

PRODUCT CATALOG

Arkh.3G series

Crystal resonators

Crystal oscillators

Monolithic crystal filters

Optical products

MEMS oscillators

Global Quality

株式会社 **大真空**

INDEX

- Handling Instructions 1
- RoHS/ELV Compliant and Lead - free products 2
- How a quartz crystal device is made 3
- About this catalog 4

ArkH3G

- Summary 6
- SMD Crystal Resonators / MHz Band Crystal Resonators
DX1008JS 7
- SMD Crystal Oscillators
DS1008JN 8
DS1008JS 9

Crystal Resonators

- Summary
Description, Terminology 12
Oscillation Circuit 13
Cut Angle and Frequency Characteristics over
Temperature 15
Selection Guide 16
- SMD Crystal Resonators / MHz Band Crystal Resonators
DSX1008A 17
DSX1210A 18
DSX1612S 19
DSX211S/DSX211SH/DSX221SH/DSX321SH 20
DSX211G 21
DSX321G 22
DSX530GA 23
- SMD Crystal Resonators with dedicated temperature
sensor / MHz Band Crystal Resonators
DSR1210ATH/DSR1612ATH/DSR1612STH 24
DSR211ATH/DSR211STH/DSR221STH 25
- SMD Tuning Fork Crystal Resonators / kHz Band Crystal Resonators
DST1210A 26
DST1610A/DST1610AL/DST210AC 27
DST311S/DST310S 28
DMX-26S 29
- Tuning Fork Crystal Resonators / kHz Band Crystal Resonators
DT-38, DT-381/DT-26, DT-261 30

Crystal Oscillators

- Summary
Selection Guide 32
Description, Terminology 34
- Temperature Compensated Crystal Oscillators [TCXO]
DSB1612WA 35
DSB1612WLB/DSB1612WDB/DSB1612WEB 36
DSB211SLB/DSB221SLB/DSB321SLB 37
DSA1612SDN/DSA211SDN/DSA221SDN/DSA321SDN
DSB1612SDN, DSB1612SDNB/DSB211SDN, DSB211SDNB/
DSB221SDN, DSB221SDNB/DSB321SDN, DSB321SDNB 38
DSA535SD, DSB535SD 40
DSA535SGA/DSB535SGA 41
DSA535SG/DSB535SG 42
DSB211SJA 43
DSK321STD 44
- SMD Real Time Clock Module [RTC]
DSK324SR 45
- Simple Packaged Crystal Oscillators [SPXO]
DSO211AH/DSO221SH/DSO321SH 46
DSO531SHH 47
DSO221SN/DSO321SN 48
DSO1612AR 49
DSO221SR/DSO321SR/DSO531SR/DSO751SR 50
DSO211AB/DSO221SBM/DSO321SBM/DSO531SBM/
DSO753SBM 52
DSO211SXF/DSO221SXF 53
DSO1612AR (kHz) 54
DSO221SY/DSO321SY 55
DSO223SK/DSO323SK/DSO223SJ/DSO323SJ/
DSO223SD/DSO323SD 56
DSO533SK/DSO533SJ 57
DSO753SK/DSO753SJ/DSO753SD 58
DLO555MBA 59
DSV321SV/DSV321SR 60
DSV531SV 61
DSV323SV/DSV323SK/DSV323SJ/DSV323SD 62
DSV753SV/DSV753SB/DSV753SK/DSV753SJ/
DSV753SD 63
Measurement Circuit 64

For Automotive

- DSX211G/DSX210GE 68
- DSX321G/DSX321GK/DSX320G/DSX320GE 69
- DSX530GK/DSX530GA 70
- DSX211SH/DSX221SH/DSX321SH 71
- DSR1612ATH/DSR211ATH/DSR211STH/DSR221STH 72
- SMD-49 73
- DST1610A/DST210AC/DST310S 74
- DMX-26S 75
- DSO211AH 76
- DSO1612AR 77
- DSO221SR/DSO321SR/DSO531SR/DSO751SR 78
- DSO211SX/DSO221SX 79
- DSO221SR/DSO321SR (kHz) 80
- DSO221SY/DSO321SY 81
- DSO223SK/DSO323SK/DSO223SJ/DSO323SJ/
DSO223SD/DSO323SD 82
- DSB211SJA 83
- DSB211SPX 84
- DSA211SP/DSB211SP 85
- DSA1612SDN/DSA211SDN/DSA221SDN/DSA321SDN
DSB1612SDN, DSB1612SDNB/DSB211SDN, DSB211SDNB/
DSB221SDN, DSB221SDNB/DSB321SDN, DSB321SDNB 86
- DSK321STD 88
- DSK324SR 89

Monolithic Crystal Filters

- Summary
Description, Terminology 92
Selection Guide 93
- SMD Monolithic Crystal Filters
DSF334S 2POLE/DSF334S 3POLE/DSF444S 2POLE/
DSF444S 3POLE 94
DSF633S 4POLE (SDF TYPE) 95
DSF753S 2POLE/DSF753S 3POLE/DSF753S 4POLE 96

Optical Products

- Description, IR Double Cut Filter 98
- Dual Pass Filters 99

MEMS Oscillators

- Selection Guide 102
- 32 kHz MEMS Oscillators / 32 kHz TC-MO
MO1532/MO1552/MO1630/MO1566/
MO1568 (µPower) 104
- MEMS Oscillators / TC-MO
MO1534/MO1569/MO1576/MO8021 (µPower) 105
- MEMS Oscillators
MO8008/MO8009/MO2001/MO2002 (Low Power) 106
MO9365/MO9366/MO9367 (Super Low Jitter) 107
MO9120/MO9121/MO9122/MO8208/
MO8209 (Low Jitter) 108
- High Temperature MEMS Oscillators
MO8918/MO8919/MO2018/MO2019/MO8920/
MO8921/MO2020/MO2021 109
- Voltage Controlled MEMS Oscillators [VCMO]
MO3372/MO3373 (Super Low Jitter) 110
MO3807/MO3808/MO3809 111
- Digitally Controlled MEMS Oscillators [DCMO]
MO3907/MO3921/MO3922 112
- TC-MO / VC TC-MO
MO5155/MO5156/MO5157/MO5356/MO5357/
MO5358/MO5359 (Super Low Jitter) 113
MO5021/MO5022 114
- MEMS Oscillators with Spread Spectrum Function [SSCG]
MO9002/MO9003/MO9005 115
- Dimensions / Land Pattern / Measurement Circuit 116

Taping Forms, etc.

- Taping 122
- Substitution Products 126
- Product introduction on the Web 127
- KDS Global Network 129

Handling Instructions

■ Soldering

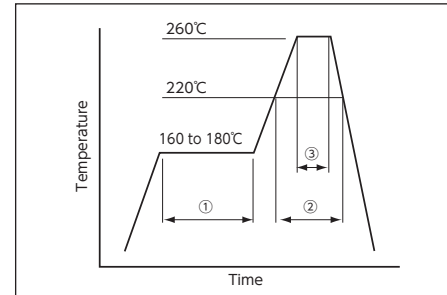
Our products are designed so they may withstand the same standard reflow soldering temperatures as most other electronics components. However, if the reflow temperature is higher than our specification allows, the performance may be affected. Avoid soldering the product at temperatures higher than specified.

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

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

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

Reflow Temperature Profile
(Available for lead free soldering)



■ Cleaning

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

■ Shock

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

■ Mounting

〈SMD crystal products〉

Surface mount crystals are designed to be compatible with most automatic mounting processes, but some processes may exert excessive shock which may damage the crystal. Therefore test mounting of the crystal prior to mass production is necessary.

If there is a possibility that PCB may be warped, make sure the warping is not to such a degree that the crystal products' operating characteristics or soldering conditions will be negatively affected.

Avoid mounting and processing by Ultrasonic welding because this method has a possibility of an excessive vibration spreading inside the crystal products and becoming the cause of characteristic deterioration and not oscillating.

〈Lead type〉

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

■ Storage

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

■ Others

〈Crystal Resonators〉

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

〈Crystal Oscillators〉

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

〈Monolithic Crystal Filters〉

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

〈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 certain Hazardous Substances : 2011/65/EU and (EU) 2015/863), ELV Directive (End-of-Life Vehicles Directive : 2000/53/EC) and Halogen-free activities etc. The below spreadsheet provide the current status of the product compliance in each environmental regulations. Please visit our website for the latest information.(<http://www.kds.info>)

As of sept.30.2020

	Type	RoHS/ELV Compliant	Halogen-free	Pb-free	Materials of pin	Note
Crystal Resonators/ MHz Band Crystal Resonators	DX1008JS	○	○	○	Ni/Au	
	DSX1008A	○	○	○	Ni/Au	
	DSX1210A	○	○	○	Ni/Au	
	DSX1612S	○	○	○	Ni/Au	
	DSX211S, DSX211SH	○	○	○	Ni/Au	
	DSX221SH	○	○	○	Ni/Au	
	DSX321SH	○	○	○	Ni/Au	
	DSX210GE	○	○	Pb in sealing-glass	Ni/Au	Pb in sealing-glass is exempted from RoHS/ELV Directive. ⁽⁴⁾
	DSX320G, DSX320GE	○	○	Pb in sealing-glass	Ni/Au	Pb in sealing-glass is exempted from RoHS/ELV Directive. ⁽⁴⁾
	DSX211G	○	○	Pb in sealing-glass	Ni/Au	Pb in sealing-glass is exempted from RoHS/ELV Directive. ⁽⁴⁾
	DSX321G, DSX321GK	○	○	Pb in sealing-glass	Ni/Au	Pb in sealing-glass is exempted from RoHS/ELV Directive. ⁽⁴⁾
	DSX530GA, DSX530GK	○	○	Pb in sealing-glass	Ni/Au	Pb in sealing-glass is exempted from RoHS/ELV Directive. ⁽⁴⁾
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. ⁽⁵⁾
	DST1210A	○	○	○	Ni/Au	
	DST1610A, DST1610AL	○	○	○	Ni/Au	
	DST210AC	○	○	○	Ni/Au	
Crystal Resonators with dedicated temperature sensor/MHz Band Crystal Resonators	DSR1210ATH	○	○	○	Ni/Au	
	DSR1612ATH, DSR1612STH	○	○	○	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/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)	DS1008J SERIES	○	○	○	Ni/Au	
	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	
	DLO555MBA	○	○	○	Sn	
	DSO751S SERIES	○	○	○	Ni/Au	
DSO753S SERIES	○	○	○	Ni/Au		
Voltage Controlled Crystal Oscillators (VCXO)	DSV321S SERIES	○	○	○	Ni/Au	
	DSV323S SERIES	○	○	○	Ni/Au	
	DSV531SV	○	○	○	Ni/Au	
	DSV753S SERIES	○	○	○	Ni/Au	
Monolithic Crystal Filters	DSF334 SERIES	○	○	○	Ni/Au	
	DSF444 SERIES	○	○	○	Ni/Au	
	DSF633 SERIES	○	○	○	Ni/Au	
	DSF753 SERIES	○	○	○	Ni/Au	

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

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.

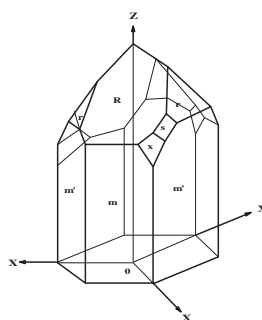


Fig. 1. Typical appearance of a quartz crystal

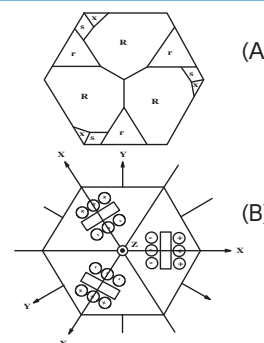


Fig. 2. (A) Typical crystallogram as obtained by viewing Fig. 1 from above
(B) Illustration of piezoelectricity

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.

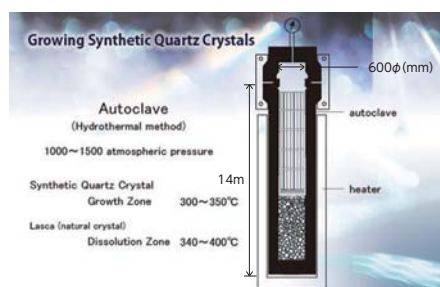


Fig.3. Autoclave



Artificial quartz crystal drawn from an autoclave



Various artificial quartz crystals

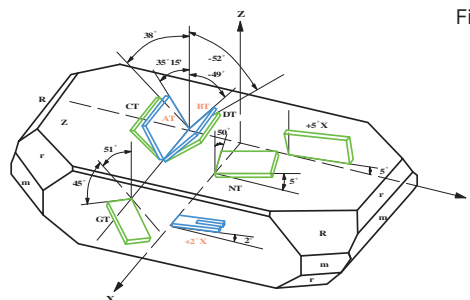
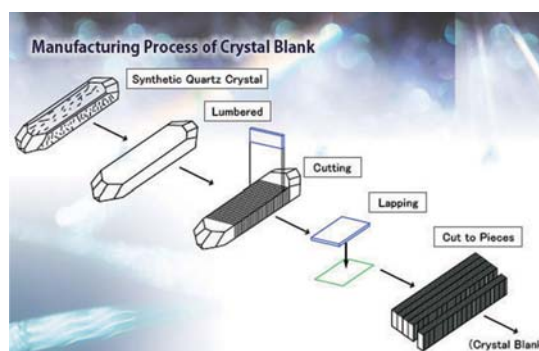


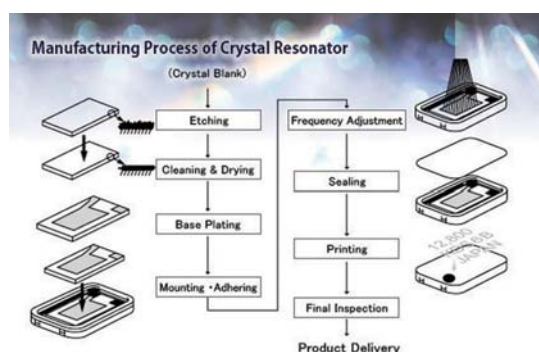
Fig.4. Designations of cuts from a piece of artificial quartz crystal

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.30.2020



Ark.3G

A logo representing Arkh.3G



Ark.3G



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



Pb-Free

No lead content.
Lead-free mounting is possible.



RoHS Compliant

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



RoHS/ELV Compliant

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

Environment

ISO14001

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

ISO9001, IATF16949

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

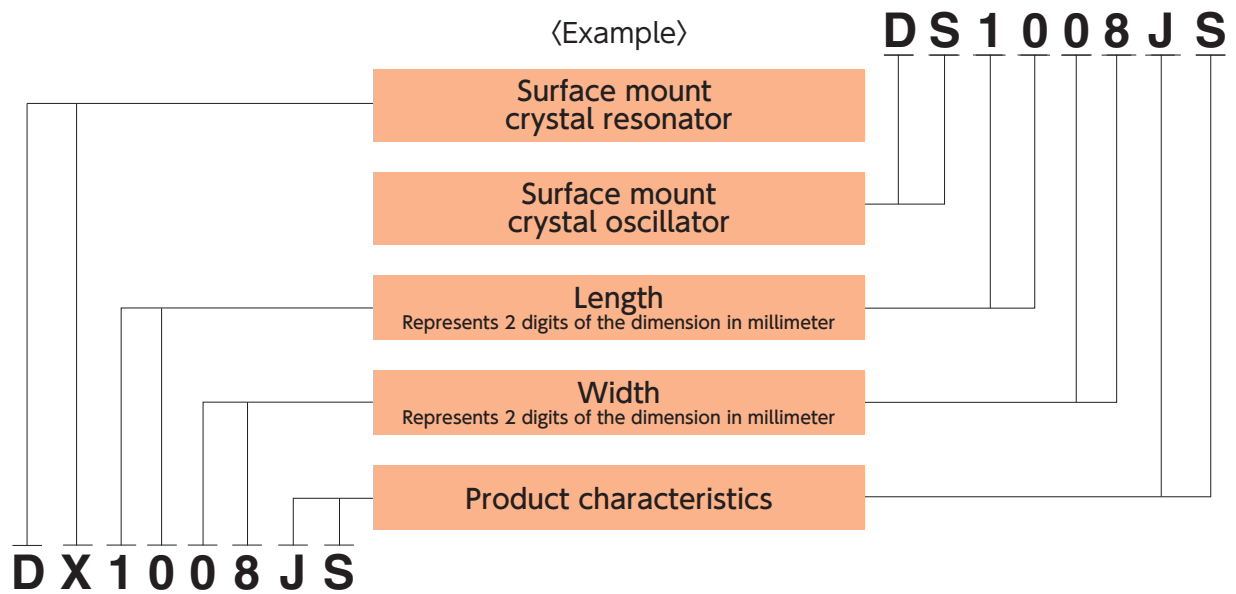
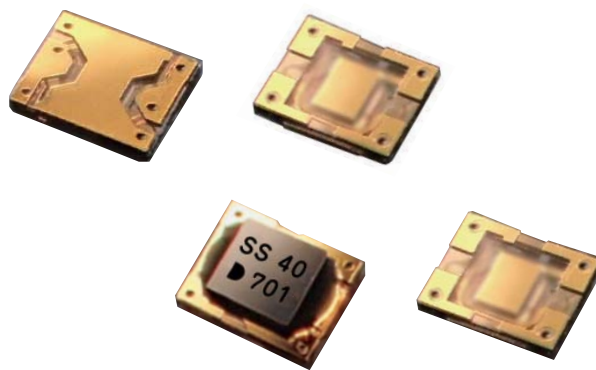
*ISO9001: except for Kanzaki plant

IATF16949: except for Kanzaki plant, HARMONY ELECTRONICS (DongGuan) CO.,LTD.

- Use this Catalog with the following points in mind.
 - The contents of this Catalog are subject to change without notice.
 - It is strictly forbidden to reprint or reproduce this Catalog, either wholly or in part, without the permission of the manufacturer.
 - The application circuits, methods and drawings included in this Catalog are provided strictly for the purposes of reference. Verify before using. The manufacturer is not liable if any third party has its rights infringed or incurs losses in connection with the information presented in this Catalog. Permission is neither given nor implied to exercise the industrial property rights of the manufacturer or any third party.
- Handle products carefully.
The products listed in this Catalog are intended for use with ordinary electronic devices. When a product is required to have especially high reliability in a given application, consult our sales representative.

Quartz Devices

Arkh.3G series



Arkh.3G SERIES

About Arkh.3G



The brand name "Arkh" is from arkhitekton, the ancient Greek from which architecture is derived. The Arkh.3G is a quartz crystal device that uses a completely novel third-generation (3G) structure. The implication of the use of architecture instead of the simpler structure represents our desire to express that the product is based on a more definite strategy and concept than before.

About the Structure and Manufacturing Process of the Arkh.3G

In the conventional structure, a quartz crystal element is held in a ceramic package by means of a conductive adhesive. In contrast, the Arkh.3G is arranged in a three-layer structure consisting of a lid, resonator, and base, the host of which is quartz crystal. With the outlines of the resonator and other parts having been formed by a photolithographic process, three quartz crystal wafers are bonded and diced into a wafer-level package. Thus the holder and resonator parts are formed into an integrated structure without the use of a conductive adhesive. This design has solved the challenges that the conventional structure needed to meet for product size reduction, namely, improved accuracy in conductive adhesive application and the provision of a margin for ensuring a quartz crystal element mounting location. Additionally, it is possible to reduce quality risks by carrying out processes ranging from wafer cleaning to bonding in a vacuum environment.

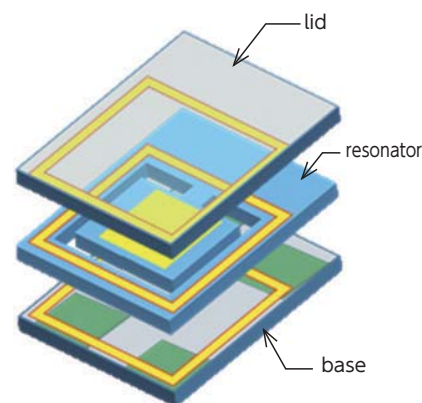
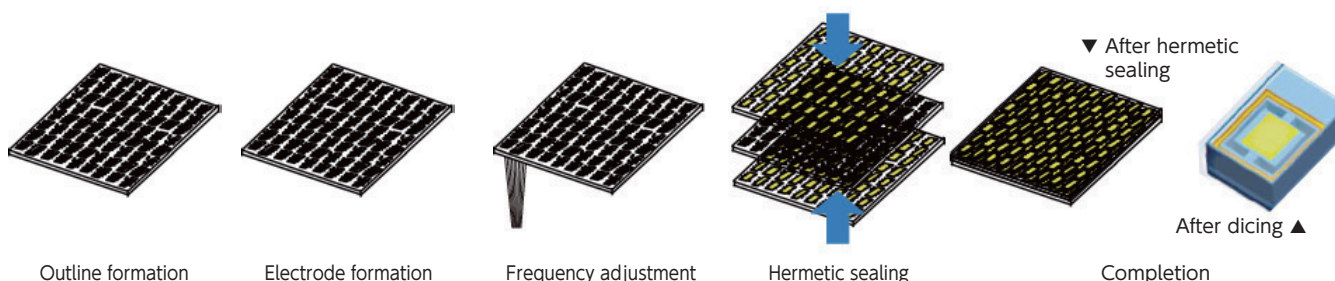


Fig.1 Structure of the Arkh.3G

Photolithography Wafer Process

Assembly process



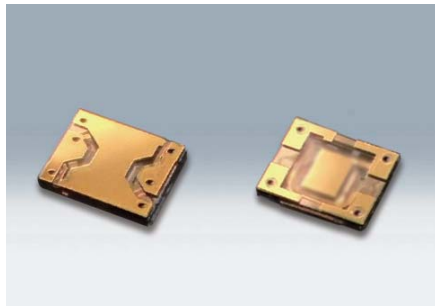
About Mounting and Usage of the Arkh.3G

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

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

SMD Crystal Resonators / MHz Band Crystal Resonators

DX1008JS



Actual size □

■ Features

- 1008 size, height 0.13mm max.
Unprecedented extremely low-profile package using a novel structure
- Composed only of quartz crystal plates and metallic films without the use of a ceramic base
- Long-term high resistance to aging, due to avoiding the use of an organic conductive adhesive
- Reduced risk of the inclusion of foreign matter due to assembly in a vacuum environment



■ Applications

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

■ Standard Specification

Item	Type	DX1008JS		
Frequency Range		48MHz	52MHz/80MHz/96MHz	120MHz
Overtone Order		Fundamental		
Load Capacitance		8pF, 10pF, 12pF		
Drive Level		10μW (100μW max.)		
Frequency Tolerance		±20×10 ⁻⁶ (at 25°C)		±100×10 ⁻⁶ (at 25°C)
Series Resistance	100Ω max.	60Ω max.		40Ω max.
Frequency Characteristics over Temperature		±30×10 ⁻⁶ / -30 to +85°C (Ref.To 25°C)		
Storage Temperature Range		-40 to +85°C		
Packing Unit (1)		3000pcs./reel (φ180)		

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

Consult our sales representative for other specifications

[mm]

■ Dimensions

■ Internal Connections

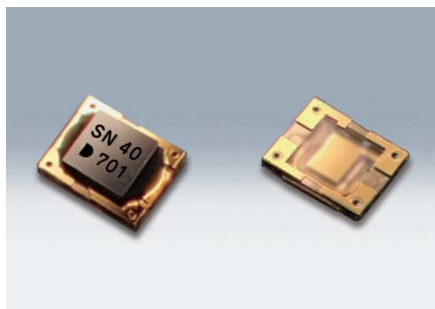
〈Top View〉

■ Recommended Land Pattern

〈Top View〉

SMD Crystal Oscillators

DS1008JN



Actual size ◻

■ Features

- 1008 size, height 0.24mm max. Unprecedented extremely low-profile package using a novel structure
- Available frequency range : 1 to 100MHz
- Low Supply Voltage : 0.9V/ 1.2V/ 1.3V/ 1.5V typ.
- 3-state function
- Available up to 100MHz by using AT cut fundamental resonator. Low jitter provides for high performance.



■ Applications

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

■ Standard Specification

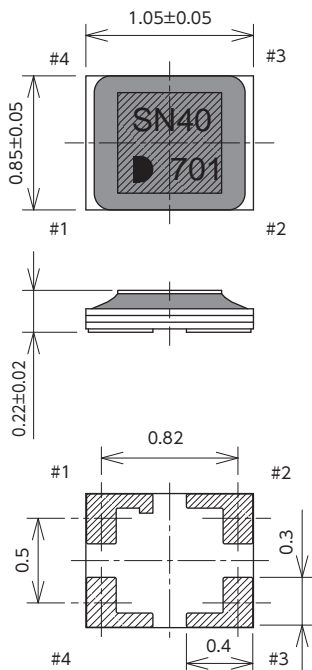
Item	Type	Legend	Spec.			Unit	Condition	
			min.	typ.	max.			
Frequency Range		fo	1	—	100	MHz		
Supply Voltage		Vcc	+0.8	—	+1.6	V		
Frequency Tolerance (Includes frequency tolerance at room temperature.)		f_tol	-100	—	+100	× 10 ⁻⁶	-40 to +125°C	-20 to +70°C (Standard Operating Temperature Range)
			-50	—	+50			
			-30	—	+30		-30 to +85°C	
			-20	—	+20			
			-20	—	+20	-20 to +70°C		
Current Consumption		lcc	—	—	1.9	mA	fo=37MHz, Vcc=+1.0V, No Load	
Stand-by Current (#1 pin "L" Level)		L_std	—	—	0.02	mA		
Load Condition		L_cmos	—	—	15	pF		
Symmetry		SYM	40	50	60	%	at 50% Vcc, fo<60MHz	
Rise and Fall Time		tr, tf	—	—	5.5	ns	10 to 90% Vcc Level	
Output Enable Time		tPZL	—	—	2	ms		
Output Disable Time		tPLZ	—	—	200	ns		
OE Pin 1 Level Input Voltage		V _{IH}	Vcc×0.8	—	—	V		
OE Pin 0 Level Input Voltage		V _{IL}	—	—	Vcc×0.2	V		
Packing Unit (1)						3000pcs./reel (φ 180)		

(1) Moisture prevention packing

Consult our sales representative for other specifications

[mm]

■ Dimensions



Pin Connection

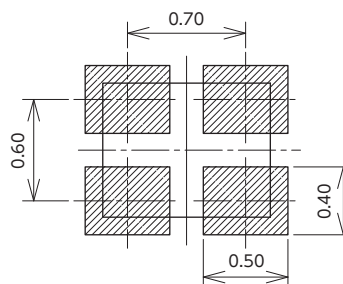
Pin No.	Connection
#1	OE (Output Enable)
#2	GND
#3	Output
#4	Vcc

Function

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

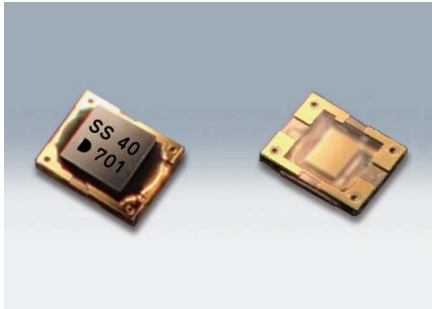
■ Recommended Land Pattern

(Top View)



SMD Crystal Oscillators

DS1008JS



Actual size ◻

■ Features

- 1008 size, height 0.24mm max. Unprecedented extremely low-profile package using a novel structure
- Available frequency range : 1 to 100MHz
- Supply Voltage : +1.8V to +3.3V
- 3-state function
- Available up to 100MHz by using AT cut fundamental resonator. Low jitter provides for high performance.



■ Applications

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

■ Standard Specification

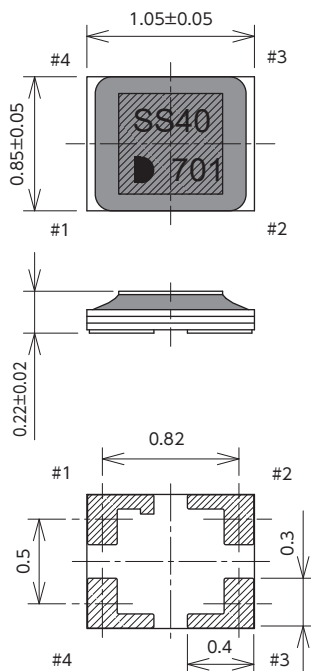
Item	Type	Legend	Spec.			Unit	Condition	
			min.	typ.	max.			
Frequency Range		f_0	1	—	100	MHz		
Supply Voltage		Vcc	+1.6	—	+3.6	V		
Frequency Tolerance (Includes frequency tolerance at room temperature.)		f_{tol}	-100	—	+100	$\times 10^{-6}$	-40 to +125°C	-20 to +70°C (Standard Operating Temperature Range)
			-50	—	+50			
			-30	—	+30		-30 to +85°C	
			-20	—	+20			
Current Consumption		Icc	—	—	1.8	mA	$f_0=24\text{MHz}$, Vcc=+1.8V, No Load	
Stand-by Current (#1 pin "L" Level)		I _{std}	—	—	0.01	mA		
Load Condition		L _{CMOS}	—	—	15	pF		
Symmetry		SYM	45	50	55	%	at 50% Vcc, $f_0 < 60\text{MHz}$	
Rise and Fall Time		tr, tf	—	—	5	ns	10 to 90% Vcc Level	
Output Enable Time		tPZL	—	—	2	ms		
Output Disable Time		tPLZ	—	—	200	ns		
OE Pin 1 Level Input Voltage		V _{IH}	Vcc $\times 0.8$	—	—	V		
OE Pin 0 Level Input Voltage		V _{IL}	—	—	Vcc $\times 0.2$	V		
Packing Unit (1)							3000pcs./reel ($\phi 180$)	

(1) Moisture prevention packing

Consult our sales representative for other specifications

[mm]

■ Dimensions



Pin Connection

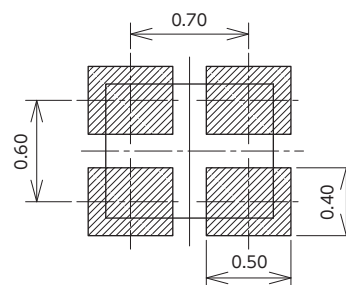
Pin No.	Connection
#1	OE (Output Enable)
#2	GND
#3	Output
#4	Vcc

Function

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

■ Recommended Land Pattern

(Top View)



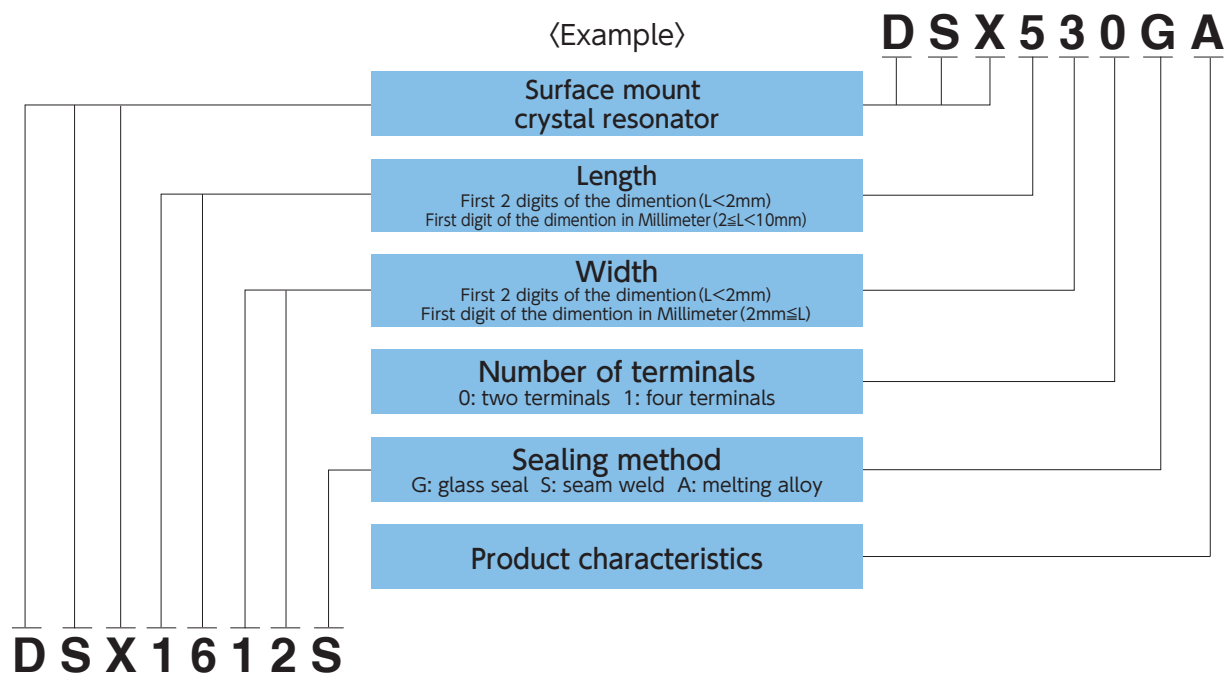
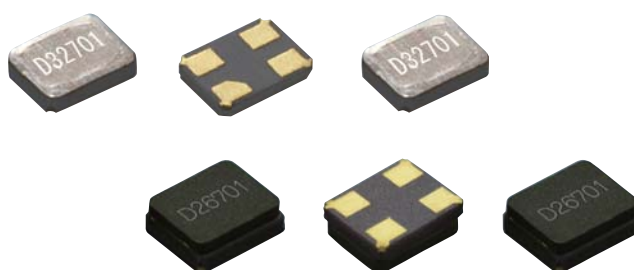
MEMO



A series of horizontal dashed lines spanning the width of the page, providing a template for writing a memo.

Quartz Devices

Crystal resonators



Crystal Resonators

Description

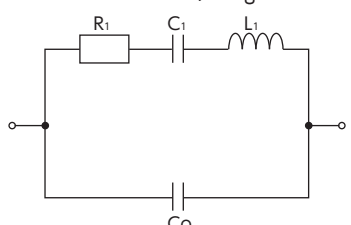
●MHz Band Crystal Resonators

A resonator using thickness-shear 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)

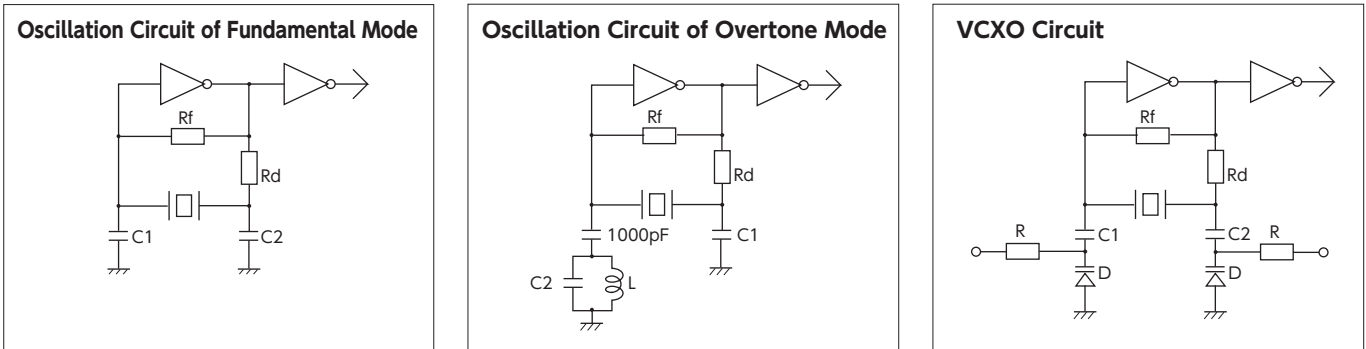
A resonator with low power consumption and a tuning fork shaped crystal blank. Common application includes watches and mobile phones.

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-shear 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	<p>An equivalent circuit near the resonance point of the crystal resonator is shown below. It consists of a series circuit including series motional inductance (L1), series capacitance (C1) and series resistance (R1), with the resonator's terminal-to-terminal capacitance (shunt capacitance: C0) connected in parallel with the series circuit. The smaller the size of the resonator, the greater the average values of R1 and L1.</p> 

Oscillation Circuit

Oscillation Circuit of Crystal Resonator



Oscillation Circuit of Fundamental Mode :

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

Oscillation Circuit of Overtone Mode :

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

VCXO Circuit :

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

Tips for Circuit Design

[IC Selection]

Selecting an IC according to the oscillation frequency.

- 〈Example〉 4069UB : From the kHz range to around 8 MHz
- 7WU04 : 4 to 30MHz
- 7WHU04 : 20 to 60MHz

[Feedback Resistance]

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

For overtone oscillation, a resistance of 1 k Ω 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 μ F
- MHz range : 0.01 to 0.1 μ F

[Line Pattern]

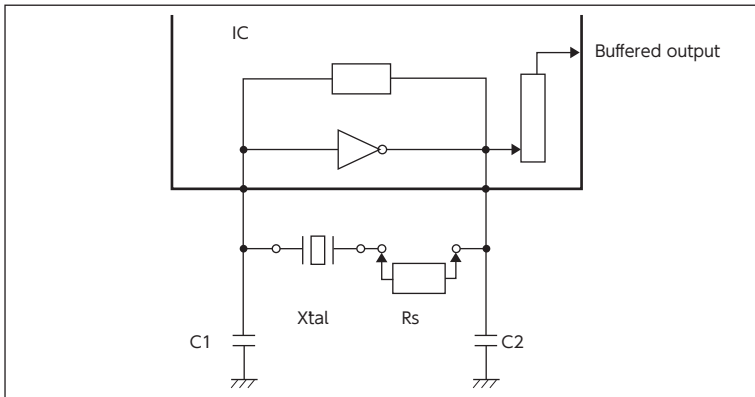
Mount parts of a oscillation circuit as closely as possible to the IC and don't put signal line of the oscillator circuit closely or cross another signal line.

Oscillation Circuit

Confirmation on Operation of Oscillation Circuit

[Negative Resistance]

As the figure shows, raise one end of the crystal resonator from the oscillation circuit and insert a resistor (R_s). Change the value of the inserted resistor (R_s). The value at which oscillation stops represents negative resistance. KDS measures the value not only at room temperature but also at low temperature, at high temperature and regards the lowest value as the negative resistance. The negative resistance value of the circuit should generally be at least five times the standard series resistance. It is recommended to provide a negative resistance that is at least ten times the standard series resistance for automotive applications and safety equipment.



Measurement Circuit for Negative Resistance

[Load Capacitance]

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

[Drive Level]

Absolute Maximum Value ; See “Drive Level” in the table of each page.
The adequate drive level differs according to the crystal resonator type and overtone order.

MHz Band Crystal Resonators

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

Tuning Fork Crystal Resonators

$2\mu W$ max., $1\mu W$ max.

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

(Measurement Method)

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

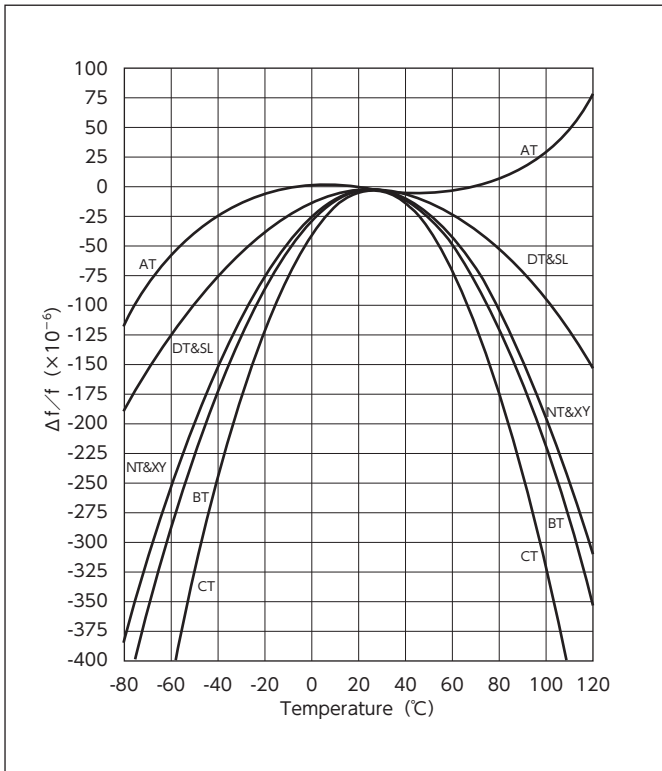
$$\text{Drive Level } P = (I/2\sqrt{2})^2 \cdot R$$

[Inquiry About The Oscillation Circuit]

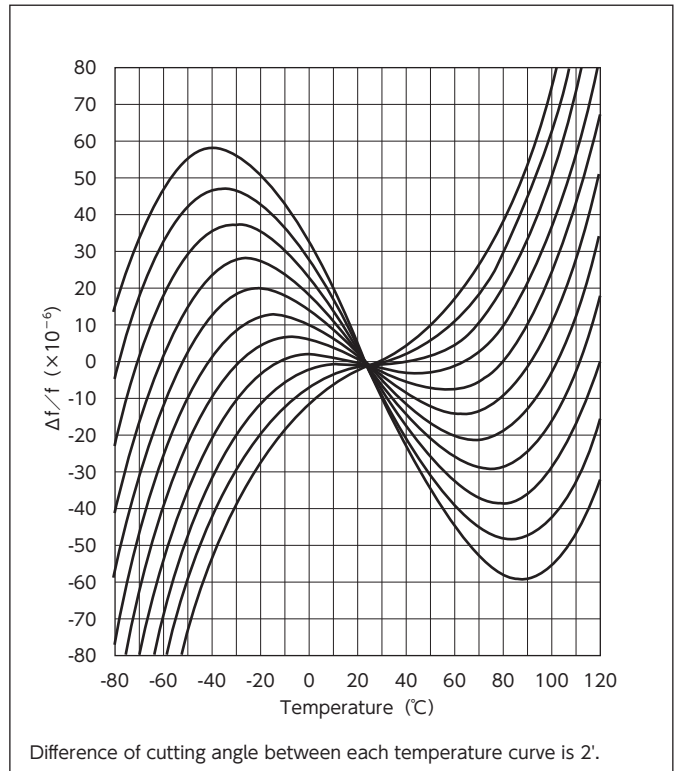
Regarding inquiries concerning oscillation circuit and its matching with the ICs you are using, please directly contact our sales department or leave us an e-mail from our website(click “CONTACT US” from the top page → select “TECHNICAL SUPPORT”).

Cut Angle and Frequency Characteristics over Temperature

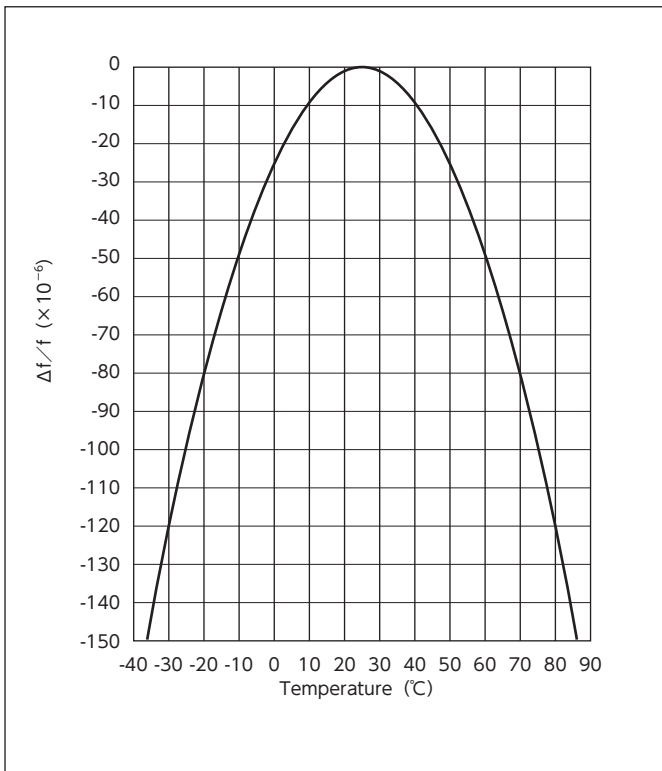
Temperature Characteristics for Various Cuts



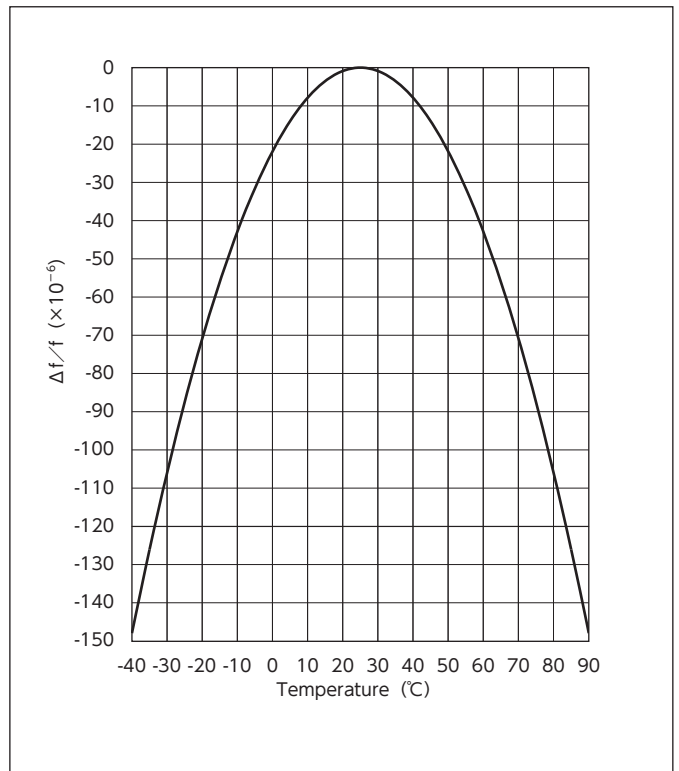
Temperature Characteristics for AT Cuts



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)			Frequency Range (MHz)	Frequency Tolerance ($\times 10^{-6}$) @+25°C	Frequency Characteristics over Temperature ($\times 10^{-6}$)	Operating Temperature Range (°C)	Load Capacitance (pF)	Drive Level ($\mu\text{w(max.)}$)	Lid	Recommended Application	Catalog Page
		L	W	H (max.)									
DSX1008A		1.0	0.8	0.3	40 to 80	± 10	± 12	-30 to +85	8, 10, 12	10 (100)	Metal	CE TC	17
DX1008JS		1.05	0.85	0.13	48, 52, 80, 96, 120	± 20	± 30	-30 to +85	8, 10, 12	10 (100)	Crystal	CE TC	7
DSX1210A		1.2	1.0	0.3	32 to 96	± 10	± 12	-30 to +85	8, 10, 12	10 (100)	Metal	CE TC	18
DSX1612S		1.6	1.2	0.4	24 to 54	± 10	± 15	-30 to +85	8, 10, 12	10 (100)	Metal	CE TC	19
DSX211S		2.0	1.6	0.5	76.8, 80, 96	± 20	± 30	-30 to +85	8, 10, 12	10 (400)	Metal	CE IE TC	20
DSX211SH		2.0	1.6	0.5	16 to 60	± 20 ± 30	± 30 ± 100	-30 to +85 -40 to +125	8, 10, 12	10 (100)	Metal	CE IE TC AE	20 71
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 (100)	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 (100)	Ceramic	CE IE TC AE	21 68
DSX320G		3.2	2.5	1.1	7.9 to 12	± 30	± 100	-40 to +125	8, 10, 12	10 (200)	Ceramic	AE	69
DSX320GE		3.2	2.5	1.1	7.9 to 64	± 30	± 100	-40 to +125	8, 10, 12	10 (200)	Ceramic	AE	69
DSX321G		3.2	2.5	0.9	12 to 64	± 20 ± 30	± 30 ± 100	-30 to +85 -40 to +125	8, 10, 12	10 (200)	Ceramic	CE IE TC AE	22 69
DSX321GK		3.2	2.5	1.0	9.8 to 40	± 30	± 100	-40 to +125	8, 10, 12	10 (200)	Ceramic	AE	69
DSX530GA		5.0	3.2	1.2	7 to 54/45 to 80 7 to 54	± 30	± 50 ± 100	-30 to +85 -40 to +125	8, 10, 12	10 (300)/10 (500) 10 (300)	Ceramic	CE IE AE	23 70
DSX530GK		5.0	3.2	1.2	8 to 54	± 30	± 100	-40 to +125	8, 10, 12	10 (300)	Ceramic	AE	70
SMD-49		11.0	4.6	4.5	4, 8	± 30	± 100	-40 to +125	8, 10, 12	10 (300)	Metal	AE	73

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

Type	Actual Size	Size (mm)			Frequency Range (MHz)	Frequency Tolerance ($\times 10^{-6}$) @+25°C	Frequency Characteristics over Temperature ($\times 10^{-6}$)	Operating Temperature Range (°C)	Load Capacitance (pF)	Drive Level ($\mu\text{w(max.)}$)	Lid	Recommended Application	Catalog Page
		L	W	H (max.)									
DSR1210ATH		1.2	1.0	0.55	38.4, 76.8	± 10	± 12	-30 to +85	6, 7, 8	10 (100)	Metal	TC	24
DSR1612ATH		1.6	1.2	0.65	38.4, 52, 76.8 38.4	± 10	± 12 ± 30	-30 to +85 -40 to +105	6, 7, 8 7, 8	10 (100)	Metal	TC AE	24 25 72
DSR211ATH		2.0	1.6	0.65	19.2	± 10	± 12 ± 30	-30 to +85 -40 to +105	7, 8	10 (100)	Metal	TC AE	24 25 72
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 (100)	Metal	TC AE	24 25 72
DSR221STH		2.5	2.0	1.0	19.2, 26 19.2	± 10	± 12 ± 20	-30 to +85 -40 to +105	7, 8	10 (100)	Metal	TC AE	24 25 72

SMD Tuning Fork Crystal Resonators / kHz Band Crystal Resonators

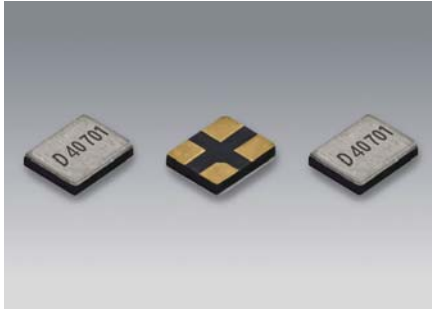
Type	Actual Size	Size (mm)			Frequency Range (kHz)	Frequency Tolerance ($\times 10^{-6}$) @+25°C	Series resistance (k Ω max.)	Operating Temperature Range (°C)	Load Capacitance (pF)	Drive Level ($\mu\text{w(max.)}$)	Package	Recommended Application	Catalog Page
		L	W	H (max.)									
DST1210A		1.25	1.05	0.35	32.768	± 20	80	-40 to +85	7, 9, 12.5	0.1 (0.2)	Ceramic	CE TC	26
DST1610A		1.6	1.0	0.5	32.768	± 20	50 120	-40 to +85 -40 to +125	6, 7, 9, 12.5	0.1 (0.5)	Ceramic	CE TC AE	27 74
							80	-40 to +85					
DST1610AL		1.6	1.0	0.35	32.768	± 20	80 120	-40 to +85 -40 to +125	6, 7, 9, 12.5	0.1 (0.5)	Ceramic	CE TC AE	27 74
DST210AC		2.0	1.2	0.55	32.768	± 20	80 120	-40 to +85 -40 to +125	6, 7, 9, 12.5	0.1 (0.5)	Ceramic	CE TC AE	27 74
DST310S		3.2	1.5	0.85	32.768	± 20	50 80, 120	-40 to +85 -40 to +125	7, 9, 12.5	0.2 (1.0)	Ceramic	CE IE TC AE	28 74
							50	-40 to +85					
DST311S		3.2	1.5	0.85	32.768	± 20	50	-40 to +85	7, 9, 12.5	0.2 (1.0)	Ceramic	CE IE TC	28
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 (2.0)	Plastic	CE AE	29 75

Tuning Fork Crystal Resonators / kHz Band Crystal Resonators

Type	Actual Size	Size (mm)			Frequency Range (kHz)	Frequency Tolerance ($\times 10^{-6}$) @+25°C	Series resistance (k Ω max.)	Operating Temperature Range (°C)	Load Capacitance (pF)	Drive Level ($\mu\text{w(max.)}$)	Package	Recommended Application	Catalog Page
		L	W	H (max.)									
DT-26		ϕ 2.0	ϕ 2.0	6.0	32.768	± 20	40	-10 to +60	12.5	1.0 (2.0)	Cylinder	CE IE	30
DT-261		ϕ 2.0	ϕ 2.0	6.0	28 to 90								
DT-38		ϕ 3.0	ϕ 3.0	8.0	32.768								
DT-381		ϕ 3.0	ϕ 3.0	8.0	20 to 90								

SMD Crystal Resonators / MHz Band Crystal Resonators

DSX1008A



Actual size □

■ Features

- 1008 size ultra miniature and lightweight SMD crystal resonator with a low profile of 0.3mm max.
- High precision and high reliability
- Allowing for high density surface mounting.

■ Applications

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



■ Standard Specification

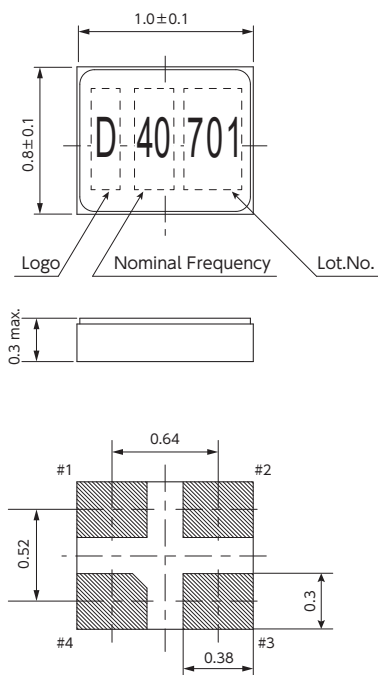
Item	Type	DSX1008A	
Frequency Range		40 to 59.97MHz	59.97 to 80MHz
Overtone Order		Fundamental	
Load Capacitance		8pF, 10pF, 12pF	
Drive Level		10μW (100μW max.)	
Frequency Tolerance		±10×10 ⁻⁶ , ±20×10 ⁻⁶ (at 25°C)	
Series Resistance		80Ω max.	60Ω max.
Frequency Characteristics over Temperature		±12×10 ⁻⁶ / -30 to +85°C (Ref. to 25°C)	
Storage Temperature Range		-40 to +85°C	
Packing Unit (1)		3000pcs./reel (φ180)	

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

Consult our sales representative for other specifications.

