



NANOSTONE PTE. LTD.

Frequency Control Products:

Quartz blanks, Quartz crystal units, Quartz crystal resonators, Quartz oscillators, Crystal filters, MEMS oscillators, VCXO and TCXO (TCVCXO), OCXO

Piezo sensors:

- ❖ Quartz crystal microbalances (QCM)
- ❖ Quartz crystal sensors (QCS)
- ❖ LGS and GaPO₄ sensors

Rubidium atomic clocks

Chip atomic clocks and Miniature atomic clocks

Frequency sources/standard

VCO



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Quartz blanks:

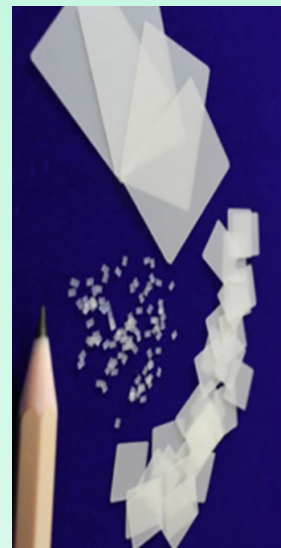
SC-cut, AT-cut, Z-cut and
fundamental inverted mesa blanks etc.

Items	SC-cut Specifications		
	Rectangular	Round (plano-plano)	Round (plano-convex)
ϕ range	$\leq 25^\circ$	$\leq 25^\circ$	$\leq 25^\circ$
ϕ tolerance	$\leq +/ -3^\circ$	$\leq +/ -3^\circ$	$\leq +/ -3^\circ$
θ range	32° to 35°	32° to 35°	32° to 35°
θ tolerance	$\leq +/ -30''$	$\leq +/ -30''$	$\leq +/ -30''$
Size	2016, 2520, 3225, 5032	6.5-10mm	6.5-10mm
Size tolerance	$\pm 0.03\text{mm}$	$\pm 0.02\text{mm}$ (dia.)	$\pm 0.02\text{mm}$ (dia.) $\pm 0.15\text{mm}$ (convex dia.)
Freq. range (fund.)	19-54MHz	-	-
Freq. range (3 rd)	-	10M or customized	26M or customized
Freq. tolerance	± 20 to $\pm 50\text{kHz}$	$\leq \pm 10\text{kHz}$	$\leq \pm 30\text{kHz}$
Roughness	$\leq 10\text{nm}$	$\leq 15\text{nm}$	$\leq 15\text{nm}$
Finish	Polished/Etch	Grind/Polished/Etch	Grind/Polished/Etch

Items	AT-cut Specification									
	SMD1210	SMD1612	SMD2016	SMD2520	SMD3225	SMD4025	SMD5032	SMD6035	SMD7050	49S
Size (mm)	0.5-0.899	0.9-1.199	1.2-1.499	1.5-1.899	1.9-2.299	2.3-2.899	2.9-3.899	3.9-4.599	4.6-5.1	> 7.99
Freq. (MHz)	32-80	24-80	16-80	12-80	8-80	8-80	7.372-80	7.372-80	4-80	3.579-80
Temp. range	-40°C to $+125^\circ\text{C}$									
Resistor (Ω)	60-100	20-100	20-80	10-80	10-300	10-100	10-100	10-60	10-60	10-150

HFF (High Frequency Fundamental) Inverted Mesa Blanks

Blanks Dimensions	Application/Packages	Frequencies
1.14x1.78mm	For 3.2x1.5mm SMD	203.16 to 222.2M
3.2x1.83mm	5x7mm SMD; 3.2x5.0mm SMD; UM-1; HC-45/U	70-1300M
3.5x1.83mm	3.2x5.0mm SMD	70-700M
3.81x2.83mm	3.5x6.0mm SMD	30-350M
4.98x2.39mm	5x7mm SMD	30-700M
3.58x3.58mm (5.08 across diagonal)	5.08mm 2 or 4-point clip mounts UM-1, HC-45 or larger packages	30-350M
5.08mm round	5.08mm 2, 3 or 4-point clip mounts UM-1, HC-45, Large SMD or larger packages	30-200M
3.96x3.96mm (5.58mm across diagonal)	5.58mm 2 or 4-point clip mounts UM-1, HC-45, Large SMD or larger packages	30-200M
5.58mm round	5.58mm 2, 3 or 4-point clip mounts UM-1, HC_45, Large SMD or larger packages	30-200M

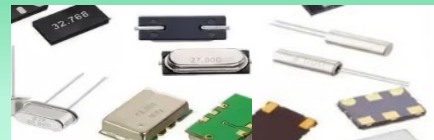




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Quartz crystal units: (2-1)

HC-49/U, UM-1, UM-5 and
SMD1.25x1.05mm to 7x5mm crystal units.



Package		Mode		Cal. tolerance		Temp. stability		Temp. range		Series/Parallel		Other		Freq.
Code	Desc.	Code	Desc.	Code	Desc.	Code	Desc.	Code	Desc.	Code	Desc.	Code	Desc.	MHz
U1	HC-49/U	1	Fund.	A	+/-10ppm	1	+/-10ppm	A	-10°C to +60°C	0	Series	MS	Mylar spacer	
U2	HC-49/U gull wing	3	3 rd	B	+/-15ppm	2	+/-15ppm	B	0°C to +70°C	xx	__pF	TR	Tape and reel	
U3	HC-49/UT	5	5 th	C	+/-20ppm	3	+/-20ppm	C	-20°C to +70°C			CL	Cut lead	
S1	HC-49/US	7	7 th	D	+/-30ppm	4	+/-30ppm	D	-40°C to +85°C			XX	Customized	
S2	HC-49/US SMD			E	+/-50ppm	5	+/-50ppm	E	-55°C to +125°C					
S3	HC-49/USS			F	+/-100ppm	6	+/-100ppm	XX	Customized					
S4	HC-49/USS SMD			X	Customized	00	Customized							
S5	HC-49/US 4 pads								Thru-hole series ordering information					
S6	HC-49/USS 4 pads													
M1	UM-1													
M2	UM-1 gull wing													
M3	UM-5													



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Quartz crystal units: (2-2)

HC-49/U, UM-1, UM-5 and SMD1.25x1.05mm to 7x5mm crystal units.

