

JAPANESE INDUSTRIAL STANDARD

JIS C 6439-1995

Fixed mica capacitors for
use in electronic equipment

November 1996

ERRATA

Page 49

Clause 1, first paragraph, line 3

Delete the expression "on the sample size" in the line 3 of the clause 1 and read the following :

"shall be decided based on the results of the tests which satis-".

Remarks: This errata is for correcting the first edition of this Standard.
Japanese Standards Association

JIS

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JIS C 6439—1995

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the original Standard in Japanese is to be final authority**

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JAPANESE INDUSTRIAL STANDARD

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Fixed mica capacitors for
use in electronic equipment

C 6439-1995

1. Scope This Japanese Industrial Standard specifies fixed capacitors, employing mica as the dielectric, which are mainly for use in electronic equipment (hereafter referred to as the "capacitors").

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

JIS C 0805	Packaging of electronic components on continuous tapes (components with axial type and radial wire lead terminals)
JIS C 5001	General rules 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 5700	General rules for reliability assured electronic components
JIS Z 9015	Sampling inspection procedures and tables by attributes with severity adjustment (receiving inspection where a consumer can select suppliers)

2. The International Standard corresponding to this Standard is given below.

IEC 384-5 Fixed capacitors for use in electronic equipment.
Part 5: Sectional specification: Fixed mica dielectric direct current capacitors with a rated voltage not exceeding 3000 V. Selection of methods of test and general requirements

2. Definitions For the purpose of this Standard, the definitions specified in JIS C 5101 apply.

3. Priority order of standards If there are provisions contrary to each other in the Standards given below, the priority order shall be as given below.

- (1) Detail specification (this JIS C 6439)
- (2) Generic specification (JIS C 5101)
- (3) Basic specification (JIS C 5001 and JIS C 5700)

4. Type designation

4.1 Structure of type designation The type designation shall be structured by arranging the symbols as shown below.

This example shows a mica capacitor, square non-metallic enclosure, same directional lead terminations, temperature coefficient $-200 \text{ ppm}/^{\circ}\text{C}$ to $+200 \text{ ppm}/^{\circ}\text{C}$, category temperature range -55°C to $+85^{\circ}\text{C}$, 500 V, 100 pF, $\pm 5\%$, Grade B, no failure rate level specified, and processed lead terminations.

Symbol denoting kind of capacitor	Symbol denoting style	Symbol denoting character- istics	Symbol denoting rated voltage	Symbol denoting nominal capacitance	Symbol denoting tolerance on capaci- tance	Symbol denoting grade
4.2.1	4.2.2	4.2.3	4.2.4	4.2.5	4.2.6	4.2.7

Example: CM 92 CD 2H 101 J B

Symbol denoting failure rate level	Symbol denoting classification by lead termination processing
4.2.8	4.2.9

Example: X A

4.2 Symbols

4.2.1 Kind of capacitor The symbol denoting kind of capacitor shall consist of two English capital letters of CM.

4.2.2 Style The symbol denoting style shall consist of two numerals as given in Table 1.

Table 1. Style

Symbol	External shape	Enclosure	Termination	
			Kind	Direction
76	Square	Non-metallic case	Lug	Opposite
92		Non-metallic enclosure	Lead wire	Same
98		Non-metallic case		Opposite

4.2.3 Characteristics The symbol denoting characteristics shall consist of two English capital letters. The first English capital letter shall be as given in Table 2 according to the temperature coefficient of capacitance and the drift of capacitance. The second English capital letter shall express the category temperature range as given in Table 3.

The combination of the first English capital letter and the second English capital letter shall be as given in Attached Tables 1.2 to 1.7 and Attached Tables 2.2 to 2.6.

Table 2. Temperature coefficient of capacitance and capacitance drift

Symbol	Temperature coefficient of capacitance ppm/°C	Capacitance drift
C	-200 to +200	$\pm(0.5\%+0.1 \text{ pF})$
D	-100 to +100	$\pm(0.3\%+0.1 \text{ pF})$
E	-20 to +100	$\pm(0.1\%+0.1 \text{ pF})$
F	0 to +70	$\pm(0.05\%+0.1 \text{ pF})$

Table 3. Category temperature range

Symbol	Category temperature range °C
Z	-55 to +150
B	-55 to +125
D	-55 to +85

4.2.4 Rated voltage The symbol denoting rated voltage shall consist of a combination of one numeral and one English capital letter as given in Table 4.

