutputN)	50Ω
Symmetry	SYM	45 to 55% [at outputs cross point]		
0 Level Output Voltage	V_{OL}	Vcc−1.81 to Vcc−1.62V	–	−0.15 to 0.15V
1 Level Output Voltage	V_{OH}	Vcc−1.025 to Vcc−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_{OD1}, V_{OD2}	–	0.247 to 0.454V	–
Change to V_{OD}	ΔV_{OD}	–	50mV [ΔV_{OD}= | V_{OD1}−V_{OD2} |]	–
Offset Voltage	V_{OS}	–	1.125 to 1.375V	–
Offset to V_{OS}	ΔV_{OS}	–	50mV	–
Crossing Point Voltage	Vcr	–	–	250 to 550mV
OE Pin 0 Level Input Voltage	V_{IL}	Vcc×0.3 max.		
OE Pin 1 Level Input Voltage	V_{IH}	Vcc×0.7 min.		
Output Disable Time	tPLZ	200ns		
Output Enable Time	tPZL	2ms		
Period Jitter (1)	tRMS	5ps typ. (13.5MHz≦fo<27MHz) / 2.5ps typ. (27MHz≦fo<212.5MHz) (σ)		
	tp-p	33ps typ. (13.5MHz≦fo<27MHz) / 22ps typ. (27MHz≦fo<212.5MHz) (Peak to peak)		
Total Jitter (1)	tTL	50ps typ. (13.5MHz≦fo<27MHz) / 35ps typ. (27MHz≦fo<212.5MHz) [tDJ + n×tRJ n=14.1(BER=1×10^{-12}) (2)]		
Phase Jitter	tpj	1.5ps max. (13.5MHz≦fo<27MHz) / 1ps max. (27MHz≦fo<212.5MHz) [13.5MHz≦fo<40MHz,fo offset:12kHz to 5MHz fo≧40MHz,fo offset:12kHz to 20MHz]		
Packing Unit	–	1000pcs./reel(φ254)		

(1)Measured WAVECREST DTS-2075
(2)tDJ:Deterministic jitter tRJ:Random jitter

Consult our sales representative for other specifications.

[mm]

■ Dimensions



Pin Connections

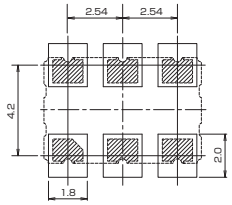
Pin No.	Connection
#1	OE(Output Enable)
#2	NC
#3	GND
#4	Output
#5	OutputN
#6	Vcc

Function

#1 Input	#4,#5 Output condition
H	Oscillation out
Open	Oscillation out
L	High Z

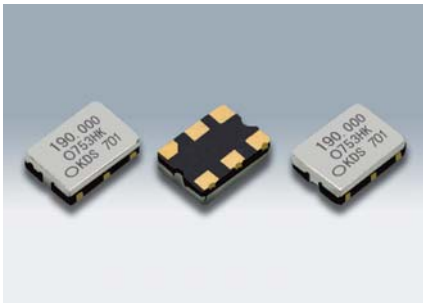
■ Recommended Land Pattern

<Top View>



SMD Crystal Oscillators

DSO753H SERIES



Actual size

RoHS Compliant

■Features

- Available with three types of output functions: CMOS, PECL, LVDS
- Differential output (LV-PECL, LVDS)
- Low jitter
- 3-state function

■Applications

- Optical transmission device, radio transmitter-receiver equipment

■Standard Specification

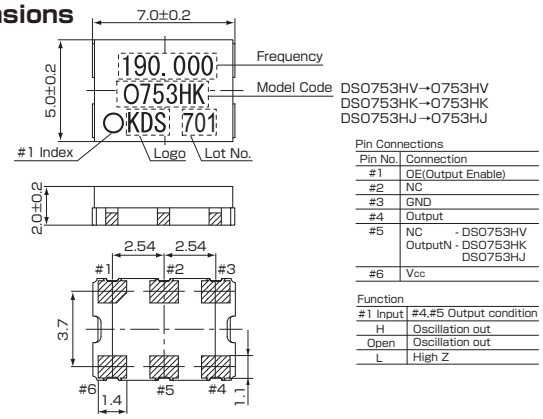
Item \ Type	Legend	DSO753HV	DSO753HK	DSO753HJ
Output Specification	–	CMOS	LV-PECL	LVDS
Output Frequency Range	fo	170 to 230MHz	212.5 to 350MHz	
Supply Voltage	Vcc	+3.3V±0.165V	+2.5V±0.125V/+3.3V±0.165V	
Frequency Tolerance (Includes frequency tolerance at room temperature.)	f_tol	±50×10^{-6} max.		
Storage Temperature Range	T_stg	−40 to +85℃		
Operating Temperature Range	T_use	−20 to +70℃		
Current Consumption	Icc	70mA max.	90mA max.	70mA max.
Stand-by Current(#1 pin "L" Level)	I_std	30μA max.		
Load Condition	Load	15pF max.	50Ω to Vcc−2V	100Ω(Output-OutputN)
Symmetry	SYM	45 to 55%[50% Vcc Level]	45 to 55%[at outputs cross point]	
0 Level Output Voltage	V_{OL}	Vcc×0.1 max.	Vcc−1.81 to Vcc−1.62V	–
1 Level Output Voltage	V_{OH}	Vcc×0.9 min.	Vcc−1.025 to Vcc−0.88V	–
Rise and Fall Time	tr, tf	2.0ns max.[10 to 90% Vcc Level]	1.0ns max.[20 to 80% Output,OutputN]	1.0ns max.[20 to 80% Output−OutputN]
Differential Output Voltage	V_{OD1}, V_{OD2}	–	–	0.247 to 0.454V
Change to V_{OD}	ΔV_{OD}	–	–	50mV[ΔV_{OD}= | V_{OD1}−V_{OD2} |]
Offset Voltage	Vos	–	–	1.125 to 1.375V
Offset to V_{OS}	ΔVos	–	–	50mV
OE Pin 0 Level Input Voltage	V_{IL}	Vcc×0.3 max.		
OE Pin 1 Level Input Voltage	V_{IH}	Vcc×0.7 min.		
Output Disable Time	tPLZ	200ns max.		
Output Enable Time	tPZL	2ms max.		
Period Jitter (1)	tRMS	2.2ps typ. [σ]	2.5ps typ. [σ]	
	tp-p	20ps typ.[Peak to peak]	22ps typ.[Peak to peak]	
Total Jitter (1)	tTL	32ps typ. [tDJ+nXtRJ n=14.1(BER=1X10^{-12}) (2)]	35ps typ. [tDJ+n×tRJ n=14.1(BER=1×10^{-12}) (2)]	
Phase Jitter	tpj	1ps max. (fo offset:12kHz to 20MHz)		
Packing Unit	–	100pcs./reel or 500pcs./reel (φ180)		

(1)Measured WAVECREST DTS-2075
(2)tDJ:Deterministic jitter tRJ:Random jitter

Consult our sales representative for other specifications.

[mm]

■Dimensions



Pin Connections

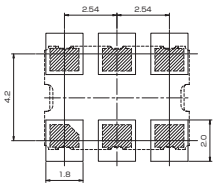
Pin No.	Connection
#1	OE(Output Enable)
#2	NC
#3	GND
#4	Output
#5	NC - DSO753HV OutputN - DSO753HK DSO753HJ
#6	Vcc

Function

#1 Input	#4,#5 Output condition
H	Oscillation out
Open	Oscillation out
L	High Z

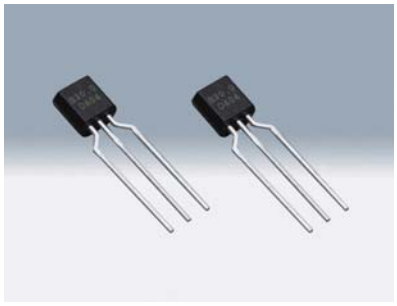
■Recommended Land Pattern

<Top View>



Crystal Oscillators

DLO555MB



■ Features

- Small crystal oscillator in TO92 package
- No PLL, No multiplier in oscillation circuit (The divider circuit, some cases be used)
- High-speed oscillation start up time(1ms)
- Tape and ammo-pack packing for automatic insertion machine

■ Type

D L O 5 5 5 M B
① ② ③ ④ ⑤ ⑥ ⑦ ⑧

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

Pb-Free

RoHS Compliant

■ Applications

- Substitution products for DOC-49S
- Industrial equipment

■ Absolute Maximum Ratings

Item	Legend	Spec.	Unit
Supply Voltage	Vcc	−0.6 to +6.0	V
Output Pin Voltage	VOUT	−0.6 to Vcc+0.6	V
Output Pin Current	IOUT	10	mA
Storage Temperature Range	T_str	−40 to +105	℃

■ Recommended Operating Conditions

Item	Legend	min.	typ.	max.	Unit
Supply Voltage	Vcc	1.6	5.0	5.5	V
Load Capacitation fo>48MHz	L_CMOS	−	−	15	pF
Load Capacitation fo≦48MHz	L_CMOS	−	−	30	pF
Operating Temperature Range	T_opr	−10	−	+85	℃

■ Standard Specification

Item	Legend	Spec. min.	Spec. typ.	Spec. max.	Unit	Condition
Output Frequency Range	fo	0.75	−	54	MHz	L_CMOS : 15pF
		0.75	−	48		L_CMOS : 30pF
Frequency Tolerance	−	−	−	±100	×10⁻⁶	T_opr=−10 to 85℃ Vcc=1.6 to 5.5V
				±50		
Aging	−	−	−	±5	×10⁻⁶/year	
Current Consumption	Icc	−	−	8	mA	No load
Symmetry	SYM	45	−	55	%	50% Vcc level
0 Level Output Voltage	VOL	−	−	Vcc×0.1	V	IOL=4mA
1 Level Output Voltage	VOH	Vcc×0.9	−	−	V	IOH=−4mA
Rise and Fall Time	tr,tf	−	1.8	3.8	ns	L_CMOS : 15pF 20 to 80% Vcc level
		−	3.8	7.5		L_CMOS : 30pF 20 to 80% Vcc level
Start Up Time	T_start	−	−	1	ms	t=0 at 90% Vcc
Phase Noise	−	−	−145	−	dBc/Hz	Offset 1kHz
		−	−158	−		Offset 100kHz
Period Jitter (1)	tRMS	−	2.4	−	ps	σ
	tp-p	−	20	−		Peak to peak
Total Jitter (1)	tTL	−	34	−		tDJ+n×tRJ n=14.2(BER=1×10⁻¹²) (2)
Phase Jitter (3)	tpj	−	−	1		10MHz≦fo<40MHz fo offset12kHz to 5MHz
						40MHz≦fo≦60MHz fo offset12kHz to 20MHz

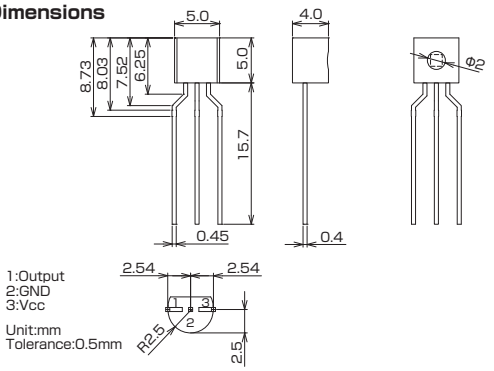
(1)Measured WAVECREST DTS-2075
(2)tDJ:Deterministic jitter tRJ:Random jitter
(3)Measured Agilent Technologies E5052B

Consult our sales representative for other specifications.

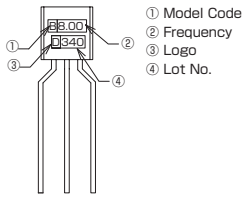
■ Dimensions

[mm]

■ Dimensions

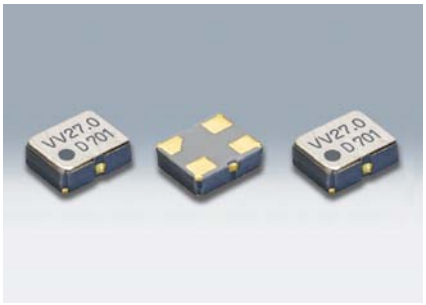


■ Marking



SMD Voltage Controlled Crystal Oscillators

DSV211AV/DSV211AR



Actual size

■ Features

- 2016size, 0.72mm height. Ultra miniature SMD-VCXO
- The product is an analog VCXO which ensures good variable frequency and a linear changing frequency
- Low current consumption

■ Applications

- DVD, Digital TV, STB
- Camera modules

Pb-Free

RoHS Compliant

■ Standard Specification

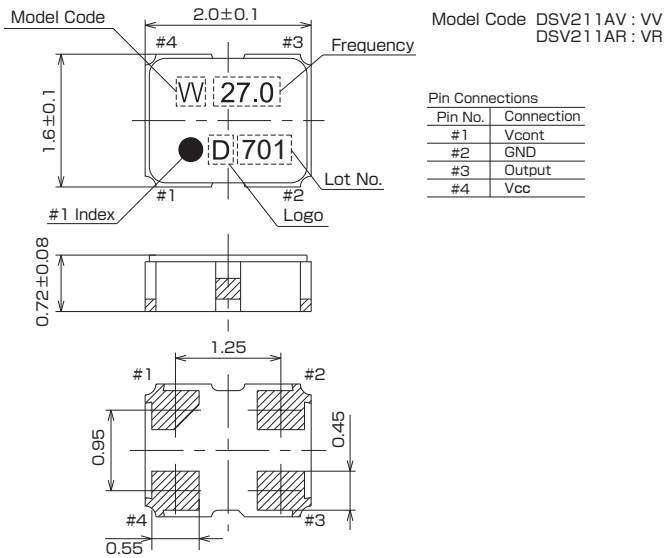
Item \ Type	Legend	DSV211AV		DSV211AR
Output Frequency Range	fo	19.2 to 80MHz	12MHz, 19.2 to 80MHz	19.2 to 30MHz, 38.4 to 60MHz
Supply Voltage	Vcc	+2.8V±0.28V	+3.3V±0.33V	+1.8V±0.18V
Frequency Control Voltage	Vcont	+1.4V±1.4V	+1.65V±1.65V	+0.9V±0.9V
Storage Temperature Range	T_stg	−40 to +85℃		
Operating TemperatureRange	T_use	−10 to 70℃ /−30 to +85℃		
Frequency Tolerance (Includes frequency tolerance at room temperature.)	f_tol	±40×10^{-6} max.		
Frequency Adjustment Range	f_cont	±100×10^{-6} min. [Positive Slope]		±80×10^{-6} min. [Positive Slope]
Current Consumption	Icc	9.4mA max. [No Load]	13.6mA max. [No Load]	2.9mA max. [No Load]
Load Condition	L_CMOS	15pF		
Symmetry	SYM	45 to 55% [50% Vcc Level]		
0 Level Output Voltage	VOL	Vcc×0.1 max.		
1 Level Output Voltage	VOH	Vcc×0.9 min.		
Rise and Fall Time	tr, tf	10ns max. [10 to 90% Vcc Level]		
Period Jitter (1)	tRMS	2.5ps typ. (σ)		3.2ps typ. (σ)
	tp-p	23ps typ. (Peak to peak)		29ps typ. (Peak to peak)
Total Jitter (1)	tTL	35ps typ. [tDJ + n×tRJ n=14.1(BER=1×10^{-12})(2)]		45ps typ. [tDJ + n×tRJ n=14.1(BER=1×10^{-12})(2)]
Phase Jitter	tpj	1ps max. (fo offset: 12kHz to 5MHz)		1.5ps max. (fo offset: 12kHz to 5MHz)
Packing Unit	−	3000pcs./reel(φ180)		

(1) Measured WAVECREST DTS-2075
(2) tDJ:Deterministic jitter tRJ:Random jitter

Consult our sales representative for other specifications.

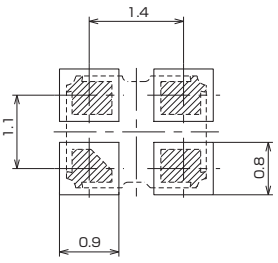
[mm]

■ Dimensions



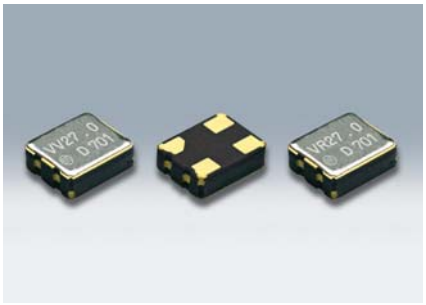
■ Recommended Land Pattern

<Top View>



SMD Voltage Controlled Crystal Oscillators

DSV221SV/DSV221SR



Actual size

■Features

- 2520 size, 0.815mm height. Miniature SMD-VCXO
- The product is an analog VCXO which ensures good variable frequency and a linear changing frequency
- Low current consumption

Pb-Free

RoHS Compliant

■Applications

- DVD, Digital TV, STB

■ Standard Specification

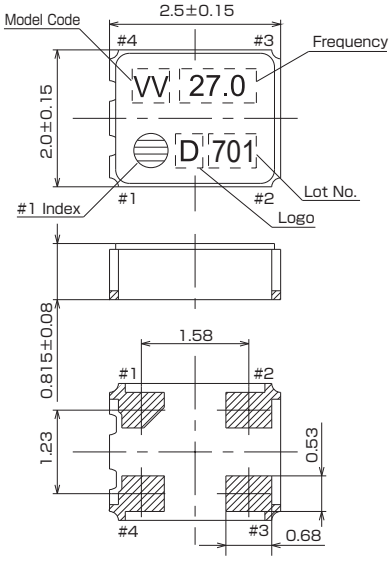
Item \ Type	Legend	DSV221SV		DSV221SR
Output Frequency Range	fo	6.75 to 90MHz		7.5 to 60MHz
Supply Voltage	Vcc	+2.8V±0.28V	+3.3V±0.33V	+1.8V±0.18V
Frequency Control Voltage	Vcont	+1.4V±1.4V	+1.65V±1.65V	+0.9V±0.9V
Storage Temperature Range	T_stg	−40 to +85℃		
Operating Temperature Range	T_use	−10 to 70℃ /−30 to +85℃		
Frequency Tolerance (Includes frequency tolerance at room temperature.)	f_tol	±40×10^{-6} max.		
Frequency Adjustment Range	f_cont	±125×10^{-6} min. [Positive Slope]		±100×10^{-6} min. [Positive Slope]
Current Consumption	Icc	3mA max.(6.75MHz≦fo≦40MHz) 5.5mA max.(40MHz<fo≦65MHz) 9.5mA max.(65MHz<fo≦90MHz) [No Load]	4mA max.(6.75MHz≦fo≦40MHz) 7.5mA max.(40MHz<fo≦65MHz) 13.5mA max.(65MHz<fo≦90MHz) [No Load]	2mA max.(7.5MHz≦fo≦40MHz) 3mA max.(40MHz<fo≦60MHz) [No Load]
Load Condition	L_CMOS	15pF		
Symmetry	SYM	45 to 55% [50% Vcc Level]		
0 Level Output Voltage	VOL	Vcc×0.1 max.		
1 Level Output Voltage	VOH	Vcc×0.9 min.		
Rise and Fall Time	tr, tf	10ns max.(6.75MHz≦fo≦40MHz) 6ns max.(40MHz<fo≦65MHz) 4ns max.(65MHz<fo≦90MHz) [10 to 90% Vcc]		10ns max.(6.75MHz≦fo≦40MHz) 6ns max.(40MHz<fo≦65MHz) [10 to 90% Vcc]
Period Jitter (1)	tRMS	2.4ps typ. (σ)		3.0ps typ. (σ)
	tp-p	22ps typ. (Peak to peak)		28ps typ. (Peak to peak)
Total Jitter (1)	tTL	33ps typ. [tDJ + n×tRJ n=14.1(BER=1×10^{-12})(2)]		42ps typ. [tDJ + n×tRJ n=14.1(BER=1×10^{-12})(2)]
Phase Jitter	tpj	1ps max. (10MHz≦fo<40MHz,fo offset:12kHz to 5MHz、 fo≧40MHz,fo offset:12kHz to 20MHz)		1.5ps max. (10MHz≦fo<40MHz,fo offset:12kHz to 5MHz、 fo≧40MHz,fo offset:12kHz to 20MHz)
Packing Unit	–	2000pcs./reel(φ180)		

(1)Measured WAVECREST DTS-2075
(2)tDJ:Deterministic jitter tRJ:Random jitter

Consult our sales representative for other specifications.

[mm]

■ Dimensions



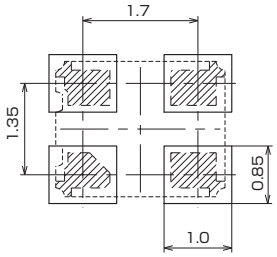
Model Code DSV221SV : VV
DSV221SR : VR

Pin Connections

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

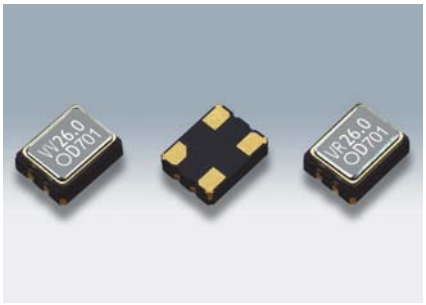
■ Recommended Land Pattern

<Top View>



SMD Voltage Controlled Crystal Oscillators

DSV321SV/DSV321SR



Actual size

■Features

- 3225 size, 1.1 mm height. Miniature SMD-VCXO
- The product is an analog VCXO which ensures good variable frequency and a linear changing frequency.
- Low current consumption

Pb-Free

RoHS Compliant

■Applications

- DVD, Digital TV, STB, backbone transmission equipment

■Standard Specification

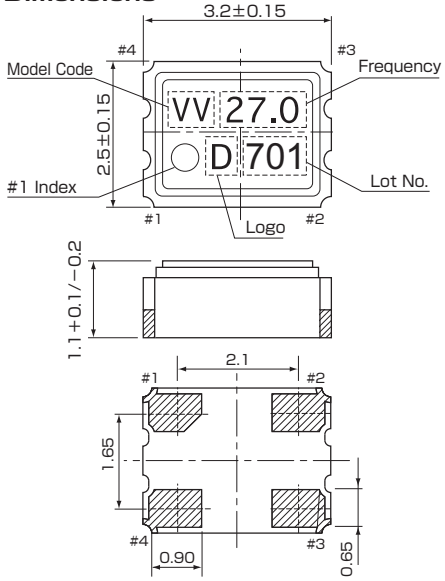
Item \ Type	Legend	DSV321SV		DSV321SR
Output Frequency Range	fo	13.5 to 54MHz	6.75 to 90MHz	13.5 to 54MHz
Supply Voltage	Vcc	+2.8V±0.28V	+3.3V±0.33V	+1.8V±0.18V
Frequency Control Voltage	Vcont	+1.4V±1.4V	+1.65V±1.65V	+0.9V±0.9V
Storage Temperature Range	T_stg	−40 to +85℃		
Operating Temperature Range	T_use	−10 to +70℃ /−30 to +85℃		
Frequency Tolerance (Includes frequency tolerance at room temperature.)	f_tol	±40×10^{-6} max.		
Frequency Adjustment Range	f_cont	±125×10^{-6} min./±100×10^{-6} min. [Positive Slope]		±100×10^{-6} min. [Positive Slope]
Current Consumption	Icc	3mA max.(13.5MHz≦fo≦40MHz) 5mA max.(40MHz<fo≦54MHz) [No Load]	5mA max.(6.75MHz≦fo≦40MHz) 8mA max.(40MHz<fo≦54MHz) 12mA max.(54MHz<fo≦90MHz) [No Load]	2mA max.(13.5MHz≦fo≦36MHz) 3mA max.(36MHz<fo≦54MHz) [No Load]
Load Condition	L_CMOS	15pF		
Symmetry	SYM	40 to 60% [50% Vcc Level]		
0 Level Output Voltage	VOL	Vcc×0.1 max.		
1 Level Output Voltage	VOH	Vcc×0.9 min.		
Rise and Fall Time	tr, tf	10ns max.(13.5MHz≦fo≦40MHz) 6ns max.(40MHz<fo≦54MHz) [10 to 90% Vcc Level]	10ns max.(6.75MHz≦fo≦40MHz) 6ns max.(40MHz<fo≦54MHz) 4ns max.(54MHz<fo≦90MHz) [10 to 90% Vcc Level]	10ns max.(13.5MHz≦fo≦40MHz) 6ns max.(40MHz<fo≦54MHz) [10 to 90% Vcc Level]
Period Jitter (1)	tRMS	2.4ps typ. (σ)		3.5ps typ. (σ)
	tp-p	22ps typ. (Peak to peak)		32ps typ. (Peak to peak)
Total Jitter (1)	tTL	33ps typ. [tDJ + n×tRJ n=14.1(BER=1×10^{-12})(2)]		49ps typ. [tDJ + n×tRJ n=14.1BER=1×10^{-12})(2)]
Phase Jitter	tpj	1ps max. (10MHz≦fo<40MHz, fo offset：12kHz to 5MHz、 fo≧40MHz, fo offset：12kHz to 20MHz)		1.5ps max. (fo<40MHz, fo offset：12kHz to 5MHz、 fo≧40MHz, fo offset：12kHz to 20MHz)
Packing Unit	–	2000pcs./reel(φ180)		

(1)Measured WAVECREST DTS-2075
(2) tDJ:Deterministic jitter tRJ:Random jitter

Consult our sales representative for other specifications.

[mm]

■ Dimensions



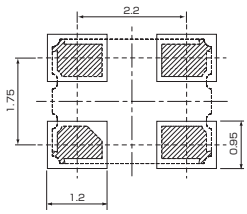
Model Code DSV321SV:VV
DSV321SR:VR

Pin Connections

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

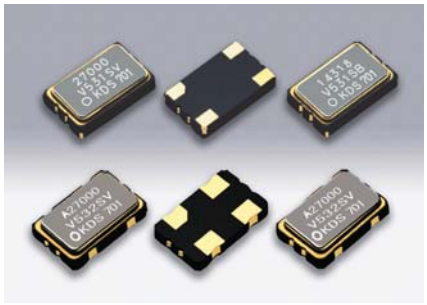
■ Recommended Land Pattern

<Top View>



SMD Voltage Controlled Crystal Oscillators

DSV531S/DSV532S SERIES



Actual size

■Features

- 5032 size, 1.2mm height. Miniature SMD-VCXO (0.022cc)
- The product is an analog VCXO which ensures good variable frequency and a linear changing frequency.

Pb-Free

RoHS Compliant

■Applications

- DVD, Digital TV, STB, backbone transmission equipment

■Standard Specification

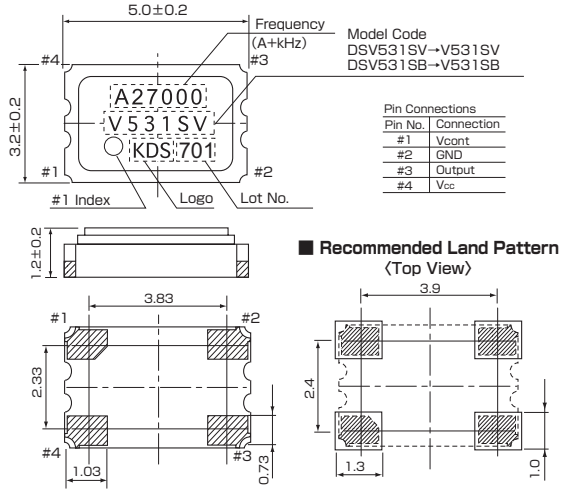
Item \ Type	Legend	DSV531SV/DSV532SV	DSV531SB/DSV532SB
Output Frequency Range	fo	1.25 to 80MHz	5 to 50MHz
Supply Voltage	Vcc	+3.3V±0.3V	+5.0V±0.5V
Frequency Control Voltage	Vcont	+1.65V±1.65V	+2.5V±2.0V
Storage Temperature Range	T_stg	−40 to +85℃	
Operating Temperature Range	T_use	−10 to +70℃	
Frequency Tolerance (Includes frequency tolerance at room temperature.)	f_tol	±50×10^{-6} max.	
Frequency Adjustment Range	f_cont	±100×10^{-6} min. [Positive Slope]	
Current Consumption	Icc	10mA max.(fo≦60MHz) 15mA max.(fo>60MHz) [No Load]	15mA max. [No Load]
Load Condition	L_CMOS	15pF max.	
Symmetry	SYM	40 to 60% [50% Vcc Level]	
0 Level Output Voltage	VOL	Vcc×0.1 max.	
1 Level Output Voltage	VOH	Vcc×0.9 min.	
Rise and Fall Time	tr, tf	10ns max.(fo≦50MHz) 6ns max.(fo>50MHz) [10 to 90% Vcc Level]	10ns max. [10 to 90% Vcc Level]
Period Jitter (1)	tRMS	2.2ps typ. [σ]	
	tp-p	20ps typ.[Peak to peak]	
Total Jitter (1)	tTL	31ps typ. [tDJ+n×tRJ n=14.1(BER=1×10^{-12}) (2)]	
Phase Jitter	tpj	1ps max. [10MHz≦fo<40MHz、fo offset:12kHz to 5MHz fo≧40MHz、fo offset:12kHz to 20MHz]	
Packing Unit	—	1000pcs./reel(φ180)	

(1)Measured WAVECREST DTS-2075
(2)tDJ:Deterministic jitter tRJ:Random jitter

Consult our sales representative for other specifications.

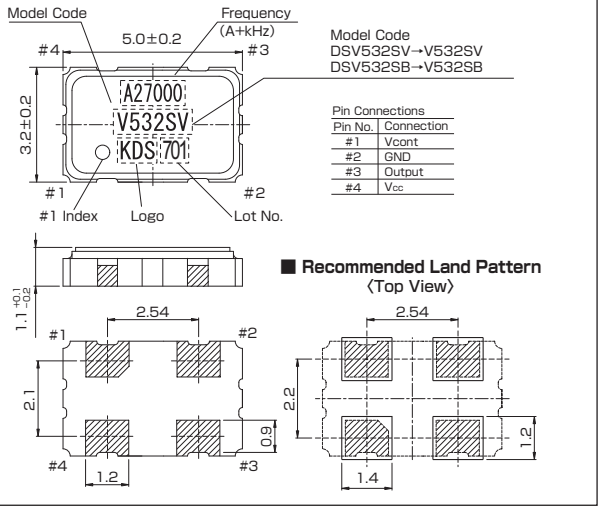
■ DSV531S SERIES [mm]

■ Dimensions



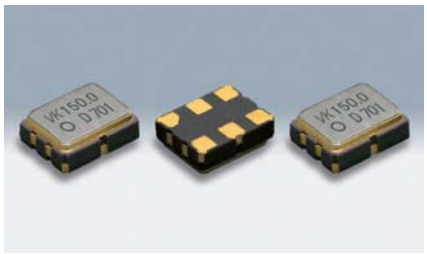
■ DSV532S SERIES [mm]

■ Dimensions



SMD Voltage Controlled Crystal Oscillators

DSV323S SERIES



Actual size

■ Features

- Available with four types of output functions: CMOS, LV-PECL, LVDS, HCSL
- Differential output (LV-PECL, LVDS, HCSL)
- Low jitter
- 3-state function

■ Applications

- Optical transmission device, radio transmitter-receiver equipment, digital image devices, and HDTV.

Pb-Free

RoHS Compliant

■ Standard Specification

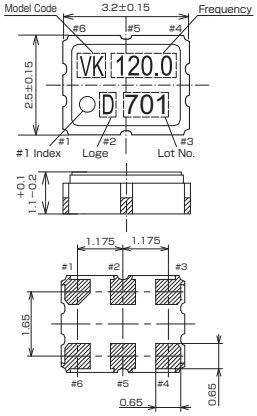
Item \ Type	Legend	DSV323SV	DSV323SK	DSV323SJ	DSV323SD
Output Specification	–	CMOS	LV-PECL	LVDS	HCSL
Output Frequency Range	fo	6.75 to 170MHz	40 to 170MHz	80 to 170MHz	
Supply Voltage	V_{CC}	+3.3V±0.165V			
Frequency Control Voltage	Vcont	+1.65V±1.65V			
Storage Temperature Range	T_stg	−40 to +85℃			
Operating Temperature Range	T_use	−10 to +70℃/−40 to +85℃			
Frequency Tolerance	f_tol	±50×10^{-6} max.			
Frequency Adjustment Range	f_cont	±100×10^{-6} min. [Positive Slope]			
Current Consumption	I_{CC}	12mA 6.75MHz≦fo≦90MHz 25mA 80MHz≦fo≦186MHz [No Load]	50mA max.	30mA max.	40mA max.
Stand-by Current(#1 pin "L" Level)	I-std	5mA 6.75MHz≦fo≦90MHz 30μA 80MHz≦fo≦186MHz	30μA		
Output Load	Load	15pF max.	50Ω to V_{CC}−2V	100Ω (Output−OutputN)	50Ω
Symmetry	SYM	40 to 60% [50% V_{CC} Level]	40 to 60% [at outputs cross point]		
0 Level Output Voltage	V_{OL}	V_{CC}×0.1 max.	V_{CC}−1.81 to V_{CC}−1.62V	–	−150 to 150mV
1 Level Output Voltage	V_{OH}	V_{CC}×0.9 min.	V_{CC}−1.025 to V_{CC}−0.88V	–	600 to 850mV
Rise and Fall Time	tr,tf	10ns max.(6.75MHz≦fo≦40MHz) 6ns max.(40MHz<fo≦54MHz) 4ns max.(54MHz<fo≦90MHz) 2ns max.(80MHz≦fo≦186MHz) [10 to 90% V_{CC}]	0.5ns max. [20 to 80% Output,OutputN]	0.5ns max. [20 to 80% Output−OutputN]	0.5ns max. [0.175 to 0.525V Level]
Differential Output Voltage	V_{OD1}, V_{OD2}	–	–	0.247 to 0.454V	–
Change to V_{OD}	ΔV_{OD}	–	–	50mV[ΔV_{OD}=|V_{OD1}−V_{OD2}|]	–
Offset Voltage	V_{OS}	–	–	1.125 to 1.375V	–
Offset to V_{OS}	ΔV_{OS}	–	–	50mV	–
Crossing Point Voltage	Vcr	–	–	–	250 to 550mV
OE Pin 0 Level Input Voltage	V_{IL}	V_{CC}×0.3 max.			
OE Pin 1 Level Input Voltage	V_{IH}	V_{CC}×0.7 min.			
Output Disable Time	tPLZ	150ns max. (6.75MHz≦fo≦90MHz) 200ns max. (80MHz≦fo≦186MHz)	200ns max.		
Output Enable Time	tPZL	150ns max. (6.75MHz≦fo≦90MHz) 2ms max. (80MHz≦fo≦186MHz)	2ms max.		
Period Jitter (1)	tRMS	2.3ps typ. (σ)			
	tp-p	22ps typ. (Peak to peak)			
Total Jitter (1)	tTL	32ps typ. [tDJ + n×tRJ n=14.1(BER=1×10^{-12})(2)]			
Phase Jitter	tpj	1ps max. [13.5MHz≦fo<40MHz, fo offset:12kHz to 5MHz fo≧40MHz, fo offset:12kHz to 20MHz]			
Packing Unit	–	2000pcs/reel(180 φ)			

(1)Measured WAVECREST DTS-2075
(2)tDJ:Deterministic jitter tRJ:Random jitter

Consult our sales representative for other specifications.

[mm]

■ Dimensions



Model Code
DSV323SV : VV
DSV323SK : VK
DSV323SJ : VJ
DSV323SD : VD

Pin Connections

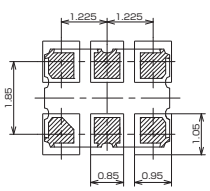
Pin No.	Connection
#1	Vcont
#2	OE(Output Enable)
#3	GND
#4	Output
#5	NC -DSV323SV OutputN -DSV323SK DSV323SJ DSV323SD
#6	V_{CC}

Function

#2 Input	#4,#5 Output condition
H	Oscillation out
Open	Oscillation out
L	High Z

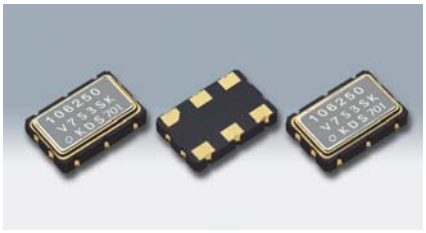
■ Recommended Land Pattern

<Top View>



SMD Voltage Controlled Crystal Oscillators

DSV753S SERIES



Actual size

■ Features

- 7.3×4.9×1.5mm size miniature SMD-VCXO(0.06cc)
- Available with four types of output function:CMOS, LV-PECL, LVDS, HCSL
- Differential output(LV-PECL, LVDS, HCSL)
- Low jitter
- 3-state function

■ Applications

- Optical transmission device,radio transmitter-receiver equipment,digital image devices and HDTV.

