

Handling Instructions

■ Soldering

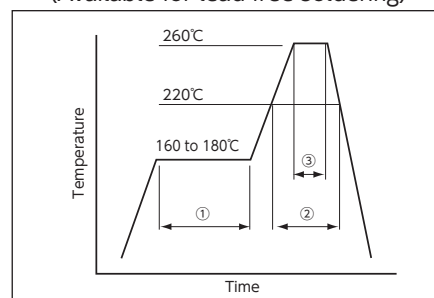
Our products are designed so they may withstand the same standard reflow soldering temperatures as most other electronics components. However, if the reflow temperature is higher than our specification allows, the performance may be affected. Avoid soldering the product at temperatures higher than specified.

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

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

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

Reflow Temperature Profile
(Available for lead free soldering)



■ Cleaning

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

■ Shock

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

■ Mounting

〈SMD crystal products〉

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

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

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

〈Lead type〉

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

■ Storage

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

■ Others

〈Crystal Resonators〉

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

〈Crystal Oscillators〉

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

〈Monolithic Crystal Filters〉

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

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. ^(*)
Tuning Fork Crystal Resonators/ kHz Band Crystal Resonators	DSX530GA	○	○	Pb in sealing-glass	Ni/Au	Pb in sealing-glass is exempted from RoHS/ELV Directive. ^(*)
	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.

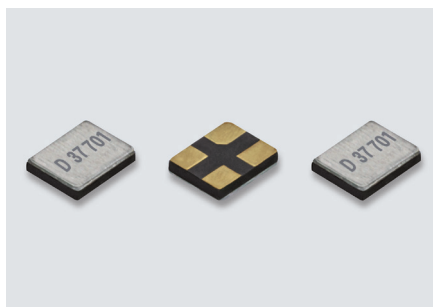
Quartz Devices

For Automotive



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

DSX1210A



Actual size □

■ Features

- 1210 size ultra miniature and lightweight SMD crystal resonator with a low profile of 0.28mm
- High precision and high reliability
(Frequency aging specification of $\pm 1 \times 10^{-6}$ /1 year or $\pm 3 \times 10^{-6}$ /5 years is available for cell phone or wireless communication systems etc.)
- Allowing for high density surface mounting.
- AEC-Q200 Compliant

■ Applications

- Automotive wireless applications such as Bluetooth, wireless LAN, etc.



■ Standard Specification

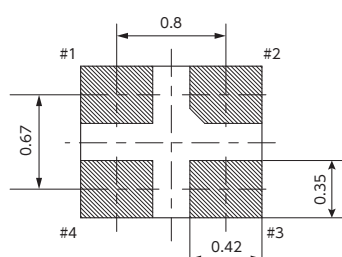
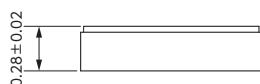
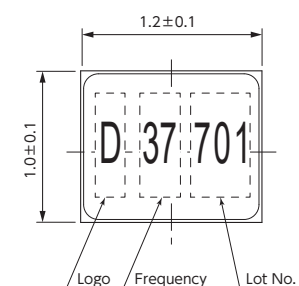
Item \ Type	DSX1210A			
Frequency Range	32MHz	37.4MHz / 38.4MHz / 40MHz	48MHz/52MHz	76.8MHz/80MHz
Overtone Order	Fundamental			
Load Capacitance	8pF, 10pF, 12pF			
Drive Level	10μW (100μW max.)			
Frequency Tolerance	$\pm 10 \times 10^{-6}$, $\pm 20 \times 10^{-6}$ (at 25°C)			
Series Resistance	100Ω max.	60Ω max.	40Ω max.	30Ω max.
Frequency Characteristics over Temperature	$\pm 30 \times 10^{-6}$ / -40 to +105°C (Ref. To 25°C)			
Storage Temperature Range	-40 to +125°C			
Reliability	AEC-Q200			
Packing Unit (1)	3000pcs./reel(φ180)			

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

Consult our sales representative for other specifications.

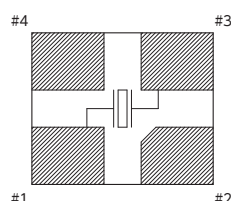
[mm]

■ Dimensions



■ Internal Connections

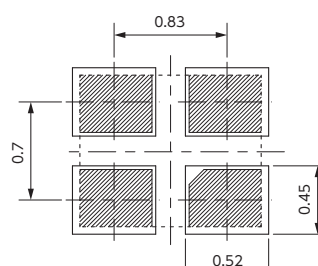
〈Top View〉



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

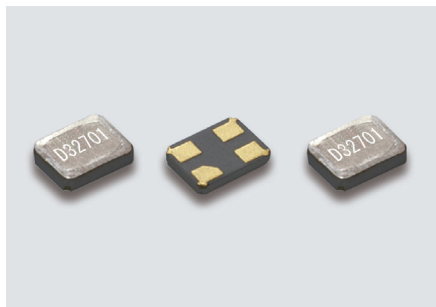
■ Recommended Land Pattern

〈Top View〉



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

DSX1612S



Actual size □

■ Features

- 1612 size ultra miniature and lightweight SMD crystal resonator with a low profile of 0.35 mm.
- High precision and high reliability
(Frequency aging specification of $\pm 1 \times 10^{-6}$ /1 year or $\pm 3 \times 10^{-6}$ /5 years is available for cell phone or wireless communication systems etc.)
- Allowing for high density surface mounting.
- AEC-Q200 Compliant

■ Applications

- Bluetooth, wireless LAN, GPS/GNSS and other automotive wireless, multimedia devices, etc.



■ Standard Specification

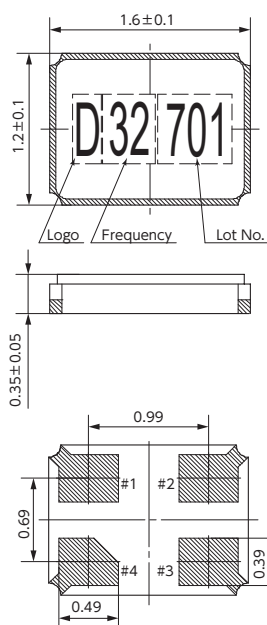
Item \ Type	DSX1612S		
Frequency Range	24 to 32MHz	32 to 40MHz	40 to 54MHz
Overtone Order	Fundamental		
Load Capacitance	8pF, 10pF, 12pF		
Drive Level	10μW (100μW max.)		
Frequency Tolerance	±10×10 ⁻⁶ , ±20×10 ⁻⁶ (at 25℃)		
Series Resistance	100Ω max.	50Ω max.	
Frequency Characteristics over Temperature	±30×10 ⁻⁶ / −40 to +125℃ (Ref. To 25℃)		
Storage Temperature Range	−40 to +125℃		
Reliability	AEC-Q200		
Packing Unit (1)	3000pcs./reel(φ180)		

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

Consult our sales representative for other specifications.

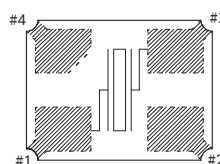
[mm]

■ Dimensions



■ Internal Connections

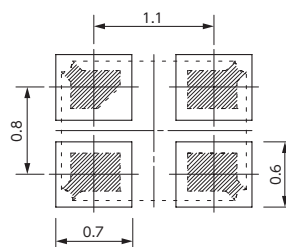
〈Top View〉



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

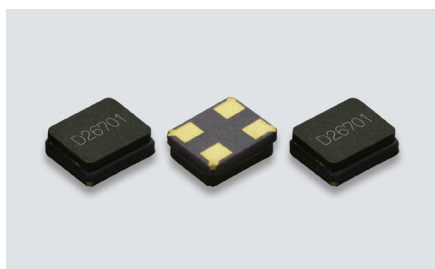
■ Recommended Land Pattern

〈Top View〉

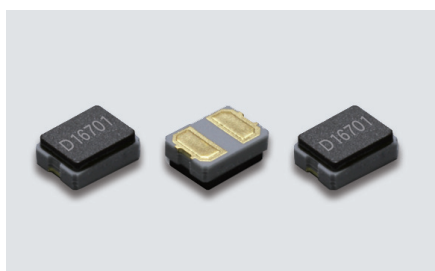


SMD Crystal Resonators / MHz Band Crystal Resonators (For Automotive)

DSX211G/DSX210GE



DSX211G



DSX210GE

Actual size ☐

Features

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

Applications

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



RoHS/ELV Compliant

Standard Specification

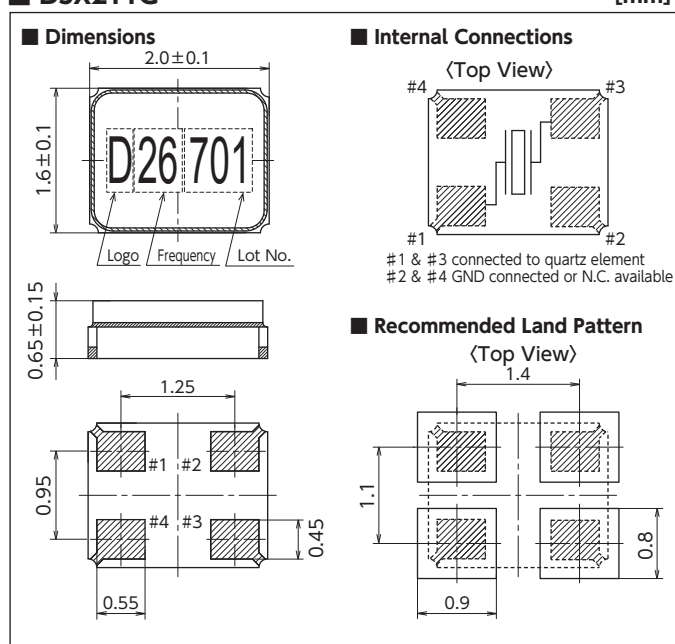
Item	Type	DSX210GE				
		DSX211G				
Frequency Range		16 to 20MHz	20 to 24MHz	24 to 30MHz	30 to 36MHz	36 to 64MHz
Overtone Order		Fundamental				
Load Capacitance		8pF, 10pF, 12pF				
Drive Level		10μW (100μW max.)				
Frequency Tolerance		±30×10 ⁻⁶ (at 25°C)				
Series Resistance		400Ω max.	200Ω max.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

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

Consult our sales representative for other specifications.

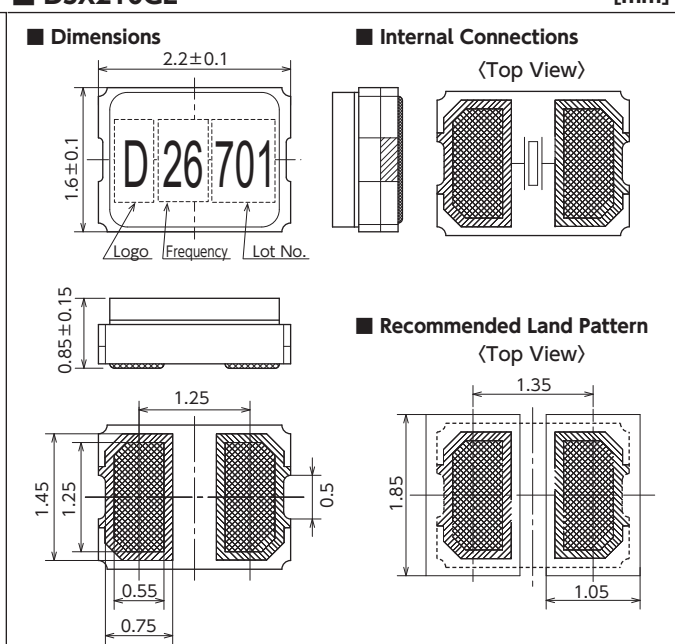
DSX211G

[mm]



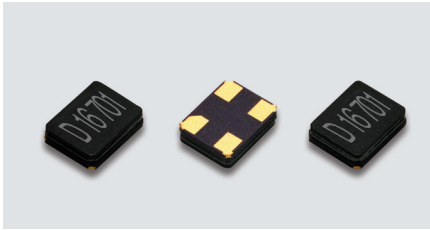
DSX210GE

[mm]



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

DSX321G/DSX321GK/DSX320GE



DSX321G/DSX321GK



DSX320GE

Actual size

■ Features

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

■ Applications

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

■ Standard Specification

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

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

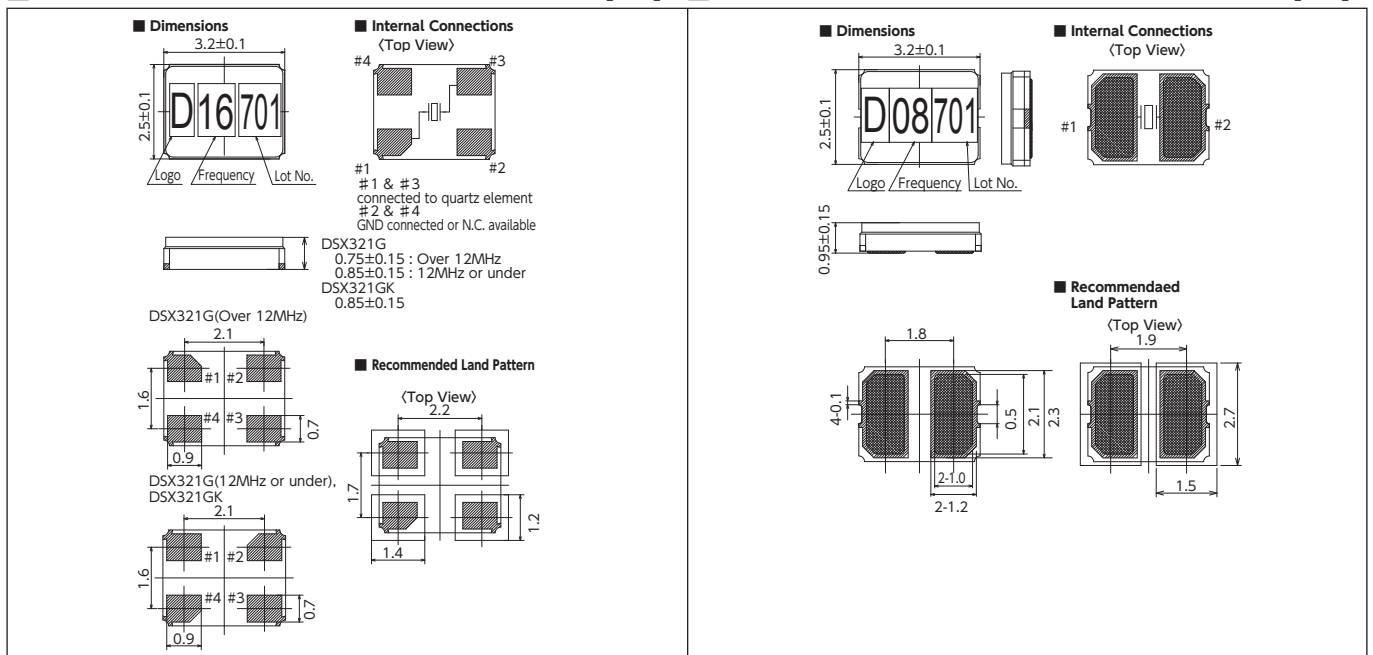
Consult our sales representative for other specifications.