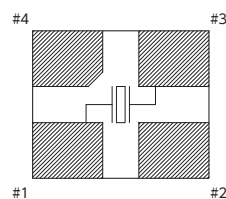
[mm]

■ Dimensions



■ Internal Connections

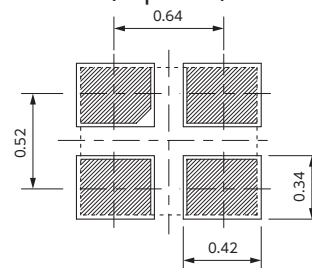
(Top View)



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

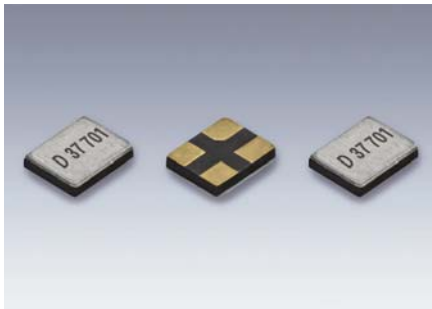
■ Recommended Land Pattern

(Top View)



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 $\pm 1 \times 10^{-6}$ /1 year or $\pm 3 \times 10^{-6}$ /5 years is available for cell phone or wireless communication systems etc.)
- Allowing for high density surface mounting.

■ Applications

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



■ Standard Specification

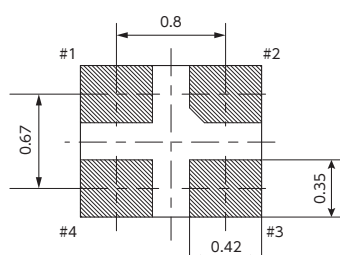
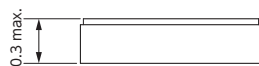
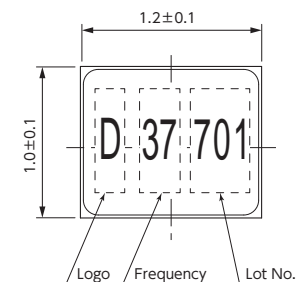
Item	Type	DSX1210A			
Frequency Range		32MHz	37.4MHz / 38.4MHz / 40MHz	48MHz/52MHz	76.8MHz/80MHz/96MHz
Overtone Order		Fundamental			
Load Capacitance		8pF, 10pF, 12pF			
Drive Level		10 μ W (100 μ W max.)			
Frequency Tolerance		$\pm 10 \times 10^{-6}$, $\pm 20 \times 10^{-6}$ (at 25°C)			
Series Resistance		100 Ω max.	60 Ω max.	40 Ω max.	30 Ω max.
Frequency Characteristics over Temperature		$\pm 12 \times 10^{-6}$, $\pm 30 \times 10^{-6}$ / -30 to +85°C (Ref. To 25°C)			
Storage Temperature Range		-40 to +85°C			
Packing Unit (1)		3000pcs./reel ($\phi 180$)			

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

Consult our sales representative for other specifications.

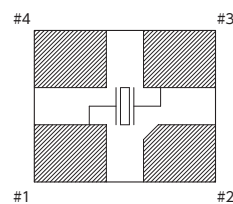
[mm]

■ Dimensions



■ Internal Connections

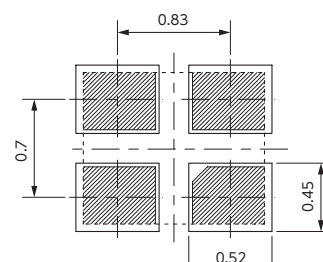
<Top View>



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

■ Recommended Land Pattern

<Top View>



SMD Crystal Resonators / MHz Band Crystal Resonators

DSX1612S



Actual size □

■ Features

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

■ Applications

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



■ Standard Specification

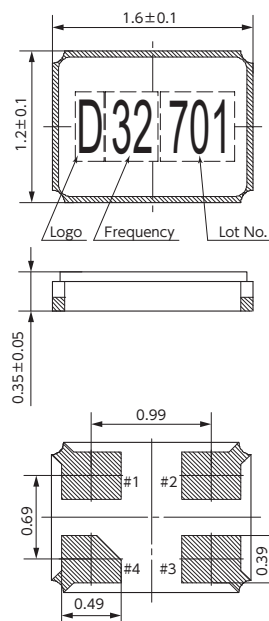
Item	Type	DSX1612S		
Frequency Range		24 to 32MHz	32 to 40MHz	40 to 54MHz
Overtone Order		Fundamental		
Load Capacitance		8pF, 10pF, 12pF		
Drive Level		10 μ W (100 μ W max.)		
Frequency Tolerance		$\pm 10 \times 10^{-6}$, $\pm 20 \times 10^{-6}$ (at 25°C)		
Series Resistance		100 Ω max.	50 Ω max.	
Frequency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

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

Consult our sales representative for other specifications.

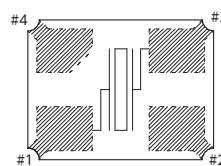
[mm]

■ Dimensions



■ Internal Connections

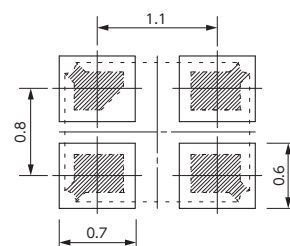
<Top View>



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

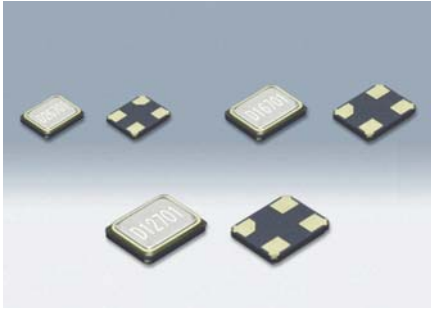
■ Recommended Land Pattern

<Top View>



SMD Crystal Resonators / MHz Band Crystal Resonators

DSX211S/DSX211SH/DSX221SH/DSX321SH



Actual size DSX211S/SH DSX221SH
DSX321SH

■ Features

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



■ Applications

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

■ Standard Specification

Item	Type	DSX211SH	DSX211S	DSX221SH	DSX321SH	
Frequency Range		16 to 30MHz / 30 to 60MHz	76.8MHz/80MHz/96MHz	12 to 24MHz / 24 to 30MHz / 30 to 54MHz	12 to 20MHz / 20 to 32MHz / 32 to 50MHz	
Overtone Order		Fundamental				
Load Capacitance		8pF, 10pF, 12pF				
Drive Level		10 μW (100 μW max.)	10 μW (400 μW max.)	10 μW (200 μW max.)		
Frequency Tolerance		$\pm 20 \times 10^{-6}$ (at 25 $^\circ\text{C}$)				
Series Resistance		100 Ω max. / 50 Ω max.	30 Ω max.	120 Ω max. / 50 Ω max.	40 Ω max. / 80 Ω max. / 50 Ω max. / 40 Ω max.	
Frequency Characteristics over Temperature		$\pm 30 \times 10^{-6} / -30$ to $+85^\circ\text{C}$ (Ref. to 25 $^\circ\text{C}$)				
Storage Temperature Range		-40 to $+85^\circ\text{C}$				
Packing Unit (1)		3000pcs./reel(ϕ 180)				

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

Consult our sales representative for other specifications.

■ DSX211S/DSX211SH [mm]

■ DSX221SH [mm]

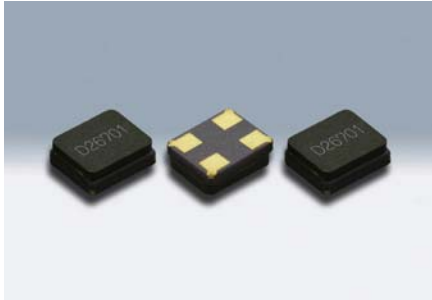
■ DSX321SH [mm]

[mm]

<p>■ Dimensions</p> <p>■ Internal Connections (Top View)</p> <p>#1 & #3 connected to quartz element #2 & #4 connected to the cover #2 & #4 recommended GND connection</p> <p>■ Recommended Land Pattern (Top View)</p>	<p>■ Dimensions</p> <p>■ Internal Connections (Top View)</p> <p>#1 & #3 connected to quartz element #2 & #4 connected to the cover #2 & #4 recommended GND connection</p> <p>■ Recommended Land Pattern (Top View)</p>	<p>■ Dimensions</p> <p>■ Internal Connections (Top View)</p> <p>#1 & #3 connected to quartz element #2 & #4 connected to the cover #2 & #4 recommended GND connection</p> <p>■ Recommended Land Pattern (Top View)</p>
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SMD Crystal Resonators / MHz Band Crystal Resonators

DSX211G



Actual size

■ Features

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

■ Applications

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

■ Standard Specification

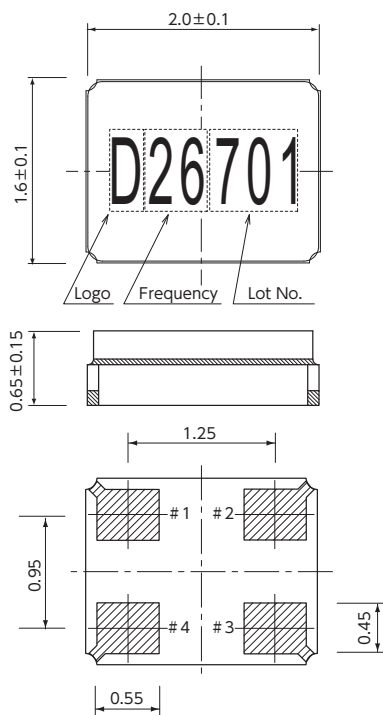
Item	Type	DSX211G			
		20 to 24MHz	24 to 30MHz	30 to 36MHz	36 to 64MHz
Frequency Range		20 to 24MHz	24 to 30MHz	30 to 36MHz	36 to 64MHz
Overtone Order		Fundamental			
Load Capacitance		8pF, 10pF, 12pF			
Drive Level		10 μW (100 μW max.)			
Frequency Tolerance		$\pm 20 \times 10^{-6}$ (at 25 $^\circ\text{C}$)			
Series Resistance		200 Ω max.	150 Ω max.	120 Ω max.	80 Ω max.
Frequency Characteristics over Temperature		$\pm 30 \times 10^{-6}$ / -30 to $+85^\circ\text{C}$ (Ref. to 25 $^\circ\text{C}$)			
Storage Temperature Range		-40 to $+85^\circ\text{C}$			
Packing Unit (1)		3000pcs./reel ($\phi 180$)			

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

Consult our sales representative for other specifications.

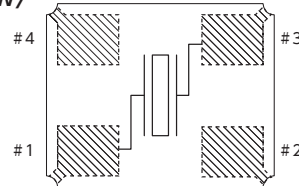
[mm]

■ Dimensions



■ Internal Connections

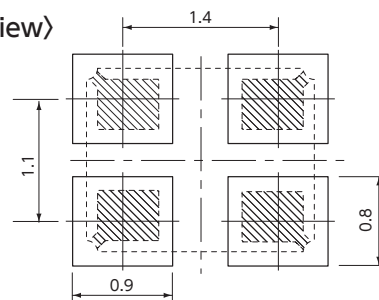
<Top View>



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

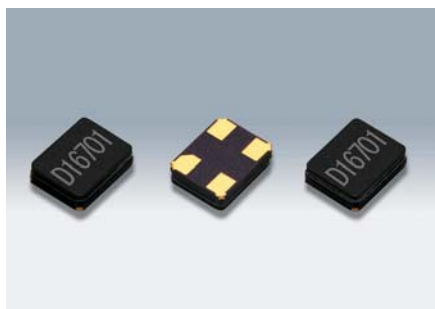
■ Recommended Land Pattern

<Top View>



SMD Crystal Resonators / MHz Band Crystal Resonators

DSX321G



Actual size

■ Features

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



RoHS Compliant

■ Applications

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

■ Standard Specification

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

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

Consult our sales representative for other specifications.

■ DSX321G (12MHz or under)

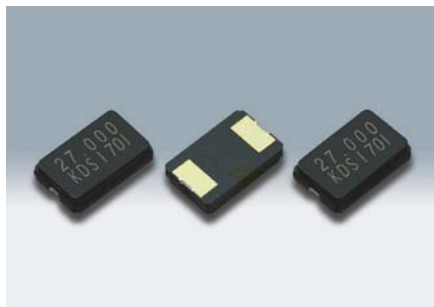
[mm] ■ DSX321G (over 12MHz)

[mm]

■ DSX321G (12MHz or under)		■ DSX321G (over 12MHz)	
■ Dimensions 	■ Internal Connections (Top View) <p>#1 & #3 connected to quartz element #2 & #4 GND connected or N.C. available</p>	■ Dimensions 	■ Internal Connections (Top View) <p>#1 & #3 connected to quartz element #2 & #4 GND connected or N.C. available</p>
■ Recommended Land Pattern (Top View) 		■ 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 80MHz.
- AEC-Q200 Compliant



■ Applications

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

■ Standard Specification

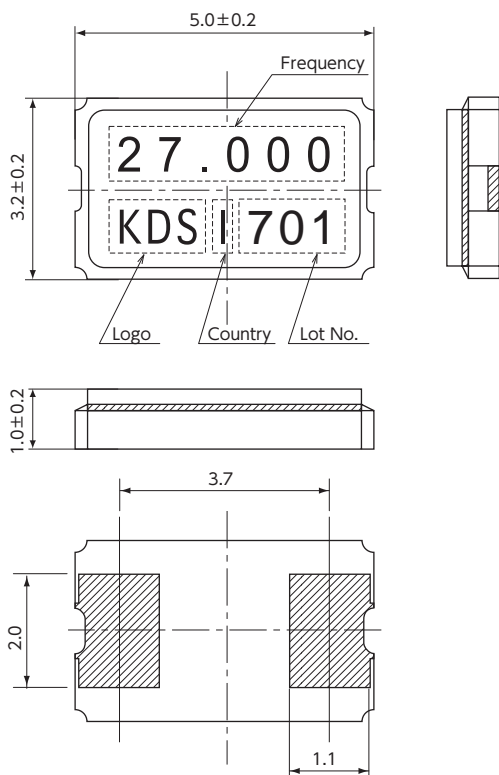
Item	Type	DSX530GA				
Frequency Range		7 to 9MHz	9 to 12MHz	12 to 40MHz	40 to 54MHz	45 to 80MHz
Overtone Order		Fundamental				3rd overtone
Load Capacitance		8pF, 10pF, 12pF				Series
Drive Level		10μW (300μW max.)				10μW (500μW max.)
Frequency Tolerance		±30×10 ⁻⁶ (at 25°C)				
Series Resistance		150Ω max.	100Ω max.	50Ω max.		100Ω max.
Frequency Characteristics over Temperature		±50×10 ⁻⁶ / -30 to +85°C (Ref. to 25°C)				
Storage Temperature Range		-40 to +85°C				
Packing Unit (1)		1000pcs./reel (φ180)				

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

Consult our sales representative for other specifications.

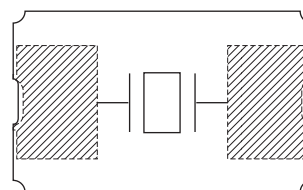
[mm]

■ Dimensions



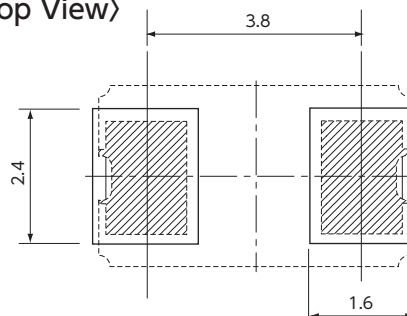
■ Internal Connections

<Top View>



■ Recommended Land Pattern

<Top View>



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

DSR1210ATH/DSR1612ATH/DSR1612STH

NEW



■ Features

- DSR1210ATH: 1210size, height 0.55mm max.
- DSR1612ATH/STH: 1612size, height 0.65mm max.
- Built-in NTC thermistor

■ Applications

- Mobile phones
- GPS/GNSS
- Wearable devices



Actual size DSR1210ATH □ DSR1612ATH □
DSR1612STH □

■ Standard Specification

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

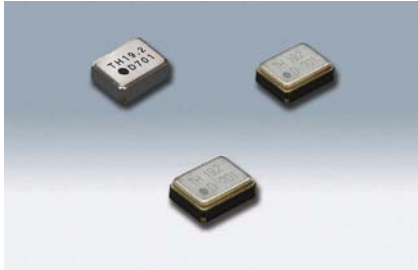
(1) Moisture prevention packing is unnecessary.
Moisture Sensitivity Level : LEVEL 1 (IPC/JEDEC J-STD-033)

Consult our sales representative for other specifications.

■ DSR1210ATH [mm]	■ DSR1612ATH [mm]	■ DSR1612STH [mm]
<p>■ Dimensions</p> <p>■ Internal Connections (Top View)</p> <p>■ Recommended Land Pattern (Top View)</p>	<p>■ Dimensions</p> <p>■ Internal Connections (Top View)</p> <p>■ Recommended Land Pattern (Top View)</p>	<p>■ Dimensions</p> <p>■ Internal Connections (Top View)</p> <p>■ Recommended Land Pattern (Top View)</p>

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

DSR211ATH/DSR211STH/DSR221STH



Actual size DSR211ATH □ DSR211STH □
DSR221STH □

Features

- 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

Applications

- Mobile phones
- GPS/GNSS
- Wearable devices



Standard Specification

Item	Type	DSR211ATH	DSR211STH	DSR221STH
Frequency Range		19.2MHz	19.2MHz / 26MHz / 38.4MHz	19.2MHz/26MHz
Overtone Order		Fundamental		
Load Capacitance		6pF, 7pF, 8pF		
Drive Level		10μW (100μW max.)		
Frequency Tolerance		±10×10 ⁻⁶ (at 25°C)		
Series Resistance		80Ω max.		
Frequency Characteristics over Temperature		±12×10 ⁻⁶ / -30 to +85 °C		
Storage Temperature Range		-40 to +125 °C		
Thermistor Resistance		22kΩ / 100kΩ (at +25°C)		
Thermistor B-constant		3380K / 4250K (+25°C to +50°C)		
Packing Unit (1)		3000pcs./reel (φ 180)		

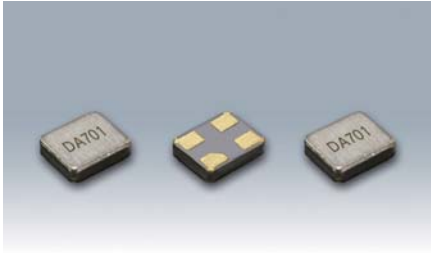
(1) Moisture prevention packing is unnecessary.
Moisture Sensitivity Level : LEVEL 1 (IPC/JEDEC J-STD-033)

Consult our sales representative for other specifications.

DSR211ATH [mm]	DSR211STH [mm]	DSR221STH [mm]
<h4>Dimensions</h4> <p>Top view: 2.0±0.1 (Frequency), 1.6±0.1 (Model Code), #4, #3, #1 Index, Logo, Lot No. (#2), 0.65mm max. (height), 0.475 (width), 1.375 (width), 0.975 (width), #1, #2, #3, #4.</p> <h4>Internal Connections</h4> <p>(Top View) #4 SENSOR, #3 Xtal, #1 Xtal, #2 GND</p> <h4>Recommended Land Pattern</h4> <p>(Top View) 0.75, 0.75, 0.45, 0.45, 0.25, 0.25, R0.20, 1.80, 2.20</p>	<h4>Dimensions</h4> <p>Top view: 2.0±0.1 (Frequency), 1.6±0.1 (Model Code), #4, #3, #1 Index, Logo, Lot No. (#2), 0.8mm max. (height), 0.65mm max. (height), 0.475 (width), 1.375 (width), 0.975 (width), #1, #2, #3, #4.</p> <h4>Internal Connections</h4> <p>(Top View) #4 SENSOR, #3 Xtal, #1 Xtal, #2 GND</p> <h4>Recommended Land Pattern</h4> <p>(Top View) 0.75, 0.75, 0.45, 0.45, 0.25, 0.25, R0.20, 1.80, 2.20</p>	<h4>Dimensions</h4> <p>Top view: 2.5±0.15 (Frequency), 2.0±0.15 (Model Code), #4, #3, #1 Index, Logo, Lot No. (#2), 1.0mm max. (height), 0.65 (width), 1.65 (width), 1.25 (width), #1, #2, #3, #4.</p> <h4>Internal Connections</h4> <p>(Top View) #4 SENSOR, #3 Xtal, #1 Xtal, #2 GND</p> <h4>Recommended Land Pattern</h4> <p>(Top View) 0.85, 1.95, 0.95, 1.55, 1.80, 2.20</p>

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.
- Metal lid connected to GND terminal to reduce EMI.

■ Applications

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



■ Standard Specification

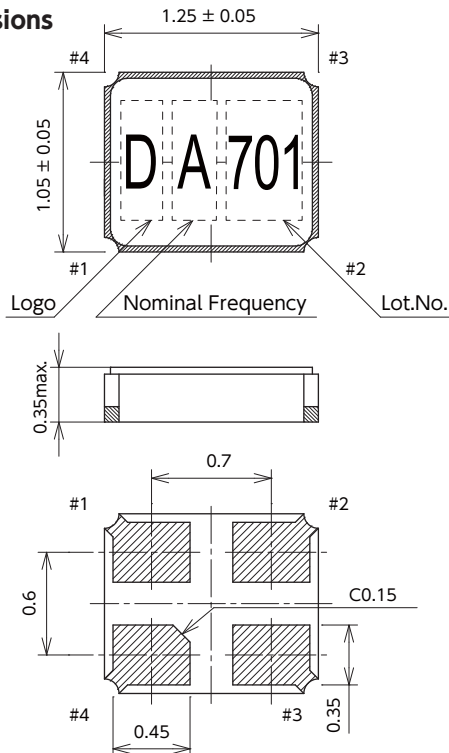
Item	Type	DST1210A
Frequency Range		32.768kHz
Load Capacitance		7pF, 9pF, 12.5pF
Drive Level		0.1 μW (0.2 μW max.)
Frequency Tolerance		±20×10 ⁻⁶ (at 25°C)
Series Resistance		80kΩ max.
Turnover Temperature		+25°C ±5°C
Parabolic Coefficient		-0.04×10 ⁻⁶ /°C ² max.
Operating Temperature Range		-40 to +85°C
Storage Temperature Range		-40 to +85°C
Shunt Capacitance		1.0pF typ.
Packing Unit (1)		3000pcs/reel (φ 180)

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

Consult our sales representative for other specifications.

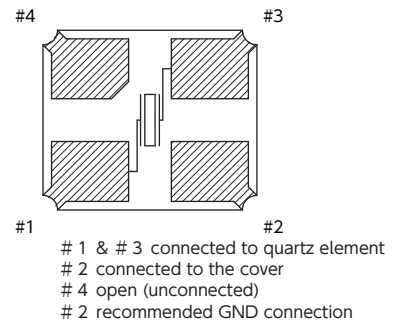
[mm]

■ Dimensions



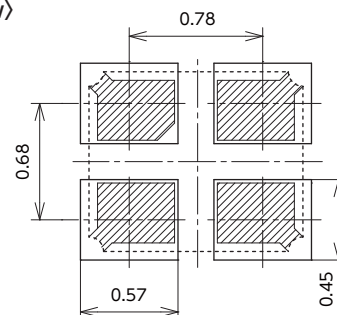
■ Internal Connections

<Top View>



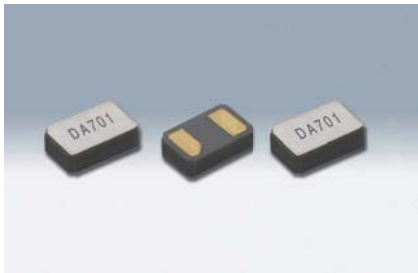
■ Recommended Land Pattern

<Top View>

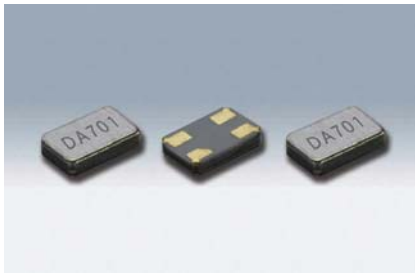


SMD Tuning Fork Crystal Resonators / kHz Band Crystal Resonators

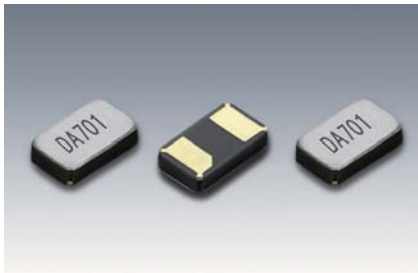
DST1610A/DST1610AL/DST210AC



DST1610A



DST1610AL



DST210AC

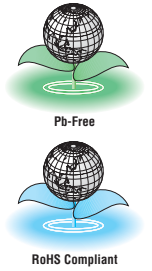
Actual size □

Actual size □

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.
- Series Resistance 50kΩ max. available (DST1610A).
- Metal lid connected to GND terminal to reduce EMI (DST1610AL).
- Suitable for mobile communications and consumer devices.
- AEC-Q200 Compliant (DST210AC)



■ Applications

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

■ Standard Specification

Item	Type	DST1610A	DST1610AL	DST210AC
Frequency Range		32.768kHz		
Load Capacitance		6pF, 7pF, 9pF, 12.5pF		
Drive Level		0.1 μW (0.5 μW max.)		
Frequency Tolerance		± 20 × 10 ⁻⁶ (at 25°C)		
Series Resistance		50kΩ max.	80kΩ max.	
Turnover Temperature		+25°C ± 5°C		
Parabolic Coefficient		-0.04 × 10 ⁻⁶ / °C ² max.		
Operating Temperature Range		-40 to +85°C		
Storage Temperature Range		-40 to +85°C		
Shunt Capacitance		1.7pF typ.	1.3pF typ.	1.2pF typ.
Packing Unit (1)		3000pcs/reel (φ 180)		

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

Consult our sales representative for other specifications.

■ DST1610A [mm]

■ DST1610AL [mm]

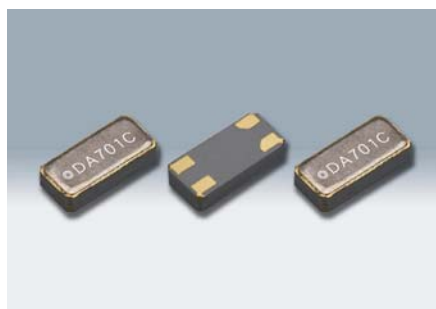
■ DST210AC [mm]

[mm]

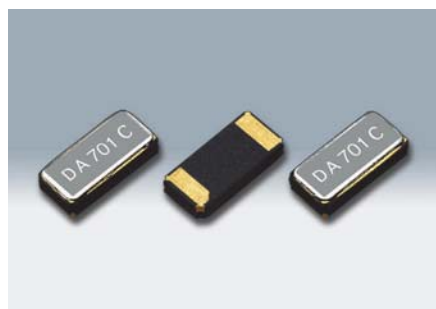
DST1610A		DST1610AL		DST210AC	
Dimensions	Internal Connections	Dimensions	Internal Connections	Dimensions	Internal Connections

SMD Tuning Fork Crystal Resonators / kHz Band Crystal Resonators

DST311S/DST310S



DST311S Actual size



DST310S Actual size

■ Features

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



■ Applications

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

■ Standard Specification

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

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

Consult our sales representative for other specifications.

■ DST311S

[mm]

■ DST310S

[mm]

DST311S		DST310S	
■ Dimensions 	■ Internal Connections <Top View> #1 & #4 connected to quartz element #2 & #3 connected to the cover #2 & #3 recommended GND connection	■ Dimensions 	■ Internal Connections <Top View>
■ Recommended Land Pattern <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



■ 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°C)
Series Resistance		50kΩ max. (1)
Turnover Temperature		+25°C±5°C (1)
Parabolic Coefficient		-0.04×10 ⁻⁶ /°C ² max.
Operating Temperature Range		-40 to +85°C
Storage Temperature Range		-40 to +85°C
Shunt Capacitance		1.25pF typ. (1)
Packing Unit (2)		2500pcs./reel (φ330)

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

Consult our sales representative for other specifications.

(2) Moisture prevention packing is unnecessary.

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

[mm]

■ Dimensions

■ Internal Connections

<Top View>

#2 & #3 open (unconnected)

■ Recommended Land Pattern

<Top View>

Tuning Fork Crystal Resonators / kHz Band Crystal Resonators

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



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



■ Features

- A cylindrical type tuning fork crystal resonator

■ Standard Specification

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

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

(2) Upon customer request.

(3) Moisture prevention packing is unnecessary.

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

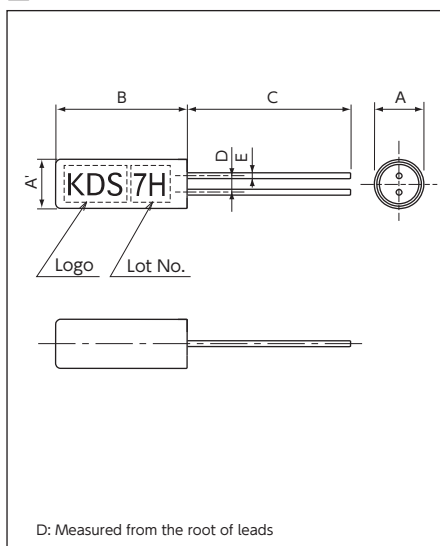
Consult our sales representative for other specifications.

■ Dimensions[mm]

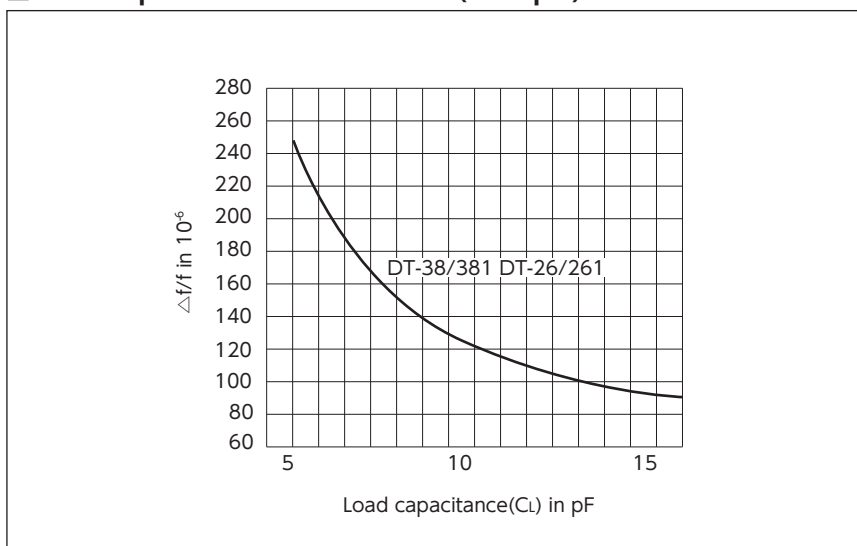
Type	A'	A	B	C	D	E
DT-38, DT-381	φ 3.0	φ 3.0 ^{+0.1} _{-0.2}	8.0 ^{+0.3} _{-0.2}	10.0±1.0	1.1±0.2	φ 0.35±0.07
DT-26, DT-261	φ 2.0	φ 2.0 ⁺⁰ _{-0.2}	6.0 ^{+0.1} _{-0.2}	7.5±1.0	0.7±0.2	φ 0.28±0.05

■ Dimensions

[mm]

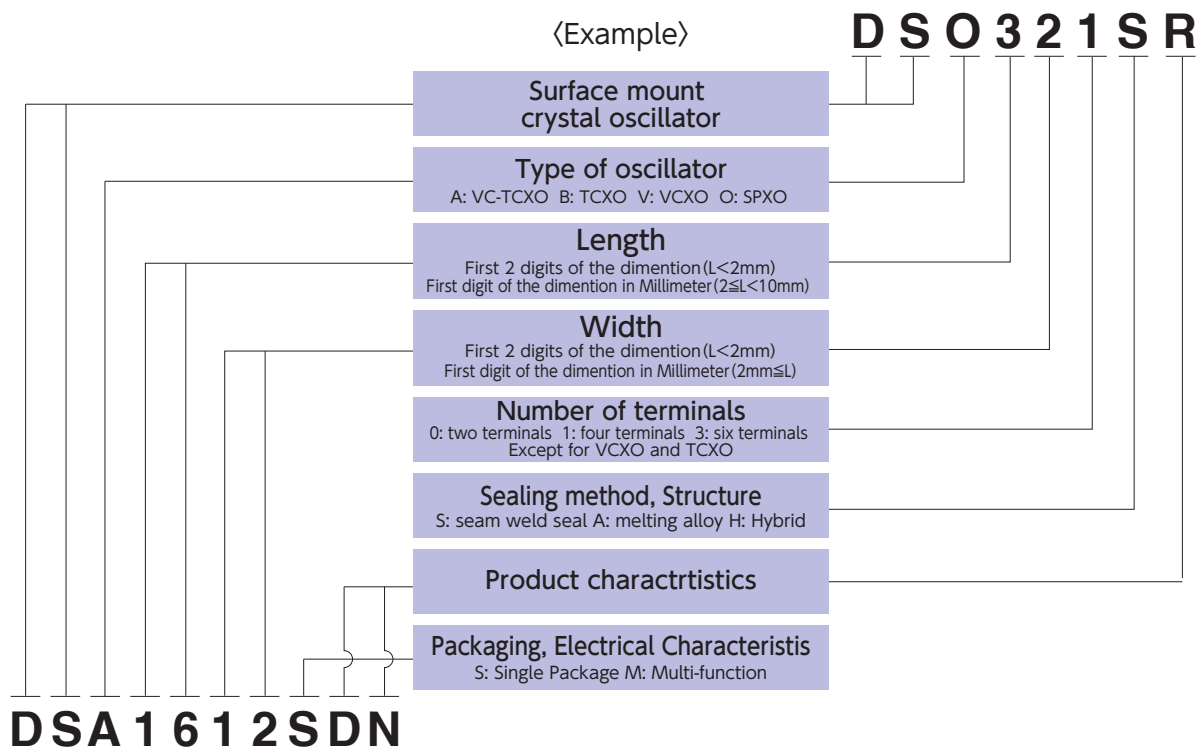
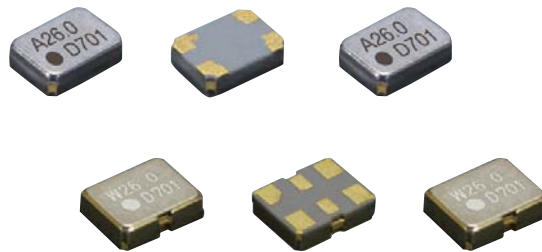


■ Load Capacitance Characteristics (Example)



Quartz Devices

Crystal oscillators



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)			Output	Frequency Range (MHz)	Frequency Characteristics over Temperature ($\times 10^{-6}$)	Operating Temperature Range (°C)	Supply Voltage (V)	Function	Recommended Application	Catalog Page										
		L	W	H (max.)																		
DSA1612SDN		1.6	1.2	0.55	CS	16 to 60	± 1.0 ± 0.5	-40 to +85	+1.68 to +3.5	VC	IE TC AE	38, 39 86, 87										
DSB1612SDN																						
DSB1612SDNB																						
DSB1612WA													0.45									
DSB1612WDB																						
DSB1612WEB																						
DSB1612WLB	0.55	13 to 104																				
DSA211SDN			2.0	1.6	0.8	CS	12.288 to 52	± 1.0 ± 0.5	-40 to +85	+1.68 to +3.63	Stb	TC	36									
DSB211SDN																						
DSB211SDNB																						
DSA221SDN	2.5	2.0	0.9	CS	9.6 to 52	± 1.0 ± 0.5	-40 to +85	+1.68 to +3.5	VC	IE TC AE	38, 39 86, 87											
DSB221SDN																						
DSB221SDNB																						
DSA321SDN												3.2	2.5	1.0	CS	9.6 to 52	± 1.0 ± 0.5	-40 to +85	+1.68 to +3.5	VC	IE TC AE	38, 39 86, 87
DSB321SDN																						
DSB321SDNB																						
DSB211SJA	2.0	1.6	0.8	CMOS	13 to 52	± 5.0	-40 to +105	+1.7 to +3.6	Stb	IE TC AE	43-83											
DSB211SLB																						
DSB221SLB	2.5	2.0	0.9	CS	12.288 to 40	± 0.5	-40 to +85	+1.1 to +1.4	Stb	TC	37											
DSB321SLB																						
DSA211SP	2.0	1.6	0.7	CS	12.288 to 52	± 1.0	-40 to +105	+1.68 to +3.5	VC	AE	85											
DSB211SP																						
DSB211SPX												2.0	1.6	0.8	CS	13 to 52	± 0.5	-40 to +105	+1.68 to +3.63	Stb	84	
DSA535SD																						
DSB535SD	5.0	3.2	1.2	CS	9.6 to 40	± 1.0 ± 0.5	-40 to +85	+2.3 to +3.6	VC	IE TC	40											
DSA535SG																						
DSB535SG																						
DSA535SGA												5.0	3.2	1.5	CS or CMOS	10 to 40	± 0.28	-40 to +85	+2.7 to +5.5	VC Stb Stb	IE TC	42
DSB535SGA																						
DSA535SGA												5.0	3.2	1.5	CS or CMOS	10 to 52	± 0.05	-40 to +85	+2.3 to +3.63	VC Stb Stb	IE TC	41
DSB535SGA																						

Clock Oscillators (SPXO)

Type	Actual Size	Size (mm)			Output	Frequency Range (MHz)	Frequency Tolerance ($\times 10^{-6}$) (Includes frequency tolerance at room temperature.)	Operating Temperature Range (°C)	Supply Voltage (V)	Current Consumption (mA)	Recommended Application	Catalog Page
		L	W	H (max.)								
DS1008JN		1.05	0.85	0.24	CMOS	1.0 to 100	± 50	-40 to +125	+0.8 to +1.6	1.9	CE TC	8
DS1008JS		1.05	0.85	0.24	CMOS	1.0 to 100	± 50	-40 to +125	+1.6 to +3.3	1.8	CE TC	9
DSO1612AR		1.6	1.2	0.58	CMOS	0.584375 to 80	± 50 ± 100	-40 to +85 -40 to +125	+1.6 to +3.6	1.4 to 3.8	CE TC AE	49 77
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	50, 51 78
DSO321SR	3.2	2.5	1.2									
DSO531SR	5.0	3.2	1.2									
DSO751SR	7.3	4.9	1.7									
DSO211AB	2.0	1.6	0.8									
DSO221SBM	2.5	2.0	0.895	CMOS	3.25 to 52	± 50	-40 to +85	+5.0	8.0	CE IE	52	
DSO321SBM	3.2	2.5	1.2									
DSO531SBM	5.0	3.2	1.2									
DSO751SBM	7.3	4.9	1.7									
DSO221SN		2.5	2.0	0.895	CMOS	12.5 to 100	± 50	-40 to +85	+0.8 to +1.6	1.2 to 6.8	CE IE	48
DSO321SN		3.2	2.5	1.2	CMOS	1.0 to 125	± 50	-40 to +125	+1.6 to +3.6	1.7 to 10.0	AE	79
DSO211SX	2.0	1.6	0.8									
DSO221SX		2.5	2.0	0.9	CMOS	1.0 to 125	± 50	-40 to +125	+1.6 to +3.6	1.7 to 10.0	CE TC	53
DSO211SXF	2.0	1.6	0.8									
DSO221SXF		2.5	2.0	0.9	CMOS	1.049 to 8.5	± 35 ± 50	-40 to +85	+1.6 to +3.6	0.7	CE TC AE	55 81
DSO211SY	2.5	2.0	0.895									
DSO321SY		3.2	2.5	1.2	CMOS	0.75 to 54	$\pm 50, \pm 100$	-10 to +85	+1.6 to +5.5	8.0	IE	59
DLO555MBA	-	5.0	4.0	5.0								

Low Phase Noise Crystal Oscillators (SPXO)

Type	Actual Size	Size (mm)			Output	Frequency Range (MHz)	Frequency Tolerance ($\times 10^{-3}$) (Includes frequency tolerance at room temperature.)	Operating Temperature Range (°C)	Supply Voltage (V)	Current Consumption (mA)	Recommended Application	Catalog Page
		L	W	H (max.)								
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	46 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	46
DSO321SH		3.2	2.5	1.2								
DSO531SHH		5.0	3.2	1.2	CMOS	20 to 50	± 50	-40 to +85	+1.62 to +3.6	2.9 to 7.7	CE TC	47

Differential Output Crystal Oscillators (SPXO)

Type	Actual Size	Size (mm)			Output	Frequency Range (MHz)	Frequency Tolerance ($\times 10^{-3}$) (Includes frequency tolerance at room temperature.)	Operating Temperature Range (°C)	Supply Voltage (V)	Current Consumption (mA)	Recommended Application	Catalog Page
		L	W	H (max.)								
DSO223SD		2.5	2.0	0.95	HCSSL	13.5 to 167	± 50 ± 80	-40 to +85 -40 to +105	+2.5, +3.3	30	CE IE TC AE	56 82
DSO223SJ					LVDS					20		
DSO223SK					LV-PECL					45		
DSO323SD		3.2	2.5	1.2	HCSSL	13.5 to 212.5 13.5 to 167	± 50 ± 80	-40 to +85 -40 to +105	+2.5, +3.3	35	CE IE TC AE	56 82
DSO323SJ					LVDS					30		
DSO323SK					LV-PECL					20		
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	57
DSO533SK					LV-PECL					50		
DSO753SD		7.3	4.9	1.7	HCSSL	13.5 to 212.5	± 50	-40 to +85	+2.5, +3.3	35	CE IE	58
DSO753SJ					LVDS					20		
DSO753SK					LV-PECL					50		
DSO753SK					LV-PECL					50		

Voltage Controlled Crystal Oscillators (VCXO)

Type	Actual Size	Size (mm)			Output	Frequency Range (MHz)	Frequency Tolerance ($\times 10^{-3}$) (Includes frequency tolerance at room temperature.)	Operating Temperature Range (°C)	Frequency Adjustment Range ($\times 10^{-3}$)	Supply Voltage (V)	Current Consumption (mA)	Recommended Application	Catalog Page
		L	W	H (max.)									
DSV321SR		3.2	2.5	1.2	CMOS	27 to 36	± 40	-30 to +85	± 90	+1.8	2.0, 3.0	CE	60
DSV321SV					6.75 to 90	± 125							
DSV323SV		3.2	2.5	1.2	CMOS	6.75 to 170	± 50	-40 to +85	± 100	+3.3	12, 25	CE TC	62
DSV531SV		5.0	3.2	1.4	CMOS	1.25 to 80	± 50	-10 to +70	± 100	+3.3	10, 15	CE	61
DSV753SB		7.3	4.9	1.7	CMOS	4.0 to 50	± 50	-40 to +85	± 100	+5.0	15	CE	63
DSV753SV					2.0 to 170	+3.3				12, 25			

Differential Output Voltage Controlled Crystal Oscillators (VCXO)

Type	Actual Size	Size (mm)			Output	Frequency Range (MHz)	Frequency Tolerance ($\times 10^{-3}$) (Includes frequency tolerance at room temperature.)	Operating Temperature Range (°C)	Frequency Adjustment Range ($\times 10^{-3}$)	Supply Voltage (V)	Current Consumption (mA)	Recommended Application	Catalog Page
		L	W	H (max.)									
DSV323SD		3.2	2.5	1.2	HCSSL	80 to 170	± 50	-40 to +85	± 100	+3.3	40	CE TC	62
DSV323SJ					LVDS						30		
DSV323SK					LV-PECL						50		
DSV753SD		7.3	4.9	1.7	HCSSL	80 to 170	± 50	-40 to +85	± 100	+3.3	40	CE	63
DSV753SJ					LVDS						30		
DSV753SK					LV-PECL						50		
DSV753SK					LV-PECL						50		

Real Time Clock Module (RTC) / kHz Band TCXO

Type	Actual Size	Size (mm)			Output	Frequency Range (kHz)	Frequency Tolerance ($\times 10^{-3}$) (Includes frequency tolerance at room temperature.)	Operating Temperature Range (°C)	Supply Voltage (V)	Current Consumption (μA)	Temperature Compensated Type	Recommended Application	Catalog Page
		L	W	H (max.)									
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	44-88
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	45-89

kHz Band SPXO

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

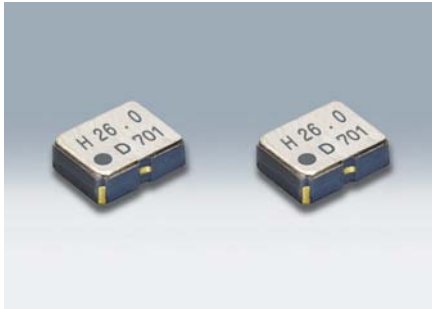
RTC is a high-precision crystal application product with built-in tuning-fork crystal oscillator, has an interrupt function and data provide function necessary for calendar clock function, such as year, month, day, hour, minute and second.

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.
Stand-by 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

DSB1612WA



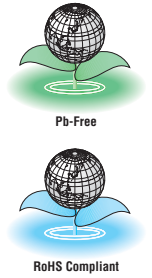
Actual size □

■ Features

- H structure
- Low voltage operation
- Low phase noise

■ Applications

- Mobile phones
- GPS/GNSS and Industrial radio communications



■ Standard Specification

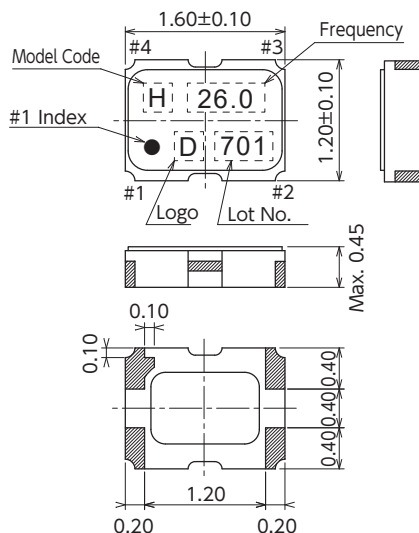
Item	Type	DSB1612WA		
Frequency Range		26MHz/38.4MHz/52MHz		
Standard Frequency		26MHz		
Supply Voltage Range		+1.68 to +3.5V		
Supply Voltage (Vcc)		+1.8V/+2.6V/+2.8V/+3.0V/+3.3V		
Current Consumption		+1.5mA max. (f≤26MHz) /+2.0mA max. (26<f≤52MHz) /+2.5mA max. (f≤60MHz)		
Output Level		0.8Vp-p min. (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 , ±2.5×10 ⁻⁶ max./-30 to +85°C ±0.5×10 ⁻⁶ , ±2.5×10 ⁻⁶ max./-40 to +85°C (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		
Start up Time		2.0ms max.		
Phase Noise		[f≤26MHz]	[26MHz<f≤40MHz]	[40MHz<f≤52MHz]
Offset 100Hz		-115dBc/Hz	-110dBc/Hz	-105dBc/Hz
Offset 1kHz		-130dBc/Hz	-130dBc/Hz	-125dBc/Hz
Offset 10kHz		-150dBc/Hz	-150dBc/Hz	-145dBc/Hz
Offset 100kHz		-155dBc/Hz	-155dBc/Hz	-150dBc/Hz
Packing Unit (1)		3000pcs./reel (φ180)		

(1) Moisture prevention packing

Consult our sales representative for other specifications.

[mm]

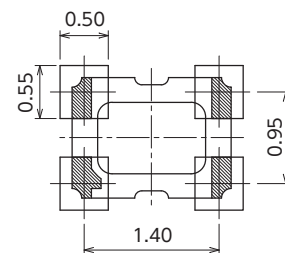
■ Dimensions



■ Recommended Land Pattern

<Top View>

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



High-precision SMD TCXO

DSB1612WLB/DSB1612WDB/DSB1612WEB

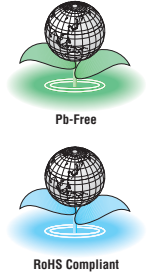
NEW



Actual size □

■ Features

- Low voltage operation: +1.2V (DSB1612WLB)
+1.8V (DSB1612WDB, DSB1612WEB)
- Low current consumption: +1.1mA max.
(DSB1612WLB, 26MHz, +1.8V)
- Low phase noise: $f_{out} \pm 100\text{kHz}$ -168dBc/Hz(Typ.)
(DSB1612WDB, 26MHz)
- Capable of operating over a wide temperature range,
from -40 up to +105°C (DSB1612WEB)



■ Applications

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

*Scheduled to be released in April 2021

■ Standard Specification

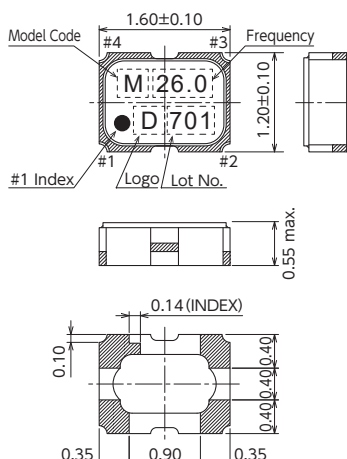
Item	Type	DSB1612WLB	DSB1612WDB	DSB1612WEB
Frequency Range		13 to 52MHz		24 to 104MHz
Standard Frequency		26MHz	26MHz/ 52MHz	52MHz/ 76.8MHz
Supply Voltage Range		+1.1 to +2.0V/ +1.68 to +2.0V	+1.68 to +3.63V	
Supply Voltage (Vcc)		+1.2V/ +1.8V	+1.8V/ +2.5V/ +2.8V/ +3.3V	
Current Consumption		+1.1mA max. (+1.8V, 26MHz) +1.8mA max. (+1.2V, 26MHz)	+2.5mA max. (26MHz) +3.0mA max. (52MHz)	+3.0mA max. (52MHz) +4.0mA max. (76.8MHz)
Stand-by Current (#1 pin "L" Level)		+6.0μA max.		
Output Level		0.8Vp-p min. (Clipped Sinewave/DC-coupled)		
Output Load		10kΩ//10pF		
Frequency Stability Tolerance		±1.5×10 ⁻⁶ max. (After 2 reflows)		
vs. Temperature		±0.5 × 10 ⁻⁶ max./-30 to +85°C ±0.5 × 10 ⁻⁶ max./-40 to +85°C (option)		±0.5 × 10 ⁻⁶ max./-30 to +85°C ±0.5 × 10 ⁻⁶ max./-40 to +85°C (option) ±5.0 × 10 ⁻⁶ max./-40 to +105°C (option)
vs. Supply Voltage		±0.2×10 ⁻⁶ max. (Vcc ±5%)		±0.1×10 ⁻⁶ max. (Vcc ±5%)
vs. Load Variation		±0.2×10 ⁻⁶ max. (10kΩ//10pF±10%)		±0.1×10 ⁻⁶ max. (10kΩ//10pF±10%)
vs. Aging		±1.0×10 ⁻⁶ max./year		±2.0×10 ⁻⁶ max./year
0 Level Output Voltage		Vcc×0.2		
1 Level Output Voltage		Vcc×0.8		
Start Up Time		2.0ms max.		
Phase Noise		26MHz (typ.)	26MHz (typ.)	52MHz (typ.)
Offset 100Hz		-115dBc/Hz	-119dBc/Hz	-113dBc/Hz
Offset 1kHz		-135dBc/Hz	-141dBc/Hz	-135dBc/Hz
Offset 10kHz		-145dBc/Hz	-158dBc/Hz	-153dBc/Hz
Offset 100kHz		-148dBc/Hz	-168dBc/Hz	-164dBc/Hz
Packing Unit (1)		3000pcs./reel (φ180)		

(1) Moisture prevention packing

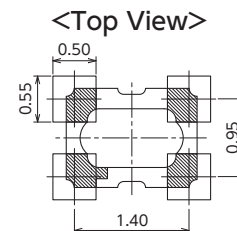
Consult our sales representative for other specifications.

[mm]

■ Dimensions



■ Recommended Land Pattern



Model Code
M : DSB1612WLB
K : DSB1612WDB
R : DSB1612WEB

Pin Connections

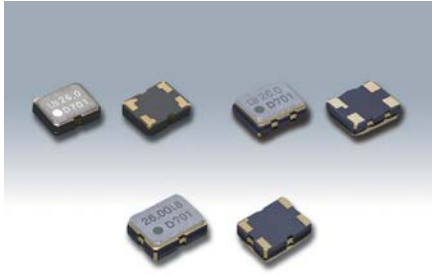
Pin No.	Connection
#1	OE (Output Enable)
#2	GND
#3	Output
#4	Vcc

Function

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

High-precision SMD TCXO

DSB211SLB/DSB221SLB/DSB321SLB



■ Features

- Low voltage operation
(Supply Voltage Range:+1.1 to +1.4V)
- Low phase noise
- Single packaged structure

■ Applications

- GPS/GNSS
- Industrial radio communications



[Type]

TCXO	Size
DSB211SLB	2016 size
DSB221SLB	2520 size
DSB321SLB	3225 size

Actual size DSB211SLB DSB221SLB
DSB321SLB

■ Standard Specification

Item	Type	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(#1 pin "L" Level)		+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°C		
vs. Supply Voltage		±0.5×10 ⁻⁶ max. / -40 to +85°C (Option)		
vs. Load		±0.1×10 ⁻⁶ max. (Vcc±5%)		
vs. Aging		±0.1×10 ⁻⁶ max. (10kΩ//10pF ±10%)		
Start up time		2.0msec. max.		
Phase Noise				
Offset 100Hz	[f ≤ 15MHz]	-115dBc/Hz	[15MHz < f ≤ 26MHz]	[26MHz < f ≤ 40MHz]
Offset 1kHz		-135dBc/Hz		-105dBc/Hz
Offset 10kHz		-145dBc/Hz		-125dBc/Hz
Offset 100kHz		-145dBc/Hz		-135dBc/Hz
				-145dBc/Hz
Packing Unit (1)		3000pcs./reel (φ180)		2000pcs./reel (φ180)

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

Consult our sales representative for other specifications.

