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INTERNATIONAL STANDARD

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

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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, ferrite and magnetic powder materials.

This third edition cancels and replaces the second edition published in 2008. This edition constitutes a technical revision.

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

a) addition of voltage-drop method of DC resistance measuring;
b) unification of technical terms.

The text of this International Standard is based on the following documents:

CDV	Report on voting
51/1187/CDV	51/1202/RVC

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

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

A list of all parts of the 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 document will remain unchanged until the stability date indicated on the IEC website under "http://webstore.iec.ch" in the data related to the specific document. At this date, the document will be

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- withdrawn,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

A bilingual version of this publication may be issued at a later date.

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 documents are referred to in the text in such a way that some or all of their content constitutes requirements 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*

IEC 62025-1, *High frequency inductive components – Non-electrical characteristics and measuring methods – Part 1: Fixed, surface mounted inductors for use in electronic and telecommunication equipment*

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

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

3 Terms and definitions

No terms and definitions are listed in this document.

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

- IEC Electropedia: available at http://www.electropedia.org/
- ISO Online browsing platform: available at http://www.iso.org/obp

4 Inductance, Q-factor and impedance

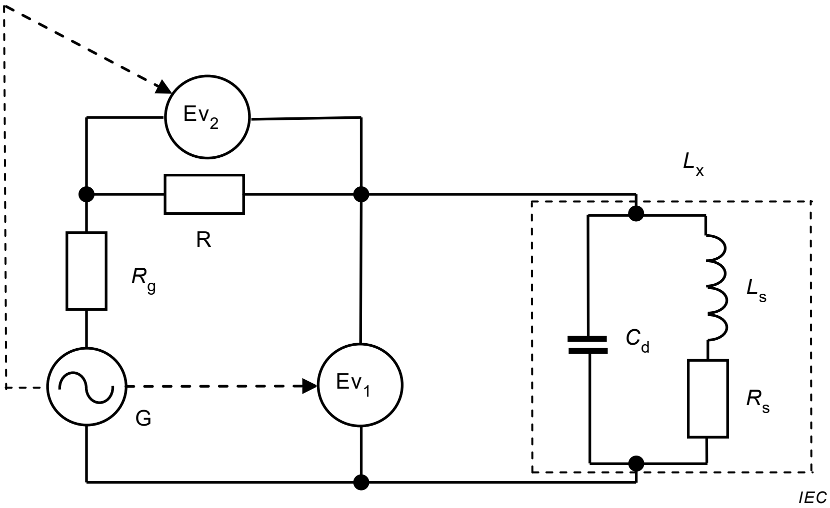
4.1 Inductance

4.1.1 Measuring method

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

4.1.2 Measuring circuit

An example of the circuit for the vector voltage/current method is shown in Figure 1.



Key

R_g	source resistance (50 Ω)
R	resistor
L_x	inductance of 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

4.1.3 Mounting the inductor for the test

4.1.3.1 General

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.

4.1.3.2 Fixture A

The shape and dimensions of fixture A shall be as shown in Figure 2 and Table 1.

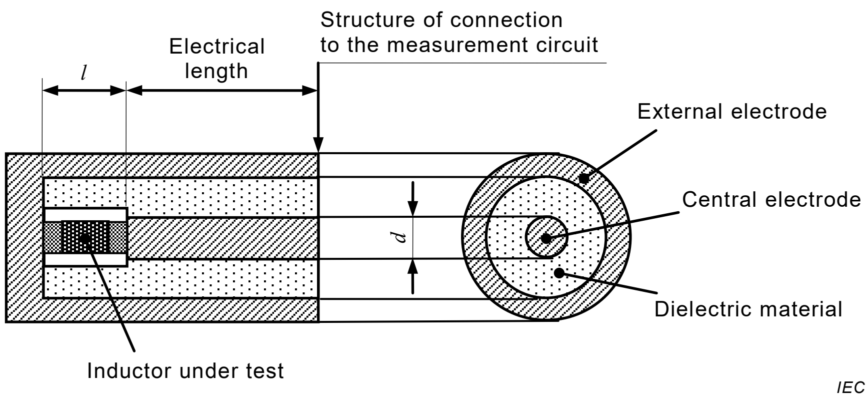


Figure 2 – Fixture A

Table 1 – Dimensions of *l* and *d*

Size of inductor under test[a]	*l* mm	*d* mm
1 608	1,6	0,95
1 005	1,0	0,60
0 603	0,6	0,36
0 402	0,4	0,26

[a] The outline dimensions of the surface mounted inductor shall be indicated by a four-digit number based on two significant figures for each dimension L, and W (or H) (refer to IEC 62025-1).

The electrodes of the test fixture shall contact 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 the test fixture shall maintain a characteristic impedance as near as possible to 50 Ω.

4.1.3.3 Fixture B

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

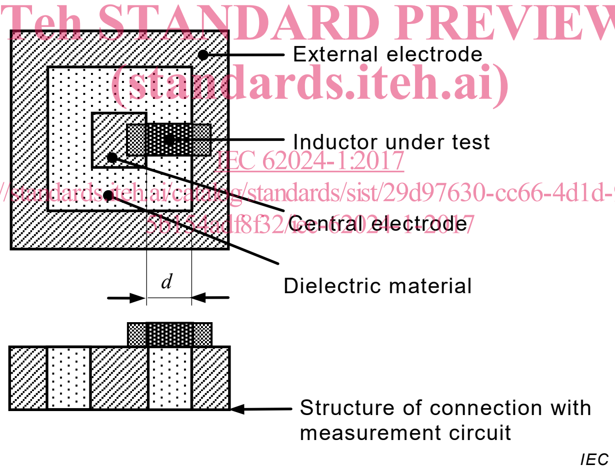


Figure 3 – Fixture B

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 the test fixture shall maintain a characteristic impedance as near as possible to 50 Ω.

Dimension d shall be specified between parties concerned.

4.1.4 Measuring method and calculation formula

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:

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

where

L_x is the inductance of the inductor under test;

Im is the imaginary part of the complex value;

R is the resistance of the 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: $2\pi f$.

4.1.5 Notes on measurement

4.1.5.1 General

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 the impedance measurement value after compensation;

Z_m is the impedance measurement value before compensation;

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

Z_{ss} is the short device inductance as defined in 4.1.5.2;

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 4.1.5.3.

4.1.5.2 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.