

# HC49/4H SMX Crystals

ISSUE 10; 4 APRIL 2002

## Delivery Options

- Please contact our sales office for current leadtimes

## Holder Style

- HC49/4H SMX crystals are resistance welded, hermetically sealed in an inert atmosphere with glass to metal seals securing the lead wires. The lead wires are formed into a gull wing and mounted on a plastic former

- Lower profiles available, please contact our sales office

## General Specifications

- Load Capacitance ( $C_L$ ): 10pF to 75pF or Series
- Drive Level: 0.5mW max
- Static Capacitance ( $C_0$ ): 9pF max
- Ageing:  $\pm 3$ ppm typical per year

## Standard Frequency Tolerances and Stabilities

- $\pm 50$ ppm,  $\pm 100$ ppm

## Operating Temperature Ranges

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

## Storage Temperature Range

- -40 to 85°C

## Environmental Specification

- Shock: 981m/s<sup>2</sup> for 6ms, three shocks in each direction along three mutually perpendicular planes,
- Vibration: 10 to 60Hz 0.75mm displacement, 60 to 500Hz 98.1m/s<sup>2</sup> acceleration, 30 minute in each of three mutually perpendicular planes

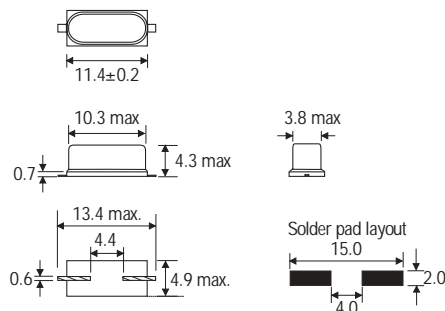
## Marking

- Frequency only

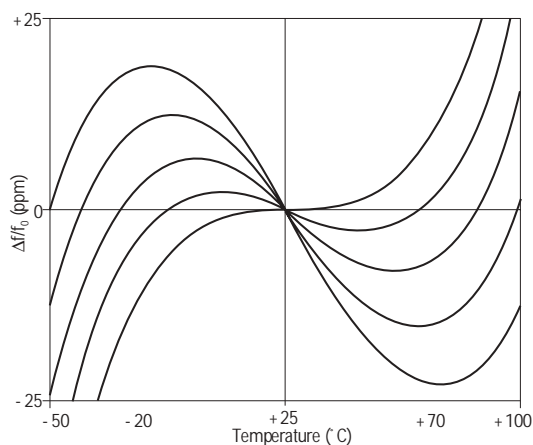
## Minimum Order Information Required

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

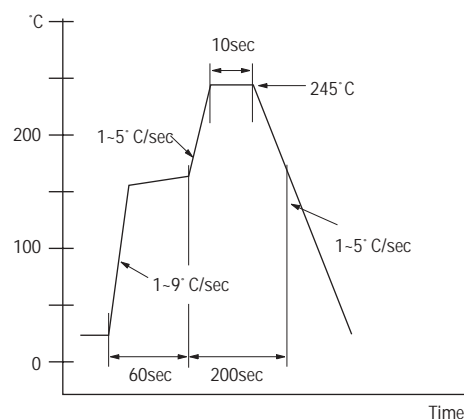
## Outline in mm



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



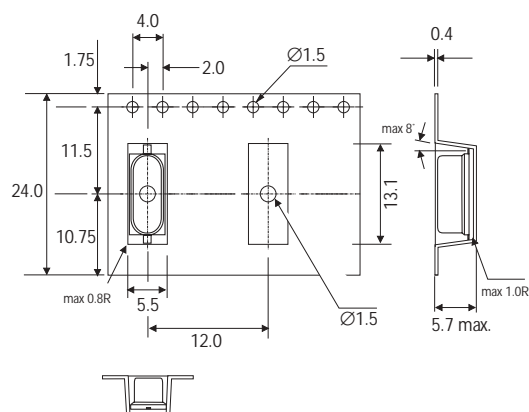
## Typical Solder Condition - Infrared Reflow



