

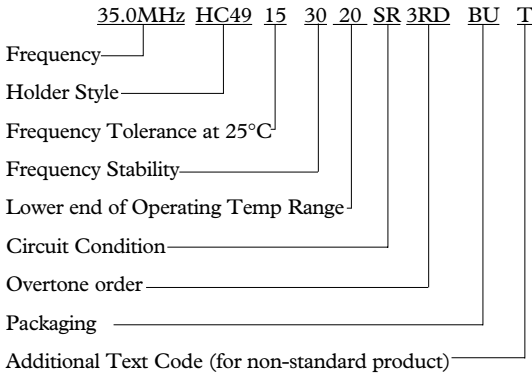
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QUARTZ
CRYSTALS

SPECIFYING QUARTZ CRYSTALS

A typical quartz crystal specification reads like this:



The following notes define each element of the specification.

Frequency

Frequency is normally specified in kilohertz (kHz) up to 999.999kHz and in megahertz (MHz) from 1.0MHz. All our computer-generated transaction documents follow this standard convention automatically.

The frequency should be given to seven significant figures. If seven significant figures are not used, any figure that might follow those given will be taken as zero. Thus a frequency given as 16.6MHz will be taken as 16.60, not 16.66667.

Some specifiers extend the use of kHz to all crystals operating in fundamental mode, reserving MHz for overtones. To minimise the possibility of misunderstanding it is best to use the standard method and specify the mode.

Holder Style

Before manufacture of the crystal can start, the holder style must be defined. If the holder size is not known or it is unimportant, we will supply the holder normally adopted for the frequency specified, such as HC49 for the majority of microprocessor applications. The holder information should also cover any mechanical variant required such as a top wire or cropped leads. The following variants for example are available for most crystals, either singly or in some cases, in combination:

- 3 lead base
- Top wire
- Insulating sleeve
- Taped and reeled
- Fitted insulator
- Cropped leads
- Formed leads

Frequency Tolerance

The cost of manufacture depends partly on the accuracy required at the reference temperature (which in the case of the AT-cut crystal, is usually 25°C).

Where high initial accuracy is important the additional manufacturing cost should be weighed against the cost of including a frequency trimming facility within the oscillator.

Frequency Stability

Frequency stability is normally specified as a frequency tolerance over a defined operating temperature range with respect to the frequency at reference temperature. The temperature ranges are defined for each crystal in the relevant data sheet. However the majority of crystals will continue to operate quite satisfactorily outside the temperature range for which they are specified, but with a possible degradation of their frequency stability.

Generalised frequency vs temperature curves for the AT-cut crystal types are illustrated in the following pages. These indicate that, without compensation, a crystal specified for operation over a wide frequency range will probably have an inferior performance over a narrower range than one whose design was optimised for the narrower range. The angle of cut of the quartz blank from its quartz stone determines which curve will be followed; the chosen angle being subject to its own tolerance. Thus, since manufacturing cost is tolerance-dependent it is wise not to specify a wider operating temperature range than is actually needed unless some sacrifice of stability, or an increase in cost, can be accepted.

Standard Frequency Tolerances and Stabilities

- $\pm 5\text{ppm}$, $\pm 10\text{ppm}$, $\pm 15\text{ppm}$, $\pm 20\text{ppm}$, $\pm 30\text{ppm}$, $\pm 50\text{ppm}$, $\pm 100\text{ppm}$

Operating Temperature Ranges

- 0 to 50°C -40 to 90°C
-10 to 60°C -55 to 105°C
-20 to 70°C -55 to 125°C
-30 to 80°C

When the required temperature range is symmetrical about 25°C, it is indicated in the specification by the lower figure, ie: -20 to 70°C would read '20' as shown in the example. If the required temperature range is not symmetrical about 25°C, both figures are used, ie: -55 to 85°C and appear in the additional text code section (T).

Circuit condition

The characters 'SR' are used to denote calibration of the crystal at series resonance. If it is to be calibrated at load resonance the characters represent the circuit load capacitance in pF.

Packaging Codes

Tape & Reel packaging is available as an option on many of the products outlined in the Quartz Crystal chapter.

Unless individual datasheets state Tape and Reel packaging, items will be Bulk packed. Please note: only complete Reels are sold.

- BU = Bulk packed
- TR = Tape & Reel packed

Additional Text Code

If the product is non-standard, the letter ‘T’ will appear at the end of the product specification. This refers to additional text on the quotation/sales order to identify the special requirements.

Outline Drawings

Dimensions on the crystal outline drawings are shown only as a guide. Precise dimensions of crystal holders are available from our Engineering Department upon request. All dimensions are shown in mm (& inches) and are nominal unless otherwise stated. All outlines are at a scale of 1:1 unless otherwise specified.

Marking

Product will be indelibly marked as detailed in the individual data sheets. Where space is limited some or all of the information will be omitted or truncated at CFP’s discretion. Full product details will be found on the individual batch packaging.

Delivery Options

The following Express delivery options are available for certain crystals; timescales refer to despatch from our factories.

- 3 working days (Express service)
- 5 working days (Express service)
- 7 working days (Express service)
- 10 working days (Express service)

Prices for larger quantities and longer delivery times are generally lower due to substantially reduced manufacturing costs. Please refer to individual datasheets for further information.

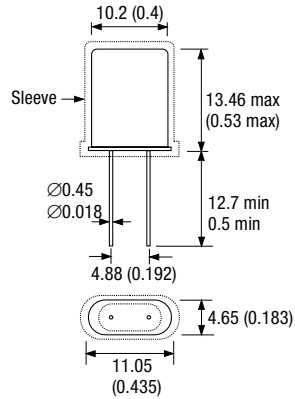
Ordering Information

- See individual datasheet

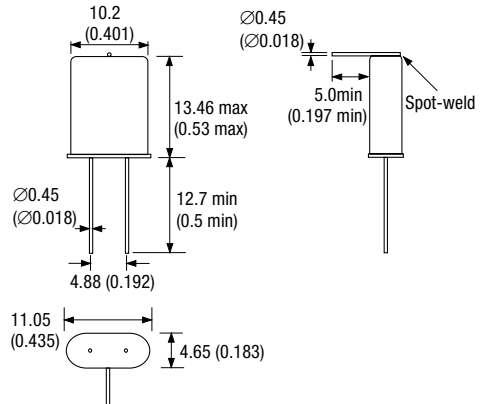
Stability Conversion Chart

10 ^x	PPM	%
10 ⁻³	1000	0.1
10 ⁻⁴	100	0.01
10 ⁻⁵	10	0.001
10 ⁻⁶	1	0.0001
10 ⁻⁷	0.1	0.00001
10 ⁻⁸	0.01	0.000001
10 ⁻⁹	0.001	0.0000001
10 ⁻¹⁰	0.0001	0.00000001

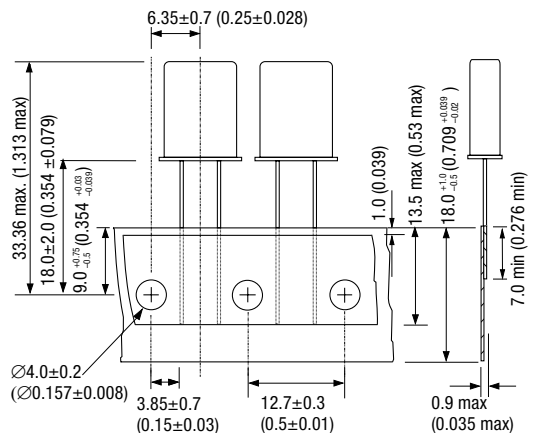
Outline in mm (inches)- Insulated Sleeve HC49 & HC43



Outline in mm (inches)- HC49 with Top Wire



Outline in mm (inches)- Tape for HC49



STOCK QUARTZ CRYSTALS

Minimum Order Information Required

- Stock Number

WATCH CRYSTALS

Frequency	Holder	Specification	Stock No.
32.7680kHz	3x8mm	20/-/12.5	A103A
32.7680kHz	3x8mm	15/-/12.5	A103B
32.7680kHz	2x6mm	20/-/12.5	A103C
40.0kHz	3x8mm	100/-/12.5	A109C

CX CRYSTALS

Frequency	Holder	Specification	Stock No.
32.7680kHz	CX-1V	30/-/40/9	C513A

HC49/4H CRYSTALS

Frequency	Holder	Specification	Stock No.
3.27680MHz	HC49/4H	30/50/10/12	A118C
3.579545MHz	HC49/4H	30/50/20/20	A119K
3.68640MHz	HC49/4H	30/50/20/30	A169K
4.0MHz	HC49/4H	20/50/10/30	A120K
4.0MHz	HC49/4H	30/50/10/30	A120L
4.0MHz	HC49/4H	50/100/40/30	E120L
4.032MHz	HC49/4H	30/50/20/30	A121K
4.096MHz	HC49/4H	30/50/10/30	A122K
4.194304MHz	HC49/4H	30/50/10/30	A123J
4.194304MHz	HC49/4H	30/50/10/12	A123K
4.433619MHz	HC49/4H	30/50/10/20	A124K
4.91520MHz	HC49/4H	30/50/20/30	A127K
5.0MHz	HC49/4H	30/50/10/30	A128K
5.76MHz	HC49/4H	30/50/10/30	L102K
6.0MHz	HC49/4H	30/50/10/30	A132K
6.1440MHz	HC49/4H	30/50/10/30	A133K
7.37280MHz	HC49/4H	30/50/10/30	A194K
7.37280MHz	HC49/4H	15/30/10/18	A194L
7.37280MHz	HC49/4H	30/50/20/18	A194M
7.86432MHz	HC49/4H	30/50/10/30	A139A
8.0MHz	HC49/4H	30/50/20/30	A140K
8.192MHz	HC49/4H	30/50/10/30	A170K
9.8304MHz	HC49/4H	30/50/10/30	A173K
10.0MHz	HC49/4H	30/50/20/30	A143K
10.752MHz	HC49/4H	30/50/10/30	A212K

Frequency	Holder	Specification	Stock No.
11.05920MHz	HC49/4H	30/50/20/30	L108K
12.0MHz	HC49/4H	30/50/20/30	A158K
12.288MHz	HC49/4H	30/50/10/30	A175K
14.31818MHz	HC49/4H	30/50/20/30	A153L
14.74560MHz	HC49/4H	30/50/10/30	A159K
15.0MHz	HC49/4H	30/50/10/30	A160K
15.36MHz	HC49/4H	20/30/10/30	M451K
16.0MHz	HC49/4H	30/50/20/30	A161K
16.9344MHz	HC49/4H	30/50/10/30	A213K
18.432MHz	HC49/4H	30/50/20/30	A146K
19.66080MHz	HC49/4H	30/50/10/30	A182K
20.0MHz	HC49/4H	30/50/20/12	A147K
20.0MHz	HC49/4H	30/50/10/20	A147L
24.0MHz	HC49/4H	30/50/10/30 Fund	A189K
24.576MHz	HC49/4H	30/50/10/20 Fund	A116K
32.0MHz	HC49/4H	30/50/20/SR 3rd	A166K
35.2512MHz	HC49/4H	15/30/20/18 3rd	A216K
40.32MHz	HC49/4H	30/50/10/18 3rd	A220H

UM1 & HC45 CRYSTALS

Frequency	Holder	Specification	Stock No.
8.1920MHz	UM-1	20/30/10/30	A170H
8.1920MHz	UM-1	20/30/10/20	A170J
9.6000MHz	UM-1	20/30/10/30	A172H
10.2450MHz	UM-1	20/30/10/30	A155H
12.2880MHz	UM-1	20/30/10/30	A175H
14.31818MHz	UM-1	20/30/10/30	A153H
16.0MHz	UM-1	20/30/10/30	A161H
16.3840MHz	UM-1	20/30/10/30	A178H
17.73447MHz	UM-1	20/30/10/20	A180J
17.73447MHz	UM-1	20/30/10/30	A180H
19.66080MHz	UM-1	20/30/10/20	A182J
20.0MHz	UM-1	20/30/10/30	A147H
20.0MHz	UM-1	20/30/10/20	A147J
22.248MHz	UM-1	20/30/10/20 Fund	L111J

HC49 (HC43) CRYSTALS

Please note: Specifications followed by ** denote USA specification.

