

JIS

JAPANESE INDUSTRIAL STANDARD

**General rules of fixed
ceramic capacitors for use in
electronic equipment**

JIS C 5130—1995

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In the event of any doubt arising,
the original Standard in Japanese is to be final authority.

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General rules of fixed ceramic capacitors for
use in electronic equipment

C 5130-1995

1. Scope This Japanese Industrial Standard is the sectional specification of fixed ceramic capacitors mainly used for electronic equipment (hereafter referred to as "capacitors"), and specifies the bases for type designation, ratings, appearance, construction, dimensions, marking, materials, performances and for requirements to be specified in detail specifications.

Remarks 1. The following standards are cited in this Standard:

JIS B 0205	Metric coarse screw threads
JIS B 0207	Metric fine screw threads
JIS C 0805	Packaging of electronic components on continuous tapes (components with axial type and radial wire lead terminals)
JIS C 0806	Packaging of electronic components on continuous tapes (surface mounting devices)
JIS C 5001	General rules for electronic components
JIS C 5003	General test procedure of failure rate for electronic components
JIS C 5101	General rules of fixed capacitors for use in electronic equipment
JIS C 5102	Test methods of fixed capacitors for use in electronic equipment
JIS C 5602	Glossary of passive components for electronic equipment
JIS Z 8601	Preferred numbers
JIS Z 9015	Sampling inspection procedures and tables by attributes with severity adjustment (receiving inspection where a consumer can select suppliers)

2. The International standards corresponding to this Standard are given below.

These standards are called generically IEC 384 hereafter.

IEC 384-8: 1988	Fixed capacitors for use in electronic equipment. Part 8: Sectional specification : Fixed capacitors of ceramic dielectric, class 1 Amendment 1 (1993)
IEC 384-9: 1988	Fixed capacitors for use in electronic equipment. Part 9: Sectional specification: Fixed capacitors of ceramic dielectric, class 2
IEC 384-10: 1989	Fixed capacitors for use in electronic equipment. Part 10: Sectional specification: Fixed multilayer ceramic chip capacitors Amendment 1 (1993)

2. **Definitions** For the purposes of this Standard the definitions given in JIS C 5101 and JIS C 5602 shall apply.

The definitions for principal terms are given below.

- (1) **ceramic capacitor class 1** A capacitor which is employing ceramics as the dielectric and intended for use in resonance circuits, other general circuits where higher Q and stability of capacitance against temperature or the like are required i.e. mainly for temperature compensation of electronic equipment.

Remarks: This is also called a temperature compensating ceramic capacitor.

- (2) **ceramic capacitor class 2** A capacitor which is employing ceramics as the dielectric and intended for such application, where severe stability on values of Q and capacitance is not of major importance, as bypass and coupling of circuits in electronic equipment.

Remarks: This is also called a high permittivity ceramic capacitor.

- (3) **ceramic capacitor class 3** A capacitor which is small sized by utilizing a semiconducting ceramic and intended for such application, where severe stability on values of Q and capacitance is not of major importance, as bypass and coupling of circuits in electronic equipment.

Remarks: This is also called a semiconducting ceramic capacitor, and generally classified into the following two classes:

- (a) Surface layer ceramic capacitor
 - (b) Boundary layer ceramic capacitor
- (4) **multilayer ceramic chip capacitor** A chip capacitor for surface mounting which is made by piling ceramic dielectrics and internal electrodes in several layers and used in electronic equipment circuit.

Informative reference These are the terms used in IEC 384.

3. **Priority of standards** If there is any different provision in the following specifications priority shall be given in the following order:

- (1) Detail specification
- (2) Sectional specification (JIS C 5130)
- (3) Generic specification (JIS C 5101)
- (4) Basic specification (JIS C 5001)

4. Type designation

4.1 Structure of type designation Type designation shall be formed in the following arrangement:

Symbol denoting class of capacitor	Symbol denoting style	Symbol denoting character- istics	Symbol denoting rated voltage	Symbol denoting rated capacitance	Symbol denoting tolerance on capaci- tance	Symbol denoting grade	Symbol denoting failure rate level	Symbol denoting other necessary item
4.2.1	4.2.2	4.2.3	4.2.4	4.2.5	4.2.6	4.2.7	4.2.8	4.2.9

Example:

CC 45 CHJ 1H 101 J C R T

4.2 Symbols

4.2.1 Class of capacitor Capacitors shall be classified and symbolized by two or three English capital letters as given in Table 1, according to the class and structure of ceramic dielectrics.