■ DSB211SLB

[mm] ■ DSB221SLB

[mm] ■ DSB321SLB

[mm]

■ Dimensions

Model Code: LB 26.0, D 701

Frequency

#1 Index, Logo, Lot No.

■ Recommended Land Pattern

<Top View>

Pin Connections

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

■ Dimensions

Model Code: LB 26.0, D 701

Frequency

#1 Index, Logo, Lot No.

■ Recommended Land Pattern

<TOP View>

Pin Connections

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

■ Dimensions

Model Code: 26.00LB, D 701

Frequency

#1 Index, Logo, Lot No.

■ Recommended Land Pattern

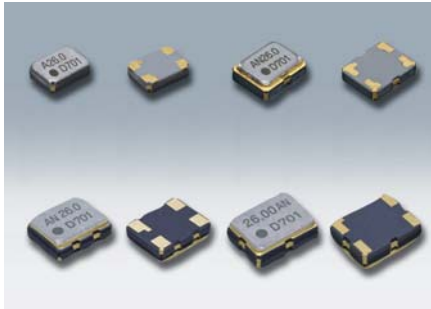
<Top View>

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, DSB1612SDNB/DSB211SDN, DSB211SDNB/DSB221SDN, DSB221SDNB/DSB321SDN, DSB321SDNB



Actual size DSA1612SDN □ DSA211SDN □
DSA221SDN □ DSA321SDN □

■ Features

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

■ Applications

- Mobile phones
- GPS/GNSS and Industrial radio communications



[Type]

VC-TCXO	TCXO	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 (#1 pin "L" Level)		-								+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°C ±1.0×10 ⁻⁶ , ±2.5×10 ⁻⁶ max./-40 to +85°C (Option)				±0.5×10 ⁻⁶ , ±2.5×10 ⁻⁶ max./-30 to +85°C ±0.5×10 ⁻⁶ , ±2.5×10 ⁻⁶ max./-40 to +85°C (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		[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			
Packing Unit (1)		DSA1612SDN/DSA211SDN/DSA221SDN, DSB1612SDN/DSB211SDN/DSB221SDN, DSB1612SDNB/DSB211SDNB/DSB221SDNB: 3000pcs./reel (φ180) DSA321SDN, DSB321SDN, DSB321SDNB: 2000pcs./reel (φ180)											

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

Consult our sales representative for other specifications.

High-precision SMD VC-TCXO/TCXO

For Mobile communications/Industrial system/GPS/GNSS

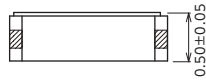
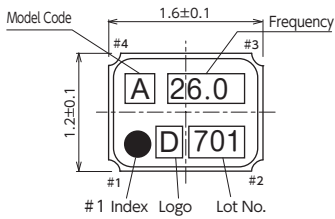
Dimensions

[mm]

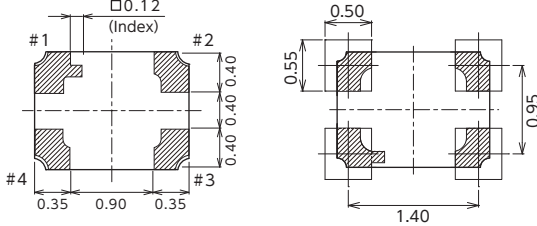
■ DSA1612SDN/DSB1612SDN/DSB1612SDNB

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



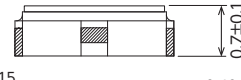
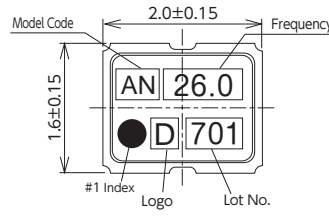
■ Recommended Land Pattern <Top View>



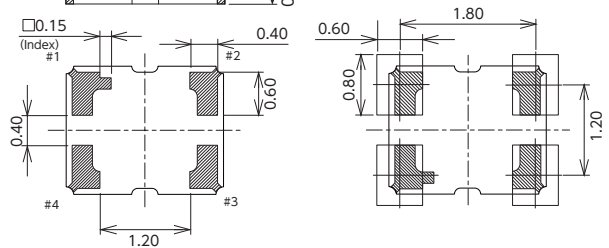
■ DSA211SDN/DSB211SDN/DSB211SDNB

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



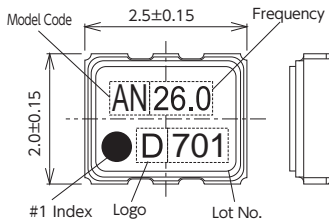
■ Recommended Land Pattern <Top View>



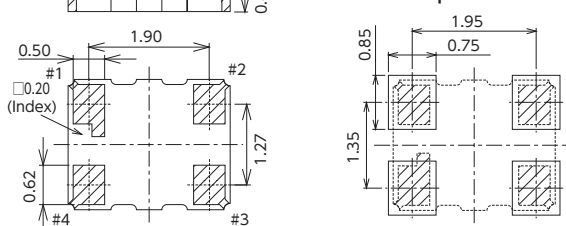
■ DSA221SDN/DSB221SDN/DSB221SDNB

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



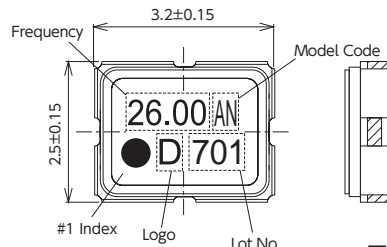
■ Recommended Land Pattern <Top View>



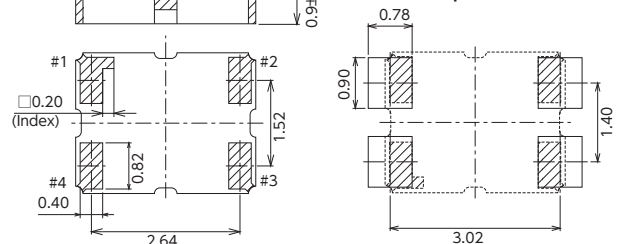
■ DSA321SDN/DSB321SDN/DSB321SDNB

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

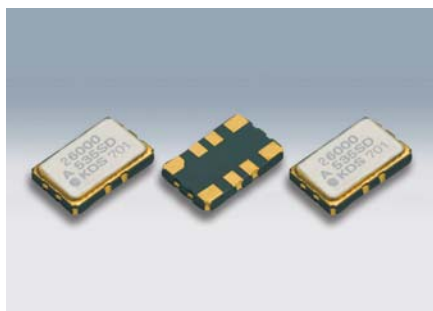


■ Recommended Land Pattern <Top View>



High-precision SMD VC-TCXO / TCXO

DSA535SD, DSB535SD



Actual size

Features

- 5032 size
- Low phase noise
- Single package structure

Applications

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



Standard Specification

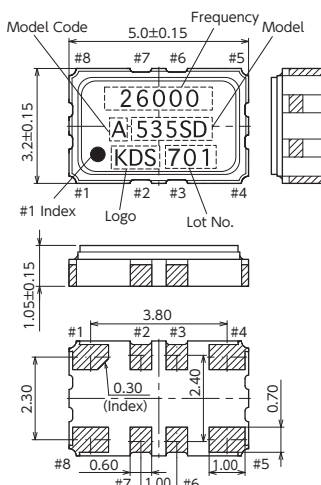
Item	DSA535SD (VC-TCXO)	DSB535SD (TCXO)	
Frequency Range	9.6 to 40MHz		
Standard Frequency	13MHz/ 19.2MHz/ 26MHz	16.3676MHz/ 16.367667MHz/ 16.368MHz/ 16.369MHz/ 16.8MHz/ 26MHz	
Supply Voltage Range	+2.3 to +3.6V		
Supply Voltage (Vcc)	+2.6V/ +2.8V/ +3.0V / +3.3V		
Current Consumption	+1.5mA max. (f≤26MHz)/+2.0mA 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	±1.0×10 ⁻⁶ max. / -30 to +85°C	±0.5×10 ⁻⁶ max. / -30 to +85°C	
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	—	
Response Slope	Positive	—	
Phase Noise	[f≤15MHz]	[15MHz<f≤26MHz]	[26MHz<f≤40MHz]
Offset 100Hz	-115dBc/Hz	-110dBc/Hz	-105dBc/Hz
Offset 1kHz	-135dBc/Hz	-130dBc/Hz	-125dBc/Hz
Offset 10kHz	-145dBc/Hz	-140dBc/Hz	-135dBc/Hz
Offset 100kHz	-145dBc/Hz	-145dBc/Hz	-145dBc/Hz
Packing Unit (1)	1000pcs./reel(φ180), 4000pcs./reel(φ330)		

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

Consult our sales representative for other specifications.

[mm]

Dimensions

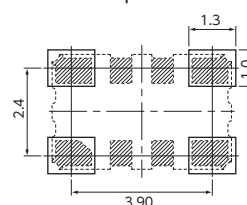


Model Code
A: VC-TCXO (DSA535SD)
B: TCXO (DSB535SD)

Pin Connections	
Pin No.	Connection
#1	Vcont(VC-TCXO)/GND(TCXO)
#2	N.C.(Test Terminal)
#3	N.C.(Test Terminal)
#4	GND
#5	Output
#6	N.C.(Test Terminal)
#7	N.C.(Test Terminal)
#8	Vcc

Recommended Land Pattern

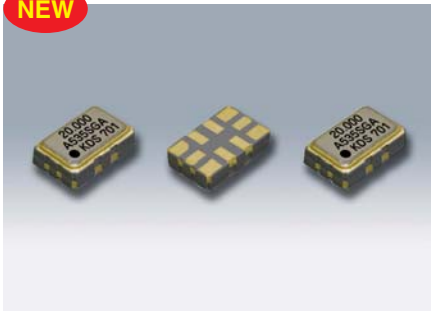
<Top View>



Ultra High-precision SMD VC-TCXO/TCXO

DSA535SGA/DSB535SGA for Stratum3/ Femtocell

NEW



Actual size

■ Features

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

■ Applications

- Stratum3, 5G, Networking, Base station



■ Standard Specification

Item	DSA535SGA (VC-TCXO)		DSB535SGA (TCXO)	
	Output Frequency Range	10 to 52MHz		
Standard Frequency	10MHz/ 19.2MHz/ 20MHz/ 38.88MHz			
Supply Voltage (Range)	+2.3 to +3.63V			
Supply Voltage (Vcc)	+2.8V/ +3.0V/ +3.3V			
Current Consumption	+4.0mA max. (Clipped sine wave)/ +8.0mA max. (CMOS)			
Output Level	Clipped sine wave 0.8Vp-p min. (DC-coupled)	CMOS '0'level 0.1×Vcc V max. '1'level 0.9×Vcc V 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	±0.10×10 ⁻⁶ max./-40 to +85°C			
vs. Hysteresis	±0.05×10 ⁻⁶ max./-40 to +85°C (Option)			
vs. Supply Voltage	±0.20×10 ⁻⁶ max./-40 to +105°C			
vs. Load Variation	±0.1×10 ⁻⁶ max.			
vs. Aging	±0.1×10 ⁻⁶ max. (Vcc±5%)			
Total Frequency Tolerance	±0.20×10 ⁻⁶ max. (10kΩ//10pF±10%/ 15pF ±10%)			
Frequency Control Control Sensitivity	±3.0 to 5.0 x 10 ⁻⁶ /Vcont=+1.5±1.0V		—	
Response Slope	Positive		—	
Phase Noise	20MHz (typ.)		20MHz (typ.)	
Offset 100Hz	-118dBc/Hz		-120dBc/Hz	
Offset 1kHz	-139dBc/Hz		-141 dBc/Hz	
Offset 10kHz	-155dBc/Hz		-155dBc/Hz	
Offset 100kHz	-158dBc/Hz		-158dBc/Hz	
Packing Unit (1)	1000pcs./reel (φ180), 4000pcs./reel (φ330)			

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

Consult our sales representative for other specifications.

[mm]

■ Dimensions

■ Recommended Land Pattern

<Top View>

Model Code
A : VC-TCXO (DSA535SGA)
B : TCXO (DSB535SGA)

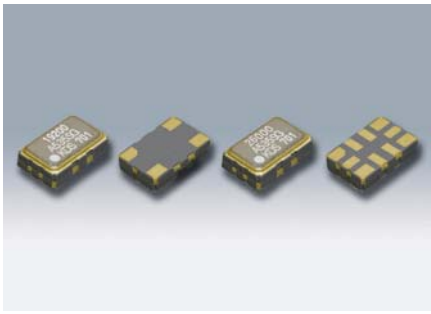
Pin Connections

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.
#8	GND(N.C.)
#9	Vcc
#10	GND(N.C.)

() Internal connection

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
- 10 terminals or 4 terminals

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		Clipped sine wave 0.8Vp-p min. (DC-coupled)	CMOS	
		'0'level 0.1 × VCC V max. '1'level 0.9 × VCC V max.			'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°C					
vs. Hysteresis	±0.10 × 10 ⁻⁶ max./ -10 to +70°C (Option)					
vs. Supply Voltage	±0.10 × 10 ⁻⁶ max.					
vs. Load Variation	±0.20 × 10 ⁻⁶ max. (VCC ± 5%)					
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				—	
Response Slope	± 3.0 × 10 ⁻⁶ to ± 5.0 × 10 ⁻⁶ / Vcont = +2.5V ± 2V (O.P.VCC = 5V)				—	
Phase Noise	[10MHz ≤ f ≤ 20MHz]		[20MHz < f ≤ 40MHz]			
	Offset 100Hz		-110dBc/Hz			
	Offset 1kHz		-132dBc/Hz			
	Offset 10kHz		-148dBc/Hz			
	Offset 100kHz		-150dBc/Hz			
Packing Unit (1)	1000pcs./reel (φ 180), 4000pcs./reel (φ 330)					

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

Consult our sales representative for other specifications.

DSA535SG/DSB535SG (4 terminals)

DSA535SG/DSB535SG (10 terminals)

[mm]

Dimensions

Model Code
A : VC-TCXO (DSA535SG)
B : TCXO (DSB535SG)
Pin Connections (4 terminals)
Pin No. | Connection
#1 | VCONT (VC-TCXO) / GND (TCXO)
#2 | GND
#3 | Output
#4 | Vcc

Recommended Land Pattern
<Top View>

Dimensions

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

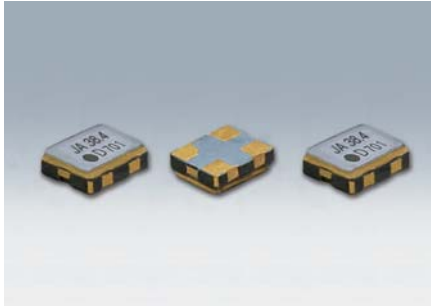
(*) Internal connection
Extra low phase noise mode with external VC_FILTER (Cvc = 0.033μF)

Recommended Land Pattern
<Top View>

Connect to GND
Bypass Capacitance
Option VC_Filter Capacitance
Connect to GND
Connect to Test Circuit
DC-cut Capacitance

SMD TCXO

DSB211SJA



Actual size

Features

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

Applications

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



Standard Specification

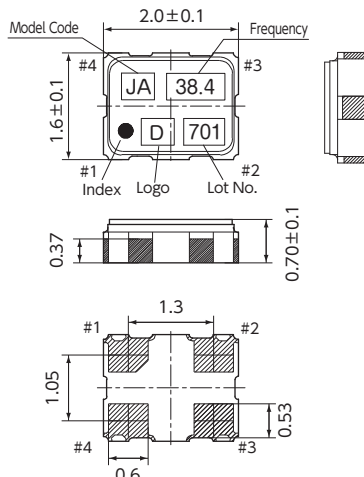
Item	Type	DSB211SJA
Frequency Range		13 to 52MHz
Standard Frequency		19.2MHz/ 25MHz/ 26MHz/ 32MHz/ 38.4MHz/ 40MHz/ 48MHz/ 52MHz
Supply Voltage (Vcc)		+1.8V/ +2.5V/ +2.8V/ +3.3V
Current Consumption		5.0mA max. [No Load]
Stand-by Current (#1 pin "L" Level)		+10μA max.
Frequency Stability Tolerance		±1.5×10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

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

Consult our sales representative for other specifications.

[mm]

Dimensions



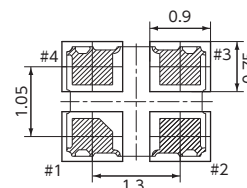
Pin Connections

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

Function	#3 Output condition
H	Oscillation out
L	High Z

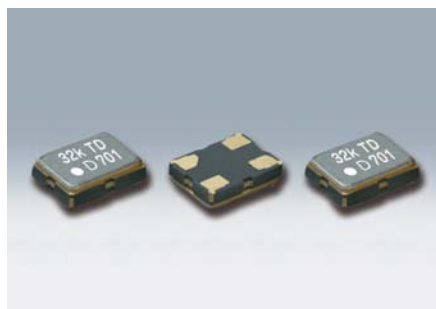
Recommended Land Pattern

<Top View>



SMD TCXO

DSK321STD



Actual size

■ Features

- Digital temperature compensated type
- High precision : $\pm 5.0 \times 10^{-6}$ (−40 to +85°C)
 $\pm 3.8 \times 10^{-6}$ (−10 to +60°C)
- Low current consumption
- AEC-Q100/AEC-Q200 compliant

■ Applications

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



■ Standard Specification

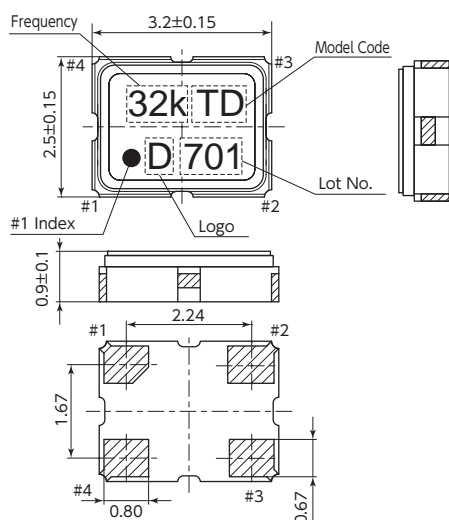
Item	Legend	Spec.				Unit	Condition
		min.	typ.	max.			
Output Frequency	f _o	—	32.768	—		kHz	
Supply Voltage Range	V _{cc}	+2.0	—	+5.5	V		(Temperature Compensated Operating)
		+1.3	—	+5.5			(Clock Timing Operating)
Frequency Tolerance	f _{tol}	−5.0	—	+5.0	× 10 ^{−6}		−40 to +85°C
		−3.8	—	+3.8			−10 to +60°C
Current Consumption	I _{cc}	—	+1.2	+2.5	μA		V _{cc} =+3.3V, Temperature Compensation Interval:0.5s, No Load
		—	+1.7	+3.2			V _{cc} =+5.0V, Temperature Compensation Interval:0.5s, No Load
		—	+1.0	+2.0			V _{cc} =+3.3V, Temperature Compensation Interval:2.0s, No Load
		—	+1.5	+3.0			V _{cc} =+5.0V, Temperature Compensation Interval:2.0s, No Load
Symmetry	SYM	40	50	60	%		at 50% V _{cc}
0 Level Output Voltage	V _{OL}	—	—	+0.4	V		
1 Level Output Voltage	V _{OH}	V _{cc} -0.4	—	—			
Rise and Fall Time	tr, tf	—	—	50	ns		V _{cc} =+2.0 to +5.5V, 10 to 90% V _{cc} Level
		—	—	200			V _{cc} =+1.3 to +5.5V, 10 to 90% V _{cc} Level
Load Condition	L _{CMOS}	—	—	15	pF		
Start Up Time	T _{start}	—	—	3.0	s		
Packing Unit (1)		2000pcs./reel (φ 180)					

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

Consult our sales representative for other specifications.

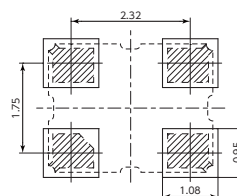
[mm]

■ Dimensions



■ Recommended Land Pattern

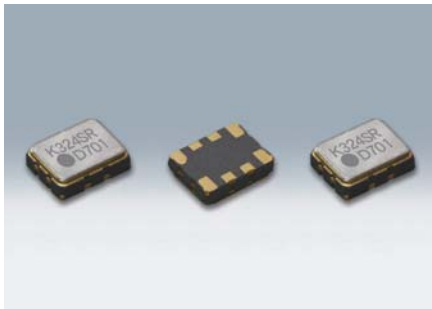
<Top View>



Pin No.	Connection
#1	V _{cc}
#2	GND
#3	Output
#4	V _{cc}

SMD Real Time Clock Module

DSK324SR



Actual size

■ Features

- Digital temperature compensated type
- High precision : $\pm 5.0 \times 10^{-6}$ (−40 to +85°C)
 $\pm 3.8 \times 10^{-6}$ (−10 to +60°C)
- Low current consumption
- Low voltage operation : +2.0 to +5.5V(Temperature Compensated Operating)
+1.3 to +5.5V(Clock Timing Operating)
- I²C-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/AEC-Q200 compliant



■ Applications

- High precision clock source

"I²C-BUS" is a registered trademark of NXP Semiconductor

■ Standard Specification

Item	Legend	Spec.			Unit	Condition
		min.	typ.	max.		
Output Frequency	f _o	—	32.768	—	kHz	
Supply Voltage Range	V _{cc}	+1.3	—	+5.5	V	(Clock Timing Operating)
	V _{tem}	+2.0	—	+5.5		(Temperature Compensated Operating)
	V _{int}	+1.5	—	+5.5		(Interface Operation) I ² C-BUS
Frequency Tolerance	f _{tol}	−5.0	—	+5.0	× 10 ^{−6}	−40 to +85°C
		−3.8	—	+3.8		−10 to +60°C
Current Consumption	I _{cc1}	—	+0.6	+2.0	μA	V _{cc} = +3.0V, Temperature Compensation Interval:30s, SCL=SDA=INTN=V _{cc} ,CLKOE=GND (Output Off)
	I _{cc2}	—	+1.5	+4.0	μA	V _{cc} = +3.0V, Temperature Compensation Interval:30, No Load, SCL=SDA=INTN=CLKOE=V _{cc} (Output On)
Load Condition	L _{CMOS}	—	—	15	pF	
Start Up Time	T _{start}	—	—	1.0	s	T _a = +25°C, V _{cc} = +1.3V
		—	—	3.0		T _a = −40 to +85°C, V _{cc} = +1.3 to +5.5V
Power Supply Detection Voltage	V _{DET1} (1)	+1.8	+1.9	+2.0	V	Temperature Compensated Operation Detection Voltage Power Supply Undervoltage Detection
	V _{DET2} (2)	+1.3	+1.4	+1.5		
Packing Unit (3)		2000pcs./reel (φ 180)				

(1) When V_{cc} 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 V_{cc} rises above V_{DET1} again, the intermittent temperature compensating is enabled.

(2) The Detection circuit operates at the temperature compensation interval.

(3) Moisture prevention packing is unnecessary.

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

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	V _{cc}	—	Supply Voltage

[mm]

■ Dimensions

■ Recommended Land Pattern

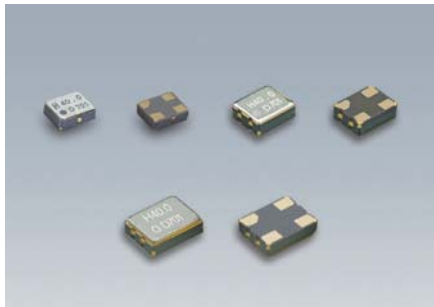
<Top View>

Pin Connections	
Pin No.	Connection
#1	OE(Output Enable)
#2	INTN
#3	N.C.
#4	GND
#5	Output
#6	SCL
#7	SDA
#8	V _{cc}

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

SMD Low Phase Noise 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 : $f_{out} \pm 1\text{kHz}$ $-145 \text{ dBc/Hz(Typ.)}$
 $f_{out} \pm 100\text{kHz}$ $-158 \text{ dBc/Hz(Typ.)}$
- Low profile : 0.72mm(DSO211AH), 0.815mm(DSO221SH),
1.1mm(DSO321SH)
- AEC-Q100/AEC-Q200 Compliant
- 3-state function

■ Applications

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

[Type]	Model	Size
	DSO211AH	2016 size
	DSO221SH	2520 size
	DSO321SH	3225 size



[Function Code]

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

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	*	DSO211AH $1.2 \leq f_0 \leq 80$ DSO221/321SH $3.5 \leq f_0 \leq 52$	V _{CC}	+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			
Frequency Tolerance (Includes frequency tolerance at room temperature.)	*	A	DSO211AH $1.2 \leq f_0 \leq 80$ DSO221/321SH $3.5 \leq f_0 \leq 52$	f _{tol}	-100	-	+100	$\times 10^{-6}$	-40 to +85°C -10 to +70°C (Standard Operating Temperature Range)	
		B			-50	-	+50			
		C			-30	-	+30			
		D			-25	-	+25			
		E			-20	-	+20			
Current Consumption	A,M	*	$1.2 \leq f_0 \leq 60$ $60 < f_0 \leq 80$	I _{CC}	-	-	4.0	mA	No Load	
	B	*			-	-	5.0			
	C	*			-	-	3.6			
		*			-	-	4.5			
Stand-by Current (#1 pin "L" Level)	*	*	*	I _{std}	-	-	10	μA		
	*	*	*	L _{CMOS}	-	-	15	pF		
	*	*	*	SYM	45	50	55	%	at 50% V _{CC}	
	*	*	*	V _{OL}	-	-	V _{CC} ×0.1	V		
Rise and Fall Time	*	*	*	tr, tf	-	-	6 (5)	ns	10 to 90% V _{CC} Level (20 to 80% V _{CC} Level)	
OE Pin 0 Level Input Voltage	*	*	*	V _{IL}	-	-	V _{CC} ×0.2	V		
OE Pin 1 Level Input Voltage	*	*	*	V _{IH}	V _{CC} ×0.8	-	-	V		
Output Disable Time	*	*	*	t _{PLZ}	-	-	150	ns		
Output Enable Time	*	*	*	t _{PZL}	-	-	5	ms		
Phase Noise	A,M,B,C	*	$1.2 \leq f_0 \leq 60$	-	-	-145	-	dBc/Hz	Offset 1kHz	
	D				-	-140	-			
	A,M,B,C		$60 < f_0 \leq 80$		-	-135	-			
	D				-	-135	-			
	A,M,B,C		$1.2 \leq f_0 \leq 60$		-	-158	-			Offset 100kHz
	D				-	-152	-			
A,M,B,C	$60 < f_0 \leq 80$	-	-155	-						
D		-	-150	-						
Period Jitter (1)	*	*	*	t _{RMS}	-	2.4	-	ps	σ Peak to peak	
Total Jitter (1)	*	*	*	t _{TL}	-	34	-	ps	t _{DJ} +n×t _{RJ} n=14.1 (BER=1×10 ⁻¹⁵) (2)	
Phase Jitter	*	*	$40 \leq f_0 \leq 80$ $10 \leq f_0 < 40$	t _{pj}	-	-	1	ps	f _o offset: 12kHz to 20MHz f _o offset: 12kHz to 5MHz	
Packing Unit (3)	DSO211AH: 3000pcs./reel (φ180) , DSO221SH/DSO321SH: 2000pcs./reel (φ180)									

- (1) Measured WAVECREST DTS-2075
- (2) t_{DJ} : Deterministic jitter t_{RJ} : Random jitter
- (3) Moisture prevention packing is unnecessary.
Moisture Sensitivity Level : Level 1 (IPC/JEDEC J-STD-033)

Consult our sales representative for other specifications.

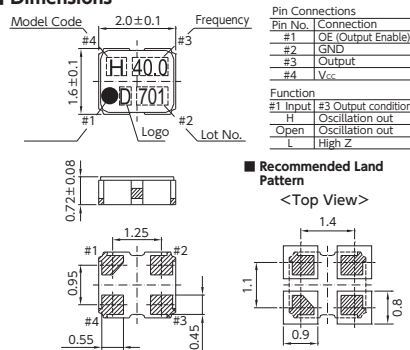
■ DSO211AH

[mm] ■ DSO221SH

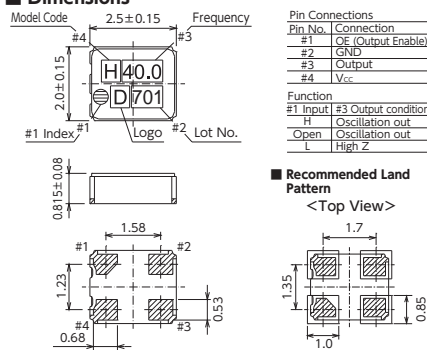
[mm] ■ DSO321SH

[mm]

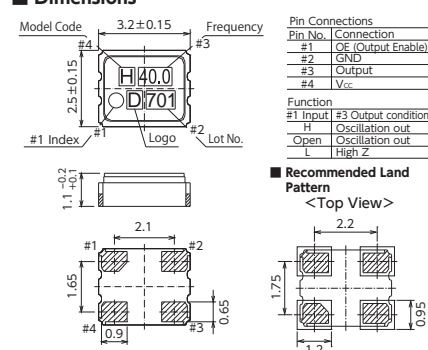
■ Dimensions



■ Dimensions

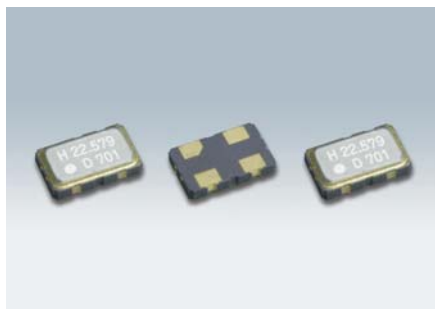


■ Dimensions



SMD Low Phase Noise Crystal Oscillators

DSO531SHH



Actual size

■ Features

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

■ Applications

- High quality audio equipment, Communication equipment and visual applications

[Function Code]

DSO531SHH A A

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

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



■ Standard Specification

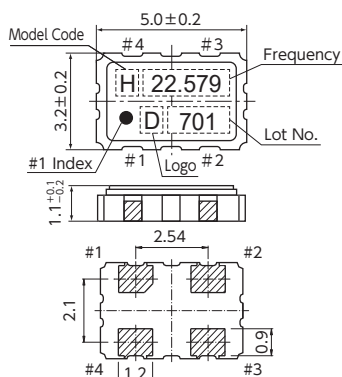
Item	Function Code		Output Frequency Range (MHz)	Legend	Spec.				Condition	
	Supply Voltage	Frequency tolerance			min.	typ.	max.	Unit		
Supply Voltage	A	*	$20 \leq f_o \leq 50$	V _{cc}	+3.0	+3.3	+3.6	V		
	B				+2.6	+2.8	+3.0			
	C				+2.25	+2.5	+2.75			
	D				+1.62	+1.8	+2.0			
Frequency Tolerance (Includes frequency tolerance at room temperature.)	*	A	*	f _{tol}	-100	-	+100	$\times 10^{-6}$	-40 to +85°C	-10 to +70°C (Standard Operating Temperature Range)
		B			-50	-	+50			
		C			-30	-	+30			
		D			-25	-	+25			
Current Consumption	A	*	$20 \leq f_o \leq 50$	I _{cc}	-	-	7.7	mA	No Load	
	B				-	-	5.5			
	C				-	-	4.8			
	D				-	-	2.9			
Stand-by Current (#1 pin "L" Level)	A	*	$20 \leq f_o \leq 50$	I _{std}	-	-	35	μA		
	B				-	-	32			
	C				-	-	30			
	D				-	-	25			
Symmetry	*	*	*	SYM	45	50	55	%	50% V _{cc} Level	
0 Level Output Voltage	*	*	*	V _{OL}	-	-	V _{cc} ×0.1	V		
1 Level Output Voltage	*	*	*	V _{OH}	V _{cc} ×0.9	-	-	V		
Rise and Fall Time	A	*	*	tr,tf	-	-	2.1	ns	10 to 90% V _{cc} Level	
	B				-	-	2.5			
	C				-	-	2.7			
	D				-	-	4.7			
Load Condition	*	*	*	L _{CMOS}	-	-	15	pF		
OE Pin 0 Level Input Voltage	*	*	*	V _{IL}	-	-	V _{cc} ×0.3	V		
OE Pin 1 Level Input Voltage	*	*	*	V _{IH}	V _{cc} ×0.7	-	-	V		
Output Enable Time	*	*	*	t _{PZL}	-	-	1	ms		
Output Disable Time	*	*	*	t _{PLZ}	-	-	10	μs		
Phase Noise	A	*	$20 \leq f_o \leq 50$	-	-	-160	-	dBc/Hz	Offset 1kHz	
	D	*			-	-158	-			
	A	*			-	-172	-		Offset 100kHz	
	D	*			-	-166	-			
Packing Unit (1)	1000pcs./reel($\phi 180$)									

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

Consult our sales representative for other specifications.

[mm]

■ Dimensions



Pin Connections

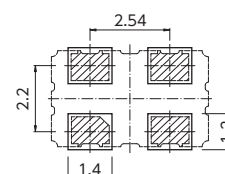
Pin No.	Connection
#1	OE(Output Enable)
#2	GND
#3	Output
#4	V _{cc}

Function

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

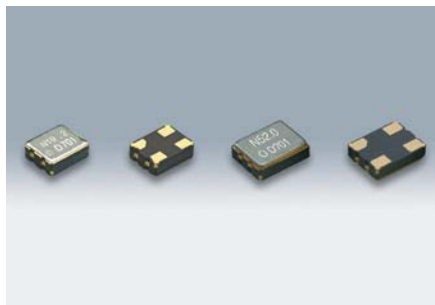
■ Recommended Land Pattern

<Top View>



SMD Crystal Oscillators

DSO221SN/DSO321SN



Actual size DSO221SN DSO321SN

■ Features

- Supply Voltage: 0.9V/1.2V/1.3V/1.5V
- Available frequency range : 12.5 to 100MHz
- Low profile: 0.815mm (DSO221SN), 1.1mm (DSO321SN)

■ Applications

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



[Function Code]
DSO****N E A

E : 1.5V	A : $\pm 100 \times 10^{-6}$
F : 1.3V	B : $\pm 50 \times 10^{-6}$
H : 1.2V	C : $\pm 30 \times 10^{-6}$
G : 0.9V	D : $\pm 25 \times 10^{-6}$
	E : $\pm 20 \times 10^{-6}$

[Type]	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	*	$12.5 \leq f_0 \leq 100$	V _{CC}	+1.4	+1.5	+1.6	V		
	F				+1.2	+1.3	+1.4			
	H				+1.1	+1.2	+1.3			
	G				+0.8	+0.9	+1.0			
Frequency Tolerance (Includes frequency tolerance at room temperature.)	*	A	*	f _{tol}	-100	-	+100	$\times 10^{-6}$	-40 to +85°C	-10 to +70°C (Standard Operating Temperature Range)
		B			-50	-	+50			
		C			-30	-	+30			
		D			-25	-	+25			
		E			-20	-	+20			
Current Consumption	E, F, H	*	$12.5 \leq f_0 \leq 50$ $50 < f_0 \leq 100$	I _{CC}	-	-	2.0	mA	No Load	
					-	-	6.8			
	G		$12.5 \leq f_0 \leq 50$ $50 < f_0 \leq 100$	-	-	1.2	mA			
			-	-	3.2					
Stand-by Current (#1 pin "L" Level)	*	*	*	I _{std}	-	-	20	μ A		
Load Condition	*	*	*	L _{CMOS}	-	-	15	pF		
Symmetry	*	*	*	SYM	45	50	55	%	50% V _{CC} Level	
0 Level Output Voltage	*	*	*	V _{OL}	-	-	V _{CC} × 0.1	V		
1 Level Output Voltage	*	*	*	V _{OH}	V _{CC} × 0.9	-	-	V		
Rise and Fall Time	E, F H, G	*	*	tr, tf	-	-	4	ns	10 to 90% V _{CC} Level	
					-	-	8			
OE Pin 0 Level Input Voltage	*	*	*	V _{IL}	-	-	V _{CC} × 0.2	V		
OE Pin 1 Level Input Voltage	*	*	*	V _{IH}	V _{CC} × 0.8	-	-	V		
Output Disable Time	*	*	*	tPLZ	-	-	10	μ s		
Output Enable Time	*	*	*	tPZL	-	-	2	ms		
Period Jitter (1)	E, F H, G E, F H, G	*	*	tRMS	-	5	-	ps	σ	
					-	7	-			
					-	40	-			
					-	60	-			
Total Jitter (1)	E, F H, G	*	*	tTL	-	70	-	ps	tDJ + n × tRJ n = 14.1 (BER = 1 × 10 ⁻¹²) (2)	
					-	98	-			
Phase Jitter	E, F H, G	*	$12.5 \leq f_0 < 40$ $40 \leq f_0 \leq 100$	tpj	-	-	2	ps	f ₀ offset: 12kHz to 5MHz f ₀ offset: 12kHz to 20MHz	
			$12.5 \leq f_0 < 40$ $40 \leq f_0 \leq 100$		-	-	4			
			$12.5 \leq f_0 < 40$ $40 \leq f_0 \leq 100$		-	-	4			
Packing Unit (3)	2000pcs./reel (φ180)									

- (1) Measured WAVECREST DTS-2075
 (2) tDJ : Deterministic jitter tRJ : Random jitter
 (3) Moisture prevention packing is unnecessary.
 Moisture Sensitivity Level : Level 1 (IPC/JEDEC J-STD-033)

Consult our sales representative for other specifications.

■ DSO221SN

■ DSO321SN

■ Dimensions

Model Code: N19.2, Frequency: [blank], Pin #1: OE(Output Enable), Pin #2: GND, Pin #3: Output, Pin #4: Vcc

Function: #1 Input, #3 Output condition

Dimensions: 2.5 ± 0.15 mm (width), 2.0 ± 0.15 mm (height), 0.815 ± 0.08 mm (thickness)

■ Recommended Land Pattern <Top View>

Dimensions: 1.7 mm (width), 1.0 mm (pin width), 1.35 mm (pin pitch), 0.85 mm (pin height)

■ Dimensions

Model Code: N32.0, Frequency: [blank], Pin #1: OE(Output Enable), Pin #2: GND, Pin #3: Output, Pin #4: Vcc

Function: #1 Input, #3 Output condition

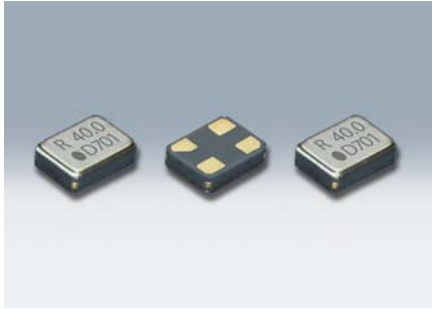
Dimensions: 3.2 ± 0.15 mm (width), 2.5 ± 0.15 mm (height), 1.1 mm (thickness)

■ Recommended Land Pattern <Top View>

Dimensions: 2.2 mm (width), 1.2 mm (pin width), 1.75 mm (pin pitch), 0.95 mm (pin height)

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/AEC-Q200 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.



■ Applications

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

[Function Code]

DSO1612AR A A

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

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

■ Standard Specification

Item	Function Code		Output Frequency Range (MHz)	Legend	Spec.			Unit	Condition		
	Supply Voltage	Frequency tolerance			min.	typ.	max.				
Supply Voltage	A	*	$0.584375 \leq f_0 < 80$	Vcc	+3.0	+3.3	+3.6	V			
	M				+2.7	+3.0	+3.3				
	B				+2.6	+2.8	+3.0				
	C				+2.25	+2.5	+2.75				
	D				+1.6	+1.8	+2.0				
Frequency Tolerance (includes frequency tolerance at room temperature)	*	A	$0.584375 \leq f_0 < 80$	f _{tol}	-100	-	+100	$\times 10^{-6}$	-40 to +85°C	-10 to +70°C (Standard Operating Temperature Range)	
		B			-50	-	+50				
		C			-30	-	+30				
		D			-25	-	+25				
		E			-20	-	+20				
Current Consumption	A,M	*	$0.584375 \leq f_0 < 40$	I _{cc}	-	-	3.0	mA	No Load		
					$40 \leq f_0 < 60$	-	-				3.4
						$60 \leq f_0 \leq 80$	-				-
					$0.584375 \leq f_0 < 40$	-	-				2.4
						$40 \leq f_0 < 60$	-				-
					$60 \leq f_0 \leq 80$	-	-				3.1
	B		$0.584375 \leq f_0 < 40$		-	-	2.0				
					$40 \leq f_0 < 60$	-	-				2.4
					$60 \leq f_0 \leq 80$	-	-				2.7
	C		$0.584375 \leq f_0 < 40$		-	-	1.4				
					$40 \leq f_0 < 60$	-	-				1.6
					$60 \leq f_0 \leq 80$	-	-				1.9
D	$0.584375 \leq f_0 < 40$	-	-	10							
		$40 \leq f_0 < 60$	-	-	15						
		$60 \leq f_0 \leq 80$	-	-	10						
Stand-by Current (#1 pin "L" Level)	*	*	*	I _{std}	-	-	10	μA	-40 to +85°C		
Load Condition	*	*	$0.584375 \leq f_0 < 80$	L _{CMOS}	-	-	15	pF			
Symmetry	*	*	$0.584375 \leq f_0 < 80$	SYM	45	50	55	%	at 50% Vcc		
0 Level Input Voltage	*	*	*	V _{OL}	-	-	Vcc×0.1	V			
1 Level Input Voltage	*	*	*	V _{OH}	Vcc×0.9	-	-	V			
Rise and Fall Time	A,M,B,C	*	$0.584375 \leq f_0 < 80$	tr, tf	-	-	3.5	ns	10 to 90% Vcc Level		
OE Pin 0 Level Input Voltage	D	*	*	V _{IL}	-	-	Vcc×0.2	V			
OE Pin 1 Level Input Voltage	*	*	*	V _{IH}	Vcc×0.8	-	-	V			
Output Disable Time	*	*	*	t _{PLZ}	-	-	200	ns			
Output Enable Time	*	*	*	t _{PZL}	-	-	1	ms			
Period Jitter (1)	*	*	*	t _{RMS}	-	2.2	-	ps	σ		
Total Jitter (1)	*	*	*	tp-p	-	20	-	ps	Peak to peak		
Phase Jitter	*	*	$40 \leq f_0 \leq 80$	t _{TL}	-	31	-	ps	t _{DJ} +n×t _{RJ} n=14.1 (BER=1×10 ⁻¹²) (2)		
									$10 \leq f_0 < 40$	1	f ₀ offset:12kHz to 20MHz
Packing Unit (3)	3000pcs./reel (φ 180)										

- (1) Measured WAVECREST DTS-2075
- (2) t_{DJ}: Deterministic jitter t_{RJ}: Random jitter
- (3) Moisture prevention packing is unnecessary. Moisture Sensitivity Level : Level 1 (IPC/JEDEC J-STD-033)

Consult our sales representative for other specifications.

[mm]

■ Dimensions

Model Code: R 0.03 D 701

Pin Connections:

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

Function:

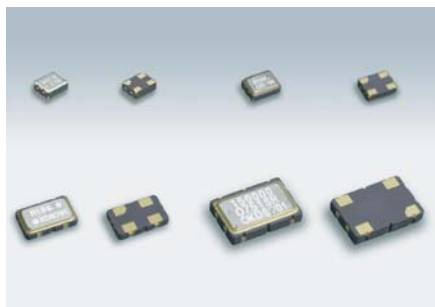
#1 Input	#3 Output condition
H	Oscillation out
Open	Oscillation out
L	High Z

■ 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: $\pm 20 \times 10^{-6}$ / $\pm 30 \times 10^{-6}$ / $\pm 50 \times 10^{-6}$ / $\pm 100 \times 10^{-6}$
- Available up to 167MHz by using AT cut fundamental resonator.
- Low jitter provides for high performance.
- Low profile: 0.815mm(DSO221SR), 1.1mm(DSO321SR/DSO531SR), 1.5mm(DSO751SR)
- AEC-Q100/AEC-Q200 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 : $\pm 100 \times 10^{-6}$
B : $\pm 50 \times 10^{-6}$
C : $\pm 30 \times 10^{-6}$
D : $\pm 25 \times 10^{-6}$
E : $\pm 20 \times 10^{-6}$

■ Standard Specification

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

Item	Function Code		Output Frequency Range (MHz)	Legend	Spec.				Condition
	Supply Voltage	Frequency tolerance			min.	typ.	max.	Unit	
Supply Voltage	A	*	$0.2 \leq f_0 \leq 167$	V _{CC}	+3.0	+3.3	+3.6	V	
	M		$0.2 \leq f_0 \leq 167$		+2.7	+3.0	+3.3		
	B		$0.2 \leq f_0 \leq 157$		+2.6	+2.8	+3.0		
	C		$0.2 \leq f_0 \leq 157$		+2.5	+2.5	+2.75		
	D		$0.2 \leq f_0 \leq 80$		+1.6	+1.8	+2.0		
Frequency Tolerance (Includes frequency tolerance at room temperature.)	*	A	$0.2 \leq f_0 \leq 167$	f _{tol}	-100	-	+100	$\times 10^{-6}$	-40 to +85°C -10 to +70°C (Standard Operating Temperature Range)
		B	$0.2 \leq f_0 \leq 125$		-50	-	+50		
		C	$0.2 \leq f_0 \leq 80$		-30	-	+30		
		D	$0.2 \leq f_0 \leq 80$		-25	-	+25		
		E	$0.2 \leq f_0 \leq 50$		-20	-	+20		
Current Consumption	A,M	*	$0.2 \leq f_0 < 32$	I _{CC}	-	-	1.8	mA	No Load
			$32 \leq f_0 < 54$		-	-	2.5		
			$54 \leq f_0 < 80$		-	-	5.0		
			$80 \leq f_0 < 125$		-	-	6.0		
			$125 \leq f_0 \leq 167$		-	-	8.0		
	B	*	$0.2 \leq f_0 < 32$		-	-	1.8		
			$32 \leq f_0 < 54$		-	-	2.5		
			$54 \leq f_0 < 125$		-	-	5.0		
			$125 \leq f_0 \leq 157$		-	-	7.0		
	C	*	$0.2 \leq f_0 < 32$		-	-	1.5		
			$32 \leq f_0 < 54$		-	-	2.0		
			$54 \leq f_0 < 125$		-	-	4.0		
			$125 \leq f_0 \leq 157$		-	-	6.0		
	D	*	$0.2 \leq f_0 < 32$		-	-	1.0		
			$32 \leq f_0 < 54$		-	-	1.4		
			$54 \leq f_0 \leq 80$		-	-	3.0		
Stand-by Current (#1 pin "L" Level)	*	*	*	I _{std}	-	-	10	μ A	
Load Condition	*	*	*	L _{CMOS}	-	-	15	pF	
	A,M	*	$0.2 \leq f_0 \leq 80$		-	-	30		
Symmetry	*	*	$f_0 < 50$	SYM	45	50	55	%	50% V _{CC} Level
			$f_0 \geq 50$		40	50	60		
0 Level Output Voltage	*	*	*	V _{OL}	-	-	V _{CC} × 0.1	V	
1 Level Output Voltage	*	*	*	V _{OH}	V _{CC} × 0.9	-	-		
Rise and Fall Time	A,M,B,C	*	$0.2 \leq f_0 \leq 54$	tr, tf	-	-	5(4)	ns	L _{CMOS} : 15pF 10 to 90% V _{CC} Level (20 to 80% V _{CC} Level)
	D		$0.2 \leq f_0 \leq 54$		-	-	7(6)		
	*		$54 < f_0 < 100$		-	-	4(3)		
	*		$100 \leq f_0 \leq 167$		-	-	3(2.5)		
	A,M		$0.2 \leq f_0 \leq 54$		-	-	10		
	A,M		$54 < f_0 \leq 80$		-	-	6		
OE Pin 0 Level Input Voltage	*	*	*	V _{IL}	-	-	V _{CC} × 0.2	V	
OE Pin 1 Level Input Voltage	*	*	*	V _{IH}	V _{CC} × 0.8	-	-		
Output Disable Time	*	*	*	t _{PLZ}	-	-	150	ns	
Output Enable Time	*	*	*	t _{PZL}	-	-	1		
Period Jitter (1)	*	*	*		t _{RMS}	-	2.2	ps	σ Peak to peak
					t _{p-p}	-	20		
Total Jitter (1)	*	*	*		t _{TL}	-	31	ps	t _{DJ} +n×t _{RJ} n=14.1(BER=1×10 ⁻¹²) (2)
Phase Jitter	*	*	$40 \leq f_0 \leq 167$	tpj	-	-	1		
			$10 \leq f_0 < 40$						
Packing Unit (3)	DSO221SR, DSO321SR: 2000pcs./reel (φ 180) , DSO531SR: 1000pcs./reel (φ 180) , DSO751SR: 1000pcs./reel (φ 254)								

(1) Measured WAVECREST DTS-2075

(2) t_{DJ} : Deterministic jitter t_{RJ} : Random jitter

(3) Moisture prevention packing is unnecessary.

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

Consult our sales representative for other specifications.

SMD Crystal Oscillators

DSO221SR/DSO321SR/DSO531SR/DSO751SR

Applications

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

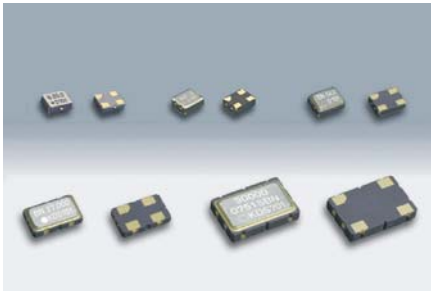
Dimensions

[mm]

Model	Dimensions (mm)	Pin Connections	Function	Recommended Land Pattern (Top View)																		
DSO221SR		<table border="1"> <tr><th>Pin No.</th><th>Connection</th></tr> <tr><td>#1</td><td>OE(Output Enable)</td></tr> <tr><td>#2</td><td>GND</td></tr> <tr><td>#3</td><td>Output</td></tr> <tr><td>#4</td><td>Vcc</td></tr> </table>	Pin No.	Connection	#1	OE(Output Enable)	#2	GND	#3	Output	#4	Vcc	<table border="1"> <tr><th>#1 Input</th><th>#3 Output condition</th></tr> <tr><td>H</td><td>Oscillation out</td></tr> <tr><td>Open</td><td>Oscillation out</td></tr> <tr><td>L</td><td>High Z</td></tr> </table>	#1 Input	#3 Output condition	H	Oscillation out	Open	Oscillation out	L	High Z	
Pin No.	Connection																					
#1	OE(Output Enable)																					
#2	GND																					
#3	Output																					
#4	Vcc																					
#1 Input	#3 Output condition																					
H	Oscillation out																					
Open	Oscillation out																					
L	High Z																					
DSO321SR		<table border="1"> <tr><th>Pin No.</th><th>Connection</th></tr> <tr><td>#1</td><td>OE(Output Enable)</td></tr> <tr><td>#2</td><td>GND</td></tr> <tr><td>#3</td><td>Output</td></tr> <tr><td>#4</td><td>Vcc</td></tr> </table>	Pin No.	Connection	#1	OE(Output Enable)	#2	GND	#3	Output	#4	Vcc	<table border="1"> <tr><th>#1 Input</th><th>#3 Output condition</th></tr> <tr><td>H</td><td>Oscillation out</td></tr> <tr><td>Open</td><td>Oscillation out</td></tr> <tr><td>L</td><td>High Z</td></tr> </table>	#1 Input	#3 Output condition	H	Oscillation out	Open	Oscillation out	L	High Z	
Pin No.	Connection																					
#1	OE(Output Enable)																					
#2	GND																					
#3	Output																					
#4	Vcc																					
#1 Input	#3 Output condition																					
H	Oscillation out																					
Open	Oscillation out																					
L	High Z																					
DSO531SR		<table border="1"> <tr><th>Pin No.</th><th>Connection</th></tr> <tr><td>#1</td><td>OE(Output Enable)</td></tr> <tr><td>#2</td><td>GND</td></tr> <tr><td>#3</td><td>Output</td></tr> <tr><td>#4</td><td>Vcc</td></tr> </table>	Pin No.	Connection	#1	OE(Output Enable)	#2	GND	#3	Output	#4	Vcc	<table border="1"> <tr><th>#1 Input</th><th>#3 Output condition</th></tr> <tr><td>H</td><td>Oscillation out</td></tr> <tr><td>Open</td><td>Oscillation out</td></tr> <tr><td>L</td><td>High Z</td></tr> </table>	#1 Input	#3 Output condition	H	Oscillation out	Open	Oscillation out	L	High Z	
Pin No.	Connection																					
#1	OE(Output Enable)																					
#2	GND																					
#3	Output																					
#4	Vcc																					
#1 Input	#3 Output condition																					
H	Oscillation out																					
Open	Oscillation out																					
L	High Z																					
DSO751SR		<table border="1"> <tr><th>Pin No.</th><th>Connection</th></tr> <tr><td>#1</td><td>OE(Output Enable)</td></tr> <tr><td>#2</td><td>GND</td></tr> <tr><td>#3</td><td>Output</td></tr> <tr><td>#4</td><td>Vcc</td></tr> </table>	Pin No.	Connection	#1	OE(Output Enable)	#2	GND	#3	Output	#4	Vcc	<table border="1"> <tr><th>#1 Input</th><th>#3 Output condition</th></tr> <tr><td>H</td><td>Oscillation out</td></tr> <tr><td>Open</td><td>Oscillation out</td></tr> <tr><td>L</td><td>High Z</td></tr> </table>	#1 Input	#3 Output condition	H	Oscillation out	Open	Oscillation out	L	High Z	
Pin No.	Connection																					
#1	OE(Output Enable)																					
#2	GND																					
#3	Output																					
#4	Vcc																					
#1 Input	#3 Output condition																					
H	Oscillation out																					
Open	Oscillation out																					
L	High Z																					

SMD Crystal Oscillators

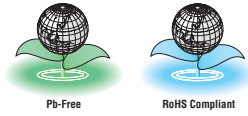
DSO211AB/DSO221SBM/DSO321SBM/DSO531SBM/DSO753SBM



Actual size DSO211AB □ DSO221SBM □ DSO321SBM □
DSO531SBM □ DSO751SBM □

Features

- Low current consumption
- 3-state function
- General purpose +5.0V HCMOS oscillator
- DSO***SBN/SVN: Optimized characteristic for single gate drive/lower loading conditions

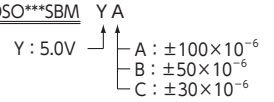


Applications

- PC, visual and FA equipment applications

[Function Code]

DSO211AB, DSO***SBM



[Type]	Model	Size
	DSO211AB	2016 size
	DSO221SBM	2520 size
	DSO321SBM	3225 size
	DSO531SBM	5032 size
	DSO751SBM	7349 size

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

Standard Specification

Item	Legend	Function Code		DSO211AB/DSO221SBM			DSO321, 531, 751 SBM			Condition			
		Supply Voltage	Frequency tolerance	Output Frequency Range (MHz)	min.	typ.	max.	Output Frequency Range (MHz)	min.		Typ.	max.	Unit
Supply Voltage	V _{CC}	*	*	3.25 ≤ f ₀ ≤ 52	+4.5	+5.0	+5.5	0.7 ≤ f ₀ ≤ 90	+4.5	+5.0	+5.5	V	
Frequency Tolerance (Includes frequency tolerance at room temperature.)	f _{tol}	*	A	3.25 ≤ f ₀ ≤ 52	-100	-	+100	0.7 ≤ f ₀ ≤ 90	-100	-	+100	X10 ⁻⁶	-40 to +85°C -20 to +70°C (Standard Operating Temperature Range)
			B	3.25 ≤ f ₀ ≤ 52	-50	-	+50	0.7 ≤ f ₀ ≤ 90	-50	-	+50		
			C	3.25 ≤ f ₀ ≤ 52	-30	-	+30	0.7 ≤ f ₀ ≤ 54	-30	-	+30		
Current Consumption	I _{CC}	*	*	3.25 ≤ f ₀ ≤ 52	-	-	8.0	0.7 ≤ f ₀ < 32	-	-	4.0	mA	No Load
								32 ≤ f ₀ < 54	-	-	6.0		
								54 ≤ f ₀ < 90	-	-	8.0		
Stand-by Current (#1 pin "L" Level)	I _{std}	*	*	*	-	-	50	*	-	-	50	μA	
Load Condition	L _{CMOS}	*	*	*	-	-	30	*	-	-	30	pF	
Symmetry	SYM	*	*	f ₀ < 26	45	50	55	f ₀ < 26	45	50	55	%	50% V _{CC} Level
				f ₀ ≥ 26	40	50	60	f ₀ ≥ 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	-	-	V	
Rise and Fall Time	t _r , t _f	*	*	3.25 ≤ f ₀ ≤ 52	-	-	10	0.7 ≤ f ₀ ≤ 54	-	-	7 (6)	ns	L _{CMOS} : 30pF 10 to 90% V _{CC} Level (20 to 80% V _{CC} Level)
								54 < f ₀ ≤ 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	-	-	V	
Output Disable Time	t _{PZL}	*	*	*	-	-	150	*	-	-	150	ns	
Output Enable Time	t _{PZL}	*	*	*	-	-	5	*	-	-	1	ms	
Period Jitter (1)	t _{RMS}	*	*	*	-	2.5	-	*	-	2.5	-	ps	σ Peak to peak
	t _{p-p}	*	*	*	-	20	-	*	-	20	-		
Total Jitter (1)	t _{TJL}	*	*	*	-	35	-	*	-	35	-	ps	t _{DJ} +n×t _{RJ} n=14.1 (BER=1×10 ⁻¹²) (2)
Phase Jitter	t _{pj}	*	*		40 ≤ f ₀ ≤ 52	-	1	40 ≤ f ₀ ≤ 90	-	-	1	ps	f ₀ offset: 12kHz to 20MHz f ₀ offset: 12kHz to 5MHz
					10 ≤ f ₀ < 40	-	1	10 ≤ f ₀ < 40	-	-	1		
Packing Unit (3)	DSO211AB: 3000pcs./reel (φ 180), DSO221SBM, DSO321SBM: 2000pcs./reel (φ 180), DSO531SBM: 1000pcs./reel (φ 180), DSO751SBM: 1000pcs./reel (φ 254)												

- (1) Measured WAVECREST DTS-2075
- (2) t_{DJ}: Deterministic jitter t_{RJ}: Random jitter
- (3) Moisture prevention packing is unnecessary.
Moisture Sensitivity Level: Level 1 (IPC/JEDEC J-STD-033)

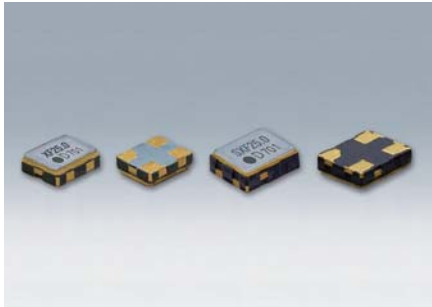
Consult our sales representative for other specifications.

