KDS DAISHINKU CORP.

2023–2024
PRODUCT CATALOG

PRODUCT CATALOG

- Arkh. series
- Crystal resonators
- Crystal oscillators
- Monolithic crystal filters
- MEMS oscillators

Global Quality

株式会社 大真空

INDEX

Handling Instructions

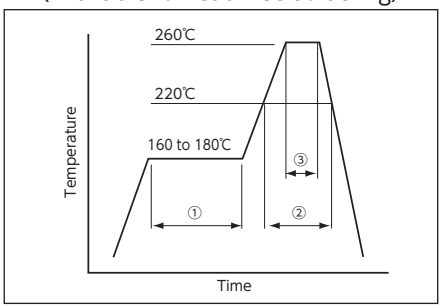
■ Soldering

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

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

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

Reflow Temperature Profile
(Available for lead free soldering)



■ Cleaning

◎General cleaning solutions or ultrasonic cleaning may be used to clean our crystal products, but verification tests are recommended prior to use.
◎Tuning fork crystals resonate at frequency bands that are close to the washing frequency of ultrasonic cleaning machines and this may cause resonance deterioration in the crystal. Therefore the use of ultrasonic cleaning machines to clean tuning fork crystals should be avoi-ded. 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.

〈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 0.01μF between Vcc and GND (e.g. Ceramic chip capacitor) and connect it at the shortest pos-sible distance. For details, refer to the specifications of each individual product.

〈Monolithic Crystal Filters〉

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

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

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

As of sept.30.2023

	Type	RoHS/ELV Compliant	Halogen-free	Pb-free	Materials of pin	Note
Crystal Resonators/ MHz Band Crystal Resonators	DX1008J SERIES	○	○	○	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.(*)
	DSX320GE	○	○	Pb in sealing-glass	Ni/Au	Pb in sealing-glass is exempted from RoHS/ELV Directive.(*)
	DSX211G	○	○	Pb in sealing-glass	Ni/Au	Pb in sealing-glass is exempted from RoHS/ELV Directive.(*)
	DSX321G, DSX321GK	○	○	Pb in sealing-glass	Ni/Au	Pb in sealing-glass is exempted from RoHS/ELV Directive.(*)
	DSX530GA	○	○	Pb in sealing-glass	Ni/Au	Pb in sealing-glass is exempted from RoHS/ELV Directive.(*)
Tuning Fork Crystal Resonators/ kHz Band Crystal Resonators	DT-26, DT-261	○	○	○	Sn	
	DT-38, DT-381	○	○	○	Sn	
	DMX-26S	○	○	High temperature solder	Sn	High temperature solder used inside the product is exempted from RoHS/ELV Directive.(*)
	DST1210A	○	○	○	Ni/Au	
	DST1610A	○	○	○	Ni/Au	
	DST210AC	○	○	○	Ni/Au	
	DST310S	○	○	○	Ni/Au	
Crystal Resonators with dedicated temperature sensor/ MHz Band Crystal Resonators	DSR1210ATH	○	○	○	Ni/Au	
	DSR1612ATH	○	○	○	Ni/Au	
	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	
	DSK1612ATD	○	○	○	Ni/Au	
	DSK321STD	○	○	○	Ni/Au	
Real Time Clock Module (RTC)	DD3225TS, DD3225TR	○	○	○	Ni/Au	
Simple Packaged Crystal Oscillators (SPXO)	DS1008J SERIES	○	○	○	Ni/Au	
	DSO1612AR	○	○	○	Ni/Au	
	DSO211S SERIES	○	○	○	Ni/Au	
	DSO221S SERIES	○	○	○	Ni/Au	
	DSO223S SERIES	○	○	○	Ni/Au	
	DSO321S SERIES	○	○	○	Ni/Au	
	DSO323S SERIES	○	○	○	Ni/Au	
	DSO531S SERIES	○	○	○	Ni/Au	
	DSO533 SERIES	○	○	○	Ni/Au	
	DLO555MBA	○	○	○	Sn	
	DSO751S SERIES	○	○	○	Ni/Au	
	DSO753S SERIES	○	○	○	Ni/Au	
Voltage Controlled Crystal Oscillators (VCXO)	DSV221SV	○	○	○	Ni/Au	
	DSV321S	○	○	○	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, 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.

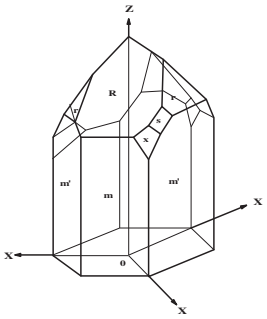


Fig. 1. Typical appearance of a quartz crystal

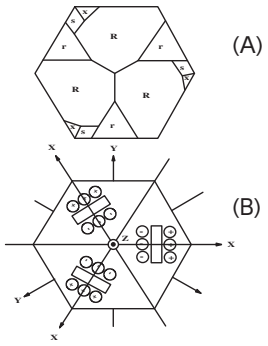


Fig. 2. (A) Typical crystallogram as obtained by viewing Fig. 1 from above
(B) Illustration of piezoelectricity

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.

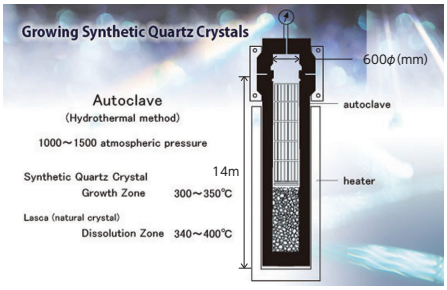


Fig.3. Autoclave

Artificial quartz crystal drawn from an autoclave

Various artificial quartz crystals

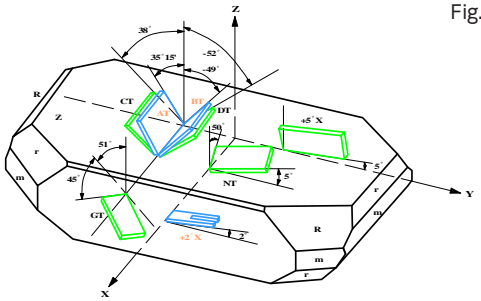
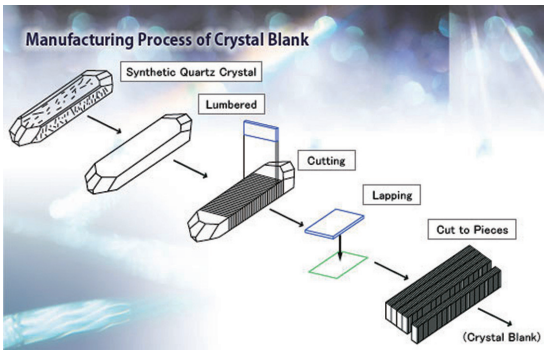


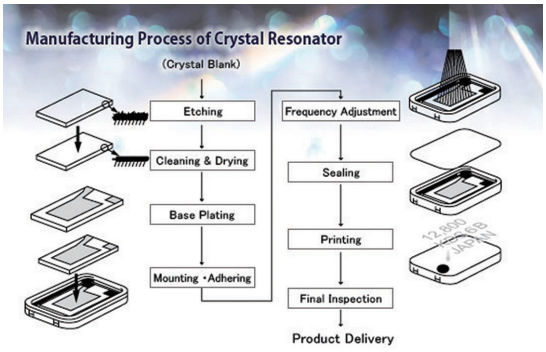
Fig.4. Designations of cuts from a piece of artificial quartz crystal

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.

Symbols

As of sept.30.2023

Arkh.Series Arkh.Series	A logo representing Arkh.Series
slim small smart	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 *.

*Except for Kanzaki Plant

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●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.

Selection Guide

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

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

SMD Crystal Resonators / MHz Band Crystal Resonators

Type	Actual Size	Size (mm) L	W	H (max.)	Frequency Range (MHz)	Frequency Tolerance ($\times10^{-6}$) @+25℃	Frequency Characteristics over Temperature ($\times10^{-6}$)	Operating Temperature Range (℃)	Load Capacitance (pF)	Drive Level (μw(max.))	Lid	Recommended Application	Catalog Page
DX1008JS		1.05	0.85	0.13	48 to 120	±20	±30	-30 to +85	8, 10 ,12	10 (100)	Crystal	CE TC	13
DX1008JT		1.0	0.8	0.19	59.97, 76.8	±20	±30	-30 to +85	5, 8, 10, 12	10 (100)	Crystal	TC	14
DSX1210A		1.2	1.0	0.3	32 to 80	±10	±12 ±30	-30 to +85 -40 to +105	8, 10, 12	10 (100)	Metal	CE TC AE	24 62
DSX1612S		1.6	1.2	0.4	24 to 54	±10	±15	-30 to +85	8, 10 ,12	10 (100)	Metal	CE TC	25
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	26
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	26 66
DSX221SH		2.5	2.0	0.5	12 to 54					10 (200)			
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	63
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	27 63
DSX320GE		3.2	2.5	1.1	7.9 to 64	±30	±100	-40 to +125	8, 10 ,12	10 (200)	Ceramic	AE	64
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	28 64
		3.2	2.5	1.0	7.9 to 12								
DSX321GK		3.2	2.5	1.0	9.8 to 40	±30	±100	-40 to +125	8, 10 ,12	10 (200)	Ceramic	AE	64
DSX530GA		5.0	3.2	1.2	7 to 54	±30	±100	-40 to +125	8, 10 ,12	10 (300)	Ceramic	AE	65

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

Type	Actual Size	Size (mm) L	W	H (max.)	Frequency Range (MHz)	Frequency Tolerance ($\times10^{-6}$) @+25℃	Frequency Characteristics over Temperature ($\times10^{-6}$)	Operating Temperature Range (℃)	Load Capacitance (pF)	Drive Level (μw(max.))	Lid	Recommended Application	Catalog Page
DSR1210ATH		1.2	1.0	0.55	76.8	±10	±12	-30 to +85	6, 7, 8	10 (100)	Metal	TC	29
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	29 67
DSR211STH		2.0	1.6	0.8 (0.65)	19.2, 26, (38.4, 55.2) 19.2, (38.4, 55.2)	±10	±12 ±30	-30 to +85 -40 to +105	6, 7, 8 7, 8	10 (100)	Metal	TC AE	30 67
DSR221STH		2.5	2.0	1.0	19.2, 26 19.2	±10	±12 ±20	-30 to +85 -40 to +105	6, 7, 8 7, 8	10 (100)	Metal	TC AE	

SMD Tuning Fork Crystal Resonators / kHz Band Crystal Resonators

Type	Actual Size	Size (mm) L	W	H (max.)	Frequency Range (kHz)	Frequency Tolerance ($\times10^{-6}$) @+25℃	Series resistance (kΩ max.)	Operating Temperature Range (℃)	Load Capacitance (pF)	Drive Level (μw(max.))	Package	Recommended Application	Catalog Page
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	31
DST1610A		1.6	1.0	0.5	32.768	±20	50/80 120	-40 to +85 -40 to +125	4, 6, 7, 9, 12.5	0.1 (0.5)	Ceramic	CE TC AE	32 68
DST210AC		2.0	1.2	0.55			50/80 120	-40 to +85 -40 to +125	6, 7, 9, 12.5			CE TC AE	
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	33 68
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	34 69

Tuning Fork Crystal Resonators / kHz Band Crystal Resonators

Type	Actual Size	Size (mm) L	W	H (max.)	Frequency Range (kHz)	Frequency Tolerance ($\times10^{-6}$) @+25℃	Series resistance (kΩ max.)	Operating Temperature Range (℃)	Load Capacitance (pF)	Drive Level (μw(max.))	Package	Recommended Application	Catalog Page
DT-26		ϕ2.0	ϕ2.0	6.0	32.768	±20	40	-10 to +60	12.5	1.0 (2.0)	Cylinder	CE IE	35
DT-261					28 to 90								
DT-38		ϕ3.0	ϕ3.0	8.0	32.768		30						
DT-381					20 to 90								

Selection Guide

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Icons VC Voltage Control Function Stb Stand-by Function
CE Consumer Equipment IE Industrial Equipment TC Mobile Phone, Wireless Communication AE Automotive Electronics

Temperature Compensated Crystal Oscillators (TCXO/VC-TCXO)

Type	Actual Size	Size (mm) L	W	H (max.)	Output	Frequency Range (MHz)	Frequency Characteristics over Temperature (×10⁻⁶)	Operating Temperature Range (℃)	Supply Voltage (V)	Function	Recommended Application	Catalog Page
DSA1612SDN		1.6	1.2	0.55	CS	16 to 60	±1.0 ±0.5	-40 to +85	+1.68 to +3.5	VC	IE TC AE	40, 41 78, 79
DSB1612SDN							±0.5					
DSA211SDN		2.0	1.6	0.8		12.288 to 52	±1.0 ±0.5		+1.68 to +3.5	VC	IE TC AE	40, 41 78, 79
DSB211SDN							±0.5					
DSA221SDN		2.5	2.0	0.9		9.6 to 52	±1.0 ±0.5			VC		
DSB221SDN							±0.5					
DSA321SDN		3.2	2.5	1.0			±1.0 ±0.5			VC		
DSB321SDN							±0.5					
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	42•80
DSB221SJA		2.5	2.0	0.9	CMOS	11 to 52	±5.0	-40 to+105	+1.7 to +3.6	Stb	IE TC	42
DSA211SP		2.0	1.6	0.7	CS	12.288 to 52	±1.0	-40 to+105	+1.68 to +3.5	VC	AE	77
DSB211SP							±0.5					
DSA535SGA		5.0	3.2	1.5	CS or CMOS	10 to 52	±0.1	-40 to +85	+2.3 to +3.63	VC Stb	IE TC	39
DSB535SGA										Stb		
DSA535SGB										VC Stb		

Clock Oscillators (SPXO)

Type	Actual Size	Size (mm) L	W	H (max.)	Output	Frequency Range (MHz)	FrequencyTolerance (×10⁻⁶) (Includes frequency tolerance at room temperature.)	Operating Temperature Range (℃)	Supply Voltage (V)	Current Consumption (mA)	Recommended Application	Catalog Page
DS1008JN		1.05	0.85	0.24	CMOS	1.0 to 100	±50	-40 to +125	+0.8 to +1.6	1.8 to 3.1	CE TC	15
DS1008JS		1.05	0.85	0.24	CMOS	1.0 to 100	±50	-40 to +125	+1.6 to +3.3	2.1 to 4.9	CE TC	16
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	1.7 to 3.7	CE TC AE	47 70
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 71
DSO321SR		3.2	2.5	1.2								
DSO531SR		5.0	3.2	1.2							CE TC	50, 51
DSO751SR		7.3	4.9	1.7								
DSO321SRS		3.2	2.5	1.2	CMOS	8.25 to 66	±100	-40 to +100	+3.0 to +3.6	3.7	CE IE	49
DSO221SBM		2.5	2.0	0.895		3.25 to 52	±50	-40 to +85	+5.0	8.0	CE IE	52
DSO321SBM		3.2	2.5	1.2		0.7 to 90				4.0 to 8.0		
DSO531SBM		5.0	3.2	1.2					+5.0	4.0 to 8.0		
DSO751SBM		7.3	4.9	1.7					+5.0	4.0 to 8.0		
DSO211SX		2.0	1.6	0.8	CMOS	1.0 to 125	±50	-40 to +125	+1.6 to +3.6	1.7 to 10.0	AE	72
DSO221SX		2.5	2.0	0.9								
DSO211SXF		2.0	1.6	0.8	CMOS	1.0 to 125	±50	-40 to +125	+1.6 to +3.6	1.7 to 10.0	CE TC	48
DSO221SXF		2.5	2.0	0.9								
DSO221SY		2.5	2.0	0.895	CMOS	1.049 to 8.5	±35 ±50	-40 to +85	+1.6 to +3.6	0.7	CE TC AE	54 74
DSO321SY		3.2	2.5	1.2								
DLO555MBA	–	5.0	4.0	5.0	CMOS	0.75 to 54	±50, ±100	-10 to +85	+1.6 to +5.5	8.0	IE	59

Low Phase Noise Crystal Oscillators (SPXO)

Type	Actual Size	Size (mm) L	W	H (max.)	Output	Frequency Range (MHz)	FrequencyTolerance (×10⁻⁶) (Includes frequency tolerance at room temperature.)	Operating Temperature Range (℃)	Supply Voltage (V)	Current Consumption (mA)	Recommended Application	Catalog Page
DSO221SH		2.5	2.0	0.895	CMOS	3.5 to 52	±50	-40 to +85	+1.6 to +3.6	2.3 to 4.2	CE TC	46
DSO321SH		3.2	2.5	1.2								

Differential Output Crystal Oscillators (SPXO)

Type	Actual Size	Size (mm) L	W	H (max.)	Output	Frequency Range (MHz)	FrequencyTolerance (×10⁻⁶) (Includes frequency tolerance at room temperature.)	Operating Temperature Range (℃)	Supply Voltage (V)	Current Consumption (mA)	Recommended Application	Catalog Page
DS1008JC		1.05	0.85	0.26	HD-LVDS	156.25	±100	-40 to +85	+3.3	35	IE	17
DS1008JK					LV-PECL					57		
DS1008JJ					LVDS				+2.5, +3.3	26		
DSO223SD		2.5	2.0	0.95	HCSL	13.5 to 167	±50 ±80	-40 to +85 -40 to +105	+2.5, +3.3	30	CE IE TC AE	55 75
DSO223SJ					LVDS					20		
DSO223SK					LV-PECL					45		
DSO323SD		3.2	2.5	1.2	HCSL	13.5 to 212.5 13.5 to 167			+1.8, +2.5, +3.3	35 30		55, 56 75, 76
DSO323SJ					LVDS					20		
DSO323SK					LV-PECL				+2.5, +3.3	50 45		55 75
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	HCSL					35	CE IE	58
DSO753SJ					LVDS					20		
DSO753SK					LV-PECL					50		

Voltage Controlled Crystal Oscillators (VCXO)

Type	Actual Size	Size (mm) L	W	H (max.)	Output	Frequency Range (MHz)	FrequencyTolerance (×10⁻⁶) (Includes frequency tolerance at room temperature.)	Operating Temperature Range (℃)	Frequency Adjustment Range (×10⁻⁶)	Supply Voltage (V)	Current Consumption (mA)	Recommended Application	Catalog Page
DSV221SV		2.5	2.0	0.9	CMOS	30.72	±40	-30 to +85	±100	+3.3	7.0	CE	60
DSV321SV		3.2	2.5	1.2		6.75 to 125					7.0 to 27		

Real Time Clock Module (RTC)/kHz Band TCXO

Type	Actual Size	Size (mm) L	W	H (max.)	Output	Frequency Range (MHz)	FrequencyTolerance (×10⁻⁶)	Operating Temperature Range (℃)	Supply Voltage (V)	Current Consumption (μA)	Temperature Compensated Type	Recommended Application	Catalog Page
DD3225TS		3.2	2.5	1.0	CMOS	32.768	±7.0	-40 to +105	+1.3 to +5.5	2.9, 4.0	Digital	CE IE AE	44, 83
DD3225TR		3.2	2.5	1.0	CMOS	32.768	±11.5	-40 to +85	+1.3 to +5.5	2.9, 4.0	Analog	CE IE	45
DSK1612ATD		1.6	1.2	0.65	CMOS	32.768	±5.0	-40 to +85	+1.5 to +3.63	3.2 to 3.5	Digital	CE IE AE	43, 81
DSK321STD		3.2	2.5	1.0	CMOS	32.768	±5.0	-40 to +85	+1.5 to +3.63	3.2, 3.5	Digital	AE	82

kHz Band SPXO

Type	Actual Size	Size (mm) L	W	H (max.)	Output	Frequency Range (MHz)	FrequencyTolerance (×10⁻⁶) (Includes frequency tolerance at room temperature.)	Operating Temperature Range (℃)	Supply Voltage (V)	Current Consumption (μA)	Recommended Application	Catalog Page
DSO1612AR (kHz)		1.6	1.2	0.6	CMOS	32.768	±100	-40 to +125	+1.6 to +3.6	32	CE TC	53
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	73
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	54 74
DSO321SY (kHz)		3.2	2.5	1.2								

Selection Guide

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

Icons IE Industrial Equipment TC Mobile Phone, Wireless Communication

Monolithic Crystal Filters

Type	Actual Size	Size (mm)			Frequency Range (MHz)	Operating Temperature Range (℃)	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	87
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			
DSF633SAF		6.0	3.5	1.3	20 to 160	-20 to +70	Fundamental	4	±3.5, ±7.5, ±15	IE TC	88
DSF633SDF					37 to 130		Fundamental				
DSF633SDO					60 to 160		3rd				
DSF753SAF		7.0	5.0	1.5	16 to 90	-20 to +70	Fundamental	2	±3.5, ±7.5, ±15	IE TC	89
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						
DSF753SDO					60 to 160		3rd				

Selection Guide

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

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

kHz Band MEMS Oscillator

Type	Actual Size	Size (mm) L	W	H (max.)	Output	Frequency Range (kHz)	Frequency Characteristics over Temperature (×10⁻⁶)	Operating Temperature Range (℃)	Supply Voltage (V)	Current Consumption (μA typ.)	Recommended Application	Catalog Page
MO1532		1.5	0.8	0.6	NanoDrive™ LVCMOS	32.768	±100	-40 to +85	+1.2 to +3.63	+0.90	CE TC	92
MO1534		1.5	0.8	0.6	NanoDrive™ LVCMOS	0.001 to 32.768	±100	-40 to +85	+1.2 to +3.63	+0.90	CE TC	93
		2.0	1.2	0.6								
MO1569		1.5	0.8	0.6	LVCMOS	0.001 to 462	±50	-40 to +85	+1.62 to +3.63	+2.0 μA (100kHz)	CE TC	
MO1630		2.0	1.2	0.6	LVCMOS	16.384, 32.768	±150	-40 to +105	+1.5 to +3.63	+1.00	CE TC	92

kHz Band Temperature Compensated MEMS Oscillators

Type	Actual Size	Size (mm) L	W	H (max.)	Output	Frequency Range (kHz)	Frequency Characteristics over Temperature (×10⁻⁶)	Operating Temperature Range (℃)	Supply Voltage (V)	Current Consumption (μA typ.)	Recommended Application	Catalog Page
MO1552		1.5	0.8	0.6	NanoDrive™ LVCMOS	32.768	±5/±10/±20 over temp.	-40 to +85	+1.5 to +3.63	+0.99	CE TC	92
MO1566					LVCMOS		±3 all inclusive		+1.8	+4.5		
MO1568							±5 all inclusive After Overmold/ Underfill					
MO1576					LVCMOS	0.001 to 2000	±5 all inclusive	-40 to +85	+1.62 to +3.63	+8.0 μA (100kHz)	CE TC	93

Low Power MEMS Oscillators

Type	Actual Size	Size (mm) L	W	H (max.)	Output	Frequency Range (MHz)	Frequency Tolerance (×10⁻⁶) (Includes frequency tolerance at room temperature.)	Operating Temperature Range (℃)	Supply Voltage (V)	Current Consumption (mA typ.)	Recommended Application	Catalog Page
MO8021		1.5	0.8	0.6	LVCMOS	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 μA stby)	CE TC	93

Low Phase Jitter MEMS Oscillators

Type	Actual Size	Size (mm) L	W	H (max.)	Output	Frequency Range (MHz)	Frequency Tolerance (×10⁻⁶) (Includes frequency tolerance at room temperature.)	Operating Temperature Range (℃)	Supply Voltage (V)	Current Consumption (mA typ.)	Recommended Application	Catalog Page
MO8208		2.7	2.4	0.8	LVCMOS	1.0 to 80	±10, ±20, ±25, ±50	-40 to +85	+2.25 to +3.63	+29 to +36 (+10 μA stby)	CE IE	95
		3.2	2.5	0.8								
		5.0	3.2	0.8								
MO8209		7.0	5.0	1.0		80 to 220						
MO9120		3.2	2.5	0.8	LVPECL LVDS	25 to 212.5	±10, ±20, ±25, ±50	-40 to +85	+2.25 to +3.63	+54 to +69	CE IE	
MO9121		5.0	3.2	0.8		1.0 to 220						
MO9122		7.0	5.0	1.0		220 to 625						
MO9365		3.2	2.5	0.8	LVPECL LVDS HCSL	32 Standard Frequencies	±10, ±20, ±25, ±50	-40 to +105	+2.25 to +3.63	+76 to +84	CE IE	94
MO9366		5.0	3.2	0.8		1.0 to 220						
MO9367		7.0	5.0	1.0		220 to 725						

Temperature Compensated MEMS Oscillators

Type	Actual Size	Size (mm) L	W	H (max.)	Output	Frequency Range (MHz)	Frequency Characteristics over Temperature (×10⁻⁶)	Operating Temperature Range (℃)	Supply Voltage (V)	Current Consumption (mA typ.)	Recommended Application	Catalog Page
MO5155		5.0	3.2	1.0	Clipped Sinewave (1 to 60 MHz) LVCMOS	10 std. GNSS Freq.	±0.5, ±1.0, ±2.5	-40 to +105℃	+2.25 to +3.63	+40 to +50	CE IE	96
MO5156						1.0 to 60						
MO5157						60 to 220						
MO5356						1.0 to 60	±0.1, ±0.2, ±0.25					
MO5357						60 to 220						
MO5358					Clipped Sinewave, LVCMOS	1.0 to 60	±0.05	0 to +70℃				
MO5359					LVCMOS	60 to 189, 200 to 220						

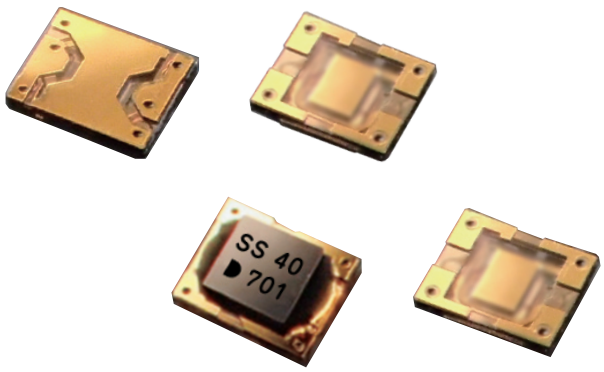
MEMS Oscillators with Spread Spectrum Function

Type	Actual Size	Size (mm) L	W	H (max.)	Output	Frequency Range (MHz)	Frequency Tolerance (×10⁻⁶) (Includes frequency tolerance at room temperature.)	Operating Temperature Range (℃)	Supply Voltage (V)	Current Consumption (mA typ.)	Recommended Application	Catalog Page
MO9002		5.0	3.2	0.8	LVPECL LVDS CML HCSL	1.0 to 220	±25, ±50	-40 to +85	+1.71 to +1.89, +2.25 to +3.63	+48 to +75	CE IE	97
		7.0	5.0	1.0								
MO9003		2.5	2.0	0.8	LVCMOS	1.0 to 110	±50, ±100			+3.2 to +4.1 (+0.4 to +4.3 μA stby)		
		3.2	2.5	0.8								
		5.0	3.2	0.8								
		7.0	5.0	1.0								
MO9005		2.0	1.6	0.8		1.0 to 141	±20, ±25, ±50		+1.62 to +1.98, +2.25 to +3.63	+5.0 to +6.5 (+0.4 to +4.3 μA stby)		
		2.5	2.0	0.8								
		3.2	2.5	0.8								

MEMO

Quartz Devices

Arkh.Series



〈Example〉 **D S 1 0 0 8 J S**

- Surface mount crystal resonator
- Surface mount crystal oscillator
- Length — Represents 2 digits of the dimension in millimeter
- Width — Represents 2 digits of the dimension in millimeter
- Product characteristics

D X 1 0 0 8 J S

KDS DAISHINKU CORP.

Arkh.3G SERIES

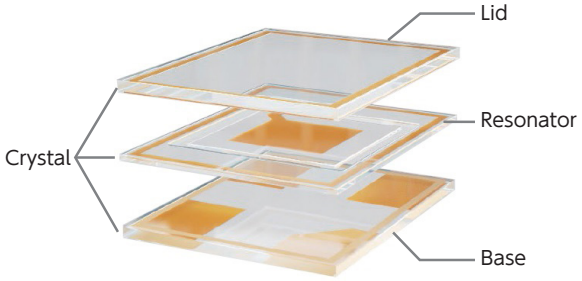
About Arkh.Series

Arkh.Series

The Arkh Series is a device with an unprecedented new structure developed as the third generation following the lead type and the surface-mount type.
The brand name "Arkh" is taken from the ancient Greek word "Arkhitekton", which is the origin of the English word "Architecture". It is not just a structure, but contains the desire to emphasize that it is the origin of crystal devices with a completely new structure.

About the Structure of the Arkh Series

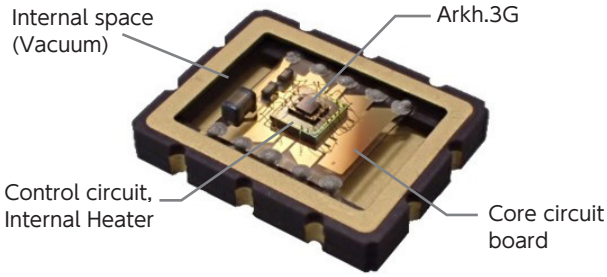
<Arkh.3G>



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

WLP technology

<Arkh.5G>



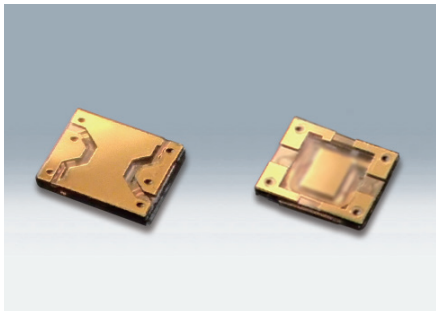
The Arkh.5G is an ultra-compact and low-power OCXO by embedding the ultra-small Arkh.3G oscillator in its core. The core of the conventional product is generally under atmospheric pressure. But the new core structure is maintained in a vacuum, which eliminates the effects of thermal convection. The conventional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

About Mounting and Usage of the Arkh.Series

The Arkh.Series can be soldered to circuit boards with a pick-and-place machine in the conventional manner.
The Arkh.3G can also be built into an IC package or used for wire bonding or molding.
*Note that, as with conventional products, the Arkh.3G is subject to resonance fracture or damage, depending on conditions such as ultrasonic cleaning and molding pressure. Therefore, it is necessary to check the Arkh.3G in advance under your particular operating conditions.

SMD Crystal Resonators / MHz Band Crystal Resonators

DX1008JS



Actual size

■ Features

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

Pb-Free

RoHS Compliant

■ Applications

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

■ Standard Specification

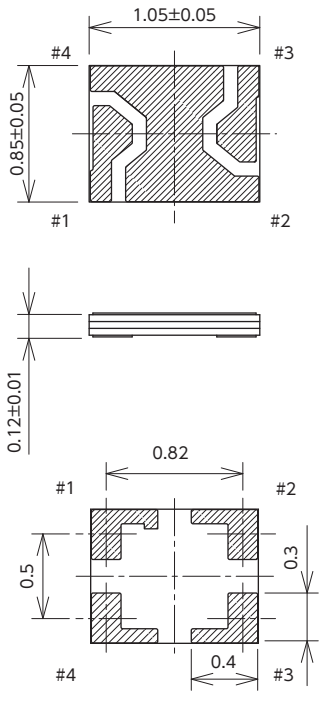
Item \ Type	DX1008JS		
Frequency Range	48 to 52MHz	52 to 96MHz	96 to 120MHz
Overtone Order	Fundmental		
Load Capacitance	8pF, 10pF, 12pF		
Drive Level	10μW (100μW max.)		
Frequency Tolerance	±20×10^{-6} (at 25℃)		±100×10^{-6} (at 25℃)
Series Resistance	100Ω max.	60Ω max.	40Ω max.
Frequency Characteristics over Temperature	±30×10^{-6} / -30 to +85℃ (Ref.To 25℃)		
Storage Temperature Range	-40 to +85℃		
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

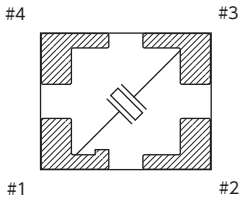
[mm]

■ Dimensions



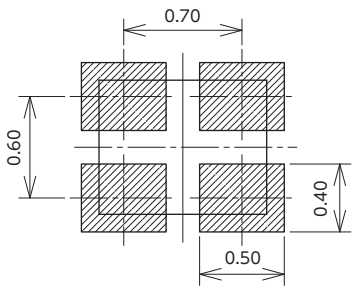
■ Internal Connections

〈Top View〉



■ Recommended Land Pattern

〈Top View〉



SMD Crystal Resonators / MHz Band Crystal Resonators

DX1008JT

NEW

■ Features

- 1008 size, height 0.18mm
  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

Pb-Free

RoHS Compliant

■ Applications

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

■ Standard Specification

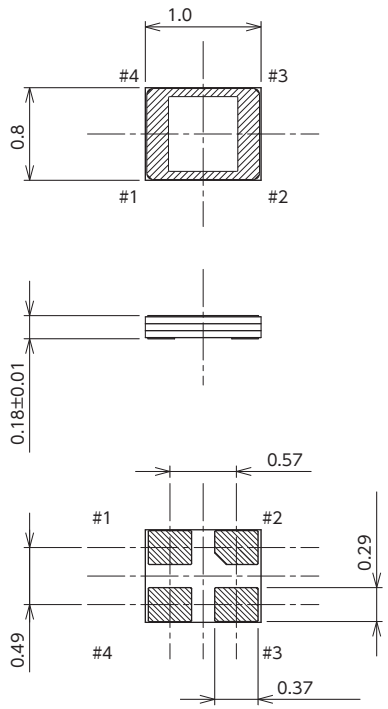
Item \ Type	DX1008JT	
Frequency Range	59.97MHz	76.8MHz
Overtone Order	Fundmental	
Load Capacitance	5pF, 8pF, 10pF, 12pF	
Drive Level	10μW (100μW max.)	
Frequency Tolerance	$\pm 20\times10^{-6}$	
Series Resistance	60Ω max.	50Ω max.
Frequency Characteristics over Temperature	$\pm 30\times10^{-6}$ / -30 to +85℃ (Ref.To 25℃)	
Storage Temperature Range	-40 to +85℃	
Packing Unit (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

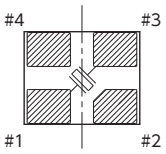
[mm]

■ Dimensions



■ Internal Connections

〈Top View〉

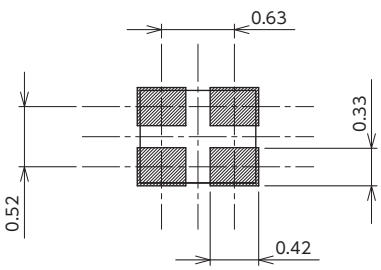


Pin Connection

Pin No.	Connection
#1	Xtal
#2	GND
#3	Xtal
#4	GND

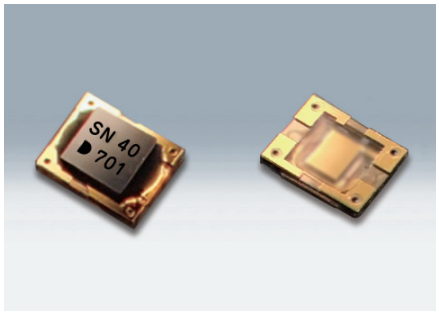
■ Recommended Land Pattern

〈Top View〉



SMD Crystal Oscillators

DS1008JN



Actual size

■ Features

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

Pb-Free

RoHS Compliant

■ Applications

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

[Function Code]

DS1008JN E A

E : 1.5V
F : 1.3V
G : 1.2V
H : 0.9V

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

■ Standard Specification

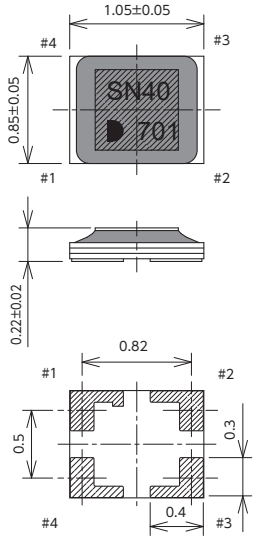
Item \ Type	Function Code: Supply Voltage	Function Code: Frequency Tolerance	Output Frequency Range (MHz)	Legend	Spec.: min.	Spec.: typ.	Spec.: max.	Spec.: Unit	Condition	
Supply Voltage	E	*	1≦f0≦100	Vcc	1.4	1.5	1.6	V		
	F				1.2	1.3	1.4			
	G				1.1	1.2	1.3			
	H				0.8	0.9	1.0			
Frequency Tolerance (Includes frequency tolerance at room temperature.)	*	A	*	f_tol	–	–	±100	ppm	-40 to +125℃	-20 to +70℃ (Standard Operating Temperature Range)
		B			–	–	±50		-30 to +85℃	
		C			–	–	±30		-20 to +70℃	
		E			–	–	±20			
Current Consumption	E	*	80≦f0≦100	Icc	–	–	3.1	mA	No Load	
			50≦f0<80		–	–	2.7			
			1≦f0<50		–	–	2.2			
	F	*	80≦f0≦100		–	–	2.8			
			50≦f0<80		–	–	2.5			
			1≦f0<50		–	–	2.1			
	G	*	80≦f0≦100		–	–	2.7			
			50≦f0<80		–	–	2.4			
			1≦f0<50		–	–	2.0			
	H	*	80≦f0≦100		–	–	2.3			
			50≦f0<80		–	–	2.1			
			1≦f0<50		–	–	1.8			
Stand-by Current (#1 pin "L" Level)	*	*	*	I_std	–	–	0.02	mA		
Load Condition	*	*	*	L_CMOS	–	–	15	pF		
Symmetry	*	*	*	SYM	40	50	60	%	at 50%	
Rise and Fall Time	*	*	*	tr, tf	–	–	5	ns	10 to 90% Vcc Level	
Output Enable Time	*	*	*	tPZL	–	–	2	ms		
Output Disable Time	*	*	*	tPLZ	–	–	200	ns		
OE Pin 1 Level Input Voltage	*	*	*	VIH	Vcc×0.8	–	–	V		
OE Pin 0 Level Input Voltage	*	*	*	VIL	–	–	Vcc×0.2	V		
Packing Unit (1)	3000pcs./reel(φ180)									

(1) Moisture prevention packing

Consult our sales representative for other specifications

[mm]

■ Dimensions



Pin Connection

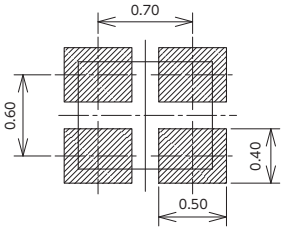
Pin No.	Connection
#1	OE (Output Enable)
#2	GND
#3	Output
#4	Vcc

Function

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

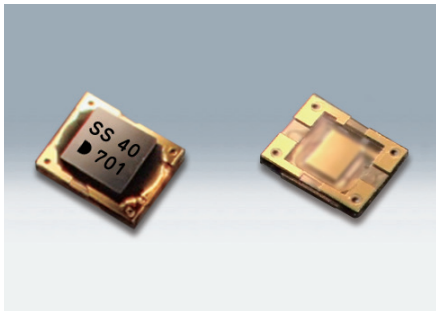
■ Recommended Land Pattern

〈Top View〉



SMD Crystal Oscillators

DS1008JS



Actual size

■ Features

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

Pb-Free

RoHS Compliant

■ Applications

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

[Function Code]

DS1008JS A A

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

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

■ Standard Specification

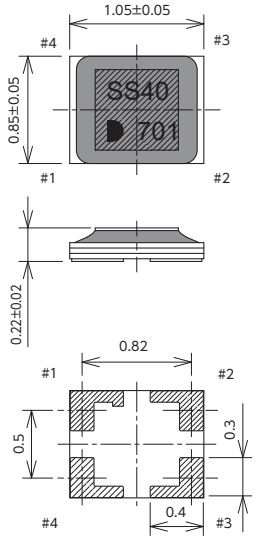
Item \ Type	Function Code: Frequency Tolerance	Function Code: Frequency Tolerance	Output Frequency Range (MHz)	Legend	Spec: min.	Spec: typ.	Spec: max.	Spec: Unit	Condition	
Supply Voltage	A	*	1≦f₀≦100	Vcc	3.0	3.3	3.6	V		
	B				2.6	2.8	3.0			
	C				2.25	2.5	2.75			
	D				1.6	1.8	2.0			
Frequency Tolerance (Includes frequency tolerance at room temperature.)	*	A	*	f_tol	–	–	±100	ppm	-40 to +125℃	-20 to +70℃ (Standard Operating Temperature Range)
		B			–	–	±50		-30 to +85℃	
		C			–	–	±30		-20 to +70℃	
		E			–	–	±20			
Current Consumption	A	*	80≦f₀≦100	Icc	–	–	4.9	mA	No Load	
			48≦f₀<80		–	–	4.2			
			1≦f₀<48		–	–	3.1			
	B	*	80≦f₀≦100		–	–	4.2			
			48≦f₀<80		–	–	3.7			
			1≦f₀<48		–	–	2.7			
	C	*	80≦f₀≦100		–	–	3.9			
			48≦f₀<80		–	–	3.4			
			1≦f₀<48		–	–	2.6			
	D	*	80≦f₀≦100		–	–	3.1			
			48≦f₀<80		–	–	2.8			
			1≦f₀<48		–	–	2.1			
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 f₀<60MHz	
Rise and Fall Time	*	*	*	tr, tf	–	–	5	ns	10 to 90% Vcc Level	
Output Enable Time	*	*	*	tPZL	–	–	2	ms		
Output Disable Time	*	*	*	tPLZ	–	–	200	ns		
OE Pin 1 Level Input Voltage	*	*	*	VIH	Vcc×0.8	–	–	V		
OE Pin 0 Level Input Voltage	*	*	*	VIL	–	–	Vcc×0.2	V		
Packing Unit (1)	3000pcs./reel(φ180)									

(1) Moisture prevention packing

Consult our sales representative for other specifications

[mm]

■ Dimensions



Pin Connection

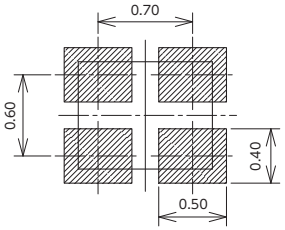
Pin No.	Connection
#1	OE (Output Enable)
#2	GND
#3	Output
#4	Vcc

Function

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

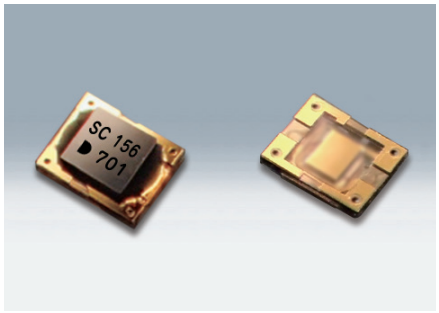
■ Recommended Land Pattern

〈Top View〉



SMD Differential Output Crystal Oscillators

DS1008JC/DS1008JK/DS1008JJ



Actual size

■ Features

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

Pb-Free

RoHS Compliant

■ Applications

- Optical transmission device

■ Standard Specification

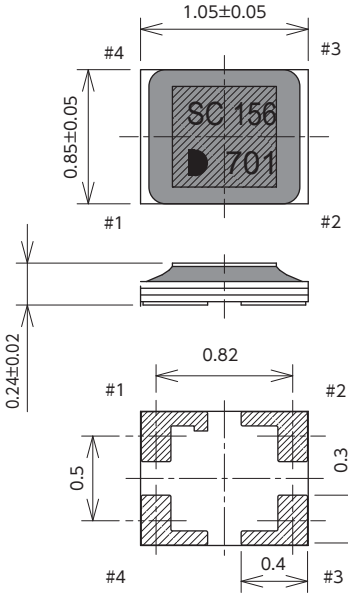
Item \ Type	Legend	DS1008JC	DS1008JK	DS1008JJ	Condition
Output Specification	–	HD-LVDS	LV-PECL	LVDS	
Output Frequency Range	f_0	156.25MHz			
Supply Voltage	Vcc	+3.3V±0.165V		+2.5V±0.125V / +3.3V±0.165V	
Frequency Tolerance (Includes frequency tolerance at room temperature.)	f_tol	±100×10^{-6} max.			-40 to +85℃
Current Consumption	Icc	35mA max.	57mA max.	26mA max.	
Load Condition	Load-R	100Ω (Output-OutputN, DC Cut)	50Ω to Vcc -2.0V	100Ω (Output-OutputN)	
Symmetry	SYM	45 to 55%			at outputs cross point
0 Level Output Voltage	V_{OL}	–	Vcc -1.81 to Vcc -1.62	–	
1 Level Output Voltage	V_{OH}	–	Vcc -1.025 to Vcc -0.88	–	
Rise and Fall Time	tr, tf	0.4ns max	0.5ns max	0.4ns max	20 to 80% Output-OutputN
Differential Output Voltage	V_{OD1}, V_{OD2}	0.500 to 1.000V	–	0.247 to 0.454V	
Change to V_{OD}	ΔV_{OD}	–	–	50mV	ΔV_{OD}=ABS(V_{OD1}-V_{OD2})
Offset Voltage	V_{OS}	–	–	1.125 to 1.375V	Output, OutputN Offset Voltage
Offset to V_{OS}	ΔV_{OS}	–	–	50mV	Magnitude Change V_{OS}
Start Up Time	Tst	2ms			
Period Jitter (1)	tRMS	2.5ps typ.			
	tp-p	22ps typ.			Peak to peak
Phase Jitter (2)	tpj	0.1ps max.		0.12ps max.	f_0 offset: 12kHz to 20MHz @ +25℃
Packing Unit (3)	3000pcs./reel (φ180)				

(1) Measured WAVECREST DTS-2075
(2) Measured Keysight Technologies E5052B
(3) Moisture prevention packing

Consult our sales representative for other specifications

[mm]

■ Dimensions

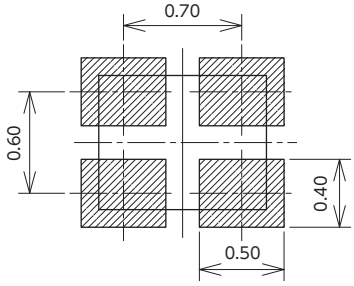


Pin Connection

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

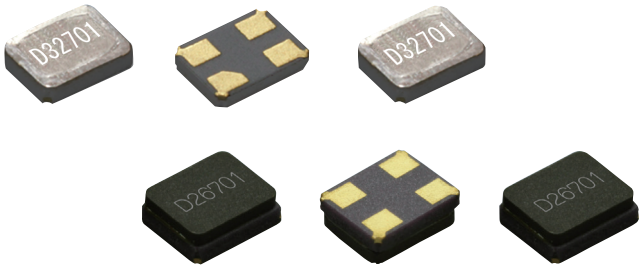
■ Recommended Land Pattern

〈Top View〉



MEMO

Quartz Devices
Crystal resonators



〈Example〉 **D S X 5 3 0 G A**

Surface mount crystal resonator	D S X
Length First 2 digits of the dimention (L<2mm) First digit of the dimention in Millimeter (2≦L<10mm)	5 3
Width First 2 digits of the dimention (L<2mm) First digit of the dimention in Millimeter (2mm≦L)	3 0
Number of terminals 0: two terminals 1: four terminals	G
Sealing method G: glass seal S: seam weld A: melting alloy	A
Product characteristics	

D S X 1 6 1 2 S

Crystal Resonators

Description

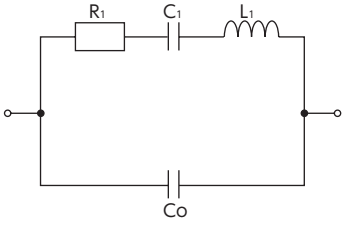
●MHz Band Crystal Resonators

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

●kHz Band Crystal Resonators(Tuning Fork Crystal Resonators)

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

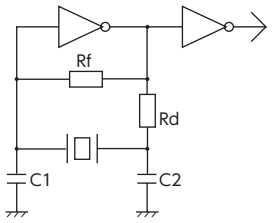
Terminology

Fundamental Crystal Resonators	Crystal resonator designed to oscillate in the lowest-order (fundamental) oscillation mode.
Overtone Crystal Resonators	Crystal resonator designed to oscillate in the overtone oscillation mode (third, fifth, and seventh).
Overtone Order	Desired order of vibration mode, (odd) integer multiples of the fundamental mode.
Vibration Mode	One factor which determines the mechanical vibration behavior of a crystal blank is cutting angle. Examples of such vibration behaviors are thickness-sheer mode and flexure mode.
Nominal Frequency	The specified center frequency of the crystal.
Load Capacitance	The effective external capacitance that determines the resonance frequency of a crystal resonator. When this capacitance is small, the crystal resonator is vulnerable to changes in the circuit characteristics, thus deteriorating the frequency stability.
Drive Level	Loading condition of crystal resonator, which is determined by electric current or power applied to the crystal blank. Electric power P is determined by the following equation: $P= I^2 \cdot R_1$, where I represents electric current and R1 represents series resistance.
Series Resistance	The resistance of the crystal at the series resonance frequency, also called the equivalent series resistance (ESR).
Frequency Tolerance (Crystal Resonators)	Allowable deviation from nominal at room temperature (25 deg.C), indicated in parts per million ($\times 10^{-6}$).
Frequency Characteristics over Temperature (Crystal Resonators)	Allowable deviation of frequency at room temperature, in parts per million ($\times 10^{-6}$). This is the maximum value within the operating temperature range.
Aging	The frequency change of the crystal operated at specific conditions for a certain period of time.
Operating Temperature Range	Temperature range over which the crystal resonator can be operated within allowable deviation range.
Storage Temperature Range	Temperature range, which crystal resonator can be stored at without any deterioration or damage independently.
Turnover Temperature	The temperature at the peak of the parabolic curve that a crystal in kHz shows with temperature. It is expected that the crystal will have a steady oscillation if the peak temperature is within the working temperature range.
Parabolic Coefficient	The temperature co-efficient of a parabolic curve shown in frequency vs. temperature.
Plastic-encapsulated (SMD) type	Crystal resonators encapsulated with resin.
Cylindrical type	Crystal resonators in cylindrical constructions, which are generally in kHz frequency range.
Equivalent Circuit to Crystal Resonator	An equivalent circuit near the resonance point of the crystal resonator is shown below. It consists of a series circuit including series motional inductance (L_1), series capacitance (C_1) and series resistance (R_1), with the resonator's terminal-to-terminal capacitance (shunt capacitance: C_0) connected in parallel with the series circuit. The smaller the size of the resonator, the greater the average values of R1 and L1. 