Frequency	Holder	Specification	Stock No.
1.84320MHz	HC49	20/50/10/30	A113B
1.84320MHz	HC49	20/50/10/SR	A113C
2.0MHz	HC49	50/100/0/20	A114E
2.45760MHz	HC49	20/50/10/30	A116C
2.45760MHz	HC49	30/50/20/32 **	A116U
3.0MHz	HC49	20/50/10/30	A150B
3.27680MHz	HC49	20/30/10/12	A118B
3.579545MHz	HC49	20/50/10/20	A119C
3.579545MHz	HC49	30/50/10/20	A119M
3.579545MHz	HC49	30/50/20/18 **	A119U
3.68640MHz	HC49	20/50/10/30	A169A
3.68640MHz	HC49	30/50/10/30	A169M
3.68640MHz	HC49	30/50/20/20 **	A169U
3.68640MHz	HC49	30/50/20/SR **	A169T
4.0MHz	HC49	20/10/20/30	A120A
4.0MHz	HC49	20/50/10/30	A120B
4.0MHz	HC49	30/50/10/30	A120N
4.0MHz	HC49	30/50/20/20 **	A120U
4.0MHz	HC49	30/50/20/SR **	A120T
4.032MHz	HC49	20/10/20/30	A121A
4.0960MHz	HC49	20/10/20/30	A122A
4.0960MHz	HC49	20/50/10/30	A122B
4.194304MHz	HC49	20/30/10/12	A123A
4.433619MHz	HC49	20/30/10/20	A124D
4.433619MHz	HC49	30/50/10/20	A124M
4.608MHz	HC49	20/50/10/30	A125C
4.91520MHz	HC49	20/50/10/30	A127A
4.91520MHz	HC49	30/50/10/30	A127B
4.91520MHz	HC49	30/50/20/SR **	A127T
5.0MHz	HC49	20/50/10/30	A128B
5.0MHz	HC49	30/50/20/20 **	A128U
5.06880MHz	HC49	20/50/10/SR	A129A
5.24288MHz	HC49	20/30/10/12	A186A
6.0MHz	HC49	20/50/10/30	A132A
6.0MHz	HC49	30/50/10/30	A132B
6.0MHz	HC49	30/50/20/SR **	A132T
6.1440MHz	HC49	20/50/10/30	A133A
6.1440MHz	HC49	20/50/0/12	A133B

Frequency	Holder	Specification	Stock No.
6.1440MHz	HC49	30/50/20/20 **	A133U
6.1440MHz	HC49	30/50/20/SR **	A133T
6.55360MHz	HC49	20/30/10/12	A135A
7.37280MHz	HC49	20/50/10/30	A194A
7.37280MHz	HC49	30/50/20/SR	A194D
7.37280MHz	HC49	30/50/20/20 **	A194U
7.6800MHz	HC49	20/50/10/30	A138A
8.0MHz	HC49	20/50/10/30	A140A
8.0MHz	HC49	30/50/10/30	A140B
8.0MHz	HC49	30/50/20/20 **	A140U
8.0MHz	HC49	30/50/20/SR **	A140T
8.192MHz	HC49	20/50/10/30	A170A
8.388608MHz	HC49	20/50/10/30	A141A
8.8672370MHz	HC49	30/30/10/20	A154A
9.83040MHz	HC49	20/50/10/30	A173A
10.0MHz	HC49	20/10/20/30	A143A
10.0MHz	HC49	20/50/10/30	A143E
10.0MHz	HC49	30/50/20/SR **	A143T
10.70MHz	HC49	20/50/10/30	A144A
10.7520MHz	HC49	20/30/10/30	A212A
11.0MHz	HC49	20/30/10/30	A193A
11.05920MHz	HC49	20/30/10/20	L108A
11.05920MHz	HC49	20/30/10/30	L108C
11.05920MHz	HC49	30/50/10/20	L108D
11.05920MHz	HC49	30/50/20/20 **	L108U
11.05920MHz	HC49	30/50/20/SR **	L108T
11.28960MHz	HC49	20/30/10/30	A214A
12.0MHz	HC49	20/30/10/30	A158A
12.0MHz	HC49	30/50/10/30	A158B
12.0MHz	HC49	30/50/20/20 **	A158U
12.0MHz	HC49	30/50/20/SR **	A158T
12.2880MHz	HC49	20/30/10/30	A175A
12.2880MHz	HC49	30/50/20/20 **	A175U
12.2880MHz	HC49	30/50/20/SR **	A175T
14.0MHz	HC49	20/50/10/30	A195A
14.31818MHz	HC49	20/50/10/SR	A153A
14.74560MHz	HC49	20/30/10/30	A159A
14.74560MHz	HC49	20/50/10/SR	A159B
15.0MHz	HC49	20/50/10/SR	A160C
15.36MHz	HC49	20/30/10/30	M451A
16.0MHz	HC49	20/30/10/30	A161A

Frequency	Holder	Specification	Stock No.
16.0MHz	HC49	30/50/10/30	A161N
16.0MHz	HC49	30/50/20/20 **	A161U
16.0MHz	HC49	30/50/20/SR **	A161T
18.432MHz	HC49	30/50/20/20 **	A146U
18.432MHz	HC49	30/50/20/SR **	A146T
19.66080MHz	HC49	20/50/10/SR	A182A
19.66080MHz	HC49	30/50/10/18	A182C
20.0MHz	HC49	20/50/10/30	A147A
20.0MHz	HC49	20/30/10/SR	A147C
20.0MHz	HC49	30/50/10/30	A147D
20.0MHz	HC49	30/50/20/SR **	A147T
20.48MHz	HC49	30/50/10/30	A208B
22.11840MHz	HC49	20/50/10/SR Fund	A183A
22.5792MHz	HC49	10/20/10/15 Fund	A315A
24.0MHz	HC49	20/50/10/SR Fund	A189A
24.00014MHz	HC49	15/30/10/18 Fund	A210A
24.5760MHz	HC49	20/50/10/30 Fund	A223A
25.0MHz	HC49	20/50/10/SR Fund	A187B
32.0MHz	HC49	20/30/10/SR 3rd	A166A
32.0MHz	HC49	30/50/10/SR Fund	A166M
35.25120MHz	HC49	15/30/10/18/3rd	A216A
40.320MHz	HC49	15/30/10/18/3rd	A220A

HC51 & HC33 CRYSTALS

Frequency	Holder	Specification	Stock No.
2.0MHz	HC51	20/50/10/30	A114D
2.45760MHz	HC33	20/50/10/30	A116A

CRYSTAL ACCESSORIES

Description	For Holder	Stock No.
Insulators (Mylar, 3 holes)	UM1 (HC45)	M153C
Insulators (Mylar, 3 holes)	HC49	M153B
Insulator (PTFE, 2 holes)	HC49	M153D
Insulators (Mylar, 2 holes)	HC51 (HC33)	M154A
Clips	HC49	M156A

WATCH CRYSTALS 32.768kHz

ISSUE 9; 12 JUNE 1998

Delivery Options

- Product available from stock. Please see p4 for details

Holder Style

- Watch crystals are press sealed. Two sizes are available: 3 × 8.2mm & 2 × 6.2mm

General Specifications

- Load Capacitance (C_L): 6pF to 15pF
- Drive Level: 1.0μW max.
- Static Capacitance (C₀): 1.6pF typical

Standard Frequency Tolerances and Stabilities

- ±20ppm, ±30ppm, ±50ppm, ±100ppm

Operating Temperature Ranges

- 0 to 50°C -20 to 70°C
- 10 to 60°C -30 to 80°C

Storage Temperature Range

- 55 to 125°C

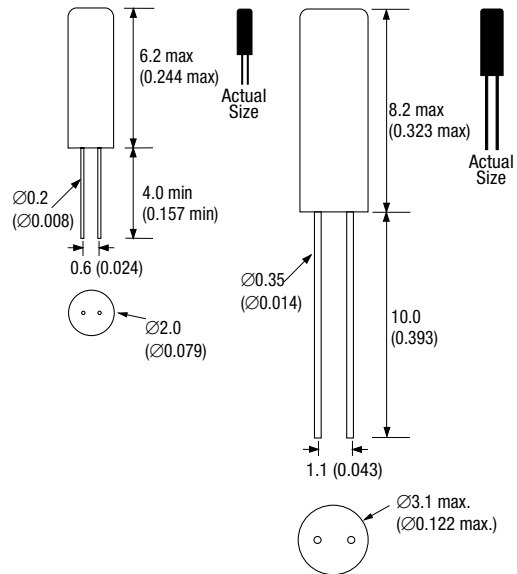
Marking

- Frequency (3 × 8.2mm only; 2 × 6.2mm product is unmarked)

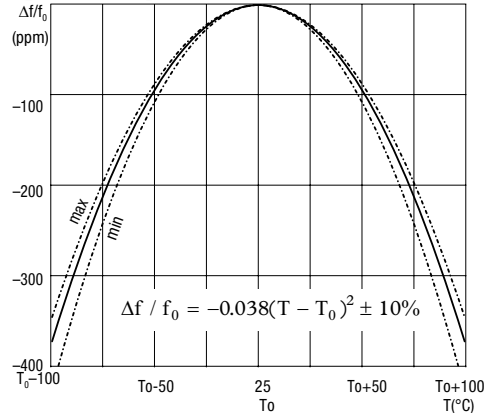
Minimum Order Information Required

- Frequency + Holder + Frequency Tolerance @ 25°C + Operating Temperature Range + Circuit Condition

Outline in mm (inches) - (scale 3:1)



Frequency Temperature Curve



Electrical Specification - maximum limiting values

Frequency Range	Frequency Tolerance @ 25°C ±2°C	Operating Temperature Range	Frequency Stability Available Over Operating Temperature		ESR Max	Vibration Mode
			Minimum	Maximum		
32.768kHz	±10ppm to ±100ppm	0 to 50°C	-25ppm	-100ppm	50kΩ	Fundamental
		-10 to 60°C	-50ppm	-100ppm		
		-20 to 70°C	-85ppm	-100ppm		
		-30 to 80°C	-150ppm	-300ppm		

CYLINDER CRYSTALS (3 x 9)

ISSUE 10; 26 MARCH 1998

Outline in mm (inches) - (scale 2:1)

Delivery Options

- Please contact our sales office for current leadtimes

Holder Style

- 3 × 9.0mm cylinder crystals are press sealed

General Specifications

- Load Capacitance (C_L):
6pF to 15pF (15.0kHz to 2.70MHz)
10pF to 50pF or Series (3.57MHz to 60.0MHz)
- Drive Level:
1.0μW max. (15.0kHz to 1.5360MHz)
5.0μW max. (1.70MHz to 2.70MHz)
500.0μW max. (3.570MHz to 60.0MHz)

Standard Frequency Tolerances and Stabilities

- ±10ppm, ±20ppm, ±30ppm, ±50ppm, ±100ppm,
±150ppm, ±200ppm, ±300ppm

Operating Temperature Ranges

- 0 to 50°C -30 to 80°C
-10 to 60°C -40 to 90°C
-20 to 70°C

Storage Temperature Range

- 55 to 125°C

Marking

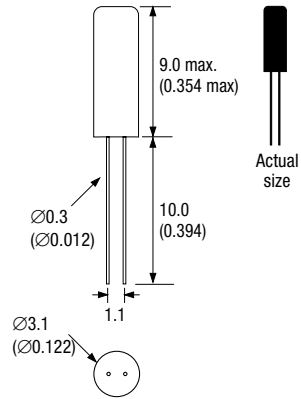
- Frequency

Minimum Order Information Required

- Frequency + Holder + Frequency Tolerance @ 25°C
+ Operating Temperature Range + Circuit Condition

Electrical Specification - maximum limiting values

Frequency Range	Frequency Tolerance @ 25°C ±2°C	Operating Temperature Range	Frequency Stability Available Over Operating Temperature		ESR max.	Vibration Mode
			Minimum	Maximum		
15.0 to 150.0kHz	±20ppm to ±100ppm	0 to 50°C	-25ppm	-300ppm	35kΩ	Fundamental
		-10 to 60°C	-50ppm	-300ppm		
		-20 to 70°C	-80ppm	-300ppm		
		-30 to 80°C	-120ppm	-300ppm		
		-40 to 90°C	-170ppm	-500ppm		
350.0kHz to 1.5360MHz	±50ppm to ±100ppm	0 to 50°C	±50ppm	±300ppm	1.5kΩ	Fundamental
		-10 to 60°C	±100ppm	±300ppm		
		-20 to 70°C	±150ppm	±300ppm		
		-30 to 80°C	±200ppm	±300ppm		
		-40 to 90°C	±300ppm	±500ppm		
1.7 to < 2.7MHz	±10ppm to ±100ppm	0 to 50°C	±10ppm	±100ppm	100Ω	Fundamental