Package		Mode		Cal. tolerance		Temp. stability		Temp. range		Series/Parallel		Freq.
Code	Desc.	Code	Desc.	Code	Desc.	Code	Desc.	Code	Desc.	Code	Desc.	MHz
X12	1.25x1.05x0.3mm	1	Fund.	A	+/-10ppm	1	+/-10ppm	A	-10°C to +60°C	0	Series	32-80M
X16	1.6x1.2x0.35mm	3	3 rd	B	+/-15ppm	2	+/-15ppm	B	0°C to +70°C	xx	__pF	24-60M
X20	2.0x1.6x0.5mm	5	5 th	C	+/-20ppm	3	+/-20ppm	C	-20°C to +70°C			16-80M
X25	2.5x2.0x0.6mm	7	7 th	D	+/-30ppm	4	+/-30ppm	D	-40°C to +85°C			12-80M
X32	3.2x2.5x0.7mm			E	+/-50ppm	5	+/-50ppm	E	-55°C to +125°C			8-200M
X53	5.0x3.2x0.9mm			F	+/-100ppm	6	+/-100ppm	XX	Customized			8-150M
X532	5.0x3.2x1.2mm (2 pads)			X	Customized	00	Customized					8-80M
X63	6.0x3.5x1.1mm											7-160M
X632	6.0x3.5x1.1mm (2 pads)			SMD series ordering information								8-50M
X75	7.0x5.0x1.2mm											6-160M

kHz crystals ordering information:

Package		Cal. tolerance		Temperature coefficient		Temp. range		Load (pF)		Freq.
Code	Desc.	Code	Desc.	Code	Desc. (max.)	Code	Desc.	Code	Desc.	kHz
X15	1.6x1.0x0.5mm	A	+/-10ppm	1	-0.04ppm/°C ²	A	-40°C to +85°C	xx	__pF	32.768kHz
X21	2.0x1.2x0.6mm	B	+/-15ppm	00	Customized	B	-40°C to +125°C			32.768kHz
X31	3.2x1.5x0.7mm	C	+/-20ppm			C	-55°C to +125°C			32.768kHz
X41	4.1x1.5x0.9mm	D	+/-30ppm			D*	-50°C to +170°C			32.768kHz
X130C	6.9x1.4x1.3mm	E	+/-50ppm			E*	-50°C to +250°C			32.768kHz
SX99	8.0x3.8x2.5mm	F	+/-100ppm			F*	-50°C to +320°C			30-100kHz
TB15SMX	5.0x1.5mm cylindrical	X	Customized			G*	-196°C to +170°C			30-100kHz
TB26SMD	6.0x2.0mm cylindrical					H*	-196°C to +250°C			30-100kHz
TB26	6.0x2.0mm cylindrical					K*	-196°C to +320°C			30-100kHz
TB38	8.0x3.0mm cylindrical					X	Customized			30-100kHz
TV206	6.1x2.0mm cylindrical	* Only for the type								32.768kHz



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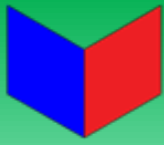
Quartz crystal resonators:

AT-cut, SC-cut and IT-cut crystal resonators with TO-5, TO-8, HC-43/U, HC-45/U, SMD6x3.5mm and SMD5x3.2mm, SMD3.2x2.5mm

Type of cut	Turn point	Typical turning point
FC	Upper	+55°C to +75°C
IT	Upper	+85°C to +105°C
SC	Lower	+60°C to +80°C
SCM1	Lower	+65°C to +85°C
SCM2	Lower	+85°C to +100°C

MODE		HOLDER				CAL. TOL.		TEMPERATURE STABILITY OR TOTAL TOLERANCE		OPERATING TEMP.		CIRCUIT CONDITION	
Code	Desc.	Code	Desc.	Code	Desc.	Code	Desc.	Code	Desc.	Code	Desc.	Code	Desc.
A	Fund.	35	HC-35/U	0	Standard	X	+/-1.5ppm	X	+/-2ppm stability	X	+15°C to +35°C	00	Series resonance
B	3 rd	36	HC-36/U	1	Surface mount	A	+/-2ppm	Y	+/-3ppm stability	Y	+10°C to +40°C	01	Parallel resonance load capacity of 100pF or more
C	5 th	37	HC-37/U	2	Surface mount	B	+/-5ppm	Z	+/-4ppm stability	Z	+5°C to +45°C		Advise actual value
D	7 th	40	HC-40/U	3	Slimline	C	+/-7ppm	B	+/-5ppm stability	A	+0°C to +50°C		
E	9 th	42	HC-42/U	4	Modified can height	D	+/-10ppm	C	+/-7ppm stability	B	-5°C to +55°C	10 to 90	Parallel resonance load capacity in pF
F	11 th	43	HC-43/U	5	Modified can height	E	+/-15ppm	D	+/-10ppm stability	D	-10°C to +60°C		
		45	HC-45/U	6	Modified can height	F	+/-20ppm	E	+/-15ppm stability	E	-15°C to +65°C	99	Calibration at reference temperature in customer's oscillator
		47	HC-47/U	7	Four point mount	G	+/-25ppm	F	+/-20ppm stability	F	-20°C to +70°C		
		48	HC-48/U	8	Modified can height	H	+/-30ppm	G	+/-25ppm stability	G	-25°C to +75°C		
		49	HC-49/U	9	Modified can height	J	+/-40ppm	H	+/-30ppm stability	H	-30°C to +80°C		
		50	HC-50/U			M	+/-50ppm	J	+/-40ppm stability	J	-40°C to +90°C		
		51	HC-51/U			K	+/-100ppm	M	+/-50ppm stability	M	-55°C to +105°C		
		52	HC-52/U					L	+/-70ppm stability	U	+50°C to +60°C oven		
		90	SM1					K	+/-100ppm stability	L	+55°C to +65°C oven		
								N	+/-150ppm stability	T	+60°C to +70°C oven		
								S	Specific curve	N	+65°C to +75°C oven		
								T	+/-20ppm (4) (B)*	P	+70°C to +80°C oven		
								U	+/-25ppm (4) (C)*	R	+75°C to +85°C oven		
								V	+/-30ppm (4) (D)*	S	+80°C to +90°C oven		
								W	+/-50ppm (4) (F)*	V	+85°C to +95°C oven		
								P	+/-100ppm (4) (H)*	W	+90°C to +100°C oven		
								R	+/-200ppm (4) (M)*	C	+95°C to +105°C oven		
								0	Turn over point in oven range	0	Not specified		
									*Corresponding calibration codes				