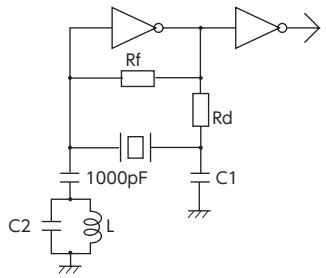
Oscillation Circuit

Oscillation Circuit of Crystal Resonator

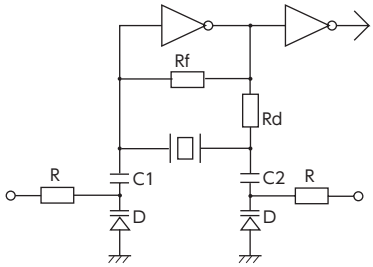
Oscillation Circuit of Fundamental Mode



Oscillation Circuit of Overtone Mode



VCXO Circuit



Oscillation Circuit of Fundamental Mode :
A circuit that allows the crystal resonator to oscillate in the fundamental mode.

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

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

Tips for Circuit Design

[IC Selection]
Selecting an IC according to the oscillation frequency.
〈Example〉 4069UB : From the kHz range to around 8 MHz
7WU04 : 4 to 30MHz
7WHU04 : 20 to 60MHz

[Feedback Resistance]
The feedback resistance for DC bias is necessary to continue the oscillation of a resonator. Generally, a resistance of 10 MΩ and above is used for oscillation in the kHz range, and a resistance of 1 MΩ and above is used for oscillation in the MHz range.
For overtone oscillation, a resistance of 1 kΩ may be used.

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

[Capacitor C1, C2]
Adjusts the negative resistance and drive level, prevents abnormal oscillation of resonator.

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

〈Example〉 kHz range : 10 to 100 μF
MHz range : 0.01 to 0.1 μF

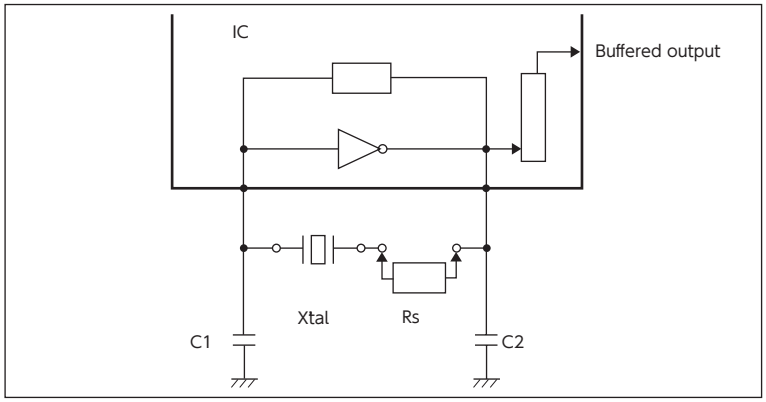
[Line Pattern]
Mount parts of a oscillation circuit as closely as possible to the IC and don't put signal line of the oscillator circuit closely or cross another signal line.

Oscillation Circuit

Confirmation on Operation of Oscillation Circuit

【Negative Resistance】

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



Measurement Circuit for Negative Resistance

【Load Capacitance】

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

【Drive Level】

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

MHz Band Crystal Resonators
Fundamental Mode: 300μW max., 200μW max., 100μW max. Overtone Mode: 1mW max., 500μW max.

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

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

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

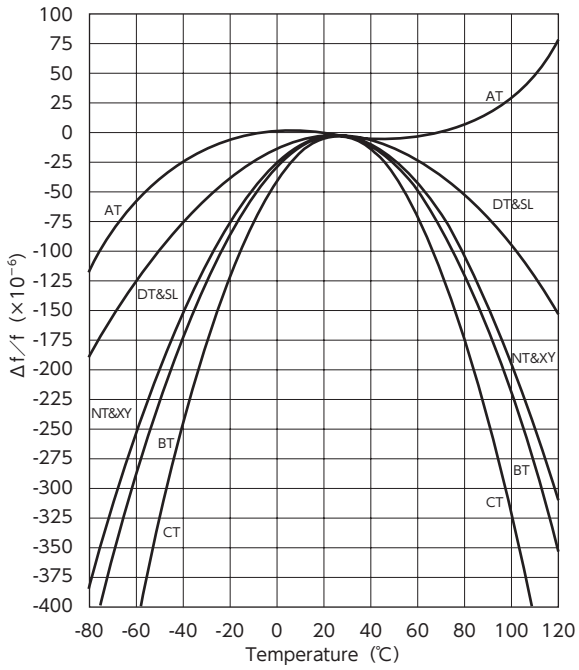
Drive Level $P = (I/2\sqrt{2})^2 \cdot R$

【Inquiry About The Oscillation Circuit】

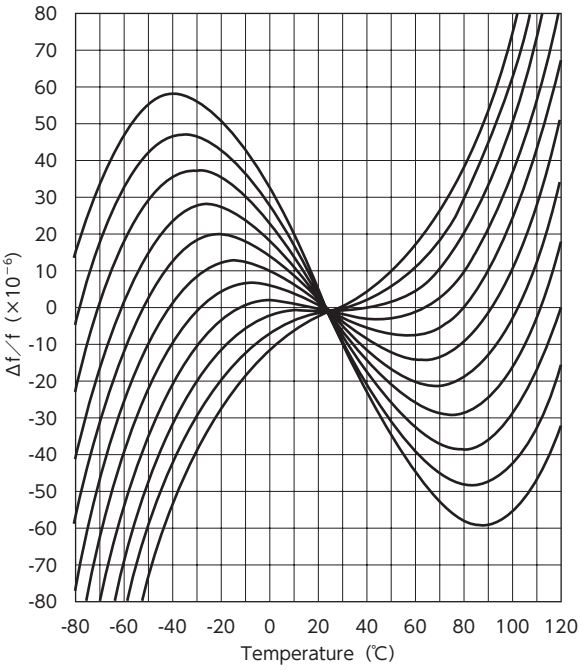
Regarding inquiries concerning oscillation circuit and its matching with the ICs you are using, please directly contact our sales department or leave us an e-mail from our website(click “CONTACT US” from the top page → select “TECHNICAL SUPPORT”).

Cut Angle and Frequency Characteristics over Temperature

Temperature Characteristics for Various Cuts

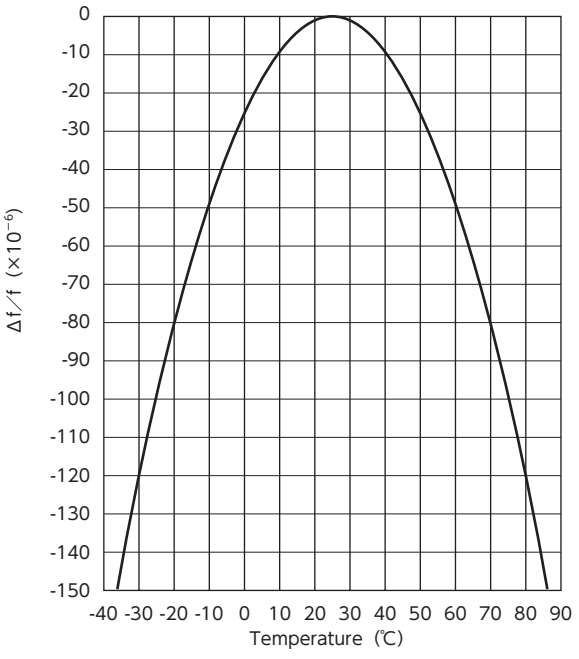


Temperature Characteristics for AT Cuts

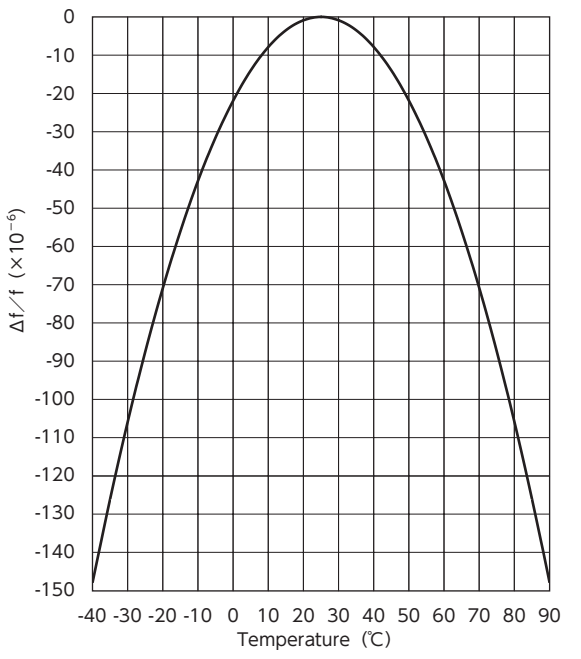


Difference of cutting angle between each temperature curve is 2'.

Temperature Characteristics for BT Cuts

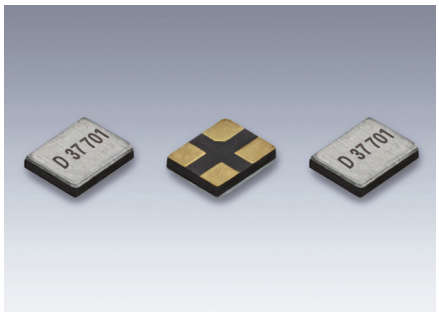


Temperature Characteristics for Tuning Fork Crystal Resonator



SMD Crystal Resonators / MHz Band Crystal Resonators

DSX1210A



Actual size

■ Features

- 1210 size ultra miniature and lightweight SMD crystal resonator with a low profile of 0.28mm
- High precision and high reliability (Frequency aging specification of $\pm1\times10^{-6}$/1 year or $\pm3\times10^{-6}$/5 years is available for cell phone or wireless communication systems etc.)
- Allowing for high density surface mounting.
- AEC-Q200 Compliant

Pb-Free

RoHS Compliant

■ Applications

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

■ Standard Specification

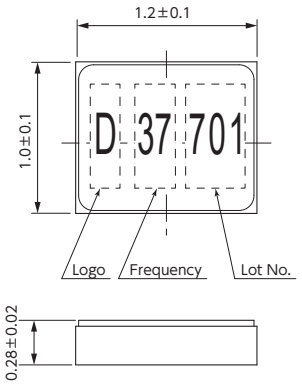
Item \ Type	DSX1210A			
Frequency Range	32MHz	37.4MHz / 38.4MHz / 40MHz	48MHz/52MHz	76.8MHz/80MHz
Overtone Order	Fundamental			
Load Capacitance	8pF, 10pF, 12pF			
Drive Level	10μW (100μW max.)			
Frequency Tolerance	$\pm10\times10^{-6}$, $\pm20\times10^{-6}$ (at 25℃)			
Series Resistance	100Ω max.	60Ω max.	40Ω max.	30Ω max.
Frequency Characteristics over Temperature	$\pm12\times10^{-6}$, $\pm30\times10^{-6}$ / −30 to +85℃ (Ref. To 25℃)			
Storage Temperature Range	−40 to +85℃			
Packing Unit (1)	3000pcs./reel (φ180)			

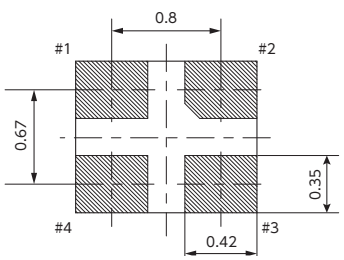
(1) Moisture prevention packing is unnecessary.
Moisture Sensitivity Level:LEVEL1 (IPC/JEDEC J-STD-033)

Consult our sales representative for other specifications.

[mm]

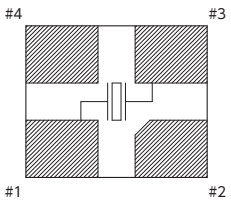
■ Dimensions





■ Internal Connections

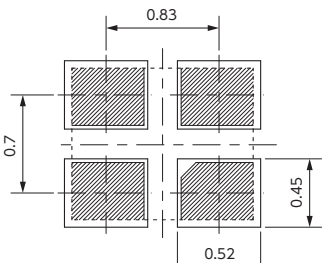
〈Top View〉



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

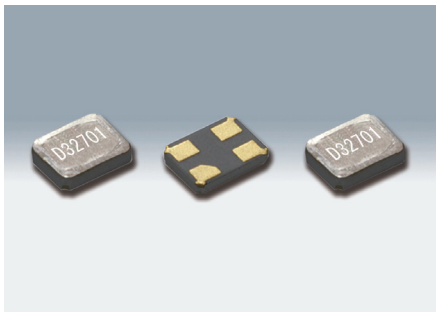
■ Recommended Land Pattern

〈Top View〉



SMD Crystal Resonators / MHz Band Crystal Resonators

DSX1612S



Actual size

■ Features

- 1612 size ultra miniature and lightweight SMD crystal resonator with a low profile of 0.35 mm.
- High precision and high reliability (Frequency aging specification of $\pm1\times10^{-6}$/1 year or $\pm3\times10^{-6}$/5 years is available for cell phone or wireless communication systems etc.)
- Allowing for high density surface mounting.

■ Applications

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

Pb-Free

RoHS Compliant

■ Standard Specification

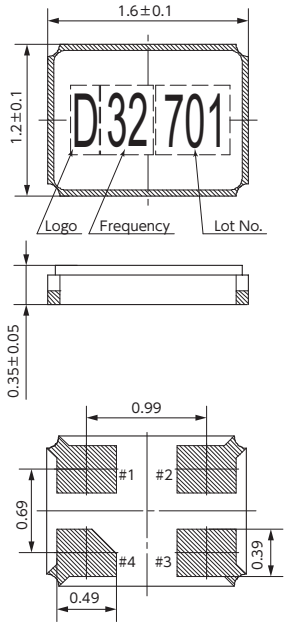
Item \ Type	DSX1612S		
Frequency Range	24 to 32MHz	32 to 40MHz	40 to 54MHz
Overtone Order	Fundamental		
Load Capacitance	8pF, 10pF, 12pF		
Drive Level	10μW (100μW max.)		
Frequency Tolerance	$\pm10\times10^{-6}$, $\pm20\times10^{-6}$ (at 25℃)		
Series Resistance	100Ω max.	50Ω max.	
Frequency Characteristics over Temperature	$\pm15\times10^{-6}$, $\pm30\times10^{-6}$ / −30 to +85℃ (Ref. To 25℃)		
Storage Temperature Range	−40 to +85℃		
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.

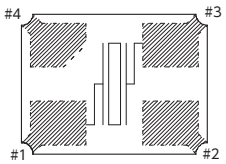
[mm]

■ Dimensions



■ Internal Connections

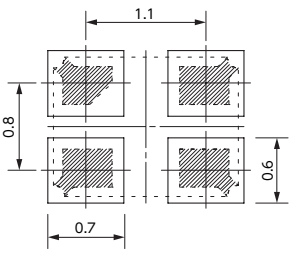
〈Top View〉



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

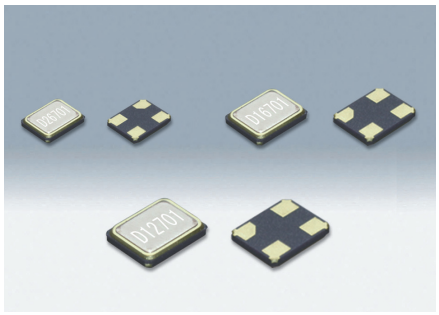
■ Recommended Land Pattern

〈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 : 12MHz to 54MHz
  - DSX321SH : 12MHz to 50MHz
- AEC-Q200 Compliant (expect for DSX211S)
- Frequency Characteristics over Temperature
  ±50×10^{-6}/ −40 to +105℃ is available for Industrial Equipment.

Pb-Free

RoHS Compliant

■ Applications

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

■ Standard Specification

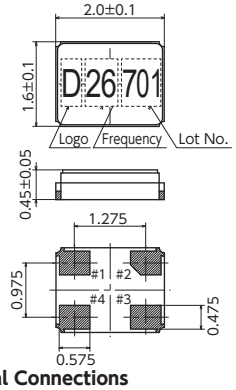
Item \ Type	DSX211SH		DSX211S	DSX221SH			DSX321SH		
Frequency Range	16 to 30MHz	30 to 60MHz	76.8MHz/80MHz/96MHz	12 to 24MHz	24 to 30MHz	30 to 54MHz	12 to 20MHz	20 to 32MHz	32 to 50MHz
Overtone Order	Fundamental								
Load Capacitance	8pF, 10pF, 12pF								
Drive Level	10μW (100μW max.)		10μW (400μW max.)	10μW (200μW max.)					
Frequency Tolerance	±20×10^{-6}(at 25℃)								
Series Resistance	100Ω max.	50Ω max.	30Ω max.	120Ω max.	50Ω max.	40Ω max.	80Ω max.	50Ω max.	40Ω max.
Frequency Characteristics over Temperature	±30×10^{-6} / −30 to +85℃ (Ref. to 25℃)								
Storage Temperature Range	−40 to +85℃								
Packing Unit (1)	3000pcs./reel(φ180)								

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

Consult our sales representative for other specifications.

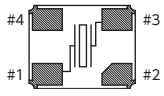
■ DSX211S/DSX211SH [mm]

■ Dimensions



■ Internal Connections

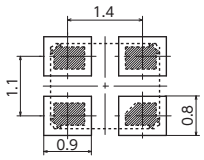
〈Top View〉



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

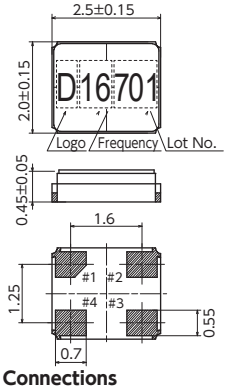
■ Recommended Land Pattern

〈Top View〉



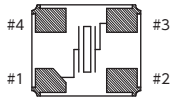
■ DSX221SH [mm]

■ Dimensions



■ Internal Connections

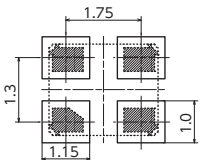
〈Top View〉



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

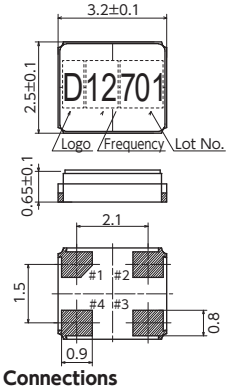
■ Recommended Land Pattern

〈Top View〉



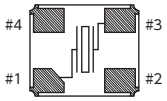
■ DSX321SH [mm]

■ Dimensions



■ Internal Connections

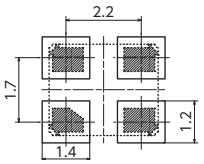
〈Top View〉



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

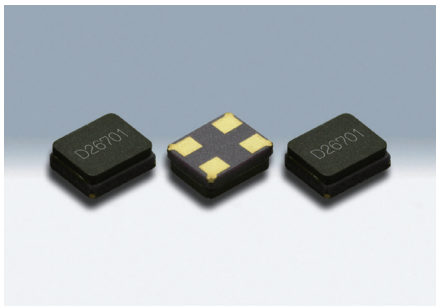
■ Recommended Land Pattern

〈Top View〉



SMD Crystal Resonators / MHz Band Crystal Resonators

DSX211G



Actual size

RoHS Compliant

■ Features

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

■ Applications

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

■ Standard Specification

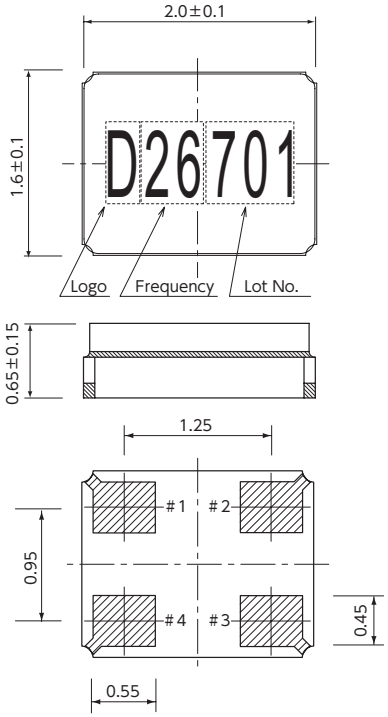
Item \ Type	DSX211G			
Frequency Range	20 to 24MHz	24 to 30MHz	30 to 36MHz	36 to 64MHz
Overtone Order	Fundamental			
Load Capacitance	8pF, 10pF, 12pF			
Drive Level	10μW (100μW max.)			
Frequency Tolerance	±20×10^{-6} (at 25℃)			
Series Resistance	200Ω max.	150Ω max.	120Ω max.	80Ω max.
Frequency Characteristics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

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

Consult our sales representative for other specifications.

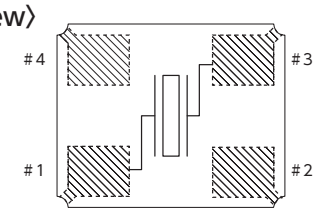
[mm]

■ Dimensions



■ Internal Connections

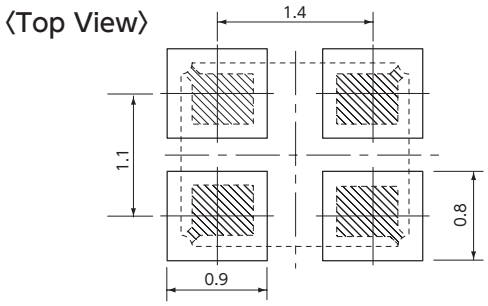
〈Top View〉



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

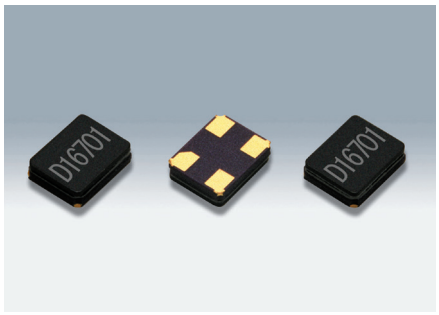
■ Recommended Land Pattern

〈Top View〉



SMD Crystal Resonators / MHz Band Crystal Resonators

DSX321G



Actual size

■ Features

- 3225 size miniature and lightweight SMD crystal resonator.
  Height DSX321G (over 12MHz): 0.75mm
  DSX321G (12MHz or under): 0.85mm
- Excellent heat resistance, High precision and high reliability (Frequency aging specification of $\pm1\times10^{-6}$/1 year or $\pm3\times10^{-6}$/5 years is available for cell phone or wireless communication systems etc.)
- Offers a wide range of frequencies from 7.9MHz up to 64MHz.
- AEC-Q200 Compliant
- Frequency Characteristics over Temperature $\pm50\times10^{-6}$/ −40 to +105℃ is available for Industrial Equipment.

RoHS Compliant

■ Applications

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

■ Standard Specification

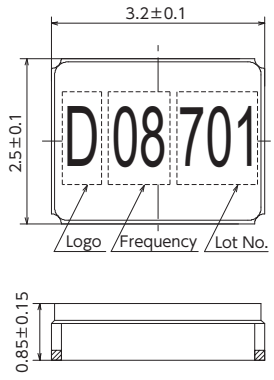
Item \ Type	DSX321G						
Frequency Range	7.9 to 9MHz	9 to 9.8MHz	9.8 to 11MHz	11 to 12MHz	12 to 20MHz	20 to 27MHz	27 to 64MHz
Overtone Order	Fundamental						
Load Capacitance	8pF, 10pF, 12pF						
Drive Level	10μW (200μW max.)						
Frequency Tolerance	$\pm20\times10^{-6}$ (at 25℃)						
Series Resistance	400Ω max.	300Ω max.	150Ω max.	100Ω max.	80Ω max.	60Ω max.	50Ω max.
Frequency Characteristics over Temperature	$\pm30\times10^{-6}$ / −30 to +85℃ (Ref. to 25℃)						
Storage Temperature Range	−40 to +85℃						
Packing Unit (1)	3000pcs./reel (φ180)						

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

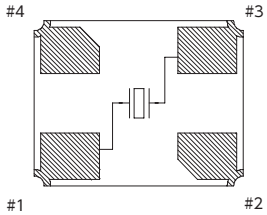
Consult our sales representative for other specifications.

■ DSX321G (12MHz or under) [mm]

■ Dimensions

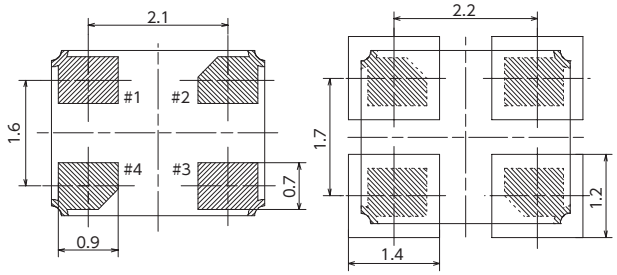


■ Internal Connections
〈Top View〉



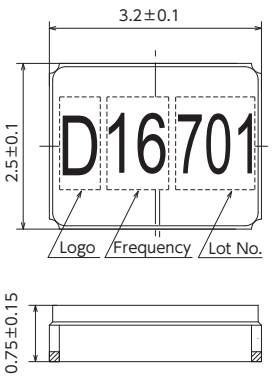
#1 & #3 connected to quartz element
#2 & #4 GND connected or N.C. available

■ Recommended Land Pattern
〈Top View〉

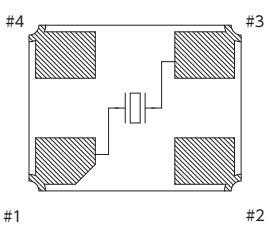


■ DSX321G (over 12MHz) [mm]

■ Dimensions

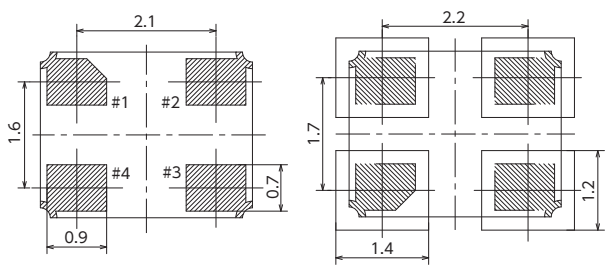


■ Internal Connections
〈Top View〉



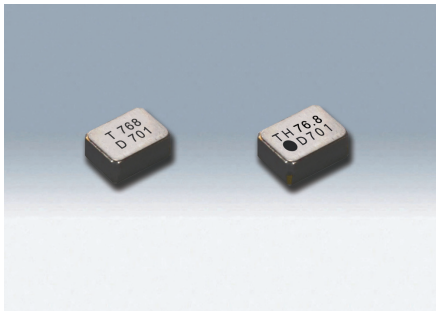
#1 & #3 connected to quartz element
#2 & #4 GND connected or N.C. available

■ Recommended Land Pattern
〈Top View〉



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

DSR1210ATH/DSR1612ATH



Actual size DSR1210ATH ▫ DSR1612ATH ▫

■ Features

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

■ Applications

- Mobile phones
- GPS/GNSS
- Wearable devices

Pb-Free

RoHS Compliant

■ Standard Specification

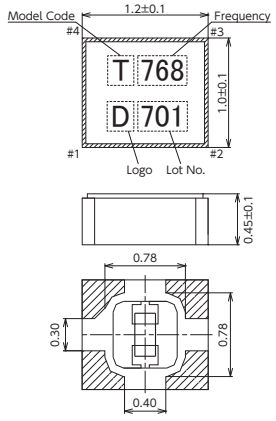
Item \ Type	DSR1210ATH	DSR1612ATH
Frequency Range	76.8MHz	38.4MHz / 52MHz / 76.8MHz
Overtone Order	Fundamental	
Load Capacitance	6pF, 7pF, 8pF	
Drive Level	10μW (100μW max.)	
Frequency Tolerance	±10×10^{-6} (at 25℃)	
Series Resistance	80Ω max.	
Frequency Characteristics over Temperature	±12×10^{-6} / −30 to +85 ℃	
Storage Temperature Range	−40 to +125 ℃	
Thermistor Resistance	100kΩ (at +25℃)	22kΩ / 100kΩ(at +25℃)
Thermistor B-constant	4250K (+25℃ to +50℃)	3380K / 4250K(+25℃ to +50℃)
Packing Unit (1)	3000pcs./reel (φ180)	

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

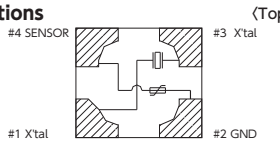
Consult our sales representative for other specifications.

■DSR1210ATH [mm]

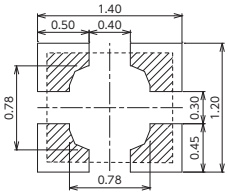
■ Dimensions



■ Internal Connections 〈Top View〉

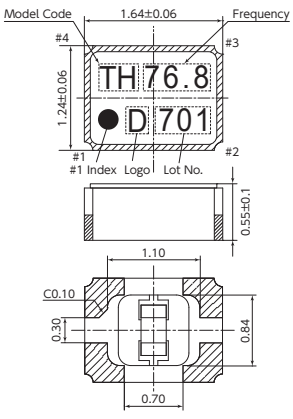


■ Recommended Land Pattern 〈Top View〉

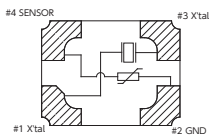


■DSR1612ATH [mm]

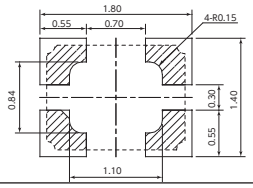
■ Dimensions



■ Internal Connections 〈Top View〉

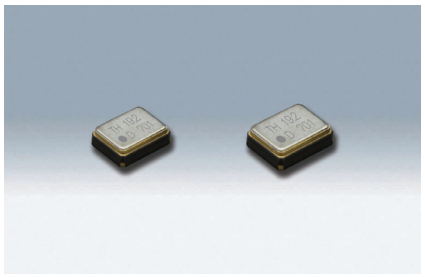


■ Recommended Land Pattern 〈Top View〉



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

DSR211STH/DSR221STH



Actual size DSR211STH DSR221STH

■ Features

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

■ Applications

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

Pb-Free

RoHS Compliant

■ Standard Specification

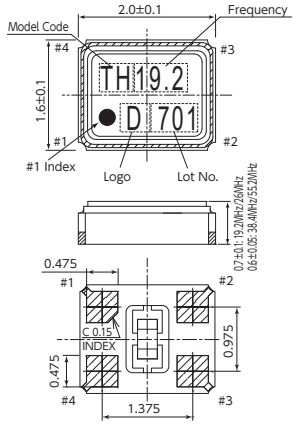
Item \ Type	DSR211STH	DSR221STH
Frequency Range	19.2MHz / 26MHz / 38.4MHz / 55.2MHz	19.2MHz / 26MHz
Overtone Order	Fundamental	
Load Capacitance	6pF, 7pF, 8pF	
Drive Level	10μW (100μW max.)	
Frequency Tolerance	±10×10^{-6} (at 25℃)	
Series Resistance	80Ω max.	
Frequency Characteristics over Temperature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

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

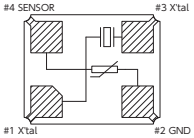
Consult our sales representative for other specifications.

■ DSR211STH [mm]

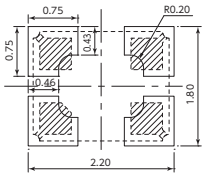
■ Dimensions



■ Internal Connections 〈Top View〉

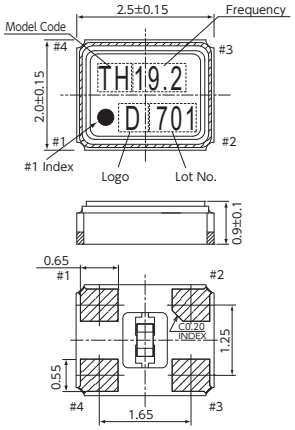


■ Recommended Land Pattern 〈Top View〉

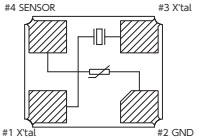


■ DSR221STH [mm]

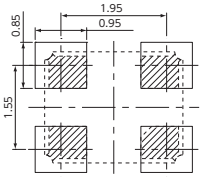
■ Dimensions



■ Internal Connections 〈Top View〉

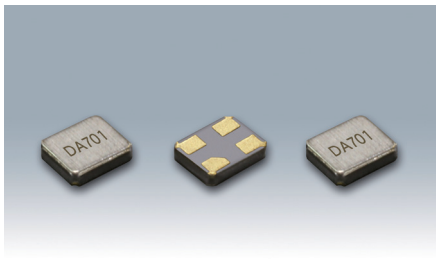


■ Recommended Land Pattern 〈Top View〉



SMD Tuning Fork Crystal Resonators / kHz Band Crystal Resonators

DST1210A



Actual size

■ Features

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

■ Applications

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

Pb-Free

RoHS Compliant

■ Standard Specification

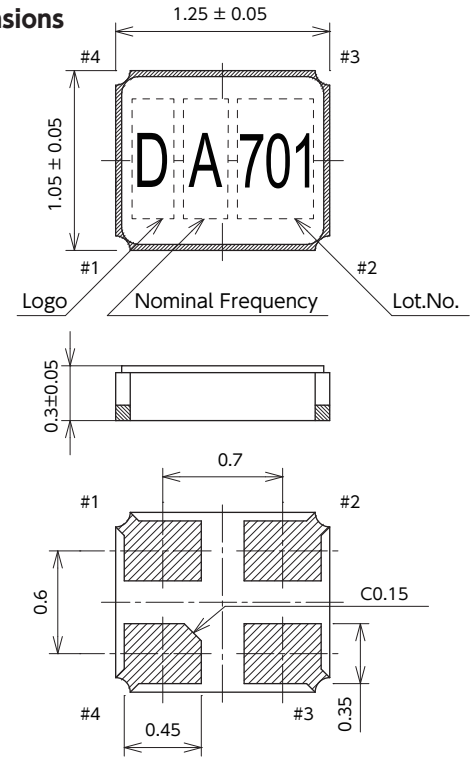
Item \ Type	DST1210A
Frequency Range	32.768kHz
Load Capacitance	7pF, 9pF, 12.5pF
Drive Level	0.1μW (0.2μW max.)
Frequency Tolerance	±20×10^{-6}(at 25℃)
Series Resistance	80kΩ max.
Turnover Temperature	+25℃±5℃
Parabolic Coefficient	−0.04×10^{-6}/℃^{2} max.
Operating Temperature Range	−40 to +85℃
Storage Temperature Range	−40 to +85℃
Shunt Capacitance	1.0pF 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.

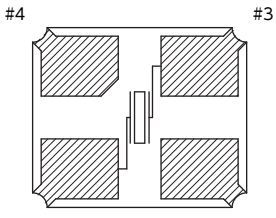
[mm]

■ Dimensions



■ Internal Connections

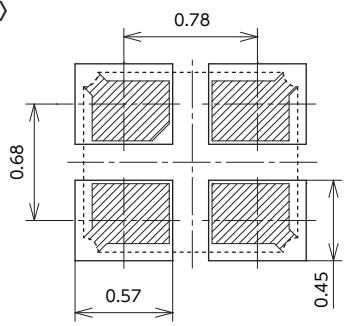
〈Top View〉



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

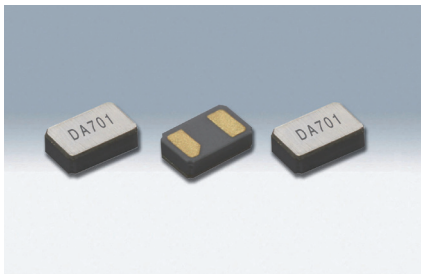
■ Recommended Land Pattern

〈Top View〉

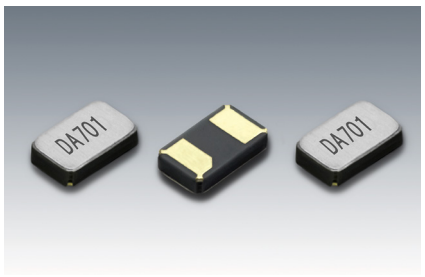


SMD Tuning Fork Crystal Resonators / kHz Band Crystal Resonators

DST1610A/DST210AC



DST1610A Actual size



DST210AC Actual size

■ Features

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

Pb-Free

RoHS Compliant

■ Applications

- Mobile communications and consumer devices, etc.

■ Standard Specification

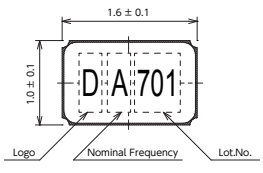
Item \ Type	DST1610A	DST210AC
Frequency Range	32.768kHz	
Load Capacitance	4pF, 6pF, 7pF, 9pF, 12.5pF	6pF, 7pF, 9pF, 12.5pF
Drive Level	0.1μW (0.5μW max.)	
Frequency Tolerance	±20×10^{-6}(at 25℃)	
Series Resistance	50/80kΩ max.	
Turnover Temperature	+25℃±5℃	
Parabolic Coefficient	−0.04×10^{-6}/℃^{2} max.	
Operating Temperature Range	−40 to +85℃	
Storage Temperature Range	−40 to +85℃	
Shunt Capacitance	1.6/1.3pF typ.	
Packing Unit (1)	3000pcs/reel (φ180)	

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

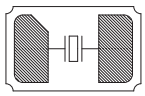
Consult our sales representative for other specifications.

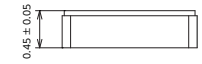
■ DST1610A [mm]

■ Dimensions

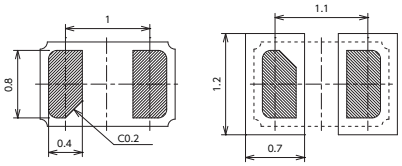


■ Internal Connections



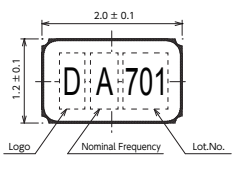


■ Recommended Land Pattern
<Top View>

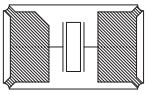


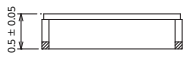
■ DST210AC [mm]

■ Dimensions

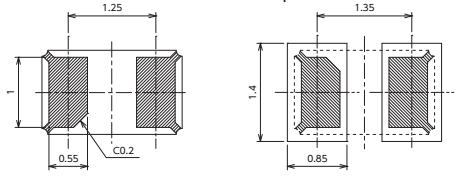


■ Internal Connections
〈Top View〉



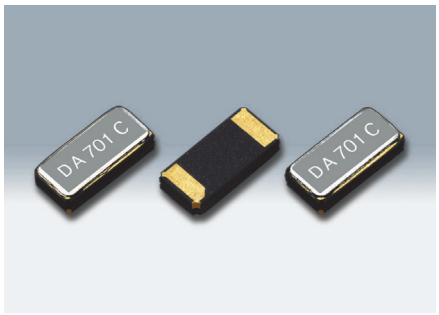


■ Recommended Land Pattern
<Top View>



SMD Tuning Fork Crystal Resonators / kHz Band Crystal Resonators

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.
- Series Resistance 50kΩ max. available.
- AEC-Q200 Compliant

Pb-Free

RoHS Compliant

■ Applications

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

■ Standard Specification

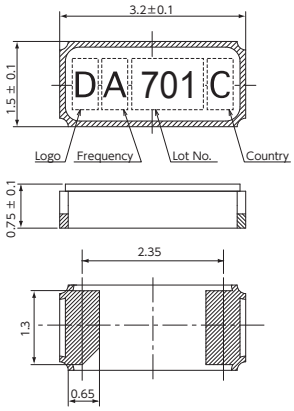
Item \ Type	DST310S
Frequency Range	32.768kHz
Load Capacitance	7pF, 9pF, 12.5pF
Drive Level	0.2μW (1.0μW max.)
Frequency Tolerance	±20×10^{-6} (at 25℃)
Series Resistance	50kΩ max.
Turnover Temperature	+25℃±5℃
Parabolic Coefficient	−0.04×10^{-6}/℃^{2} max.
Operating Temperature Range	−40 to +85℃
Storage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

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

Consult our sales representative for other specifications.

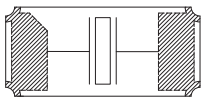
[mm]

■ Dimensions



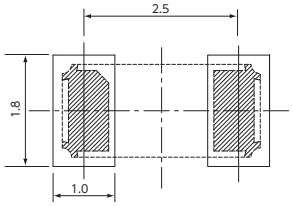
■ Internal Connections

<Top View>



■ Recommended Land Pattern

<Top View>



SMD Tuning Fork Crystal Resonators / kHz Band Crystal Resonators

DMX-26S

Actual size 

■ Features

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

RoHS Compliant

■ Standard Specification

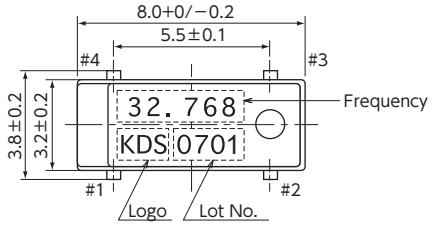
Item \ Type	DMX-26S
Frequency Range	32.768kHz (30 to 90kHz)
Load Capacitance	7pF, 9pF, 12.5pF
Drive Level	1.0μW (2.0μW max.)
Frequency Tolerance	±20×10^{-6}(at 25℃)
Series Resistance	50kΩ max. (1)
Turnover Temperature	+25℃±5℃ (1)
Parabolic Coefficient	−0.04×10^{-6}/℃^{2} max.
Operating Temperature Range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

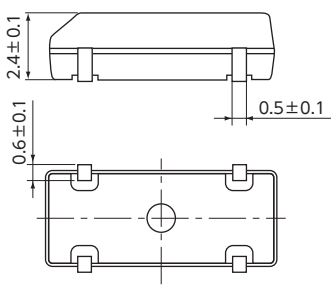
(1) custom specification will be provided for the frequency other than 32.768kHz.
(2) Moisture prevention packing is unnecessary.
Moisture Sensitivity Level : LEVEL 1(IPC/JEDEC J-STD-033)

Consult our sales representative for other specifications.

[mm]

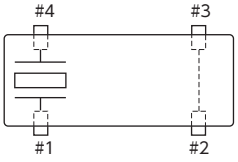
■ Dimensions





■ Internal Connections

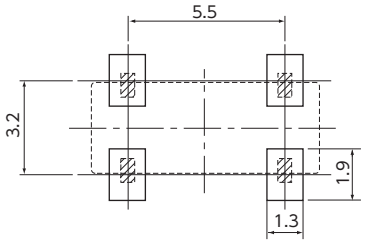
<Top View>



#2 & #3 open (unconnected)

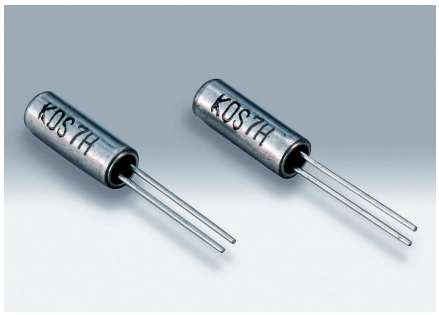
■ Recommended Land Pattern

<Top View>



Tuning Fork Crystal Resonators / kHz Band Crystal Resonators

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



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

Pb-Free

RoHS Compliant

■ Features

- A cylindrical type tuning fork crystal resonator

■ Standard Specification

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

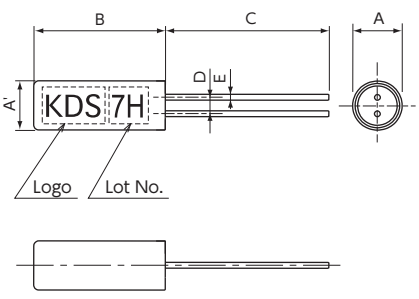
(1) Other capacitance value is available upon your request.
(2) Upon customer request.
(3) Moisture prevention packing is unnecessary.
Moisture Sensitivity Level : LEVEL 1(IPC/JEDEC J-STD-033)

Consult our sales representative for other specifications.

■ Dimensions[mm]

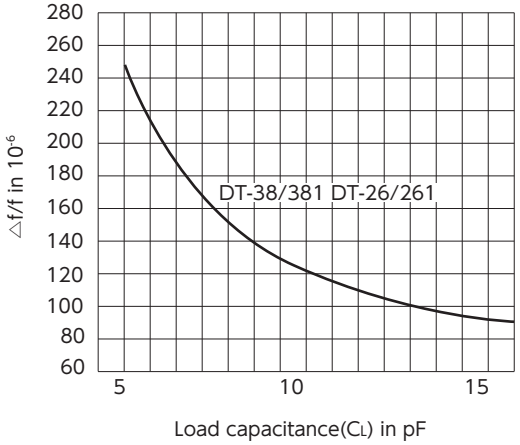
Type	A'	A	B	C	D	E
DT-38, DT-381	φ3.0	φ3.0 $^{+0.1}_{-0.2}$	8.0 $^{+0.3}_{-0.2}$	10.0±1.0	1.1±0.2	φ0.35±0.07
DT-26, DT-261	φ2.0	φ2.0 $^{+0}_{-0.2}$	6.0 $^{+0.1}_{-0.2}$	7.5±1.0	0.7±0.2	φ0.28±0.05

■ Dimensions [mm]



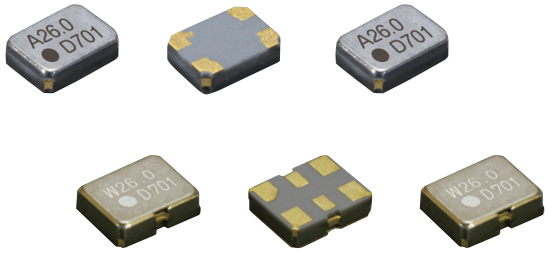
D: Measured from the root of leads

■ Load Capacitance Characteristics (Example)



MEMO

Quartz Devices
Crystal oscillators



〈Example〉 **D S O 3 2 1 S R**

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

D S A 1 6 1 2 S D N

KDS DAISHINKU CORP.

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 charac-teristic 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.

We also have a lineup of crystal oscillators (molded oscillators) in which the crystal resonators and IC are packaged in a molded package.

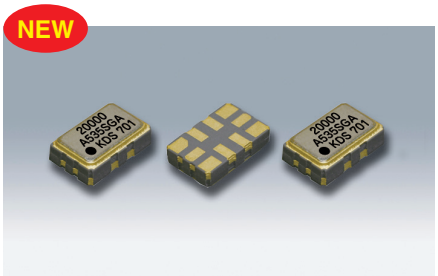
Terminology

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.