Table 4. Rated voltage

Symbol	Rated voltage V
2A	100
2F	315
2H	500
3A	1 000

4.2.5 Nominal capacitance The symbol denoting nominal capacitance shall consist of three numerals. The first and second numerals express the significant figures of nominal capacitance in the unit of picofarad (pF) and the third numeral expresses the number of zeros following the significant figures. If there is a decimal point, it is expressed by an English capital letter R and all the numerals are significant figures. Symbol 1R0 may be expressed as 010, 2R0 as 020.

Examples: 1R0 1 pF
 101 100 pF
 102 1000 pF

4.2.6 Tolerances on capacitance The symbol denoting tolerances on capacitance shall consist of one English capital letter as given in Table 5.

Table 5. Tolerances on capacitance

Symbol	Tolerances on capacitance	Remarks
D	± 0.5 pF	Applicable to capacitors of nominal capacitance not exceeding 10 pF.
F	$\pm 1\%$ ⁽¹⁾	Applicable to capacitors of nominal capacitance exceeding 10 pF.
G	$\pm 2\%$ ⁽¹⁾	
J	$\pm 5\%$	
K	$\pm 10\%$	

Note ⁽¹⁾ This is applied to capacitors whose tolerances on capacitance are ± 0.25 pF or more.

4.2.7 Grade The symbol denoting grade shall consist of one English capital letter as given in Table 6.

Table 6. Grade

Symbol	Description of grade
B	Quality assessment is necessary and the level is general level 1.
C	Quality assessment is necessary and the level is simplified level.
E	Quality assessment is necessary and the level is general level 2.
X	Quality assessment is not specified.

Informative reference: The general level 1 corresponds to the general level of JIS C 5700, and general level 2 corresponds to the Assessment Level E of IEC.

4.2.8 Failure rate level The symbol denoting failure rate level shall consist of one English capital letter as given in Table 7.

The failure rate level of capacitors of Grade C and Grade X shall be X (not specified).

Table 7. Failure rate level

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

4.2.9 Classification by lead termination processing The symbol denoting classification by lead termination processing is applicable to products with processed lead terminations or taped terminations, and shall consist of one English capital letter as given in Table 8.

Table 8. Classification by lead termination processing

Symbol	Classification by lead termination processing
A	Processed product
T	Taped product

5. Ratings

5.1 Category temperature range The category temperature range shall be as given in Table 3.

5.2 Rated voltage The rated voltage shall be expressed in volt (V) as given in Table 4.

5.3 Nominal capacitance The nominal capacitance shall be expressed in the unit of picofarad (pF), capacitors exceeding 10 pF shall have the numerical value equal to 10^n times (n is a positive integer) the preferred numbers of E24 series in Table 9 and shall be as given in Attached Tables 1.1 to 2.2.

Capacitors not exceeding 10 pF shall have the numerical values in Table 10, and shall be as given in Attached Tables 1.1 to 2.5.

Table 9. Preferred numbers of E24

E24	1.0	1.1	1.2	1.3	1.5	1.6	1.8	2.0	2.2	2.4	2.7	3.0
	3.3	3.6	3.9	4.3	4.7	5.1	5.6	6.2	6.8	7.5	8.2	9.1

Table 10. Nominal capacitance
not exceeding 10 pF

Nominal capacitance pF							
1	2	3	5	6	7	8	

5.4 Tolerances on capacitance The tolerances on capacitance shall be as given in Table 5.

6. Performances and test methods The performances and test methods shall be as stated in Table 11.

When such description as characteristic C□, D□ is stated in Table 11, Attached Tables 1.2 to 1.7 and Attached Tables 2.2 to 2.6, the □ means the symbol of the category temperature range.

The combination of the tests and the sequence of tests in qualification approval test and quality conformance inspection shall be as given in Annex 2 Table 1, Annex 2 Table 2, Annex 4 Table 1 and Annex 4 Table 2.

The matters concerning processing of lead wire and taping of products with processed or taped lead wires are subject to agreement between the parties concerned with acceptance.