■ DSX321G/DSX321GK

[mm]

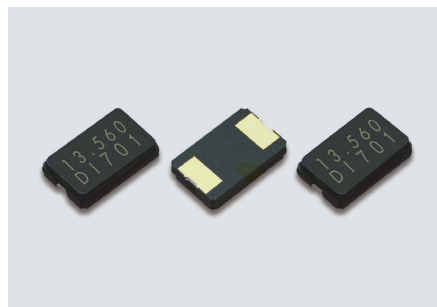
■ DSX320GE

[mm]



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

DSX530GA



Actual size

■ Features

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

■ Applications

- Multimedia devices such as car navigation systems and car audio



■ Standard Specification

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

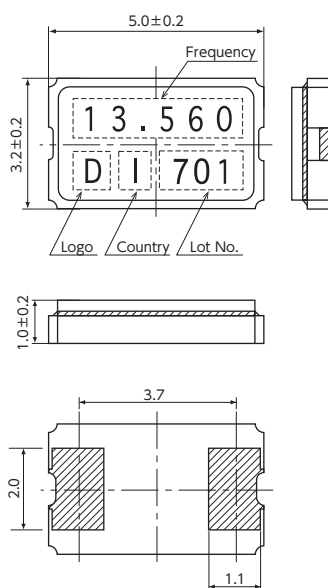
(1) Moisture prevention packing is unnecessary.
Moisture Sensitivity Level: LEVEL1 (IPC/JEDEC J-STD-033)

Consult our sales representative for other specifications.

■ DSX530GK/DSX530GA

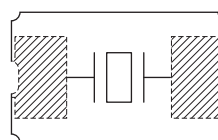
[mm]

■ Dimensions



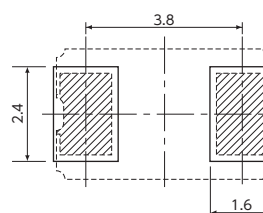
■ Internal Connections

〈Top View〉



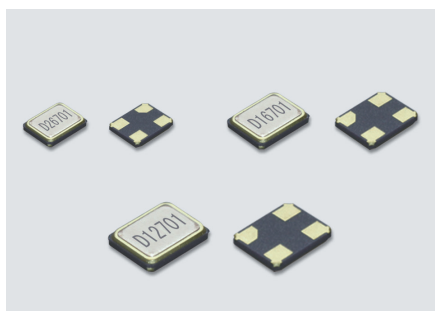
■ Recommended Land Pattern

〈Top View〉



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

DSX211SH/DSX221SH/DSX321SH



Actual size DSX211SH □ DSX221SH □
DSX321SH □

Features

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



Applications

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

Standard Specification

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

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

Consult our sales representative for other specifications.

DSX211SH

[mm]

DSX221SH

[mm]

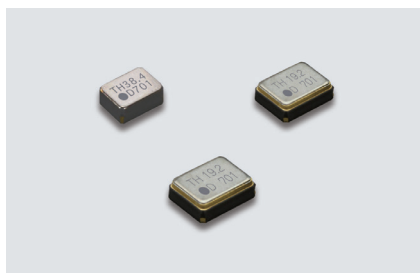
DSX321SH

[mm]

■ Dimensions ■ Internal Connections (Top View) #1 & #3 connected to quartz element #2 & #4 connected to the cover #2 & #4 recommended GND connection ■ Recommended Land Pattern (Top View)	■ Dimensions ■ Internal Connections (Top View) #1 & #3 connected to quartz element #2 & #4 connected to the cover #2 & #4 recommended GND connection ■ Recommended Land Pattern (Top View)	■ Dimensions ■ Internal Connections (Top View) #1 & #3 connected to quartz element #2 & #4 connected to the cover #2 & #4 recommended GND connection ■ Recommended Land Pattern (Top View)
--	--	--

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

DSR1612ATH/DSR211STH/DSR221STH



Actual size DSR1612ATH □ DSR211STH □
DSR221STH □

■ Features

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

■ Applications

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



■ Standard Specification

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

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

Consult our sales representative for other specifications.

■ DSR1612ATH

[mm]

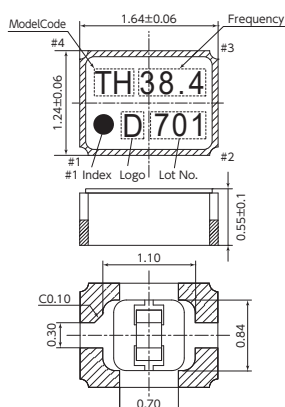
■ DSR211STH

[mm]

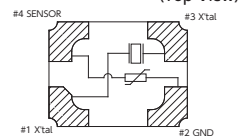
■ DSR221STH

[mm]

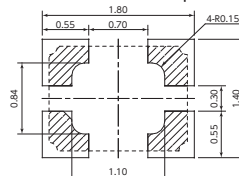
■ Dimensions



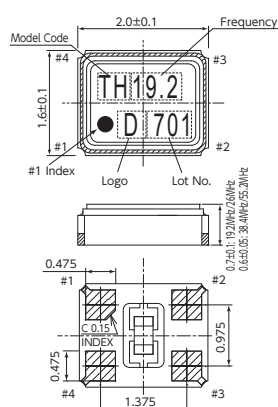
■ Internal Connections



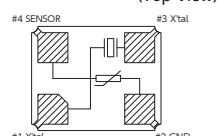
■ Recommended Land Pattern



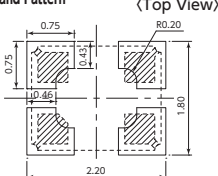
■ Dimensions



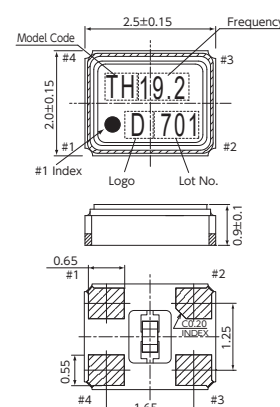
■ Internal Connections



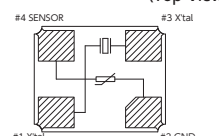
■ Recommended Land Pattern



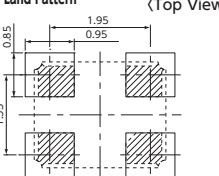
■ Dimensions



■ Internal Connections

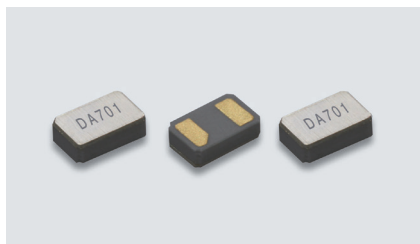


■ Recommended Land Pattern



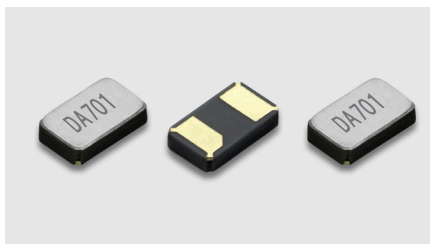
SMD Tuning Fork Crystal Resonators / kHz Band Crystal Resonators (For Automotive)

DST1610A/DST210AC/DST310SA



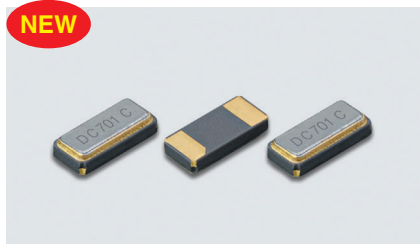
DST1610A

Actual size □



DST210AC

Actual size □



DST310SA

Actual size □

■ Features

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

■ Applications

- Automotive multimedia devices



■ Standard Specification

Item	Type	DST1610A	DST210AC	DST310SA
Frequency Range		32.768kHz		
Load Capacitance		7pF, 9pF, 12.5pF		
Drive Level		0.1μW (0.5μW max.)		
Frequency Tolerance		±20×10 ⁻⁶ (at 25°C)		
Series Resistance		50kΩ max. (-40 to +85°C) 80kΩ max. (-40 to +125°C)	80kΩ max. (-40 to +85°C) 120kΩ max. (-40 to +125°C)	50kΩ max. (-40 to +85°C) 80kΩ max. (-40 to +125°C)
Turnover Temperature		+25°C±5°C		
Parabolic Coefficient		-0.04×10 ⁻⁶ / °C ² max.		
Operating Temperature Range		-40 to +85°C / -40 to +125°C		
Storage Temperature Range		-40 to +125°C		
Shunt Capacitance		1.6pF typ.	1.3pF typ.	1.7pF typ.
Reliability		AEC-Q200		
Packing Unit (1)		3000pcs./reel (φ180)		

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

Consult our sales representative for other specifications.

■ DST1610A

[mm]

■ DST210AC

[mm]

■ DST310SA

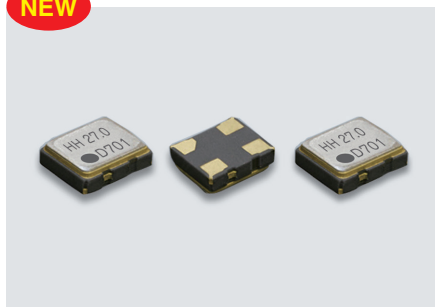
[mm]

■ Dimensions 	■ Internal Connections (Top View) 	■ Dimensions 	■ Internal Connections (Top View) 	■ Dimensions 	■ Internal Connections (Top View)
■ Recommended Land Pattern (Top View) 		■ Recommended Land Pattern (Top View) 		■ Recommended Land Pattern (Top View) 	

SMD Crystal Oscillators (For Automotive)

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
- 3-state function
- CMOS Level Output
- AEC-Q200 Compliant
(Option: Equivalent to AEC-Q100)

Applications

- Automotive multimedia device

[Function Code]

DSO221SHH

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

A : $\pm 100 \times 10^{-6}$
B : $\pm 50 \times 10^{-6}$
C : $\pm 30 \times 10^{-6}$



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

Standard Specification

Reliability	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 +125℃
		B			-50	—	+50		-40 to +85℃
		C			-30	—	+30		-20 to +70℃
Current Consumption	A	*	2.0≤f0≤54	Icc	—	—	4.2	mA	No Load
	B				—	—	4.2		
	C				—	—	2.3		
	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 10≤f0<40	tpj	—	—	1	ps	f0 offset:12kHz to 20MHz f0 offset:12kHz to 5MHz
Reliability	AEC-Q100/AEC-Q200								
Packing Unit(3)	3000pcs./reel(φ180)								

(1) Measured WAVECREST DTS-2075

(2) tDJ:Deterministic jitter tRJ:Random jitter

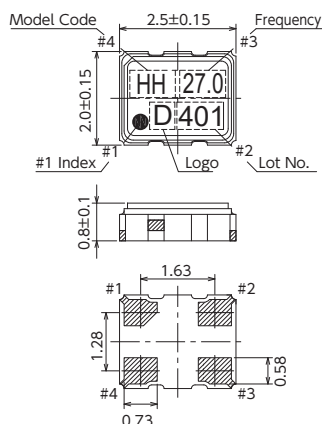
(3) Moisture prevention packing is unnecessary.

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

Consult our sales representative for other specifications.