Ultra High-precision SMD VC-TCXO/TCXO

DSA535SGA/DSB535SGA/DSA535SGB 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 compatible devices, Networking, Base station

Pb-Free

RoHS Compliant

■ Standard Specification

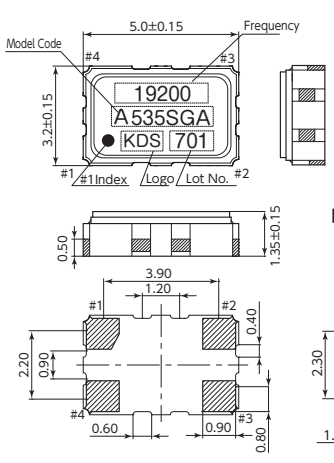
Item	DSA535SGB (VC-TCXO)	DSA535SGA (VC-TCXO)	DSB535SGA (TCXO)
Output Frequency Range	10 to 52MHz		
Standard Frequency	10MHz/ 19.2MHz/ 20MHz/ 38.88MHz		
Supply Voltage (Range)	+2.3 to +3.63V		
Supply Voltage (Vcc)	+2.8V/ +3.0V/ +3.3V		
Current Consumption	+4.0mA max. (Clipped sine wave)/ +8.0mA max. (CMOS)		
Output Level	0.8Vp-p min. (Clipped sine wave/DC-coupled) '0'level 0.1×Vcc V max./'1'level0.9×Vcc V min. (CMOS)		
Output Load	10kΩ//10pF (Clipped sine wave)/15pF (CMOS)		
Frequency Stability			
Tolerance	$\pm1.5\times10^{-6}$ max. (After 2 reflows)		
vs. Temperature	$\pm0.10\times10^{-6}$ max. / -40 to +85℃ $\pm0.20\times10^{-6}$ max. / -40 to +105℃		
vs. Temperature Characteristic Control Voltage Change	$\pm0.1\times10^{-6}$ max. (Frequency control sensitivity $\pm5\times10^{-6}$, Vcont=+1.5V±1.0V)	—	
vs. Hysteresis	$\pm0.1\times10^{-6}$ max.		
vs. Supply Voltage	$\pm0.1\times10^{-6}$ max. (Vcc±5% : Clipped sine wave, CMOS (f≦40))/$\pm0.2\times10^{-6}$ max. (Vcc±5% : CMOS (40<f))		
vs. Load Variation	$\pm0.20\times10^{-6}$ max. (10kΩ//10pF±10%/ 15pF ±10%)		
vs. Aging	$\pm1.0\times10^{-6}$ max./year		
Total Frequency Tolerance	$\pm4.6\times10^{-6}$ max. (Inclusive of variations over operating temperature, initial tolerance, supply voltage, load variation, aging)		
Frequency Control			
Control Sensitivity	±3.0 to ±5.0 x 10^{-6}/Vcont=+1.5±1V		—
Response Slope	Positive		—
Phase Noise Offset 100Hz Offset 1kHz Offset 10kHz Offset 100kHz	20MHz (typ.) −118dBc/Hz −139dBc/Hz −155dBc/Hz −158dBc/Hz		20MHz (typ.) −120dBc/Hz −141dBc/Hz −155dBc/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.

■DSA535SGA/DSB535SGA/DSA535SGB (4terminals) [mm]

■ Dimensions

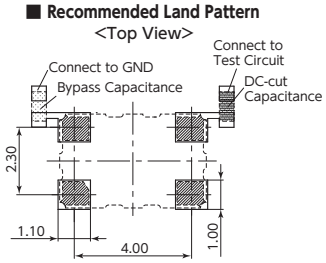


Model Code
DSA535SGA→A535SGA
DSB535SGA→B535SGA
DSA535SGB→A535SGB

Pin Connections(4terminals)

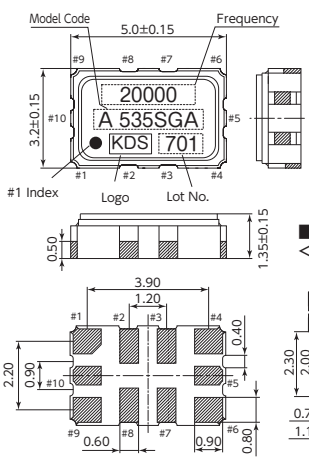
Pin No.	Connection
#1	VCONT(VC-TCXO)/ GND(TCXO)
#2	GND
#3	Output
#4	Vcc

■ Recommended Land Pattern
<Top View>



■ DSA535SGA/DSB535SGA/DSA535SGB (10 terminals) [mm]

■ Dimensions



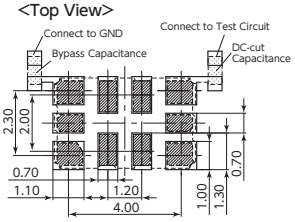
Model Code
DSA535SGA→A535SGA
DSB535SGA→B535SGA
DSA535SGB→A535SGB

Pin Connections

Pin No.	Connection
#1	Vcont(VC-TCXO)/GND(TCXO)
#2	Do Not Connect
#3	ENABLE/DISABLE
#4	GND
#5	Do Not Connect
#6	Output
#7	Do Not Connect/Vcfilter(Option)
#8	Do Not Connect
#9	Vcc
#10	GND

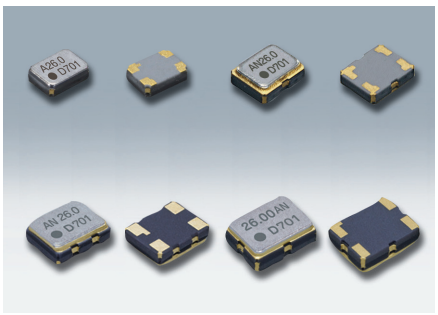
( ):Internal connection

■ Recommended Land Pattern
<Top View>



High-precision SMD VC-TCXO/TCXO

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



Actual size DSA1612SDN DSA211SDN DSA221SDN DSA321SDN

■ Features

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

■ Applications

- Mobile phones
- GPS/GNSS and Industrial radio communications

Pb-Free

RoHS Compliant

[Type]

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

■ Standard Specification

Item \ Type	VC-TCXO				TCXO			
	DSA1612SDN	DSA211SDN	DSA221SDN	DSA321SDN	DSB1612SDN	DSB211SDN	DSB221SDN	DSB321SDN
Frequency Range	16 to 60MHz	12.288 to 52MHz	9.6 to 52MHz		16 to 60MHz	12.288 to 52MHz	9.6 to 52MHz	
Standard Frequency	19.2MHz/26MHz/38.4MHz/40MHz/52MHz				16.3676MHz/16.367667MHz/16.368MHz/16.369MHz/16.8MHz/26MHz/33.6MHz			
Supply Voltage Range	+1.68 to +3.5V							
Supply Voltage (Vcc)	+1.8V/+2.6V/+2.8V/+3.0V/+3.3V							
Current Consumption	+1.5mA max. (f≦26MHz) /+2.0mA max. (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	±1.0×10^{-6},±2.5×10^{-6} max./-30 to +85℃ ±1.0×10^{-6},±2.5×10^{-6} max./-40 to +85℃(Option)				±0.5×10^{-6},±2.5×10^{-6} max./-30 to +85℃ ±0.5×10^{-6},±2.5×10^{-6} max./-40 to +85℃(Option)			
vs. Supply Voltage	±0.2×10^{-6} max. (Vcc ±5%)							
vs. Load Variation	±0.2×10^{-6} max. (10kΩ//10pF±10%)							
vs. Aging	±1.0×10^{-6} max./year							
Frequency Control Control Sensitivity	±3.0×10^{-6} to ±5.0×10^{-6}/Vcont=+1.4V±1V @Vcc≧+2.6V ±3.0×10^{-6} to ±5.0×10^{-6}/Vcont=+0.9V±0.6V @Vcc=+1.8V				–			
Response Slope	Positive				–			
Start up Time	2.0ms max.							
Phase Noise Offset 100Hz Offset 1kHz Offset 10kHz Offset 100kHz	[f≦26MHz] -115dBc/Hz -130dBc/Hz -150dBc/Hz -155dBc/Hz		[26MHz<f≦40MHz] -110dBc/Hz -130dBc/Hz -150dBc/Hz -155dBc/Hz		[40MHz<f≦52MHz] -105dBc/Hz -125dBc/Hz -145dBc/Hz -150dBc/Hz			
Packing Unit (1)	DSA1612SDN/DSA211SDN/DSA221SDN, DSB1612SDN/DSB211SDN/DSB221SDN : 3000pcs./reel (ϕ180) DSA321SDN, DSB321SDN : 2000pcs./reel (ϕ180)							

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

Consult our sales representative for other specifications.

High-precision SMD VC-TCXO/TCXO

For Mobile communications/Industrial system/GPS/GNSS

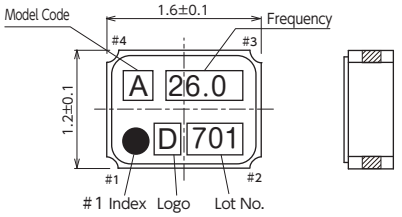
■ Dimensions

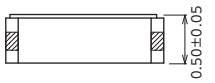
[mm]

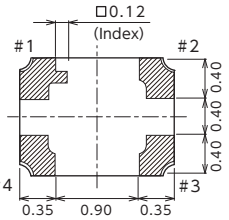
■ DSA1612SDN/DSB1612SDN

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

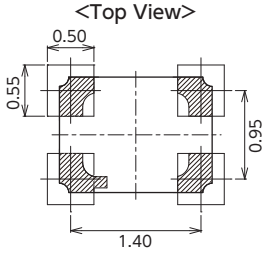
Pin Connections	
Pin No.	Connection
#1	Vcont(VC-TCXO)/GND(TCXO)
#2	GND
#3	Output
#4	Vcc







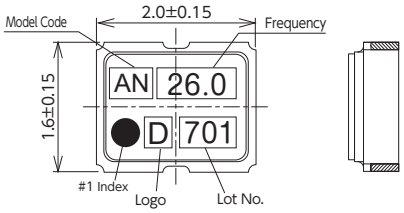
■ Recommended Land Pattern
<Top View>

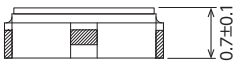


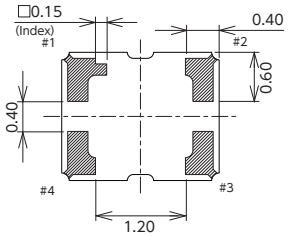
■ DSA211SDN/DSB211SDN

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

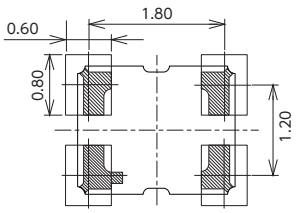
Pin Connections	
Pin No.	Connection
#1	Vcont(VC-TCXO)/GND(TCXO)
#2	GND
#3	Output
#4	Vcc







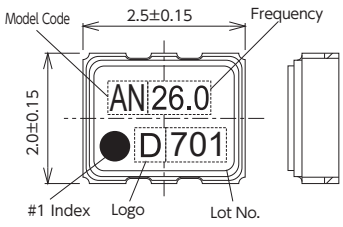
■ Recommended Land Pattern
<Top View>

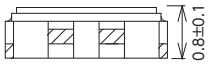


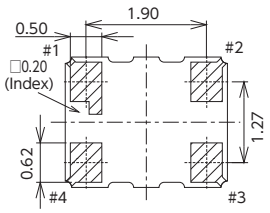
■ DSA221SDN/DSB221SDN

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

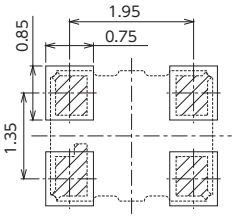
Pin Connections	
Pin No.	Connection
#1	Vcont(VC-TCXO)/GND(TCXO)
#2	GND
#3	Output
#4	Vcc







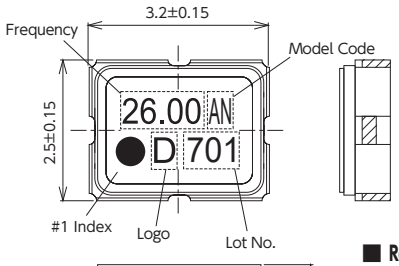
■ Recommended Land Pattern
<Top View>

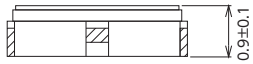


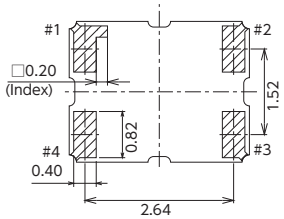
■ DSA321SDN/DSB321SDN

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

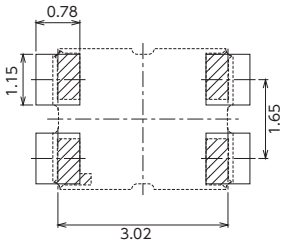
Pin Connections	
Pin No.	Connection
#1	Vcont(VC-TCXO)/GND(TCXO)
#2	GND
#3	Output
#4	Vcc





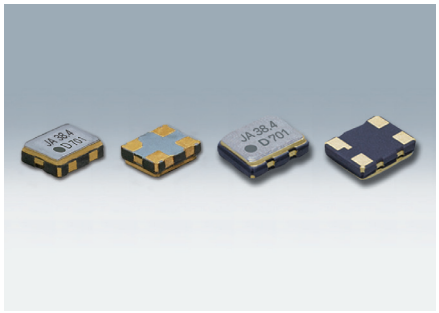


■ Recommended Land Pattern
<Top View>



SMD TCXO

DSB211SJA/DSB221SJA



Actual size DSB211SJA DSB221SJA

■ Features

- Capable of operating over a wide temperature range, from -40 to +105℃
- Supply voltage from +1.7 up to +3.6V
- CMOS Level Output
- Low phase noise
- Single package structure
- AEC-Q100/AEC-Q200 Compliant (DSB211SJA)

Pb-Free

RoHS Compliant

■ Applications

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

■ Standard Specification

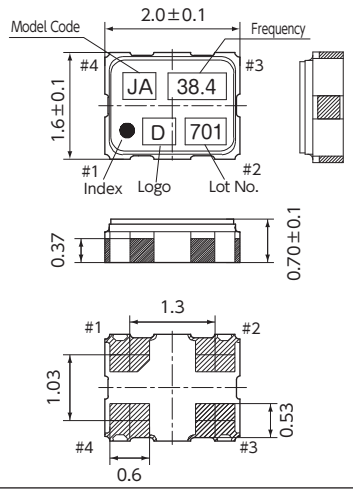
Item \ Type	DSB211SJA	DSB221SJA
Frequency Range	13 to 52MHz	11 to 52MHz
Standard Frequency	19.2MHz/ 25MHz/ 26MHz/ 32MHz/ 38.4MHz/ 40MHz/ 48MHz/ 52MHz	
Supply Voltage (Vcc)	+1.8V/ +2.5V/ +2.8V/ +3.3V	
Current Consumption	5.0mA max. [No Load]	
Stand-by Current (#1 pin "L" Level)	+10μA max.	
Frequency Stability Tolerance	±1.5×10^{-6} max.(After 2 reflows)	
vs. Temperature	±2.5×10^{-6} max./ -40 to +85℃ ±5.0×10^{-6} max./ -40 to +105℃ ±20×10^{-6} max./ -40 to +125℃(Option)	
vs. Aging	±1.0×10^{-6} max./year	
Symmetry	45 to 55% (50% Vcc Level)	
0 Level Output Voltage	Vcc×0.1V max.	
1 Level Output Voltage	Vcc×0.9V min.	
Output Load	15pF	
Rise and Fall Time	5ns max.(10% to 90% Vcc Level)	
OE Pin 0 Level Input Voltage	Vcc×0.2V max.	
OE Pin 1 Level Input Voltage	Vcc×0.8V min.	
Start Up Time	3.0ms max.	
Output Enable Time	3.0ms max.	
Output Disable Time	150ns max.	
Phase Noise	[f≦26MHz]	[26MHz<f≦52MHz]
Offset 1kHz	-145dBc/Hz	-141dBc/Hz
Offset 100kHz	-158dBc/Hz	-157dBc/Hz
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.

■ DSB211SJA [mm]

■ Dimensions

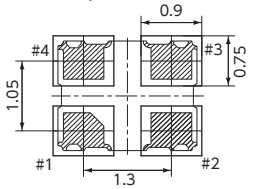


Pin Connections	
Pin No.	Connection
#1	OE (Output Enable)
#2	GND
#3	Output
#4	Vcc

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

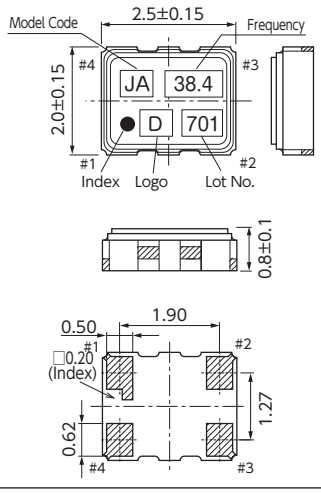
■ Recommended Land Pattern

<Top View>



■ DSB221SJA [mm]

■ Dimensions

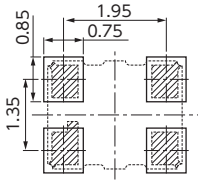


Pin Connections	
Pin No.	Connection
#1	OE (Output Enable)
#2	GND
#3	Output
#4	Vcc

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

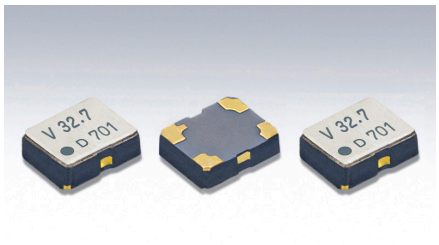
■ Recommended Land Pattern

<Top View>



SMD TCXO

DSK1612ATD



Actual size

■ Features

- Digital temperature compensated type
- High precision : ±5.0×10^{-6} (-40 to +85℃)
- Low current consumption

■ Applications

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

Pb-Free

RoHS Compliant

■ Standard Specification

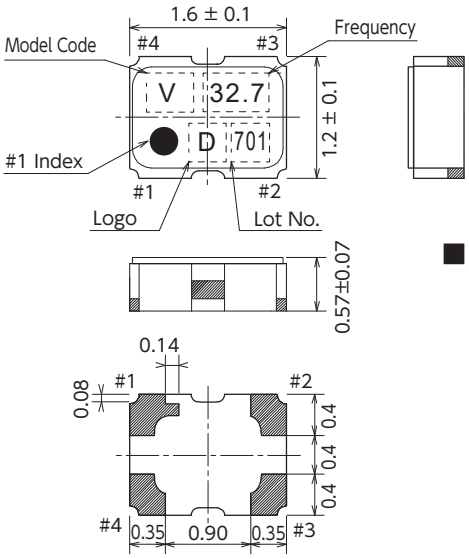
Item	Legend	Spec.				Condition
		min.	typ.	max.	Unit	
Output Frequency	f_0	–	32.768	–	kHz	
Supply Voltage Range	Vcc	+1.5	–	3.63	V	Temperature Compensated Operating
Frequency Tolerance	f_tol	−5.0	–	+5.0	×10^{-6}	Vcc=+1.8V or +3.3V, TA=-40 to +85℃ (Standard operating temperature range, Referenced to 32.768kHz)
Current Consumption	I_{CC1}	–	0.90	1.90	μA	Vcc=+1.8V, TA=-40 to +85℃, at No Load (1)
		–	1.23	2.60		Vcc=+3.3V, TA=-40 to +85℃, at No Load (1)
	I_{CC2}	–	1.26	2.43		Vcc=+1.8V, TA=-40 to +85℃, at No Load Temperature Compensation Interval: 0.5s (standard specification) (2)
		–	1.59	3.12		VCC=+3.3V, TA=-40 to +85℃, at No Load Temperature Compensation Interval: 0.5s (standard specification) (2)
Symmetry	SYM	40	50	60	%	at 50% Vcc
0 Level Output Voltage	V_{OL}	–	–	Vcc×0.1	V	
1 Level Output Voltage	V_{OH}	Vcc×0.9	–	–	V	
Rise and Fall Time	tr, tf	–	–	40	ns	10 to 90% Vcc Level
Load Condition	L_{CMOS}	–	–	15	pF	
Start Up Time	Tstart	–	–	0.5	s	
Packing Unit (3)	3000pcs./reel (φ180)					

(1) I_{CC1} is the current value when the temperature compensation circuit is not operating.
(2) I_{CC2} is the average current value when the temperature compensation circuit is operating and non-operating.
(3) Moisture prevention packing is unnecessary. Moisture Sensitivity Level : Level1 (IPC/JEDEC J-STD-033)

Consult our sales representative for other specifications.

[mm]

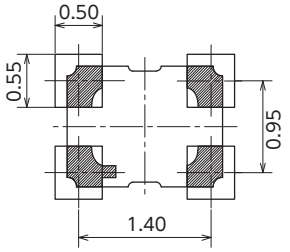
■ Dimensions



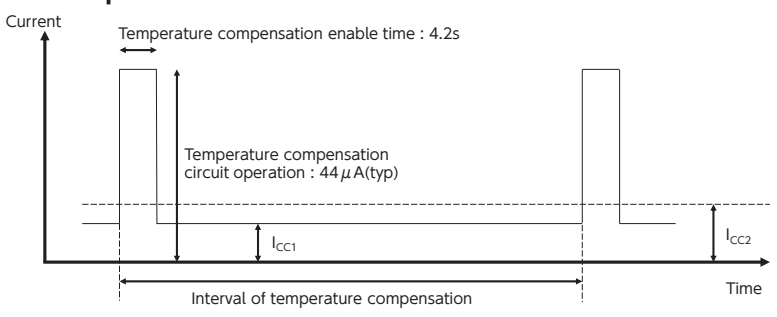
Pin No.	Connection
#1	GND
#2	Output
#3	Vcc
#4	GND

■ Recommended Land Pattern

<Top View>



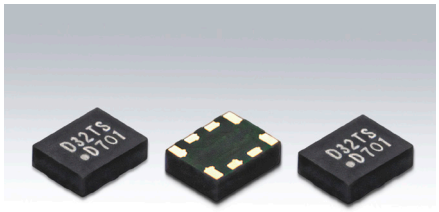
■ Current profile



I_{CC2} (typ)=0.90μA×(0.5s-4.2ms)/0.5s + 44μA×4.2ms/0.5s=1.26 (Vcc=1.8V)
I_{CC2} (typ)=1.23μA×(0.5s-4.2ms)/0.5s + 44μA×4.2ms/0.5s=1.59 (Vcc=3.3V)

SMD Real Time Clock Module

DD3225TS



Actual size

■ Features

- Digital temperature compensated type
- High precision : ±5.0×10^{-6} (-40 to +85℃), ±7.0×10^{-6} (-40 to +105℃)
- Low current consumption
- Low voltage operation : +1.5 to +5.5V (Temperature Compensated Operating), +1.3 to +5.5V (Clock Timing Operating)
- I^{2}C-BUS serial interface : 400kHz fast-mode compatible
- Clock function : hour•minute•second, Calendar function with auto leap year adjustment : year•month•day•day of week
- Alarm interrupt function : day•day of week•hour•minute
- Fixed-cycle timer interrupt function : 244μs to 255min
- Time update interrupt function : minute•second
- Clock output function : 32.768kHz, 1024Hz, 32Hz, 1Hz
- Supply voltage detection function : +1.5V temperature compensation operating voltage detection +1.3V supply voltage under voltage detection
- CMOS Level Output
- AEC-Q100/AEC-Q200 compliant

* "I^{2}C-BUS" is a trademark of NXP semiconductors.

Pb-Free

RoHS Compliant

■ Applications

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

■ Standard Specification

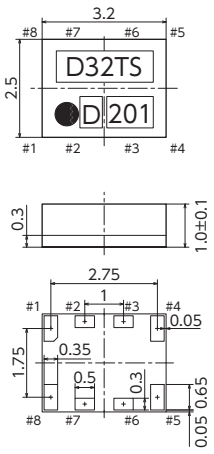
Item	Legend	Spec. min.	Spec. typ.	Spec. max.	Spec. unit	Condition	
Output Frequency	f0	–	32.768	–	kHz		
Supply Voltage Range	Vcc	+1.3	–	+5.5	V	(Clock Timing Operating)	
	Vtem	+1.5	–	+5.5		(Temperature Compensated Operating)	
	Vint	+1.5	–	+5.5		(Interface Operation) I^{2}C-BUS	
Frequency Tolerance	f_tol	-5	–	+5	× 10^{-6}	-40 to +85℃	
		-7	–	+7		-40 to +105℃	
Current Consumption	Icc1	–	0.30	2.10	μA	Vcc = +3.0V	Temperature Compensation Interval:30s, SCL = SDA = INTN = Vcc,OE = GND (Output Off)
		–	0.42	2.90		Vcc = +5.0V	
	Icc2	–	0.90	2.80		Vcc = +3.0V	Temperature Compensation Interval:30s, SCL = SDA = INTN = OE = Vcc (Output On), No Load
		–	1.30	4.00		Vcc = +5.0V	
Load Condition	L_CMOS	–	–	15	pF		
Symmetry	SYM	40	–	60	%	50%Vcc	
1 level Output Voltage	VOH	0.8xVcc	–	–	V	IOH=-1mA	
0 level Output Voltage	VOL	–	–	0.2xVcc	V	IOL=1mA	
Rise / Fall Time	Tr/Tf	–	–	100	ns	20 to 80%Vcc	
OE Pin 1 level Input Voltage	VIH	0.8xVcc	–	Vcc	V		
OE Pin 0 level Input Voltage	VIL	0	–	0.2xVcc	V		
Start Up Time	Tstart	–	–	1	s	Ta = +25℃ , Vcc = +1.3V	
Packing Unit (1)	2000pcs./reel (φ 180)						

(1) Moisture prevention packing
Moisture sensitivity level : Level 2 (IPC/JEDEC J-STD-033)

Consult our sales representative for other specifications.

[mm]

■ Dimensions

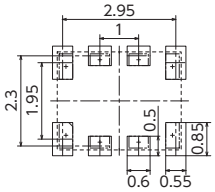


Function	
#1 Input	#5 Output Condition
H	Oscillation out
L	High Z

Marking	
(1) Type	D32TS
(2) Logo	D
(3) Date code	Year(1digit) + Week(2digits) e.g.2022/1/1 → 201

■ Recommended Land Pattern

<Top View>

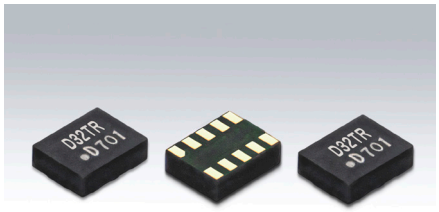


Pin Function

No.	Name	I/0	Description
#1	OE	I	Output control enable input (L:High impedance, H:Clock output)
#2	INTN	0	1Hz signal, alarm interrupt signal, fixed-cycle timer interrupt signal, and time update interrupt signal, Nch open-drain output.
#3	N.C.	-	Do not connect
#4	GND	-	Ground connection.
#5	Output	0	Clock output connection.
#6	SCL	I	I²C-BUS serial interface clock input connection.
#7	SDA	I/0	I²C-BUS serial interface data input/output connection.
#8	Vcc	-	Supply Voltage

SMD Real Time Clock Oscillator

DD3225TR



Actual size

■ Features

- Precision : ±11.5×10^{-6} (30 seconds per month), ±23.0×10^{-6} (60 seconds per month)
- Low current consumption
- Low voltage operation : +1.5 to +5.5V, +1.3 to +5.5V (Clock Timing Operating)
- I^{2}C-BUS serial interface : 400kHz fast-mode compatible
- Clock function : hour•minute•second, Calendar function with auto leap year adjustment : year•month•day•day of week
- Alarm interrupt function : day•day of week•hour•minute
- Fixed-cycle timer interrupt function : 244μs to 255min
- Time update interrupt function : minute•second
- Clock output function : 32.768kHz, 1024Hz, 32Hz, 1Hz
- CMOS Level Output

* "I^{2}C-BUS" is a trademark of NXP semiconductors.

Pb-Free

RoHS Compliant

■ Applications

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

■ Standard Specification

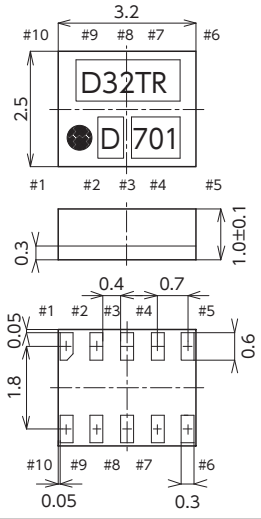
Item	Legend	Spec. min.	Spec. typ.	Spec. max.	Spec. unit	Condition	
Output Frequency	f_0	–	32.768	–	kHz		
Supply Voltage Range	Vcc	+1.3	–	+5.5	V	(Clock Timing Operating)	
	Vint	+1.5	–	+5.5		(Interface Operation) I^{2}C-BUS	
Frequency Tolerance	f_tol	-11.5	–	+11.5	× 10^{-6}	Ta = 25℃ , Vcc = +3.0V (30 seconds per month)	
		-23	–	+23		Ta = 25℃ , Vcc = +3.0V (60 seconds per month)	
Operating temperature range	Ta	-40	–	+85	℃		
Current Consumption	Icc1	–	0.29	2.10	μA	Vcc = +3.0V	SCL = SDA = INTN = Vcc,OE = GND (Output Off)
		–	0.41	2.90		Vcc = +5.0V	
	Icc2	–	0.89	2.80		Vcc = +3.0V	SCL = SDA = INTN = OE = Vcc (Output On), No Load
		–	1.29	4.00		Vcc = +5.0V	
Load Condition	L_CMOS	–	–	15	pF		
Symmetry	SYM	40	–	60	%	50%Vcc	
1 level Output Voltage	V_{OH}	0.8xVcc	–	–	V	I_{OH}=-1mA	
0 level Output Voltage	V_{OL}	–	–	0.2xVcc	V	I_{OL}=1mA	
Rise / Fall Time	Tr/Tf	–	–	100	ns	20 to 80%Vcc	
OE Pin 1 level Input Voltage	V_{IH}	0.8xVcc	–	Vcc	V		
OE Pin 0 level Input Voltage	V_{IL}	0	–	0.2xVcc	V		
Start Up Time	Tstart	–	–	1	s	Ta = +25℃ , Vcc = +1.3V	
Packing Unit (1)	2000pcs./reel (φ 180)						

(1) Moisture prevention packing
Moisture sensitivity level : Level 2 (IPC/JEDEC J-STD-033)

Consult our sales representative for other specifications.

[mm]

■ Dimensions

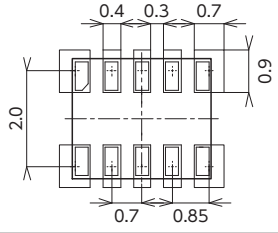


Function	
#2 Input	#4 Output Condition
H	Oscillation out
L	High Z

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

■ Recommended Land Pattern

<Top View>

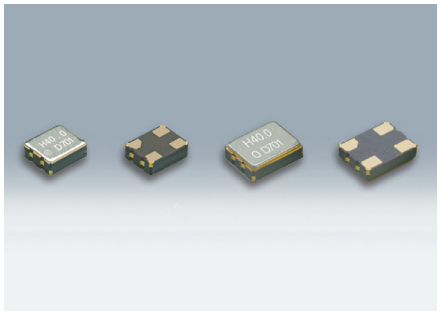


Pin Function

No.	Name	I/O	Function
#1	Vcc	-	Supply Voltage
#2	OE	I	Output control enable input (L:High impedance, H:Clock output)
#3	N.C.	-	Do not connect
#4	Output	O	Clock output connection
#5	SCL	I	I^{2}C-BUS serial interface clock input connection.
#6	EVENT	I	Trigger input for Time stamp request. Internal pull-up resistor can be selected. Input polarity can be selected.
#7	SDA	I/O	I^{2}C-BUS serial interface data input/output connection.
#8	N.C.	-	
#9	GND	-	Ground connection.
#10	INTN	O	1Hz signal, alarm interrupt signal, fixed-cycle timer interrupt signal, and time update interrupt signal, Nch open-drain output.

SMD Low Phase Noise Crystal Oscillators

DSO221SH/DSO321SH



Actual size DSO221SH DSO321SH

■ Features

- Supply Voltage : 1.8V/2.5V/2.8V/3.0V/3.3V
- Low phase noise : fout ±1kHz −145 dBc/Hz(Typ.)
  fout ±100kHz −158 dBc/Hz(Typ.)
- Low profile : 0.815mm(DSO221SH), 1.1mm(DSO321SH)
- AEC-Q200 Compliant (Option: Equivalent to AEC-Q100)
- CMOS Level Output
- 3-state function

Pb-Free

RoHS Compliant

■ Applications

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

[Type]

DSO221SH	2520 size
DSO321SH	3225 size

[Function Code]

DSO****H A A

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

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

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

■ Standard Specification

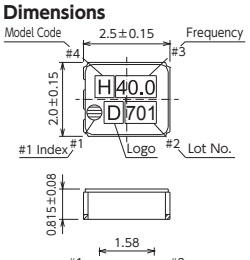
Item	Function Code: Supply Voltage	Function Code: Frequency tolerance	Output Frequency Range (MHz)	Legend	Spec.: min.	Spec.: typ.	Spec.: max.	Spec.: Unit	Condition	
Supply Voltage	A	*	3.5≦f0≦52	V_{CC}	+3.0	+3.3	+3.6	V		
	M				+2.7	+3.0	+3.3			
	B				+2.6	+2.8	+3.0			
	C				+2.25	+2.5	+2.75			
	D				+1.6	+1.8	+2.0			
Frequency Tolerance (Includes frequency tolerance at room temperature.)	*	A	3.5≦f0≦52	f_tol	−100	−	+100	×10^{-6}	−40 to +85℃	−10 to +70℃ (Standard Operating Temperature Range)
		B			−50	−	+50			
		C			−30	−	+30		−20 to +70℃	
		D			−25	−	+25			
		E			−20	−	+20		−10 to +70℃	
Current Consumption	A,M	*	3.5≦f0≦52	I_{CC}	−	−	4.2	mA	No Load	
	B	*								
	C	*								
	D	*			−	−	2.3			
Stand-by Current (#1 pin "L" Level)	*	*	*	I_std	−	−	10	μA		
Load Condition	*	*	*	L_{CMOS}	−	−	15	pF		
Symmetry	A,M,B,C	*	*	SYM	45	50	55	%	at 50% V_{CC}	
	D				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	*	*	tr, tf	−	−	4.0	ns	10 to 90% V_{CC} Level	
	C,D				−	−	6.5			
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	*	*	*	tPLZ	−	−	100	ns		
Output Enable Time	*	*	*	tPZL	−	−	2.0	ms		
Phase Noise	*	*	*	−	−	−140	−	dBc/Hz	Offset 1kHz	
					−	−153	−		Offset 100kHz	
Period Jitter (1)	*	*	*	tRMS	−	2.4	−	ps	σ	
				tp-p	−	23	−		Peak to peak	
Total Jitter (1)	*	*	*	tTL	−	34	−	ps	tDJ+n×tRJ n=14.1(BER=1×10^{-12}) (2)	
Phase Jitter	*	*	40≦f0≦52	tpj	−	−	1	ps	f0 offset:12kHz to 20MHz	
			10≦f0<40						f0 offset:12kHz to 5MHz	
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.

■ DSO221SH [mm]

■ Dimensions

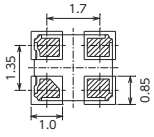


Pin Connections	
Pin No.	Connection
#1	OE (Output Enable)
#2	GND
#3	Output
#4	V_{CC}

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

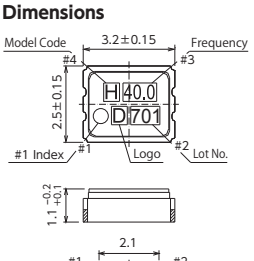
■ Recommended Land Pattern

<Top View>



■ DSO321SH [mm]

■ Dimensions

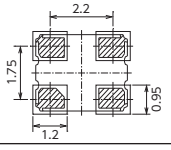


Pin Connections	
Pin No.	Connection
#1	OE (Output Enable)
#2	GND
#3	Output
#4	V_{CC}

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

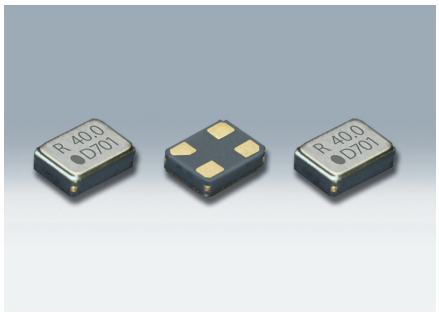
■ Recommended Land Pattern

<Top View>



SMD Crystal Oscillators

DSO1612AR



Actual size

■ Features

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

Pb-Free

RoHS Compliant

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

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

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

■ Standard Specification

Item	Function Code: Supply Voltage	Function Code: Frequency tolerance	Output Frequency Range (MHz)	Legend	Spec. min.	Spec. typ.	Spec. max.	Unit	Condition	
Supply Voltage	A	*	0.584375≦f₀≦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≦f₀≦80	f_tol	−100	−	+100	×10⁻⁶	−40 to +85℃	−10 to +70 (Standard Operating Temperature Range)
		B			−50	−	+50		−20 to +70℃	
		C			−30	−	+30		−10 to +70℃	
		D	0.584375≦f₀≦50		−25	−	+25			
		E			−20	−	+20			
Current Consumption	A,M	*	0.584375≦f₀<40	Icc	−	−	3.0	mA	No Load	
			40≦f₀≦80		−	−	4.2			
	B		0.584375≦f₀<40		−	−	2.4			
			40≦f₀≦80		−	−	3.7			
	C		0.584375≦f₀<40		−	−	2.0			
			40≦f₀≦80		−	−	3.4			
	D		0.584375≦f₀<40		−	−	1.7			
			40≦f₀≦80		−	−	2.7			
Stand-by Current (#1 pin "L" Level)	*	*	*	I_std	−	−	10	μA	−40 to +85℃	
Load Condition	*	*	0.584375≦f₀≦80	L_CMOS	−	−	15	pF		
Symmetry	*	*	0.584375≦f₀≦80	SYM	45	50	55	%	at 50% Vcc	
0 Level Output Voltage	*	*	*	V_{OL}	−	−	Vcc×0.1	V		
1 Level Output Voltage	*	*	*	V_{OH}	Vcc×0.9	−	−			
Rise and Fall Time	A,M,B,C	*	0.584375≦f₀≦80	tr, tf	−	−	3.0	ns	10 to 90% Vcc Level	
	D				−	−	5.0			
OE Pin 0 Level Input Voltage	*	*	*	V_{IL}	−	−	Vcc×0.2	V		
OE Pin 1 Level Input Voltage	*	*	*	V_{IH}	Vcc×0.8	−	−			
Output Disable Time	*	*	*	tPLZ	−	−	200	ns		
Output Enable Time	*	*	*	tPZL	−	−	2	ms		
Period Jitter (1)	*	*	*	tRMS	−	2.2	−	ps	σ	
			*	tp-p	−	20	−		Peak to peak	
Total Jitter (1)	*	*	*	tTL	−	31	−	ps	tDJ+n×tRJ n=14.1 (BER=1×10⁻¹²) (2)	
Phase Jitter	*	*	40≦f₀≦80	tpj	−	−	1	ps	f₀ offset:12kHz to 20MHz	
			10≦f₀<40						f₀ offset:12kHz to 5MHz	
Packing Unit (3)	3000pcs./reel (φ180)									

(1) Measured WAVECREST DTS-2075

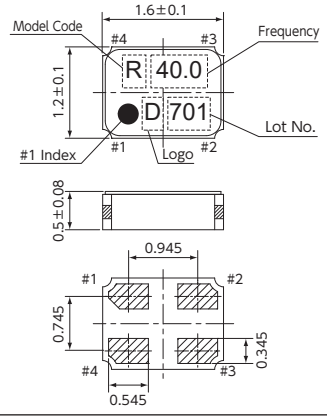
(2) tDJ : Deterministic jitter tRJ : Random jitter

(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



Pin Connections

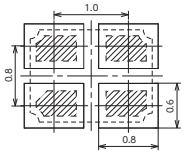
Pin No.	Connection
#1	OE(Output Enable)
#2	GND
#3	Output
#4	Vcc

Function

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

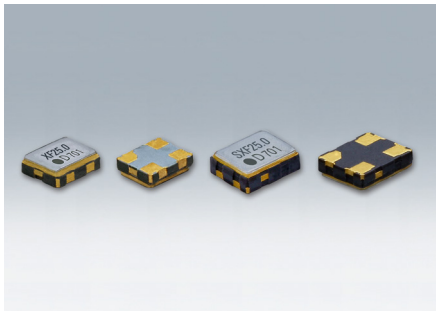
■ Recommended Land Pattern

<Top View>



SMD Crystal Oscillators

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℃ .
- 3-state function

Pb-Free

RoHS Compliant

■ Applications

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

[Type]

DSO211SXF	2016 size
DSO221SXF	2520 size

[Function Code]

DSO***SXF A Z

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

A : ±100×10⁻⁶
Z : ±80×10⁻⁶
B : ±50×10⁻⁶
C : ±30×10⁻⁶
D : ±25×10⁻⁶
E : ±20×10⁻⁶

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

■ Standard Specification

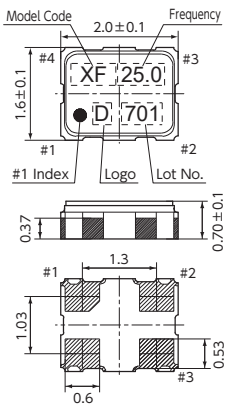
Item	Function Code: Supply Voltage	Function Code: Frequency tolerance	Output Frequency Range (MHz)	Legend	Spec.: min.	Spec.: typ.	Spec.: max.	Spec.: Unit	Condition	
Supply Voltage	A	*	1≦f0≦125	Vcc	+3.0	+3.3	+3.6	V		
	B				+2.6	+2.8	+3.0			
	C				+2.25	+2.5	+2.75			
	D		1≦f0≦100		+1.6	+1.8	+2.0			
Frequency Tolerance (includes frequency tolerance at room temperature)	*	A	*	f_tol	–	–	±100	×10⁻⁶	−40 to +125℃	−10 to +70℃ (Standard Operating Temperature Range)
		Z			–	–	±80			
		B			–	–	±50			
					–	–	±50		−40 to +85℃	
		C			–	–	±30			
		D			–	–	±25		−20 to +70℃	
		E			–	–	±20			
Current Consumption	A	*	100≦f0≦125	Icc	–	–	10.0	mA	No Load	
			40≦f0<100		–	–	4.2			
			1≦f0<40		–	–	2.4			
	B		100≦f0≦125		–	–	9.0			
			40≦f0<100		–	–	3.7			
			1≦f0<40		–	–	2.2			
	C		100≦f0≦125		–	–	8.0			
			40≦f0<100		–	–	3.4			
			1≦f0<40		–	–	2.0			
	D		40≦f0≦100		–	–	2.7			
			1≦f0<40		–	–	1.7			
Stand-by Current (#1 pin "L"Level)	*	*	*	I_std	–	–	10	μA		
Load Condition	*	*	*	L_CMOS	–	–	15	pF		
Symmetry	*	*	*	SYM	45	50	55	%	50% Vcc Level	
0 Level Output Voltage	*	*	*	VOL	–	–	Vcc×0.1	V		
1 Level Output Voltage	*	*	*	VOH	Vcc×0.9	–	–			
Rise and Fall Time	A, B, C	*	*	tr, tf	–	–	3	ns	10 to 90% Vcc Level	
	D				–	–	5			
OE Pin 0 Level Input Voltage	*	*	*	VIL	–	–	Vcc×0.3	V		
OE Pin 1 Level Input Voltage	*	*	*	VIH	Vcc×0.7	–	–			
Output Disable Time	*	*	*	tPLZ	–	–	200	ns		
Output Enable Time	*	*	*	tPZL	–	–	2	ms		
Period Jitter (1)	*	*	*	tRMS	–	2.4	–	ps	σ	
				tp-p	–	23	–		Peak to peak	
Total Jitter (1)	*	*	*	tTL	–	34	–	ps	tDJ+n×tRJ n=14.1(BER=1×10⁻¹²) (2)	
Phase Jitter	*	*	40≦f0≦125	tpj	–	–	1	ps	f0 offset:12kHz to 20MHz	
			10≦f0<40						f0 offset:12kHz to 5MHz	
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 : Level1 (IPC/JEDEC J-STD-033)

Consult our sales representative for other specifications.

■ DSO211SXF [mm]

■ Dimensions



Pin Connections

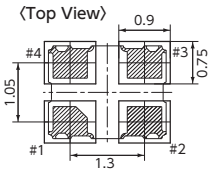
Pin No.	Connection
#1	OE(Output Enable)
#2	GND
#3	Output
#4	Vcc

Function

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

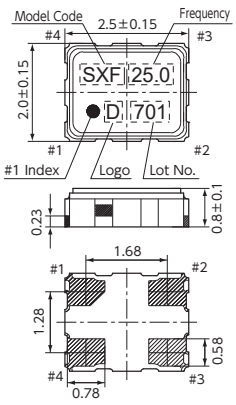
■ Recommended Land Pattern

〈Top View〉



■ DSO221SXF [mm]

■ Dimensions



Pin Connections

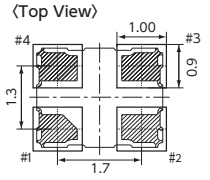
Pin No.	Connection
#1	OE(Output Enable)
#2	GND
#3	Output
#4	Vcc

Function

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

■ Recommended Land Pattern

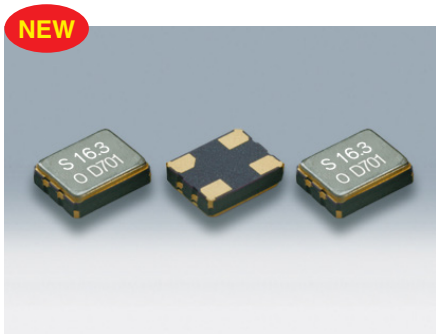
〈Top View〉



SMD Crystal Oscillators

DSO321SRS

NEW



Actual size

■ Features

- Fast output enable time : 200ns
- 3-state function
- Supply Voltage : 3.3V
- Available frequency range : 8.25 to 66MHz
- CMOS Level Output

■ Applications

- Visual applications, Sever, SSD
- Industrial equipment

[Function Code]

DSO321SRS A A

A :3.3V

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

Pb-Free

RoHS Compliant

■ 一般仕様

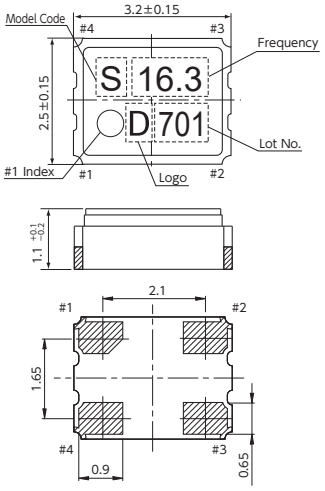
Item	Function Code		Output Frequency Range (MHz)	Legend	Spec.				Condition	
	Supply Voltage	Frequency tolerance			min.	typ.	max.	Unit		
Supply Voltage	A	*	8.25≦f0≦66	Vcc	+3.0	+3.3	+3.6	V		
Frequency Tolerance (Includes frequency tolerance at room temperture)	*	A	*	f_tol	−100	−	+100	×10⁻⁶	−40 to +100℃	−10 to +70℃ (Standard Operating Temperature Range)
		B			−50	−	+50		−40 to +85℃	
		C			−30	−	+30		−20 to +70℃	
		D			−25	−	+25			
		E			−20	−	+20		−10 to +70℃	
Current Consumption	A	*	33<f0≦66	Icc	−	−	4.8	mA	No Load	
			16.5<f0≦33		−	−	4.1			
			8.25≦f0≦16.5		−	−	3.7			
Stand-by Current (#1 pin "L" Level)	A	*	33<f0≦66	I_std	−	−	3.8	mA		
			16.5≦f0≦33		−	−	2.9			
			8.25≦f0<16.5		−	−	2.4			
Load Condition	*	*	*	L_CMOS	−	−	15	pF		
Symmetry	*	*	*	SYM	45	50	55	%	at 50% Vcc	
0 Level Output Voltage	*	*	*	VOL	−	−	Vcc×0.1	V		
1 Level Output Voltage	*	*	*	VOH	Vcc×0.9	−	−	V		
Rise and Fall Time	*	*	*	tr, tf	−	−	10	ns	10 to 90% Vcc Level	
OE Pin 0 Level Input Voltage	*	*	*	VIL	−	−	Vcc×0.2	V		
OE Pin 1 Level Input Voltage	*	*	*	VIH	Vcc×0.8	−	−	V		
Output Disable Time	*	*	*	tPLZ	−	−	100	ns		
Output Enable Time	*	*	*	tPZL	−	−	200	ns		
Period Jitter (1)	*	*	*	tRMS	−	2.2	−	ps	σ	
	*	*	*	tp-p	−	20	−		Peak to peak	
Total Jitter (1)	*	*	*	tTL	−	31	−		tDJ+n×tRJ n=14.1(BER=1×10⁻¹²) (2)	
Phase Jitter	*	*	40≦f0≦66	tpj	−	−	1		f0 offset:12kHz to 20MHz	
			10≦f0<40						f0 offset:12kHz to 5MHz	
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.