Table 11. Performances and test methods

No.	Item	Performance			Test method (JIS C 5102)	Informative reference (Essential point of JIS C 5102)
		Grades C and X	Grade B	Grade E		
1	Voltage proof	No abnormality.			Comply with 7.1. Test voltage and duration of application: apply 200% of rated voltage for the duration specified below. Grade E: in qualification approval and qualification maintenance tests: 1 min In lot quality inspection: 2 s to 5 s Grades C, X and B: 1 s to 5 s Limit of charge and discharge currents: 50 mA max.	—
	Between termi- na- tions case				Comply with 7.1. Test voltage and duration of application: apply 200% of rated voltage for the duration specified below. Grade E: in qualification approval and qualification maintenance tests: 1 min In lot quality inspection: 2 s to 5 s Grades C, X and B: 1 s to 5 s Limit of charge and discharge currents: 50 mA max. Method of test voltage application Styles 76 and 98: (3.1) V block method Style 92: (3.3) small metal ball method	

Table 11. (continued)

No.	Item	Performance			Test method (JIS C 5102)	Informative reference (Essential point of JIS C 5102)	
		Grades C and X	Grade B	Grade E		Measuring voltage	Applicable rated voltage V
2	Insulation resistance	Between terminations	Capacitor of nominal capacitance not exceeding 10000 pF: 100000 MΩ min. Capacitor of nominal capacitance exceeding 10000 pF: $\frac{1000}{C_R^{(2)}}$ MΩ min.		Comply with 7.6. Measuring voltage: as specified in Table 9.	Measuring voltage V 100±15 500±50	100, 315 500, 1000
		Between terminations and case or enclosure	100000 MΩ min.		Comply with 7.6. Measuring voltage: as specified in Table 9. Method of test voltage application Styles 76 and 98: (3.1) V block method Style 92: (3.3) small metal ball method	Duration of measuring voltage application: 60±5 s. If the reading of measuring instrument stabilizes or further increases above the specified value of insulation resistance even in the specified duration, the decision may be made by such behavior.	
3	Capacitance	Within specified tolerances			Comply with 7.8. Measuring conditions: 2 or 3 of Table 10	Measuring voltage: 5 Vrms max. Measuring frequency Capacitor not exceeding 1000 pF: 1 MHz±20% Capacitor exceeding 1000 pF: 1 kHz±20%	
4	Tangent of loss angle	Not exceed the value shown in Fig. 1	Nominal capacitance of less than 10 pF: value shown in Figure max. Nominal capacitance of 10 pF or over up to and including 25 pF: 0.003 max. Nominal capacitance of over 25 pF up to and including 100 pF: 0.002 max. Nominal capacitance of over 100 pF: 0.001 max.			Comply with 7.9. Measuring conditions: 2 or 3 of Table 10	

Note (2) C_R means the numerical value of nominal capacitance expressed in pF.

Table 11. (continued)

No.	Item	Performance			Test method (JIS C 5102)	Informative reference (Essential point of JIS C 5102)																							
		Grades C and X	Grade B	Grade E																									
5	Characteristic change due to temperature	Temperature coefficient of capacitance ppm/°C	To satisfy Table 2.			Comply with 7.12. Measuring conditions: Table 12 Measuring method: static method	<table><tr><th>Step</th><th>Temperature °C</th><th>Remarks</th></tr><tr><td>1</td><td>20±2</td><td>—</td></tr><tr><td>2</td><td>−55±3</td><td>—</td></tr><tr><td>3</td><td>20±2</td><td>—</td></tr><tr><td rowspan="3">4</td><td>85±2</td><td>Category temperature range D</td></tr><tr><td>125±2</td><td>Category temperature range B</td></tr><tr><td>150±2</td><td>Category temperature range Z</td></tr><tr><td>5</td><td>20±2</td><td>—</td></tr></table>	Step	Temperature °C	Remarks	1	20±2	—	2	−55±3	—	3	20±2	—	4	85±2	Category temperature range D	125±2	Category temperature range B	150±2	Category temperature range Z	5	20±2	—
								Step	Temperature °C	Remarks																			
	1	20±2	—																										
2	−55±3	—																											
3	20±2	—																											
4	85±2	Category temperature range D																											
	125±2	Category temperature range B																											
	150±2	Category temperature range Z																											
5	20±2	—																											
6	Robustness of termination	Tensile strength of termination	No abnormalities such as break and loosening of termination.			Comply with 8.1.	<table><tr><th>Kind of termination</th><th>Nominal wire diameter mm</th><th>Tensile force N</th><th>Duration s</th></tr><tr><td rowspan="3">Lead termination</td><td>0.4</td><td>5</td><td rowspan="3">10±1</td></tr><tr><td>0.6 and 0.8</td><td>10</td></tr><tr><td>1.0</td><td>20</td></tr><tr><td>Lug termination</td><td>—</td><td>20</td><td></td></tr></table>	Kind of termination	Nominal wire diameter mm	Tensile force N	Duration s	Lead termination	0.4	5	10±1	0.6 and 0.8	10	1.0	20	Lug termination	—	20							
								Kind of termination	Nominal wire diameter mm	Tensile force N	Duration s																		
								Lead termination	0.4	5	10±1																		
0.6 and 0.8	10																												
1.0	20																												
Lug termination	—	20																											