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Quartz oscillators:

From min. size 2x1.6mm to most of popular sizes, including gated oscillators and PLL oscillators (PLO, PLXO, FCXO)

We can offer oscillators ([including programmable oscillators and 32.768kHz oscillators](#)) in a wide range of packages and output types including HCMOS, True Sinewave, LVPECL, HCSL and LVDS



GATED OSCILLATORS FOR SECONDARY RADAR (IFF, AIR SECURITY)

Please contact us

PHASE-LOCKED CRYSTAL OSCILLATORS (PLO, PLXO, FCXO)

Pls contact us

Type	Supply voltage	Temp. range		Over temp.	Output	Freq.
SX1 = 2x1.6mm	18 = +1.8V 25 = +2.5V 28 = +2.8V 30 = +3.0V 33 = +3.3V 50 = +5V	A = -60°C	M = +60°C	20 = +/-20ppm 50 = +/-50ppm . . . xy = +/-xyppm	C = CMOS LP = LVPECL LD = LVDS HS = HCSL LE = Low EMI TS = True Sine	Pls specify
SX2 = 2.5x2mm		B = -55°C	N = +70°C			
SX3 = 3.2x2.5mm		C = -50°C	O = +80°C			
SX5 = 5x3.2mm		D = -45°C	P = +85°C			
SX7 = 7x5mm		E = -40°C	Q = +90°C			
SP2 = 14.3x8.7mm		F = -35°C	R = +100°C			
DIP08 = 12.7x12.7mm		G = -30°C	S = +105°C			
DIP14 = 20.7x13.1mm		H = -25°C	T = +125°C			
		I = -20°C	U = +150°C			
		J = -15°C	V = +175°C			
		K = -10°C	W = +200°C			
		L = 0°C	X = +225°C			



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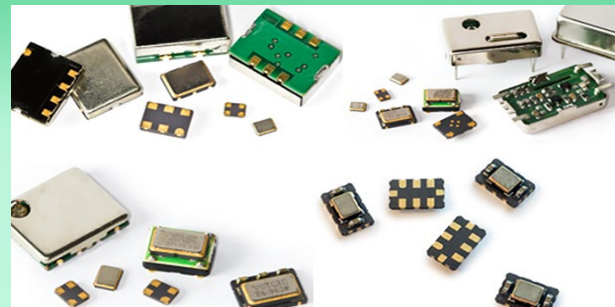
VCXO and TCXO (TCVCXO):

Our Voltage Controlled Crystal Oscillators (VCXOs) and Temperature-Compensated Crystal Oscillators (TCXOs) / TCVCXOs are produced with CMOS, LVPECL, LVDS, HCSL, CML or True Sine Wave outputs in a wide variety of packages and specifications

For quotation, pls offer below options:

Eg.: SX7-30-AP-05-E2-6P-5-C-700M

Means SMD7x5mm, +3.0V, -60C to +85C, +/-0.5ppm temp. stab., #2 pin tri-state, 6 pads, +/-5ppm pulling, CMOS output, 700M



Type	Supply voltage	Temp. range		Over temp.	Tri-state	Pads	Pulling (min.)	Output	Freq.
SX2 = 2.5x2mm SX3 = 3.2x2.5mm SX5 = 5x3.2mm SX7 = 7x5mm SP2 = 14.3x8.7mm DIP08 = 12.7x12.7mm DIP14 = 20.7x13.1mm SX2KTF = 2.15x1.35mm SX3KTF = 3.28x2.5mm	18 = +1.8V 25 = +2.5V 28 = +2.8V 30 = +3.0V 33 = +3.3V 50 = +5.0V	A = -60°C B = -55°C C = -50°C D = -45°C E = -40°C F = -35°C G = -30°C H = -25°C I = -20°C J = -15°C K = -10°C L = 0°C	M = +60°C N = +70°C O = +80°C P = +85°C Q = +90°C R = +100°C S = +105°C T = +125°C U = +150°C V = +175°C W = +200°C X = +225°C	05 = +/-0.5ppm 2 = +/-2ppm 20 = +/-20ppm 50 = +/-50ppm . . . xy = +/-xyppm	E1 = #1 tri-state E2 = #2 tri-state F = None	4P = 4 pads 6P = 6 pads	5 = +/-5ppm 50 = +/-50ppm 100 = +/-100ppm . . . xy = +/-xyppm	C = CMOS LP = LVPECL LD = LVDS HS = HCSL TS = True Sine CL = CML	Pls specify



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OCXO (2-1):

We can offer high stability and low phase noise
OCXO with low cost



For below OCXOs, pls contact us

- 1) Vibration insensitive oscillators (Vibration isolated)
- 2) Oscillators for aerospace & defence
- 3) Oscillators for space
- 4) Oscillator modules for aerospace & defence
- 5) Phase-locked oscillator modules
- 6) GHz crystal-controlled sources
- 7) Gated crystal oscillators for IFF
- 8) Masterclocks
- 9) Ultra-low phase noise oscillators

General Standard OCXOs

Type	Size (mm)	Aging	Phase noise (@ 1kHz)	Temp. range	Temp. stab.	Typical freq.
H55A	50.8x50.8x19	+/-0.05ppb/day +/-0.01ppm/year	-150dBc/Hz	-40°C to +85°C	+/-0.01ppb	10M
H23B	36x27x12.7	+/-0.2ppb/day +/-0.02ppm/year	-150dBc/Hz	-40°C to +85°C	+/-0.1ppb	10M
H22S	25x22x12 (SMD)	+/-0.5ppb/day +/-0.05ppm/year	-158dBc/Hz	-40°C to +85°C	+/-0.5ppb	10M
H11F	14.4x9.5x6.5 (SMD)	+/-1ppb/day +/-0.1ppm/year	-160dBc/Hz	-55°C to +95°C	+/-1.0ppb	10M, 12.8M, 19.2M, 20M, 38.88M
H79A	9.7x7.5x3.9 (SMD)	+/-1ppb/day +/-0.1ppm/year	-160dBc/Hz	-55°C to +95°C	+/-10ppb	10M, 19.2M, 20M, 25.6M, 38.88M
			-143dBc/Hz	-55°C to +85°C	+/-100ppb	100M
H75A	7.5x5.5x3.3 (SMD)	+/-1ppb/day +/-0.3ppm/year	-160dBc/Hz	-55°C to +95°C	+/-20ppb	10M, 12.8M, 19.2M, 20M, 38.88M
H22B	25.4x25.4x12.7 (SMD)	+/-1ppb/day +/-0.1ppm/year	-165dBc/Hz	-40°C to +85°C	+/-50ppb	100M