Frequency Range	Frequency Tolerance @ 25°C ±2°C	Operating Temperature Range	Frequency Stability Available Over Operating Temperature		ESR max.	Vibration Mode
			Minimum	Maximum		
3.57 to < 3.7MHz	±30ppm to ±100ppm	0 to 50°C	±10ppm	±100ppm	200Ω	Fundamental
		-10 to 60°C	±20ppm	±100ppm		
		-20 to 70°C	±30ppm	±100ppm		
		-30 to 80°C	±40ppm	±100ppm		
		-40 to 90°C	±50ppm	±100ppm		
3.7 to < 4.0MHz	±30ppm to ±100ppm	0 to 50°C	±10ppm	±100ppm	180Ω	Fundamental
		-10 to 60°C	±20ppm	±100ppm		
		-20 to 70°C	±30ppm	±100ppm		
		-30 to 80°C	±40ppm	±100ppm		
		-40 to 90°C	±50ppm	±100ppm		
4.0 to < 5.0MHz	±30ppm to ±100ppm	0 to 50°C	±10ppm	±100ppm	200Ω	Fundamental
		-10 to 60°C	±20ppm	±100ppm		
		-20 to 70°C	±30ppm	±100ppm		
		-30 to 80°C	±40ppm	±100ppm		
		-40 to 90°C	±50ppm	±100ppm		
5.0 to < 10.0MHz	±30ppm to ±100ppm	0 to 50°C	±10ppm	±100ppm	120Ω	Fundamental
		-10 to 60°C	±20ppm	±100ppm		
		-20 to 70°C	±30ppm	±100ppm		
		-30 to 80°C	±40ppm	±100ppm		
		-40 to 90°C	±50ppm	±100ppm		
10.0 to < 16.0MHz	±30ppm to ±100ppm	0 to 50°C	±10ppm	±100ppm	50Ω	Fundamental
		-10 to 60°C	±20ppm	±100ppm		
		-20 to 70°C	±30ppm	±100ppm		
		-30 to 80°C	±40ppm	±100ppm		
		-40 to 90°C	±50ppm	±100ppm		
16.0 to < 26.0MHz	±30ppm to ±100ppm	0 to 50°C	±10ppm	±100ppm	40Ω	Fundamental
		-10 to 60°C	±20ppm	±100ppm		
		-20 to 70°C	±30ppm	±100ppm		
		-30 to 80°C	±40ppm	±100ppm		
		-40 to 90°C	±50ppm	±100ppm		
26.0 to < 36.0MHz	±30ppm to ±100ppm	0 to 50°C	±10ppm	±100ppm	100Ω	Fundamental
		-10 to 60°C	±20ppm	±100ppm		
		-20 to 70°C	±30ppm	±100ppm		
		-30 to 80°C	±40ppm	±100ppm		
		-40 to 90°C	±50ppm	±100ppm		
36.0 to 60.0MHz	±30ppm to ±100ppm	0 to 50°C	±10ppm	±100ppm	80Ω	Fundamental
		-10 to 60°C	±20ppm	±100ppm		
		-20 to 70°C	±30ppm	±100ppm		
		-30 to 80°C	±40ppm	±100ppm		
		-40 to 90°C	±50ppm	±100ppm		

CX-1-03 CRYSTALS 10.0kHz to 2.1MHz

ISSUE 6; 26 MARCH 1998

Delivery Options

- Common frequencies are available from stock. Please see p4 for details

Description

- Statek's CX-1,-1V, -1H crystals are high quality chemically etched resonators manufactured with a photolithographic process.
- The CX-1H version is a tuning fork resonator intended for use in simple series oscillators over the frequency range 10.0 to < 614.4kHz.
- The CX-1V versions are intended for use in simple Pierce oscillators. They are tuning fork resonators over the frequency range 10.0 to < 614.4kHz.
- The CX-1 are length extensional resonators covering the frequency range 530.0kHz to 2.1MHz.

Holder Style

- CX-1-03 crystals are housed in a ceramic package, hermetically sealed, with a soft soldered glass lid & leads.

General Specifications

- Load Capacitance (C_L) CX-1V type:
 - 11pF (10.0 to < 16.0kHz)
 - 10pF (16.0 to < 25.0kHz)
 - 9pF (25.0 to < 55.0kHz)
 - 8pF (55.0 to < 100.0kHz)
 - 5pF (100.0 to < 180.0kHz)
 - 4pF (180.0 to < 614.4kHz)
- Load Capacitance (C_L) CX-1 type:
 - 7pF (530.0kHz to 2.1MHz)
 Other values available upon request
 CX-1H type is calibrated at Series Resonance
- Static Capacitance (C_0): 1.0pF to 2.0pF
- Drive Level CX-1V type:
 - 0.5 μ W max. (10.0 to < 25.0kHz)
 - 1.0 μ W max. (25.0 to < 614.4kHz)
- Drive Level CX-1 type:
 - 3.0 μ W max. (530.0kHz to 2.1MHz)
- Drive Level CX-1H type:
 - 1.5 μ W max. (10.0 to < 25.0kHz)
 - 3.0 μ W max. (25.0 to < 614.4kHz)
- Ageing: ± 5 ppm maximum first year

Operating Temperature Ranges

- 10 to 70°C = C
- 40 to 85°C = I
- 55 to 125°C = M

Storage Temperature Range

- 55 to 125°C

Environmental Specification

- Shock: 1000g, 1.0ms $\frac{1}{2}$ sine (< 614.4kHz)
- Shock: 750g, 0.3ms $\frac{1}{2}$ sine (530.0kHz to 2.1MHz)
- Vibration: 20g, 10 to 2000Hz

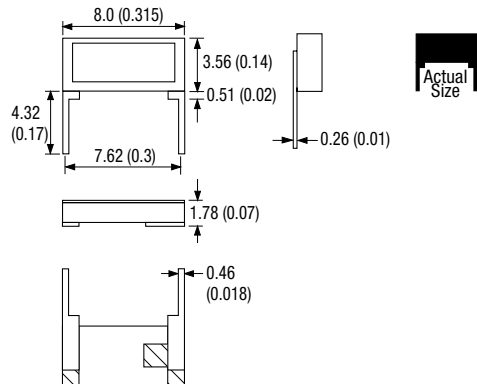
Marking

- Includes Frequency

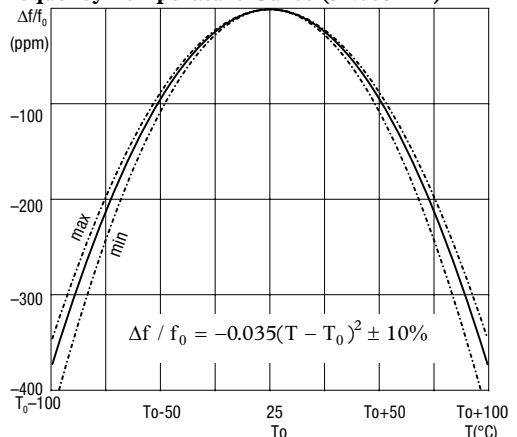
Minimum Order Information Required

- Frequency + Model + Terminations + Frequency Tolerance @ 25°C + Operating Temperature Range + Circuit Condition

Outline in mm (inches) - (scale 2:1)



Frequency Temperature Curve (32.768kHz)



Electrical Specification – maximum limiting values

Frequency Range	*Frequency Tolerance @ 25°C ±2°C	Operating Temperature Range	**ESR max.	Vibration Mode
10.0 to < 25.0kHz	A = ±30ppm B = ±100ppm C = ±1000ppm	-10 to 70°C	2.1MΩ	Tuning Fork
		-40 to 85°C		
		-55 to 125°C		
25.0 to < 50.0kHz	A = ±30ppm B = ±100ppm C = ±1000ppm	-10 to 70°C	360kΩ	Tuning Fork
		-40 to 85°C		
		-55 to 125°C		
50.0 to < 75.0kHz	A = ±30ppm B = ±100ppm C = ±1000ppm	-10 to 70°C	160kΩ	Tuning Fork
		-40 to 85°C		
		-55 to 125°C		
75.0 to < 170.0kHz	A = ±50ppm B = ±100ppm C = ±1000ppm	-10 to 70°C	100kΩ	Tuning Fork
		-40 to 85°C		
		-55 to 125°C		
170.0 to < 250.0kHz	A = ±100ppm B = ±200ppm C = ±2000ppm	-10 to 70°C	50kΩ	Tuning Fork
		-40 to 85°C		
		-55 to 125°C		
250.0 to < 614.4kHz	A = ±200ppm B = ±500ppm C = ±5000ppm	-10 to 70°C	25kΩ	Tuning Fork
		-40 to 85°C		
		-55 to 125°C		
530.0kHz to 2.1MHz ***	A = ±500ppm B = ±1000ppm C = ±10000ppm	-10 to 70°C	3kΩ	Extensional
		-40 to 85°C		
		-55 to 125°C		

Ordering Example 50kHz CX-1V 03 C C 9pF

Frequency _____

Model No _____

Terminations _____

Frequency Tolerance @ 25°C _____

Operating Temperature Range: C = -10 to 70°C; I = -40 to 85°C; M = -55 to 125°C _____

Load Capacitance (Circuit Condition) - if non-standard _____

*Please note: other frequency tolerances are available on request.
 ** Above ESR values are for CX-1H only, CX-1V divide above values by 3.
 *** Only CX-1 available

CX-1-03 CRYSTALS 8.0 to 160.0MHz

ISSUE 6; 26 MARCH 1998

Delivery Options

- Please contact our sales office for current leadtimes

Description

- Statek's CX-1-03 crystals are high quality chemically etched resonators manufactured with a photolithographic process.

Holder Style

- CX-1-03 crystals are housed in a ceramic package, hermetically sealed, with a soft soldered glass lid & leads.

General Specifications

- Load Capacitance (C_L): 20pF
Other values available upon request
- Static Capacitance (C_0): 2.0 to 3.5pF
- Drive Level: 500 μ W max
- Ageing: ± 5 ppm max first year

Standard Frequency Tolerances*

- ± 100 ppm, ± 1000 ppm, ± 10000 ppm
* Tighter tolerances available

Operating Temperature Ranges

- -10 to 70°C = C
- -40 to 85°C = I
- -55 to 125°C = M

Storage Temperature Range

- -55 to 125°C

Environmental Specification (higher specification available on request)

- Shock: 3000g, 0.3ms $\frac{1}{2}$ sine
- Vibration: 20g rms, 10 to 2000Hz random

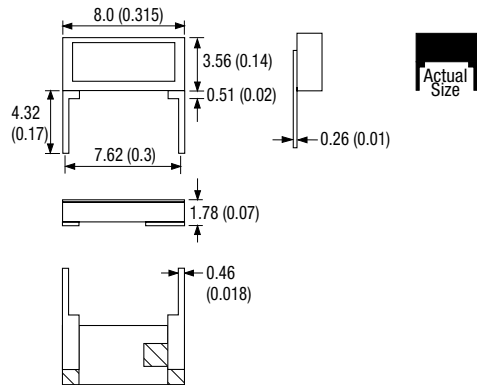
Marking

- Includes Frequency

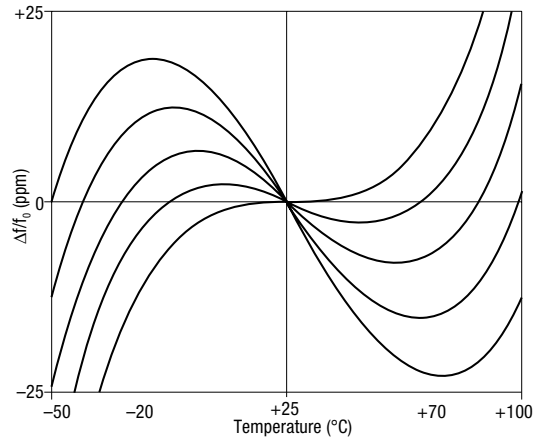
Minimum Order Information Required

- Frequency + Model + Terminations + Frequency Tolerance @ 25°C + Frequency Stability + Operating Temperature Range + Circuit Condition

Outline in mm (inches) - (scale 2:1)



Frequency Temperature Curve



Electrical Specification – maximum limiting values

Frequency Range	*Frequency Tolerance @ 25°C ±2°C	Operating Temperature Range	Frequency Stability Available Over Operating Temperature		ESR Max	Vibration Mode
			Minimum	Maximum		
8.0 to < 9.0MHz	A = ±100ppm B = ±1000ppm C = ±10000ppm	-10 to 70°C	±10ppm	±100ppm	300Ω	Fundamental AT cut
		-40 to 85°C	±20ppm	±100ppm		
		-55 to 125°C	±30ppm	±300ppm		
9.0 to < 11.0MHz	A = ±100ppm B = ±1000ppm C = ±10000ppm	-10 to 70°C	±10ppm	±100ppm	200Ω	Fundamental AT cut
		-40 to 85°C	±20ppm	±100ppm		
		-55 to 125°C	±30ppm	±300ppm		
11.0 to < 14.0MHz	A = ±100ppm B = ±1000ppm C = ±10000ppm	-10 to 70°C	±10ppm	±100ppm	100Ω	Fundamental AT cut
		-40 to 85°C	±20ppm	±100ppm		
		-55 to 125°C	±30ppm	±300ppm		
14.0 to < 20.0MHz	A = ±100ppm B = ±1000ppm C = ±10000ppm	-10 to 70°C	±10ppm	±100ppm	70Ω	Fundamental AT cut
		-40 to 85°C	±20ppm	±100ppm		
		-55 to 125°C	±30ppm	±300ppm		
20.0 to 70.0MHz	A = ±100ppm B = ±1000ppm C = ±10000ppm	-10 to 70°C	±10ppm	±100ppm	50Ω	Fundamental AT cut
		-40 to 85°C	±20ppm	±100ppm		
		-55 to 125°C	±30ppm	±300ppm		
48.0 to 160.0MHz	A = ±100ppm B = ±1000ppm C = ±10000ppm	-10 to 70°C	±10ppm	±100ppm	80Ω	3rd Overtone
		-40 to 85°C	±20ppm	±100ppm		
		-55 to 125°C	±30ppm	±300ppm		
Ordering Example 10.0MHz CX-1 03 A 100ppm C 18pF Frequency _____ Model No _____ Terminations _____ Frequency Tolerance @ 25°C _____ Frequency Stability _____ Operating Temperature Range: C = -10 to 70°C; I = -40 to 85°C; M = -55 to 125°C _____ Load Capacitance (Circuit Condition) -if non-standard _____						
*Please note: other frequency tolerances are available on request.						

