IEC 62024-1

Edition 2.0 2008-02

INTERNATIONAL STANDARD

NORME INTERNATIONALE

High frequency inductive components – Electrical characteristics and measuring methods – Part 1: Nanohenry range chip inductor

Composants inductifs à haute fréquence – Caractéristiques électriques et méthodes de mesure – Partie 1: Inductance pastille de l'ordre du nanohenry

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CONTENTS

INTERNATIONAL ELECTROTECHNICAL COMMISSION

HIGH FREQUENCY INDUCTIVE COMPONENTS – ELECTRICAL CHARACTERISTICS AND MEASURING METHODS –

Part 1: Nanohenry range chip inductor

FOREWORD

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International Standard IEC 62024-1 has been prepared by IEC technical committee 51: Magnetic components and ferrite materials.

This second edition cancels and replaces the first edition published in 2002. This edition constitutes a technical revision.

This edition includes the following significant technical changes with respect to the previous edition:

a) sizes 0402 added in Table 1 and Table 2;
b) contents of 4.4 reviewed for easier understanding;
c) correct errors in 3.1.4.2.

This bilingual version (2012-09) corresponds to the monolingual English version, published in 2008-02.

The text of this standard is based on the following documents:

FDIS	Report on voting
51/908/FDIS	51/915/RVD

Full information on the voting for the approval of this standard can be found in the report on voting indicated in the above table.

The French version of this standard has not been voted upon.

This publication has been drafted in accordance with the ISO/IEC Directives, Part 2.

A list of all parts of IEC 62024 series, published under the general title *High frequency inductive components – Electrical characteristics and measuring methods*, can be found on the IEC website.

The committee has decided that the contents of this publication will remain unchanged until the maintenance result date indicated on the IEC web site under "http://webstore.iec.ch" in the data related to the specific publication. At this date, the publication will be

- reconfirmed,
- withdrawn,
- replaced by a revised edition, or
- amended.

The contents of the corrigendum of July 2008 have been included in this copy.

HIGH FREQUENCY INDUCTIVE COMPONENTS – ELECTRICAL CHARACTERISTICS AND MEASURING METHODS –

Part 1: Nanohenry range chip inductor

1 Scope

This part of IEC 62024 specifies electrical characteristics and measuring methods for the nanohenry range chip inductor that is normally used in high frequency (over 100 kHz) range.

2 Normative references

The following referenced documents are indispensable for the application of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

IEC 61249-2-7, *Materials for printed boards and other interconnecting structures – Part 2-7: Reinforced base materials clad and unclad – Epoxide woven E-glass laminated sheet of defined flammability (vertical burning test) copper-clad*

ISO 6353-3, *Reagents for chemical analysis – Part 3: Specifications – Second series*

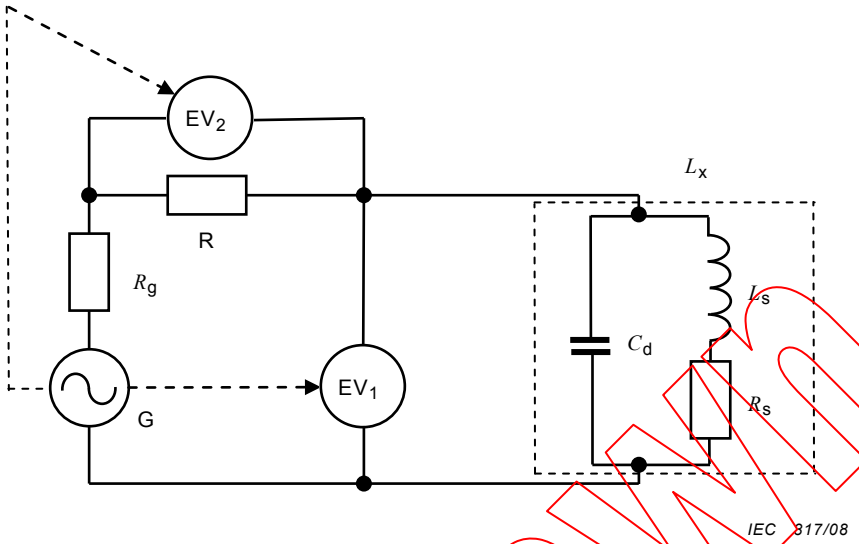
ISO 9453, *Soft solder alloys – Chemical compositions and forms*

3 Inductance, Q-factor and impedance

3.1 Inductance

The inductance of an inductor is measured by the vector voltage/current method.