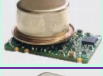
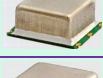
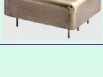
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OCXO (2-2):

We can offer high stability and low phase noise
OCXO with low cost



IHRT (Internal Heating Resonator Technology) OCXO

Type	Package (LxW)		Supply voltage	Temp. range		Over temp.	Aging (day/year)	Output	Freq.
M78	16x15.3mm		33 = +3.3V 50 = +5.0V 12 = +12V	A = -60°C B = -55°C C = -50°C D = -45°C E = -40°C F = -35°C G = -30°C H = -25°C I = -20°C J = -15°C K = -10°C L = 0°C	M = +60°C N = +70°C O = +80°C P = +85°C Q = +90°C R = +100°C S = +105°C T = +125°C U = +150°C V = +175°C W = +200°C X = +225°C	10 = +/-1E-10ppb 39 = +/-3E-9ppb 28 = +/-2E-8ppb . . . XY = +/-XE-Yppb	A = 0.1ppb / 0.01ppm B = 0.2ppb / 0.02ppm C = 0.3ppb / 0.03ppm D = 0.5ppb / 0.05ppm E = 1ppb / 0.1ppm F = 1.5ppb / 0.15ppm G = 2ppb / 0.2ppm H = 3ppb / 0.3ppm	C = CMOS S = Sine wave	Pls specify
M78S	16x15.3mm								
M714	21.6x15.3mm								
M714S	20.9x15.3mm								
MR	20.2x20.2								
MS	25.4x22								
MI	25.8x25.8								
ME	35.4x26.7								



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Crystal filters (2-1):

We can offer discrete crystal filter (DCF) and monolithic crystal filter (MCF) with customized specifications



1). Standard crystal filters

Including discrete crystal filter (DCF) and monolithic crystal filter (MCF)

Type (LxW)	Poles	Temp. range		Insertion Loss (dB)	Ripple (dB)	3dB bandwidth (+/-kHz)	Stop band		Freq.
							dB	+/-kHz	
S3 = 3.2x2.5mm S5 = 5x3.2mm S7 = 7x5mm U1 = UM-1 U5 = UM-5 H49 = HC-49/U T2 = 11.2x8.7mm T3 = 14x8.7mm T5 = 18.5x12mm T13 = 25.1x14.1mm T17 = 38.4x18.2mm T20 = 36.1x27.2mm	2 = 2 poles 4 = 4 poles 6 = 6 poles 8 = 8 poles 10 = 10 poles	A = -60°C B = -55°C C = -50°C D = -45°C E = -40°C F = -35°C G = -30°C H = -25°C I = -20°C J = -15°C K = -10°C L = 0°C	M = +60°C N = +70°C O = +80°C P = +85°C Q = +90°C R = +100°C S = +105°C T = +125°C U = +150°C V = +175°C W = +200°C X = +225°C	Pls specify	Pls specify	Pls specify	Pls specify	Pls specify	Pls specify



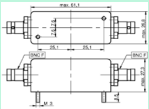
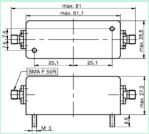
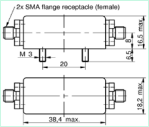
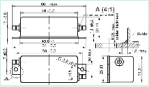
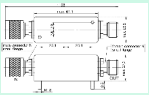
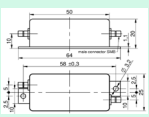
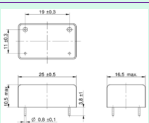
NANOSTONE PTE. LTD.

Crystal filters (2-2):

We can offer discrete crystal filter (DCF) and monolithic crystal filter (MCF) with customized specifications



2). Front-end crystal filters (Antenna filters)

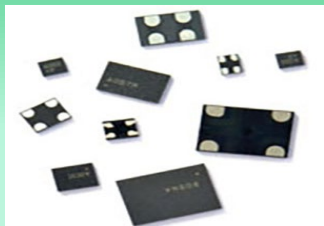
Type (LxWxH) / Drawing	Poles	Temp. range	Insertion Loss (dB)	Ripple (dB)	3dB bandwidth (+/-kHz)	Stop band		Freq.
						dB	+/-kHz	
KA2 = 61.1x26.8x27.3mm 	2 = 2 poles 4 = 4 poles 6 = 6 poles 8 = 8 poles 10 = 10 poles	A = -60°C B = -55°C C = -50°C D = -45°C E = -40°C F = -35°C G = -30°C H = -25°C I = -20°C J = -15°C K = -10°C L = 0°C M = +60°C N = +70°C O = +80°C P = +85°C Q = +90°C R = +100°C S = +105°C T = +125°C U = +150°C V = +175°C W = +200°C X = +225°C	Pls specify	Pls specify	Pls specify	Pls specify	Pls specify	Pls specify
KA3 = 81x26.8x27.3mm 			Pls specify	Pls specify	Pls specify	Pls specify	Pls specify	Pls specify
KA5 = 38.4*18.2x16.5mm 			Pls specify	Pls specify	Pls specify	Pls specify	Pls specify	Pls specify
KA7 = 66x25x11mm 			Pls specify	Pls specify	Pls specify	Pls specify	Pls specify	Pls specify
KA41 = 108x26.8x27.3mm 			Pls specify	Pls specify	Pls specify	Pls specify	Pls specify	Pls specify
KA72 = 64x25x20mm 			Pls specify	Pls specify	Pls specify	Pls specify	Pls specify	Pls specify
KF15 = 25x16.5x10.5mm 			Pls specify	Pls specify	Pls specify	Pls specify	Pls specify	Pls specify



NANOSTONE PTE. LTD.