HC35 (TO5) CRYSTALS

ISSUE 9; 19 JUNE 1998

Delivery Options

- 3 day Express Manufacturing Service, subject to piece part stock availability

Holder Style

- HC35 (TO5) crystals are resistance welded, hermetically sealed in an inert atmosphere with glass to metal seals securing the lead wires

General Specifications

- Load Capacitance (C_L): 10pF to 75pF or Series
- Drive Level: 1.0mW max.
- Static Capacitance (C_0): 7pF max.
- Ageing: ± 3 ppm typical per year

Standard Frequency Tolerances and Stabilities

- ± 5 ppm, ± 10 ppm, ± 15 ppm, ± 20 ppm, ± 30 ppm, ± 50 ppm, ± 100 ppm

Operating Temperature Ranges

- 0 to 50°C -40 to 90°C
- -10 to 60°C -55 to 105°C
- -20 to 70°C -55 to 125°C
- -30 to 80°C

Storage Temperature Range

- -55 to 125°C

Environmental Specification

- Shock: 981m/s² for 6ms, three shocks in each direction along three mutually perpendicular planes
- Vibration: 10 to 60Hz 0.75mm displacement, 60 to 2000Hz 98.1m/s² acceleration, 30 minutes in each of three mutually perpendicular planes

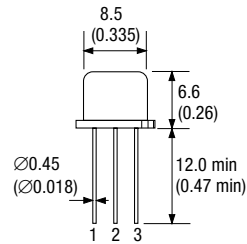
Marking

- Includes Frequency

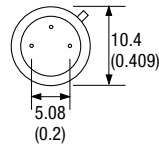
Minimum Order Information Required

- Frequency + Holder + Frequency Tolerance @ 25°C + Frequency Stability + Operating Temperature Range + Circuit Condition + Overtone Order

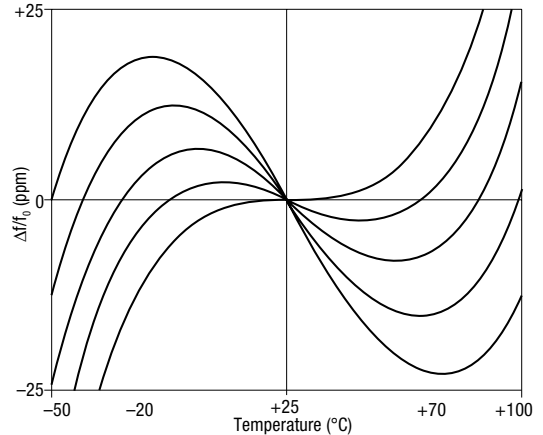
Outline in mm (inches)



Pin connections
 1. Crystal
 2. Case & ground
 3. Crystal



Typical Frequency vs Temperature Curves for various angles of AT-cut crystals



Electrical Specification – maximum limiting values

Frequency Range	Frequency Tolerance @ 25°C ±2°C	Operating Temperature Range	Frequency Stability Available Over Operating Temperature		ESR max.	Vibration Mode
			Minimum	Maximum		
6.0 to < 8.0MHz	±5ppm to ±100ppm	0 to 50°C	±10ppm	±100ppm	60Ω	Fundamental AT cut
		-10 to 60°C	±15ppm	±100ppm		
		-20 to 70°C	±15ppm	±100ppm		
		-30 to 80°C	±20ppm	±100ppm		
		-40 to 90°C	±25ppm	±100ppm		
		-55 to 105°C	±50ppm	±100ppm		
		-55 to 125°C	±50ppm	±100ppm		
8.0 to < 15.0MHz	±5ppm to ±100ppm	0 to 50°C	±10ppm	±100ppm	30Ω	Fundamental AT cut
		-10 to 60°C	±15ppm	±100ppm		
		-20 to 70°C	±15ppm	±100ppm		
		-30 to 80°C	±20ppm	±100ppm		
		-40 to 90°C	±25ppm	±100ppm		
		-55 to 105°C	±50ppm	±100ppm		
		-55 to 125°C	±50ppm	±100ppm		
15.0 to 30.0MHz	±5ppm to ±100ppm	0 to 50°C	±5ppm	±100ppm	20Ω	Fundamental AT cut
		-10 to 60°C	±5ppm	±100ppm		
		-20 to 70°C	±10ppm	±100ppm		
		-30 to 80°C	±20ppm	±100ppm		
		-40 to 90°C	±25ppm	±100ppm		
		-55 to 105°C	±50ppm	±100ppm		
		-55 to 125°C	±50ppm	±100ppm		
25.0 to 90.0MHz	±5ppm to ±100ppm	0 to 50°C	±5ppm	±100ppm	40Ω	3rd Overtone AT cut
		-10 to 60°C	±5ppm	±100ppm		
		-20 to 70°C	±10ppm	±100ppm		
		-30 to 80°C	±20ppm	±100ppm		
		-40 to 90°C	±25ppm	±100ppm		
		-55 to 105°C	±50ppm	±100ppm		
		-55 to 125°C	±50ppm	±100ppm		
60.0 to 150.0MHz	±5ppm to ±100ppm	0 to 50°C	±5ppm	±100ppm	60Ω	5th Overtone AT cut
		-10 to 60°C	±5ppm	±100ppm		
		-20 to 70°C	±10ppm	±100ppm		
		-30 to 80°C	±20ppm	±100ppm		
		-40 to 90°C	±25ppm	±100ppm		
		-55 to 105°C	±50ppm	±100ppm		
		-55 to 125°C	±50ppm	±100ppm		
125.0 to 175.0MHz	±5ppm to ±100ppm	0 to 50°C	±5ppm	±100ppm	100Ω	7th Overtone AT cut
		-10 to 60°C	±5ppm	±100ppm		
		-20 to 70°C	±10ppm	±100ppm		
		-30 to 80°C	±20ppm	±100ppm		
		-40 to 90°C	±25ppm	±100ppm		
		-55 to 105°C	±50ppm	±100ppm		
		-55 to 125°C	±50ppm	±100ppm		
170.0 to 210.0MHz	±5ppm to ±100ppm	0 to 50°C	±5ppm	±100ppm	200Ω	9th Overtone AT cut
		-10 to 60°C	±5ppm	±100ppm		
		-20 to 70°C	±10ppm	±100ppm		
		-30 to 80°C	±20ppm	±100ppm		
		-40 to 90°C	±25ppm	±100ppm		
		-55 to 105°C	±50ppm	±100ppm		
		-55 to 125°C	±50ppm	±100ppm		

UM1 CRYSTALS

ISSUE 8; 15 JUNE 1998

Delivery Options

- Common frequencies are available from stock. Please see p4 for details
- 3 day Express Manufacturing Service, subject to piece part stock availability

Holder Style

- UM1 crystals are resistance welded, hermetically sealed in an inert atmosphere with glass to metal seals securing the lead wires
- Holders suffixed '-3L' have a centre third wire which grounds the case
- HC45 is not dimensionally identical to the UM1 but for most purposes the two are interchangeable

General Specifications

- Load Capacitance (C_L): 10pF to 75pF or Series
- Drive Level: 1mW max.
- Static Capacitance (C_0): 7pF max.
- Ageing: ± 3 ppm typical per year

Standard Frequency Tolerances and Stabilities

- ± 5 ppm, ± 10 ppm, ± 15 ppm, ± 20 ppm, ± 30 ppm, ± 50 ppm, ± 100 ppm

Operating Temperature Ranges

- 0 to 50°C
- 10 to 60°C
- 20 to 70°C
- 30 to 80°C
- 40 to 90°C
- 55 to 105°C
- 55 to 125°C

Storage Temperature Range

- 55 to 125°C

Environmental Specification

- Shock: 981m/s^2 for 6ms, three shocks in each direction along three mutually perpendicular planes
- Vibration: 10 to 60Hz 0.75mm displacement, 60 to 2000Hz 98.1m/s^2 acceleration, 30 minutes in each of three mutually perpendicular planes

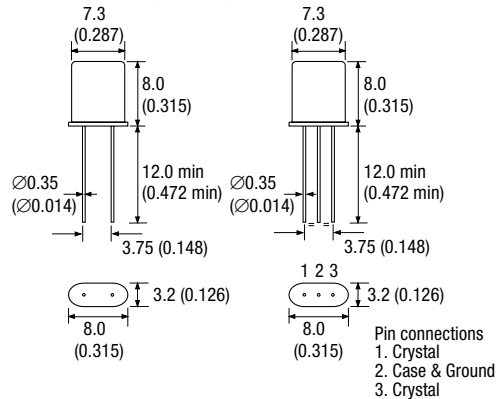
Marking

- Includes Frequency

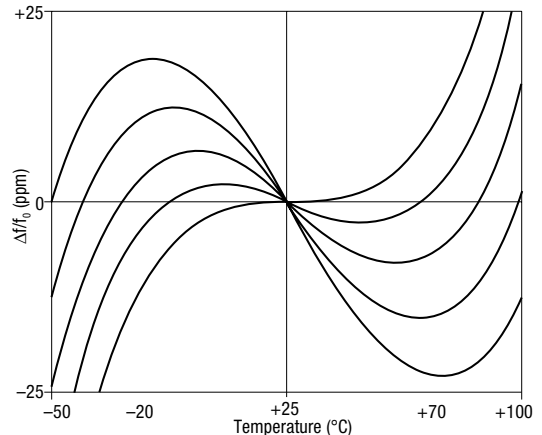
Minimum Order Information Required

- Frequency + Holder + Frequency Tolerance @ 25°C + Frequency Stability + Operating Temperature Range + Circuit Condition + Overtone Order