[mm]

■ Dimensions



Pin Connections

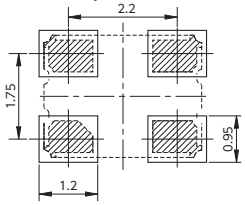
Pin No.	Connection
#1	OE(Output Enable)
#2	GND
#3	Output
#4	Vcc

Function

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

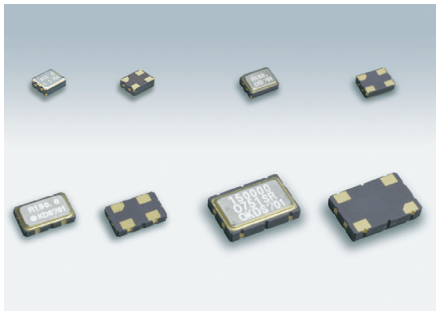
■ Recommended Land Pattern

<Top View>



SMD Crystal Oscillators

DSO221SR/DSO321SR/DSO531SR/DSO751SR



Actual size DSO221SR DSO321SR DSO531SR DSO751SR

■ Features

- Low current consumption: 8mA max (167MHz, 3.3V)
- Supply Voltage: 1.8V/2.5V/2.8V/3.0V/3.3V
- Offers Narrow deviation: $\pm 20\times10^{-6}/\pm 30\times10^{-6}/\pm 50\times10^{-6}/\pm 100\times10^{-6}$
- Available up to 167MHz by using AT cut fundamental resonator.
- Low jitter provides for high performance.
- Low profile: 0.815mm(DSO221SR),
  1.1mm(DSO321SR/DSO531SR),
  1.5mm(DSO751SR)
- AEC-Q200 Compliant
  (Option: Equivalent to AEC-Q100)
  (DSO221SR/DSO321SR)
- CMOS Level Output

Pb-Free

RoHS Compliant

[Type]

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

[Function Code]

DSO***SR A A

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

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

■ Standard Specification

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

Item	Function Code: Supply Voltage	Function Code: Frequency tolerance	Output Frequency Range (MHz)	Legend	Spec.: min.	typ.	max.	Unit	Condition
Supply Voltage	A	*	0.2≦f0≦167	Vcc	+3.0	+3.3	+3.6	V	
	M		0.2≦f0≦167		+2.7	+3.0	+3.3		
	B		0.2≦f0≦157		+2.6	+2.8	+3.0		
	C		0.2≦f0≦157		+2.25	+2.5	+2.75		
	D		0.2≦f0≦80		+1.6	+1.8	+2.0		
Frequency Tolerance (Includes frequency tolerance at room temperature.)	*	A	0.2≦f0≦167	f_tol	−100	−	+100	×10⁻⁶	−40 to +85℃ / −10 to +70℃ (Standard Operating Temperature Range)
		B	0.2≦f0≦125		−50	−	+50		
		C	0.2≦f0≦80		−30	−	+30		−20 to +70℃ / −10 to +70℃ (Standard Operating Temperature Range)
		D	0.2≦f0≦80		−25	−	+25		
		E	0.2≦f0≦50		−20	−	+20		−10 to +70℃ / −10 to +70℃ (Standard Operating Temperature Range)
Current Consumption	A,M	*	0.2≦f0<32	Icc	−	−	1.8	mA	No Load
			32≦f0<54		−	−	2.5		
			54≦f0<80		−	−	5.0		
			80≦f0<125		−	−	6.0		
			125≦f0≦167		−	−	8.0		
	B	*	0.2≦f0<32		−	−	1.8		
			32≦f0<54		−	−	2.5		
			54≦f0<125		−	−	5.0		
			125≦f0≦157		−	−	7.0		
	C	*	0.2≦f0<32		−	−	1.5		
			32≦f0<54		−	−	2.0		
			54≦f0<125		−	−	4.0		
			125≦f0≦157		−	−	6.0		
	D	*	0.2≦f0<32		−	−	1.0		
			32≦f0<54		−	−	1.4		
			54≦f0≦80		−	−	3.0		
Stand-by Current (#1 pin "L" Level)	*	*	*	I_std	−	−	10	μA	
Load Condition	*	*	*	L_CMOS	−	−	15	pF	
	A,M		0.2≦f0≦80		−	−	30		
Symmetry	*	*	f0<50	SYM	45	50	55	%	50% Vcc Level
			f0≧50		40	50	60		
0 Level Output Voltage	*	*	*	VOL	−	−	Vcc×0.1	V	
1 Level Output Voltage	*	*	*	VOH	Vcc×0.9	−	−		
Rise and Fall Time	A,M,B,C	*	0.2≦f0≦54	tr, tf	−	−	5 (4)	ns	L_CMOS:15pF 10 to 90% Vcc Level (20 to 80% Vcc Level)
	D		0.2≦f0≦54		−	−	7 (6)		
	*		54<f0<100		−	−	4 (3)		
	*		100≦f0≦167		−	−	3 (2.5)		
	A,M		0.2≦f0≦54		−	−	10		L_CMOS:30pF 10 to 90% Vcc Level
	A,M		54<f0≦80		−	−	6		
OE Pin 0 Level Input Voltage	*	*	*	VIL	−	−	Vcc×0.2	V	
OE Pin 1 Level Input Voltage	*	*	*	VIH	Vcc×0.8	−	−		
Output Disable Time	*	*	*	tPLZ	−	−	150	ns	
Output Enable Time	*	*	*	tPZL	−	−	1	ms	
Period Jitter (1)	*	*	*	tRMS	−	2.2	−	ps	σ
				tp-p	−	20	−		Peak to peak
Total Jitter (1)	*	*	*	tTL	−	31	−	ps	tDJ+n×tRJ n=14.1(BER=1×10⁻¹²) (2)
Phase Jitter	*	*	40≦f0≦167	tpj	−	−	1	ps	f0 offset:12kHz to 20MHz
			10≦f0<40						f0 offset:12kHz to 5MHz
Packing Unit (3)	DSO221SR, DSO321SR: 2000pcs./reel (φ180) , DSO531SR: 1000pcs./reel (φ180) , DSO751SR: 1000pcs./reel (φ254)								

Consult our sales representative for other specifications.

(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)

SMD Crystal Oscillators

DSO221SR/DSO321SR/DSO531SR/DSO751SR

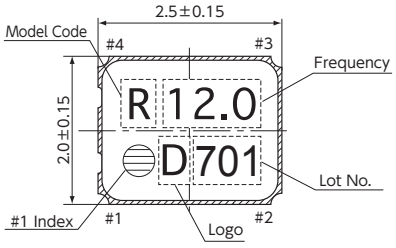
■ Applications

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

■ Dimensions

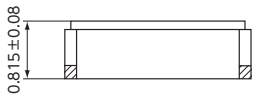
[mm]

DSO221SR

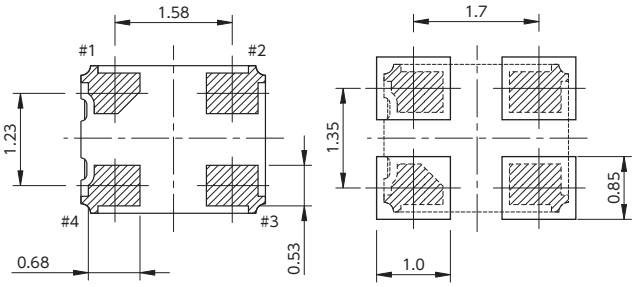


Pin Connections	
Pin No.	Connection
#1	OE(Output Enable)
#2	GND
#3	Output
#4	Vcc

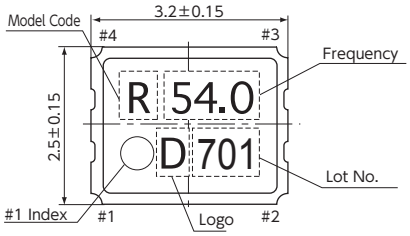
Function	
#1Input	#3 Output condition
H	Oscillation out
Open	Oscillation out
L	High Z



■ Recommended Land Pattern
〈Top View〉

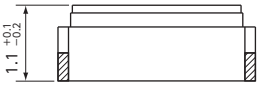


DSO321SR

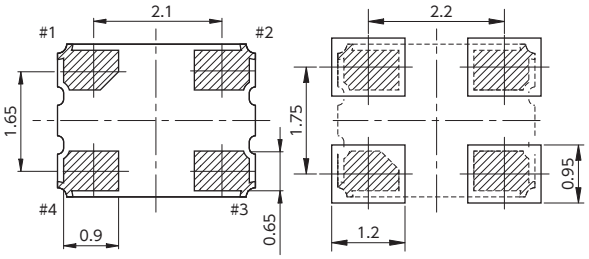


Pin Connections	
Pin No.	Connection
#1	OE(Output Enable)
#2	GND
#3	Output
#4	Vcc

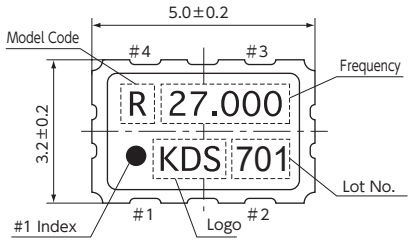
Function	
#1Input	#3 Output condition
H	Oscillation out
Open	Oscillation out
L	High Z



■ Recommended Land Pattern
〈Top View〉

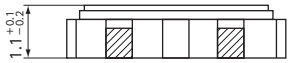


DSO531SR

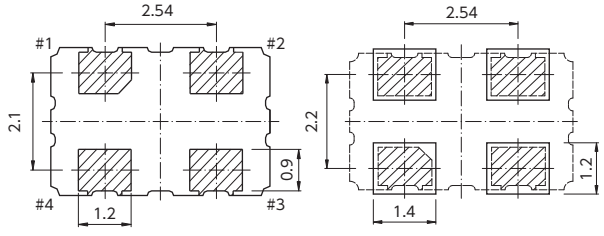


Pin Connections	
Pin No.	Connection
#1	OE(Output Enable)
#2	GND
#3	Output
#4	Vcc

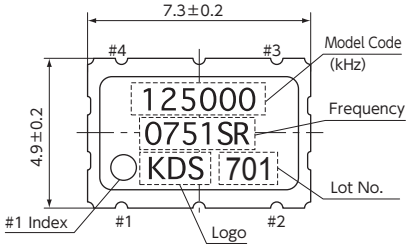
Function	
#1Input	#3 Output condition
H	Oscillation out
Open	Oscillation out
L	High Z



■ Recommended Land Pattern
〈Top View〉

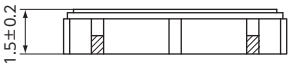


DSO751SR

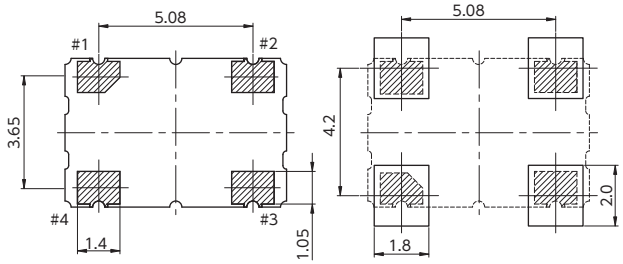


Pin Connections	
Pin No.	Connection
#1	OE(Output Enable)
#2	GND
#3	Output
#4	Vcc

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

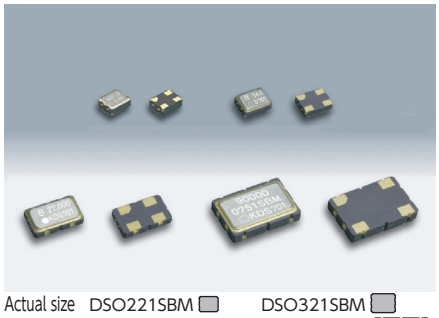


■ Recommended Land Pattern
〈Top View〉



SMD Crystal Oscillators

DSO221SBM/DSO321SBM/DSO531SBM/DSO751SBM



Actual size DSO221SBM DSO321SBM
DSO531SBM DSO751SBM

■ Features

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

■ Applications

- PC, visual and FA equipment applications

[Type]

DSO221SBM	2520 size
DSO321SBM	3225 size
DSO531SBM	5032 size
DSO751SBM	7349 size

Pb-Free RoHS Compliant

[Function Code]

DSO***SBM Y A

Y : 5.0V
A : ±100×10^{-6}
B : ±50×10^{-6}
C : ±30×10^{-6}

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

■ Standard Specification

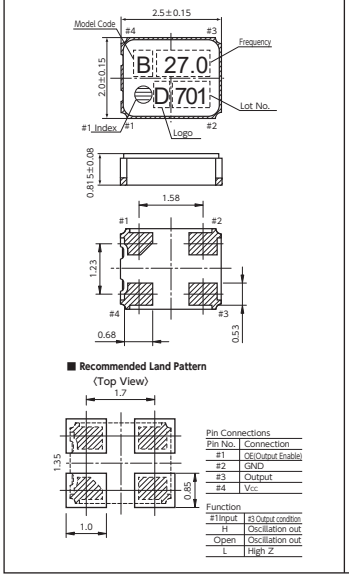
Item	Legend	Function Code		DSO221SBM Output Frequency Range (MHz)	DSO221SBM Spec. min.	typ.	max.	DSO321, 531, 751 SBM Output Frequency Range (MHz)	DSO321, 531, 751 SBM Spec. min.	Typ.	max.	Unit	Condition
Supply Voltage	V_{CC}	*	*	3.25≦f_0≦52	+4.5	+5.0	+5.5	0.7≦f_0≦90	+4.5	+5.0	+5.5	V	
Frequency Tolerance (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℃ / −10 to +70℃ (Standard Operating Temperature Range)
			B	3.25≦f_0≦52	−50	–	+50	0.7≦f_0≦90	−50	–	+50		−20 to +70℃
			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	*	*	*	–	–	10	*	–	–	50	μA	
Load Condition	L_{CMOS}	*	*	*	–	–	15	*	–	–	30	pF	
Symmetry	SYM	*	*	*	45	50	55	f_0<26	45	50	55	%	50% V_{CC} Level
								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	–	–		
Rise and Fall Time	tr, tf	*	*	3.25≦f_0≦52	–	–	4.0	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	–	–		
Output Disable Time	tPLZ	*	*	*	–	–	100	*	–	–	150	ns	
Output Enable Time	tPZL	*	*	*	–	–	2.0	*	–	–	1	ms	
Period Jitter (1)	tRMS	*	*	*	–	2.5	–	*	–	2.5	–	ps	σ
	tp-p			*	–	20	–	*	–	20	–		Peak to peak
Total Jitter (1)	tTL	*	*	*	–	35	–	*	–	35	–	ps	tDJ+n×tRJ n=14.1 (BER=1×10^{-12}) (2)
Phase Jitter	tpj	*	*	40≦f_0≦52	–	–	1	40≦f_0≦90	–	–	1	ps	f_0 offset:12kHz to 20MHz
				10≦f_0<40				10≦f_0<40					f_0 offset:12kHz to 5MHz
Packing Unit (3)	DSO221SBM, DSO321SBM: 2000pcs./reel (φ180) , DSO531SBM: 1000pcs./reel (φ180) , DSO751SBM: 1000pcs./reel (φ254)												

(1) Measured WAVECREST DTS-2075
(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.

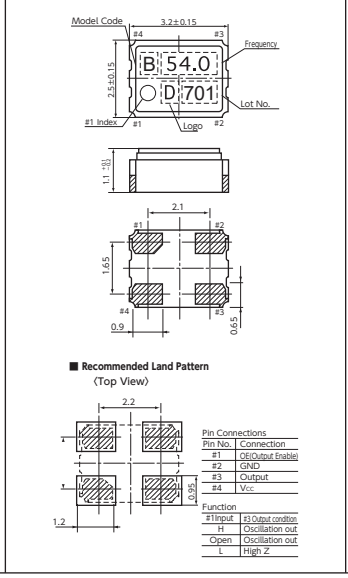
■ DSO221SBM [mm]

■ Dimensions



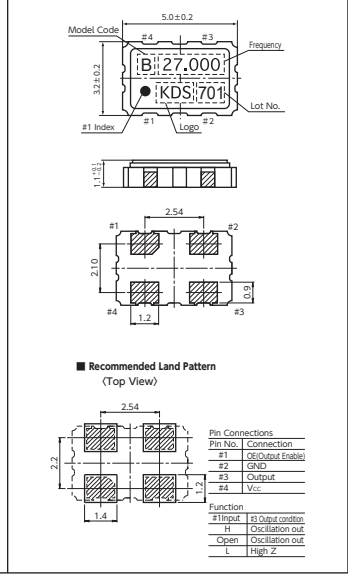
■ DSO321SBM [mm]

■ Dimensions



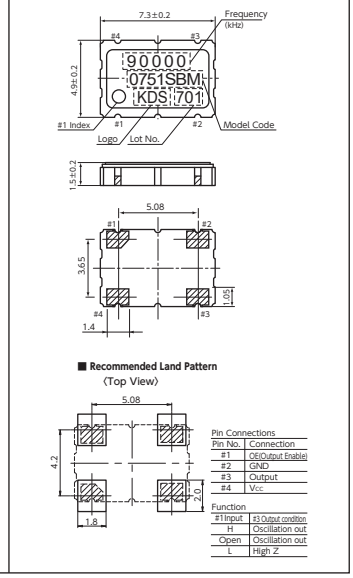
■ DSO531SBM [mm]

■ Dimensions



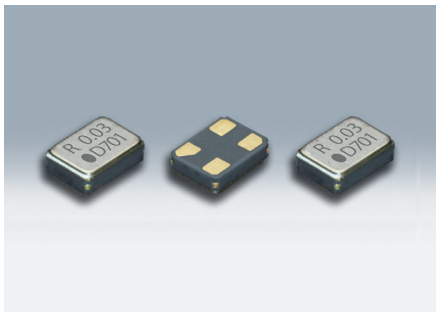
■ DSO751SBM [mm]

■ Dimensions



SMD Crystal Oscillators

DSO1612AR (kHz)



Actual size

■ Features

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

Pb-Free

RoHS Compliant

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

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

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

■ Standard Specification

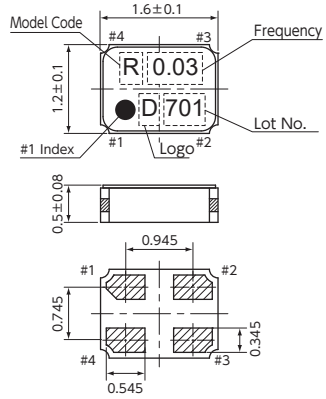
Item	Function Code: Supply Voltage	Function Code: Frequency tolerance	Output Frequency (kHz)	Legend	Spec.: min.	Spec.: typ.	Spec.: max.	Unit	Condition	
Supply Voltage	A	*	*	Vcc	+3.0	+3.3	+3.6	V		
	M				+2.7	+3.0	+3.3			
	B				+2.6	+2.8	+3.0			
	C				+2.25	+2.5	+2.75			
	D				+1.6	+1.8	+2.0			
Frequency Tolerance (includes frequency tolerance at room temperature)	*	Y	*	f_tol	–	–	±100	×10^{-6}	−40 to +125℃	−10 to +70℃ (Standard Operating Temperature Range)
	*	Z			–	–	±80		−40 to +110℃	
	*	A			–	–	±100		−40 to +85℃	
	*	B			–	–	±50			
	*	C			–	–	±30		−20 to +70℃	
	*	D			–	–	±25		−10 to +70℃	
	*	E			–	–	±20			
Current Consumption	*	*	*	Icc	–	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% Vcc Level	
0 Level Output Voltage	*	*	*	VOL	–	–	Vcc×0.1	V		
1 Level Output Voltage	*	*	*	VOH	Vcc×0.9	–	–			
Rise and Fall Time	*	*	*	tr, tf	–	–	50	ns	10 to 90% Vcc Level	
OE Pin 0 Level Input Voltage	*	*	*	VIL	–	–	Vcc×0.3	V		
OE Pin 1 Level Input Voltage	*	*	*	VIH	Vcc×0.7	–	–			
Output Disable Time	*	*	*	tPLZ	–	–	1	μs		
Output Enable Time	*	*	*	tPZL	–	–	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



Pin Connections

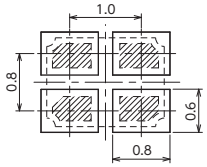
Pin No.	Connection
#1	OE(Output Enable)
#2	GND
#3	Output
#4	Vcc

Function

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

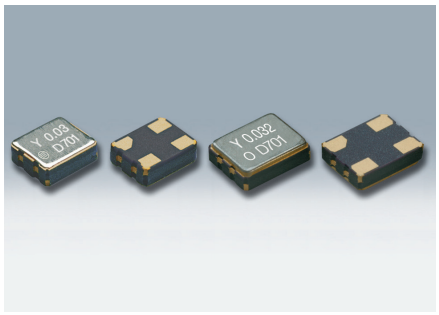
■ Recommended Land Pattern

<Top View>



SMD Crystal Oscillators

DSO221SY/DSO321SY



Actual size DSO221SY ▭ DSO321SY ▭

■ Features

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

Pb-Free

RoHS Compliant

■ Applications

- Timer module, Industrial measuring equipment, Consumer Product

[Type]

DSO221SY	2520 size
DSO321SY	3225 size

[Function Code]

DSO***SY A A

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

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

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

■ Standard Specification

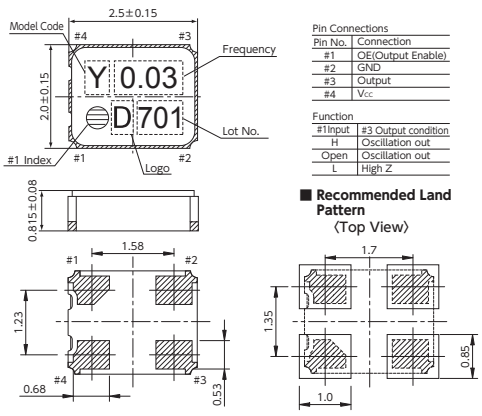
Item	Function Code		Output Frequency Range	Legend	Spec.				Condition	
	Supply Voltage	Frequency tolerance			min.	typ.	max.	Unit		
Supply Voltage	A	*	32.768kHz 1.049≦f0≦8.5MHz	Vcc	+3.0	+3.3	+3.6	V		
	B				+2.6	+2.8	+3.0			
	C				+2.25	+2.5	+2.75			
	D				+1.6	+1.8	+2.0			
Frequency Tolerance (includes frequency tolerance at room temperature)	*	A	32.768kHz 1.049≦f0≦8.5MHz	f_tol	−100	−	+100	×10^{-6}	−40 to +85℃	−10 to +70℃ (Standard Operating Temperature Range)
		B			−50	−	+50			
		N			−35	−	+35			
		C			−30	−	+30		−20 to +70℃	
		D			−25	−	+25		−10 to +70℃	
Current Consumption	*	*	32.768kHz	Icc	−	−	18	μA	No Load	
			1.049≦f0≦8.5MHz		−	−	700			
Stand-by Current (#1 pin "L" Level)	*	*	*	I_std	−	−	3	μA	−40 to +85℃	
Load Condition	*	*	*	L_CMOS	−	−	15	pF		
Symmetry	*	*	32.768kHz	SYM	45	50	55	%	at 50% Vcc	
			1.049≦f0≦8.5MHz		40	50	60			
0 Level Output Voltage	*	*	*	VOL	−	−	Vcc×0.1	V		
1 Level Output Voltage	*	*	*	VOH	Vcc×0.9	−	−			
Rise and Fall Time	*	*	*	tr, tf	−	−	15	ns	10 to 90% Vcc Level	
OE Pin 0 Level Input Voltage	*	*	*	VIL	−	−	Vcc×0.2	V		
OE Pin 1 Level Input Voltage	*	*	*	VIH	Vcc×0.8	−	−			
Output Disable Time	*	*	*	tPLZ	−	−	100	ns		
Output Enable Time	*	*	*	tPZL	−	−	20	ms		
Packing Unit (1)	2000pcs./reel (φ180)									

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

Consult our sales representative for other specifications.

■ DSO221SY [mm]

■ Dimensions



Pin Connections

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

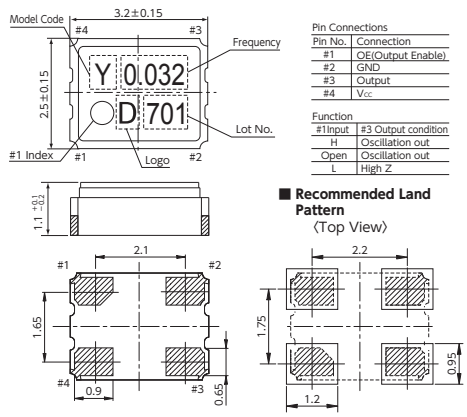
Function

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

■ Recommended Land Pattern
〈Top View〉

■ DSO321SY [mm]

■ Dimensions



Pin Connections

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

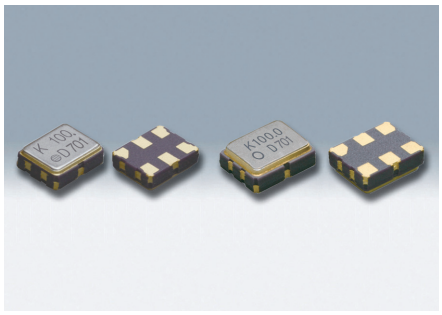
Function

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

■ Recommended Land Pattern
〈Top View〉

SMD 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)
- DSO223SK/SJ/SD: AEC-Q200 Compliant
  DSO323SK/SJ/SD: AEC-Q200 Compliant (Option: Equivalent to AEC-Q100)

Pb-Free

RoHS Compliant

■ Applications

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

[Type]

DSO223S SERIES	2520 size
DSO323S SERIES	3225 size

[Function Code]

DSO***S K A A A

- Model Code: K : LVPECL / J : LVDS / D : HCSL
- Supply Voltage: A : 3.3V / C : 2.5V
- Operating Temperature Range: A : − 10 to +70℃ / C : − 40 to +85℃
- Frequency Tolerance: A : ±100×10^{-6} / B : ±50×10^{-6}

■ Standard Specification

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

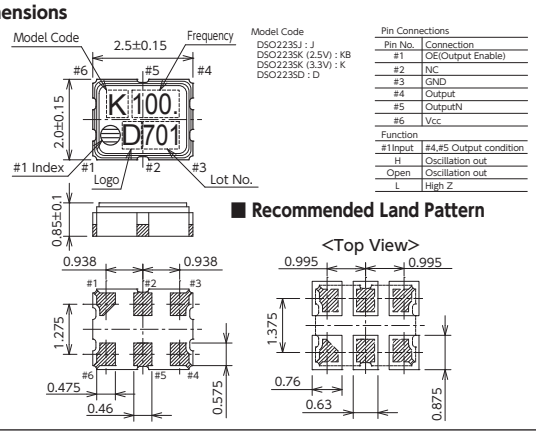
Item \ Type	Legend	DSO223SK DSO323SK	DSO223SJ DSO323SJ	DSO223SD DSO323SD
Output Specification	–	LV-PECL	LVDS	HCSL
Output Frequency Range	f_0	13.5 to 167MHz (DSO223S SERIES) /13.5 to 212.5MHz (DSO323S SERIES)		
Supply Voltage	V_{CC}	+2.5V±0.125V/+3.3V±0.165V		
Frequency Tolerance (Includes frequency tolerance at room temperature.)	f_tol	±50×10^{-6} max., ±100×10^{-6} max.		
Storage Temperature Range	T_stg	−40 to +85℃		
Operating Temperature Range	T_use	−10 to +70℃ ,−40 to +85℃		
Current Consumption	I_{CC}	45mA max. (f_0≦170MHz), 50mA max. (170MHz<f_0≦212.5MHz)	20mA max.	30mA max. (f_0≦170MHz), 35mA max. (170MHz<f_0≦212.5MHz)
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	tr, tf	0.5ns max. [20 to 80% Output, OutputN]	0.4ns max. [20 to 80% Output−OutputN]	0.5ns max. [0.175 to 0.525V Level]
Differential Output Voltage	V_{OD1}, V_{OD2}	–	0.247 to 0.454V	–
Change to V_{OD}	ΔV_{OD}	–	50mV [ΔV_{OD}= | V_{OD1}−V_{OD2} |]	–
Offset Voltage	V_{OS}	–	1.125 to 1.375V	–
Offset to V_{OS}	ΔV_{OS}	–	50mV	–
Crossing Point Voltage	Vcr	–	–	250 to 550mV
OE Pin 0 Level Input Voltage	V_{IL}	V_{CC}×0.3 max.		
OE Pin 1 Level Input Voltage	V_{IH}	V_{CC}×0.7 min.		
Output Disable Time	tPLZ	200ns		
Output Enable Time	tPZL	2ms		
Period Jitter (1)	tRMS	5ps typ. (13.5MHz≦f_0<27MHz) / 2.5ps typ. (27MHz≦f_0≦212.5MHz) (σ)		
	tp-p	33ps typ. (13.5MHz≦f_0<27MHz) / 22ps typ. (27MHz≦f_0≦212.5MHz) (Peak to peak)		
Total Jitter (1)	tTL	50ps typ. (13.5MHz≦f_0<27MHz) / 35ps typ. (27MHz≦f_0≦212.5MHz) [tDJ + n×tRJ n=14.1(BER=1×10^{-12}) (2)]		
Phase Jitter	tpj	1.5ps max. (13.5MHz≦f_0<27MHz) / 1ps max. (27MHz≦f_0≦212.5MHz) [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 (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.

■ DSO223S SERIES [mm]

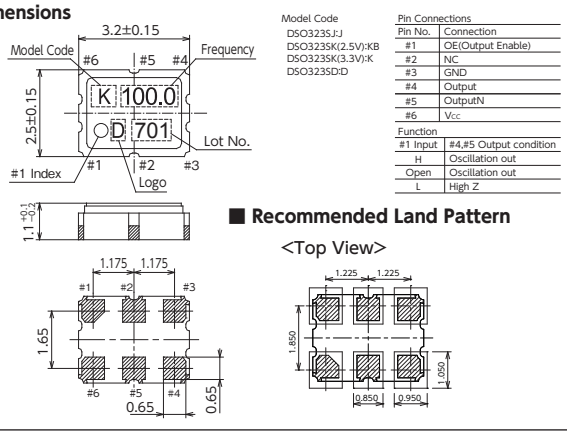
■ Dimensions



■ Recommended Land Pattern

■ DSO323S SERIES [mm]

■ Dimensions

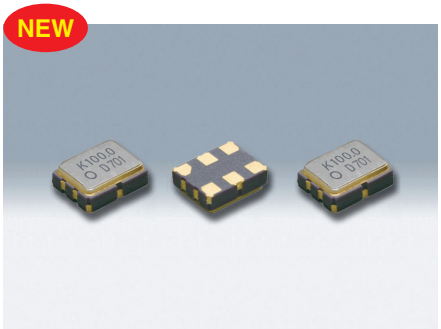


■ Recommended Land Pattern

SMD Differential Output Crystal Oscillators - Low Voltage

DSO323SJ/DSO323SD

NEW



Actual size

■ Features

- 1.8V operating voltage, High speed type
- 3-state function
- LVDS output (DSO323SJ)
- HCSL output (DSO323SD)
- AEC-Q200 Compliant (Option: Equivalent to AEC-Q100)

■ Applications

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

Pb-Free

RoHS Compliant

[Function Code]

DSO323S J D A A

- Model Code: J : LVDS / D : HCSL
- Operating Temperature Range: A : − 10 to +70℃ / C : − 40 to +85℃
- Supply Voltage: D : 1.8V
- Frequency Tolerance: A : ±100 × 10^{-6} / B : ±50 × 10^{-6}

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

■ Standard Specification

Item \ Type	Legend	DSO323SJ	DSO323SD
Output Specification	–	LVDS	HCSL
Output Frequency Range	f_0	100 to 167MHz	
Supply Voltage	V_{CC}	+1.8V±0.09V	
Frequency Tolerance (Includes frequency tolerance at room temperature.)	f_tol	±50×10^{-6} max., ±100×10^{-6} max.	
Storage Temperature Range	T_stg	−40 to +85℃	
Operating Temperature Range	T_use	−10 to +70℃ ,−40 to +85℃	
Current Consumption	Icc	25mA max.	50mA max.
Stand-by Current (#1 pin "L" Level)	I_std	30μA max.	
Load Condition	Load-R	100Ω (Output−OutputN)	50Ω
Symmetry	SYM	45 to 55% [at outputs cross point]	
0 Level Output Voltage	V_{OL}	–	−0.15 to 0.15V
1 Level Output Voltage	V_{OH}	–	0.55 to 1.0V
Rise and Fall Time	tr, tf	0.4ns max. [20 to 80% Output−OutputN]	0.5ns max. [−0.15 to 0.15V/Output-OutputN]
Differential Output Voltage	V_{OD1}, V_{OD2}	0.247 to 0.454V	–
Change to V_{OD}	ΔV_{OD}	50mV [ΔV_{OD}= | V_{OD1}−V_{OD2} |]	–
Offset Voltage	V_{OS}	1.125 to 1.375V	–
Offset to V_{OS}	ΔV_{OS}	50mV	–
OE Pin 0 Level Input Voltage	V_{IL}	Vcc×0.3 max.	
OE Pin 1 Level Input Voltage	V_{IH}	Vcc×0.7 min.	
Output Disable Time	tPLZ	200ns	
Output Enable Time	tPZL	2ms	
Period Jitter (1)	tRMS	2.5ps typ. (σ)	
	tp-p	22ps typ. (Peak to peak)	
Total Jitter (1)	tTL	35ps typ. [tDJ + n×tRJ n=14.1(BER=1×10^{-12}) (2)]	
Phase Jitter	tpj	0.15ps max.	
Packing Unit (3)	–	2000pcs./reel (φ180)	

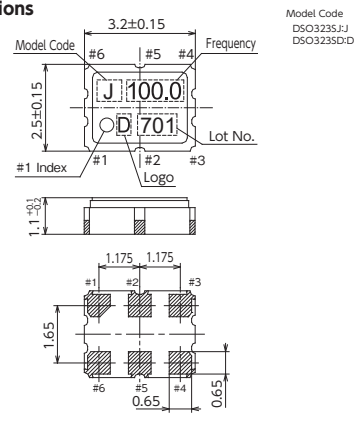
(1) Measured WAVECREST DTS-2075
(2) tDJ : Deterministic jitter tRJ : Random jitter
(3) Moisture prevention packing is unnecessary.
Moisture Sensitivity Level : Level 1 (IPC/JEDEC J-STD-033)

Consult our sales representative for other specifications.

■ DSO323S SERIES

[mm]

■ Dimensions



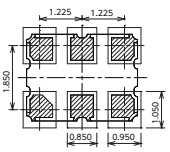
Model Code
DSO323SJ:J
DSO323SD:D

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

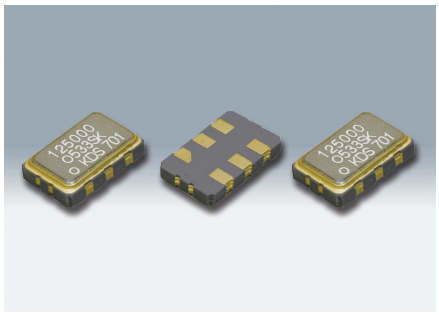
■ Recommended Land Pattern

<Top View>



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

Pb-Free

RoHS Compliant

■ Standard Specification

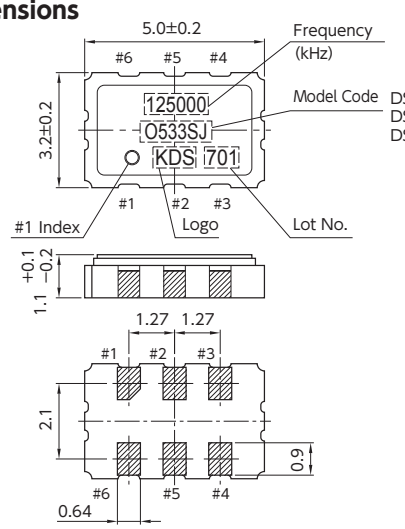
Item \ Type	Legend	DSO533SK	DSO533SJ
Output Specification	–	LV-PECL	LVDS
Output Frequency Range	f_0	13.5 to 212.5MHz	
Supply Voltage	V_{CC}	+2.5V±0.125V/+3.3V±0.165V	
Frequency Tolerance (Includes frequency tolerance at room temperature.)	f_tol	$\pm50\times10^{-6}$ max., $\pm100\times10^{-6}$ max.	
Storage Temperature Range	T_stg	−40 to +85℃	
Operating Temperature Range	T_use	−10 to +70℃ , −40 to +85℃	
Current Consumption	I_{CC}	45mA max. (f_0≦170MHz), 50mA max. (170MHz<f_0≦212.5MHz)	20mA max.
Stand-by Current (#1 pin "L" Level)	I_std	10μA max.	
Load Condition	Load-R	50Ω to V_{CC}−2V	100Ω (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	tr, tf	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}	⊿V_{OD}	–	50mV [⊿V_{OD}= | V_{OD1}−V_{OD2} |]
Offset Voltage	V_{OS}	–	1.125 to 1.375V
Offset to V_{OS}	⊿V_{OS}	–	50mV
OE Pin 0 Level Input Voltage	V_{IL}	V_{CC}×0.3 max.	
OE Pin 1 Level Input Voltage	V_{IH}	V_{CC}×0.7 min.	
Output Disable Time	tPLZ	200ns	
Output Enable Time	tPZL	2ms	
Period Jitter (1)	tRMS	5ps typ. (13.5MHz≦f_0<27MHz) / 2.5ps typ. (27MHz≦f_0≦212.5MHz) (σ)	
	tp-p	33ps typ. (13.5MHz≦f_0<27MHz) / 22ps typ. (27MHz≦f_0≦212.5MHz) (Peak to peak)	
Total Jitter (1)	tTL	50ps typ. (13.5MHz≦f_0<27MHz) / 35ps typ. (27MHz≦f_0≦212.5MHz) [tDJ + n×tRJ n=14.1(BER=1×10^{-12}) (2)]	
Phase Jitter	tpj	1.5ps max. (13.5MHz≦f_0<27MHz) / 1ps max. (27MHz≦f_0≦212.5MHz) [13.5MHz≦f_0<40MHz, f_0 offset:12kHz to 5MHz f_0≧40MHz, f_0 offset:12kHz to 20MHz]	
Packing Unit (3)	–	1000pcs./reel (φ 180)	

(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



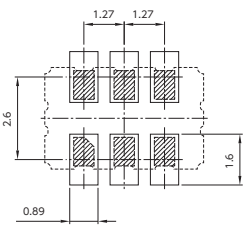
DSO533SJ(2.5V,3.3V) → O533SJ
DSO533SK(2.5V) → O533SKB
DSO533SK(3.3V) → O533SK

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

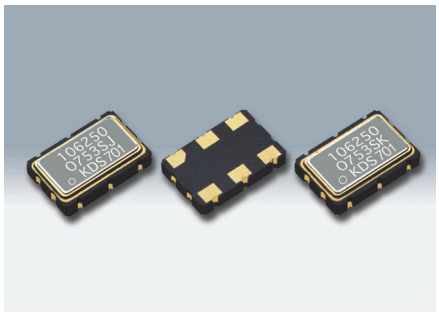
■ Recommended Land Pattern

<Top View>



SMD Differential Output Crystal Oscillators

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

- Sever, FC-HBA

Pb-Free

RoHS Compliant

■ Standard Specification

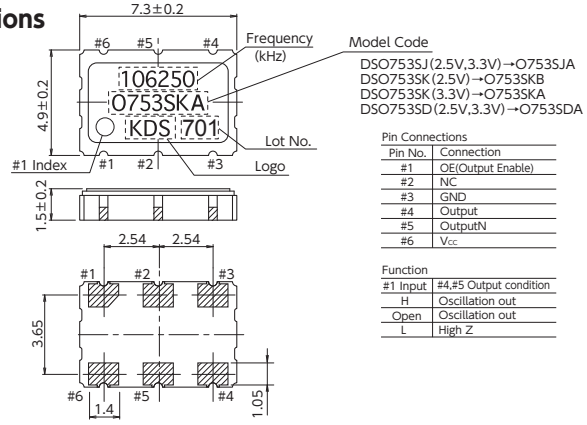
Item \ Type	Legend	DSO753SK	DSO753SJ	DSO753SD
Output Specification	–	LV-PECL	LVDS	HCSL
Output Frequency Range	f_0	13.5 to 212.5MHz		
Supply Voltage	V_{CC}	+2.5V±0.125V/+3.3V±0.165V		
Frequency Tolerance (Includes frequency tolerance at room temperature.)	f_tol	±50×10^{-6} max., ±100×10^{-6} max.		
Storage Temperature Range	T_stg	−40 to +85℃		
Operating Temperature Range	T_use	−10 to +70℃ , −40 to +85℃		
Current Consumption	I_{CC}	45mA max. (f_0≦170MHz), 50mA max. (170MHz<f_0≦212.5MHz)	20mA max.	30mA max. (f_0≦170MHz), 35mA max. (170MHz<f_0≦212.5MHz)
Stand-by Current (#1 pin "L" Level)	I_std	10μA max.		
Load Condition	Load-R	50Ω to VCC−2V	100Ω (Output−OutputN)	50Ω
Symmetry	SYM	45 to 55% [at outputs cross point]		
0 Level Output Voltage	V_{OL}	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	Vcr	–	–	250 to 550mV
OE Pin 0 Level Input Voltage	V_{IL}	V_{CC}×0.3 max.		
OE Pin 1 Level Input Voltage	V_{IH}	V_{CC}×0.7 min.		
Output Disable Time	tPLZ	200ns		
Output Enable Time	tPZL	2ms		
Period Jitter (1)	tRMS	5ps typ. (13.5MHz≦f_0<27MHz) / 2.5ps typ. (27MHz≦f_0≦212.5MHz) (σ)		
	tp-p	33ps typ. (13.5MHz≦f_0<27MHz) / 22ps typ. (27MHz≦f_0≦212.5MHz) (Peak to peak)		
Total Jitter (1)	tTL	50ps typ. (13.5MHz≦f_0<27MHz) / 35ps typ. (27MHz≦f_0≦212.5MHz) [tDJ + n×tRJ n=14.1(BER=1×10^{-12}) (2)]		
Phase Jitter	tpj	1.5ps max. (13.5MHz≦f_0<27MHz) / 1ps max. (27MHz≦f_0≦212.5MHz) [13.5MHz≦f_0<40MHz, f_0 offset:12kHz to 5MHz f_0≧40MHz, f_0 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



Model Code

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

Pin Connections

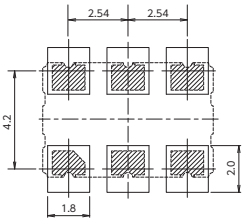
Pin No.	Connection
#1	OE(Output Enable)
#2	NC
#3	GND
#4	Output
#5	OutputN
#6	V_{CC}

Function

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

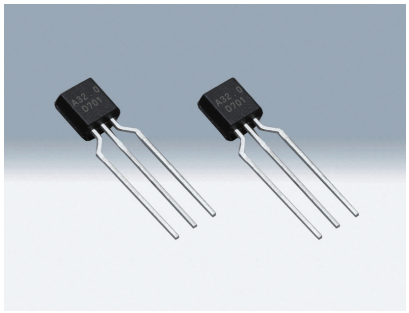
■ Recommended Land Pattern

<Top View>



Crystal Oscillators

DLO555MBA



■ Features

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

■ 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

Pb-Free

RoHS Compliant

■ Applications

- Gaming equipment
- Industrial equipment

■ Absolute Maximum Ratings

Item	Legend	Spec.	Unit
Supply Voltage	Vcc	−0.5 to +6.0	V
Output Pin Voltage	VOUT	−0.5 to Vcc+0.5	V
Output Pin Current	IOUT	10	mA
Storage Temperature Range	T_str	−40 to +105	℃

■ Recommended Operating Conditions

Item	Legend	min.	typ.	max.	Unit
Supply Voltage	Vcc	3.0	5.0	5.5	V
Load Condition	L_CMOS	–	–	15	pF
				30	
Operating Temperature Range	T_opr	−10	–	+85	℃

■ Standard Specification

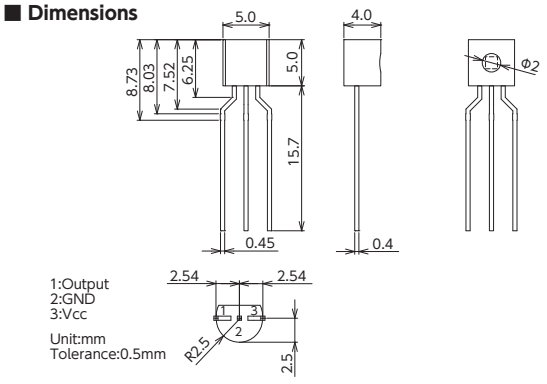
Item	Legend	Spec. min.	Spec. typ.	Spec. max.	Unit	Condition
Output Frequency Range	f0	1.5	–	54	MHz	L_CMOS : 30pF
Frequency Tolerance	f_tol	−100	–	+100	×10⁻⁶	T_opr=−10 to +85℃ Vcc=+3.0 to +5.5V
		−50		+50		
Aging	–	–	–	±5	×10⁻⁶/year	
Current Consumption	Icc	–	–	8	mA	No load
Symmetry	SYM	45	–	55	%	50% Vcc level
0 Level Output Voltage	VOL	–	–	Vcc×0.1	V	
1 Level Output Voltage	VOH	Vcc×0.9	–	–	V	
Rise and Fall Time	tr,tf	–	–	7.5	ns	L_CMOS : 30pF 20 to 80% Vcc level
Start Up Time	T_start	–	–	1	ms	t=0 at 90% Vcc
Phase Noise	–	–	−139	–	dBc/Hz	Offset 1kHz
		–	−156	–		Offset 100kHz
Period Jitter (1)	tRMS	–	2.4	–	ps	σ
	tp-p	–	20	–		Peak to peak
Total Jitter (1)	tTL	–	34	–		tDJ+n×tRJ n=14.1(BER=1×10⁻¹²) (2)
Phase Jitter (3)	tpj	–	–	1		10MHz≦f0<54MHz f0 offset12kHz to 5MHz
						40MHz≦f0≦60MHz f0 offset12kHz to 20MHz
Built-in Bypass Capacitors Capacitance	Cbp	–	0.1	–	μF	Vcc to GND capacitance

(1) Measured WAVECREST DTS-2075
(2) tDJ : Deterministic jitter tRJ : Random jitter
(3) Measured Keysight Technologies E5052B
*Moisture prevention packing is unnecessary. Moisture Sensitivity Level : Level 1 (IPC/JEDEC J-STD-033)

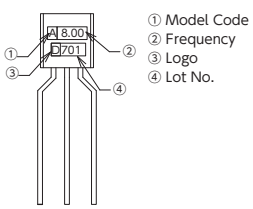
Consult our sales representative for other specifications.

