Handling Instructions

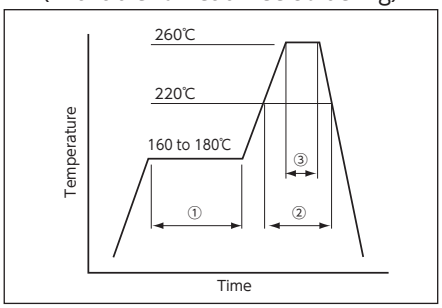
■ Soldering

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.

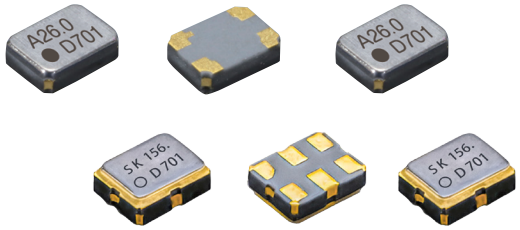
KDS is fully committed to environmental protection and has been proactively working to comply with the major environmental regulations such as RoHS Directive (Directive of the Restriction of the use of certain Hazardous Substances : 2011/65/EU and (EU) 2015/863), ELV Directive (End-of-Life Vehicles Directive : 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.30.2024

	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	DST1210A	○	○	○	Ni/Au	
	DST1610A	○	○	○	Ni/Au	
	DST210AC	○	○	○	Ni/Au	
	DST310SA	○	○	○	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)	DA/DB2016AS	○	○	○	Ni/Au	
	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	
	DS2016A SERIES	○	○	○	Ni/Au	
	DS2520A SERIES	○	○	○	Ni/Au	
	DS3225A 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.

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.

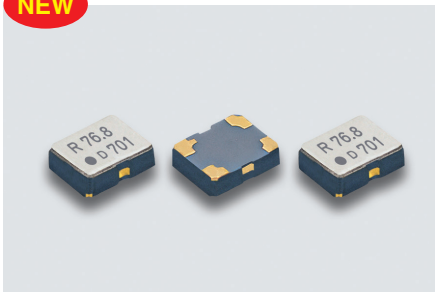
Terminology

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.

High-precision SMD VC-TCXO/TCXO

DSB1612SEB

NEW



Actual size

■ Features

- Capable of operating over a wide temperature range from −40 to +105℃
- High frequencies operation
- Low voltage operation
- Clipped sine wave
- Low phase noise
- Single package structure
- AEC-Q200 Compliant

Pb-Free

RoHS Compliant

■ Applications

- Automotive WiFi, WiLAN, WiMAX, Bluetooth
- GNSS, Industrial equipment

■ Standard Specification

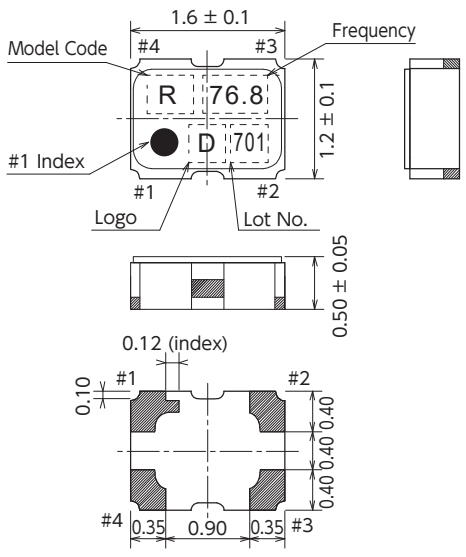
Item		DSB1612SEB	
Output Frequency Range		26 to 76.8MHz	
Supply Voltage Range		+1.8 to +3.3V	
Current Consumption		+4.5mA max.(f≦52MHz)/+5.0mA max.(f>52MHz)	
Stand-by Current (#1 pin "L" Level)		+3uA max.	
Output Level		0.8Vp-p min. (Clipped Sine Wave / DC-coupled)	
Output Load		10kΩ//10pF	
Frequency Stability			
	Tolerance	±2.0×10^{-6} max.(After 2 reflows)	
	vs. Temperature	±5.0×10^{-6} max. (−40 to +105℃)	±0.5×10^{-6} max. (−40 to +85℃)
	vs. Supply Voltage	±0.2×10^{-6} max. (Vcc±5%)	
	vs. Load Variation	±0.2×10^{-6} max.	
	vs. Aging	±2.0×10^{-6} max./year	
Start up Time		2.0ms max.	
Phase Noise		[f≦52MHz]	[f>52MHz]
	Offset 100Hz	−110dBc/Hz	−108dBc/Hz
	Offset 1kHz	−130dBc/Hz	−125dBc/Hz
	Offset 10kHz	−152dBc/Hz	−150dBc/Hz
	Offset 100kHz	−155dBc/Hz	−155dBc/Hz
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



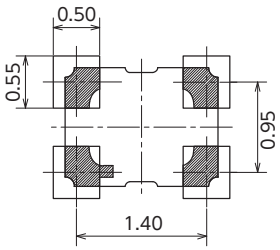
Pin Connections

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

Output Enable
H Oscillation
L Stand by

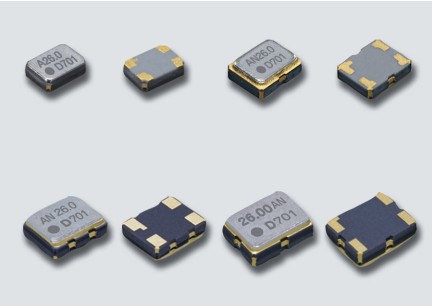
■ Recommended Land Pattern

<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
- Selectable between standard type and GPS/GNSS specialized type (DSB1612SDN)
- Clipped sine wave
- 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

Type / Item	VC-TCXO				TCXO			
	DSA1612SDN	DSA211SDN	DSA221SDN	DSA321SDN	DSB1612SDN	DSB211SDN	DSB221SDN	DSB321SDN
Frequency Range	9.6 to 60MHz	9.6 to 52MHz	9.6 to 52MHz		9.6 to 60MHz	9.6 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

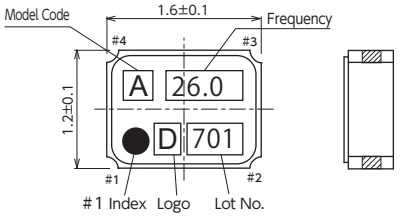
■ Dimensions

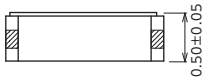
[mm]

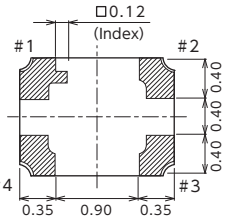
■ DSA1612SDN/DSB1612SDN

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

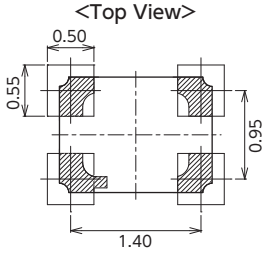
Pin Connections	
Pin No.	Connection
#1	Vcont(VC-TCXO)/GND(TCXO)
#2	GND
#3	Output
#4	Vcc







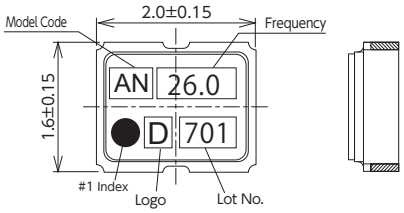
■ Recommended Land Pattern
<Top View>

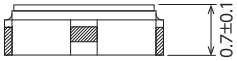


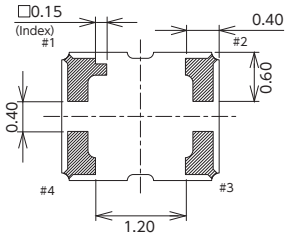
■ DSA211SDN/DSB211SDN

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

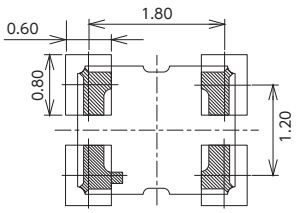
Pin Connections	
Pin No.	Connection
#1	Vcont(VC-TCXO)/GND(TCXO)
#2	GND
#3	Output
#4	Vcc







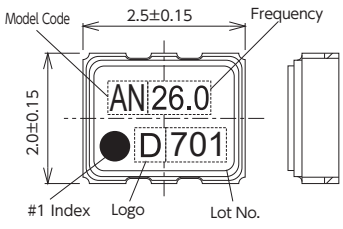
■ Recommended Land Pattern
<Top View>

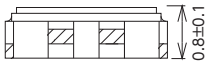


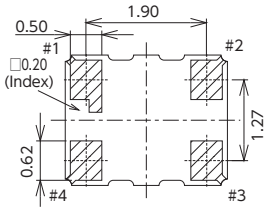
■ DSA221SDN/DSB221SDN

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

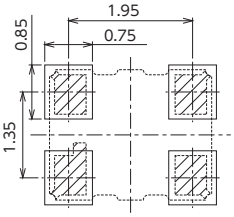
Pin Connections	
Pin No.	Connection
#1	Vcont(VC-TCXO)/GND(TCXO)
#2	GND
#3	Output
#4	Vcc







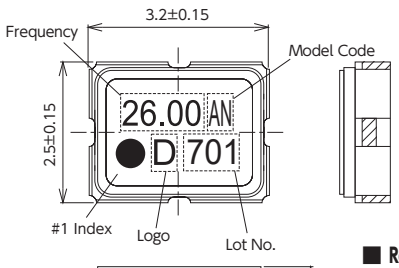
■ Recommended Land Pattern
<Top View>

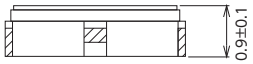


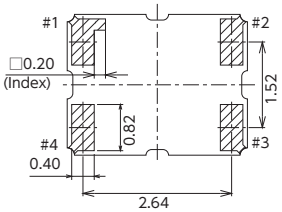
■ DSA321SDN/DSB321SDN

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

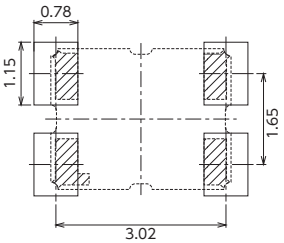
Pin Connections	
Pin No.	Connection
#1	Vcont(VC-TCXO)/GND(TCXO)
#2	GND
#3	Output
#4	Vcc





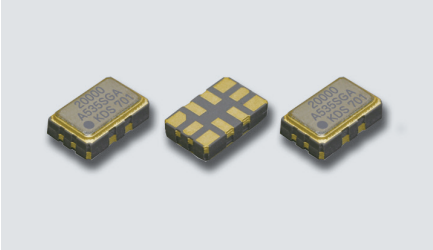


■ Recommended Land Pattern
<Top View>



Ultra High-precision SMD VC-TCXO/TCXO

DSA535SGA/DSB535SGA/DSA535SGB for Stratum3/ Femtocell



Actual size

■ Features

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

■ Applications

- Stratum3, 5G compatible devices, Networking, Base station

Pb-Free

RoHS Compliant

■ Standard Specification

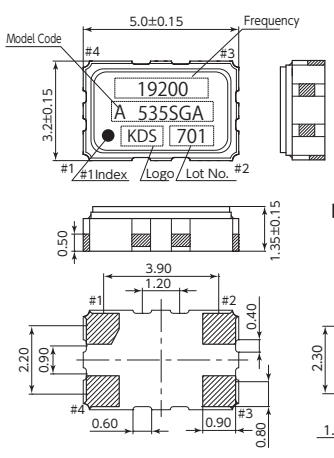
Item	DSA535SGB (VC-TCXO)	DSA535SGA (VC-TCXO)	DSB535SGA (TCXO)
Output Frequency Range	10 to 52MHz		
Standard Frequency	10MHz/ 19.2MHz/ 20MHz/ 38.88MHz		
Supply Voltage (Range)	+2.3 to +3.63V		
Supply Voltage (Vcc)	+2.8V/ +3.0V/ +3.3V		
Current Consumption	+4.0mA max. (Clipped sine wave)/ +8.0mA max. (CMOS)		
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	±1.5×10^{-6} max. (After 2 reflows)		
vs. Temperature	±0.10×10^{-6} max. / −40 to +85℃ ±0.20×10^{-6} max. / −40 to +105℃		
vs. Temperature Characteristic Control Voltage Change	±0.1×10^{-6} max. (Frequency control sensitivity ±5×10^{-6}, Vcont=+1.5V±1.0V)	—	
vs. Hysteresis	±0.1×10^{-6} max.		
vs. Supply Voltage	±0.1×10^{-6} max. (Vcc±5%: Clipped sine wave, CMOS (f≦40MHz))/±0.2×10^{-6} max. (Vcc±5% :CMOS (40MHz<f))		
vs. Load Variation	±0.20×10^{-6} max. (10kΩ//10pF±10%/ 15pF ±10%)		
vs. Aging	±1.0×10^{-6} max./year		
Total Frequency Tolerance	±4.6×10^{-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

