

Quartz crystals - general applications HC-49/U

9922 520 0/3.... series

FEATURES

- The units are mass produced on an automatic production line which guarantees a high level of reliability as well as a high level of uniformity. The quartz design yields low resistance and high pullability values.
- The units are available in several styles and packaging methods.

APPLICATIONS

- TV colour decoders
- TV teletext
- TV digital sound
- Video cassette recorders (VCR)
- Audio
- CD players
- CDI players
- DCC players
- Telephony
- Domestic appliance control
- Microprocessors
- Traffic control
- Weather balloons
- Medical systems
- Military applications
- Communication systems
- Agrarian applications
- Machine control
- Environmental applications.

DESCRIPTION

The unit consists of a silver-plated AT-cut quartz plate, encapsulated in a nitrogen-filled metal holder. The holder is hermetically sealed by resistance-welding and provided with connecting leads (HC-49/U).

QUICK REFERENCE DATA

SYMBOL	PARAMETER	MIN.	TYP.	MAX.	UNIT
f_{nom}	nominal frequency: fundamental mode	1.8	–	27.0	MHz
	third overtone	20.0	–	75.0	MHz
	fifth overtone	75.0	–	125.0	MHz
	seventh overtone	125.0	–	175.0	MHz
$\Delta f/f_{nom}$	adjustment tolerance	± 10	± 30	–	ppm
$\Delta f/f_{25}$	frequency stability over temperature range from -20 to $+70$ °C with respect to $T_{amb} = 25$ °C	–	± 30	–	ppm
C_1	motional capacitance tolerance	10	–	–	%
C_0	parallel capacitance tolerance	10	–	–	%
$\Delta f/f$	ageing over 10 years at 25 °C	± 5	–	± 10	ppm

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MECHANICAL DATA

Package and box outlines

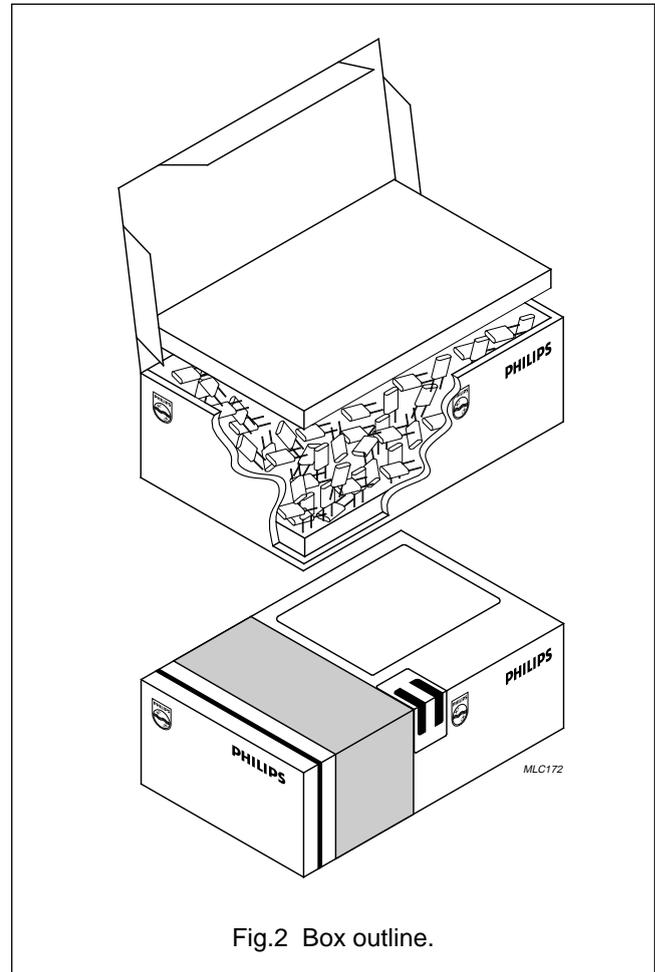
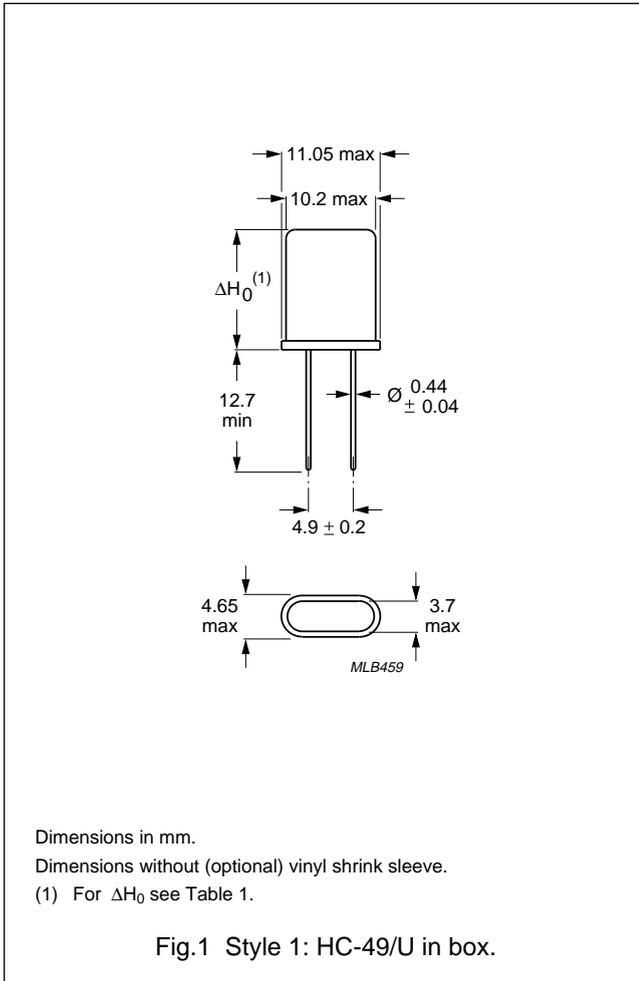


Table 1 Product height; notes 1 and 2

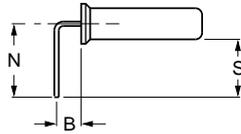
MAXIMUM PRODUCT HEIGHT ΔH_0 (mm)	FREQUENCY RANGE (MHz)	
	FUNDAMENTAL MODE	THIRD OVERTONE
9.6	8.0 to 27.0	24.0 to 75.0
11.0	8.0 to 27.0	24.0 to 75.0
13.4	all frequencies	

Notes

1. Available lead length: up to 13 mm.
2. Lead length tolerance (for Style 1):
 - a) $H_2 > 3$ mm: ± 0.5 mm
 - b) $H_2 \leq 3$ mm: ± 0.2 mm.

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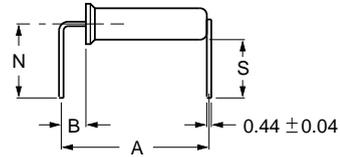


MBC072

Dimensions in mm.

STYLE 4	N	B	S
a	7.0 ±0.6	2.5 ±0.6	5.2 ±0.6
b	8.0 ±0.6	2.0 ±0.6	6.2 ±0.6
c	9.7 ±0.6	3.0 ±0.6	7.9 ±0.6

Fig.3 Style 4: HC-49/U on tray in box.