DSO211AB [mm] ■ DSO221SBM [mm] ■ DSO321SBM [mm] ■ DSO531SBM [mm] ■ DSO751SBM [mm]

Model	Dimensions (mm)	Recommended Land Pattern (Top View)	Pin Connections	Function
DSO211AB			#1 Input #2 GND #3 Output #4 V _{CC}	#1 Input #3 Output condition H Oscillation out Open Oscillation out L High Z
DSO221SBM			#1 Input #2 GND #3 Output #4 V _{CC}	#1 Input #3 Output condition H Oscillation out Open Oscillation out L High Z
DSO321SBM			#1 Input #2 GND #3 Output #4 V _{CC}	#1 Input #3 Output condition H Oscillation out Open Oscillation out L High Z
DSO531SBM			#1 Input #2 GND #3 Output #4 V _{CC}	#1 Input #3 Output condition H Oscillation out Open Oscillation out L High Z
DSO751SBM			#1 Input #2 GND #3 Output #4 V _{CC}	#1 Input #3 Output condition H Oscillation out Open Oscillation out L High Z

SMD Crystal Oscillators

DSO211SXF/DSO221SXF



Actual size DSO211SXF □ DSO221SXF □

Features

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

Applications

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



[Function Code]

DSO***SXF A Z

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

[Type]

DSO211SXF	2016 size
DSO221SXF	2520 size

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

Standard Specification

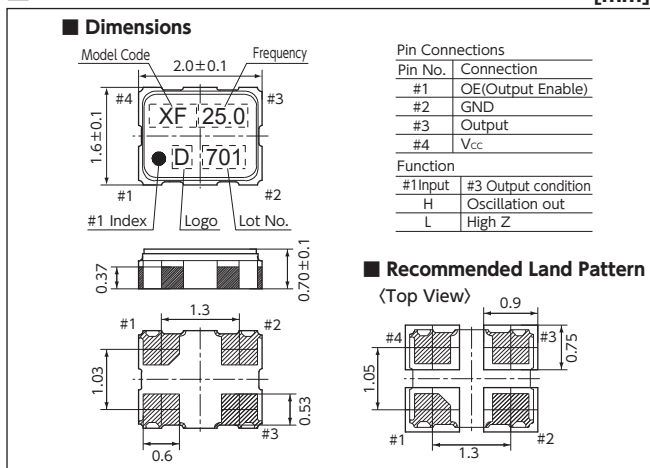
Item	Function Code		Output Frequency Range (MHz)	Legend	Spec.				Condition			
	Supply Voltage	Frequency tolerance			min.	typ.	max.	Unit				
Supply Voltage	A	*	$1 \leq f_0 \leq 125$	V _{cc}	+3.0	+3.3	+3.6	V	-40 to +125°C	-10 to +70°C (Standard Operating Temperature Range)		
	B				+2.6	+2.8	+3.0					
	C		+2.25		+2.5	+2.75						
	D		+1.6		+1.8	+2.0						
Frequency Tolerance (includes frequency tolerance at room temperature)	*	Z	*	f _{tol}	-	-	+80	$\times 10^{-6}$			-40 to +85°C	-10 to +70°C (Standard Operating Temperature Range)
		B			-	-	+50					
		C			-	-	+50					
		D			-	-	+30					
		E			-	-	+25		-20 to +70°C			
Current Consumption	A, B, C, D	*	No Load	I _{cc}	100 ≤ f ₀ ≤ 125			mA	No Load			
					40 ≤ f ₀ < 100							
					1 ≤ f ₀ < 40							
					100 ≤ f ₀ ≤ 125							
					40 ≤ f ₀ < 100							
					1 ≤ f ₀ < 40							
					100 ≤ f ₀ ≤ 125							
					40 ≤ f ₀ < 100							
					1 ≤ f ₀ < 40							
					40 ≤ f ₀ ≤ 100							
					1 ≤ f ₀ < 40							
					40 ≤ f ₀ ≤ 100							
Stand-by Current (#1 pin "L" Level)	*	*	*	I _{std}	-	-	10	μA				
Load Condition	*	*	*	L _{CMOS}	-	-	15	pF				
Symmetry	*	*	*	SYM	45	50	55	%	50% V _{cc} Level			
0 Level Input Voltage	*	*	*	V _{OL}	-	-	V _{cc} × 0.1	V				
1 Level Input Voltage	*	*	*	V _{OH}	V _{cc} × 0.9	-	-	V				
Rise and Fall Time	A, B, C, D	*	*	tr, tf	-	-	3 5	ns	10 to 90% V _{cc} Level			
OE Pin 0 Level Input Voltage	*	*	*	V _{IL}	-	-	V _{cc} × 0.3	V				
OE Pin 1 Level Input Voltage	*	*	*	V _{IH}	V _{cc} × 0.7	-	-	V				
Output Disable Time	*	*	*	tPLZ	-	-	200	ns				
Output Enable Time	*	*	*	tPZL	-	-	2	ms				
Packing Unit (1)	3000pcs./reel (φ 180)											

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

Consult our sales representative for other specifications.

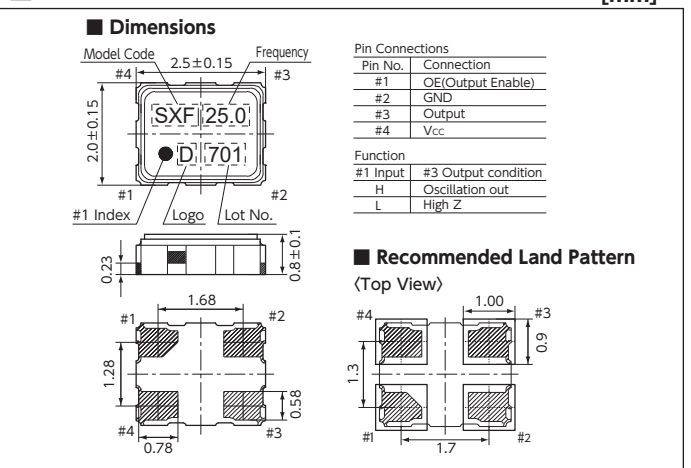
DSO211SXF

[mm]



DSO221SXF

[mm]



SMD Crystal Oscillators

DSO1612AR (kHz)

NEW



Actual size □

Features

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

Applications

- short-range wireless modules, PC, car navigation systems, car audio, multimedia devices, industrial measuring equipment, consumer product



[Function Code]

DSO1612AR A A

A : 3.3V	A, Y : ±100×10 ⁻⁶
M : 3.0V	Z : ±80×10 ⁻⁶
B : 2.8V	B : ±50×10 ⁻⁶
C : 2.5V	C : ±30×10 ⁻⁶
D : 1.8V	D : ±25×10 ⁻⁶
	E : ±20×10 ⁻⁶

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

Standard Specification

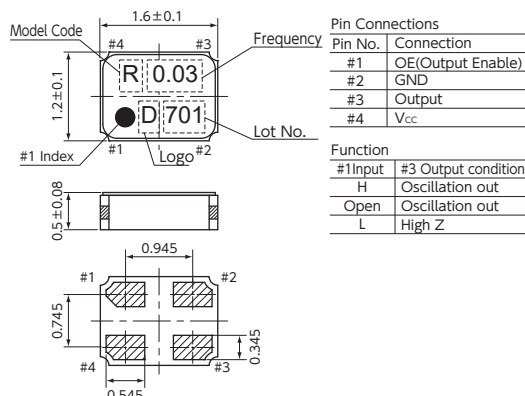
Item	Function Code		Output Frequency Range (MHz)	Legend	Spec.			Unit	Condition	
	Supply Voltage	Frequency tolerance			min.	typ.	max.			
Supply Voltage	A	*	*	V _{CC}	+3.0	+3.3	+3.6	V		
	M				+2.7	+3.0	+3.3			
	B				+2.6	+2.8	+3.0			
	C				+2.25	+2.5	+2.75			
	D				+1.6	+1.8	+2.0			
Frequency Tolerance (includes frequency tolerance at room temperature)	*	Y	*	f _{tol}	-	-	±100	×10 ⁻⁶	-40 to +125°C	-10 to +70°C (Standard Operating Temperature Range)
	*	Z			-	-	±80		-40 to +110°C	
	*	A			-	-	±100		-40 to +85°C	
	*	B			-	-	±50		-20 to +70°C	
	*	C			-	-	±30			
	*	D			-	-	±25			
Current Consumption	*	*	*	I _{CC}	-	18	32	μA	No Load	
Stand-by Current (#1 pin "L" Level)	*	*	*	I _{std}	-	-	5	μA		
Load Condition	*	*	*	L _{CMOS}	-	-	15	pF		
Symmetry	*	*	*	SYM	45	50	55	%	50% V _{CC} Level	
0 Level Input Voltage	*	*	*	V _{OL}	-	-	V _{CC} ×0.1	V		
1 Level Input Voltage	*	*	*	V _{OH}	V _{CC} ×0.9	-	-			
Rise and Fall Time	*	*	*	t _r , t _f	-	-	50	ns	10 to 90% V _{CC} Level	
OE Pin 0 Level Input Voltage	*	*	*	V _{IL}	-	-	V _{CC} ×0.3	V		
OE Pin 1 Level Input Voltage	*	*	*	V _{IH}	V _{CC} ×0.7	-	-			
Output Disable Time	*	*	*	t _{PLZ}	-	-	1	μs		
Output Enable Time	*	*	*	t _{PZL}	-	-	10	ms		
Packing Unit (1)	3000pcs./reel (φ180)									

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

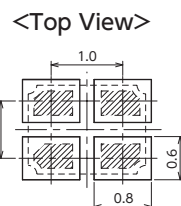
Consult our sales representative for other specifications.

[mm]

Dimensions

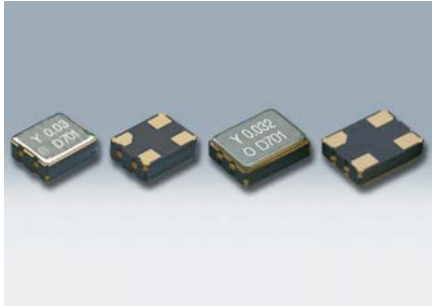


Recommended Land Pattern



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-Q100/AEC-Q200 compliant



Applications

- Timer module, Industrial measuring equipment, Consumer Product

[Type]	Model	Size
DSO221SY		2520 size
DSO321SY		3225 size

[Function Code]

DSO***SY	AA
A : 3.3V	A : ±100×10 ⁻⁶
B : 2.8V	B : ±50×10 ⁻⁶
C : 2.5V	N : ±35×10 ⁻⁶
D : 1.8V	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 ≤ f ₀ ≤ 8.5MHz	V _{cc}	+3.0	+3.3	+3.6	V		
	B				+2.6	+2.8	+3.0			
	C				+2.25	+2.5	+2.75			
	D				+1.6	+1.8	+2.0			
Frequency Tolerance (includes frequency tolerance at room temperature)	*	A	32.768kHz 1.049 ≤ f ₀ ≤ 8.5MHz	f _{tol}	-100	-	+100	× 10 ⁻⁶	-40 to +85°C	-10 to +70°C (Standard Operating Temperature Range)
		B			-50	-	+50			
		N			-35	-	+35			
		C			-30	-	+30			
Current Consumption	*	*	32.768kHz 1.049 ≤ f ₀ ≤ 8.5MHz	I _{cc}	-	-	18	μA	No Load	
					-	-	700			
					-	-	-			
					-	-	-			
Stand-by Current (#1 pin "L" Level)	*	*	*	I _{std}	-	-	3	μA	-40 to +85°C	
Load Condition	*	*	*	L _{CMOS}	-	-	15	pF		
Symmetry	*	*	32.768kHz 1.049 ≤ f ₀ ≤ 8.5MHz	SYM	45 40	50 50	55 60	%	at 50% V _{cc}	
0 Level Input Voltage	*	*	*	V _{OL}	-	-	V _{cc} ×0.1	V		
1 Level Input Voltage	*	*	*	V _{OH}	V _{cc} ×0.9	-	-	V		
Rise and Fall Time	*	*	*	tr, tf	-	-	15	ns	10 to 90% V _{cc} Level	
OE Pin 0 Level Input Voltage	*	*	*	V _{IL}	-	-	V _{cc} ×0.2	V		
OE Pin 1 Level Input Voltage	*	*	*	V _{IH}	V _{cc} ×0.8	-	-	V		
Output Disable Time	*	*	*	t _{PLZ}	-	-	100	ns		
Output Enable Time	*	*	*	t _{PZL}	-	-	20	ms		
Packing Unit (1)					2000pcs./reel (φ 180)					

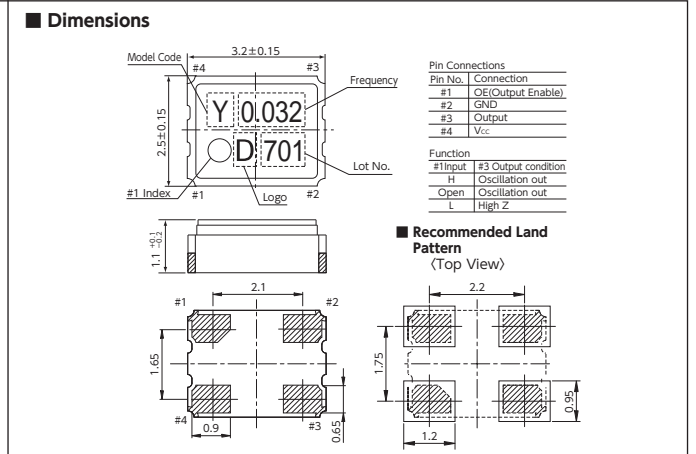
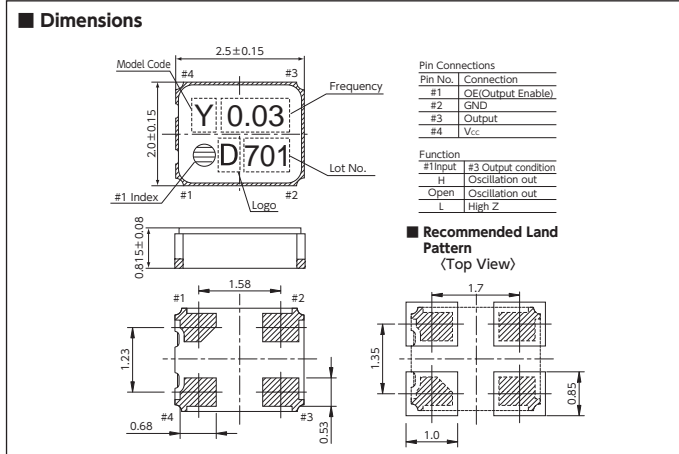
(1) Moisture prevention packing is unnecessary.
Moisture Sensitivity Level : Level 1 (IPC/JEDEC J-STD-033)

Consult our sales representative for other specifications.

DSO221SY

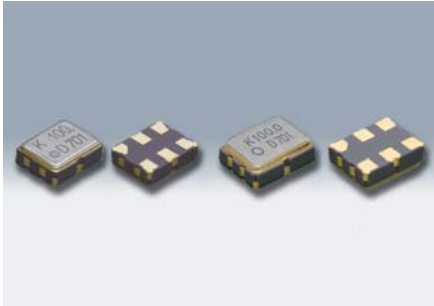
[mm] DSO321SY

[mm]



SMD Differential Output Crystal Oscillators

DSO223SK/DSO323SK/DSO223SJ/DSO323SJ/DSO223SD/DSO323SD



Actual size DSO223S DSO323S

■ Features

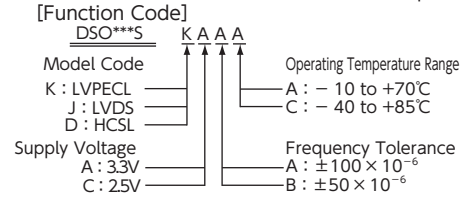
- 2.5V/3.3V operating voltage, High speed type
- 3-state function
- LV-PECL output (DSO223/323SK)
- LVDS output (DSO223/323SJ)
- HCSL output (DSO223/323SD)
- AEC-Q200 Compliant (DSO223SK/SJ/SD)
- AEC-Q100/AEC-Q200 Compliant (DSO323SK/SJ/SD)

■ Applications

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



[Type]	
DSO223S SERIES	2520 size
DSO323S SERIES	3225 size



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

■ Standard Specification

Item	Type	Legend	DSO223SK DSO323SK	DSO223SJ DSO323SJ	DSO223SD DSO323SD
Output Specification	-	-	LV-PECL	LVDS	HCSL
Output Frequency Range	f _o	-	13.5 to 167MHz (DSO223S SERIES) / 13.5 to 212.5MHz (DSO323S SERIES)		
Supply Voltage	V _{CC}	-	+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°C		
Operating Temperature Range	T _{use}	-	-10 to +70°C, -40 to +85°C		
Current Consumption	I _{CC}	-	45mA max. (f _o ≤170MHz), 50mA max. (170MHz<f _o ≤212.5MHz)	20mA max.	30mA max. (f _o ≤170MHz), 35mA max. (170MHz<f _o ≤212.5MHz)
Stand-by Current (#1 pin "I" Level)	I _{std}	-	10μA max.		
Load Condition	Load-R	-	50Ω to V _{CC} -2V	100Ω (Output-OutputN)	50Ω
Symmetry	SYM	-	45 to 55% [at outputs cross point]		
0 Level Output Voltage	V _{OL}	-	V _{CC} -1.81 to V _{CC} -1.62V	-	-0.15 to 0.15V
1 Level Output Voltage	V _{OH}	-	V _{CC} -1.025 to V _{CC} -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	V _{CR}	-	-	-	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	t _{PLZ}	-	200ns		
Output Enable Time	t _{PZL}	-	2ms		
Period Jitter (1)	t _{RMS}	-	5ps typ. (13.5MHz≤f _o <27MHz) / 2.5ps typ. (27MHz≤f _o ≤212.5MHz) (σ)		
	tp-p	-	33ps typ. (13.5MHz≤f _o <27MHz) / 22ps typ. (27MHz≤f _o ≤212.5MHz) (Peak to peak)		
Total Jitter (1)	t _{JL}	-	50ps typ. (13.5MHz≤f _o <27MHz) / 35ps typ. (27MHz≤f _o ≤212.5MHz) [t _{DJ} + n×t _{RJ} n=14.1 (BER=1×10 ⁻¹²) (2)]		
Phase Jitter	tpj	-	1.5ps max. (13.5MHz≤f _o <27MHz) / 1ps max. (27MHz≤f _o ≤212.5MHz) [13.5MHz≤f _o <40MHz, f _o offset:12kHz to 5MHz f _o ≥40MHz, f _o offset:12kHz to 20MHz]		
Packing Unit (3)	-	-	2000pcs./reel (φ180)		

- (1) Measured WAVECREST DTS-2075
- (2) t_{DJ} : Deterministic jitter t_{RJ} : Random jitter
- (3) Moisture prevention packing is unnecessary.
Moisture Sensitivity Level : Level 1 (IPC/JEDEC J-STD-033)

Consult our sales representative for other specifications.

■ DSO223S SERIES

[mm] ■ DSO323S SERIES

[mm]

■ Dimensions

Model Code

DSO223S-J

DSO223SK (2.5V) : KB

DSO223SK (3.3V) : K

DSO223SD : D

Pin Connections

Pin No.	Connection
#1	OE(Output Enable)
#2	NC
#3	GND
#4	Output
#5	OutputN
#6	V _{CC}

Function

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

■ Recommended Land Pattern

<Top View>

■ Dimensions

Model Code

DSO323S-J

DSO323SK (2.5V) : KB

DSO323SK (3.3V) : K

DSO323SD : D

Pin Connections

Pin No.	Connection
#1	OE(Output Enable)
#2	NC
#3	GND
#4	Output
#5	OutputN
#6	V _{CC}

Function

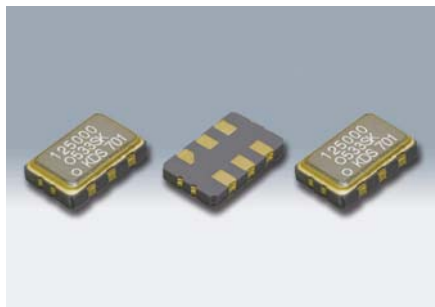
#1 Input	#4,#5 Output condition
H	Oscillation out
Open	Oscillation out
L	High Z

■ Recommended Land Pattern

<Top View>

SMD Differential Output Crystal Oscillators

DSO533SK/DSO533SJ



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



Standard Specification

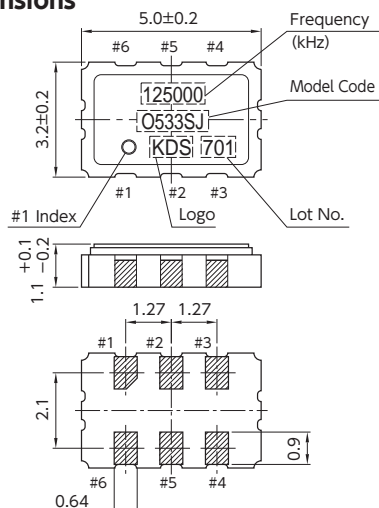
Item	Type	Legend	DSO533SK	DSO533SJ
Output Specification	-	-	LV-PECL	LVDS
Output Frequency Range	f_0	-	13.5 to 212.5MHz	
Supply Voltage	V_{CC}	-	$+2.5V \pm 0.125V / +3.3V \pm 0.165V$	
Frequency Tolerance (Includes frequency tolerance at room temperature.)	f_{tol}	-	$\pm 50 \times 10^{-6}$ max., $\pm 100 \times 10^{-6}$ max.	
Storage Temperature Range	T_{stg}	-	-40 to +85°C	
Operating Temperature Range	T_{use}	-	-10 to +70°C, -40 to +85°C	
Current Consumption	I_{CC}	-	45mA max. ($f_0 \leq 170$ MHz), 50mA max. (170 MHz $< f_0 \leq 212.5$ MHz)	20mA max.
Stand-by Current (#1 pin "L" Level)	I_{std}	-	10 μ A max.	
Load Condition	Load-R	-	50 Ω to $V_{CC}-2V$	100 Ω (Output-OutputN)
Symmetry	SYM	-	45 to 55% [at outputs cross point]	
0 Level Output Voltage	V_{OL}	-	$V_{CC}-1.81$ to $V_{CC}-1.62V$	-
1 Level Output Voltage	V_{OH}	-	$V_{CC}-1.025$ to $V_{CC}-0.88V$	-
Rise and Fall Time	t_r, t_f	-	0.5ns max. [20 to 80% Output, OutputN]	0.4ns 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 [$\Delta V_{OD} = V_{OD1} - V_{OD2} $]
Offset Voltage	V_{OS}	-	-	1.125 to 1.375V
Offset to V_{OS}	ΔV_{OS}	-	-	50mV
OE Pin 0 Level Input Voltage	V_{IL}	-	$V_{CC} \times 0.3$ max.	
OE Pin 1 Level Input Voltage	V_{IH}	-	$V_{CC} \times 0.7$ min.	
Output Disable Time	t_{PLZ}	-	200ns	
Output Enable Time	t_{PZL}	-	2ms	
Period Jitter (1)	t_{RMS}	-	5ps typ. (13.5MHz $\leq f_0 < 27$ MHz) / 2.5ps typ. (27MHz $\leq f_0 \leq 212.5$ MHz) (σ)	
	t_{p-p}	-	33ps typ. (13.5MHz $\leq f_0 < 27$ MHz) / 22ps typ. (27MHz $\leq f_0 \leq 212.5$ MHz) (Peak to peak)	
Total Jitter (1)	t_{TL}	-	50ps typ. (13.5MHz $\leq f_0 < 27$ MHz) / 35ps typ. (27MHz $\leq f_0 \leq 212.5$ MHz) [$t_{DJ} + n \times t_{RJ}$ n=14.1 (BER=1 $\times 10^{-12}$) (2)]	
Phase Jitter	t_{pj}	-	1.5ps max. (13.5MHz $\leq f_0 < 27$ MHz) / 1ps max. (27MHz $\leq f_0 \leq 212.5$ MHz) [13.5MHz $\leq f_0 < 40$ MHz, f_0 offset: 12kHz to 5MHz $f_0 \geq 40$ MHz, f_0 offset: 12kHz to 20MHz]	
Packing Unit (3)	-	-	1000pcs./reel ($\phi 180$)	

- (1) Measured WAVECREST DTS-2075
 (2) t_{DJ} : Deterministic jitter t_{RJ} : Random jitter
 (3) Moisture prevention packing is unnecessary.
 Moisture Sensitivity Level: Level 1 (IPC/JEDEC J-STD-033)

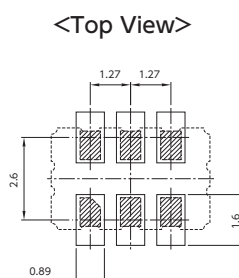
Consult our sales representative for other specifications.

[mm]

Dimensions



Recommended Land Pattern

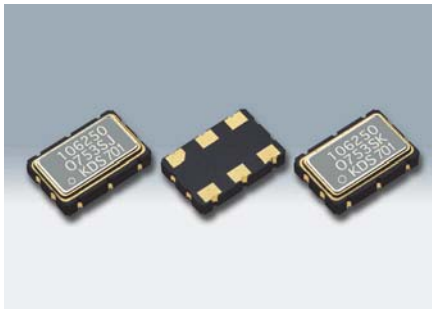


Pin No.	Connection
#1	OE(Output Enable)
#2	NC
#3	GND
#4	Output
#5	OutputN
#6	V_{CC}

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

SMD Differential Output Crystal Oscillators

DSO753SK/DSO753SJ/DSO753SD



Actual size

Features

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

Applications

- Server, FC-HBA



Standard Specification

Item	Type	Legend	DSO753SK	DSO753SJ	DSO753SD
Output Specification	-	-	LV-PECL	LVDS	HCSL
Output Frequency Range	f_o	-	13.5 to 212.5MHz		
Supply Voltage	V_{cc}	-	+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°C		
Operating Temperature Range	T_{use}	-	-10 to +70°C, -40 to +85°C		
Current Consumption	I_{cc}	-	45mA max. ($f_o \leq 170$ MHz), 50mA max. (170MHz < $f_o \leq 212.5$ MHz)	20mA max.	30mA max. ($f_o \leq 170$ MHz), 35mA max. (170MHz < $f_o \leq 212.5$ MHz)
Stand-by Current (#1 pin "L" Level)	I_{std}	-	10µA max.		
Load Condition	Load-R	-	50Ω to $V_{CC}-2V$	100Ω (Output-OutputN)	50Ω
Symmetry	SYM	-	45 to 55% [at outputs cross point]		
0 Level Output Voltage	V_{OL}	-	$V_{CC}-1.81$ to $V_{CC}-1.62V$	-	-0.15 to 0.15V
1 Level Output Voltage	V_{OH}	-	$V_{CC}-1.025$ to $V_{CC}-0.88V$	-	0.58 to 0.85V
Rise and Fall Time	t_r, t_f	-	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 [$\Delta V_{od} = V_{OD1} - V_{OD2} $]	-
Offset Voltage	V_{os}	-	-	1.125 to 1.375V	-
Offset to V_{os}	ΔV_{os}	-	-	50mV	-
Crossing Point Voltage	V_{cr}	-	-	-	250 to 550mV
OE Pin 0 Level Input Voltage	V_{IL}	-	$V_{CC} \times 0.3$ max.		
OE Pin 1 Level Input Voltage	V_{IH}	-	$V_{CC} \times 0.7$ min.		
Output Disable Time	t_{PLZ}	-	200ns		
Output Enable Time	t_{PZL}	-	2ms		
Period Jitter (1)	t_{RMS}	-	5ps typ. (13.5MHz ≤ f_o < 27MHz) / 2.5ps typ. (27MHz ≤ f_o ≤ 212.5MHz) (σ)		
	t_{p-p}	-	33ps typ. (13.5MHz ≤ f_o < 27MHz) / 22ps typ. (27MHz ≤ f_o ≤ 212.5MHz) (Peak to peak)		
Total Jitter (1)	t_{TL}	-	50ps typ. (13.5MHz ≤ f_o < 27MHz) / 35ps typ. (27MHz ≤ f_o ≤ 212.5MHz) [tDJ + n×tRJ n=14.1 (BER=1×10 ⁻¹²) (2)]		
Phase Jitter	t_{pj}	-	1.5ps max. (13.5MHz ≤ f_o < 27MHz) / 1ps max. (27MHz ≤ f_o ≤ 212.5MHz) [13.5MHz ≤ f_o < 40MHz, f_o offset: 12kHz to 5MHz f_o ≥ 40MHz, f_o offset: 12kHz to 20MHz]		
Packing Unit (3)	-	-	1000pcs./reel (φ254)		

- (1) Measured WAVECREST DTS-2075
- (2) tDJ : Deterministic jitter tRJ : Random
- (3) Moisture prevention packing is unnecessary.
Moisture Sensitivity Level : Level 1 (IPC/JEDEC J-STD-033)

Consult our sales representative for other specifications.

[mm]

Dimensions

Recommended Land Pattern

<Top View>

Model Code
 DSO753SJ (2.5V, 3.3V) → O753SJA
 DSO753SK (2.5V) → O753SKB
 DSO753SK (3.3V) → O753SKA
 DSO753SD (2.5V, 3.3V) → O753SDA

Pin Connections

Pin No.	Connection
#1	OE (Output Enable)
#2	NC
#3	GND
#4	Output
#5	OutputN
#6	V _{CC}

Function

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

Crystal Oscillators

DLO555MBA

NEW



Features

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

Type D L O 5 5 5 M B A

① ② ③ ④ ⑤ ⑥ ⑦ ⑧ ⑨

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



Applications

- Gaming equipment
- Industrial equipment

Absolute Maximum Ratings

Item	Legend	Spec.	Unit
Supply Voltage	V _{cc}	-0.6 to +6.0	V
Output Pin Voltage	V _{OUT}	-0.6 to V _{cc} +0.6	V
Output Pin Current	I _{OUT}	10	mA
Storage Temperature Range	T _{str}	-40 to +105	°C

Recommended Operating Conditions

Item	Legend	min.	typ.	max.	Unit
Supply Voltage	V _{cc}	1.6	5.0	5.5	V
Load Condition f _o >48MHz	L _{CMOS}	-	-	15	pF
Load Condition f _o ≤48MHz	L _{CMOS}	-	-	30	pF
Operating Temperature Range	T _{opr}	-10	-	+85	°C

Standard Specification

Item	Legend	Spec.			Unit	Condition
		min.	typ.	max.		
Output Frequency Range	f _o	0.75	-	54	MHz	L _{CMOS} : 15pF
		0.75	-	48		L _{CMOS} : 30pF
Frequency Tolerance	f _{tol}	-100	-	+100	×10 ⁻⁶	T _{opr} =-10 to 85°C V _{cc} =1.6 to 5.5V
		-50	-	+50		
Aging	-	-	-	±5	×10 ⁻⁶ /year	-
Current Consumption	I _{cc}	-	-	8	mA	No load
Symmetry	SYM	45	-	55	%	50% V _{cc} level
0 Level Output Voltage	V _{OL}	-	-	V _{cc} ×0.1	V	I _{OL} =4mA
1 Level Output Voltage	V _{OH}	V _{cc} ×0.9	-	-	V	I _{OH} =-4mA
0 Level time	T _{L1}	11	-	-	ns	20% V _{cc} or less time (f _o ≤32MHz)
1 Level time	T _{H1}	11	-	-	ns	80% V _{cc} or less time (f _o ≤32MHz)
Rise and Fall Time	tr,tf	-	1.8	3.8	ns	L _{CMOS} : 15pF 20 to 80% V _{cc} level
		-	3.8	7.5		L _{CMOS} : 30pF 20 to 80% V _{cc} level
Start Up Time	T _{start}	-	-	1	ms	t=0 at 90% V _{cc}
Phase Noise	-	-	-145	-	dBc/Hz	Offset 1kHz
		-	-158	-		Offset 100kHz
Period Jitter (1)	t _{RMS} tp-p	-	2.4	-	ps	σ
		-	20	-		Peak to peak
Total Jitter (1)	t _{TL}	-	34	-	ps	t _{DJ} +n×t _{RJ} n=14.1(BER=1×10 ⁻¹²) (2)
Phase Jitter (3)	tpj	-	-	1	ps	10MHz≤f _o <40MHz f _o offset12kHz to 5MHz
		-	-	1		40MHz≤f _o ≤60MHz f _o offset12kHz to 20MHz
Built-in Bypass Capacitors Capacitance	Cbp	-	0.1	-	μF	V _{cc} to GND capacitance

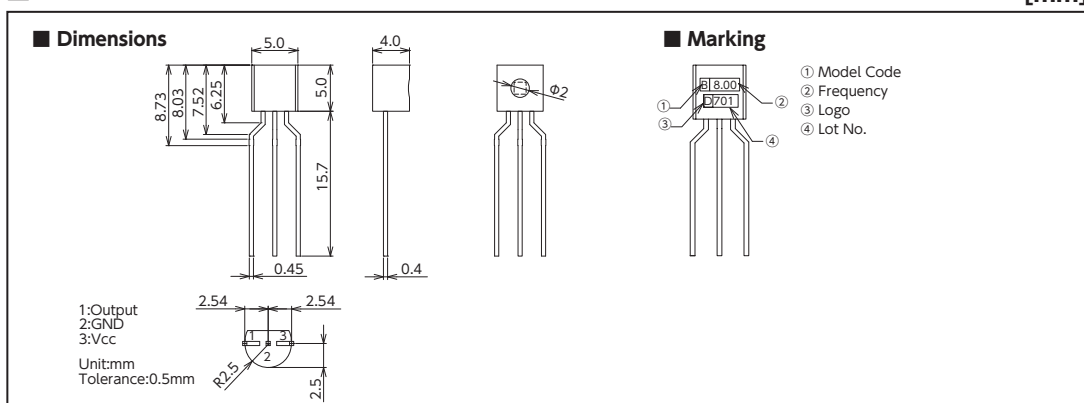
- (1) Measured WAVECREST DTS-2075
 (2) t_{DJ} : Deterministic jitter t_{RJ} : Random jitter
 (3) Measured Agilent Technologies E5052B

Consult our sales representative for other specifications.

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

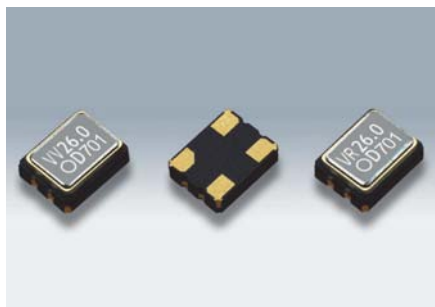
Dimensions

[mm]



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

■ Applications

- DVD, Digital TV, STB, backbone transmission equipment



■ Standard Specification

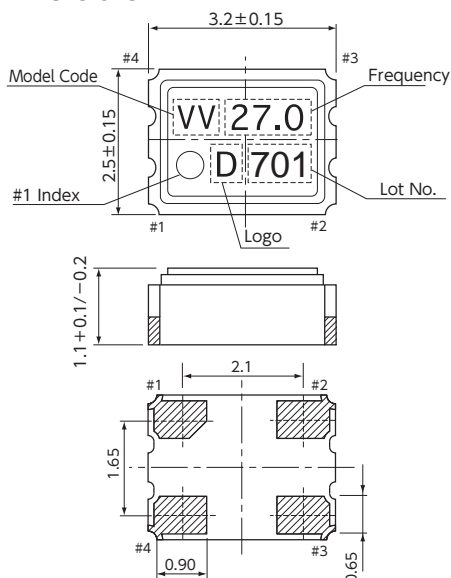
Item	Type	Legend	DSV321SV	DSV321SR
Output Frequency Range		f_0	13.5 to 54MHz	6.75 to 90MHz
Supply Voltage		V_{cc}	$+2.8V \pm 0.28V$	$+3.3V \pm 0.33V$
Frequency Control Voltage		V_{cont}	$+1.4V \pm 1.4V$	$+1.65V \pm 1.65V$
Storage Temperature Range		T_{stg}	-40 to +85°C	
Operating Temperature Range		T_{use}	-10 to +70°C / -30 to +85°C	
Frequency Tolerance. (Includes frequency tolerance at room temperature.)		f_{tol}	$\pm 40 \times 10^{-6}$ max.	
Frequency Adjustment Range		f_{cont}	$\pm 125 \times 10^{-6}$ min./ $\pm 100 \times 10^{-6}$ min. [Positive Slope]	$\pm 90 \times 10^{-6}$ min. [Positive Slope]
Current Consumption		I_{cc}	3mA max. (13.5MHz $\leq f_0 \leq 40$ MHz) 5mA max. (40MHz $< f_0 \leq 54$ MHz) [No Load]	2mA max. (27MHz $\leq f_0 \leq 36$ MHz) [No Load]
Load Condition		L_{cmos}	15pF	
Symmetry		SYM	40 to 60% [50% V_{cc} Level]	
0 Level Output Voltage		V_{OL}	$V_{cc} \times 0.1$ max.	
1 Level Output Voltage		V_{OH}	$V_{cc} \times 0.9$ min.	
Rise and Fall Time		t_r, t_f	10ns max. (13.5MHz $\leq f_0 \leq 40$ MHz) 6ns max. (40MHz $< f_0 \leq 54$ MHz) [10 to 90% V_{cc} Level]	10ns max. (6.75MHz $\leq f_0 \leq 40$ MHz) 6ns max. (40MHz $< f_0 \leq 54$ MHz) 4ns max. (54MHz $< f_0 \leq 90$ MHz) [10 to 90% V_{cc} Level]
Period Jitter (1)		t_{RMS}	2.4ps typ. (σ)	
		t_{p-p}	22ps typ. (Peak to peak)	
Total Jitter (1)		t_{TL}	33ps typ. [$t_{DJ} + n \times t_{RJ} \quad n=14.1(BER=1 \times 10^{-12})(2)$]	
Phase Jitter		t_{pj}	1ps max. (10MHz $\leq f_0 < 40$ MHz, f_0 offset : 12kHz to 5MHz, $f_0 \geq 40$ MHz, f_0 offset : 12kHz to 20MHz)	
Packing Unit (3)		-	2000pcs./reel ($\phi 180$)	

- (1) Measured WAVECREST DTS-2075
 (2) t_{DJ} : Deterministic jitter t_{RJ} : Random jitter
 (3) Moisture prevention packing is unnecessary.
 Moisture Sensitivity Level: Level 1 (IPC/JEDEC J-STD-033)

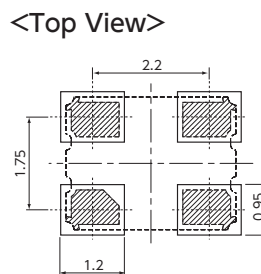
Consult our sales representative for other specifications.

[mm]

■ Dimensions



■ Recommended Land Pattern



SMD Voltage Controlled Crystal Oscillators

DSV531SV



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.

■ Applications

- DVD, Digital TV, STB, backbone transmission equipment



■ Standard Specification

Item	Type	Legend	DSV531SV
Output Frequency Range		f _o	1.25 to 80MHz
Supply Voltage		V _{cc}	+3.3V±0.3V
Frequency Control Voltage		V _{cont}	+1.65V±1.65V
Storage Temperature Range		T _{stg}	-40 to +85°C
Operating Temperature Range		T _{use}	-10 to +70°C
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		I _{cc}	10mA max. (f _o ≤60MHz) 15mA max. (f _o >60MHz) [No Load]
Load Condition		L _{CMOS}	15pF max.
Symmetry		SYM	40 to 60% [50% V _{cc} Level]
0 Level Output Voltage		V _{OL}	V _{cc} ×0.1 max.
1 Level Output Voltage		V _{OH}	V _{cc} ×0.9 min.
Rise and Fall Time		t _r , t _f	10ns max. (f _o ≤50MHz) 6ns max. (f _o >50MHz) [10 to 90% V _{cc} Level]
Period Jitter (1)		t _{RMS}	2.2ps typ. [σ]
		t _{p-p}	20ps typ.[Peak to peak]
Total Jitter (1)		t _{TL}	31ps typ. [t _{DJ} +n×t _{RJ} n=14.1(BER=1×10 ⁻¹²) (2)]
Phase Jitter		t _{pj}	1ps max. [10MHz≤f _o <40MHz, f _o offset:12kHz to 5MHz f _o ≥40MHz, f _o offset:12kHz to 20MHz]
Packing Unit (3)		-	1000pcs./reel (φ180)

(1) Measured WAVECREST DTS-2075

(2) t_{DJ}: Deterministic jitter t_{RJ}: Random jitter

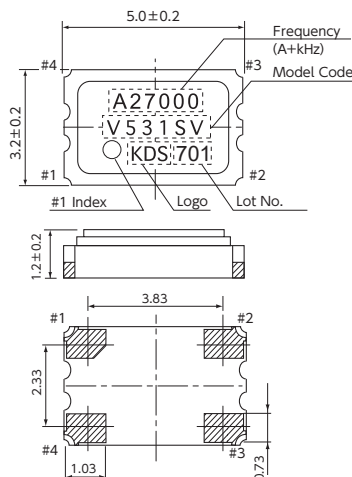
(3) Moisture prevention packing is unnecessary.

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

Consult our sales representative for other specifications.

[mm]

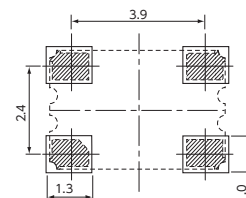
■ Dimensions



Pin No.	Connection
#1	V _{cont}
#2	GND
#3	Output
#4	V _{cc}

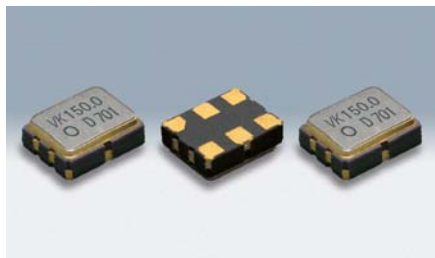
■ Recommended Land Pattern

<Top View>



SMD Differential Output Voltage Controlled Crystal Oscillators

DSV323SV/DSV323SK/DSV323SJ/DSV323SD



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.



■ Standard Specification

Item	Type	Legend	DSV323SV	DSV323SK	DSV323SJ	DSV323SD
Output Specification		—	CMOS	LV-PECL	LVDS	HCSL
Output Frequency Range		f ₀	6.75 to 170MHz		80 to 170MHz	
Supply Voltage		V _{CC}			+3.3V±0.165V	
Frequency Control Voltage		V _{cont}			+1.65V±1.65V	
Storage Temperature Range		T _{stg}			-40 to +85°C	
Operating Temperature Range		T _{use}			-10 to +70°C / -40 to +85°C	
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≤f ₀ ≤90MHz 25mA 80MHz≤f ₀ ≤186MHz [No Load]	50mA max.	30mA max.	40mA max.
Stand-by Current (#1 pin "L" Level)		I _{std}	5mA 6.75MHz≤f ₀ ≤90MHz 30μA 80MHz≤f ₀ ≤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≤f ₀ ≤40MHz) 6ns max.(40MHz<f ₀ ≤54MHz) 4ns max.(54MHz<f ₀ ≤90MHz) 2ns max.(80MHz≤f ₀ ≤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		V _{cr}	—	—	—	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		t _{PLZ}	150ns max. (6.75MHz≤f ₀ ≤90MHz) 200ns max. (80MHz≤f ₀ ≤186MHz)		200ns max.	
Output Enable Time		t _{PZL}	150ns max. (6.75MHz≤f ₀ ≤90MHz) 2ms max. (80MHz≤f ₀ ≤186MHz)		2ms max.	
Period Jitter (1)		t _{RMS}			2.3ps typ. (σ)	
		t _{p-p}			22ps typ. (Peak to peak)	
Total Jitter (1)		t _{TJ}			32ps typ. [t _{DJ} + n×t _{RJ} n=14.1 (BER=1×10 ⁻¹³) (2)]	
Phase Jitter		t _{pj}			1ps max. [13.5MHz≤f ₀ <40MHz, f ₀ offset:12kHz to 5MHz f ₀ ≥40MHz, f ₀ offset:12kHz to 20MHz]	
Packing Unit (3)		—			2000pcs/reel(180 φ)	

(1) Measured WAVECREST DTS-2075

(2) t_{DJ} : Deterministic jitter t_{RJ} : Random jitter

(3) Moisture prevention packing is unnecessary.

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

Consult our sales representative for other specifications.

[mm]

■ Dimensions

Model Code: VK120.0, D701

Frequency: 120.0 MHz

Dimensions: 3.2±0.15, 2.5±0.15, 1.1, 1.175, 1.175, 1.65, 0.65

■ Recommended Land Pattern

<Top View>

Dimensions: 1.225, 1.225, 1.85, 0.85, 0.95, 1.05

Pin Connections:

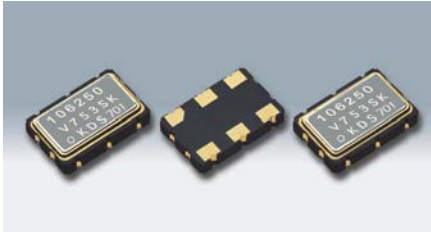
Pin No.	Connection
#1	V _{cont}
#2	OE(Output Enable)
#3	GND
#4	Output
#5	OutputN
#6	V _{CC}

Function:

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

SMD Differential Output Voltage Controlled Crystal Oscillators

DSV753SV/DSV753SB/DSV753SK/DSV753SJ/DSV753SD



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, HCSSL
- Differential output(LV-PECL, LVDS, HCSSL)
- Low jitter
- 3-state function

■ Applications

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



■ Standard Specification

Item	Type	Legend	DSV753SV	DSV753SB	DSV753SK	DSV753SJ	DSV753SD
Output Specification		—	CMOS		LV-PECL	LVDS	HCSSL
Output Frequency Range	f _o		2 to 170MHz	4 to 50MHz		80 to 170MHz	
Supply Voltage	V _{cc}		+3.3V±0.33V	+5.0V±0.5V		+3.3V±0.165V	
Frequency Control Voltage	V _{cont}		+1.65V±1.65V	+2.5V±2.0V		+1.65V±1.65V	
Storage Temperature Range	T _{stg}		-40 to 85°C				
Operating Temperature Range	T _{use}		-10 to 70°C / -40 to 85°C				
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≤f _o ≤90MHz) 25mA max. (80MHz≤f _o ≤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≤f _o ≤90MHz) 30μA max. (80MHz≤f _o ≤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≤f _o ≤40MHz) 6ns max. (40MHz<f _o ≤54MHz) 4ns max. (54MHz<f _o ≤90MHz) 2ns max. (80MHz≤f _o ≤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	V _{cr}		—	—	—	—	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	t _{PLZ}		150ns max. (2MHz≤f _o ≤90MHz) 200ns max. (80MHz≤f _o ≤170MHz)	150ns max.	200ns max.		
Output Enable Time	t _{PZL}		150ns max. (2MHz≤f _o ≤90MHz) 2ms max. (80MHz≤f _o ≤170MHz)	150ns max.	2ms max.		
Period Jitter (1)	t _{RMS}		2.4ps typ. (σ)				
	tp-p		22ps typ. (Peak to peak)				
Total Jitter (1)	t _{TL}		33ps typ. [t _{DJ} + n×t _{RJ} 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 (3)			1000pcs/reel (254φ)				

- (1) Measured WAVECREST DTS-2075
- (2) t_{DJ} : Deterministic Jitter t_{RJ} : Random Jitter
- (3) Moisture prevention packing is unnecessary.
Moisture Sensitivity Level : Level 1 (IPC/JEDEC J-STD-033)

Consult our sales representative for other specifications.