■ Dimensions [mm]

■ Dimensions

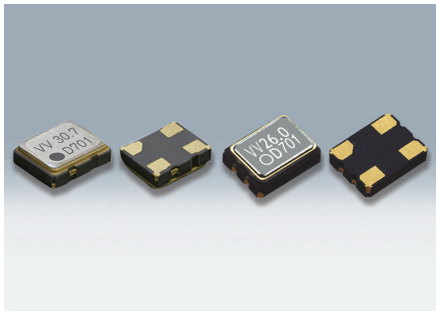


■ Marking



SMD Voltage Controlled Crystal Oscillators

DSV221SV/DSV321SV



Actual size DSV221SV ▭ DSV321SV ▭

■ Features

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

■ Applications

- DVD, Digital TV, STB, backbone transmission equipment

Pb-Free

RoHS Compliant

■ Standard Specification

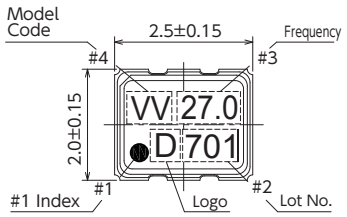
Item \ Type	Legend	DSV221SV	DSV321SV
Output Frequency Range	f_0	30.72MHz	6.75 to 125MHz
Supply Voltage	V_{CC}	+3.3V±0.33V	
Frequency Control Voltage	Vcont	+1.65V±1.65V	
Storage Temperature Range	T_stg	−40 to +85℃	
Operating Temperature Range	T_use	-30 to +85℃	−10 to +70℃ / −30 to +85℃
Frequency Tolerance (Includes frequency tolerance at room temperature.)	f_tol	$\pm40\times10^{-6}$ max.	
Frequency Adjustment Range	f_cont	$\pm100\times10^{-6}$ min. [Positive Slope]	
Current Consumption	I_{CC}	7mA max. [No Load]	7mA max. (6.75MHz≦f_0≦36MHz) 17mA max. (36MHz<f_0≦70MHz) 27mA max. (70MHz<f_0≦125MHz) [No Load]
Load Condition	L_{CMOS}	15pF	
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	tr, tf	5ns max. [10 to 90% Vcc Level]	5ns max. (6.75MHz≦f_0≦90MHz) 3ns max. (90MHz<f_0≦125MHz) [10 to 90% V_{CC} Level]
Period Jitter (1)	tRMS	2.4ps typ. (σ)	
	tp-p	22ps typ. (Peak to peak)	
Total Jitter (1)	tTL	33ps typ. [tDJ + n×tRJ n=14.1(BER=1×10^{-12})(2)]	
Phase Jitter	tpj	1ps max. (10MHz≦f_0<40MHz, f_0 offset : 12kHz to 5MHz、 f_0≧40MHz, f_0 offset : 12kHz to 20MHz)	
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)

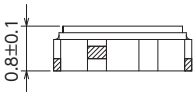
Consult our sales representative for other specifications.

■ DSV221SV [mm]

■ Dimensions

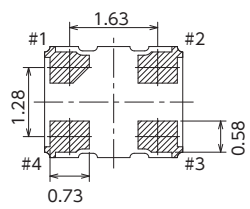


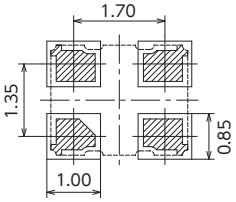
Pin Connections	
Pin No.	Connection
#1	Vcont
#2	GND
#3	Output
#4	Vcc



■ Recommended Land Pattern

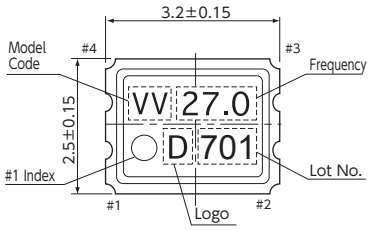
<Top View>



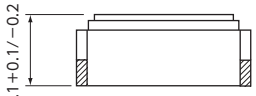


■ DSV321SV [mm]

■ Dimensions

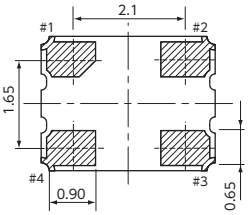


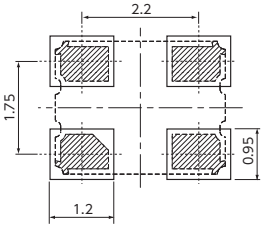
Pin Connections	
Pin No.	Connection
#1	Vcont
#2	GND
#3	Output
#4	Vcc



■ Recommended Land Pattern

<Top View>



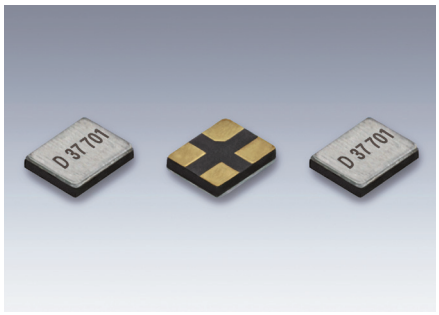


Quartz Devices
For Automotive

KDS DAISHINKU CORP.

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

DSX1210A



Actual size

■ Features

- 1210 size ultra miniature and lightweight SMD crystal resonator with a low profile of 0.28mm
- High precision and high reliability (Frequency aging specification of $\pm1\times10^{-6}$/1 year or $\pm3\times10^{-6}$/5 years is available for cell phone or wireless communication systems etc.)
- Allowing for high density surface mounting.
- AEC-Q200 Compliant

Pb-Free

RoHS/ELV Compliant

■ Applications

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

■ Standard Specification

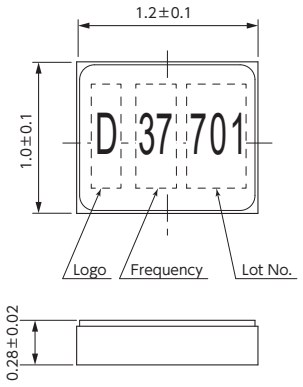
Item \ Type	DSX1210A			
Frequency Range	32MHz	37.4MHz / 38.4MHz / 40MHz	48MHz/52MHz	76.8MHz/80MHz
Overtone Order	Fundamental			
Load Capacitance	8pF, 10pF, 12pF			
Drive Level	10μW (100μW max.)			
Frequency Tolerance	$\pm10\times10^{-6}$, $\pm20\times10^{-6}$ (at 25℃)			
Series Resistance	100Ω max.	60Ω max.	40Ω max.	30Ω max.
Frequency Characteristics over Temperature	$\pm30\times10^{-6}$ / −40 to +105℃(Ref. To 25℃)			
Storage Temperature Range	−40 to +125℃			
Reliability	AEC-Q200			
Packing Unit (1)	3000pcs./reel(φ180)			

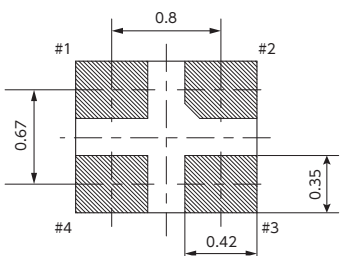
(1) Moisture prevention packing is unnecessary.
Moisture Sensitivity Level:LEVEL1 (IPC/JEDEC J-STD-033)

Consult our sales representative for other specifications.

[mm]

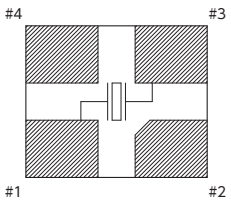
■ Dimensions





■ Internal Connections

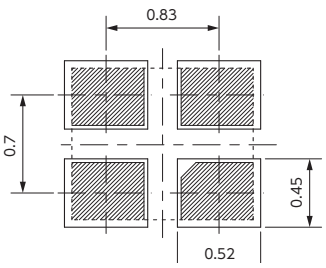
〈Top View〉



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

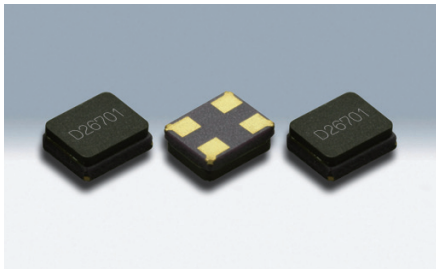
■ Recommended Land Pattern

〈Top View〉

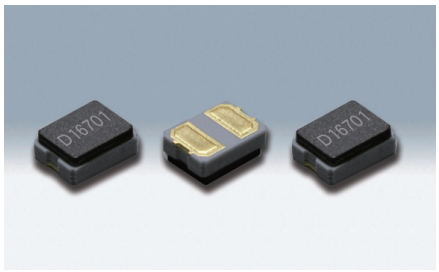


SMD Crystal Resonators / MHz Band Crystal Resonators〈For Automotive〉

DSX211G/DSX210GE



DSX211G



DSX210GE

Actual size

RoHS/ELV Compliant

■ Features

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

■ Applications

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

■ Standard Specification

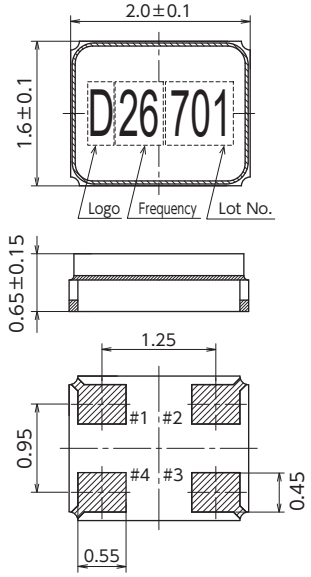
Item \ Type		DSX210GE			
		DSX211G			
Frequency Range	16 to 20MHz	20 to 24MHz	24 to 30MHz	30 to 36MHz	36 to 64MHz
Overtone Order	Fundamental				
Load Capacitance	8pF, 10pF, 12pF				
Drive Level	10μW (100μW max.)				
Frequency Tolerance	±30×10^{-6} (at 25℃)				
Series Resistance	400Ω max.	200Ω max.	150Ω max.	120Ω max.	80Ω max.
Frequency Characteristics over Temperature	±100×10^{-6}/−40 to +125℃ (Ref. to 25℃)				
Storage Temperature Range	−40 to +150℃				
Reliability	AEC-Q200				
Packing Unit (1)	3000pcs./reel(φ180)				

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

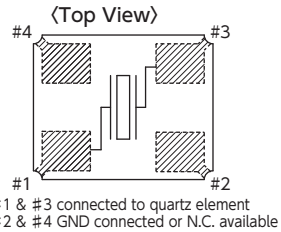
Consult our sales representative for other specifications.

■ DSX211G [mm]

■ Dimensions

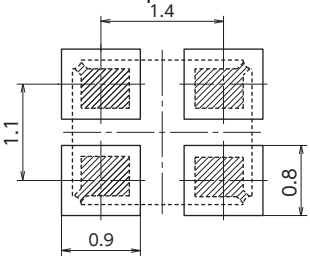


■ Internal Connections



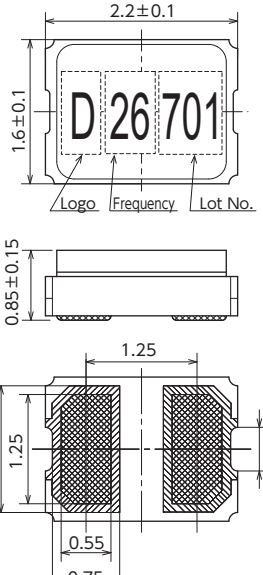
#1 & #3 connected to quartz element
#2 & #4 GND connected or N.C. available

■ Recommended Land Pattern

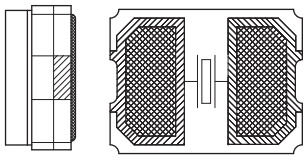


■ DSX210GE [mm]

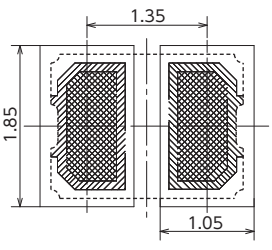
■ Dimensions



■ Internal Connections

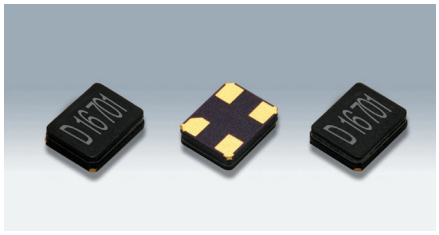


■ Recommended Land Pattern

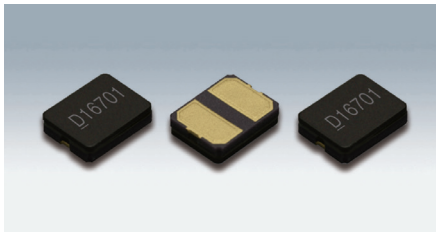


SMD Crystal Resonators / MHz Band Crystal Resonators〈For Automotive〉

DSX321G/DSX321GK/DSX320GE



DSX321G/DSX321GK



DSX320GE

Actual size

RoHS/ELV Compliant

■ Features

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

■ Applications

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

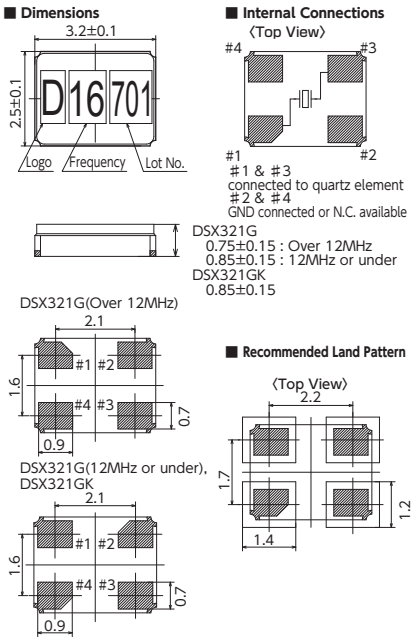
■ Standard Specification

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

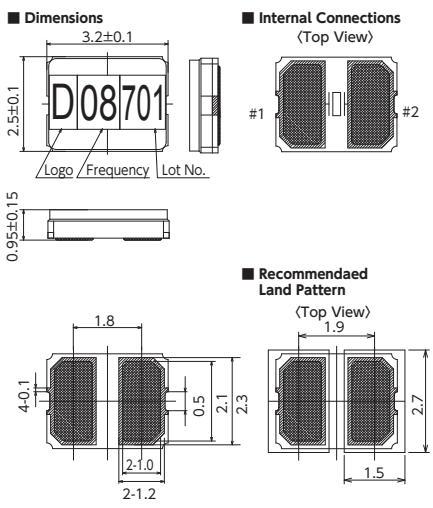
(1) Moisture prevention packing is unnecessary.
Moisture Sensitivity Level:LEVEL1 (IPC/JEDEC J-STD-033)

Consult our sales representative for other specifications.

■ DSX321G/DSX321GK [mm]

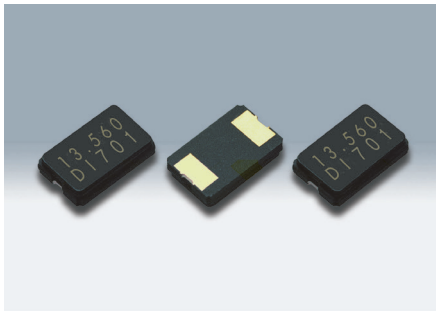


■ DSX320GE [mm]



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

DSX530GA



Actual size

■ Features

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

RoHS/ELV Compliant

■ Applications

- Multimedia devices such as car navigation systems and car audio

■ Standard Specification

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

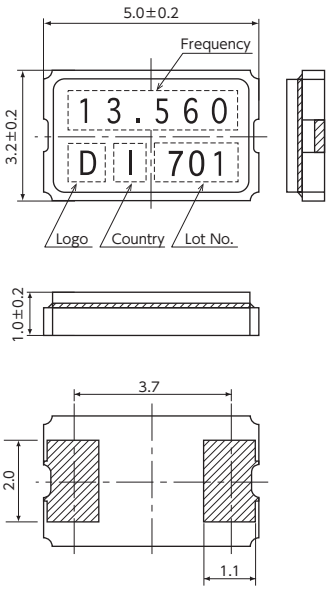
(1) Moisture prevention packing is unnecessary.
Moisture Sensitivity Level:LEVEL1 (IPC/JEDEC J-STD-033)

Consult our sales representative for other specifications.

■ DSX530GK/DSX530GA

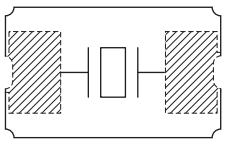
[mm]

■ Dimensions



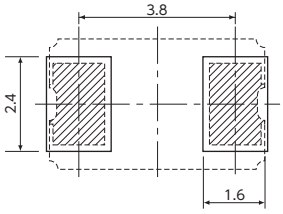
■ Internal Connections

〈Top View〉



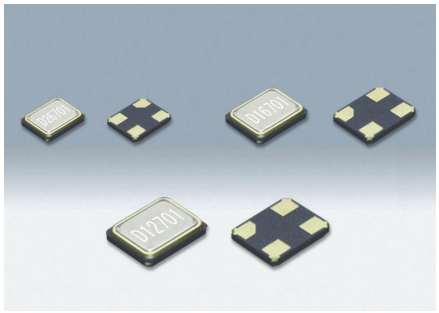
■ Recommended Land Pattern

〈Top View〉



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

DSX211SH/DSX221SH/DSX321SH



Actual size DSX211SH DSX221SH DSX321SH

■ Features

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

Pb-Free

RoHS/ELV Compliant

■ Applications

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

■ Standard Specification

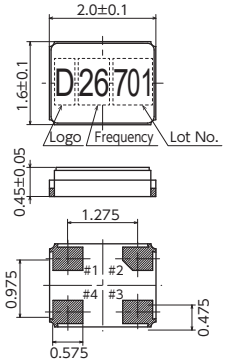
Item \ Type	DSX211SH		DSX221SH			DSX321SH		
Frequency Range	16 to 30MHz	30 to 60MHz	12 to 24MHz	24 to 30MHz	30 to 54MHz	12 to 20MHz	20 to 32MHz	32 to 50MHz
Overtone Order	Fundamental							
Load Capacitance	8pF, 10pF, 12pF							
Drive Level	10μW (100μW max.)		10μW (200μW max.)					
Frequency Tolerance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

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

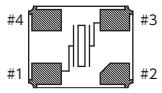
Consult our sales representative for other specifications.

■ DSX211SH [mm]

■ Dimensions

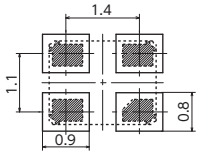


■ Internal Connections
〈Top View〉



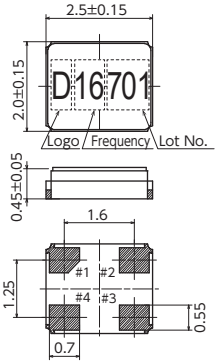
#1 & #3 connected to quartz element
#2 & #4 connected to the cover
#2 & #4 recommended GND connection

■ Recommended Land Pattern
〈Top View〉

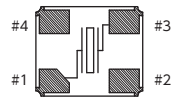


■ DSX221SH [mm]

■ Dimensions

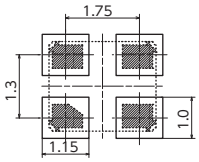


■ Internal Connections
〈Top View〉



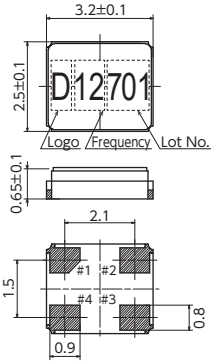
#1 & #3 connected to quartz element
#2 & #4 connected to the cover
#2 & #4 recommended GND connection

■ Recommended Land Pattern
〈Top View〉

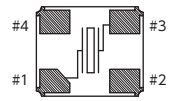


■ DSX321SH [mm]

■ Dimensions

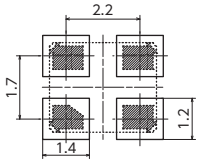


■ Internal Connections
〈Top View〉



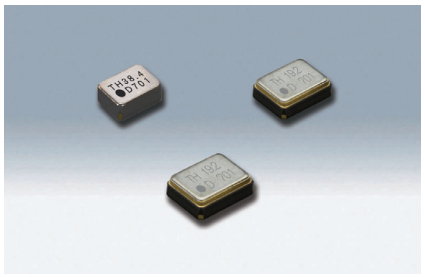
#1 & #3 connected to quartz element
#2 & #4 connected to the cover
#2 & #4 recommended GND connection

■ Recommended Land Pattern
〈Top View〉



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

DSR1612ATH/DSR211STH/DSR221STH



Actual size DSR1612ATH DSR211STH DSR221STH

■ Features

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

Pb-Free

RoHS/ELV Compliant

■ Applications

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

■ Standard Specification

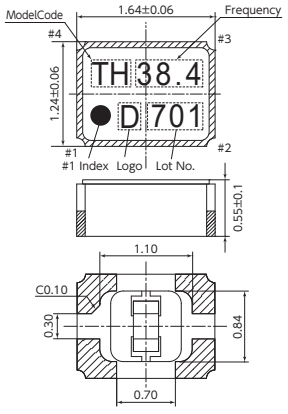
Item \ Type	DSR1612ATH	DSR211STH	DSR221STH
Frequency Range	38.4Mhz	19.2MHz / 38.4MHz / 55.2MHz	19.2MHz
Overtone Order	Fundamental		
Load Capacitance	7pF, 8pF		
Drive Level	10μW (100μW max.)		
Frequency Tolerance	±10×10^{-6} (at 25℃)		
Series Resistance	80Ω max.		
Frequency Characteristics over Temperature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

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

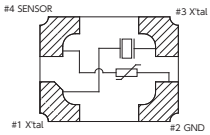
Consult our sales representative for other specifications.

■ DSR1612ATH [mm]

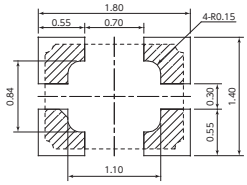
■ Dimensions



■ Internal Connections 〈Top View〉

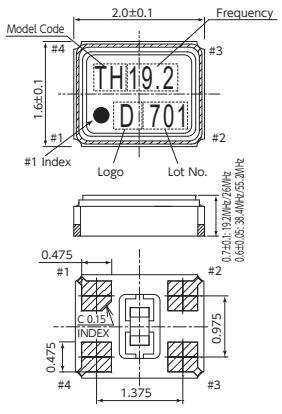


■ Recommended Land Pattern 〈Top View〉

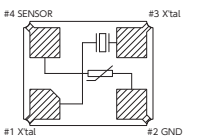


■ DSR211STH [mm]

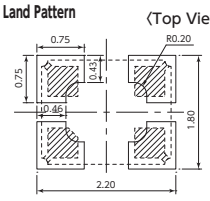
■ Dimensions



■ Internal Connections 〈Top View〉

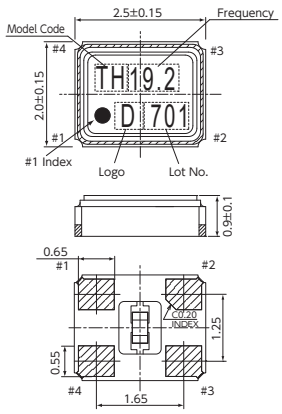


■ Recommended Land Pattern 〈Top View〉

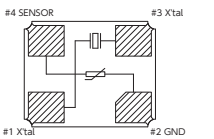


■ DSR221STH [mm]

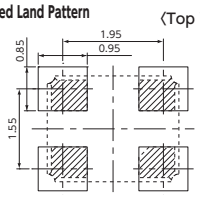
■ Dimensions



■ Internal Connections 〈Top View〉

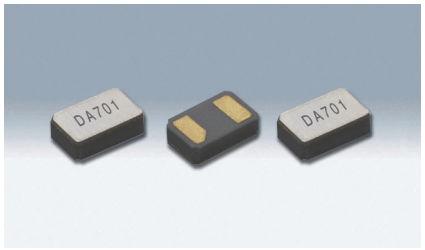


■ Recommended Land Pattern 〈Top View〉

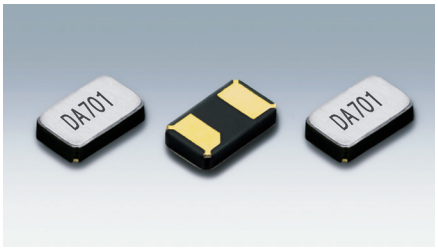


SMD Tuning Fork Crystal Resonators / kHz Band Crystal Resonators〈For Automotive〉

DST1610A/DST210AC/DST310S



DST1610A Actual size



DST210AC Actual size

■ Features

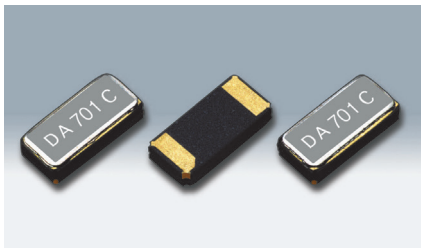
- AEC-Q200 Compliant
- Pb free
- RoHS/ELV Compliant

■ Applications

- Automotive multimedia devices

Pb-Free

RoHS/ELV Compliant



DST310S Actual size

■ Standard Specification

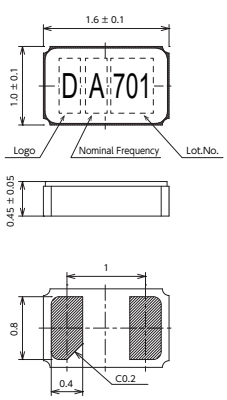
Item \ Type	DST1610A	DST210AC	DST310S
Frequency Range	32.768kHz		
Load Capacitance	7pF, 9pF, 12.5pF		
Drive Level	0.1μW (0.5μW max.)		0.2μW (1.0μW max.)
Frequency Tolerance	±20×10^{-6} (at 25℃)		
Series Resistance	50kΩ max. (−40 to +85℃) 80kΩ max. (−40 to +125℃)	80kΩ max. (−40 to +85℃) 120kΩ max. (−40 to +125℃)	50kΩ max. (−40 to +85℃) 80kΩ max. (−40 to +125℃)
Turnover Temperature	+25℃±5℃		
Parabolic Coefficient	−0.04×10^{-6} / ℃^{2} max.		
Operating Temperature Range	−40 to +85℃ / −40 to +125℃		
Storage Temperature Range	−40 to +125℃		
Shunt Capacitance	1.6pF typ.	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)

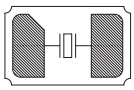
Consult our sales representative for other specifications.

■ DST1610A [mm]

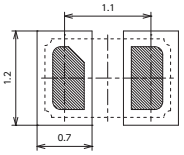
■ Dimensions



■ Internal Connections 〈Top View〉

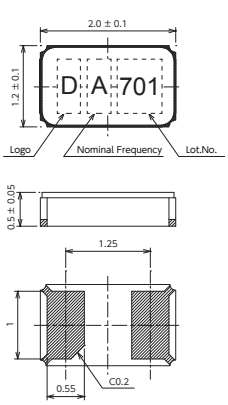


■ Recommended Land Pattern 〈Top View〉

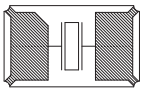


■ DST210AC [mm]

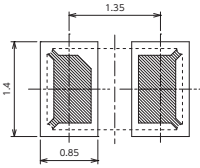
■ Dimensions



■ Internal Connections 〈Top View〉

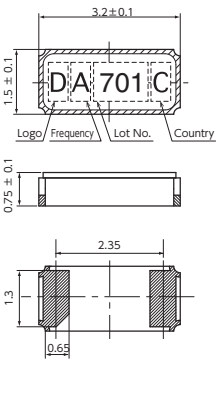


■ Recommended Land Pattern 〈Top View〉

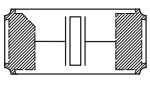


■ DST310S [mm]

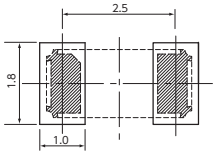
■ Dimensions



■ Internal Connections 〈Top View〉

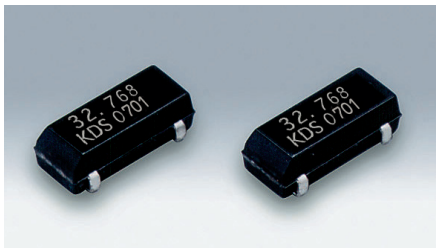


■ Recommended Land Pattern 〈Top View〉



SMD Tuning Fork Crystal Resonators / kHz Band Crystal Resonators〈For Automotive〉

DMX-26S



Actual size

■ Features

- AEC-Q200 Compliant
- RoHS/ELV Compliant

RoHS/ELV Compliant

■ Applications

- Automotive multimedia devices

■ Standard Specification

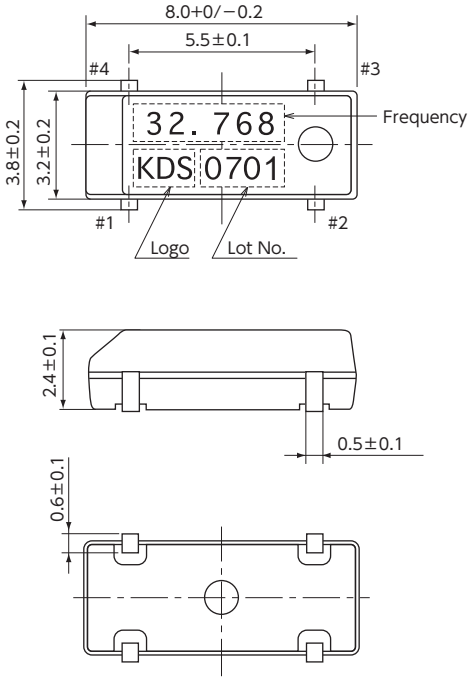
Item \ Type	DMX-26S
Frequency Range	32.768kHz(30 to 90kHz)
Load Capacitance	7pF, 9pF, 12.5pF
Drive Level	1.0μW(2.0μW max.)
Frequency Tolerance	±20×10^{-6} (at 25℃)
Series Resistance	50kΩ max. (−40 to +85℃) 80kΩ max. (−40 to +125℃)
Turnover Temperature	+25℃±5℃
Parabolic Coefficient	−0.04×10^{-6} / ℃^{2}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

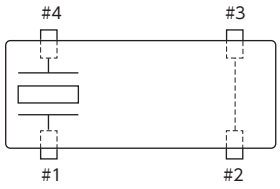
[mm]

■ Dimensions



■ Internal Connections

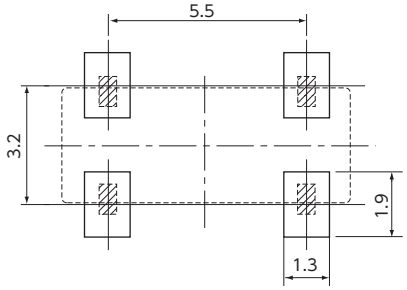
〈Top View〉



#2 & #3 OPEN (unconnected)

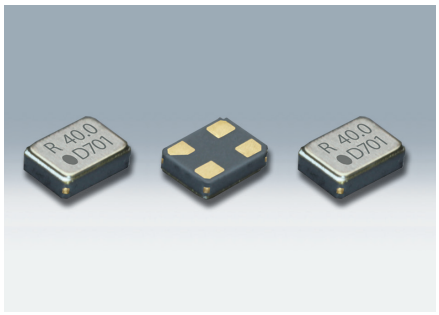
■ Recommended Land Pattern

〈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℃.
- AEC-Q200 Compliant (Option: Equivalent to AEC-Q100)
- CMOS Level Output

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

Pb-Free

RoHS/ELV Compliant

■ Standard Specification

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

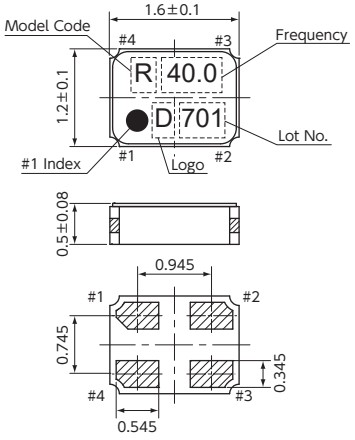
Item	Function Code		Legend	Output Frequency Range (MHz)	Spec.				Condition
	Supply Voltage	Frequency tolerance			min.	typ.	max.	Unit	
Supply Voltage	A	*	Vcc	0.584375≦f0≦80	+3.0	+3.3	+3.6	V	
	M				+2.7	+3.0	+3.3		
	B				+2.6	+2.8	+3.0		
	C				+2.25	+2.5	+2.75		
	D				+1.6	+1.8	+2.0		
Frequency Tolerance (Includes frequency tolerance at room temperature.)	*	Y	f_tol	0.584375≦f0≦80	-100	–	+100	10^{-6}	−40 to +125℃
		Z			-80	–	+80		−40 to +110℃
		B			-50	–	+50		−40 to +85℃
Current Consumption	A,M	*	Icc	0.584375≦f0<40	–	–	+3.0	mA	No Load
				40≦f0<80	–	–	+4.2		
	B			0.584375≦f0<40	–	–	+2.4		
				40≦f0≦80	–	–	+3.7		
	C			0.584375≦f0<40	–	–	+2.0		
				40≦f0≦80	–	–	+3.4		
	D			0.584375≦f0<40	–	–	+1.7		
				40≦f0≦80	–	–	+2.7		
Stand-by Current (#1 pin "L"level)	*	*	I_std	*	–	–	+20	μA	
Load Condition	*	*	L_CMOS	*	–	–	15	pF	
Symmetry	*	*	SYM	*	40	50	60	%	at 50% Vcc
0 Level Output Voltage	*	*	VOL	*	–	–	Vcc×0.1	V	
1 Level Output Voltage	*	*	VOH	*	Vcc×0.9	–	–		
Rise and Fall Time	A,M,B,C	*	tr, tf	*	–	–	3.0	ns	10 to 90% Vcc Level
	D				–	–	5		
OE Pin 0 Level Input Voltage	*	*	VIL	*	–	–	Vcc×0.2	V	
OE Pin 1 Level Input Voltage	*	*	VIH	*	Vcc×0.8	–	–		
Output Disable Time	*	*	tPLZ	*	–	–	200	ns	
Output Enable Time	*	*	tPZL	*	–	–	2	ms	
Period Jitter (1)	*	*	tRMS	*	–	2.2	–	ps	σ
			tp-p		–	20	–		Peak to peak
Total Jitter (1)	*	*	tTL	*	–	31	–	ps	tDJ+n×tRJ n=14.1(BER=1×10^{-12}) (2)
Phase Jitter	*	*	tpj	40≦f0≦80	–	–	1	ps	f0 offset:12kHz to 20MHz
				10≦f0<40					f0 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



Pin Connections

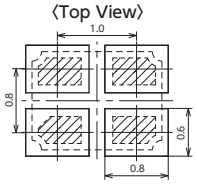
Pin No.	Connection
#1	OE(Output Enable)
#2	GND
#3	Output
#4	Vcc

Function

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

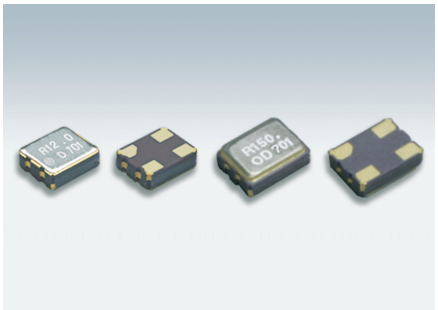
■ Recommended Land Pattern

〈Top View〉



SMD Crystal Oscillators〈For Automotive〉

DSO221SR/DSO321SR



Actual size DSO221SR DSO321SR

■ Features

- 3-state function
- Capable of operating over a wide temperature range, from −40 to +125℃ .
- AEC-Q200 Compliant (Option: Equivalent to AEC-Q100)
- CMOS Level Output

■ Applications

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

[Type]

DSO221SR	2520 size
DSO321SR	3225 size

Pb-Free

RoHS/ELV Compliant

[Function Code]

DSO***SR A A

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

A,Y : ±100×10⁻⁶
Z : ±80×10⁻⁶
B : ±50×10⁻⁶

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

■ Standard Specification

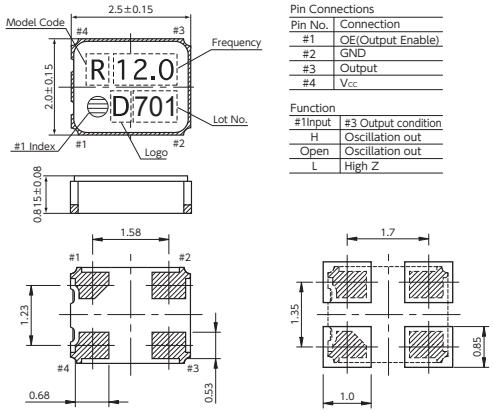
Item	Function Code: Supply Voltage	Function Code: Frequency tolerance	Output Frequency Range (MHz)	Legend	Spec.: min.	typ.	max.	Unit	Condition
Supply Voltage	A	*	0.2≦f₀≦125	V_{CC}	+3.0	+3.3	+3.6	V	
	M		0.2≦f₀≦125		+2.7	+3.0	+3.3		
	B		0.2≦f₀≦100		+2.6	+2.8	+3.0		
	C		0.2≦f₀≦100		+2.25	+2.5	+2.75		
	D		0.2≦f₀≦80		+1.6	+1.8	+2.0		
Frequency Tolerance (Includes frequency tolerance at room temperature.)	*	Y	0.2≦f₀≦100	f_tol	−100	—	+100	×10⁻⁶	−40 to +125℃
		Z	0.2≦f₀≦100		−80	—	+80		−40 to +110℃
		A	100<f₀≦125		−100	—	+100		−40 to +85℃
		B	0.2≦f₀≦100		−50	—	+50		
Current Consumption	A,M	*	0.2≦f₀<54	I_{CC}	—	—	+4.0	mA	No Load
			54≦f₀<80		—	—	+6.0		
			80≦f₀≦125		—	—	+8.0		
	B	*	0.2≦f₀<54		—	—	+3.5		
			54≦f₀<80		—	—	+5.5		
			80≦f₀≦100		—	—	+7.5		
	C	*	0.2≦f₀<54		—	—	+3.0		
			54≦f₀<80		—	—	+5.0		
			80≦f₀≦100		—	—	+7.0		
	D	*	0.2≦f₀<54		—	—	+2.5		
			54≦f₀≦80		—	—	+4.5		
Stand-by Current (#1 pin "L"level)	*	*	*	I_std	—	—	+10	μA	
Load Condition	*	*	*	L_CMOS	—	—	15	pF	
Symmetry	*	*	*	SYM	40	50	60	%	50% V_{CC} Level
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	*	*	0.2≦f₀≦54	tr,tf	—	—	8	ns	10 to 90% V_{CC} Level
			54<f₀<100		—	—	4		
			100≦f₀≦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	—	—		
Output Disable Time	*	*	*	tPLZ	—	—	150	ns	
Output Enable Time	*	*	*	tPZL	—	—	5	ms	
Period Jitter (1)	*	*	*	tRMS	—	2.2	—	ps	σ
				tp-p	—	20	—		Peak to peak
Total Jitter (1)	*	*	*	tTL	—	31	—	ps	tDJ+nxtRJ n=14.1(BER=1×10⁻¹²) (2)
Phase Jitter	*	*	40≦f₀≦125	tpj	—	—	1	ps	f₀ offset:12kHz to 20MHz
			10≦f₀<40						f₀ offset:12kHz to 5MHz
Reliability	AEC-Q100/AEC-Q200								
Packing Unit (3)	2000pcs./reel(180 φ)								

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

Consult our sales representative for other specifications.

■ DSO221SR [mm]

■ Dimensions



Pin Connections

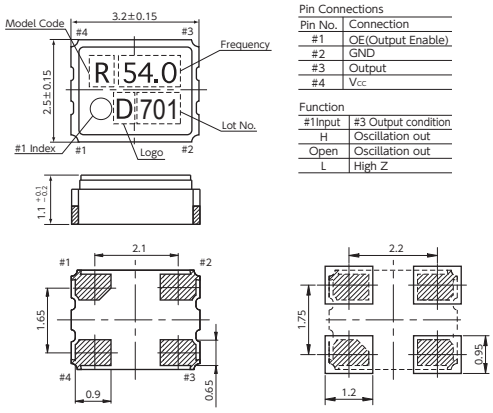
Pin No.	Connection
#1	OE(Output Enable)
#2	GND
#3	Output
#4	Vcc

Function

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

■ DSO321SR [mm]

■ Dimensions



Pin Connections

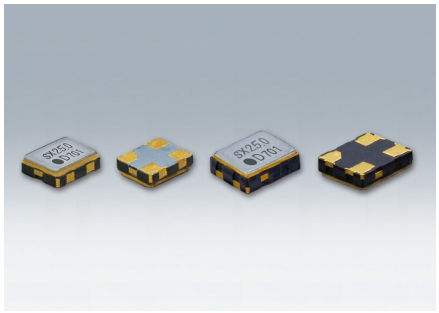
Pin No.	Connection
#1	OE(Output Enable)
#2	GND
#3	Output
#4	Vcc

Function

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

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℃ .
- 3-state function
- Conforms to Autonomous Driving Level II
- AEC-Q100/AEC-Q200 Compliant

Pb-Free

RoHS/ELV Compliant

■ Applications

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

[Type]

DSO211SX	2016 size
DSO221SX	2520 size

[Function Code]

DSO***SX A Z

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

A : ±100×10⁻⁶
Z : ±80×10⁻⁶
B : ±50×10⁻⁶
C : ±30×10⁻⁶

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

■ Standard Specification

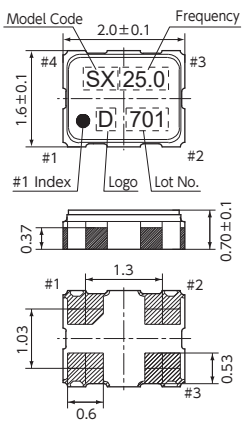
Item	Function Code: Supply Voltage	Function Code: Frequency tolerance	Output Frequency Range (MHz)	Legend	Spec. min.	Spec. typ.	Spec. max.	Unit	Condition
Supply Voltage	A	*	1≦f0≦125	VCC	+3.0	+3.3	+3.6	V	
	B				+2.6	+2.8	+3.0		
	C				+2.25	+2.5	+2.75		
	D		1≦f0≦100		+1.6	+1.8	+2.0		
Frequency Tolerance (includes frequency tolerance at room temperature)	*	A	*	f_tol	–	–	±100	×10⁻⁶	−40 to+125℃
		Z			–	–	±80		
		B			–	–	±50		−40 to +85℃
		C			–	–	±30		
Current Consumption	A	*	100≦f0≦125	ICC	–	–	10.0	mA	No Load
			40≦f0<100		–	–	4.2		
			1≦f0<40		–	–	2.4		
	B		100≦f0≦125		–	–	9.0		
			40≦f0<100		–	–	3.7		
			1≦f0<40		–	–	2.2		
	C		100≦f0≦125		–	–	8.0		
			40≦f0<100		–	–	3.4		
			1≦f0<40		–	–	2.0		
	D		40≦f0≦100		–	–	2.7		
			1≦f0<40		–	–	1.7		
Stand-by Current (#1 pin "L"Level)	*	*	*	I_std	–	–	10	μA	
Load Condition	*	*	*	L_CMOS	–	–	15	pF	
Symmetry	*	*	*	SYM	45	50	55	%	50% Vcc Level
0 Level Output Voltage	*	*	*	VOL	–	–	Vcc×0.1	V	
1 Level Output Voltage	*	*	*	VOH	Vcc×0.9	–	–		
Rise and Fall Time	A,B,C	*	*	tr, tf	–	–	3	ns	10 to 90% Vcc Level
	D				–	–	5		
OE Pin 0 Level Input Voltage	*	*	*	VIL	–	–	Vcc×0.3	V	
OE Pin 1 Level Input Voltage	*	*	*	VIH	Vcc×0.7	–	–		
Output Disable Time	*	*	*	tPLZ	–	–	200	ns	
Output Enable Time	*	*	*	tPZL	–	–	2	ms	
Period Jitter (1)	*	*	*	tRMS	–	2.4	–	ps	σ
				tp-p	–	23	–		Peak to peak
Total Jitter (1)	*	*	*	tTL	–	34	–	ps	tDJ+n×tRJ n=14.1(BER=1×10⁻¹²) (2)
Phase Jitter	*	*	40≦f0≦125	tpj	–	–	1	ps	f0 offset:12kHz to 20MHz
			10≦f0<40						f0 offset:12kHz to 5MHz
Reliability	AEC-Q100/AEC-Q200								
Packing Unit (3)	3000pcs./reel (φ180)								

Consult our sales representative for other specifications.

(1) Measured WAVECREST DTS-2075
(2) tDJ:Deterministic jitter tRJ:Random jitter
(3) Moisture prevention packing is unnecessary. Moisture Sensitivity Level:Level1 (IPC/JEDEC J-STD-033)

■ DSO211SX [mm]

■ Dimensions



Pin Connections

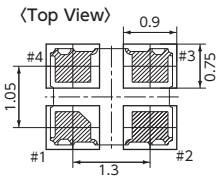
Pin No.	Connection
#1	OE(Output Enable)
#2	GND
#3	Output
#4	Vcc

Function

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

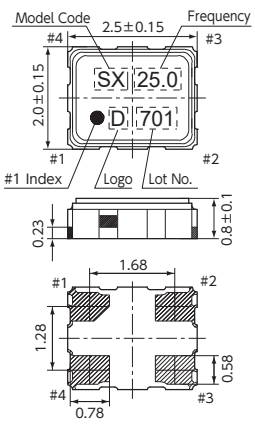
■ Recommended Land Pattern

〈Top View〉



■ DSO221SX [mm]

■ Dimensions



Pin Connections

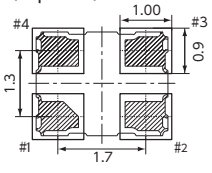
Pin No.	Connection
#1	OE(Output Enable)
#2	GND
#3	Output
#4	Vcc

Function

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

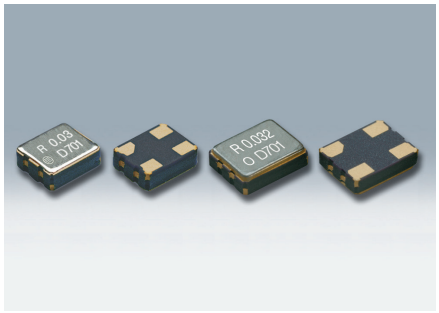
■ Recommended Land Pattern

〈Top View〉



SMD Crystal Oscillators〈For Automotive〉

DSO221SR/DSO321SR (kHz)



Actual size DSO221SR DSO321SR

■ Features

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

Pb-Free

RoHS/ELV Compliant

■ Applications

- Multimedia devices such as car navigation systems and car audio

[Type]

DSO221SR	2520 size
DSO321SR	3225 size

[Function Code]

DSO***SR A Y

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

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

■ Standard Specification

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

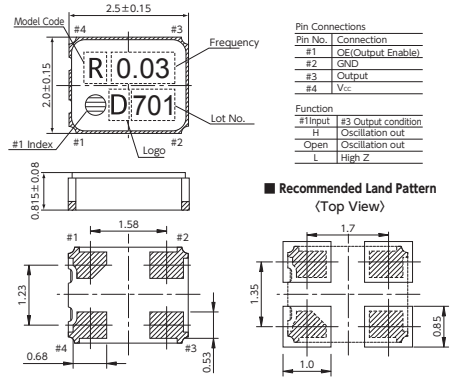
Item	Function Code		Output Frequency Range (KHz)	Legend	Spec.				Condition
	Supply Voltage	Frequency tolerance			min.	typ.	max.	Unit	
Supply Voltage	A	*	32.768≦fo≦50	Vcc	+3.0	+3.3	+3.6	V	
	M				+2.7	+3.0	+3.3		
	B				+2.6	+2.8	+3.0		
	C				+2.25	+2.5	+2.75		
	D				+1.6	+1.8	+2.0		
	Y				+4.5	+5.0	+5.5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

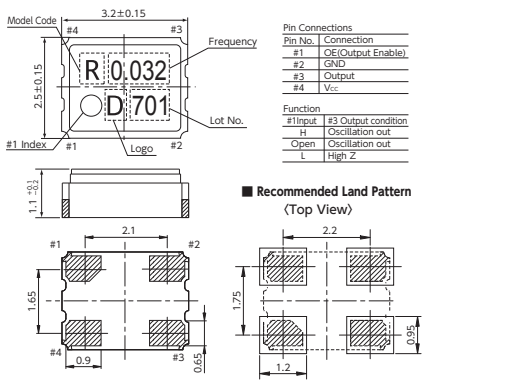
■ DSO221SR(kHz) [mm]

■ Dimensions



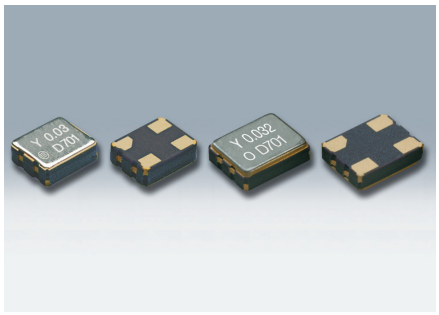
■ DSO321SR(kHz) [mm]

■ Dimensions



SMD Crystal Oscillators〈For Automotive〉

DSO221SY/DSO321SY



Actual size DSO221SY DSO321SY

■ Features

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

Pb-Free

RoHS/ELV Compliant

■ Applications

- Multimedia devices such as car navigation systems and car audio

[Type]

DSO221SY	2520 size
DSO321SY	3225 size

[Function Code]

DSO***SY A A

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

A :±100×10^{-6}
B :±50×10^{-6}

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

■ Standard Specification

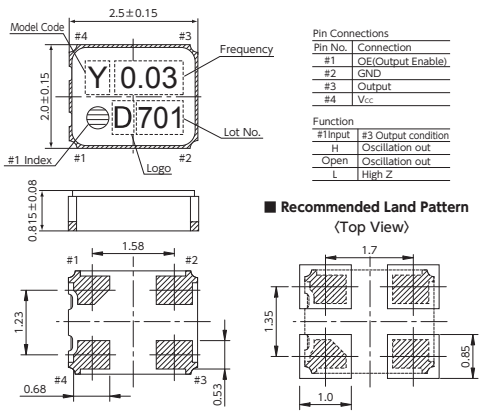
Item	Function Code		Output Frequency Range	Legend	Spec.				Condition
	Supply Voltage	Frequency tolerance			min.	typ.	max.	Unit	
Supply Voltage	A	*	32.768kHz 1.049≦fo≦8.5MHz	Vcc	+3.0	+3.3	+3.6	V	
	B				+2.6	+2.8	+3.0		
	C				+2.25	+2.5	+2.75		
	D				+1.6	+1.8	+2.0		
Frequency Tolerance (includes frequency tolerance at room temperature)	*	A	32.768kHz 1.049≦fo≦8.5MHz	f_tol	−100	−	+100	×10^{-6}	−40 to +85℃
		B			−50	−	+50		
Current Consumption	*	*	32.768kHz	Icc	−	−	18	μA	No Load
			1.049≦fo≦8.5MHz		−	−	700		
Stand-by Current (#1 pin "L" Level)	*	*	*	I_std	−	−	3	μA	
Load Condition	*	*	*	L_CMOS	−	−	15	pF	
Symmetry	*	*	32.768kHz	SYM	45	50	55	%	at 50% Vcc
			1.049≦fo≦8.5MHz		40	50	60		
0 Level Output Voltage	*	*	*	VOL	−	−	Vcc×0.1	V	
1 Level Output Voltage	*	*	*	VOH	Vcc×0.9	−	−		
Rise and Fall Time	*	*	*	tr, tf	−	−	15	ns	10 to 90% Vcc Level
OE Pin 0 Level Input Voltage	*	*	*	VIL	−	−	Vcc×0.2	V	
OE Pin 1 Level Input Voltage	*	*	*	VIH	Vcc×0.8	−	−		
Output Disable Time	*	*	*	tPLZ	−	−	100	ns	
Output Enable Time	*	*	*	tPZL	−	−	20	ms	
Reliability	AEC-Q100/AEC-Q200								
Packing Unit (1)	2000pcs./reel(φ180)								

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

Consult our sales representative for other specifications.