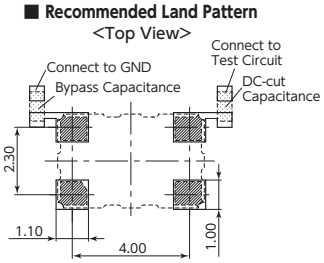


Model Code
DSA535SGA→A535SGA
DSB535SGA→B535SGA
DSA535SGB→A535SGA

Pin Connections(4terminals)

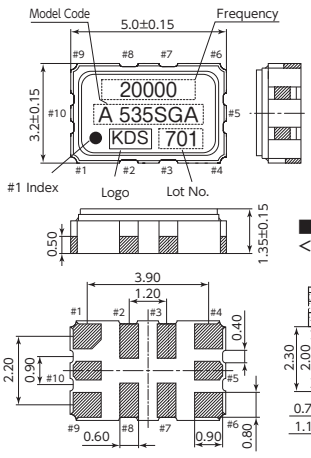
Pin No.	Connection
#1	VCONT(VC-TCXO)/ GND(TCXO)
#2	GND
#3	Output
#4	Vcc

■ Recommended Land Pattern
<Top View>



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

■ Dimensions



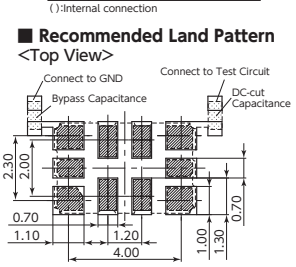
Model Code
DSA535SGA→A535SGA
DSB535SGA→B535SGA
DSA535SGB→A535SGA

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

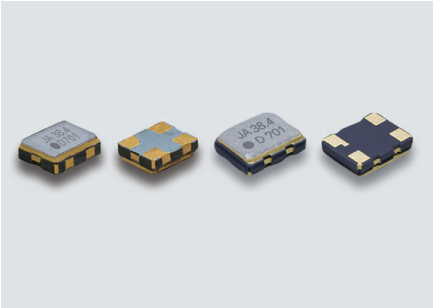
( ):Internal connection

■ Recommended Land Pattern
<Top View>



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

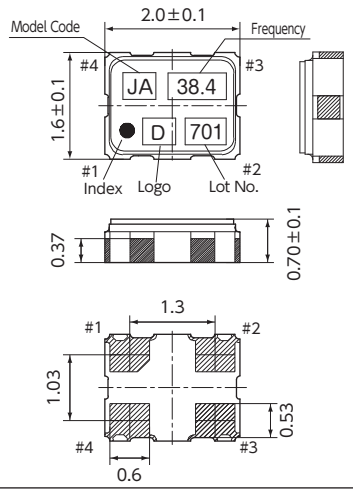
Item \ Type	DSB211SJA	DSB221SJA
Frequency Range	13 to 54MHz	11 to 52MHz
Standard Frequency	19.2MHz/ 25MHz/ 26MHz/ 32MHz/ 38.4MHz/ 40MHz/ 48MHz/ 52MHz	
Supply Voltage (Vcc)	+1.8V/ +2.5V/ +2.8V/ +3.3V	
Current Consumption	5.0mA max. [No Load]	
Stand-by Current (#1 pin "L" Level)	+10μA max.	
Frequency Stability 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.	
Start Up Time	[f≦26MHz]	[26MHz<f≦52MHz]
Offset 1kHz	−145dBc/Hz	−141dBc/Hz
Offset 100kHz	−158dBc/Hz	−157dBc/Hz
Packing Unit (1)	3000pcs./reel (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

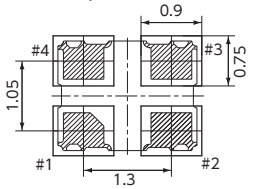


Pin Connections	
Pin No.	Connection
#1	OE (Output Enable)
#2	GND
#3	Output
#4	Vcc

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

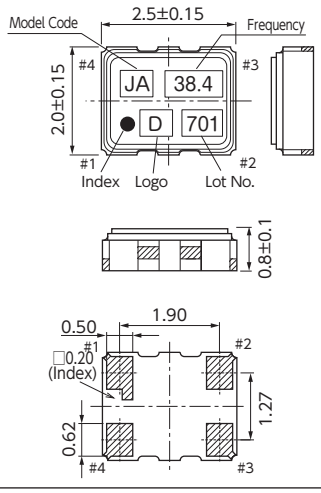
■ Recommended Land Pattern

<Top View>



■ DSB221SJA [mm]

■ Dimensions

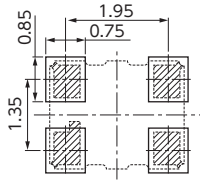


Pin Connections	
Pin No.	Connection
#1	OE (Output Enable)
#2	GND
#3	Output
#4	Vcc

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

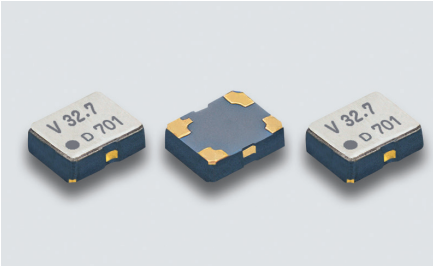
■ Recommended Land Pattern

<Top View>



SMD TCXO

DSK1612ATD



Actual size

■ Features

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

■ Applications

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

Pb-Free

RoHS Compliant

■ Standard Specification

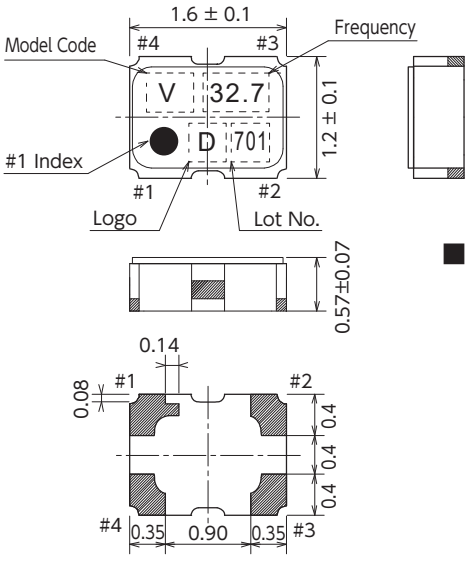
Item	Legend	Spec.				Condition
		min.	typ.	max.	Unit	
Output Frequency	f_0	–	32.768	–	kHz	
Supply Voltage Range	Vcc	+1.5	–	3.63	V	Temperature Compensated Operating
Frequency Tolerance	f_tol	−5.0	–	+5.0	×10^{-6}	Vcc=+1.8V or +3.3V, TA=−40 to +85℃ (Standard operating temperature range, Referenced to 32.768kHz)
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]

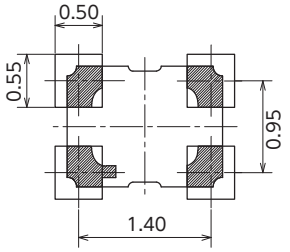
■ Dimensions



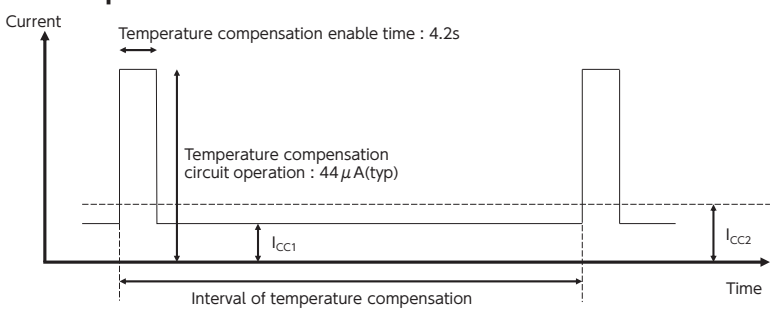
Pin No.	Connection
#1	GND
#2	Output
#3	Vcc
#4	GND

■ Recommended Land Pattern

<Top View>



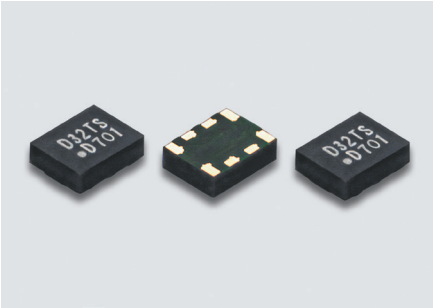
■ Current profile



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

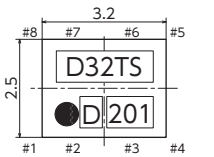
Item	Legend	Spec. min.	Spec. typ.	Spec. max.	Spec. unit	Condition	
Output Frequency	f0	–	32.768	–	kHz		
Supply Voltage Range	Vcc	+1.3	–	+5.5	V	(Clock Timing Operating)	
	Vtem	+1.5	–	+5.5		(Temperature Compensated Operating)	
	Vint	+1.5	–	+5.5		(Interface Operation) I^{2}C-BUS	
Frequency Tolerance	f_tol	– 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)						

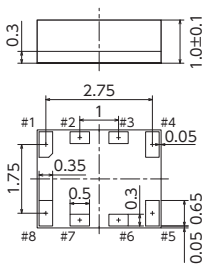
(1) Moisture prevention packing
Moisture sensitivity level : Level 2 (IPC/JEDEC J-STD-033)

Consult our sales representative for other specifications.

[mm]

■ Dimensions



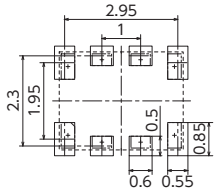


Function	
#1 Input	#5 Output Condition
H	Oscillation out
L	High Z

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>

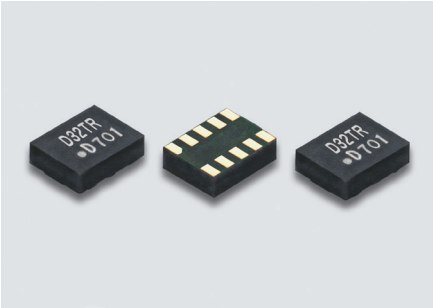


Pin Function

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

Pb-Free

RoHS Compliant

■ 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.