Pb-Free

RoHS Compliant

■ Standard Specification

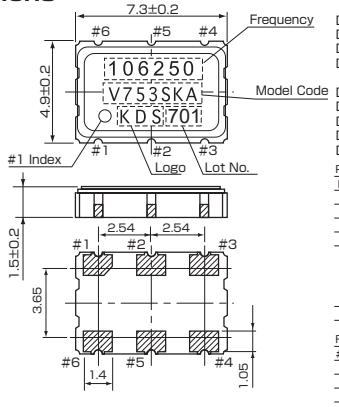
Item \ Type	Legend	DSV753SV	DSV753SB	DSV753SK	DSV753SJ	DSV753SD
Output Specification	–	CMOS		LV-PECL	LVDS	HCSL
Output Frequency Range	fo	2 to 170MHz	4 to 50MHz	40 to 170MHz	80 to 170MHz	80 to 170MHz
Supply Voltage	V_{CC}	+3.3V±0.33V	+5.0V±0.5V	+3.3V±0.165V		
Frequency Control Voltage	Vcont	+1.65V±1.65V	+2.5V±2.0V	+1.65V±1.65V		
Storage Temperature Range	T_stg	−40 to 85℃				
Operating Temperature Range	T_use	−10 to 70℃ / −40 to 85℃				
Frequency Tolerance	f_tol	±50 X 10^{-6} max.				
Frequency Adjustment Range	f_cont	±100 X 10^{-6} min. [Positive Slope]				
Current Consumption	I_{CC}	12mA max.(2MHz≦fo≦90MHz) 25mA max.(80MHz≦fo≦170MHz) [No Load]	15mA max. [No Load]	50mA max.	30mA max.	40mA max.
Stand-by Current (#1 pin "L" Level)	I_std	5mA max.(2MHz≦fo≦90MHz) 30μA max.(80MHz≦fo≦170MHz)	8mA max.	30μA max.		
Output Load	Load	15pF max.		50Ω to V_{CC}−2V	100Ω(Output-OutputN)	50Ω
Symmetry	SYM	40 to 60%[50% V_{CC} Level]		40 to 60%[at outputs cross point]		
0 Level Output Voltage	V_{OL}	V_{CC}×0.1 max.		V_{CC} −1.81 to V_{CC}−1.62V	–	−150 to 150mV
1 Level Output Voltage	V_{OH}	V_{CC}×0.9 min.		V_{CC} −1.025 to V_{CC}−0.88V	–	600 to 850mV
Rise and Fall Time	tr, tf	10ns max.(2MHz≦fo≦40MHz) 6ns max.(40MHz<fo≦54MHz) 4ns max.(54MHz<fo≦90MHz) 2ns max.(80MHz≦fo≦170MHz) [10 to 90% V_{CC} Level]	10ns max. [10 to 90% V_{CC} Level]	0.5ns max. [20 to 80% Output, OutputN]	0.5ns max. [20 to 80% Output-OutputN]	0.5ns max. [0.175 to 0.525V Level]
Differential Output Voltage	V_{OD1}, V_{OD2}	–	–	–	0.247 to 0.454V	–
Change to V_{OD}	ΔV_{OD}	–	–	–	50mV [ΔV_{OD}= | V_{OD1}−V_{OD2} |]	–
Offset Voltage	V_{OS}	–	–	–	1.125 to 1.375V	–
Offset to V_{OS}	ΔV_{OS}	–	–	–	50mV	–
Crossing Point Voltage	Vcr	–	–	–	–	250 to 550mV
OE Pin 0 Level Input Voltage	V_{IL}	V_{CC}×0.3 max.				
OE Pin 1 Level Input Voltage	V_{IH}	V_{CC}×0.7 min.				
Output Disable Time	tPLZ	150ns max.(2MHz≦fo≦90MHz) 200ns max. (80MHz≦fo≦170MHz)	150ns max.	200ns max.		
Output Enable Time	tPZL	150ns max.(2MHz≦fo≦90MHz) 2ms max. (80MHz≦fo≦170MHz)	150ns max.	2ms max.		
Period Jitter (1)	tRMS	2.4ps typ. (σ)				
	tp-p	22ps typ. (Peak to peak)				
Total Jitter (1)	tTL	33ps typ. [tDJ + n×tRJ n=14.1 (BER=1×10^{-12})(2)]				
Phase Jitter	tpj	1ps max. (fo<40MHz,fo offset:12kHz to 5MHz、40MHz≦fo,fo offset:12kHz to 20MHz)				
Packing Unit	–	1000pcs/reel(254φ)				

(1)Measured WAVECREST DTS-2075
(2)tDJ:Deterministic Jitter tRJ:Random Jitter

Consult our sales representative for other specifications.

[mm]

■ Dimensions



Frequency
DSV753SV DSV753SB(A+kHz)
DSV753SK(kHz)
DSV753SJ
DSV753SD

Model Code
DSV753SV→V753SV
DSV753SB→V753SB
DSV753SK→V753SKA
DSV753SJ→V753SJA
DSV753SD→V753SDA

Pin Connections

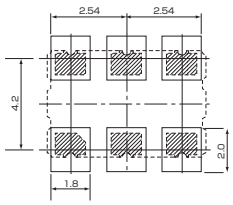
Pin No.	Connection
#1	Vcont
#2	OE(Output Enable)
#3	GND
#4	Output
#5	NC - DSV753SV DSV753SB OutputN - DSV753SK DSV753SJ DSV753SD
#6	V_{CC}

Function

#2 Input	#4,#5 Output condition
H	Oscillation out
Open	Oscillation out
L	High Z

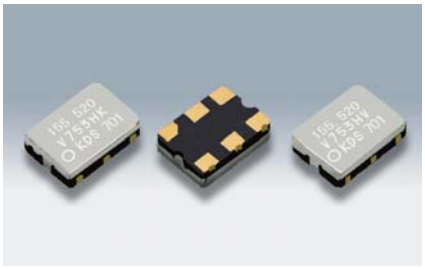
■ Recommended Land Pattern

<Top View>



SMD Voltage Controlled Crystal Oscillators

DSV753H SERIES



Actual size

RoHS Compliant

■Features

- Available with three types of output functions: CMOS, LV-PECL, LVDS
- Differential output (LV-PECL, LVDS)
- Low jitter
- 3-state function

■Applications

- Optical transmission device, radio transmitter-receiver equipment, digital image devices, and HDTV related equipment.

■ Stabdart Specification

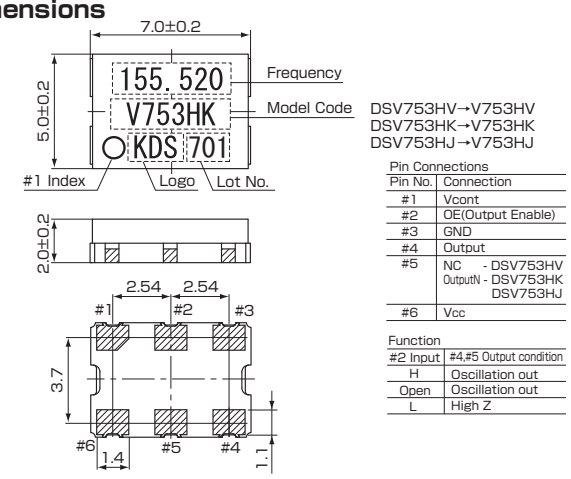
Item \ Type	Legend	DSV753HV	DSV753HK	DSV753HJ
Output Specification	–	CMOS	LV-PECL	LVDS
Output Frequency Range	fo	170 to 230MHz	170 to 350MHz	
Supply Voltage	Vcc	+3.3V±0.165V		
Frequency Control Voltage	Vcont	+1.65V±1.65V		
Storage Temperature Range	T_stg	−40 to +85℃		
Operating Temperature Range	T_use	−20 to +70℃		
Frequency Tolerance (Includes frequency tolerance at room temperature.)	f_tol	±50×10^{-6} max.		
Frequency Adjustment Range	f_cont	±100×10^{-6} min. Positive Slope		
Current Consumption	Icc	70mA max.	90mA max.	70mA max.
Stand-by Current (#2 pin "L"level)	I_std	30μA max.		
Output Load	Load	15pF max.	50Ω to Vcc−2V	100Ω(Output−OutputN)
Symmetry	SYM	45 to 55%[50% Vcc Level]	45 to 55%[at outputs cross point]	
0 Level Output Voltage	VOL	Vcc×0.1 max.	Vcc−1.81 to Vcc−1.62V	–
1 Level Output Voltage	VOH	Vcc×0.9 min.	Vcc−1.025 to Vcc−0.88V	–
Rise and Fall Time	tr, tf	2.0ns max.[10 to 90% Vcc Level]	1.0ns max.[20 to 80% Output,OutputN]	1.0ns max.[20 to 80% Output-OutputN]
Differential Output Voltage	VOD1, VOD2	–	–	0.247 to 0.454V
Change to V_{OD}	⊿VOD	–	–	50mV[⊿VOD= | VOD1−VOD2 |]
Offset Voltage	VOS	–	–	1.125 to 1.375V
Offset to V_{OS}	⊿VOS	–	–	50mV
OE Pin 0 Level Input Voltage	VIL	Vcc×0.3 max.		
OE Pin 1 Level Input Voltage	VIH	Vcc×0.7 min.		
Period Jitter (1)	tRMS	2.2ps typ. [σ]	2.5ps typ. [σ]	
	tp-p	20ps typ.[Peak to peak]	22ps typ.[Peak to peak]	
Total Jitter (1)	tTL	32ps typ. [tDJ+n×tRJ n=14.1(BER=1×10^{-12}) (2)]	35ps typ. [tDJ+n×tRJ n=14.1(BER=1×10^{-12}) (2)]	
Phase Jitter	tpj	1ps max. (fo offset:12kHz to 20MHz)		
Packing Unit	–	100pcs. / reel or 500pcs. / reel(φ180)		

(1)Measured WAVECREST DTS-2075
(2)tDJ:Deterministic jitter tRJ:Random jitter

Consult our sales representative for other specifications.

[mm]

■ Dimensions



DSV753HV→V753HV
DSV753HK→V753HK
DSV753HJ→V753HJ

Pin Connections

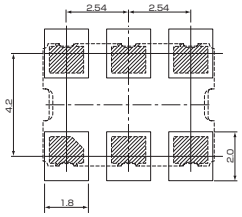
Pin No.	Connection
#1	Vcont
#2	OE(Output Enable)
#3	GND
#4	Output
#5	NC - DSV753HV OutputN - DSV753HK DSV753HJ
#6	Vcc

Function

#2 Input	#4,#5 Output condition
H	Oscillation out
Open	Oscillation out
L	High Z

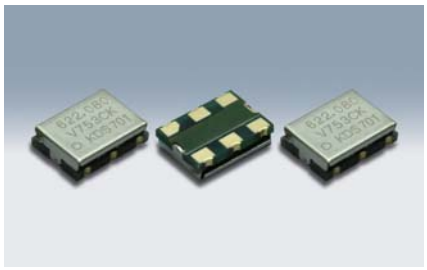
■ Recommended Land Pattern

<Top View>



SMD Voltage Controlled Crystal Oscillators

DSV753C SERIES



Actual size

RoHS Compliant

■Features

- Available with two types of output functions: LV-PECL, and LVDS
- Differential output (LV-PECL, LVDS)
- Low jitter
- Available up to 700MHz by using AT cut fundamental resonator.

■Applications

- Optical transmission device, radio transmitter-receiver equipment, digital image devices, and HDTV related equipment.

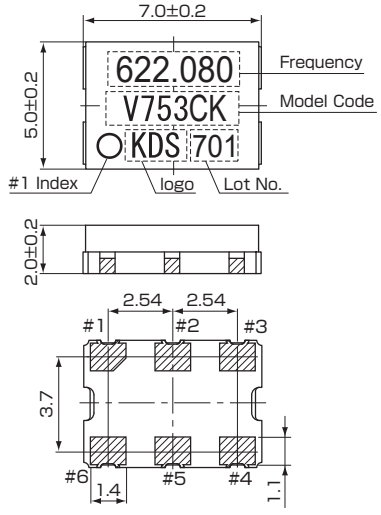
■ Stabdart Specification

Item \ Type	Legend	DSV753CK	DSV753CJ
Output Specification	–	LV-PECL	LVDS
Output Frequency Range	fo	350 to 700MHz	
Supply Voltage	Vcc	+3.3V±0.165V	
Frequency Control Voltage	Vcont	+1.65V±1.65V	
Storage Temperature Range	T_stg	−40 to +85℃	
Operating Temperature Range	T_use	−20 to +70℃	
Frequency Tolerance (Includes frequency tolerance at room temperature.)	f_tol	$\pm 50\times10^{-6}$ max.	
Frequency Adjustment Range	f_cont	$\pm 100\times10^{-6}$ min. Positive Slope	
Current Consumption	Icc	80mA max.	60mA max.
Output Load	Load	50Ω to Vcc−2V	100Ω(Output−OutputN)
Symmetry	SYM	45 to 55%[at outputs cross point]	
0 Level Output Voltage	VOL	2.155 to 2.405V	–
1 Level Output Voltage	VOH	1.355 to 1.700V	–
Rise and Fall Time	tr, tf	0.4ns max.[20 to 80% Output,OutputN]	0.4ns max.[20 to 80% Output-OutputN]
Differential Output Voltage	VOD1, VOD2	–	0.247 to 0.454V
Change to V_{OD}	⊿VOD	–	50mV[ΔV_{OD}= | $V_{OD1}-V_{OD2}$ |]
Offset Voltage	VOS	–	1.125 to 1.375V
Offset to V_{OS}	⊿VOS	–	100mV
Phase Jitter	tpj	1ps max. (fo offset:12kHz to 20MHz)	
Packing Unit	–	100pcs. / reel or 500pcs. / reel(φ180)	

Consult our sales representative for other specifications.

[mm]

■ Dimensions



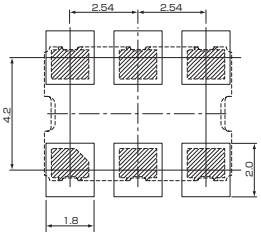
DSV753CK→V753CK
DSV753CJ→V753CJ

Pin Connections

Pin No.	Connection
#1	Vcont
#2	NC
#3	GND
#4	Output
#5	OutputN - DSV753CK DSV753CJ
#6	Vcc

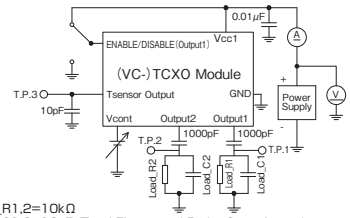
■ Recommended Land Pattern

<Top View>



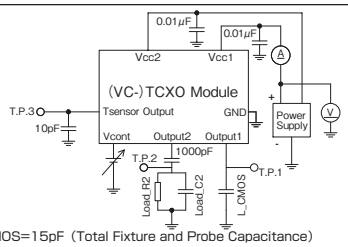
Measurement Circuit

DSA222MAA



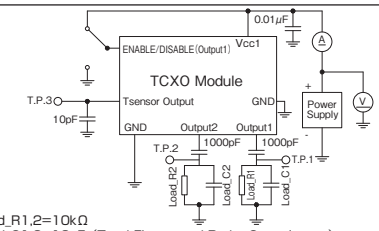
Load_R1,2=10kΩ
Load_C1,2=10pF (Total Fixture and Probe Capacitance)

DSA222MAB



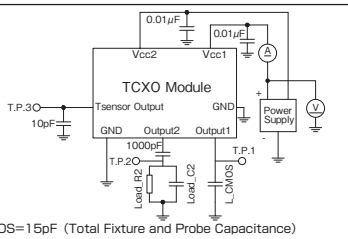
L_CMOS=15pF (Total Fixture and Probe Capacitance)

DSB222MAA



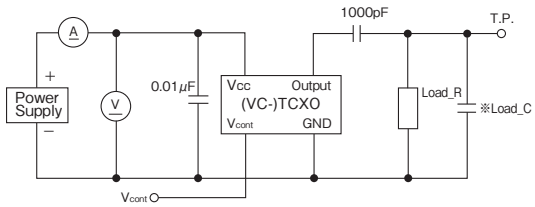
Load_R1,2=10kΩ
Load_C1,2=10pF (Total Fixture and Probe Capacitance)

DSB222MAB



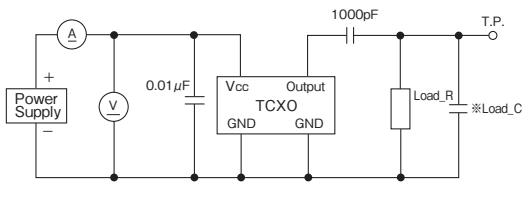
L_CMOS=15pF (Total Fixture and Probe Capacitance)

VC-TCXO(DSA***SDN, SP, 535SC/SD)



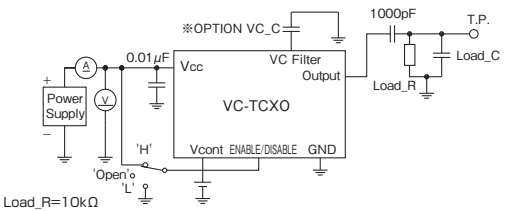
Load_R=10kΩ
※Load_C=10pF (Total Fixture and Probe Capacitance)

TCXO(DSB***SDN, SP, 535SC/SD)



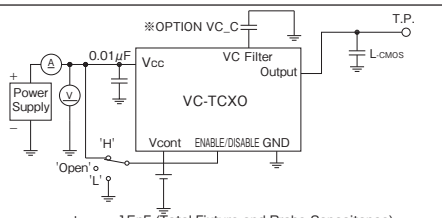
Load_R=10kΩ
※Load_C=10pF (Total Fixture and Probe Capacitance)

DSA535SG (Clipped Sine)



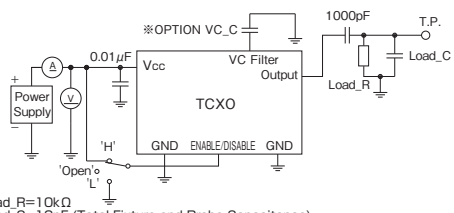
Load_R=10kΩ
Load_C=10pF (Total Fixture and Probe Capacitance)
※Option VC_C=VC Filter Capacitance

DSA535SG (CMOS)



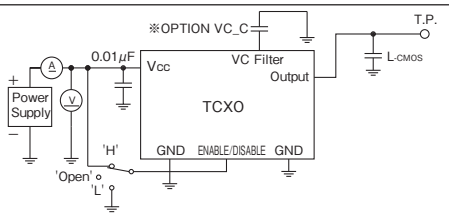
L-CMOS=15pF (Total Fixture and Probe Capacitance)
※Option VC_C=VC Filter Capacitance

DSB535SG (Clipped Sine)



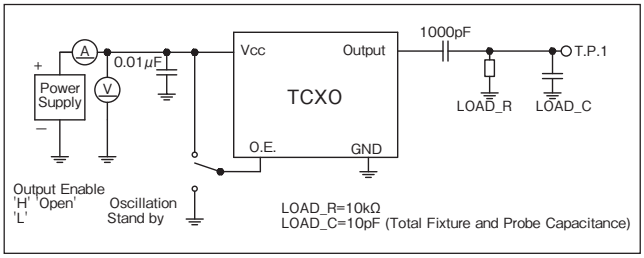
Load_R=10kΩ
Load_C=10pF (Total Fixture and Probe Capacitance)
※Option VC_C=VC Filter Capacitance

DSB535SG (CMOS)



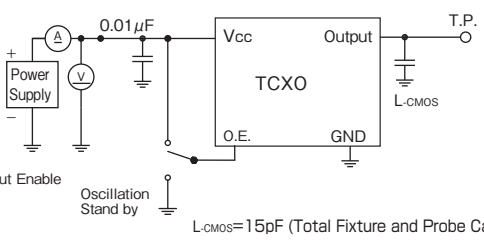
L-CMOS=15pF (Total Fixture and Probe Capacitance)
※Option VC_C=VC Filter Capacitance

TCXO(DSB***SDNB, SLB)



LOAD_R=10kΩ
LOAD_C=10pF (Total Fixture and Probe Capacitance)

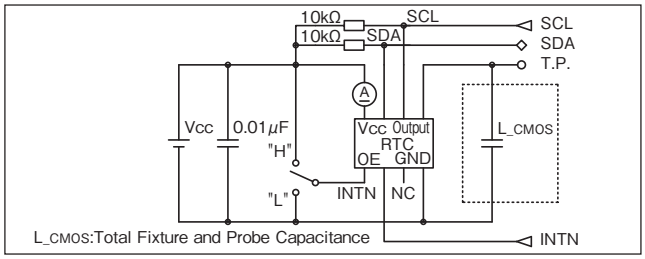
DSB211SJA



L-CMOS=15pF (Total Fixture and Probe Capacitance)

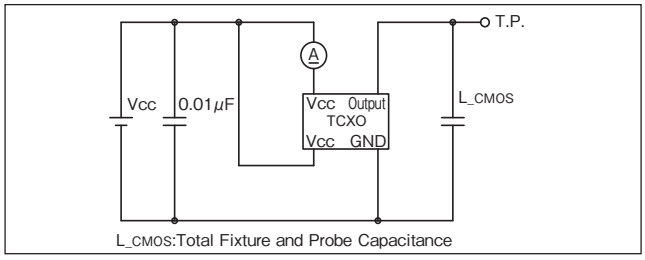
Measurement Circuit

DSK324SR



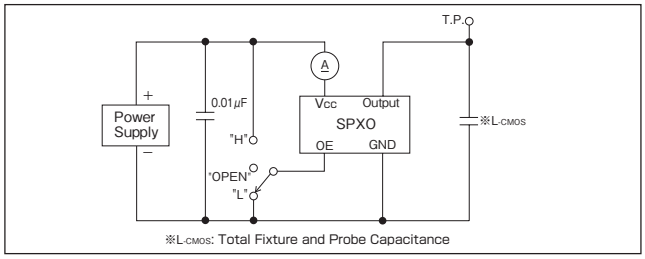
L_CMOS:Total Fixture and Probe Capacitance

DSK321STD



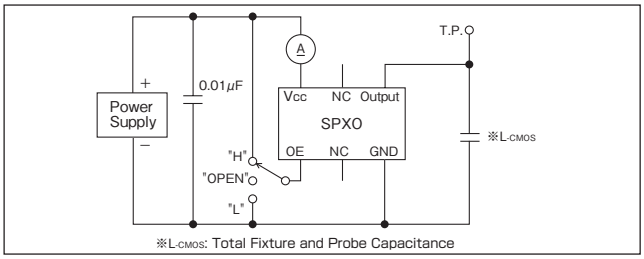
L_CMOS:Total Fixture and Probe Capacitance

DSO***AN,AB,AR,AH,SN,SR,SH,SY,SHF,SBM/SBN



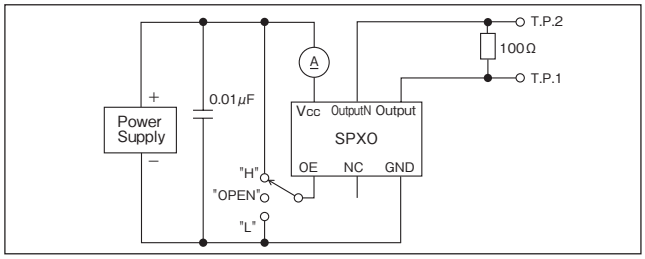
※L-CMOS: Total Fixture and Probe Capacitance

DSO753HV

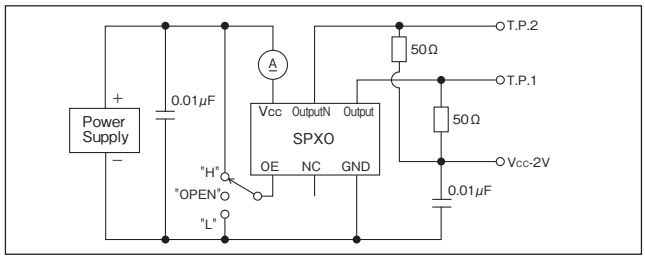


※L-CMOS: Total Fixture and Probe Capacitance

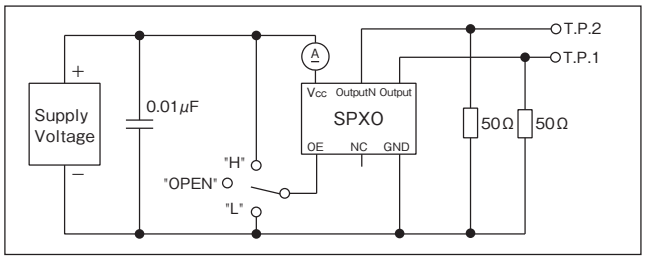
DSO223SJ, DSO323SJ, DSO533SJ, DSO753SJ/HJ



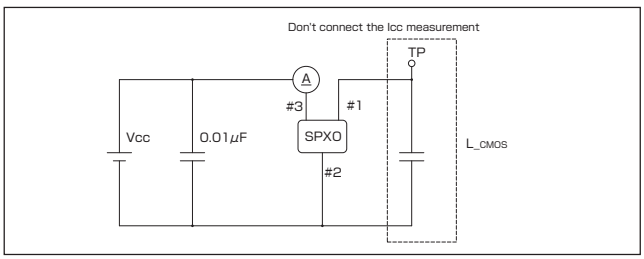
DSO223SK, DSO323SK, DSO533SK, DSO753SK/HK



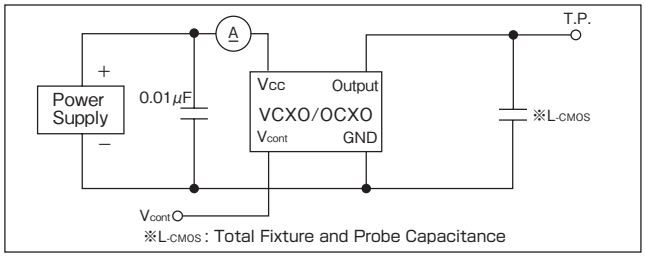
DSO223SD, DSO323SD, DSO753SD



DLO555MB

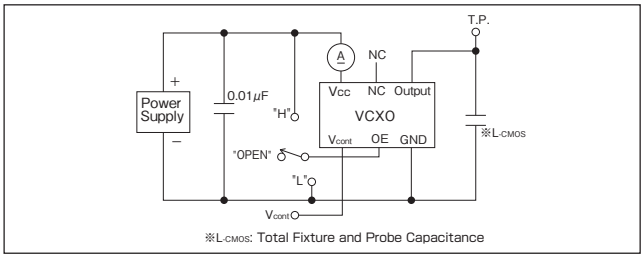


DSV211, 221, 321, 531, 532 SERIES, DLC117



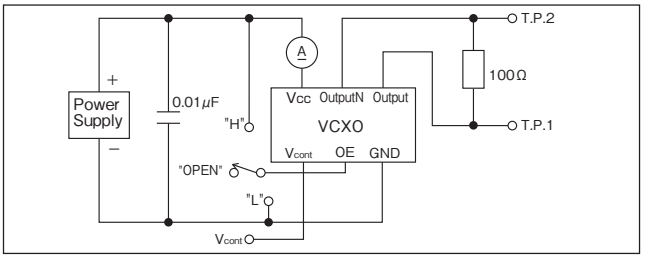
※L-CMOS : Total Fixture and Probe Capacitance

DSV323SV, DSV753SV/SB/HV

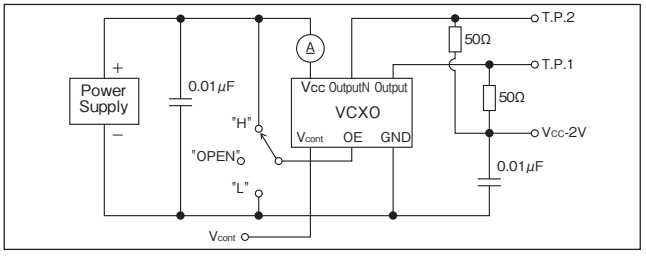


※L-CMOS: Total Fixture and Probe Capacitance

DSV323SJ, DSV753SJ/HJ

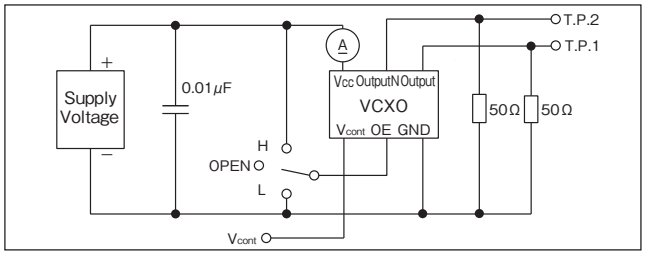


DSV323SK, DSV753SK

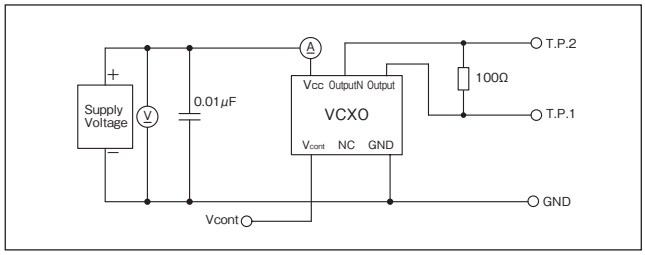


Measurement Circuit

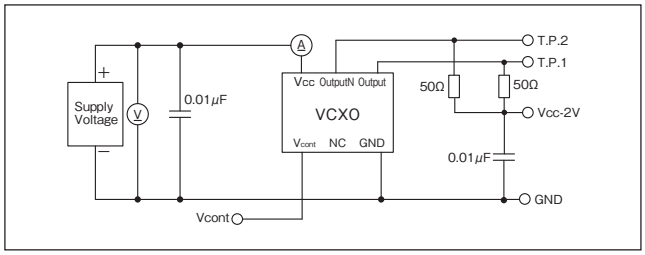
DSV323SD,DSV753SD



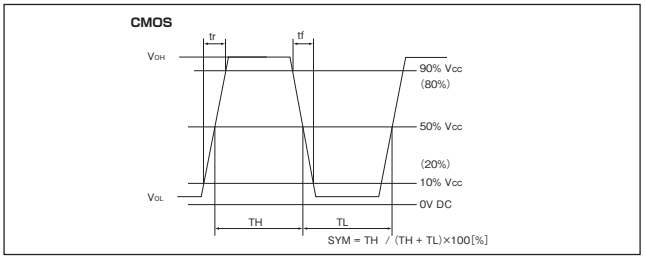
DSV753CJ

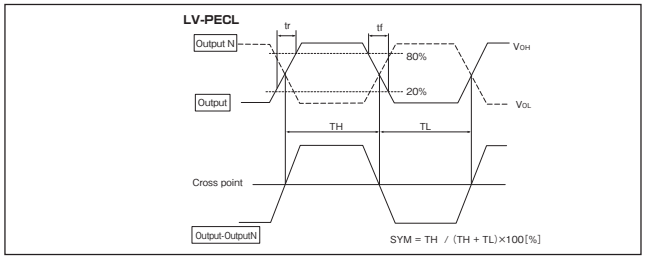


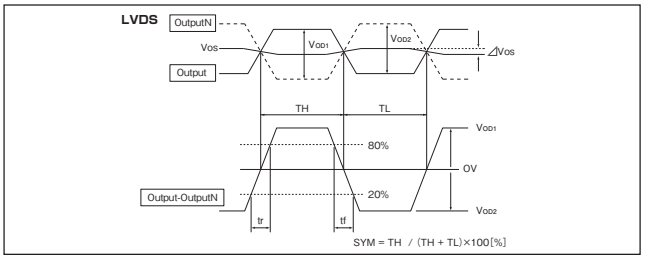
DSV753CK

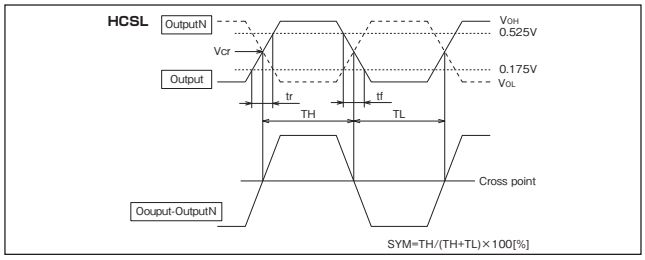


■Output Wave Form

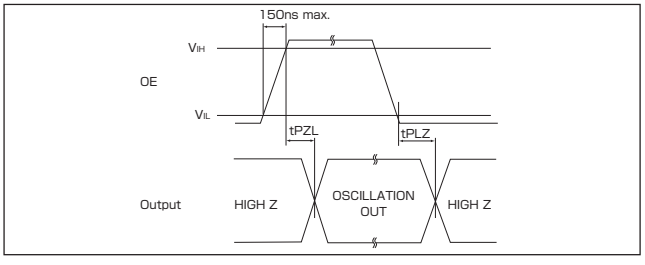








■Input and Output Conditions



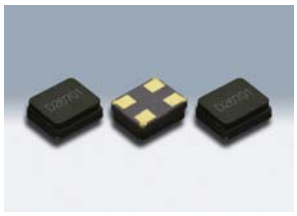
MEMO

Quartz Devices
For Automotive

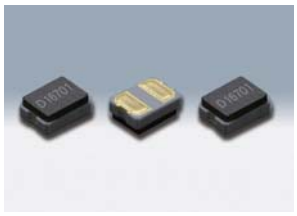
KDS DAISHINKU CORP.

SMD Crystal Resonators / MHz Band Crystal Resonators〈For Automotive〉

DSX211G/DSX210GE



DSX211G



DSX210GE

Actual size

RoHS/ELV Compliant

■ 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℃ "(DSX210GE)
- Moisture prevention packing is unnecessary. Moisture Sensitivity Level:LEVEL1 (IPC/JEDEC J-STD-033)
- 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)

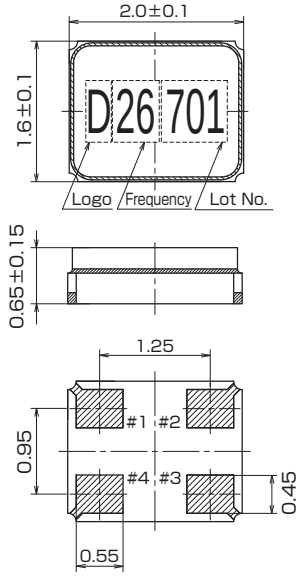
■ Standard Specification

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^{-6} (at 25℃)				
Series Resistance (Inside Atomosphere:nitrogen)	400Ω max.	200Ω max.	150Ω max.	120Ω max.	80Ω max.
Series Resistance (Inside Atomosphere:vaccum)	300Ω max.	150Ω max.	100Ω max.		60Ω max.
Frequency Characteristics over Temperature	±100×10^{-6}/−40 to +125℃ (Ref. to 25℃)				
Storage Temperature Range	−40 to +150℃				
Reliability	AEC-Q200				
Packing Unit	3000pcs./reel(φ180)				

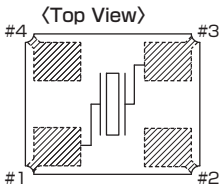
Consult our sales representative for other specifications.

■ DSX211G [mm]

■ Dimensions

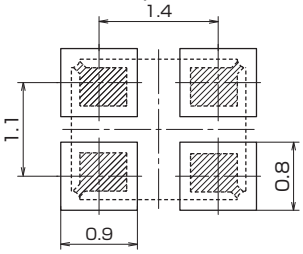


■ Internal Connections



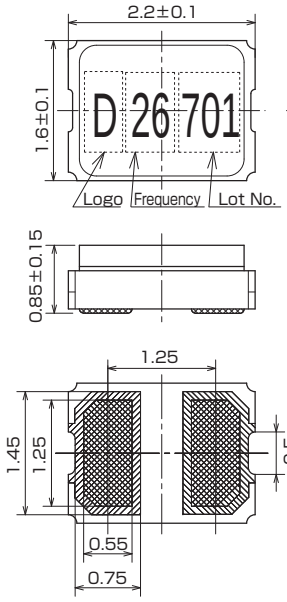
#1 & #3 connected to quartz element
#2 & #4 open (unconnected)

■ Recommended Land Pattern

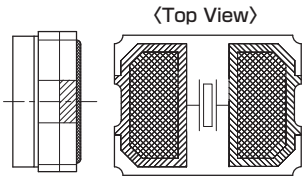


■ DSX210GE [mm]

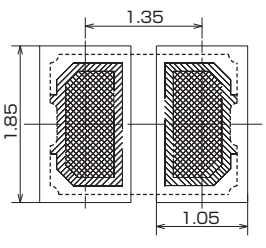
■ Dimensions



■ Internal Connections

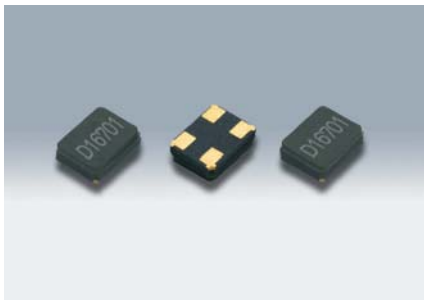


■ Recommended Land Pattern



SMD Crystal Resonators / MHz Band Crystal Resonators〈For Automotive〉

DSX221G



Actual size

RoHS/ELV Compliant

■ Features

- 2520 size miniature and lightweight SMD crystal resonator with a low profile of 0.75mm.
- Excellent heat resistance, High precision and high reliability
- Offers a wide range of frequencies from a comparatively low 12MHz up to 64MHz.
- Moisture prevention packing is unnecessary. Moisture Sensitivity Level:LEVEL1 (IPC/JEDEC J-STD-033)
- AEC-Q200 Compliant

■ Applications

- Automotive radio applications such as Bluetooth, wireless LAN, GPS/GNSS.
- RKE(Remote Keyless Entry), safety controls and multimedia devices

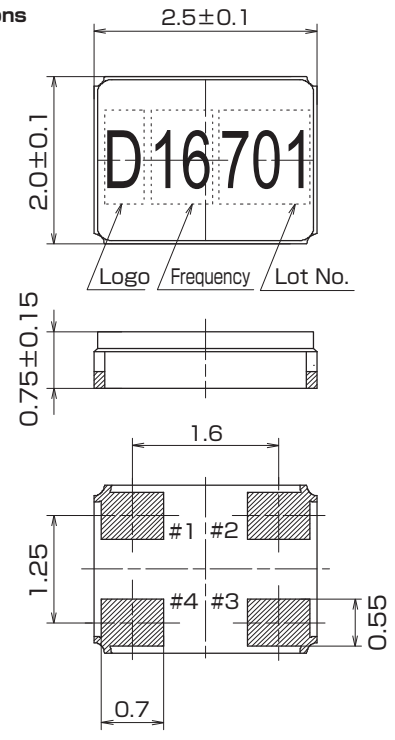
■ Standard Specification

Item \ Type	DSX221G				
Frequency Range	12 to 13MHz	13 to 16MHz	16 to 20MHz	20 to 27MHz	27 to 64MHz
Overtone Order	Fundamental				
Load Capacitance	8pF, 10pF, 12pF				
Drive Level	10μW (200μW max.)				
Frequency Tolerance	±30×10^{-6} (at 25℃)				
Series Resistance	300Ω max.	200Ω max.	150Ω max.	120Ω max.	100Ω max.
Frequency Characteristics over Temperature	±100×10^{-6}/−40 to +125℃ (Ref. to 25℃)				
Storage Temperature Range	−40 to 150℃				
Reliability	AEC-Q200				
Packing Unit	3000pcs./reel(φ180)				

Consult our sales representative for other specifications.