[mm]

Dimensions



Pin Connections

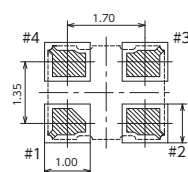
Pin No.	Connection
#1	OE(Output Enable)
#2	GND
#3	Output
#4	V _{cc}

Function

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

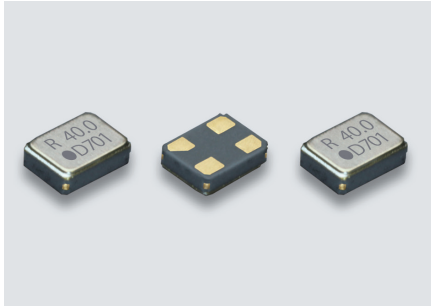
Recommended Land Pattern

<Top View>



SMD Crystal Oscillators (For Automotive)

DSO1612AR



Actual size □

Features

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

Applications

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

[Function Code]

DSO1612AR

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



Standard Specification

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

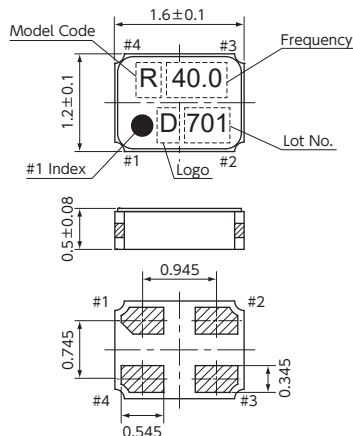
Item	Function Code		Legend	Output Frequency Range (MHz)	Spec.				Condition
	Supply Voltage	Frequency tolerance			min.	typ.	max.	Unit	
Supply Voltage	A	*	Vcc	0.584375≤f ₀ ≤80	+3.0	+3.3	+3.6	V	
	M				+2.7	+3.0	+3.3		
	B				+2.6	+2.8	+3.0		
	C				+2.25	+2.5	+2.75		
	D				+1.6	+1.8	+2.0		
Frequency Tolerance (Includes frequency tolerance at room temperature.)	*	Y	f _t tol	0.584375≤f ₀ ≤80	−100	−	+100	10 ^{−6}	−40 to +125°C
		Z			−80	−	+80		−40 to +110°C
		B			−50	−	+50		−40 to +85°C
Current Consumption	A,M	*	I _{cc}	0.584375≤f ₀ <40	−	−	+3.0	mA	No Load
				40≤f ₀ <80	−	−	+4.2		
	B			0.584375≤f ₀ <40	−	−	+2.4		
				40≤f ₀ ≤80	−	−	+3.7		
	C			0.584375≤f ₀ <40	−	−	+2.0		
				40≤f ₀ ≤80	−	−	+3.4		
	D			0.584375≤f ₀ <40	−	−	+1.7		
				40≤f ₀ ≤80	−	−	+2.7		
Stand-by Current (#1 pin "L" level)	*	*	I _{std}	*	−	−	+20	μA	
Load Condition	*	*	L _{CMOS}	*	−	−	15	pF	
Symmetry	*	*	SYM	*	40	50	60	%	at 50% Vcc
0 Level Output Voltage	*	*	V _{OL}	*	−	−	Vcc×0.1	V	
1 Level Output Voltage	*	*	V _{OH}	*	Vcc×0.9	−	−		
Rise and Fall Time	A,M,B,C	*	tr, tf	*	−	−	3.0	ns	10 to 90% Vcc Level
	D				−	−	5		
OE Pin 0 Level Input Voltage	*	*	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 ^{−13}) (2)
Phase Jitter	*	*	tpj	40≤f ₀ ≤80	−	−	1	ps	f ₀ offset:12kHz to 20MHz
				10≤f ₀ <40					f ₀ offset:12kHz to 5MHz
Reliability	AEC-Q100/AEC-Q200								
Packing Unit (3)	3000pcs./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)

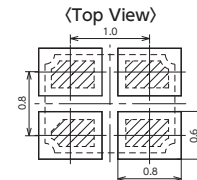
Consult our sales representative for other specifications.

[mm]

Dimensions



Recommended Land Pattern

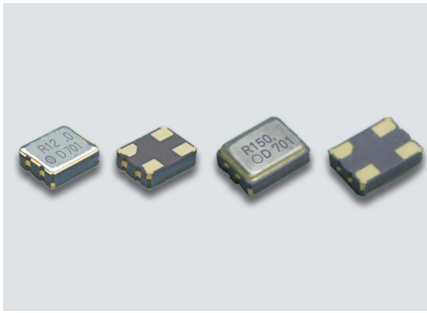


Pin Connections	
Pin No.	Connection
#1	OE(Output Enable)
#2	GND
#3	Output
#4	Vcc

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

SMD Crystal Oscillators (For Automotive)

DSO221SR/DSO321SR



Actual size DSO221SR DSO321SR

Features

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

Applications

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

[Type]

DSO221SR	2520 size
DSO321SR	3225 size

[Function Code]

DSO***SR A A

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



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

Standard Specification

Item	Function Code		Output Frequency Range (MHz)	Legend	Spec.				Condition
	Supply Voltage	Frequency tolerance			min.	typ.	max.	Unit	
Supply Voltage	A	*	$0.2\leq f_0\leq 125$	V _{CC}	+3.0	+3.3	+3.6	V	
	M		$0.2\leq f_0\leq 125$		+2.7	+3.0	+3.3		
	B		$0.2\leq f_0\leq 100$		+2.6	+2.8	+3.0		
	C		$0.2\leq f_0\leq 100$		+2.25	+2.5	+2.75		
	D		$0.2\leq f_0\leq 80$		+1.6	+1.8	+2.0		
Frequency Tolerance (Includes frequency tolerance at room temperature.)	*	Y	$0.2\leq f_0\leq 100$	f _{tol}	-100	—	+100	×10 ⁻⁶	-40 to +125℃
		Z	$0.2\leq f_0\leq 100$		-80	—	+80		-40 to +110℃
		A	$100<f_0\leq 125$		-100	—	+100		-40 to +85℃
		B	$0.2\leq f_0\leq 100$		-50	—	+50		
Current Consumption	A,M	*	$0.2\leq f_0<54$	I _{CC}	—	—	+4.0	mA	No Load
			$54\leq f_0<80$		—	—	+6.0		
			$80\leq f_0\leq 125$		—	—	+8.0		
	B	*	$0.2\leq f_0<54$		—	—	+3.5		
			$54\leq f_0<80$		—	—	+5.5		
			$80\leq f_0\leq 100$		—	—	+7.5		
	C	*	$0.2\leq f_0<54$		—	—	+3.0		
			$54\leq f_0<80$		—	—	+5.0		
			$80\leq f_0\leq 100$		—	—	+7.0		
	D	*	$0.2\leq f_0<54$		—	—	+2.5		
			$54\leq f_0\leq 80$		—	—	+4.5		
	Stand-by Current (#1 pin "L" level)	*	*		*	I _{std}	—		
Load Condition	*	*	*	L _{CMOS}	—	—	15	pF	
Symmetry	*	*	*	SYM	40	50	60	%	50% V _{CC} Level
0 Level Output Voltage	*	*	*	V _{OL}	—	—	V _{CC} ×0.1	V	
1 Level Output Voltage	*	*	*	V _{OH}	V _{CC} ×0.9	—	—	V	
Rise and Fall Time	*	*	$0.2\leq f_0\leq 54$	tr,tf	—	—	8	ns	10 to 90% V _{CC} Level
			$54<f_0<100$		—	—	4		
			$100\leq f_0\leq 125$		—	—	3		
OE Pin 0 Level Input Voltage	*	*	*	V _{IL}	—	—	V _{CC} ×0.2	V	
OE Pin 1 Level Input Voltage	*	*	*	V _{IH}	V _{CC} ×0.8	—	—	V	
Output Disable Time	*	*	*	tPLZ	—	—	150	ns	
Output Enable Time	*	*	*	tPZL	—	—	5	ms	
Period Jitter (1)	*	*	*	tRMS	—	2.2	—	ps	σ
Total Jitter (1)	*	*	*	tp-p	—	20	—	ps	Peak to peak
Phase Jitter	*	*	*	tTL	—	31	—	ps	tDJ+n×tRJ n=14.1(BER=1×10 ⁻¹³) (2)
			$40\leq f_0\leq 125$		—	—	1		f _o offset:12kHz to 20MHz f _o offset:12kHz to 5MHz
Reliability	AEC-Q100/AEC-Q200								
Packing Unit (3)	2000pcs./reel(180 ϕ)								

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

Consult our sales representative for other specifications.

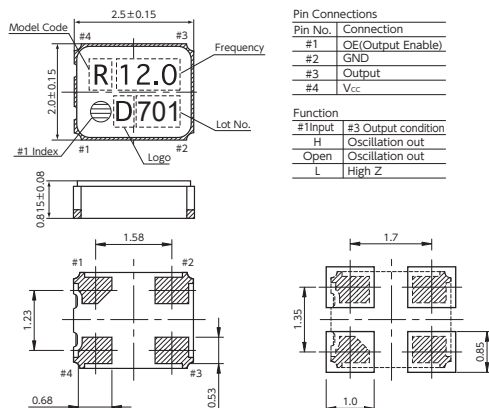
DSO221SR

[mm]

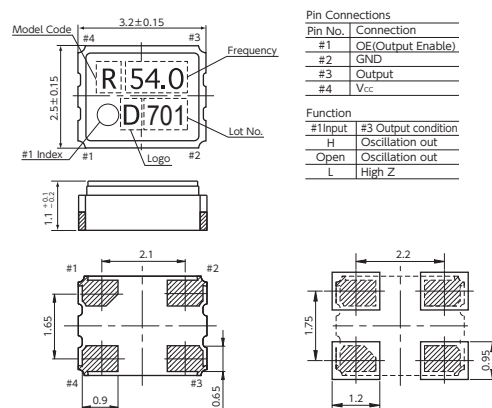
DSO321SR

[mm]

Dimensions

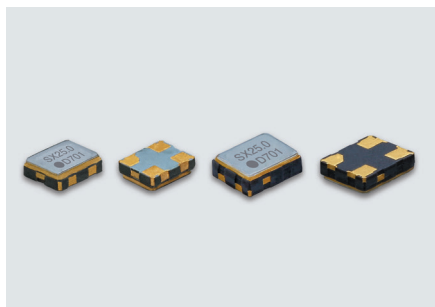


Dimensions



SMD Crystal Oscillators (For Automotive)

DSO211SX/DSO221SX



Actual size DSO211SX DSO221SX

Features

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



Applications

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

[Type]

DSO211SX	2016 size
DSO221SX	2520 size

[Function Code]

DSO***SX	A Z
A : 3.3V	A : $\pm 100 \times 10^{-6}$
B : 2.8V	Z : $\pm 80 \times 10^{-6}$
C : 2.5V	B : $\pm 50 \times 10^{-6}$
D : 1.8V	C : $\pm 30 \times 10^{-6}$

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

Standard Specification

Item	Function Code		Output Frequency Range (MHz)	Legend	Spec.				Condition	
	Supply Voltage	Frequency tolerance			min.	typ.	max.	Unit		
Supply Voltage	A	*	1 ≤f ₀ ≤ 125	V _{CC}	+3.0	+3.3	+3.6	V		
	B				+2.6	+2.8	+3.0			
	C		1 ≤f ₀ ≤ 100		+2.25	+2.5	+2.75			
	D				+1.6	+1.8	+2.0			
Frequency Tolerance (includes frequency tolerance at room temperature)	*	A	*	f _t tol	—	—	±100	×10 ⁻⁶	-40 to +125℃	
		Z			—	—	±80			
		B			—	—	±50		-40 to +85℃	
		C			—	—	±50			
Current Consumption	A	*	1 ≤f ₀ < 40	I _{CC}	—	—	2.4	mA	No Load	
			40 ≤f ₀ < 100		—	—	4.2			
			100 ≤f ₀ ≤ 125		—	—	10.0			
			1 ≤f ₀ < 40		—	—	2.2			
	B		40 ≤f ₀ < 100		—	—	3.7			
			100 ≤f ₀ ≤ 125		—	—	9.0			
			1 ≤f ₀ < 40		—	—	2.0			
			40 ≤f ₀ < 100		—	—	3.4			
	C		100 ≤f ₀ ≤ 125		—	—	8.0			
			1 ≤f ₀ < 40		—	—	1.7			
			40 ≤f ₀ < 100		—	—	2.7			
			D		40 ≤f ₀ < 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% V _{CC} Level
0 Level Output Voltage	*	*	*	V _{OL}	—	—	V _{CC} ×0.1	V	10 to 90% V _{CC} Level	
1 Level Output Voltage	*	*	*	V _{OH}	V _{CC} ×0.9	—	—			
Rise and Fall Time	A,B,C	*	*	tr, tf	—	—	3	ns		
D	—				—	5				
OE Pin 0 Level Input Voltage	*	*	*	V _{IL}	—	—	V _{CC} ×0.3	V		
OE Pin 1 Level Input Voltage	*	*	*	V _{IH}	V _{CC} ×0.7	—	—			
Output Disable Time	*	*	*	tPLZ	—	—	200	ns		
Output Enable Time	*	*	*	tPZL	—	—	2	ms		
Period Jitter (1)	*	*	*	t _{RMS}	—	2.4	—	ps	σ	
Total Jitter (1)	*	*	*	tp-p	—	23	—	ps	Peak to peak	
Phase Jitter	*	*	40≤f ₀ ≤125	tpj	—	—	1	ps	tDJ+n×tRJ n=14.1(BER=1×10 ⁻¹²) (2)	
			10≤f ₀ <40					f ₀ offset:12kHz to 20MHz		
Reliability	AEC-Q100/AEC-Q200									
Packing Unit (3)	3000pcs./reel (φ 180)									

(1) Measured WAVECREST DTS-2075

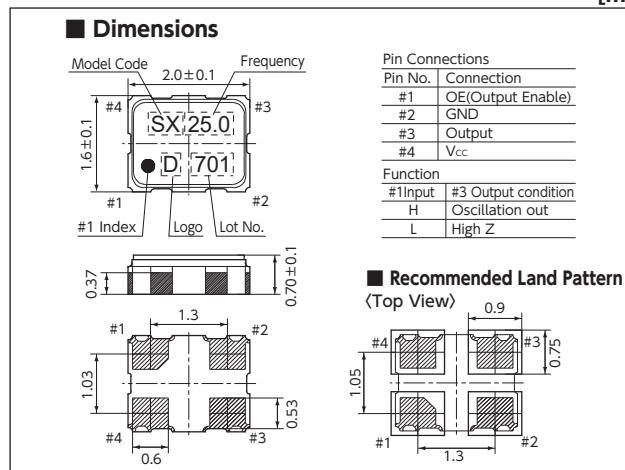
(2) t_{DJ}:Deterministic jitter t_{RJ}:Random jitter

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

Consult our sales representative for other specifications.