■ Applications

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

■ Standard Specification

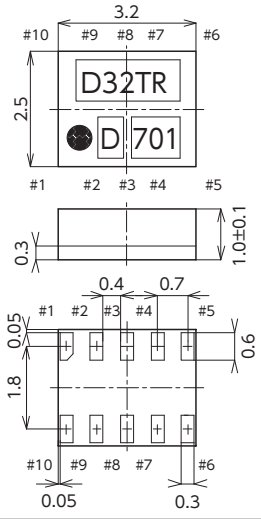
Item	Legend	Spec. min.	Spec. typ.	Spec. max.	Spec. unit	Condition	
Output Frequency	f_0	–	32.768	–	kHz		
Supply Voltage Range	Vcc	+1.3	–	+5.5	V	(Clock Timing Operating)	
	Vint	+1.5	–	+5.5		(Interface Operation) I^{2}C-BUS	
Frequency Tolerance	f_tol	− 11.5	–	+11.5	× 10^{-6}	Ta = 25℃ , Vcc = +3.0V (30 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	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

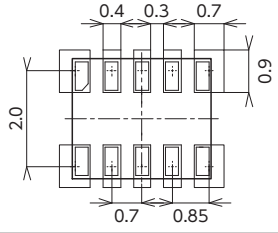


Function	
#2 Input	#4 Output Condition
H	Oscillation out
L	High Z

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>

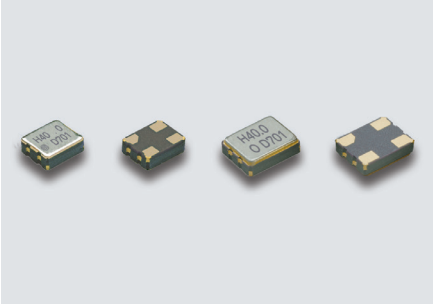


Pin Function

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	0	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/0	I^{2}C-BUS serial interface data input/output connection.
#8	N.C.	-	
#9	GND	-	Ground connection.
#10	INTN	0	1Hz signal, alarm interrupt signal, fixed-cycle timer interrupt signal, and time update interrupt signal, Nch open-drain output.

SMD Low Phase Noise Crystal Oscillators

DSO221SH/DSO321SH



Actual size DSO221SH DSO321SH

■ Features

- Supply Voltage : 1.8V/2.5V/2.8V/3.0V/3.3V
- Low phase noise : Offset 1kHz −145 dBc/Hz(Typ.)
  Offset 100kHz −158 dBc/Hz(Typ.)
- Low profile : 0.815mm(DSO221SH), 1.1mm(DSO321SH)
- CMOS Level Output
- 3-state function

■ Applications

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

Pb-Free

RoHS Compliant

[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.

[Type]

DSO221SH	2520 size
DSO321SH	3225 size

■ Standard Specification

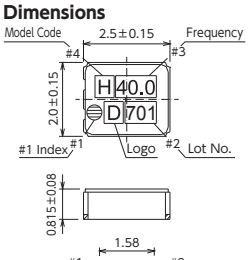
Item	Function Code: Supply Voltage	Function Code: Frequency tolerance	Output Frequency Range (MHz)	Legend	Spec.: min.	Spec.: typ.	Spec.: max.	Spec.: Unit	Condition	
Supply Voltage	A	*	3.5≦f0≦52	V_{CC}	+3.0	+3.3	+3.6	V		
	M				+2.7	+3.0	+3.3			
	B				+2.6	+2.8	+3.0			
	C				+2.25	+2.5	+2.75			
	D				+1.6	+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

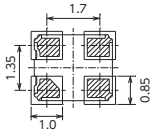


Pin Connections	
Pin No.	Connection
#1	OE (Output Enable)
#2	GND
#3	Output
#4	V_{CC}

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

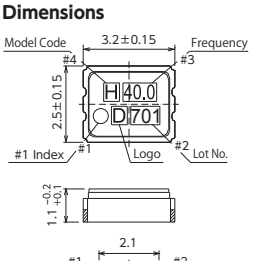
■ Recommended Land Pattern

<Top View>



■ DSO321SH [mm]

■ Dimensions

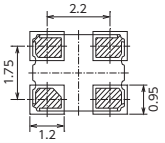


Pin Connections	
Pin No.	Connection
#1	OE (Output Enable)
#2	GND
#3	Output
#4	V_{CC}

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

■ Recommended Land Pattern

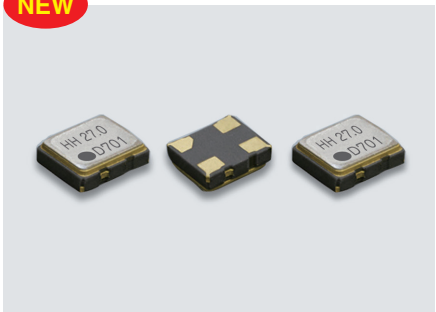
<Top View>



SMD Crystal Oscillators

DSO221SHH

NEW



Actual size

■ Features

- Supply Voltage: 1.8V/2.5V/2.8V/3.3V
- Low phase noise : Offset 1kHz −146dBc/Hz(typ.)
  : Offset 100kHz −164dBc/Hz(typ.)
- Available frequency range: 2.0 to 54MHz
- Low profile : 0.8 mm
- CMOS Level Output
- 3-state function

■ Applications

- WiLAN, WiMAX, Bluetooth
- Visual applications
- PC, gaming equipment, audio equipment

Pb-Free

RoHS Compliant

[Function Code]

DSO221SHH 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}

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

■ Standard Specification

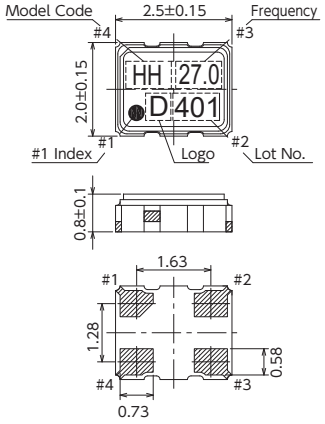
Item	Function Code		Output Frequency Range (MHz)	Legend	Spec.				Condition	
	Supply Voltage	Frequency tolerance			min.	typ.	max.	Unit		
Supply Voltage	A	*	2.0≦f0≦54	Vcc	+3.0	+3.3	+3.6	V		
	B				+2.6	+2.8	+3.0			
	C				+2.25	+2.5	+2.75			
	D				+1.62	+1.8	+2.0			
Frequency Tolerance (Includes frequency tolerance at room temperature.)	*	A	*	f_tol	−100	−	+100	×10^{-6}	−40 to +85℃	−10 to +70℃ (Standard Operating Temperature Range)
		B			−50	−	+50			
		C			−30	−	+30		−20 to +70℃	
Current Consumption	A	*	2.0≦f0≦54	Icc	−	−	4.2	mA	No Load	
	B									
	C									
	D				−	−	2.3			
Stand-by Current (#1 pin "L" Level)	*	*	*	I_std	−	−	10	μA		
Symmetry	*	*	*	SYM	40	50	60	%	50% Vcc Level	
0 Level Output Voltage	*	*	*	V_{OL}	−	−	Vcc×0.1	V		
1 Level Output Voltage	*	*	*	V_{OH}	Vcc×0.9	−	−	V		
Rise and Fall Time	A, B, C	*	*	tr, tf	−	−	4	ns	10 to 90% Vcc Level	
	D				−	−	6.5			
Load Condition	*	*	*	L_{CMOS}	−	−	15	pF		
OE Pin 0 Level Input Voltage	*	*	*	V_{IL}	−	−	Vcc×0.2	V		
OE Pin 1 Level Input Voltage	*	*	*	V_{IH}	Vcc×0.8	−	−	V		
Output Disable Time	*	*	*	tPLZ	−	−	100	ns		
Output Enable Time	*	*	*	tPZL	−	−	2	ms		
Phase Noise	*	*	*	−	−	−146	−	dBc/Hz	Offset 1kHz	
					−	−164	−		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≦54	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

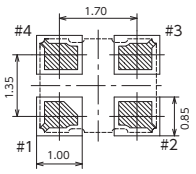


Pin Connections	
Pin No.	Connection
#1	OE(Output Enable)
#2	GND
#3	Output
#4	Vcc

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

■ Recommended Land Pattern

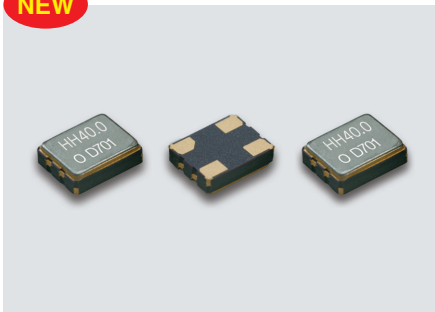
<Top View>



SMD Crystal Oscillators

DSO321SHH

NEW



Actual size

■ Features

- Supply Voltage: 1.8V/2.5V/2.8V/3.3V
- Ultra low phase noise : Offset 1kHz −160dBc/Hz(typ.)
  : Offset 100kHz −172dBc/Hz(typ.)
- Available frequency range: 20 to 50MHz
- Low profile : 1.1 mm
- CMOS Level Output
- 3-state function

■ Applications

- High quality audio equipment, Communication equipment and visual applications

Pb-Free

RoHS Compliant

[Function Code]

DSO321SHH 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}
D : ±25×10^{-6}

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

■ Standard Specification

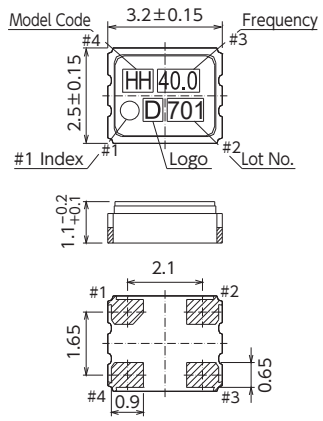
Item	Function Code		Output Frequency Range (MHz)	Legend	Spec.				Condition	
	Supply Voltage	Frequency tolerance			min.	typ.	max.	Unit		
Supply Voltage	A	*	20≦f0≦50	Vcc	+3.0	+3.3	+3.6	V		
	B				+2.6	+2.8	+3.0			
	C				+2.25	+2.5	+2.75			
	D				+1.62	+1.8	+2.0			
Frequency Tolerance (Includes frequency tolerance at room temperature.)	*	A	*	f_tol	−100	−	+100	×10^{-6}	−40 to +85℃	−10 to +70℃ (Standard Operating Temperature Range)
		B			−50	−	+50			
		C			−30	−	+30		−20 to +70℃	
		D			−25	−	+25		−10 to +70℃	
Current Consumption	A	*	20≦f0≦50	Icc	−	−	7.7	mA	No Load	
	B				−	−	5.5			
	C				−	−	4.8			
	D				−	−	2.9			
Stand-by Current (#1 pin "L" Level)	A	*	20≦f0≦50	I_std	−	−	35	μA		
	B				−	−	32			
	C				−	−	30			
	D				−	−	25			
Symmetry	*	*	*	SYM	45	50	55	%	50% Vcc Level	
0 Level Output Voltage	*	*	*	V_{OL}	−	−	Vcc×0.1	V		
1 Level Output Voltage	*	*	*	V_{OH}	Vcc×0.9	−	−	V		
Rise and Fall Time	A	*	*	tr, tf	−	−	2.1	ns	10 to 90% Vcc Level	
	B				−	−	2.5			
	C				−	−	2.7			
	D				−	−	4.7			
Load Condition	*	*	*	L_{CMOS}	−	−	15	pF		
OE Pin 0 Level Input Voltage	*	*	*	VIL	−	−	Vcc×0.3	V		
OE Pin 1 Level Input Voltage	*	*	*	VIH	Vcc×0.7	−	−	V		
Output Disable Time	*	*	*	tPLZ	−	−	10	μs		
Output Enable Time	*	*	*	tPZL	−	−	1	m s		
Phase Noise	A	*	20≦f0≦50	−	−	−160	−	dBc/Hz	Offset 1kHz	
	D				−	−158	−			
	A				−	−172	−		Offset 100kHz	
	D				−	−166	−			
Packing Unit (1)	DSO321SHH: 2000pcs./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

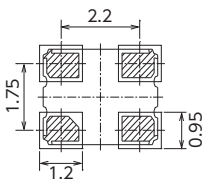


Pin Connections	
Pin No.	Connection
#1	OE (Output Enable)
#2	GND
#3	Output
#4	Vcc