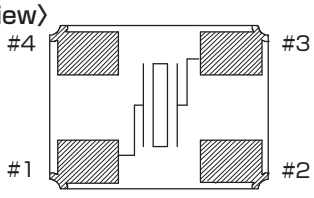
[mm]

■ Dimensions



■ Internal Connections

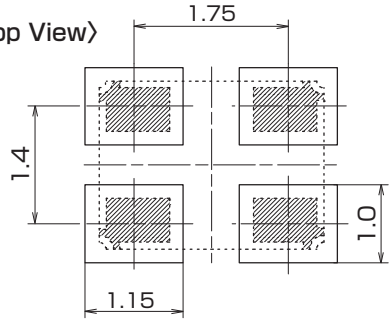
〈Top View〉



#1 & #3 connected to quartz element
#2 & #4 open(unconnected)

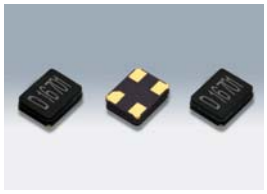
■ Recommended Land Pattern

〈Top View〉

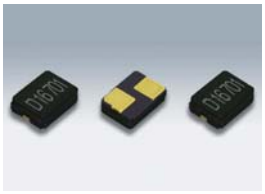


SMD Crystal Resonators / MHz Band Crystal Resonators〈For Automotive〉

DSX321G/DSX321GK/DSX320G/DSX320GE

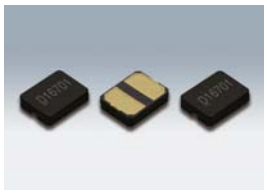


DSX321G/DSX321GK



DSX320G

Actual size



DSX320GE

■ Features

RoHS/ELV Compliant

- Miniature and lightweight SMD crystal resonator
  height DSX321G (over 12MHz): 0.75mm
  (under 12MHz): 0.85mm
  DSX321GK: 0.85mm
  DSX320G (over 12MHz): 0.85mm
  (under 12MHz): 0.95mm
  DSX320GE: 0.95mm
- Excellent heat resistance, High precision and high reliability
- Offers a wide range of frequencies
  DSX321G/DSX320G/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℃"(DSX320G/DSX320GE)
- Moisture prevention packing is unnecessary.
- Moisture Sensitivity Level:LEVEL1 (IPC/JEDEC J-STD-033)
  AEC-Q200 Compliant
  Fully lead free option available. (DSX321G)

■ Applications

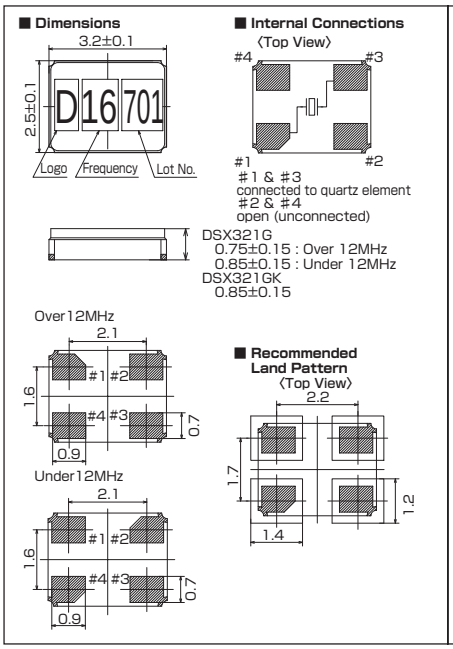
- Multimedia devices such as car navigation systems and car audio,safety controls,TPMS,keyless entry(DSX321G/DSX321GK)
- ECU (engine, body work control), safety relations, car body controls, ABS,EPS(DSX320G/DSX320GE)

■ Standard Specification

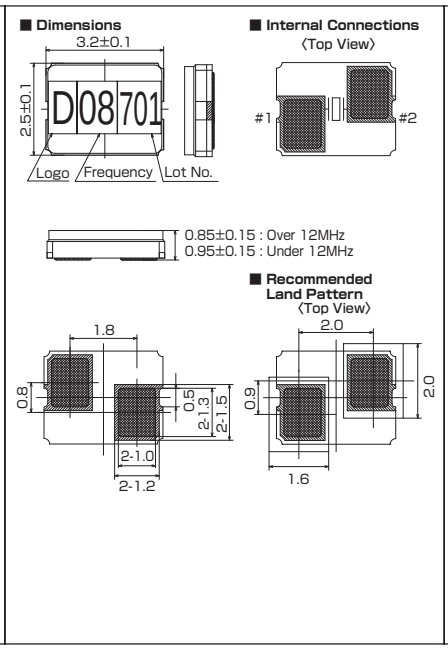
Item \ Type	DSX321G/DSX320G/DSX320GE					
	DSX321GK					
Frequency Range	7.9 to 9.8MHz	9.8 to 11MHz	11 to 12MHz	12 to 27MHz	27 to 40MHz	40 to 64MHz
Overtone Order	Fundamental					
Load Capacitance	8pF, 10pF, 12pF					
Drive Level	10μW(200μW max.)					
Frequency Tolerance	±30×10^{-6} (at 25℃)					
Series Resistance	400Ω max.	200Ω max.	150Ω max.	120Ω max.	100Ω max.	
Frequency Characteristics over Temperature	±100×10^{-6}/−40 to +125℃(Ref. to 25℃)					
Storage Temperature Range	−40 to +150℃					
Reliability	AEC-Q200					
Packing Unit	3000pcs./reel(φ180)					

Consult our sales representative for other specifications.

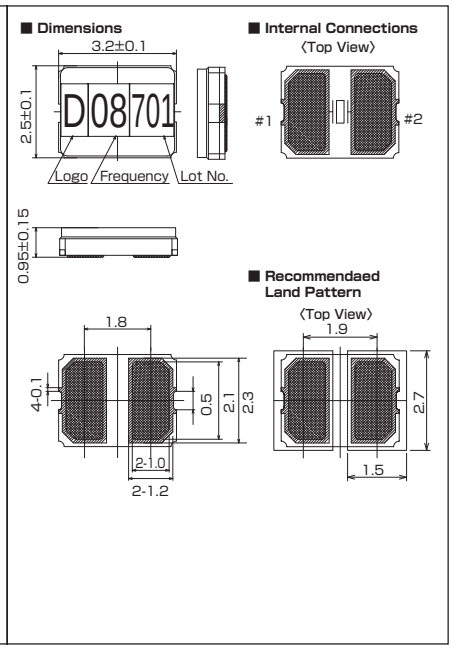
■ DSX321G/DSX321GK [mm]



■ DSX320G [mm]

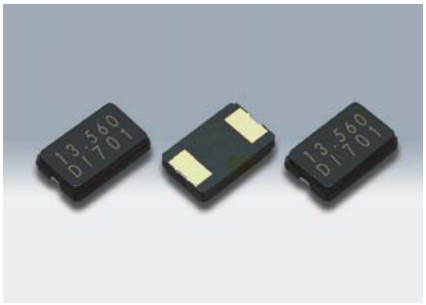


■ DSX320GE [mm]



SMD Crystal Resonators / MHz Band Crystal Resonators〈For Automotive〉

DSX530GK/DSX530GA



Actual size

■ Features

- Miniature and low profile SMD crystal resonator (height 1.0mm)
- Excellent heat resistance, High reliability.
- Moisture prevention packing is unnecessary.
  Moisture Sensitivity Level:LEVEL1 (IPC/JEDEC J-STD-033)
- AEC-Q200 Compliant

RoHS/ELV Compliant

■ Applications

- RKE (Remote Keyless Entry), safety controls and multimedia devices (DSX530GK)
- Multimedia devices such as car navigation systems and car audio (DSX530GA)

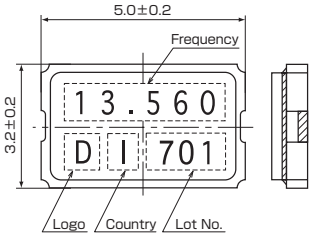
■ Standard Specification

Item \ Type	DSX530GA / DSX530GK			
Frequency Range	7 to 8MHz	8 to 12MHz	12 to 20MHz	20 to 54MHz
Overtone Order	Fundamental			
Load Capacitance	8pF, 10pF, 12pF			
Drive Level	10μW (300μW max.)			
Frequency Tolerance	±30×10^{-6} (at 25℃)			
Series Resistance	200Ω max.	150Ω max.	100Ω max.	50Ω max.
Frequency Characteristics over Temperature	±100×10^{-6} / −40 to +125℃ (Ref. to 25℃)			
Storage Temperature Range	−40 to +150℃			
Reliability	AEC-Q200			
Packing Unit	1000pcs./reel (φ180)			

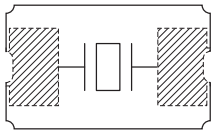
Consult our sales representative for other specifications.

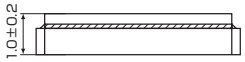
■ DSX530GK [mm]

■ Dimensions

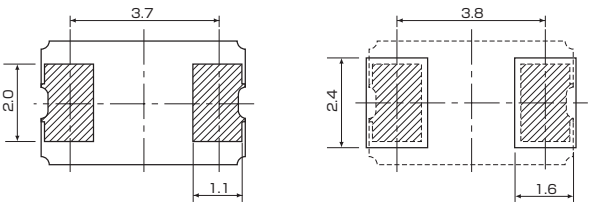


■ Internal Connections
〈Top View〉



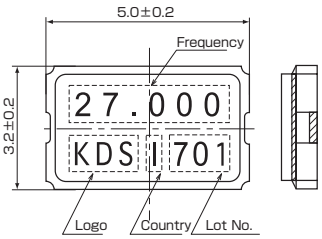


■ Recommended Land Pattern
〈Top View〉

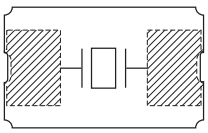


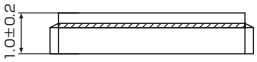
■ DSX530GA [mm]

■ Dimensions

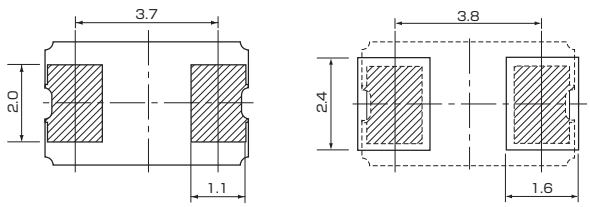


■ Internal Connections
〈Top View〉



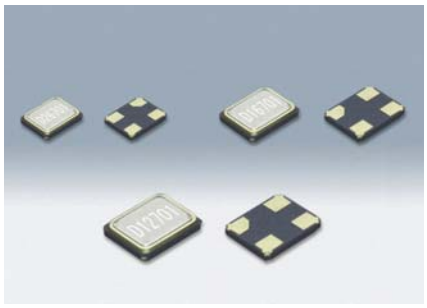


■ Recommended Land Pattern
〈Top View〉



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 : 24MHz to 50MHz
  - DSX221SH : 16MHz to 54MHz
  - DSX321SH : 12MHz to 50MHz
- Moisture prevention packing is unnecessary.
  Moisture Sensitivity Level:LEVEL1 (IPC/JEDEC J-STD-033)
- AEC-Q200 Compliant

Pb-Free

RoHS/ELV Compliant

■ Applications

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

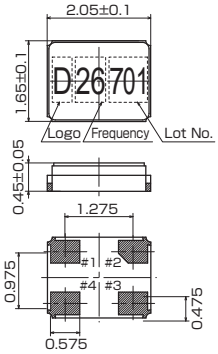
■ Standard Specification

Item \ Type	DSX211SH		DSX221SH				DSX321SH		
Frequency Range	24 to 30MHz	30 to 50MHz	12 to 16MHz	16 to 24MHz	24 to 30MHz	30 to 54MHz	12 to 20MHz	20 to 28MHz	28 to 50MHz
Overtone Order	Fundamental								
Load Capacitance	8pF, 10pF, 12pF								
Drive Level	10μW (100μW max.)		10μW (200μW max.)						
Frequency Tolerance	±30×10^{-6}(at 25℃)								
Series Resistance	150Ω max.	100Ω max.	250Ω max.	200Ω max.	150Ω max.	100Ω max.	120Ω max.	100Ω max.	80Ω max.
Frequency Characteristics over Temperature	±100×10^{-6} / −40 to +125℃ (Ref. to 25℃)								
Storage Temperature Range	−40 to +150℃								
Reliability	AEC-Q200								
Packing Unit	3000pcs./reel(φ180)								

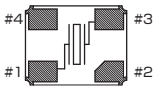
Consult our sales representative for other specifications.

■ DSX211SH [mm]

■ Dimensions

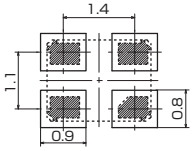


■ Internal Connections
〈Top View〉



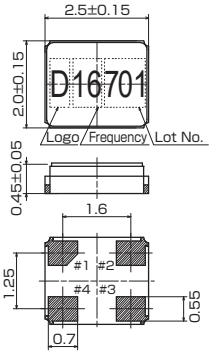
#1 & #3 connected to quartz element
#2 & #4 connected to the cover
#2 & #4 recommended GND connection

■ Recommended Land Pattern
〈Top View〉

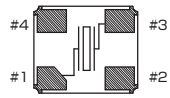


■ DSX221SH [mm]

■ Dimensions

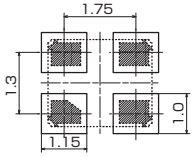


■ Internal Connections
〈Top View〉



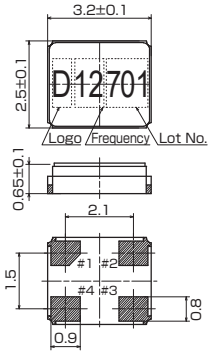
#1 & #3 connected to quartz element
#2 & #4 connected to the cover
#2 & #4 recommended GND connection

■ Recommended Land Pattern
〈Top View〉

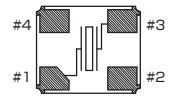


■ DSX321SH [mm]

■ Dimensions

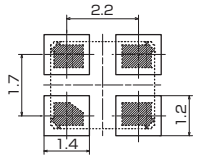


■ Internal Connections
〈Top View〉



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

■ Recommended Land Pattern
〈Top View〉



SMD Crystal Resonators with dedicated temperature sensor / MHz Band Crystal Resonators〈For Automotive〉

DSR211ATH/DSR211STH/DSR221STH

NEW

Actual size DSR211ATH DSR211STH DSR221STH

Pb-Free

RoHS/ELV Compliant

■ Features

- DSR211ATH: 2016size, height 0.65mm max.
  DSR211STH: 2016size,
  height 0.8mm max. (19.2MHz)
  0.65mm max. (38.4MHz)
  DSR221STH: 2520size, height 1.0mm max.
- Built-in NTC thermistor
- Moisture prevention packing is unnecessary.
  Moisture Sensitivity Level : LEVEL 1(IPC/JEDEC J-STD-033)
- AEC-Q200 Compliant

■ Applications

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

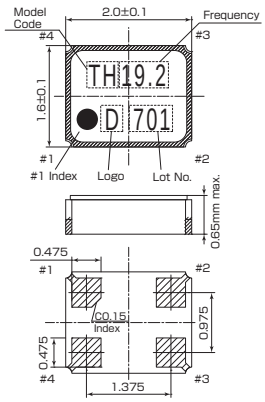
■ Standard Specification

Item \ Type	DSR211ATH	DSR211STH	DSR221STH
Frequency Range	19.2MHz	19.2MHz/38.4MHz	19.2MHz
Overtone Order	Fundamental		
Load Capacitance	7pF, 8pF		
Drive Level	10μW (100μW max.)		
Frequency Tolerance	±10×10^{-6} (at 25℃)		
Series Resistance	80Ω max.		
Frequency Characteristics over Temperature	±30×10^{-6} / −40 to +105 ℃ (±12×10^{-6} / −30 to+85 ℃)		±30×10^{-6} / −40 to +105 ℃ (±12×10^{-6} / −30 to +85 ℃) ±20×10^{-6} / −40 to +105 ℃
Storage Temperature Range	−40 to +125 ℃		
Thermistor Resistance	100kΩ (at +25℃)		
Thermistor B-constant	4250K (+25℃ to +50℃)		
Reliability	AEC-Q200		
Packing Unit	3000pcs./reel (φ180)		

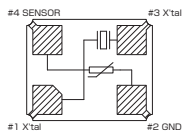
Consult our sales representative for other specifications.

■DSR211ATH [mm]

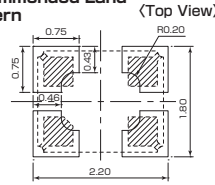
■ Dimensions



■ Internal Connections 〈Top View〉

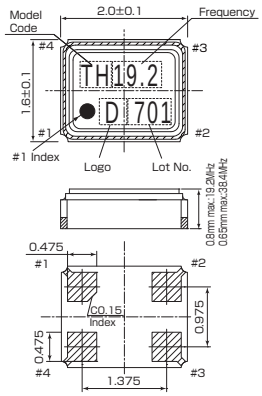


■ Recommended Land Pattern 〈Top View〉

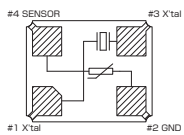


■DSR211STH [mm]

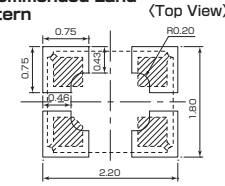
■ Dimensions



■ Internal Connections 〈Top View〉

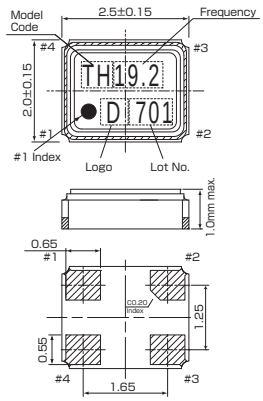


■ Recommended Land Pattern 〈Top View〉

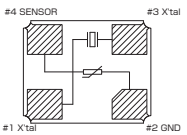


■DSR221STH [mm]

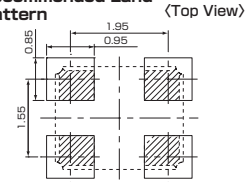
■ Dimensions



■ Internal Connections 〈Top View〉



■ Recommended Land Pattern 〈Top View〉



SMD Crystal Resonators / MHz Band Crystal Resonators〈For Automotive〉

SMD-49

Actual size

■ Features

- Capable of operating over a wide temperature range.
- 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

Pb-Free

RoHS/ELV Compliant

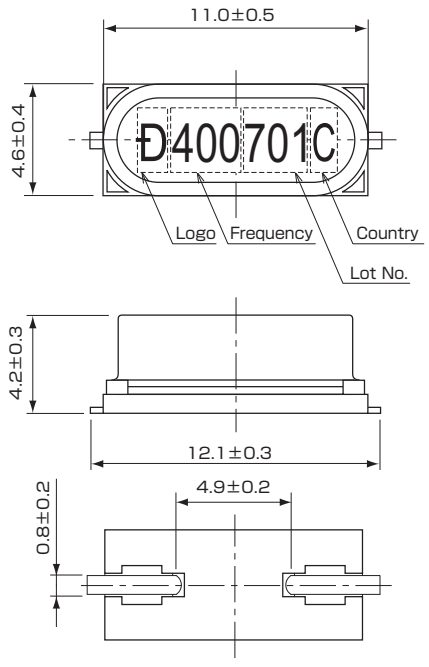
■ Standard Specification

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

Consult our sales representative for other specifications.

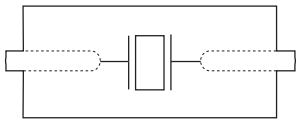
[mm]

■ Dimensions



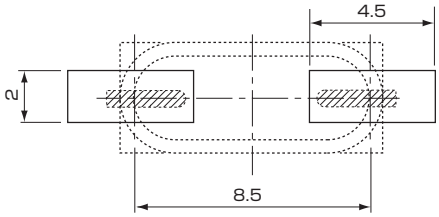
■ Internal Connections

〈Top View〉



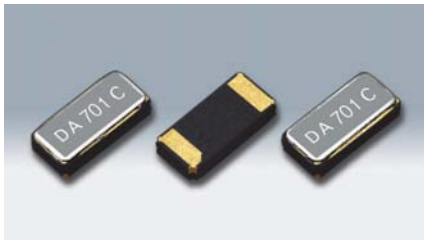
■ Recommended Land Pattern

〈Top View〉



SMD Tuning Fork Crystal Resonators / kHz Band Crystal Resonators ⟨For Automotive⟩

DST310S/DMX-26S



DST310S Actual size

DMX-26S Actual size

■ Features

- AEC-Q200 Compliant
- Pb free (DST310S)
- RoHS/ELV Compliant

■ Applications

- Automotive multimedia devices

Pb-Free

RoHS/ELV Compliant

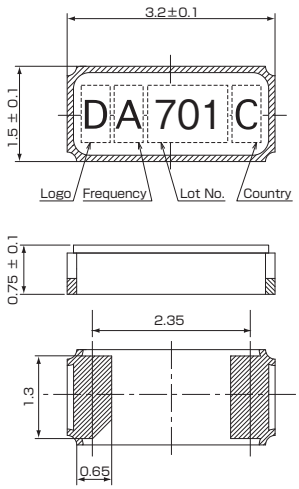
■ Standard Specification

Item \ Type	DST310S	DMX-26S
Frequency Range	32.768kHz	32.768kHz(30 to 90kHz)
Load Capacitance	7pF, 9pF, 12.5pF	
Drive Level	0.2μW(1.0μW max.)	1.0μW(2.0μW max.)
Frequency Tolerance	±20×10^{-6} (at 25℃)	
Series Resistance	80kΩ max./120kΩ max.	50kΩ max./80kΩ max.
Turnover Temperature	25℃±5℃	
Parabolic Coefficient	−0.04×10^{-6} / ℃^{2} max.	
Operating Temperature Range	−40 to +85℃ / −40 to +125℃	
Storage Temperature Range	−40 to +125℃	
Shunt Capacitance	1.3pF typ.	1.25pF typ.
Reliability	AEC-Q200	
Packing Unit	3000pcs./reel(φ180)	2500pcs./reel(φ330)

Consult our sales representative for other specifications.

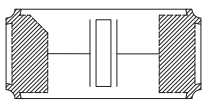
■ DST310S [mm]

■ Dimensions



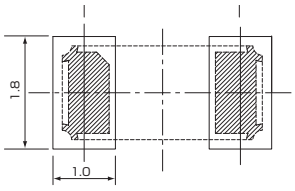
■ Internal Connections

⟨Top View⟩



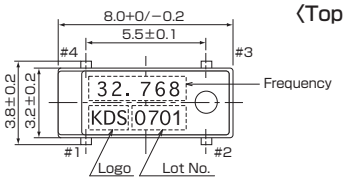
■ Recommended Land Pattern

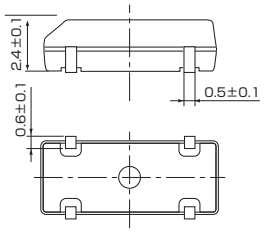
⟨Top View⟩



■ DMX-26S [mm]

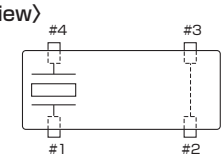
■ Dimensions





■ Internal Connections

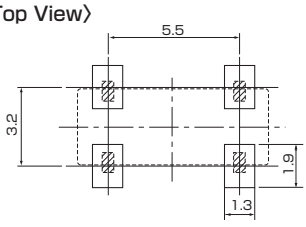
⟨Top View⟩



#2 & #3 OPEN (unconnected)

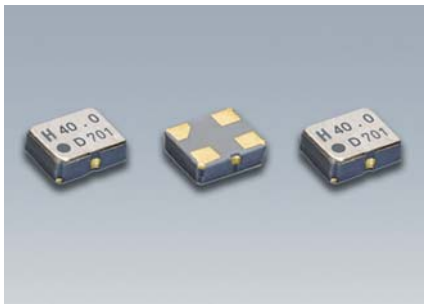
■ Recommended Land Pattern

⟨Top View⟩



SMD Crystal Oscillators〈For Automotive〉

DSO211AH



Actual size

■Features

- Supply Voltage: 1.8V/2.5V/2.8V/3.0V/3.3V
- Low phase noise: fout ±1kHz −145 dBc/Hz(Typ.)
  fout ±100kHz −158 dBc/Hz(Typ.)
- Low profile: 0.72mm
- AEC-Q100 Compliant
- 3-state function

Pb-Free

RoHS/ELV Compliant

■ Applications

- Multimedia devices such as car navigation systems and car audio
- Automotive radio applications such as Bluetooth, wireless LAN and automotive camera

[Function Code]

DSO211H A A

- A : 3.3V
- M : 3.0V
- B : 2.8V
- C : 2.5V
- D : 1.8V

- A : ±100×10^{-6}
- Z : ±80×10^{-6}
- B : ±50×10^{-6}
- C : ±30×10^{-6}
- D : ±25×10^{-6}
- E : ±20×10^{-6}

■ Standard Specification

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

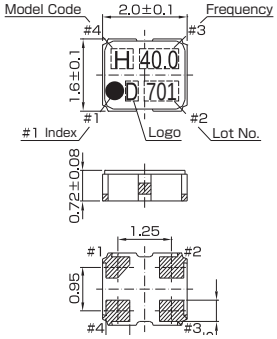
Item	Function Code: Supply Voltage	Function Code: Frequency tolerance	Output Frequency Range (MHz)	Legend	Spec.: min.	Spec.: typ.	Spec.: max.	Spec.: Unit	Condition
Supply Voltage	A	*	1.2≦fo≦80	Vcc	+3.0	+3.3	+3.6	V	
	M				+2.7	+3.0	+3.3		
	B				+2.6	+2.8	+3.0		
	C				+2.25	+2.5	+2.75		
	D				+1.6	+1.8	+2.0		
Frequency Tolerance (Includes frequency tolerance at room temperature.)	*	Z	1.2≦fo≦80	f_tol	−80	−	+80	×10^{-6}	−40 to +105℃
		A			−100	−	+100		−40 to +85℃
		B			−50	−	+50		
		C			−30	−	+30		−20 to +70℃
		D			−25	−	+25		
		E			−20	−	+20		−10 to +70℃
Current Consumption	A,M	*	1.2≦fo≦60	Icc	−	−	4.0	mA	No Load
			60<fo≦80		−	−	5.0		
	B	*	1.2≦fo≦60		−	−	3.6		
			60<fo≦80		−	−	4.5		
	C	*	1.2≦fo≦60		−	−	3.4		
			60<fo≦80		−	−	4.0		
	D	*	1.2≦fo≦60		−	−	2.8		
			60<fo≦80		−	−	3.5		
Stand-by Current(#1 pin "L" Level)	*	*	*	I_std	−	−	10	μA	
Load Condition	*	*	*	L_CMOS	−	−	15	pF	
Symmetry	*	*	*	SYM	45	50	55	%	at 50% Vcc
0 Level Output Voltage	*	*	*	VOL	−	−	Vcc×0.1	V	
1 Level Output Voltage	*	*	*	VOH	Vcc×0.9	−	−		
Rise and Fall Time	*	*	*	tr, tf	−	−	6(5)	ns	10 to 90% Vcc Level (20 to 80% Vcc Level)
					−	−			
OE Pin 0 Level Input Voltage	*	*	*	VIL	−	−	Vcc×0.2	V	
OE Pin 1 Level Input Voltage	*	*	*	VIH	Vcc×0.8	−	−		
Output Disable Time	*	*	*	tPLZ	−	−	150	ns	
Output Enable Time	*	*	*	tPZL	−	−	5	ms	
Phase Noise	A,M,B,C	*	1.2≦fo≦60	−	−	−145	−	dBc/Hz	Offset 1kHz
	D				−	−140	−		
	A,M,B,C	*	60<fo≦80		−	−135	−		
	D				−	−135	−		
	A,M,B,C	*	1.2≦fo≦60		−	−158	−		Offset 100kHz
	D				−	−152	−		
	A,M,B,C	*	60<fo≦80		−	−155	−		
	D				−	−150	−		
Period Jitter (1)	*	*	*	tRMS	−	2.4	−	ps	σ
				tp-p	−	23	−		Peak to peak
Total Jitter (1)	*	*	*	tTL	−	34	−	ps	tDJ+n×tRJ n=14.1(BER=1×10^{-12}) (2)
Phase Jitter	*	*	40≦fo≦80	tpj	−	−	1	ps	fo offset:12kHz to 20MHz
			10≦fo<40						fo offset:12kHz to 5MHz
Reliability	AEC-Q100								
Packing Unit	3000pcs./reel(φ180)								

(1) Measured WAVECREST DTS-2075
(2) tDJ:Deterministic jitter tRJ:Random jitter

Consult our sales representative for other specifications.

[mm]

■ Dimensions



Pin Connections

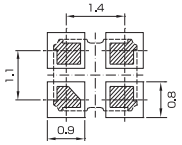
Pin No.	Connection
#1	OE(Output Enable)
#2	GND
#3	Output
#4	Vcc

Function

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

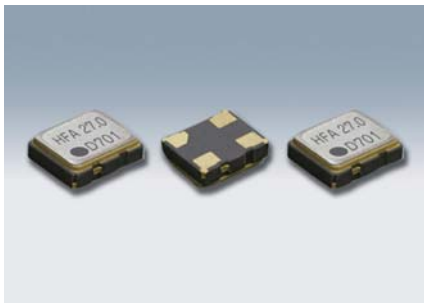
■ Recommended Land Pattern

<Top View>



SMD Crystal Oscillators〈For Automotive〉

DSO221SHF



Actual size

■ Features

- Supply Voltage: 1.8V/2.5V/2.8V/3.3V
- Low phase noise: fout ±1kHz -145 dBc/Hz(typ.)
  fout ±100kHz -158 dBc/Hz(typ.)
- Low profile: 0.8mm
- 3-state function
- AEC-Q100 Compliant

■ Applications

- Multimedia devices such as car navigation systems and car audio
- Automotive radio applications such as Bluetooth, wireless LAN and automotive camera

Pb-Free

RoHS/ELV Compliant

[Function Code]

DSO221SHF A A

A : 3.3V
B : 2.8V
C : 2.5V
D : 1.8V

A,Y : ±100×10^{-6}
B : ±50×10^{-6}

When requesting the product, please select the model and function

■ Standard Specification

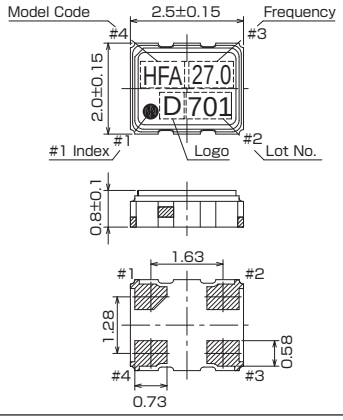
Item	Function Code		Output Frequency Range (MHz)	Legend	Spec.				Condition
	Supply Voltage	Frequency tolerance			min.	typ.	max.	Unit	
Supply Voltage	A	*	1.5≦fo≦80	Vcc	+3.0	+3.3	+3.6	V	
	B				+2.6	+2.8	+3.0		
	C				+2.25	+2.5	+2.75		
	D				+1.6	+1.8	+2.0		
Frequency Tolerance (Includes frequency tolerance at room temperature.)	*	Y		f_tol	−100	−	+100	×10^{-6}	−40 to +125℃ L_CMOS=15pF
		A			−100	−	+100		−40 to +85℃
		B			−50	−	+50		
Current Consumption	A	*	1.5≦fo<50	Icc	−	−	4.9	mA	No Load
			50≦fo≦80		−	−	9.1		
	B		1.5≦fo<50		−	−	4.3		
			50≦fo≦80		−	−	8.1		
	C		1.5≦fo<50		−	−	4.0		
			50≦fo≦80		−	−	7.6		
	D		1.5≦fo<50		−	−	3.7		
			50≦fo≦80		−	−	6.2		
Stand-by Current(#1 pin "L" Level)	*	*	*	I_std	−	−	10	μA	
Load Condition	*	*	*	L_CMOS	−	−	15	pF	
Symmetry	*	*	*	SYM	45	50	55	%	at 50% Vcc
0 Level Output Voltage	*	*	*	VOL	−	−	Vcc×0.1	V	
1 Level Output Voltage	*	*	*	VOH	Vcc×0.9	−	−		
Rise and Fall Time	*	*	1.5≦fo<50	tr, tf	−	−	8	ns	10 to 90% Vcc Level
			50≦fo≦80		−	−	6		
OE Pin 0 Level Input Voltage	*	*	*	VIL	−	−	Vcc×0.2	V	
OE Pin 1 Level Input Voltage	*	*	*	VIH	Vcc×0.8	−	−		
Output Disable Time	*	*	*	tPLZ	−	−	150	ns	
Output Enable Time	*	*	*	tPZL	−	−	3	ms	
Phase Noise	A·B·C	*	10≦fo<50	−	−	−145	−	dBc/Hz	Offset 1kHz
	D				−	−140	−		
	A·B·C·D		50≦fo≦80		−	−135	−		
	A·B·C		10≦fo<50		−	−158	−		Offset 100kHz
	D				−	−152	−		
	A·B·C		50≦fo≦80		−	−156	−		
	D					−150	−		
Period Jitter (1)	*	*	*	tRMS	−	2.4	−	ps	σ
				tp-p	−	23	−		Peak to peak
Total Jitter (1)	*	*	*	tTL	−	34	−	ps	tDJ+n×tRJ n=14.1(BER=1×10^{-12}) (2)
Phase Jitter	*	*	40≦fo≦80	tpj	−	−	1	ps	fo offset12kHz to 20MHz
			10≦fo<40						fo offset12kHz to 5MHz
Reliability	AEC-Q100								
Packing Unit	3000pcs./reel (φ180)								

(1)Measured WAVECREST DTS-2075
(2)tDJ:Deterministic jitter tRJ:Random jitter

Consult our sales representative for other specifications.

[mm]

■ Dimensions



Pin Connections

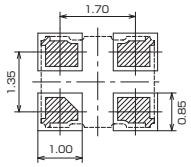
Pin No.	Connection
#1	OE(Output Enable)
#2	GND
#3	Output
#4	Vcc

Function

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

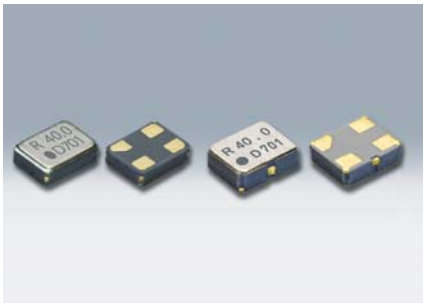
■ Recommended Land Pattern

<Top View>



SMD Crystal Oscillators〈For Automotive〉

DSO1612AR/DSO211AR



Actual size DSO1612AR ▫ DSO211AR ▫

■ Features

- 3-state function
- Capable of operating over a wide temperature range, from −40 to +125℃ .
- AEC-Q100 Compliant

■ Applications

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

[Function Code]

DSO****AR A Y

A : 3.3V
M : 3.0V
B : 2.8V
C : 2.5V
D : 1.8V

Y : ±100x10^{-6}
Z : ±80x10^{-6}
B : ±50x10^{-6}

Pb-Free

RoHS/ELV Compliant

■ Standard Specification

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

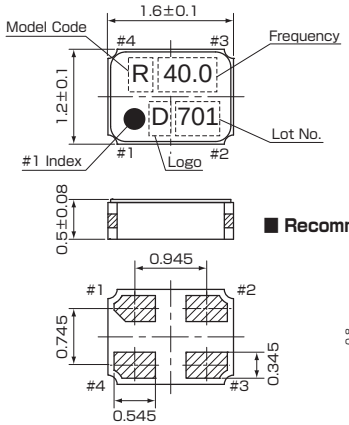
Item	Function Code			DSO1612AR					DSO211AR					Condition
	Supply Voltage		Frequency tolerance	Legend	Output Frequency Range (MHz)	Spec. min.	Spec. typ.	Spec. max.	Output Frequency Range (MHz)	Spec. min.	Spec. typ.	Spec. max.	Unit	
	DSO 1612AR	DSO 211AR												
Supply Voltage	A		*	Vcc	0.584375≤fo<80	+3.0	+3.3	+3.6	0.4≤fo<80	+3.0	+3.3	+3.6	V	
	M					+2.7	+3.0	+3.3		+2.7	+3.0	+3.3		
	B					+2.6	+2.8	+3.0		+2.6	+2.8	+3.0		
	C					+2.25	+2.5	+2.75		+2.25	+2.5	+2.75		
	D					+1.6	+1.8	+2.0		+1.6	+1.8	+2.0		
Frequency Tolerance (Includes frequency tolerance at room temperature.)	*		Y	f_tol	0.584375≤fo<80	-100	–	+100	0.4≤fo<80	-100	–	+100	×10^{-6}	−40 to +125℃
			Z			-80	–	+80		-80	–	+80		−40 to +110℃
			B			-50	–	+50		-50	–	+50		−40 to +85℃
Current Consumption	A,M		*	Icc	0.584375≤fo<40	–	–	+3.0	0.4≤fo<54	–	–	4.0	mA	No Load
					40≤fo<60	–	–	+3.4		–	–			
					60≤fo≤80	–	–	+3.8	54≤fo≤80	–	–	6.0		
	B				0.584375≤fo<40	–	–	+2.4	0.4≤fo<54	–	–	3.5		
					40≤fo<60	–	–	+2.8		–	–			
					60≤fo≤80	–	–	+3.1	54≤fo≤80	–	–	5.5		
	C				0.584375≤fo<40	–	–	+2.0	0.4≤fo<54	–	–	3.0		
					40≤fo<60	–	–	+2.4		–	–			
					60≤fo≤80	–	–	+2.7	54≤fo≤80	–	–	5.0		
	D				0.584375≤fo<40	–	–	+1.4	0.4≤fo<54	–	–	2.5		
					40≤fo<60	–	–	+1.6		–	–			
					60≤fo≤80	–	–	+1.9	54≤fo≤80	–	–	4.5		
Stand-by Current (#1 pin "L"level)	*		*	I_std	*	–	–	+20	*	–	–	+10	μA	
Load Condition	*		*	L_CMOS	*	–	–	15	*	–	–	15	pF	
Symmetry	*		*	SYM	*	40	50	60	*	40	50	60	%	at 50% Vcc
0 Level Output Voltage	*		*	V_{OL}	*	–	–	Vcc×0.1	*	–	–	Vcc×0.1	V	
1 Level Output Voltage	*		*	V_{OH}	*	Vcc×0.9	–	–	*	Vcc×0.9	–	–		
Rise and Fall Time	A,M,B,C	*	*	tr, tf	*	–	–	3.5	0.4≤fo<54	–	–	8	ns	10 to 90% Vcc Level
	D					–	–	5	54≤fo≤80	–	–			
OE Pin 0 Level Input Voltage	*		*	V_{IL}	*	–	–	Vcc×0.2	*	–	–	Vcc×0.2	V	
OE Pin 1 Level Input Voltage	*		*	V_{IH}	*	Vcc×0.8	–	–	*	Vcc×0.8	–	–		
Output Disable Time	*		*	tPLZ	*	–	–	200	*	–	–	150	ns	
Output Enable Time	*		*	tPZL	*	–	–	1	*	–	–	5	ms	
Period Jitter (1)	*		*	tRMS	*	–	2.2	–	*	–	2.2	–	ps	σ
				tp-p		–	20	–		–	20	–		Peak to peak
Total Jitter (1)	*		*	tTL	*	–	31	–	*	–	31	–	ps	tDJ+n×tRJ n=14.1(BER=1×10^{-12}) (2)
Phase Jitter	*		*	tpj	40≤fo≤80	–	–	1	40≤fo≤125	–	–	1	ps	fo offset:12kHz to 20MHz
					10≤fo<40				10≤fo<40					fo offset:12kHz to 5MHz
Reliability	AEC-Q100													
Packing Unit	3000pcs./reel(φ180)													

(1)Measured WAVECREST DTS-2075
(2)tDJ:Deterministic jitter tRJ:Random jitter

Consult our sales representative for other specifications.