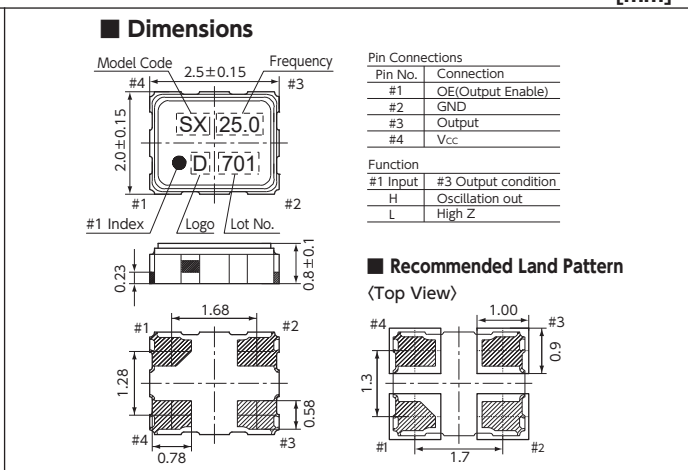
DSO211SX

[mm]



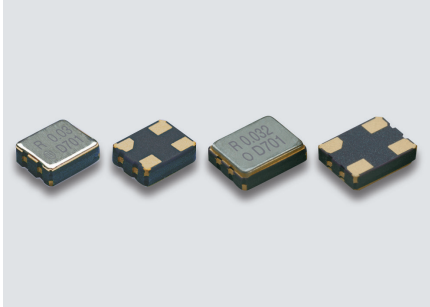
DSO221SX

[mm]



SMD Crystal Oscillators (For Automotive)

DSO221SR/DSO321SR (kHz)



Actual size DSO221SR DSO321SR

Features

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

Applications

- Multimedia devices such as car navigation systems and car audio



Pb-Free



RoHS/ELV Compliant

[Type]

DSO221SR	2520 size
DSO321SR	3225 size

[Function Code]
DSO***SR

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

Standard Specification

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

Item	Function Code		Output Frequency Range (KHz)	Legend	Spec.				Condition
	Supply Voltage	Frequency tolerance			min.	typ.	max.	Unit	
Supply Voltage	A	*	32.768≤f0≤50	Vcc	+3.0	+3.3	+3.6	V	
	M				+2.7	+3.0	+3.3		
	B				+2.6	+2.8	+3.0		
	C				+2.25	+2.5	+2.75		
	D				+1.6	+1.8	+2.0		
	Y				+4.5	+5.0	+5.5		
Frequency Tolerance (includes frequency tolerance at room temperature)	*	Y	32.768≤f0≤50	f_tol	−100	−	+100	×10 ⁶	−40 to +125℃
	*	Z			−80	−	+80		−40 to +110℃
	*	W			−50	−	+50		−40 to +105℃
	*	B			−50	−	+50		−40 to +85℃
Current Consumption	A,M,B, C,D	*	f0=32.768	Icc	−	−	65	μA	No Load
	32.768<f0≤50		−		−	100			
	f0=32.768		−		−	80			
	32.768<f0≤50		−		−	120			
Stand-by Current (#1 pin "L" Level)	*	*	32.768≤f0≤50	I_std	−	−	3	μA	−40 to +125℃
Load Condition	*	*	32.768≤f0≤50	L_CMOS	−	−	15	pF	
Symmetry	*	*	32.768≤f0≤50	SYM	45	50	55	%	at 50% Vcc
0 Level Output Voltage	*	*	*	VOL	−	−	Vcc×0.1	V	
1 Level Output Voltage				VOH	Vcc×0.9	−	−		
Rise and Fall Time	*	*	32.768≤f0≤50	tr, tf	−	−	20	ns	10 to 90% Vcc Level
OE Pin 0 Level Input Voltage	*	*	*	VIL	−	−	Vcc×0.2	V	
OE Pin 1 Level Input Voltage	*	*	*	VIH	Vcc×0.8	−	−		
Output Disable Time	*	*	*	tPLZ	−	−	150	ns	
Output Enable Time	*	*	*	tPZL	−	−	2	ms	
Period Jitter (1)	*	*	*	tRMS	−	15	−	ps	σ
			*	tp-p	−	150	−		Peak to peak
Total Jitter (1)	*	*	*	tTL	−	220	−	ps	tDJ+n×tRJ n=14.1 (BER=1×10 ^{−13}) (2)
Reliability	AEC-Q100/AEC-Q200								
Packing Unit (3)	2000pcs./reel (φ180)								

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

Consult our sales representative for other specifications.

DSO221SR(kHz)

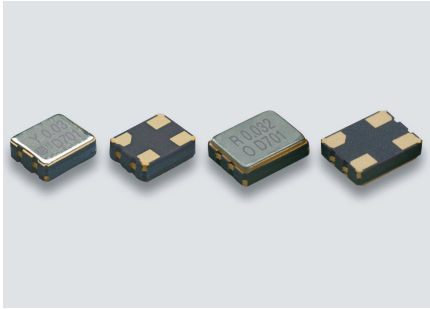
DSO321SR(kHz)

[mm]

Dimensions	Dimensions
Model Code: #4 2.5±0.15 #3 Frequency #1 Index #1 #2 Lot No. R 0.03 D 701 2.0±0.15 0.815±0.09 1.23 0.68 0.53 1.58 1.7 1.35 1.0 0.85 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)	Model Code: #4 3.2±0.15 #3 Frequency #1 Index #1 #2 Lot No. R 0.032 D 701 2.5±0.15 1.1±0.1 1.65 0.9 0.65 2.1 2.2 1.75 1.2 0.95 Pin Connections Pin No. Connection #1 OE(Output Enable) #2 GND #3 Output #4 V_{CC} Function #1 Input #3 Output condition H Oscillation out Open Oscillation out L High Z Recommended Land Pattern (Top View)

SMD Crystal Oscillators (For Automotive)

DSO221SY/DSO321SY



Actual size DSO221SY □ DSO321SY □

Features

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

Applications

- Multimedia devices such as car navigation systems and car audio



Pb-Free



RoHS/ELV Compliant

[Type]

DSO221SY	2520 size
DSO321SY	3225 size

[Function Code]

DSO***SY A A

A : 3.3V	A : ±100×10 ⁻⁶
B : 2.8V	B : ±50×10 ⁻⁶
C : 2.5V	
D : 1.8V	

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

Standard Specification

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

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

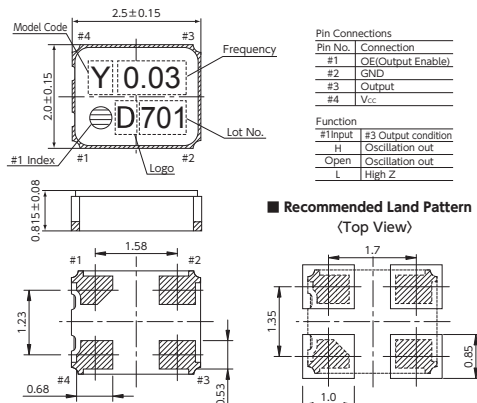
Consult our sales representative for other specifications.

DSO221SY

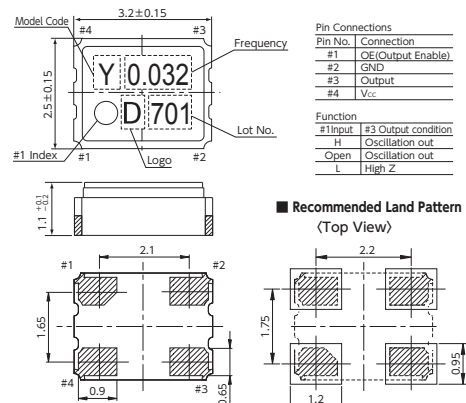
[mm] DSO321SY

[mm]

Dimensions

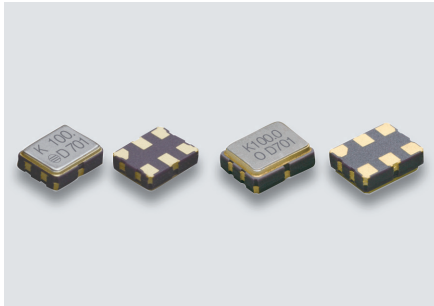


Dimensions



SMD Differential Output Crystal Oscillators (For Automotive)

DSO223SK/DSO323SK/DSO223SJ/DSO323SJ/DSO223SD/DSO323SD



Actual size DSO223S ■ DSO323S ■

■ Features

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

■ Applications

- Multimedia devices such as car navigation systems and car audio

[Type]

DSO223S SERIES	2520 size
DSO323S SERIES	3225 size



Pb-Free



RoHS/ELV Compliant

[Function Code]

Model Code	Supply Voltage	Operating Temperature Range	Frequency Tolerance
K : LVPECL	A : 3.3V	C : -40 to +85°C	A : $\pm 100 \times 10^{-6}$
J : LVDS	C : 2.5V	E : -40 to +105°C	B : $\pm 50 \times 10^{-6}$
D : HCSL			

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

■ Standard Specification

Item	Type	Legend	DSO223SK DSO323SK	DSO223SJ DSO323SJ	DSO223SD DSO323SD
Output Specification	—	—	LV-PECL	LVDS	HCSL
Output Frequency Range	f _o	—	—	13.5 to 167MHz	—
Supply Voltage	V _{CC}	—	—	+2.5V ± 0.125 V/+3.3V ± 0.165 V	—
Frequency Tolerance (Includes frequency tolerance at room temperature.)	f _{tol}	—	—	$\pm 50 \times 10^{-6}$ max., $\pm 80 \times 10^{-6}$ max. / $\pm 100 \times 10^{-6}$ max.	—
Storage Temperature Range	T _{stg}	—	—	-40 to +105°C	—
Operating Temperature Range	T _{use}	—	—	-40 to +85°C, -40 to +105°C	—
Current Consumption	I _{CC}	—	45mA max.	20mA max.	30mA max.
Stand-by Current (#1 pin "L" Level)	I _{std}	—	—	10 μ A max.	—
Load Resistance	Load-R	—	50 Ω to V _{CC} -2V	100 Ω (Output-OutputN)	50 Ω
Symmetry	SYM	—	—	45 to 55% [at outputs cross point]	—
0 Level Output Voltage	V _{OL}	—	V _{CC} -1.81 to V _{CC} -1.62V	—	-0.15 to 0.15V
1 Level Output Voltage	V _{OH}	—	V _{CC} -1.025 to V _{CC} -0.88V	—	0.58 to 0.85V
Rise and Fall Time	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 [$\Delta V_{OD} = V_{OD1} - V_{OD2} $]	—
Offset Voltage	V _{OS}	—	—	1.125 to 1.375V	—
Offset to V _{OS}	ΔV_{OS}	—	—	50mV	—
Crossing Point Voltage	V _{CR}	—	—	—	250 to 550mV
OE Pin 0 Level input Voltage	V _{IL}	—	—	V _{CC} $\times 0.3$ max.	—
OE Pin 1 Level input Voltage	V _{IH}	—	—	V _{CC} $\times 0.7$ min.	—
Output Disable Time	t _{PLZ}	—	—	200ns	—
Output Enable Time	t _{PZL}	—	—	2ms	—
Period Jitter (1)	t _{RMS}	—	—	5ps typ. (13.5MHz $\leq f_o < 27$ MHz) / 2.5ps typ. (27MHz $\leq f_o \leq 167$ MHz) (σ)	—
	tp-p	—	—	33ps typ. (13.5MHz $\leq f_o < 27$ MHz) / 22ps typ. (27MHz $\leq f_o \leq 167$ MHz) (Peak to peak)	—
Total Jitter (1)	t _{TJL}	—	—	50ps typ. (13.5MHz $\leq f_o < 27$ MHz) / 35ps typ. (27MHz $\leq f_o \leq 167$ MHz) [t _{DJ} + n $\times$ t _{RJ} n=14.1 (BER=1 $\times 10^{-12}$) (2)]	—
Phase Jitter	tpj	—	—	1.5ps max. (13.5MHz $\leq f_o < 27$ MHz) / 1ps max. (27MHz $\leq f_o \leq 167$ MHz) [13.5MHz $\leq f_o < 40$ MHz, f _o offset: 12kHz to 5MHz f _o ≥ 40 MHz, f _o offset: 12kHz to 20MHz]	—
Reliability	—	—	—	AEC-Q200(DSO223 SERIES), AEC-Q100/AEC-Q200(DSO323 SERIES)	—
Packing Unit (3)	—	—	—	2000pcs./reel($\phi 180$)	—

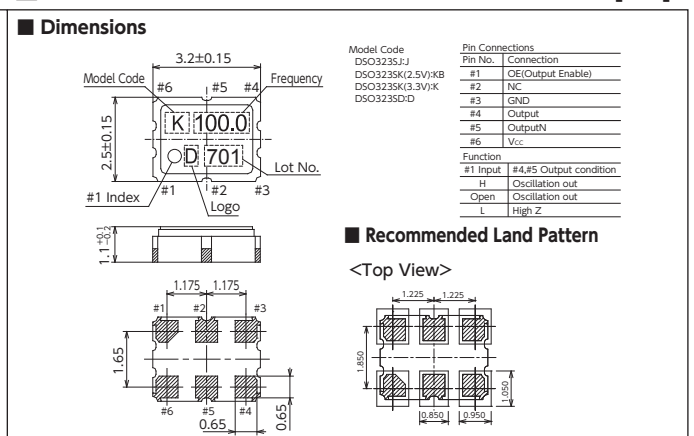
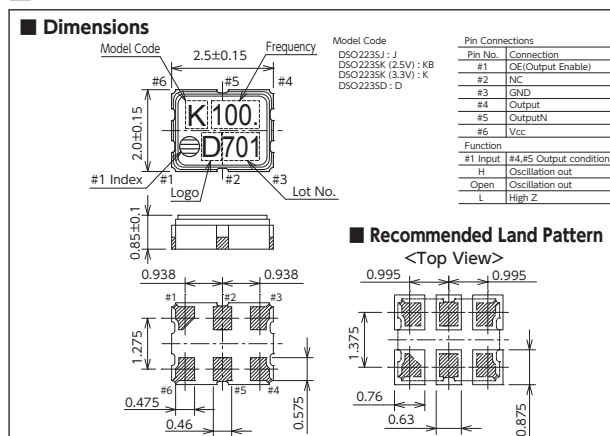
- (1) Measured WAVECREST DTS-2075
(2) t_{DJ}:Deterministic jitter t_{RJ}:Random jitter
(3) Moisture prevention packing is unnecessary.
Moisture Sensitivity Level: LEVEL 1 (IPC/JEDEC J-STD-033)

Consult our sales representative for other specifications.