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

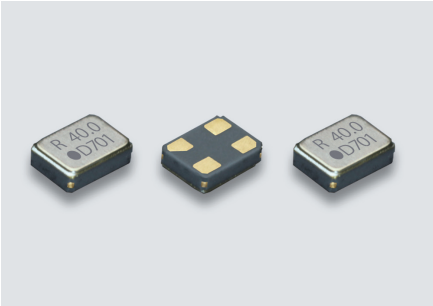
■ Recommended Land Pattern

<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

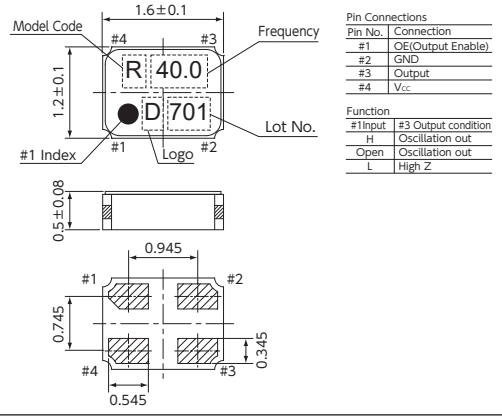
Item	Function Code		Output Frequency Range (MHz)	Legend	Spec.			Unit	Condition	
	Supply Voltage	Frequency tolerance			min.	typ.	max.			
Supply Voltage	A	*	0.584375≦f0≦80	Vcc	+3.0	+3.3	+3.6	V		
	M				+2.7	+3.0	+3.3			
	B				+2.6	+2.8	+3.0			
	C				+2.25	+2.5	+2.75			
	D				+1.6	+1.8	+2.0			
Frequency 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

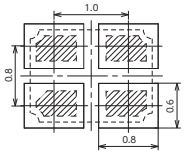
Pin No.	Connection
#1	OE(Output Enable)
#2	GND
#3	Output
#4	Vcc

Function

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

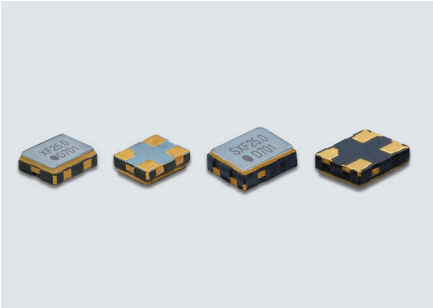
■ Recommended Land Pattern

<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

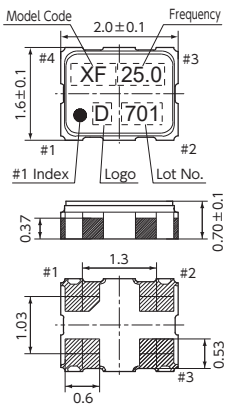
Item	Function Code: Supply Voltage	Function Code: Frequency tolerance	Output Frequency Range (MHz)	Legend	Spec.: min.	Spec.: typ.	Spec.: max.	Spec.: Unit	Condition	
Supply Voltage	A	*	1≦f0≦125	Vcc	+3.0	+3.3	+3.6	V		
	B				+2.6	+2.8	+3.0			
	C				+2.25	+2.5	+2.75			
	D		1≦f0≦100		+1.6	+1.8	+2.0			
Frequency 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		−40 to +85℃	
					–	–	±50			
		C			–	–	±30			
		D			–	–	±25		−20 to +70℃	
		E			–	–	±20			
Current Consumption	A	*	1≦f0<40	Icc	–	–	2.4	mA	No Load	
			40≦f0<100		–	–	4.2			
			100≦f0≦125		–	–	10.0			
	B		1≦f0<40		–	–	2.2			
			40≦f0<100		–	–	3.7			
			100≦f0≦125		–	–	9.0			
	C		1≦f0<40		–	–	2.0			
			40≦f0<100		–	–	3.4			
			100≦f0≦125		–	–	8.0			
	D		1≦f0<40		–	–	1.7			
			40≦f0<100		–	–	2.7			
Stand-by Current (#1 pin "L"Level)	*	*	*	I_std	–	–	10	μA		
Load Condition	*	*	*	L_CMOS	–	–	15	pF		
Symmetry	*	*	*	SYM	45	50	55	%	50% Vcc Level	
0 Level Output Voltage	*	*	*	VOL	–	–	Vcc×0.1	V		
1 Level Output Voltage	*	*	*	VOH	Vcc×0.9	–	–			
Rise and Fall Time	A, B, C	*	*	tr, tf	–	–	3	ns	10 to 90% Vcc Level	
	D				–	–	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

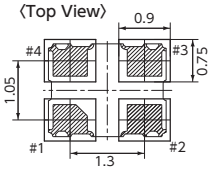


Pin Connections	
Pin No.	Connection
#1	OE(Output Enable)
#2	GND
#3	Output
#4	Vcc

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

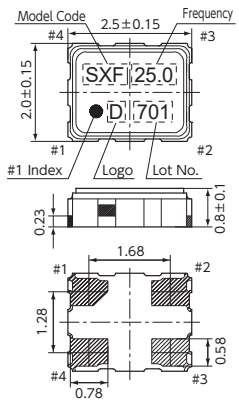
■ Recommended Land Pattern

〈Top View〉



■ DSO221SXF [mm]

■ Dimensions

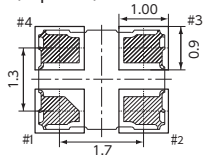


Pin Connections	
Pin No.	Connection
#1	OE(Output Enable)
#2	GND
#3	Output
#4	Vcc

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

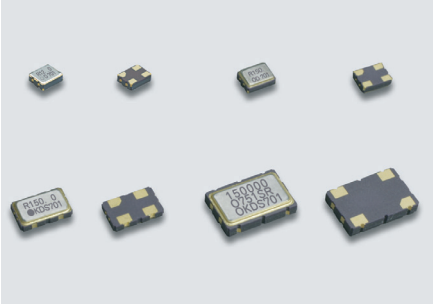
■ Recommended Land Pattern

〈Top View〉



SMD Crystal Oscillators

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℃	
		D	0.2≦f0≦80		−25	−	+25			
		E	0.2≦f0≦50		−20	−	+20		−10 to +70℃	
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)									

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

Consult our sales representative for other specifications.

SMD Crystal Oscillators

DSO221SR/DSO321SR/DSO531SR/DSO751SR

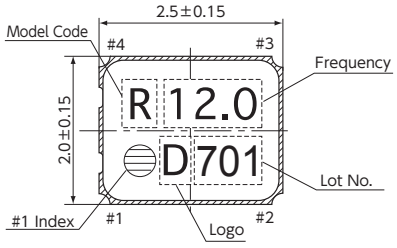
■ Applications

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

■ Dimensions

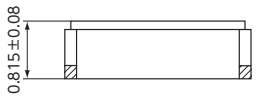
[mm]

DSO221SR

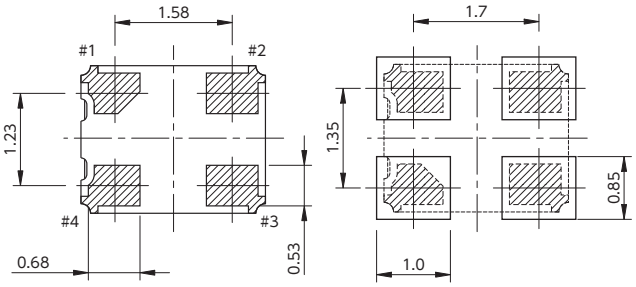


Pin Connections	
Pin No.	Connection
#1	OE(Output Enable)
#2	GND
#3	Output
#4	Vcc

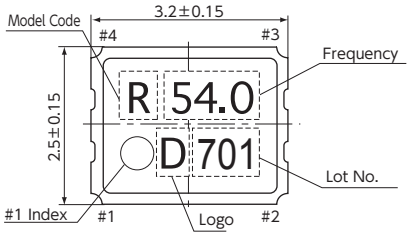
Function	
#1Input	#3 Output condition
H	Oscillation out
Open	Oscillation out
L	High Z



■ Recommended Land Pattern
〈Top View〉

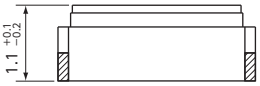


DSO321SR

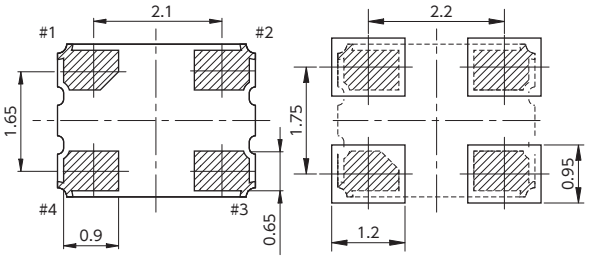


Pin Connections	
Pin No.	Connection
#1	OE(Output Enable)
#2	GND
#3	Output
#4	Vcc

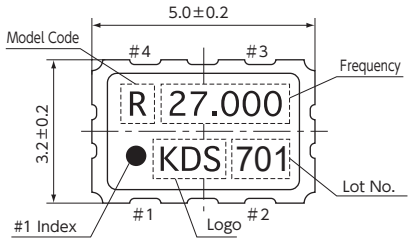
Function	
#1Input	#3 Output condition
H	Oscillation out
Open	Oscillation out
L	High Z



■ Recommended Land Pattern
〈Top View〉

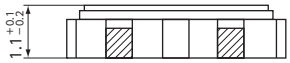


DSO531SR

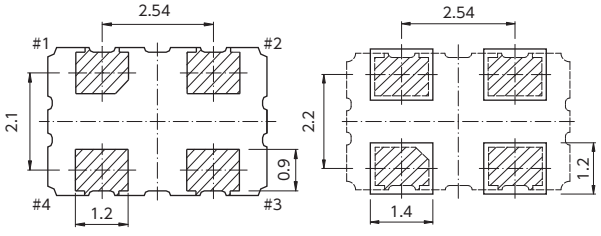


Pin Connections	
Pin No.	Connection
#1	OE(Output Enable)
#2	GND
#3	Output
#4	Vcc

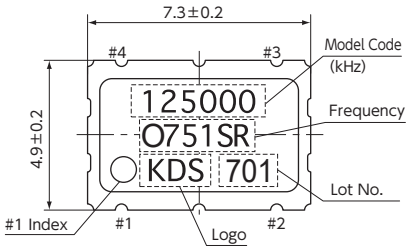
Function	
#1Input	#3 Output condition
H	Oscillation out
Open	Oscillation out
L	High Z



■ Recommended Land Pattern
〈Top View〉



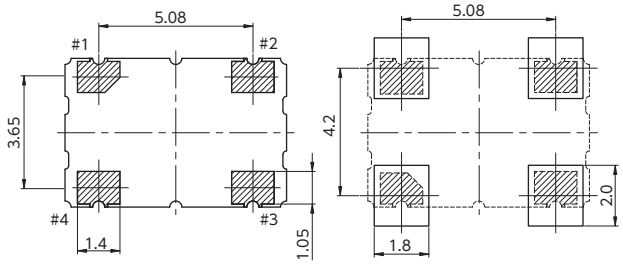
DSO751SR



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

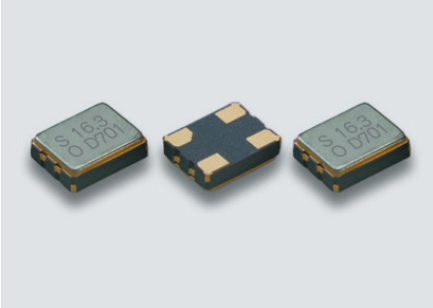
Function	
#1Input	#3 Output condition
H	Oscillation out
Open	Oscillation out
L	High Z

■ Recommended Land Pattern
〈Top View〉



SMD Crystal Oscillators

DSO321SRS



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

■ Standard Specification

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	*	8.25≦f0≦16.5	Icc	−	−	3.7	mA	No Load	
			16.5<f0≦33		−	−	4.1			
			33<f0≦66		−	−	4.8			
Stand-by Current (#1 pin "L" Level)	A	*	8.25≦f0≦16.5	I_std	−	−	2.4	mA		
			16.5<f0≦33		−	−	2.9			
			33<f0≦66		−	−	3.8			
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

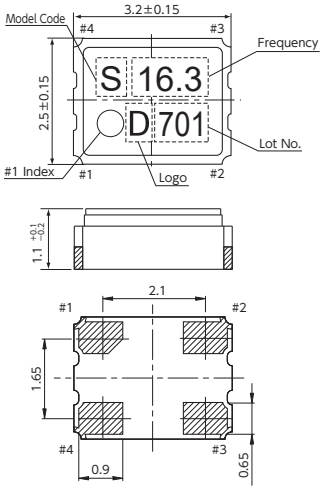
Consult our sales representative for other specifications.

