

## Quartz crystals - general applications HC-49/L and HC-49/S

### 9922 520 2/6.... series

#### FEATURES

- Ultra low profile (height 3.5 and 2.5 mm) which allows for a very compact design of equipment
- Manufactured in a clean-room environment on a highly automated production line with a high level of reliability and uniformity.  
This results in very low belt and field reject levels and a low DLD (start-up resistance). It contributes to a consistent product quality level in applications that incorporate these crystals.
- Available in several styles and packaging methods to fit in most assembly environments.

#### QUICK REFERENCE DATA

SYMBOL	PARAMETER	MIN.	TYP.	MAX.	UNIT
$f_{nom}$	nominal frequency range: fundamental mode AT	3.5	–	28.0	MHz
	fundamental mode BT	26.0	–	50.0	MHz
	third overtone AT	29.0	–	66.0	MHz
$T_{oper}$	operating temperature	–40	–	+85	°C
$T_{op}$	operable temperature	–40	–	+125	°C
$\Delta f/f_{nom}$	adjustment tolerance	±15	±50	–	ppm
$\Delta f/f_{25}$	frequency stability over temperature range: –20 to +70 °C with respect to $T_{amb} = 25 \pm 2$ °C	±10	±50	–	ppm
$C_1$	motional capacitance tolerance	±20	–	–	%
$C_0$	parallel capacitance tolerance	±20	–	–	%
$\Delta f/f$	ageing over 10 years at 25 °C	±5	–	±10	ppm

#### APPLICATIONS

- E.D.P.
- Mobile telecom
- Audio/Video
- Portable equipment.

#### DESCRIPTION

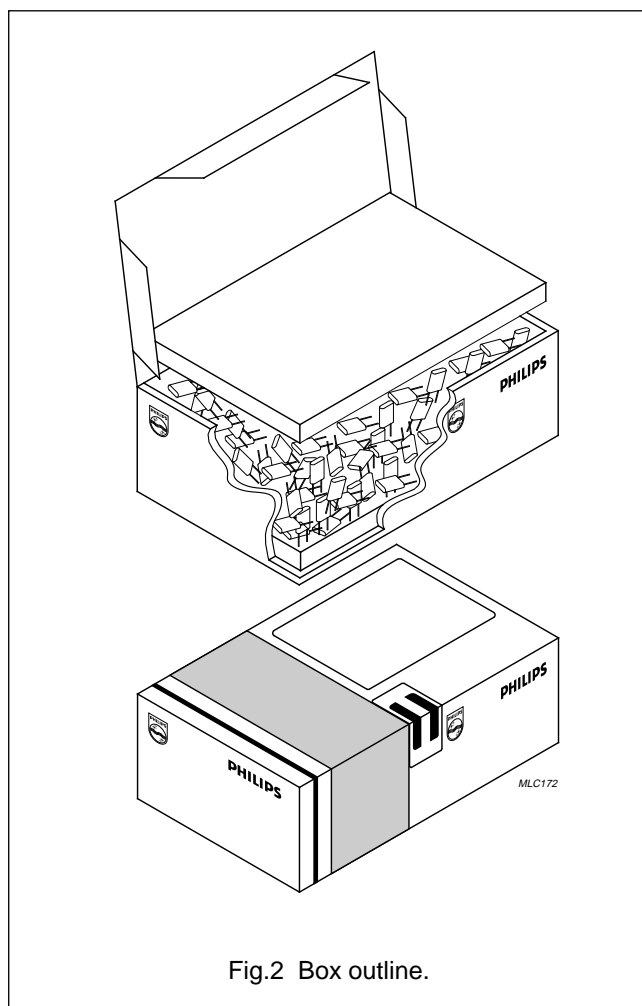
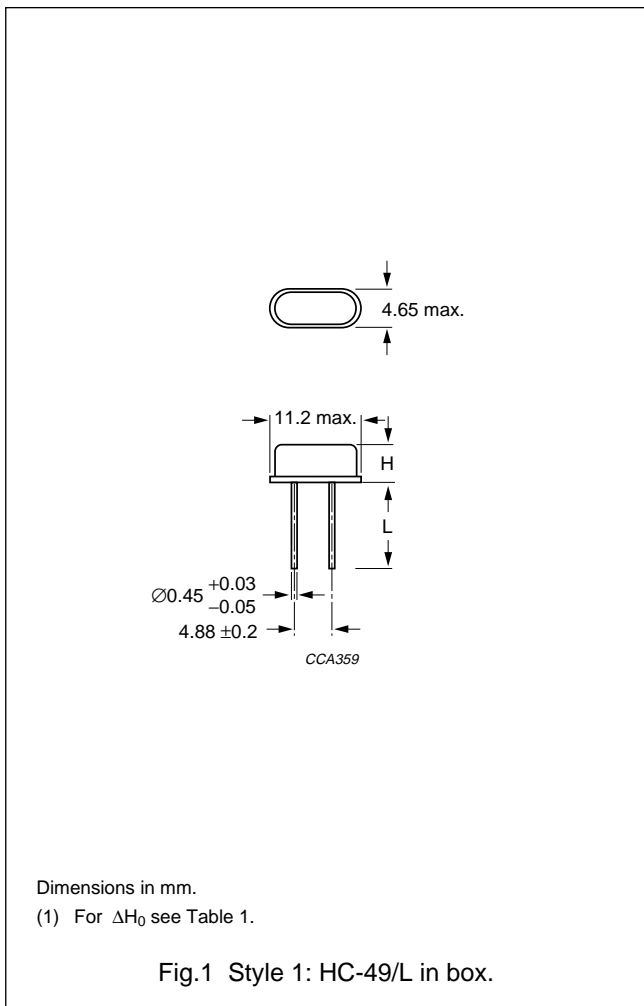
The unit consists of a silver-plated AT-cut quartz strip, encapsulated in a nitrogen-filled metal holder. The low profile holder is hermetically sealed by resistance-welding and provided with connecting leads.