Outline in mm (inches) - UM1 & UM1-3L



Typical Frequency vs Temperature Curves for various angles of AT-cut crystals



Electrical Specification – maximum limiting values

Frequency Range	Frequency Tolerance @ 25°C ±2°C	Operating Temperature Range	Frequency Stability Available Over Operating Temperature		ESR max.	Vibration Mode
			Minimum	Maximum		
6.0 to < 10.0MHz	±5ppm to ±100ppm	0 to 50°C	±10ppm	±100ppm	80Ω	Fundamental AT cut
		-10 to 60°C	±15ppm	±100ppm		
		-20 to 70°C	±15ppm	±100ppm		
		-30 to 80°C	±20ppm	±100ppm		
		-40 to 90°C	±25ppm	±100ppm		
		-55 to 105°C	±50ppm	±100ppm		
		-55 to 125°C	±50ppm	±100ppm		
10.0 to < 15.0MHz	±5ppm to ±100ppm	0 to 50°C	±10ppm	±100ppm	60Ω	Fundamental AT cut
		-10 to 60°C	±15ppm	±100ppm		
		-20 to 70°C	±15ppm	±100ppm		
		-30 to 80°C	±20ppm	±100ppm		
		-40 to 90°C	±25ppm	±100ppm		
		-55 to 105°C	±50ppm	±100ppm		
		-55 to 125°C	±50ppm	±100ppm		
15.0 to 30.0MHz	±5ppm to ±100ppm	0 to 50°C	±5ppm	±100ppm	30Ω	Fundamental AT cut
		-10 to 60°C	±5ppm	±100ppm		
		-20 to 70°C	±10ppm	±100ppm		
		-30 to 80°C	±20ppm	±100ppm		
		-40 to 90°C	±25ppm	±100ppm		
		-55 to 105°C	±50ppm	±100ppm		
		-55 to 125°C	±50ppm	±100ppm		
25.0 to 90.0MHz	±5ppm to ±100ppm	0 to 50°C	±5ppm	±100ppm	45Ω	3rd Overtone AT cut
		-10 to 60°C	±5ppm	±100ppm		
		-20 to 70°C	±10ppm	±100ppm		
		-30 to 80°C	±20ppm	±100ppm		
		-40 to 90°C	±25ppm	±100ppm		
		-55 to 105°C	±50ppm	±100ppm		
		-55 to 125°C	±50ppm	±100ppm		
60.0 to 150.0MHz	±5ppm to ±100ppm	0 to 50°C	±5ppm	±100ppm	100Ω	5th Overtone AT cut
		-10 to 60°C	±5ppm	±100ppm		
		-20 to 70°C	±10ppm	±100ppm		
		-30 to 80°C	±20ppm	±100ppm		
		-40 to 90°C	±25ppm	±100ppm		
		-55 to 105°C	±50ppm	±100ppm		
		-55 to 125°C	±50ppm	±100ppm		
125.0 to 175.0MHz	±5ppm to ±100ppm	0 to 50°C	±5ppm	±100ppm	150Ω	7th Overtone AT cut
		-10 to 60°C	±5ppm	±100ppm		
		-20 to 70°C	±10ppm	±100ppm		
		-30 to 80°C	±20ppm	±100ppm		
		-40 to 90°C	±25ppm	±100ppm		
		-55 to 105°C	±50ppm	±100ppm		
		-55 to 125°C	±50ppm	±100ppm		
175.0 to 250.0MHz	±5ppm to ±100ppm	0 to 50°C	±5ppm	±100ppm	200Ω	9th Overtone AT cut
		-10 to 60°C	±5ppm	±100ppm		
		-20 to 70°C	±10ppm	±100ppm		
		-30 to 80°C	±20ppm	±100ppm		
		-40 to 90°C	±25ppm	±100ppm		
		-55 to 105°C	±50ppm	±100ppm		
		-55 to 125°C	±50ppm	±100ppm		

UM5 & UM4 CRYSTALS

ISSUE 6; 12 JANUARY 1996

Delivery Options

- Please contact our sales office for current leadtimes

Holder Style

- UM5 & UM4 crystals are resistance welded, hermetically sealed in an inert atmosphere with glass to metal seals securing the lead wires
- Holders suffixed '-3L' have a centre third wire which grounds the case

General Specifications

- Load Capacitance (C_L): 10pF to 75pF or Series
- Drive Level: 1mW max.
- Static Capacitance (C_0): 6pF max
- Ageing: ± 3 ppm typical per year

Standard Frequency Tolerances and Stabilities

- ± 5 ppm, ± 10 ppm, ± 15 ppm, ± 20 ppm, ± 30 ppm, ± 50 ppm, ± 100 ppm

Operating Temperature Ranges

- 0 to 50°C
- -10 to 60°C
- -20 to 70°C
- -30 to 80°C
- -40 to 90°C
- -55 to 105°C

Storage Temperature Range

- -55 to 125°C

Environmental Specification

- Shock: 981m/s² for 6ms, three shocks in each direction along three mutually perpendicular planes
- Vibration: 10 to 60Hz 0.75mm displacement, 60 to 500Hz 98.1m/s² acceleration, 30 minutes in each of three mutually perpendicular planes

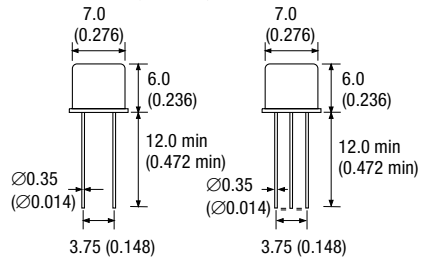
Marking

- Includes Frequency

Minimum Order Information Required

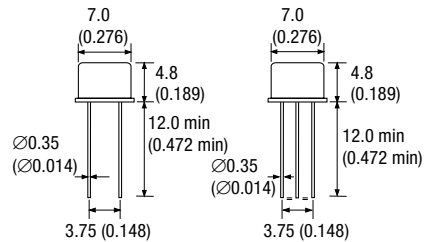
- Frequency + Holder + Frequency Tolerance @ 25°C
+ Frequency Stability + Operating Temperature
Range + Circuit Condition + Overtone Order

Outline in mm (inches) - UM5 & UM5-3L



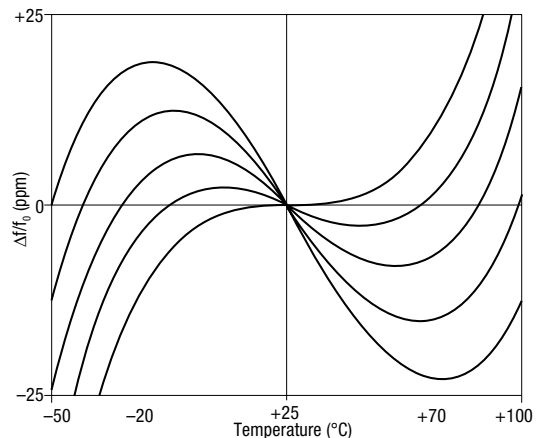
Pin connections
1. Crystal
2. Case & ground
3. Crystal

Outline in mm (inches) - UM4 & UM4-3L



Pin connections
1. Crystal
2. Case & ground
3. Crystal

Typical Frequency vs Temperature Curves for various angles of AT-cut crystals



Electrical Specification – maximum limiting values

Frequency Range	Frequency Tolerance @ 25°C ±2°C	Operating Temperature Range	Frequency Stability Available Over Operating Temperature		ESR max.	Vibration Mode
			Minimum	Maximum		
10.0 to < 16.0MHz	±10ppm to ±100ppm	0 to 50°C	±10ppm	±100ppm	60Ω	Fundamental AT cut
		-10 to 60°C	±15ppm	±100ppm		
		-20 to 70°C	±15ppm	±100ppm		
		-30 to 80°C	±20ppm	±100ppm		
		-40 to 90°C	±25ppm	±100ppm		
		-55 to 105°C	±50ppm	±100ppm		
16.0 to < 20.0MHz	±5ppm to ±100ppm	0 to 50°C	±10ppm	±100ppm	50Ω	Fundamental AT cut
		-10 to 60°C	±15ppm	±100ppm		
		-20 to 70°C	±15ppm	±100ppm		
		-30 to 80°C	±20ppm	±100ppm		
		-40 to 90°C	±25ppm	±100ppm		
		-55 to 105°C	±50ppm	±100ppm		
20.0 to < 30.0MHz	±5ppm to ±100ppm	0 to 50°C	±10ppm	±100ppm	40Ω	Fundamental AT cut
		-10 to 60°C	±15ppm	±100ppm		
		-20 to 70°C	±15ppm	±100ppm		
		-30 to 80°C	±20ppm	±100ppm		
		-40 to 90°C	±25ppm	±100ppm		
		-55 to 105°C	±50ppm	±100ppm		
30.0 to 40.0MHz	±10ppm to ±100ppm	0 to 50°C	±10ppm	±100ppm	40Ω	Fundamental AT cut
		-10 to 60°C	±15ppm	±100ppm		
		-20 to 70°C	±15ppm	±100ppm		
		-30 to 80°C	±20ppm	±100ppm		
		-40 to 90°C	±25ppm	±100ppm		
		-55 to 105°C	±50ppm	±100ppm		
40.0 to 90.0MHz	±5ppm to ±100ppm	0 to 50°C	±10ppm	±100ppm	120Ω	3rd Overtone AT cut
		-10 to 60°C	±15ppm	100ppm		
		-20 to 70°C	±15ppm	±100ppm		
		-30 to 80°C	±20ppm	±100ppm		
		-40 to 90°C	±25ppm	±100ppm		
		-55 to 105°C	±50ppm	±100ppm		
70.0 to 150.0MHz	±5ppm to ±100ppm	0 to 50°C	±10ppm	±100ppm	150Ω	5th Overtone AT cut
		-10 to 60°C	±15ppm	±100ppm		
		-20 to 70°C	±15ppm	±100ppm		
		-30 to 80°C	±20ppm	±100ppm		
		-40 to 90°C	±25ppm	±100ppm		
		-55 to 105°C	±50ppm	±100ppm		
125.0 to 175.0MHz	±5ppm to ±100ppm	0 to 50°C	±10ppm	±100ppm	150Ω	7th Overtone AT cut
		-10 to 60°C	±15ppm	±100ppm		
		-20 to 70°C	±15ppm	±100ppm		
		-30 to 80°C	±20ppm	±100ppm		
		-40 to 90°C	±25ppm	±100ppm		
		-55 to 105°C	±50ppm	±100ppm		

QUARTZ
CRYSTALS

HC49/4H & HC49/3H CRYSTALS

ISSUE 8; 12 JUNE 1998

Delivery Options

- Common frequencies are available from stock. Please see p4 for details

Holder Style

- HC49/4H & HC49/3H crystals are resistance welded, hermetically sealed in an inert atmosphere with glass to metal seals securing the lead wires.
- Holders suffixed '-3L' have a centre third wire which grounds the case

General Specifications

- Load Capacitance (C_L): 10pF to 75pF or Series
- Drive Level: 500µW max.
- Static Capacitance (C_0): 7pF max.
- Ageing: ± 3 ppm typical per year

Standard Frequency Tolerances and Stabilities

- ± 10 ppm, ± 20 ppm, ± 30 ppm, ± 50 ppm, ± 100 ppm

Operating Temperature Ranges

- 0 to 50°C -30 to 80°C
- 10 to 60°C -40 to 90°C
- 20 to 70°C -55 to 105°C

Storage Temperature Range

- 55 to 125°C

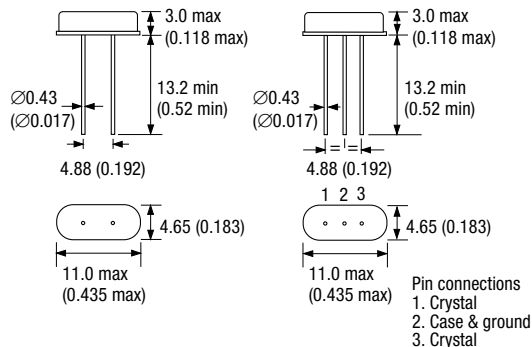
Environmental Specification

- Shock: 981m/s² for 6ms, three shocks in each direction along three mutually perpendicular planes
- Vibration: 10 to 60Hz 0.75mm displacement, 60 to 500Hz 98.1m/s² acceleration, 30 minutes in each of three mutually perpendicular planes

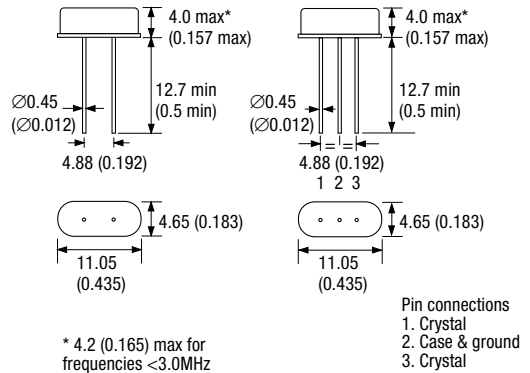
Marking

- Frequency only

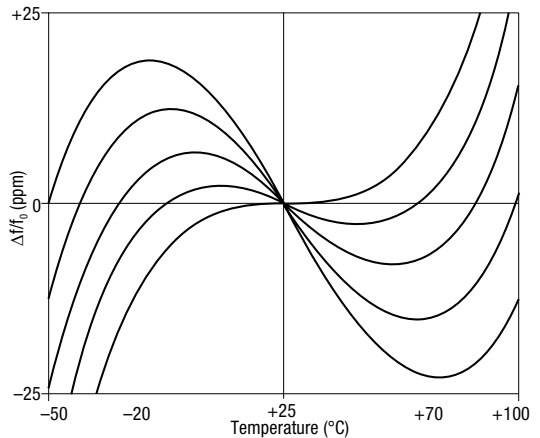
Outline in mm (inches) - HC49/3H & HC49/3H-3L



