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(JEITA)

Fixed capacitors for use in electronic equipment— Part 8: Sectional specification: Fixed capacitors of ceramic dielectric, Class 1

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Foreword

This translation has been made based on the original Japanese Industrial Standard revised by the Minister of Economy, Trade and Industry through deliberations at the Japanese Industrial Standards Committee as the result of proposal for revision of Japanese Industrial Standard submitted by Japan Electronics and Information Technology Industries Association (JEITA) with the draft being attached, based on the provision of Article 12 Clause 1 of the Industrial Standardization Law applicable to the case of revision by the provision of Article 14.

Consequently **JIS C 5101-8:1998** is replaced with this Standard.

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Attention is drawn to the possibility that some parts of this Standard may conflict with a patent right, application for a patent after opening to the public, utility model right or application for registration of utility model after opening to the public which have technical properties. The relevant Minister and the Japanese Industrial Standards Committee are not responsible for identifying the patent right, application for a patent after opening to the public, utility model right or application for registration of utility model after opening to the public which have the said technical properties.

JIS C 5101 consists of the following 43 parts under the general title “*Fixed capacitors for use in electronic equipment*”:

JIS C 5101-1 *Part 1: Generic specification*

JIS C 5101-2 *Part 2: Sectional specification: Fixed metallized polyethylene-terephthalate film dielectric d.c. capacitors*

JIS C 5101-2-1 *Part 2: Blank detail specification: Fixed metallized polyethylene-terephthalate film dielectric d.c. capacitors Assessment level E*

JIS C 5101-3 *Part 3: Sectional specification: Fixed tantalum chip capacitors*

JIS C 5101-3-1 *Part 3: Blank detail specification: Fixed tantalum chip capacitors Assessment level E*

JIS C 5101-4 *Part 4: Sectional specification: Aluminium electrolytic capacitors with solid and non-solid electrolyte*

JIS C 5101-4-1 *Part 4: Blank detail specification: Aluminium electrolytic capacitors with non-solid electrolyte Assessment level E*

JIS C 5101-4-2 *Part 4: Blank detail specification: Aluminium electrolytic capacitors with solid electrolyte Assessment level E*

JIS C 5101-8 *Part 8: Sectional specification: Fixed capacitors of ceramic dielectric, Class 1*

JIS C 5101-8-1 *Part 8-1: Blank detail specification: Fixed capacitors of ceramic dielectric, Class 1 Assessment level EZ*

JIS C 5101-9 *Part 9: Sectional specification: Fixed capacitors of ceramic dielectric, Class 2*

JIS C 5101-9-1 *Part 9-1: Blank detail specification: Fixed capacitors of ceramic dielectric, Class 2 Assessment level EZ*

- JIS C 5101-11 *Part 11: Sectional specification: Fixed polyethylene-terephthalate film dielectric metal foil d.c. capacitors*
- JIS C 5101-11-1 *Part 11: Blank detail specification: Fixed polyethylene-terephthalate film dielectric metal foil d.c. capacitors Assessment level E*
- JIS C 5101-13 *Part 13: Sectional specification: Fixed polypropylene film dielectric metal foil d.c. capacitors*
- JIS C 5101-13-1 *Part 13: Blank detail specification: Fixed polypropylene film dielectric metal foil d.c. capacitors Assessment level E*
- JIS C 5101-14 *Part 14: Sectional specification: Fixed capacitors for electromagnetic interference suppression and connection to the supply mains*
- JIS C 5101-14-1 *Part 14: Blank detail specification: Fixed capacitors for electromagnetic interference suppression and connection to the supply mains Assessment level D*
- JIS C 5101-14-2 *Part 14-2: Blank detail specification: Fixed capacitors for electromagnetic interference suppression and connection to the supply mains—Safety tests only*
- JIS C 5101-14-3 *Part 14-3: Blank detail specification: Fixed capacitors for electromagnetic interference suppression and connection to the supply mains—Assessment level DZ*
- JIS C 5101-15 *Part 15: Sectional specification: Fixed tantalum capacitors with non-solid or solid electrolyte*
- JIS C 5101-15-1 *Part 15: Blank detail specification: Fixed tantalum capacitors with non-solid electrolyte and foil electrode Assessment level E*
- JIS C 5101-15-2 *Part 15: Blank detail specification: Fixed tantalum capacitors with non-solid electrolyte and porous anode Assessment level E*
- JIS C 5101-15-3 *Part 15: Blank detail specification: Fixed tantalum capacitors with solid electrolyte and porous anode Assessment level E*
- JIS C 5101-16 *Part 16: Sectional specification: Fixed metallized polypropylene film dielectric d.c. capacitors*
- JIS C 5101-16-1 *Part 16: Blank detail specification: Fixed metallized polypropylene film dielectric d.c. capacitors Assessment level E*
- JIS C 5101-17 *Part 17: Sectional specification: Fixed metallized polypropylene film dielectric a.c. and pulse capacitors*
- JIS C 5101-17-1 *Part 17: Blank detail specification: Fixed metallized polypropylene film dielectric a.c. and pulse capacitors Assessment level E*
- JIS C 5101-18 *Part 18: Sectional specification: Fixed aluminium electrolytic chip capacitors with solid (MnO₂) and non-solid electrolyte*
- JIS C 5101-18-1 *Part 18: Blank detail specification: Fixed aluminium electrolytic chip capacitors with solid (MnO₂) electrolyte Assessment level E*
- JIS C 5101-18-2 *Part 18: Blank detail specification: Fixed aluminium electrolytic chip capacitors with non-solid electrolyte Assessment level E*