Table 1. Classification of capacitor

Symbol	Class of capacitor	Remarks
CC	Class 1	Temperature compensating ceramic capacitor
CK	Class 2	High permittivity ceramic capacitor
CGA	Class 3	Surface layer ceramic capacitor
CGB		Boundary layer ceramic capacitor

4.2.2 Style The symbol denoting style shall consist of two numerals as given in Table 2. However, one numeral shall be added to each of symbols 72, 73 and 77 according to the classification by positions of surface mounting terminations (or electrodes) so that capacitors of this type are denoted by three numerals as shown in Table 3.

Table 2. Style

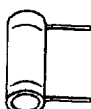
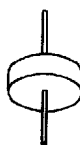
Symbol	Style	Enclosure	Termination		Remarks	Drawing for informative reference		
			Kind	Direction				
05	Cylindrical	Non-metal case	Lead wire	Opposite	—			
14		Non-metal enclosure						
27	Cylindrical (chip)	Non-metal enclosure	Surface mounting terminations (or electrodes)	Opposite	—			
29		No enclosure						
13	Cylindrical	No enclosure	Lead wire	Same	—			
16		Non-metal enclosure						
17	Cylindrical	Metal case	Lead wire	Through	With mounting means			
18		No enclosure						
43	Round	No enclosure	Lead wire	Opposite	—			
51		Non-metal enclosure	Lug					
59		No enclosure	Screw					
60		Non-metal case						
					With mounting means			

Table 2. Style (Continued)

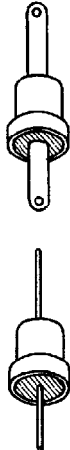
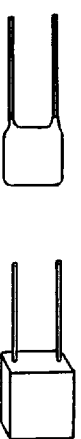
Symbol	Style	Enclosure	Termination		Remarks	Drawing for informative reference
			Kind	Direction		
44	Round	No enclosure	Surface mounting terminations (or electrodes)	Opposite	—	
45	Round	Non-metal enclosure	Lead wire	Same	—	
46	Round	Metal case	Lead wire	Through	—	
47			Lug		With mounting means	
52					—	
56					With mounting means	
57	Round	Metal case	Lug	Opposite	With mounting means, one end earthed	
96	Square	No enclosure	Lead wire	Opposite	—	
98		Non-metal case				

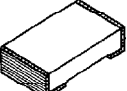
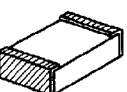
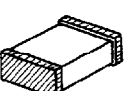
Table 2. Style (Continued)

Symbol	Style	Enclosure	Termination		Remarks	Drawing for informative reference
			Kind	Direction		
72	Square (chip)	No enclosure	Surface mounting terminations (or electrodes)	Opposite	See Table 3	
73		Non-metal enclosure				
77		Non-metal case				
92	Squaer	Non-metal enclosure	Lead wire	Same	—	
97		No enclosure				
99		Non-metal case				

Remarks

1. Resin mould is included in non-metal case.
2. No enclosure means bare element or a capacitor painted without guarantee of insulation.
3. Non-metal enclosure means an enclosure formed by thick dipped coating or by taping with insulating material.
4. Square type includes rectangular type.
5. Lug termination includes plate termination and wrapping termination.
6. Lead wire termination includes lead frame.
7. Cylindrical means such one that the electrodes are formed on internal surface and external surface of a cylindrical ceramic, and disc type means such one that the electrodes are formed on both surfaces.

Table 3. Position of surface mounting termination (or electrode) on capacitor of style symbol 72, 73 and 77

Symbol	Position of terminations (or electrodes)	Drawing for informative reference
721	Capacitor whose surface mounting terminations (or electrodes) exist on its one face only.	
722	Capacitor whose surface mounting terminations (or electrodes) are spreading over its two faces.	
723	Capacitor whose surface mounting terminations (or electrodes) are spreading over its three faces.	
725	Capacitor whose surface mounting terminations (or electrodes) are spreading over its five faces.	
726 736 776	Capacitor whose surface mounting terminations (or electrodes) are placed towards outside of body.	

Remarks: The broken lines in informative reference figures show the positions of surface mounting terminations (or electrodes).

4.2.3 Characteristics

4.2.3.1 Characteristics of class 1 capacitors The symbol denoting characteristics of class 1 capacitors shall consist of a combination of three English capital letters. The first letter shall express nominal value of temperature coefficient of capacitance as shown in Table 4. The second letter shall express tolerances on temperature coefficient of capacitance over a temperature range from 20°C to 85°C as given in Table 5. The third letter shall express the category temperature range as given in Table 6.