■ DSO223S SERIES

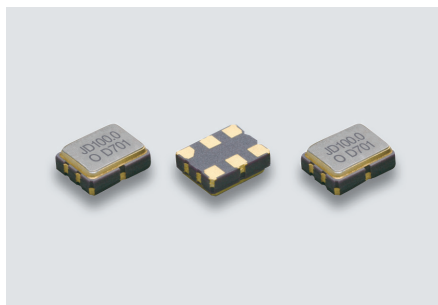
■ DSO323S SERIES

[mm]



SMD Differential Output Crystal Oscillators - Low Voltage (For Automotive)

DSO323SJ/DSO323SD



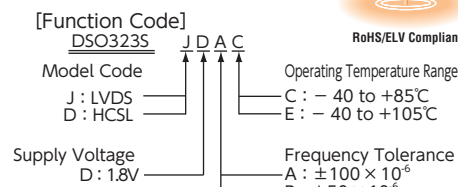
Actual size

■ 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

- Multimedia devices such as car navigation systems and car audio



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

■ Standard Specification

Item	Type	Legend	DSO323SJ	DSO323SD
Output Specification	—	—	LVDS	HCSL
Output Frequency Range	fo	—	100 to 167MHz	100 to 167MHz
Supply Voltage	V _{CC}	—	+1.8V±0.09V	+1.8V±0.09V
Frequency Tolerance (Includes frequency tolerance at room temperature.)	f _{tol}	—	±50×10 ⁻⁶ max., ±80×10 ⁻⁶ max. / ±100×10 ⁻⁶ max.	±50×10 ⁻⁶ max., ±80×10 ⁻⁶ max. / ±100×10 ⁻⁶ max.
Storage Temperature Range	T _{stg}	—	-40 to +105°C	-40 to +105°C
Operating Temperature Range	T _{use}	—	-40 to +85°C	-40 to +105°C
Current Consumption	I _{CC}	—	25mA max.	50mA max.
Stand-by Current (#1 pin "L" Level)	I _{std}	—	30μA max.	30μA max.
Load Resistance	Load-R	—	100Ω (Output-OutputN)	50Ω
Symmetry	SYM	—	45 to 55% [at outputs cross point]	45 to 55% [at outputs cross point]
0 Level Output Voltage	V _{OL}	—	-0.15 to 0.15V	-0.15 to 0.15V
1 Level Output Voltage	V _{OH}	—	0.55 to 1.0V	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.	V _{CC} ×0.3 max.
OE Pin 1 Level input Voltage	V _{IH}	—	V _{CC} ×0.7 min.	V _{CC} ×0.7 min.
Output Disable Time	t _{PLZ}	—	200ns	200ns
Output Enable Time	t _{PZL}	—	2ms	2ms
Period Jitter (1)	t _{RMS}	—	2.5ps typ. (σ)	2.5ps typ. (σ)
	t _{p-p}	—	22ps typ. (Peak to peak)	22ps typ. (Peak to peak)
Total Jitter (1)	t _{TL}	—	35ps typ. [t _{DJ} + n×t _{RJ} n=14.1 (BER=1×10 ⁻¹²) (2)]	35ps typ. [t _{DJ} + n×t _{RJ} n=14.1 (BER=1×10 ⁻¹²) (2)]
Phase Jitter	t _{pj}	—	0.15ps max.	0.15ps max.
Reliability	—	—	AEC-Q100/AEC-Q200	AEC-Q100/AEC-Q200
Packing Unit (3)	—	—	2000pcs./reel (φ180)	2000pcs./reel (φ180)

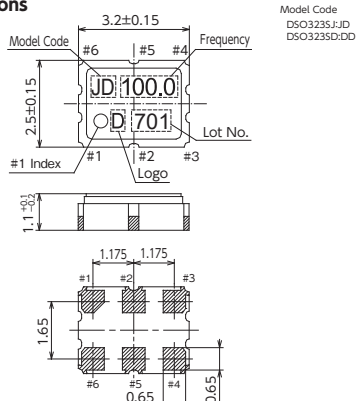
- (1) Measured WAVECREST DTS-2075
 (2) t_{DJ}:Deterministic jitter t_{RJ}:Random jitter
 (3) Moisture prevention packing is unnecessary.
 Moisture Sensitivity Level: LEVEL 1 (IPC/JEDEC J-STD-033)

Consult our sales representative for other specifications.

■ DSO323S SERIES

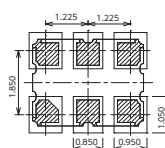
[mm]

■ Dimensions



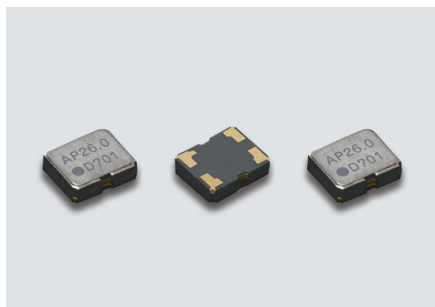
■ Recommended Land Pattern

<Top View>



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

DSA211SP/DSB211SP



Actual size

Features

- Capable of operating over a wide temperature range, from -40 to $+105^{\circ}\text{C}$
- Low voltage operation
- Low phase noise
- Single packaged structure
- AEC-Q100/AEC-Q200 compliant

Applications

- GPS / GNSS
- Telematics, Satellite radio



Standard Specification

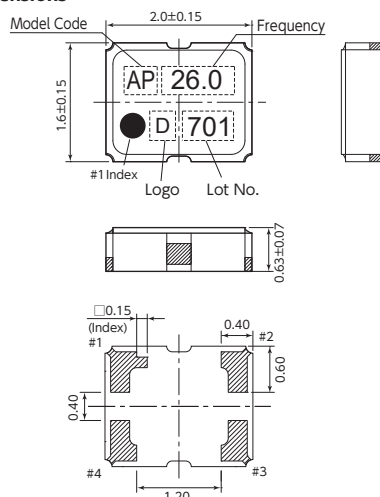
Item	Type	DSA211SP(VC-TCXO)	DSB211SP(TCXO)
Output Frequency Range		12.288 to 52 MHz	12.288 to 52 MHz
Standard Frequency		16.3676/ 16.367667/ 16.368/ 16.369/ 16.8/ 26/ 38.4 MHz	
Supply Voltage Range		+1.68 to +3.5V	
Supply Voltage (Vcc)		+1.8V / +2.8 V / +3.0V / +3.3V	
Current Consumption		+1.7 mA max. ($f \leq 26\text{MHz}$)/+2.2 mA max. ($f > 26\text{MHz}$)	
Output Level		0.8 Vp-p min. (Clipped Sine Wave / DC-coupled)	
Output Load		10 k Ω /10 pF	
Frequency Stability Tolerance		$\pm 1.5 \times 10^{-6}$ max. (After 2 reflows)	
vs. Temperature		$\pm 1.0 \times 10^{-6}$ max. / -40 to $+105^{\circ}\text{C}$	$\pm 0.5 \times 10^{-6}$ max. / -40 to $+105^{\circ}\text{C}$
vs. Supply Voltage		$\pm 0.2 \times 10^{-6}$ max. ($V_{\text{cc}} \pm 5\%$)	
vs. Load Variation		$\pm 0.2 \times 10^{-6}$ max.	
vs. Aging		$\pm 1.0 \times 10^{-6}$ max. /year	
Start up Time		2.0ms max.	
Frequency Control Control Sensitivity		$\pm 3.0 \times 10^{-6}$ to $\pm 5.0 \times 10^{-6}$ / Vcont=+1.4V $\pm$ 1V @Vcc $\geq$ +2.6V $\pm 3.0 \times 10^{-6}$ to $\pm 5.0 \times 10^{-6}$ / Vcont=+0.9V $\pm$ 0.6V @Vcc=+1.8V	—
Response Slope		Positive	—
SSB Phase Noise		[f $\leq$ 15MHz]	[15MHz < f $\leq$ 26MHz]
Offset 100Hz		-115 dBc/Hz	-110 dBc/Hz
Offset 1kHz		-135 dBc/Hz	-130 dBc/Hz
Offset 10kHz		-145 dBc/Hz	-140 dBc/Hz
Offset 100kHz		-145 dBc/Hz	-145 dBc/Hz
Reliability		AEC-Q100/AEC-Q200	
Packing Unit (1)		3000pcs./reel (ϕ 180)	

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

Consult our sales representative for other specifications.

[mm]

Dimensions



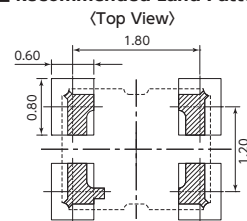
Model Code

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

Pin Connections

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

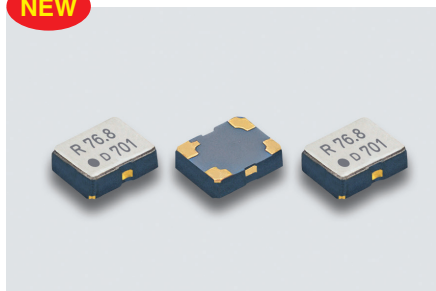
Recommended Land Pattern



High-precision SMD TCXO (For Automotive)

DSB1612SEB

NEW



Actual size □

Features

- Capable of operating over a wide temperature range from -40 to $+105^{\circ}\text{C}$
- High frequencies operation
- Low voltage operation
- Clipped sine wave
- Low phase noise
- Single package structure
- AEC-Q200 Compliant

Applications

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



Standard Specification

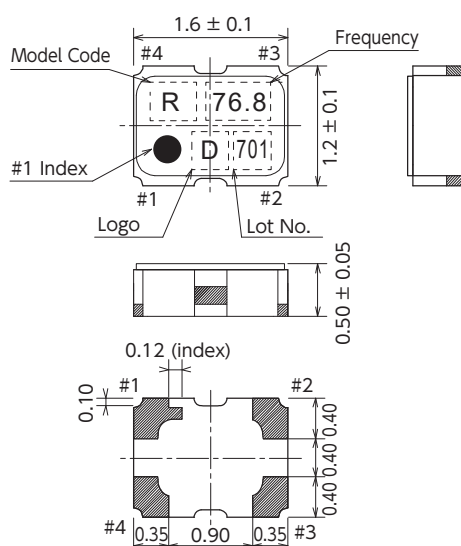
DSB1612SEB	
Output Frequency Range	26 to 76.8MHz
Supply Voltage Range	+1.8 to +3.3V
Current Consumption	+4.5mA max.($f \leq 52\text{MHz}$)/+5.0mA max.($f > 52\text{MHz}$)
Stand-by Current (#1 pin "L" Level)	+3uA max.
Output Level	0.8Vp-p min. (Clipped Sine Wave / DC-coupled)
Output Load	10k Ω /10pF
Frequency Stability	
Tolerance	$\pm 2.0 \times 10^{-6}$ max.(After 2 reflows)
vs. Temperature	$\pm 5.0 \times 10^{-6}$ max. (-40 to $+105^{\circ}\text{C}$) $\pm 0.5 \times 10^{-6}$ max. (-40 to $+85^{\circ}\text{C}$)
vs. Supply Voltage	$\pm 0.2 \times 10^{-6}$ max. ($V_{CC} \pm 5\%$)
vs. Load Variation	$\pm 0.2 \times 10^{-6}$ max.
vs. Aging	$\pm 2.0 \times 10^{-6}$ max./year
Start up Time	2.0ms max.
Phase Noise	
Offset 100Hz	[$f \leq 52\text{MHz}$] [$f > 52\text{MHz}$] -110dBc/Hz -108dBc/Hz
Offset 1kHz	-130dBc/Hz -125dBc/Hz
Offset 10kHz	-152dBc/Hz -150dBc/Hz
Offset 100kHz	-155dBc/Hz -155dBc/Hz
Reliability	AEC-Q200
Packing Unit (1)	3000pcs./reel ($\Phi 180$)

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

Consult our sales representative for other specifications.