- JIS C 5101-20 *Part 20: Sectional specification: Fixed metallized polyphenylene sulfide film dielectric chip d.c. capacitors*
- JIS C 5101-20-1 *Part 20: Blank detail specification: Fixed metallized polyphenylene sulfide film dielectric chip d.c. capacitors Assessment level EZ*
- JIS C 5101-21 *Part 21: Sectional specification: Fixed surface mount multilayer capacitors of ceramic dielectric, Class 1*
- JIS C 5101-21-1 *Part 21-1: Blank detail specification: Fixed surface mount multilayer capacitors of ceramic dielectric, Class 1—Assessment level EZ*
- JIS C 5101-22 *Part 22: Sectional specification: Fixed surface mount multilayer capacitors of ceramic dielectric, Class 2*
- JIS C 5101-22-1 *Part 22-1: Blank detail specification: Fixed surface mount multilayer capacitors of ceramic dielectric, Class 2—Assessment level EZ*
- JIS C 5101-23 *Part 23: Sectional specification—Fixed surface mount metallized polyethylene naphthalate film dielectric DC capacitors*
- JIS C 5101-23-1 *Part 23-1: Blank detail specification—Fixed surface mount metallized polyethylene naphthalate film dielectric DC capacitors—Assessment level EZ*
- JIS C 5101-24 *Part 24: Sectional specification—Surface mount fixed tantalum electrolytic capacitors with conductive polymer solid electrolyte (to be published)*
- JIS C 5101-24-1 *Part 24-1: Blank detail specification—Surface mount fixed tantalum electrolytic capacitors with conductive polymer solid electrolyte—Assessment level EZ (to be published)*
- JIS C 5101-25 *Part 25: Sectional specification—Surface mount fixed aluminium electrolytic capacitors with conductive polymer solid electrolyte (to be published)*
- JIS C 5101-25-1 *Part 25-1: Blank detail specification—Surface mount fixed aluminium electrolytic capacitors with conductive polymer solid electrolyte—Assessment level EZ (to be published)*

**Fixed capacitors for use
in electronic equipment—
Part 8: Sectional specification:
Fixed capacitors of ceramic dielectric,
Class 1**

Introduction

This Japanese Industrial Standard has been prepared based on the third edition of **IEC 60384-8** published in 2005 without modifying the technical contents.

The portions underlined with dots are the matters not stated in the original International Standard.

1 General

1.1 Scope

This Standard is a sectional specification associated with the generic specification, **JIS C 5101-1** and specifies fixed capacitors of ceramic dielectric for use in electronic equipment, Class 1. This Standard is applicable to fixed capacitors (hereafter referred to as “capacitors”) of ceramic dielectric with a defined temperature coefficient (dielectric Class 1), intended for use in electronic equipment, including leadless capacitors but excluding fixed surface mount multilayer capacitors of ceramic dielectric.¹⁾

Capacitors for electromagnetic interference suppression are not included, but are covered by **JIS C 5101-14**.