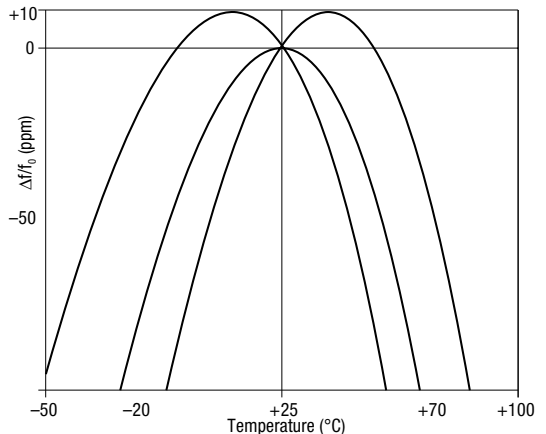
Outline in mm (inches) - HC49/4H & HC49/4H-3L



Typical Frequency vs Temperature Curves for various angles of AT-cut crystals



Typical Frequency vs Temperature Curves for various angles of BT-cut crystals



Minimum Order Information Required

- Frequency + Holder + Frequency Tolerance @ 25°C + Frequency Stability + Operating Temperature Range + Circuit Condition + Overtone Order

Electrical Specification – maximum limiting values

Frequency Range	Frequency Tolerance @ 25°C ±2°C	Operating Temperature Range	Frequency Stability Available Over Operating Temperature		ESR max.	Vibration Mode
			Minimum	Maximum		
3.5 to <5.0MHz	±15ppm to ±100ppm	0 to 50°C	±15ppm	±100ppm	200Ω	Fundamental AT cut
		-10 to 60°C	±20ppm	±100ppm		
		-20 to 70°C	±20ppm	±100ppm		
		-30 to 80°C	±25ppm	±100ppm		
		-40 to 90°C	±30ppm	±100ppm		
		-55 to 105°C	±100ppm	±500ppm		
5.0 to <8.0MHz	±15ppm to ±100ppm	0 to 50°C	±15ppm	±100ppm	120Ω	Fundamental AT cut
		-10 to 60°C	±20ppm	±100ppm		
		-20 to 70°C	±20ppm	±100ppm		
		-30 to 80°C	±25ppm	±100ppm		
		-40 to 90°C	±30ppm	±100ppm		
		-55 to 105°C	±100ppm	±500ppm		
8.0 to <12.0MHz	±15ppm to ±100ppm	0 to 50°C	±10ppm	±100ppm	70Ω	Fundamental AT cut
		-10 to 60°C	±15ppm	±100ppm		
		-20 to 70°C	±15ppm	±100ppm		
		-30 to 80°C	±20ppm	±100ppm		
		-40 to 90°C	±50ppm	±100ppm		
		-55 to 105°C	±50ppm	±100ppm		
12.0 to 25.0MHz	±15ppm to ±100ppm	0 to 50°C	±10ppm	±100ppm	50Ω	Fundamental AT cut
		-10 to 60°C	±15ppm	±100ppm		
		-20 to 70°C	±15ppm	±100ppm		
		-30 to 80°C	±20ppm	±100ppm		
		-40 to 90°C	±50ppm	±100ppm		
		-55 to 105°C	±50ppm	±100ppm		
20.0 to 40.0MHz	Inclusive with Frequency Stability	0 to 50°C	±50ppm	±100ppm	50Ω	Fundamental BT cut
		-10 to 60°C	±50ppm	±100ppm		
		-20 to 70°C	±100ppm	±100ppm		
		-30 to 80°C	±100ppm	±100ppm		
25.0 to 70.0MHz	±15ppm to ±100ppm	0 to 50°C	±15ppm	±100ppm	100Ω	3rd Overtone AT cut
		-10 to 60°C	±20ppm	±100ppm		
		-20 to 70°C	±20ppm	±100ppm		
		-30 to 80°C	±25ppm	±100ppm		
		-40 to 90°C	±50ppm	±100ppm		
		-55 to 105°C	±50ppm	±100ppm		

Please Note: Frequencies 3.0 to 3.5MHz are available; AT fundamentals are available up to 32.0MHz; please contact the sales office for more information.

QUARTZ CRYSTALS

HC49 CRYSTALS

ISSUE 8; 18 MAY 1998

Delivery Options

- Common frequencies are available from stock. Please see p5 for details
- 3 day Express Manufacturing Service, subject to piece part stock availability

Holder Style

- HC49 crystals are resistance welded, hermetically sealed in an inert atmosphere with glass to metal seals securing the lead wires; HC49/T is truncated version; HC50 is plug-in version
- HC43 crystals are cold welded; HC43/T is truncated version; HC42 is plug-in version
- Holders suffixed '-3L have a centre third wire which grounds the case; this is not applicable to the HC50 and HC42
- Truncated versions are only available in the frequency range 4.0 to 300.0MHz

General Specifications

- Load Capacitance (C_L): 10pF to 75pF or Series
- Drive Level: 1mW max.
- Static Capacitance (C_0): 7pF max.
- Ageing: ± 3 ppm typical per year

Standard Frequency Tolerances and Stabilities

- ± 5 ppm, ± 10 ppm, ± 15 ppm, ± 20 ppm, ± 30 ppm, ± 50 ppm, ± 100 ppm

Operating Temperature Ranges

- 0 to 50°C -40 to 90°C
- 10 to 60°C -55 to 105°C
- 20 to 70°C -55 to 125°C
- 30 to 80°C

Storage Temperature Range

- 55 to 125°C

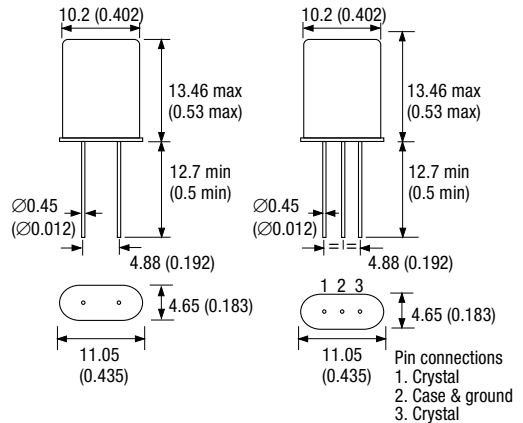
Environmental Specification

- Shock: 981m/s² for 6ms, three shocks in each direction along three mutually perpendicular planes
- Vibration: 10 to 60Hz 0.75mm displacement, 60 to 500Hz 98.1m/s² acceleration, 30 minutes in each of three mutually perpendicular planes

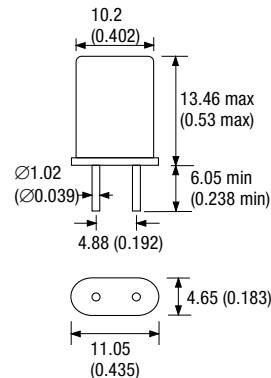
Marking

- Includes Frequency

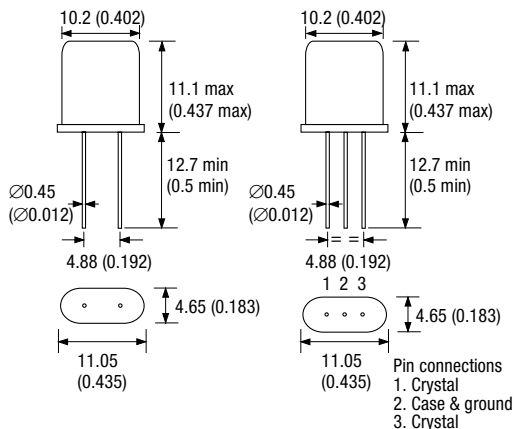
Outline in mm (inches) - HC49 & HC49-3L



Outline in mm (inches) - HC50 & HC42



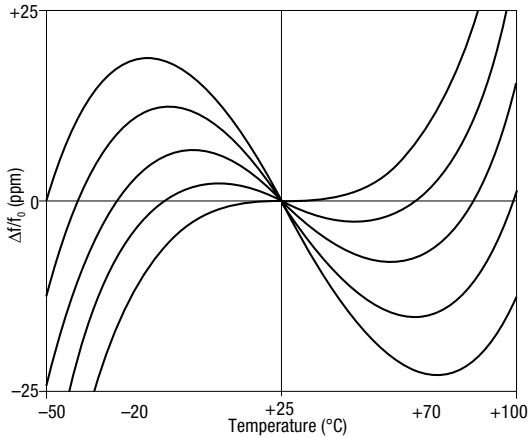
Outline in mm (inches) - HC49/T & HC49/T-3L



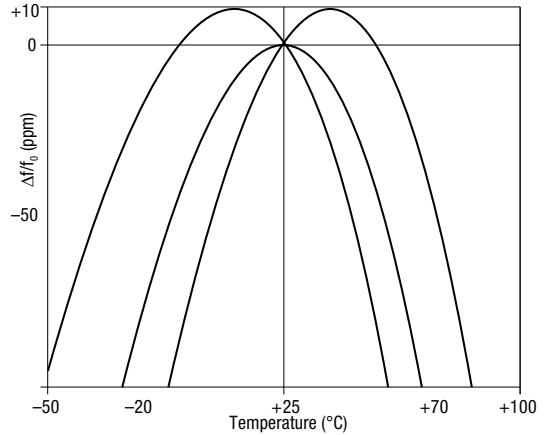
Minimum Order Information Required

- Frequency + Holder + Frequency Tolerance @ 25°C + Frequency Stability + Operating Temperature Range + Circuit Condition + Overtone Order

Typical Frequency vs Temperature Curves for various angles of AT-cut crystals



Typical Frequency vs Temperature Curves for various angles of BT-cut crystals



QUARTZ CRYSTALS

Electrical Specification – maximum limiting values

Frequency Range	Frequency Tolerance @ 25°C ±2°C	Operating Temperature Range	Frequency Stability Available Over Operating Temperature		ESR max.	Vibration Mode
			Minimum	Maximum		
1.8432 to < 3.0MHz	±5ppm to ±100ppm	0 to 50°C	±15ppm	±200ppm	600Ω	Fundamental AT cut
		-10 to 60°C	±20ppm	±200ppm		
		-20 to 70°C	±20ppm	±200ppm		
		-30 to 80°C	±25ppm	±200ppm		
		-40 to 90°C	±30ppm	±200ppm		
		-55 to 105°C	±50ppm	±200ppm		
		-55 to 125°C	±100ppm	±200ppm		
3.0 to < 4.0MHz	±5ppm to ±100ppm	0 to 50°C	±15ppm	±200ppm	150Ω	Fundamental AT cut
		-10 to 60°C	±20ppm	±200ppm		
		-20 to 70°C	±20ppm	±200ppm		
		-30 to 80°C	±25ppm	±200ppm		
		-40 to 90°C	±30ppm	±200ppm		
		-55 to 105°C	±50ppm	±200ppm		
		-55 to 125°C	±55ppm	±200ppm		
4.0 to < 7.0MHz	±5ppm to ±100ppm	0 to 50°C	±10ppm	±100ppm	100Ω	Fundamental AT cut
		-10 to 60°C	±15ppm	±100ppm		
		-20 to 70°C	±15ppm	±100ppm		
		-30 to 80°C	±20ppm	±100ppm		
		-40 to 90°C	±25ppm	±100ppm		
		-55 to 105°C	±50ppm	±100ppm		
		-55 to 125°C	±50ppm	±100ppm		
7.0 to < 10.0MHz	±5ppm to ±100ppm	0 to 50°C	±10ppm	±100ppm	50Ω	Fundamental AT cut
		-10 to 60°C	±10ppm	±100ppm		