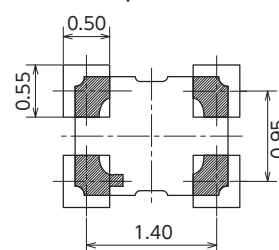
[mm]

Dimensions



Recommended Land Pattern

<Top View>



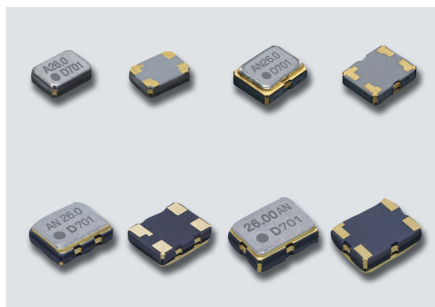
Pin Connections

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

Output Enable
 H Oscillation
 L Stand by

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

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



Actual size DSA1612SDN DSA211SDN DSA221SDN DSA321SDN

Features

- Low voltage operation
- Selectable between standard type and GPS/GNSS specialized type (DSB1612SDN)
- Clipped sine wave
- Low phase noise
- Single packaged structure
- AEC-Q200 Compliant (Option: Equivalent to AEC-Q100)

Applications

- Telematics, Satellite radio



[Type]

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

Standard Specification

Type	VC-TCXO				TCXO										
Item	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. (26MHz<f≤52MHz) /+2.5mA max. (f≤60MHz)														
Output Level	0.8Vp-p min. (f≤52MHz) (Clipped Sinewave/DC-coupled)														
Output Load	10kΩ//10pF														
Frequency Stability	±1.5×10 ⁻⁶ max. (After 2 reflows)														
Tolerance															
vs. Temperature									±1.0×10 ⁻⁶ , ±2.5×10 ⁻⁶ max/−40 to +85℃				±0.5×10 ⁻⁶ , ±2.5×10 ⁻⁶ max/−40 to +85℃		
vs. Supply Voltage									±0.2×10 ⁻⁶ max. (Vcc ±5%)						
vs. Load Variation									±0.2×10 ⁻⁶ max. (10kΩ//10pF±10%)						
vs. Aging	±1.0×10 ⁻⁶ max./year														
Frequency Control	±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				—										
Control Sensitivity															
Response Slope									Positive						
Start up Time	2.0ms max.														
Phase Noise	[f≤26MHz]		[26MHz<f≤40MHz]		[40MHz<f≤52MHz]										
Offset 100Hz	−115dBc/Hz		−110dBc/Hz		−105dBc/Hz										
Offset 1kHz	−130dBc/Hz		−130dBc/Hz		−125dBc/Hz										
Offset 10kHz	−150dBc/Hz		−150dBc/Hz		−145dBc/Hz										
Offset 100kHz	−155dBc/Hz		−155dBc/Hz		−150dBc/Hz										
Reliability	AEC-Q100/AEC-Q200														
Packing Unit (1)	DSA1612SDN/DSA211SDN/DSA221SDN, DSB1612SDN/DSB211SDN/DSB221SDN: 3000pcs./reel(φ180) DSA321SDN, DSB321SDN: 2000pcs./reel(φ180)														

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

Consult our sales representative for other specifications.

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

For Automotive Applications

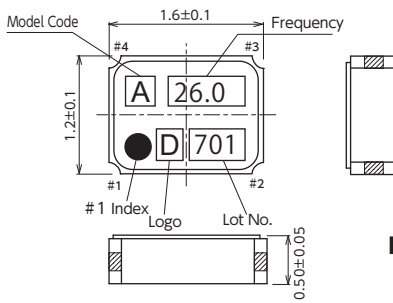
■ Dimensions

[mm]

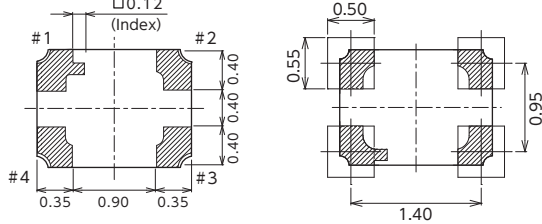
■ DSA1612SDN/DSB1612SDN

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

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



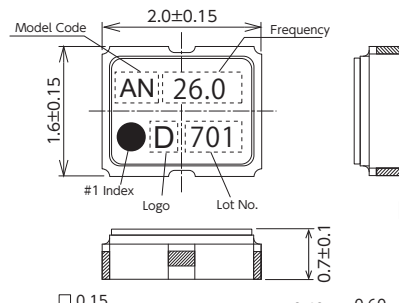
■ Recommended Land Pattern <Top View>



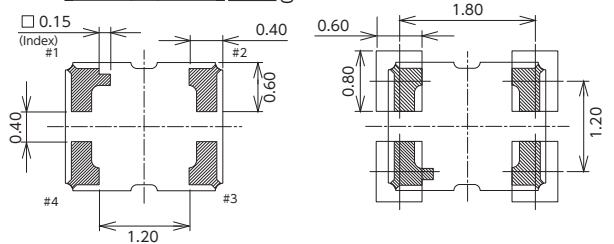
■ DSA211SDN/DSB211SDN

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

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



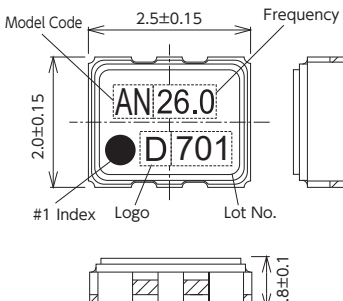
■ Recommended Land Pattern <Top View>



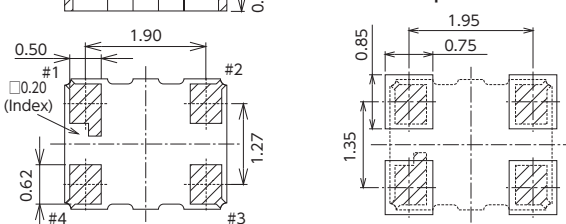
■ DSA221SDN/DSB221SDN

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

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



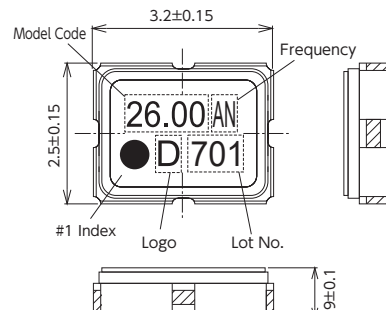
■ Recommended Land Pattern <Top View>



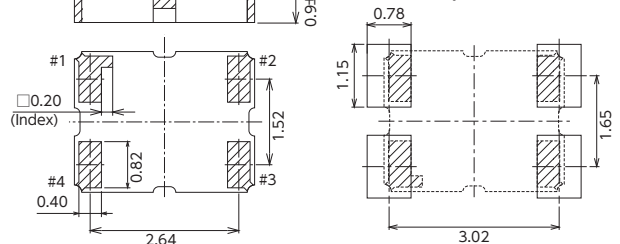
■ DSA321SDN/DSB321SDN

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

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

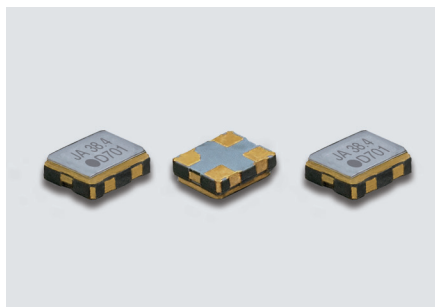


■ Recommended Land Pattern <Top View>



SMD TCXO <For Automotive>

DSB211SJA



Actual size

Features

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

Applications

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



Standard Specification

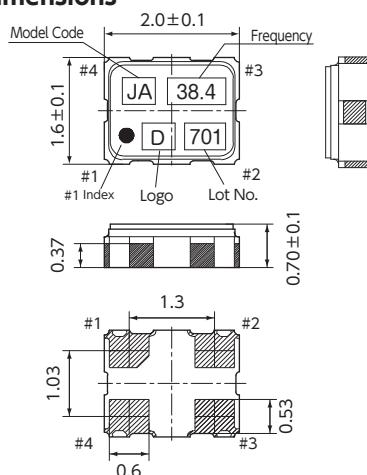
Item	Type	DSB211SJA
Frequency Range		13 to 54MHz
Standard Frequency		19.2MHz/ 25MHz/ 26MHz/ 32MHz/ 38.4MHz/ 40MHz/ 48MHz/ 52MHz
Supply Voltage (Vcc)		$+1.8\text{V}/ +2.5\text{V}/ +2.8\text{V}/ +3.3\text{V}$
Current Consumption		5.0mA max. [No Load]
Stand-by Current (#1 pin "L" Level)		$+10\mu\text{A}$ max.
Frequency Stability Tolerance		$\pm 1.5 \times 10^{-6}$ max. (After 2 reflows)
vs. Temperature		$\pm 2.5 \times 10^{-6}$ max./ -40 to $+85^{\circ}\text{C}$ $\pm 5.0 \times 10^{-6}$ max./ -40 to $+105^{\circ}\text{C}$ $\pm 20 \times 10^{-6}$ max./ -40 to $+125^{\circ}\text{C}$ (Option)
vs. Aging		$\pm 1.0 \times 10^{-6}$ max./year
Symmetry		45 to 55% (50% Vcc Level)
0 Level Output Voltage		$V_{\text{cc}} \times 0.1\text{V}$ max.
1 Level Output Voltage		$V_{\text{cc}} \times 0.9\text{V}$ min.
Output Load		15pF
Rise and Fall Time		5ns max. (10% to 90% Vcc Level)
OE Pin 0 Level Input Voltage		$V_{\text{cc}} \times 0.2\text{V}$ max.
OE Pin 1 Level Input Voltage		$V_{\text{cc}} \times 0.8\text{V}$ min.
Start Up Time		3.0ms max.
Output Enable Time		3.0ms max.
Output Disable Time		150ns max.
Phase Noise		[$f \leq 26\text{MHz}$] [$26\text{MHz} < f \leq 52\text{MHz}$]
Offset 1kHz		-145dBc/Hz -141dBc/Hz
Offset 100kHz		-158dBc/Hz -157dBc/Hz
Reliability		AEC-Q100/AEC-Q200
Packing Unit (1)		3000pcs./reel ($\phi 180$)

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

Consult our sales representative for other specifications.

[mm]

Dimensions



Pin Connections

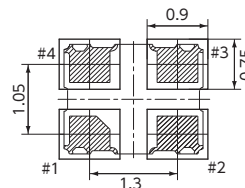
Pin No.	Connection
#1	OE (Output Enable)
#2	GND
#3	Output
#4	Vcc

Function

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

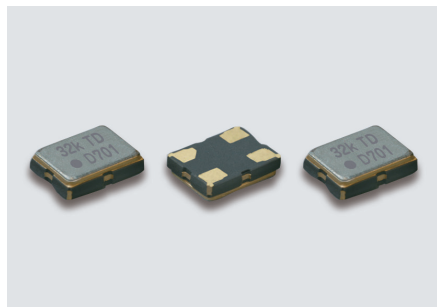
Recommended Land Pattern

<Top View>



SMD TCXO〈For Automotive〉

DSK321STD



Actual size

■ Features

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

■ Applications

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



■ Standard Specification

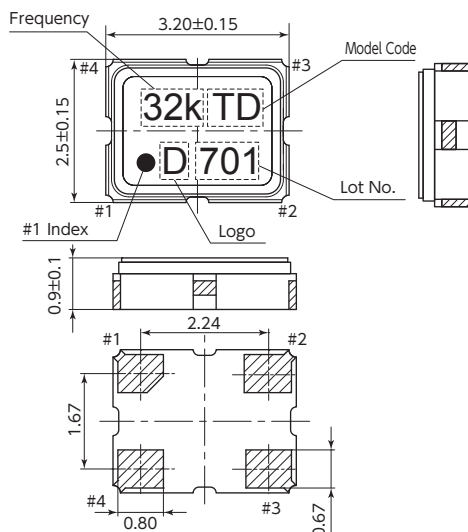
Item	Legend	Spec.				Condition
		min.	typ.	max.	Unit	
Output Frequency	f_0	—	32.768	—	kHz	
Supply Voltage Range	V_{CC}	+1.5	—	+3.63	V	(Temperature Compensated Operating)
Frequency Tolerance (Includes frequency tolerance at room temperature.)	f_{tol}	-5.0	—	+5.0	$\times 10^{-6}$	-40 to $+85^{\circ}\text{C}$
Current Consumption	I_{CC}	—	—	+3.5	μA	$V_{CC}=+1.8\text{V}$ or $+3.3\text{V}$, Temperature Compensation Interval:0.5s, No Load
		—	—	+3.2		$V_{CC}=+1.8\text{V}$ or $+3.3\text{V}$, Temperature Compensation Interval:2.0s, No Load
Symmetry	SYM	40	50	60	%	at 50% V_{CC}
0 Level Output Voltage	V_{OL}	—	—	$V_{CC} \times 0.1$	V	
1 Level Output Voltage	V_{OH}	$V_{CC} \times 0.9$	—	—		
Rise and Fall Time	t_r, t_f	—	—	50	ns	$V_{CC}=+1.5$ to $+3.63\text{V}$, 10 to 90% V_{CC} Level
Load Condition	L_{CMOS}	—	—	15	pF	
Start Up Time	T_{start}	—	—	1.0	s	
Reliability		AEC-Q200				
Packing Unit (1)		2000pcs./reel ($\phi 180$)				

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

Consult our sales representative for other specifications.