■ DSO221SY [mm]

■ Dimensions



Pin Connections

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

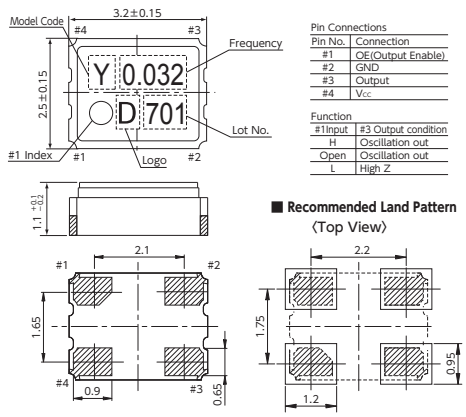
Function

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

■ Recommended Land Pattern
〈Top View〉

■ DSO321SY [mm]

■ Dimensions



Pin Connections

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

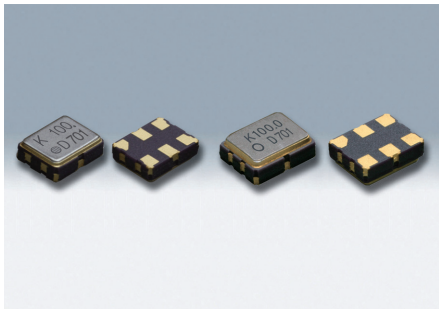
Function

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

■ Recommended Land Pattern
〈Top View〉

SMD Differential Output Crystal Oscillators〈For Automotive〉

DSO223SK/DSO323SK/DSO223SJ/DSO323SJ/DSO223SD/DSO323SD



Actual size DSO223S DSO323S

■ Features

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

Pb-Free

RoHS/ELV Compliant

■ Applications

- Multimedia devices such as car navigation systems and car audio

[Type]

DSO223S SERIES	2520 size
DSO323S SERIES	3225 size

[Function Code]

DSO***S K A A C

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

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

■ Standard Specification

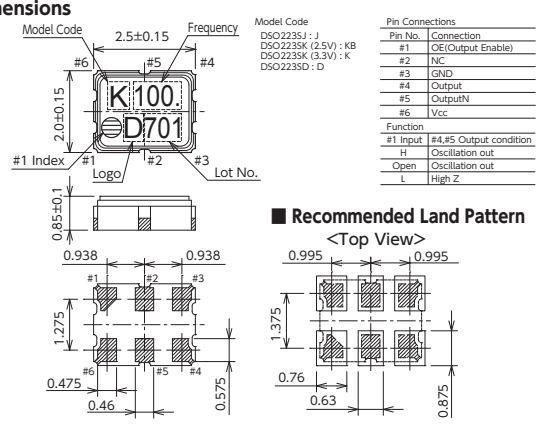
Item \ Type	Legend	DSO223SK DSO323SK	DSO223SJ DSO323SJ	DSO223SD DSO323SD
Output Specification	–	LV-PECL	LVDS	HCSL
Output Frequency Range	f0	13.5 to 167MHz		
Supply Voltage	Vcc	+2.5V±0.125V/+3.3V±0.165V		
Frequency Tolerance (Includes frequency tolerance at room temperature.)	f_tol	±50×10^{-6} max., ±80×10^{-6} max. / ±100×10^{-6} max.		
Storage Temperature Range	T_stg	−40 to +105℃		
Operating Temperature Range	T_use	−40 to +85℃, −40 to +105℃		
Current Consumption	Icc	45mA max.	20mA max.	30mA max.
Stand-by Current (#1 pin "L" Level)	I_std	10μA max.		
Load Resistance	Load-R	50Ω to Vcc−2V	100Ω (Output−OutputN)	50Ω
Symmetry	SYM	45 to 55% [at outputs cross point]		
0 Level Output Voltage	VOL	Vcc−1.81 to Vcc−1.62V	–	−0.15 to 0.15V
1 Level Output Voltage	VOH	Vcc−1.025 to Vcc−0.88V	–	0.58 to 0.85V
Rise and Fall Time	tr, tf	0.5ns max. [20 to 80% Output, OutputN]	0.4ns max. [20 to 80% Output−OutputN]	0.5ns max. [0.175 to 0.525V Level]
Differential Output Voltage	VOD1, VOD2	–	0.247 to 0.454V	–
Change to VOD	⊿VOD	–	50mV [⊿VOD= | VOD1−VOD2 |]	–
Offset Voltage	VOS	–	1.125 to 1.375V	–
Offset to VOS	⊿VOS	–	50mV	–
Crossing Point Voltage	Vcr	–	–	250 to 550mV
OE Pin 0 Level input Voltage	VIL	Vcc×0.3 max.		
OE Pin 1 Level input Voltage	VIH	Vcc×0.7 min.		
Output Disable Time	tPLZ	200ns		
Output Enable Time	tPZL	2ms		
Period Jitter (1)	tRMS	5ps typ. (13.5MHz≦f0<27MHz) / 2.5ps typ. (27MHz≦f0≦167MHz) (σ)		
	tp-p	33ps typ. (13.5MHz≦f0<27MHz) / 22ps typ. (27MHz≦f0≦167MHz) (Peak to peak)		
Total Jitter (1)	tTL	50ps typ. (13.5MHz≦f0<27MHz) / 35ps typ. (27MHz≦f0≦167MHz) [tDJ + n×tRJ n=14.1(BER=1×10^{-12}) (2)]		
Phase Jitter	tpj	1.5ps max. (13.5MHz≦f0<27MHz) / 1ps max. (27MHz≦f0≦167MHz) [13.5MHz≦f0<40MHz,f0 offset:12kHz to 5MHz f0≧40MHz,f0 offset:12kHz to 20MHz]		
Reliability	AEC-Q200(DSO223 SERIES), AEC-Q100/AEC-Q200(DSO323 SERIES)			
Packing Unit (3)	2000pcs./reel(φ180)			

(1) Measured WAVECREST DTS-2075
(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.

■ DSO223S 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

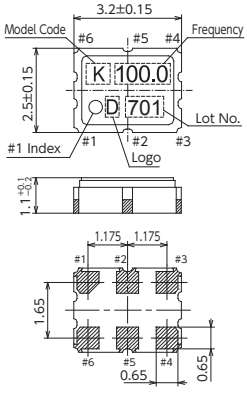
#1 Input	#4,#5 Output condition
H	Oscillation out
Open	Oscillation out
L	High Z

■ Recommended Land Pattern

<Top View>

■ DSO323S SERIES [mm]

■ Dimensions



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

Pin Connections

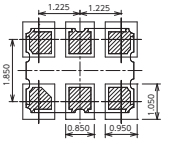
Pin No.	Connection
#1	OE(Output Enable)
#2	NC
#3	GND
#4	Output
#5	OutputN
#6	Vcc

Function

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

■ Recommended Land Pattern

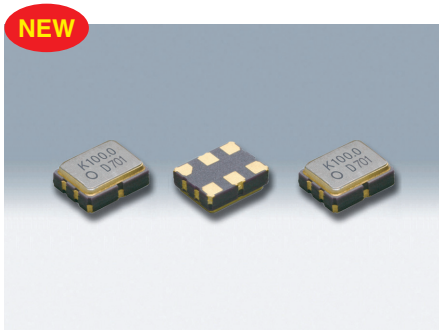
<Top View>



SMD Differential Output Crystal Oscillators - Low Voltage〈For Automotive〉

DSO323SJ/DSO323SD

NEW



Actual size

■ Features

- 1.8V operating voltage, High speed type
- 3-state function
- LVDS output (DSO323SJ)
- HCSL output (DSO323SD)
- AEC-Q200 Compliant (Option: Equivalent to AEC-Q100)

■ Applications

- Multimedia devices such as car navigation systems and car audio

Pb-Free

RoHS/ELV Compliant

[Function Code]

DSO323S J D A A

- Model Code: J : LVDS / D : HCSL
- Operating Temperature Range: C : − 40 to +85℃ / E : − 40 to +105℃
- Supply Voltage: D : 1.8V
- Frequency Tolerance: A : ±100×10⁻⁶ / B : ±50×10⁻⁶

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

■ Standard Specification

Item \ Type	Legend	DSO323SJ	DSO323SD
Output Specification	–	LVDS	HCSL
Output Frequency Range	fo	100 to 167MHz	
Supply Voltage	V_{CC}	+1.8V±0.09V	
Frequency Tolerance (Includes frequency tolerance at room temperature.)	f_tol	±50×10⁻⁶ max., ±80×10⁻⁶ max. / ±100×10⁻⁶ max.	
Storage Temperature Range	T_stg	−40 to +105℃	
Operating Temperature Range	T_use	−40 to +85℃, −40 to +105℃	
Current Consumption	I_{CC}	25mA max.	50mA max.
Stand-by Current(#1 pin "L" Level)	I_std	30μA max.	
Load Resistance	Load-R	100Ω (Output−OutputN)	50Ω
Symmetry	SYM	45 to 55% [at outputs cross point]	
0 Level Output Voltage	V_{OL}	–	−0.15 to 0.15V
1 Level Output Voltage	V_{OH}	–	0.55 to 1.0V
Rise and Fall Time	tr, tf	0.4ns max. [20 to 80% Output−OutputN]	0.5ns max. [−0.15 to 0.15V/Output-OutputN]
Differential Output Voltage	V_{OD1}, V_{OD2}	0.247 to 0.454V	–
Change to V_{OD}	ΔV_{OD}	50mV [ΔV_{OD}= | V_{OD1}−V_{OD2} |]	–
Offset Voltage	V_{OS}	1.125 to 1.375V	–
Offset to V_{OS}	ΔV_{OS}	50mV	–
OE Pin 0 Level input Voltage	V_{IL}	V_{CC}×0.3 max.	
OE Pin 1 Level input Voltage	V_{IH}	V_{CC}×0.7 min.	
Output Disable Time	tPLZ	200ns	
Output Enable Time	tPZL	2ms	
Period Jitter(1)	tRMS	2.5ps typ. (σ)	
	tp-p	22ps typ. (Peak to peak)	
Total Jitter(1)	tTL	35ps typ. [tDJ + n×tRJ n=14.1(BER=1×10⁻¹²) (2)]	
Phase Jitter	tpj	0.15ps max.	
Reliability	AEC-Q100/AEC-Q200		
Packing Unit (3)	2000pcs./reel(φ180)		

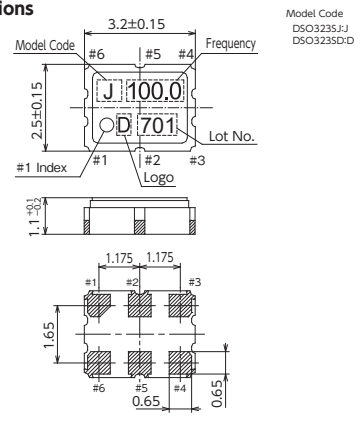
(1) Measured WAVECREST DTS-2075
(2) tDJ:Deterministic jitter tRJ:Random jitter
(3) Moisture prevention packing is unnecessary.
Moisture Sensitivity Level: LEVEL 1 (IPC/JEDEC J-STD-033)

Consult our sales representative for other specifications.

■ DSO323S SERIES

[mm]

■ Dimensions



Model Code
DSO323SJ:J
DSO323SD:D

Pin Connections

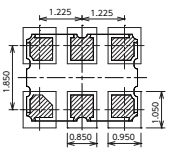
Pin No.	Connection
#1	OE(Output Enable)
#2	NC
#3	GND
#4	Output
#5	OutputN
#6	Vcc

Function

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

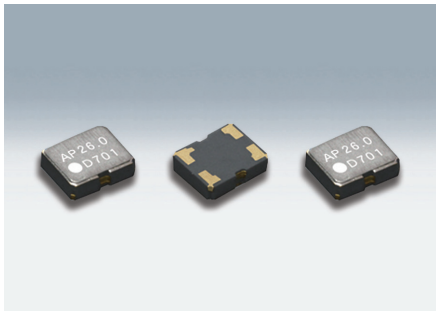
■ Recommended Land Pattern

<Top View>



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℃
- Low voltage operation
- Low phase noise
- Single packaged structure
- AEC-Q100/AEC-Q200 compliant

■ Applications

- GPS / GNSS
- Telematics,Satellite radio

Pb-Free

RoHS/ELV Compliant

■ Standard Specification

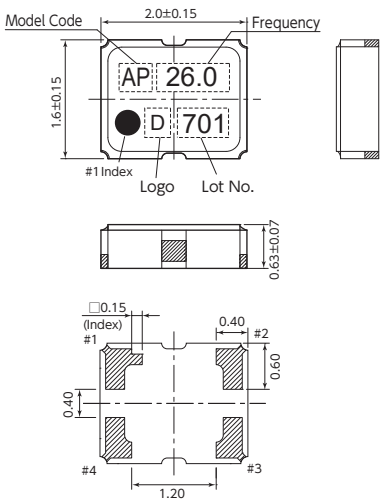
Item \ Type	DSA211SP(VC-TCXO)	DSB211SP(TCXO)
Output Frequency Range	12.288 to 52 MHz	12.288 to 52 MHz
Standard Frequency	16.3676/ 16.367667/ 16.368/ 16.369/ 16.8/ 26/ 38.4 MHz	
Supply Voltage Range	+1.68 to +3.5V	
Supply Voltage(Vcc)	+1.8V / +2.8 V / +3.0V / +3.3V	
Current Consumption	+1.7 mA max. (f≦26MHz)/+2.2 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℃	±0.5×10^{-6} max. / −40 to +105℃
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]	[f>26MHz]
Offset 100Hz	−115 dBc/Hz	−110 dBc/Hz	−105 dBc/Hz
Offset 1kHz	−135 dBc/Hz	−130 dBc/Hz	−125 dBc/Hz
Offset 10kHz	−145 dBc/Hz	−140 dBc/Hz	−135 dBc/Hz
Offset 100kHz	−145 dBc/Hz	−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



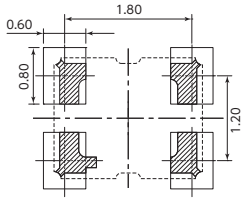
Model Code
AP : VC-TCXO(DSA211SP)
BP : TCXO(DSB211SP)

Pin Connections

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

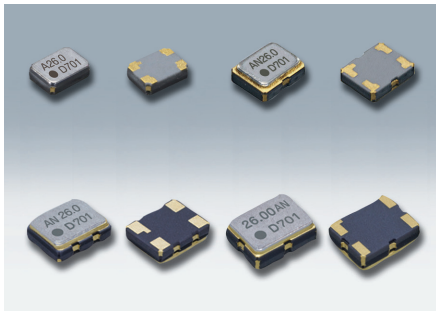
■ Recommended Land Pattern

〈Top View〉



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

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



Actual size DSA1612SDN DSA211SDN DSA221SDN DSA321SDN

■ Features

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

■ Applications

- Telematics, Satellite radio

Pb-Free

RoHS/ELV Compliant

[Type]

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

■ Standard Specification

Item \ Type	VC-TCXO				TCXO			
	DSA1612SDN	DSA211SDN	DSA221SDN	DSA321SDN	DSB1612SDN	DSB211SDN	DSB221SDN	DSB321SDN
Frequency Range	16 to 60MHz	12.288 to 52MHz	9.6 to 52MHz		16 to 60MHz	12.288 to 52MHz	9.6 to 52MHz	
Standard Frequency	19.2MHz/26MHz/38.4MHz/40MHz/52MHz				16.3676MHz/16.367667MHz/16.368MHz/16.369MHz/16.8MHz/26MHz/33.6MHz			
Supply Voltage Range	+1.68 to +3.5V							
Supply Voltage (Vcc)	+1.8V/+2.6V/+2.8V/+3.0V/+3.3V							
Current Consumption	+1.5mA max. (f≦26MHz) /+2.0mA max. (26MHz<f≦52MHz) /+2.5mA max. (f≦60MHz)							
Output Level	0.8Vp-p min. (f≦52MHz) (Clipped Sinewave/DC-coupled)							
Output Load	10kΩ//10pF							
Frequency Stability Tolerance	±1.5×10^{-6} max. (After 2 reflows)							
vs. Temperature	±1.0×10^{-6}, ±2.5×10^{-6} max/-40 to +85℃				±0.5×10^{-6}, ±2.5×10^{-6} max/-40 to +85℃			
vs. Supply Voltage	±0.2×10^{-6} max. (Vcc ±5%)							
vs. Load Variation	±0.2×10^{-6} max. (10kΩ//10pF±10%)							
vs. Aging	±1.0×10^{-6} max./year							
Frequency Control Control Sensitivity	±3.0×10^{-6} to ±5.0×10^{-6}/Vcont=+1.4V±1V @Vcc≧+2.6V ±3.0×10^{-6} to ±5.0×10^{-6}/Vcont=+0.9V±0.6V @Vcc=+1.8V				–			
Response Slope	Positive				–			
Start up Time	2.0ms max.							
Phase Noise	[f≦26MHz]		[26MHz<f≦40MHz]		[40MHz<f≦52MHz]			
Offset 100Hz	-115dBc/Hz		-110dBc/Hz		-105dBc/Hz			
Offset 1kHz	-130dBc/Hz		-130dBc/Hz		-125dBc/Hz			
Offset 10kHz	-150dBc/Hz		-150dBc/Hz		-145dBc/Hz			
Offset 100kHz	-155dBc/Hz		-155dBc/Hz		-150dBc/Hz			
Reliability	AEC-Q100/AEC-Q200							
Packing Unit (1)	DSA1612SDN/DSA211SDN/DSA221SDN, DSB1612SDN/DSB211SDN/DSB221SDN: 3000pcs./reel(φ180) DSA321SDN, DSB321SDN: 2000pcs./reel(φ180)							

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

Consult our sales representative for other specifications.

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

For Automotive Applications

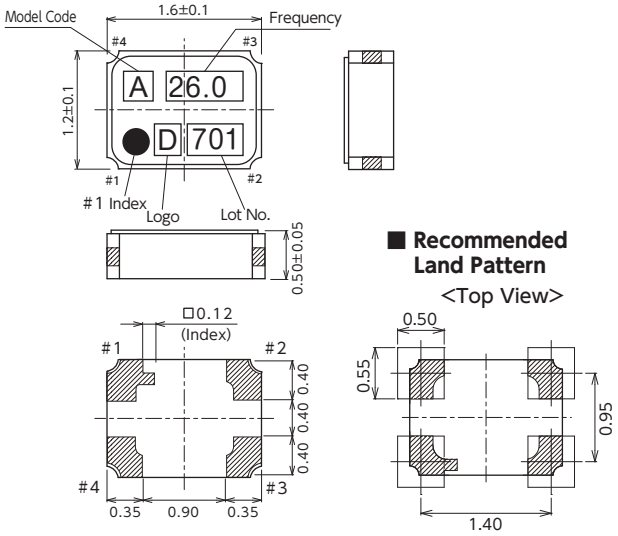
■ Dimensions

[mm]

■ DSA1612SDN/DSB1612SDN

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

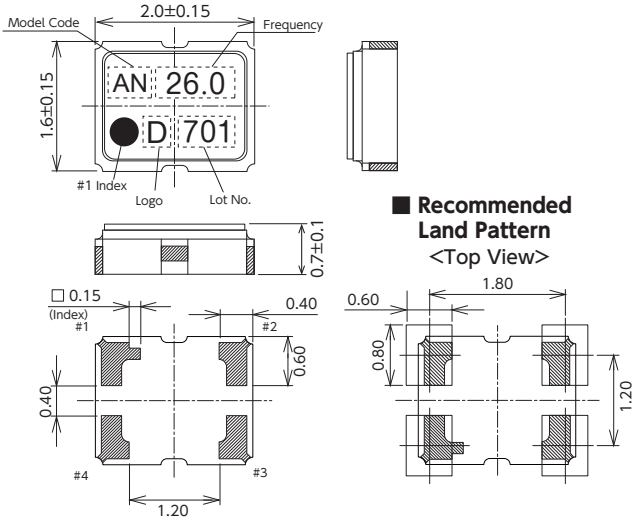
Pin Connections	
Pin No.	Connection
#1	Vcont(VC-TCXO)/GND(TCXO)
#2	GND
#3	Output
#4	Vcc



■ DSA211SDN/DSB211SDN

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

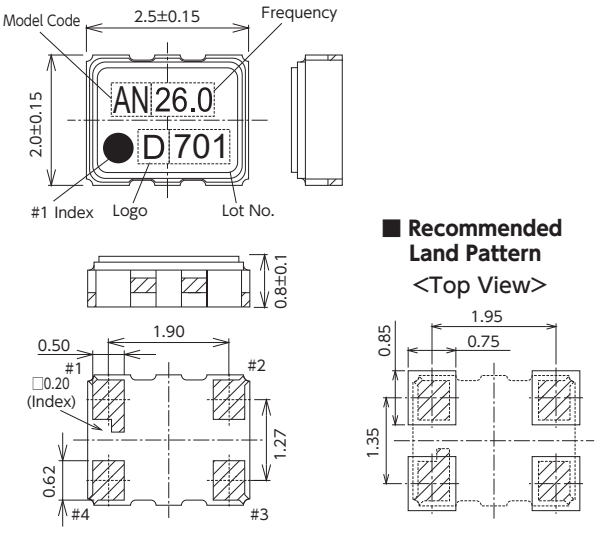
Pin Connections	
Pin No.	Connection
#1	Vcont(VC-TCXO)/GND(TCXO)
#2	GND
#3	Output
#4	Vcc



■ DSA221SDN/DSB221SDN

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

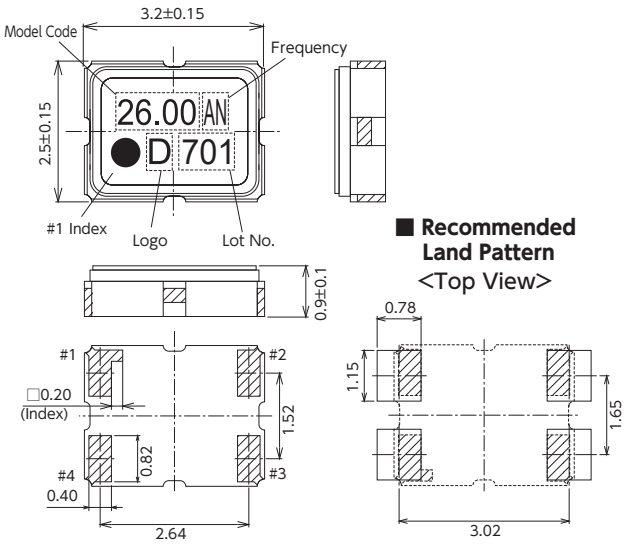
Pin Connections	
Pin No.	Connection
#1	Vcont(VC-TCXO)/GND(TCXO)
#2	GND
#3	Output
#4	Vcc



■ DSA321SDN/DSB321SDN

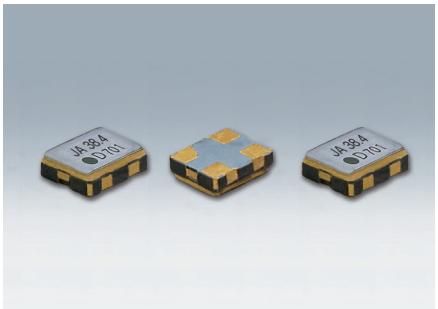
Model Code
AN : VC-TCXO (DSA321SDN)
BN : TCXO (DSB321SDN)

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



SMD TCXO〈For Automotive〉

DSB211SJA



Actual size

■ Features

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

Pb-Free

RoHS/ELV Compliant

■ Applications

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

■ Standard Specification

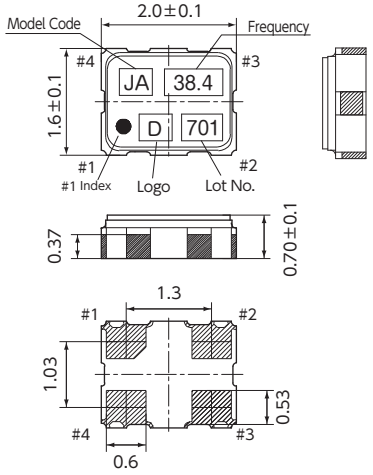
Item \ Type	DSB211SJA	
Frequency Range	13 to 52MHz	
Standard Frequency	19.2MHz/ 25MHz/ 26MHz/ 32MHz/ 38.4MHz/ 40MHz/ 48MHz/ 52MHz	
Supply Voltage (Vcc)	+1.8V/ +2.5V/ +2.8V/ +3.3V	
Current Consumption	5.0mA max. [No Load]	
Stand-by Current (#1 pin "L" Level)	+10μA max.	
Frequency Stability Tolerance	±1.5×10^{-6}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

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

Consult our sales representative for other specifications.

[mm]

■ Dimensions



Pin Connections

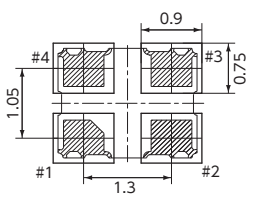
Pin No.	Connection
#1	OE (Output Enable)
#2	GND
#3	Output
#4	Vcc

Function

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

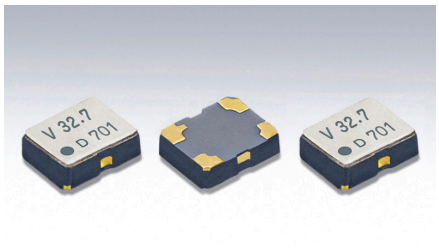
■ Recommended Land Pattern

<Top View>



SMD TCXO〈For Automotive〉

DSK1612ATD



Actual size

■ Features

- Digital temperature compensated type
- High precision: ±5.0×10^{-6} (-40 to +85℃)
- Low current consumption
- AEC-Q200 Compliant

■ Applications

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

Pb-Free

RoHS Compliant

■ Standard Specification

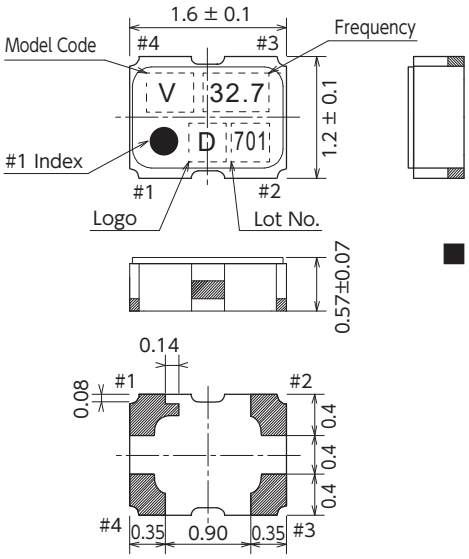
Item	Legend	Spec. min.	Spec. typ.	Spec. max.	Spec. Unit	Condition
Output Frequency	f_0	–	32.768	–	kHz	
Supply Voltage Range	Vcc	+1.5	–	3.63	V	Temperature Compensated Operating
Frequency Tolerance	f_tol	−5.0	–	+5.0	×10^{-6}	Vcc=+1.8V or +3.3V, T_A=-40 to +85℃ (Standard operating temperature range, Referenced to 32.768kHz)
Current Consumption	I_{CC1}	–	0.90	1.90	μA	Vcc=+1.8V, T_A=-40 to +85℃, at No Load (1)
		–	1.23	2.60		Vcc=+3.3V, T_A=-40 to +85℃, at No Load (1)
	I_{CC2}	–	1.26	2.43		Vcc=+1.8V, T_A=-40 to +85℃, at No Load Temperature Compensation Interval: 0.5s (standard specification) (2)
		–	1.59	3.12		VCC=+3.3V, T_A=-40 to +85℃, at No Load Temperature Compensation Interval: 0.5s (standard specification) (2)
Symmetry	SYM	40	50	60	%	at 50% Vcc
0 Level Output Voltage	V_{OL}	–	–	Vcc×0.1	V	
1 Level Output Voltage	V_{OH}	Vcc×0.9	–	–	V	
Rise and Fall Time	tr, tf	–	–	40	ns	10 to 90% Vcc Level
Load Condition	L_{CMOS}	–	–	15	pF	
Start Up Time	Tstart	–	–	0.5	s	
Reliability	AEC-Q200					
Packing Unit (3)	3000pcs./reel (φ180)					

(1) I_{CC1} is the current value when the temperature compensation circuit is not operating.
(2) I_{CC2} is the average current value when the temperature compensation circuit is operating and non-operating.
(3) Moisture prevention packing is unnecessary. Moisture Sensitivity Level: Level1 (IPC/JEDEC J-STD-033)

Consult our sales representative for other specifications.

[mm]

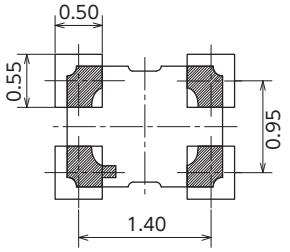
■ Dimensions



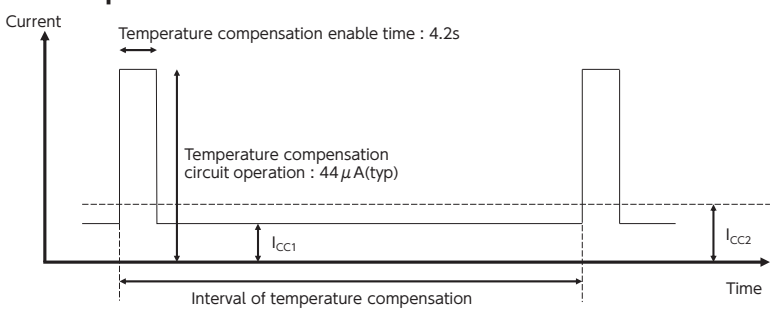
Pin No.	Connection
#1	GND
#2	Output
#3	Vcc
#4	GND

■ Recommended Land Pattern

<Top View>



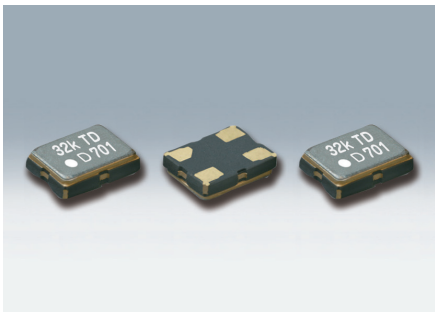
■ Current profile



I_{CC2} (typ)=0.90μA×(0.5s-4.2ms)/0.5s + 44μA×4.2ms/0.5s=1.26 (Vcc=1.8V)
I_{CC2} (typ)=1.23μA×(0.5s-4.2ms)/0.5s + 44μA×4.2ms/0.5s=1.59 (Vcc=3.3V)

SMD TCXO〈For Automotive〉

DSK321STD



Actual size

■ Features

- Digital temperature compensated type
- High precision: ±5.0×10^{-6} (−40 to +85℃)
- Low current consumption
- AEC-Q200 Compliant
- CMOS Level Output

■ Applications

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

Pb-Free

RoHS/ELV Compliant

■ Standard Specification

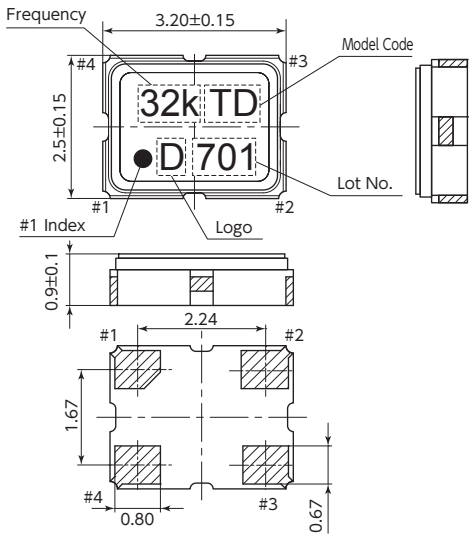
Item	Legend	Spec.				Condition
		min.	typ.	max.	Unit	
Output Frequency	f0	–	32.768	–	kHz	
Supply Voltage Range	Vcc	+1.5	–	+3.63	V	(Temperature Compensated Operating)
Frequency Tolerance (Includes frequency tolerance at room temperature.)	f_tol	−5.0	–	+5.0	×10^{-6}	−40 to +85℃
Current Consumption	Icc	–	–	+3.5	μA	Vcc=+1.8V or +3.3V, Temperature Compensation Interval:0.5s, No Load
		–	–	+3.2		Vcc=+1.8V or +3.3V, Temperature Compensation Interval:2.0s, No Load
Symmetry	SYM	40	50	60	%	at 50% Vcc
0 Level Output Voltage	VOL	–	–	Vcc×0.1	V	
1 Level Output Voltage	VOH	Vcc×0.9	–	–		
Rise and Fall Time	tr, tf	–	–	50	ns	Vcc=+1.5 to +3.63V, 10 to 90% Vcc Level
Load Condition	L_CMOS	–	–	15	pF	
Start Up Time	Tstart	–	–	1.0	s	
Reliability	AEC-Q200					
Packing Unit (1)	2000pcs./reel (φ180)					

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

Consult our sales representative for other specifications.

[mm]

■ Dimensions

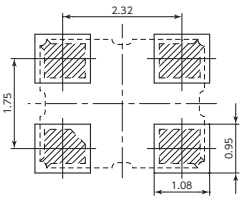


Pin Connections

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

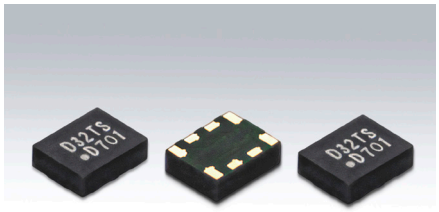
■ Recommended Land Pattern

<Top View>



SMD Real Time Clock Module〈For Automotive〉

DD3225TS



Actual size

Pb-Free

RoHS Compliant

■ Features

- Digital temperature compensated type
- High precision : ±5.0×10^{-6} (-40 to +85℃), ±7.0×10^{-6} (-40 to +105℃)
- Low current consumption
- Low voltage operation : +1.5 to +5.5V (Temperature Compensated Operating), +1.3 to +5.5V (Clock Timing Operating)
- I^{2}C-BUS serial interface:400kHz fast-mode compatible
- Clock function:hour･minute･second, Calendar function with auto leap year adjustment:year･month･day･day of week
- Alarm interrupt function:day･day of week･hour･minute
- Fixed-cycle timer interrupt function:244μs to 255min
- Time update interrupt function:minute･second
- Clock output function:32.768kHz, 1024Hz, 32Hz, 1Hz
- Supply voltage detection function:
  +1.5V temperature compensation operating voltage detection
  +1.3V supply voltage under voltage detection
- CMOS Level Output
- AEC-Q100/AEC-Q200 compliant

* "I^{2}C-BUS" is a trademark of NXP semiconductors.

■ Applications

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

■ Standard Specification

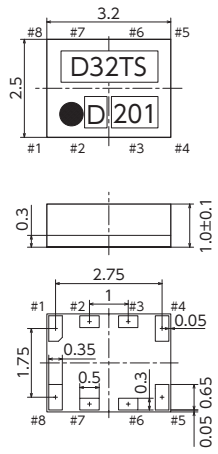
Item	Legend	Spec. min.	Spec. typ.	Spec. max.	Spec. unit	Condition	
Output Frequency	f0	–	32.768	–	kHz		
Supply Voltage Range	Vcc	+1.3	–	+5.5	V	(Clock Timing Operating)	
	Vtem	+1.5	–	+5.5		(Temperature Compensated Operating)	
	Vint	+1.5	–	+5.5		(Interface Operation) I^{2}C-BUS	
Frequency Tolerance	f_tol	-5	–	+5	× 10^{-6}	-40 to +85℃	
		-7	–	+7		-40 to +105℃	
Current Consumption	Icc1	–	0.30	2.10	μA	Vcc = +3.0V	Temperature Compensation Interval:30s, SCL = SDA = INTN = Vcc,OE = GND (Output Off)
		–	0.42	2.90		Vcc = +5.0V	
	Icc2	–	0.90	2.80		Vcc = +3.0V	Temperature Compensation Interval:30s, SCL = SDA = INTN = OE = Vcc (Output On), No Load
		–	1.30	4.00		Vcc = +5.0V	
Load Condition	L_CMOS	–	–	15	pF		
Symmetry	SYM	40	–	60	%	50%Vcc	
1 level Output Voltage	VOH	0.8xVcc	–	–	V	IOH=-1mA	
0 level Output Voltage	VOL	–	–	0.2xVcc	V	IOL=1mA	
Rise / Fall Time	Tr/Tf	–	–	100	ns	20 to 80%Vcc	
OE Pin 1 level Input Voltage	VIH	0.8xVcc	–	Vcc	V		
OE Pin 0 level Input Voltage	VIL	0	–	0.2xVcc	V		
Start Up Time	Tstart	–	–	1	s	Ta = +25℃ , Vcc = +1.3V	
Packing Unit (1)	2000pcs./reel (φ 180)						

(1) Moisture prevention packing
Moisture sensitivity level : Level 2 (IPC/JEDEC J-STD-033)

Consult our sales representative for other specifications.

[mm]

■ Dimensions

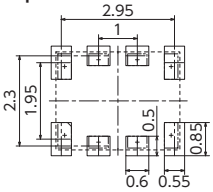


Function	
#1 Input	#5 Output Condition
H	Oscillation out
L	High Z

Marking	
(1) Type	D32TS
(2) Logo	D
(3) Date code	Year(1digit) + Week(2digits) e.g.2022/1/1 → 201

■ Recommended Land Pattern

<Top View>



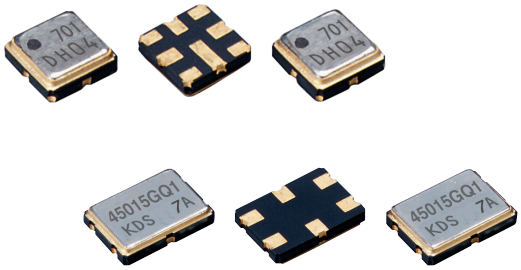
Pin Function

No.	Name	I/O	Description
#1	OE	I	Output control enable input (L:High impedance, H:Clock output)
#2	INTN	0	1Hz signal, alarm interrupt signal, fixed-cycle timer interrupt signal, and time update interrupt signal, Nch open-drain output.
#3	N.C.	-	Do not connect
#4	GND	-	Ground connection.
#5	Output	0	Clock output connection.
#6	SCL	I	I²C-BUS serial interface clock input connection.
#7	SDA	I/O	I²C-BUS serial interface data input/output connection.
#8	Vcc	-	Supply Voltage

MEMO

Quartz Devices

Monolithic crystal filters



〈Example〉 **D S F 3 3 4 S A F**

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

KDS DAISHINKU CORP.

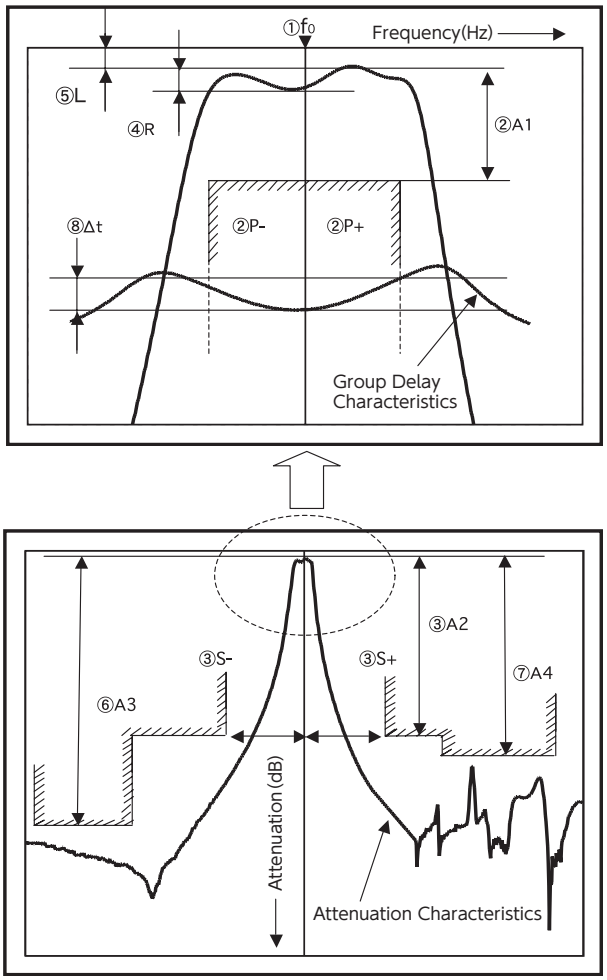
Monolithic Crystal Filters

Description

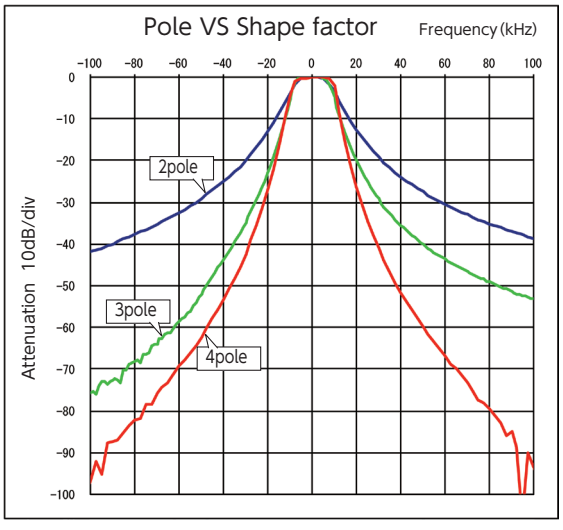
A monolithic crystal filter is a device that has a frequency screening function. From a wide frequency range, it passes a specific frequency and attenuates unnecessary ones. It plays the role of extracting desired frequency in radio communication equipment.
With the high Q factor of the crystal, these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

Terminology

①	**Nominal Frequency** fo (MHz)	Nominal value of center frequency.
②	**Pass Bandwidth** P± (kHz), A1(dB)	Frequency interval at which relative attenuation is guaranteed to be equal to or less than a given value, A1.
③	**Stop Bandwidth** S± (kHz), A2 (dB)	Frequency interval at which relative attenuation is guaranteed to be equal to or more than a given value, A2.
④	**Ripple** R (dB)	The maximum difference between the minimum attenuation and the minimum loss within the pass band.
⑤	**Insertion Loss** L (dB)	Difference in attenuation when filter is inserted and not inserted. Can be either of the following. Minimum loss: Minimum value of insertion loss. Insertion loss at f0: Insertion loss at nominal frequency.
⑥	**Guaranteed Attenuation** A3 (dB)	Relative attenuation guaranteed in a specific range within the stop band.
⑦	**Spurious** A4 (dB)	Relative attenuation produced as a result of spurious frequencies in a specific range within the stop band.
⑧	**Tolerance in Group Delay Time** Δt (μs)	Difference between the maximum value and minimum value of the group delay time within the pass band.
Terminating Impedance Rt//Ct (Ω//pF)		Signal-source impedance or loading impedance as viewed from the filter side. Expressed as resistance and parallel capacitance including floating capacitance.
Coupling Capacitance Cc (pF)		Capacitance of the connection between elements for 4pole filter.
Operating Temperature Range		Temperature range over which the monolithic crystal filter can be operated within allowable deviation range.

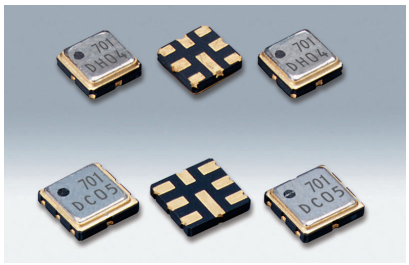


Pole VS Shape factor



SMD Monolithic Crystal Filters

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



Actual size DSF334S DSF444S

Features

- DSF334S 2POLE, 3POLE: 3030 size, 0.9mm height, miniature SMD crystal filter and lightweight(0.03g)
  DSF444S 2POLE, 3POLE: 3838 size, 0.9mm height, miniature SMD crystal filter and lightweight(0.05g)
- Excellent shock and vibration resistance.
- Low spurious

Applications

- Radio communications

Pb-Free

RoHS Compliant

Standard Specification

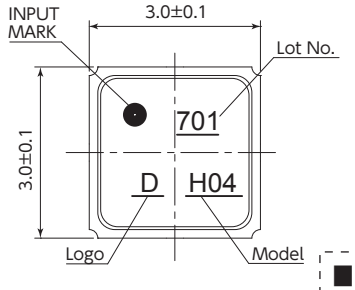
Type	DSF334SAF	DSF334SAF	DSF334SCF	DSF444SAF	DSF444SCF
Model	D50003AM	D50015AM	DA6115FM	D50003AL	D73313FL
Pole	2	2	3	2	3
Overtone Order	Fundamental	Fundamental	Fundamental	Fundamental	Fundamental
Nominal Frequency	50.000 MHz	50.000 MHz	161.950 MHz	50.000 MHz	73.350 MHz
Pass Bandwidth	±1.5kHz min./3dB	±7.5kHz min./3dB	±7.5kHz min./3dB	±1.75kHz min./3dB	±6.5kHz min./3dB
Stop Bandwidth	±18kHz max./15dB	±25kHz max./13dB	±20dB min./50kHz	±16kHz max./15dB	±20kHz max./18dB
Ripple	1dB max.	1dB max.	1dB max.	1dB max.	1dB max.
Insertion Loss	40dB max.	3.5dB max.	5dB max.	4dB max.	3.5dB max.
Guaranteed Attenuation	60dB min.	60dB min.	70dB min.	50dB min.	70dB min.
Terminating Impedance	400Ω//9pF	750Ω//3pF	120Ω//−0.8pF	380Ω//9.0pF	380Ω//−1pF
Operating Temperature Range	−20 to +70℃				
Packing Unit (1)	2000pcs./reel(φ180)			1000pcs./reel(φ180)	

1) Moisture prevention packing is unnecessary.
Moisture Sensitivity Level: LEVEL 1 (IPC/JEDEC J-STD-03

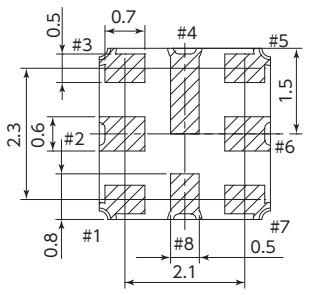
Consult our sales representative for other specifications.