Frequency Range	Frequency Tolerance @ 25°C ±2°C	Operating Temperature Range	Frequency Stability Available Over Operating Temperature		ESR max.	Vibration Mode
			Minimum	Maximum		
7.0 to < 10.0MHz	±5ppm to ±100ppm	-20 to 70°C	±10ppm	±100ppm	50Ω	Fundamental AT cut
		-30 to 80°C	±20ppm	±100ppm		
		-40 to 90°C	±25ppm	±100ppm		
		-55 to 105°C	±50ppm	±100ppm		
		-55 to 125°C	±50ppm	±100ppm		
10.0 to 36.0MHz	±5ppm to ±100ppm	0 to 50°C	±5ppm	±100ppm	35Ω	Fundamental AT cut
		-10 to 60°C	±5ppm	±100ppm		
		-20 to 70°C	±10ppm	±100ppm		
		-30 to 80°C	±20ppm	±100ppm		
		-40 to 90°C	±25ppm	±100ppm		
		-55 to 105°C	±50ppm	±100ppm		
		-55 to 125°C	±50ppm	±100ppm		
20.0 to 45.0MHz	Inclusive with Frequency Stability	0 to 50°C	±50ppm	±100ppm	35Ω	Fundamental BT cut
		-10 to 60°C	±50ppm	±100ppm		
		-20 to 70°C	±100ppm	±100ppm		
		-30 to 80°C	±100ppm	±100ppm		
21.0 to 90.0MHz	±5ppm to ±100ppm	0 to 50°C	±5ppm	±100ppm	40Ω	3rd Overtone AT cut
		-10 to 60°C	±5ppm	±100ppm		
		-20 to 70°C	±10ppm	±100ppm		
		-30 to 80°C	±20ppm	±100ppm		
		-40 to 90°C	±25ppm	±100ppm		
		-55 to 105°C	±50ppm	±100ppm		
		-55 to 125°C	±50ppm	±100ppm		
45.0 to 135.0MHz	Inclusive with Frequency Stability	0 to 50°C	±50ppm	±100ppm	35Ω	3rd Overtone BT cut
		-10 to 60°C	±50ppm	±100ppm		
		-20 to 70°C	±100ppm	±100ppm		
		-30 to 80°C	±100ppm	±100ppm		
60.0 to 150.0MHz	±5ppm to ±100ppm	0 to 50°C	±5ppm	±100ppm	70Ω	5th Overtone AT cut
		-10 to 60°C	±5ppm	±100ppm		
		-20 to 70°C	±10ppm	±100ppm		
		-30 to 80°C	±20ppm	±100ppm		
		-40 to 90°C	±25ppm	±100ppm		
		-55 to 105°C	±50ppm	±100ppm		
		-55 to 125°C	±50ppm	±100ppm		
90.0 to 225.0MHz	Inclusive with Frequency Stability	0 to 50°C	±50ppm	±100ppm	70Ω	5th Overtone BT cut
		-10 to 60°C	±50ppm	±100ppm		
		-20 to 70°C	±100ppm	±100ppm		
		-30 to 80°C	±100ppm	±100ppm		
85.0 to 210.0MHz	±5ppm to ±100ppm	0 to 50°C	±5ppm	±100ppm	100Ω	7th Overtone AT cut
		-10 to 60°C	±5ppm	±100ppm		
		-20 to 70°C	±10ppm	±100ppm		
		-30 to 80°C	±20ppm	±100ppm		
		-40 to 90°C	±25ppm	±100ppm		
		-55 to 105°C	±50ppm	±100ppm		
		-55 to 125°C	±50ppm	±100ppm		

Frequency Range	Frequency Tolerance @ 25°C ±2°C	Operating Temperature Range	Frequency Stability Available Over Operating Temperature		ESR max.	Vibration Mode
			Minimum	Maximum		
125.0 to 300.0MHz	Inclusive with Frequency Stability	0 to 50°C	±50ppm	±100ppm	100Ω	7th Overtone BT cut
		-10 to 60°C	±50ppm	±100ppm		
		-20 to 70°C	±100ppm	±100ppm		
		-30 to 80°C	±100ppm	±100ppm		
110.0 to 270.0MHz	±5ppm to ±100ppm	0 to 50°C	±5ppm	±100ppm	150Ω	9th Overtone AT cut
		-10 to 60°C	±5ppm	±100ppm		
		-20 to 70°C	±10ppm	±100ppm		
		-30 to 80°C	±20ppm	±100ppm		
		-40 to 90°C	±25ppm	±100ppm		
		-55 to 105°C	±50ppm	±100ppm		
		-55 to 125°C	±50ppm	±100ppm		

HC51 & HC47 CRYSTALS

ISSUE 8; 19 JUNE 1997

Delivery Options

- Common frequencies are available from stock. Please see p6 for details
- 3 day Express Manufacturing Service, subject to piece part stock availability

Holder Style

- HC51 crystals are resistance welded, hermetically sealed in an inert atmosphere with glass to metal seals securing the lead wires; HC48 is plug-in version
- HC47 crystals are cold welded; HC36 is plug-in version
- Holders suffixed '-3L' have a centre third wire which grounds the case; this is not applicable to the HC36 and HC48

General Specifications

- Load Capacitance (C_L): 10pF to 75pF or Series
- Drive Level: 1mW max.
- Static Capacitance (C_0): 9pF max.
- Ageing: ± 3 ppm typical per year

Standard Frequency Tolerances and Stabilities

- ± 10 ppm, ± 15 ppm, ± 20 ppm, ± 30 ppm, ± 50 ppm, ± 100 ppm

Operating Temperature Ranges

- 0 to 50°C
- 10 to 60°C
- 20 to 70°C
- 30 to 80°C
- 40 to 90°C
- 55 to 105°C
- 55 to 125°C

Storage Temperature Range

- 55 to 125°C

Environmental Specification

- Shock: 981m/s² for 6ms, three shocks in each direction along three mutually perpendicular p planes
- Vibration: 10 to 60Hz 0.75mm displacement, 60 to 500Hz 98.1m/s² acceleration, 30 minutes in each of three mutually perpendicular planes

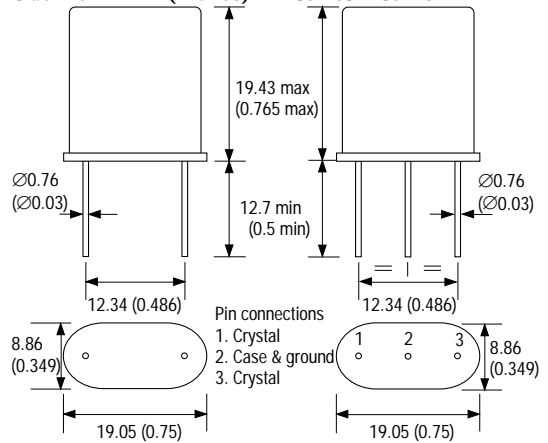
Marking

- Includes Frequency

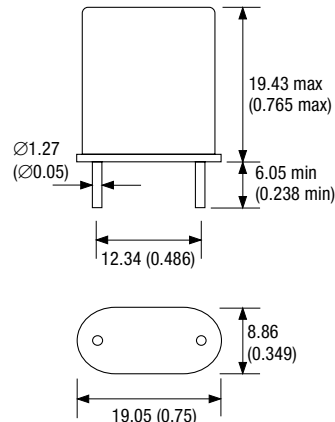
Minimum Order Information Required

- Frequency + Holder + Frequency Tolerance @ 25°C
- + Frequency Stability + Operating Temperature Range + Circuit Condition + Overtone Order

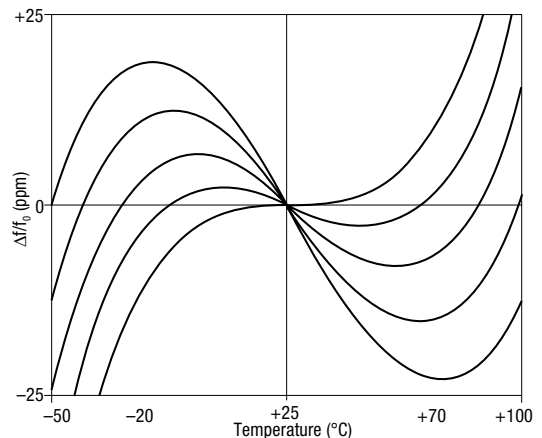
Outline in mm (inches) - HC51 & HC51-3L



Outline in mm (inches) - HC48 & HC36



Typical Frequency vs Temperature Curves for various angles of AT-cut crystals



Electrical Specification – maximum limiting values

Frequency Range	Frequency Tolerance @ 25°C ±2°C	Operating Temperature Range	Frequency Stability Available Over Operating Temperature		ESR max.	Vibration Mode
			Minimum	Maximum		
890.0kHz to < 1.5MHz	±10ppm to ±100ppm	0 to 50°C	±10ppm	±100ppm	700Ω	Fundamental AT cut
		-10 to 60°C	±15ppm	±100ppm		
		-20 to 70°C	±15ppm	±100ppm		
		-30 to 80°C	±20ppm	±100ppm		
		-40 to 90°C	±25ppm	±100ppm		
		-55 to 105°C	±50ppm	±100ppm		
1.5 to < 2.5MHz	±10ppm to ±100ppm	0 to 50°C	±10ppm	±100ppm	350Ω	Fundamental AT cut
		-10 to 60°C	±15ppm	±100ppm		
		-20 to 70°C	±15ppm	±100ppm		
		-30 to 80°C	±20ppm	±100ppm		
		-40 to 90°C	±25ppm	±100ppm		
		-55 to 105°C	±50ppm	±100ppm		
2.5 to < 3.5MHz	±10ppm to ±100ppm	0 to 50°C	±10ppm	±100ppm	200Ω	Fundamental AT cut
		-10 to 60°C	±15ppm	±100ppm		
		-20 to 70°C	±15ppm	±100ppm		
		-30 to 80°C	±20ppm	±100ppm		
		-40 to 90°C	±25ppm	±100ppm		
		-55 to 105°C	±50ppm	±100ppm		
3.5 to < 7.0MHz	±10ppm to ±100ppm	0 to 50°C	±10ppm	±100ppm	100Ω	Fundamental AT cut
		-10 to 60°C	±15ppm	±100ppm		
		-20 to 70°C	±15ppm	±100ppm		
		-30 to 80°C	±20ppm	±100ppm		
		-40 to 90°C	±25ppm	±100ppm		
		-55 to 105°C	±50ppm	±100ppm		
7.0 to < 12.0MHz	±10ppm to ±100ppm	0 to 50°C	±10ppm	±100ppm	40Ω	Fundamental AT cut
		-10 to 60°C	±15ppm	±100ppm		
		-20 to 70°C	±15ppm	±100ppm		
		-30 to 80°C	±20ppm	±100ppm		
		-40 to 90°C	±25ppm	±100ppm		
		-55 to 105°C	±50ppm	±100ppm		
12.0 to 24.0MHz	±10ppm to ±100ppm	0 to 50°C	±10ppm	±100ppm	20Ω	Fundamental AT cut
		-10 to 60°C	±15ppm	±100ppm		
		-20 to 70°C	±15ppm	±100ppm		
		-30 to 80°C	±20ppm	±100ppm		
		-40 to 90°C	±25ppm	±100ppm		
		-55 to 105°C	±50ppm	±100ppm		
9.0 to 30.0MHz	±10ppm to ±100ppm	0 to 50°C	±10ppm	±100ppm	20Ω	3rd Overtone AT cut
		-10 to 60°C	±15ppm	±100ppm		
		-20 to 70°C	±15ppm	±100ppm		
		-30 to 80°C	±20ppm	±100ppm		
		-40 to 90°C	±25ppm	±100ppm		
		-55 to 105°C	±50ppm	±100ppm		
15.0 to 50.0MHz	±10ppm to ±100ppm	0 to 50°C	±10ppm	±100ppm	20Ω	5th Overtone AT cut
		-10 to 60°C	±15ppm	±100ppm		
		-20 to 70°C	±15ppm	±100ppm		
		-30 to 80°C	±20ppm	±100ppm		
		-40 to 90°C	±25ppm	±100ppm		
		-55 to 105°C	±50ppm	±100ppm		

SC CUT CRYSTALS: CFPX-2000 SERIES

ISSUE 1; 18 MAY 1998

- The CFPX-2000 series of SC cut quartz resonators are double rotated crystals that offer considerable advantages over single rotated AT or BT cuts for certain applications. The term SC stands for "Stress Compensated" and it was the property of compensation for thermal transient and planar stress effects that was sought in its original development. The frequency/temperature characteristics of the SC cut are most suitable for oven controlled oscillator applications for precision frequency control.

