HC49/4HSMX CRYSTALS

ISSUE 17; 1 NOVEMBER 2010 □ RoHS 2002/95/EC

Description

- Industry standard low cost SMD crystal
- SMD version of the HC49/4H
- Resistance welded, hermetically sealed in an inert atmosphere, glass to metal seals on leads. Lead wires are mounted onto a plastic former to create a gull wing mount
- Low profile versions available please contact our sales offices for details
- Stock parts listed at the beginning of this chapter

General Specifications

- Load Capacitance (C_L): 10pF to 75pF or Series
- Drive Level: 500µW max
- Ageing: ±5ppm typ per year at 25°C
- Shunt Capacitance (C_0): 7pF max

Standard Frequency Tolerances and Stabilities

- ±30ppm, ±50ppm, ±100ppm

Operating Temperature Ranges

- 0 to 50°C
- □10 to 60°C
- □20 to 70°C
- –30 to 80°C
- □40 to 85°C
- □55 to 105°C

Storage Temperature Range

- □55 to 125°C

Environmental

- Shock: 981m/s^2, 6ms, 3 times in each of 3 mutually perpendicular planes
- Vibration: 10Hz-60Hz, 0.75mm amplitude, 60Hz-500Hz, 98.1m/s^2, 30mins in 3 mutually perpendicular planes

Packaging

- Loose in bulk pack, 100pcs per bag
- Tape and reel in accordance with EIA-481-D, 1kpcs per reel (please see pages 372 & 373)

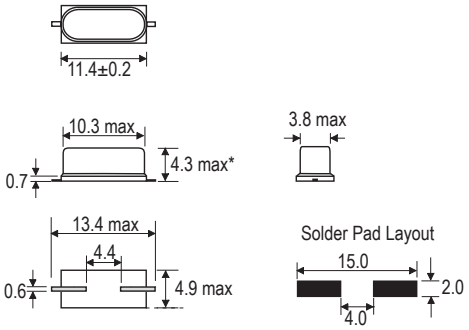
Ordering Information (*minimum required)

- Frequency*
- Model*
- Frequency Tolerance (@25°C)*
- Frequency Stability (over operating temperature range)*
- Operating Temperature Range*
- Load Capacitance*
- Overtone*

Example

- 10.00MHz HC49/4HSMX 50/50/□40 to 85C/10 FUND

Outline (mm)



* Lower Profile Options
HC49/3.5H 3.7mm max
HC49/3H 3.1mm max
HC49/2.5H 2.7mm max

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Electrical Specifications - maximum limiting values

Frequency Range	Frequency Tolerance @25°C ±2°C	Operating Temperature Range	Frequency Stability Available Over Operating Temperature Range		ESR Max	Vibration Mode
			Minimum	Maximum		
3.2 to <4.0MHz	±10ppm to ±100ppm	0 to 50°C	±15ppm	±100ppm	300Ω	Fundamental AT cut
		□ 10 to 60°C	±20ppm			
		□ 20 to70°C				
		□ 30 to 80°C	±25ppm			
		□ 40 to 85°C	±30ppm			
		□ 55 to 105°C	±100ppm	±500ppm		
4.0 to <5.5MHz		0 to 50°C	±15ppm	±100ppm	130Ω	
		□ 10 to 60°C	±20ppm			
		□ 20 to70°C				
		□ 30 to 80°C	±25ppm			
		□ 40 to 85°C	±30ppm			
		□ 55 to 105°C	±100ppm	±500ppm		
5.5 to <8.0MHz		0 to 50°C	±15ppm	±100ppm	60Ω	
		□ 10 to 60°C	±20ppm			
		□ 20 to70°C				
		□ 30 to 80°C	±25ppm			
		□ 40 to 85°C	±30ppm			
		□ 55 to 105°C	±100ppm	±500ppm		
8.0 to <40.0MHz		0 to 50°C	±15ppm	±100ppm	40Ω	
		□ 10 to 60°C	±20ppm			
		□ 20 to70°C				
		□ 30 to 80°C	±25ppm			
		□ 40 to 85°C	±30ppm			
		□ 55 to 105°C	±100ppm	±500ppm		
27.0 to 50.0MHz	Inclusive with Frequency Stability	0 to 50°C	±50ppm	±100ppm		Fundamental BT cut
		□ 10 to 60°C	±70ppm			
		□ 20 to70°C	±100ppm			
26.0 to 100.0MHz	±10ppm to 100ppm	0 to 50°C	±15ppm	±100ppm	100Ω	3rd Overtone AT cut
		□ 10 to 60°C	±20ppm			
		□ 20 to70°C				
		□ 30 to 80°C	±25ppm			
		□ 40 to 85°C	±30ppm			
		□ 55 to 105°C	±100ppm	±500ppm		
Note: For other frequency / specification combinations, please contact our sales offices						