■ DSO1612AR [mm]

■ Dimensions

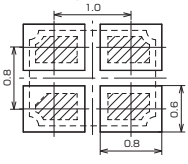


Pin Connections	
Pin No.	Connection
#1	OE(Output Enable)
#2	GND
#3	Output
#4	Vcc

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

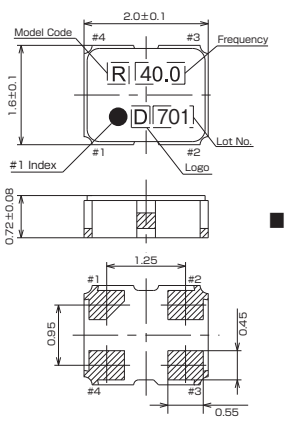
■ Recommended Land Pattern

〈Top View〉



■ DSO211AR [mm]

■ Dimensions

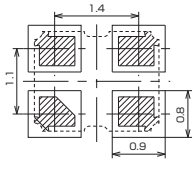


Pin Connections	
Pin No.	Connection
#1	OE(Output Enable)
#2	GND
#3	Output
#4	Vcc

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

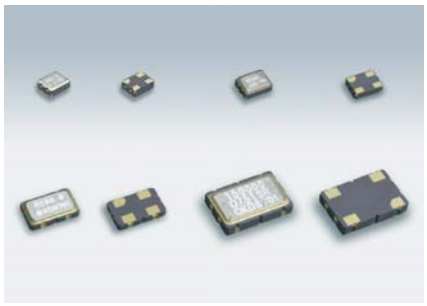
■ Recommended Land Pattern

〈Top View〉



SMD Crystal Oscillators〈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℃.
- AEC-Q100 Compliant

■ 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
M : 3.0V
B : 2.8V
C : 2.5V
D : 1.8V

A,Y : ±100×10^{-6}
Z : ±80×10^{-6}
B : ±50×10^{-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	*	0.2≤fo≤125	Vcc	+3.0	+3.3	+3.6	V	
	M		0.2≤fo≤125		+2.7	+3.0	+3.3		
	B		0.2≤fo≤100		+2.6	+2.8	+3.0		
	C		0.2≤fo≤100		+2.25	+2.5	+2.75		
	D		0.2≤fo≤80		+1.6	+1.8	+2.0		
Frequency Tolerance (Includes frequency tolerance at room temperature.)	*	Y	0.2≤fo≤100	f_tol	−100	—	+100	×10^{-6}	−40 to +125℃
		Z	0.2≤fo≤100		−80	—	+80		−40 to +110℃
		A	100<fo≤125		−100	—	+100		−40 to +85℃
		B	0.2≤fo≤100		−50	—	+50		
Current Consumption	A,M	*	0.2≤fo<54	Icc	—	—	+4.0	mA	No Load
			54≤fo<80		—	—	+6.0		
			80≤fo<125		—	—	+8.0		
	B	*	0.2≤fo<54		—	—	+3.5		
			54≤fo<80		—	—	+5.5		
			80≤fo<100		—	—	+7.5		
	C	*	0.2≤fo<54		—	—	+3.0		
			54≤fo<80		—	—	+5.0		
			80≤fo<100		—	—	+7.0		
	D	*	0.2≤fo<54		—	—	+2.5		
			54≤fo≤80		—	—	+4.5		
Stand-by Current (#1 pin "L"level)	*	*	*	I_std	—	—	+10	μA	
Load Condition	*	*	*	L_CMOS	—	—	15	pF	
Symmetry	*	*	*	SYM	40	50	60	%	50% Vcc Level
0 Level Output Voltage	*	*	*	VOL	—	—	Vcc×0.1	V	
1 Level Output Voltage	*	*	*	VOH	Vcc×0.9	—	—		
Rise and Fall Time	*	*	0.2≤fo≤54	tr,tf	—	—	8	ns	10 to 90% Vcc Level
			54<fo<100		—	—	4		
			100≤fo≤125		—	—	3		
OE Pin 0 Level Input Voltage	*	*	*	VIL	—	—	Vcc×0.2	V	
OE Pin 1 Level Input Voltage	*	*	*	VIH	Vcc×0.8	—	—		
Output Disable Time	*	*	*	tPLZ	—	—	150	ns	
Output Enable Time	*	*	*	tPZL	—	—	5	ms	
Period Jitter (1)	*	*	*	tRMS	—	2.2	—	ps	σ
				tp-p	—	20	—		Peak to peak
Total Jitter (1)	*	*	*	tTL	—	31	—	ps	tDJ+nxtRJ n=14.1(BER=1x10^{-12}) (2)
Phase Jitter	*	*	40≤fo≤125	tpj	—	—	1	ps	fo offset:12kHz to 20MHz
			10≤fo<40						fo offset:12kHz to 5MHz
Reliability	AEC-Q100								
Packing Unit	DSO221SR, DSO321SR : 2000pcs./reel(180 φ), DSO531SR : 1000pcs./reel(180 φ), DSO751SR : 1000pcs./reel(254 φ)								

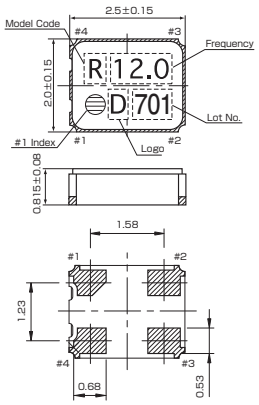
(1)Measured WAVECREST DTS-2075

(2)tDJ:Deterministic jitter tRJ:Random jitter

Consult our sales representative for other specifications.

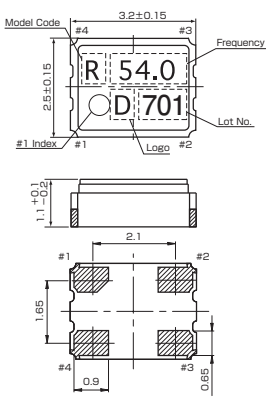
■ DSO221SR [mm]

■ Dimensions



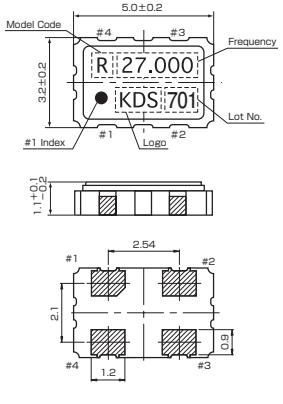
■ DSO321SR [mm]

■ Dimensions



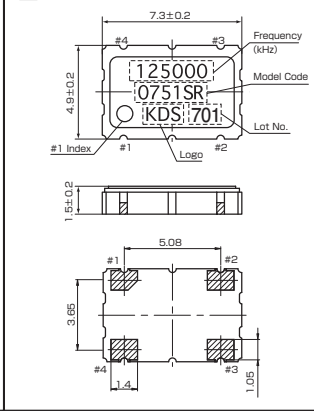
■ DSO531SR [mm]

■ Dimensions



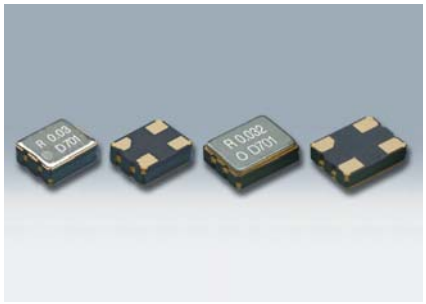
■ DSO751SR [mm]

■ Dimensions



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-Q 100 compliant

Pb-Free

RoHS/ELV Compliant

■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
M :3.0V
B :2.8V
C :2.5V
D :1.8V
Y :5.0V

Y:±100×10^{-6}
Z:±80×10^{-6}
B,W:±50×10^{-6}

■ Standard Specification

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

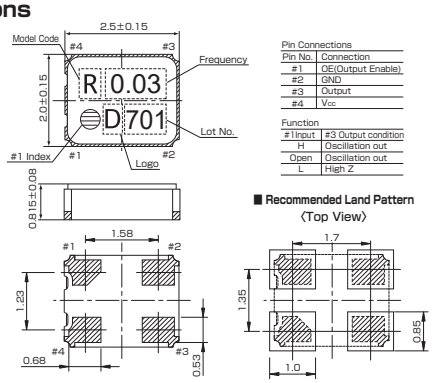
Item	Function Code		Output Frequency Range (KHz)	Legend	Spec.				Condition
	Supply Voltage	Frequency tolerance			min.	typ.	max.	Unit	
Supply Voltage	A	*	32.768≦fo≦50	Vcc	+3.0	+3.3	+3.6	V	
	M				+2.7	+3.0	+3.3		
	B				+2.6	+2.8	+3.0		
	C				+2.25	+2.5	+2.75		
	D				+1.6	+1.8	+2.0		
	Y				+4.5	+5.0	+5.5		
Frequency Tolerance (includes frequency tolerance at room temperature)	*	Y	32.768≦fo≦50	f_tol	−100	−	+100	×10^{-6}	−40 to +125℃
	*	Z			−80	−	+80		−40 to +110℃
	*	W			−50	−	+50		−40 to +105℃
	*	B			−50	−	+50		−40 to +85℃
Current Consumption	A,M,B, C,D	*	fo=32.768	Icc	−	−	65	μA	No Load
			32.768<fo≦50		−	−	100		
	Y		fo=32.768		−	−	80		
			32.768<fo≦50		−	−	120		
Stand-by Current(#1 pin "L" Level)	*	*	32.768≦fo≦50	I_std	−	−	3	μA	−40 to +125℃
Load Condition	*	*	32.768≦fo≦50	L_CMOS	−	−	15	pF	
Symmetry	*	*	32.768≦fo≦50	SYM	45	50	55	%	at 50% Vcc
0 Level Input Voltage	*	*	*	VOL	−	−	Vcc×0.1	V	
1 Level Input Voltage				VOH	Vcc×0.9	−	−		
Rise and Fall Time	*	*	32.768≦fo≦50	tr, tf	−	−	20	ns	10 to 90% Vcc Level
OE Pin 0 Level Input Voltage	*	*	*	VIL	−	−	Vcc×0.2	V	
OE Pin 1 Level Input Voltage	*	*	*	VIH	Vcc×0.8	−	−		
Output Disable Time	*	*	*	tPLZ	−	−	150	ns	
Output Enable Time	*	*	*	tPZL	−	−	2	ms	
Period Jitter (1)	*	*	*	tRMS	−	15	−	ps	σ
			*	tp-p	−	150	−		Peak to peak
Total Jitter (1)	*	*	*	tTL	−	220	−	ps	tDJ+n×tRJ n=14.1 (BER=1×10^{-12}) (2)
Reliability	AEC-Q100								
Packing Unit	2000pcs./reel(φ180)								

(1) Measured WAVECREST DTS-2075
(2) tDJ:Deterministic jitter tRJ:Random jitter

Consult our sales representative for other specifications.

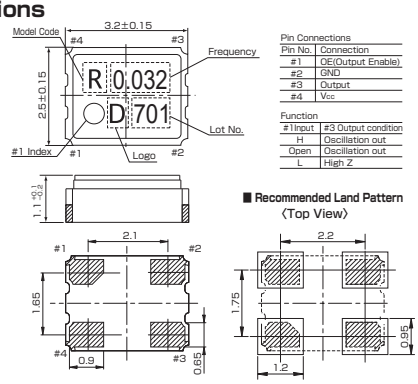
■ DSO221SR(kHz) [mm]

■ Dimensions



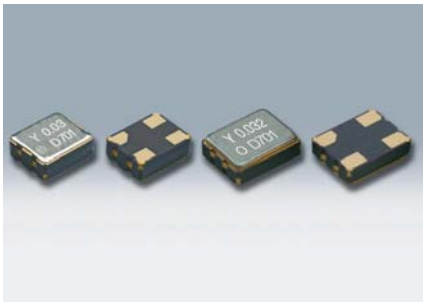
■ DSO321SR(kHz) [mm]

■ 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-Q 100 compliant

Pb-Free

RoHS/ELV Compliant

■Applications

- Multimedia devices such as car navigation systems and car audio

[Type]

DSO221SY	2520 size
DSO321SY	3225 size

[Function Code]

DSO***SY A A

A :3.3V
B :2.8V
C :2.5V
D :1.8V

A:±100×10^{-6}
B:±50×10^{-6}

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

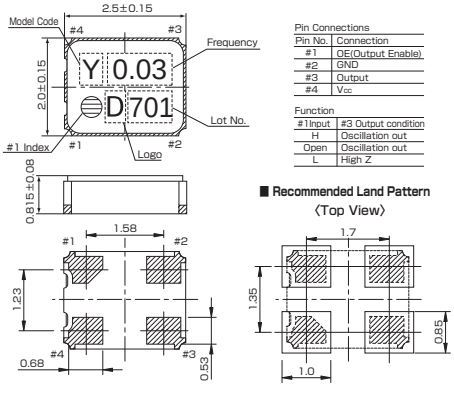
■ Standard Specification

Item	Function Code		Output Frequency Range	Legend	Spec.				Condition
	Supply Voltage	Frequency tolerance			min.	typ.	max.	Unit	
Supply Voltage	A	*	32.768kHz 1.049≦fo≦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≦fo≦8.5MHz	f_tol	−100	−	+100	×10^{-6}	−40 to +85℃
		B			−50	−	+50		
Current Consumption	*	*	32.768kHz	Icc	−	−	18	μA	No Load
			1.049≦fo≦8.5MHz		−	−	700		
Stand-by Current(#1 pin "L" Level)	*	*	*	I_std	−	−	3	μA	
Load Condition	*	*	*	L_CMOS	−	−	15	pF	
Symmetry	*	*	32.768kHz	SYM	45	50	55	%	at 50% Vcc
			1.049≦fo≦8.5MHz		40	50	60		
0 Level Input Voltage	*	*	*	VOL	−	−	Vcc×0.1	V	
1 Level Input Voltage	*	*	*	VOH	Vcc×0.9	−	−		
Rise and Fall Time	*	*	*	tr, tf	−	−	15	ns	10 to 90% Vcc Level
OE Pin 0 Level Input Voltage	*	*	*	VIL	−	−	Vcc×0.2	V	
OE Pin 1 Level Input Voltage	*	*	*	VIH	Vcc×0.8	−	−		
Output Disable Time	*	*	*	tPLZ	−	−	100	ns	
Output Enable Time	*	*	*	tPZL	−	−	20	ms	
Packing Unit	2000pcs./reel(φ180)								

Consult our sales representative for other specifications.

■ DSO221SY [mm]

■ Dimensions



Pin Connections

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

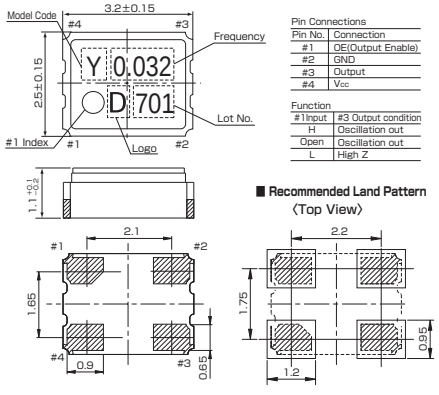
Function

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

■ Recommended Land Pattern
〈Top View〉

■ DSO321SY [mm]

■ Dimensions



Pin Connections

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

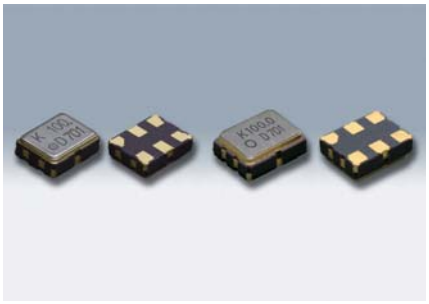
Function

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

■ Recommended Land Pattern
〈Top View〉

SMD Crystal Oscillators〈For Automotive〉

DSO223S/DSO323S SERIES



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-Q100 Compliant

■ 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

[Function Code]

DSO***S K A A C

- Model Code: K : LVPECL / J : LVDS / D : HCSL
- Operating Temperature Range: C : − 40 to +85℃ / E : − 40 to +105℃
- Supply Voltage: A : 3.3V / C : 2.5V
- Frequency Tolerance: A : ±100×10^{-6} / B : ±50×10^{-6}

■ Standard Specification

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

Item \ Type	Legend	DSO223SK DSO323SK	DSO223SJ DSO323SJ	DSO223SD DSO323SD
Output Specification	−	LV-PECL	LVDS	HCSL
Output Frequency Range	fo	13.5 to 167MHz		
Supply Voltage	Vcc	+2.5V±0.125V/+3.3V±0.165V		
Frequency Tolerance (Includes frequency tolerance at room temperature.)	f_tol	±50×10^{-6} max., ±80×10^{-6} max. / ±100×10^{-6} max.		
Storage Temperature Range	T_stg	−40 to +105℃		
Operating Temperature Range	T_use	−40 to +85℃, −40 to +105℃		
Current Consumption	Icc	45mA max.	20mA max.	30mA max.
Stand-by Current(#1 pin "L" Level)	I_std	10μA max.		
Load Resistance	Load-R	50Ω to Vcc−2V	100Ω (Output−OutputN)	50Ω
Symmetry	SYM	45 to 55% [at outputs cross point]		
0 Level Output Voltage	VOL	Vcc−1.81 to Vcc−1.62V	−	−0.15 to 0.15V
1 Level Output Voltage	VOH	Vcc−1.025 to Vcc−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	VOD1, VOD2	−	0.247 to 0.454V	−
Change to VOD	⊿VOD	−	50mV [⊿VOD=｜VOD1−VOD2｜]	−
Offset Voltage	VOS	−	1.125 to 1.375V	−
Offset to VOS	⊿VOS	−	50mV	−
Crossing Point Voltage	Vcr	−	−	250 to 550mV
OE Pin 0 Level input Voltage	VIL	Vcc×0.3 max.		
OE Pin 1 Level input Voltage	VIH	Vcc×0.7 min.		
Output Disable Time	tPLZ	200ns		
Output Enable Time	tPZL	2ms		
Period Jitter(1)	tRMS	5ps typ. (13.5MHz≦fo<27MHz) / 2.5ps typ. (27MHz≦fo<167MHz) (σ)		
	tp-p	33ps typ. (13.5MHz≦fo<27MHz) / 22ps typ. (27MHz≦fo<167MHz) (Peak to peak)		
Total Jitter(1)	tTL	50ps typ. (13.5MHz≦fo<27MHz) / 35ps typ. (27MHz≦fo<167MHz) [tDJ + nxtRJ n=14.1(BER=1×10^{-12}) (2)]		
Phase Jitter	tpj	1.5ps max. (13.5MHz≦fo<27MHz) / 1ps max. (27MHz≦fo<167MHz) [13.5MHz≦fo<40MHz,fo offset:12kHz to 5MHz fo≧40MHz,fo offset:12kHz to 20MHz]		
Reliability	AEC-Q100			
Packing Unit	2000pcs./reel(φ180)			

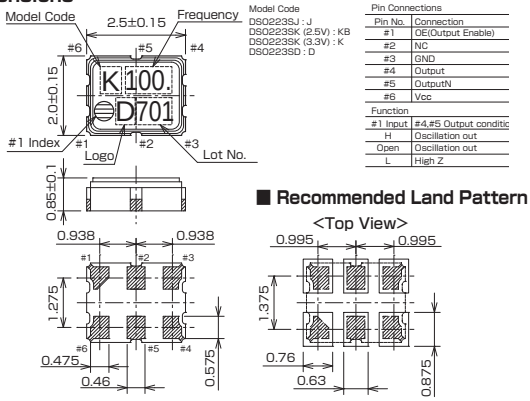
(1)Measured WAVECREST DTS-2075

(2)tDJ:Deterministic jitter tRJ:Random jitter

Consult our sales representative for other specifications.

■ DSO223S SERIES [mm]

■ Dimensions

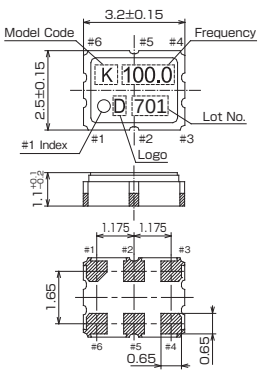


■ Recommended Land Pattern

<Top View>

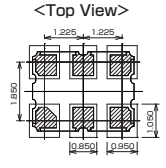
■ DSO323S SERIES [mm]

■ Dimensions



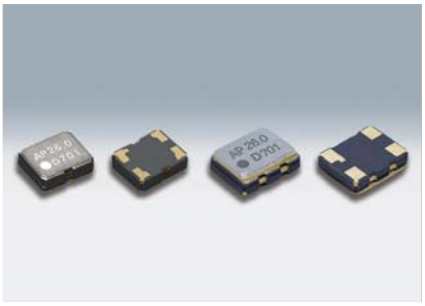
■ Recommended Land Pattern

<Top View>



High-precision SMD VC-TCXO/TCXO〈For Automotive〉

DSA211SP/DSA221SP,DSB211SP/DSB221SP



Actual size DSA211SP DSA221SP

■ Features

- Capable of operating over a wide temperature range,from-40 to +105℃
- Low phase noise
- Single packaged structure
- Prevention of moisture packing is unnecessary
- Moisture Sensitivity Level : LEVEL 1
- (IPC/JEDEC J-STD-033)
- AEC-Q100 compliant

Pb-Free

RoHS/ELV Compliant

■ Applications

- GPS / GNSS
- Telematics,Satellite radio

[Type]

VC-TCXO	TCXO	Size
DSA211SP	DSB211SP	2016 size
DSA221SP	DSB221SP	2520 size

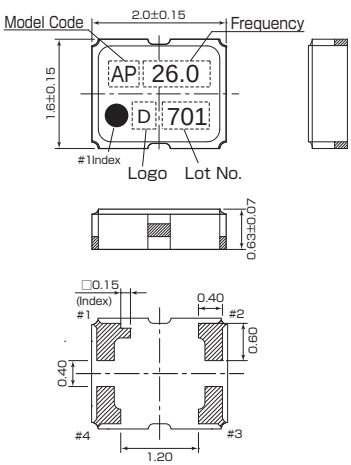
■ Standard Specification

Item \ Type	VC-TCXO		TCXO	
	DSA211SP	DSA221SP	DSB211SP	DSB221SP
Output Frequency Range	12.288 to 52 MHz	9.6 to 52 MHz	12.288 to 52 MHz	9.6 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^{-6} max.(After 2 reflows)			
vs. Temperature	±1.0×10^{-6} max. / −40 to +105℃		±0.5×10^{-6} max. / −40 to +105℃ ±10×10^{-6} max. / −40 to +125℃ (Option)	
vs. Supply Voltage	±0.2×10^{-6} max. (Vcc±5%)			
vs. Load Variation	±0.2×10^{-6} max.			
vs. Aging	±1.0×10^{-6} max. /year			
Start up Time	2.0ms max.			
Frequency Control Control Sensitivity	±3.0×10^{-6} to ±5.0×10^{-6} / Vcont=+1.4V±1V @Vcc≧+2.6V ±3.0×10^{-6} to ±5.0×10^{-6} / Vcont=+0.9V±0.6V @Vcc=+1.8V		−	
Response Slope	Positive		−	
SSB Phase Noise Offset 100Hz Offset 1kHz Offset 10kHz Offset 100kHz	[f≦15MHz] −115 dBc/Hz −135 dBc/Hz −145 dBc/Hz −145 dBc/Hz	[15MHz<f≦26MHz] −110 dBc/Hz −130 dBc/Hz −140 dBc/Hz −145 dBc/Hz	[f>26MHz] −105 dBc/Hz −125 dBc/Hz −135 dBc/Hz −145 dBc/Hz	
Reliability	AEC-Q100			
Packing Unit	3000pcs./reel (φ180)			

Consult our sales representative for other specifications.

■ DSA211SP/DSB211SP [mm]

■ Dimensions



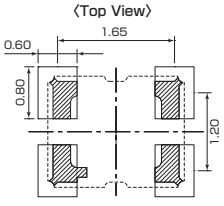
Model Code
AP : VC-TCXO(DSA211SP)
BP : TCXO(DSB211SP)

Pin Connections

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

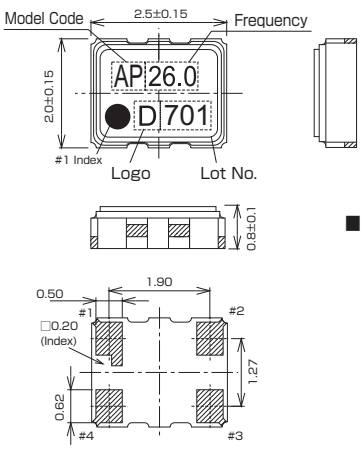
■ Recommended Land Pattern

〈Top View〉



■ DSA221SP/DSB221SP [mm]

■ Dimensions



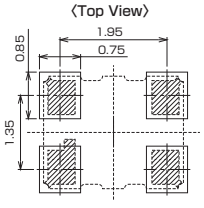
Model Code
AP : VC-TCXO (DSA221SP)
BP : TCXO (DSB221SP)

Pin Connections

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

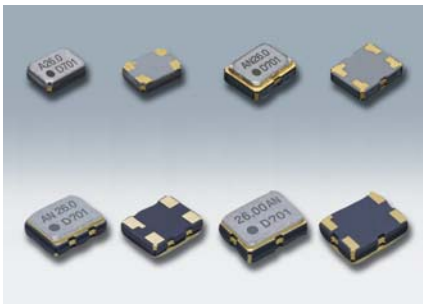
■ Recommended Land Pattern

〈Top View〉



High-precision SMD VC-TCXO/TCXO〈For Automotive〉

DSA1612SDN/DSA211SDN/DSA221SDN/DSA321SDN
DSB1612SDN/DSB211SDN/DSB221SDN/DSB321SDN/DSB1612SDNB/DSB211SDNB/DSB221SDNB/DSB321SDNB



Actual size DSA1612SDN DSA211SDN DSA221SDN DSA321SDN

■ Features

- Low phase noise
- Single packaged structure
- Moisture prevention packing is unnecessary.
  Moisture Sensitivity Level: LEVEL 1 (IPC/JEDEC J-STD-033)
- AEC-Q100 Compliant

Pb-Free

RoHS/ELV Compliant

■ Applications

- Telematics, Satellite radio

[Type]

VC-TCXO	TCXO	TCXO(Stand-by Function)	Size
DSA1612SDN	DSB1612SDN	DSB1612SDNB	1612 size
DSA211SDN	DSB211SDN	DSB211SDNB	2016 size
DSA221SDN	DSB221SDN	DSB221SDNB	2520 size
DSA321SDN	DSB321SDN	DSB321SDNB	3225 size

■ Standard Specification

Item \ Type	VC-TCXO				TCXO							
	DSA1612SDN	DSA211SDN	DSA221SDN	DSA321SDN	DSB1612SDN	DSB211SDN	DSB221SDN	DSB321SDN	DSB1612SDNB (Stand-by Function)	DSB211SDNB (Stand-by Function)	DSB221SDNB (Stand-by Function)	DSB321SDNB (Stand-by Function)
Frequency Range	16 to 60MHz	12.288 to 52MHz	9.6 to 52MHz		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)											
Stand-by Current	–								+3μA max.			
Output Level	0.8Vp-p min.(f≦52MHz) (Clipped Sinewave/DC-coupled)											
Output Load	10kΩ//10pF											
Frequency Stability Tolerance	±1.5×10^{-6} max.(After 2 reflows)											
vs. Temperature	±0.5×10^{-6} max./−40 to +85℃											
vs. Supply Voltage	±0.2×10^{-6} max.(Vcc ±5%)											
vs. Load Variation	±0.2×10^{-6} max.(10kΩ//10pF±10%)											
vs. Aging	±1.0×10^{-6} max./year											
Frequency Control Control Sensitivity	±3.0×10^{-6} to ±5.0×10^{-6}/Vcont=+1.4V±1V @Vcc≧+2.6V ±3.0×10^{-6} to ±5.0×10^{-6}/Vcont=+0.9V±0.6V @Vcc=+1.8V				–							
Response Slope	Positive				–							
Start up Time	2.0ms max.											
Output Enable 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											
Packing Unit	DSA1612SDN/DSA211SDN/DSA221SDN, DSB1612SDN/DSB211SDN/DSB221SDN, DSB1612SDNB/DSB211SDNB/DSB221SDNB: 3000pcs./reel(φ180) DSA321SDN, DSB321SDN, DSB321SDNB: 2000pcs./reel(φ180)											

Consult our sales representative for other specifications.

High-precision SMD VC-TCXO/TCXO〈For Automotive〉

For Automotive Applications

■ Dimensions

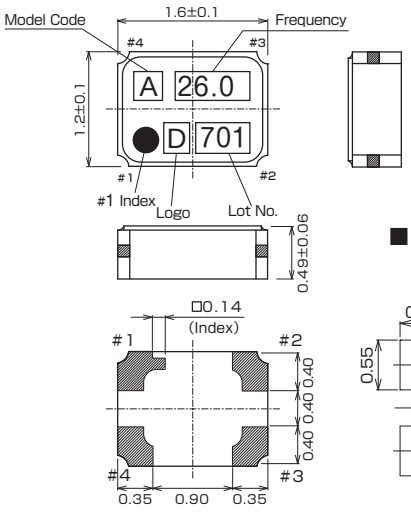
[mm]

■ DSA1612SDN/DSB1612SDN/DSB1612SDNB

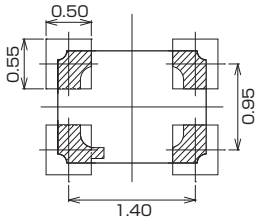
Model Code
A:VC-TCXO(DSA1612SDN)
B:TCXO(DSB1612SDN)
C:TCXO(DSB1612SDNB Stand-by Function)

Pin Connections

Pin No.	Connection
#1	Vcont(VC-TCXO)/GND(TCXO) ENABLE/DISABLE (Stand-by Function)
#2	GND
#3	Output
#4	Vcc



■ Recommended Land Pattern
<Top View>

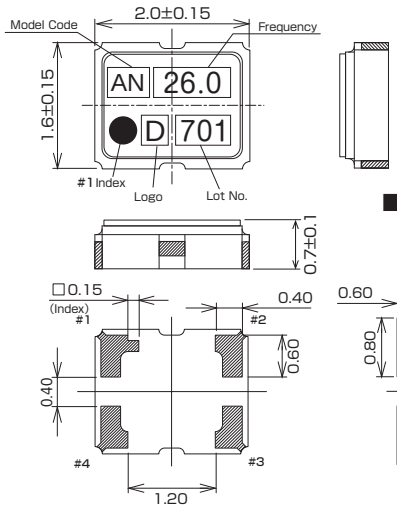


■ DSA211SDN/DSB211SDN/DSB211SDNB

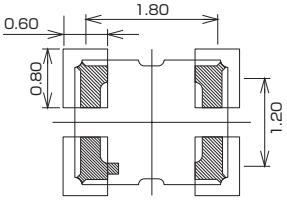
Model Code
AN : VC-TCXO (DSA211SDN)
BN : TCXO (DSB211SDN)
CN : TCXO(DSB211SDNB Stand-by Function)

Pin Connections

Pin No.	Connection
#1	Vcont(VC-TCXO)/GND(TCXO) ENABLE/DISABLE (Stand-by Function)
#2	GND
#3	Output
#4	Vcc



■ Recommended Land Pattern
<Top View>

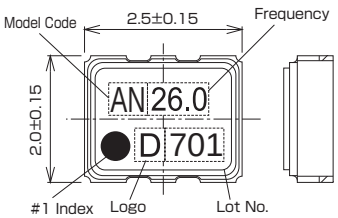


■ DSA221SDN/DSB221SDN/DSB221SDNB

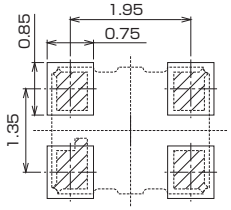
Model Code
AN : VC-TCXO (DSA221SDN)
BN : TCXO (DSB221SDN)
CN : TCXO (DSB221SDNB Stand-by Function)

Pin Connections

Pin No.	Connection
#1	Vcont(VC-TCXO)/GND(TCXO) ENABLE/DISABLE (Stand-by Function)
#2	GND
#3	Output
#4	Vcc



■ Recommended Land Pattern
<Top View>

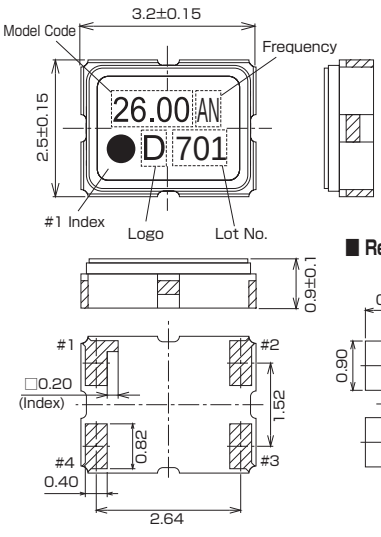


■ DSA321SDN/DSB321SDN/DSB321SDNB

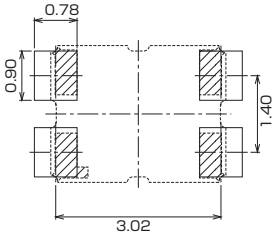
Model Code
AN : VC-TCXO (DSA321SDN)
BN : TCXO (DSB321SDN)
CN : TCXO (DSB321SDNB Stand-by Function)

Pin Connections

Pin No.	Connection
#1	Vcont(VC-TCXO)/GND(TCXO) ENABLE/DISABLE (Stand-by Function)
#2	GND
#3	Output
#4	Vcc

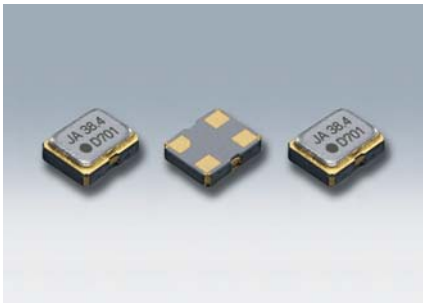


■ Recommended Land Pattern
<Top View>



SMD TCXO〈For Automotive〉

DSB211SJA



Actual size

■ Features

- Capable of operating over a wide temperature range, from -40 to +105℃
- Supply voltage up to +1.7 to +3.6V
- CMOS Level Output
- Low phase noise
- Single package structure
- Moisture prevention packing is unnecessary.
  Moisture Sensitivity Level: LEVEL 1 (IPC/JEDEC J-STD-033)
- AEC-Q100 Compliant

Pb-Free

RoHS/ELV Compliant

■ Applications

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

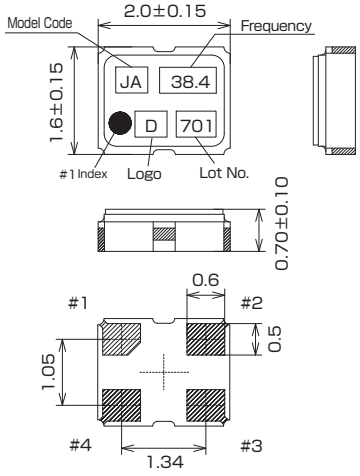
■ Standard Specification

Item \ Type	DSB211SJA (TCXO)	
Frequency Range	13 to 26, 32 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	+10μA max.	
Frequency Stability Tolerance	±1.5×10^{-6} max. (After 2 reflows)	
vs. Temperature	±2.5×10^{-6} max./ -40 to +85℃ ±5.0×10^{-6} max./ -40 to +105℃ ±20×10^{-6} max./ -40 to +125℃(Option)	
vs. Aging	±1.0×10^{-6} max./year	
Symmetry	45 to 55% (50% Vcc Level)	
0 Level Output Voltage	Vcc×0.1V	
1 Level Output Voltage	Vcc×0.9V	
Output Load	15pF	
Rise and Fall Time	5ns max. (10% to 90% Vcc Level)	
OE Pin 0 Level Input Voltage	Vcc×0.2V	
OE Pin 1 Level Input Voltage	Vcc×0.8V	
Start Up Time	3.0ms max.	
Output Enable Time	3.0ms max.	
Output Disable Time	150ns max.	
SSB Phase Noise (Typ.)	[f≦26MHz]	[26MHz<f≦52MHz]
Offset 1kHz	-145dBc/Hz	-141dBc/Hz
Offset 100kHz	-158dBc/Hz	-157dBc/Hz
Reliability	AEC-Q100	
Packing Unit	3000pcs./reel (φ180)	

Consult our sales representative for other specifications.