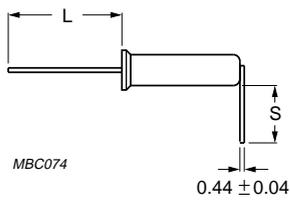


MBC073

The third lead is symmetric, ±0.5 mm with respect to the other leads.
 Dimensions in mm.

STYLE 5	N	B	A	S
a	5.7 ±1.0	1.5	15.2 ±0.2	3.9 ±1.0
b	5.9 ±1.0	4.1	17.8 ±0.2	4.1 ±1.0
c	10.2 ±1.0	3.3	16.5 ±0.2	8.4 ±1.0
d	5.7 ±1.0	1.9	15.6 ±0.2	3.9 ±1.0

Fig.4 Style 5: HC-49/U on tray in box.

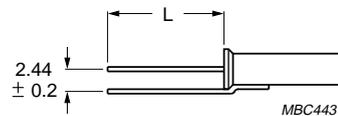


MBC074

The third lead is symmetric, ±0.5 mm with respect to the other leads.
 Dimensions in mm.

STYLE 6	L	S
a	13.2 ±0.5	4.5 ±1.0
b	13.2 ±0.5	10.0 ±1.0
c	5.0 ±0.5	19.5 ±1.0
d	13.2 ±0.5	19.5 ±1.0

Fig.5 Style 6: HC-49/U on tray in box.



MBC443

L: min. 12.7 mm; max. 13.0 mm.

The third lead is symmetric, ±0.5 mm with respect to the other leads.
 Dimensions in mm.

Fig.6 Style 7: HC-49/U on tray in box.

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Taping data

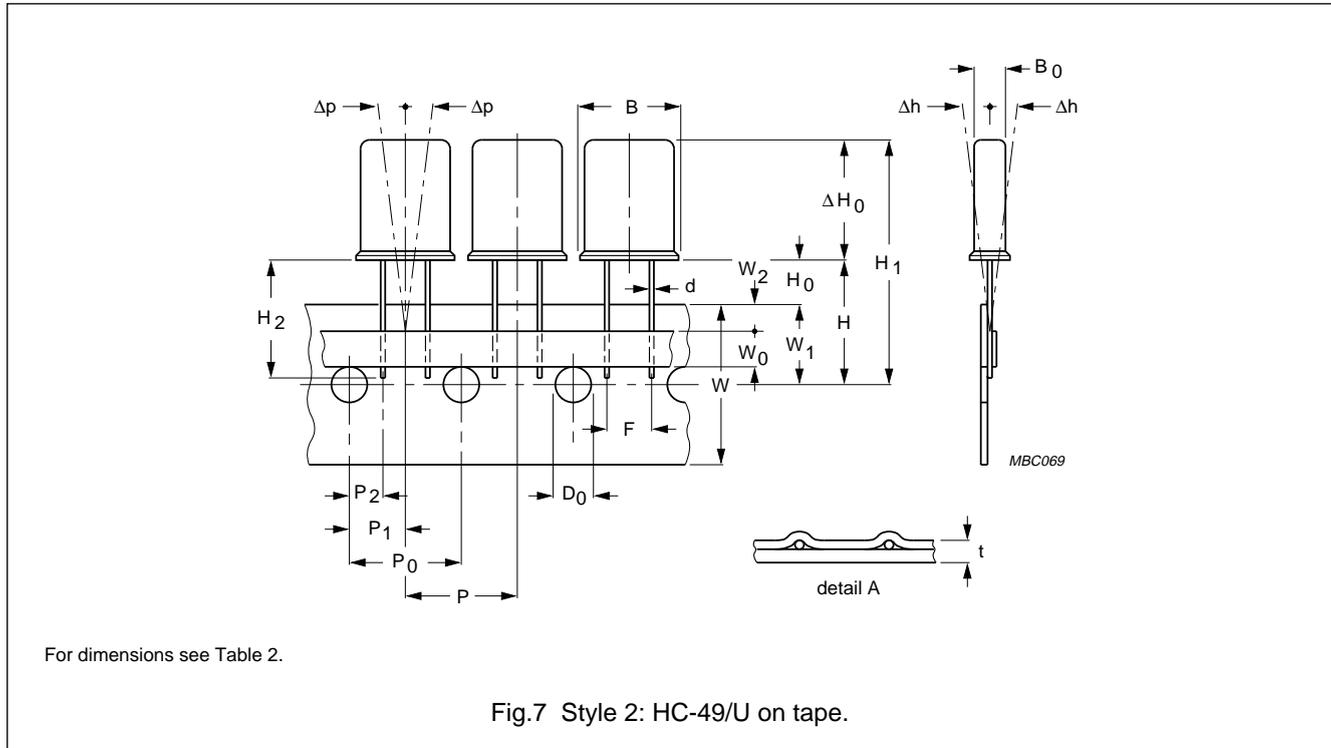
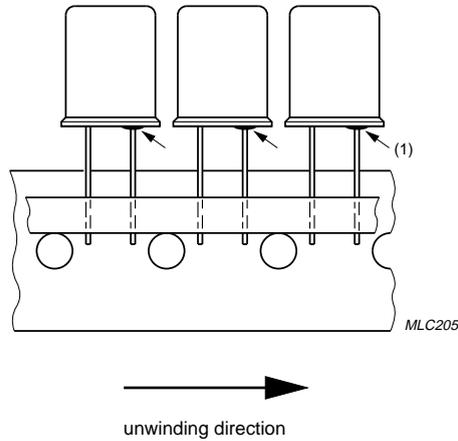


Table 2 Taping dimensions (without the insulation plate) in accordance with "IEC 286-2"; see Fig.7

SYMBOL	PARAMETER	VALUE	TOLERANCE	UNIT
B ₀	body thickness	4.43	±0.05	mm
B	body width	10.75	±0.1	mm
Δh	component alignment vertical to tape plane	–	±2	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	mm
P ₀	feed-hole pitch	12.7	±0.3	mm
P ₂	feed-hole centre to lead	3.9	±0.7	mm
P ₁	feed-hole centre to component centre	6.35	±0.3	mm
D ₀	feed-hole diameter	4.0	±0.2	mm
H	distance of component from tape centre, option	16.0/18.5	+2/0	mm
H ₀	minimum component base to tape top	7.0	–	mm
H ₂	lead length	12.7	±0.5	mm
W	carrier tape width	18.0	+1/–0.5	mm
W ₀	maximum hold-down tape width, option	7.0/13.0	–	mm
W ₁	feed-hole position	9.0	+0.75/–0.5	mm
W ₂	maximum hold-down tape position	3.0	–	mm
t	maximum total tape thickness	0.9	–	mm

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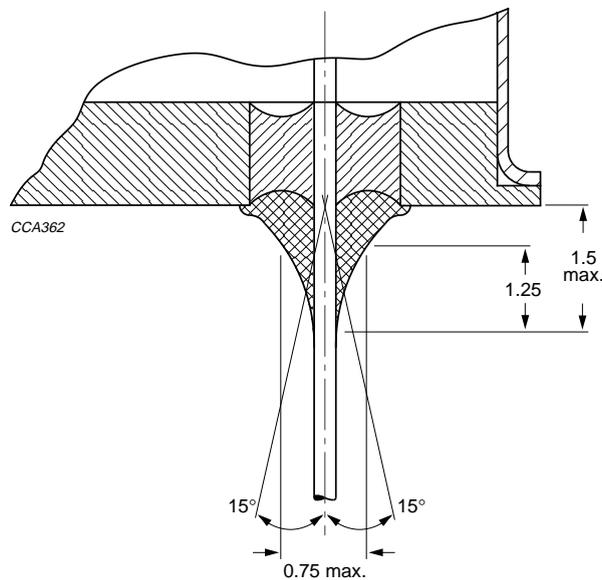


Style 11a is taped in ammopack; see Fig.10.