[mm]

■ Dimensions

■ Recommended Land Pattern

<Top View>

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

Model Code: DSV753SV→V753SV
DSV753SB→V753SB
DSV753SK→V753SKA
DSV753SJ→V753JA
DSV753SD→V753SDA

Pin Connections

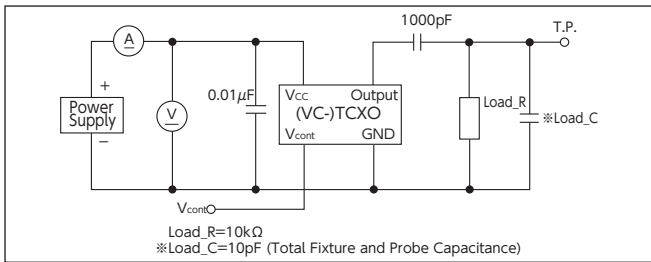
Pin No.	Connection
#1	V _{cont}
#2	OE (Output Enable)
#3	GND
#4	Output
#5	NC - DSV753SV OutputN - DSV753SB OutputN - DSV753SK DSV753SJ DSV753SD
#6	V _{cc}

Function

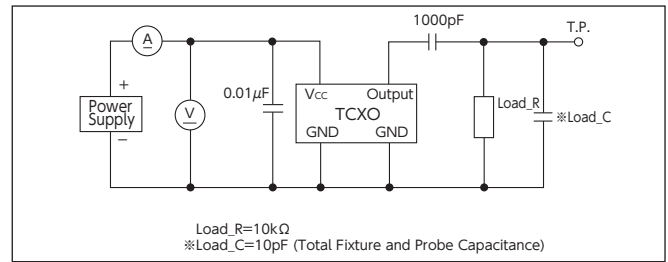
#2 Input	#4,#5 Output condition
H	Oscillation out
Open	Oscillation out
L	High Z

Measurement Circuit

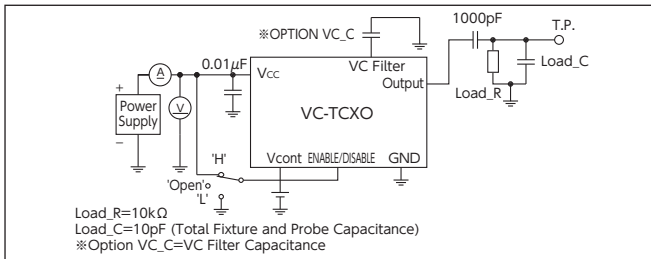
VC-TCXO (DSA***SDN, SP, 535SD)



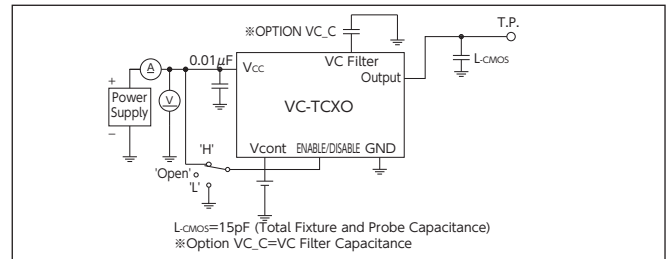
TCXO (DSB***SDN, SP, WA, 535SD)



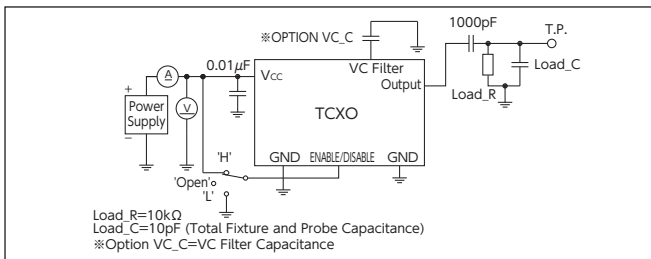
DSA535SG, SGA (Clipped Sine)



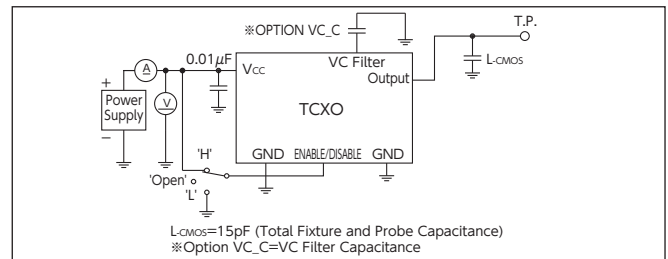
DSA535SG, SGA (CMOS)



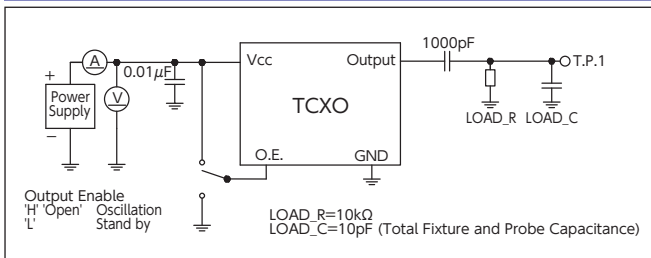
DSB535SG, SGA (Clipped Sine)



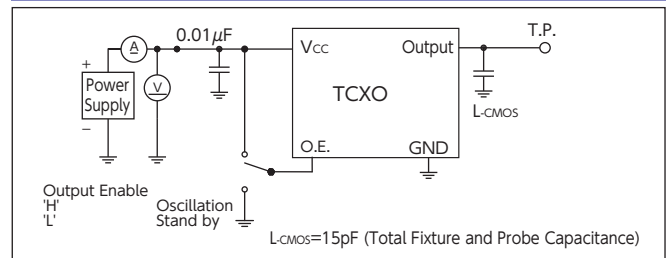
DSB535SG, SGA (CMOS)



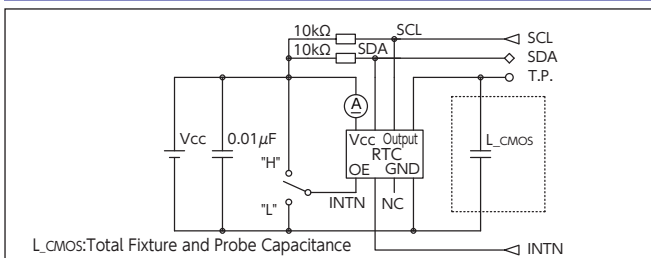
TCXO (DSB***SDNB, SLB, SPX, WLB, WDB, WEB)



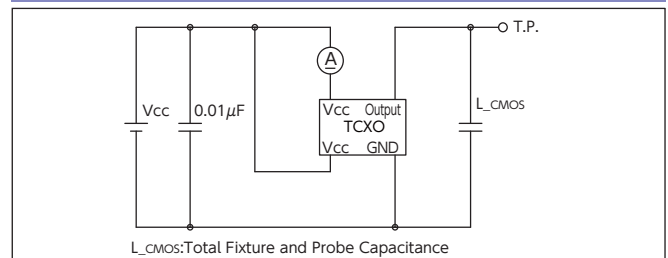
DSB211SJA



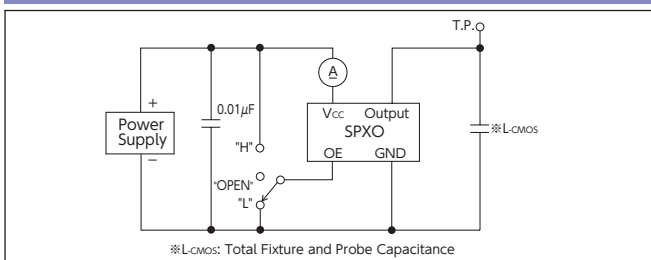
DSK324SR



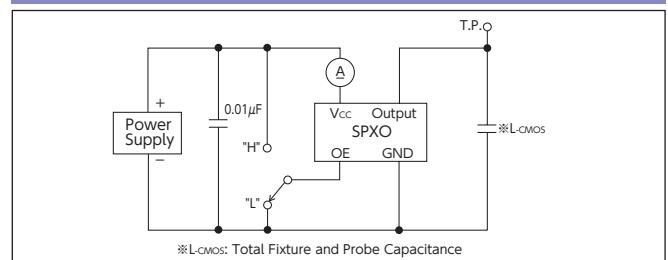
DSK321STD



DS1008JS, JN, DSO***AB, AR, AH, SN, SR, SH, SY, SHH, SBM

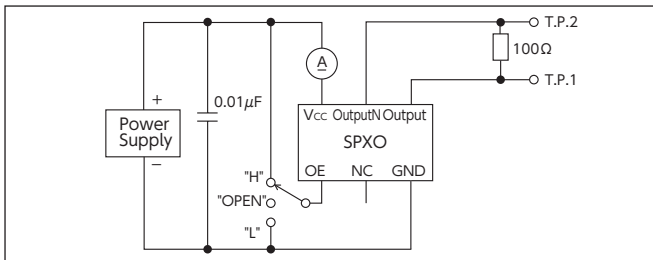


DSO***SX, SXF

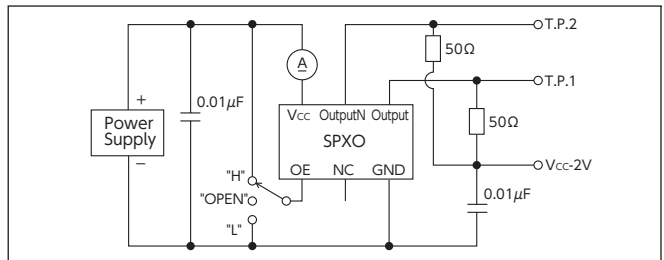


Measurement Circuit

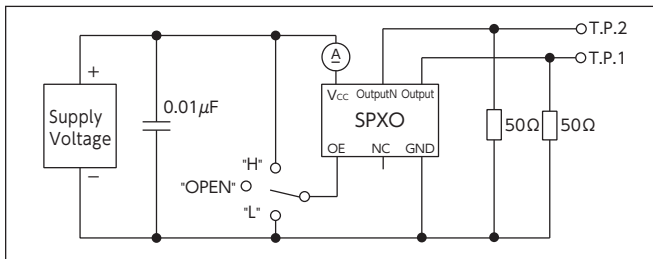
DSO223SJ, DSO323SJ, DSO533SJ, DSO753SJ



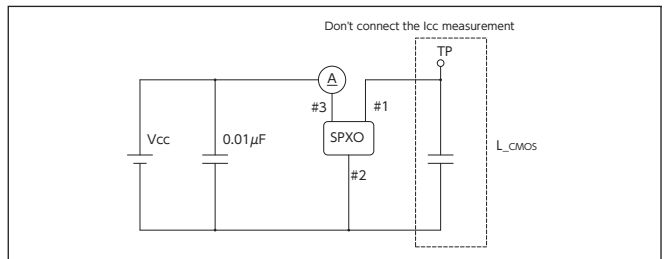
DSO223SK, DSO323SK, DSO533SK, DSO753SK



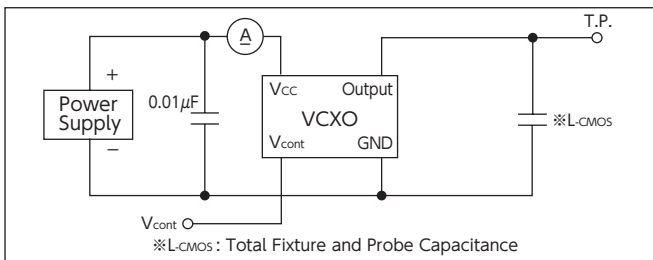
DSO223SD, DSO323SD, DSO753SD



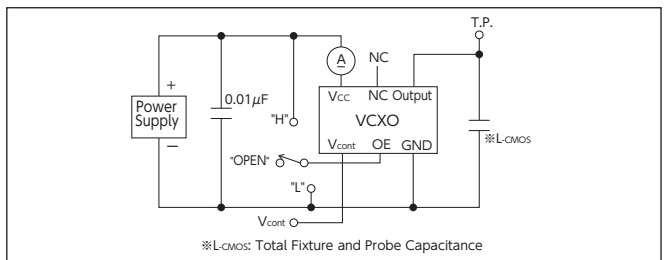
DLO555MBA



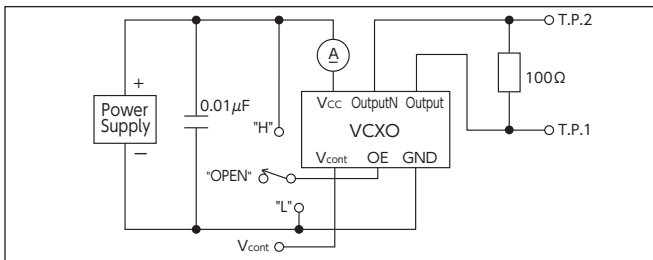
DSV321, 531SERIES



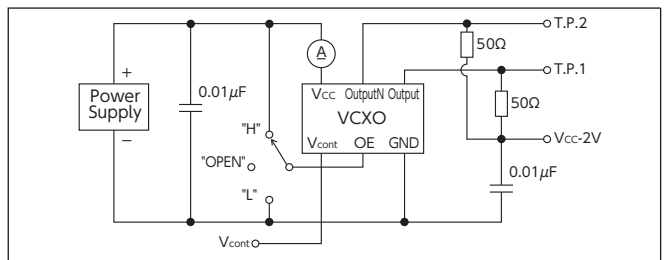
DSV323SV, DSV753SV/SB



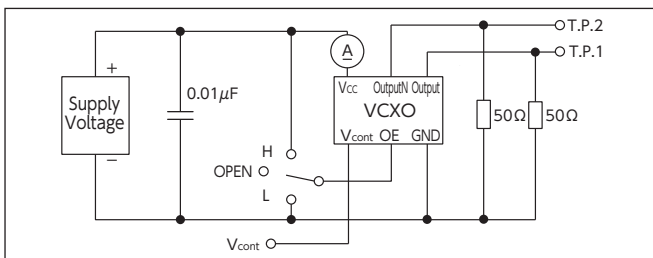
DSV323SJ, DSV753SJ



DSV323SK, DSV753SK

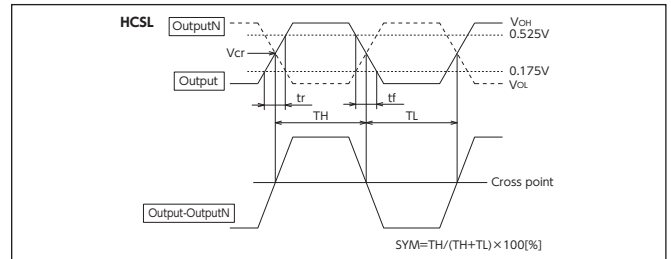
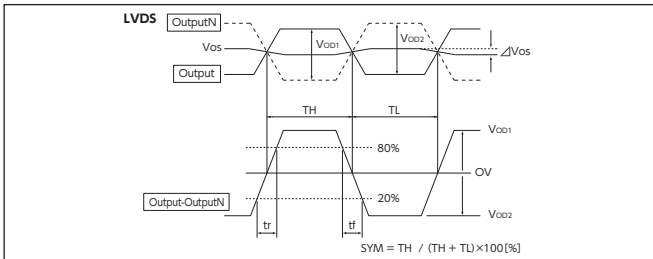
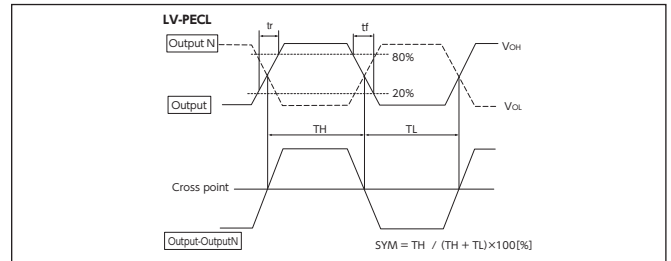
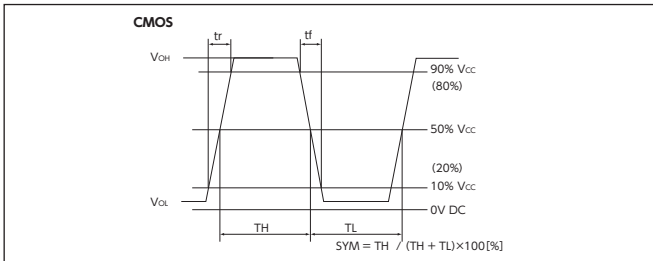


DSV323SD, DSV753SD

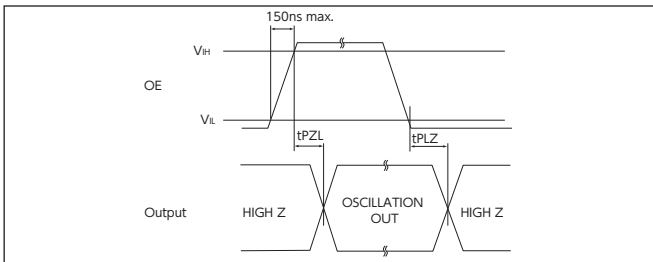


Measurement Circuit

Output Wave Form



Input and Output Conditions



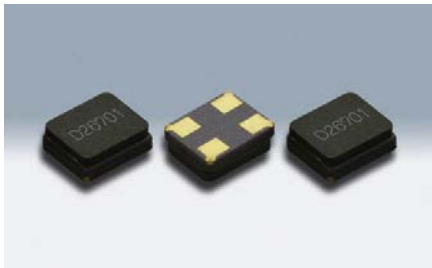
Quartz Devices

For Automotive

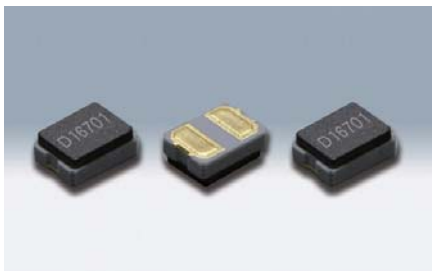


SMD Crystal Resonators / MHz Band Crystal Resonators (For Automotive)

DSX211G/DSX210GE



DSX211G



DSX210GE

Actual size

■ Features

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

■ Applications

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

■ Standard Specification

Item	Type	DSX210GE				
		DSX211G				
Frequency Range		16 to 20MHz	20 to 24MHz	24 to 30MHz	30 to 36MHz	36 to 64MHz
Overtone Order		Fundamental				
Load Capacitance		8pF, 10pF, 12pF				
Drive Level		10 μW (100 μW max.)				
Frequency Tolerance		$\pm 30 \times 10^{-6}$ (at 25 $^{\circ}\text{C}$)				
Series Resistance		400 Ω max.	200 Ω max.	150 Ω max.	120 Ω max.	80 Ω max.
Frequency Characteristics over Temperature		$\pm 100 \times 10^{-6} / -40$ to $+125^{\circ}\text{C}$ (Ref. to 25 $^{\circ}\text{C}$)				
Storage Temperature Range		-40 to $+150^{\circ}\text{C}$				
Reliability		AEC-Q200				
Packing Unit (1)		3000pcs./reel($\phi 180$)				

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

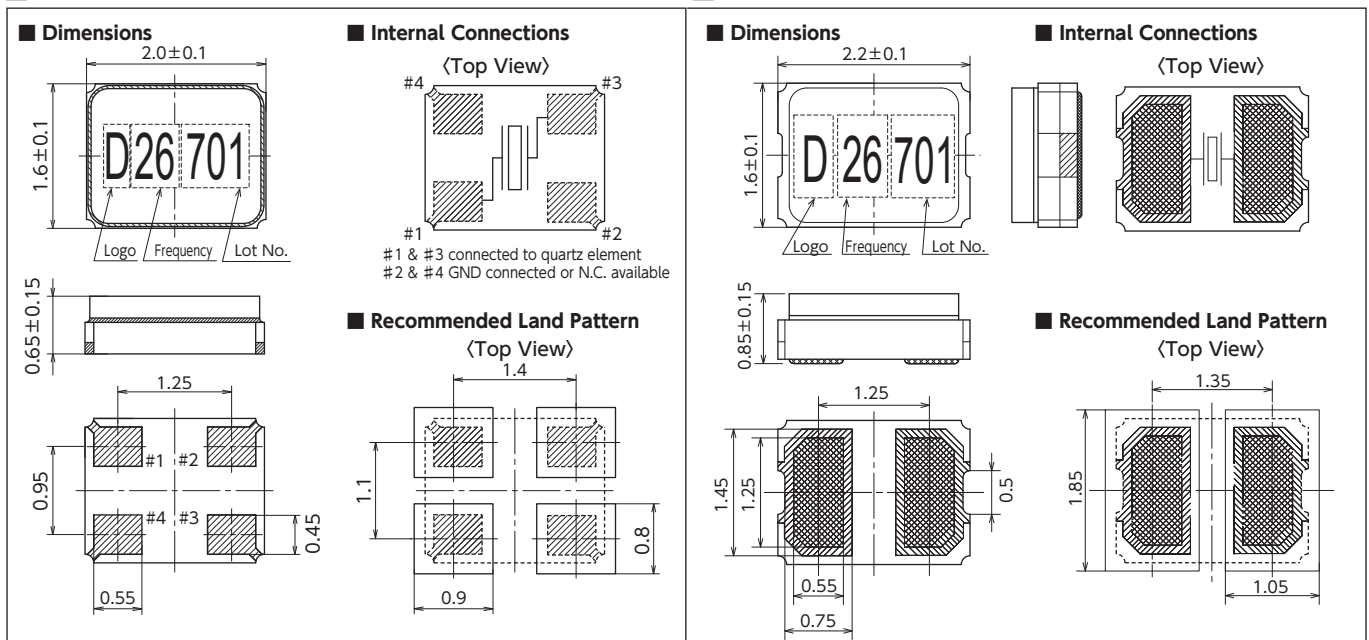
Consult our sales representative for other specifications.

■ DSX211G

[mm]

■ DSX210GE

[mm]



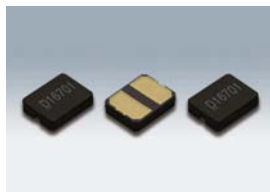
SMD Crystal Resonators / MHz Band Crystal Resonators (For Automotive)

DSX321G/DSX321GK/DSX320G/DSX320GE



DSX321G/DSX321GK

DSX320G



DSX320GE

Actual size

■ Features

- Miniature and lightweight SMD crystal resonator height DSX321G (over 12MHz): 0.75mm (12MHz or under): 0.85mm DSX321GK: 0.85mm DSX320G (over 12MHz): 0.85mm (12MHz or under): 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°C" (DSX320G/DSX320GE)
- AEC-Q200 Compliant
- Fully lead free option available. (DSX321G)



■ Applications

- RKE (Remote Keyless Entry), TPMS and safety controls (DSX321GK)
- Multimedia devices such as car navigation systems and car audio (DSX321G)
- ECU (engine, body work control), safety relations, car body controls, ABS, EPS (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°C)					
Series Resistance		400Ω max.	200Ω max.	150Ω max.	120Ω max.	100Ω max.	
Frequency Characteristics over Temperature		±100×10 ⁻⁶ /-40 to +125°C(Ref. to 25°C)					
Storage Temperature Range		-40 to +150°C					
Reliability		AEC-Q200					
Packing Unit (1)		3000pcs./reel(φ180)					

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

Consult our sales representative for other specifications.

■ DSX321G/DSX321GK [mm]

■ DSX320G [mm]

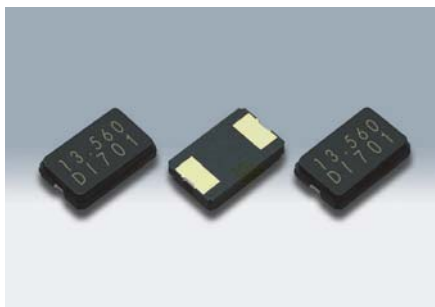
■ DSX320GE [mm]

[mm]

■ Dimensions	■ Internal Connections (Top View)	■ Dimensions	■ Internal Connections (Top View)	■ Dimensions	■ Internal Connections (Top View)
<p>3.2±0.1 2.5±0.1 Logo Frequency Lot No.</p> <p>DSX321G 0.75±0.15 : Over 12MHz 0.85±0.15 : 12MHz or under DSX321GK 0.85±0.15</p>	<p>#1 & #3 connected to quartz element #2 & #4 GND connected or N.C. available</p>	<p>3.2±0.1 2.5±0.1 Logo Frequency Lot No.</p> <p>0.85±0.15 : Over 12MHz 0.95±0.15 : 12MHz or under</p>		<p>3.2±0.1 2.5±0.1 0.95±0.15 Logo Frequency Lot No.</p>	
<p>DSX321G(Over 12MHz) 2.1 1.6 0.9 0.7</p> <p>DSX321G(12MHz or under), DSX321GK 2.1 1.6 0.9</p> <p>Recommended Land Pattern (Top View) 2.2 1.7 1.4 1.2</p>		<p>1.8 0.8 0.5 2-1.3 2-1.5 2.0 1.6</p>		<p>1.8 4.01 2.1 2.3 2-1.0 2-1.2 1.9 1.5 2.7</p>	

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.
- AEC-Q200 Compliant



RoHS/ELV Compliant

■ Applications

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

■ Standard Specification

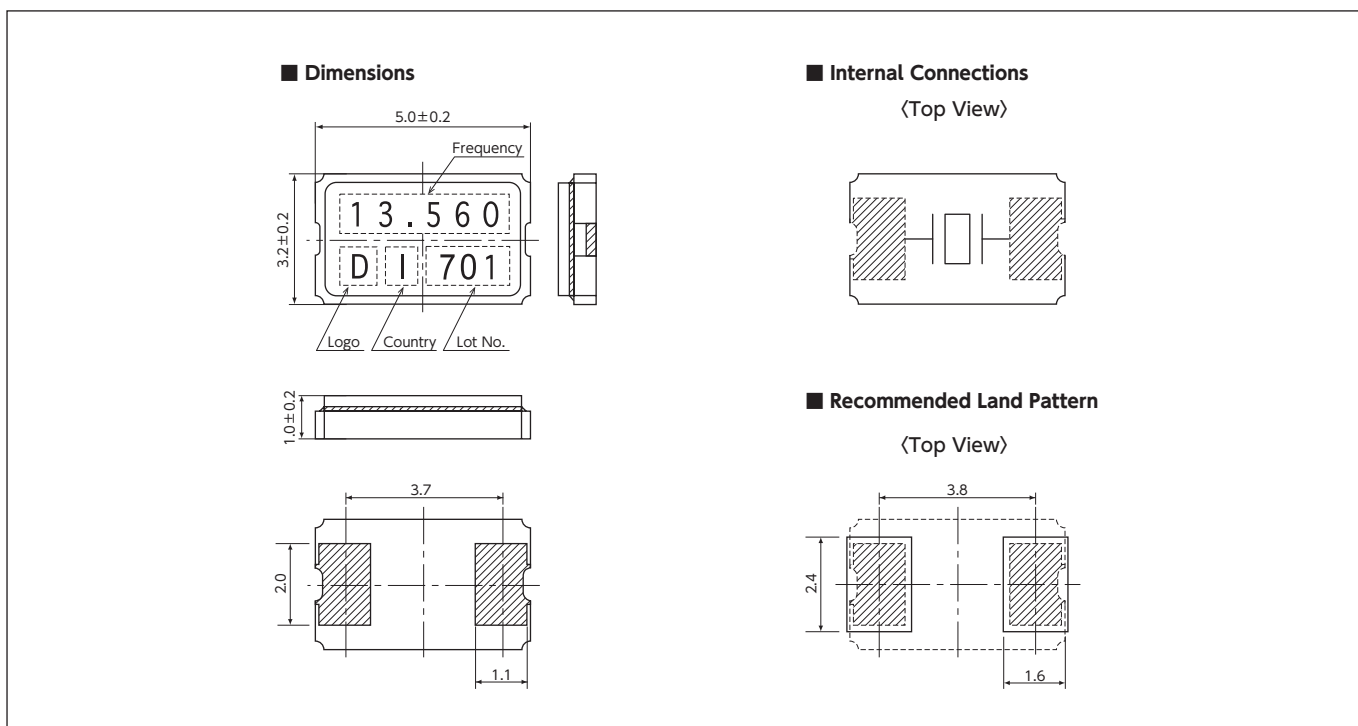
Item	Type	DSX530GA			
		DSX530GK			
Frequency Range	7 to 8MHz	8 to 12MHz	12 to 20MHz	20 to 54MHz	
Overtone Order		Fundamental			
Load Capacitance		8pF, 10pF, 12pF			
Drive Level		10μW (300μW max.)			
Frequency Tolerance		±30×10 ⁻⁶ (at 25°C)			
Series Resistance	200Ω max.	150Ω max.	100Ω max.	50Ω max.	
Frequency Characteristics over Temperature		±100×10 ⁻⁶ / -40 to +125°C (Ref. to 25°C)			
Storage Temperature Range		-40 to +150°C			
Reliability		AEC-Q200			
Packing Unit (1)		1000pcs./reel (φ180)			

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

Consult our sales representative for other specifications.

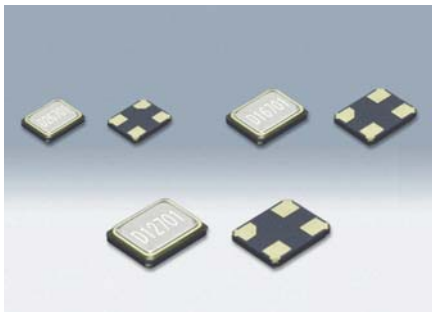
■ DSX530GK/DSX530GA

[mm]



SMD Crystal Resonators / MHz Band Crystal Resonators (For Automotive)

DSX211SH/DSX221SH/DSX321SH



Actual size DSX211SH □ DSX221SH □
DSX321SH □

■ Features

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



■ Applications

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

■ Standard Specification

Item	Type	DSX211SH		DSX221SH			DSX321SH			
		16 to 30MHz	30 to 60MHz	12 to 24MHz	24 to 30MHz	30 to 54MHz	12 to 20MHz	20 to 32MHz	32 to 50MHz	
Frequency Range		16 to 30MHz	30 to 60MHz	12 to 24MHz	24 to 30MHz	30 to 54MHz	12 to 20MHz	20 to 32MHz	32 to 50MHz	
Overtone Order		Fundamental								
Load Capacitance		8pF, 10pF, 12pF								
Drive Level		10μW (100μW max.)			10μW (200μW max.)					
Frequency Tolerance		±30×10 ⁻⁶ (at 25°C)								
Series Resistance		100Ω max.	50Ω max.	120Ω max.	50Ω max.	40Ω max.	80Ω max.	50Ω max.	40Ω max.	
Frequency Characteristics over Temperature		±100×10 ⁻⁶ / -40 to +125°C (Ref. to 25°C)								
Storage Temperature Range		-40 to +150°C								
Reliability		AEC-Q200								
Packing Unit (1)		3000pcs./reel(φ180)								

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

Consult our sales representative for other specifications.

■ DSX211SH

[mm]

■ DSX221SH

[mm]

■ DSX321SH

[mm]

■ Dimensions

■ 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)

■ 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)

■ 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)

DSR1612ATH/DSR211ATH/DSR211STH/DSR221STH



Actual size DSR1612ATH □ DSR211ATH □
DSR211STH □ DSR221STH □

■ Features

- DSR1612ATH: 1612size, height 0.65mm max.
- 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
- AEC-Q200 Compliant

■ Applications

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



■ Standard Specification

Item	Type	DSR1612ATH	DSR211ATH	DSR211STH	DSR221STH
Frequency Range		38.4Mhz	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°C)			
Series Resistance		80Ω max.			
Frequency Characteristics over Temperature		±30×10 ⁻⁶ / -40 to +105 °C (±12×10 ⁻⁶ / -30 to +85 °C)			±30×10 ⁻⁶ / -40 to +105 °C (±12×10 ⁻⁶ / -30 to +85 °C) ±20×10 ⁻⁶ / -40 to +105 °C
Storage Temperature Range		-40 to +125 °C			
Thermistor Resistance		100kΩ (at +25°C)			
Thermistor B-constant		4250K (+25°C to +50°C)			
Reliability		AEC-Q200			
Packing Unit (1)		3000pcs./reel (φ 180)			

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

Consult our sales representative for other specifications.

■ DSR1612ATH [mm]	■ DSR211ATH [mm]	■ DSR211STH [mm]	■ DSR221STH [mm]
<p>■ Dimensions</p> <p>Model Code #4, Frequency, #3, #2, #1 Index, Logo, Lot No. #1, #4, 1.64±0.06, 1.24±0.06, 0.65mm max., 1.10, 0.10, 0.30, 0.70, 0.84</p> <p>■ Internal Connections (Top View)</p> <p>#4 SENSOR, #3 Xtal, #1 Xtal, #2 GND</p> <p>■ Recommended Land Pattern (Top View)</p> <p>0.55, 0.70, 4-R0.15, 0.84, 0.30, 0.55, 1.40, 1.10</p>	<p>■ Dimensions</p> <p>Model Code #4, Frequency, #3, #2, #1 Index, Logo, Lot No. #1, #4, 2.0±0.1, 1.6±0.1, 0.65mm max., 0.475, 0.15, 0.975, 1.375, 0.75, 1.80, 0.45, 0.75, 2.20</p> <p>■ Internal Connections (Top View)</p> <p>#4 SENSOR, #3 Xtal, #1 Xtal, #2 GND</p> <p>■ Recommended Land Pattern (Top View)</p> <p>0.75, 0.45, 0.30, 0.75, 1.80, 2.20</p>	<p>■ Dimensions</p> <p>Model Code #4, Frequency, #3, #2, #1 Index, Logo, Lot No. #1, #4, 2.0±0.1, 1.6±0.1, 0.8mm max. 19.2MHz/26MHz, 0.65mm max. 38.4MHz, 0.475, 0.15, 0.975, 1.375, 0.75, 1.80, 0.45, 0.75, 2.20</p> <p>■ Internal Connections (Top View)</p> <p>#4 SENSOR, #3 Xtal, #1 Xtal, #2 GND</p> <p>■ Recommended Land Pattern (Top View)</p> <p>0.75, 0.45, 0.30, 0.75, 1.80, 2.20</p>	<p>■ Dimensions</p> <p>Model Code #4, Frequency, #3, #2, #1 Index, Logo, Lot No. #1, #4, 2.5±0.15, 2.0±0.15, 1.0mm max., 0.65, 0.55, 1.25, 1.65, 0.85, 1.95, 0.95, 1.55, 1.10</p> <p>■ Internal Connections (Top View)</p> <p>#4 SENSOR, #3 Xtal, #1 Xtal, #2 GND</p> <p>■ Recommended Land Pattern (Top View)</p> <p>0.85, 1.95, 0.95, 1.55, 1.10</p>

SMD Crystal Resonators / MHz Band Crystal Resonators (For Automotive)

SMD-49



Actual size

■ Features

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



■ Standard Specification

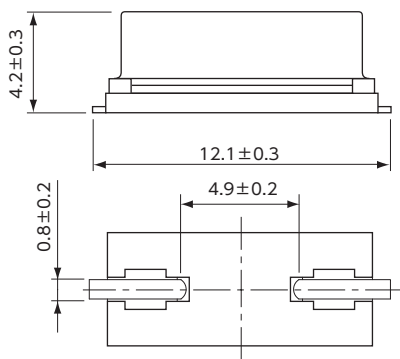
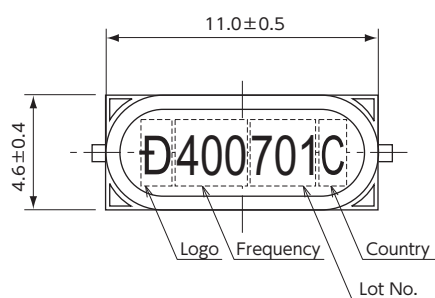
Item	Type	SMD-49	
Frequency Range		4MHz	8MHz
Overtone Order		Fundamental	
Load Capacitance		8pF, 10pF, 12pF	
Drive Level		10μW (300μW max.)	
Frequency Tolerance		±30×10 ⁻⁶ (at 25°C)	
Series Resistance		120Ω max.	60Ω max.
Frequency Characteristics over Temperature		±100×10 ⁻⁶ / -40 to +125°C	
Storage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

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

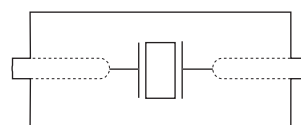
Consult our sales representative for other specifications.

[mm]

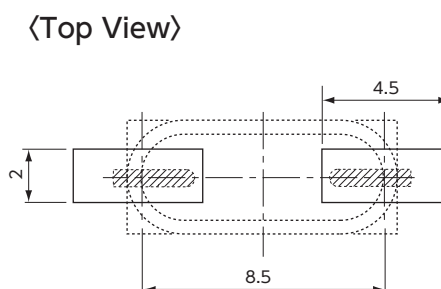
■ Dimensions



■ Internal Connections (Top View)

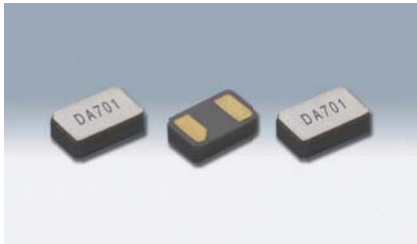


■ Recommended Land Pattern (Top View)



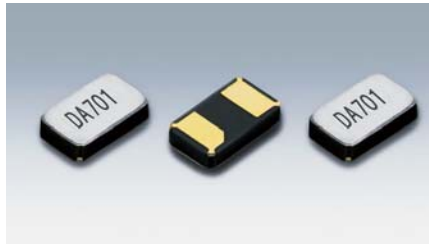
SMD Tuning Fork Crystal Resonators / kHz Band Crystal Resonators (For Automotive)

DST1610A/DST210AC/DST310S



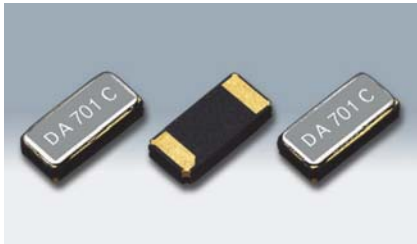
DST1610A

Actual size



DST210AC

Actual size



DST310S

Actual size

■ Features

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

■ Applications

- Automotive multimedia devices



■ Standard Specification

Item	Type	DST1610A	DST210AC	DST310S
Frequency Range		32.768kHz		
Load Capacitance		7pF, 9pF, 12.5pF		
Drive Level		0.1μW(0.5μW max.)		0.2μW(1.0μW max.)
Frequency Tolerance		±20×10 ⁻⁶ (at 25°C)		
Series Resistance		80kΩ max. (-40 to +85°C) 120kΩ max. (-40 to +125°C)		50kΩ max. (-40 to +85°C) 80kΩ max. (-40 to +125°C)
Turnover Temperature		+25°C±5°C		
Parabolic Coefficient		-0.04×10 ⁻⁶ / °C ² max.		
Operating Temperature Range		-40 to +85°C / -40 to +125°C		
Storage Temperature Range		-40 to +125°C		
Shunt Capacitance		1.3pF typ.		
Reliability		AEC-Q200		
Packing Unit (1)		3000pcs./reel(φ180)		

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

Consult our sales representative for other specifications.

■ DST1610A

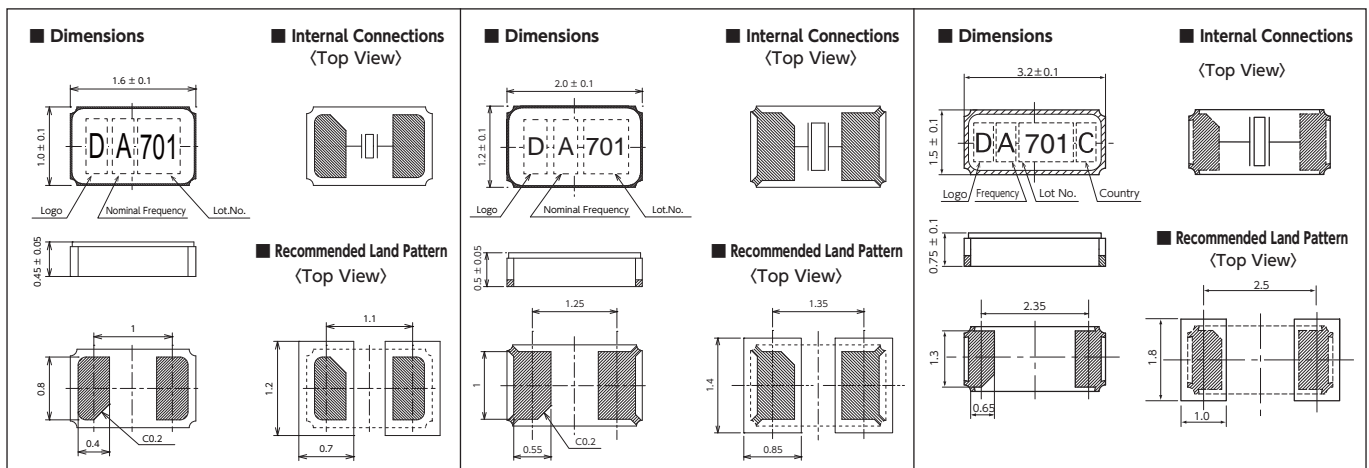
[mm]

■ DST210AC

[mm]

■ DST310S

[mm]



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

DMX-26S



Actual size

■ Features

- AEC-Q200 Compliant
- RoHS/ELV Compliant

■ Applications

- Automotive multimedia devices



RoHS/ELV Compliant

■ Standard Specification

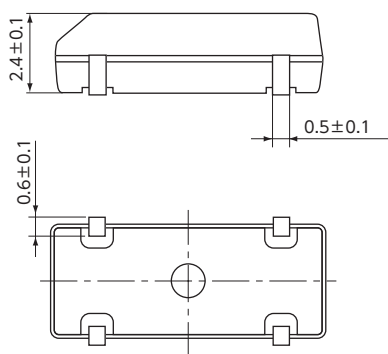
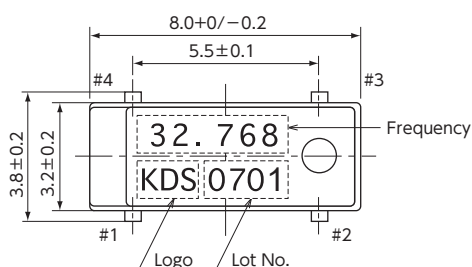
Item	Type	DMX-26S
Frequency Range		32.768kHz (30 to 90kHz)
Load Capacitance		7pF, 9pF, 12.5pF
Drive Level		1.0μW (2.0μW max.)
Frequency Tolerance		±20×10 ⁻⁶ (at 25°C)
Series Resistance		50kΩ max. (-40 to +85°C) 80kΩ max. (-40 to +125°C)
Turnover Temperature		+25°C±5°C
Parabolic Coefficient		-0.04×10 ⁻⁶ / °C ² max.
Operating Temperature Range		-40 to +85°C / -40 to +125°C
Storage Temperature Range		-40 to +125°C
Shunt Capacitance		1.25pF typ.
Reliability		AEC-Q200
Packing Unit (1)		2500pcs./reel(φ330)

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

Consult our sales representative for other specifications.

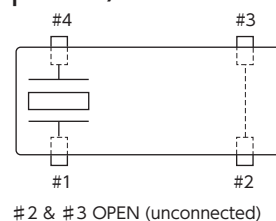
[mm]

■ Dimensions



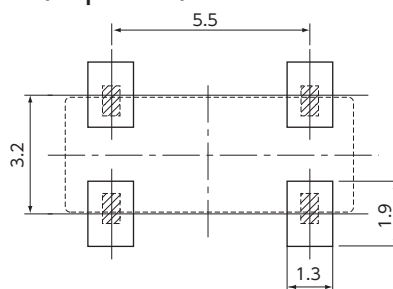
■ Internal Connections

〈Top View〉



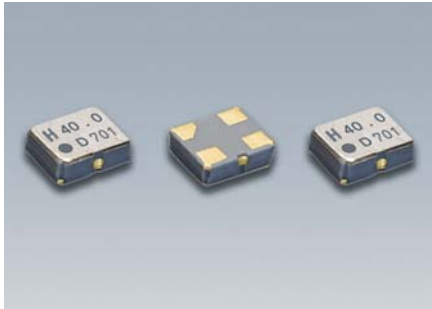
■ Recommended Land Pattern

〈Top View〉



SMD Low Phase Noise Crystal Oscillators (For Automotive)

DSO211AH



Actual size

■ Features

- Supply Voltage: 1.8V/2.5V/2.8V/3.0V/3.3V
- Low phase noise: $f_{out} \pm 1\text{kHz}$ $-145 \text{ dBc/Hz(Typ.)}$
 $f_{out} \pm 100\text{kHz}$ $-158 \text{ dBc/Hz(Typ.)}$
- Low profile: 0.72mm
- AEC-Q100/AEC-Q200 Compliant
- 3-state function

■ Applications

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

[Function Code]
DSO211AH A A

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



■ Standard Specification

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

Item	Function Code		Output Frequency Range (MHz)	Legend	Spec.				Condition
	Supply Voltage	Frequency tolerance			min.	typ.	max.	Unit	
Supply Voltage	A	*	$1.2 \leq f_0 \leq 80$	V _{cc}	+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	$1.2 \leq f_0 \leq 80$	f _{tol}	-80	-	+80	$\times 10^{-6}$	-40 to +105°C
		A			-100	-	+100		-40 to +85°C
		B			-50	-	+50		-20 to +70°C
		C			-30	-	+30		-10 to +70°C
		D			-25	-	+25		
Current Consumption	A,M	*	$1.2 \leq f_0 \leq 60$ $60 < f_0 \leq 80$	I _{cc}	-	-	4.0	mA	No Load
	B				-	-	5.0		
	C				-	-	3.6		
					-	-	4.5		
	D				-	-	3.4		
Stand-by Current (#1 pin "L" Level)	*	*	*	I _{std}	-	-	10	μA	
	*	*	*	L _{CMOS}	-	-	15	pF	
Symmetry	*	*	*	SYM	45	50	55	%	at 50% V _{cc}
0 Level Output Voltage	*	*	*	V _{OL}	-	-	V _{cc} ×0.1	V	
1 Level Output Voltage	*	*	*	V _{OH}	V _{cc} ×0.9	-	-	V	
Rise and Fall Time	*	*	*	t _r , t _f	-	-	6 (5)	ns	10 to 90% V _{cc} Level (20 to 80% V _{cc} Level)
OE Pin 0 Level Input Voltage	*	*	*	V _{IL}	-	-	V _{cc} ×0.2	V	
OE Pin 1 Level Input Voltage	*	*	*	V _{HI}	V _{cc} ×0.8	-	-	V	
Output Disable Time	*	*	*	t _{PLZ}	-	-	150	ns	
Output Enable Time	*	*	*	t _{PZL}	-	-	5	ms	
Phase Noise	A,M,B,C	*	$1.2 \leq f_0 \leq 60$	-	-	-145	-	dBc/Hz	Offset 1kHz
	D				-	-140	-		
	A,M,B,C	*	$60 < f_0 \leq 80$		-	-135	-		
	D				-	-135	-		
	A,M,B,C	*	$1.2 \leq f_0 \leq 60$		-	-158	-		Offset 100kHz
	D				-	-152	-		
A,M,B,C	*	$60 < f_0 \leq 80$	-	-155	-				
D			-	-150	-				
Period Jitter (1)	*	*	*	t _{RMS}	-	2.4	-	ps	σ
Total Jitter (1)	*	*	*	tp-p	-	23	-	ps	Peak to peak
				t _{TL}	-	34	-	ps	t _{DJ} +n×t _{RJ} n=14.1 (BER=1×10 ⁻¹⁵) (2)
Phase Jitter	*	*	$40 \leq f_0 \leq 80$ $10 \leq f_0 < 40$	tpj	-	-	1	ps	f _o offset: 12kHz to 20MHz f _o offset: 12kHz to 5MHz
Reliability	AEC-Q100/AEC-Q200								
Packing Unit (3)	3000pcs./reel(φ180)								

- (1) Measured WAVECREST DTS-2075
- (2) t_{DJ}:Deterministic jitter t_{RJ}:Random jitter
- (3) Moisture prevention packing is unnecessary.
Moisture Sensitivity Level:Level 1 (IPC/JEDEC J-STD-033)

Consult our sales representative for other specifications.

[mm]

■ Dimensions

Model Code: H 40.0 D 701
Frequency: #3
#1 Index: #1
Logo: #2
Lot No.: #4

Pin Connections

Pin No.	Connection
#1	OE (Output Enable)
#2	GND
#3	Output
#4	V _{cc}

Function

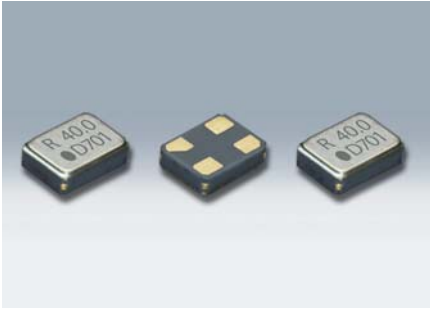
#1 Input	#3 Output condition
H	Oscillation out
Open	Oscillation out
L	High Z

■ Recommended Land Pattern

<Top View>

SMD Crystal Oscillators (For Automotive)

DSO1612AR



Actual size □

■ Features

- 3-state function
- Capable of operating over a wide temperature range, from -40 to +125°C.
- AEC-Q100/AEC-Q200 Compliant

■ Applications

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

[Function Code]

DSO1612AR A Y

A : 3.3V

M : 3.0V

B : 2.8V

C : 2.5V

D : 1.8V

Y : ±100×10⁻⁶

Z : ±80×10⁻⁶

B : ±50×10⁻⁶



■ Standard Specification

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

Item	Function Code		Legend	Output Frequency Range (MHz)	Spec.			Condition			
	Supply Voltage	Frequency tolerance			min.	typ.	max.				
Supply Voltage	A	*	Vcc	0.584375 ≤ fo < 80	+3.0	+3.3	+3.6				
	M				+2.7	+3.0	+3.3				
	B				+2.6	+2.8	+3.0				
	C				+2.25	+2.5	+2.75				
Frequency Tolerance (Includes frequency tolerance at room temperature.)	*	Y	f_tol	0.584375 ≤ fo < 80	-100	-	+100	-40 to +125°C			
		Z			-80	-	+80	-40 to +110°C			
Current Consumption	A,M	*	I_cc	0.584375 ≤ fo < 40	-	-	+3.0	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	*	-	-	+20				
Load Condition	*	*	L_cmos	*	-	-	15				
Symmetry	*	*	SYM	*	40	50	60	at 50% Vcc			
0 Level Output Voltage	*	*	V_OL	*	-	-	Vcc×0.1				
1 Level Output Voltage	*	*	V_OH	*	Vcc×0.9	-	-				
Rise and Fall Time	A,M,B,C	*	tr, tf	*	-	-	3.5	10 to 90% Vcc Level			
	D				-	-	5				
OE Pin 0 Level Input Voltage	*	*	V_IL	*	-	-	Vcc×0.2				
OE Pin 1 Level Input Voltage	*	*	V_IH	*	Vcc×0.8	-	-				
Output Disable Time	*	*	t_PLZ	*	-	-	200				
Output Enable Time	*	*	t_PZL	*	-	-	1				
Period Jitter (1)	*	*	t_RMS	*	-	2.2	-	σ			
			t_p-p	*	-	20	-	Peak to peak			
Total Jitter (1)	*	*	t_TL	*	-	31	-	tDJ+n×tRJ n=14.1 (BER=1×10 ⁻¹⁵) (2)			
Phase Jitter	*	*	tpj	40 ≤ fo ≤ 80	-	-	1	fo offset: 12kHz to 20MHz			
				10 ≤ fo < 40	-	-	1	fo offset: 12kHz to 5MHz			
Reliability	AEC-Q100/AEC-Q200										
Packing Unit (3)	3000pcs./reel (φ180)										

(1) Measured WAVECREST DTS-2075

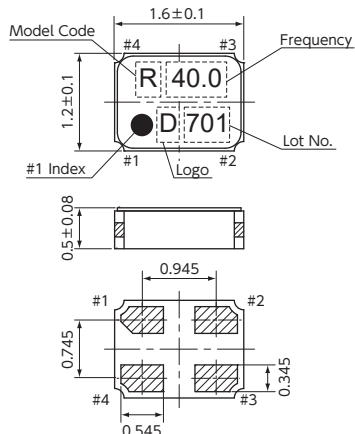
(2) tDJ:Deterministic jitter tRJ:Random jitter

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

Consult our sales representative for other specifications.

[mm]

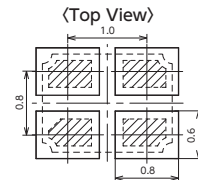
■ Dimensions



■ Recommended Land Pattern

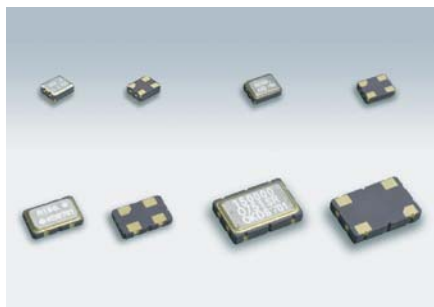
Pin No.	Connection
#1	OE (Output Enable)
#2	GND
#3	Output
#4	Vcc

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



SMD Crystal Oscillators (For Automotive)

DSO221SR/DSO321SR/DSO531SR/DSO751SR



Features

- 3-state function
- Capable of operating over a wide temperature range, from -40 to +125°C.
- AEC-Q100/AEC-Q200 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



[Function Code]

DSO***SR

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

A, Y : $\pm 100 \times 10^{-6}$
Z : $\pm 80 \times 10^{-6}$
B : $\pm 50 \times 10^{-6}$

Actual size DSO221SR DSO321SR DSO531SR DSO751SR

Standard Specification

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

Item	Function Code		Output Frequency Range (MHz)	Legend	Spec.				Condition
	Supply Voltage	Frequency tolerance			min.	typ.	max.	Unit	
Supply Voltage	A	*	$0.2 \leq f_0 \leq 125$	V _{CC}	+3.0	+3.3	+3.6	V	
	M		$0.2 \leq f_0 \leq 125$		+2.7	+3.0	+3.3		
	B		$0.2 \leq f_0 \leq 100$		+2.6	+2.8	+3.0		
	C		$0.2 \leq f_0 \leq 100$		+2.25	+2.5	+2.75		
Frequency Tolerance (Includes frequency tolerance at room temperature.)	*	Y	$0.2 \leq f_0 \leq 100$	f _{tol}	-100	-	+100	$\times 10^{-6}$	-40 to +125°C
		Z	$0.2 \leq f_0 \leq 100$		-80	-	+80		-40 to +110°C
		A	$100 < f_0 \leq 125$		-100	-	+100		-40 to +85°C
		B	$0.2 \leq f_0 \leq 100$		-50	-	+50		
Current Consumption	A, M	*	$0.2 \leq f_0 < 54$	I _{CC}	-	-	+4.0	mA	No Load
			$54 \leq f_0 < 80$		-	-	+6.0		
			$80 \leq f_0 \leq 125$		-	-	+8.0		
	B	*	$0.2 \leq f_0 < 54$		-	-	+3.5		
			$54 \leq f_0 < 80$		-	-	+5.5		
			$80 \leq f_0 \leq 100$		-	-	+7.5		
	C	*	$0.2 \leq f_0 < 54$		-	-	+3.0		
			$54 \leq f_0 < 80$		-	-	+5.0		
			$80 \leq f_0 \leq 100$		-	-	+7.0		
	D	*	$0.2 \leq f_0 < 54$		-	-	+2.5		
			$54 \leq f_0 < 80$		-	-	+4.5		
					-	-			
Stand-by Current (#1 pin 'L' level)	*	*	*	L _{std}	-	-	+10	μ A	
Load Condition	*	*	*	L _{CMOS}	-	-	15	pF	
Symmetry	*	*	*	SYM	40	50	60	%	50% V _{CC} Level
0 Level Output Voltage	*	*	*	V _{OL}	-	-	V _{CC} × 0.1	V	
1 Level Output Voltage	*	*	*	V _{OH}	V _{CC} × 0.9	-	-	V	
Rise and Fall Time	*	*	$0.2 \leq f_0 \leq 54$	tr,tf	-	-	8	ns	10 to 90% V _{CC} Level
			$54 < f_0 < 100$		-	-	4		
			$100 \leq f_0 \leq 125$		-	-	3		
OE Pin 0 Level Input Voltage	*	*	*	V _{IL}	-	-	V _{CC} × 0.2	V	
OE Pin 1 Level Input Voltage	*	*	*	V _{IH}	V _{CC} × 0.8	-	-	V	
Output Disable Time	*	*	*	t _{PLZ}	-	-	150	ns	
Output Enable Time	*	*	*	t _{PZL}	-	-	5	ms	
Period Jitter (1)	*	*	*	t _{RMS}	-	2.2	-	ps	σ
					t _{p-p}	-	20		
Total Jitter (1)	*	*	*	t _{TL}	-	31	-	ps	Peak to peak
						-	-		
Phase Jitter	*	*	$40 \leq f_0 \leq 125$	tpj	-	-	1	ps	f _o offset: 12kHz to 20MHz
			$10 \leq f_0 < 40$		-	-	-		
Reliability	AEC-Q100/AEC-Q200								
Packing Unit (3)	DSO221SR, DSO321SR : 2000pcs./reel(180 ϕ), DSO531SR : 1000pcs./reel(180 ϕ), DSO751SR : 1000pcs./reel(254 ϕ)								

- (1) Measured WAVECREST DTS-2075
- (2) t_{DJ}:Deterministic jitter t_{RJ}:Random jitter
- (3) Moisture prevention packing is unnecessary. Moisture Sensitivity Level:Level 1 (IPC/JEDEC J-STD-033)

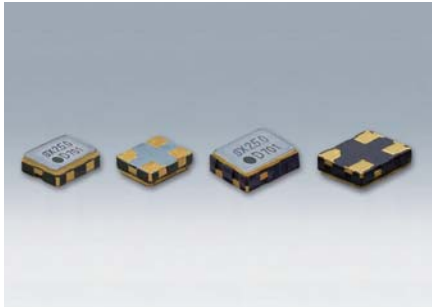
Consult our sales representative for other specifications.