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**MECHANICAL DATA**

**Package and box outlines**



**Table 1** Product height; notes 1 and 2

<b>MAXIMUM                      PRODUCT HEIGHT  <math>\Delta H_0</math>                      (mm)</b>	<b>MINIMUM FREQUENCY                      (MHz)</b>	
	<b>FUNDAMENTAL MODE</b>	<b>THIRD OVERTONE</b>
2.5 (for type HC-49/L)	7.3 to 50.0	29.0 to 66.0
3.5 (for type HC-49/S)	3.5 to 50.0	26.0 to 66.0

**Notes**

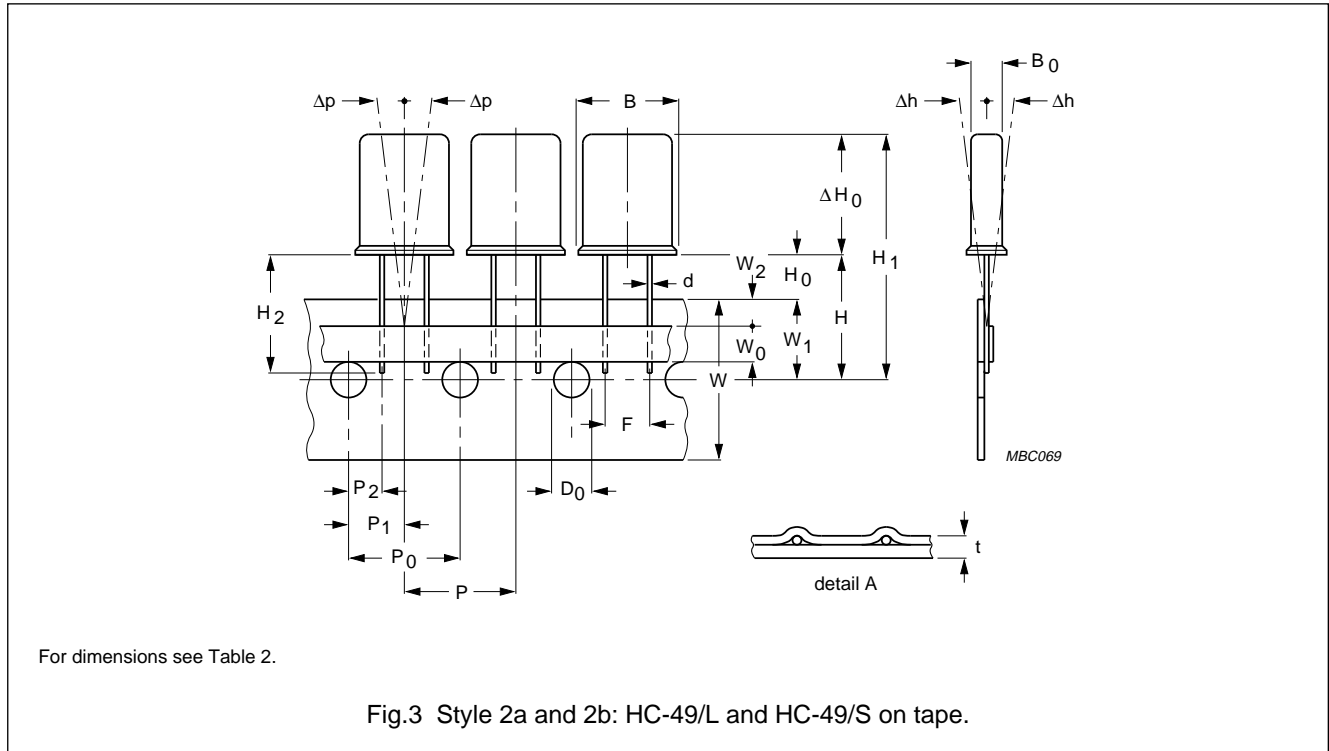
1. Available lead length from 0.5 mm up to 20.0 mm.
2. Lead length tolerance:
  - a) Lead length  $L < 3.0$  mm:  $\pm 0.2$  mm
  - b) Lead length  $L$  from 3.0 to 13.0 mm:  $\pm 0.5$  mm
  - c) Lead length  $L$  20.0 mm:  $\pm 1.0$  mm.