Style 11b is taped on reel; see Fig.11.

(1) Lead connected to metal case.

Fig.8 Style 11 taped units with one lead connected to case, otherwise as Style 2 (see Fig.7).



Dimensions in mm.

The electrical resistance shall be $<5 \Omega$ after 2 times 15° bending of the lead.

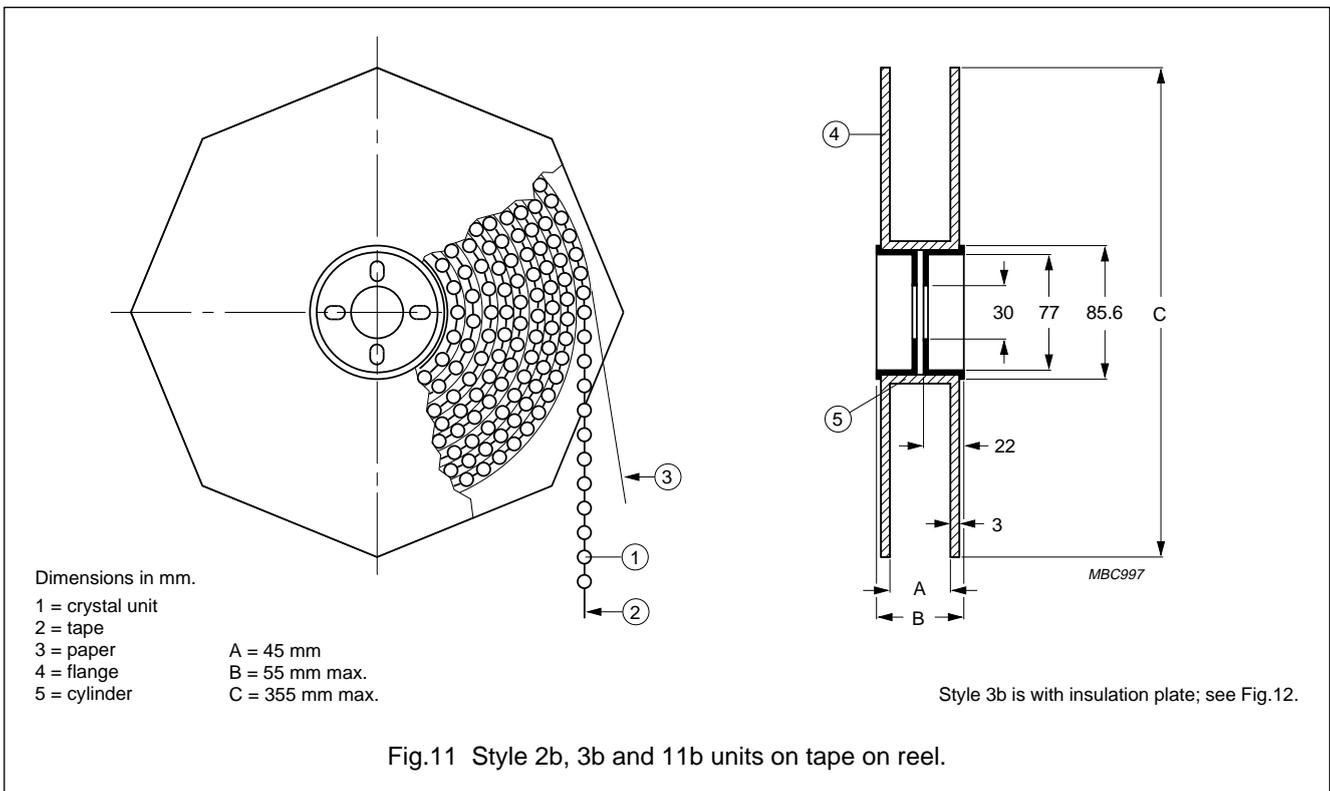
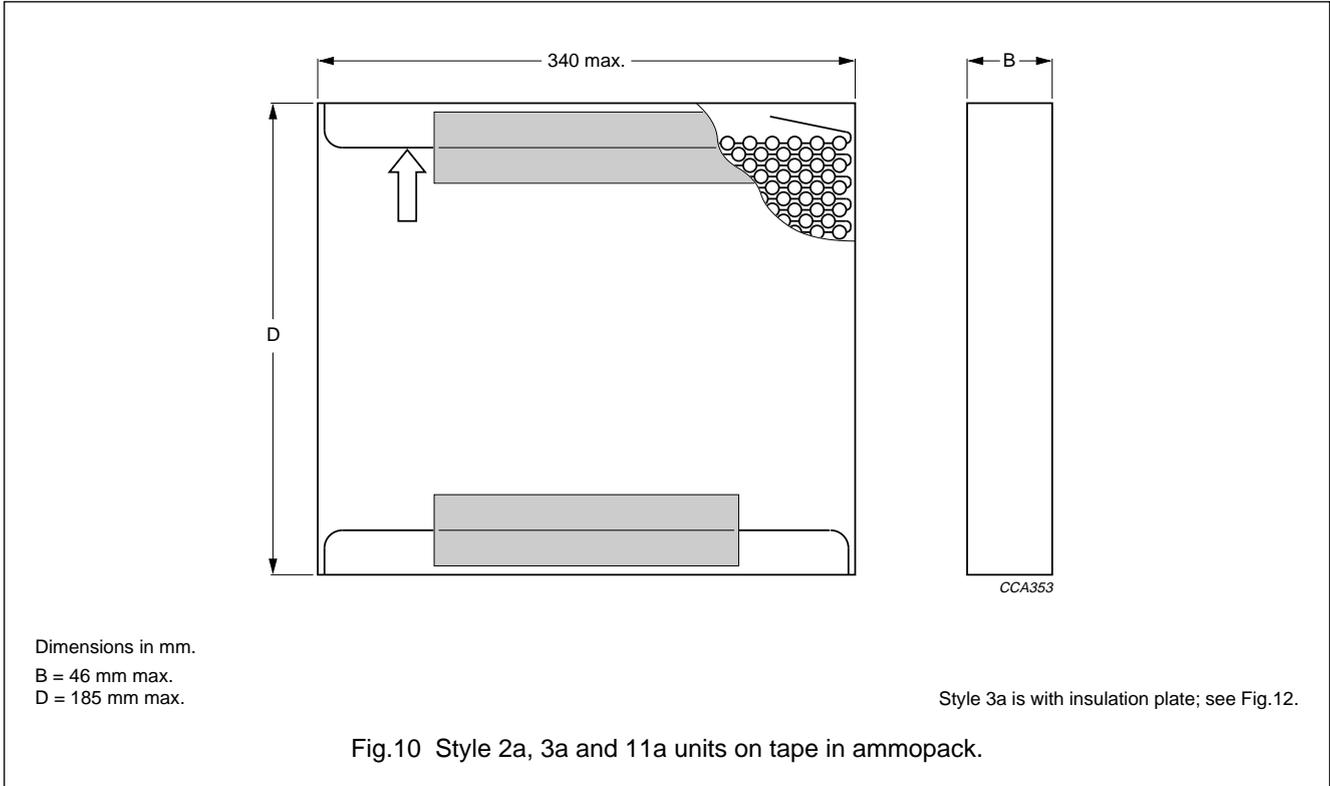
Coverage of glass bead by silver adhesive is a minimum of 40%.