[mm]

■ Dimensions



Pin Connections

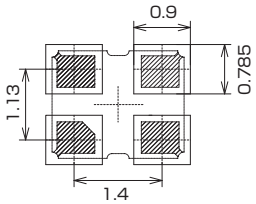
Pin No.	Connection
#1	OE (Output Enable)
#2	GND
#3	Output
#4	Vcc

Function

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

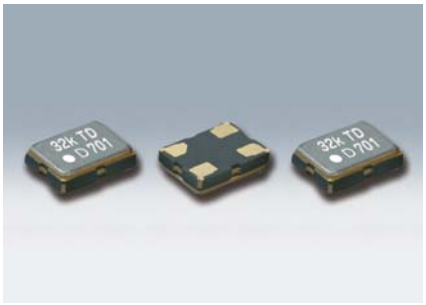
■ Recommended Land Pattern

<Top View>



SMD TCXO〈For Automotive〉

DSK321STD



Actual size

■ Features

- Digital temperature compensated type
- High precision: ±5.0×10^{-6} (−40 to +85℃)
  ±3.8×10^{-6} (−10 to +60℃)
- Low current consumption
- Moisture prevention packing is unnecessary.
  Moisture Sensitivity Level: Level 1 (IPC/JEDEC J-STD-033)
- AEC-Q100 Compliant

Pb-Free

RoHS/ELV Compliant

■ Applications

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

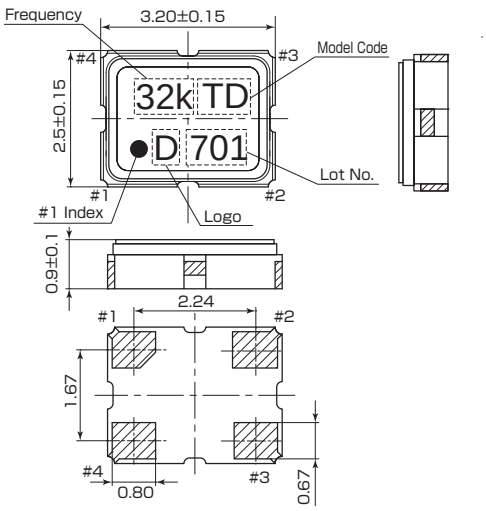
■ Standard Specification

Item	Legend	Spec. min.	Spec. typ.	Spec. max.	Unit	Condition
Output Frequency	fo	–	32.768	–	kHz	
Supply Voltage Range	Vcc	+2.0	–	+5.5	V	(Temperature Compensated Operating)
		+1.3	–	+5.5		(Clock Timing Operating)
Frequency Tolerance (Includes frequency tolerance at room temperature.)	f_tol	−5.0	–	+5.0	×10^{-6}	−40 to +85℃
		−3.8	–	+3.8		−10 to +60℃
Current Consumption	Icc	–	+1.2	+2.5	μA	Vcc=+3.3V, Temperature Compensation Interval:0.5s, No Load
		–	+1.7	+3.2		Vcc=+5.0V, Temperature Compensation Interval:0.5s, No Load
		–	+1.0	+2.0		Vcc=+3.3V, Temperature Compensation Interval:2.0s, No Load
		–	+1.5	+3.0		Vcc=+5.0V, Temperature Compensation Interval:2.0s, No Load
Symmetry	SYM	40	50	60	%	at 50% Vcc
0 Level Output Voltage	VOL	–	–	+0.4	V	
1 Level Output Voltage	VOH	Vcc-0.4	–	–		
Rise and Fall Time	tr, tf	–	–	50	ns	Vcc=+2.0 to +5.5V, 10 to 90% Vcc Level
		–	–	200		Vcc=+1.3 to +5.5V, 10 to 90% Vcc Level
Load Condition	L_CMOS	–	–	15	pF	
Start Up Time	Tstart	–	–	3.0	s	
Reliability	AEC-Q100					
Packing Unit	2000pcs./reel (φ180)					

Consult our sales representative for other specifications.

[mm]

■ Dimensions

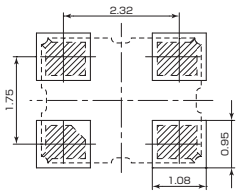


Pin Connections

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

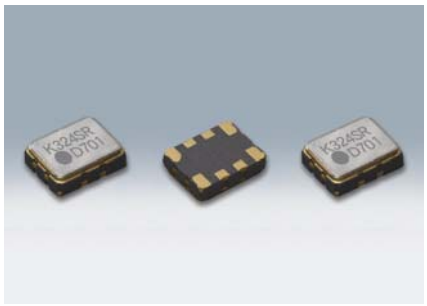
■ Recommended Land Pattern

<Top View>



SMD Real Time Clock Module〈For Automotive〉

DSK324SR



Actual size

■Features

- Digital temperature compensated type
- High precision:±5.0×10^{-6} (−40 to +85℃)
  ±3.8×10^{-6} (−10 to +60℃)
- Low current consumption
- Low voltage operation:+2.0 to +5.5V(Temperature Compensated Operating)
  +1.3 to +5.5V(Clock Timing Operating)
- I^{2}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:
  +2.0V temperature compensation operating voltage detection.
  +1.5V supply voltage undervoltage detection
- AEC-Q100 Compliant

Pb-Free

RoHS/ELV Compliant

■Applications

- High precision clock source

"I^{2}C-BUS" is a registered trademark of NXP Semiconductor

■ Standard Specification

Item	Legend	Spec. min.	Spec. typ.	Spec. max.	Unit	Condition
Output Frequency	fo	–	32.768	–	kHz	
Supply Voltage Range	Vcc	+1.3	–	+5.5	V	(Clock Timing Operating)
	Vtem	+2.0	–	+5.5		(Temperature Compensated Operating)
	Vint	+1.5	–	+5.5		(Interface Operation) I^{2}C-BUS
Frequency Tolerance	f_tol	−5.0	–	+5.0	×10^{-6}	−40 to +85℃
		−3.8	–	+3.8		−10 to +60℃
Current Consumption	Icc1	–	+0.6	+2.0	μA	Vcc=+3.0V, Temperature Compensation Interval:30s, SCL=SDA=INTN=Vcc,CLKOE=GND(Output Off)
	Icc2	–	+1.5	+4.0	μA	Vcc=+3.0V, Temperature Compensation Interval:30, No Load, SCL=SDA=INTN=CLKOE=Vcc(Output On)
Load Condition	L_CMOS	–	–	15	pF	
Start Up Time	Tstart	–	–	1.0	s	Ta=+25℃, Vcc=+1.3V
		–	–	3.0		Ta=−40 to +85℃, Vcc=+1.3 to +5.5V
Power Supply Detection Voltage	VDET1*1	+1.8	+1.9	+2.0	V	Temperature Compensated Operation Detection Voltage
	VDET2*2	+1.3	+1.4	+1.5		Power Supply Undervoltage Detection
Reliability	AEC-Q100					
Packing Unit	2000pcs./reel (φ180)					

*1:When Vcc falls below VDET1, the internal detection circuit operates, and the intermittent temperature compensating stops. At the same time, the current temperature compensating data value is retained. When Vcc rises above VDET1 again, the intermittent temperature compensating is enabled.

*2:The Detection circuit operates at the temperature compensation interval.

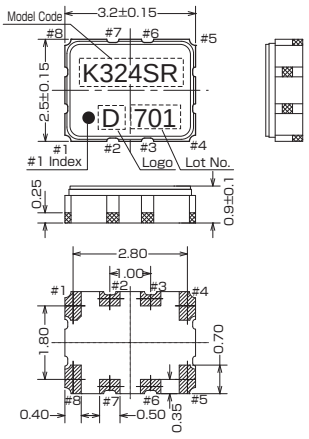
Consult our sales representative for other specifications.

Description

Pin No.	Name	I/O	Function
#1	OE	I	Output control enable input (L:High impedance, H:Clock output)
#2	INTN	O	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	O	Clock output connection.
#6	SCL	I	I^{2}C-BUS serial interface clock input connection.
#7	SDA	I/O	I^{2}C-BUS serial interface data input/output connection.
#8	Vcc	–	Supply Voltage

[mm]

■ Dimensions



Pin Connections

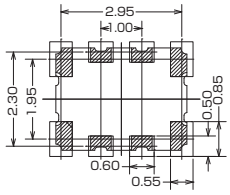
Pin No.	Connection
#1	OE(Output Enable)
#2	INTN
#3	N.C.
#4	GND
#5	Output
#6	SCL
#7	SDA
#8	Vcc

Function

#1 Input	#5 Output condition
H	Oscillation out
L	High Z

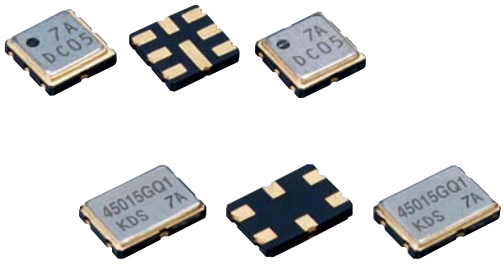
■ Recommended Land Pattern

<Top View>



Quartz Devices

Monolithic crystal filters



〈Example〉 **D S F 3 3 4 S A F**

Surface mount monolithic crystal filter	**D S F**
Length Represents first digit of the dimension in millimeter	**3**
Width Represents first digit of the dimension in millimeter	**3**
Number of terminals 3: six terminals 4: eight terminals	**4**
Sealing method S: seam weld seal	**S**
Product characteristics A: 2pole B, D: 4pole C: 3pole	**A**
Product characteristics F: Fundamental O: Overtone	**F**

KDS DAISHINKU CORP.

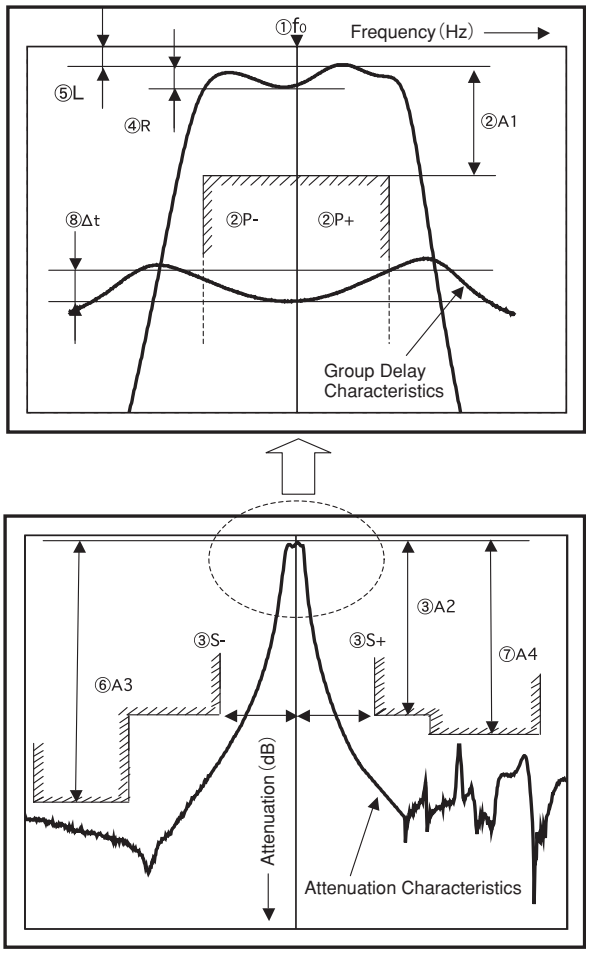
Monolithic Crystal Filters

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	**Nominal Frequency** fo(MHz)	Nominal value of center frequency.
②	**Pass Bandwidth** P±(kHz)、A1(dB)	Frequency interval at which relative attenuation is guaranteed to be equal to or less than a given value, A1.
③	**Stop Bandwidth** S±(kHz)、A2(dB)	Frequency interval at which relative attenuation is guaranteed to be equal to or more than a given value, A2.
④	**Ripple** R(dB)	The maximum difference between the minimum attenuation and the minimum loss within the pass band.
⑤	**Insertion Loss** 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 f0: Insertion loss at nominal frequency.
⑥	**Guaranteed Attenuation** A3(dB)	Relative attenuation guaranteed in a specific range within the stop band.
⑦	**Spurious** A4(dB)	Relative attenuation produced as a result of spurious frequencies in a specific range within the stop band.
⑧	**Tolerance in Group Delay Time** Δt(μs)	Difference between the maximum value and minimum value of the group delay time within the pass band.
	Terminating Impedance Rt//Ct (Ω//pF)	Signal-source impedance or loading impedance as viewed from the filter side. Expressed as resistance and parallel capacitance including floating capacitance.
	Coupling Capacitance Cc (pF)	Capacitance of the connection between elements for 4pole filter.
	Operating Temperature Range	Temperature range over which the monolithic crystal filter can be operated within allowable deviation range.



Selection Guide

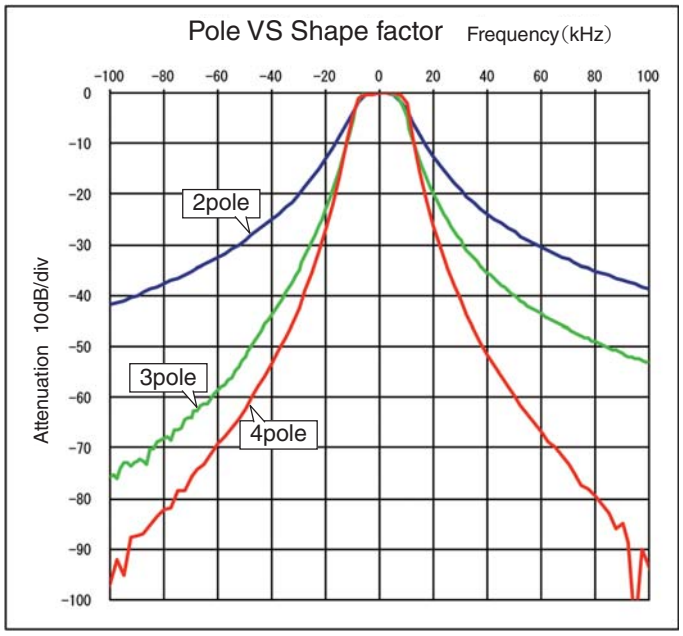
Scan the QR code to check the table of contents page of our web site "Monolithic Crystal Filters" (URL: http://www.kds.info/class/3-l-cf/).

Icons IE Industrial Equipment TC Mobile Phone, Wireless Communication

Monolithic Crystal Filters

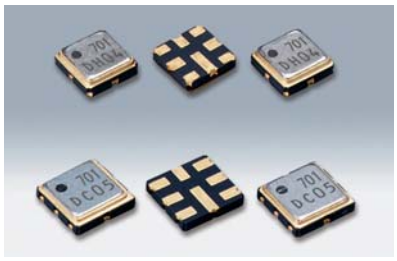
Type	Actual Size	Size (mm)			Frequency Range (MHz)	Operating Temperature Range (℃)	Overtone Order	Pole	Pass Bandwidth (kHz min./3dB)	Recommended Application	Catalog Page
		L	W	H (max.)							
DSF334SAF		3.0	3.0	1.1	45 to 130	-20 to +70℃	Fundamental	2	±3.5, ±7.5, ±15	TC	92
DSF334SAO					100 to 160		3rd				
DSF334SCF					60 to 130		Fundamental	3			
DSF444SAF		3.8	3.8	1.1	40 to 130		Fundamental	2			
DSF444SAO					100 to 160		3rd				
DSF444SCF					60 to 130		Fundamental	3			
DSF444SCO					100 to 160		3rd				
DSF753SAF		7.0	5.0	1.5	16 to 90		Fundamental	2			
DSF753SAO					60 to 160		3rd				
DSF753SCF					20 to 130		Fundamental	3		IE TC	93
DSF753SCO					90 to 160		3rd				
DSF753SBF					30 to 70		Fundamental	4			
DSF633SDF		6.0	3.5	1.3	45 to 130	-20 to +70℃	Fundamental	4	±3.5, ±7.5, ±15	IE TC	94
DSF753SDF		7.0	5.0	1.5	20 to 130						

Pole VS Shape factor



SMD Monolithic Crystal Filters

DSF334S 2POLE/3POLE, DSF444S 2POLE/3POLE



Actual size DSF334S DSF444S

Features

- 3030 size, lightweight (0.03g) and miniature SMD crystal filter. Just 0.9mm height.
  3838 size, lightweight (0.05g) and miniature SMD crystal filter. Just 0.9mm height.
- Excellent shock and vibration resistance.
- Low spurious

Pb-Free

RoHS Compliant

Applications

- Radio communications

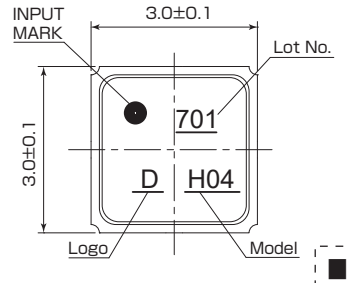
Standard Specification

Type	DSF334SAF		DSF334SCF	DSF444SAF	DSF444SCF
Model	D50015AM	DA1030AM	D85330FM	D45030AL	D73313FL
Pole	2	2	3	2	3
Overtone Order	Fundamental	Fundamental	Fundamental	Fundamental	Fundamental
Nominal Frequency	50.000 MHz	110.520 MHz	85.380 MHz	45.000	73.350
Pass Bandwidth	±7.5kHz min./3dB	±15kHz min./ 3dB	±15kHz min./3dB	±15kHz min./3dB	±6.5kHz min./3dB
Stop Bandwidth	±25kHz max./13dB	±60kHz max./18dB	±60kHz max./25dB	±60kHz max./15dB	±20kHz max./18dB
Ripple	1dB max.	1dB max.	1dB max.	1dB max.	1dB max.
Insertion Loss	3.5dB max.	4dB max.	5dB max.	3dB max.	3.5dB max.
Guaranteed Attenuation	60dB min.	60dB min.	70dB min.	70dB min.	70dB min.
Terminating Impedance	750Ω//3pF	200Ω//3pF	400Ω//−0.5pF	800Ω//1.5pF	380Ω//−1pF
Operating Temperature Range	−20 to +70℃				
Packing Unit	2000pcs./reel(φ180)			1000pcs./reel(φ180)	

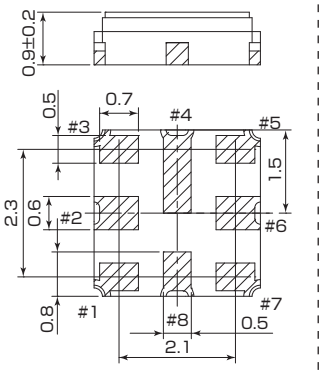
Consult our sales representative for other specifications.

DSF334S [mm]

Dimensions

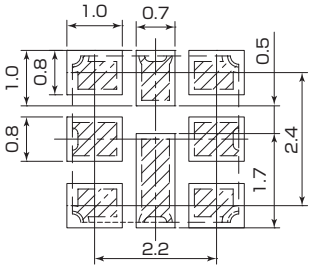


Pin No.	Connection
#1	Input
#2	GND.
#3	GND.
#4	GND.
#5	Output
#6	GND.
#7	GND.
#8	GND.

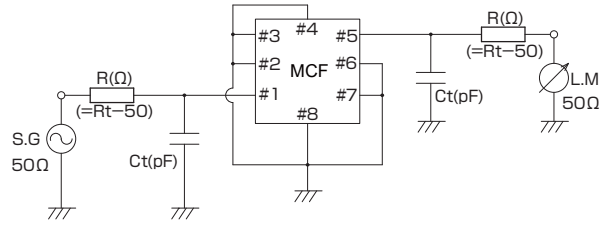


Recommended Land Pattern

〈Top View〉

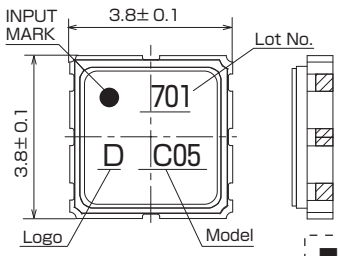


Measurement Circuit

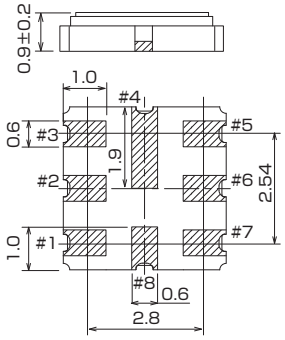


DSF444S [mm]

Dimensions

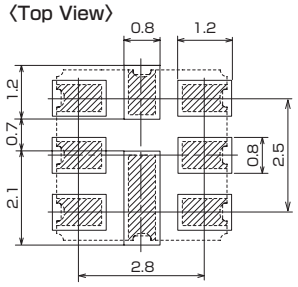


Pin No.	Connection
#1	Input
#2	GND.
#3	GND.
#4	GND.
#5	Output
#6	GND.
#7	GND.
#8	GND.

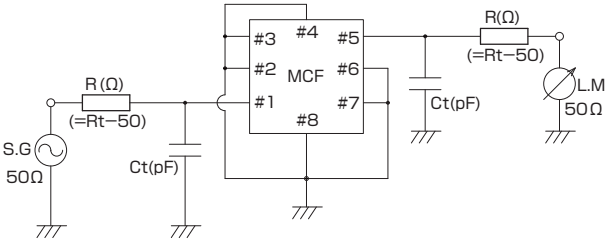


Recommended Land Pattern

〈Top View〉

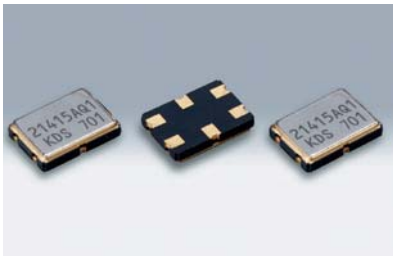


Measurement Circuit



SMD Monolithic Crystal Filters

DSF753S 2POLE/3POLE/4POLE



Actual size

■ Features

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

■ Applications

- Radio communications

Pb-Free

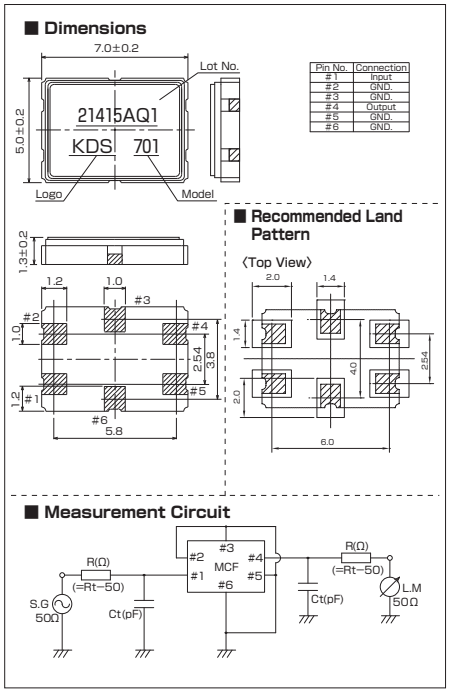
RoHS Compliant

■ Standard Specification

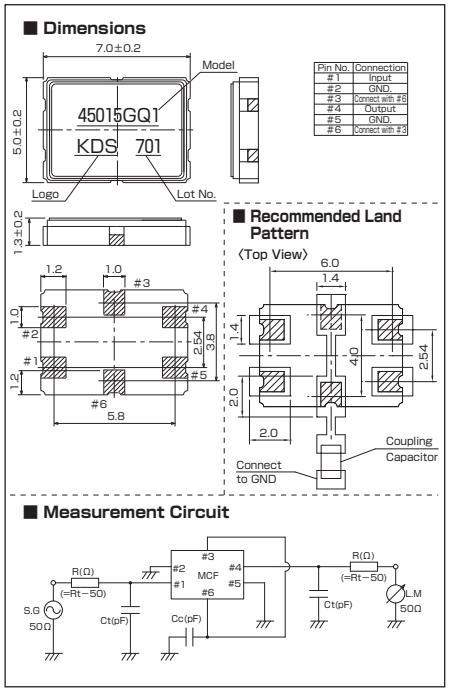
Type	DSF753SAF				DSF753SCF	DSF753SBF	
Model	D21415AQ	D38830AQ	D45015AQ	D55707AQ	D45015FQ	D38807GQ	D45015GQ
Pole	2	2	2	2	3	4	4
Overtone Order	Fundamental	Fundamental	Fundamental	Fundamental	Fundamental	Fundamental	Fundamental
Nominal Frequency	21.400 MHz	38.850 MHz	45.000 MHz	55.700 MHz	45.000 MHz	38.850MHz	45.000MHz
Pass Bandwidth	±7.5kHz min./ 3dB	±15kHz min./3dB	±7.5kHz min./3dB	±3.5kHz min./3dB	±7.5kHz min./3dB	±3.75kHz min./3dB	±7.5kHz min./3dB
Stop Bandwidth	±25kHz max./18dB	±50kHz max./15dB	±25kHz max./14dB	±12.5kHz max./10dB	±50kHz max./30dB	±15kHz max./35dB	±25kHz max./25dB
Ripple	1dB max.	1dB max.	1dB max.	1dB max.	1dB max.	1dB max.	1dB max.
Insertion Loss	2dB max.	3dB max.	2.5dB max.	4dB max.	3dB max.	4dB max.	4dB max.
Guaranteed Attenuation	70dB min.	50dB min.	60dB min.	70dB min.	70dB min.	80dB min.	80dB min.
Terminating Impedance	1500Ω//2.5pF	2150Ω//1pF	550Ω//3pF	550Ω//4pF	700Ω//−1pF	560Ω//5pF Cc=13pF	600Ω//2pF Cc=10pF
Operating Temperature Range	−20 to +70℃						
Packing Unit	1000pcs./reel(φ180)						

Consult our sales representative for other specifications.

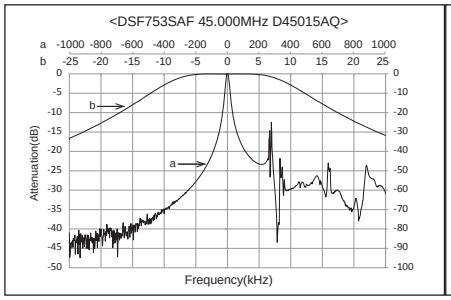
■ DSF753SA/DSF753SC [mm]



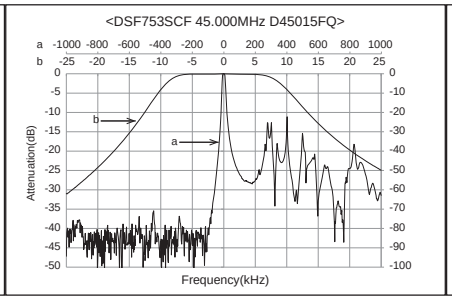
■ DSF753SB [mm]



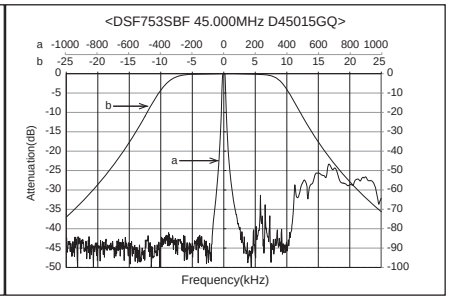
■ Characteristics Chart(fo=45MHz, P=±7.5kHz 2POLE)



■ Characteristics Chart(fo=45MHz, P=±7.5kHz 3POLE)



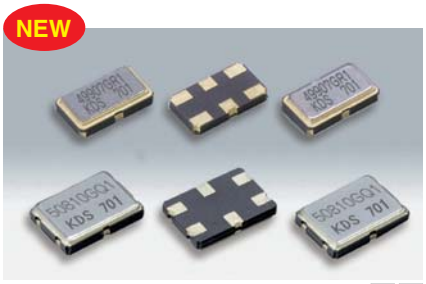
■ Characteristics Chart(fo=45MHz, P=±7.5kHz 4POLE)



SMD Monolithic Crystal Filters

DSF633S 4POLE, DSF753S 4POLE (SDF TYPE)

NEW



Actual size DSF633S DSF753S

■ Features

- 6035 size, lightweight (0.072g) and miniature SMD crystal filter. Just 1.1mm height.
  7050 size, miniature SMD crystal filter. Just 1.3mm height.
- 4 pole function in a single package.
- Excellent guaranteed attenuation.
- Excellent shock and vibration resistance.

■ Applications

- Radio communications

Pb-Free

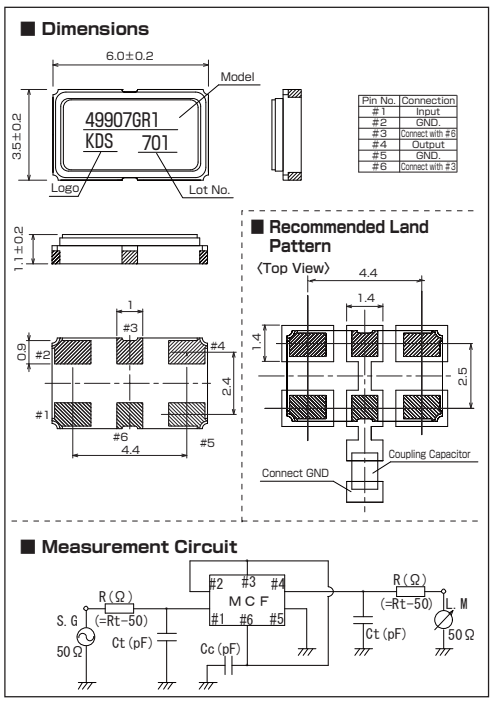
RoHS Compliant

■ Standard Specification

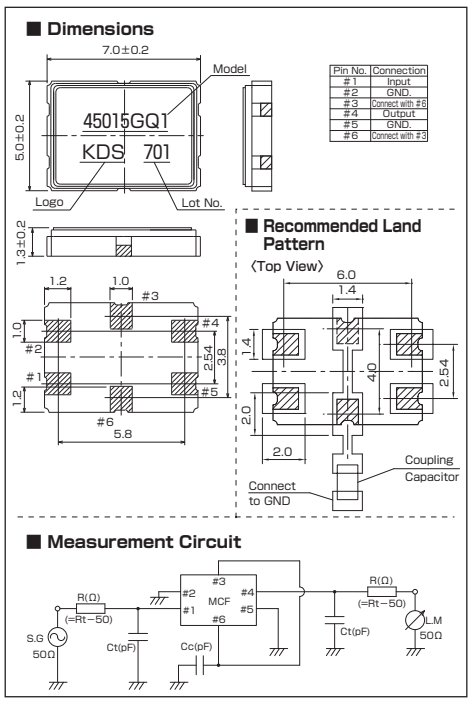
Type	DSF633SDF		DSF753SDF		
Model	D49907GR	D58010GR	D46307GQ	D50810GQ	D73312GQ
Pole	4	4	4	4	4
Overtone Order	Fundamental	Fundamental	Fundamental	Fundamental	Fundamental
Nominal Frequency	49.950 MHz	58.050 MHz	46.350MHz	50.850MHz	73.350MHz
Pass Bandwidth	±3.5kHz min./3dB	±5.0kHz min./3dB	±3.5kHz min./3dB	±5kHz min./3dB	±6kHz min./3dB
Stop Bandwidth	±15kHz max./35dB	±12.5kHz max./25dB	±18kHz max./40dB	±20kHz max./40dB	±25kHz max./40dB
Ripple	1db max.	1db max.	1dB max.	1dB max.	1dB max.
Insertion Loss	5db max.	5db max.	5dB max.	5dB max.	5dB max.
Guaranteed Attenuation	80db min.	80db min.	80dB min.	80dB min.	80dB min.
Terminating Impedance	220Ω//7pF Cc=23pF	450Ω//4.5pF Cc=9.5pF	400Ω//4pF Cc=17.5pF	560Ω//4pF Cc=9.7pF	450Ω//4pF Cc=9.2pF
Operating Temperature Range	−20 to +70℃				
Packing Unit	1000pcs./reel(φ180)				

Consult our sales representative for other specifications.

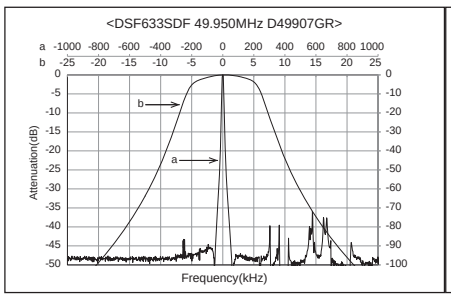
■ DSF633SD [mm]



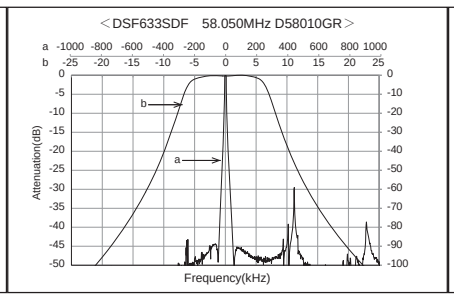
■ DSF753SD [mm]



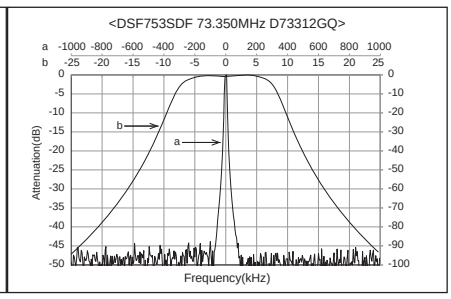
■ Characteristics Chart(fo=49.95MHz, P=±3.5kHz)



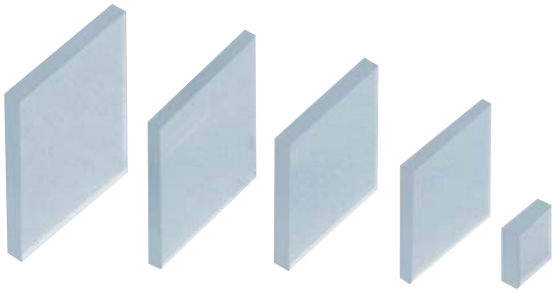
■ Characteristics Chart(fo=58.050MHz, P=±5kHz)



■ Characteristics Chart(fo=73.350MHz, P=±6kHz)



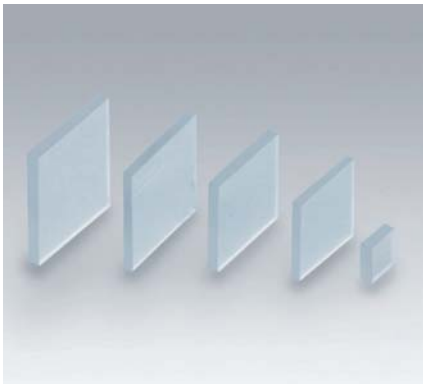
Quartz Devices
Optical products



KDS DAISHINKU CORP.

Optical Products

Description



Crystal has wider transmission wavelength range of the light compared to common glass, and is physically stable material. In addition, it has depolarization properties, optical rotation property and double refraction properties that separates the ordinary and extraordinary light. It is used for wave plate, heat dissipation plate, OLPF (Optical Low Pass Filters).
The dielectric multilayer film can control the transmission of the light and is used in various electronic and optical devices. It can be formed on the various kinds of substrates, such as crystal, glass, etc.

■ Applications

- Surveillance camera, FA cameras, cameras for automotive electronics, action camera, digital still camera, video camera.

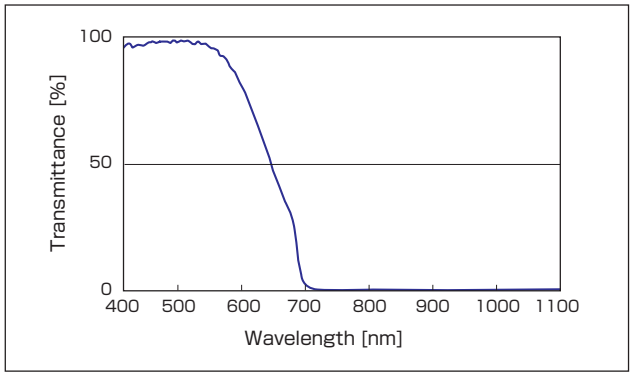
IR Double Cut Filter

"IR Double Cut Filter" is designed with the absorptive material and coating which blocks the transmission of the infrared. It comes with improved transmittance rate at visible light range, blocks near infrared light range and reduces the flares.