Key Features:

- Thermal transient compensation - fast warm up
- Low frequency/temperature response slope suitable for ovened applications
- Smooth frequency/temperature characteristics reduce coupled mode problems
- Low thermal hysteresis
- Ageing as low as 1×10^{-10} /day at 85°C (3rd overtone) can be achieved
- Low acceleration sensitivity
- Q factor > 1.2 million for 10MHz 3rd overtone crystal

Environmental Specification:

- Bump: IEC 68-2-29 Test Eb, 4000 ±10 bumps at 400m/s² (40_{gn}) in each of three mutually perpendicular planes
- Vibration: IEC 68-2-6 Test Fc Procedure B4 (MIL-STD-202 Method 204), Duration 12 hours, 10 to 55Hz 0.75mm D.A., 55 to 2000Hz 98m/s² (10_{gn})
- Shock: IEC 68-2-27 Test Ea, (MIL-STD-202 Method 213) ½ sine wave, 981m/s² (100_{gn}) 11ms, 6 shocks in each plane
- Damp Heat: IEC 68-2-3 Test Ca (Steady State), Duration 56 days, recovery time 12 hours
- Change of temperature: IEC 68-2-14 Test Na (Rapid Change) (MIL-STD-202 Method 107), 10 cycles of 30 minutes duration each for -55/+125°C cycle
- Solderability: IEC 68-2-20 Test Ta Method1 (Solder Bath) (MIL-STD-202 Method 208), Temperature 235°C
- Robustness of Termination: IEC 68-2-21 Test Ua (Tensile or Thrust)(MIL-STD-202 Method 211), 10 Newtons (Tensile) or 20 Newtons (Thrust)
- Hermetic Seal: IEC 68-2-17 Test Qk (Fine Leak), (MIL-STD-202 Method 112 Test condition C) and IEC 68-2-17 Test Qc (Gross Leak) (MIL-STD-202 Method 112 Test condition D)
- Marking: Heat cured epoxy or engraving

Frequency\Holder Range

Frequency Range	Mode	Holder	IEC Code
8.0 to 50.0MHz	Fundamental	HC35/U (TO5) HC45/U	DK EB
30.0 to 150.0MHz	3rd Overtone		
5.0 to 20.0MHz	Fundamental	HC37/U (TO8)	DL
8.0 to 20.0MHz	3rd Overtone		
1.5 to 10.0MHz	Fundamental	HC40/U HC36/U	DU, DM, DR DN
4.0 to 20.0MHz	3rd Overtone		

General Characteristics

- Turnover temperature: 50 to 85°C
105 to 125°C
- Ageing: < 5×10^{-9} /day at 85°C (fundamental)
< 1×10^{-9} /day at 85°C (3rd overtone)

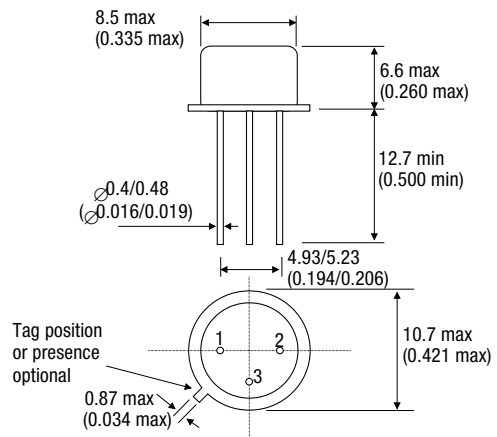
Note: Tighter specifications available

- Q - factor: > 1.2 million for 10MHz 3rd overtone
- g - sensitivity: < 1×10^{-9} /g typical for HC35, HC37 or HC40

Note: These holders employ 4-point mounting and are recommended where low g - sensitivity is a requirement

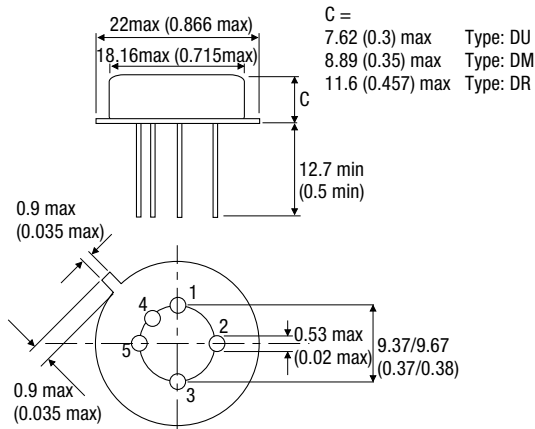
- Material: Swept premium Q, low inclusion density
- To determine your exact requirements please contact our Applications Support Department

Outline in mm (inches) - HC35/U (TO5) DK - (scale 1.5:1)

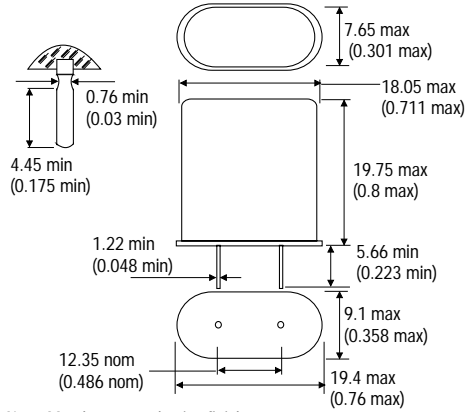


CFPX-2000 Series Outline Drawings

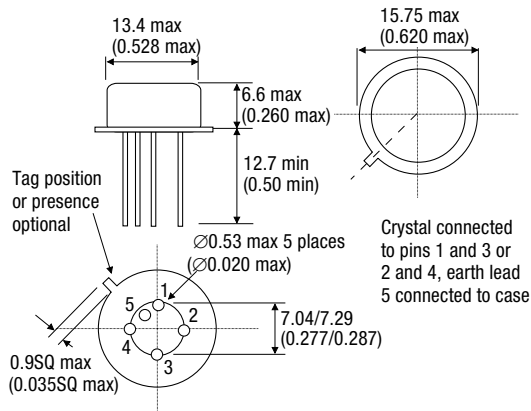
Outline in mm (inches) - HC40/U, DU, DM, DR



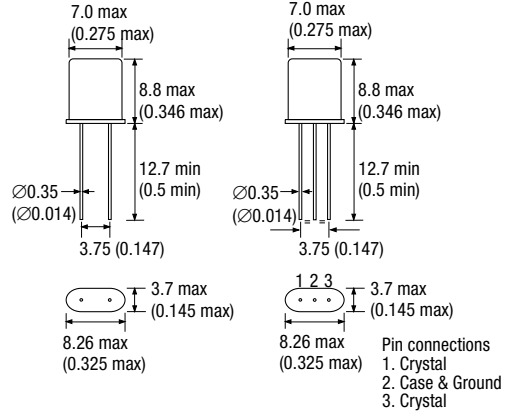
Outline in mm (inches) - HC36/U, DN



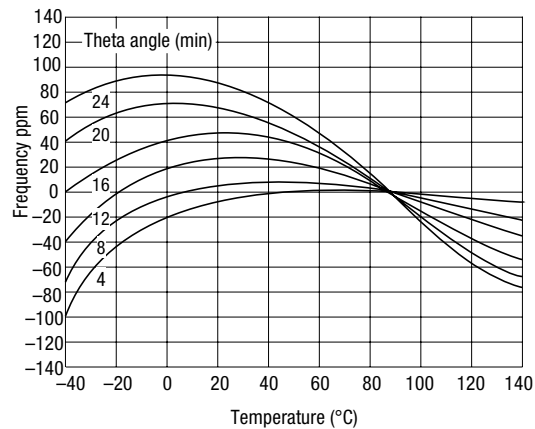
Outline in mm (inches) - HC37/U (TO8) DL



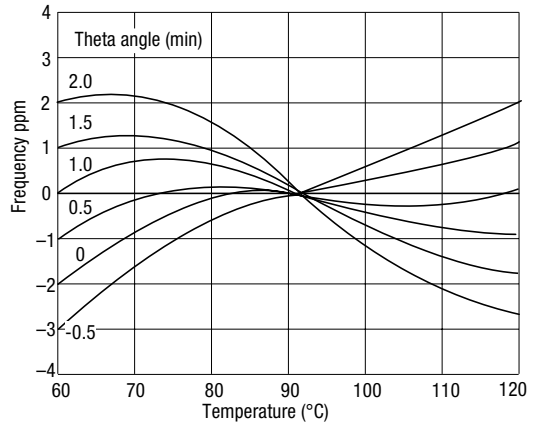
Outline in mm (inches) - HC45/U, EB



Frequency/Temperature Curves SC Cut -40+140°C



Frequency/Temperature Curves SC Cut -60+120°C



CFPX-3000 ESA/SCC Approved Quartz Crystals

ISSUE 1; 18 MAY 1998

- C-MAC has held ESA/SCC Qualification Approval for quartz crystals since 1985. This provides customers with a source of crystal units that can be released as fully conforming to ESA/SCC requirements. The certification is for Qualification Approval, which enables C-MAC to supply crystal resonators within the frequency range and holder styles listed below. The applicable specifications are Generic Specification ESA/SCC 3501 and Detail Specifications 3501/001, 3501/002, 3501/008, 3501/009 and 3501/011.

Key Features:

- A range of quartz crystal units to full ESA/SCC approval
- The product and processes are under the control of the ESA inspectorate via Lot Acceptance Testing
- Specifications can be issued against specific customer requirements within the boundaries of the approval
- Products can be supplied against this release for all ESA projects

Range of Qualification

ESA/SCC 3501/001, 3501/008 and 3501/011 specification:

- Frequency: 4.0 - 140.0MHz in Fundamental, 3rd Overtone and 5th Overtone Mode
- Holder Style: Metal welded type T807
- CFPX Series: CFPX-3750

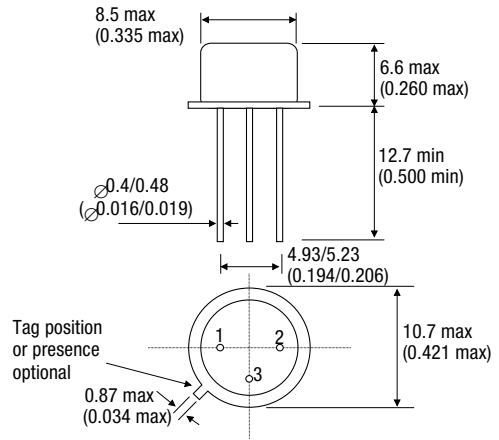
ESA/SCC 3501/002 and 3501/009 specification:

- Frequency: 2.5 - 20.0MHz Fundamental Mode
- Holder Style: Metal welded type T1507
- CFPX Series: CFPX-3758

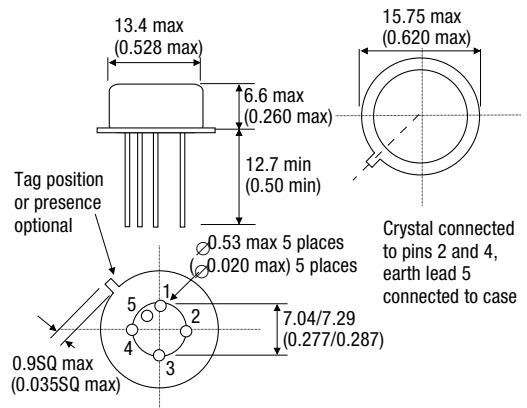
Ordering Procedure

- Please refer to ESA/SCC Table 1 and enter parameters as required

Outline in mm (inches): ESA/SCC 3501/001, 3501/008 & 3501/011 CFPX-3750 Series - (scale 1.5:1)



Outline in mm (inches): ESA/SCC 3501/002 & 3501/009 CFPX-3758 Series



ESA/SCC Table 1

Customer Fax Form - Please copy form, fill out and fax to CFP on +44 (0)1460 72578

No	Characteristic	Symbol	Limits		Unit	Remarks
			Min.	Max.		
1	Holder Style					
2	Resonance Frequency	F_r or f_L			MHz	
3	Reference Temperature	T_o			°C	
4	Overtone Order					
5	Load Capacitance	C_L			pF	
6	Rated Drive Level	P_o			mW	
7	Frequency Adjustment Tolerance	$\frac{\Delta f}{f}$			10^{-6}	At T_o °C
8	Resonance Resistance	R_r or R_L			Ω	At T_o °C
9	Frequency Variation with Temperature over T_{op}	$\frac{\Delta f}{f}$			10^{-6}	From frequency measured at T_o °C
10	Resistance Variation with Temperature over T_{op}	$\frac{\Delta R}{R}$			%	From resistance measured at T_o °C
11	Operating Temperature Range	T_{op}			°C	
12	Frequency variation with Drive Level	$\frac{\Delta f}{f}$			10^{-6}	From $P_{S1} =$ mW to $P_{S2} =$ mW
13	Resistance variation with Drive Level	$\frac{\Delta R}{R}$			%	
14	Motional Inductance	L_1			mH	
15	Motional Capacitance	C_1			fF	
16	Static Capacitance	C_o			pF	
17	Q Factor	Q			-	
18	Ratio of unwanted: Response Resistance to Resonance Resistance or Response Impedance to Resonance Resistance	R_p/R or $I Z_p/I/R$				In the frequency range: f - kHz to f + kHz
19	Ageing	$\frac{\Delta f}{f}$			10^{-6}	
20	Terminal Length	L			mm	
21	Storage Temperature Range	T_{stg}			°C	
22	Intended Application					

QUARTZ
CRYSTALS