(2) tDJ : Deterministic jitter tRJ : Random jitter

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

[mm]

■ Dimensions



Pin Connections

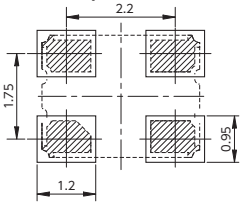
Pin No.	Connection
#1	OE(Output Enable)
#2	GND
#3	Output
#4	Vcc

Function

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

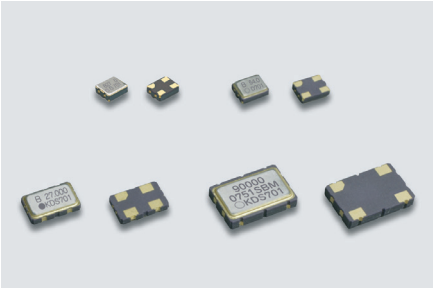
■ Recommended Land Pattern

<Top View>



SMD Crystal Oscillators

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

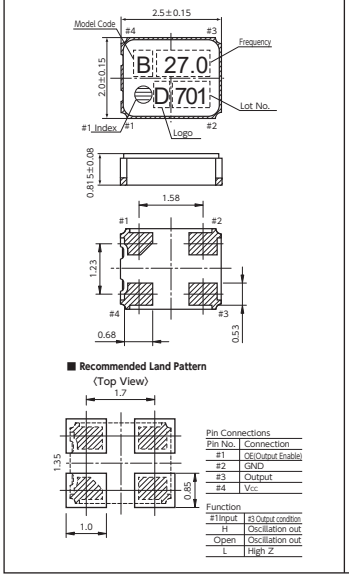
Item	Legend	Function Code		DSO221SBM				DSO321, 531, 751 SBM					Condition	
		Supply Voltage	Frequency tolerance	Output Frequency Range (MHz)	Spec. min.	Spec. typ.	Spec. max.	Output Frequency Range (MHz)	Spec. min.	Spec. Typ.	Spec. max.	Unit		
Supply Voltage	V_{CC}	*	*	3.25≦f$_0$≦52	+4.5	+5.0	+5.5	0.7≦f$_0$≦90	+4.5	+5.0	+5.5	V		
Frequency Tolerance (Includes frequency tolerance at room temperature.)	f_tol	*	A	3.25≦f$_0$≦52	−100	–	+100	0.7≦f$_0$≦90	−100	–	+100	X10^{-6}	−40 to +85℃	−10 to +70℃ (Standard Operating Temperature Range)
			B	3.25≦f$_0$≦52	−50	–	+50	0.7≦f$_0$≦90	−50	–	+50			
			C	3.25≦f$_0$≦52	−30	–	+30	0.7≦f$_0$≦54	−30	–	+30		−20 to +70℃	
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.

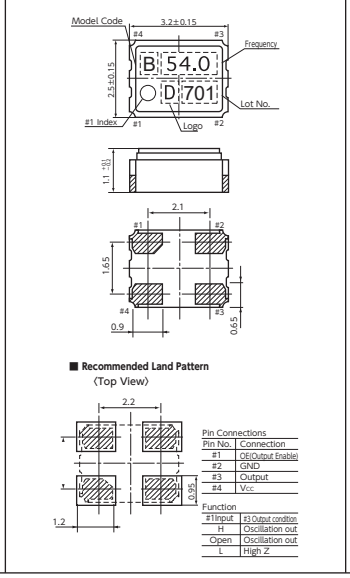
■ DSO221SBM [mm]

■ Dimensions



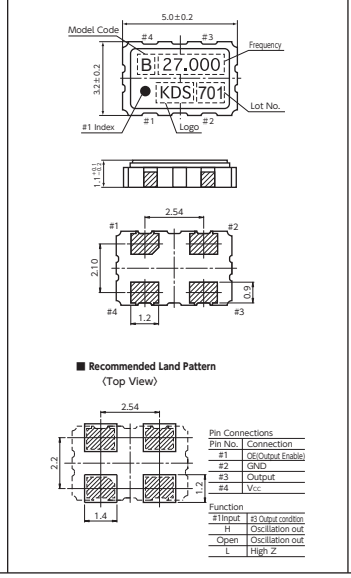
■ DSO321SBM [mm]

■ Dimensions



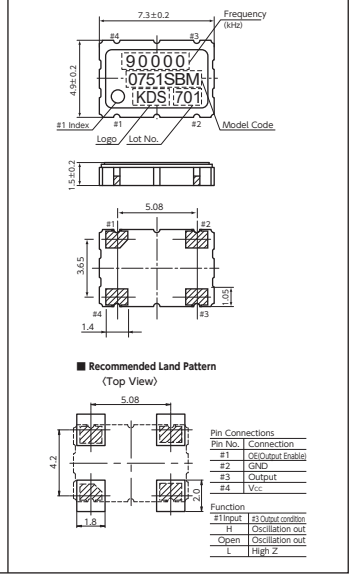
■ DSO531SBM [mm]

■ Dimensions



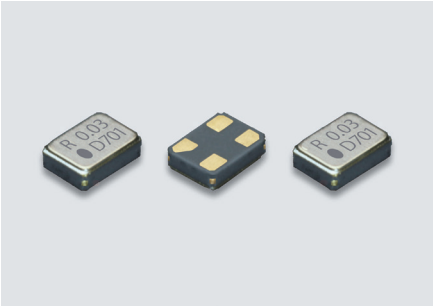
■ DSO751SBM [mm]

■ 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, multimedia devices, industrial measuring equipment, consumer product

[Function Code]

DSO1612AR A A

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

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

■ Standard Specification

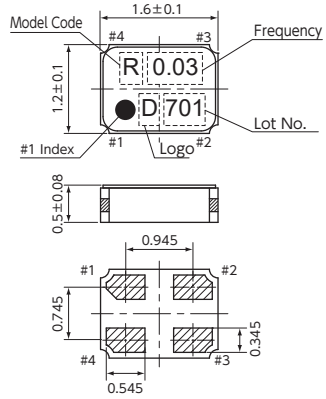
Item	Function Code: Supply Voltage	Function Code: Frequency tolerance	Output Frequency (kHz)	Legend	Spec.: min.	Spec.: typ.	Spec.: max.	Unit	Condition	
Supply Voltage	A	*	*	Vcc	+3.0	+3.3	+3.6	V		
	M				+2.7	+3.0	+3.3			
	B				+2.6	+2.8	+3.0			
	C				+2.25	+2.5	+2.75			
	D				+1.6	+1.8	+2.0			
Frequency 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

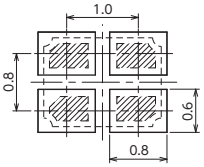
Pin No.	Connection
#1	OE(Output Enable)
#2	GND
#3	Output
#4	Vcc

Function

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

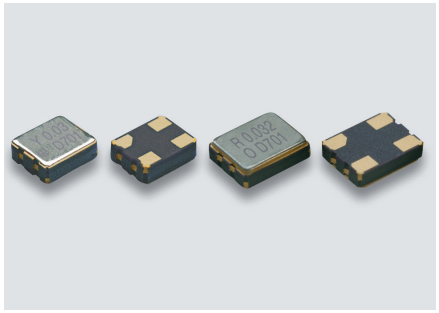
■ Recommended Land Pattern

<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

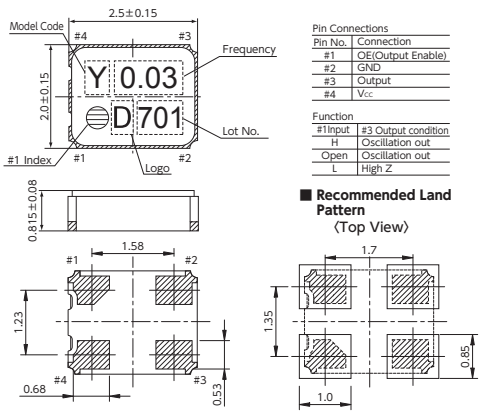
Item	Function Code		Output Frequency Range	Legend	Spec.				Condition	
	Supply Voltage	Frequency tolerance			min.	typ.	max.	Unit		
Supply Voltage	A	*	32.768kHz 1.049≦f0≦8.5MHz	Vcc	+3.0	+3.3	+3.6	V		
	B				+2.6	+2.8	+3.0			
	C				+2.25	+2.5	+2.75			
	D				+1.6	+1.8	+2.0			
Frequency Tolerance (includes 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

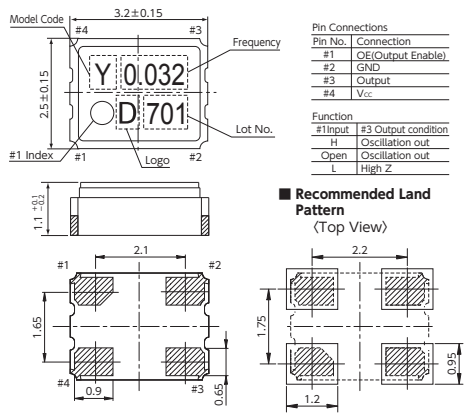
Function

#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

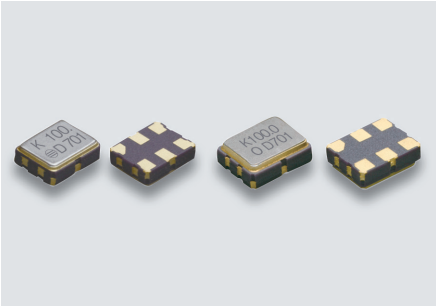
Function

#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.