MEMS oscillators:

We can provide a wide range of packages and supply voltages, frequencies between 1.0M and 137M. They are a perfect fit for high shock applications. Delivery times are 1-2 weeks



For quotation, pls offer below options:

Type	Supply voltage	Temp. range		Over temp.	Tri-state	Output	Freq.
MX1 = 2x1.6mm MX2 = 2.5x2mm MX3 = 3.2x2.5mm MX5 = 5x3.2mm MX7 = 7x5mm	18 = +1.8V 25 = +2.5V 28 = +2.8V 30 = +3.0V 33 = +3.3V	A = -60°C	M = +60°C	20 = +/-20ppm 50 = +/-50ppm . . . xy = +/-xyppm	E = Tri-state enable B = Tri-state power down F = None	15 = 15pF H > 15pF, pls specify	Pls specify
		B = -55°C	N = +70°C				
		C = -50°C	O = +80°C				
		D = -45°C	P = +85°C				
		E = -40°C	Q = +90°C				
		F = -35°C	R = +100°C				
	1V3 = +1.8V to +3.3V 2V3 = +2.5V to +3.3V	G = -30°C	S = +105°C				
		H = -25°C	T = +125°C				
		I = -20°C	U = +150°C				
		J = -15°C	V = +175°C				
		K = -10°C	W = +200°C				
		L = 0°C	X = +225°C				



NANOSTONE PTE. LTD.

Piezo sensors:

Quartz crystal microbalances (QCM) and Quartz crystal sensors (QCS)

Quartz crystal microbalances (QCM)

Type	Size (mm)	Electrode A (plano side)		Electrode B		Shape	Surface	Cut	Nominal freq.	Adjustment freq.
		Material	From	Material	From					
QCM4	φ12.45	Cr-Au	FP	Cr-Au Cr-Au-Cr Cr-Au-Ti	FP	PC+BEV	L	AT	4M	Pls specify
QCM5	φ13.97 φ12.45	Cr-Au Ag-Al Cr-Ag Ni-Ag	FP	Cr-Au Ag-Al Ti Ni-Ag Cr-Ag	DA FP SA	PC	L	AT	5M	Pls specify
QCM6	φ13.97	Cr-Au Cr-Al Ni-Ag Ag-Al Cr-Ag Al Ag-Al-Ti	FP	Cr-Au Ni-Ag Ag-Al Cr-Au Ti Al Ag-Al-Ti	DA SA FP	PC	L	AT SC	6M	Pls specify

Quartz crystal sensors (QCS)

Type	Size (mm)	Electrode A (plano side)		Electrode B		Shape	Surface	Cut	Nominal freq.	Adjustment freq.
		Material	From	Material	From					
QCS1	φ25.4	Cr-Au	FP DA KH None	Cr-Au	KH SA FP DA None	PP PP+BEV PC P+BEV BC	P L None	AT AT, 3rd	1M	1M
QCS3	φ13.69x13.44	Ti-Au		Ti-Au					3M	3M
QCS4	φ13.97	Ni-Ag		Cr-Au-Fe					4M	4M
	φ13.97x13.77	Ag-Al		Cr-Au-Ni						
QCS5	φ8.7	Al		Cr-Au-SiO ₂					5M	Pls specify
	φ13.69	Cr-Au-Fe		Ti						
QCS6	φ13.69x13.44	Ti-Au-TiO ₂		Ti-Au-Fe					6M	Pls specify
	φ14.0x13.75	Ti		Ti-Au-Zn						
QCS7	φ14.0x13.7	Cu		Ti-Au-SiO ₂					7M	Pls specify
	φ12.0x11.3	Ti-Au-graphite		Ti-Au-TiO ₂						
QCS8	φ12.0x11.7	Cr-Au-Cr-Ag		Cr-Au-Mo					8M	Pls specify
	φ8.0	Ti-Au-Zn		Ni-Ag						
QCS9	7.9x7.9	Ti-Au-Mo		Ti-Ag					9M	Pls specify
	φ8.5	Ti-Au-SiO ₂		Ni-Ag						
QCS10	φ14.0	Ti-Au-Ti		Cr-Au-Cr-Ag					10M	Pls specify
	φ10.0x9.7	Ti-Ni-Au		Ti-Ni-Au						
QCS14		Cr-Ag		Cr-Ag					14M	Pls specify
		Ti-Au-Fe		Ti-Au-graphite						
		None		Ti-Au-Ti						



Notes: Caption:

Electrode Style	Blank Shape				Blank Surface	
	DA = Double Anchor FP = Fully Plated SA = Single Anchor KH = Key Hole	BEV = Bevelled BC = Bi-Convex PC = Plano-Convex PP = Plano-Plano			L = Lapped P = Polished	



NANOSTONE PTE. LTD.

LGS sensors and GaPO₄ sensors:

We can offer 5M, 10M, 5.8M and 5.6M with $\phi 10$ and $\phi 13.97$ sizes



High-temperature sensors (LGS and GaPO₄ sensors)

Type	Size (mm)	Electrode A (plano side)		Electrode B		Shape	Surface	Cut	Nominal freq.	Adjustment freq.
		Material	From	Material	From					
HCM5	$\phi 10 \times 9.9$	Cr-Au	KH FP	Cr-Au	KH	PP PP+BEV	P	LGS Y	5M	5M
HCM6	$\phi 13.97$	Cr-Au	FP	Cr-Au	DA SA	PC	L	LGS Y LGS Y-16°	6M	Pls specify
HCM10	$\phi 10.0$	Cr-Au	KH	Cr-Au	KH	PP	L	LGS	10M	10M
HCM58	$\phi 13.97$	Ni-Cr-Au	FP	Ni-Cr-Au	DA	PC	L	GaPO ₄ Y-12°	5.8M	5.8M
HCM56	$\phi 13.97$	Pt	FP	Pt	DA	PC	L	GaPO ₄ Y-12° GaPO ₄ Y-11.1°	5.6M	5.6M

Note: Caption:

Electrode Style	Blank Shape	Blank Surface
DA = Double Anchor	BEV = Bevelled	L = Lapped
FP = Fully Plated	BC = Bi-Convex	P = Polished
SA = Single Anchor	PC = Plano-Convex	
KH = Key Hole	PP = Plano-Plano	



NANOSTONE PTE. LTD.