Fig.9 Detailed drawing of the connection between the lead and base.

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Ammopack and reel data



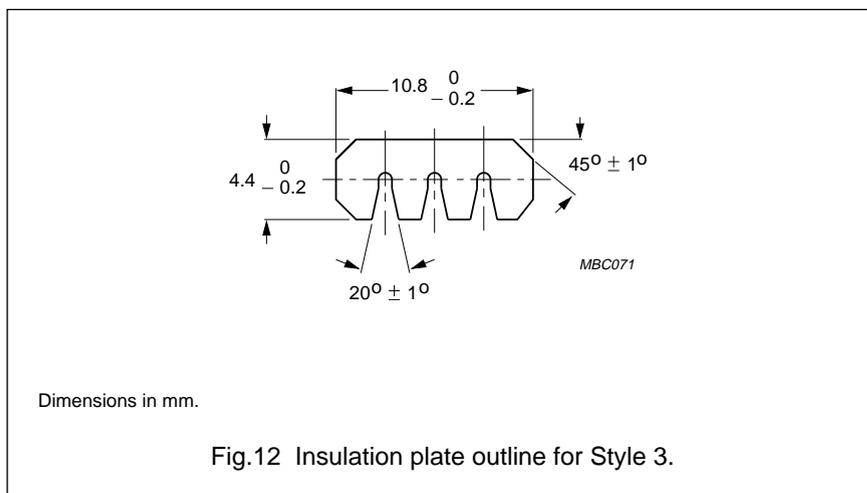
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Insulation plate

Style 3 units are equipped with an insulation plate (see Fig.12) 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/U 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			
	on tray in box	100 units per tray, 1 or 10 trays in box			
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	367	61
4, 5, 6, 7	on tray in box	100 units per tray per box	380	90	168
5c	on tray in box	50 units per tray, 10 trays per box, minimum 2 boxes	380	90	168

STANDARD MARKING⁽¹⁾

- Line 1: PHILIPS
- Line 2: frequency in kHz (fundamental mode) or in MHz (overtone)
- Line 3: last five digits of catalogue number followed by the manufacturing date code (last four digits of week code in accordance with the "Philips Concern calendar system UN-D 1120").

MASS AND LEADS

Typical mass: 1.2 g.

The leads are finished with Sn99Cu1 or 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 $T_{amb} = 25 \pm 2$ °C and a nominal drive level of 100 μ W into 25 Ω unless otherwise specified. Measuring system: π -network in accordance with "IEC 444" recommendations.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
f_{nom}	nominal frequency	fundamental	1.8	–	27.0	MHz
		third overtone	20.0	–	75.0	MHz
		fifth overtone	75.0	–	125.0	MHz
		seventh overtone	125.0	–	175.0	MHz
$\Delta f/f_{nom}$	adjustment tolerance	see note 1	± 10	± 30	–	ppm
R_r	resonance resistance	see notes 1 and 2	see Figs 13 and 16			Ω
C_L	load capacitance	see note 1	5	20	∞	pF
T_{oper}	operating temperature	see note 1	–40	–	+130	°C
T_{op}	operable temperature		–40	–	+155	°C
$\Delta f/f_{25}$	frequency stability over temperature range, with respect to $T_{amb} = 25$ °C	see note 1	see Table 4			ppm
$R_r(T)$	resonance resistance over temperature range	see notes 1 and 2	available from R_r upwards			Ω
C_1	motional capacitance	see note 1	see Figs 14 and 17			fF
	tolerance		± 10	–	–	%
C_0	parallel capacitance	see note 1	see Figs 15 and 18			pF
	tolerance		± 10	–	–	%
$\Delta f/f$	ageing	10 years at 25 °C; see Figs 19 and 20	± 5	–	10	ppm

Notes

- Values available on request.
- All resistance values are measured in series resonance, load resonance measurement available on request.