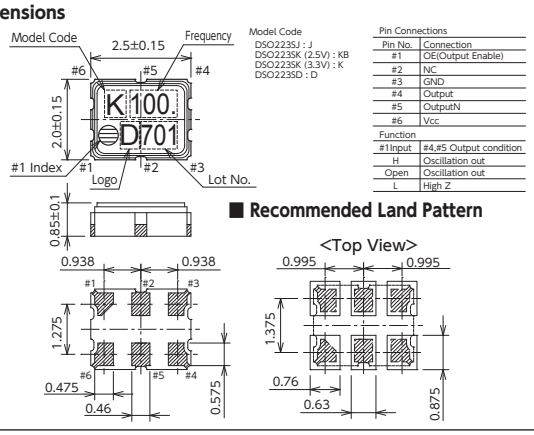
Item \ Type	Legend	DSO223SK DSO323SK	DSO223SJ DSO323SJ	DSO223SD DSO323SD
Output Specification	–	LV-PECL	LVDS	HCSL
Output Frequency Range	f_0	13.5 to 167MHz (DSO223S SERIES) /13.5 to 212.5MHz (DSO323S SERIES)		
Supply Voltage	V_{CC}	+2.5V±0.125V/+3.3V±0.165V		
Frequency Tolerance (Includes frequency tolerance 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



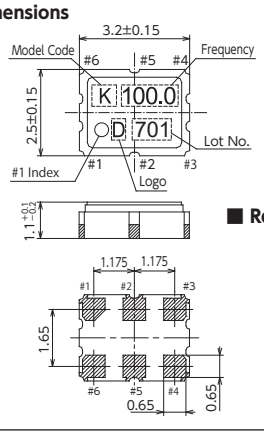
Model Code
DSO223SJ : J
DSO223SK (2.5V) : KB
DSO223SK (3.3V) : K
DSO223SD : D

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

■ DSO323S SERIES [mm]

■ Dimensions



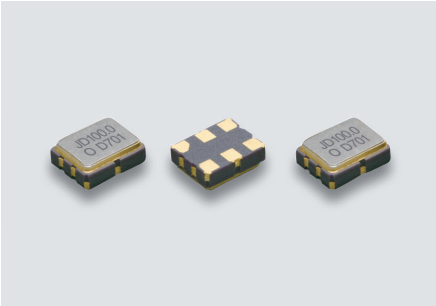
Model Code
DSO323SJ:J
DSO323SK(2.5V):KB
DSO323SK(3.3V):K
DSO323SD:D

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

SMD Differential Output Crystal Oscillators - Low Voltage

DSO323SJ/DSO323SD



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}	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.	
Packing Unit (3)	–	2000pcs./reel (φ180)	

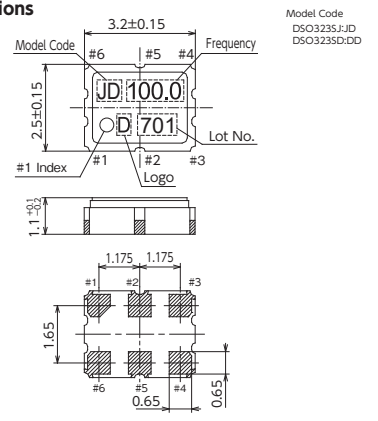
(1) Measured WAVECREST DTS-2075
(2) tDJ : Deterministic jitter tRJ : Random jitter
(3) Moisture prevention packing is unnecessary.
Moisture Sensitivity Level : Level 1 (IPC/JEDEC J-STD-033)

Consult our sales representative for other specifications.

■ DSO323S SERIES

[mm]

■ Dimensions



Model Code
DSO323SJ:JD
DSO323SD:DD

Pin Connections

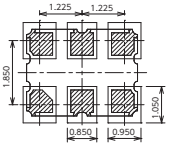
Pin No.	Connection
#1	OE(Output Enable)
#2	NC
#3	GND
#4	Output
#5	OutputN
#6	Vcc

Function

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

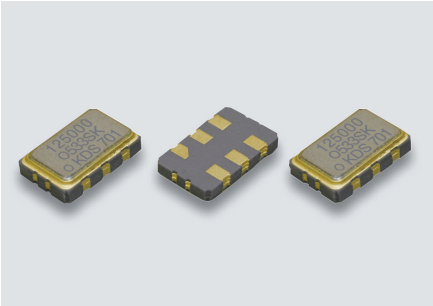
■ Recommended Land Pattern

<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

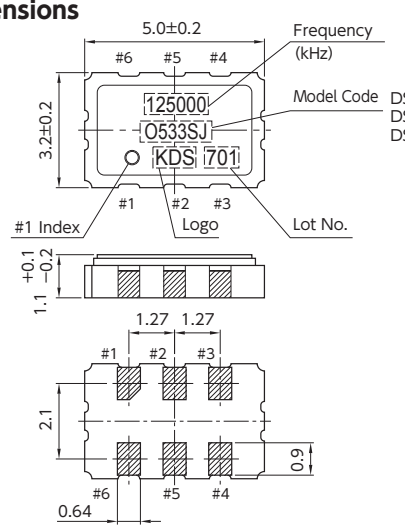
Item \ Type	Legend	DSO533SK	DSO533SJ
Output Specification	–	LV-PECL	LVDS
Output Frequency Range	f_0	13.5 to 212.5MHz	
Supply Voltage	V_{CC}	+2.5V±0.125V/+3.3V±0.165V	
Frequency Tolerance (Includes frequency tolerance at room temperature.)	f_tol	$\pm 50 \times 10^{-6}$ max., $\pm 100 \times 10^{-6}$ max.	
Storage Temperature Range	T_stg	−40 to +85℃	
Operating Temperature Range	T_use	−10 to +70℃ , −40 to +85℃	
Current Consumption	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}	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	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



Pin Connections

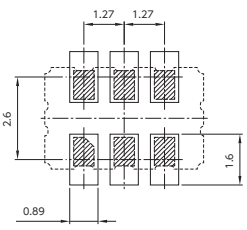
Pin No.	Connection
#1	OE(Output Enable)
#2	NC
#3	GND
#4	Output
#5	OutputN
#6	V_{CC}

Function

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

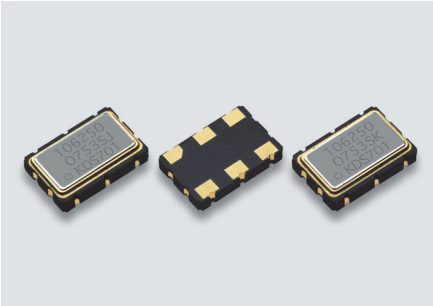
■ Recommended Land Pattern

<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

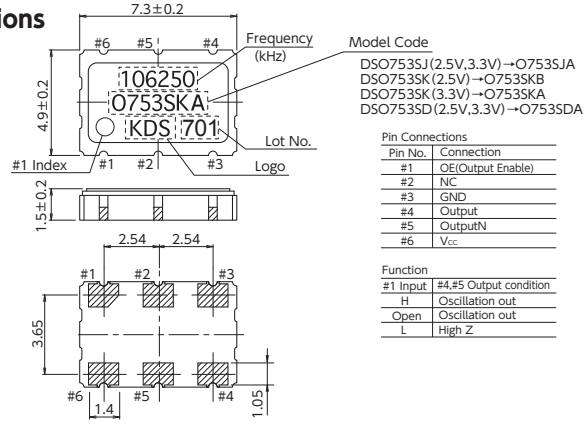
Item \ Type	Legend	DSO753SK	DSO753SJ	DSO753SD
Output Specification	–	LV-PECL	LVDS	HCSL
Output Frequency Range	f_0	13.5 to 212.5MHz		
Supply Voltage	V_{CC}	+2.5V±0.125V/+3.3V±0.165V		
Frequency Tolerance (Includes frequency tolerance at room temperature.)	f_tol	±50×10^{-6} max., ±100×10^{-6} max.		
Storage 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

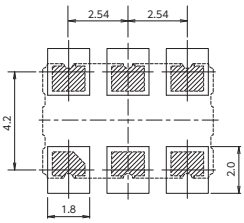
Pin No.	Connection
#1	OE(Output Enable)
#2	NC
#3	GND
#4	Output
#5	OutputN
#6	V_{CC}

Function

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

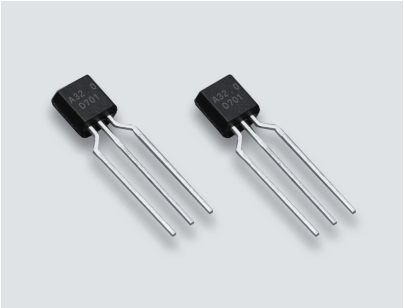
■ Recommended Land Pattern

<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

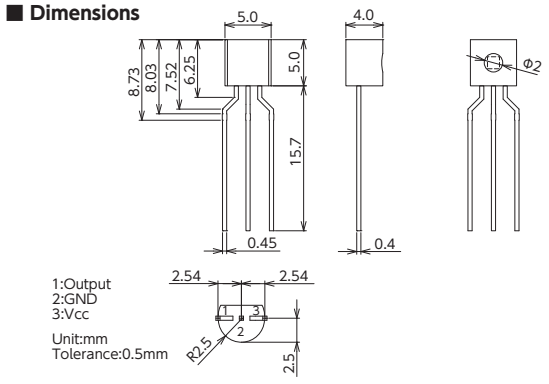
Item	Legend	Spec. min.	Spec. typ.	Spec. max.	Unit	Condition
Output Frequency Range	f0	1.5	–	54	MHz	L_CMOS : 30pF
Frequency Tolerance	f_tol	−100	–	+100	×10^{-6}	T_opr=−10 to +85℃ Vcc=+3.0 to +5.5V
		−50		+50		
Aging	–	–	–	±5	×10^{-6}/year	
Current Consumption	Icc	–	–	8	mA	No load
Symmetry	SYM	45	–	55	%	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)

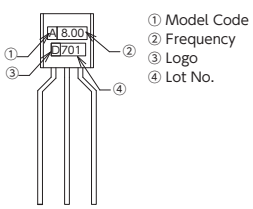
Consult our sales representative for other specifications.

■ Dimensions [mm]

■ Dimensions

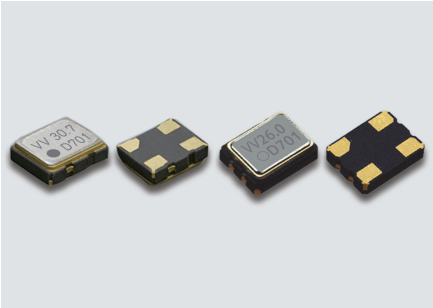


■ Marking



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

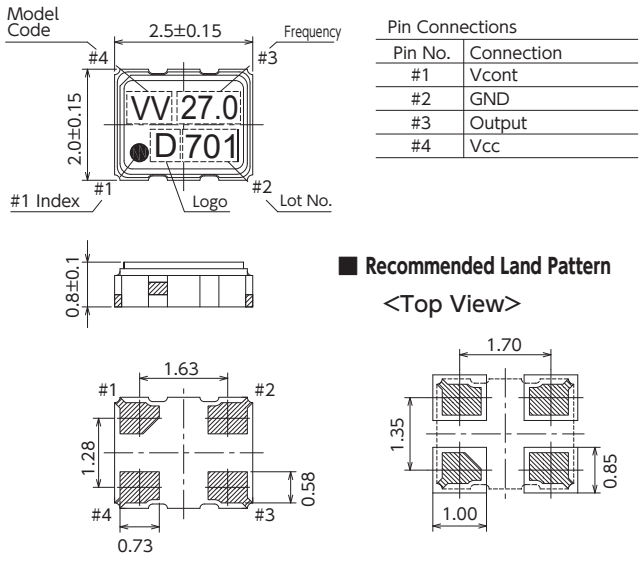
Item \ Type	Legend	DSV221SV	DSV321SV
Output Frequency Range	f_0	30.72MHz	6.75 to 125MHz
Supply Voltage	V_{CC}	+3.3V±0.33V	
Frequency Control Voltage	Vcont	+1.65V±1.65V	
Storage Temperature Range	T_stg	−40 to +85℃	
Operating Temperature Range	T_use	-30 to +85℃	−10 to +70℃ /−30 to +85℃
Frequency Tolerance (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

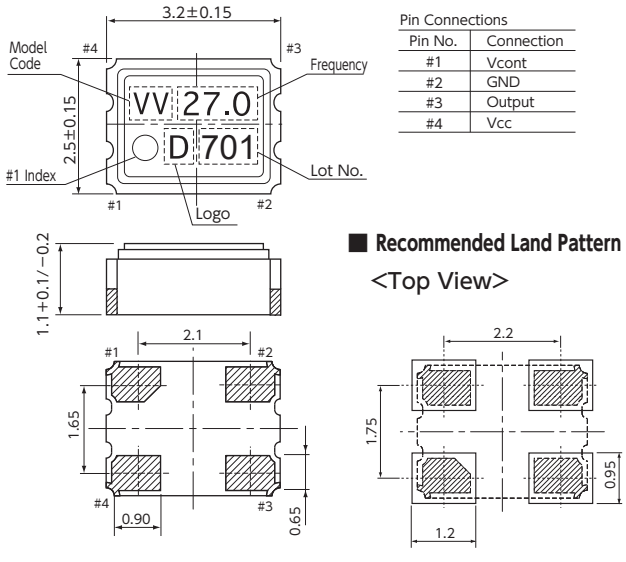
Pin No.	Connection
#1	Vcont
#2	GND
#3	Output
#4	Vcc