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### Taping data

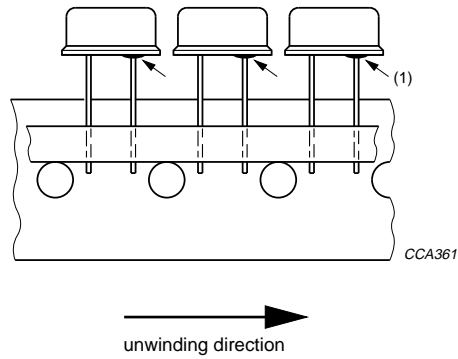


**Table 2** Taping dimensions (without the insulation plate) in accordance with "IEC 286-2"; see Fig.3

SYMBOL	PARAMETER	VALUE	TOLERANCE	UNIT
B <sub>0</sub>	maximum body thickness	4.65	–	mm
B	body width	11.2	–	mm
Δh	component alignment vertical to tape plane	–	±2.0	mm
Δp	component alignment in tape plane	–	±1.3	mm
d	lead wire diameter	0.44	±0.04	mm
F	lead-to-lead	4.9	–	mm
P	pitch of components	12.7	±1.0	mm
P <sub>0</sub>	feed-hole pitch	12.7	±0.3	mm
P <sub>2</sub>	feed-hole centre to lead	3.9	±0.7	mm
P <sub>1</sub>	feed-hole centre to component centre	6.35	±0.3	mm
D <sub>0</sub>	feed-hole diameter	4.0	±0.2	mm
H	distance of component from tape centre	18.0	+2/0	mm
H <sub>0</sub>	minimum component base to tape top	9.0	–	mm
H <sub>2</sub>	lead length	20.0	±0.5	mm
W	carrier tape width	18.0	+1/–0.5	mm
W <sub>0</sub>	maximum hold-down tape width, options	7.0/13.0	–	mm
W <sub>1</sub>	feed-hole position	9.0	+0.75/–0.5	mm
W <sub>2</sub>	maximum hold-down tape position	3.0	–	mm
t	maximum total tape thickness	0.9	–	mm

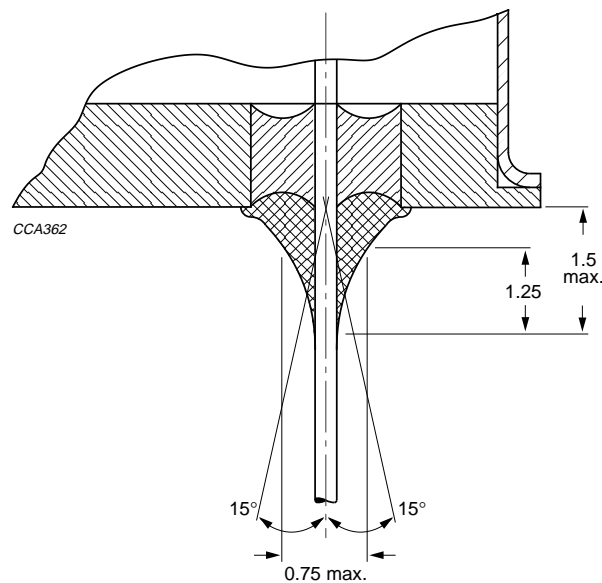
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Style 11a is taped in ammopack; see Fig.6.  
 Style 11b is taped on reel; see Fig.7.  
 (1) Lead connected to metal case.

Fig.4 Style 11 taped units with one lead connected to case, otherwise as Style 2 (see Fig.3).