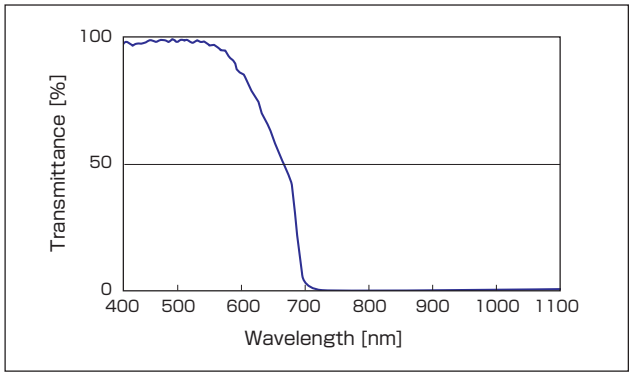
■ Example of Spectrum Characteristics

Infrared Absorbing Glass + Infrared Cut Coating Type

(High sensitivity type)



(Super high sensitivity type)



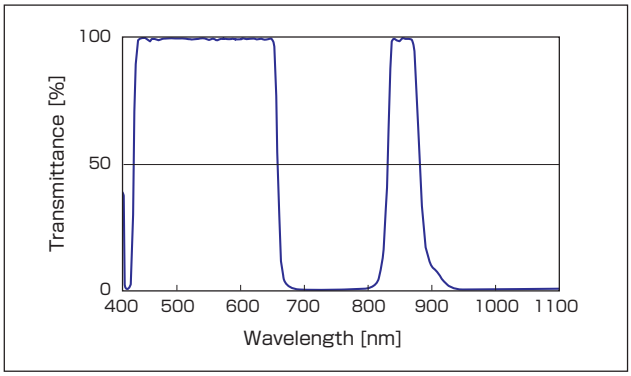
Optical Products

Dual Pass Filters

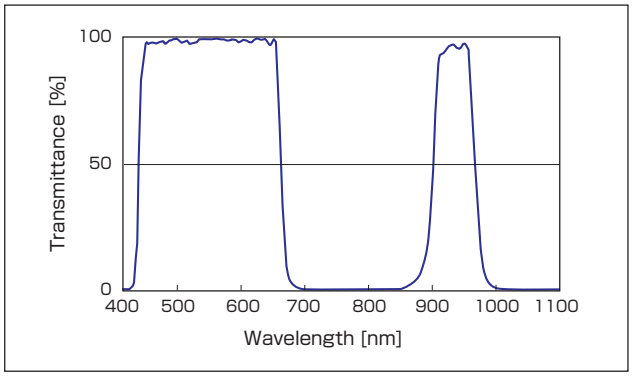
"Dual Pass filter" is a filter that has a transmission range of the near-infrared region and the visible light region.This filter is suitable to the surveillance cameras for shooting day and night continuously.

■ Example of Spectrum Characteristics

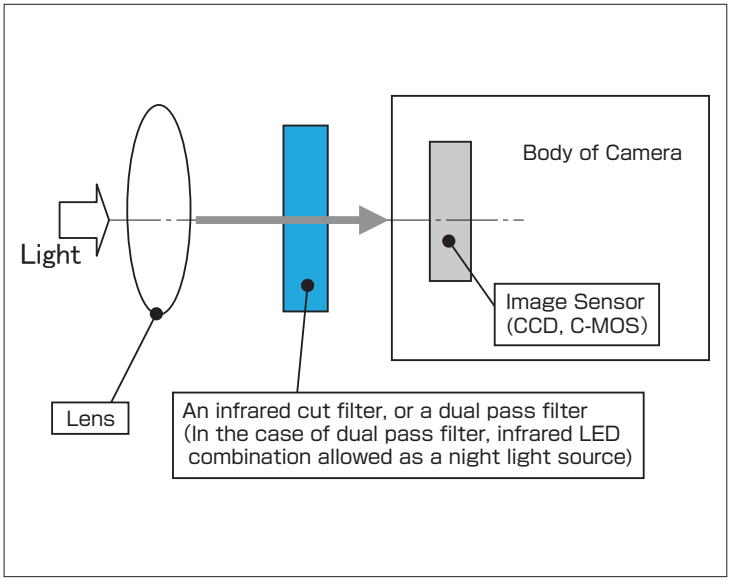
Type Ⅰ



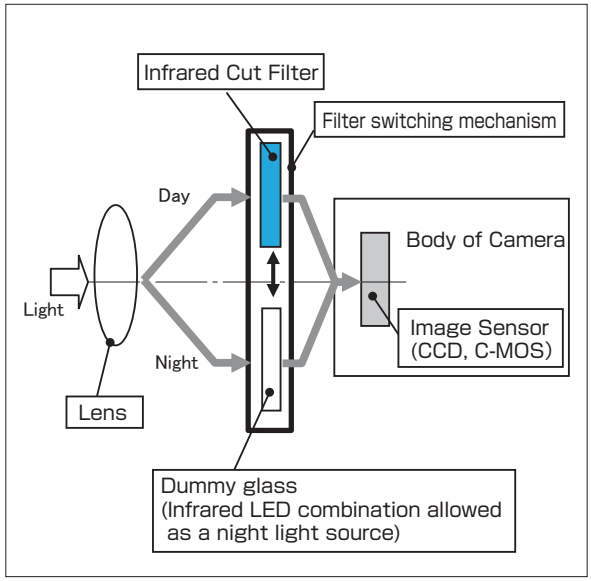
Type Ⅱ



■ Usage Examples



General camera

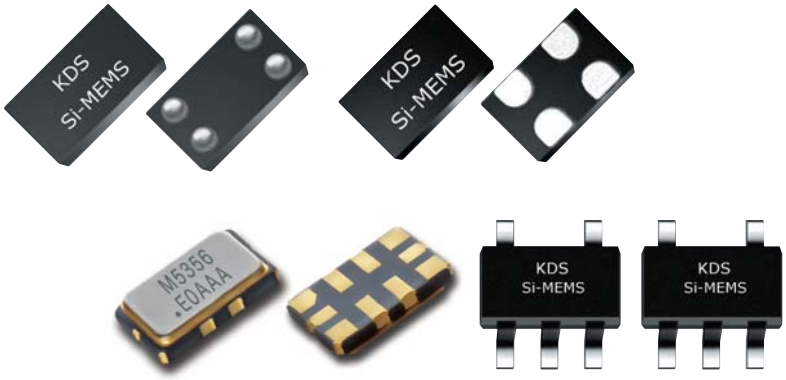


Day&Night mechanism with a camera

MEMO

Silicon Timing Devices

MEMS oscillators



KDS DAISHINKU CORP.

Selection Guide

Scan the QR code to check the table of contents page of our web site "MEMS Oscillators" (URL: http://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) L	W	H (max.)	Output	Frequency Range (kHz)	Frequency Characteristics over Temperature (×10⁻⁶)	Operating Temperature Range (℃)	Supply Voltage (V)	Current Consumption (μA typ.)	Recommended Application	Catalog Page
MO1532		1.5	0.8	0.6	NanoDrive™ LVCMOS	32.768	±100	-10 to +70℃ -40 to +85℃	+1.2 to +3.63	+0.90	CE TC	102
MO1534		1.5	0.8	0.6	NanoDrive™ LVCMOS	0.001 to 32.768	±100	-10 to +70℃ -40 to +85℃	+1.2 to +3.63	+0.90	CE TC	103
		2.0	1.2	0.6								
MO1569		1.5	0.8	0.6	LVCMOS	0.001 to 462	±50	-40 to +85℃	+1.62 to +3.63	+2.0 μA (100kHz)	CE TC	
MO1630		2.0	1.2	0.6	LVCMOS	32.768	±150	-40 to +105℃	+1.5 to +3.63	+1.00	CE TC	102

kHz Band Temperature Compensated MEMS Oscillators

Type	Actual Size	Size (mm) L	W	H (max.)	Output	Frequency Range (kHz)	Frequency Characteristics over Temperature (×10⁻⁶)	Operating Temperature Range (℃)	Supply Voltage (V)	Current Consumption (μA typ.)	Recommended Application	Catalog Page
MO1552					NanoDrive™ LVCMOS		±5/±10/±20 over temp.		+1.5 to +3.63	+0.99		
MO1566					LVCMOS		±3 all inclusive		+1.8	+4.5		
MO1568		1.5	0.8	0.6		32.768	±5 all inclusive After Overmold/ Underfill	-40 to +85℃			CE TC	102
MO1576					LVCMOS	0.001 to 2000	±5 all inclusive	-40 to +85℃	+1.62 to +3.63	+8.0 μA (100kHz)	CE TC	103

Low Power MEMS Oscillators

Type	Actual Size	Size (mm) L	W	H (max.)	Output	Frequency Range (MHz)	Frequency Tolerance (×10⁻⁶) (Includes frequency tolerance at room temperature.)	Operating Temperature Range (℃)	Supply Voltage (V)	Current Consumption (mA typ.)	Recommended Application	Catalog Page
MO8008		2.0 2.5 3.2 5.0	1.6 2.0 2.5 3.2	0.8 0.8 0.8 0.8	LVCMOS	1.0 to 110	±20, ±25, ±50	-40 to +85℃	+1.62 to +1.98, +2.25 to +3.63	+3.1 to +5.4 (+0.6 to +1.0 μA stby)	CE IE	104
MO8009		7.0	5.0	1.0		115 to 137						
MO8021		1.5	0.8	0.6	LVCMOS	1.0 to 26	±100	-40 to +85℃	+1.71 to 1.89	+0.006 to +0.34 (+0.9 μA stby)	CE TC	103

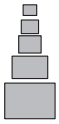
MEMS Oscillators for Clock

Type	Actual Size	Size (mm) L	W	H (max.)	Output	Frequency Range (MHz)	Frequency Tolerance (×10⁻⁶) (Includes frequency tolerance at room temperature.)	Operating Temperature Range (℃)	Supply Voltage (V)	Current Consumption (mA typ.)	Recommended Application	Catalog Page
MO2001		2.9	2.8	1.3	LVCMOS	1.0 to 110	±20, ±25, ±50	-40 to +85℃	+1.62 to +1.98, +2.25 to +3.63	+3.6 to +5.4 (+0.6 to +1.0 μA stby)	CE IE	104
MO2002						115 to 137						

Low Phase Jitter MEMS Oscillators

Type	Actual Size	Size (mm) L	W	H (max.)	Output	Frequency Range (MHz)	Frequency Tolerance (×10⁻⁶) (Includes frequency tolerance at room temperature.)	Operating Temperature Range (℃)	Supply Voltage (V)	Current Consumption (mA typ.)	Recommended Application	Catalog Page
MO8208		2.7 3.2 5.0	2.4 2.5 3.2	0.8 0.8 0.8	LVCMOS	1.0 to 80	±10, ±20, ±25, ±50	-40 to +85℃	+2.25 to +3.63	+29 to +36 (+10 μA stby)	CE IE	106
MO8209		7.0	5.0	1.0		80 to 220						
MO9120		3.2	2.5	0.8	LVPECL LVDS	25 to 212.5	±10, ±20, ±25, ±50	-40 to +85℃	+2.25 to +3.63	+54 to +69	CE IE	106
MO9121		5.0	3.2	0.8		1.0 to 220						
MO9122		7.0	5.0	1.0		220 to 625						
MO9365		3.2	2.5	0.8	LVPECL LVDS HCSL	32 Standard Frequencies	±10, ±20, ±25, ±50	-40 to +85℃	+2.25 to +3.63	+76 to +84	CE IE	105
MO9366						1.0 to 220						
MO9367		7.0	5.0	1.0		220 to 725						

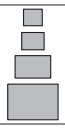
High Temperature MEMS Oscillators

Type	Actual Size	Size (mm) L	W	H (max.)	Output	Frequency Range (MHz)	Frequency Tolerance ($\times 10^{-6}$) (Includes frequency tolerance at room temperature.)	Operating Temperature Range (℃)	Supply Voltage (V)	Current Consumption (mA typ.)	Recommended Application	Catalog Page
MO1618		2.0	1.6	0.8	LVCMOS	33 Standard Frequencies	±20, ±25, ±30, ±50	-40 to +125℃	+1.62 to +1.98, +2.25 to +3.63	+3.6 to +5.4 (+1.0 µA stby)	CE IE	107
MO8918		2.5	2.0	0.8		1.0 to 110						
MO8919		3.2	2.5	0.8		115 to 137						
MO8920		5.0	3.2	0.8		1.0 to 110		-55 to +125℃				
MO8921		7.0	5.0	1.0		119 to 137						

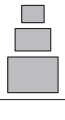
High Temperature MEMS Oscillators for Clock

Type	Actual Size	Size (mm) L	W	H (max.)	Output	Frequency Range (MHz)	Frequency Tolerance ($\times 10^{-6}$) (Includes frequency tolerance at room temperature.)	Operating Temperature Range (℃)	Supply Voltage (V)	Current Consumption (mA typ.)	Recommended Application	Catalog Page
MO2018		2.9	2.8	1.3	LVCMOS	1.0 to 110	±20, ±25, ±30, ±50	-40 to +85℃	+1.62 to +1.98, +2.25 to +3.63	+3.6 to +5.4 (+1.0 µA stby)	CE IE	107
MO2019						115 to 137						
MO2020						1.0 to 110		-55 to +125℃				
MO2021						119 to 137						

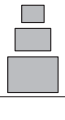
Voltage Controlled MEMS Oscillators

Type	Actual Size	Size (mm) L	W	H (max.)	Output	Frequency Range (MHz)	Frequency Tolerance ($\times 10^{-6}$) (Includes frequency tolerance at room temperature.)	Operating Temperature Range (℃)	Supply Voltage (V)	Current Consumption (mA typ.)	Recommended Application	Catalog Page
MO3372		3.2	2.5	0.8	LVPECL LVDS HCSL	1.0 to 220	±10, ±25, ±50	-40 to +85℃	+2.25 to +3.63	+76 to +84	CE IE	108
MO3373		7.0	5.0	1.0		220 to 725						
MO3807		2.7	2.4	0.8	LVCMOS	30 Standard Frequencies	±25, ±50	-40 to +85℃	+1.71 to +1.89, +2.25 to +3.63	+29 to +36 (+10 µA stby)	CE IE	109
MO3808		3.2	2.5	0.8		1.0 to 80	±10, ±25, ±50					
MO3809		5.0	3.2	0.8		80 to 220	±10, ±25, ±50					
		7.0	5.0	1.0								

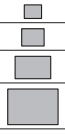
Digitally Controlled MEMS Oscillators

Type	Actual Size	Size (mm) L	W	H (max.)	Output	Frequency Range (MHz)	Frequency Tolerance ($\times 10^{-6}$) (Includes frequency tolerance at room temperature.)	Operating Temperature Range (℃)	Supply Voltage (V)	Current Consumption (mA typ.)	Recommended Application	Catalog Page
MO3907		3.2	2.5	0.8	LVCMOS	1.0 to 220	±10, ±25, ±50	-40 to +85℃	+1.71 to +1.89, +2.25 to +3.63	+29 to +36 (+10 µA stby)	CE IE	110
MO3921		5.0	3.2	0.8	LVPECL LVDS				+2.25 to +3.63	+55 to +69		
MO3922		7.0	5.0	1.0		220 to 625						

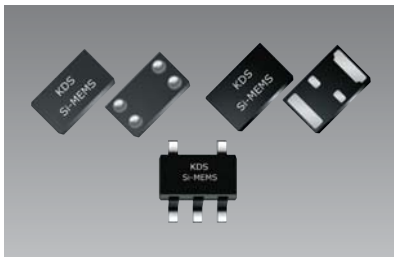
Temperature Compensated MEMS Oscillators

Type	Actual Size	Size (mm) L	W	H (max.)	Output	Frequency Range (MHz)	Frequency Characteristics over Temperature ($\times 10^{-6}$)	Operating Temperature Range (℃)	Supply Voltage (V)	Current Consumption (mA typ.)	Recommended Application	Catalog Page
MO5021		3.2	2.5	0.8	LVPECL LVDS	1.0 to 220	±5.0	-40 to +85℃	+2.25 to +3.63	+54 to +69	CE IE	112
MO5022		5.0	3.2	0.8		220 to 625						
		7.0	5.0	1.0								
MO5155		5.0	3.2	1.0	LVCMOS Clipped Sinewave	10 std. GNSS Freq.	±0.5, ±1.0, ±2.5	-40 to +85℃	+2.25 to +3.63	+40 to +45	CE IE	111
MO5156						1.0 to 60						
MO5157						60 to 220						
MO5356						1.0 to 60	±0.1, ±0.2, ±0.25					
MO5357						60 to 220						

MEMS Oscillators with Spread Spectrum Function

Type	Actual Size	Size (mm) L	W	H (max.)	Output	Frequency Range (MHz)	Frequency Tolerance ($\times 10^{-6}$) (Includes frequency tolerance at room temperature.)	Operating Temperature Range (℃)	Supply Voltage (V)	Current Consumption (mA typ.)	Recommended Application	Catalog Page
MO9002		5.0	3.2	0.8	LVPECL LVDS CML HCSL	1.0 to 220	±25, ±50	-40 to +85℃	+1.71 to +1.89, +2.25 to +3.63	+48 to +75	CE IE	113
		7.0	5.0	1.0								
MO9003		2.5	2.0	0.8	LVCMOS	1.0 to 110	±50, ±100			+3.2 to +4.1 (+0.4 to +4.3 µA stby)		
		3.2	2.5	0.8								
		5.0	3.2	0.8								
		7.0	5.0	1.0								
MO9005		2.0	1.6	0.8		1.0 to 141	±20, ±25, ±50		+1.62 to +1.98, +2.25 to +3.63	+5.0 to +6.5 (+0.4 to +4.3 µA stby)		
		2.5	2.0	0.8								
		3.2	2.5	0.8								

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



■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

Pb-Free

RoHS Compliant

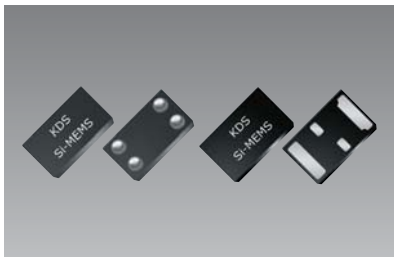
Model	Output Frequency (kHz)	Frequency Tolerance ($\times 10^{-6}$)	Supply Voltage (V)	Current Consumption (μA Typ.)	Size (mm)	Output
MO1532	32.768	±10 room; 75, 100 over temp.	+1.2 to +3.63	+0.90	1.5×0.8×0.6 (CSP)	NanoDrive™ LVCMOS
MO1552 TC-MO		±5, ±10, ±20 over temp.	+1.5 to +3.63	+0.99		
MO1630 -40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

■ 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℃ to +70℃
		+1.5	-	+3.63		T_A = -40℃ to +85℃
Operating Temperature Range	T_use	-10 to +70 / -40 to +85			℃	
Frequency Stability [1]	F_stab	-	-	+75	$\times 10^{-6}$	T_A = -10℃ to +70℃, Vdd: +1.5V to +3.63V
		-	-	+100		T_A = -40℃ to +85℃, Vdd: +1.5V to +3.63V
		-	-	+250		T_A = -10℃ to +70℃, Vdd: +1.2V to +1.5V
Frequency Tolerance [2]	F_tol	-	-	+10	$\times 10^{-6}$	T_A = +25℃, post reflow, Vdd: +1.5V to +3.63V
		-	-	+20		T_A = +25℃, 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℃
Core Operating Current [3]	Idd	-	+0.9	-	µA	T_A = +25℃, Vdd: +1.8V. No load
		-	-	+1.3		T_A = -10℃ to +70℃, Vdd max: +3.63V. No load
		-	-	+1.4		T_A = -40℃ to +85℃, Vdd max: +3.63V. No load
Start-up Time [4]	T_start	-	180	300	ms	T_A = -40℃ ≦ T_A ≦ +50℃, valid output
		-	-	450		T_A = +50℃ < T_A ≦ +85℃, valid output
LVCMOS Output Option, TA = -40°C to +85°C, typical values are at T_A = +25°C						
Duty Cycle	DC	48	-	52	%	
Output Low Voltage	V_{OL}	-	-	Vdd×0.1	V	Vdd: +1.5V to +3.63V, I_{OL} = +10 µA, 15 pF
Output High Voltage	V_{OH}	Vdd×0.9	-	-	V	Vdd: +1.5V to +3.63V, I_{OH} = -10 µA, 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 ≧ +1.62V

[1]. Measured peak-to-peak. Inclusive of Initial Tolerance at +25° 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 ≥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 µA/V) × (output voltage swing).
[4]. Measured from the time Vdd reaches +1.5V.

MEMS Oscillators / TC-MO -µPower



■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

Pb-Free

RoHS Compliant

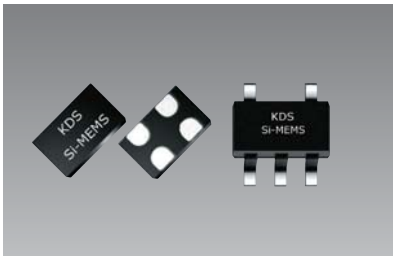
Model	Output Frequency (kHz)	Frequency Tolerance ($\times 10^{-6}$)	Supply Voltage (V)	Current Consumption (μA Typ.)	Size (mm)	Output
MO1534	1 Hz to 32.768 kHz	±20 room; ±75,100,150 over temp	+1.2 to +3.63	+0.90	1.5×0.8×0.6 (CSP) 2.0×1.2×0.6 (QFN)	NanoDrive™ LVCMOS
MO1569	1 Hz to 462kHz	±50	+1.62 to +3.63	+2.0 (100 kHz)	1.5×0.8×0.6 (CSP)	LVCMOS
MO1576 Super TC-MO	1 Hz to 2 MHz	±5 all inclusive		+8.0 (100 kHz)		
MO8021	1 Hz to 26 MHz	±100	+1.71 to +1.89	+6 to +340 (0.9 µA 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	
Operating Temperature Range	T_use	-20	-	+70	℃	Extended Commercial
		-40	-	+85		Industrial
Frequency Stability	F_tol	-15	-	+15	$\times 10^{-6}$	Frequency offset at +25℃ 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_A = +25℃
Current Consumption [1]	Idd	-	+60	-	µA	f = 3.072 MHz, no load
		-	+110	+130		f = 6.144 MHz, no load
		-	+230	+270		f = 6.144 MHz, 10 pF load
		-	+160	-		f = 12 MHz, no load
Standby Current	I_std	-	+0.7	+1.3	µA	ST pin = HIGH, output is weakly pulled down
Duty Cycle	DC	45	-	55	%	
Output Low Voltage	V_{OL}	-	-	Vdd×0.1	V	I_{OL} = +0.5 mA
Output High Voltage	V_{OH}	Vdd×0.9	-	-	V	I_{OH} = -0.5 mA
Rise and Fall Time	Tr, Tf	-	+4.0	+8.0	ns	20% to 80%
Input Low Voltage	V_{IL}	-	-	Vdd×0.2	V	
Input High Voltage	V_{IH}	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	µs	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
RMS Phase Jitter (random)	T_phj	-	0.8	2.5	ns	f = 6.144 MHz, Integration bandwidth = 100 Hz to 40 kHz
						Note [2]

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

MEMS Oscillators - Low Power



■Features

- Excellent total frequency tolerance as low as ±20×10^{-6}
- Low power consumption of +3.5 mA typical (f = 20 MHz, Vdd = +1.8V)

■ Applications

- Ideal for DSC, DVC, DVR, IP CAM, Tablets, e-Books, SSD, GPON, EPON, etc.
- Ideal for high-speed serial protocols such as: USB, SATA, SAS, Firewire, 100M/1G/10G Ethernet, etc.

Pb-Free

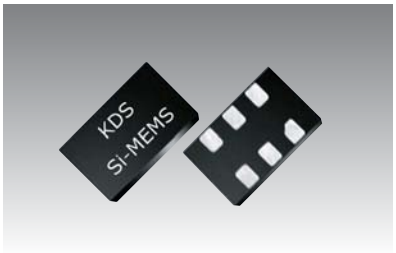
RoHS Compliant

Model	Output Frequency (MHz)	Frequency Tolerance (×10^{-6})	Supply Voltage (V)	Current Consumption (mA Typ.)	Size (mm)	Output
MO8008	1 to 110	±20, ±25, ±50	+1.62 to +1.98, +2.25 to +3.63	+3.1 to +5.4 (+0.6 to +1.0 µA stby)	2.0×1.6×0.8, 2.5×2.0×0.8, 3.2×2.5×0.8, 5.0×3.2×0.8, 7.0×5.0×1.0 (QFN)	LVCMOS
MO8009	115 to 137					
MO2001	1 to 110				2.9×2.8×1.3 (SOT23-5)	
MO2002	115 to 137					

■ Standard Specification (MO8008)

Item	Legend	Min.	Typ.	Max.	Unit	Condition
Output Frequency Range	f	1	-	110	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	℃	Extended Commercial
		-40	-	+85		Industrial
Frequency Stability	F_stab	-20	-	+20	×10^{-6}	Inclusive of initial tolerance at +25° C, 1st year aging at +25° C, and variations over operating temperature, rated power supply voltage and load.
		-25	-	+25		
		-50	-	+50		
Current Consumption	Idd	-	+3.8	+4.5	mA	No load condition, f = 20 MHz, Vdd = +2.8V to +3.3V
		-	+3.7	+4.2		No load condition, f = 20 MHz, Vdd = +2.5V
		-	+3.5	+4.1		No load condition, f = 20 MHz, Vdd = +1.8V
OE Disable Current	I_od	-	-	+4.2	mA	Vdd = +2.5V to +3.3V, OE = GND, Output in high-Z state
		-	-	+4.0		Vdd = +1.8V, OE = GND, Output in high-Z state
Standby Current	I_std	-	+2.1	+4.3	µA	$\overline{ST}$ = GND, Vdd = +2.8V to +3.3V, Output is weakly pulled down
		-	+1.1	+2.5		ST = GND, Vdd = +2.5V , Output, Output is weakly pulled down
		-	+0.2	+1.3		ST = GND, Vdd = +1.8V, Output i, Output is weakly pulled down
Duty Cycle	DC	45	-	55	%	All Vdds
Output Low Voltage	V_{OL}	-	-	Vdd×0.1	V	I_{OL} = +4.0 mA (Vdd = +3.0V or +3.3V) I_{OL} = +3.0 mA (Vdd = +2.8V and Vdd = +2.5V) I_{OL} = +2.0 mA (Vdd = +1.8V)
Output High Voltage	V_{OH}	Vdd×0.9	-	-	V	I_{OH} = -4.0 mA (Vdd = +3.0V or +3.3V) I_{OH} = -3.0 mA (Vdd = +2.8V and Vdd = +2.5V) I_{OH} = -2.0 mA (Vdd = +1.8V)
Rise and Fall Time	Tr, Tf	-	1.0	2.0	ns	Vdd = +2.5V, +2.8V, +3.0V or +3.3V, 20% to 80%
		-	1.3	2.5		Vdd =+1.8V, 20% to 80%
		-	-	2.0		Vdd = +2.25V to +3.63V, 20% to 80%
Input Low Voltage	V_{IL}	-	-	Vdd×0.3	V	Pin 1, OE or $\overline{ST}$
Input High Voltage	V_{IH}	Vdd×0.7	-	-	V	Pin 1, OE or $\overline{ST}$
Start-up Time	T_start	-	-	5.0	ms	Measured from the time Vdd reaches its rated minimum value
Enable and Disable Time	T_oe	-	-	130	ns	f = 110 MHz. For other frequencies, T_oe = 100 ns + 3×cycles
Resume Time	T_resume	-	-	5.0	ms	Measured from the time $\overline{ST}$ pin crosses 50% threshold
RMS Period Jitter	T_jitt	-	1.8	3.0	ps	f = 75 MHz, Vdd = +2.5V, +2.8V, +3.0V or +3.3V
		-	1.8	3.0		f = 75 MHz, Vdd = +1.8V
Peak-to-peak Period Jitter	T_pk	-	12	25	ps	f = 75 MHz, Vdd = +2.5V, +2.8V, +3.0V or +3.3V
		-	14	30		f = 75 MHz, Vdd = +1.8V
RMS Phase Jitter (random)	T_phj	-	0.5	0.9	ps	f = 75 MHz, Integration bandwidth = 900 kHz to 7.5 MHz
		-	1.3	2.0		f = 75 MHz, Integration bandwidth = 12 kHz to 20 MHz

MEMS Oscillators - Super Low Jitter



■Features

- Industry-Standard packages: 3.2×2.5 mm, 7.0×5.0 mm
- Output signaling types: LVPECL, LVDS, HCSL
- Frequency tolerance as low as ±10×10^{-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

Pb-Free

RoHS Compliant

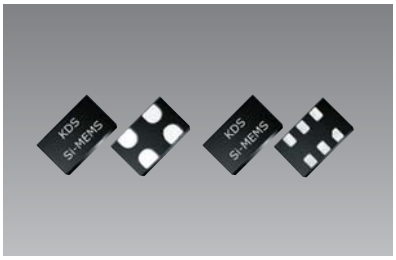
Model	Output Frequency (MHz)	Frequency Tolerance (×10^{-6})	Supply Voltage (V)	Current Consumption (mA Typ.)	Size (mm)	Output
MO9365	32 Standard Frequencies	±10, ±20, ±25, ±50	+2.25 to +3.63	+76 to +84	3.2×2.5×0.8, 7.0×5.0×1.0 (QFN)	LVPECL LVDS HCSL
MO9366	1 to 220					
MO9367	220 to 725					

■ 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	℃	Extended Commercial
		-40	-	+85		Industrial
Frequency Tolerance	F_stab	-10	-	+10	×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	-	±1	-	×10^{-6}	T_A = +25℃
Duty Cycle	DC	45	-	55	%	
Input Low Voltage	V_{IL}	-	-	Vdd×0.3	V	Pin 1, OE
Input High Voltage	V_{IH}	Vdd×0.7	-	-	V	Pin 1, OE
Start-up Time	T_start	-	-	5.0	ms	Measured from the time Vdd reaches its rated minimum value
Enable and Disable Time	T_oe	-	-	515	ns	f = 212.5 MHz - For other frequencies, T_oe = 500ns + 3 period
RMS Phase Jitter [1]	T_jitt	-	1	2	ps	f = 100, 156.25 or 212.5 MHz, Vdd = 3.3 or 2.5 V
RMS Phase Jitter (random)	T_phj	-	0.23	-	ps	f = 156.25 MHz, Integration bandwidth = 12 kHz to 20 MHz, all Vdds
LVPECL output						
Current Consumption	Idd	-	-	+84	mA	Excluding Load Termination Current, Vdd = +3.3V or +2.5V
OE Disable Supply Current	I_oe	-	-	+55	mA	OE = Low
Output Low Voltage	V_{OL}	Vdd - 1.9	-	Vdd - 1.5	V	
Output High Voltage	V_{OH}	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	-	250	-	ps	20% to 80%
LVDS output						
Current Consumption	Idd	-	-	+76	mA	Excluding Load Termination Current, Vdd = +3.3V or +2.5V
OE Disable Supply Current	I_oe	-	-	+55	mA	OE = Low
Rise and Fall Time	Tr, Tf	-	340	-	ps	Measured with 2 pF capacitive loading to GND, 20% to 80%
Differential Output Voltage	V_{OD}	+250	-	+450	mV	
V_{OD} Magnitude Change	ΔV_{OD}	-	-	+50	mV	
Offset Voltage	V_{OS}	+1.125	-	+1.375	V	
V_{OS} Magnitude Change	ΔV_{OS}	-	-	+50	mV	
HCSL output						
Current Consumption	Idd	-	-	+84	mA	Excluding Load Termination Current, Vdd = +3.3V or +2.5V
OE Disable Supply Current	I_oe	-	-	+55	mA	OE = Low
Output Voltage Low	V_{OL}	-0.05	-	+0.05	V	
Output Voltage High	V_{OH}	0.6	-	0.8	V	
Differential Output Voltage	V_Swing	1.0	1.4	1.8	V	
Rise and Fall Time	Tr, Tf	-	350	-	ps	Measured with 2 pF capacitive loading to GND, 20% to 80%

[1]. Measured according to JESD65B

MEMS Oscillators - Low Jitter



■Features

- Frequency tolerance as low as ±10×10^{-6}
- Ultra-Low phase Jitter

■ Applications

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

Pb-Free

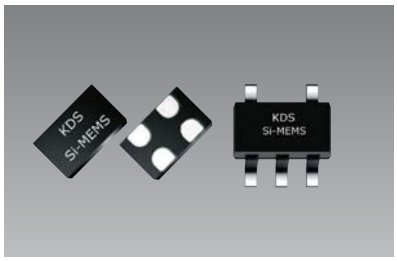
RoHS Compliant

Model	Output Frequency (MHz)	Frequency Tolerance (×10^{-6})	Supply Voltage (V)	Current Consumption (mA Typ.)	Size (mm)	Output
MO9120	25 to 212.5	±10, ±20, ±25, ±50	+2.25 to +3.63	+54 to +69	3.2×2.5×0.8, 5.0×3.2×0.8, 7.0×5.0×1.0 (QFN)	LVPECL LVDS
MO9121	1 to 220					
MO9122	220 to 625					
MO8208	1 to 80			+29 to +36 (+10 µA stby)	2.5×2.0×0.8, 3.2×2.5×0.8, 5.0×3.2×0.8, 7.0×5.0×1.0 (QFN)	LVCMOS
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	℃	Extended Commercial
		-40	-	+85		Industrial
Frequency Tolerance	F_stab	-10	-	+10	×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	-2.0	-	+2.0	×10^{-6}	T_A = +25℃
10-year Aging	F_aging10	-5.0	-	+5.0		T_A = +25℃
Duty Cycle	DC	45	-	55	%	
Input Low Voltage	V_{IL}	-	-	Vdd×0.3	V	Pin 1, OE or $\overline{ST}$
Input High Voltage	V_{IH}	Vdd×0.7	-	-	V	Pin 1, OE or $\overline{ST}$
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	Idd	-	+61	+69	mA	Excluding Load Termination Current, Vdd = +3.3V or +2.5V
OE Disable Supply Current	I_oe	-	-	+35	mA	OE = Low
Standby Current	I_std	-	-	+100	µA	$\overline{ST}$ = Low, for all Vdds
Output Low Voltage	V_{OL}	Vdd - 1.9	-	Vdd - 1.5	V	
Output High Voltage	V_{OH}	Vdd - 1.1	-	Vdd - 0.7	V	
Rise and Fall Time	Tr, Tf	-	300	700	ps	20% to 80%
Enable and Disable Time	T_oe	-	-	115	ns	f = 212.5 MHz - For other frequencies, T_oe = 100ns + 3 period
RMS Period Jitter	T_jitt	-	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_phj	-	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	Idd	-	+47	+55	mA	Excluding Load Termination Current, Vdd = +3.3V or +2.5V
OE Disable Supply Current	I_oe	-	-	+35	mA	OE = Low
Standby Current	I_std	-	-	+100	µA	$\overline{ST}$ = Low, for all Vdds
Rise and Fall Time	Tr,Tf	-	495	700	ps	20% to 80%
Differential Output Voltage	V_{OD}	+250	+350	+450	mV	
V_{OD} Magnitude Change	ΔV_{OD}	-	-	+50	mV	
Offset Voltage	V_{OS}	+1.125	+1.2	+1.375	V	
V_{OS} Magnitude Change	ΔV_{OS}	-	-	+50	mV	
Enable and Disable Time	T_oe	-	-	115	ns	f = 212.5 MHz - For other frequencies, T_oe = 100ns + 3 period
RMS Period Jitter	T_jitt	-	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_phj	-	0.6	0.85	ps	f = 156.25 MHz, Integration bandwidth = 12 kHz to 20 MHz, all Vdds

High Temperature MEMS Oscillators



■Features

- Low power consumption of +3.5 mA typical (20 MHz, +1.8 V)
- Excellent total frequency tolerance as low as $\pm 20 \times 10^{-6}$

■ Applications

- High temp industrial equipment such as industrial control systems and industrial sensors
- Servo motor, PLC & High-temp networking gears
- Outdoor systems (medical and health monitoring)
- Asset tracking systems

Pb-Free

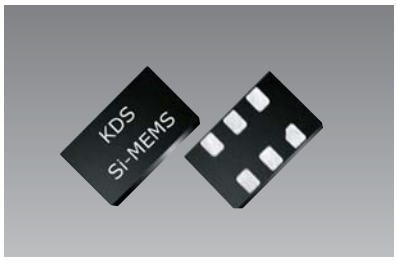
RoHS Compliant

Model	Output Frequency (MHz)	Frequency Tolerance ($\times 10^{-6}$)	Supply Voltage (V)	Current Consumption (mA Typ.)	Size (mm)	Output
MO1618	33 standard frequencies	±20,±25,±30,±50 (−40 to +125℃)	+1.62 to +1.98, +2.25 to +3.63	+3.6 to +5.4 (+1.0 µA stby)	2.0×1.6×0.8, 2.5×2.0×0.8, 3.2×2.5×0.8, 5.0×3.2×0.8, 7.0×5.0×1.0 (QFN)	LVCMOS
MO8918	1 to 110					
MO8919	115 to 137					
MO2018	1 to 110				2.9×2.8×1.3 (SOT23-5)	
MO2019	115 to 137					
MO8920	1 to 110	±20,±25,±30,±50 (−55 to +125℃)			2.0×1.6×0.8, 2.5×2.0×0.8, 3.2×2.5×0.8, 5.0×3.2×0.8, 7.0×5.0×1.0 (QFN)	LVCMOS
MO8921	119 to 137					
MO2020	1 to 110				2.9×2.8×1.3 (SOT23-5)	
MO2021	119 to 137					

■ Standard Specification (MO8918)

Item	Legend	Min.	Typ.	Max.	Unit	Condition
Output Frequency Range	f	1	-	110	MHz	Refer to datasheet for exact list of supported frequencies
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	-40	-	+105	℃	Extended Industrial
		-40	-	+125		Automotive
Frequency Tolerance	F_stab	-20	-	+20	$\times 10^{-6}$	Inclusive of Initial tolerance at +25° C, 1st year aging at +25° C, and variations over operating temperature, rated power supply voltage and load (15 pF ± 10%).
		-25	-	+25		
		-30	-	+30		
		-50	-	+50		
Current Consumption	Idd	-	+3.8	+4.7	mA	No load condition, f = 20 MHz, Vdd = +2.8V, +3.0V or +3.3V
		-	+3.6	+4.5		No load condition, f = 20 MHz, Vdd = +2.5V
		-	+3.5	+4.5		No load condition, f = 20 MHz, Vdd = +1.8V
OE Disable Current	I_od	-	-	+4.5	mA	Vdd = +2.5V to +3.3V, OE = Low, Output in high Z state
		-	-	+4.3		Vdd = +1.8V, OE = Low, Output in high Z state
Standby Current	I_std	-	+2.6	+8.5	µA	Vdd = +2.8V to +3.3V, $\overline{ST}$ = Low, Output is weakly pulled down
		-	+1.4	+5.5		Vdd = +2.5V, $\overline{ST}$ = Low, Output is weakly pulled down
		-	+0.6	+4.0		Vdd = +1.8V, $\overline{ST}$ = Low, Output is weakly pulled down
Duty Cycle	DC	45	-	55	%	All Vdds
Output Low Voltage	V_{OL}	-	-	Vdd×0.1	V	I_{OL} = +4.0 mA (Vdd = +3.0V or +3.3V) I_{OL} = +3.0 mA (Vdd = +2.8V or +2.5V) I_{OL} = +2.0 mA (Vdd = +1.8V)
Output High Voltage	V_{OH}	Vdd×0.9	-	-	V	I_{OH} = − 4.0 mA (Vdd = +3.0V or +3.3V) I_{OH} = − 3.0 mA (Vdd = +2.8V or +2.5V) I_{OH} = − 2.0 mA (Vdd = +1.8V)
Rise and Fall Time	Tr, Tf	-	1.0	2.0	ns	Vdd = +2.5V, +2.8V, +3.0V or +3.3V, 20% to 80%
		-	1.3	2.5		Vdd = +1.8V, 20% to 80%
		-	1.0	3.0		Vdd = +2.25V to +3.63V, 20% to 80%
Input Low Voltage	V_{IL}	-	-	Vdd×0.3	V	Pin 1, OE or $\overline{ST}$
Input High Voltage	V_{IH}	Vdd×0.7	-	-	V	Pin 1, OE or $\overline{ST}$
Start-up Time	T_start	-	-	5.0	ms	Measured from the time Vdd reaches its rated minimum value.
Enable and Disable Time	T_oe	-	-	130	ns	f = 110 MHz. For other frequencies, T_oe = 100 ns + 3×cycles
Resume Time	T_resume	-	-	5.0	ms	Measured from the time $\overline{ST}$ pin crosses 50% threshold
RMS Period Jitter	T_jitt	-	1.6	2.5	ps	f = 75 MHz, Vdd = +2.5V, +2.8V, +3.0V or +3.3V
		-	1.9	3.0		f = 75 MHz, Vdd = +1.8V
Peak-to-peak Period Jitter	T_pk	-	12	20	ps	f = 75 MHz, Vdd = +2.5V, +2.8V, +3.0V or +3.3V
		-	14	25		f = 75 MHz, Vdd = +1.8V
RMS Phase Jitter (random)	T_phj	-	0.5	0.8	ps	f = 75 MHz, Integration bandwidth = 900 kHz to 7.5 MHz
		-	1.3	2.0		f = 75 MHz, Integration bandwidth = 12 kHz to 20 MHz

Voltage Controlled MEMS Oscillators (VCMO) - Super Low Jitter



■Features

- Industry-Standard packages: 3.2×2.5 mm, 7.0×5.0 mm
- Widest pull range options: ±25, ±50, ±80, ±100, ±150, ±200, ±400, ±800, ±1600, ±3200×10^{-6}
- 0.23 ps RMS phase jitter (Typ.)