■ Recommended Land Pattern

<Top View>

■ DSV321SV [mm]

■ Dimensions



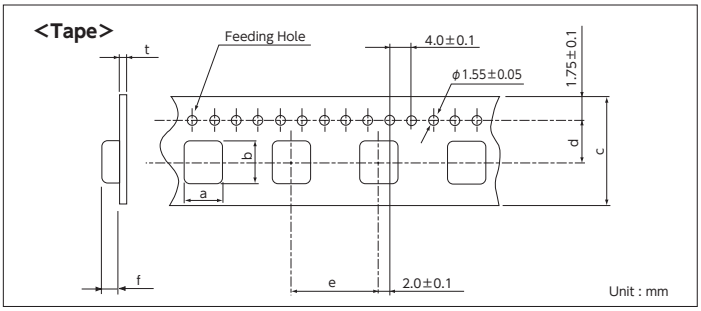
Pin Connections

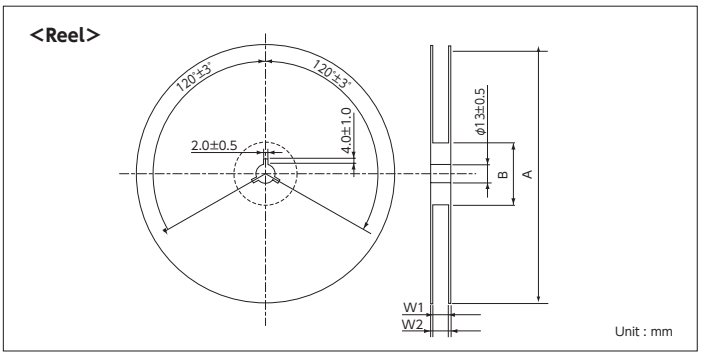
Pin No.	Connection
#1	Vcont
#2	GND
#3	Output
#4	Vcc

■ Recommended Land Pattern

<Top View>

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.
DSA/DSB321SDN DSK321STD	2.8 ±0.1	3.5 ±0.1	8.0 ±0.2	3.50 ±0.05	4.0 ±0.1	1.5 ±0.1	0.25 ±0.05	φ180 +0/−3	φ60 +1/−0	9.0 ±0.3	11.4 ±1.0
DSA/DSB221SDN 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
DA/DB2016AS 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 DSB1612SEB	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

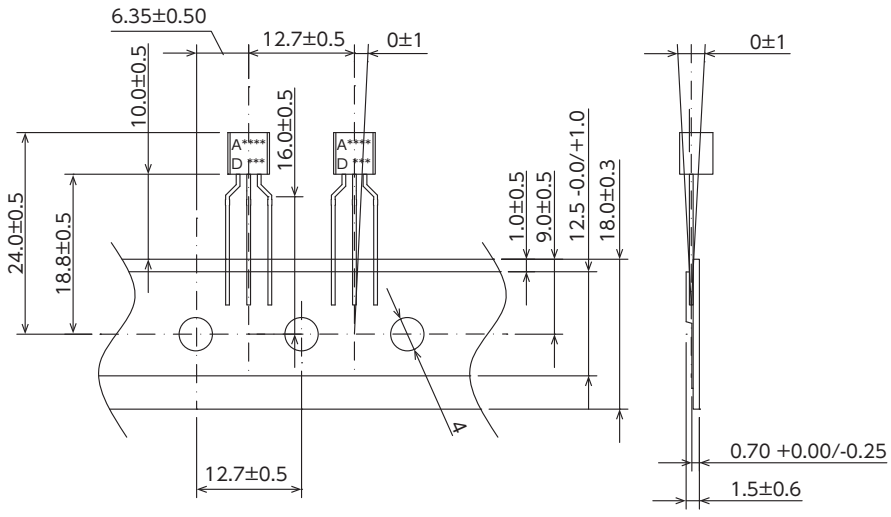
SPXO/VCXO/RTC

TYPE	a	b	c	d	e	f	t	A	B	W1	W2
DSO751SR/SBM 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/SBM 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
DD3225TR/TS DS3225AD/AJ/AK DSO321SH/SR/SY/SBM/SHH/SRS DSO323SD/SJ/SK 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
DS2520AD/AJ/AK/AS DSO221SH/SR/SX/SY/SBM/SHH/SXF DSO223SD/SJ/SK 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
DS2016AD/AJ/AK/AS 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
DS1008JC/JJ/JK/JN/JS	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

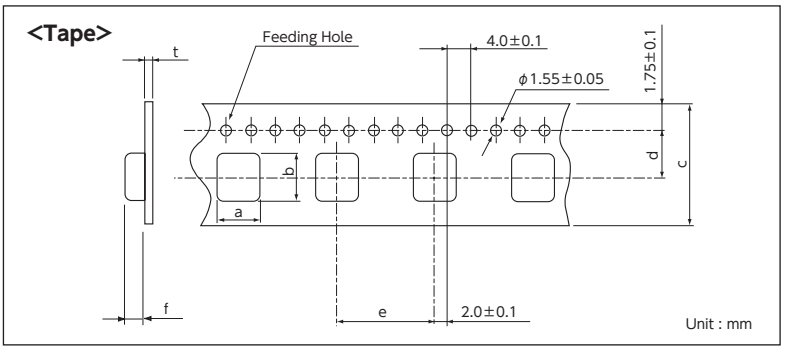
※ 1: To indicate product name and other information, place those information on a label, and affix the label on one side of the flange.
2: DSA/DSB535SGA, DSA535SGB: reel φ180 available.

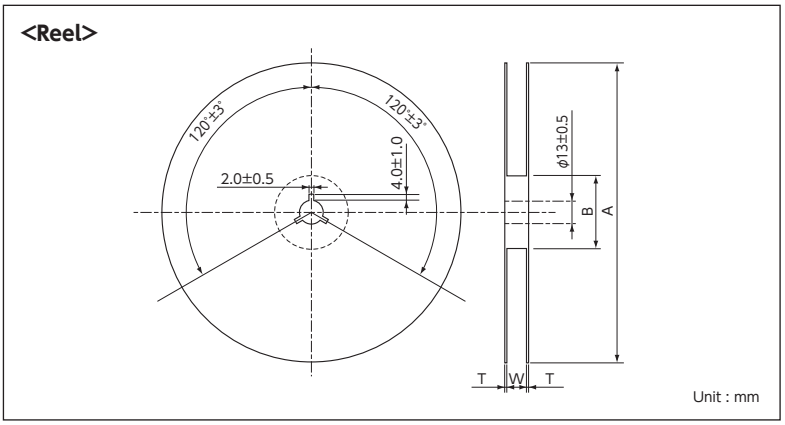
Radial Tape (Crystal Oscillators)

DLO555MBA



Emboss Carrier Tape (SMD Monolithic Crystal Filters)





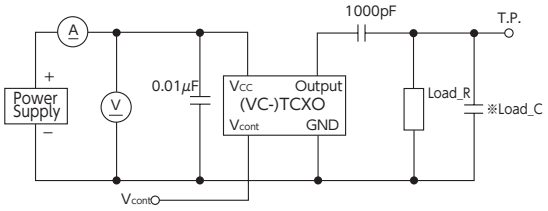
■ Standard Specification

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.

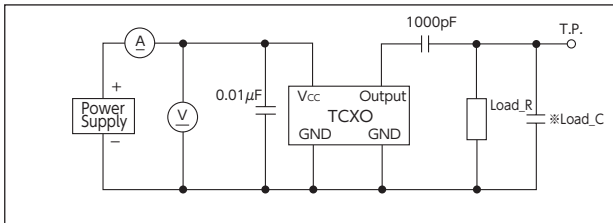
Measurement Circuit (Crystal Oscillators)

VC-TCXO (DA2016AS, DSA***SDN, SP)



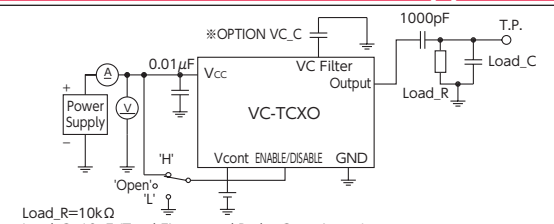
Load_R=10kΩ
※Load_C=10pF (Total Fixture and Probe Capacitance)

TCXO (DB2016AS, DSB***SDN, SP)



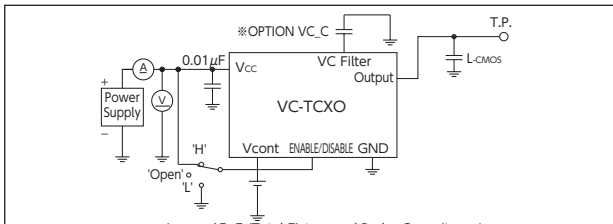
Load_R=10kΩ
※Load_C=10pF (Total Fixture and Probe Capacitance)

DSA535SGA, DSA535SGB (Clipped Sine)



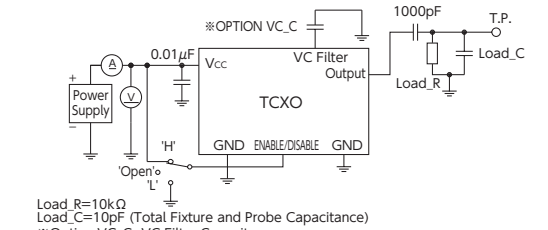
Load_R=10kΩ
Load_C=10pF (Total Fixture and Probe Capacitance)
※Option VC_C=VC Filter Capacitance

DSA535SGA, DSA535SGB (CMOS)



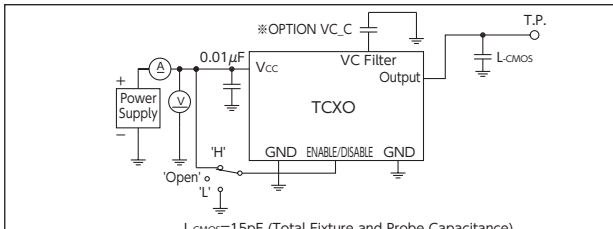
L-CMOS=15pF (Total Fixture and Probe Capacitance)
※Option VC_C=VC Filter Capacitance

DSB535SGA (Clipped Sine)



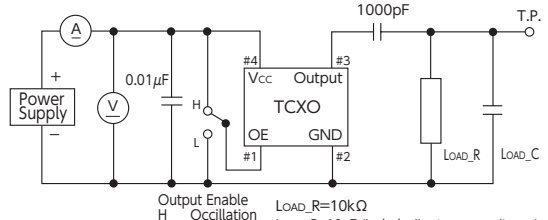
Load_R=10kΩ
Load_C=10pF (Total Fixture and Probe Capacitance)
※Option VC_C=VC Filter Capacitance

DSB535SGA (CMOS)



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

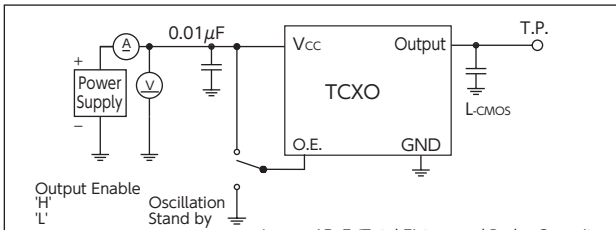
DSB1612SEB



Output Enable
H Oscillation
L Stand by

LOAD_R=10kΩ
LOAD_C=10pF (Include Jig stray capacitance)