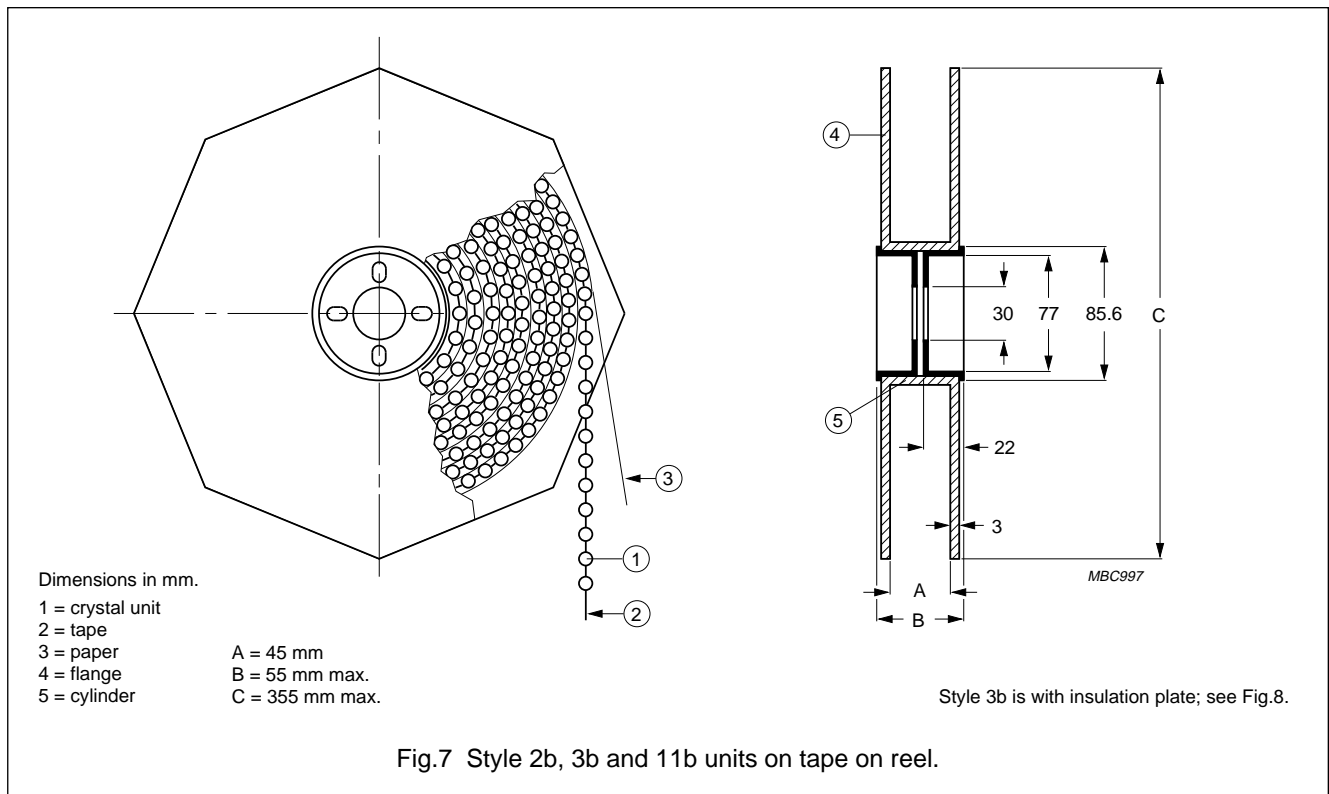
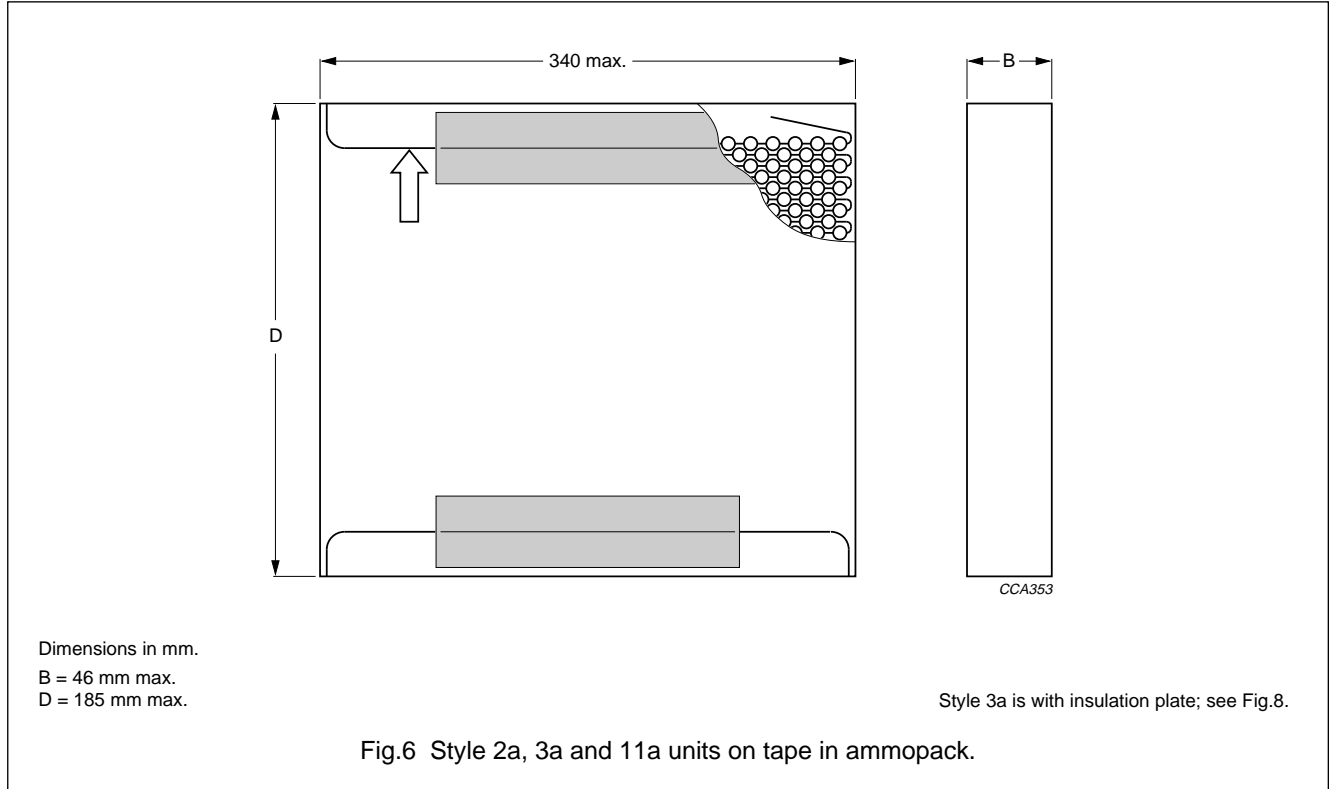
Dimensions in mm.  
 The electrical resistance shall be  $<5 \Omega$  after 2 times  $15^\circ$  bending of the lead.  
 Coverage of glass bead by silver adhesive is a minimum of 40%.