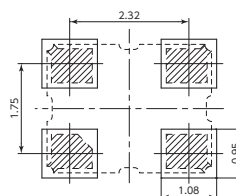
[mm]

■ Dimensions



■ Recommended Land Pattern

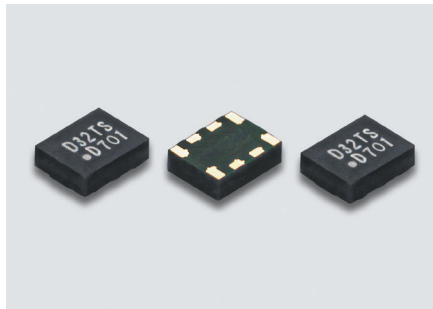
<Top View>



Pin No.	Connection
#1	V_{CC}
#2	GND
#3	Output
#4	V_{CC}

SMD Real Time Clock Module

DD3225TS



Actual size

Features

- Digital temperature compensated type
- High precision : $\pm 5.0 \times 10^{-6}$ (-40 to $+85^{\circ}\text{C}$), $\pm 7.0 \times 10^{-6}$ (-40 to $+105^{\circ}\text{C}$)
- Low current consumption
- Low voltage operation : $+1.5$ to $+5.5\text{V}$ (Temperature Compensated Operating), $+1.3$ to $+5.5\text{V}$ (Clock Timing Operating)
- I²C-BUS serial interface: 400kHz fast-mode compatible
- Clock function: hour-minute-second, Calendar function with auto leap year adjustment: year-month-day-day of week
- Alarm interrupt function: day-day of week-hour-minute
- Fixed-cycle timer interrupt function: 244 μs 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
- * "I²C-BUS" is a trademark of NXP semiconductors.



Applications

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

Standard Specification

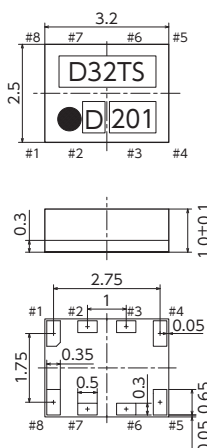
Item	Legend	Spec.				Condition
		min.	typ.	max.	unit	
Output Frequency	f _o	—	32.768	—	kHz	
Supply Voltage Range	V _{cc}	+1.3	—	+5.5	V	(Clock Timing Operating)
	V _{tem}	+1.5	—	+5.5		(Temperature Compensated Operating)
	V _{int}	+1.5	—	+5.5		(Interface Operation) I ² C-BUS
Frequency Tolerance	f _{tol}	—5	—	+5	$\times 10^{-6}$	—40 to +85 $^{\circ}\text{C}$
		—7	—	+7		—40 to +105 $^{\circ}\text{C}$
Current Consumption	I _{cc1}	—	0.30	2.10	μA	V _{cc} = +3.0V Temperature Compensation Interval: 30s,
		—	0.42	2.90		SCL = SDA = INTN = V _{cc} , OE = GND (Output Off)
	I _{cc2}	—	0.90	2.80		V _{cc} = +3.0V Temperature Compensation Interval: 30s,
		—	1.30	4.00		SCL = SDA = INTN = OE = V _{cc} (Output On), No Load
Load Condition	L _{CMOS}	—	—	15	pF	
Symmetry	SYM	40	—	60	%	50%V _{cc}
1 level Output Voltage	V _{OH}	0.8xV _{cc}	—	—	V	I _{OH} = — 1mA
0 level Output Voltage	V _{OL}	—	—	0.2xV _{cc}	V	I _{OL} = 1mA
Rise / Fall Time	Tr/Tf	—	—	100	ns	20 to 80%V _{cc}
OE Pin 1 level Input Voltage	V _{IH}	0.8xV _{cc}	—	V _{cc}	V	
OE Pin 0 level Input Voltage	V _{IL}	0	—	0.2xV _{cc}	V	
Start Up Time	T _{start}	—	—	1	s	T _a = +25 $^{\circ}\text{C}$, V _{cc} = +1.3V
Reliability						AEC - Q100/AEC-Q200
Packing Unit (1)						2000pcs./reel (ϕ 180)

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

Consult our sales representative for other specifications.

[mm]

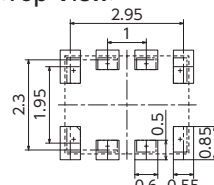
Dimensions



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

Recommended Land Pattern

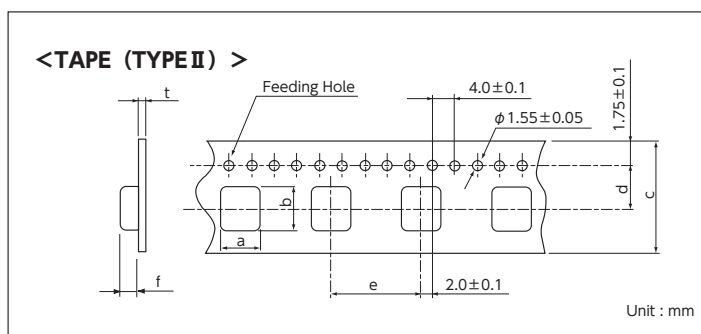
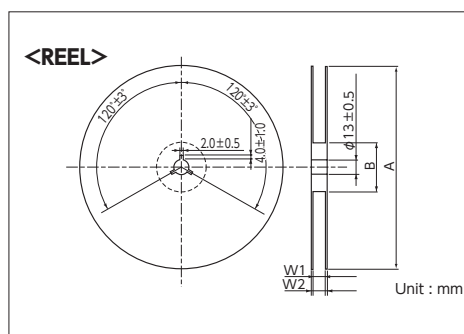
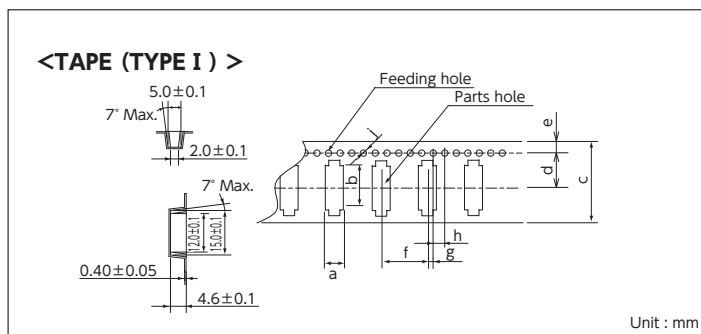
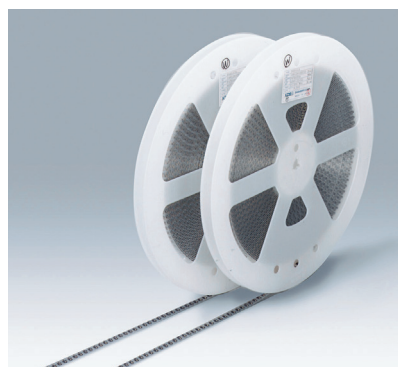
<Top View>



Pin Function

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

Emboss Carrier Tape (SMD Crystal Resonators)



Standard Specification

MHz Band Crystal Resonators / Crystal Resonators with dedicated temperature sensor

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

kHz Band Crystal Resonators

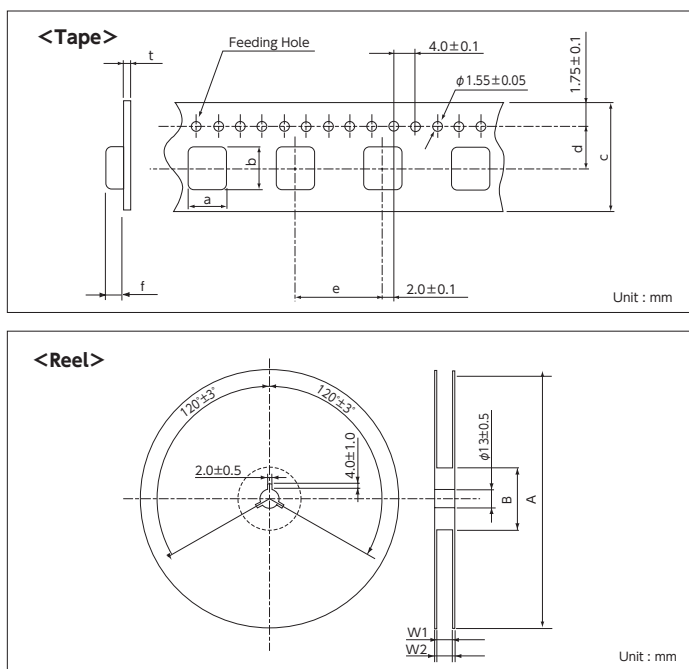
DST310SA	1.70 ±0.05	3.40 ±0.05	12.0 ±0.2	5.50 ±0.05	4.0 ±0.1	0.95 ±0.05	0.25 ±0.05	φ180 +0/-3	φ60 +1/-0	13.0 ±0.3	15.5 ±1.0
DST210AC	1.45 ±0.1	2.3 ±0.1	8.0 ±0.2	3.50 ±0.05	4.0 ±0.1	0.65 ±0.10	0.20 ±0.05	φ180 +0/-3	φ60 +1/-0	9.0 ±0.3	11.4 ±1.0
DST1610A	1.28 ±0.05	1.79 ±0.05	8.0 +0.3/-0.1	3.50 ±0.05	4.0 ±0.1	0.65 ±0.10	0.20 ±0.05	φ180 +0/-3	φ60 +1/-0	9.0 ±0.3	11.4 ±1.0
DST1210A	1.17 ±0.05	1.42 ±0.05	8.0 +0.3/-0.1	3.50 ±0.05	4.0 ±0.1	0.48 ±0.05	0.20 ±0.05	φ180 +0/-3	φ60 +1/-0	9.0 ±0.3	11.4 ±1.0

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

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

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

Emboss Carrier Tape (SMD Crystal Oscillators)



Standard Specification

VC-TXCO/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

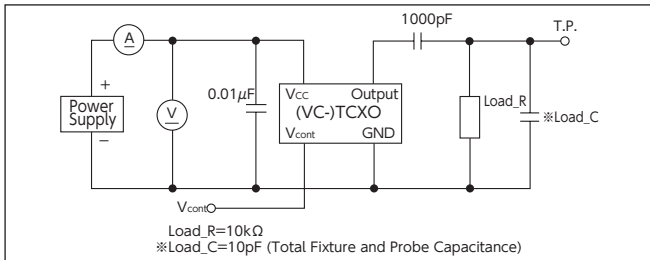
TYPE	a	b	c	d	e	f	t	A	B	W1	W2
DSO751SR/SBM DSO753SK/SJ/SD	5.5 ±0.1	7.9 ±0.1	16.0 ±0.3	7.5 ±0.1	8.0 ±0.1	2.4 ±0.1	0.30 ±0.05	φ254 ±2	φ80 ±0.5	17.0 ±0.5	21.0 ±1.0
DSO531SR/SBM DSO533SK/SJ	3.6 ±0.1	5.45 ±0.1	12.0 ±0.2	5.50 ±0.05	8.0 ±0.1	1.55 ±0.10	0.30 ±0.05	φ180 +0/-3	φ60 +1/-0	13.0 ±0.3	15.4 ±1.0
DD3225TR/TS 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.

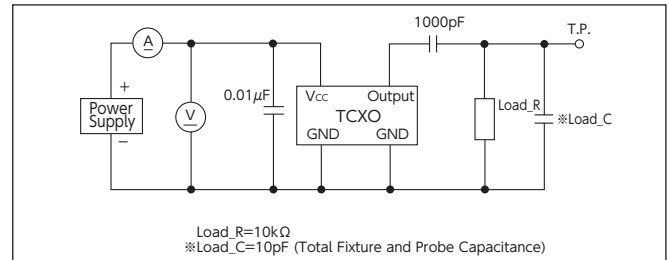
2: DSA/DSB535SGA, DSA535SGB: reel φ180 available.

Measurement Circuit (Crystal Oscillators)

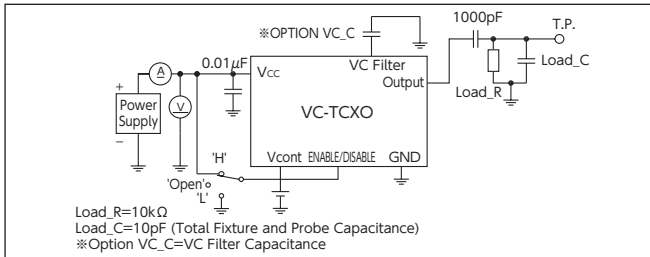
VC-TCXO (DA2016AS, DSA***SDN, SP)



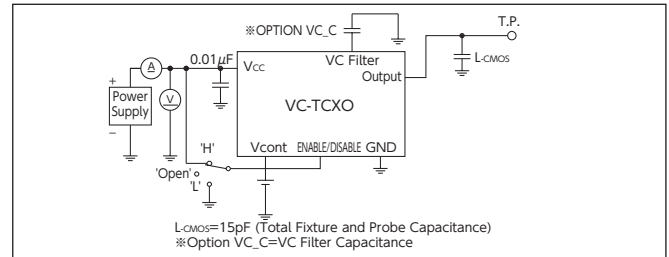
TCXO (DB2016AS, DSB***SDN, SP)



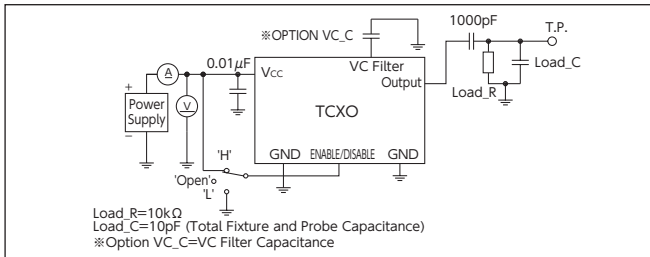
DSA535SGA, DSA535SGB (Clipped Sine)