Frequency Reference Units (3-1):

1). OCXO frequency references

Model	Freq. stab.			Phase noise		Standard parameters
		SO	DO	LN	ULN	
AXIOM9000	Initial tol. @ delivery	< ±10ppb	< ±10ppb	-100dBc/Hz @ 1Hz	-108dBc/Hz @ 1Hz	10M, Sine wave, AC 230V Output ports: 1 OCXO direct output, 3 splitted outputs Short-term stability: 2E-12/s Temp. range: -10°C to +60°C Size: 483x250x44mm (Slim 19" rack with 1HU)
	Temp. stab.	< ±2ppb	< ±0.1ppb	-130dBc/Hz @ 10Hz	-138dBc/Hz @ 10Hz	
	Daily aging	< ±0.5ppb	< ±0.1ppb	-145dBc/Hz @ 100Hz	-155dBc/Hz @ 100Hz	
	Yearly aging	< ±50ppb	< ±20ppb	-150dBc/Hz @ 1kHz	-163dBc/Hz @ 1kHz	
				-160dBc/Hz @ 10kHz	-170dBc/Hz @ 10kHz	
AXIOM9000	Initial tol. @ delivery	< ±10ppb	< ±10ppb	-100dBc/Hz @ 1Hz	-108dBc/Hz @ 1Hz	10M, Sine wave, AC 230V Output ports: 4, 8, 16 (Pls specify) Short-term stability: 2E-12/s Temp. range: -10°C to +60°C Size: 483x250x44mm (Slim 19" rack with 1HU)
	Temp. stab.	< ±2ppb	< ±0.1ppb	-130dBc/Hz @ 10Hz	-138dBc/Hz @ 10Hz	
	Daily aging	< ±0.5ppb	< ±0.1ppb	-145dBc/Hz @ 100Hz	-148dBc/Hz @ 100Hz	
	Yearly aging	< ±50ppb	< ±20ppb	-150dBc/Hz @ 1kHz	-158dBc/Hz @ 1kHz	
				-155dBc/Hz @ 10kHz	-163dBc/Hz @ 10kHz	
				-160dBc/Hz @ >= 100kHz	-170dBc/Hz @ >= 100kHz	
				-160dBc/Hz @ >= 100kHz	-170dBc/Hz @ >= 100kHz	

2). Miniature atomic clock

Type	Supply voltage	Temp. range		Short-term stability	Long-term stability	Phase noise	Other parameters
TA4135 (41x35x11.5mm)	33 = +3.3V	B = -55°C C = -50°C D = -45°C E = -40°C	J = -15°C K = -10°C L = 0°C M = +60°C	<= 3.0E-10/1s <= 1.0E-10/10s <= 3.0E-11/100s	<= 9E-10/month	<= -70dBc/Hz @ 10Hz <= -113dBc/Hz @ 100Hz <= -128dBc/Hz @ 1kHz <= -135dBc/Hz @ 10kHz	10M, CMOS (Sine optional) MTBF > 100k hours Temp. stab. <= 5E-10
TA4536 (45x36x13.5mm)	33 = +3.3V	F = -35°C G = -30°C H = -25°C I = -20°C	N = +70°C O = +80°C P = +85°C Q = +90°C	<= 3.0E-10/1s <= 1.0E-10/10s <= 3.0E-11/100s	<= 9E-10/month	<= -100dBc/Hz @ 10Hz <= -125dBc/Hz @ 100Hz <= -140dBc/Hz @ 1kHz <= -145dBc/Hz @ 10kHz	10M, CMOS (LVCMOS optional) MTBF > 100k hours Temp. stab. <= 1E-9



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Frequency Reference Units (3-2):

3). Rubidium atomic clocks

Type	Supply voltage	Temp. range		Temp. stab.	Short-term stability	Phase noise	Other parameters
R89 (89x76x28mm)	12 = +12V	B = -55°C	J = -15°C	+/-0.60ppb	<= 3.0E-11/1s <= 1.0E-11/10s <= 3.0E-12/100s	<= -100dBc/Hz @ 10Hz <= -130dBc/Hz @ 100Hz <= -140dBc/Hz @ 1kHz	10M, Sinewave RF output 1PPS output: LVCMOS 9-Pin D-Sub male with jack posts
R55 (50.8x50.8x25mm)	12 = +12V	C = -50°C D = -45°C E = -40°C	K = -10°C L = 0°C M = +60°C	+/-0.60ppb	<= 5.0E-11/1s <= 2.0E-11/10s <= 5.0E-12/100s	<= -95dBc/Hz @ 10Hz <= -125dBc/Hz @ 100Hz <= -135dBc/Hz @ 1kHz	10M, Sinewave RF output
AXRB9000 (Slim 19" rack with 1HU)	AC 230V	F = -35°C G = -30°C H = -25°C I = -20°C	N = +70°C O = +80°C P = +85°C Q = +90°C	+/-0.30ppb	<= 1.0E-11/1s <= 5.0E-12/10s <= 1.0E-12/100s	<= -100dBc/Hz @ 1Hz <= -140dBc/Hz @ 10Hz <= -160dBc/Hz @ 100Hz <= -165dBc/Hz @ 1kHz <= -170dBc/Hz >= 10kHz	10M, Sinewave RF output RF output RF1: Sinewave RF output RF2: HCMOS/TTL RF connectors: BNC female Communication connector: 9-Pin D-Sub male with jack posts

4). Cesium atomic clocks

		Standard Version	High Performance Version
Frequency accuracy		+/-1E-12	+/-5E-13
Frequency deviation over full operating conditions: -5°C to +55°C		+/-2E-12	+/-1E-12
Short term stability (ADEV)	1s	2E-11	5E-12
	10s	2E-11	2.7E-12
	100s	5E-12	8.5E-13
	1,000s	1.5E-12	2.7E-13
	10,000s	5E-13	8.5E-14
	100,000s	3E-13	2.7E-14
	Floor	3E-13	2E-14
Frequency		10MHz with BNC connector	
Output phase noise	■ 1Hz offset	-90dBc/Hz	
	■ 10Hz offset	-120dBc/Hz	
	■ 100Hz offset	-135dBc/Hz	
	■ 1kHz offset	-145dBc/Hz	
	■ 10kHz offset	-145dBc/Hz	
	■ 100kHz offset	-145dBc/Hz	
Programmable auxiliary output		1M / 5M / 10MHz	
DC power input		48V DC nominal floating (24V to 60V)	
AC power input		90V to 260V AC	
Size	133x535x270mm (5.24"x19"x10.63") 3U 19" mounting and ETSI		