■ DSO221SR [mm] ■ DSO321SR [mm] ■ DSO531SR [mm] ■ DSO751SR [mm]

Dimensions	Dimensions	Dimensions	Dimensions

SMD Crystal Oscillators (For Automotive)

DSO211SX/DSO221SX



Actual size DSO211SX DSO221SX

Features

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



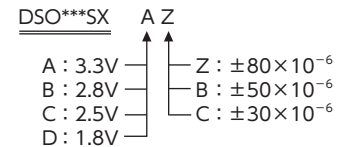
Applications

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

[Type]

DSO211SX	2016 size
DSO221SX	2520 size

[Function Code]



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

Standard Specification

Item	Function Code		Output Frequency Range (MHz)	Legend	Spec.				Condition
	Supply Voltage	Frequency tolerance			min.	typ.	max.	Unit	
Supply Voltage	A	*	1 ≤ f ₀ ≤ 125	V _{cc}	+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)	*	Z	*	f _{tol}	-	-	+80	×10 ⁻⁶	-40 to +125°C
		B			-	-	+50		-40 to +85°C
		C			-	-	+50		
Current Consumption	A	*	100 ≤ f ₀ ≤ 125	I _{cc}	-	-	10.0	mA	No Load
			40 ≤ f ₀ < 100		-	-	4.2		
			1 ≤ f ₀ < 40		-	-	2.4		
			100 ≤ f ₀ ≤ 125		-	-	9.0		
			40 ≤ f ₀ < 100		-	-	3.7		
			1 ≤ f ₀ < 40		-	-	2.2		
	B		100 ≤ f ₀ ≤ 125		-	-	8.0		
			40 ≤ f ₀ < 100		-	-	3.4		
			1 ≤ f ₀ < 40		-	-	2.0		
	C		40 ≤ f ₀ ≤ 100		-	-	2.7		
			1 ≤ f ₀ < 40		-	-	1.7		
			40 ≤ f ₀ ≤ 100		-	-	10		
Stand-by Current (#1 pin "L" Level)	*	*	*	I _{std}	-	-	10	μA	
Load Condition	*	*	*	L _{CMOS}	-	-	15	pF	
Symmetry	*	*	*	SYM	45	50	55	%	50% V _{cc} Level
0 Level Input Voltage	*	*	*	V _{OL}	-	-	V _{cc} × 0.1	V	
1 Level Input Voltage	*	*	*	V _{OH}	V _{cc} × 0.9	-	-	V	
Rise and Fall Time	A,B,C	*	*	tr, tf	-	-	3	ns	10 to 90% V _{cc} Level
					D	-	-		
OE Pin 0 Level Input Voltage	*	*	*	V _{IL}	-	-	V _{cc} × 0.3	V	
OE Pin 1 Level Input Voltage	*	*	*	V _{IH}	V _{cc} × 0.7	-	-	V	
Output Disable Time	*	*	*	t _{PLZ}	-	-	200	ns	
Output Enable Time	*	*	*	t _{PZL}	-	-	2	ms	
Reliability	AEC-Q100/AEC-Q200								
Packing Unit (1)	3000pcs./reel (φ 180)								

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

Consult our sales representative for other specifications.

DSO211SX

[mm]

DSO221SX

[mm]

Dimensions

Model Code: SX, 25.0, D, 701

Frequency: 2.0 ± 0.1

Dimensions: 1.6 ± 0.1, 0.70 ± 0.1, 0.37, 1.03, 0.6, 1.3, 0.53

Pin Connections:

Pin No.	Connection
#1	OE(Output Enable)
#2	GND
#3	Output
#4	V _{cc}

Function:

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

Recommended Land Pattern (Top View)

Dimensions: 0.9, 0.75, 1.05, 1.3, 0.6

Dimensions

Model Code: SX, 25.0, D, 701

Frequency: 2.5 ± 0.15

Dimensions: 2.0 ± 0.15, 0.8 ± 0.1, 0.23, 1.28, 0.78, 1.68, 0.58, 1.7, 1.00, 0.9

Pin Connections:

Pin No.	Connection
#1	OE(Output Enable)
#2	GND
#3	Output
#4	V _{cc}

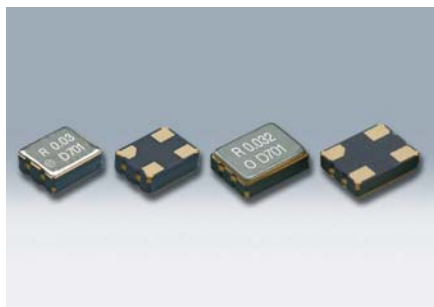
Function:

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

Recommended Land Pattern (Top View)

SMD Crystal Oscillators (For Automotive)

DSO221SR/DSO321SR (kHz)



Actual size DSO221SR DSO321SR

■ Features

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

■ Applications

- Multimedia devices such as car navigation systems and car audio



[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

[Type]

DSO221SR	2520 size
DSO321SR	3225 size

■ Standard Specification

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

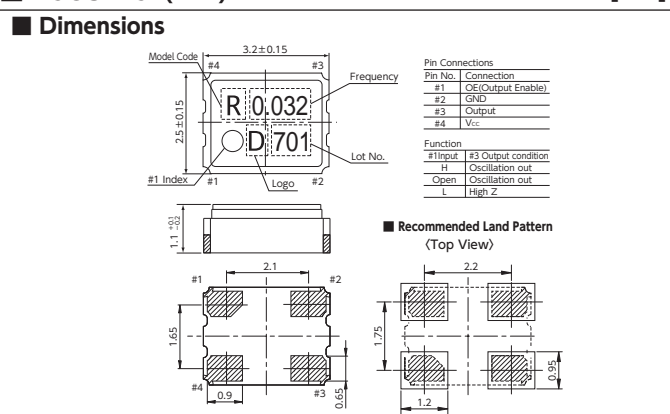
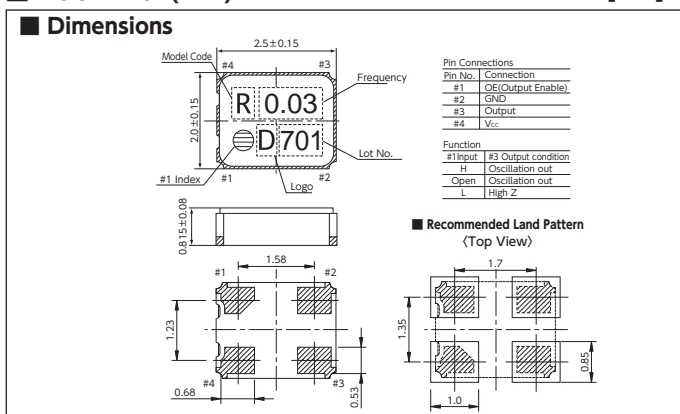
Item	Function Code		Output Frequency Range (KHz)	Legend	Spec.				Condition
	Supply Voltage	Frequency tolerance			min.	typ.	max.	Unit	
Supply Voltage	A	*	32.768 ≤ f ₀ ≤ 50	V _{cc}	+3.0	+3.3	+3.6	V	
	M				+2.7	+3.0	+3.3		
	B				+2.6	+2.8	+3.0		
	C				+2.25	+2.5	+2.75		
	D				+1.6	+1.8	+2.0		
	Y				+4.5	+5.0	+5.5		
Frequency Tolerance (includes frequency tolerance at room temperature)	*	Y	32.768 ≤ f ₀ ≤ 50	f _{tol}	-100	-	+100	×10 ⁻⁶	-40 to +125°C
	*	Z			-80	-	+80		-40 to +110°C
	*	W			-50	-	+50		-40 to +105°C
	*	B			-50	-	+50		-40 to +85°C
Current Consumption	A, M, B, C, D	*	f ₀ =32.768	I _{cc}	-	-	65	μA	No Load
	Y		32.768 < f ₀ ≤ 50		-	-	100		
			f ₀ =32.768		-	-	80		
			32.768 < f ₀ ≤ 50		-	-	120		
Stand-by Current (#1 pin "L" Level)	*	*	32.768 ≤ f ₀ ≤ 50	I _{std}	-	-	3	μA	-40 to +125°C
Load Condition	*	*	32.768 ≤ f ₀ ≤ 50	L _{CMOS}	-	-	15	pF	
Symmetry	*	*	32.768 ≤ f ₀ ≤ 50	SYM	45	50	55	%	at 50% V _{cc}
0 Level Input Voltage	*	*	*	V _{OL}	-	-	V _{cc} × 0.1	V	
1 Level Input Voltage	*	*	*	V _{OH}	V _{cc} × 0.9	-	-		
Rise and Fall Time	*	*	32.768 ≤ f ₀ ≤ 50	t _r , t _f	-	-	20	ns	10 to 90% V _{cc} Level
OE Pin 0 Level Input Voltage	*	*	*	V _{IL}	-	-	V _{cc} × 0.2	V	
OE Pin 1 Level Input Voltage	*	*	*	V _{IH}	V _{cc} × 0.8	-	-		
Output Disable Time	*	*	*	t _{PLZ}	-	-	150	ns	
Output Enable Time	*	*	*	t _{PZL}	-	-	2	ms	
Period Jitter (1)	*	*	*	t _{RMS}	-	15	-	ps	σ
			*	t _{p-p}	-	150	-		Peak to peak
Total Jitter (1)	*	*	*	t _L	-	220	-	ps	t _{DJ} +n×t _{RJ} n=14.1 (BER=1×10 ⁻¹²) (2)
Reliability	AEC-Q100/AEC-Q200								
Packing Unit (3)	2000pcs./reel (φ180)								

- (1) Measured WAVECREST DTS-2075
- (2) t_{DJ}:Deterministic jitter t_{RJ}:Random jitter
- (3) Moisture prevention packing is unnecessary. Moisture Sensitivity Level:Level 1 (IPC/JEDEC J-STD-033)

Consult our sales representative for other specifications.

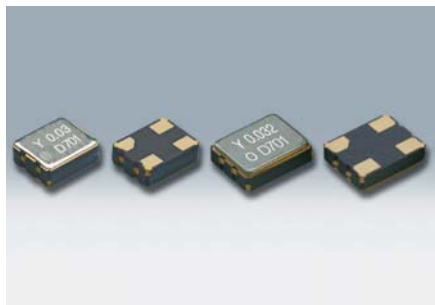
■ DSO221SR(kHz)

■ DSO321SR(kHz)



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-Q100/AEC-Q200 compliant

■ Applications

- Multimedia devices such as car navigation systems and car audio

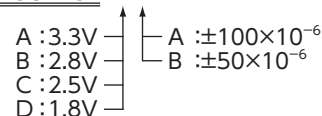


[Type]

DSO221SY	2520 size
DSO321SY	3225 size

[Function Code]

DSO***SY A A



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

■ Standard Specification

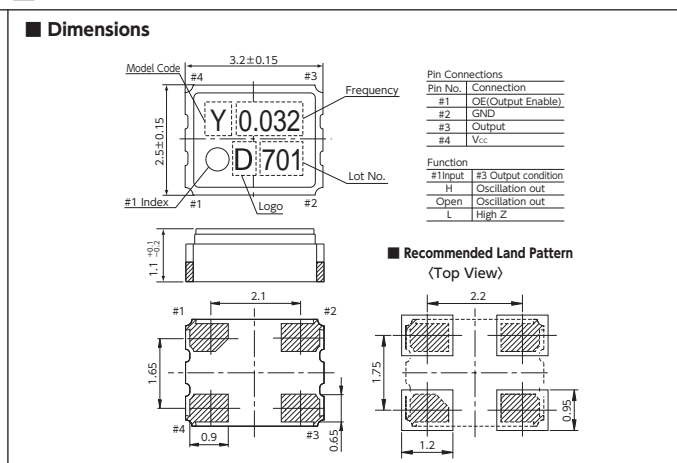
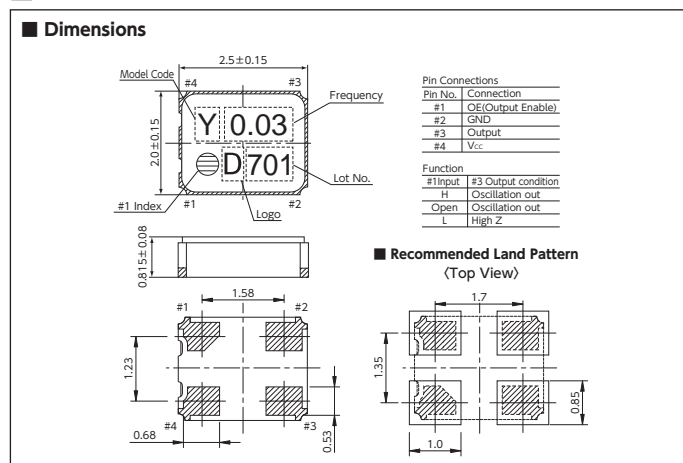
Item	Function Code		Output Frequency Range	Legend	Spec.				Condition
	Supply Voltage	Frequency tolerance			min.	typ.	max.	Unit	
Supply Voltage	A	*	32.768kHz 1.049 ≤ f _o ≤ 8.5MHz	V _{cc}	+3.0	+3.3	+3.6	V	
	B				+2.6	+2.8	+3.0		
	C				+2.25	+2.5	+2.75		
	D				+1.6	+1.8	+2.0		
Frequency Tolerance (includes frequency tolerance at room temperature)	*	A	32.768kHz 1.049 ≤ f _o ≤ 8.5MHz	f _{tol}	-100	-	+100	× 10 ⁻⁶	-40 to +85°C
		B			-50	-	+50		
Current Consumption	*	*	32.768kHz 1.049 ≤ f _o ≤ 8.5MHz	I _{cc}	-	-	18	μA	No Load
Stand-by Current (#1 pin "L" Level)	*	*	*	I _{std}	-	-	3	μA	
Load Condition	*	*	*	L _{CMOS}	-	-	15	pF	
Symmetry	*	*	32.768kHz 1.049 ≤ f _o ≤ 8.5MHz	SYM	45	50	55	%	at 50% V _{cc}
0 Level Input Voltage	*	*	*	V _{OL}	-	-	V _{cc} × 0.1	V	
1 Level Input Voltage	*	*	*	V _{OH}	V _{cc} × 0.9	-	-	V	
Rise and Fall Time	*	*	*	tr, tf	-	-	15	ns	10 to 90% V _{cc} Level
OE Pin 0 Level Input Voltage	*	*	*	V _{IL}	-	-	V _{cc} × 0.2	V	
OE Pin 1 Level Input Voltage	*	*	*	V _{IH}	V _{cc} × 0.8	-	-	V	
Output Disable Time	*	*	*	t _{PLZ}	-	-	100	ns	
Output Enable Time	*	*	*	t _{PZL}	-	-	20	ms	
Reliability	AEC-Q100/AEC-Q200								
Packing Unit (1)	2000pcs./reel (φ 180)								

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

Consult our sales representative for other specifications.

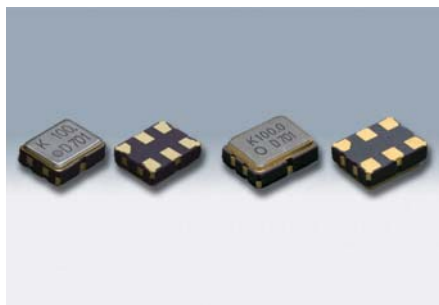
■ DSO221SY

■ DSO321SY



SMD Differential Output Crystal Oscillators (For Automotive)

DSO223SK/DSO323SK/DSO223SJ/DSO323SJ/DSO223SD/DSO323SD



Actual size DSO223S DSO323S

Features

- 2.5V/3.3V operating voltage, High speed type
- 3-state function
- LV-PECL output (DSO223/323SK)
- LVDS output (DSO223/323SJ)
- HCSL output (DSO223/323SD)
- AEC-Q200 Compliant (DSO223SK/SJ/SD)
- AEC-Q100/AEC-Q200 Compliant (DSO323SK/SJ/SD)

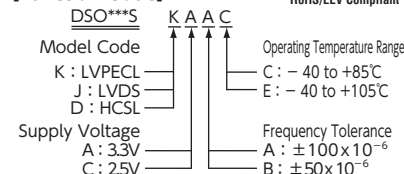
Applications

- Multimedia devices such as car navigation systems and car audio

[Type]

DSO223S SERIES	2520 size
DSO323S SERIES	3225 size

[Function Code]



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	f_o	—	13.5 to 167MHz		
Supply Voltage	V_{CC}	—	+2.5V \pm 0.125V/+3.3V \pm 0.165V		
Frequency Tolerance (Includes frequency tolerance at room temperature.)	f_{tol}	—	$\pm 50 \times 10^{-6}$ max., $\pm 80 \times 10^{-6}$ max. / $\pm 100 \times 10^{-6}$ max.		
Storage Temperature Range	T_{stg}	—	-40 to +105°C		
Operating Temperature Range	T_{use}	—	-40 to +85°C, -40 to +105°C		
Current Consumption	I_{CC}	—	45mA max.	20mA max.	30mA max.
Stand-by Current (#1 pin "L" Level)	I_{std}	—	10 μ A max.		
Load Resistance	Load-R	—	50 Ω to $V_{CC}-2V$	100 Ω (Output-OutputN)	50 Ω
Symmetry	SYM	—	45 to 55% [at outputs cross point]		
0 Level Output Voltage	V_{OL}	—	$V_{CC}-1.81$ to $V_{CC}-1.62V$	—	-0.15 to 0.15V
1 Level Output Voltage	V_{OH}	—	$V_{CC}-1.025$ to $V_{CC}-0.88V$	—	0.58 to 0.85V
Rise and Fall Time	t_r, t_f	—	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 [$\Delta V_{OD} = V_{OD1} - V_{OD2} $]	—
Offset Voltage	V_{OS}	—	—	1.125 to 1.375V	—
Offset to V_{OS}	ΔV_{OS}	—	—	50mV	—
Crossing Point Voltage	V_{CR}	—	—	—	250 to 550mV
OE Pin 0 Level input Voltage	V_{IL}	—	$V_{CC} \times 0.3$ max.		
OE Pin 1 Level input Voltage	V_{IH}	—	$V_{CC} \times 0.7$ min.		
Output Disable Time	t_{PLZ}	—	200ns		
Output Enable Time	t_{PZL}	—	2ms		
Period Jitter (1)	t_{RMS}	—	5ps typ. (13.5MHz $\leq f_o < 27$ MHz) / 2.5ps typ. (27MHz $\leq f_o \leq 167$ MHz) (σ)		
	t_{p-p}	—	33ps typ. (13.5MHz $\leq f_o < 27$ MHz) / 22ps typ. (27MHz $\leq f_o \leq 167$ MHz) (Peak to peak)		
Total Jitter (1)	t_{TL}	—	50ps typ. (13.5MHz $\leq f_o < 27$ MHz) / 35ps typ. (27MHz $\leq f_o \leq 167$ MHz) [$t_{DJ} + n \times t_{RJ}$ n=14.1 (BER=1 $\times 10^{-12}$) (2)]		
Phase Jitter	t_{PJ}	—	1.5ps max. (13.5MHz $\leq f_o < 27$ MHz) / 1ps max. (27MHz $\leq f_o \leq 167$ MHz) [13.5MHz $\leq f_o < 40$ MHz, f_o offset: 12kHz to 5MHz $f_o \geq 40$ MHz, f_o offset: 12kHz to 20MHz]		
Reliability	—	—	AEC-Q200(DSO223 SERIES), AEC-Q100/AEC-Q200(DSO323 SERIES)		
Packing Unit (3)	—	—	2000pcs./reel(ϕ 180)		

- (1) Measured WAVECREST DTS-2075
- (2) t_{DJ} :Deterministic jitter t_{RJ} :Random jitter
- (3) Moisture prevention packing is unnecessary.
Moisture Sensitivity Level: LEVEL 1 (IPC/JEDEC J-STD-033)

Consult our sales representative for other specifications.

DSO223S SERIES

[mm]

DSO323S SERIES

[mm]

Dimensions

Model Code: DSO223SJ: J, DSO223SK(2.5V): KB, DSO223SK(3.3V): K, DSO223SD: D

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>

Dimensions

Model Code: DSO323SJ, DSO323SK(2.5V):KB, DSO323SK(3.3V):K, DSO323SD

Pin Connections:

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

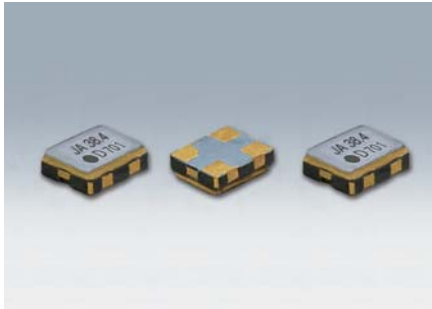
Function:

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

Recommended Land Pattern <Top View>

SMD TCXO (For Automotive)

DSB211SJA



Actual size

Features

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

Applications

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



Standard Specification

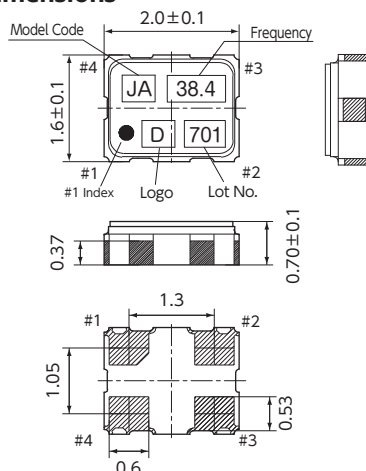
Item	Type	DSB211SJA
Frequency Range		13 to 52MHz
Standard Frequency		19.2MHz/ 25MHz/ 26MHz/ 32MHz/ 38.4MHz/ 40MHz/ 48MHz/ 52MHz
Supply Voltage (Vcc)		+1.8V/ +2.5V/ +2.8V/ +3.3V
Current Consumption		5.0mA max. [No Load]
Stand-by Current (#1 pin "L" Level)		+10 μ A max.
Frequency Stability Tolerance		$\pm 1.5 \times 10^{-6}$ max. (After 2 reflows)
vs. Temperature		$\pm 2.5 \times 10^{-6}$ max./ -40 to +85°C $\pm 5.0 \times 10^{-6}$ max./ -40 to +105°C $\pm 20 \times 10^{-6}$ max./ -40 to +125°C (Option)
vs. Aging		$\pm 1.0 \times 10^{-6}$ max./year
Symmetry		45 to 55% (50% Vcc Level)
0 Level Output Voltage		Vcc \times 0.1V
1 Level Output Voltage		Vcc \times 0.9V
Output Load		15pF
Rise and Fall Time		5ns max. (10% to 90% Vcc Level)
OE Pin 0 Level Input Voltage		Vcc \times 0.2V
OE Pin 1 Level Input Voltage		Vcc \times 0.8V
Start Up Time		3.0ms max.
Output Enable Time		3.0ms max.
Output Disable Time		150ns max.
Phase Noise		[f \leq 26MHz] [26MHz < f \leq 52MHz]
Offset 1kHz		-145dBc/Hz -141dBc/Hz
Offset 100kHz		-158dBc/Hz -157dBc/Hz
Reliability		AEC-Q100/AEC-Q200
Packing Unit (1)		3000pcs./reel (ϕ 180)

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

Consult our sales representative for other specifications.

[mm]

Dimensions

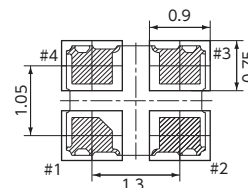


Pin Connections	
Pin No.	Connection
#1	OE (Output Enable)
#2	GND
#3	Output
#4	Vcc

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

Recommended Land Pattern

<Top View>



High-precision SMD TCXO (For Automotive)

DSB211SPX

NEW



Actual size

Features

- Capable of operating over a wide temperature range, from -40 to +125°C
- Supply voltage from +1.7 up to +3.6V
- Single packaged structure
- AEC-Q100/AEC-Q200 compliant

Applications

- GPS/GNSS, DSRC(WiFi11p), In-vehicle RF



Standard Specification

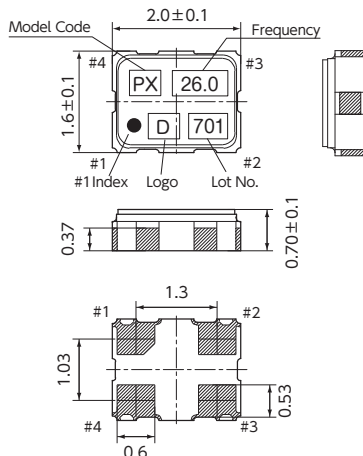
Item	Type	DSB211SPX
Output Frequency Range		13 to 52 MHz
Standard Frequency		26MHz/ 38.4MHz/ 40MHz/ 52MHz
Supply Voltage Range		+1.68 to +3.63V
Supply Voltage (Vcc)		+1.8V/ +2.5 V/ +2.8V/ +3.3V
Current Consumption		+3.0mA max. (+3.3V, 26MHz)
Stand-by Current (#1 pin "L" Level)		+10μA max.
Output Level		0.8 V _{p-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		±0.5×10 ⁻⁶ max./-40 to +105°C
vs. Supply Voltage		±5.0×10 ⁻⁶ max./-40 to +125°C (option)
vs. Load Variation		±0.2×10 ⁻⁶ max. (Vcc±5%)
vs. Aging		±0.2×10 ⁻⁶ max. (10kΩ//10pF ±10%)
0 Level Output Voltage		±1.0×10 ⁻⁶ max./year
1 Level Output Voltage		Vcc×0.2
Start up Time		Vcc×0.8
SSB Phase Noise		3.0ms max.
Offset 100Hz		40MHz (typ.)
Offset 1kHz		-110dBc/Hz
Offset 10kHz		-133dBc/Hz
Offset 100kHz		-152dBc/Hz
Reliability		-148dBc/Hz
Packing Unit (1)		AEC-Q100/AEC-Q200
		3000pcs./reel (φ 180)

(1) Prevention of moisture packing is unnecessary
Moisture Sensitivity Level : LEVEL 1 (IPC/JEDEC J-STD-033)

Consult our sales representative for other specifications.

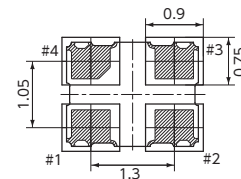
[mm]

Dimensions



Recommended Land Pattern

<Top View>



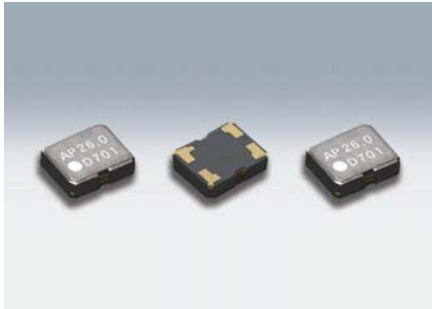
Pin Connections

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

Function	#3 Output condition
OE(#1) Input	Oscillation out
"H"	Oscillation out
"L"	High Z

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

DSA211SP/DSB211SP



Actual size

■ Features

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

■ Applications

- GPS / GNSS
- Telematics, Satellite radio



■ Standard Specification

Item	Type	DSA211SP(VC-TCXO)	DSB211SP(TCXO)
Output Frequency Range		12.288 to 52 MHz	12.288 to 52 MHz
Standard Frequency		16.3676/ 16.367667/ 16.368/ 16.369/ 16.8/ 26/ 38.4 MHz	
Supply Voltage Range		+1.68 to +3.5V	
Supply Voltage (Vcc)		+1.8V / +2.8 V / +3.0V / +3.3V	
Current Consumption		+1.7 mA max. (f≤26MHz)/+2.2 mA max. (f>26MHz)	
Output Level		0.8 Vp-p min. (Clipped Sine Wave / DC-coupled)	
Output Load		10 kΩ//10 pF	
Frequency Stability Tolerance		±1.5×10 ⁻⁶ max.(After 2 reflows)	
vs. Temperature		±1.0×10 ⁻⁶ max. / -40 to +105°C	±0.5×10 ⁻⁶ max. / -40 to +105°C ±10×10 ⁻⁶ max. / -40 to +125°C (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		[f≤15MHz]	[15MHz<f≤26MHz]
Offset 100Hz		-115 dBc/Hz	-110 dBc/Hz
Offset 1kHz		-135 dBc/Hz	-130 dBc/Hz
Offset 10kHz		-145 dBc/Hz	-140 dBc/Hz
Offset 100kHz		-145 dBc/Hz	-145 dBc/Hz
Reliability		AEC-Q100/AEC-Q200	
Packing Unit (1)		3000pcs./reel (φ180)	

(1) Prevention of moisture packing is unnecessary
Moisture Sensitivity Level : LEVEL 1 (IPC/JEDEC J-STD-033)

Consult our sales representative for other specifications.

[mm]

■ Dimensions

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

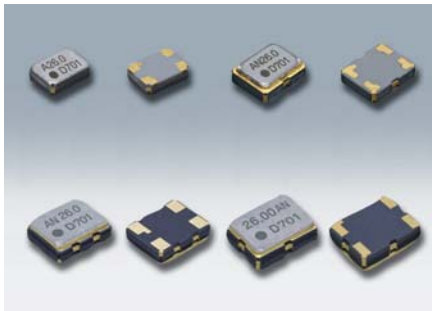
Pin Connections

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

■ Recommended Land Pattern (Top View)

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

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



Actual size DSA1612SDN DSA211SDN
DSA221SDN DSA321SDN

Features

- Low voltage operation
- Low phase noise
- Single packaged structure
- AEC-Q100/AEC-Q200 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	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 (#1 pin "L" Level)		-							+3μA max.				
Output Level		0.8Vp-p min. (f≤52MHz) (Clipped Sinewave/DC-coupled)											
Output Load		10kΩ//10pF											
Frequency Stability		±1.5×10 ⁻⁶ max. (After 2 reflows)											
Tolerance		±1.5×10 ⁻⁶ max. (After 2 reflows)											
vs. Temperature		±0.5×10 ⁻⁶ max./-40 to +85°C											
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		±3.0×10 ⁻⁶ to ±5.0×10 ⁻⁶ /Vcont=+1.4V±1V @Vcc≥+2.6V				-							
Control Sensitivity		±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/AEC-Q200											
Packing Unit (1)		DSA1612SDN/DSA211SDN/DSA221SDN, DSB1612SDN/DSB211SDN/DSB221SDN, DSB1612SDNB/DSB211SDNB/DSB221SDNB: 3000pcs./reel(φ180) DSA321SDN, DSB321SDN, DSB321SDNB: 2000pcs./reel(φ180)											

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

Consult our sales representative for other specifications.

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

For Automotive Applications

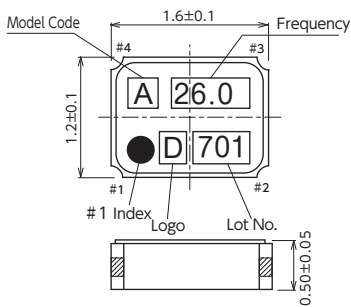
■ Dimensions

[mm]

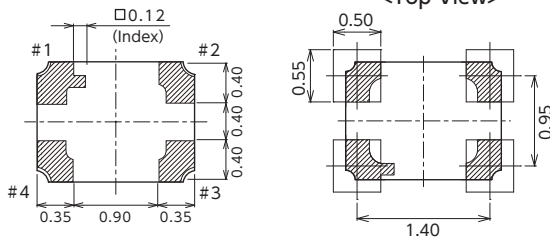
■ DSA1612SDN/DSB1612SDN/DSB1612SDNB

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



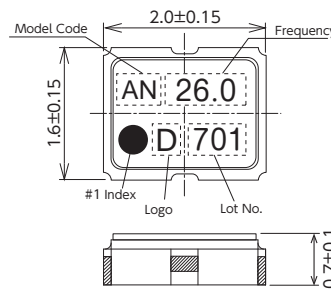
■ Recommended Land Pattern <Top View>



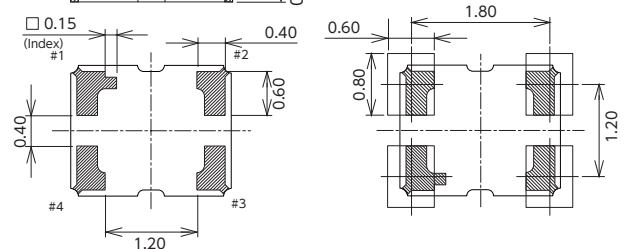
■ DSA211SDN/DSB211SDN/DSB211SDNB

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



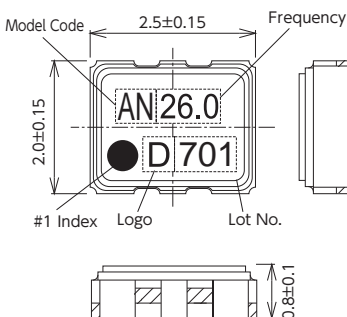
■ Recommended Land Pattern <Top View>



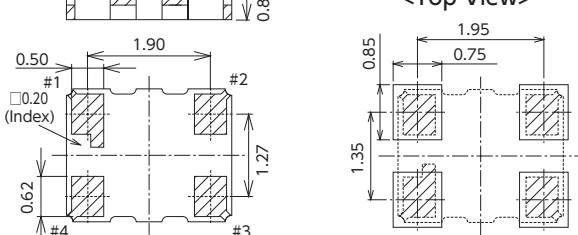
■ DSA221SDN/DSB221SDN/DSB221SDNB

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



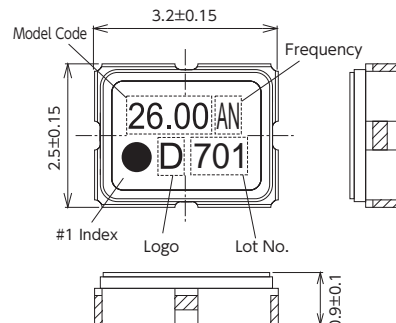
■ Recommended Land Pattern <Top View>



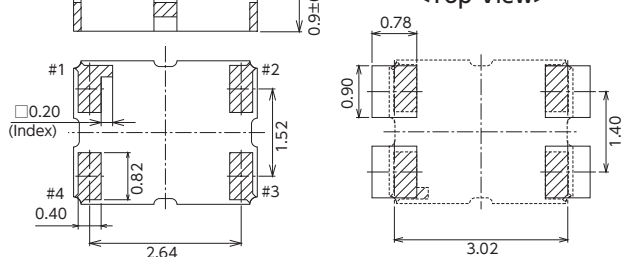
■ DSA321SDN/DSB321SDN/DSB321SDNB

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

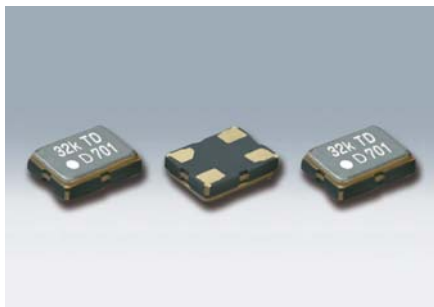


■ Recommended Land Pattern <Top View>



SMD TCXO (For Automotive)

DSK321STD



Actual size

■ Features

- Digital temperature compensated type
- High precision: $\pm 5.0 \times 10^{-6}$ (−40 to +85°C)
 $\pm 3.8 \times 10^{-6}$ (−10 to +60°C)
- Low current consumption
- AEC-Q100/AEC-Q200 Compliant

■ Applications

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



■ Standard Specification

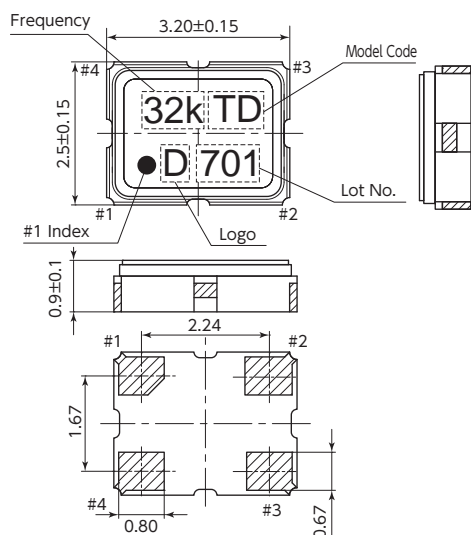
Item	Legend	Spec.				Condition
		min.	typ.	max.	Unit	
Output Frequency	f _o	–	32.768	–	kHz	
Supply Voltage Range	V _{cc}	+2.0	–	+5.5	V	(Temperature Compensated Operating)
		+1.3	–	+5.5		(Clock Timing Operating)
Frequency Tolerance (Includes frequency tolerance at room temperature.)	f _{tol}	−5.0	–	+5.0	$\times 10^{-6}$	−40 to +85°C
		−3.8	–	+3.8		−10 to +60°C
Current Consumption	I _{cc}	–	+1.2	+2.5	μ A	V _{cc} =+3.3V, Temperature Compensation Interval:0.5s, No Load
		–	+1.7	+3.2		V _{cc} =+5.0V, Temperature Compensation Interval:0.5s, No Load
		–	+1.0	+2.0		V _{cc} =+3.3V, Temperature Compensation Interval:2.0s, No Load
		–	+1.5	+3.0		V _{cc} =+5.0V, Temperature Compensation Interval:2.0s, No Load
Symmetry	SYM	40	50	60	%	at 50% V _{cc}
0 Level Output Voltage	V _{OL}	–	–	+0.4	V	
1 Level Output Voltage	V _{OH}	V _{cc} -0.4	–	–		
Rise and Fall Time	t _r , t _f	–	–	50	ns	V _{cc} =+2.0 to +5.5V, 10 to 90% V _{cc} Level
		–	–	200		V _{cc} =+1.3 to +5.5V, 10 to 90% V _{cc} Level
Load Condition	L _{CMOS}	–	–	15	pF	
Start Up Time	T _{start}	–	–	3.0	s	
Reliability						AEC-Q100/AEC-Q200
Packing Unit (1)						2000pcs./reel (φ 180)

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

Consult our sales representative for other specifications.

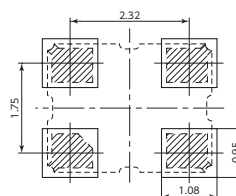
[mm]

■ Dimensions



■ Recommended Land Pattern

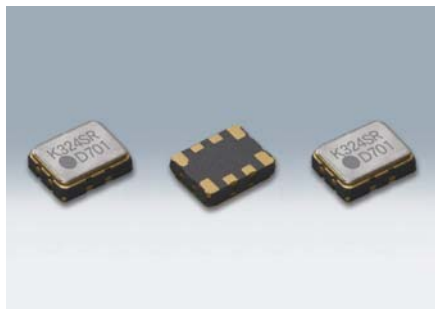
<Top View>



Pin No.	Connection
#1	V _{cc}
#2	GND
#3	Output
#4	V _{cc}

SMD Real Time Clock Module (For Automotive)

DSK324SR



Actual size

Features

- Digital temperature compensated type
- High precision: $\pm 5.0 \times 10^{-6}$ (−40 to +85°C)
 $\pm 3.8 \times 10^{-6}$ (−10 to +60°C)
- Low current consumption
- Low voltage operation:
+2.0 to +5.5V(Temperature Compensated Operating)
+1.3 to +5.5V(Clock Timing Operating)
- I²C-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/AEC-Q200 Compliant



Applications

- High precision clock source

"I²C-BUS" is a registered trademark of NXP Semiconductor

Standard Specification

Item	Legend	Spec.			Unit	Condition
		min.	typ.	max.		
Output Frequency	f _o	—	32.768	—	kHz	
Supply Voltage Range	V _{cc}	+1.3	—	+5.5	V	(Clock Timing Operating)
	V _{tem}	+2.0	—	+5.5		(Temperature Compensated Operating)
	V _{int}	+1.5	—	+5.5		(Interface Operation) I ² C-BUS
Frequency Tolerance	f _{tol}	−5.0	—	+5.0	×10 ^{−6}	−40 to +85°C
		−3.8	—	+3.8		−10 to +60°C
Current Consumption	l _{cc1}	—	+0.6	+2.0	μA	V _{cc} = +3.0V, Temperature Compensation Interval:30s, SCL=SDA=INTN=V _{cc} ,CLKOE=GND (Output Off)
	l _{cc2}	—	+1.5	+4.0	μA	V _{cc} = +3.0V, Temperature Compensation Interval:30, No Load, SCL=SDA=INTN=CLKOE=V _{cc} (Output On)
Load Condition	L _{CMOS}	—	—	15	pF	
Start Up Time	T _{start}	—	—	1.0	s	T _a = +25°C, V _{cc} = +1.3V
		—	—	3.0		T _a = −40 to +85°C, V _{cc} = +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
Reliability						AEC-Q100/AEC-Q200
Packing Unit (3)						2000pcs./reel (φ 180)

- (1) When V_{cc} 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 V_{cc} rises above V_{DET1} again, the intermittent temperature compensating is enabled.
- (2) The Detection circuit operates at the temperature compensation interval.
- (3) Moisture prevention packing is unnecessary.
Moisture Sensitivity Level: LEVEL 1 (IPC/JEDEC J-STD-033)

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	V _{cc}	—	Supply Voltage

Consult our sales representative for other specifications.

Dimensions

Pin Connections

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

Function

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

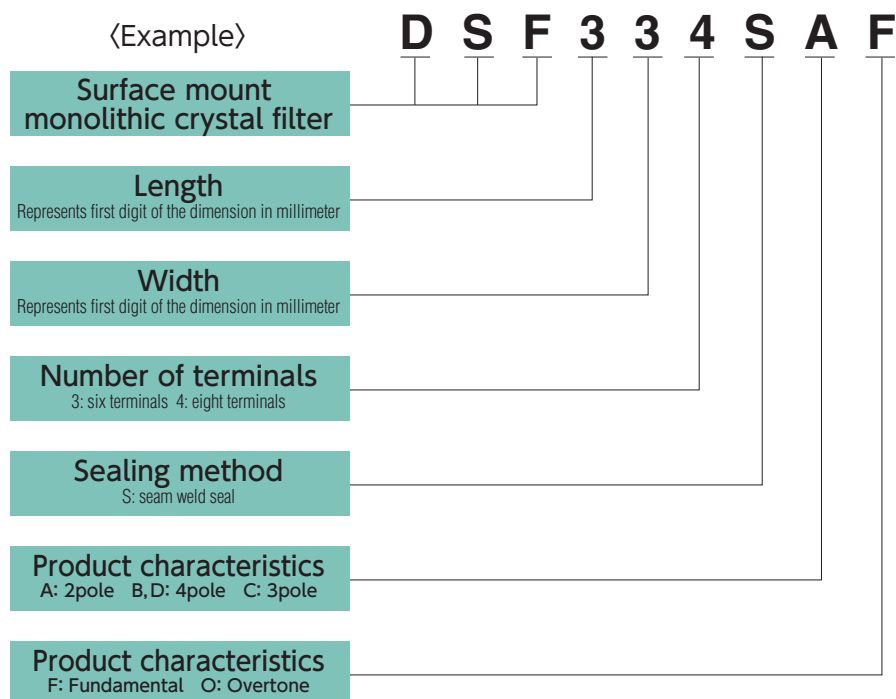
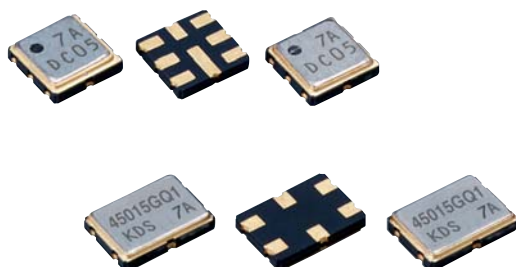
Recommended Land Pattern <Top View>

MEMO

A series of horizontal dashed lines for writing.

Quartz Devices

Monolithic crystal filters



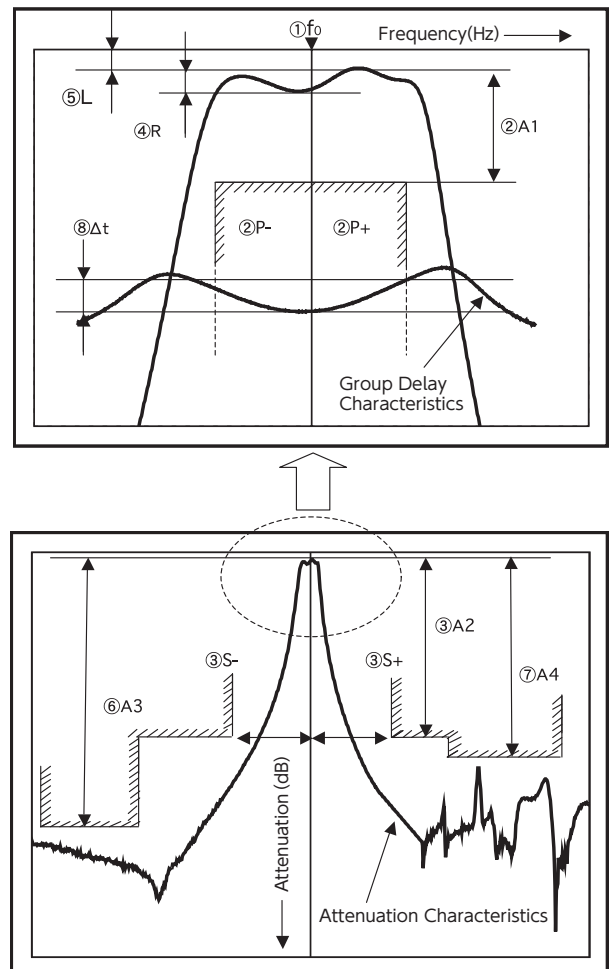
Monolithic Crystal Filters

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 f_0 (MHz)	Nominal value of center frequency.
②	Pass Bandwidth $P \pm$ (kHz), A_1 (dB)	Frequency interval at which relative attenuation is guaranteed to be equal to or less than a given value, A_1 .
③	Stop Bandwidth $S \pm$ (kHz), A_2 (dB)	Frequency interval at which relative attenuation is guaranteed to be equal to or more than a given value, A_2 .
④	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 f_0 : Insertion loss at nominal frequency.
⑥	Guaranteed Attenuation A_3 (dB)	Relative attenuation guaranteed in a specific range within the stop band.
⑦	Spurious A_4 (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 $R_t // C_t$ ($\Omega // pF$)		Signal-source impedance or loading impedance as viewed from the filter side. Expressed as resistance and parallel capacitance including floating capacitance.
Coupling Capacitance C_c (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



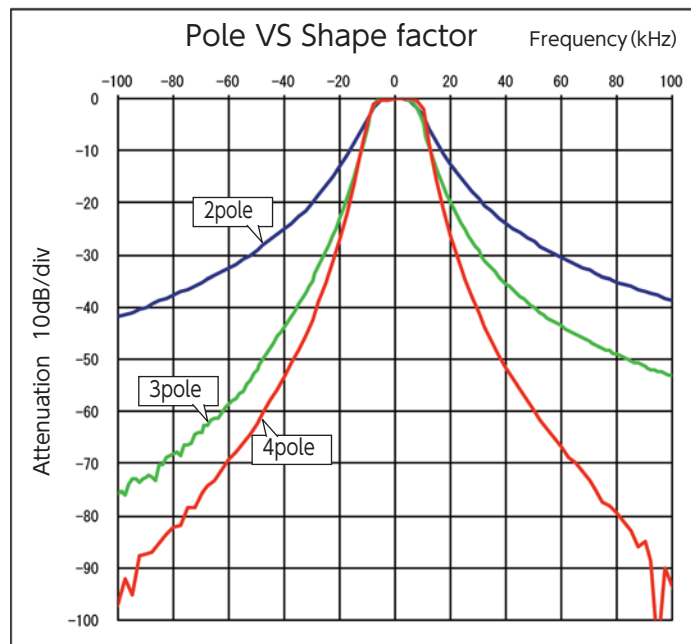
Scan the QR code to check the table of contents page of our web site "Monolithic Crystal Filters" (URL: <http://www.kds.info/class/3-l-cf/>).

Icons IE Industrial Equipment TC Mobile Phone, Wireless Communication

Monolithic Crystal Filters

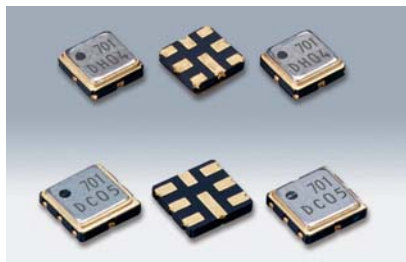
Type	Actual Size	Size (mm)			Frequency Range (MHz)	Operating Temperature Range (°C)	Overtone Order	Pole	Pass Bandwidth (kHz min./3dB)	Recommended Application	Catalog Page
		L	W	H (max.)							
DSF334SAF		3.0	3.0	1.1	45 to 130	-20 to +70	Fundamental	2	±3.5, ±7.5, ±15	TC	94
DSF334SAO					100 to 160		3rd				
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					
DSF633SDF		6.0	3.5	1.3	37 to 130	-20 to +70	Fundamental	4	±3.5, ±7.5, ±15	IE TC	95
DSF753SAF		7.0	5.0	1.5	16 to 90	-20 to +70	Fundamental	2	±3.5, ±7.5, ±15	IE TC	96
DSF753SAO					60 to 160		3rd				
DSF753SCF					20 to 130		Fundamental	3			
DSF753SCO					90 to 160		3rd				
DSF753SBF					30 to 70		Fundamental	4			
DSF753SDF					20 to 130						

Pole VS Shape factor



SMD Monolithic Crystal Filters

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

■ 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°C				
Packing Unit (1)	2000pcs./reel(φ180)			1000pcs./reel(φ180)	

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

Consult our sales representative for other specifications.

■ 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

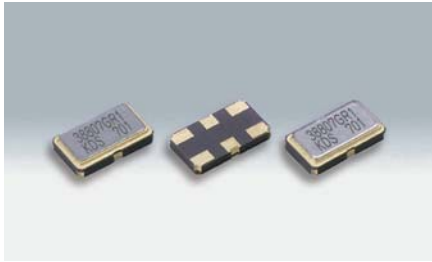
Pin No.	Connection
#1	Input
#2	GND.
#3	GND.
#4	GND.
#5	Output
#6	GND.
#7	GND.
#8	GND.

■ Recommended Land Pattern (Top View)

■ Measurement Circuit

SMD Monolithic Crystal Filters

DSF633S 4POLE (SDF TYPE)



Actual size

■ Features

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

■ Applications

- Radio communications



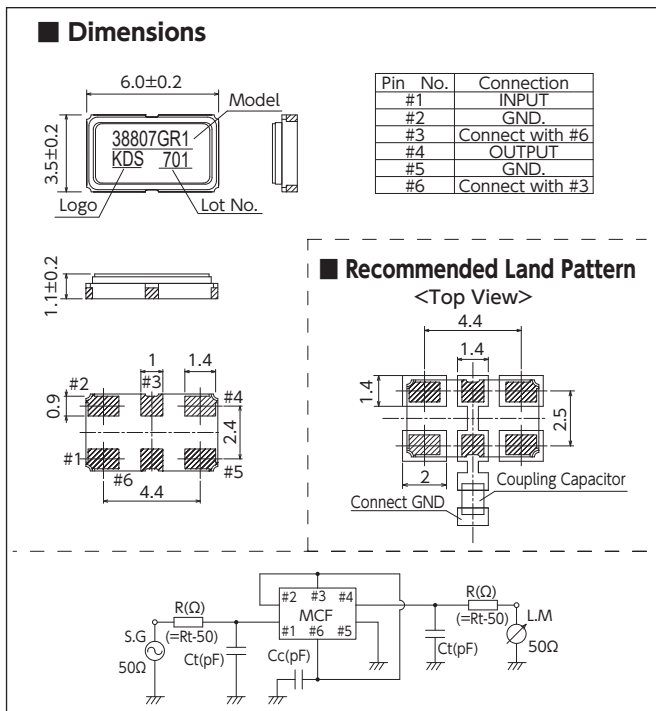
■ Standard Specification

Type	DSF633SDF				
Model	D38807GR	D49903GR	D58010GR	D73312GR	DA3050GR
Pole	4	4	4	4	4
Overtone Order	Fundamental	Fundamental	Fundamental	Fundamental	Fundamental
Nominal Frequency	38.850 MHz	49.950 MHz	58.050 MHz	73.350MHz	130.000MHz
Pass Bandwidth	±3.75kHz min./3dB	±1.75kHz min./3dB	±5.0kHz min./3dB	±6.0kHz min./3dB	±25.0kHz min./3dB
Stop Bandwidth	±15.0kHz min./35dB	±6.25kHz max./20dB	±12.5kHz max./25dB	±25kHz max./40dB	±100kHz max./35dB
Ripple	1dB max.	1dB max.	1dB max.	1dB max.	1dB max.
Insertion Loss	6dB max.	6dB max.	5dB max.	5dB max.	5dB max.
Guaranteed Attenuation	76dB min.	76dB min.	80dB min.	80dB min.	70dB min.
Terminating Impedance	710Ω//4pF Cc=12.5pF	150Ω//11pF Cc=33pF	450Ω//4.5pF Cc=9.5pF	380Ω//5pF Cc=11pF	560Ω//0.2pF Cc=3.5pF
Operating Temperature Range	-20 to +70°C				
Packing Unit (1)	1000pcs./reel(φ180)				

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

Consult our sales representative for other specifications.