DSF334S [mm]

Dimensions

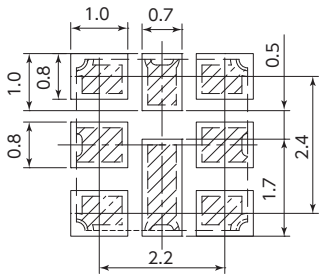


Pin No.	Connection
#1	Input
#2	GND.
#3	GND.
#4	GND.
#5	Output
#6	GND.
#7	GND.
#8	GND.

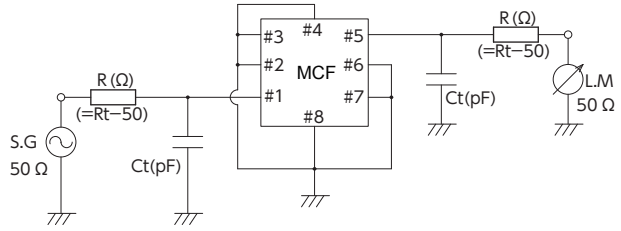


Recommended Land Pattern

〈Top View〉

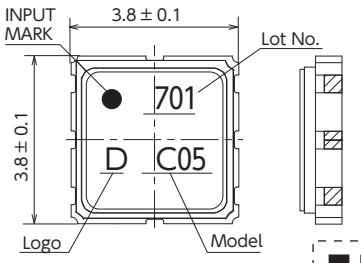


Measurement Circuit

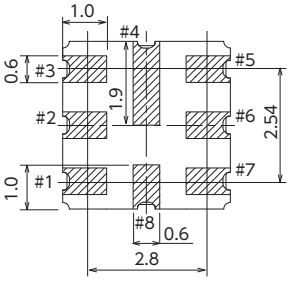


DSF444S [mm]

Dimensions

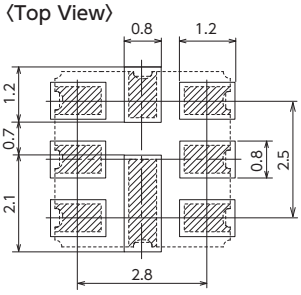


Pin No.	Connection
#1	Input
#2	GND.
#3	GND.
#4	GND.
#5	Output
#6	GND.
#7	GND.
#8	GND.

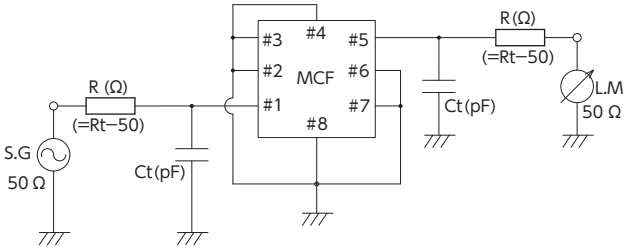


Recommended Land Pattern

〈Top View〉

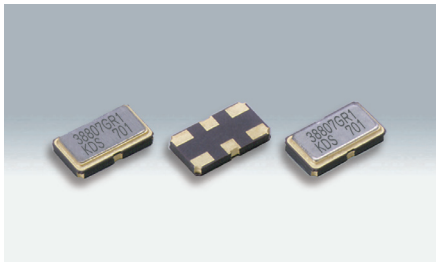


Measurement Circuit



SMD Monolithic Crystal Filters

DSF633S 2POLE/DSF633S 4POLE



Actual size

■ Features

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

■ Applications

- Radio communications

Pb-Free

RoHS Compliant

■ Standard Specification

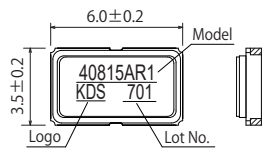
Type	DSF633SDF				
Model	D38807GR	D49903GR	D58010GR	D73312GR	DA3050GR
Pole	4	4	4	4	4
Overtone Order	Fundamental	Fundamental	Fundamental	Fundamental	Fundamental
Nominal Frequency	38.850 MHz	49.950 MHz	58.050 MHz	73.350MHz	130.000MHz
Pass Bandwidth	±3.75kHz min./3dB	±1.75kHz min./3dB	±5.0kHz min./3dB	±6.0kHz 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℃				
Packing Unit (1)	1000pcs./reel(φ180)				

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

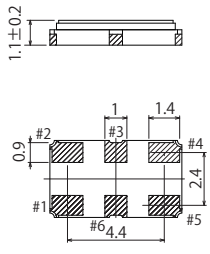
Consult our sales representative for other specifications.

■ DSF633SA [mm]

■ Dimensions

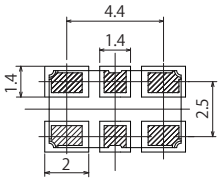


Pin No.	Connection
#1	INPUT
#2	GND.
#3	GND.
#4	OUTPUT
#5	GND.
#6	GND.

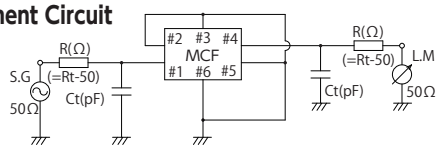


■ Recommended Land Pattern

<Top View>

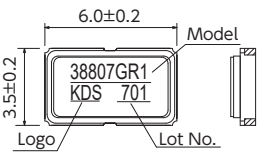


■ Measurement Circuit

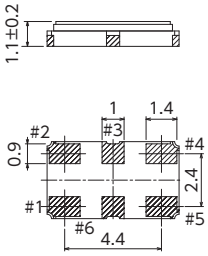


■ DSF633SD [mm]

■ Dimensions

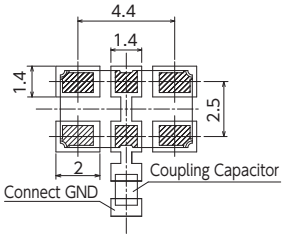


Pin No.	Connection
#1	INPUT
#2	GND.
#3	Connect with #6
#4	OUTPUT
#5	GND.
#6	Connect with #3

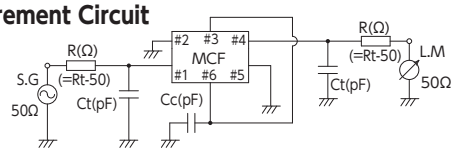


■ Recommended Land Pattern

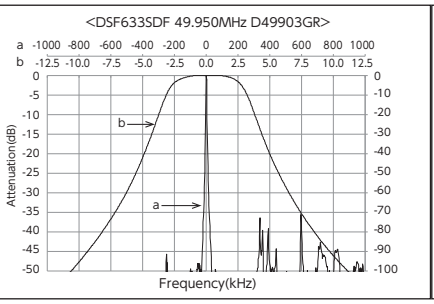
<Top View>



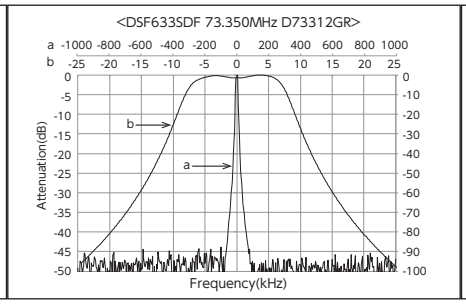
■ Measurement Circuit



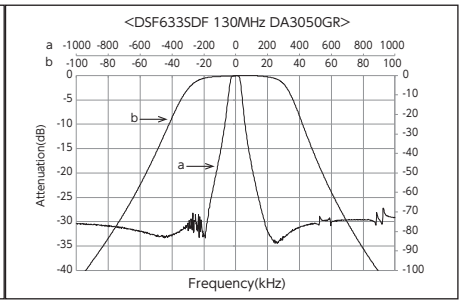
■ Characteristics Chart (fo=49.95MHz, P=±1.75kHz)



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

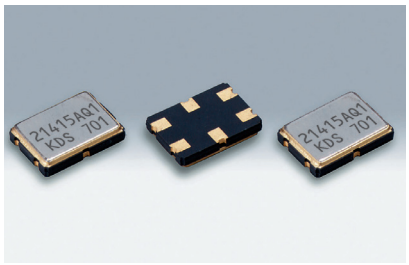


■ Characteristics Chart (fo=130.000MHz, P=±25.0kHz)



SMD Monolithic Crystal Filters

DSF753S 2POLE/DSF753S 3POLE/DSF753S 4POLE



Actual size 

■ Features

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

■ Applications

- Radio communications

Pb-Free

RoHS Compliant

■ Standard Specification

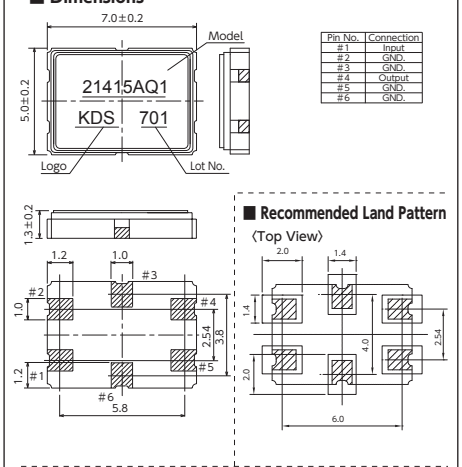
Type	DSF753SAF	DSF753SCF	DSF753SBF/DSF753SDF			DSF753SDO
Model	D21415AQ	D45015FQ	D46307GQ	D50810GQ	D73312GQ	DA4917GQ
Pole	2	3	4	4	4	4
Overtone Order	Fundamental	Fundamental	Fundamental	Fundamental	Fundamental	3rd overtone
Nominal Frequency	21.400 MHz	45.000 MHz	46.350MHz	50.850MHz	73.350MHz	149.9725 MHz
Pass Bandwidth	±7.5kHz min./ 3dB	±7.5kHz min./3dB	±3.5kHz min./3dB	±5.0kHz min./3dB	±6.0kHz min./3dB	±8.68kHz min./3dB
Stop Bandwidth	±25kHz max./18dB	±50kHz max./30dB	±18kHz max./40dB	±20kHz max./40dB	±25kHz max./40dB	±15dB min./30kHz
Ripple	1dB max.	1dB max.	1dB max.	1dB max.	1dB max.	1dB max.
Insertion Loss	2dB max.	3dB max.	5dB max.	5dB max.	5dB max.	6dB max.
Guaranteed Attenuation	70dB min.	70dB min.	80dB min.	80dB min.	80dB min.	60dB min.
Terminating Impedance	1500Ω//2.5pF	700Ω//−1pF	400Ω//4pF Cc=17.5pF	560Ω//4pF Cc=9.7pF	450Ω//4pF Cc=9.2pF	800Ω//-0.2pF Cc=0.6pF
Operating Temperature Range	−20 to +70℃					
Packing Unit (1)	1000pcs./reel(φ180)					

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

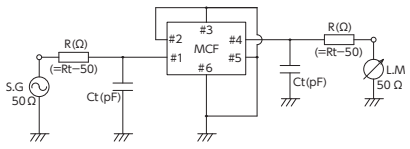
Consult our sales representative for other specifications.

■ DSF753SA/DSF753SC [mm]

■ Dimensions

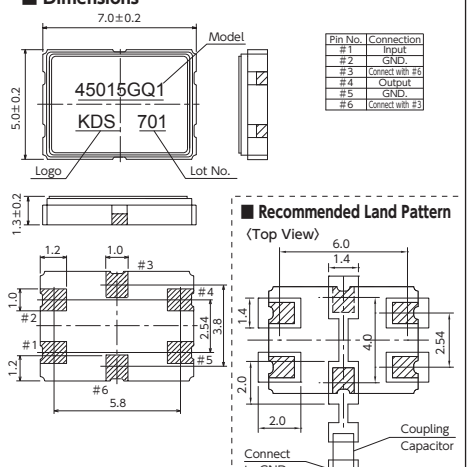


■ Measurement Circuit

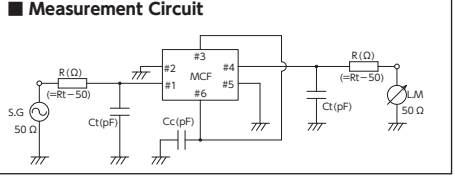


■ DSF753SB/DSF753SD [mm]

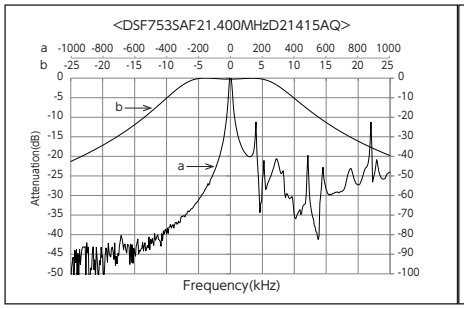
■ Dimensions



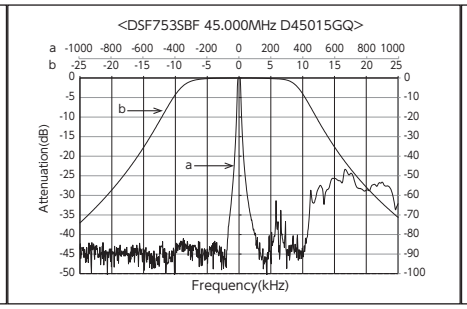
■ Measurement Circuit



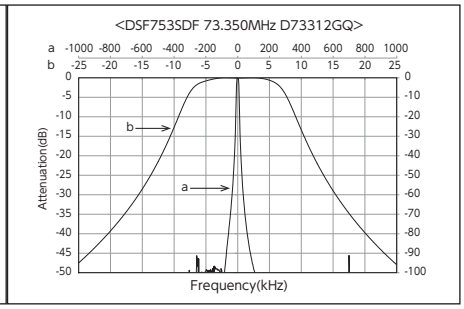
■ Characteristics Chart (fo=45MHz, P=±7.5kHz 2POLE)



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

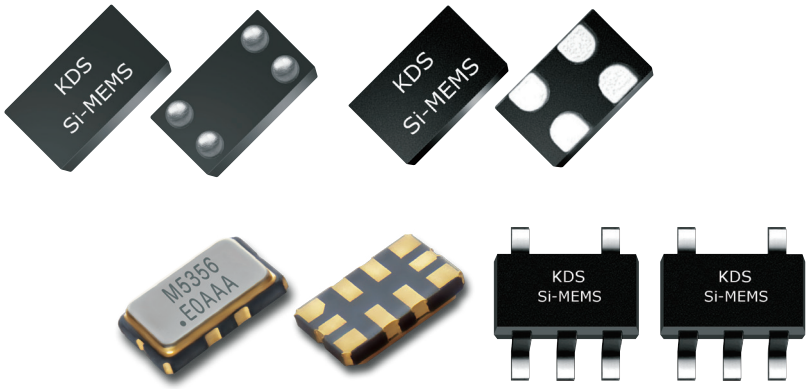


■ Characteristics Chart (fo=73.350MHz, P=±6.0kHz 4POLE)



MEMO

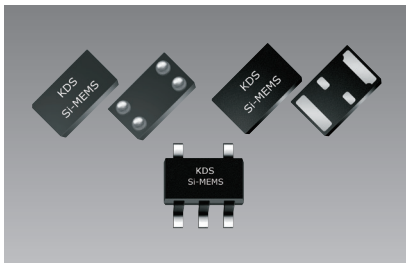
Silicon Timing Devices
MEMS oscillators



DAISHINKU CORP.

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

MO1532/MO1552/MO1630/MO1566/MO1568



■Features

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

■ Applications

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

Pb-Free

RoHS Compliant

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

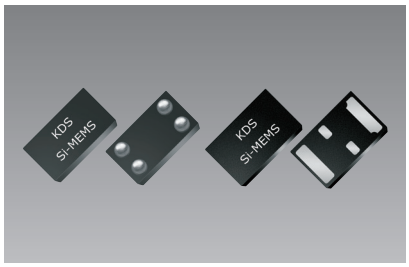
■ Standard Specification (MO1532)

Item	Legend	Min.	Typ.	Max.	Unit	Condition
Output Frequency Range	Fout		32.768		kHz	
Supply Voltage	Vdd	+1.2	-	+3.63	V	T_A = -10℃ to +70℃
		+1.5	-	+3.63		T_A = -40℃ to +85℃
Operating Temperature Range	T_use	-10 to +70 / -40 to +85			℃	
Frequency Stability [1]	F_stab	-	-	+75	$\times 10^{-6}$	T_A = -10℃ to +70℃, Vdd: +1.5V to +3.63V
		-	-	+100		T_A = -40℃ to +85℃, Vdd: +1.5V to +3.63V
		-	-	+250		T_A = -10℃ to +70℃, Vdd: +1.2V to +1.5V
Frequency Tolerance [2]	F_tol	-	-	+10	$\times 10^{-6}$	T_A = +25° C, post reflow, Vdd: +1.5V to +3.63V
		-	-	+20		T_A = +25° C, post reflow with board-level underfill, Vdd: +1.5V to +3.63V
First Year Aging	F_aging1	-1.0	-	+1.0	$\times 10^{-6}$	T_A = +25℃
Core Operating Current [3]	Idd	-	+0.9	-	µA	T_A = +25℃, Vdd: +1.8V. No load
		-	-	+1.3		T_A = -10℃ to +70℃, Vdd max: +3.63V. No load
		-	-	+1.4		T_A = -40℃ to +85℃, Vdd max: +3.63V. No load
Start-up Time [4]	T_start	-	180	300	ms	T_A = -40℃ ≦ T_A ≦ +50℃, valid output
		-	-	450		T_A = +50℃ < T_A ≦ +85℃, valid output
LVCMOS Output Option, TA = -40℃ to +85℃, typical values are at T_A = +25℃						
Duty Cycle	DC	48	-	52	%	
Output Low Voltage	V_{OL}	-	-	Vdd×0.1	V	Vdd: +1.5V to +3.63V, I_{OL} = +10 µA, 15 pF
Output High Voltage	V_{OH}	Vdd×0.9	-	-	V	Vdd: +1.5V to +3.63V, I_{OH} = -10 µA, 15 pF
Rise and Fall Time	Tr, Tf	-	100	200	ns	10 to 90% (Vdd), 15 pF load, Vdd = +1.5V to +3.63V
		-	-	50		10 to 90% (Vdd), 5 pF load, Vdd ≧ +1.62V
Packing Unit	1000pcs./reel (φ180) or 3000pcs./reel (φ180)					

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

MEMS Oscillators / TC-MO - µPower

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

Pb-Free

RoHS Compliant

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

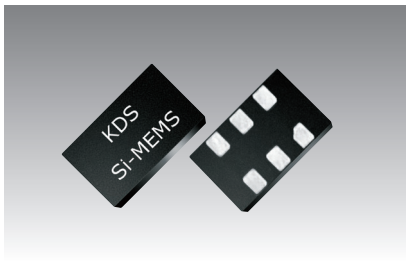
■ Standard Specification (MO8021)

Item	Legend	Min.	Typ.	Max.	Unit	Condition
Output Frequency Range	f	1	–	26	MHz	
Operating Supply Voltage	Vdd	+1.62	+1.8	+1.98	V	
		+2.25	–	+3.63		Any voltage from +2.25 to +3.63V
Operating Temperature Range	T_use	-20	–	+70	℃	Extended Commercial
		-40	–	+85		Industrial
Frequency Stability	F_tol	-15	–	+15	$\times 10^{-6}$	Frequency offset at +25℃ post reflow
Frequency Tolerance	F_stab	-100	–	+100	$\times 10^{-6}$	Inclusive of initial tolerance, and variations over operating temperature, rated power supply voltage and output load.
First Year Aging	F_aging1	-3.0	–	+3.0	$\times 10^{-6}$	T_A = +25℃
Current Consumption [1]	Idd	–	+60	–	µA	f = 3.072 MHz, 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	µA	Vdd = +1.8V, ST pin = HIGH, output is weakly pulled down
		–	–	+1.5		Vdd = +2.25V to +3.63V, ST pin = HIGH, output is weakly pulleddown
Duty Cycle	DC	45	–	55	%	
Output Low Voltage	V_{OL}	–	–	Vdd×0.1	V	I_{OL} = +0.5 mA
Output High Voltage	V_{OH}	Vdd×0.9	–	–	V	I_{OH} = -0.5 mA
Rise and Fall Time	Tr, Tf	–	+4.0	+8.0	ns	20% to 80%
Input Low Voltage	V_{IL}	–	–	Vdd×0.2	V	
Input High Voltage	V_{IH}	Vdd×0.8	–	–	V	
Start-up Time	T_start	–	75	150	ms	Measured from the time Vdd reaches 90% of its final value
Standby Time	T_stdby	–	–	20	µs	Measured from the time ST pin crosses 50% threshold
Resume Time	T_resume	–	2.0	3.0	ms	Measured from the time ST pin crosses 50% threshold
RMS Period Jitter	T_jitt	–	75	110	ps	f = 6.144 MHz, 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
						Vdd = +1.8V, Note [2]
		–	–	2.5		f = 6.144 MHz, Integration bandwidth = 100 Hz ~ 40 kHz
						Vdd = +2.25V to +3.63V, Note [2]
Packing Unit	1000pcs./reel (φ180) or 3000pcs./reel (φ180)					

[1]. Supply current with load is a function of the output frequency and output load.
For any given output frequency, the capacitive loading will increase supply current equal to C_load × Vdd × f(MHz).
[2]. Max spec inclusive of +25 mV peak-to-peak sinusoidal noise on Vdd. Noise frequency 100 Hz to 20 MHz.

MEMS Oscillators - 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 ±10×10^{-6}
- 0.1 ps RMS phase jitter (random) for Ethernet applications

■ Applications

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

Pb-Free

RoHS Compliant

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

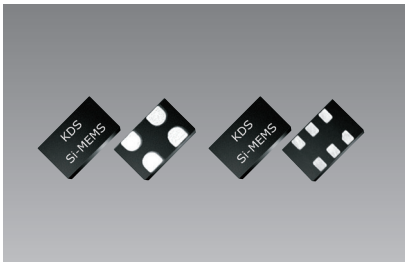
■ Standard Specification (MO9366)

Item	Legend	Min.	Typ.	Max.	Unit	Condition
Output Frequency Range	f	1	–	220	MHz	Accurate to 6 decimal places
Supply Voltage	Vdd	+2.25	+2.50	+2.75	V	
		+2.52	+2.80	+3.08		
		+2.70	+3.00	+3.30		
		+2.97	+3.30	+3.63		
Operating Temperature Range	T_use	-20	–	+70	℃	Extended Commercial
		-40	–	+85		Industrial
		-40	–	+95		
		-40	–	+105		Extended Industrial
Frequency Tolerance	F_stab	-10	–	+10	×10^{-6}	Inclusive of initial tolerance, and variations over operating temperature, rated power supply voltage and output load.
		-20	–	+20		
		-25	–	+25		
		-50	–	+50		
First Year Aging	F_aging1	–	±1	–	×10^{-6}	T_A = +25℃
Duty Cycle	DC	45	–	55	%	
OE Disable Supply Current	I_oe	–	–	+58	mA	OE = Low
Input Low Voltage	V_{IL}	–	–	Vdd×0.3	V	Pin 1, OE
Input High Voltage	V_{IH}	Vdd×0.7	–	–	V	Pin 1, OE
Start-up Time	T_start	–	–	3.0	ms	Measured from the time Vdd reaches its rated minimum value
Enable and Disable Time	T_oe	–	–	3.8	μs	f = 156.25 MHz
RMS Phase Jitter [1]	T_jitt	–	1	1.6	ps	f = 100, 156.25 or 212.5 MHz, Vdd = 3.3 or 2.5 V
LVPECL output						
Current Consumption	Idd	–	–	+89	mA	Excluding Load Termination Current, Vdd = +3.3V or +2.5V
Output Low Voltage	V_{OL}	Vdd - 1.9	–	Vdd - 1.5	V	
Output High Voltage	V_{OH}	Vdd - 1.1	–	Vdd - 0.7	V	
Differential Output Voltage	V_Swing	1.2	1.6	2.0	V	
Rise and Fall Time	Tr, Tf	–	225	290	ps	20% to 80%
RMS Phase Jitter [random]	T_phj	–	0.225	0.275	ps	Note [2]
LVDS output						
Current Consumption	Idd	–	–	+79	mA	Excluding Load Termination Current, Vdd = +3.3V or +2.5V
Differential Output Voltage	V_{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	Tr, Tf	–	400	470	ps	Measured with 2 pF capacitive loading to GND, 20% to 80%
RMS Phase Jitter [random]	T_phj	–	0.235	0.275	ps	Note [2]
HCSL output						
Current Consumption	Idd	–	–	+89	mA	Excluding Load Termination Current, Vdd = +3.3V or +2.5V
Output Voltage Low	V_{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	Tr, Tf	–	360	465	ps	Measured with 2 pF capacitive loading to GND, 20% to 80%
RMS Phase Jitter [random]	T_phj	–	0.225	0.275	ps	Note [2]
Packing Unit	1000pcs./reel (φ180) or 3000pcs./reel (φ180: 3225 package)					

[1]. Measured according to JESD65B
[2]. 5.0×3.2 and 3.2×2.5 mm package, f = 156.25 MHz, Integration bandwidth = 12 kHz to 20 MHz, all Vdd levels, includes spurs. Temperature ranges -20 to +70°C and -40 to +85°C

MEMS Oscillators - Low Jitter

MO9120/MO9121/MO9122/MO8208/MO8209



■Features

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

■ Applications

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

Pb-Free

RoHS Compliant

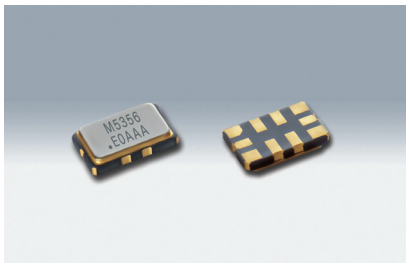
Model	Output Frequency (MHz)	Frequency Tolerance (×10^{-6})	Supply Voltage (V)	Current Consumption (mA Typ.)	Size (mm)	Output
MO9120	25 to 212.5	±10, ±20, ±25, ±50	+2.25 to +3.63	+54 to +69	3.2×2.5×0.8, 5.0×3.2×0.8, 7.0×5.0×1.0 (QFN)	LVPECL LVDS
MO9121	1 to 220					
MO9122	220 to 625					
MO8208	1 to 80			+29 to +36 (+10 µA stby)	2.7×2.4×0.8, 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	℃	Extended Commercial
		–40	–	+85		Industrial
Frequency Tolerance	F_stab	–10	–	+10	×10^{-6}	Inclusive of initial tolerance, and variations over operating temperature, rated power supply voltage and output load.
		–20	–	+20		
		–25	–	+25		
		–50	–	+50		
First Year Aging	F_aging1	–2.0	–	+2.0	×10^{-6}	T_A = +25℃
10-year Aging	F_aging10	–5.0	–	+5.0		T_A = +25℃
Duty Cycle	DC	45	–	55	%	
Input Low Voltage	V_{IL}	–	–	Vdd×0.3	V	Pin 1, OE or $\overline{ST}$
Input High Voltage	V_{IH}	Vdd×0.7	–	–	V	Pin 1, OE or $\overline{ST}$
Start-up Time	T_start	–	6.0	10	ms	Measured from the time Vdd reaches its rated minimum value.
Resume Time	T_resume	–	6.0	10	ms	In Standby mode, measured from the time ST pin crosses 50% threshold.
LVPECL, DC and AC Characteristics						
Current Consumption	Idd	–	+61	+69	mA	Excluding Load Termination Current, Vdd = +3.3V or +2.5V
OE Disable Supply Current	I_oe	–	–	+35	mA	OE = Low
Standby Current	I_std	–	–	+100	µA	$\overline{ST}$ = Low, for all Vdds
Output Low Voltage	V_{OL}	Vdd - 1.9	–	Vdd - 1.5	V	
Output High Voltage	V_{OH}	Vdd - 1.1	–	Vdd - 0.7	V	
Rise and Fall Time	Tr, Tf	–	300	700	ps	20% to 80%
Enable and Disable Time	T_oe	–	–	115	ns	f = 212.5 MHz - For other frequencies, T_oe = 100ns + 3 period
RMS Period Jitter	T_jitt	–	1.2	1.7	ps	f = 100 MHz, Vdd = +3.3V or +2.5V
		–	1.2	1.7		f = 156.25 MHz, Vdd = +3.3V or +2.5V
		–	1.2	1.7		f = 212.5 MHz, Vdd = +3.3V or +2.5V
RMS Phase Jitter (random)	T_phj	–	0.6	0.85	ps	f = 156.25 MHz, Integration bandwidth = 12 kHz to 20 MHz, all Vdds
LVDS, DC and AC Characteristics						
Current Consumption	Idd	–	+47	+55	mA	Excluding Load Termination Current, Vdd = +3.3V or +2.5V
OE Disable Supply Current	I_oe	–	–	+35	mA	OE = Low
Standby Current	I_std	–	–	+100	µA	$\overline{ST}$ = Low, for all Vdds
Rise and Fall Time	Tr,Tf	–	495	700	ps	20% to 80%
Differential Output Voltage	V_{OD}	+250	+350	+450	mV	
V_{OD} Magnitude Change	ΔV_{OD}	–	–	+50	mV	
Offset Voltage	V_{OS}	+1.125	+1.2	+1.375	V	
V_{OS} Magnitude Change	ΔV_{OS}	–	–	+50	mV	
Enable and Disable Time	T_oe	–	–	115	ns	f = 212.5 MHz - For other frequencies, T_oe = 100ns + 3 period
RMS Period Jitter	T_jitt	–	1.2	1.7	ps	f = 100 MHz, Vdd = +3.3V or +2.5V
		–	1.2	1.7		f = 156.25 MHz, Vdd = +3.3V or +2.5V
		–	1.2	1.7		f = 212.5 MHz, Vdd = +3.3V or +2.5V
RMS Phase Jitter (random)	T_phj	–	0.6	0.85	ps	f = 156.25 MHz, Integration bandwidth = 12 kHz to 20 MHz, all Vdds
Packing Unit	1000pcs./reel (φ180) or 3000pcs./reel (φ180: 3225 package)					

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

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



■Features

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

■ Applications

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

Pb-Free

RoHS Compliant

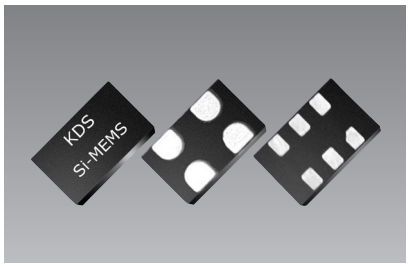
Model	Output Frequency (MHz)	Frequency Tolerance ($\times 10^{-6}$)	Supply Voltage (V)	Current Consumption (mA Typ.)	Size (mm)	Output
MO5155	10 std. GNSS Freq.	±0.5, ±1.0, ±2.5	+2.25 to +3.63	+40 to +50	5.0×3.2×0.95 (Ceramic)	Clipped Sinewave (1 to 60 MHz) LVCMOS
MO5156	1 to 60					
MO5157	60 to 220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

■ Standard Specification (MO5356)

Item	Legend	Min.	Typ.	Max.	Unit	Condition
Output Frequency Range	f	1	-	60	MHz	
Supply Voltage	Vdd	+2.25	+2.50	+2.75	V	
		+2.52	+2.80	+3.08		
		+2.70	+3.00	+3.30		
		+2.97	+3.30	+3.63		
Operating Temperature Range	T_use	-20	-	+70	℃	Extended commercial
		-40	-	+85		Industrial
		-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℃
Frequency Stability over temperature	F_stab	-0.10	-	+0.10	$\times 10^{-6}$	Referenced to (fmas + fmin)/2 over the specified temperature range
		-0.20	-	+0.20		
		-0.25	-	+0.25		
First Year Aging	F_aging1	-	±1.0	-	$\times 10^{-6}$	T_A = +25℃
Pull Range	PR	±6.25			$\times 10^{-6}$	VC TC-MO mode. Contact KDS for ±12.5, ±25
		±6.25, ±10, ±12.5,±25, ±50, ±80, ±100, ±125, ±150, ±200, ±400, ±600, ±800, ±1200, ±1600, ±3200			$\times 10^{-6}$	DC TC-MO mode.
Upper Control Voltage	VC_U	Vdd×0.9	-	-	V	
Control Voltage Range	VC_L	-	-	Vdd×0.1	V	
Control Voltage Input Impedance	VC_z	8	-	-	MΩ	
Control Voltage Input Bandwidth	VC_c	-	10	-	kHz	
Frequency Change Polarity	-	Positive Slope			-	
Current Consumption	Idd	-	+44	+53	mA	No load condition, f = 19.2 MHz, TC-MO and DC TC-MO mode.
		-	+48	+57		No load condition, f = 19.2 MHz, VC TC-MO mode.
OE Disable Current	I_od	-	+43	+51	mA	OE = GND, output is weakly pull down, TC-MO and DC TC-MO mode.
		-	+47	+55		OE = GND, output is weakly pull down, VC TC-MO mode.
Input Low Voltage	V_{IL}	-	-	Vdd×0.3	V	For OE pin
Intput High Voltage	V_{IH}	Vdd×0.7	-	-	V	For OE pin
Start-up Time	T_start	-	2.5	3.5	ms	Time to first pulse, Measured from the time Vdd reaches its rated minimum value.
RMS Period Jitter	T_jitt	-	0.8	1.1	ps	f = 10 MHz
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_{OH} = +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 ℃
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 ℃
Packing Unit	1000pcs./reel (φ180)					

MEMS Oscillators with Spread Spectrum Function (SSCG)

MO9002/MO9003/MO9005



■Features

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

■ Applications

- Printers
- Flat panel drivers
- PCI
- Microprocessors

Pb-Free

RoHS Compliant

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	5.0×3.2×0.8, 7.0×5.0×1.0 (QFN)	LVPECL CML LVDS HCSL
MO9003	1 to 110	±50, ±100		+3.2 to +4.1 (+0.4 to +4.3 µA stby)	2.5×2.0×0.8, 3.2×2.5×0.8, 5.0×3.2×0.8, 7.0×5.0×1.0 (QFN)	LVCMOS
MO9005	1 to 141	±20, ±25, ±50	+1.62 to +1.98, +2.25 to +3.63	5.0 to 6.5 (0.4 to4.3 µA stby)	2.0×1.6×0.8, 2.5×2.0×0.8, 3.2×2.5×0.8 (QFN)	

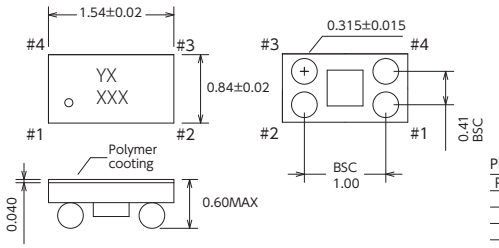
■ Standard Specification (MO9005)

Item	Legend	Min.	Typ.	Max.	Unit	Condition
Output Frequency Range	f	1	-	141	MHz	
Supply Voltage	Vdd	+1.62	+1.8	+1.98	V	
		+2.25	+2.5	+2.75		
		+2.52	+2.8	+3.08		
		+2.7	+3.0	+3.3		
		+2.97	+3.3	+3.63		
		+2.25	-	+3.63		
Operating Temperature Range	T_use	-20	-	+70	℃	Extended Commercial
		-40	-	+85		Industrial
Frequency Tolerance	F_tol	-20	-	+20	$\times 10^{-6}$	Inclusive of initial tolerance at +25℃, 1st year aging at +25℃, and variations over operating temperature, rated power supply voltage.
		-25	-	+25		
		-50	-	+50		
Current Consumption	Idd	-	+5.6	+6.5	mA	No load condition, f = 40 MHz, Vdd = +2.5V to +3.3V
		-	+5.0	+5.5		No load condition, f = 40 MHz, Vdd = +1.8V
Standby Current	I_std	-	+2.1	+4.3	µA	$\overline{ST}$ = GND, Vdd = +2.5V to +3.3V, Output is weakly pulled down
		-	+0.4	+1.5		$\overline{ST}$ = GND, Vdd = +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%	-	-	Vdd	I_{OH} = -4 mA (Vdd = +3.0V or +3.3V) I_{OH} = -3 mA (Vdd = +2.8V and Vdd = +2.5V) I_{OH} = -2 mA (Vdd = +1.8V)
Output High Voltage	V_{OH}	-	-	10%	Vdd	I_{OL} = +4 mA (Vdd = +3.0V or +3.3V) I_{OL} = +3 mA (Vdd = +2.8V and Vdd = +2.5V) I_{OL} = +2 mA (Vdd = +1.8V)
Rise and Fall Time	Tr, Tf	-	1	2	ns	Vdd = +2.5V, +2.8V, +3.0V or +3.3V, 20% to 80%, default derive strength
		-	1.3	2.5		Vdd = +1.8V, 20% to 80%, default derive strength
		-	-	2.0		Vdd = +2.25V to +3.63V, 20% to 80%, default derive strength
Input Low Voltage	V_{IL}	-	-	Vdd×0.3	V	Pin 1, OE or $\overline{ST}$
Input High Voltage	V_{IH}	Vdd×0.7	-	-	V	Pin 1, OE or $\overline{ST}$
OE Disable Current	I_oe	-	+5.0	+6.5	mA	f = 40 MHz, Vdd = +2.5V to +3.3V, OE = GND, Output in high-Z state
		-	+4.6	+5.2		f = 40 MHz, Vdd = +1.8V, OE = GND, Output in high-Z state
Enable/Disable Time	T_oe	-	-	180	ns	f = 40 MHz - For other frequencies, T_oe = 100ns + 3 period
Packing Unit	1000pcs./reel(φ180)					

Dimensions and Land Pattern

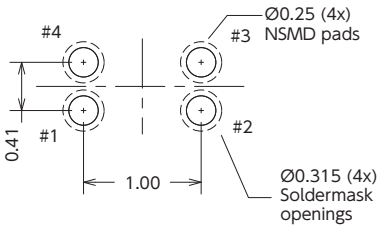
Package Size – Dimensions (unit:mm)	Recommended Land Pattern (unit:mm)

1.55 × 0.85 mm CSP



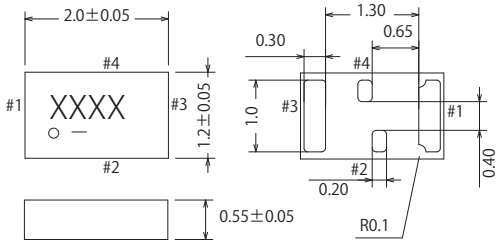
Pin Connections

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



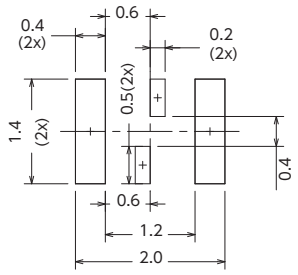
(soldermask openings shown with heavy dashed line)

2.0 × 1.2 mm QFN

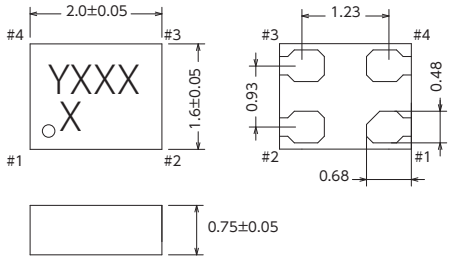


Pin Connections

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

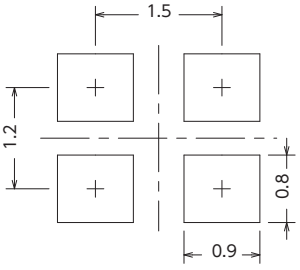


2.0 × 1.6 mm QFN

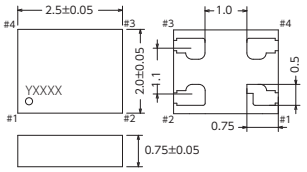


Pin Connections

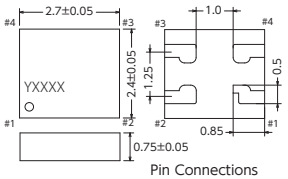
Pin No.	Connection
#1	OE/ST/NC/SD
#2	Output
#3	Vdd
#4	GND



2.5 × 2.0 mm QFN

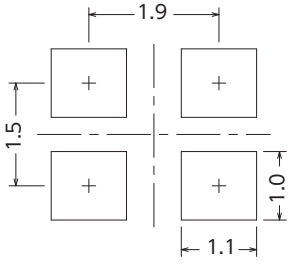


2.7 × 2.4 mm QFN

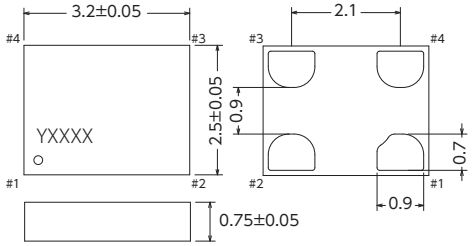


Pin Connections

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

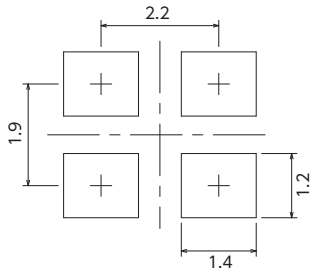


3.2 × 2.5 mm QFN (4-pin)

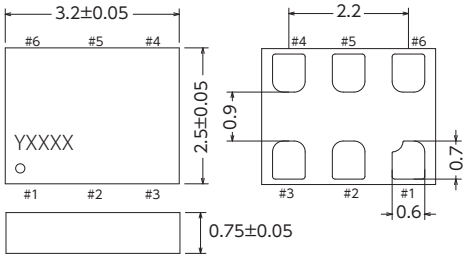


Pin Connections

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

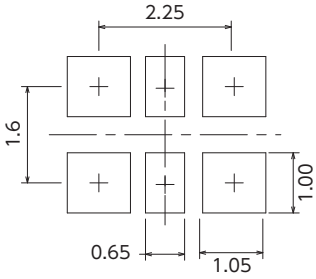


3.2 × 2.5 mm QFN (6-pin)



Pin Connections

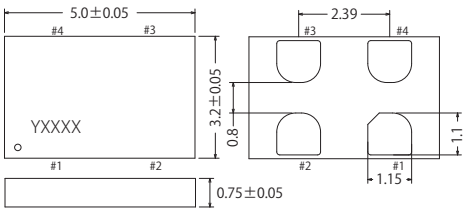
Pin No.	Connection
#1	OE/ST/NC/VC/SD/DP
#2	NC/OE
#3	GND
#4	Output+
#5	Output-
#6	Vdd



Dimensions and Land Pattern

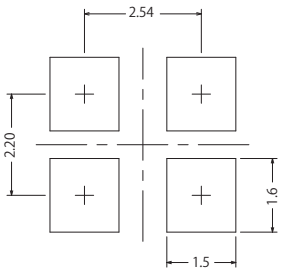
Package Size – Dimensions (unit:mm)	Recommended Land Pattern (unit:mm)

5.0 × 3.2 mm QFN (4-pin)

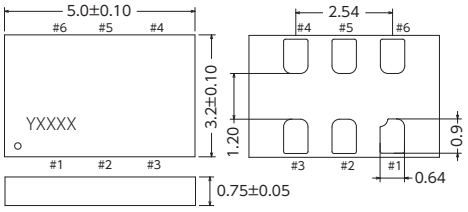


Pin Connections

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

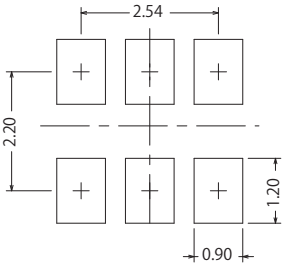


5.0 × 3.2 mm QFN (6-pin)

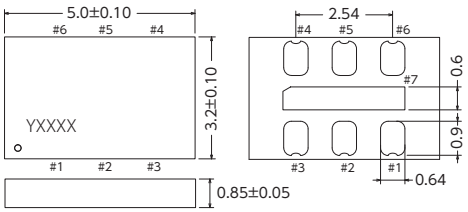


Pin Connections

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

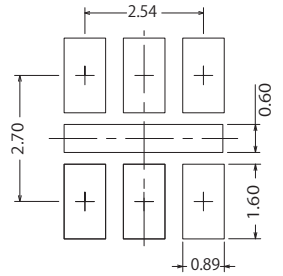


5.0 × 3.2 mm QFN (6-pin with center pad)

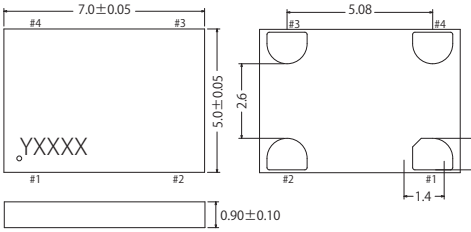


Pin Connections

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

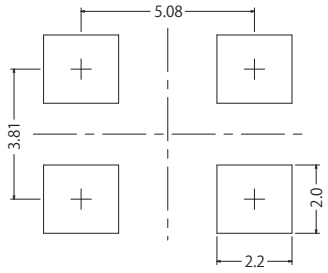


7.0 × 5.0 mm QFN (4-pin)

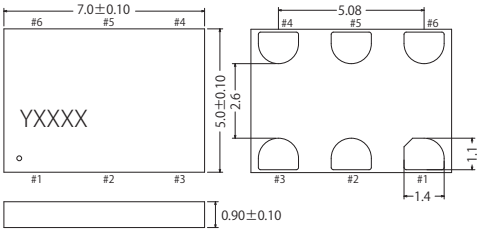


Pin Connections

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

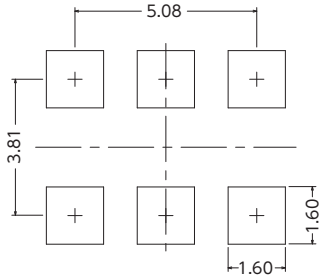


7.0 × 5.0 mm QFN (6-pin)

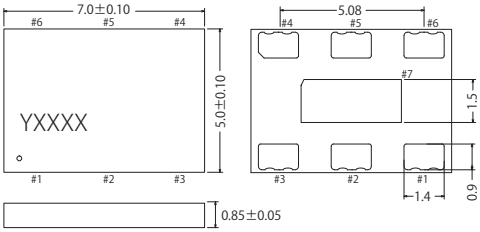


Pin Connections

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

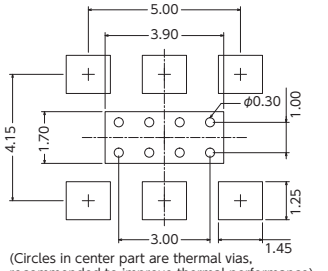


7.0 × 5.0 mm QFN (6-pin with center pad)



Pin Connections

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

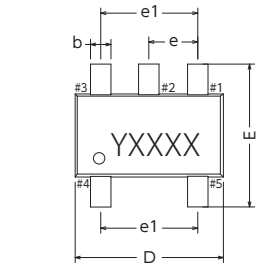


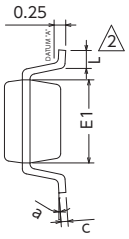
(Circles in center part are thermal vias, recommended to improve thermal performance)

Dimensions and Land Pattern

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

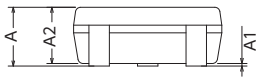
2.9 × 2.8 mm (SOT23-5)



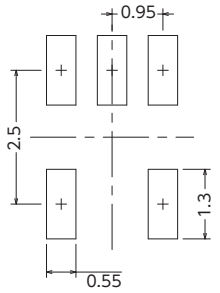


Pin Connections

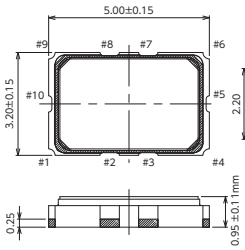
Pin No.	Connection
#1	GND
#2	NC
#3	OE/NC/ST
#4	Vdd
#5	Output

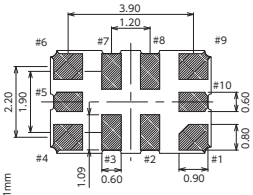


Symbol	Min.	Nom.	Max.
A	0.9	1.25	1.45
A1	0	0.05	0.15
A2	0.9	1.1	1.3
b	0.35	0.4	0.5
c	0.08	0.15	0.2
D	2.8	2.9	3
E	2.6	2.8	3
E1	1.5	1.625	1.75
L	0.35	0.45	0.6
L1	0.60 REF		
e	0.95 BSC.		
e1	1.90 BSC.		
α	0°	2.5°	8°



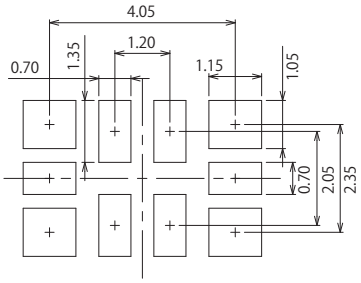
5.0 × 3.2 mm (Ceramic)



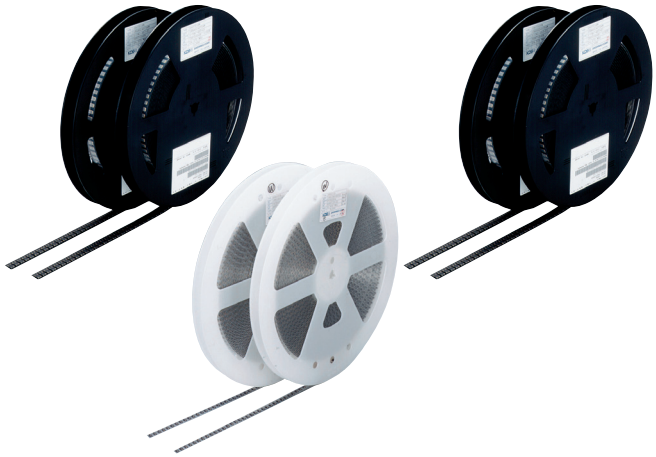


Pin Connections

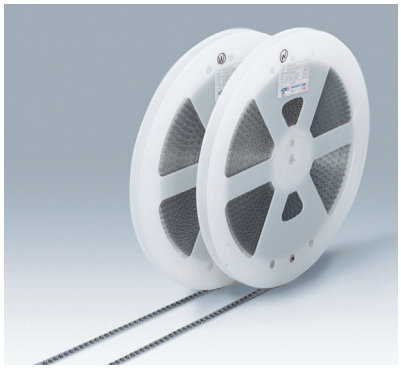
Pin No.	Connection
#1	OE/NC/VC
#2	NC
#3	NC
#4	GND
#5	NC
#6	#6 Output
#7	NC
#8	NC
#9	Vdd
#10	NC



Taping Forms, etc.