NOTE 1 This Standard specifies the characteristics of capacitors; however, specifications concerning characteristics thereof essentially show the targeted values of design, therefore it is not intended to perform conformity assessment

NOTE 2 The leadless capacitors means capacitors of such shape as “round, without enclosure, without lead termination and opposed electrodes”, or “round metallic case, lug termination one end earthed and with mounting structure” and the like. However, “cylindrical chip” is excluded.

NOTE 3 The International Standard corresponding to this Standard is as follows.
IEC 60384-8:2005 *Fixed capacitors for use in electronic equipment—
Part 8: Sectional specification: Fixed capacitors of ceramic dielectric,
Class 1* (IDT)

In addition, symbols which denote the degree of correspondence in the contents between the relevant International Standard and **JIS** are IDT (identical), MOD (modified), and NEQ (not equivalent) according to **ISO/IEC Guide 21**.

Note ¹⁾ For fixed surface mount multilayer capacitors of ceramic dielectric, Class 1, **JIS C 5101-21** is applicable.

1.2 Object

The object of this Standard is to prescribe preferred ratings and characteristics and to select from **JIS C 5101-1**, the appropriate quality assessment procedures, tests and measuring methods and to give general performance requirements for this type of capacitor. Test severities and requirements prescribed in detail specifications referring to this sectional specification shall be of equal or higher performance level because lower performance levels are not permitted.

1.3 Normative references

The following standards contain provisions which, through reference in this text, constitute provisions of this Standard. If the indication of the year of publication is given to these referred standards, only the edition of indicated year constitutes the provision of this Standard but the revision and amendment made thereafter do not apply. The normative references without the indication of the year of publication apply only to the most recent editions (including amendments).

JIS C 5063:1997 *Preferred number series for resistors and capacitors*

NOTE : Corresponding International Standard: IEC 60063:1963 *Preferred number series for resistors and capacitors*, Amendment 1:1967, and Amendment 2:1977 (IDT)

JIS C 5101-1:1998 *Fixed capacitors for use in electronic equipment Part 1: Generic specification*

NOTE : Corresponding International Standard: IEC 60384-1:1982 *Fixed capacitors for use in electronic equipment Part 1: Generic specification*, Amendment 2:1987, Amendment 3:1989 and Amendment 4:1992 (MOD)

In addition, **JIS C 5101-1:1998** does not correspond to the latest edition, **IEC 60384-1:1999**, so the numbering system of applicable items may not correspond with each other. In the case of discrepancy in the numbering, the number of **IEC 60384-1:1999** is shown in NOTE.

JIS C 5101-14 *Fixed capacitors for use in electronic equipment Part 14: Sectional specification: Fixed capacitors for electromagnetic interference suppression and connection to the supply mains*

NOTE : Corresponding International Standard: IEC 60384-14:2005 *Fixed capacitors for use in electronic equipment—Part 14: Sectional specification: Fixed capacitors for electromagnetic interference suppression and connection to the supply mains* (IDT)

JIS C 60068-1:1993 *Environmental testing Part 1: General and guidance*

NOTE : Corresponding International Standard: IEC 60068-1:1988 *Environmental testing. Part 1: General and guidance* and Amendment 1:1992 (IDT)

JIS Z 8601:1954 *Preferred numbers*

NOTE : Corresponding International Standard: ISO 3:1973 *Preferred numbers—Series of preferred numbers* (MOD)

JIS Z 9015-1 *Sampling procedures for inspection by attributes—Part 1: Sampling schemes indexed by acceptance quality limit (AQL) for lot-by-lot inspection*

NOTE : Corresponding International Standard: IEC 60410 : 1973 *Sampling plans and procedures for inspection by attributes* (MOD)

1.4 Information to be given in a detail specification

Detail specifications shall be derived from the relevant blank detail specification.

Detail specifications shall not specify requirements inferior to those of the generic, sectional or blank detail specification. When more severe requirements are included, they shall be listed in **1.9** of the detail specification and indicated in the test schedules, for example by an asterisk (*).

NOTE : The information given in **1.4.1** may for convenience, be presented in tabular form.

The following information shall be given in each detail specification and the values quoted shall preferably be selected from those given in the appropriate clause of this sectional specification.

1.4.1 Outline drawing and dimensions

These shall be an illustration of the capacitor as an aid to easy recognition and for comparison of the capacitor with others.