The combination of the first letter (nominal value of temperature coefficient of capacitance) and the second letter (tolerances on temperature coefficient of capacitance) shall be specified in the detail specification. However, the combination of SL and YN expresses that the temperature coefficient of capacitance falls within a range of +350 ppm/°C to -1000 ppm/°C and -800 ppm/°C to -5800 ppm/°C, respectively, over the temperature range from 20°C to 85°C, inspite of the numerical values of Tables 4 and 5.

In such a case that the category temperature range includes a temperature not more than 20°C or more than 85°C, the detail specification shall specify the tolerances on temperature coefficient of capacitance and the ranges of temperature coefficients of capacitance corresponding to symbols SL and YN.

Table 4. Nominal value of temperature coefficient of capacitance

Unit: ppm/°C	
Symbol	Nominal value of temperature coefficient of capacitance
A	+ 100
B	+ 30
C	0
H	- 33
L	- 75
P	- 150
R	- 220
S	- 330
T	- 470
U	- 750
V	- 1000
W	- 1500
X	- 2200
Y	- 3300
Z	- 4700

Table 5. Tolerance on temperature coefficient of capacitance

Unit: ppm/°C	
Symbol	Tolerance on temperature coefficient of capacitance
F	± 15
G	± 30
H	± 60
J	± 120
K	± 250
L	± 500
M	± 1000
N	± 2500

Table 6. Category temperature range

Unit: °C	
Symbol	Category temperature range
B	-55 to +125
D	-55 to + 85
J	-25 to + 85
S	-25 to +125

Informative reference: Symbols V, W, X, Y and Z are denoted, in both of IEC 384-8 and IEC 384-10, Q(-1000), V(-1500), K(-2200), D(-3300) and E(-4700) respectively.

4.2.3.2 Characteristics of class 2 and class 3 capacitors The symbol denoting characteristics of class 1 and class 3 capacitors shall consist of two English capital letters. The first letter shall express the maximum rate of capacitance change within the category temperature range with respect to the capacitance at reference temperature 20°C, as given in Table 7. The second letter shall express the category temperature range as given in Table 6.

The rate of capacitance change under voltage application shall be specified in the detail specification.

Table 7. Rate of capacitance change

Unit: %

Symbol	Rate of capacitance change	Symbol	Rate of capacitance change
A	± 5	C	± 20
V	± 7.5	D	+ 20 - 30
B	± 10	E	+ 22 - 56
R	± 15	F	+ 30 - 80

4.2.4 Rated voltage The symbol denoting rated voltage shall consist of a combination of two characters the first one being a numeral, the second one being an English capital letter and shall be as given in Table 8.

Table 8. Rated voltage

Unit: V

First character	Second character									
	A	B	C	D	E	F	G	H	J	K
0	1.0	1.25	1.6	2.0	2.5	3.15	4.0	5.0	6.3	8.0
1	10	12.5	16	20	25	31.5	40	50	63	80
2	100	125	160	200	250	315	400	500	630	800
3	1 000	1 250	1 600	2 000	2 500	3 150	4 000	5 000	6 300	8 000
4	10 000	12 500	16 000	20 000	25 000	31 500	40 000	50 000	63 000	80 000

Example: 1H..... 50 V 2H 500 V 3D..... 2000 V

Remarks: The first character indicates the power of 10 by which the numerical values indicated by the second character is multiplied, and the second character is corresponding to the R10 preferred numbers specified in JIS Z 8601.

4.2.5 Rated capacitance The symbol denoting rated capacitance shall consist of three numerals. The first and second numerals mean the significant figures of rated capacitance in the unit of picofarad (pF), and the third numeral indicates the number of zeros following the significant figures. If there is a decimal point, it shall be expressed by an English capital letter R, and all the numerals, in this case, shall be the significant figures.

Examples: R50 0.5 pF
 1R0 1 pF
 1R5 1.5 pF
 100 10 pF
 102 1 000 pF
 473 47 000 pF

Remarks: R50 may be denoted as 0R5 and 1R0 may be denoted as 010 but it is desirable not to use such expression.

4.2.6 Tolerance on capacitance The symbol denoting tolerance on capacitance shall consist of one English capital letter as given in Tables 9 and 10.