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Frequency Reference Units (3-3):

5). GPS-disciplined oscillators

Type	Temp. range		Freq. stab.	Short-term stability	Phase noise	Other parameters
AXGPS5050	B = -55°C	J = -15°C	Tracking accuracy (GPS locked): 2E-13 Holdover stability over 24 hours: 1E-11	$\leq 1.0\text{E-}11/1\text{s-}100\text{s}$ $\leq 6.0\text{E-}12/1\text{ks}$ $\leq 1.0\text{E-}12/10\text{ks}$ $\leq 1.0\text{E-}13/100\text{ks}$	$\leq -100\text{dBc/Hz @ } 1\text{Hz}$ $\leq -130\text{dBc/Hz @ } 10\text{Hz}$ $\leq -150\text{dBc/Hz @ } 100\text{Hz}$ $\leq -155\text{dBc/Hz @ } 1\text{kHz}$ $\leq -155\text{dBc/Hz @ } 10\text{kHz}$	RF1 output: 10M Sinewave RF2 output: 1PPS, LVCMOS +12V supply GPS input: 1575.42MHz Size: 50x50x25mm max.
AXGPS9000 (483x250x44mm)	C = -50°C D = -45°C E = -40°C F = -35°C G = -30°C	K = -10°C L = 0°C M = +60°C N = +70°C O = +80°C	Tracking accuracy (GPS locked): 2E-13 Holdover stability over 24 hours: 1E-11	$\leq 1.0\text{E-}11/1\text{s-}100\text{s}$ $\leq 6.0\text{E-}12/1\text{ks}$ $\leq 1.0\text{E-}12/10\text{ks}$ $\leq 1.0\text{E-}13/100\text{ks}$	$\leq -108\text{dBc/Hz @ } 1\text{Hz}$ $\leq -138\text{dBc/Hz @ } 10\text{Hz}$ $\leq -155\text{dBc/Hz @ } 100\text{Hz}$ $\leq -165\text{dBc/Hz @ } 1\text{kHz}$ $\leq -170\text{dBc/Hz @ } 10\text{kHz}$	RF output RF1: Sinewave RF output RF2: Square wave / TTL GPS input: 1575.42MHz AC 230V supply Slim 19" rack with 1HU
AXGPS9000RB (483x250x44mm)	H = -25°C I = -20°C	P = +85°C Q = +90°C	Tracking accuracy (GPS locked): 2E-13 Holdover stability over 24 hours: 1E-12	$\leq 1.0\text{E-}11/1\text{s}$ $\leq 4.0\text{E-}12/10\text{s}$ $\leq 1.0\text{E-}12/100\text{s}$ $\leq 1.0\text{E-}12/1\text{ks}$ $\leq 7.0\text{E-}13/10\text{ks}$ $\leq 1.0\text{E-}13/100\text{ks}$	$\leq -108\text{dBc/Hz @ } 1\text{Hz}$ $\leq -138\text{dBc/Hz @ } 10\text{Hz}$ $\leq -155\text{dBc/Hz @ } 100\text{Hz}$ $\leq -165\text{dBc/Hz @ } 1\text{kHz}$ $\leq -170\text{dBc/Hz @ } 10\text{kHz}$	RF output RF1: Sinewave RF output RF2: HCMOS/TTL GPS input: 1575.42MHz AC 230V supply Slim 19" rack with 1HU

6). Distribution amplifiers

Type	Temp. range		Residual inter-channel stab. @ 10M	Residual phase noise @ 10M	Other parameters
AXDA9000 (483x250x44mm)	B = -55°C C = -50°C D = -45°C E = -40°C F = -35°C G = -30°C H = -25°C I = -20°C	J = -15°C K = -10°C L = 0°C M = +60°C N = +70°C O = +80°C P = +85°C Q = +90°C	5E-14 @ 1s 7E-15 @ 10s 5E-15 @ 100s 2E-15 @ 1000s 2E-16 @ 10,000s	$\leq -145\text{dBc/Hz @ } 10\text{Hz}$ $\leq -155\text{dBc/Hz @ } 100\text{Hz}$ $\leq -160\text{dBc/Hz @ } 1\text{kHz}$ $\leq -165\text{dBc/Hz @ } \geq 10\text{kHz}$	Frequencies: 5M, 10M or 100M Output: Sinewave RF output ports: 8 or 16 AC 230V supply Slim 19" rack with 1HU



NANOSTONE PTE. LTD.

Frequency sources/standard (1U and 2U):

- ❖ Universal low phase noise frequency source: Adopting direct digital frequency synthesizer technology, providing users with 1M~50G arbitrary frequency signals with additional frequency stability better than $2\text{E-}13/\text{s}$. The frequency adjustment resolution of this device is $\leq 1\mu\text{Hz}$, which can facilitate users to quickly output various frequency signals. It is an AOM, EOM preferred
- ❖ Multi channel low noise signal source: Supports any frequency output from 200M to 20G, and can provide 4 independent outputs, with a frequency accuracy of $\leq \pm 1\text{M}$ and a power stability of $< 0.1\text{dB}$

Input: 10MHz; Supply voltage: 220VAC; Size: 2U; SMA-K Output: 1MHz-50GHz		
	5M output	10M output
Short-term stability (Typ.)	1.5E-13 per 1s 2.8E-14 per 10s 5.9E-15 per 100s	1.0E-13 per 1s 2.3E-14 per 10s 5.0E-15 per 100s
Residual phase noise (Typ.)	-135dBc/Hz @ 10Hz -147dBc/Hz @ 100Hz -154dBc/Hz @ 1kHz -160dBc/Hz @ 10kHz	-130dBc/Hz @ 10Hz -142dBc/Hz @ 100Hz -150dBc/Hz @ 1kHz -155dBc/Hz @ 10kHz



Signal source	Frequency	0.2MHz to 20GHz
	Output channels	4 channels
	Frequency tolerance	$\leq \pm 1\text{kHz}$
	Phase noise @ 10GHz	$\leq -106\text{dBc/Hz @ } 1\text{kHz}$ $\leq -120\text{dBc/Hz @ } 10\text{kHz}$
Clock input	Frequency	10M
	Phase noise	$\leq -155\text{dBc/Hz @ } 1\text{kHz}$
Synchronous clock input	Frequency	3600M
	Phase noise	$\leq -126\text{dBc/Hz @ } 1\text{kHz}$
Clock output	Frequency	100M
	Phase noise	$\leq -155\text{dBc/Hz @ } 1\text{kHz}$
Synchronous clock output	Frequency	3600M
	Phase noise	$\leq -126\text{dBc/Hz @ } 1\text{kHz}$
Size	1U with SMA output and RJ-45 network port	



NANOSTONE PTE. LTD.