■ Applications

- Telecom clock synchronization, instrumentation
- Low bandwidth analog PLL, jitter cleaner, clock recovery, audio
- Video, 3G/HD-SDI, FPGA, broadband and networking

Pb-Free

RoHS Compliant

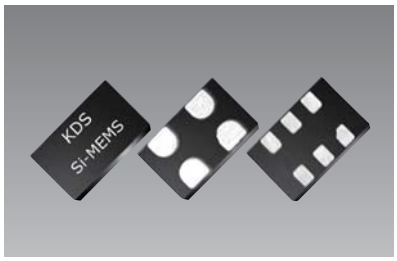
Model	Output Frequency (MHz)	Frequency Tolerance (×10^{-6})	Supply Voltage (V)	Current Consumption (mA Typ.)	Size (mm)	Output
MO3372	1 to 220	±10,±25,±50	+2.25 to 3.63	+76 to +84	3.2×2.5×0.8, 7.0×5.0×1.0 (QFN)	LVPECL LVDS HCSL
MO3373	220 to 725					

■ Standard Specification (MO3372)

Item	Legend	Min.	Typ.	Max.	Unit	Condition
Output Frequency Range	f	10	-	220	MHz	Accurate to 6 decimal places
Supply Voltage	Vdd	+2.97	+3.30	+3.63	V	
		+2.70	+3.00	+3.30		
		+2.52	+2.80	+3.08		
		+2.25	+2.50	+2.75		
Operating Temperature Range	T_use	-20	-	+70	℃	Extended Commercial
		-40	-	+85		Industrial
Frequency Stability	F_stab	-15	-	+15	×10^{-6}	Inclusive of initial tolerance, operating temperature, rated power supply voltage, load variations, and first year aging at +25° C condition
		-25	-	+25		
		-30	-	+30		
		-50	-	+50		
Duty Cycle	DC	45	-	55	%	
Input Low Voltage	V_{IL}	-	-	Vdd×0.3	V	Pin 2, OE
Input High Voltage	V_{IH}	Vdd×0.7	-	-	V	Pin 2, OE
Start-up Time	T_start	-	-	5.0	ms	Measured from the time Vdd reaches its rated minimum value.
Enable and Disable Time	T_oe	-	-	515	ms	f = 212.5 MHz - For other frequencies, T_oe = 500ns + 3 period
Pull Range	PR	±25, ±50, ±80, ±100, ±150, ±200, ±400, ±800, ±1600, ±3200			×10^{-6}	
Lower Control Voltage	VC_L	-	-	Vdd×0.1	V	Voltage at which minimum frequency deviation is guaranteed
Upper Control Voltage	VC_U	Vdd×0.9	-	-	V	Voltage at which maximum frequency deviation is guaranteed
Control Voltage Input Impedance	VC_z	-	10	-	MΩ	
Control Voltage Input Bandwidth	V_c	-	10	-	kHz	
Pull Range Linearity	Lin	-	1	TBD	%	
Frequency Change Polarity	-	Positive Slope			-	
RMS Period Jitter [1]	T_jitt	-	1.0	2.0	ps	f = 156.25 MHz, Vdd = +3.3V or +2.5V
RMS Phase Jitter (random)	T_phj	-	0.23	-	ps	f = 156.25 MHz, Integration bandwidth = 12 kHz to 20 MHz, all Vdds
LVPECL Specific						
Current Consumption	Idd	-	-	+84	mA	Excluding Load Termination Current, Vdd = +3.3V or +2.5V
OE Disable Supply Current	I_oe	-	-	+55	mA	OE = Low
Output Disable Leakage Current	I_leak	-	+0.15	-	μA	OE = Low
Maximum Output Current	I_driver	-	-	+30	mA	Maximum average current drawn from OUT+ or OUT-
Output Low Voltage	V_{OL}	Vdd - 1.9	-	Vdd - 1.5	V	
Output High Voltage	V_{OH}	Vdd - 1.1	-	Vdd - 0.7	V	
Output Differential Voltage Swing	V_Swing	+1.2	+1.6	+2.0	V	
Rise and Fall Time	Tr, Tf	-	250	-	ps	20% to 80%
LVDS Specific						
Current Consumption	Idd	-	-	+76	mA	Excluding Load Termination Current, Vdd = +3.3V or +2.5V
OE Disable Supply Current	I_oe	-	-	+55	mA	OE = Low
Output Disable Leakage Current	I_leak	-	+0.15	-	μA	OE = Low
Rise and Fall Time	Tr,Tf	-	340	-	ps	Measured with 2pF capacitive loading to GND, 20% to 80%
Differential Output Voltage	V_{OD}	+250	-	+450	mV	
V_{OD} Magnitude Change	ΔV_{OD}	-	-	+50	mV	
Offset Voltage	V_{OS}	+1.125	-	+1.375	V	
V_{OS} Magnitude Change	ΔV_{OS}	-	-	+50	mV	
HCSL Specific						
Current Consumption	Idd	-	-	+84	mA	Excluding Load Termination Current, Vdd = +3.3V or +2.5V
OE Disable Supply Current	I_oe	-	-	+55	mA	OE = Low
Output Disable Leakage Current	I_leak	-	+0.15	-	μA	OE = Low
Rise and Fall Time	Tr, Tf	-	350	-	ps	Measured with 2pF capacitive loading to GND, 20% to 80%
Output Low Voltage	V_{OL}	-0.05	-	+0.05	V	
Output High Voltage	V_{OH}	+0.6	-	+0.8	V	
Output Differential Voltage Swing	V_Swing	+1.0	+1.4	+1.8	V	

[1]. Measured according to JESD65B

Voltage Controlled MEMS Oscillators (VCMO)



■Features

- Frequency Tolerance as tight as ±25×10^{-6}
- Widest pull range options: ±25 to ±1600×10^{-6}
- Industry-Standard packages:
  2.7×2.4 mm (4-pin, compatible with 2.5×2.0 mm footprint)
  3.2×2.5 mm (4-pin), 5.0×3.2 mm (6-pin),
  7.0×5.0 mm (6-pin)

Pb-Free

RoHS Compliant

■ Applications

- Telecom clock synchronization, instrumentation
- Low bandwidth analog PLL, jitter cleaner, clock recovery, audio
- Video, 3G/HD-SDI, FPGA, broadband and networking

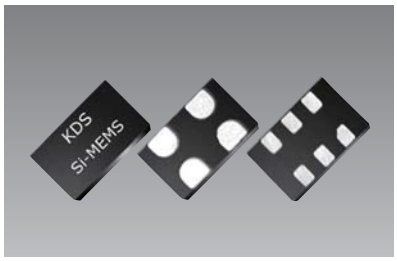
Model	Output Frequency (MHz)	Frequency Tolerance (×10^{-6})	Supply Voltage (V)	Current Consumption (mA Typ.)	Size (mm)	Output
MO3807	30 standard frequencies	±25,±50	+1.71 to +1.89, +2.25 to +3.63	+29 to +36 (+10 µA stby)	2.7×2.4×0.8, 3.2×2.5×0.8, 5.0×3.2×0.8, 7.0×5.0×1.0 (QFN)	LVCMOS
MO3808	1 to 80	±10,±25,±50				
MO3809	80 to 220					

■ Standard Specification (MO3808)

Item	Legend	Min.	Typ.	Max.	Unit	Condition
Output Frequency Range	f	1	-	80	MHz	
Supply Voltage	Vdd	+1.71	+1.8	+1.89	V	Additional supply voltages between +2.5V and +3.3V can be supported.
		+2.25	+2.5	+2.75		
		+2.52	+2.8	+3.08		
		+2.97	+3.3	+3.63		
Operating Temperature Range	T_use	-20	-	+70	℃	Extended Commercial
		-40	-	+85		Industrial
Frequency Stability	F_stab	-10	-	+10	×10^{-6}	Inclusive of Initial tolerance[4] at +25° C and variation over temperature, rated supply voltage and load.
		-25	-	+25		
		-50	-	+50		
10-year Aging	F_aging10	-5.0	-	+5.0	×10^{-6}	10 years, T_A = +25℃
Current Consumption	Idd	-	+31	+33	mA	No load condition, f = 20 MHz, Vdd = +2.5V, +2.8V or +3.3V
		-	+29	+31		No load condition, f = 20 MHz, Vdd = +1.8V
Standby Current	I_std	-	-	+70	µA	Vdd = +2.5V, +2.8V ,+3.3V, ST = GND, Output is weakly pulled down
		-	-	+10		Vdd = +1.8V, ST = GND, Output is weakly pulled down
Duty Cycle	DC	45	-	55	%	All Vdds
Output Low Voltage	V_{OL}	-	-	Vdd×0.1	V	I_{OL} = +7.0 mA (Vdd = +3.0V or +3.3V) I_{OL} = +4.0 mA (Vdd = +2.8V or +2.5V) I_{OL} = +2.0 mA (Vdd = +1.8V)
Output High Voltage	V_{OH}	Vdd×0.9	-	-	V	I_{OH} = − 7.0 mA (Vdd = +3.0V or +3.3V) I_{OH} = − 4.0 mA (Vdd = +2.8V or +2.5V) I_{OH} = − 2.0 mA (Vdd = +1.8V)
Rise and Fall Time	Tr, Tf	-	1.5	2.0	ns	Vdd = +1.8V, +2.5v, +2.8V or +3.3V, 10% to 90% Vdd level
Pull Range [5,6]	PR	±25, ±50, ±100, ±150, ±200, ±400, ±800, ±1600,			×10^{-6}	See the Absolute Pull Range and APR table of datasheet
Upper Control Voltage	VC_U	+1.7	-	-	V	Vdd = +1.8V, Voltage at which maximum deviation is guaranteed.
		+2.4	-	-		Vdd = +2.5V, Voltage at which maximum deviation is guaranteed.
		+2.7	-	-		Vdd = +2.8V, Voltage at which maximum deviation is guaranteed.
		+3.2	-	-		Vdd = +3.3V, Voltage at which maximum deviation is guaranteed.
Lower Control Voltage	VC_L	-	-	+0.1	V	Voltage at which minimum deviation is guaranteed.
Control Voltage Input Impedance	Z_in	100	-	-	kΩ	
Control Voltage Input Capacitance	C_in	-	5.0	3.0	pF	
Linearity	Lin	-	0.1	1.0	%	
Frequency Change Polarity	-	Positive slope			-	
Start-up Time	T_start	-	-	10	ms	
Enable and Disable Time	T_oe	-	-	180	ns	f = 40MHz, all Vdds, For other freq., T_oe = 100 ns + 3 clock periods
Resume Time	T_resume	-	7.0	10	ms	
RMS Period Jitter	T_jitt	-	1.5	2.0	ps	f = 20 MHz, Vdd = +2.5V, +2.8V or +3.3V
		-	2.0	3.0		f = 20 MHz, Vdd = +1.8V
RMS Phase Jitter (random)	T_phj	-	0.5	1.0	ps	f = 20 MHz, Integration bandwidth = 12 kHz to 20 MHz, All Vdds

[1]. All electrical specifications in the above table are specified with 15 pF output load and for all Vdd(s) unless otherwise stated.
[2]. The typical value of any parameter in the Electrical Characteristics table is specified for the nominal value of the highest voltage option for that parameter and at +25 ° C temperature.
[3]. All max and min specifications are guaranteed across rated voltage variations and operating temperature ranges, unless specified otherwise.
[4]. Initial tolerance is measured at Vin = Vdd/2.
[5]. Absolute Pull Range (APR) is defined as the guaranteed pull range over temperature and voltage.
[6]. APR = pull range (PR) - frequency tolerance (F_stab) - Aging (F_aging)

Digitally Controlled MEMS Oscillators (DCMO)



■Features

- Industry-Standard packages:
  3.2×2.5 (4-pin), 5.0×3.2 (6-pin), and 7.0×5.0 mm (6-pin)
- Digitally controlled pull range from ±25 to ±1600×10^{-6}
- Superior pull range linearity of ≦0.01 %

■ Applications

- Ideal for clock synchronization, instrumentation, low bandwidth PLL, Jitter cleaner, clock recovery, audio, video, and FPGA

Pb-Free

RoHS Compliant

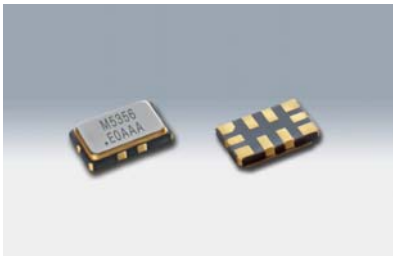
Model	Output Frequency (MHz)	Frequency Tolerance (×10^{-6})	Supply Voltage (V)	Current Consumption (mA Typ.)	Size (mm)	Output
MO3907	1 to 220	±10,±25,±50	+1.71 to +1.89, +2.25 to +3.63	+29 to +36 (+10 µA stby)	3.2×2.5×0.8, 5.0×3.2×0.8, 7.0×5.0×1.0 (QFN)	LVCMOS
MO3921			+2.25 to +3.63	+55 to +69		LVPECL LVDS
MO3922	220 to 625					

■ Standard Specification (MO3907)

Item	Legend	Min.	Typ.	Max.	Unit	Condition
Output Frequency Range	f	1	-	220	MHz	
Supply Voltage	Vdd	+1.71	+1.8	+1.89	V	
		+2.25	+2.5	+2.75		
		+2.52	+2.8	+3.08		
		+2.97	+3.3	+3.63		
Operating Temperature Range	T_use	-20	-	+70	℃	Extended Commercial
		-40	-	+85		Industrial
Frequency Stability	F_stab	-10	-	+10	×10^{-6}	Inclusive of Initial tolerance, operating temperature, rated power, supply voltage and load change
		-25	-	+25		
		-50	-	+50		
10-year Aging	F_aging10	-5.0	-	+5.0	×10^{-6}	10 years, T_A = +25℃
Current Consumption	Idd	-	+32	+34	mA	No load condition, f = 100 MHz, Vdd = +2.5V, +2.8V or +3.3V
		-	+31	+34		No load condition, f = 100 MHz, Vdd = +1.8V
Duty Cycle	DC	45	-	55	%	Vdd = +1.8V, +2.5V, +2.8V or +3.3V
Pull Range [1,2]	PR	±25, ±50, ±100, ±200, ±400 ,±800, ±1600			×10^{-6}	See the Absolute Pull Range and ARR table of datasheet
Linearity	Lin	-	-	0.01	%	
Frequency Update Rate	F_update	-	-	2.5	kU/s	Frequency control mode 1
		-	-	12.5		Frequency control mode 2
Output Low Voltage	V_{OL}	-	-	Vdd×0.1	V	I_{OL} = +6.0 mA (Vdd = +3.3V, +2.8V, +2.5V) I_{OL} = +3.0 mA (Vdd = +1.8V)
Output High Voltage	V_{OH}	Vdd×0.9	-	-	V	I_{OH} = -6.0 mA (Vdd = +3.3V, +2.8V, +2.5V) I_{OH} = -3.0 mA (Vdd = +1.8V)
Rise and Fall Time	Tr, Tf	-	1.2	2.0	ns	Vdd = +1.8V, +2.5V, +2.8V or +3.3V, 10% to 90% Vdd level
Input Low Voltage	V_{IL}	-	-	Vdd×0.2	V	
Input Middle Voltage	V_{IM}	Vdd×0.4		Vdd×0.6	V	
Input High Voltage	V_{IH}	Vdd×0.8	-	-	V	
Input High or Low Logic Pulse	T_logic	500	-	-	ns	
Input Middle Pulse Width	T_middle	500	-	-	ns	
RMS Period Jitter	T_jitt	-	1.5	2.0	ps	f = 20 MHz, all Vdds
		-	2.0	3.0		f = 20 MHz, all Vdds
RMS Phase Jitter (random)	T_phj	-	0.6	1.0	ps	f = 20 MHz, Integration bandwidth = 12 kHz to 20 MHz all vdds. No activity on DP pin
		-	0.65	1.0		With full activity on DP pin.

[1]. Absolute Pull Range (APR) is defined as the guaranteed pull range over temperature and voltage.
[2]. APR = pull range (PR) - frequency tolerance (F_stab) - Aging (F_aging)

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



■Features

- 5.0×3.2 mm Ceramic package
- LVCMOS or Clipped Sinewave output

■ Applications

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

Pb-Free

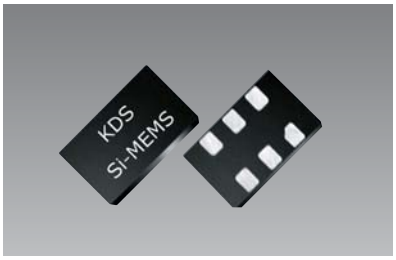
RoHS Compliant

Model	Output Frequency (MHz)	Frequency Tolerance ($\times10^{-6}$)	Supply Voltage (V)	Current Consumption (mA Typ.)	Size (mm)	Output
MO5356	1 to 60	±0.1, ±0.2, ±0.25	+2.25 to +3.63	+40 to +45	5.0×3.2×0.95 (Ceramic)	LVCMOS Clipped Sinewave
MO5357	60 to 220					
MO5155	10 std. GNSS Freq.	±0.5, ±1.0, ±2.5				
MO5156	1 to 60					
MO5157	60 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	℃	Extended commercial
		-40	-	+85		Industrial
Initial Tolerance	F_init	-1.0	-	+1.0	$\times10^{-6}$	Inclusive of solder-down shift at 48 hours after 2 reflows at +25℃
Frequency Stability over temperature	F_stab	-0.10	-	+0.10	$\times10^{-6}$	Referenced to (fmas + fmin)/2 over the specified temperature range
		-0.20	-	+0.20		
		-0.25	-	+0.25		
First Year Aging	F_aging1	-	±0.5	-	$\times10^{-6}$	T_A = +25℃
20-year Aging	F_aging20	-	±3.0	-	$\times10^{-6}$	T_A = +25℃
Pull Range	PR	±6.25, ±12.5, ±25			$\times10^{-6}$	
Upper Control Voltage	VC_U	Vdd×0.9	-	-	V	
Control Voltage Range	VC_L	-	-	Vdd×0.1	V	
Control Voltage Input Impedance	VC_z	-	10	-	MΩ	
Control Voltage Input Bandwidth	VC_c	-	10	-	kHz	
Frequency Change Polarity	-	Positive Slope			-	
Current Consumption	Idd	-	+40.5	TBD	mA	No load condition, f = 19.2 MHz
OE Disable Current	I_od	-	+40.0	TBD	mA	OE = GND, output is weakly pull down
Input Low Voltage	V_{IL}	-	-	Vdd×0.3	V	For OE pin
Intput High Voltage	V_{IH}	Vdd×0.7	-	-	V	For OE pin
Start-up Time	T_start	-	5.0	-	ms	Measured from the time Vdd reaches its rated minimum value.
RMS Period Jitter	T_jitt	-	2.0	-	ps	f = 10 MHz
RMS Phase Jitter (random)	T_phj	-	0.35	-	ps	f = 10 MHz, Integration bandwidth = 12 kHz to 5 MHz
LVCMOS Output						
Duty Cycle	DC	45	-	55	%	
Output Low Voltage	V_{OL}	-	-	Vdd×0.1	V	I_{OL} = +6.0 mA (Vdd = +3.3V, +2.8V, +2.5V) I_{OL} = +3.0 mA (Vdd = +1.8V)
Output High Voltage	V_{OH}	Vdd×0.9	-	-	V	I_{OH} = -6.0 mA (Vdd = +3.3V, +2.8V, +2.5V) I_{OH} = -3.0 mA (Vdd = +1.8V)
Rise and Fall Time	Tr, Tf	-	1.0	-	ns	10% to 90% Vdd.
Clipped Sinewave Output						
Output Voltage Level	Vout	+0.8	-	+1.2	%	Measured peak-to-peak swing at any Vdd
Rise and Fall Time	Tr, Tf	-	6.0	-	V	19.2 MHz, Load = 10 pF ‖ 10 kΩ

TC-MO / VC TC-MO



■Features

- Industry-Standard packages: 3.2×2.5, 5.0×3.2 and 7.0×5.0 mm
- Frequency tolerance as low as ±5×10^{-6}
- 0.6ps RMS phase Jitter (random)

■ Applications

- SATA, SAS, 10GB Ethernet, Fibre Channel, PCI-Express
- Networking, broadband, instrumentation

Pb-Free

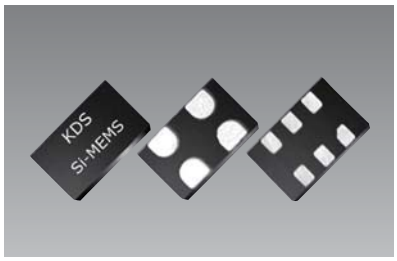
RoHS Compliant

Model	Output Frequency (MHz)	Frequency Tolerance (×10^{-6})	Supply Voltage (V)	Current Consumption (mA Typ.)	Size (mm)	Output
MO5021	1 to 220	±5	+2.25 to +3.63	+54 to +69	3.2×2.5×0.8, 5.0×3.2×0.8, 7.0×5.0×1.0 (QFN)	LVPECL LVDS
MO5022	220 to 625					

■ Standard Specification (MO5021)

Item	Legend	Min.	Typ.	Max.	Unit	Condition
Output Frequency Range	f	1	–	220	MHz	
Supply Voltage	Vdd	+2.25	+2.5	+2.75	V	
		+2.97	+3.3	+3.63		
		+2.25		+3.63		
Operating Temperature Range	T_use	-20	–	+70	℃	Extended Commercial
		-40	–	+85		Industrial
Frequency Stability	F_stab	-5.0	–	+5.0	×10^{-6}	Over operating temperature range at rated nominal power supply voltage and load.
Supply Voltage	F_Vdd	–	50	–	×10^{-9}	± 10% Vdd
Output Load	F_load	–	0.1	–	×10^{-6}	15pF ± 10% of load
First Year Aging	F_aging1	-2.5	–	+2.5	×10^{-6}	T_A = +25℃
10-year Aging	F_aging10	-5.0	–	+5.0		T_A = +25℃
Pull Range	PR	±12.5, ±25, ±50			×10^{-6}	
Upper Control Voltage	VC_U	Vdd - 0.1	–	–	V	All Vdds, Voltage at which maximum deviation is guaranteed.
Control Voltage Range	VC_L	–	–	+0.1	V	
Frequency Change Polarity	–	Positive slope			–	
Input Low Voltage	V_{IL}	–	–	Vdd×0.3	V	Pin 1, OE or $\overline{ST}$
Input High Voltage	V_{IH}	Vdd×0.7	–	–	V	Pin 1, OE or $\overline{ST}$
Start-up Time	T_start	–	6	10	ms	Measured from the time Vdd reaches its rated minimum value.
Resume Time	T_resume	–	6	10	ms	In Standby mode, measured from the time $\overline{ST}$ pin crosses
Duty Cycle	DC	45	–	55	%	
Standby Current	I_std	–	–	+100	μA	$\overline{ST}$ = Low, for all Vdds
OE Disable Supply Current	I_oe	–	–	+35	mA	OE = Low
Enable and Disable Time	T_oe	–	–	115	ns	f = 212.5 MHz- For other frequencies, T_oe = 100ns + 3 period
LVPECL, DC and AC Characteristics						
Current Consumption	Idd	–	+61	+69	mA	Excluding Load Termination Current, Vdd = +3.3V or +2.5V
Output Low Voltage	V_{OL}	Vdd - 1.9	–	Vdd - 1.5	V	
Output High Voltage	V_{OH}	Vdd - 1.1	–	Vdd - 0.7	V	
Output Differential Voltage Swing	V_Swing	+1.2	+1.6	+2.0	V	
Rise and Fall Time	Tr, Tf	–	300	500	ps	20% to 80%
RMS Period Jitter	T_jitt	–	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_phj	–	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	Idd	–	+47	+55	mA	Excluding Load Termination Current, Vdd = +3.3V or +2.5V
Differential Output Voltage	V_{OD}	+250	+350	+450	mV	
V_{OD} Magnitude Change	ΔV_{OD}	–	–	+50	mV	
Offset Voltage	V_{OS}	+1.125	+1.2	+1.375	V	
V_{OS} Magnitude Change	ΔV_{OS}	–	–	+50	mV	
Rise and Fall Time	Tr, Tf	–	495	600	ps	20% to 80%
RMS Period Jitter	T_jitt	–	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_phj	–	0.6	0.85	ps	f = 156.25 MHz, Integration bandwidth = 12 kHz to 20 MHz, all vdds

MEMS Oscillators with Spread Spectrum Function (SSCG)



■Features

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

Pb-Free

RoHS Compliant

■ Applications

- Printers
- Flat panel drivers
- PCI
- Microprocessors

Model	Output Frequency (MHz)	Frequency Tolerance ($\times10^{-6}$)	Supply Voltage (V)	Current Consumption (mA Typ.)	Size (mm)	Output
MO9002	1 to 220	±25, ±50	+1.71 to +1.89, +2.25 to +3.63	+48 to +75	5.0×3.2×0.8, 7.0×5.0×1.0 (QFN)	LVPECL CML LVDS HCSL
MO9003	1 to 110	±50, ±100		+3.2 to +4.1 (+0.4 to +4.3 µA stby)	2.5×2.0×0.8, 3.2×2.5×0.8, 5.0×3.2×0.8, 7.0×5.0×1.0 (QFN)	LVCMOS
MO9005	1 to 141	±20, ±25, ±50	+1.62 to +1.98, +2.25 to +3.63	5.0 to 6.5 (0.4 to4.3 µA stby)	2.0×1.6×0.8, 2.5×2.0×0.8, 3.2×2.5×0.8 (QFN)	

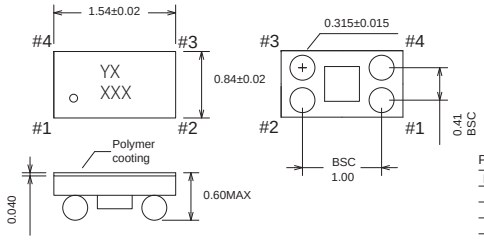
■ Standard Specification (MO9003)

Item	Legend	Min.	Typ.	Max.	Unit	Condition
Output Frequency Range	f	1	-	110	MHz	
Supply Voltage	Vdd	+1.71	+1.8	+1.89	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		
Operating Temperature Range	T_use	-20	-	+70	℃	Extended Commercial
		-40	-	+85		Industrial
Frequency Tolerance	F_tol	-50	-	+50	$\times10^{-6}$	Inclusive of: Initial stability, operating temperature, rated power, supply voltage change, load change, shock and vibration, Spread Off
		-100	-	+100		
Current Consumption	Idd	-	+3.7	+4.1	mA	No load condition, f = 20 MHz, Vdd = +2.5V, +2.8V or +3.3V
		-	+3.2	+3.5		No load condition, f = 20 MHz, Vdd = +1.8V
Standby Current	I_std	-	+2.4	+4.3	µA	$\overline{ST}$ = GND, Vdd = +3.3V, Output is Weakly Pulled Down
		-	+1.2	+2.2		$\overline{ST}$ = GND, Vdd = +2.5 or +2.8V, Output is Weakly Pulled Down
		-	+0.4	+0.8		$\overline{ST}$ = GND, Vdd = +1.8V, Output is Weakly Pulled Down
Spread Spectrum	-	±0.25 / ±0.5			%	Center Spread:
		-0.5 / -1.0				Down Spread:
Duty Cycle	DC	45	-	55	%	All Vdds. f ≦ 70 MHz
		40	-	60		All Vdds. f > 70 MHz
Output Low Voltage	V_{OL}	-	-	Vdd×0.1	V	I_{OL} = +4.0 mA (Vdd = +3.3V) I_{OL} = +3.0 mA (Vdd = +2.8V and +2.5V) I_{OL} = +2.0 mA (Vdd = +1.8V)
Output High Voltage	V_{OH}	Vdd×0.9	-	-	V	I_{OH} = -4.0 mA (Vdd = +3.3V) I_{OH} = -3.0 mA (Vdd = +2.8V and +2.5V) I_{OH} = -2.0 mA (Vdd = +1.8V)
Rise and Fall Time	Tr, Tf	-	1.0	2.0	ns	20% to 80% Vdd = +2.5V, +2.8V or +3.3V, 15 pF load
		-	1.3	2.5		20% to 80% Vdd = +1.8V, 15 pF load
Input Low Voltage	V_{IL}	-	-	Vdd×0.3	V	Pin 1, OE or $\overline{ST}$ or SD
Input High Voltage	V_{IH}	Vdd×0.7	-	-	V	Pin 1, OE or $\overline{ST}$ or SD
Output Load	Ld	-	-	15	pF	At maximum frequency and supply voltage.
Cycle-to-Cycle Jitter	T_cyc	-	-	26	ps	f = 50 MHz, Spread = ON
		-	-	26		f = 50 MHz, Spread = OFF

Dimensions and Land Pattern

Package Size – Dimensions (unit:mm)

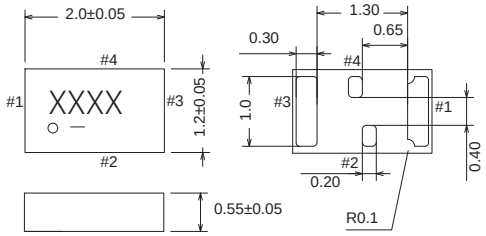
1.55 × 0.85 mm CSP



Pin Connections

Pin No.	Connection
#1	NC/ST/GND
#2	Output
#3	Vdd
#4	GND

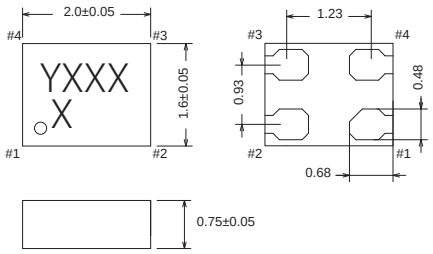
2.0 × 1.2 mm QFN



Pin Connections

Pin No.	Connection
#1	NC
#2	GND
#3	Output
#4	Vdd

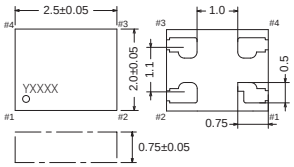
2.0 × 1.6 mm QFN



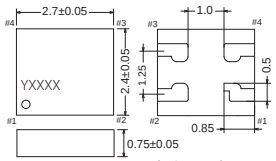
Pin Connections

Pin No.	Connection
#1	OE/ST/NC/SD
#2	Output
#3	Vdd
#4	GND

2.5 × 2.0 mm QFN



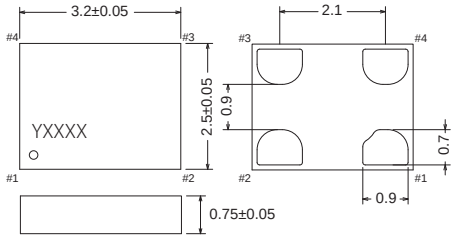
2.7 × 2.4 mm QFN



Pin Connections

Pin No.	Connection
#1	OE/ST/NC/VC/SD
#2	GND
#3	Output
#4	Vdd

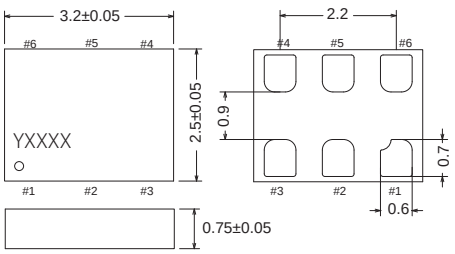
3.2 × 2.5 mm QFN (4-pin)



Pin Connections

Pin No.	Connection
#1	OE/ST/NC/VC/SD/DP
#2	GND
#3	Output
#4	Vdd

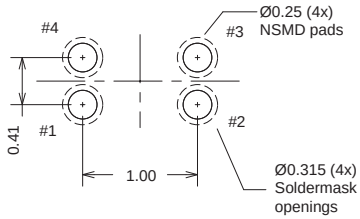
3.2 × 2.5 mm QFN (6-pin)



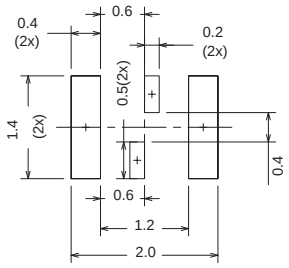
Pin Connections

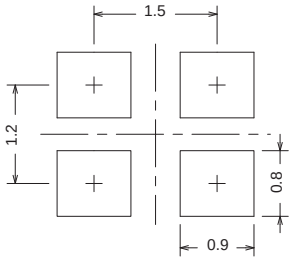
Pin No.	Connection
#1	OE/ST/NC/VC/SD/DP
#2	NC/OE
#3	GND
#4	Output+
#5	Output-
#6	Vdd

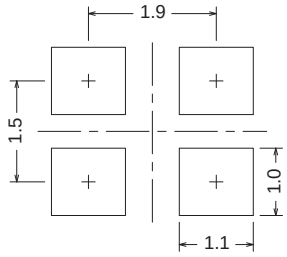
Recommended Land Pattern (unit:mm)

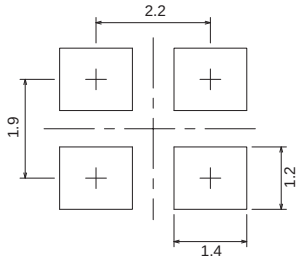


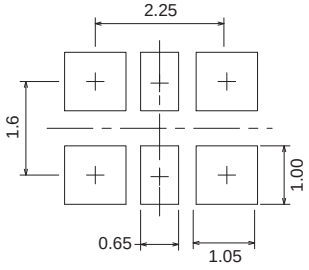
(soldermask openings shown with heavy dashed line)