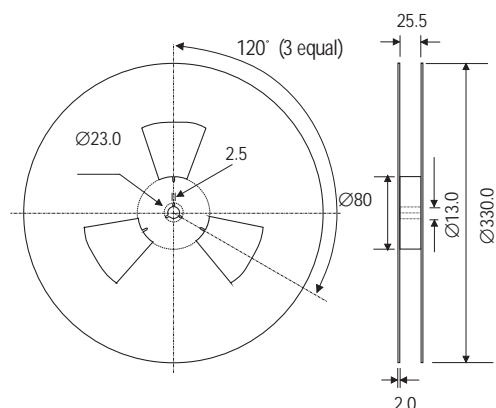
# Electrical Specification – maximum limiting values

Frequency Range	Frequency Tolerance @ 25°C ±2°C	Operating Temperature Range	Frequency Stability Available Over Operating Temperature		ESR max.	Vibration Mode
			Minimum	Maximum		
3.0 to < 5.0MHz	±10ppm 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		
5.0 to < 8.0MHz	±10ppm 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		
8.0 to < 12.0MHz	±10ppm 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		
12.0 to < 25.0MHz	±10ppm to ±100ppm	0 to 50°C	±5ppm	±100ppm	50Ω	Fundamental AT cut
		-10 to 60°C	±15ppm	±100ppm		
		-20 to 70°C	±15ppm	±100ppm		
		-30 to 80°C	±20ppm	±100ppm		
25.0 to < 32.0MHz	±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		
25.0 to < 40.0MHz	Inclusive with Frequency Stability	0 to 50°C	±50ppm	±100ppm	50Ω	Fundamental BT cut
		-10 to 60°C	±70ppm	±100ppm		
		-20 to 70°C	±100ppm	±100ppm		
28.0 to < 86.0MHz	±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		

Outline in mm - Tape



Outline in mm - Reel (scale 1:7)



# SPECIFYING SURFACE MOUNT QUARTZ CRYSTALS

A typical surface mount quartz crystal specification reads like this:

24.0140MHz 14SMX 15 30 20 18 FUND TR T

Frequency  
Holder Style  
Frequency Tolerance at 25°C  
Frequency Stability  
Lower end of Operating Temp Range  
Circuit Condition  
Overtone order  
Packaging  
Additional Text Code (for non-standard product)

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 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. To minimise the possibility of misunderstanding it is best to use the standard method and specify fundamental or overtone mode separately.

Please contact the sales office for details of developed frequencies.

## Holder Style

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

## 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.

## Frequency Stability

Frequency stability is normally specified as a frequency tolerance over a defined operating temperature range with respect to the frequency 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 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) 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.

## Operating Temperature Range

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 90°C  
-55 to 105°C  
-55 to 125°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

Tray Packaging is available as an option on many of the products outlined in the SM Quartz Crystal chapter.

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

BU = Bulk packed

TR = Tape & Reel packed

TY = Tray 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 purchase 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 factory 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.

### Standard Frequency Tolerances and Stabilities

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

### Soldering Conditions

Recommended solder pad layouts and soldering temperature profile are shown on each data sheet.

### Delivery Options

The following delivery options are available for crystals; timescales refer to despatch from our factories. Prices for larger quantities and longer delivery times are generally lower due to substantially reduced manufacturing costs.

6 weeks

10 to 12 weeks

### Marking

Where possible the frequency of operation will be marked in full on the crystal. On the smaller types the full frequency may not fit in the available space and will therefore be truncated. Please refer to the despatch packaging for the relevant crystal to see the frequency in full.

Some stock surface mount crystals are marked only with the C-MAC Frequency Products stock code. Referencing this to the stock table will give you the full frequency and specification.

### Ordering Information

See individual datasheets

### Stability Conversion Chart

10 <sup>x</sup>	PPM	%
10 <sup>-3</sup>	1000	0.1
10 <sup>-4</sup>	100	0.01
10 <sup>-5</sup>	10	0.001
10 <sup>-6</sup>	1	0.0001
10 <sup>-7</sup>	0.1	0.00001
10 <sup>-8</sup>	0.01	0.000001
10 <sup>-9</sup>	0.001	0.0000001
10 <sup>-10</sup>	0.0001	0.00000001