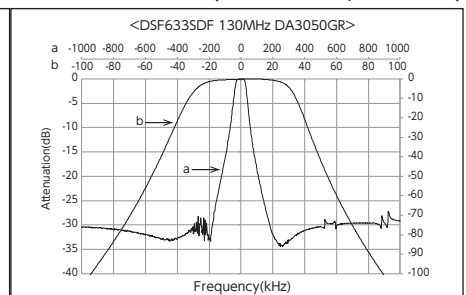
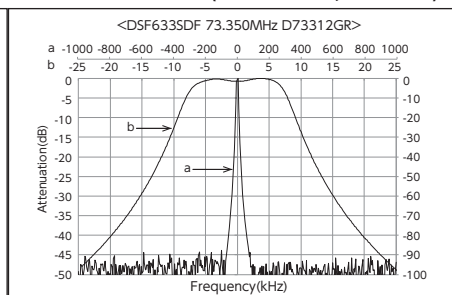
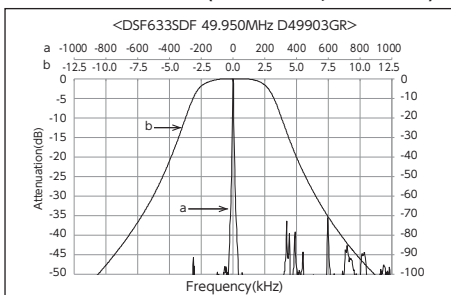
[mm]



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

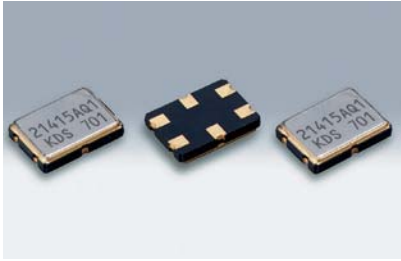
■ Characteristics Chart (fo=73.350MHz, P=±6.0kHz)

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



SMD Monolithic Crystal Filters

DSF753S 2POLE/DSF753S 3POLE/DSF753S 4POLE



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



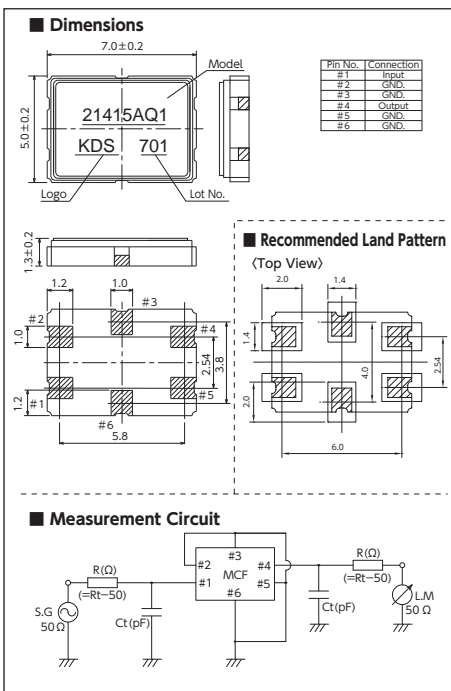
■ Standard Specification

Type	DSF753SAF		DSF753SCF	DSF753SBF/DSF753SDF		
Model	D21415AQ	D45015AQ	D45015FQ	D46307GQ	D50810GQ	D73312GQ
Pole	2	2	3	4	4	4
Overtone Order	Fundamental	Fundamental	Fundamental	Fundamental	Fundamental	Fundamental
Nominal Frequency	21.400 MHz	45.000 MHz	45.000 MHz	46.350MHz	50.850MHz	73.350MHz
Pass Bandwidth	±7.5kHz min./3dB	±7.5kHz min./3dB	±7.5kHz min./3dB	±3.5kHz min./3dB	±5.0kHz min./3dB	±6.0kHz min./3dB
Stop Bandwidth	±25kHz max./18dB	±25kHz max./14dB	±50kHz max./30dB	±18kHz max./40dB	±20kHz max./40dB	±25kHz max./40dB
Ripple	1dB max.	1dB max.	1dB max.	1dB max.	1dB max.	1dB max.
Insertion Loss	2dB max.	2.5dB max.	3dB max.	5dB max.	5dB max.	5dB max.
Guaranteed Attenuation	70dB min.	60dB min.	70dB min.	80dB min.	80dB min.	80dB min.
Terminating Impedance	1500Ω//2.5pF	550Ω//3pF	700Ω//1pF	400Ω//4pF Cc=17.5pF	560Ω//4pF Cc=9.7pF	450Ω//4pF Cc=9.2pF
Operating Temperature Range	-20 to +70°C					
Packing Unit (1)	1000pcs./reel(φ 180)					

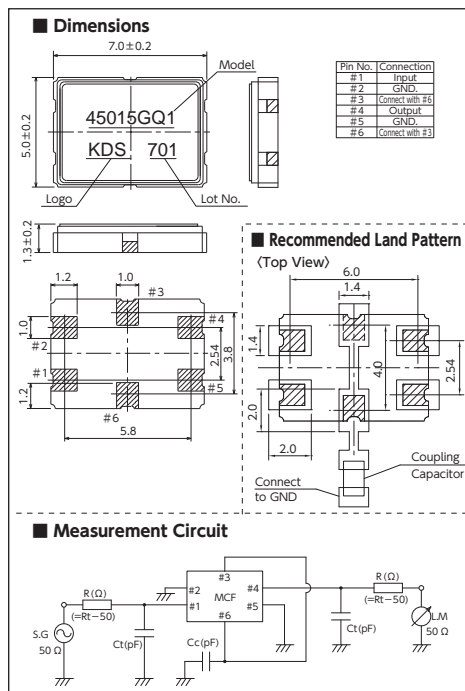
(1) Moisture prevention packing is unnecessary.
Moisture Sensitivity Level: LEVEL 1 (IPC/JEDEC J-STD-033)

Consult our sales representative for other specifications.

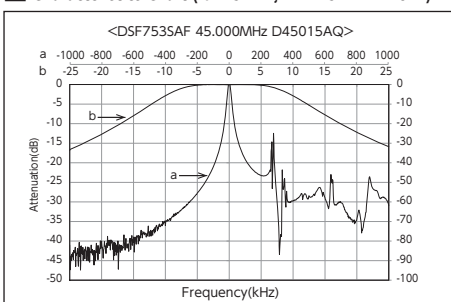
■ DSF753SA/DSF753SC [mm]



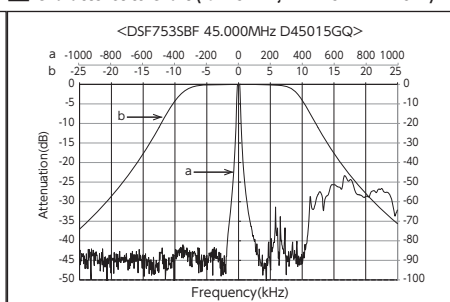
■ DSF753SB/DSF753SD [mm]



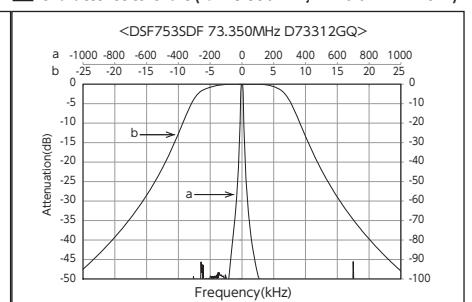
■ Characteristics Chart (fo=45MHz, P=±7.5kHz 2POLE)



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

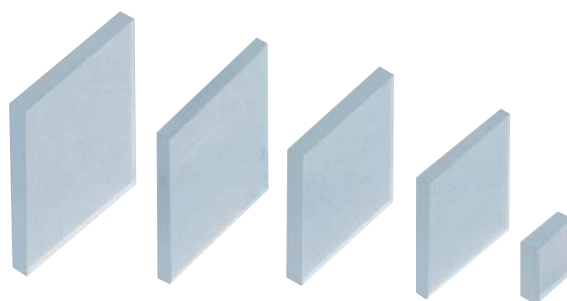


■ Characteristics Chart (fo=73.350MHz, P=±6.0kHz 4POLE)



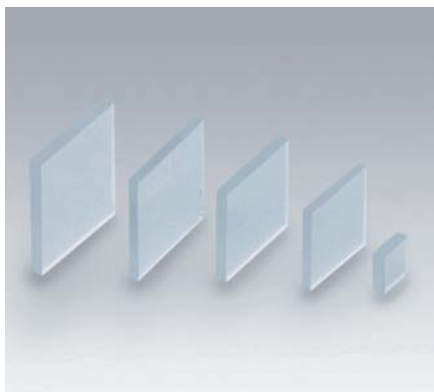
Quartz Devices

Optical products



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.

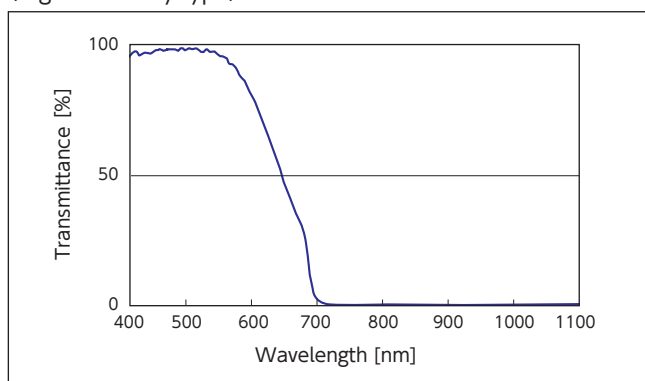
IR Double Cut Filter (IR Cut Filter)

"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.

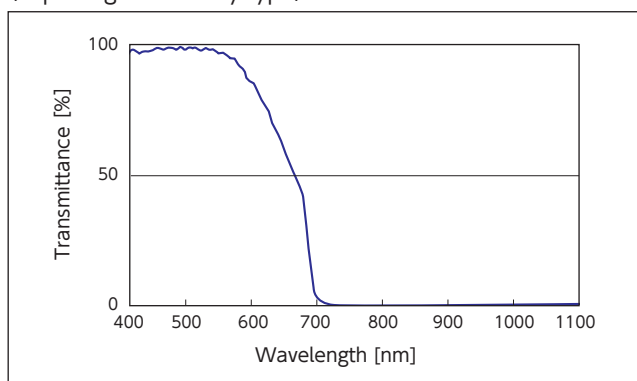
■ Example of Spectrum Characteristics

Infrared Absorbing Glass + Infrared Cut Coating Type

(High sensitivity type)



(Super high sensitivity type)



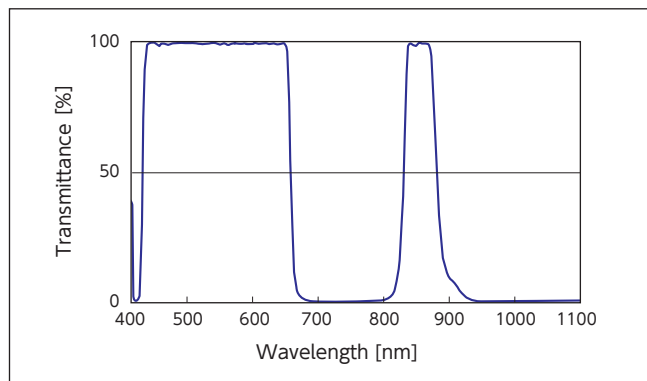
Optical Products

Dual Pass Filters (Dual Band Pass Filters)

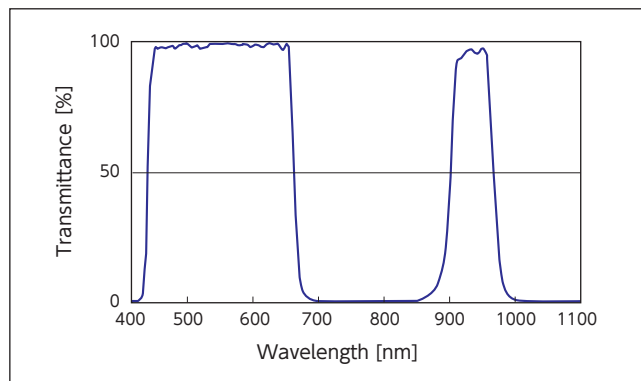
"Dual Pass filter" is a filter that has a transmission range of the near-infrared region and the visible light region. This filter is suitable to the surveillance cameras for shooting day and night continuously.

Example of Spectrum Characteristics

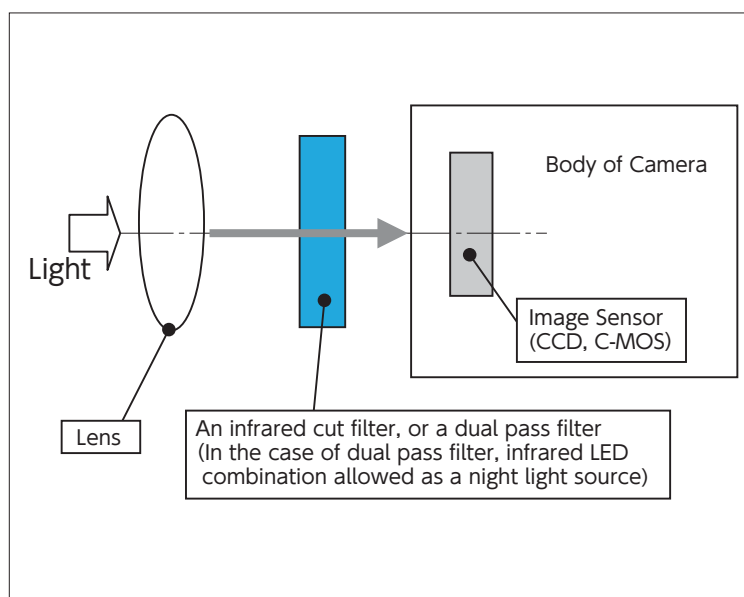
Type I



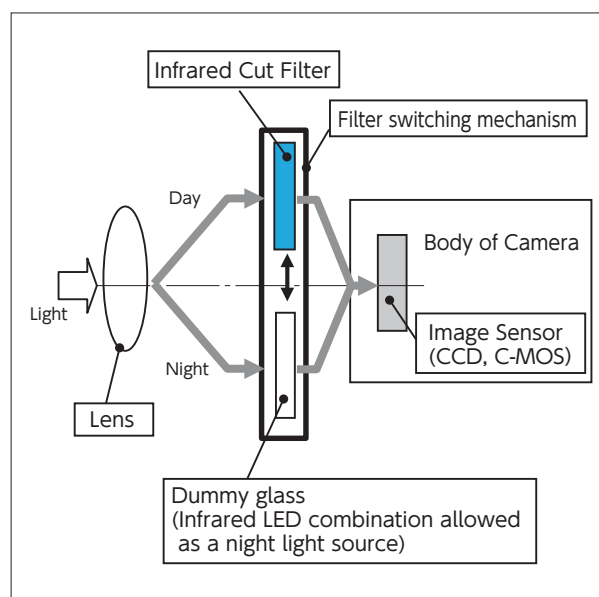
Type II



Usage Examples



General camera



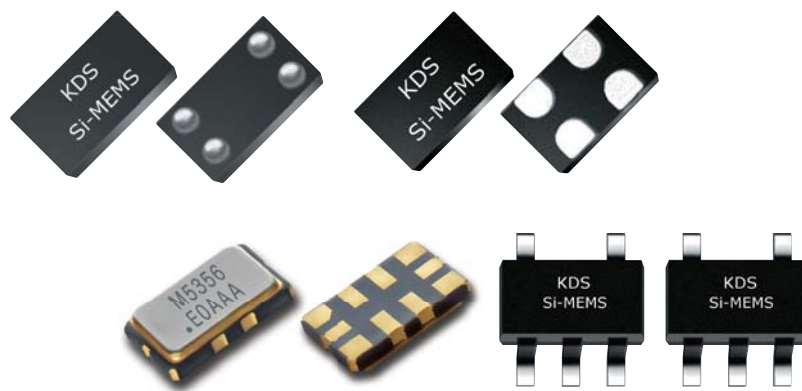
Day&Night mechanism with a camera

MEMO

A series of horizontal dashed lines for writing.

Silicon Timing Devices

MEMS oscillators



Selection Guide



Scan the QR code to check the table of contents page of our web site "MEMS Oscillators" (URL: <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)			Output	Frequency Range (kHz)	Frequency Characteristics over Temperature ($\times 10^{-9}$)	Operating Temperature Range (°C)	Supply Voltage (V)	Current Consumption (μ A typ.)	Recommended Application	Catalog Page
		L	W	H (max.)								
MO1532		1.5	0.8	0.6	NanoDrive™ LVC MOS	32.768	± 100	-40 to +85	+1.2 to +3.63	+0.90	CE TC	104
MO1534		1.5	0.8	0.6	NanoDrive™ LVC MOS	0.001 to 32.768	± 100	-40 to +85	+1.2 to +3.63	+0.90	CE TC	105
		2.0	1.2	0.6								
MO1569		1.5	0.8	0.6	LVC MOS	0.001 to 462	± 50	-40 to +85	+1.62 to +3.63	+2.0 μ A (100kHz)	CE TC	
MO1630		2.0	1.2	0.6	LVC MOS	16.384, 32.768	± 150	-40 to +105	+1.5 to +3.63	+1.00	CE TC	104

kHz Band Temperature Compensated MEMS Oscillators

Type	Actual Size	Size (mm)			Output	Frequency Range (kHz)	Frequency Characteristics over Temperature ($\times 10^{-9}$)	Operating Temperature Range (°C)	Supply Voltage (V)	Current Consumption (μ A typ.)	Recommended Application	Catalog Page
		L	W	H (max.)								
MO1552		1.5	0.8	0.6	NanoDrive™ LVC MOS	32.768	$\pm 5/\pm 10/\pm 20$ over temp.	-40 to +85	+1.5 to +3.63	+0.99	CE TC	104
MO1566					LVC MOS				± 3 all inclusive	+1.8		
MO1568					LVC MOS	± 5 all inclusive After Overmold/ Underfill	-40 to +85	+1.62 to +3.63	+8.0 μ A (100kHz)	CE TC	105	
MO1576					LVC MOS	± 5 all inclusive						

Low Power MEMS Oscillators

Type	Actual Size	Size (mm)			Output	Frequency Range (MHz)	Frequency Tolerance ($\times 10^{-6}$) (Includes frequency tolerance at room temperature.)	Operating Temperature Range (°C)	Supply Voltage (V)	Current Consumption (mA typ.)	Recommended Application	Catalog Page
		L	W	H (max.)								
MO8008		2.0	1.6	0.8	LVC MOS	1.0 to 110	$\pm 20, \pm 25, \pm 50$	-40 to +85	+1.62 to +1.98, +2.25 to +3.63	+3.1 to +5.4 (+0.6 to +1.0 μ A stby)	CE IE	106
		2.5	2.0	0.8								
		3.2	2.5	0.8								
MO8009		5.0	3.2	0.8		115 to 137						
MO8021		1.5	0.8	0.6	LVC MOS	1.0 to 26	± 100	-40 to +85	+1.62 to +1.98, +2.25 to +3.63	+0.006 to +0.34 (+0.9 μ A stby)	CE TC	105

MEMS Oscillators for Clock

Type	Actual Size	Size (mm)			Output	Frequency Range (MHz)	Frequency Tolerance ($\times 10^{-6}$) (Includes frequency tolerance at room temperature.)	Operating Temperature Range (°C)	Supply Voltage (V)	Current Consumption (mA typ.)	Recommended Application	Catalog Page
		L	W	H (max.)								
MO2001		2.9	2.8	1.3	LVC MOS	1.0 to 110	$\pm 20, \pm 25, \pm 50$	-40 to +85	+1.62 to +1.98, +2.25 to +3.63	+3.6 to +5.4 (+0.6 to +1.0 μ A stby)	CE IE	106
MO2002						115 to 137						

Low Phase Jitter MEMS Oscillators

Type	Actual Size	Size (mm)			Output	Frequency Range (MHz)	Frequency Tolerance ($\times 10^{-6}$) (Includes frequency tolerance at room temperature.)	Operating Temperature Range (°C)	Supply Voltage (V)	Current Consumption (mA typ.)	Recommended Application	Catalog Page
		L	W	H (max.)								
MO8208		2.7	2.4	0.8	LVC MOS	1.0 to 80	$\pm 10, \pm 20, \pm 25, \pm 50$	-40 to +85	+2.25 to +3.63	+29 to +36 (+10 μ A stby)	CE IE	108
		3.2	2.5	0.8								
MO8209		5.0	3.2	0.8		80 to 220						
MO9120		3.2	2.5	0.8	LVPECL LVDS	25 to 212.5	$\pm 10, \pm 20, \pm 25, \pm 50$	-40 to +85	+2.25 to +3.63	+54 to +69	CE IE	107
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 HC SL	32 Standard Frequencies	$\pm 10, \pm 20, \pm 25, \pm 50$	-40 to +105	+2.25 to +3.63	+76 to +84	CE IE	107
MO9366		5.0	3.2	0.8		1.0 to 220						
MO9367		7.0	5.0	1.0		220 to 725						

High Temperature MEMS Oscillators

Type	Actual Size	Size (mm)			Output	Frequency Range (MHz)	Frequency Tolerance ($\times 10^4$) (Includes frequency tolerance at room temperature.)	Operating Temperature Range (°C)	Supply Voltage (V)	Current Consumption (mA typ.)	Recommended Application	Catalog Page
		L	W	H (max.)								
MO8918		2.0	1.6	0.8	LVC MOS	1.0 to 110	$\pm 20, \pm 25, \pm 30, \pm 50$	-40 to +125	+1.62 to +1.98, +2.25 to +3.63	+3.6 to +5.4 (+1.0 μ A stby)	CE IE	109
MO8919		2.5	2.0	0.8		115 to 137						
MO8920		3.2	2.5	0.8		1.0 to 110						
MO8921		5.0	3.2	0.8		119 to 137						
		7.0	5.0	1.0								

High Temperature MEMS Oscillators for Clock

Type	Actual Size	Size (mm)			Output	Frequency Range (MHz)	Frequency Tolerance ($\times 10^4$) (Includes frequency tolerance at room temperature.)	Operating Temperature Range (°C)	Supply Voltage (V)	Current Consumption (mA typ.)	Recommended Application	Catalog Page
		L	W	H (max.)								
MO2018		2.9	2.8	1.3	LVC MOS	1.0 to 110	$\pm 20, \pm 25, \pm 30, \pm 50$	-40 to +85	+1.62 to +1.98, +2.25 to +3.63	+3.6 to +5.4 (+1.0 μ A stby)	CE IE	109
MO2019						115 to 137		-55 to +125				
MO2020						1.0 to 110						
MO2021						119 to 137						

Voltage Controlled MEMS Oscillators

Type	Actual Size	Size (mm)			Output	Frequency Range (MHz)	Frequency Tolerance ($\times 10^4$) (Includes frequency tolerance at room temperature.)	Operating Temperature Range (°C)	Supply Voltage (V)	Current Consumption (mA typ.)	Recommended Application	Catalog Page			
		L	W	H (max.)											
MO3372		3.2	2.5	0.8	LVPECL LVDS HCSL	1.0 to 220	$\pm 15, \pm 25, \pm 35, \pm 50$	-40 to +105	+2.25 to +3.63	+76 to +84	CE IE	110			
MO3373													7.0	5.0	1.0
MO3807		2.7	2.4	0.8	LVC MOS	30 Standard Frequencies	$\pm 25, \pm 50$	-40 to +85	+1.71 to +1.89, +2.25 to +3.63	+29 to +36 (+10 μ A stby)	CE IE	111			
MO3808						3.2	2.5						0.8	1.0 to 80	$\pm 10, \pm 25, \pm 50$
MO3809														7.0	5.0

Digitally Controlled MEMS Oscillators

Type	Actual Size	Size (mm)			Output	Frequency Range (MHz)	Frequency Tolerance ($\times 10^4$) (Includes frequency tolerance at room temperature.)	Operating Temperature Range (°C)	Supply Voltage (V)	Current Consumption (mA typ.)	Recommended Application	Catalog Page			
		L	W	H (max.)											
MO3907		3.2	2.5	0.8	LVC MOS	1.0 to 220	$\pm 10, \pm 25, \pm 50$	-40 to +85	+1.71 to +1.89, +2.25 to +3.63	+29 to +36 (+10 μ A stby)	CE IE	112			
MO3921													5.0	3.2	0.8
MO3922													7.0	5.0	1.0

Temperature Compensated MEMS Oscillators

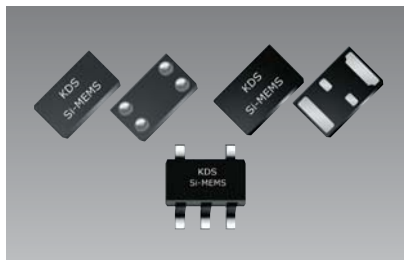
Type	Actual Size	Size (mm)			Output	Frequency Range (MHz)	Frequency Characteristics over Temperature ($\times 10^6$)	Operating Temperature Range (°C)	Supply Voltage (V)	Current Consumption (mA typ.)	Recommended Application	Catalog Page
		L	W	H (max.)								
MO5021		3.2	2.5	0.8	LVPECL LVDS	1.0 to 220	± 5.0	-40 to +85	+2.25 to +3.63	+54 to +69	CE IE	114
MO5022												
MO5155		5.0	3.2	1.0	Clipped Sinewave (1 to 60 MHz) LVC MOS	10 std. GNSS Freq.	$\pm 0.5, \pm 1.0, \pm 2.5$	-40 to +105°C	+2.25 to +3.63	+40 to +50	CE IE	113
MO5156						1.0 to 60						
MO5157						60 to 220						
MO5356						1.0 to 60						
MO5357					60 to 220							
MO5358					Clipped Sinewave, LVC MOS	1.0 to 60	± 0.05	0 to +70°C				
MO5359					LVC MOS	60 to 189, 200 to 220						

MEMS Oscillators with Spread Spectrum Function

Type	Actual Size	Size (mm)			Output	Frequency Range (MHz)	Frequency Tolerance ($\times 10^4$) (Includes frequency tolerance at room temperature.)	Operating Temperature Range (°C)	Supply Voltage (V)	Current Consumption (mA typ.)	Recommended Application	Catalog Page			
		L	W	H (max.)											
MO9002		5.0	3.2	0.8	LVPECL LVDS CML HCSL	1.0 to 220	$\pm 25, \pm 50$	-40 to +85	+1.71 to +1.89, +2.25 to +3.63	+48 to +75	CE IE	115			
MO9003													LVC MOS	2.5	2.0
	3.2	2.5	0.8												
	7.0	5.0	1.0												
MO9005		2.0	1.6	0.8	LVC MOS	1.0 to 141	$\pm 20, \pm 25, \pm 50$	-40 to +85	+1.62 to +1.98, +2.25 to +3.63	+5.0 to +6.5 (+0.4 to +4.3 μ A stby)	CE IE	115			
													2.5	2.0	0.8
													3.2	2.5	0.8

32 kHz MEMS Oscillators / 32 kHz TC-MO - μ Power

MO1532/MO1552/MO1630/MO1566/MO1568



■ Features

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

■ Applications

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



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

■ Standard Specification (MO1532)

Item	Legend	Min.	Typ.	Max.	Unit	Condition
Output Frequency Range	F _{out}	32.768			kHz	
Supply Voltage	V _{dd}	+1.2	-	+3.63	V	T _A = -10°C to +70°C
		+1.5	-	+3.63		T _A = -40°C to +85°C
Operating Temperature Range	T _{use}	-10 to +70 / -40 to +85			°C	
Frequency Stability [1]	F _{stab}	-	-	+75	$\times 10^{-6}$	T _A = -10°C to +70°C, V _{dd} : +1.5V to +3.63V
		-	-	+100		T _A = -40°C to +85°C, V _{dd} : +1.5V to +3.63V
		-	-	+250		T _A = -10°C to +70°C, V _{dd} : +1.2V to +1.5V
Frequency Tolerance [2]	F _{tol}	-	-	+10	$\times 10^{-6}$	T _A = +25° C, post reflow, V _{dd} : +1.5V to +3.63V
		-	-	+20		T _A = +25° C, post reflow with board-level underfill, V _{dd} : +1.5V to +3.63V
First Year Aging	F _{aging1}	-1.0	-	+1.0	$\times 10^{-6}$	T _A = +25°C
Core Operating Current [3]	I _{dd}	-	+0.9	-	μ A	T _A = +25°C, V _{dd} : +1.8V. No load
		-	-	+1.3		T _A = -10°C to +70°C, V _{dd} max: +3.63V. No load
		-	-	+1.4		T _A = -40°C to +85°C, V _{dd} max: +3.63V. No load
Start-up Time [4]	T _{start}	-	180	300	ms	T _A = -40°C \leq T _A \leq +50°C, valid output
		-	-	450		T _A = +50°C < T _A \leq +85°C, valid output
LVCMOS Output Option, T _A = -40°C to +85°C, typical values are at T _A = +25°C						
Duty Cycle	DC	48	-	52	%	
Output Low Voltage	V _{OL}	-	-	V _{dd} \times 0.1	V	V _{dd} : +1.5V to +3.63V, I _{OL} = +10 μ A, 15 pF
Output High Voltage	V _{OH}	V _{dd} \times 0.9	-	-	V	V _{dd} : +1.5V to +3.63V, I _{OH} = -10 μ A, 15 pF
Rise and Fall Time	Tr, Tf	-	100	200	ns	10 to 90% (V _{dd}), 15 pF load, V _{dd} = +1.5V to +3.63V
		-	-	50		10 to 90% (V _{dd}), 5 pF load, V _{dd} \geq +1.62V
Packing Unit	1000pcs./reel (ϕ 180) or 3000pcs./reel (ϕ 180)					

[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.

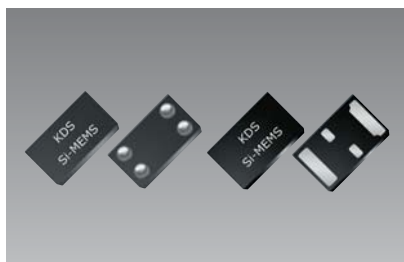
[2]. Measured peak-to-peak. Tested with Keysight 53132A frequency counter. Due to the low operating frequency, the gate time must be \geq 100 ms to ensure an accurate frequency measurement.

[3]. Core operating current does not include output driver operating current or load current. To derive total operating current (no load), add core operating current + (+0.065 μ A/V) \times (output voltage swing).

[4]. Measured from the time V_{dd} reaches +1.5V.

MEMS Oscillators / TC-MO - μ Power

MO1534/MO1569/MO1576/MO8021



■ Features

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

■ Applications

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



Model	Output Frequency (kHz)	Frequency Tolerance ($\times 10^{-6}$)	Supply Voltage (V)	Current Consumption (μ A Typ.)	Size (mm)	Output
MO1534	1 Hz to 32.768 kHz	± 20 room; $\pm 75, 100, 150$ over temp	+1.2 to +3.63	+0.90	1.5 \times 0.8 \times 0.6 (CSP) 2.0 \times 1.2 \times 0.6 (QFN)	NanoDrive™ LVCMOS
MO1569	1 Hz to 462kHz	± 50	+1.62 to +3.63	+2.0 (100 kHz)	1.5 \times 0.8 \times 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	+1.62 to +1.98, +2.25 to +3.63	+6 to +340 (0.9 μ A stby)		

■ Standard Specification (MO8021)

Item	Legend	Min.	Typ.	Max.	Unit	Condition
Output Frequency Range	f	1	-	26	MHz	
Operating Supply Voltage	Vdd	+1.62	+1.8	+1.98	V	Any voltage from +2.25 to +3.63V
		+2.25	-	+3.63		
Operating Temperature Range	T _{use}	-20	-	+70	°C	Extended Commercial
		-40	-	+85		Industrial
Frequency Stability	F _{tol}	-15	-	+15	$\times 10^{-6}$	Frequency offset at +25°C post reflow
Frequency Tolerance	F _{stab}	-100	-	+100	$\times 10^{-6}$	Inclusive of initial tolerance, and variations over operating temperature, rated power supply voltage and output load.
First Year Aging	F _{aging1}	-3.0	-	+3.0	$\times 10^{-6}$	T _A = +25°C
Current Consumption [1]	I _{dd}	-	+60	-	μ A	f = 3.072 MHz, Vdd = +1.8V, no load
		-	+110	+130		f = 6.144 MHz, Vdd = +1.8V, no load
		-	+230	+270		f = 6.144 MHz, Vdd = +1.8V, 10 pF load
		-	+160	-		f = 12 MHz, Vdd = +1.8V, no load
		-	-	+160		f = 6.144 MHz, Vdd = +2.25V to +3.63V, no load
Standby Current	I _{std}	-	+0.7	+1.3	μ A	Vdd = +1.8V, ST pin = HIGH, output is weakly pulled down
		-	-	+1.5		Vdd = +2.25V to +3.63V, ST pin = HIGH, output is weakly pulled down
Duty Cycle	DC	45	-	55	%	
Output Low Voltage	V _{OL}	-	-	Vdd \times 0.1	V	I _{OL} = +0.5 mA
Output High Voltage	V _{OH}	Vdd \times 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 \times 0.2	V	
Input High Voltage	V _{IH}	Vdd \times 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	μ s	Measured from the time ST pin crosses 50% threshold
Resume Time	T _{resume}	-	2.0	3.0	ms	Measured from the time ST pin crosses 50% threshold
RMS Period Jitter	T _{jitt}	-	75	110	ps	f = 6.144 MHz, Vdd = +1.8V
		-	-	110		f = 6.144 MHz, Vdd = +2.25V to +3.63V
RMS Phase Jitter (random)	T _{phj}	-	0.8	2.5	ns	f = 6.144 MHz, Integration bandwidth = 100 Hz to 40 kHz
		-	-	2.5		Vdd = +1.8V, Note [2]
		-	-	2.5		f = 6.144 MHz, Integration bandwidth = 100 Hz ~ 40 kHz
Packing Unit		1000pcs./reel (ϕ 180) or 3000pcs./reel (ϕ 180)				

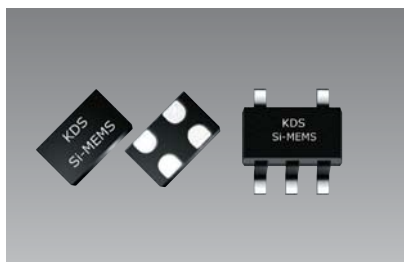
[1]. Supply current with load is a function of the output frequency and output load.

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

MO8008/MO8009/MO2001/MO2002



■ Features

- Excellent total frequency tolerance as low as $\pm 20 \times 10^{-6}$
- 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.



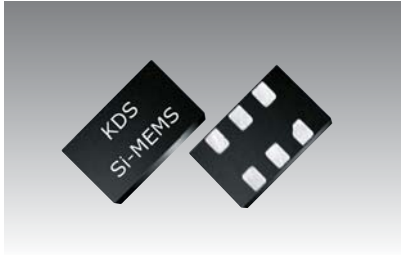
Model	Output Frequency (MHz)	Frequency Tolerance ($\times 10^{-6}$)	Supply Voltage (V)	Current Consumption (mA Typ.)	Size (mm)	Output
MO8008	1 to 110	$\pm 20, \pm 25, \pm 50$	+1.62 to +1.98, +2.25 to +3.63	+3.1 to +5.4 (+0.6 to +1.0 μ A stby)	2.0 \times 1.6 \times 0.8, 2.5 \times 2.0 \times 0.8, 3.2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

■ 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		
Operating Temperature Range	T _{use}	-20	-	+70	°C	Extended Commercial
		-40	-	+85		Industrial
Frequency Stability	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.
		-25	-	+25		
		-50	-	+50		
Current Consumption	I _{dd}	-	+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	μ A	\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 \times 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 \times 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 \times 0.3	V	Pin 1, OE or \overline{ST}
Input High Voltage	V _{IH}	Vdd \times 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 \times 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
Packing Unit		1000pcs./reel (ϕ 180) or 3000pcs./reel (ϕ 180: 2016, 2520, 3225 package)				

MEMS Oscillators - Super Low Jitter

MO9365/MO9366/MO9367



■ Features

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

■ Applications

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



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

■ Standard Specification (MO9366)

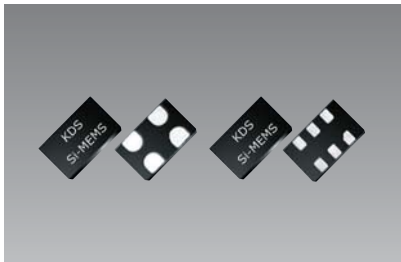
Item	Legend	Min.	Typ.	Max.	Unit	Condition
Output Frequency Range	f	1	-	220	MHz	Accurate to 6 decimal places
Supply Voltage	V _{dd}	+2.25	+2.50	+2.75	V	
		+2.52	+2.80	+3.08		
		+2.70	+3.00	+3.30		
		+2.97	+3.30	+3.63		
Operating Temperature Range	T _{use}	-20	-	+70	°C	Extended Commercial
		-40	-	+85		Industrial
		-40	-	+95		Extended Industrial
		-40	-	+105		
Frequency Tolerance	F _{stab}	-10	-	+10	$\times 10^{-6}$	Inclusive of initial tolerance, and variations over operating temperature, rated power supply voltage and output load.
		-20	-	+20		
		-25	-	+25		
		-50	-	+50		
First Year Aging	F _{aging1}	-	± 1	-	$\times 10^{-6}$	T _A = +25°C
Duty Cycle	DC	45	-	55	%	
OE Disable Supply Current	I _{oe}	-	-	+58	mA	OE = Low
Input Low Voltage	V _{IL}	-	-	V _{dd} ×0.3	V	Pin 1, OE
Input High Voltage	V _{IH}	V _{dd} ×0.7	-	-	V	Pin 1, OE
Start-up Time	T _{start}	-	-	3.0	ms	Measured from the time V _{dd} reaches its rated minimum value
Enable and Disable Time	T _{oe}	-	-	3.8	μs	f = 156.25 MHz
RMS Phase Jitter [1]	T _{jitt}	-	1	1.6	ps	f = 100, 156.25 or 212.5 MHz, V _{dd} = 3.3 or 2.5 V
LVPECL output						
Current Consumption	I _{dd}	-	-	+89	mA	Excluding Load Termination Current, V _{dd} = +3.3V or +2.5V
Output Low Voltage	V _{OL}	V _{dd} - 1.9	-	V _{dd} - 1.5	V	
Output High Voltage	V _{OH}	V _{dd} - 1.1	-	V _{dd} - 0.7	V	
Differential Output Voltage	V _{Swing}	1.2	1.6	2.0	V	
Rise and Fall Time	T _r , T _f	-	225	290	ps	20% to 80%
RMS Phase Jitter [random]	T _{phj}	-	0.225	0.275	ps	Note [2]
LVDS output						
Current Consumption	I _{dd}	-	-	+79	mA	Excluding Load Termination Current, V _{dd} = +3.3V or +2.5V
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	
Rise and Fall Time	T _r , T _f	-	400	470	ps	Measured with 2 pF capacitive loading to GND, 20% to 80%
RMS Phase Jitter [random]	T _{phj}	-	0.235	0.275	ps	Note [2]
HCSL output						
Current Consumption	I _{dd}	-	-	+89	mA	Excluding Load Termination Current, V _{dd} = +3.3V or +2.5V
Output Voltage Low	V _{OL}	-0.05	-	+0.08	V	
Output Voltage High	V _{OH}	0.6	-	+0.9	V	
Differential Output Voltage	V _{Swing}	1.0	1.4	1.8	V	
Rise and Fall Time	T _r , T _f	-	360	465	ps	Measured with 2 pF capacitive loading to GND, 20% to 80%
RMS Phase Jitter [random]	T _{phj}	-	0.225	0.275	ps	Note [2]
Packing Unit		1000pcs./reel (φ 180) or 3000pcs./reel (φ 180: 3225 package)				

[1]. Measured according to JESD65B

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

MEMS Oscillators - Low Jitter

MO9120/MO9121/MO9122/MO8208/MO8209



■ Features

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

■ Applications

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



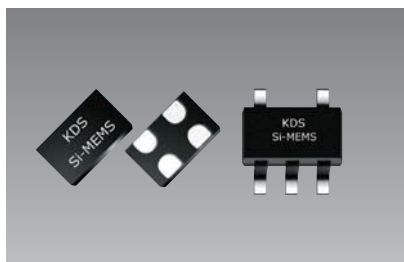
Model	Output Frequency (MHz)	Frequency Tolerance ($\times 10^{-6}$)	Supply Voltage (V)	Current Consumption (mA Typ.)	Size (mm)	Output
MO9120	25 to 212.5	$\pm 10, \pm 20, \pm 25, \pm 50$	+2.25 to +3.63	+54 to +69	3.2×2.5×0.8, 5.0×3.2×0.8, 7.0×5.0×1.0 (QFN)	LVPECL LVDS
MO9121	1 to 220					
MO9122	220 to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

■ Standard Specification (MO9121)

Item	Legend	Min.	Typ.	Max.	Unit	Condition
Output Frequency Range	f	1	-	220	MHz	Refer to datasheet for exact list of supported frequencies
Supply Voltage	Vdd	+2.97	+3.3	+3.63	V	
		+2.25	+2.5	+2.75		
		+2.25	-	+3.63		
Operating Temperature Range	T _{use}	-20	-	+70	°C	Extended Commercial Industrial
		-40	-	+85		
Frequency Tolerance	F _{stab}	-10	-	+10	$\times 10^{-6}$	Inclusive of initial tolerance, and variations over operating temperature, rated power supply voltage and output load.
		-20	-	+20		
		-25	-	+25		
		-50	-	+50		
First Year Aging	F _{aging1}	-2.0	-	+2.0	$\times 10^{-6}$	T _A = +25°C
10-year Aging	F _{aging10}	-5.0	-	+5.0	$\times 10^{-6}$	T _A = +25°C
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	I _{dd}	-	+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	μ A	\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	I _{dd}	-	+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	μ A	\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
Packing Unit	1000pcs./reel (ϕ 180) or 3000pcs./reel (ϕ 180: 3225 package)					

High Temperature MEMS Oscillators

MO8918/MO8919/MO2018/MO2019/MO8920/MO8921/MO2020/MO2021



■ 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



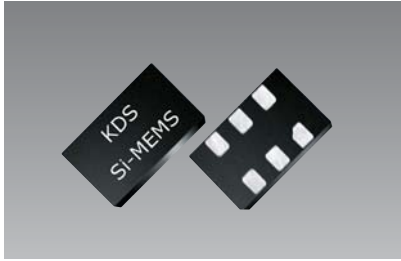
Model	Output Frequency (MHz)	Frequency Tolerance ($\times 10^{-6}$)	Supply Voltage (V)	Current Consumption (mA Typ.)	Size (mm)	Output
MO8918	1 to 110	$\pm 20, \pm 25, \pm 30, \pm 50$ (-40 to +125°C)	+1.62 to +1.98, +2.25 to +3.63	+3.6 to +5.4 (+1.0 μ A stby)	2.0 \times 1.6 \times 0.8, 2.5 \times 2.0 \times 0.8, 3.2 \times 2.5 \times 0.8, 5.0 \times 3.2 \times 0.8, 7.0 \times 5.0 \times 1.0 (QFN)	LVC MOS
MO8919	115 to 137					
MO2018	1 to 110				2.9 \times 2.8 \times 1.3 (SOT23-5)	
MO2019	115 to 137					
MO8920	1 to 110	$\pm 20, \pm 25, \pm 30, \pm 50$ (-55 to +125°C)			2.0 \times 1.6 \times 0.8, 2.5 \times 2.0 \times 0.8, 3.2 \times 2.5 \times 0.8, 5.0 \times 3.2 \times 0.8, 7.0 \times 5.0 \times 1.0 (QFN)	LVC MOS
MO8921	119 to 137					
MO2020	1 to 110				2.9 \times 2.8 \times 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	V _{dd}	+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	°C	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 \pm 10%).
		-25	-	+25		
		-30	-	+30		
		-50	-	+50		
Current Consumption	I _{dd}	-	+3.8	+4.7	mA	No load condition, f = 20 MHz, V _{dd} = +2.8V, +3.0V or +3.3V
		-	+3.6	+4.5		No load condition, f = 20 MHz, V _{dd} = +2.5V
		-	+3.5	+4.5		No load condition, f = 20 MHz, V _{dd} = +1.8V
OE Disable Current	I _{od}	-	-	+4.5	mA	V _{dd} = +2.5V to +3.3V, OE = Low, Output in high Z state
		-	-	+4.3		V _{dd} = +1.8V, OE = Low, Output in high Z state
Standby Current	I _{std}	-	+2.6	+8.5	μ A	V _{dd} = +2.8V to +3.3V, \overline{ST} = Low, Output is weakly pulled down
		-	+1.4	+5.5		V _{dd} = +2.5V, \overline{ST} = Low, Output is weakly pulled down
		-	+0.6	+4.0		V _{dd} = +1.8V, \overline{ST} = Low, Output is weakly pulled down
Duty Cycle	DC	45	-	55	%	All V _{dds}
Output Low Voltage	V _{OL}	-	-	V _{dd} \times 0.1	V	I _{OL} = +4.0 mA (V _{dd} = +3.0V or +3.3V)
						I _{OL} = +3.0 mA (V _{dd} = +2.8V or +2.5V)
						I _{OL} = +2.0 mA (V _{dd} = +1.8V)
Output High Voltage	V _{OH}	V _{dd} \times 0.9	-	-	V	I _{OH} = -4.0 mA (V _{dd} = +3.0V or +3.3V)
						I _{OH} = -3.0 mA (V _{dd} = +2.8V or +2.5V)
						I _{OH} = -2.0 mA (V _{dd} = +1.8V)
Rise and Fall Time	Tr, Tf	-	1.0	2.0	ns	V _{dd} = +2.5V, +2.8V, +3.0V or +3.3V, 20% to 80%
		-	1.3	2.5		V _{dd} = +1.8V, 20% to 80%
		-	1.0	3.0		V _{dd} = +2.25V to +3.63V, 20% to 80%
Input Low Voltage	V _{IL}	-	-	V _{dd} \times 0.3	V	Pin 1, OE or \overline{ST}
Input High Voltage	V _{IH}	V _{dd} \times 0.7	-	-	V	Pin 1, OE or \overline{ST}
Start-up Time	T _{start}	-	-	5.0	ms	Measured from the time V _{dd} reaches its rated minimum value.
Enable and Disable Time	T _{oe}	-	-	130	ns	f = 110 MHz. For other frequencies, T _{oe} = 100 ns + 3 \times 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, V _{dd} = +2.5V, +2.8V, +3.0V or +3.3V
		-	1.9	3.0		f = 75 MHz, V _{dd} = +1.8V
Peak-to-peak Period Jitter	T _{pk}	-	12	20	ps	f = 75 MHz, V _{dd} = +2.5V, +2.8V, +3.0V or +3.3V
		-	14	25		f = 75 MHz, V _{dd} = +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
Packing Unit		1000pcs./reel (ϕ 180) or 3000pcs./reel (ϕ 180: 2016, 2520, 3225 package)				

Voltage Controlled MEMS Oscillators (VCMO) - Super Low Jitter

MO3372/MO3373



■ Features

- Industry-Standard packages: 3.2×2.5 mm, 5.0×3.2 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



Model	Output Frequency (MHz)	Frequency Tolerance (×10 ⁻⁶)	Supply Voltage (V)	Current Consumption (mA Typ.)	Size (mm)	Output
MO3372	1 to 220	±15, ±25, ±35, ±50	+2.25 to 3.63	+76 to +84	3.2×2.5×0.8, 5.0×3.2×0.8, 7.0×5.0×1.0 (QFN)	LVPECL
MO3373	220 to 725					LVDS HCSSL

■ Standard Specification (MO3372)

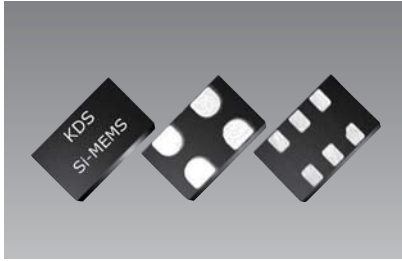
Item	Legend	Min.	Typ.	Max.	Unit	Condition
Output Frequency Range	f	1	-	220	MHz	Accurate to 6 decimal places
Supply Voltage	V _{dd}	+2.97	+3.3	+3.63	V	
		+2.7	+3.0	+3.3		
		+2.52	+2.8	+3.08		
		+2.25	+2.5	+2.75		
Operating Temperature Range	T _{use}	-20	-	+70	°C	Extended Commercial
		-40	-	+85		Industrial
		-40	-	+95		
		-40	-	+105		Extended 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		
		-35	-	+35		
		-50	-	+50		
Duty Cycle	DC	45	-	55	%	
Input Low Voltage	V _{il}	-	-	V _{dd} ×0.3	V	Pin 2, OE
Input High Voltage	V _{ih}	V _{dd} ×0.7	-	-	V	Pin 2, OE
Start-up Time	T _{start}	-	-	3.0	ms	Measured from the time V _{dd} reaches its rated minimum value.
Enable and Disable Time	T _{oe}	-	-	3.8	μs	f = 156.25 MHz
Pull Range	PR	±25, ±50, ±80, ±100, ±150, ±200, ±400, ±800, ±1600, ±3200	-	-	×10 ⁻⁶	
Output Disable Leakage Current	I _{leak}	-	+0.15	-	μA	OE = Low
Lower Control Voltage	VC _L	-	-	V _{dd} ×0.1	V	Voltage at which minimum frequency deviation is guaranteed
Upper Control Voltage	VC _U	V _{dd} ×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	%	
Frequency Change Polarity	-	Positive Slope		-	-	
RMS Period Jitter [1]	T _{jitt}	-	1.0	1.6	ps	f = 156.25 MHz, V _{dd} = +3.3V or +2.5V
LVPECL Specific						
Current Consumption	I _{dd}	-	-	+92	mA	Excluding Load Termination Current, V _{dd} = +3.3V or +2.5V
OE Disable Supply Current	I _{oe}	-	-	+61	mA	OE = Low
Maximum Output Current	I _{driver}	-	-	+30	mA	Maximum average current drawn from OUT+ or OUT-
Output Low Voltage	V _{OL}	V _{dd} - 2.0	-	V _{dd} - 1.5	V	
Output High Voltage	V _{OH}	V _{dd} - 1.15	-	V _{dd} - 0.7	V	
Output Differential Voltage Swing	V _{Swing}	+1.2	+1.6	+2.0	V	
Rise and Fall Time	Tr, Tf	-	225	290	ps	20% to 80%
RMS Phase Jitter (random)	T _{phj}	-	0.225	0.275	ps	Note [2]
LVDS Specific						
Current Consumption	I _{dd}	-	-	+84	mA	Excluding Load Termination Current, V _{dd} = +3.3V or +2.5V
OE Disable Supply Current	I _{oe}	-	-	+62	mA	OE = Low
Rise and Fall Time	Tr, Tf	-	400	470	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	
RMS Phase Jitter (random)	T _{phj}	-	0.235	0.275	ps	Note [2]
HCSSL Specific						
Current Consumption	I _{dd}	-	-	+97	mA	Excluding Load Termination Current, V _{dd} = +3.3V or +2.5V
OE Disable Supply Current	I _{oe}	-	-	+62	mA	OE = Low
Rise and Fall Time	Tr, Tf	-	360	495	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	-	+0.9	V	
Output Differential Voltage Swing	V _{Swing}	+1.2	+1.4	+1.8	V	
RMS Phase Jitter (random)	T _{phj}	-	0.23	0.275	ps	Note [2]
Packing Unit	1000pcs./reel (φ180) or 3000pcs./reel (φ180: 3225 package)					

[1]. Measured according to JESD65B

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

Voltage Controlled MEMS Oscillators (VCMO)

MO3807/MO3808/MO3809



■ Features

- Frequency Tolerance as tight as $\pm 25 \times 10^{-6}$
- Widest pull range options: ± 25 to $\pm 1600 \times 10^{-6}$
- 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)



■ 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 ($\times 10^{-6}$)	Supply Voltage (V)	Current Consumption (mA Typ.)	Size (mm)	Output
MO3807	30 standard frequencies	$\pm 25, \pm 50$	+1.71 to +1.89, +2.25 to +3.63	+29 to +36 (+10 μ A 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	$\pm 10, \pm 25, \pm 50$				
MO3809	80 to 220					

■ Standard Specification (MO3808)

Item	Legend	Min.	Typ.	Max.	Unit	Condition
Output Frequency Range	f	1	-	80	MHz	
Supply Voltage	V _{dd}	+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	°C	Extended Commercial Industrial
		-40	-	+85		
Frequency Stability	F _{stab}	-10	-	+10	$\times 10^{-6}$	Inclusive of Initial tolerance[4] at +25° C and variation over temperature, rated supply voltage and load.
		-25	-	+25		
10-year Aging	F _{aging10}	-5.0	-	+5.0	$\times 10^{-6}$	10 years, T _A = +25°C
Current Consumption	I _{dd}	-	+31	+33	mA	No load condition, f = 20 MHz, V _{dd} = +2.5V, +2.8V or +3.3V
		-	+29	+31		No load condition, f = 20 MHz, V _{dd} = +1.8V
Standby Current	I _{std}	-	-	+70	μ A	V _{dd} = +2.5V, +2.8V, +3.3V, ST = GND, Output is weakly pulled down
		-	-	+10		V _{dd} = +1.8V, ST = GND, Output is weakly pulled down
Duty Cycle	DC	45	-	55	%	All V _{dds}
Output Low Voltage	V _{OL}	-	-	V _{dd} ×0.1	V	I _{OL} = +7.0 mA (V _{dd} = +3.0V or +3.3V) I _{OL} = +4.0 mA (V _{dd} = +2.8V or +2.5V) I _{OL} = +2.0 mA (V _{dd} = +1.8V)
Output High Voltage	V _{OH}	V _{dd} ×0.9	-	-	V	I _{OH} = -7.0 mA (V _{dd} = +3.0V or +3.3V) I _{OH} = -4.0 mA (V _{dd} = +2.8V or +2.5V) I _{OH} = -2.0 mA (V _{dd} = +1.8V)
Rise and Fall Time	Tr, Tf	-	1.5	2.0	ns	V _{dd} = +1.8V, +2.5V, +2.8V or +3.3V, 10% to 90% V _{dd} level
Pull Range [5,6]	PR	$\pm 25, \pm 50, \pm 100, \pm 150, \pm 200, \pm 400, \pm 800, \pm 1600,$	-	-	$\times 10^{-6}$	See the Absolute Pull Range and APR table of datasheet
Upper Control Voltage	VC _U	+1.7	-	-	V	V _{dd} = +1.8V, Voltage at which maximum deviation is guaranteed.
		+2.4	-	-		V _{dd} = +2.5V, Voltage at which maximum deviation is guaranteed.
		+2.7	-	-		V _{dd} = +2.8V, Voltage at which maximum deviation is guaranteed.
		+3.2	-	-		V _{dd} = +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	-	-	k Ω	
Control Voltage Input Capacitance	C _{in}	-	5.0	-	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 V _{dds} , 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, V _{dd} = +2.5V, +2.8V or +3.3V
		-	2.0	3.0		f = 20 MHz, V _{dd} = +1.8V
RMS Phase Jitter (random)	T _{phj}	-	0.5	1.0	ps	f = 20 MHz, Integration bandwidth = 12 kHz to 20 MHz, All V _{dds}
Packing Unit	1000pcs./reel (ϕ 180) or 3000pcs./reel (ϕ 180: 2724, 3225 package)					

[1]. All electrical specifications in the above table are specified with 15 pF output load and for all V_{dd}(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.