Table 9. Tolerance on capacitance (exceeding 10 pF in rated value)

Unit: %

Symbol	G	J	K	M	S	Z	P
Tolerances on capacitance	± 2	± 5	± 10	± 20	$\begin{smallmatrix} +50 \\ -20 \end{smallmatrix}$	$\begin{smallmatrix} +80 \\ -20 \end{smallmatrix}$	$\begin{smallmatrix} +100 \\ 0 \end{smallmatrix}$

Table 10. Tolerance on capacitance (not exceeding 10 pF in rated value)

Unit: pF

Symbol	B	C	D	F	G
Tolerances on capacitance	± 0.1	± 0.25	± 0.5	± 1	± 2

4.2.7 Grade The symbol denoting grade shall consist of one English capital letter as given in Table 11.

Table 11. Grade

Symbol	Description of grade
B	A general level applicable to capacitors for which the quality assurance program in Annex 1 of JIS C 5101, quality level, test details, etc. are required at relatively higher levels.
C	A simplified level applicable to capacitors for which a level lower than the general level is required and some parts of test items may be omitted.
E	A level corresponding to the "assessment level E" in the corresponding International standard.
X	A level to which the quality assurance specified in Annexes of this Standard (JIS C 5130) is not applicable.

Informative reference: The "assessment level E" of corresponding International standard in the row of symbol E means the "assessment level E" specified in the sectional specifications based on IEC 384.

4.2.8 Failure rate level The symbol denoting failure rate level shall consist of one English capital letter as given in Table 12.

Table 12. Failure rate level

Unit %/1000 h	
Symbol	Failure rate
M	1.0
P	0.1
R	0.01
S	0.001
X	Not specified

4.2.9 Other necessary item The symbol denoting other necessary items is applicable for expression of performance, construction, materials and other necessary matters which can not be denoted by the symbols given in 4.2.1 to 4.2.8 and shall be specified in the detail specification. However, the symbols given in Table 12 shall not be used.

5. Ratings

5.1 Category temperature range The category temperature ranges shall be as given in Table 6.

5.2 Rated voltage The rated voltages shall be as given in Table 8.

5.3 Rated capacitance The rated capacitance shall be expressed in picofarad (pF). The numerical values selected from among the E3 to E24 series multiplied by 10^n (n is an integer) in Table 13 shall be used. However, for rated capacitance not exceeding 10 pF, the numerical values in Table 14 shall be used.

Table 13. Preferred numbers of rated capacitance and its tolerances
(exceeding 10 pF)

Series of preferred numbers	E3	E6	E12	E24
Capacitance tolerances and their symbols	$+80\%$ (Z) -20% (P)	$\pm 20\%$ (M) $+50\%$ (S) -20% (S)	$\pm 10\%$ (K)	$\pm 2\%$ (G) $\pm 5\%$ (J)
Preferred numbers of rated capacitance	1.0	1.0	1.0	1.0
				1.1
			1.2	1.2
				1.3
		1.5	1.5	1.5
				1.6
			1.8	1.8
				2.0
	2.2	2.2	2.2	2.2
				2.4
			2.7	2.7
				3.0
		3.3	3.3	3.3
				3.6
			3.9	3.9
				4.3
	4.7	4.7	4.7	4.7
				5.1
			5.6	5.6
				6.2
		6.8	6.8	6.8
				7.5
			8.2	8.2
				9.1

Table 14. Rated capacitance and its tolerance
(not exceeding 10 pF)

Capacitance tolerances and their symbols	± 0.1 pF (B) ± 0.25 pF (C)	± 0.5 pF (D)	± 1 pF (F) ± 2 pF (G)
Rated capacitance pF	0.5	—	—
	0.75	0.75	
	1	1	
	1.5	1.5	
	2	2	
	3	3	
	4	4	
	5	5	5
	—	6	6
		7	7
		8	8
		9	9
		10	10

Remarks: Numerical values of E12 series other than values in Table 14 may also be used.

5.4 Tolerances on capacitance The tolerances on capacitance shall be combined with the rated capacitance, and expressed by percent (%) as shown in Table 13. For the rated capacitance 10 pF or less, it shall be expressed by picofarad (pF) as shown in Table 14.

6. Materials, construction and dimensions

6.1 Materials The materials for each component of a capacitor shall be stable materials which satisfy the function of the capacitor.

If necessary, they shall be specified in the detail specification.

6.2 Construction The construction shall comply with the following requirements together with the provisions of detail specification:

- (1) The capacitor element shall consist of a ceramic dielectric and electrodes.
- (2) The terminations of a capacitor shall be firmly connected with the capacitor element electrically and mechanically.

The termination shall withstand corrosion, and that connected by soldering shall be adequately treated so that the soldering is easy.