Fig.5 Detailed drawing of the connection between the lead and base.

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Ammopack and reel data

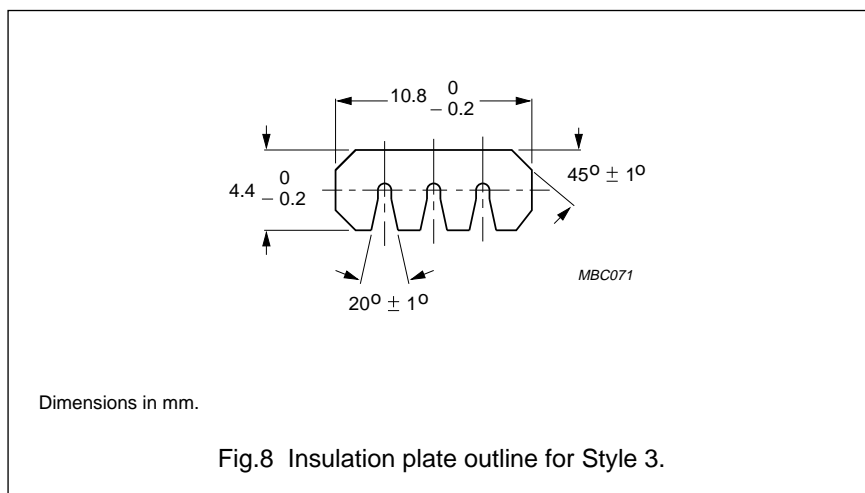


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**Insulation plate**

Style 3 units are equipped with an insulation plate (see Fig.8) at the unit base. The insulation plate is made of PEEK (polyetherketone) in 0.25 mm thickness and resistant to soldering heat tests.



**PACKAGING AND QUANTITIES**

**Table 3** HC-49/L holder

STYLE	PACKAGING	QUANTITY	DIMENSIONS OF BOX (mm)		
			LENGTH	WIDTH	HEIGHT
1	in box	maximum 1 000 units per box	200	125	70
	in blister	24 units per blister, 8 blisters per box	315	155	67
2a, 3a and 11a	on tape in ammopack	1 000 units per pack, in box	340	185	46
2b, 3b and 11b	on tape on reel	1 000 units per reel, in box	361	61	367

**STANDARD MARKING<sup>(1)</sup>**

- Line 1: frequency in kHz (fundamental mode) or in MHz (overtone); PH
- Line 2: last five digits of catalogue number followed by the manufacturing date code (last four digits of week code in accordance with UN-D1120).

**MASS AND LEADS**

Typical mass: 0.8 g.  
 The leads are finished with Sn60Pb40 on a nickel underplate.  
 The first 1 mm from the body is not guaranteed for soldering.

(1) Special marking on product and/or package is available on request.