IQD Frequency Products Ltd

Main
Automotive
Statek

Part Numbers for IQD HC49/4HSMX

Frequency	Specification	Part Number	Packaging	
			Bulk	Reel
3.57955MHz	30/50/-10 to 60C/16 FUND	**LFXTAL003058**	✓	✓
3.6864MHz	30/50/-10 to 60C/16 FUND	**LFXTAL003260**	✓	✓
4MHz	30/50/-10 to 60C/16 FUND	**LFXTAL003071**	✓	✓
4MHz	30/50/-10 to 60C/30 FUND	**LFXTAL011300**	✓	✓
4.9152MHz	30/50/-10 to 60C/16 FUND	**LFXTAL018153**	✓	✓
4.9152MHz	30/50/-20 to 70C/18 FUND	**LFXTAL028392**		✓
5MHz	30/50/-10 to 60C/30 FUND	**LFXTAL012312**	✓	✓
6MHz	30/50/-10 to 60C/30 FUND	**LFXTAL016788**	✓	✓
6MHz	20/50/-10 to 60C/16 FUND	**LFXTAL026900**	✓	✓
7.3728MHz	30/50/-10 to 60C/16 FUND	**LFXTAL003334**	✓	✓
7.3728MHz	30/50/-10 to 60C/30 FUND	**LFXTAL010689**	✓	✓
8MHz	30/50/-10 to 60C/16 FUND	**LFXTAL003151**	✓	✓
8MHz	30/50/-10 to 60C/30 FUND	**LFXTAL011301**	✓	✓
8MHz	30/50/-20 to 70C/18 FUND	**LFXTAL020423**		✓
8.192MHz	20/50/-10 to 60C/16 FUND	**LFXTAL026902**	✓	✓
9.8304MHz	30/50/-10 to 60C/30 FUND	**LFXTAL017048**	✓	
10MHz	30/50/-10 to 60C/30 FUND	**LFXTAL017145**	✓	✓
10MHz	30/50/-20 to 70C/18 FUND	**LFXTAL021675**		✓
10MHz	30/50/-10 to 60C/16 FUND	**LFXTAL003166**	✓	✓
11.0592MHz	30/50/-10 to 60C/16 FUND	**LFXTAL003519**	✓	✓
12MHz	30/50/-10 to 60C/16 FUND	**LFXTAL003210**	✓	
12MHz	30/50/-10 to 60C/30 FUND	**LFXTAL010043**	✓	✓
14.7456MHz	20/50/-10 to 60C/16 FUND	**LFXTAL026908**	✓	✓
14.7456MHz	30/50/-10 to 60C/30 FUND	**LFXTAL012313**	✓	✓
16MHz	30/50/-10 to 60C/16 FUND	**LFXTAL003237**	✓	✓
18.432MHz	20/50/-10 to 60C/16 FUND	**LFXTAL026911**	✓	✓
20MHz	30/50/-10 to 60C/16 FUND	**LFXTAL003181**	✓	✓
20MHz	30/50/-10 to 60C/30 FUND	**LFXTAL017146**	✓	✓
20MHz	30/50/-20 to 70C/18 FUND	**LFXTAL020131**		✓
24MHz	30/50/-10 to 60C/16 FUND	**LFXTAL012504**	✓	✓
24MHz	30/50/-20 to 70C/18 FUND	**LFXTAL026548**		✓
25MHz	30/50/-10 to 60C/16 FUND	**LFXTAL010595**	✓	✓
25MHz	30/50/-20 to 70C/18 FUND	**LFXTAL033342**		✓

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SPECIFYING QUARTZ CRYSTALS

Quartz crystals are the most technically simple product IQD offer, the package contains only a piece of quartz wafer, all the supporting circuitry needed to create the oscillation must be provided by the customer's circuit. The quartz wafer inside is cut and shaped to give a resonant frequency within the specified limits. IQD's quartz crystal part numbers all contain the code XTAL.

The electrical parameters are given on the specification to facilitate the correct circuit design. Further guidance can be found in the Application Notes chapter of this book. Our Application Support team can also provide assistance if required; please contact one of our sales offices for this support.