DSB211SJA, 221SJA

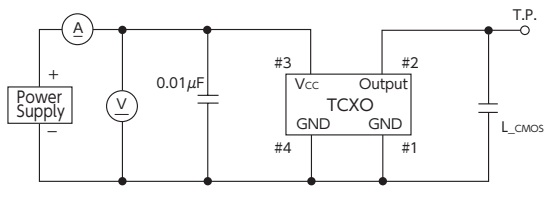


Output Enable
'H'
'L'

Oscillation
Stand by

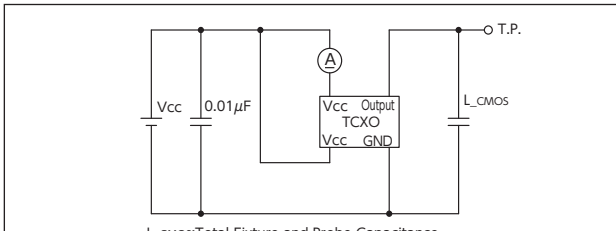
L-CMOS=15pF (Total Fixture and Probe Capacitance)

DSK1612ATD



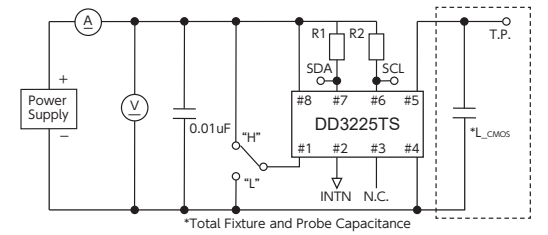
LOAD_C : Include jig stray capacitance

DSK321STD



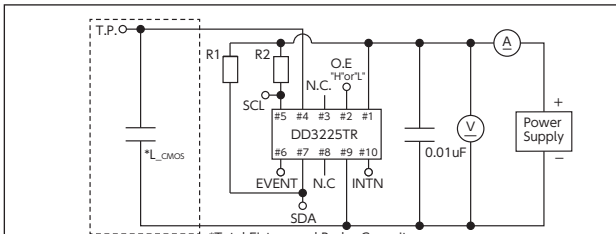
L_CMOS:Total Fixture and Probe Capacitance

DD3225TS



*Total Fixture and Probe Capacitance

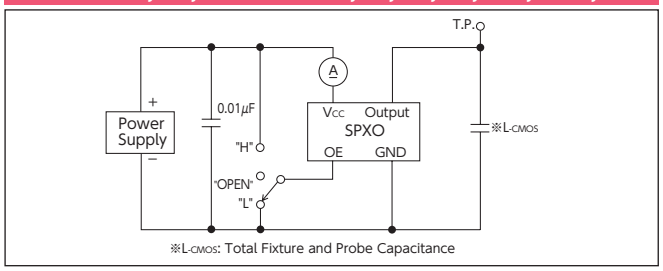
DD3225TR



*Total Fixture and Probe Capacitance

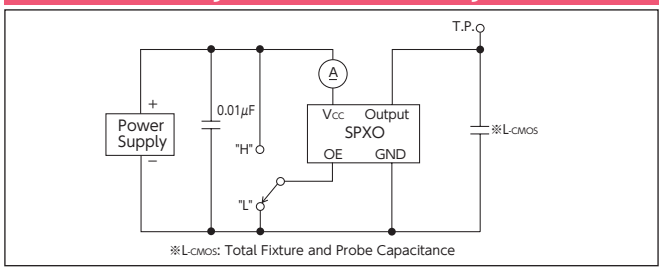
Measurement Circuit (Crystal Oscillators)

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



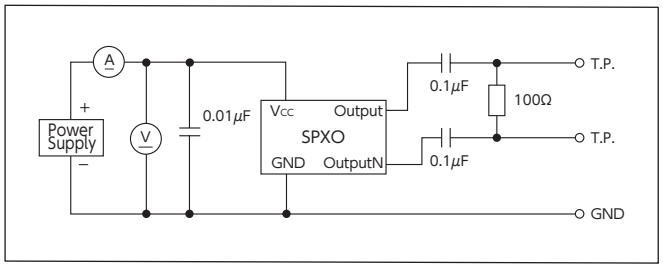
※L-CMOS: Total Fixture and Probe Capacitance

DS***AS, DSO***SX, SXF

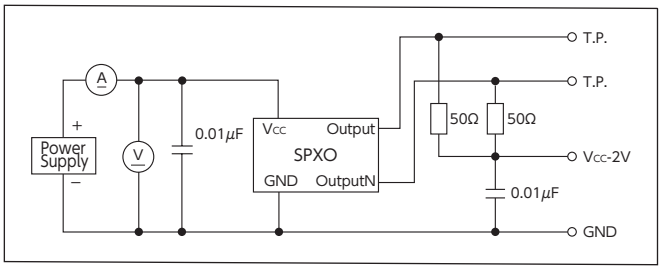


※L-CMOS: Total Fixture and Probe Capacitance

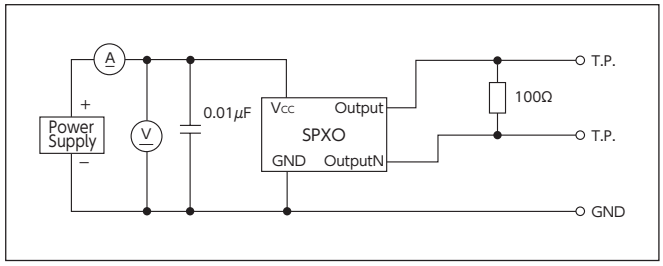
DS1008JC



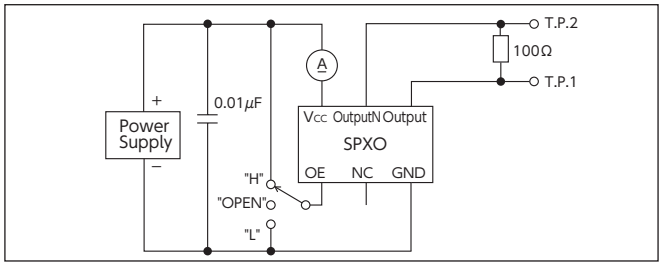
DS1008JK



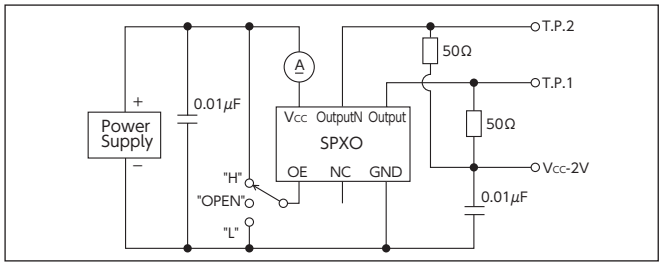
DS1008JJ



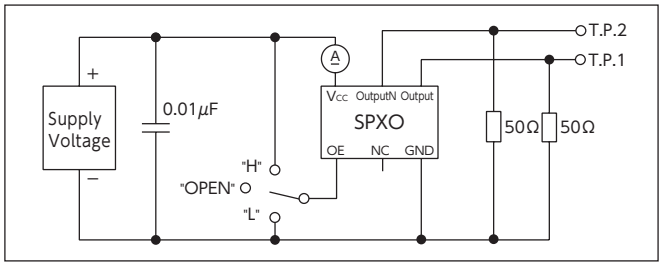
DS****AJ, DSO***SJ



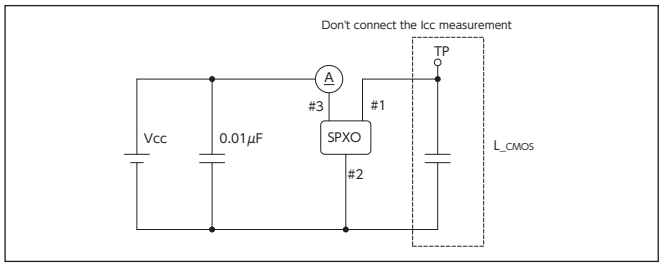
DS****AK, DSO***SK



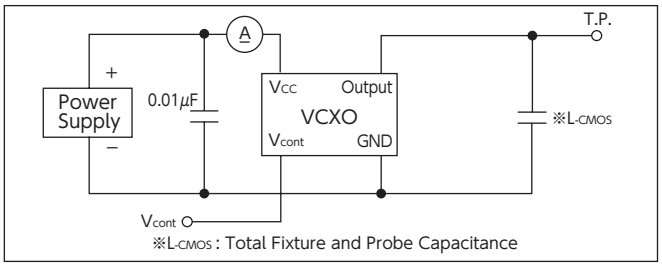
DS****AD, DSO***SD



DLO555MBA



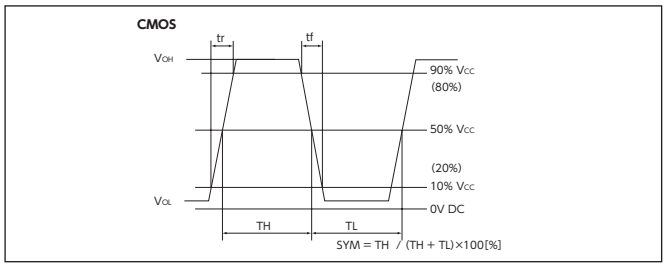
DSV221SV, 321SV

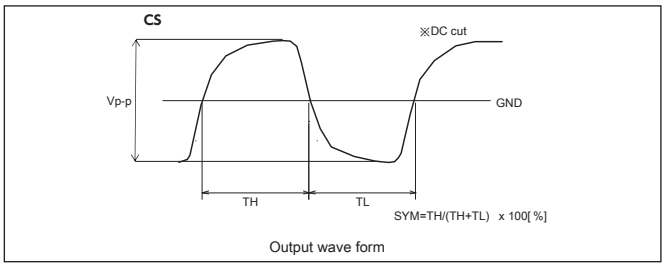


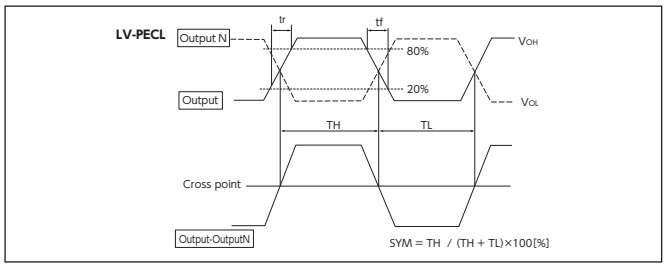
※L-CMOS : Total Fixture and Probe Capacitance

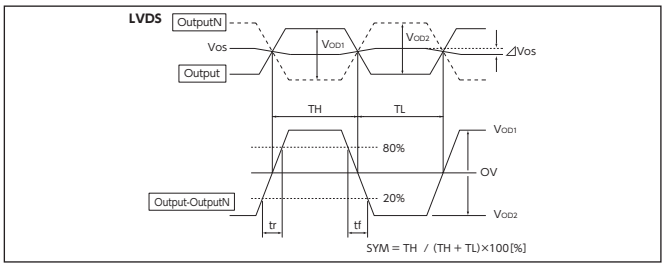
Measurement Circuit

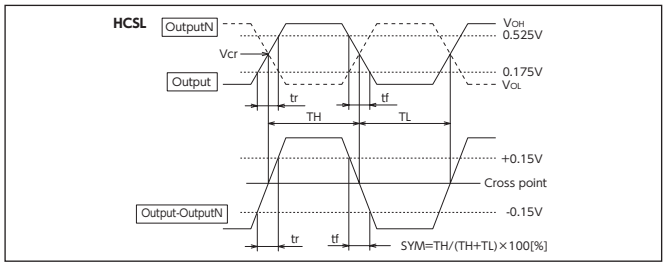
■ Output Wave Form











■ Input and Output Conditions