Dimensions and their associated tolerances, which affect interchangeability and mounting, shall be given in the detail specification. All dimensions shall preferably be stated in millimetres.

Normally, the numerical values shall be given for the length of the body, the width and height of the body and the wire spacing, or for cylindrical types, the body diameter, and the length and diameter of the terminations. When necessary, for example when a number of items (capacitance values/voltage ranges) are covered by a detail specification, the dimensions and their associated tolerances shall be placed in a table below the drawing.

When the configuration is other than described above, the detail specification shall state such dimensional information as will adequately describe the capacitors. When the capacitor is not designed for use on printed boards, this shall be clearly stated in the detail specification.

1.4.2 Mounting

The detail specification shall specify the method of mounting to be applied for normal use and for the application of the vibration and the bump or shock tests. The capacitors shall be mounted by their normal means. The design of the capacitor may be such that special mounting fixtures are required in its use. In this case, the detail specification shall describe the mounting fixtures and they shall be used in the application of the vibration and bump or shock tests.

1.4.3 Ratings and characteristics

The ratings and characteristics shall be in accordance with the relevant clauses of this specification, together with the following:

1.4.3.1 Rated capacitance range

See **2.2.4.1**.

NOTE: In the case of International Electrotechnical Commission Quality Assessment System for Electronic Components (**IECQ**), when products approved to the detail specification have different ranges, the following statement should be added: "The range of values available in each voltage range is given in the qualified product list (**QPL**)".

1.4.3.2 Particular characteristics

Additional characteristics may be listed, when they are considered necessary to specify adequately the component for design and application purposes.

1.4.3.3 Soldering

The detail specification shall prescribe the test methods, severities and requirements applicable for the solderability and the resistance to soldering heat tests.

1.4.4 Marking

The detail specification shall specify the content of the marking on the capacitor and on the package. Deviations from **1.6**, shall be specifically stated.

1.5 Terms and definitions

For the purposes of this document, the applicable terms and definitions of **JIS C 5101-1** and the following apply.

1.5.1 fixed capacitors of ceramic dielectric, class 1

capacitor specially designed and suited for resonant circuit application where low losses and high stability of capacitance are essential or where a precisely defined temperature coefficient is required, for example for compensating temperature effects in the circuit

The ceramic dielectric is defined by its rated temperature coefficient (α).

1.5.2 subclass

for a given rated temperature coefficient, it is defined by the rated tolerance on the temperature coefficient (see table 2)

NOTE : The rated temperature coefficient value and its tolerance refer to the temperature interval of +20 °C to +85 °C but because in practice TC curves are not strictly linear, it is necessary to define limiting capacitance deviations ($\Delta C/C$) for other temperatures (see table 3). The same information is expressed in graphical form in figures A.1 to A.15.

These figures enable the user to form an estimate of the value and tolerance of $1/C \times (dC/dT)_T$, the incremental temperature coefficient from the variation of capacitance at a given temperature T , though this quantity is not required specially to be measured in the test.

1.5.3 rated voltage, U_R

maximum d.c. voltage, which may be applied continuously to the terminations of a capacitor at the rated temperature

NOTE : The sum of the d.c. voltage and the peak a.c. voltage applied to the capacitor should not exceed the rated voltage. The value of the peak alternating voltage should not exceed the value determined by the permissible reactive power.

1.6 Marking

See **JIS C 5101-1, 2.4**, with the following details:

1.6.1 Marking on the capacitor and the package

The information given in the marking is normally selected from the following list; the relative importance of each item is indicated by its position in the list:

- a) rated capacitance;
- b) rated voltage (d.c. voltage may be indicated by the symbol $\overline{\text{---}}$ or ---);
- c) tolerance on rated capacitance;
- d) temperature coefficient and, space permitting, its tolerance in code, see **2.2.5**;
- e) year and month (or week) of manufacture;
- f) manufacturer's name or trade mark;
- g) climatic category;
- h) manufacturer's type designation;
- i) reference to the detail specification.

NOTE : Information required under **1.6.1 b)** and **1.6.1 d)** may be given in code form under manufacturer's, or national, type or style designation.

1.6.2 Marking of coding of temperature coefficient and its tolerance

Coding of temperature coefficient is given in table 2. In case of colour code spot, stripe or ring may be used; moreover for temperature coefficients, where two colours are required, the second colour may be provided by the colour of the body or of the typographical marking.