Table 4 Frequency stability with temperature variation

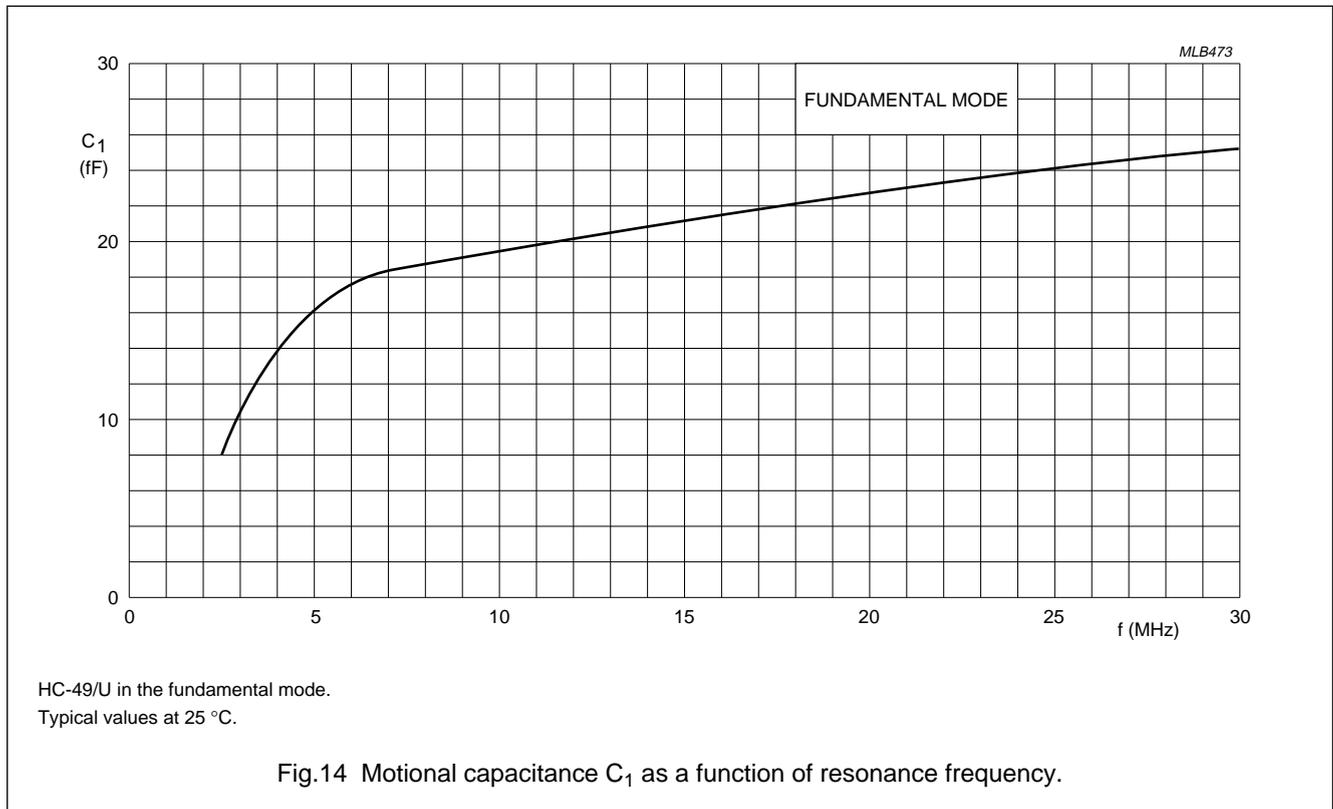
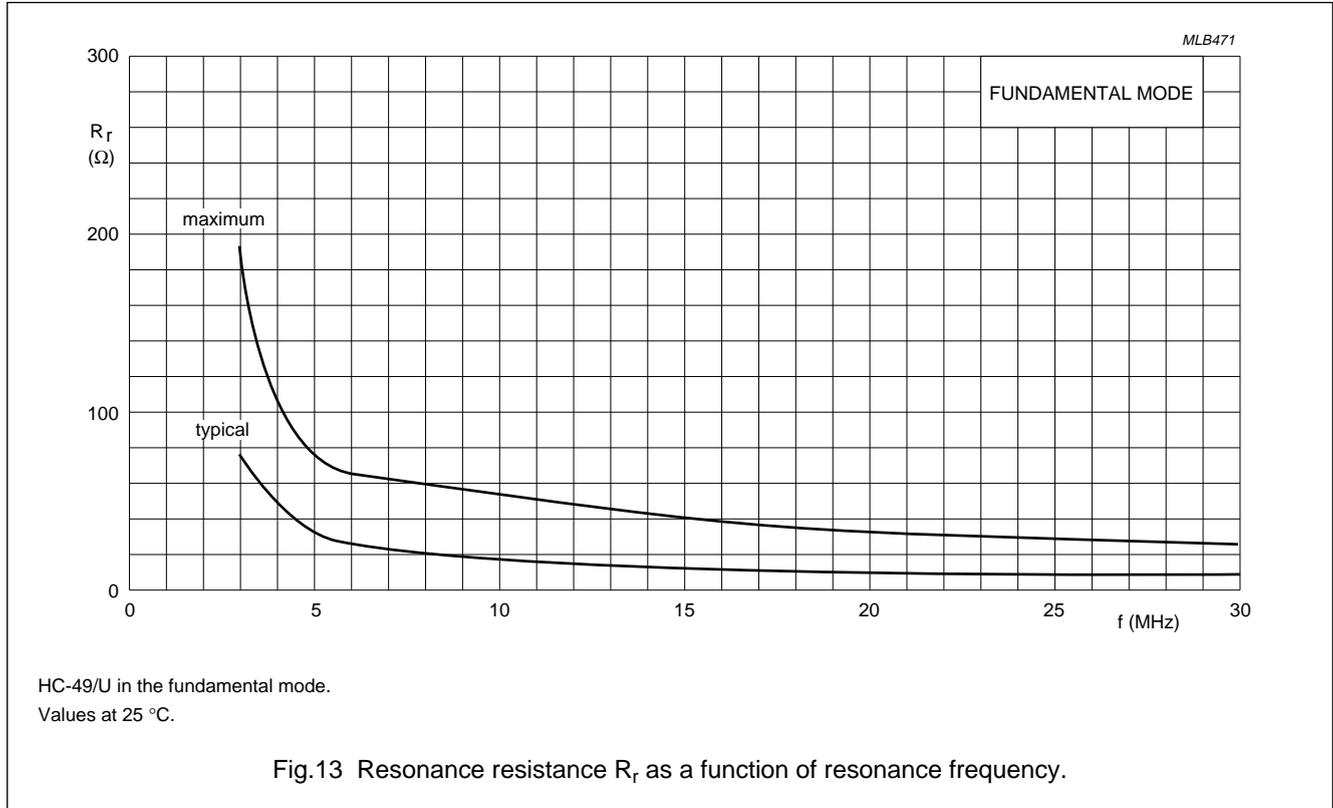
TEMPERATURE RANGE ⁽¹⁾ (°C)	MAX. FREQUENCY STABILITY (ppm)	
	CLASS 2 (best available values)	DEFAULT
+20/+30	± 2.0	± 4
0/+50	± 10.0	± 20
–10/+60	± 15.0	± 25
–20/+70	± 20.0	± 30
–30/+80	± 25.0	± 40
–40/+90	± 30.0	± 55
–55/+105	± 40.0	± 80
–40/+130	± 80.0	–

Note

- To obtain the same stability at frequencies below 8.0 MHz, the upper temperature limit is 10 °C lower.