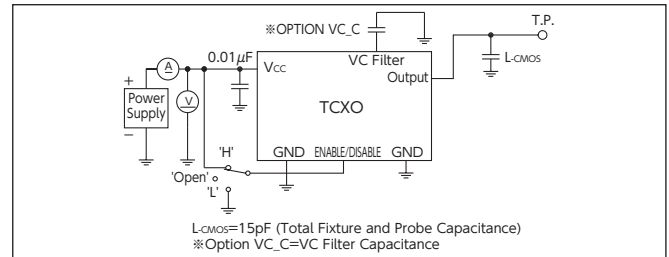
DSA535SGA, DSA535SGB (CMOS)



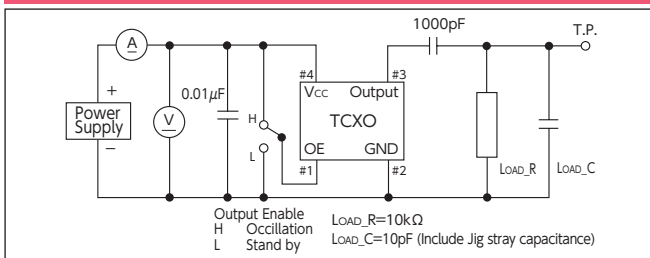
DSB535SGA (Clipped Sine)



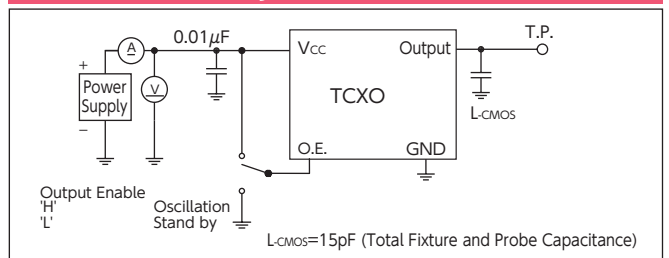
DSB535SGA (CMOS)



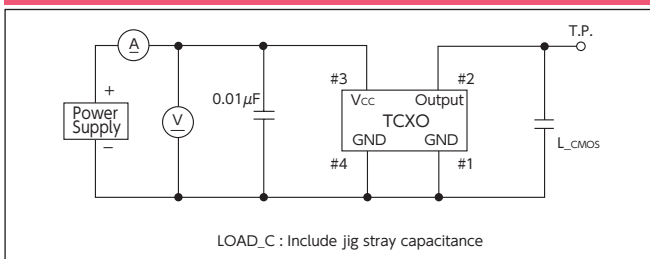
DSB1612SEB



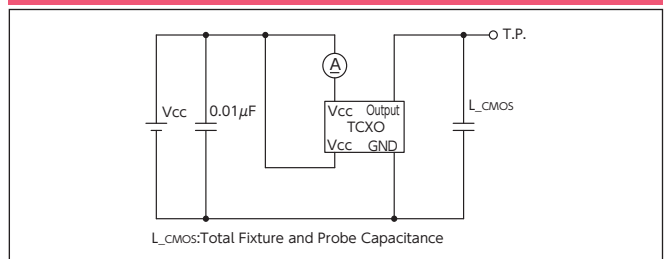
DSB211SJA, 221SJA



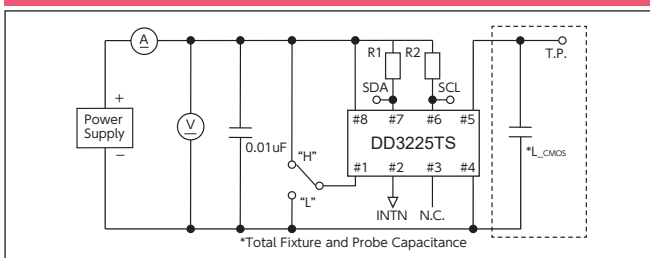
DSK1612ATD



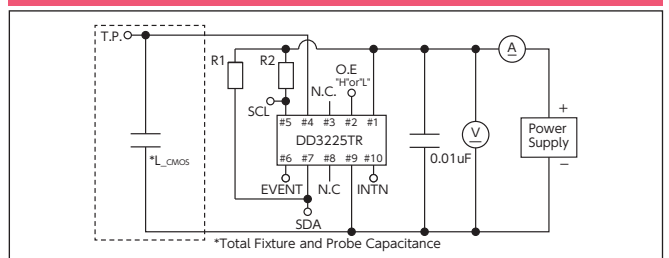
DSK321STD



DD3225TS

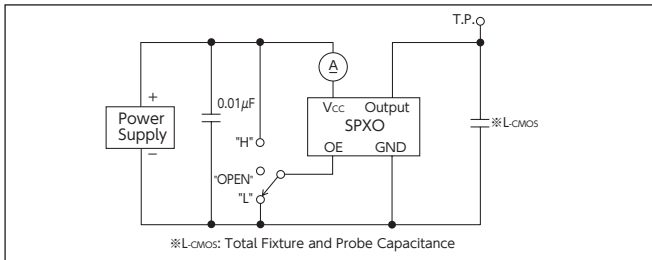


DD3225TR

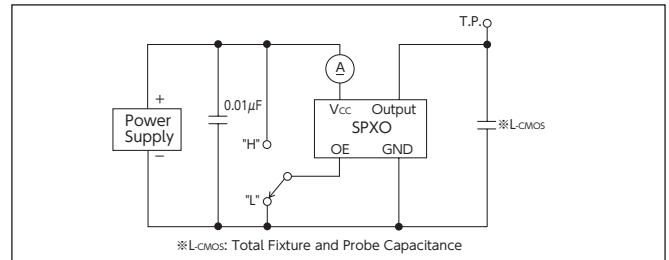


Measurement Circuit (Crystal Oscillators)

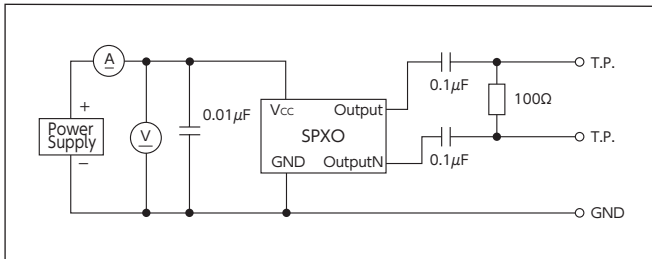
DS1008JS, JN, DSO***AR, SR, SH, SY, SRS, SBM, SHH



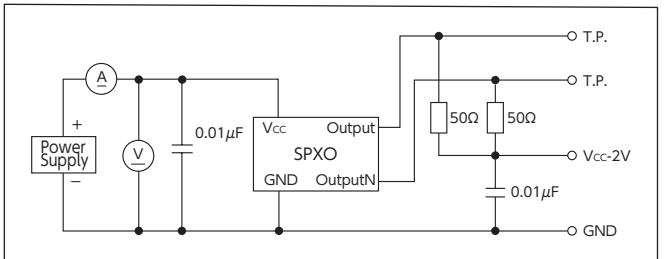
DS***AS, DSO***SX, SXF



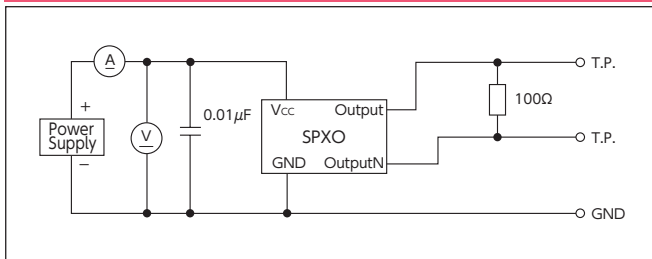
DS1008JC



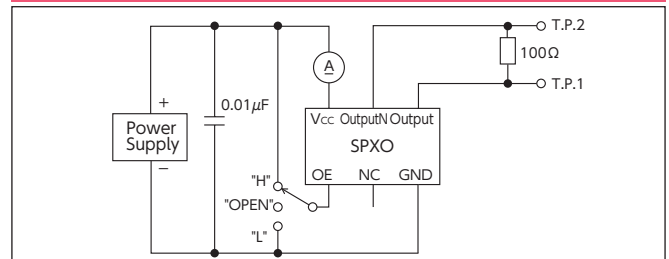
DS1008JK



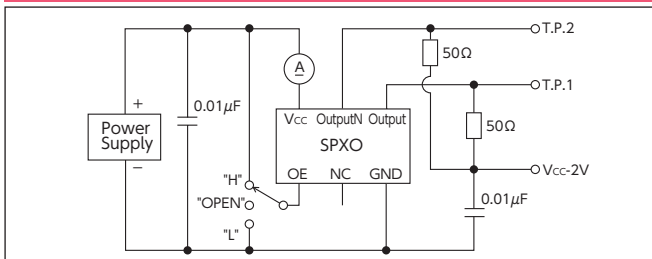
DS1008JJ



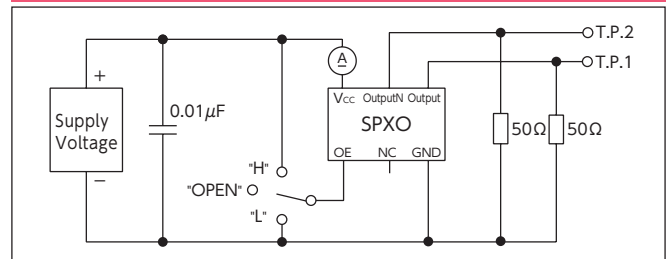
DS***AJ, DSO***SJ



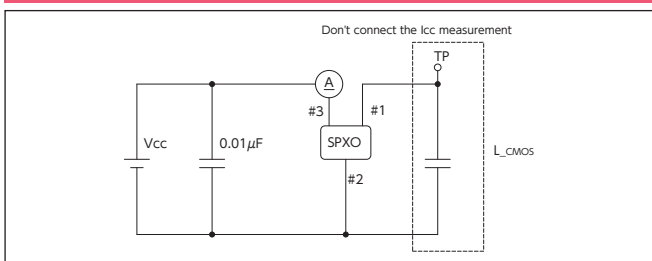
DS***AK, DSO***SK



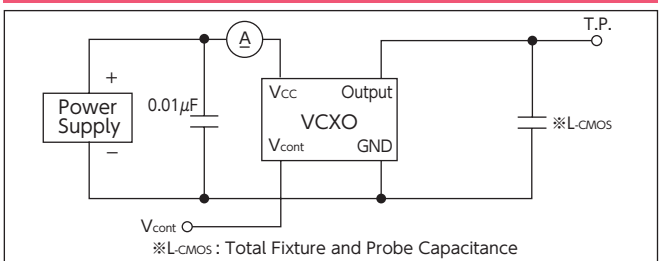
DS***AD, DSO***SD



DLO555MBA

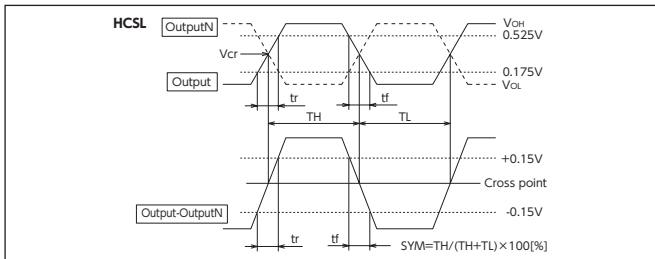
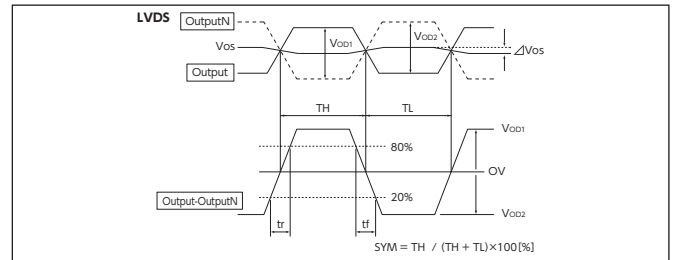
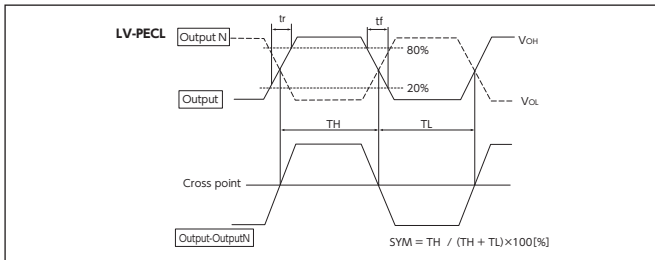
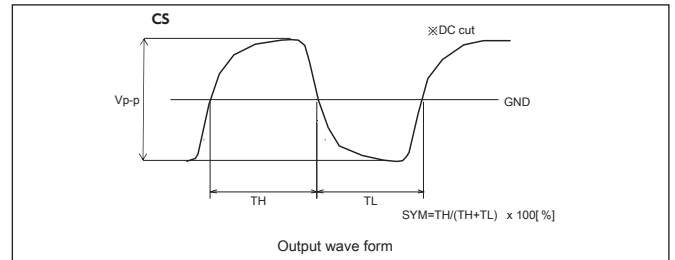
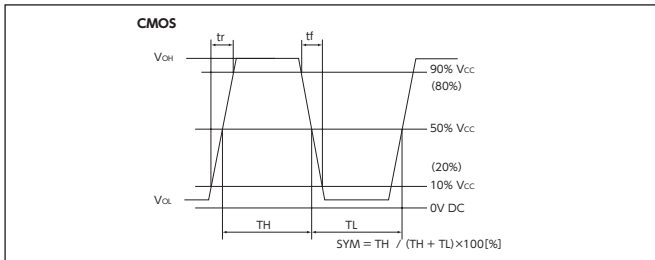


DSV221SV, 321SV



Measurement Circuit

Output Wave Form



Input and Output Conditions