1.6.3 Marking on the capacitor

The capacitor shall be clearly marked with **a)**, **b)** and **c)** in **1.6.1** and with as many as possible of the remaining items as is considered necessary. Any duplication of information in the marking on the capacitor should be avoided.

1.6.4 Marking on the package

The package containing the capacitor(s) shall be clearly marked with all the information listed in **1.6.1**.

1.6.5 Additional marking

Any additional marking other than those specified in **1.6.1** and **1.6.2** shall be so applied that no confusion can arise.

2 Preferred ratings and characteristics

2.1 Preferred characteristics

The values given in detail specifications shall preferably be selected from the following:

2.1.1 Preferred climatic categories

The capacitors covered by this specification are classified into climatic categories according to the general rules given in clause 8 of **JIS C 60068-1**.

The lower and upper category temperatures and the duration of the damp heat, steady state test shall be chosen from the following:

Lower category temperature: $-55\text{ }^{\circ}\text{C}$, $-40\text{ }^{\circ}\text{C}$, $-25\text{ }^{\circ}\text{C}$ and $-10\text{ }^{\circ}\text{C}$

Upper category temperature: $+70\text{ }^{\circ}\text{C}$, $+85\text{ }^{\circ}\text{C}$, $+100\text{ }^{\circ}\text{C}$ and $+125\text{ }^{\circ}\text{C}$

Duration of the damp heat, steady state test: 4, 10, 21 and 56 days

The severities for the cold and dry heat tests are the lower and upper category temperatures respectively.

2.2 Preferred values of ratings

2.2.1 Rated temperature

For capacitors covered by this specification, the rated temperature is equal to the upper category temperature.

2.2.2 Rated voltage (U_R)

For the preferred values of rated voltage, the basic series of preferred values R5 given in **JIS Z 8601** are used and are as follows. If other values are needed, they may be chosen from the R10 series.

R5 series: 25 V, 40 V, 63 V, 100 V, 160 V, 250 V, 400 V, 630 V, 1 000 V, 1 600 V, 2 500 V, 4 000 V and 6 300 V

R10 series: 50 V, 200 V, 500 V, 2 000 V, 3 150 V and 5 000 V

2.2.3 Category voltage (U_C)

Since the rated temperature is defined as the upper category temperature, the category voltage is equal to the rated voltage, as defined in **JIS C 5101-1**, 2.2.17.

2.2.4 Preferred values of rated capacitance and associated tolerance values

2.2.4.1 Preferred values of rated capacitance

Rated capacitance values shall be taken from the series of **JIS C 5063**; the E6, E12 and E24 series are preferred.

2.2.4.2 Preferred tolerances on rated capacitance

Preferred tolerances on rated capacitance are shown in table 1.

Table 1 Preferred tolerances on rated capacitance

Preferred series	Tolerances			
	$C_R \geq 10 \text{ pF}$	Letter code	$C_R < 10 \text{ pF}$	Letter code
E6	$\pm 20 \%$	M	$\pm 2 \text{ pF}$	G
E12	$\pm 10 \%$	K	$\pm 1 \text{ pF}$	F
	$\pm 5 \%$	J	$\pm 0.5 \text{ pF}$	D
E24	$\pm 2 \%$	G	$\pm 0.25 \text{ pF}$	C
	$\pm 1 \%$	F	$\pm 0.1 \text{ pF}$	B

2.2.5 Temperature coefficient (α)

2.2.5.1 Table 2 shows the preferred rated temperature coefficient and the associated tolerances, expressed in parts per million per Kelvin ($10^{-6}/\text{K}$), and the corresponding subclasses and codes.

The detail specification shall specify for each temperature coefficient the minimum value of capacitance for which the given tolerance of temperature coefficient may be verified, considering the accuracy of the methods of capacitance measurement specified.

For values of capacitance lower than these minimum values:

- The detail specification shall specify a multiplying factor for the tolerance on α , as well as the permissible changes of capacitance at the lower and upper category temperature;
- Special methods of measurement may be necessary and, if required, shall be stated in the detail specification.

2.2.5.2 Figures A.1 to A.15 show the limits of variation of capacitance with temperature for the temperature coefficients and subclasses listed in table 3.