3.1.1 Measuring circuit



Components

R_g	source resistance (50 Ω)
R	resistor
L_x	inductor under test
C_d	distributed capacitance of inductor under test
L_s	series inductance of inductor under test
R_s	series resistance of inductor under test
- - ▶	phase reference signal
Ev_1, Ev_2	vector voltmeter
G	signal generator

Figure 1 – Example of circuit for vector voltage/current method

3.1.2 Mounting of the inductor to the test fixture

The inductor shall be measured in a test fixture as specified in the relevant standard. If no fixture is specified, one of the following test fixtures A or B shall be used. The fixture used shall be reported.

3.1.2.1 Fixture A

The shape and dimensions of fixture A shall be as shown in Figure 2.

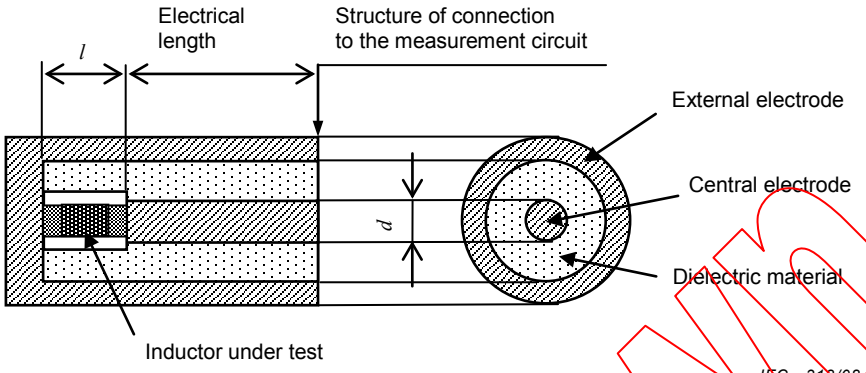


Figure 2 – Fixture A

Table 1 – Dimensions of *l* and *d*

Size of inductor under test	*l* mm	*d* mm
1608	1,6	0,95
1005	1,0	0,60
0603	0,6	0,36
0402	0,4	0,26

The electrodes of test fixture shall contact the electrodes of inductor under test by mechanical force provided by an appropriate method. This force shall be chosen so as to provide satisfactory measurement stability without influencing the characteristics of the inductor. The electrode force shall be specified. The structure between the measurement circuit and test fixture shall maintain a characteristic impedance as near as possible to 50 Ω.

3.1.2.2 Fixture B

The test fixture B as shown in Figure 3 shall be used.

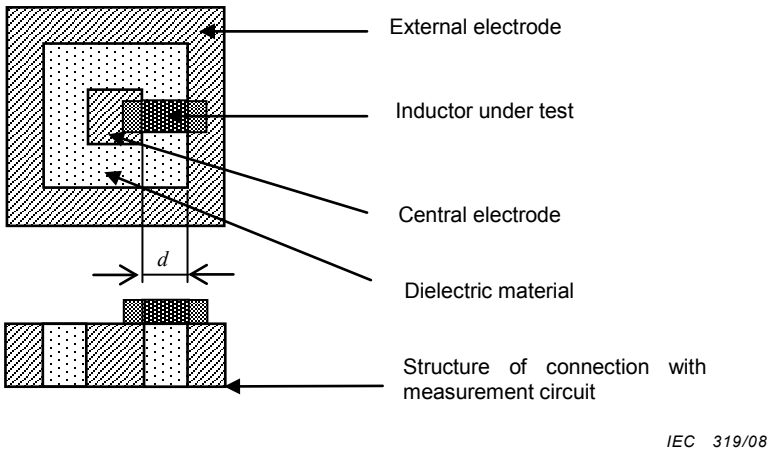


Figure 3 – Fixture B

The electrodes of the test fixture shall be in contact with the electrodes of the inductor under test by mechanical force provided by an appropriate method. This force shall be chosen so as to provide satisfactory measurement stability without influencing the characteristics of the inductor. The electrode force shall be specified.

The structure between the measurement circuit and test fixture shall maintain a characteristic impedance as near as possible to 50 Ω.