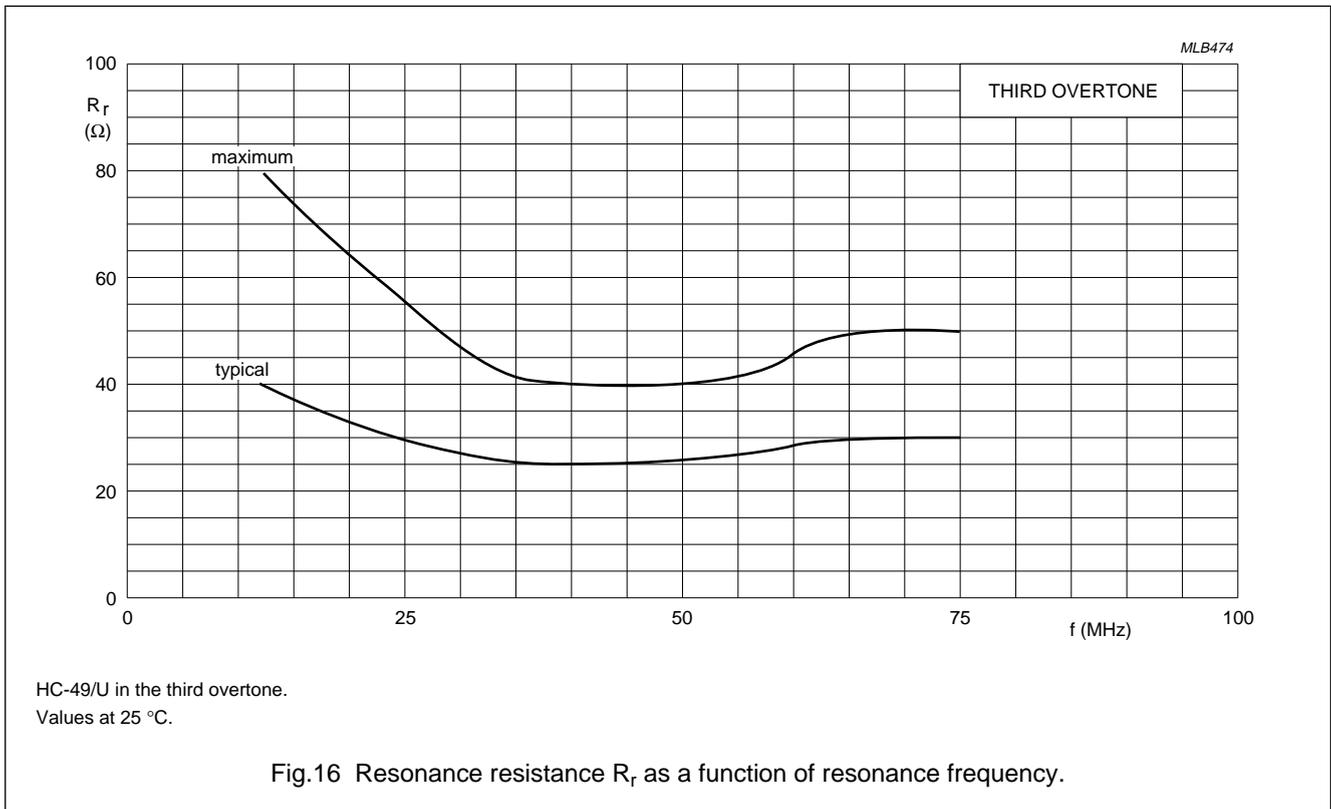
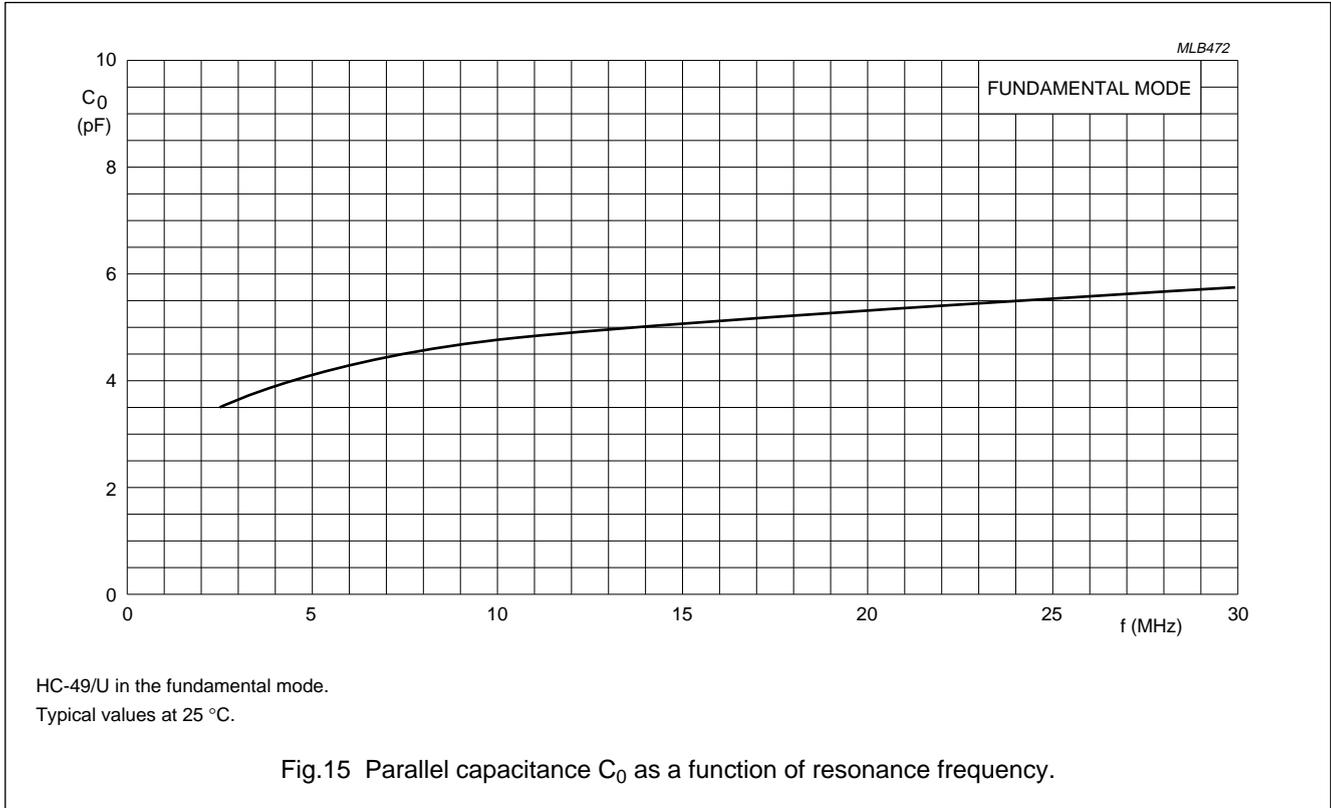
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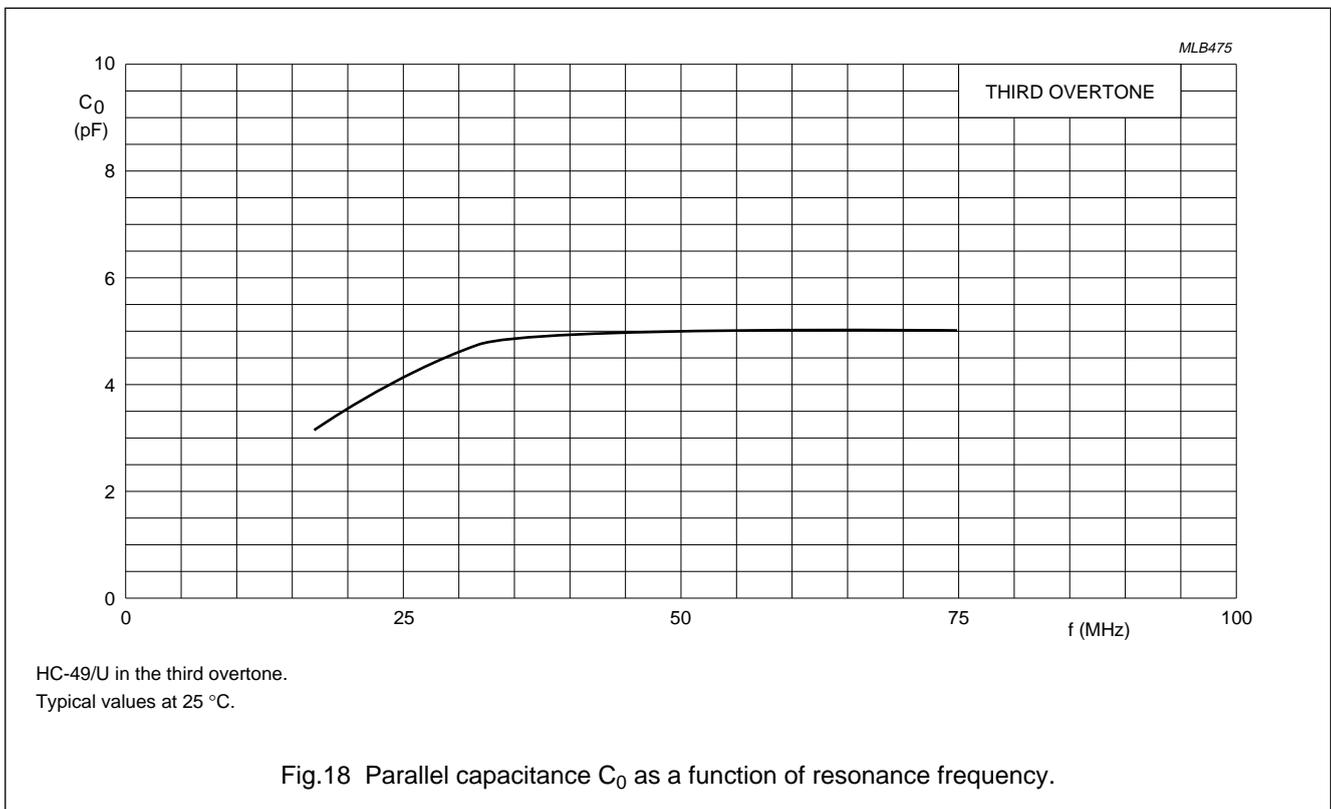
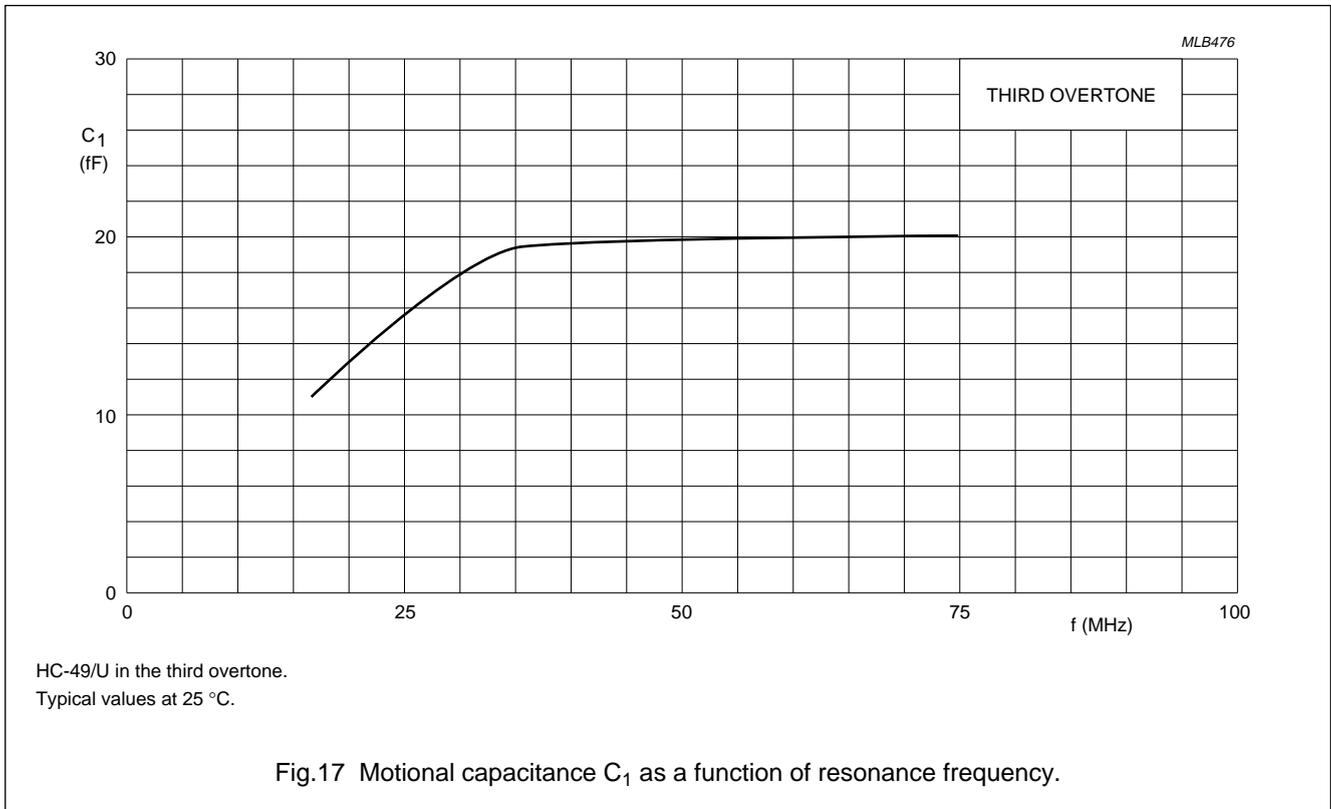