Emboss Carrier Tape (SMD Crystal Resonators)



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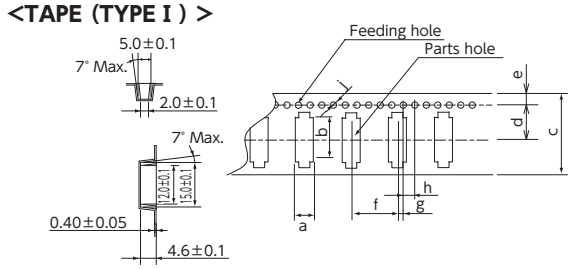
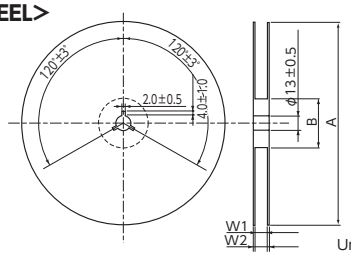


Unit : mm

<REEL>



Unit : mm

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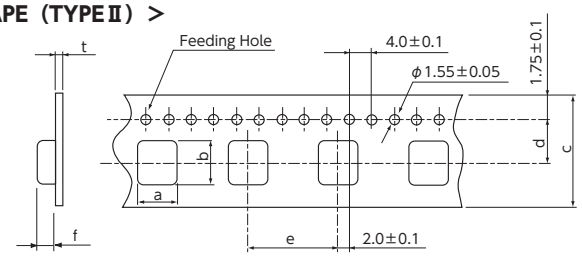


Unit : mm

■ Standard Specification

MHz Band Crystal Resonators / Crystal Resouators with dedicated temperature sensor

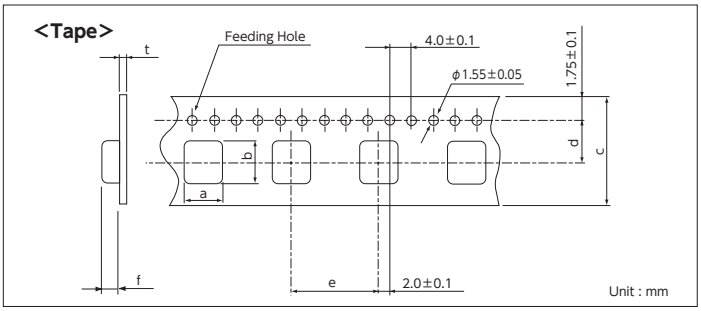
TYPEⅡ	a	b	c	d	e	f	t	A	B	W1	W2
DSX530GA/GK	3.6 ±0.1	5.45 ±0.10	12.0 ±0.2	5.50 ±0.10	8.0 ±0.1	1.55 ±0.10	0.30 ±0.05	ϕ180 +0/−3	ϕ60 +1.0/−0	13.0 +0.3	15.4 ±1.0
DSX321G/GK DSX320GE	2.8 ±0.1	3.5 ±0.1	8.0 ±0.2	3.50 ±0.05	4.0 ±0.1	1.0 ±0.1	0.25 ±0.05	ϕ180 +0/−3	ϕ60 +1/−0	9.0 ±0.3	11.4 ±1.0
DSX321SH	2.7 ±0.1	3.4 ±0.1	8.0 ±0.2	3.50 ±0.05	4.0 ±0.1	1.4 ±0.1	0.25 ±0.05	ϕ180 +0/−3	ϕ60.0 +1/−0	9.0 ±0.3	11.4 ±1.0
DSX221SH	2.25 ±0.1	2.7 ±0.1	8.0 ±0.2	3.50 ±0.05	4.0 ±0.1	0.8 ±0.05	0.25 ±0.05	ϕ180 +0/−3	ϕ60.0 +1/−0	9.0 ±0.3	11.4 ±1.0
DSX211S/SH	1.9 ±0.1	2.3 ±0.1	8.0 ±0.2	3.50 ±0.05	4.0 ±0.1	0.65 ±0.10	0.25 ±0.05	ϕ180 +0/−3	ϕ60.0 +1/−0	9.0 ±0.3	11.4 ±1.0
DSX211G	1.85 ±0.10	2.25 ±0.10	8.0 ±0.2	3.50 ±0.05	4.0 ±0.1	0.95 ±0.10	0.25 ±0.05	ϕ180 +0/−3	ϕ60 +1/−0	9.0 ±0.3	11.4 ±1.0
DSX210GE	2.0 ±0.1	2.4 ±0.1	8.0 ±0.2	3.50 ±0.05	4.0 ±0.1	0.95 ±0.1	0.25 ±0.05	ϕ180 +0/−3	ϕ60 +1/−0	9.0 ±0.3	11.4 ±1.0
DSX1612S	1.45 ±0.15	1.85 ±0.15	8.0 ±0.2	3.50 ±0.05	4.0 ±0.1	0.45 ±0.15	0.25 ±0.05	ϕ180 +0/−3	ϕ60 +1/−0	9.0 ±0.3	11.4 ±1.0
DSX1210A	1.17 ±0.05	1.42 ±0.05	8.0 +0.3/−0.1	3.50 ±0.05	4.0 ±0.1	0.48 ±0.05	0.20 ±0.05	ϕ180 +0/−3	ϕ60 +1/−0	9.0 ±0.3	11.4 ±1.0
DX1008JS/JT	1.0 ±0.05	1.2 ±0.05	8.0 ±0.2	3.50 ±0.05	4.0 ±0.1	0.45 ±0.05	0.20 ±0.05	ϕ180 +0/−3	ϕ60 +1/−0	9.0 ±0.3	11.4 ±1.0
DSR221STH	2.25 ±0.1	2.7 ±0.1	8.0 ±0.2	3.50 ±0.05	4.0 ±0.1	1.15 ±0.10	0.25 ±0.05	ϕ180 +0/−3	ϕ60 +1/−0	9.0 ±0.3	11.4 ±1.0
DSR211STH	1.9 ±0.1	2.3 ±0.1	8.0 ±0.2	3.50 ±0.05	4.0 ±0.1	0.85 ±0.10	0.25 ±0.05	ϕ180 +0/−3	ϕ60 +1/−0	9.0 ±0.3	11.4 ±1.0
DSR1612ATH	1.40 ±0.1	1.80 ±0.1	8.0 ±0.2	3.50 ±0.05	4.0 ±0.1	0.70 ±0.10	0.25 ±0.05	ϕ180 +0/−3	ϕ60 +1/−0	9.0 ±0.3	11.4 ±1.0
DSR1210ATH	1.3 ±0.1	1.5 ±0.1	8.0 ±0.2	3.5 ±0.05	4.0 ±0.1	0.65 ±0.01	0.25 ±0.05	ϕ180 +0/−3	ϕ60 +1/−0	9.0 ±0.3	11.4 ±1.0

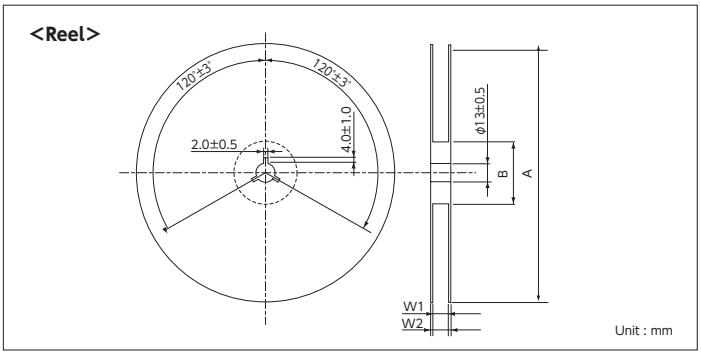
kHz Band Crystal Resonators

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

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

Emboss Carrier Tape (SMD Crystal Oscillators)





■ Standard Specification

VC-TCXO/TCXO

TYPE	a	b	c	d	e	f	t	A	B	W1	W2
DSA/DSB535SGA DSA535SGB	3.5 ±0.1	5.4 ±0.1	12.0 ±0.2	5.50 ±0.1	8.0 ±0.1	1.7 ±0.1	0.30 ±0.05	φ330 ±2	φ100 ±1	13.5 ±1.0	18.5 max.
DSK321STD DSA/DSB321SDN	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 DSB221SJA	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 DSB211SJA	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	1.4 ±0.10	1.8 ±0.10	8.0 ±0.2	3.50 ±0.05	4.0 ±0.1	0.7 ±0.1	0.25 ±0.05	φ180 +0/−3	φ60 +1/−0	9.0 ±0.3	11.4 ±1.0
DSK1612ATD	1.45 ±0.10	1.8 ±0.1	8.0 ±0.2	3.50 ±0.05	4.0 ±0.1	0.75 ±0.10	0.25 ±0.05	φ180 +0/−3	φ60 +1/−0	9.0 ±0.3	11.4 ±1.0

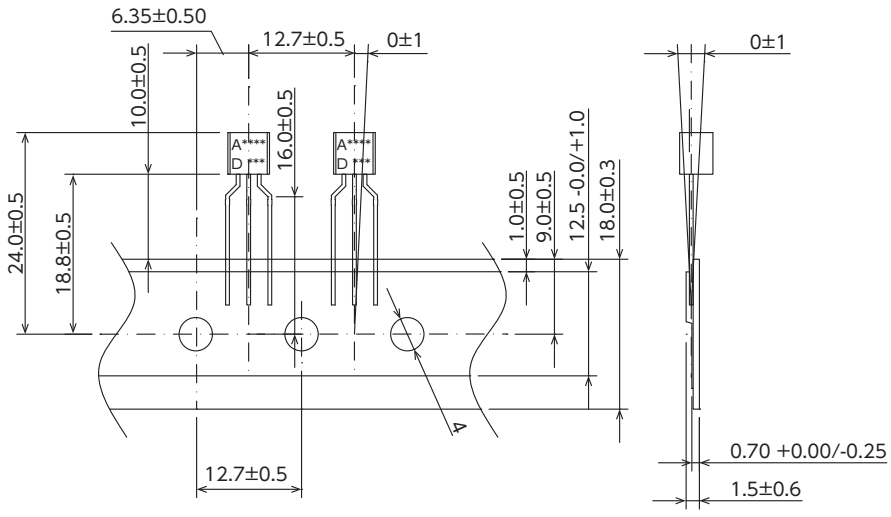
SPXO/VCXO/RTC

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

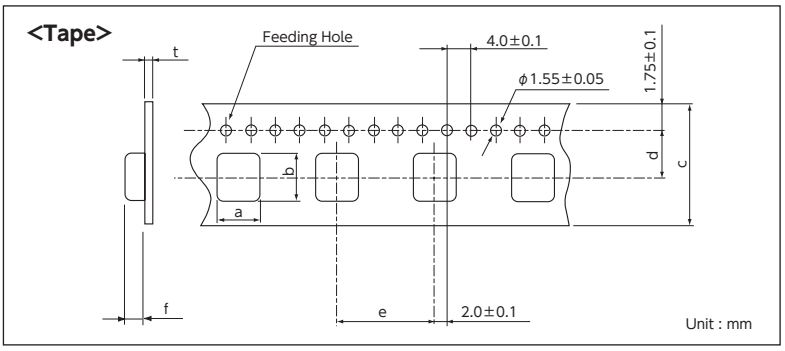
※ 1: To indicate product name and other information, place those information on a label, and affix the label on one side of the flange.
2: DSA/DSB535SGA, DSA535SGB: reel φ180 available.

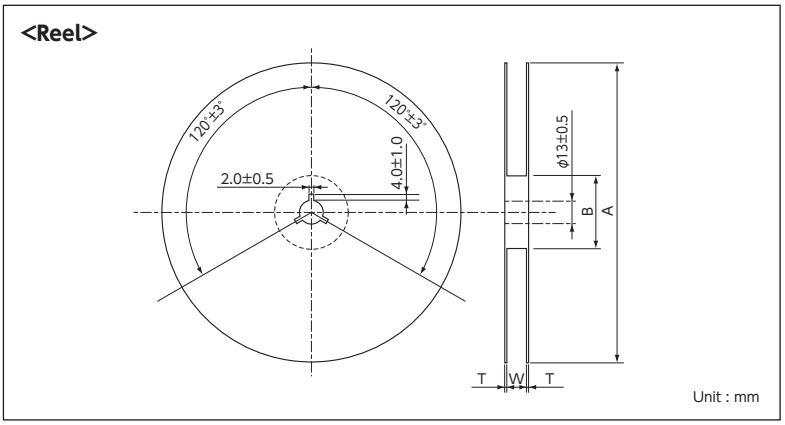
Radial Tape (Crystal Oscillators)

DLO555MBA



Emboss Carrier Tape (SMD Monolithic Crystal Filters)



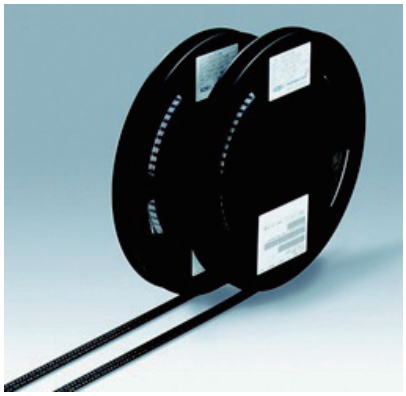


■ Standard Specification

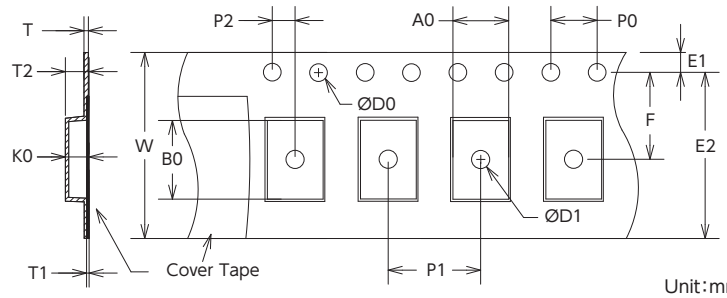
TYPE	a	b	c	d	e	f	t	A	B	T	W
DSF753S SERIES	5.6 ±0.1	7.6 ±0.1	16.0 ±0.3	7.5 ±0.1	8.0 ±0.1	1.7 ±0.1	0.30 ±0.05	ϕ178 ±2	ϕ60 +1/−0	1.2 ±0.5	17.0 ±0.3
DSF633S SERIES	4.0 ±0.1	6.5 ±0.1	12.0 ±0.2	5.5 ±0.05	8.0 ±0.1	1.7 ±0.1	0.30 ±0.05	ϕ178 ±2	ϕ60 ±1/−0	1.2 ±0.5	13.0 ±0.3
DSF444S SERIES	4.0 ±0.1	4.0 ±0.1	12.0 ±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.

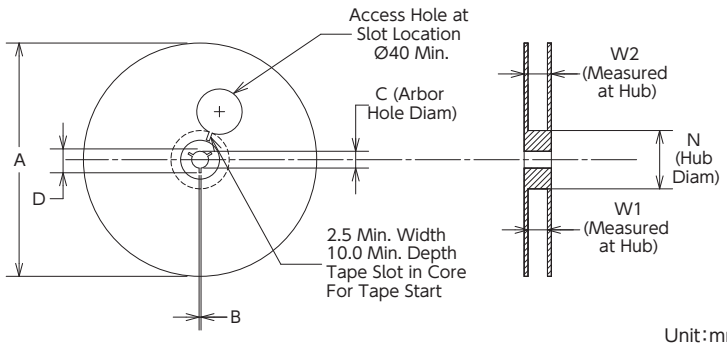
Emboss Carrier Tape (MEMS Oscillators)



<Tape>



<Reel>



■ Reel Standard Specification

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

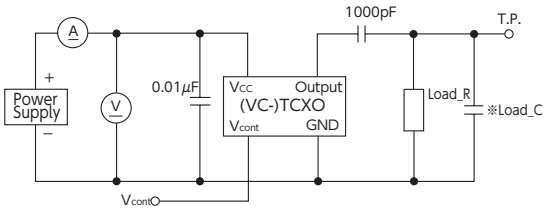
■ Carrier Tape Standard Specification

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

Refer to datasheet for details of emboss carrier tape specifications.

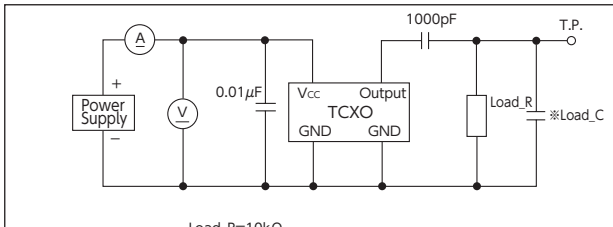
Measurement Circuit (Crystal Oscillators)

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



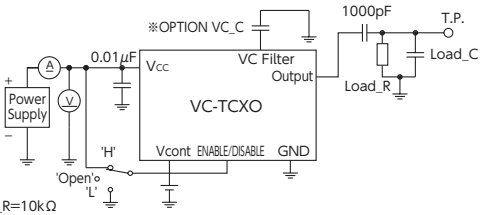
Load_R=10kΩ
※Load_C=10pF (Total Fixture and Probe Capacitance)

TCXO (DSB***SDN, SP)



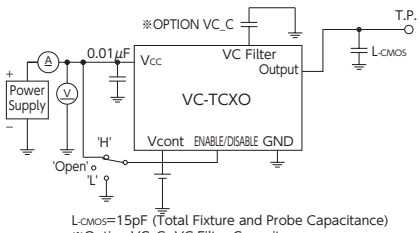
Load_R=10kΩ
※Load_C=10pF (Total Fixture and Probe Capacitance)

DSA535SGA, DSA535SGB (Clipped Sine)



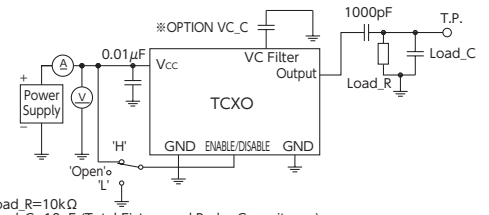
Load_R=10kΩ
Load_C=10pF (Total Fixture and Probe Capacitance)
※Option VC_C=VC Filter Capacitance

DSA535SGA, DSA535SGB (CMOS)



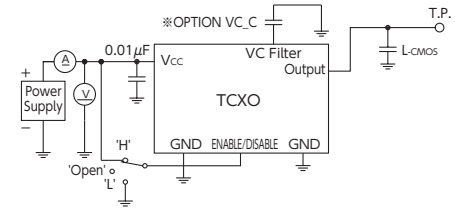
L-CMOS=15pF (Total Fixture and Probe Capacitance)
※Option VC_C=VC Filter Capacitance

DSB535SGA (Clipped Sine)



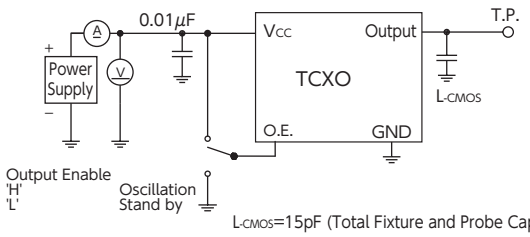
Load_R=10kΩ
Load_C=10pF (Total Fixture and Probe Capacitance)
※Option VC_C=VC Filter Capacitance

DSB535SGA (CMOS)



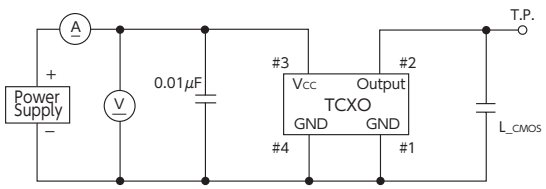
L-CMOS=15pF (Total Fixture and Probe Capacitance)
※Option VC_C=VC Filter Capacitance

DSB211SJA, 221SJA



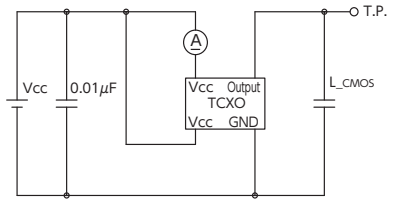
L-CMOS=15pF (Total Fixture and Probe Capacitance)

DSK1612ATD



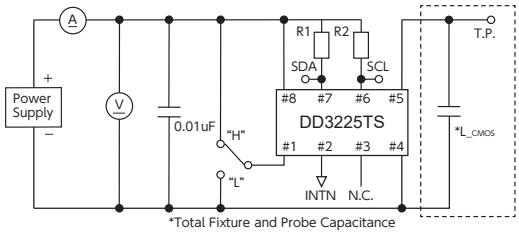
LOAD_C : Include jig stray capacitance

DSK321STD



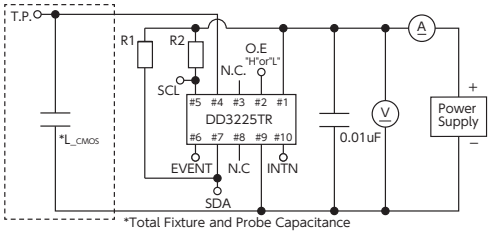
L_CMOS:Total Fixture and Probe Capacitance

DD3225TS



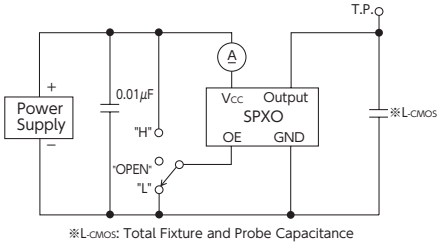
*Total Fixture and Probe Capacitance

DD3225TR



*Total Fixture and Probe Capacitance

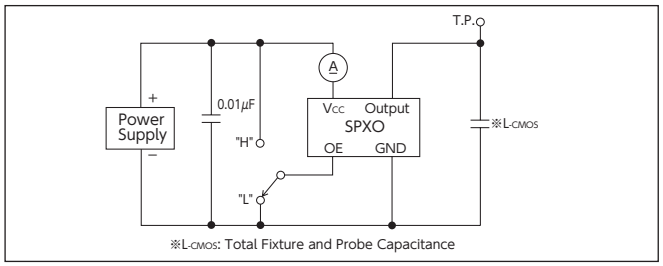
DS1008JS,JN,DSO***AR,SR,SH,SY,SRS,SBM



※L-CMOS: Total Fixture and Probe Capacitance

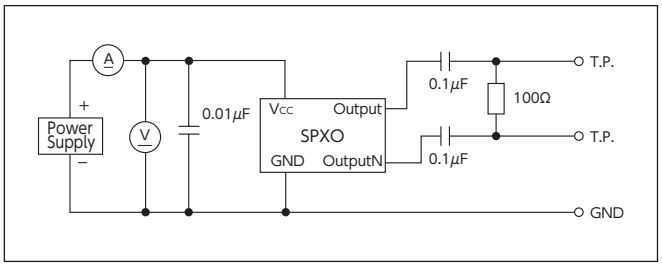
Measurement Circuit (Crystal Oscillators)

DSO***SX, SXF

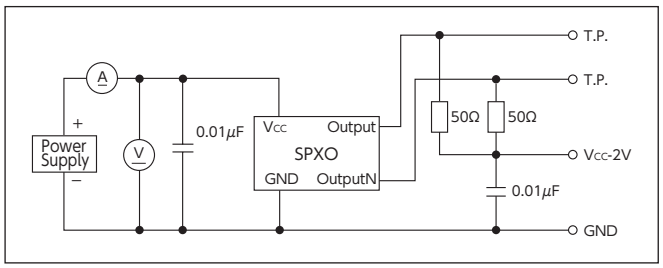


※L-CMOS: Total Fixture and Probe Capacitance

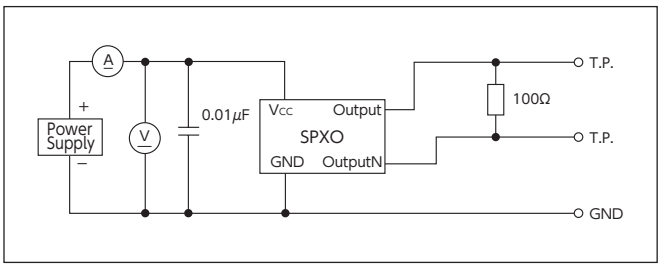
DS1008JC



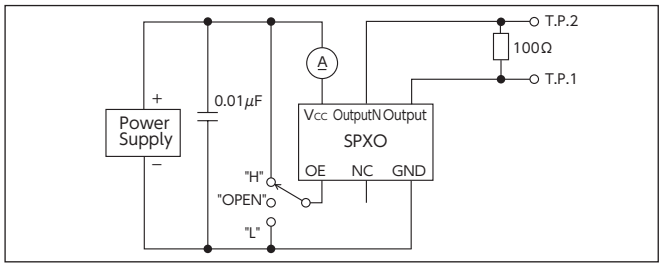
DS1008JK



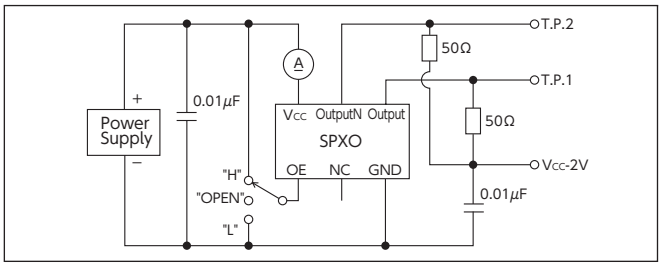
DS1008JJ



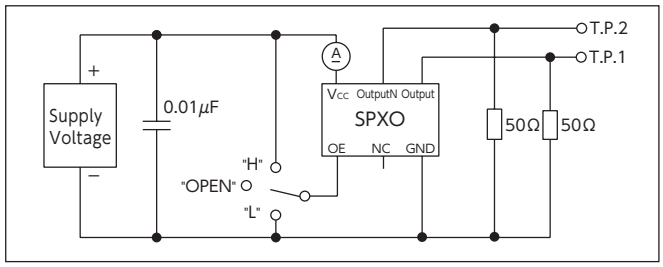
DSO223SJ, DSO323SJ, DSO533SJ, DSO753SJ



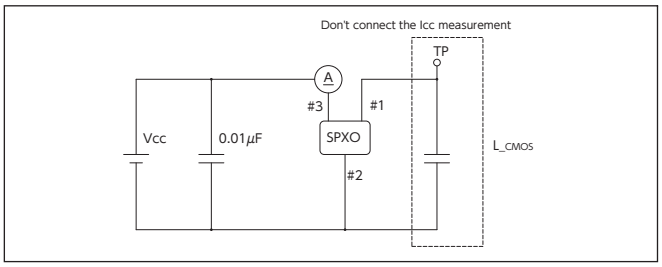
DSO223SK, DSO323SK, DSO533SK, DSO753SK



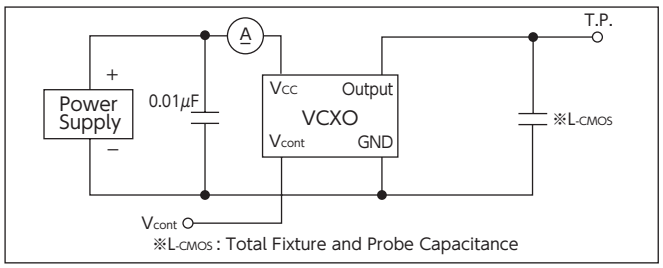
DSO223SD, DSO323SD, DSO753SD



DLO555MBA



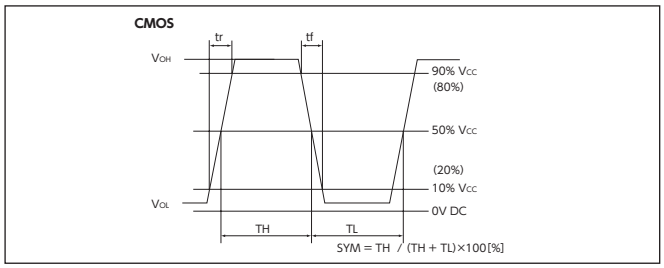
DSV221SV, 321SV

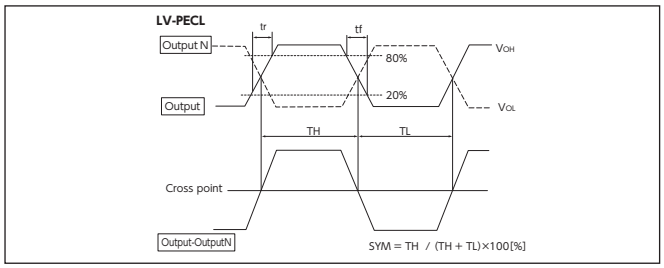


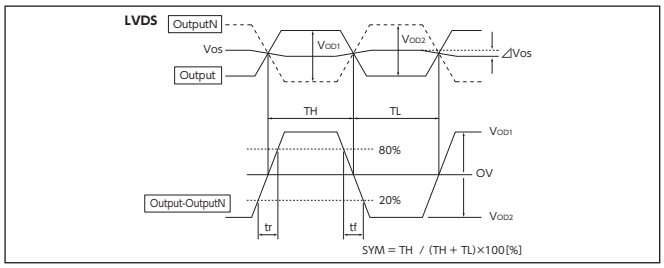
※L-CMOS : Total Fixture and Probe Capacitance

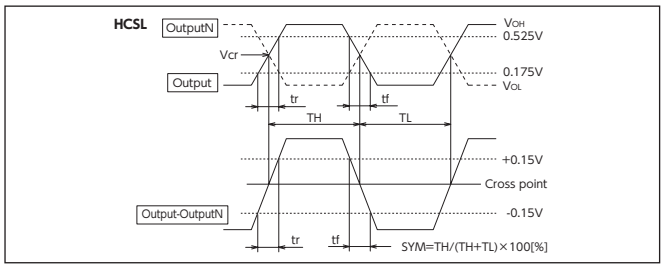
Measurement Circuit

■ Output Wave Form

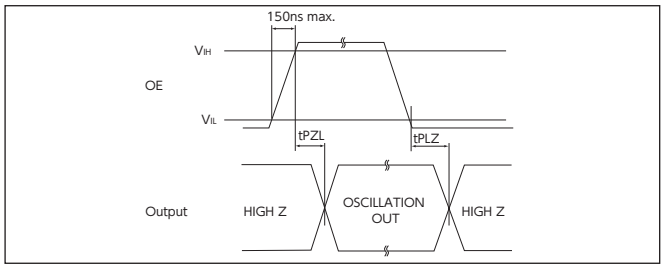






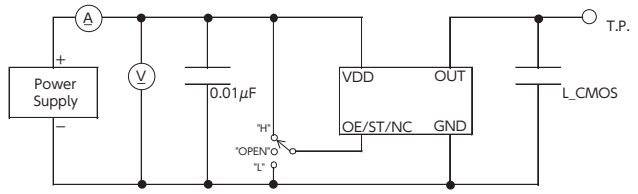


■ Input and Output Conditions



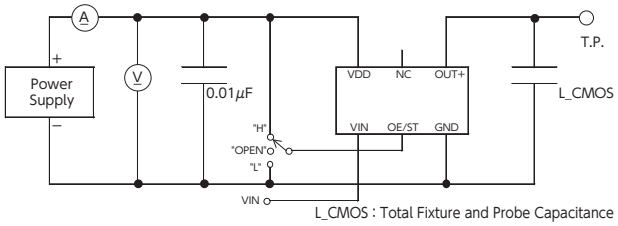
Measurement Circuit (MEMS Oscillators)

CMOS



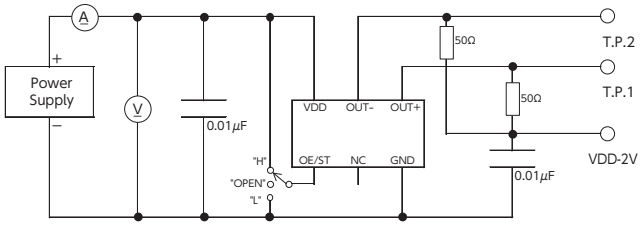
L_CMOS: Total Fixture and Probe Capacitance

CMOS (VCMO)

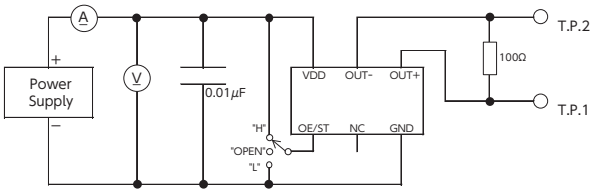


L_CMOS : Total Fixture and Probe Capacitance

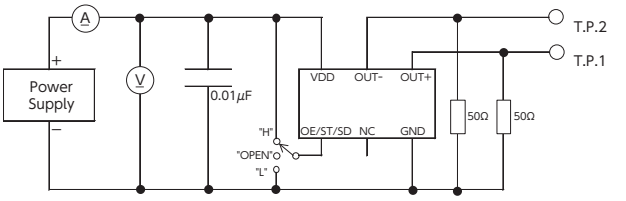
LVPECL



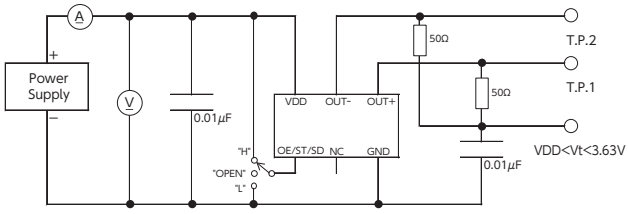
LVDS



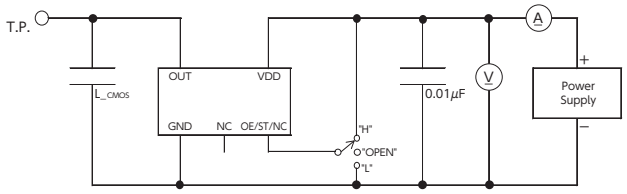
HCSL



CML

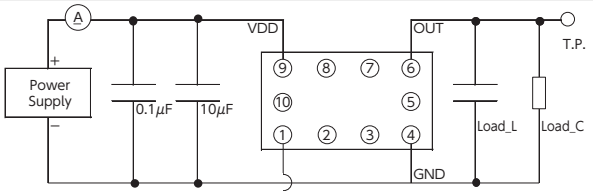


2.9 × 2.8 mm (SOT23-5)



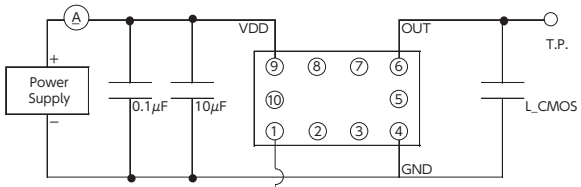
L_CMOS : Total Fixture and Probe Capacitance

5.0 × 3.2 mm (Ceramic) - Clipped Sine



Load_L : Total Fixture and Probe Capacitance
Load_C : Total Fixture and Probe Resistance

5.0 × 3.2 mm (Ceramic) - CMOS



L_CMOS : Total Fixture and Probe Capacitance

Substitution Products

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

Oven Controlled Crystal Oscillators	
Type	Substitution Products
DC5032AS	–

High-precision SMD TCXO	
Type	Substitution Products
DSB1612WA	DSB1612SDN
DSB1612WEB	–

SMD Crystal Resonators	
Type	Substitution Products
DSX530GA	DSX321G

SMD Low Phase Noise Crystal Oscillators	
Type	Substitution Products
DSO531SHH	–

SMD Tuning Fork Crystal Resonators	
Type	Substitution Products
DST1610AL	DST1210A
DST311S	DST1210A

SMD Crystal Resonators <For Automotive>	
Type	Substitution Products
SMD-49	–

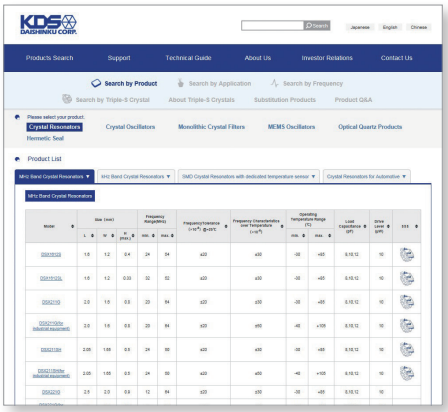
SMD Crystal Resonators with dedicated temperature sensor	
Type	Substitution Products
DSR1612STH	DSR1612ATH

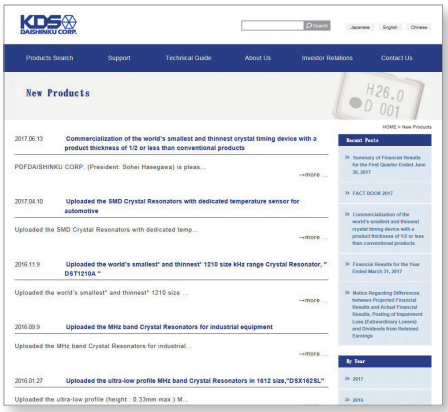
SMD Crystal Oscillators <For Automotive>	
Type	Substitution Products
DSO531SR	DSO321SR
DSO751SR	DSO321SR

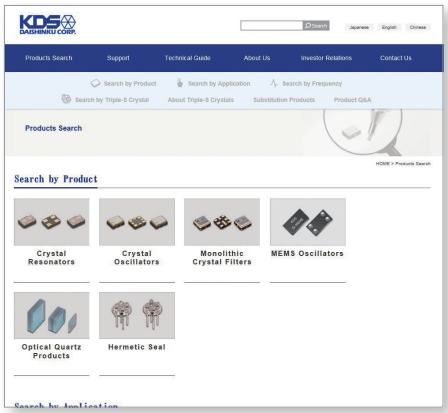
Product introduction on the Web

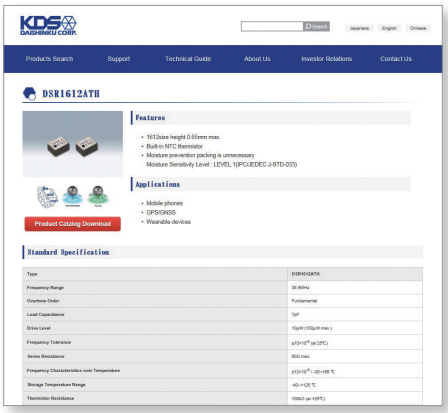
Sending products information through Internet

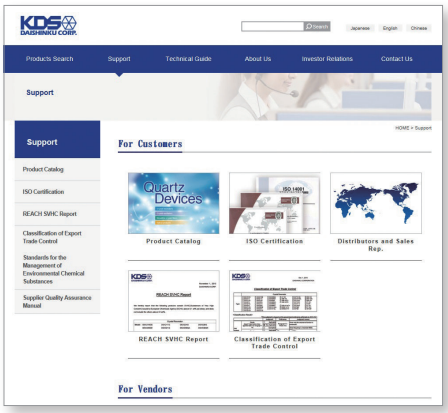
DAISHINKU has been supplying the latest products information through Internet. Please use this service.
DAISHINKU Web site: https://www.kds.info





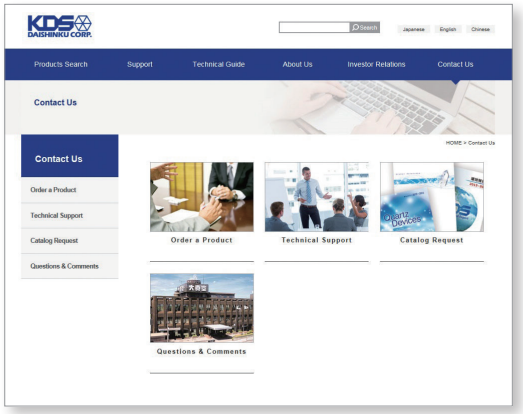






Contact us

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



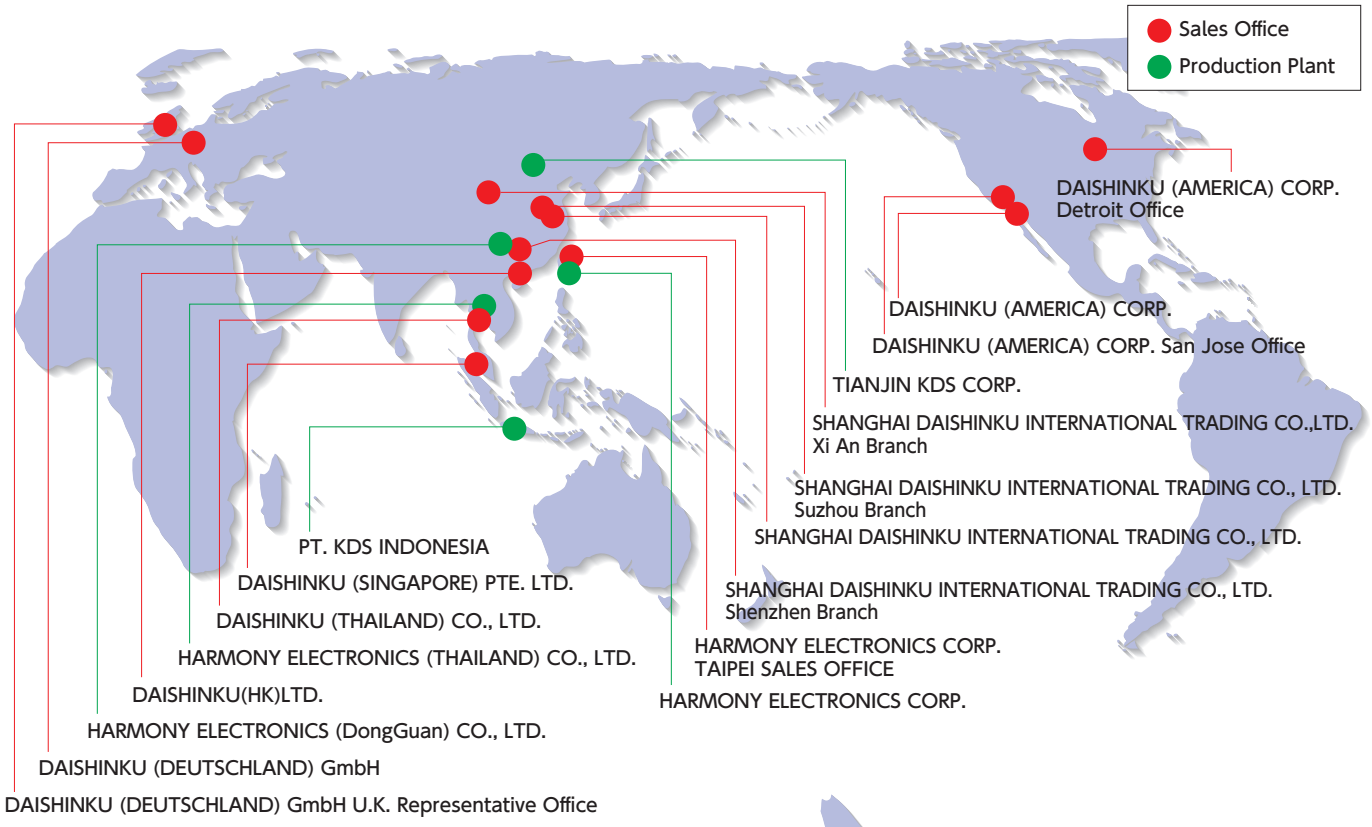
You may also contact us directory by e-mail.
e-mail address: kouhou602@kds.info

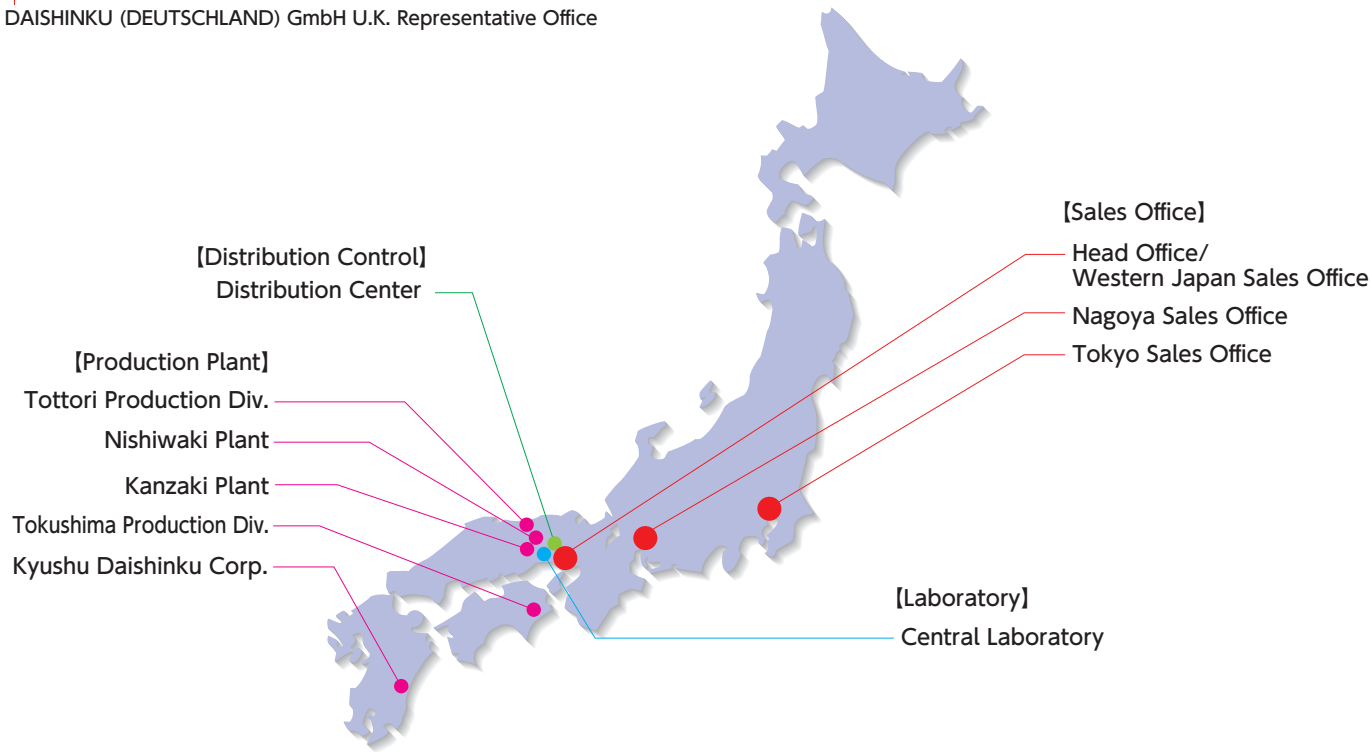
MEMO

KDS Global Network

Our global network accelerates our business.

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





General Manufacturer of Quartz Devices

株式会社 大真空
DAISHINKU CORP.

https://www.kds.info

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VEGETABLE OIL INK

2023.10