Dimension d shall be specified between parties concerned.

3.1.3 Measurement method and calculation

Inductance L_x of the inductor L_x is defined by the vector sum of reactance caused by L_s and C_d (see Figure 1). The frequency f of the signal generator output signal shall be set to a frequency as separately specified. The inductor under test shall be connected to the measurement circuit by using the test fixture as described above. Vector voltage E_1 and E_2 shall be measured by vector voltage meters Ev_1 and Ev_2, Respectively. The inductance L_x shall be calculated by the following formula:

$$L_x = \frac{\mathrm{Im}\left[R\dfrac{E_1}{E_2}\right]}{\omega} \tag{1}$$

where

L_x is the inductance of inductor under test;

Im is the imaginary part of the complex value;

R is the resistance of resistor;

E_1 is the value indicated on vector voltmeter Ev_1;

E_2 is the value indicated on vector voltmeter Ev_2;

ω is the angular frequency: $2\pi f$.

3.1.4 Notes on measurement

The electrical length of the test fixture shall be compensated by an appropriate method followed by open-short compensation. If an electrical length that is not commonly accepted is used, it shall be specified. Open-short compensation shall be calculated by the following formulae:

$$Z_x = A_c \frac{Z_m - B_c}{1 - Z_m C_c} \tag{2}$$

$$A_c = 1 + j0 \tag{3}$$

$$B_c = \frac{Z_{sm} - (1 - Y_{om}Z_{sm})Z_{ss} - Z_{sm}Y_{os}Z_{ss}}{1 - Y_{om}Z_{sm}Y_{os}Z_{ss}} \tag{4}$$

$$C_c = \frac{Y_{om} - (1 - Y_{om}Z_{sm})Y_{os} - Y_{om}Y_{os}Z_{ss}}{1 - Y_{om}Z_{sm}Y_{os}Z_{ss}} \tag{5}$$

where

Z_x is impedance measurement value after compensation;

Z_m is impedance measurement value before compensation;

Z_{sm} is the impedance measurement value of short device;

Z_{ss} is the short device inductance as defined in 3.1.4.1;

Y_{om} is the admittance measurement value of the fixture with test device absent;

Y_{os} is the admittance measurement value of the test fixture as defined in 3.1.4.2.

3.1.4.1 Short compensation

For test fixture A, the applicable short device dimension and shape are as shown in Figure 4 and Table 2. The appropriate short device inductance shall be selected from Table 2 depending on the dimension of the inductor under test. The inductance of the selected short device shall be used as a compensation value.

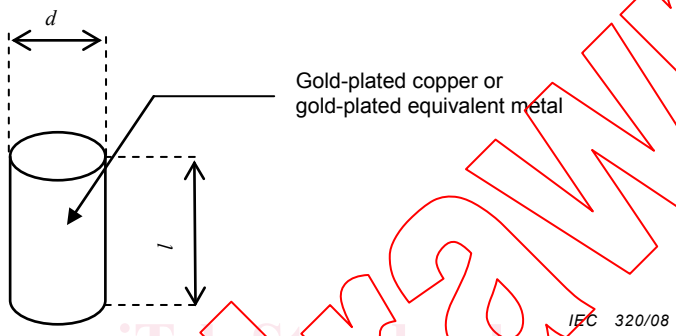


Figure 4 – Short device shape

Table 2 – Short device dimensions and inductances

Size of inductor under test	*l* mm	*d* mm	Inductance value nH
1608	1,6	0,95	0,43
1005	1,0	0,60	0,27
0603	0,6	0,36	0,16
0402	0,4	0,26	0,11

If an inductance value other than defined in Table 2 is used for test fixture A, the employed value shall be specified. For test fixture B, short device dimension, shape and inductance values shall be specified.

3.1.4.2 Open compensation

Open compensation for test fixture A shall be performed with test fixture electrodes at the same distance apart from each other as with the inductor under test mounted in the fixture. The admittance Y_{os} is defined as 0S (zero Siemens) unless otherwise specified.

Open compensation for test fixture B shall be performed without mounting the inductor. The admittance Y_{os} is defined as 0S (zero Siemens) unless otherwise specified.

3.2 Quality factor

3.2.1 Measurement method

The Q of the inductor shall be measured by the vector voltage/current method.