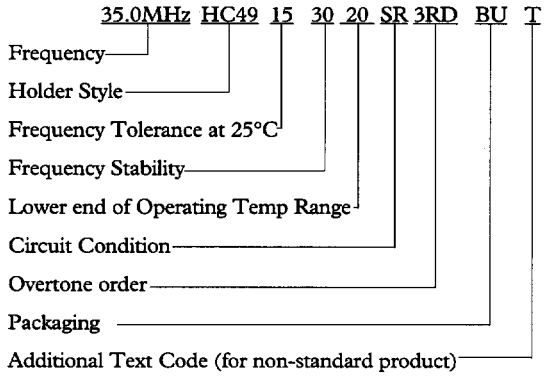
SPECIFYING QUARTZ CRYSTALS

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

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

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.

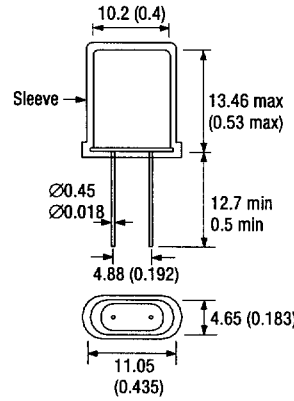
Ordering Information

- See individual datasheet

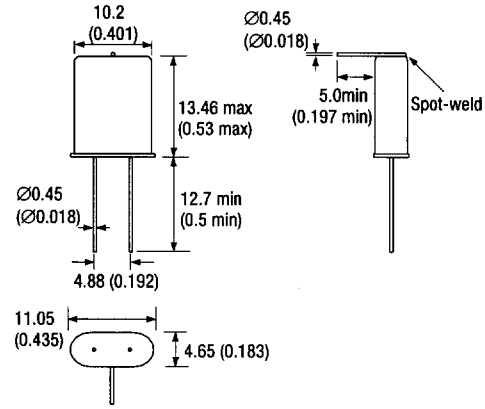
Stability Conversion Chart

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

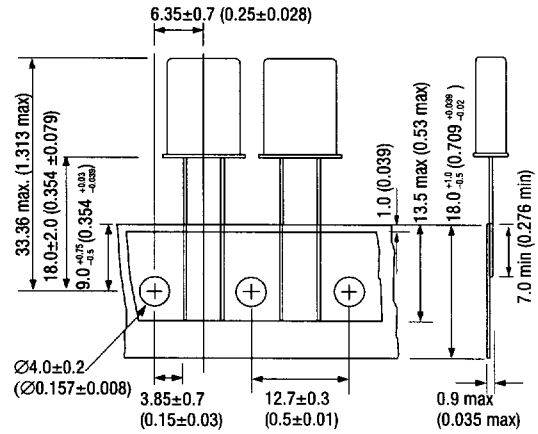
Outline in mm (inches)- Insulated Sleeve HC49 & HC43



Outline in mm (inches)- HC49 with Top Wire



Outline in mm (inches)- Tape for HC49



QUARTZ CRYSTALS

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
7.3728OMHz	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
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
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