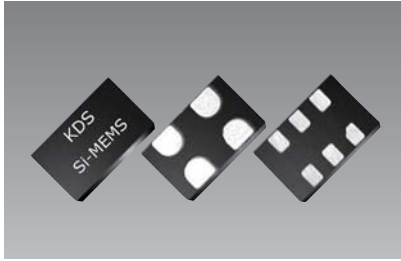
[4]. Initial tolerance is measured at V_{in} = V_{dd}/2.

[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)

MO3907/MO3921/MO3922



■ 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 $\pm 1600 \times 10^{-6}$
- Superior pull range linearity of $\leq 0.01\%$

■ Applications

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



Model	Output Frequency (MHz)	Frequency Tolerance ($\times 10^{-6}$)	Supply Voltage (V)	Current Consumption (mA Typ.)	Size (mm)	Output
MO3907	1 to 220	$\pm 10, \pm 25, \pm 50$	+1.71 to +1.89, +2.25 to +3.63	+29 to +36 (+10 μ A 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
MO3922	220 to 625					LVDS

■ Standard Specification (MO3907)

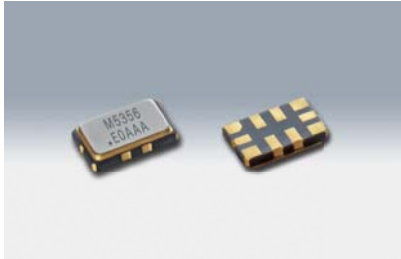
Item	Legend	Min.	Typ.	Max.	Unit	Condition
Output Frequency Range	f	1	-	220	MHz	
Supply Voltage	V _{dd}	+1.71	+1.8	+1.89	V	
		+2.25	+2.5	+2.75		
		+2.52	+2.8	+3.08		
		+2.97	+3.3	+3.63		
Operating Temperature Range	T _{use}	-20	-	+70	°C	Extended Commercial
		-40	-	+85		Industrial
Frequency Stability	F _{stab}	-10	-	+10	$\times 10^{-6}$	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	$\times 10^{-6}$	10 years, T _A = +25°C
Current Consumption	I _{dd}	-	+32	+34	mA	No load condition, f = 100 MHz, V _{dd} = +2.5V, +2.8V or +3.3V
		-	+31	+34		No load condition, f = 100 MHz, V _{dd} = +1.8V
Duty Cycle	DC	45	-	55	%	V _{dd} = +1.8V, +2.5V, +2.8V or +3.3V
Pull Range [1,2]	PR	$\pm 25, \pm 50, \pm 100, \pm 200, \pm 400, \pm 800, \pm 1600$			$\times 10^{-6}$	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}	-	-	V _{dd} ×0.1	V	I _{OL} = +6.0 mA (V _{dd} = +3.3V, +2.8V, +2.5V) I _{OL} = +3.0 mA (V _{dd} = +1.8V)
Output High Voltage	V _{OH}	V _{dd} ×0.9	-	-	V	I _{OH} = -6.0 mA (V _{dd} = +3.3V, +2.8V, +2.5V) I _{OH} = -3.0 mA (V _{dd} = +1.8V)
Rise and Fall Time	Tr, Tf	-	1.2	2.0	ns	V _{dd} = +1.8V, +2.5V, +2.8V or +3.3V, 10% to 90% V _{dd} level
Input Low Voltage	V _{IL}	-	-	V _{dd} ×0.2	V	
Input Middle Voltage	V _{IM}	V _{dd} ×0.4	-	V _{dd} ×0.6	V	
Input High Voltage	V _{IH}	V _{dd} ×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 V _{dds}
		-	2.0	3.0		f = 20 MHz, all V _{dds}
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.
Packing Unit	1000pcs./reel (ϕ 180) or 3000pcs./reel (ϕ 180: 3225 package)					

[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

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



■ 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



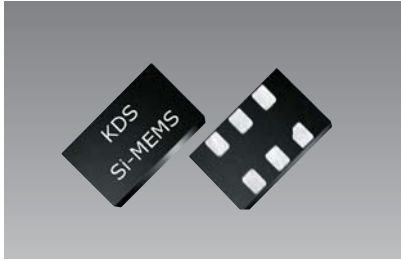
Model	Output Frequency (MHz)	Frequency Tolerance ($\times 10^{-6}$)	Supply Voltage (V)	Current Consumption (mA Typ.)	Size (mm)	Output
MO5155	10 std. GNSS Freq.	$\pm 0.5, \pm 1.0, \pm 2.5$	+2.25 to +3.63	+40 to +50	5.0×3.2×0.95 (Ceramic)	Clipped Sinewave (1 to 60 MHz) LVCMOS
MO5156	1 to 60					
MO5157	60 to 220					
MO5356	1 to 60	$\pm 0.1, \pm 0.2, \pm 0.25$	+2.25 to +3.63	+40 to +50	5.0×3.2×0.95 (Ceramic)	Clipped sinewave, LVCMOS
MO5357	60 to 220					
MO5358	1.0 to 60	± 0.05	+2.25 to +3.63	+40 to +50	5.0×3.2×0.95 (Ceramic)	Clipped sinewave, LVCMOS
MO5359	60 to 189, 200 to 220					

■ Standard Specification (MO5356)

Item	Legend	Min.	Typ.	Max.	Unit	Condition
Output Frequency Range	f	1	-	60	MHz	
Supply Voltage	Vdd	+2.25	+2.50	+2.75	V	
		+2.52	+2.80	+3.08		
		+2.70	+3.00	+3.30		
		+2.97	+3.30	+3.63		
Operating Temperature Range	T _{use}	-20	-	+70	°C	Extended commercial
		-40	-	+85		Industrial
		-40	-	+105		Extended Industrial, ambient temperature
Initial Tolerance	F _{init}	-1.0	-	+1.0	$\times 10^{-6}$	Inclusive of solder-down shift at 48 hours after 2 reflows at +25°C
Frequency Stability over temperature	F _{stab}	-0.10	-	+0.10	$\times 10^{-6}$	Referenced to (f _{mas} + f _{min})/2 over the specified temperature range
		-0.20	-	+0.20		
		-0.25	-	+0.25		
First Year Aging	F _{aging1}	-	± 1.0	-	$\times 10^{-6}$	T _A = +25°C
Pull Range	PR	± 6.25			$\times 10^{-6}$	VC TC-MO mode. Contact KDS for $\pm 12.5, \pm 25$
		$\pm 6.25, \pm 10, \pm 12.5, \pm 25, \pm 50, \pm 80, \pm 100, \pm 125, \pm 150, \pm 200, \pm 400, \pm 600, \pm 800, \pm 1200, \pm 1600, \pm 3200$			$\times 10^{-6}$	DC TC-MO mode.
Upper Control Voltage	VC _U	Vdd×0.9	-	-	V	
Control Voltage Range	VC _L	-	-	Vdd×0.1	V	
Control Voltage Input Impedance	VC _z	8	-	-	MΩ	
Control Voltage Input Bandwidth	VC _c	-	10	-	kHz	
Frequency Change Polarity	-	Positive Slope			-	
Current Consumption	I _{dd}	-	+44	+53	mA	No load condition, f = 19.2 MHz, TC-MO and DC TC-MO mode.
		-	+48	+57		No load condition, f = 19.2 MHz, VC TC-MO mode.
OE Disable Current	I _{od}	-	+43	+51	mA	OE = GND, output is weakly pull down, TC-MO and DC TC-MO mode.
		-	+47	+55		OE = GND, output is weakly pull down, VC TC-MO mode.
Input Low Voltage	V _{IL}	-	-	Vdd×0.3	V	For OE pin
Input High Voltage	V _{HI}	Vdd×0.7	-	-	V	For OE pin
Start-up Time	T _{start}	-	2.5	3.5	ms	Time to first pulse, Measured from the time Vdd reaches its rated minimum value.
RMS Period Jitter	T _{jitt}	-	0.8	1.1	ps	f = 10 MHz
LVCMOS Output						
Duty Cycle	DC	45	-	55	%	
Output Low Voltage	V _{OL}	-	-	Vdd×0.1	V	I _{OL} = -3mA
Output High Voltage	V _{OH}	Vdd×0.9	-	-	V	I _{OHI} = +3 mA
Rise and Fall Time	Tr, Tf	0.8	1.2	1.9	ns	10% to 90% Vdd.
RMS Phase Jitter (random)	T _{phj}	-	0.31	0.48	ps	f = 50 MHz, Integration bandwidth = 12 kHz to 20 MHz, -40 to +85 °C
Clipped Sinewave Output						
Output Voltage Level	Vout	+0.8	-	+1.2	%	10kΩ 10pF ± 10%
Rise and Fall Time	Tr, Tf	-	3.5	4.6	V	20% to 80% Vdd, 19.2MHz
RMS Phase Jitter (random)	T _{phj}	-	0.31	0.48	ps	f = 60 MHz, Integration bandwidth = 12 kHz to 20 MHz, -40 to +85 °C
Packing Unit	1000pcs./reel (φ 180)					

TC-MO / VC TC-MO

MO5021/MO5022



■ Features

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

■ Applications

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



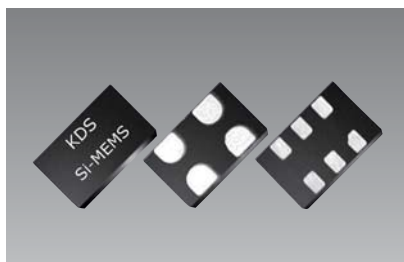
Model	Output Frequency (MHz)	Frequency Tolerance ($\times 10^{-6}$)	Supply Voltage (V)	Current Consumption (mA Typ.)	Size (mm)	Output
MO5021	1 to 220	±5	+2.25 to +3.63	+54 to +69	3.2×2.5×0.8, 5.0×3.2×0.8, 7.0×5.0×1.0 (QFN)	LVPECL LVDS
MO5022	220 to 625					

■ 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	°C	Extended Commercial Industrial
		-40	-	+85		
Frequency Stability	F _{stab}	-5.0	-	+5.0	$\times 10^{-6}$	Over operating temperature range at rated nominal power supply voltage and load.
Supply Voltage	F _{Vdd}	-	50	-	$\times 10^{-9}$	±10% Vdd
Output Load	F _{load}	-	0.1	-	$\times 10^{-6}$	15pF ±10% of load
First Year Aging	F _{aging1}	-2.5	-	+2.5	$\times 10^{-6}$	T _A = +25°C
10-year Aging	F _{aging10}	-5.0	-	+5.0	$\times 10^{-6}$	T _A = +25°C
Pull Range	PR	±12.5, ±25, ±50			$\times 10^{-6}$	
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	I _{dd}	-	+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	I _{dd}	-	+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
Packing Unit	1000pcs./reel (φ180) or 3000pcs./reel (φ180: 3225 package)					

MEMS Oscillators with Spread Spectrum Function (SSCG)

MO9002/MO9003/MO9005



■ Features

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

■ Applications

- Printers
- Flat panel drivers
- PCI
- Microprocessors



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

■ Standard Specification (MO9005)

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

Dimensions and Land Pattern

Package Size - Dimensions (unit:mm)	Recommended Land Pattern (unit:mm)														
<p>1.55 × 0.85 mm CSP</p> <p>Pin Connections</p> <table border="1"> <tr><th>Pin No.</th><th>Connection</th></tr> <tr><td>#1</td><td>NC/ST/GND</td></tr> <tr><td>#2</td><td>Output</td></tr> <tr><td>#3</td><td>Vdd</td></tr> <tr><td>#4</td><td>GND</td></tr> </table>	Pin No.	Connection	#1	NC/ST/GND	#2	Output	#3	Vdd	#4	GND	<p>(soldermask openings shown with heavy dashed line)</p>				
Pin No.	Connection														
#1	NC/ST/GND														
#2	Output														
#3	Vdd														
#4	GND														
<p>2.0 × 1.2 mm QFN</p> <p>Pin Connections</p> <table border="1"> <tr><th>Pin No.</th><th>Connection</th></tr> <tr><td>#1</td><td>NC</td></tr> <tr><td>#2</td><td>GND</td></tr> <tr><td>#3</td><td>Output</td></tr> <tr><td>#4</td><td>Vdd</td></tr> </table>	Pin No.	Connection	#1	NC	#2	GND	#3	Output	#4	Vdd					
Pin No.	Connection														
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<p>2.0 × 1.6 mm QFN</p> <p>Pin Connections</p> <table border="1"> <tr><th>Pin No.</th><th>Connection</th></tr> <tr><td>#1</td><td>OE/ST/NC/SD</td></tr> <tr><td>#2</td><td>Output</td></tr> <tr><td>#3</td><td>Vdd</td></tr> <tr><td>#4</td><td>GND</td></tr> </table>	Pin No.	Connection	#1	OE/ST/NC/SD	#2	Output	#3	Vdd	#4	GND					
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#3	Vdd														
#4	GND														
<p>2.5 × 2.0 mm QFN 2.7 × 2.4 mm QFN</p> <p>Pin Connections</p> <table border="1"> <tr><th>Pin No.</th><th>Connection</th></tr> <tr><td>#1</td><td>OE/ST/NC/VC/SD</td></tr> <tr><td>#2</td><td>GND</td></tr> <tr><td>#3</td><td>Output</td></tr> <tr><td>#4</td><td>Vdd</td></tr> </table>	Pin No.	Connection	#1	OE/ST/NC/VC/SD	#2	GND	#3	Output	#4	Vdd					
Pin No.	Connection														
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#2	GND														
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<p>3.2 × 2.5 mm QFN (4-pin)</p> <p>Pin Connections</p> <table border="1"> <tr><th>Pin No.</th><th>Connection</th></tr> <tr><td>#1</td><td>OE/ST/NC/VC/SD/DP</td></tr> <tr><td>#2</td><td>GND</td></tr> <tr><td>#3</td><td>Output</td></tr> <tr><td>#4</td><td>Vdd</td></tr> </table>	Pin No.	Connection	#1	OE/ST/NC/VC/SD/DP	#2	GND	#3	Output	#4	Vdd					
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#1	OE/ST/NC/VC/SD/DP														
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<p>3.2 × 2.5 mm QFN (6-pin)</p> <p>Pin Connections</p> <table border="1"> <tr><th>Pin No.</th><th>Connection</th></tr> <tr><td>#1</td><td>OE/ST/NC/VC/SD/DP</td></tr> <tr><td>#2</td><td>NC/OE</td></tr> <tr><td>#3</td><td>GND</td></tr> <tr><td>#4</td><td>Output+</td></tr> <tr><td>#5</td><td>Output-</td></tr> <tr><td>#6</td><td>Vdd</td></tr> </table>	Pin No.	Connection	#1	OE/ST/NC/VC/SD/DP	#2	NC/OE	#3	GND	#4	Output+	#5	Output-	#6	Vdd	
Pin No.	Connection														
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#2	NC/OE														
#3	GND														
#4	Output+														
#5	Output-														
#6	Vdd														

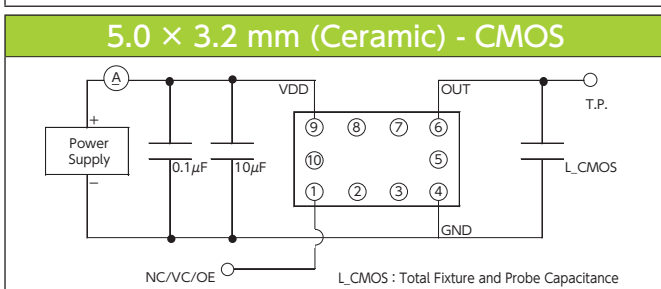
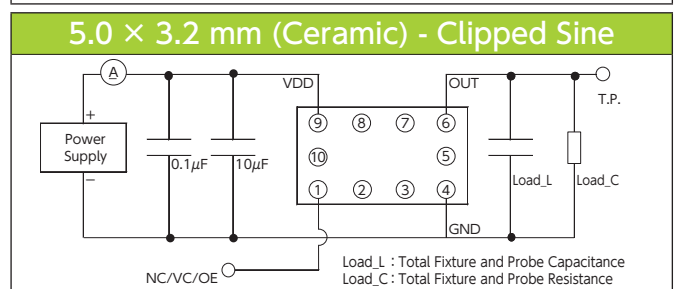
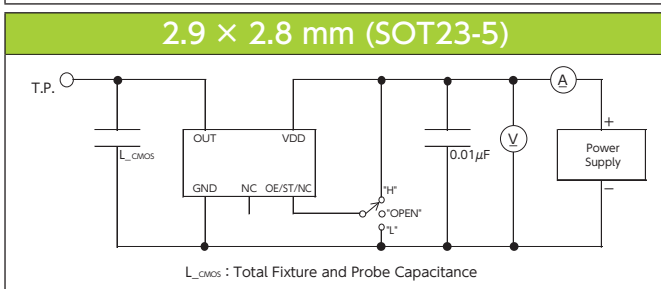
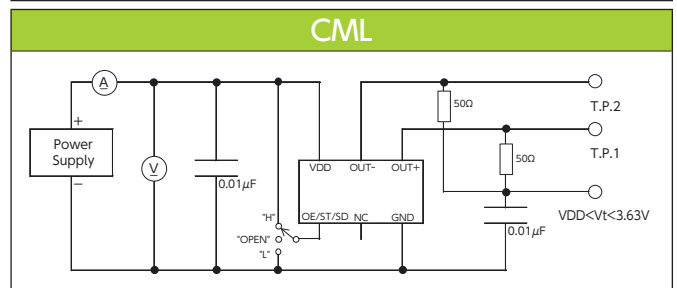
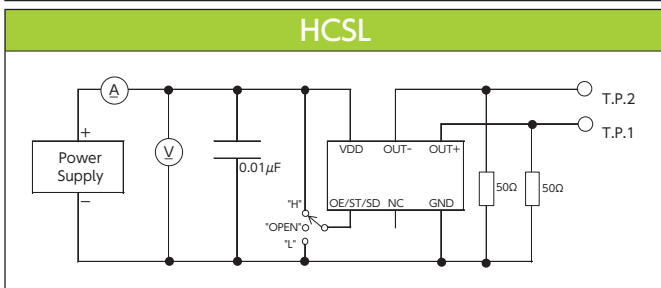
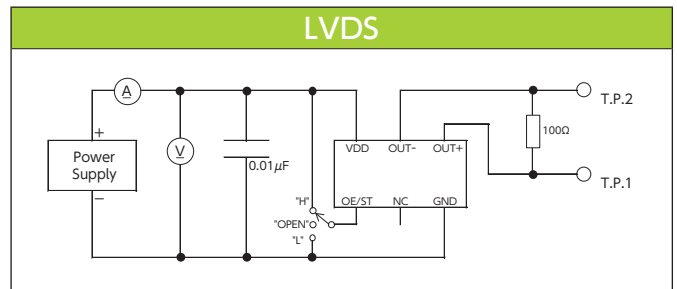
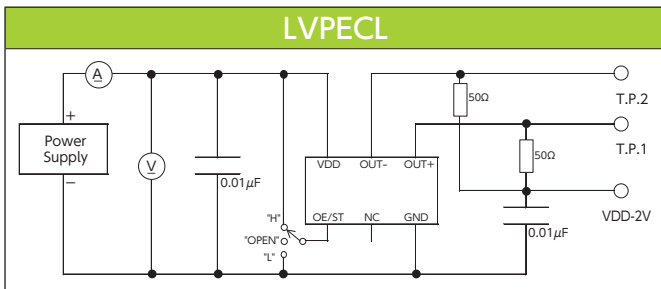
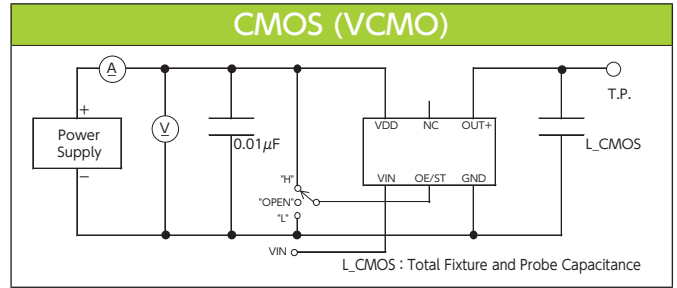
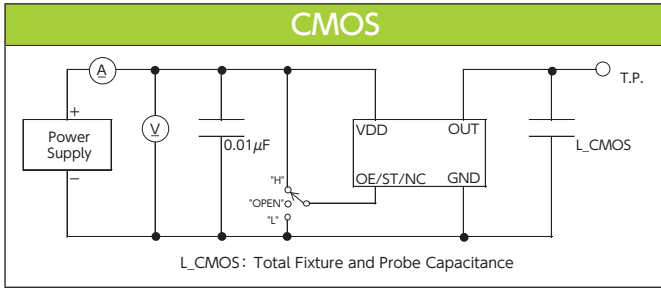
Dimensions and Land Pattern

Package Size - Dimensions (unit:mm)	Recommended Land Pattern (unit:mm)																
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Dimensions and Land Pattern

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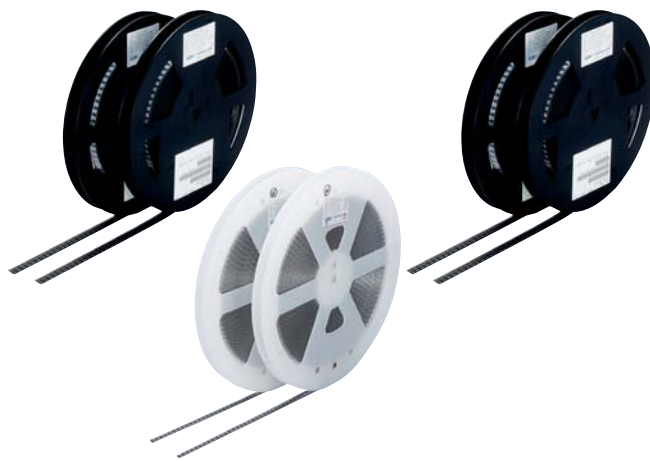
Measurement Circuit



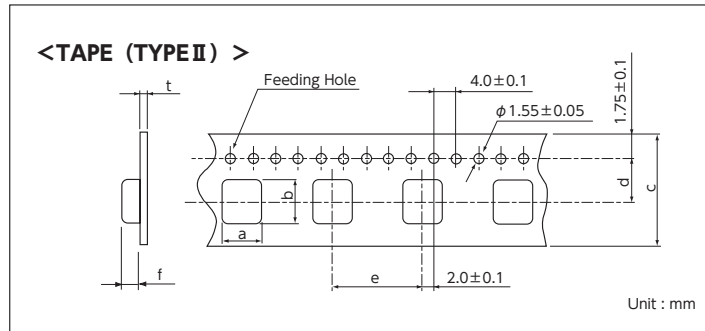
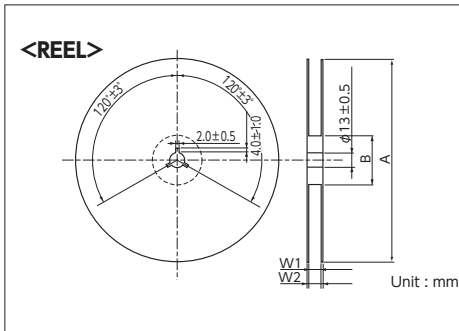
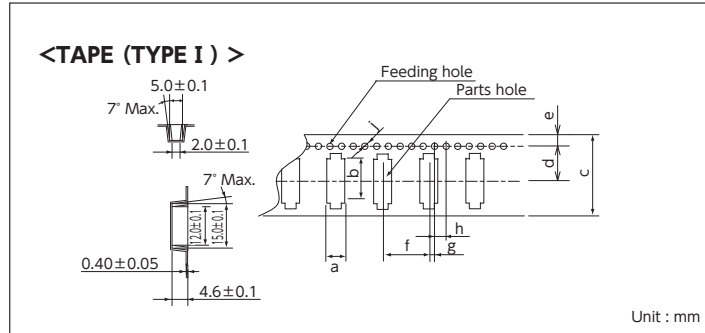
MEMO

A series of horizontal dashed lines for writing.

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	φ 330 ±2	φ 80 ±1	25.5 ±1.0	29.5 ±1.0

MHz Band Crystal Resonators / Crystal Resonators with dedicated temperature sensor

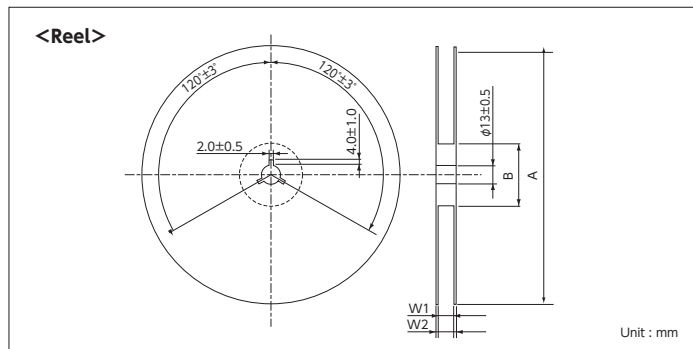
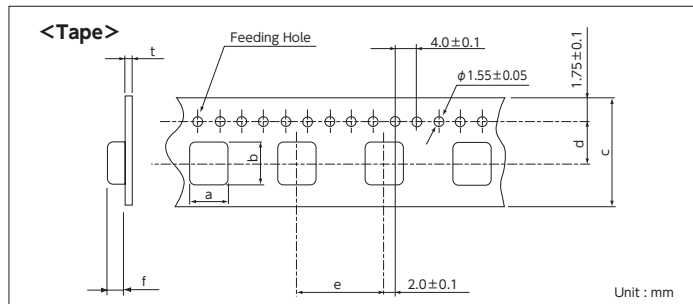
TYPE II	a	b	c	d	e	f	t	A	B	W1	W2
DSX530GA/GK	3.6 ±0.1	5.45 ±0.10	12.0 ±0.2	5.50 ±0.10	8.0 ±0.1	1.55 ±0.10	0.30 ±0.05	φ 180 +0/-3	φ 60 +1.0/-0	13.0 +0.3	15.4 ±1.0
DSX321G/GK DSX320G/GE	2.8 ±0.1	3.5 ±0.1	8.0 ±0.2	3.50 ±0.05	4.0 ±0.1	1.0 ±0.1	0.25 ±0.05	φ 180 +0/-3	φ 60 +1/-0	9.0 ±0.3	11.4 ±1.0
DSX321SH	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	φ 180 +0/-3	φ 60.0 +1/-0	9.0 ±0.3	11.4 ±1.0
DSX221SH	2.25 ±0.1	2.7 ±0.1	8.0 ±0.2	3.50 ±0.05	4.0 ±0.1	0.8 ±0.05	0.25 ±0.05	φ 180 +0/-3	φ 60.0 +1/-0	9.0 ±0.3	11.4 ±1.0
DSX211S/SH	1.9 ±0.1	2.3 ±0.1	8.0 ±0.2	3.50 ±0.05	4.0 ±0.1	0.65 ±0.10	0.25 ±0.05	φ 180 +0/-3	φ 60.0 +1/-0	9.0 ±0.3	11.4 ±1.0
DSX211G	1.85 ±0.10	2.25 ±0.10	8.0 ±0.2	3.50 ±0.05	4.0 ±0.1	0.95 ±0.10	0.25 ±0.05	φ 180 +0/-3	φ 60 +1/-0	9.0 ±0.3	11.4 ±1.0
DSX210GE	2.0 ±0.1	2.4 ±0.1	8.0 ±0.2	3.50 ±0.05	4.0 ±0.1	0.95 ±0.1	0.25 ±0.05	φ 180 +0/-3	φ 60 +1/-0	9.0 ±0.3	11.4 ±1.0
DSX1612S	1.45 ±0.15	1.85 ±0.15	8.0 ±0.2	3.50 ±0.05	4.0 ±0.1	0.45 ±0.15	0.25 ±0.05	φ 180 +0/-3	φ 60 +1/-0	9.0 ±0.3	11.4 ±1.0
DSX1210A	1.17 ±0.05	1.42 ±0.05	+0.3/-0.1	3.50 ±0.05	4.0 ±0.1	0.48 ±0.05	0.20 ±0.05	φ 180 +0/-3	φ 60 +1/-0	9.0 ±0.3	11.4 ±1.0
DSX1008A DX1008JS	1.0 ±0.05	1.2 ±0.05	8.0 ±0.2	3.50 ±0.05	4.0 ±0.1	0.45 ±0.05	0.20 ±0.05	φ 180 +0/-3	φ 60 +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	φ 180 +0/-3	φ 60 +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	φ 180 +0/-3	φ 60 +1/-0	9.0 ±0.3	11.4 ±1.0
DSR1612ATH/STH	1.40 ±0.1	1.80 ±0.1	8.0 ±0.2	3.50 ±0.05	4.0 ±0.1	0.70 ±0.10	0.25 ±0.05	φ 180 +0/-3	φ 60 +1/-0	9.0 ±0.3	11.4 ±1.0
DSR1210ATH	1.3 ±0.1	1.5 ±0.1	8.0 ±0.2	3.5 ±0.05	4.0 ±0.1	0.4 ±0.15	0.25 ±0.05	φ 180 +0/-3	φ 60 +1/-0	9.0 ±0.3	11.4 ±1.0

kHz Band Crystal Resonators

	a	b	c	d	e	f	t	A	B	W1	W2
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	φ 330 ±2	φ 80 ±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	φ 180 +0/-3	φ 60 +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	φ 180 +0/-3	φ 60 +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	φ 180 +0/-3	φ 60 +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	φ 180 +0/-3	φ 60 +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	φ 180 +0/-3	φ 60 +1/-0	9.0 ±0.3	11.4 ±1.0

- ※1: To indicate product name and other information, place those information on a label, and affix the label on one side of the flange.
- 2: For DSX321G, DSX1612S pin No.1 is located on the sprocket-hole side of the tape.
- 3: For other models, the insertion direction is not specified.

Emboss Carrier Tape (SMD Crystal Oscillators)



Standard Specification

VC-TCXO/TCXO

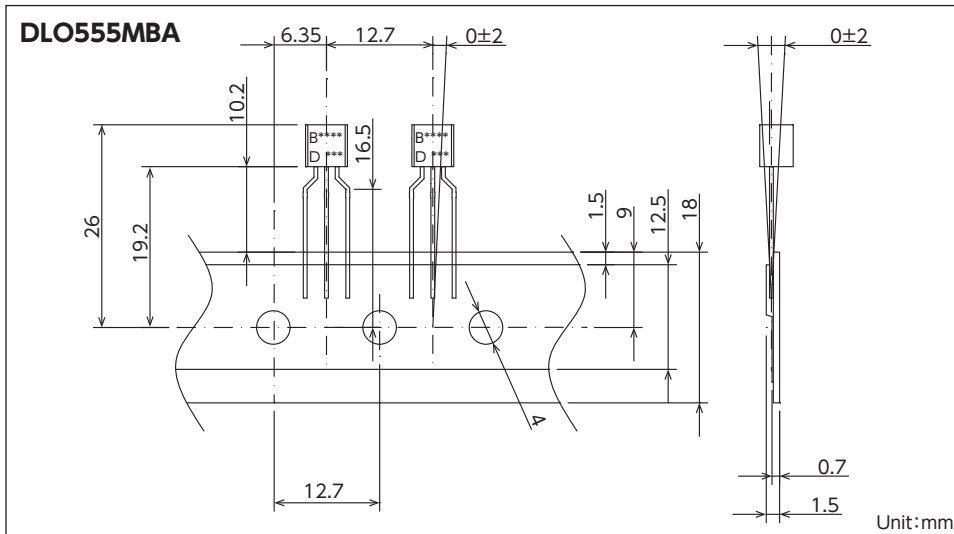
TYPE	a	b	c	d	e	f	t	A	B	W1	W2
DSA/DSB535SD DSA/DSB535SG/SGA	3.5 ±0.1	5.4 ±0.1	12.0 ±0.2	5.50 ±0.1	8.0 ±0.1	1.7 ±0.1	0.30 ±0.05	φ330 ±2	φ100 ±1	13.5 ±1.0	18.5 max.
DSA/DSB321SDN DSB321SDNB/SLB DSK321STD	2.8 ±0.1	3.5 ±0.1	8.0 ±0.2	3.50 ±0.05	4.0 ±0.1	1.5 ±0.1	0.25 ±0.05	φ180 +0/-3	φ60 +1/-0	9.0 ±0.3	11.4 ±1.0
DSA/DSB221SDN 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/SPX 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 DSB1612WA/WLB/WDB/WEB	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

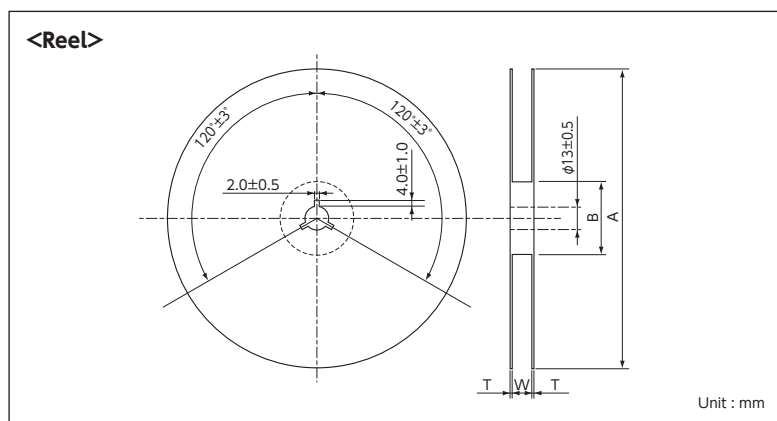
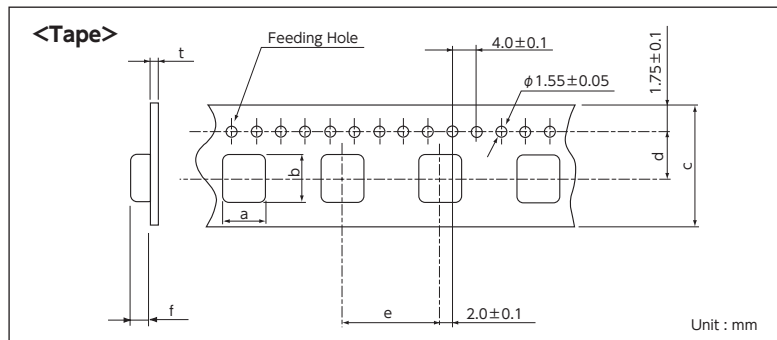
TYPE	a	b	c	d	e	f	t	A	B	W1	W2
DSO751SR DSO751SBM DSO753SK/SJ/SD DSV753SV/SB/SK/SJ/SD	5.5 ±0.1	7.9 ±0.1	16.0 ±0.3	7.5 ±0.1	8.0 ±0.1	2.4 ±0.1	0.30 ±0.05	φ254 ±2	φ80 ±0.5	17.0 ±0.5	21.0 ±1.0
DSO531SR DSO531SB DSO533SK/SJ DSV531SV	3.6 ±0.1	5.45 ±0.1	12.0 ±0.2	5.50 ±0.05	8.0 ±0.1	1.55 ±0.10	0.30 ±0.05	φ180 +0/-3	φ60 +1/-0	13.0 ±0.3	15.4 ±1.0
DSO323SK/SJ/SD DSO321SR/SH/SN/SY DSO321SBM 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/SY/SX/SXF DSO221SBM DSO223SK/SJ/SD DSV221SV	2.3 ±0.1	2.8 ±0.1	8.0 ±0.2	3.50 ±0.05	4.0 ±0.1	1.15 ±0.10	0.30 ±0.05	φ180 +0/-3	φ60 +1/-0	9.0 ±0.3	11.4 ±1.0
DSO211AH/AB/SX/SXF	1.85 ±0.10	2.25 ±0.10	8.0 ±0.2	3.50 ±0.05	4.0 ±0.1	0.95 ±0.10	0.25 ±0.05	φ180 +0/-3	φ60 +1/-0	9.0 ±0.3	11.4 ±1.0
DSO1612AR	1.4 ±0.1	1.8 ±0.1	8.0 ±0.2	3.50 ±0.05	4.0 ±0.1	0.7 ±0.1	0.25 ±0.05	φ180 +0/-3	φ60 +1/-0	9.0 ±0.3	11.4 ±1.0
DS1008JS/JN	1.0 ±0.05	1.2 ±0.05	8.0 ±0.2	3.50 ±0.05	4.0 ±0.1	0.45 ±0.05	0.20 ±0.05	φ180 +0/-3	φ60 +1/-0	9.0 ±0.3	11.4 ±1.0

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

Radial Tape (Crystal Oscillators)



Emboss Carrier Tape (SMD Monolithic Crystal Filters)

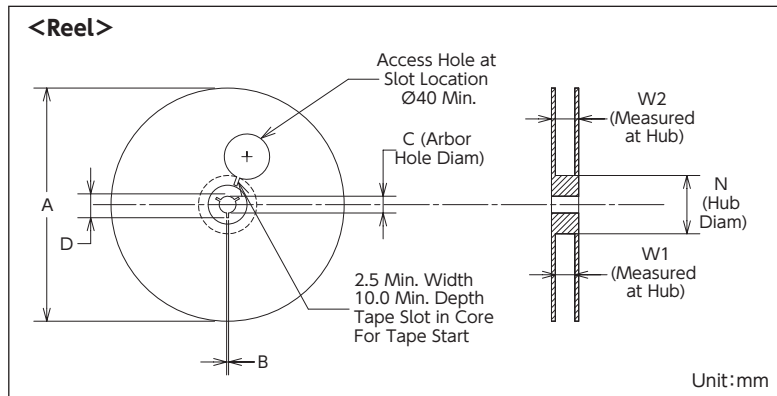
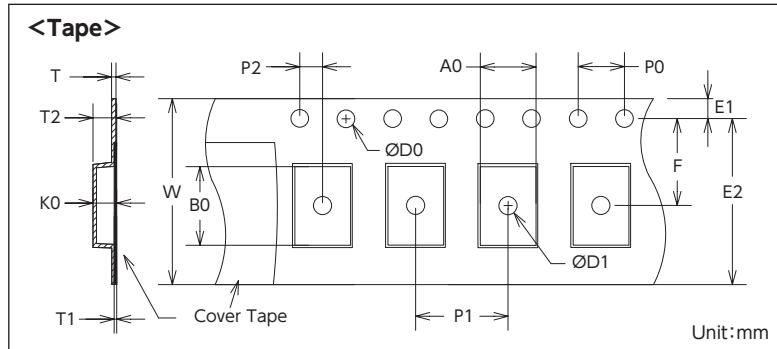
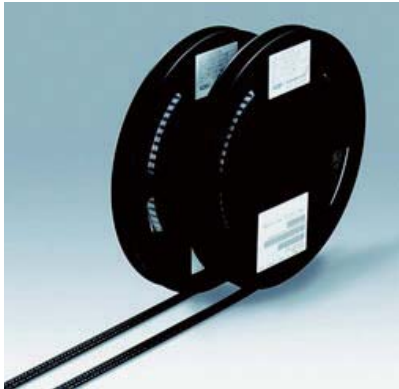


Standard Specification

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)



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
DSX1612SL	DSX1612S
DSX221G	DSX211G

SMD VC-TCXO/TCXO	
Type	Substitution Products
DSA222MAA/MAB DSB222MAA/MAB	—

High-precision SMD VC-TCXO/TCXO	
Type	Substitution Products
DSA535SC DSB535SC	DSA535SD DSB535SD

Oven Controlled Crystal Oscillator	
Type	Substitution Products
DLC117	—

SMD Crystal Oscillators	
Type	Substitution Products
DSO211AN	DSO221SN
DSO211AR	DSO211SXF
DSO221SHF	DSO221SXF
DSO321SBN	DSO321SBM
DSO531SBN	DSO531SBM
DSO751SBN	DSO751SBM
DSO321SVN	DSO321SR
DSO531SVN	DSO531SR
DSO751SVN	DSO751SR
DSO753HV/HK/HJ	—

SMD Crystal Resonators / MHz Band Crystal Resonators (For Automotive)	
Type	Substitution Products
DSX221G	DSX211G

SMD Crystal Oscillators (For Automotive)	
Type	Substitution Products
DSO211AR	DSO211SX
DSO221SHF	DSO221SX

Crystal Oscillators	
Type	Substitution Products
DLO555MB	DLO555MBA

SMD Voltage Controlled Crystal Oscillators	
Type	Substitution Products
DSV211AV	—
DSV221SV	—
DSV531SB	—
DSV532SB	—
DSV532SV	DSV321SV DSV531SV
DSV753CK/CJ	—
DSV753HV/HK/HJ	—

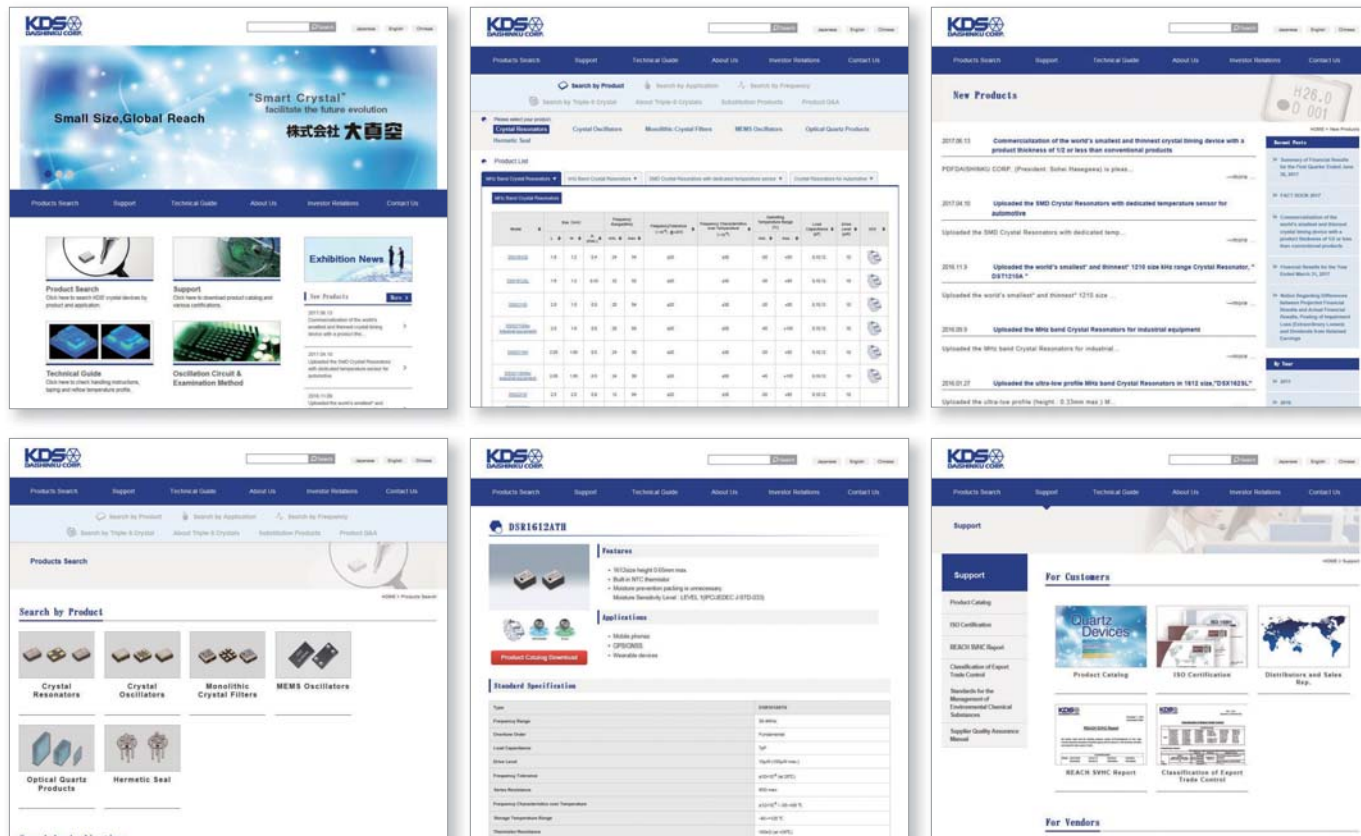
High-precision SMD VC-TCXO (For Automotive)	
Type	Substitution Products
DSA221SP DSB221SP	DSA211SP DSB211SP

Product introduction on the Web

Sending products information through Internet

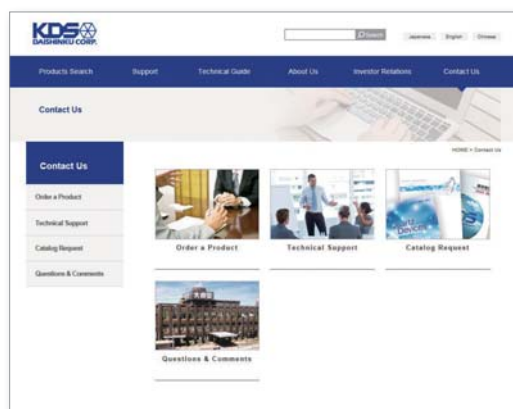
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DAISHINKU Web site: <http://www.kds.info>



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.
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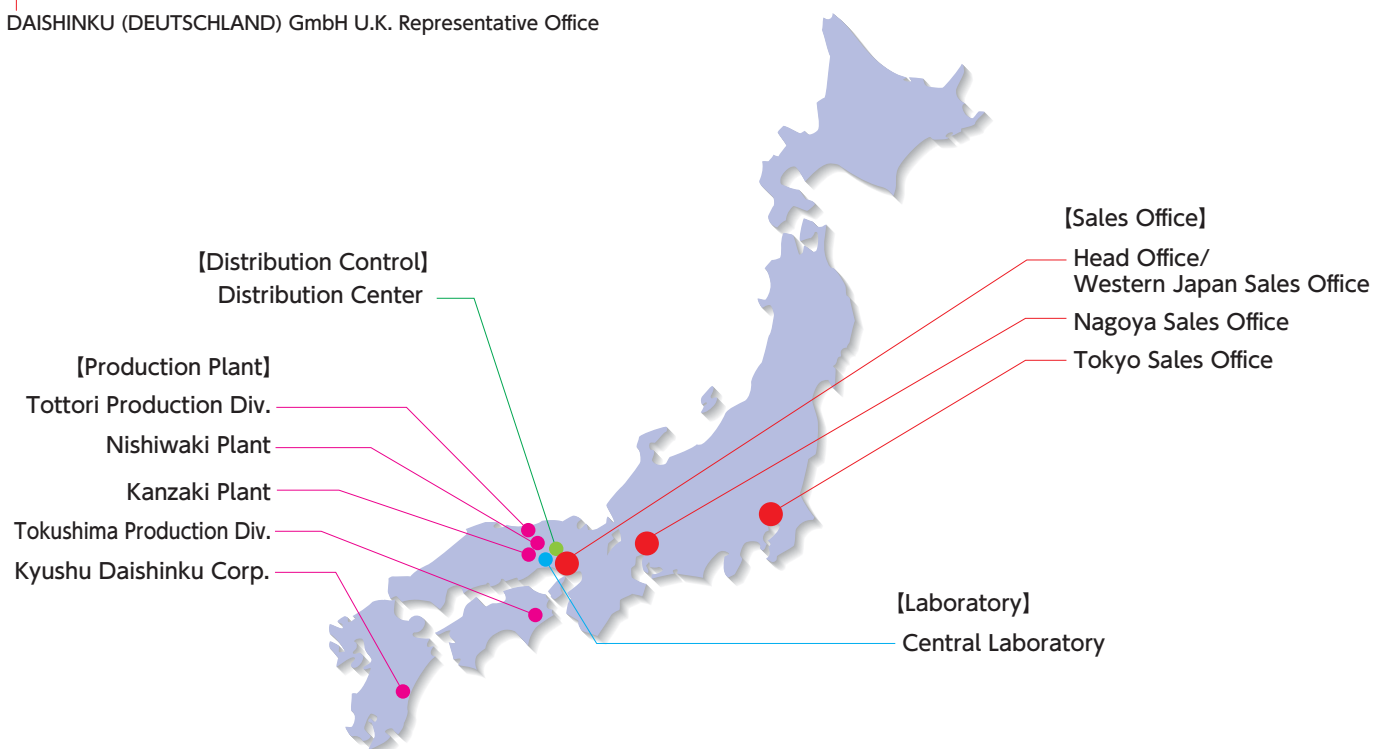
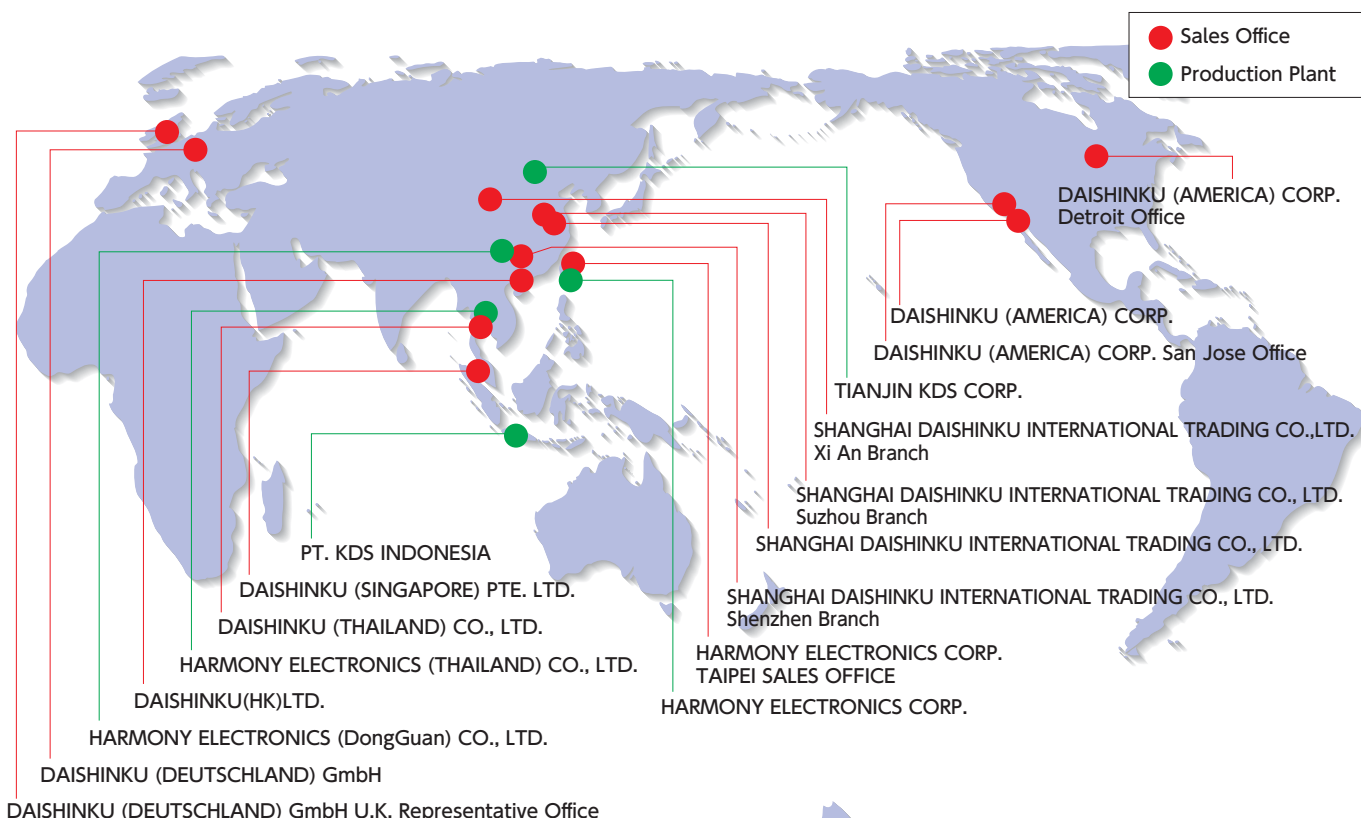
MEMO

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KDS Global Network

Our global network accelerates our business.

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





General Manufacturer of Quartz Devices

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