The limits given in the following specifications are indicative of the standard crystal design, in the event that a specification is needed which is outside the standard crystal designs offered please contact our Sales team.

A typical quartz crystal specification reads like this:

10.0MHz 12SMX-B
50/50/–20 to 70C/20/ FUND TE

The data in the example above is translated in the following order

- Frequency
- Model & Variant
- Frequency Tolerance @ 25°C
- Frequency Stability (over operating temperature range)
- Operating Temperature Range
- Load Capacitance
- Overtone
- Additional Text Code

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 described to seven significant figures. If seven significant figures are not used, we assume that any figure that might follow those given may 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, this method is not used by IQD. To minimise the possibility of misunderstanding it is best to use the standard method and specify fundamental or overtone mode separately.

Please contact a sales office for details of developed frequencies.

Model

Before manufacture of the crystal can start, the model must be defined. Each model covers a frequency range which is defined in the relevant specification.

The model information should also cover any mechanical variants required such as a top wire or cropped leads.

For leaded versions, 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
- Fitted insulator
- Cropped leads
- Formed leads

Frequency Tolerance

The cost of manufacture depends partly on the accuracy required at 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 circuit design.

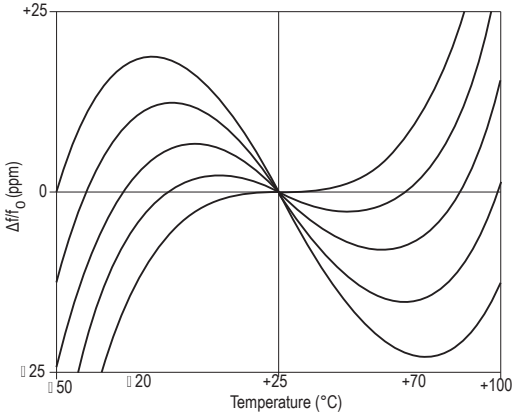
Frequency Stability

Frequency stability is normally specified as a frequency variation 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 in the value of frequency stability. Under normal conditions this will not damage the crystal.

A crystal designed for operation over a restricted operating temperature range, (such as from 0 to 50°C) generally has a better frequency stability over that range than one designed for operation over a wide operating temperature range. Therefore it is important not to over specify the temperature range, as doing so will result in inferior performance for the same or greater cost; or greater cost for the same or inferior performance.

Generalised frequency vs temperature curves for the AT-cut crystal types are illustrated below. 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.

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



Standard Frequency Tolerances and Stabilities

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

Operating Temperature Ranges

The standard operating temperature ranges for a crystal are:

- 0 to 50°C
- –10 to 60°C
- –20 to 70°C
- –30 to 80°C
- –40 to 85°C
- –55 to 105°C
- –55 to 125°C

Load 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.

Overtone Order

Quartz crystals resonate in specific "modes" depending upon the frequency in question and oscillator circuit configuration in which it is used. The main mode of operation is called "fundamental". i.e. a 10MHz crystal vibrates at a frequency of 10MHz

However for high frequency use, quartz crystals can be made to operate at odd multiples of its fundamental frequency.

These multiples are termed "overtones" and are denoted by their multiple as: 3rd , 5th, 7th, 9th. e.g. a 10MHz crystal can be made to operate at its 3rd overtone which is approximately 3 times its fundamental frequency.

If an overtone mode crystal is chosen then the circuit design must include the relevant components required to suppress the fundamental mode of operation to ensure oscillation at the intended frequency.

Where there is a cross-over band in the modes available, the mode required must be specified when ordering. For general use and simplicity of circuit design we recommend that fundamental mode be chosen where possible.

Additional Text Code

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

Packaging Codes

These are given directly after the part number for example LFXTAL012345Bulk and LFXTAL012345Reel are the same part packaged either loose in bulk pack or on tape and reel.

Tray packaging is available as an option for some products outlined in the individual data sheets.

Unless individual data sheets state Bulk packaging, surface mount versions will be Tape & Reel packed. Please note: only complete reels are sold. Sample quantities are avialable on request

- Bulk = Bulk packed
- Reel = Tape and reel packed
- Tray = Tray packed

Outline Drawings

Dimensions on the crystal outline drawings are shown only as a guide. Precise dimensions of crystal holders are available upon request. All dimensions are shown in mm and are nominal unless otherwise stated.

Marking

Due to the small size of modern SMT devices many components are now not marked with any customer readable information beyond the pad 1 denominator. In these cases the marking will be production specific data.