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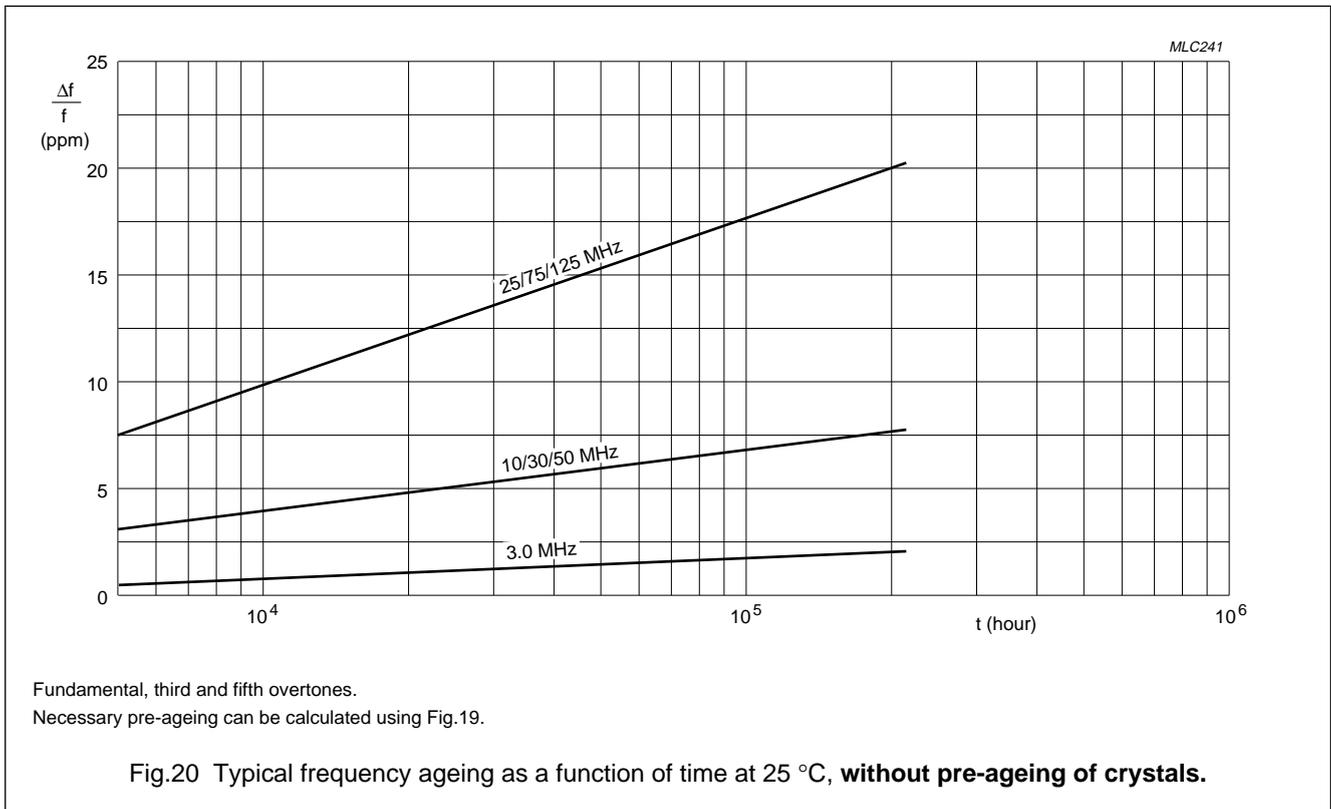
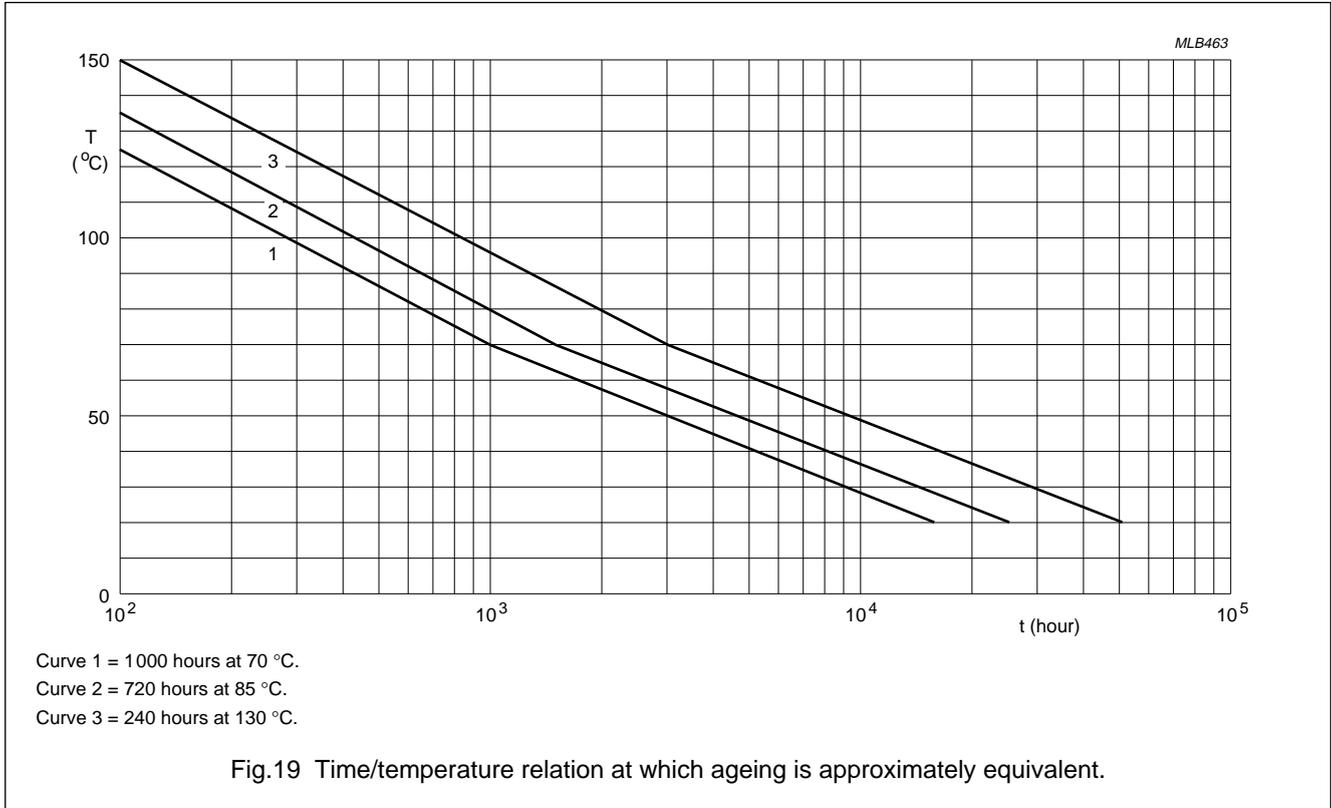
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TESTS AND REQUIREMENTS