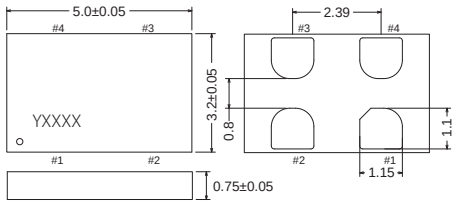




Dimensions and Land Pattern

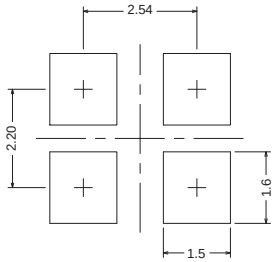
Package Size – Dimensions (unit:mm)	Recommended Land Pattern (unit:mm)

5.0 × 3.2 mm QFN (4-pin)

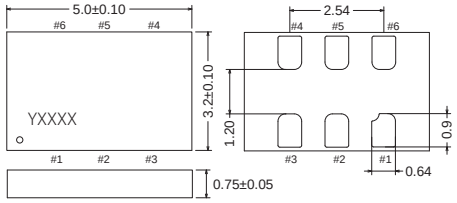


Pin Connections

Pin No.	Connection
#1	OE/ST/NC/SD
#2	GND
#3	Output
#4	Vdd

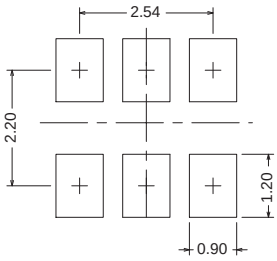


5.0 × 3.2 mm QFN (6-pin)

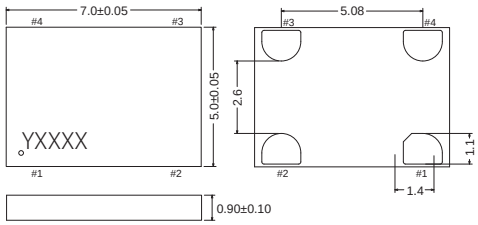


Pin Connections

Pin No.	Connection
#1	OE/ST/NC/VC/SD/DP
#2	NC/OE/ST
#3	GND
#4	Output+/Output
#5	Output-/NC-
#6	Vdd

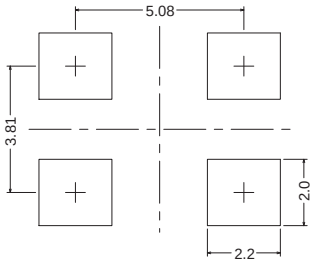


7.0 × 5.0 mm QFN (4-pin)

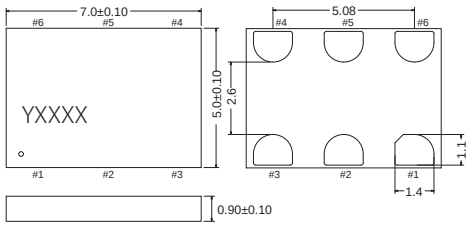


Pin Connections

Pin No.	Connection
#1	OE/ST/NC/SD
#2	GND
#3	Output
#4	Vdd

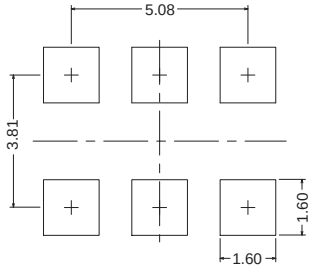


7.0 × 5.0 mm QFN (6-pin)

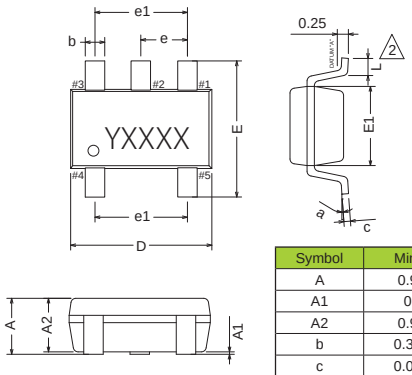


Pin Connections

Pin No.	Connection
#1	OE/ST/NC/VC/SD/DP
#2	NC/OE/ST
#3	GND
#4	Output+/Output
#5	Output-/NC
#6	Vdd



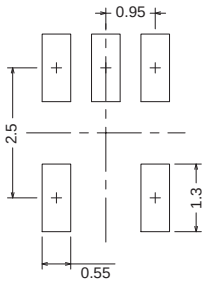
2.9 × 2.8 mm (SOT23-5)



Pin Connections

Pin No.	Connection
#1	GND
#2	NC
#3	OE/NC/ST
#4	Vdd
#5	Output

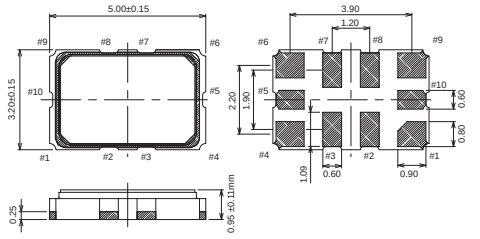
Symbol	Min.	Nom.	Max.
A	0.9	1.25	1.45
A1	0	0.05	0.15
A2	0.9	1.1	1.3
b	0.35	0.4	0.5
c	0.08	0.15	0.2
D	2.8	2.9	3
E	2.6	2.8	3
E1	1.5	1.625	1.75
L	0.35	0.45	0.6
L1	0.60 REF		
e	0.95 BSC.		
e1	1.90 BSC.		
α	0°	2.5°	8°



Dimensions and Land Pattern

Package Size – Dimensions (unit:mm)

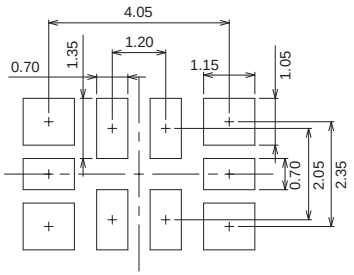
5.0 × 3.2 mm (Ceramic)



Pin Connections

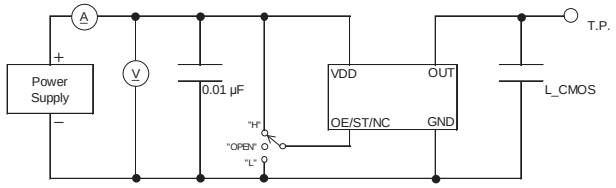
Pin No.	Connection
#1	OE/NC/VC
#2	NC
#3	NC
#4	GND
#5	NC
#6	#6 Output
#7	NC
#8	NC
#9	Vdd
#10	NC

Recommended Land Pattern (unit:mm)



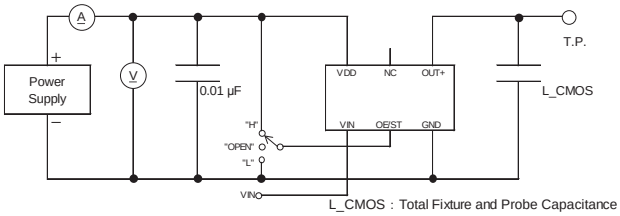
Measurement Circuit

CMOS



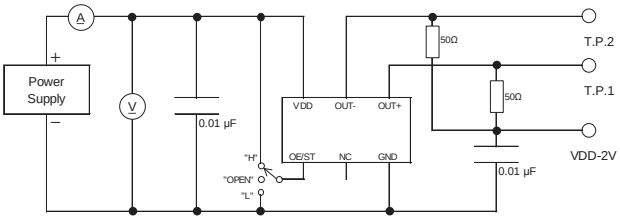
L_CMOS : Total Fixture and Probe Capacitance

CMOS (VCMO)

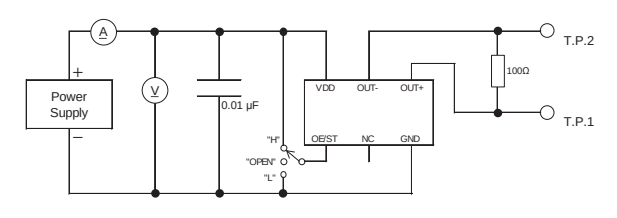


L_CMOS : Total Fixture and Probe Capacitance

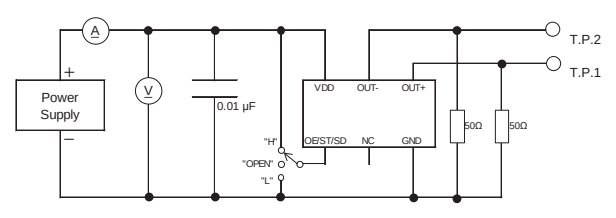
LVPECL



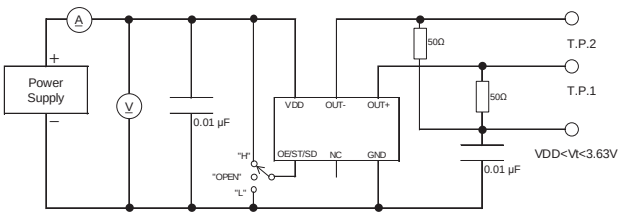
LVDS



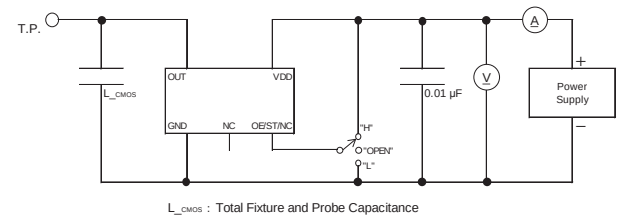
HCSL



CML

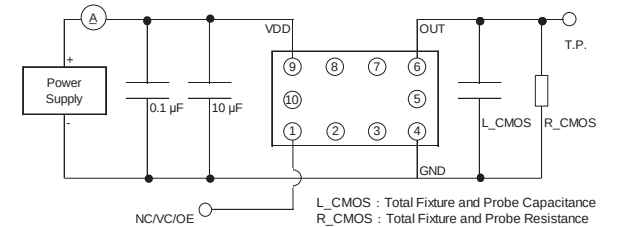


2.9 x 2.8 mm (SOT23-5)



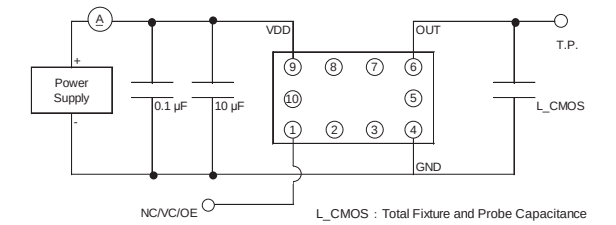
L_CMOS : Total Fixture and Probe Capacitance

5.0 x 3.2 mm (Ceramic) - Clipped Sine



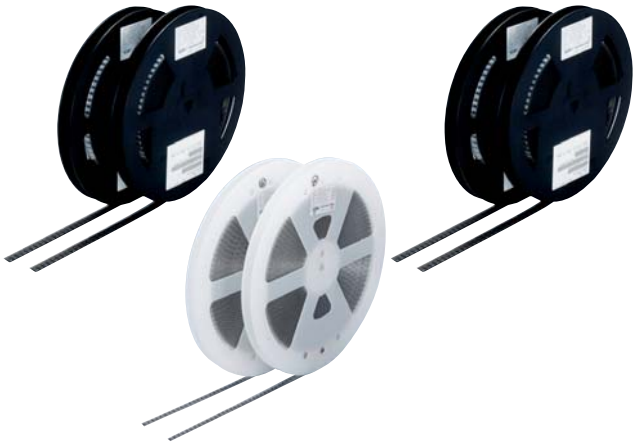
L_CMOS : Total Fixture and Probe Capacitance
R_CMOS : Total Fixture and Probe Resistance

5.0 x 3.2 mm (Ceramic) - CMOS

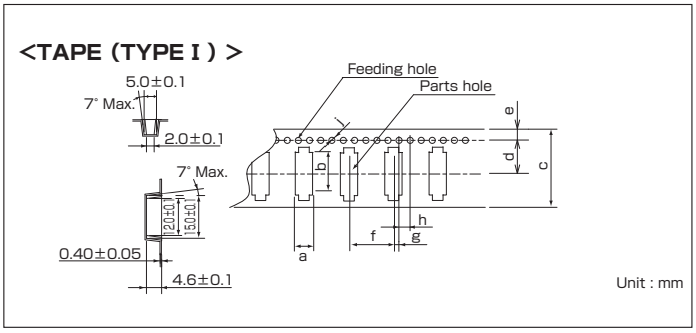


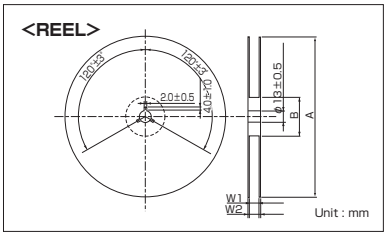
L_CMOS : Total Fixture and Probe Capacitance

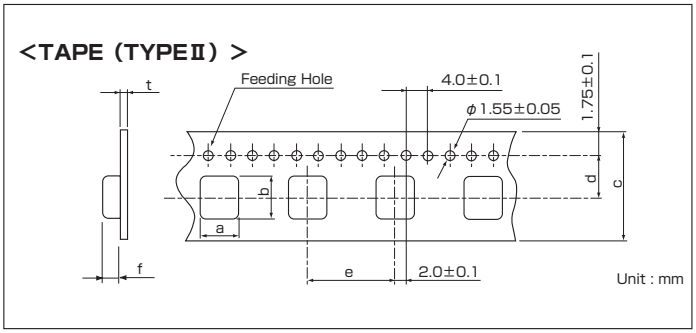
Taping Forms, etc.



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	1.5 +0.1/ −0	ϕ330 ± 2	ϕ80 ± 1	25.5 ± 1.0	29.5 ± 1.0

MHz Band Crystal Resonators / Crystal Resouators with dedicated temperature sensor

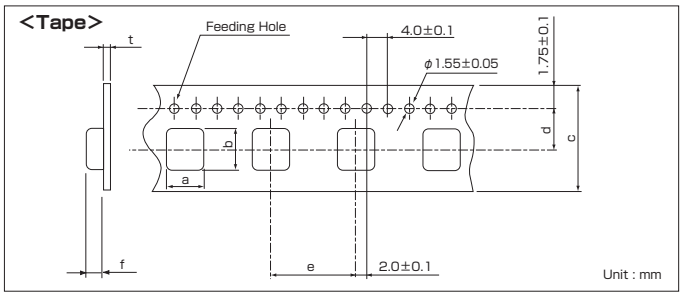
TYPEⅡ	a	b	c	d	e	f	t	A	B	W1	W2
DSX530GA/GK	3.6 ±0.1	5.45 ±0.10	12.0 ±0.2	5.50 ±0.10	8.0 ±0.1	1.55 ±0.10	0.30 ±0.05	ϕ180 +0/−3	ϕ60 +1.0/−0	13.0 +0.3	15.4 ±1.0
DSX321G/GK DSX320G/GE	2.8 ±0.1	3.5 ±0.1	8.0 ±0.2	3.50 ±0.05	4.0 ±0.1	1.0 ±0.1	0.25 ±0.05	ϕ180 +0/−3	ϕ60 +1/−0	9.0 ±0.3	11.4 ±1.0
DSX321SH	2.7 ±0.1	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
DSX221G	2.3 ±0.1	2.8 ±0.1	8.0 ±0.2	3.5 ±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
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
DSX211SH	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	3.5 ±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	3.5 ±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/SL	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
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
DSR211ATH/STH	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	1.40 ±0.1	1.80 ±0.1	0.70 ±0.1	3.50 ±0.05	4.0 ±0.1	0.70 ±0.10	0.20 ±0.05	ϕ180 +0/−3	ϕ60 +1/−0	9.0 ±0.3	11.4 ±1.0

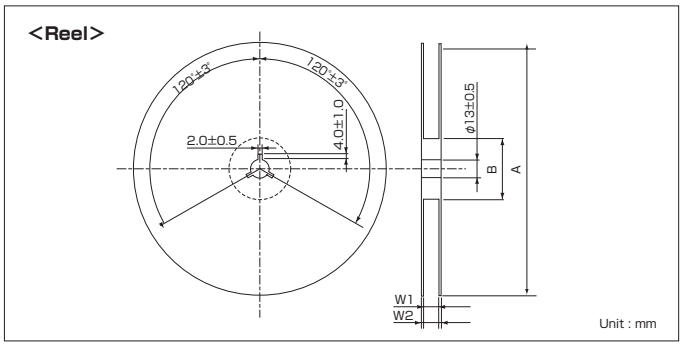
kHz Band Crystal Resonators

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 +0.3/−0.1	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 +0.3/−0.1	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, DSX221G, DSX1612S, DSX1612SL 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

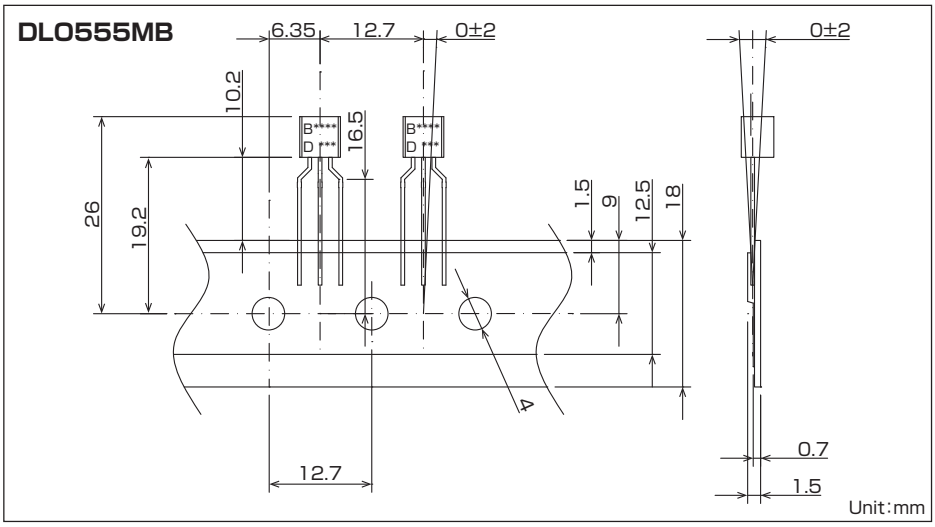
TYPE	a	b	c	d	e	f	t	A	B	W1	W2
DSA/DSB535SC DSA/DSB535SD DSA/DSB535SG	3.5 ±0.1	5.4 ±0.1	12.0 ±0.2	5.50 ±0.1	8.0 ±0.1	1.7 ±0.1	0.30 ±0.05	φ330 ±2	φ100 ±1	13.5 ±1.0	18.5 max.
DSA/DSB321SDN DSB321SDNB/SLB DSK321STD	2.8 ±0.1	3.5 ±0.1	8.0 ±0.2	3.50 ±0.05	4.0 ±0.1	1.5 ±0.1	0.25 ±0.05	φ180 +0/−3	φ60 +1/−0	9.0 ±0.3	11.4 ±1.0
DSA/DSB222MAA DSA/DSB222MAB DSA/DSB221SDN/SP DSB221SDNB/SLB	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
DSA/DSB211SDN/SP DSB211SDNB/SLB/SJA	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
DSA/DSB1612SDN DSB1612SDNB	1.45 ±0.10	1.85 ±0.10	8.0 ±0.2	3.50 ±0.05	4.0 ±0.1	0.8 ±0.1	0.20 ±0.05	φ180 +0/−3	φ60 +1/−0	9.0 ±0.3	11.4 ±1.0

SPXO/VCXO/RTC

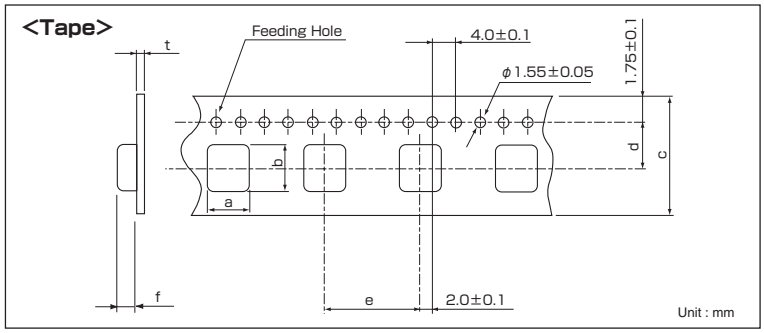
TYPE	a	b	c	d	e	f	t	A	B	W1	W2
DSO751SR DSO751SBM/SBN/SVN DSO753SK/SJ/SD DSV753SV/SB/SK/SJ/SD	5.5 ±0.1	7.9 ±0.1	16.0 ±0.3	7.5 ±0.1	8.0 ±0.1	2.4 ±0.1	0.30 ±0.05	φ254 ±2	φ80 ±0.5	17.0 ±0.5	21.0 ±1.0
DSO753HV/HK/HJ DSV753HV/HK/HJ/CK/CJ	5.5 ±0.1	7.9 ±0.1	16.0 ±0.3	7.5 ±0.1	8.0 ±0.1	2.4 ±0.1	0.30 ±0.05	φ180 +0/−3	φ60 +1/−0	17.0 ±0.5	21.0 ±1.0
DSO531SR DSO531SB/SBN/SVN DSO533SK/SJ DSV531SV/SB DSV532SV/SB	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/SN/SY DSO321SBM/SBN/SVN DSV323SV/SK/SJ/SD DSV321SV/SR DSK324SR	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/SN/SHF/SY DSO221SBM/SBN/SVN DSO223SK/SJ/SD DSV221SV/SR	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
DSO211AH/AR/AN/AB DSV211AV/211AR	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

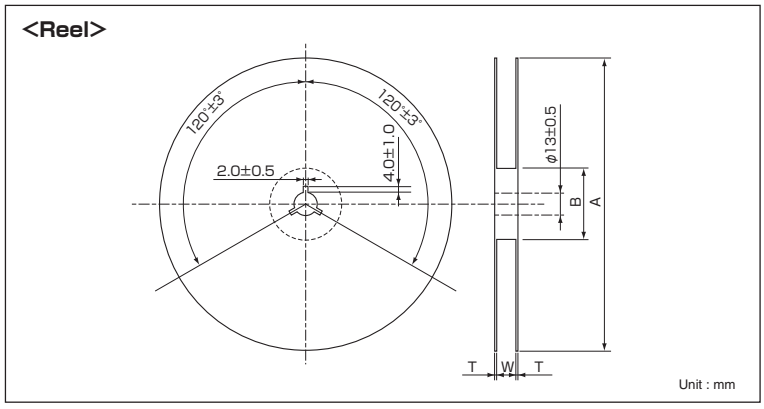
※ 1: To indicate product name and other information, place those information on a label, and affix the label on one side of the flange.
2: DSA/DSB535 series reel φ180 available.

Radial Tape (Crystal Oscillators)



Emboss Carrier Tape (SMD Monolithic Crystal Filters)



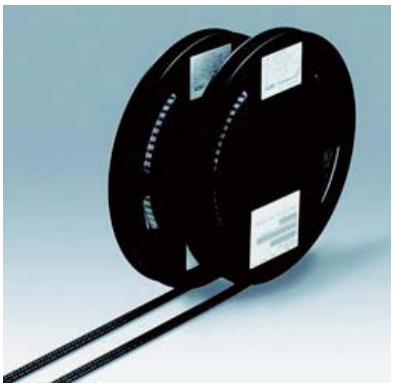


■ Standard Specification

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
DSF444S SERIES	4.0 ±0.1	4.0 ±0.1	12.0 ±0.3	5.5 ±0.1	8.0 ±0.1	1.5 ±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)



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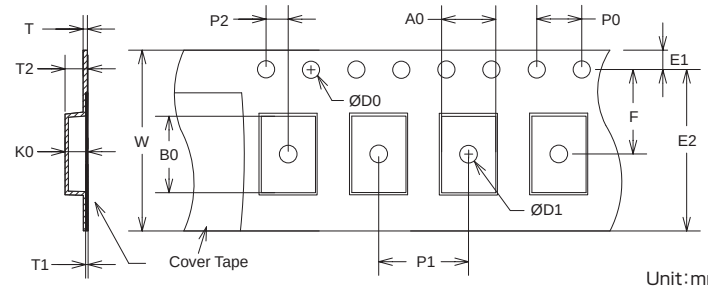
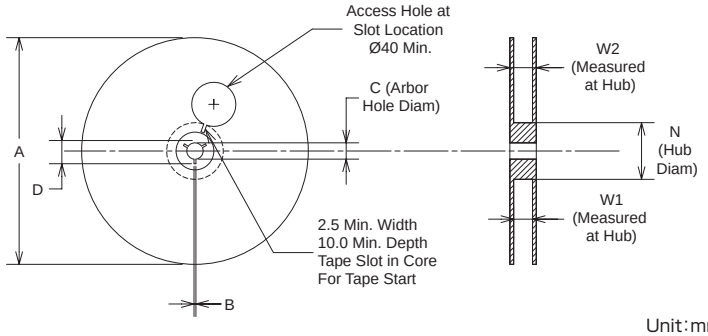


<Reel>



■ 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	5.5 ±0.05	4.0 ±0.1	4.0 ±0.1	2.0 ±0.05	0.6	0.1	1.65	12.3	2.3 ±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	3.5 ±0.10	1.10 ±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	0.2 ±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.

Substitution Products

Please contact our sales representative for further assistance.
You may also visit our web site (http://www.kds.info) to obtain standard specification.

SMD Crystal Resonators / MHz Band Crystal Resonators	
Type	Substitution Products
DSX211AL	DSX211G,DSX211SH
DSX531S	DSX321SH
DSX630G	DSX321G
DSX840GA	DSX321G
DSX840GT	DSX321G
DSX151GAL	DSX321G
SMD-49	DSX321G

Crystal Resonators / MHz Band Crystal Resonators	
Type	Substitution Products
AT-49	DSX321G

High-precision SMD VC-TCXO/TCXO	
Type	Substitution Products
DSA1612SDM DSB1612SDM/SDB	DSA1612SDN DSB1612SDN/SDNB
DSA211SDM DSB211SDM/SDB	DSA211SDN DSB211SDN/SDNB
DSA221SDM DSB221SDM/SDB	DSA221SDN DSB221SDN/SDNB
DSA321SDM DSB321SDM/SDB	DSA321SDN DSB321SDN/SDNB

High-precision with dedicated temp. sensor SMD VC-TCXO/TCXO	
Type	Substitution Products
DSA/DSB211SDT	–
DSA/DSB221SDT	–

SMD Crystal Oscillators with dedicated temp. sensor	
Type	Substitution Products
DSG211STA	–
DSG221STA	–

SMD Crystal Oscillators with Spread Spectrum Function	
Type	Substitution Products
DSS753SVC/SVD	–

SMD Crystal Resonators / MHz Band Crystal Resonators〈For Automotive〉	
Type	Substitution Products
DSX220G	DSX210GE,DSX211G
DSX840GT	SMD-49
DSX840GK	DSX321G
DSX151GAL	SMD-49

SMD Crystal Oscillators 〈For Automotive〉	
Type	Substitution Products
DSO213AW	DSB211SJA
DSO221SW	
DSO321SW	

Optical Quartz Products 〈For Automotive〉	
Type	Substitution Products
Optical Low Pass Filters (Single Plate)	–

Optical Quartz Products	
Type	Substitution Products
Optical Low Pass Filters for Small Sized Image Sensors	–
Optical Low Pass Filters for Large Sized Image Sensors	–
Crystal Plate for Projectors	–

SMD Tuning Fork Crystal Resonators / kHz Band Crystal Resonators	
Type	Substitution Products
DST210A	DST210AC
DST410S	DST1610A
DST520	DST1610A
DST621	DST1610A
SM-26F	DMX-26S
DMX-26	DMX-26S
DMX-38	DMX-26S

SMD VC-TCXO/TCXO	
Type	Substitution Products
DSA211SCM DSB211SCM/SCB	DSA211SDN DSB211SDN/SDNB
DSA221SCM DSB221SCM/SCB	DSA221SDN DSB221SDN/SDNB
DSA321SCM DSB321SCM/SCB	DSA321SDN DSB321SDN/SDNB
DSA221SJ	–
DSB211SJ	DSB211SJA
DSB221SJ	
DSB321SJ	
DSK321STA	DSK321STD

SMD Crystal Oscillators	
Type	Substitution Products
DSO213AW	DSB211SJA
DSO221SW	
DSO321SW	

Crystal Resonators 〈For Automotive〉	
Type	Substitution Products
AT-49	SMD-49

SMD Tuning Fork Crystal Resonators 〈For Automotive〉	
Type	Substitution Products
DST410S	DST310S,DST1610A

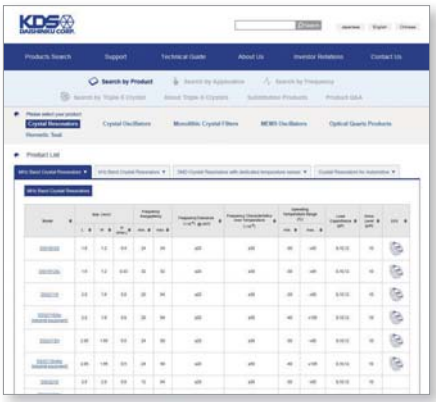
SMD TCXO 〈For Automotive〉	
Type	Substitution Products
DSB211SJ	DSB211SJA
DSB221SJ	
DSB321SJ	
DSK321STA	DSK321STD

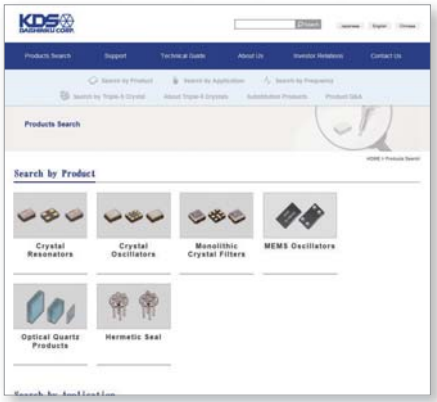
SMD VC-TCXO/TCXO 〈For Automotive〉	
Type	Substitution Products
DSA/DSB321SF	DSA/DSB1612SDN DSA/DSB211SDN DSA/DSB221SDN DSA/DSB321SDN

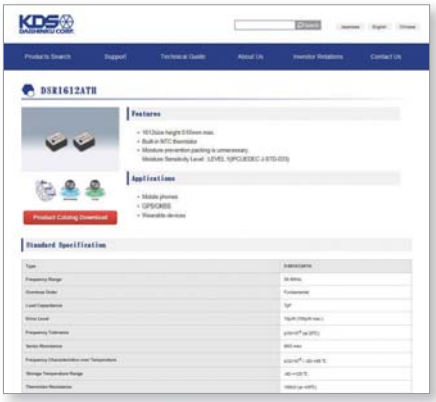
Optical Thin Film	
Type	Substitution Products
Infrared Cut Filters (IRCF)	–
Band Pass Filters	–
IR Pass Filters	–
Anti Refrection Coating	–

Sending products information through Internet

DAISHINKU has been supplying the latest products information through Internet. Please use this service.
DAISHINKU Web site: http://www.kds.info

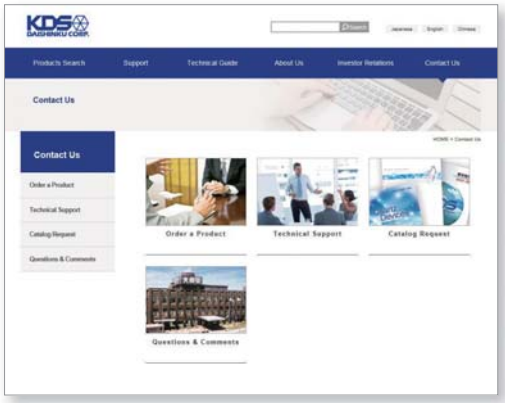






Contact us

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

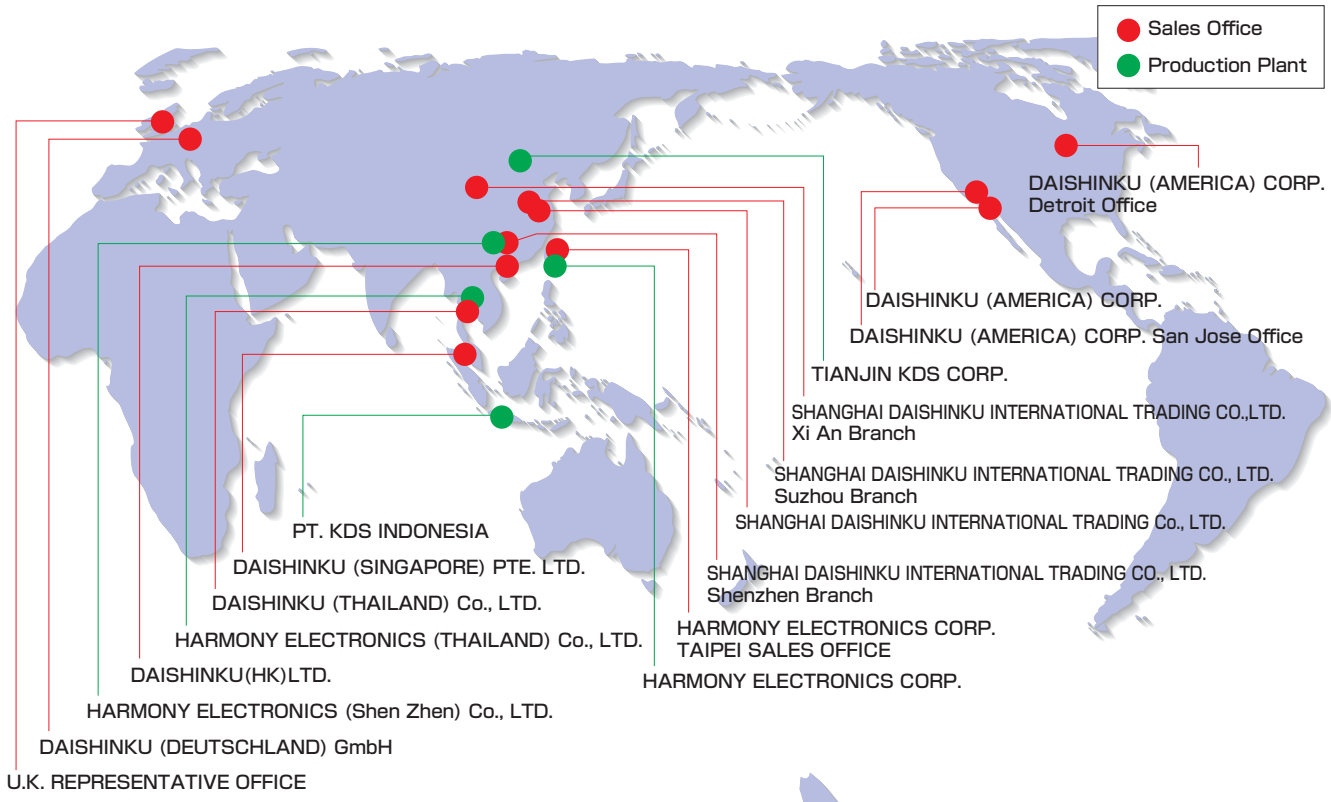


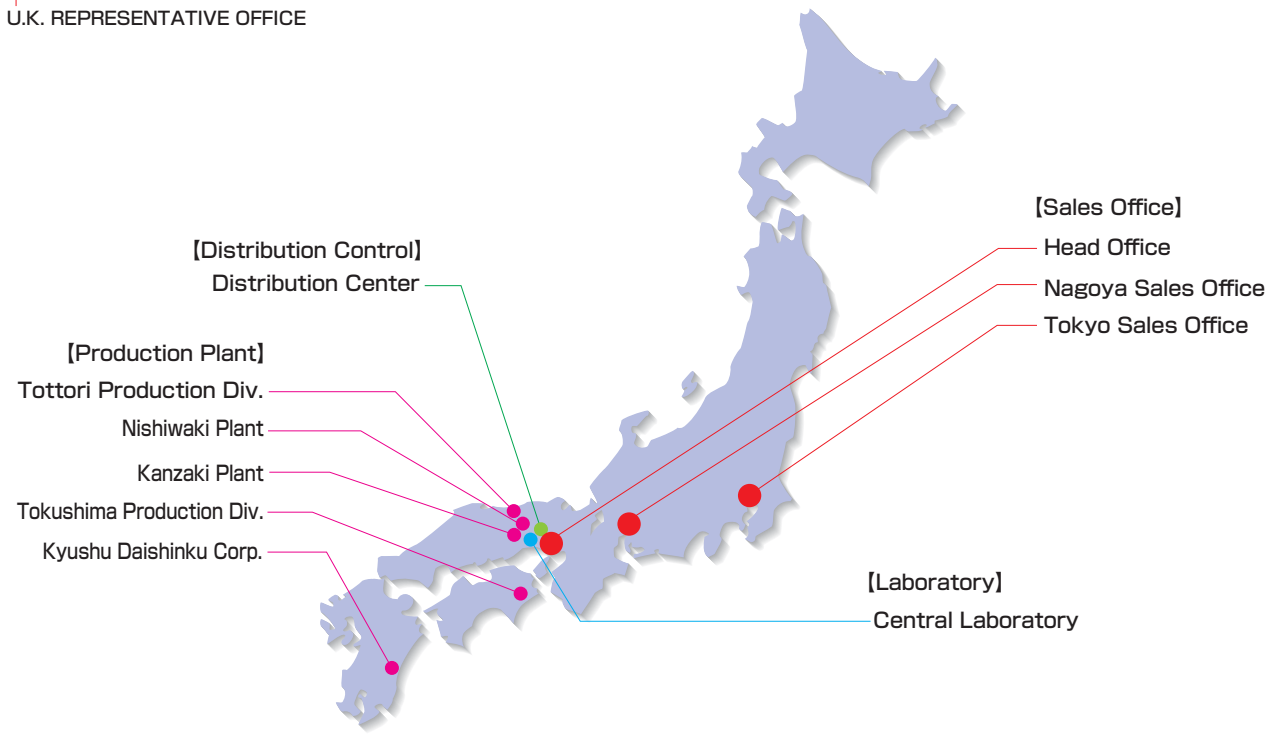
You may also contact us directory by e-mail.
e-mail address: kouhou602@kds.info

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

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