VCO (Voltage Control Oscillator):

The frequency covers 10M~5000M, with Low phase noise, low voltage, low power consumption, the output frequency and other indicators can be customized on demand; It can be used for various types of equipment such as communication equipment, aerospace and instrumentation

SMD7x5mm

Type	F min. (MHz)	F max. (MHz)	VC min. (V)	VC max. (V)	Output (dBm)	Phase noise dBc/Hz @ 10kHz
270M356M	270	356	0.5	6	5	-129
358M380M	358	380	0.5	3	7	-133
374M391M	374	391	0.5	3	8	-132
415M425M	415	425	0.5	3	4	-130
435M440M	435	440	0.5	3	4	-130
600M01G2	600	1235	1	13	9	-100
750M01G3	750	1300	0.5	10	7	-99
800M01G6	800	1600	0	6	6	-97
900M01G1	900	1100	1	11	4	-105
01G001G3	1000	1300	0	13	0	-105
01G401G8	1400	1850	0	9	9	-98
01G602G1	1600	2100	1	14	11	-98
01G702G0	1750	2033	1	22	0	-100
01G802G4	1829	2393	2	24	0	-100
01G902G5	1900	2500	0	15	0	-95
01G902G3	1950	2350	0	9	9	-95
02G002G8	2050	2750	0	10	9	-98
02G30400	2300	2400	0.5	4.5	0	-95
02G403G0	2400	3000	1	12	7	-95
02G403G4	2400	3400	1	15	3	-95
03G003G5	3000	3500	2	12	0	-99
03G203G8	3200	3800	0.2	13.8	0	-98
04G104G7	4130	4730	0.2	7	0	-88
04G405G0	4400	5000	0.2	6	0	-88
04G905G6	4900	5600	0	22	0	-10

SMD12.7x12.7mm

Type	F min. (MHz)	F max. (MHz)	VC min. (V)	VC max. (V)	Output (dBm)	Phase noise dBc/Hz @ 10kHz
140M265M	140	265	1	15	10	-100
200M240M	200	240	0.5	6	9	-199
300M400M	300	400	1	15	10	-100
325M775M	325	775	0	12	7	-102
400M500M	400	500	0.5	4.5	5	-107
400M800M	400	800	0.4	4.6	0	-99
460M920M	460	920	2	13	10	-100
600M01G2	600	1235	1	13	11	-100
750M01G3	750	1300	0.5	10	7	-99
800M01G6	800	1600	0	6	6	-97
900M01G1	900	1100	1	11	4	-105
01G001G3	1000	1300	0	13	0	-105
01G401G8	1400	1850	0	9	9	-98
01G602G1	1600	2100	1	14	11	-98
01G702G1	1750	2033	1	22	0	-100
01G802G3	1829	2393	2	24	0	-100
01G902G5	1900	2500	0	15	0	-95
01G902G3	1950	2350	0	9	9	-95
02G002G7	2050	2750	0	10	9	-98
02G302G4	2300	2400	0.5	4.5	0	-95
02G403G0	2400	3000	1	12	7	-95
02G403G4	2400	3400	1	15	3	-95
03G03G50	3000	3500	2	12	0	-99
03G203G8	3200	3800	0.2	13.8	0	-98
04G104G7	4130	4730	0.2	7	0	-88
04G405G0	4400	5000	0.2	6	0	-88
05G205G3	5220	5280	0	3	0	-85



CRYSTAL/OSCILLATOR PRODUCTION LINES



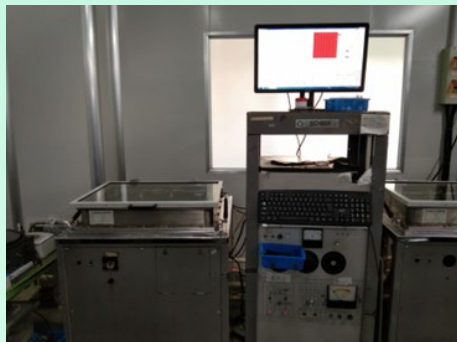
Blank processing



Vapor plating process



Die bonding process



Frequency adjusting process



Welding process



Testing instrument (350D)



Temperature cycle test(2200)



OCXO PRODUCTION LINES (1)



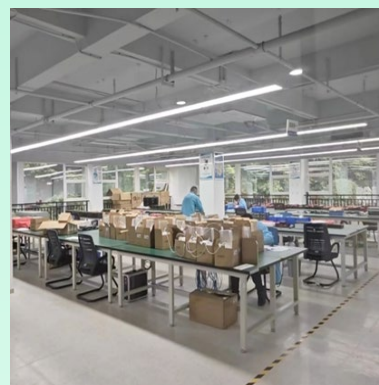
R&D area



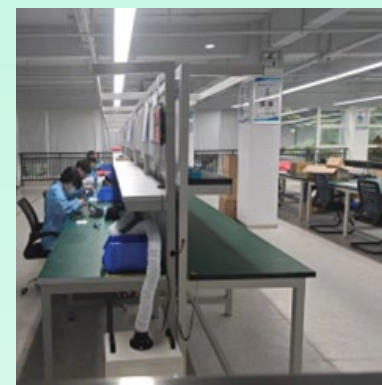
Production test area



Assembly and marking area



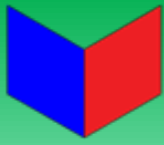
Quality inspection and control area





Key instruments

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