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 5 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	4000 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 6	$\Delta f/f \leq \pm 5$ 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 ± 5 °C; 2 ± 0.5 s; flux 600 (activated); option: steam pre-heat for 8 hours. This reflects at least 36 months of storage at room temperature	$\geq 90\%$, except for 1 mm from body; no visible damage, no leaks
Tb	resistance to soldering heat	350 ± 5 °C; 3.5 ± 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 leads	1 \times 90°; 5 N	no visible damage

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IEC 68-2 METHOD	TEST	PROCEDURE	REQUIREMENTS
Other applicable tests			
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.

Table 6 Height of fall

h (mm)	FREQUENCY RANGE ⁽¹⁾ (MHz)	
	FUNDAMENTAL MODE	THIRD OVERTONE
750	1.8 to 7.5	20.00 to 22.5
500	7.51 to 10.0	22.51 to 30.0
250	10.10 to 27.0	30.10 to 75.0

Note

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

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PREFERRED TYPES

Table 7 Preferred type list for standard crystals in a HC-49/U holder

FREQUENCY (kHz)	CATALOGUE NUMBER (12NC)	LOAD CAPACITANCE (C _L) (pF)	APPLICATION	RELATED ICs
3575.611	9922 520 00383	series	one-chip colour decoder PAL-M	TDA836X
3575.611	9922 520 00413	18.0	BCTV video processor PAL-M	TDA91XX
3579.545	9922 520 00382	series	one-chip colour decoder NTSC	TDA836X
3579.545	9922 520 00412	18.0	BCTV video processor NTSC	TDA91XX
3582.056	9922 520 00381	series	one-chip colour decoder PAL-M	TDA836X
3582.056	9922 520 00411	18.0	BCTV video processor PAL-M	TDA91XX
4000.000	4322 143 04093	30.0	digital tuning; general purpose	TSA6060
4194.304	4322 143 04073	11.4	car locks	PCF117XC
4433.619	9922 520 00384	series	one-chip colour decoder PAL B/G	TDA836X
4433.619	4322 143 04043	20.0	colour encoder PAL B/G	TDA8501
4433.619	9922 520 00414	18.0	BCTV video processor PAL B/G	TDA91XX
6000.000	4322 143 04101	20.0	teletext video processor	SAA5231/5243
7159.090	4322 143 04181	20.0	colour decoder NTSC	TDA3566A
8192.000	9922 520 00193	15.0	one-chip NICAM stereo sound decoder	SAA7283
8867.238	4322 143 04051	20.0	colour decoder PAL B/G	TDA3566A
10000.000	9922 520 00429	20.0	TV stereo/dual sound processor I ² C	TDA8415/16/17
11700.000	9922 520 00203	15.0	one-chip NICAM stereo sound decoder	SAA7283
12000.000	9922 520 00076	20.0	general purpose, microprocessor	
13104.000	9922 520 00202	15.0	one-chip NICAM stereo sound decoder	SAA7283
13875.000	4322 143 05331	20.0	teletext video processor	SAA5191/5231
24576.000	9922 520 30009	8.0	digital CCIR decoder	
26800.000	9922 520 30004	8.0	digital square pixel decoder	
27000.000	9922 520 30003	20.0	VIP teletext	SAA5246A