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### ELECTRICAL DATA

Valid at an ambient temperature  $T_{amb} = 25 \pm 2$  °C and a nominal drive level of 100  $\mu$ W into 25  $\Omega$  unless otherwise specified. Measuring system:  $\pi$ -network in accordance with "IEC 444" recommendations.

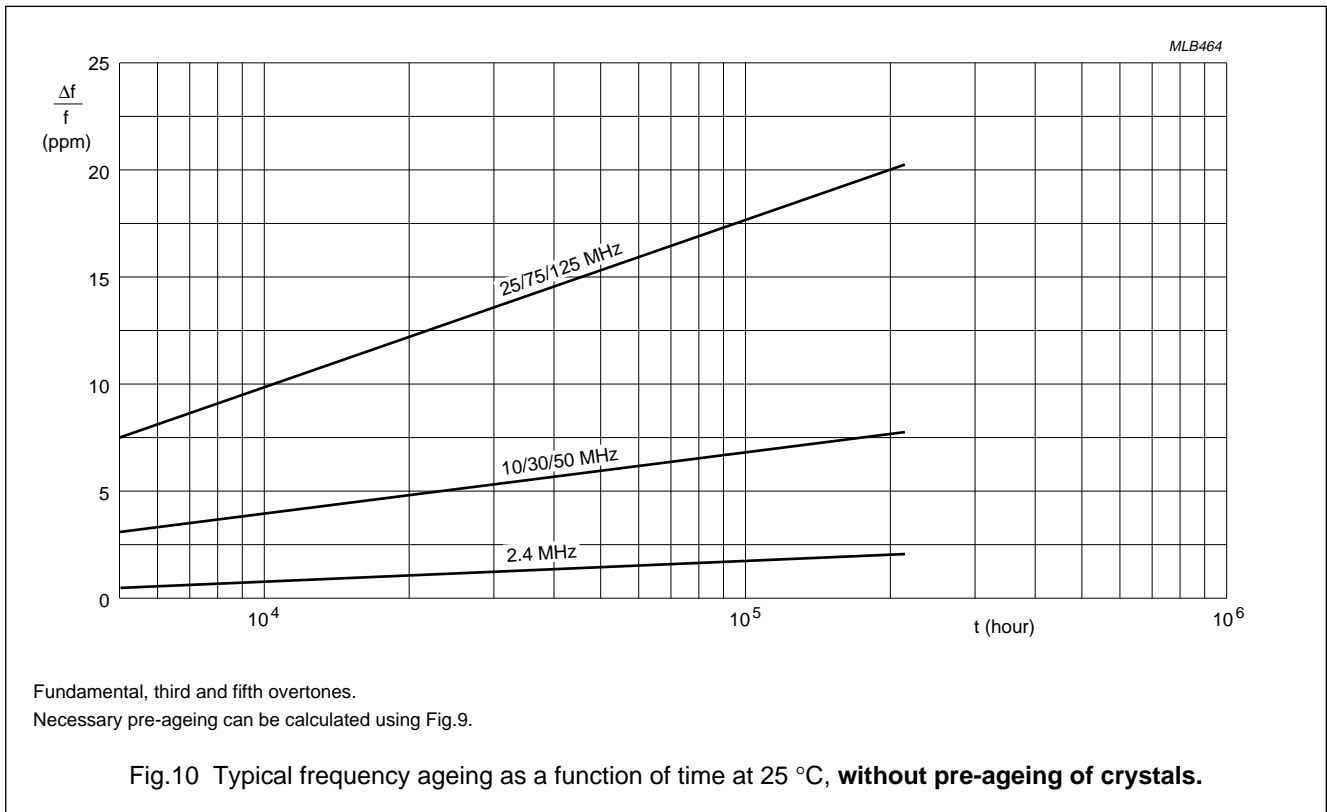
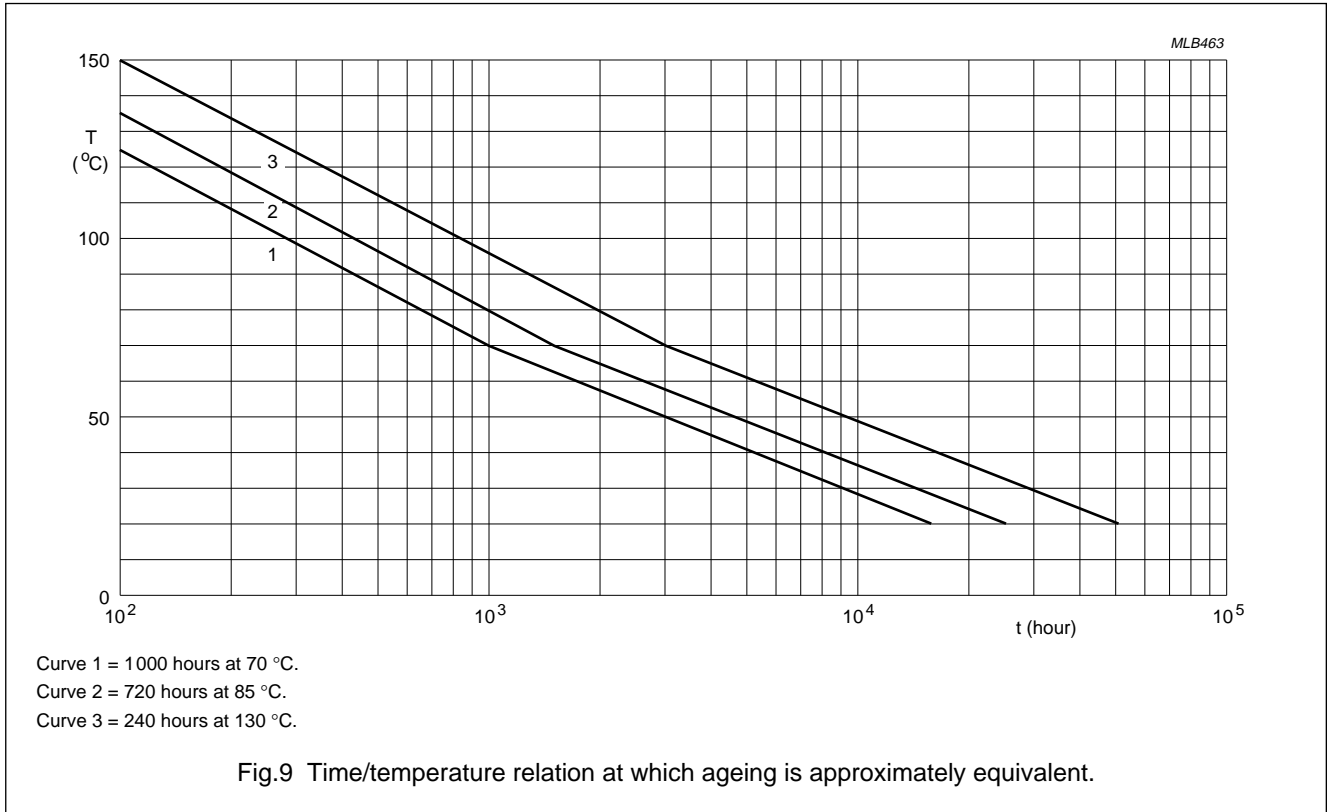
SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
$f_{nom}$	nominal frequency; note 1	fundamental (AT-cut)	3.5	–	28.0	MHz
		fundamental (BT-cut)	26.0	–	50.0	MHz
		third overtone (AT-cut)	29.0	–	66.0	MHz
$\Delta f/f_{nom}$	adjustment tolerance	see specific 12NC	–	$\pm 50$	–	ppm
$R_r$	resonance resistance	see note 2	–	–	–	$\Omega$
$C_L$	load capacitance	see note 2	5	–	$\infty$	pF
$T_{oper}$	operating temperature	see specific 12NC	–40	–	+85	°C
$T_{op}$	operable temperature		–40	–	+125	°C
$\Delta f/f_{25}$	frequency stability over temperature range, with respect to $T_{amb} = 25$ °C	see notes 2 and 3	$\pm 10$	$\pm 50$	–	ppm
$R_r(T)$	resonance resistance over temperature range	see note 2	available from $R_r$ upwards			$\Omega$
$C_1$	motional capacitance	see specific 12NC	–	–	–	fF
	tolerance		$\pm 20$	–	–	%
$C_o$	parallel capacitance	see specific 12NC	–	–	7	pF
	tolerance		$\pm 20$	–	–	%
$\Delta f/f$	ageing	10 years at $T_{amb} = 25$ °C	$\pm 5$	–	$\pm 10$	ppm
$R_{ins}$	insulation resistance	DC test voltage = 100 V	500	–	–	M $\Omega$

### Notes

- A specific value should be chosen within the given range.
- All resistance values are measured in series resonance:
  - See specific 12NC for actual values.
  - Load resonance measurement is available on request.
- Frequency measurement in temperature range is performed in series resonance if not requested otherwise:
  - See specific 12NC for actual values.
  - BT-cuts have a frequency stability of +0 to –100 ppm from –20 °C to +70 °C.

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### TESTS AND REQUIREMENTS

Essentially all tests are carried out in accordance with IEC publication 68-2, "Recommended basic climatic and mechanical robustness testing procedure for electronic components" and IEC publication 1178-1, "Generic specification for quartz crystal units".

**Table 4** Test procedures and requirements; note 1

IEC 68-2 METHOD	TEST	PROCEDURE	REQUIREMENTS
Ba	ageing	1 000 hours at 70 °C	$\Delta f/f \leq \pm 5$ ppm
Db	accelerated damp heat	+25 to +55 °C; 6 cycles at RH >95%	$\Delta f/f \leq \pm 5$ ppm $\Delta R_r \pm 5 \Omega$ or $\pm 20\%$ whichever is the greater
Ea	shock	100 g; half sinewave; 6 directions; 1 blow/direction	$\Delta f/f \leq \pm 5$ ppm $\Delta R_r \pm 5 \Omega$ or $\pm 20\%$ whichever is the greater
Eb	bump	4 000 bumps of 40 g	$\Delta f/f \leq \pm 5$ ppm $\Delta R_r \pm 5 \Omega$ or $\pm 20\%$ whichever is the greater
Ed	free fall	3 times on hard wood; for height of fall (h) see Table 5	$\Delta f/f \leq \pm 5$ ppm $\Delta R_r \pm 5 \Omega$ or $\pm 20\%$ whichever is the greater
Fc	vibration	frequency 10 to 500 to 10 Hz; acceleration 10 g; 3 directions; 30 minutes/direction	$\Delta f/f \leq \pm 5$ ppm $\Delta R_r \pm 5 \Omega$ or $\pm 20\%$ whichever is the greater
Na	temperature cycling test	-40 to +85 °C; 10 cycles; 0.1 hour/cycle	$\Delta f/f \leq \pm 5$ ppm $\Delta R_r \pm 5 \Omega$ or $\pm 20\%$ whichever is the greater
Q	sealing (method 1)	16 hours; 700 kPa He	$< 1 \times 10^{-8}$ ncc/s He
Ta	solderability	235 $\pm$ 5 °C; 2 $\pm$ 0.5 s; flux 600 (activated)	$\geq 90\%$ , except for 1 mm from body; no visible damage, no leaks
Tb	resistance to soldering heat	350 $\pm$ 5 °C; 3.5 $\pm$ 0.5 s	$\Delta f/f \leq \pm 5$ ppm $\Delta R_r \pm 5 \Omega$ or $\pm 20\%$ whichever is the greater
Ub	bending of terminations	1 $\times$ 90°; 5 N	no visible damage, no leaks

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IEC 68-2 METHOD	TEST	PROCEDURE	REQUIREMENTS
<b>Other applicable tests</b>			
Xa	resistance to solvents; note 2: Bio-Act EC7®; Neutropon P3® and Saxin P3®; Meta Clean 820®; Lonco 446®; Isopropanol cleaning solvent; Dowanol DPM® (glass crystals only)	in accordance with "IEC 68-2-45", "IEC 653" (immersion time 5 minutes) and "MIL 202 E215". At ambient temperature and ultrasonic frequency (40 kHz)	no degradation of marking

**Notes**

1. Test table including MIL-specs ("MIL-Std 883" and "MIL-Std 202") can be provided upon request.
2. Bio-Act is a registered trademark of Petroform.  
 Neutropon P3 and Saxin P3 are registered trademarks of Henkel.  
 Meta Clean 820 is a registered trademark of Mavom.  
 Lonco 447 is a registered trademark of London Chemical Co.  
 Dowanol DPM is a registered trademark of Dow Chemical.

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**Table 5** Height of fall

h (mm)	FREQUENCY RANGE <sup>(1)</sup> (MHz)		
	FUNDAMENTAL MODE	THIRD OVERTONE	FIFTH OVERTONE
750	2.4 to 16.0	20.0 to 48.0	50.0 to 80.0
500	16.1 to 27.0	48.1 to 75.0	80.1 to 125.0

**Note**

1. Typical values. Actual designs can be made to obtain higher or lower values.

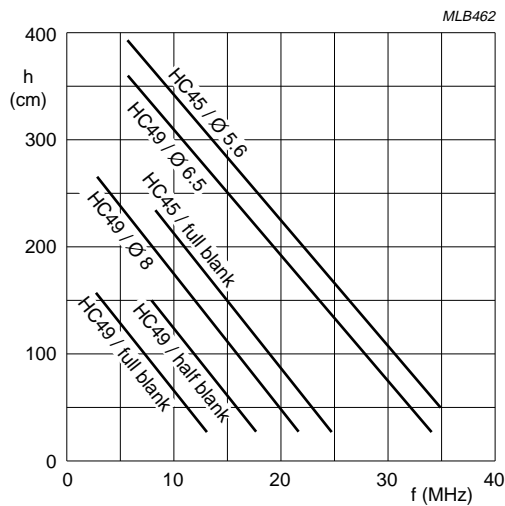


Fig.11 Typical height of fall values (3× on hard wood) for various quartz blank and holder combinations. 'Full' and 'half' blanks refer to rectangular quartz designs; 'Ø' designates circular quartz designs and the appropriate diameter.