Table 11. (continued)

No.	Item	Performance			Test method (JIS C 5102)	Informative reference (Essential point of JIS C 5102)		
		Grades C and X	Grade B	Grade E			Angle	Number of times
6	Robustness of termination (cont'd)	No abnormalities such as break and loosening of termination. (cont'd)			Comply with 8.1. Carry out after tensile strength test. Test conditions: Grades C, X and B: severity 1 Grade E: severity 2	Condition 1	360 degrees	3
						Condition 2	180 degrees	2
	Bending strength of lead termination (apply to style 92)				Comply with 8.1. Carry out after tensile strength test.	Number of times: 2		
						Nominal wire diameter mm	Bending force N	Informative reference mass of weight kg
						0.4	2.5	0.25
						0.6 and 0.8	5	0.51
						1.0	10	1.0
						Number of times: 1		
						Sectional area of joint with external wiring or minimum sectional area mm ²	Tensile force N	
						Over 0.5 up to and including 1	10	
						Over 1	25	

Table 11. (continued)

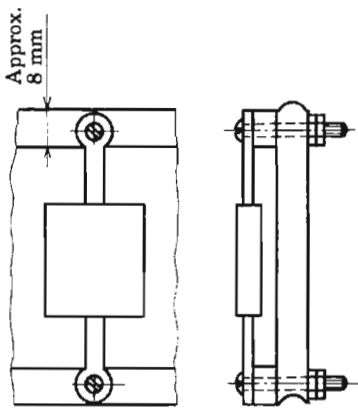
No.	Item	Performance			Test method (JIS C 5102)	Informative reference (Essential point of JIS C 5102)		
		Grades C and X	Grade B	Grade E				
7	Resistance to vibration	During 30 min before completion of test	Electrical connection	No electrical discontinuity of 0.5 ms or more.		Comply with 8.2. Kind of test: kind A Peak-to-peak amplitude: 1.5 mm Mounting: as specified in 8.2.2 (1) for styles 92 and 98, or as given in the following figure for styles 76. 	Rate of sweep: 10–55–10 Hz (1 min) Direction of vibration: direction considered to be most severe and 2 directions perpendicular to the above and to each other (3 directions in total) 2 h in each direction, 6 h in total Measurement during vibration: examine existence or non-existence of open circuit and short circuit during 30 min before completion of test.	
			After completion of test	Appearance	No remarkable abnormality, and marking shall be legible.			
			Voltage proof (between terminations)	To satisfy No. 1.	Not applied.			
			Insulation resistance (between terminations)	To satisfy No. 2.				
			Tangent of loss angle	To satisfy No. 4.				
			Capacitance change	±1% of the value before test or ±1 pF whichever is the greater.				

Table 11. (continued)

No.	Item	Performance			Test method (JIS C 5102)	Informative reference (Essential point of JIS C 5102)
		Grades C and X	Grade B	Grade E		
8	Resistance to shock	Not applied.	No electrical discontinuity of 0.5 ms or more during testing.	Directions: positive and negative directions along X, Y and Z axes (6 directions in total) Number of times: 3 times in each direction (18 times in total)		
			No remarkable abnormality and marking shall be legible.			
			Not more than 120% of the value specified in No. 4.			
			For characteristics C□•D□•E□: ±1% of the value before test or ±1 pF whichever is the greater. For characteristic F□ : ±0.5% or ±0.5 pF whichever is the greater.			
9	Solderability	At least 95% of the circumferential area is covered with new solder to the point of immersion.			Comply with 8.3. Shock waveform: half-sine wave Peak acceleration: 490 m/s ² Duration: 11 ms Accelerated steam aging, 1 h (1a) Conditioning of termination: Allow it to stand in boiling distilled water for 60 min. Flux: ethanol solution of colophony (25 wt%) Solder: H60A, H60S, or H63A Temperature of solder: 235±5°C Duration of immersion: 2±0.5 s Speed of immersion: 25±2.5 mm/s	
9	Solderability	At least 95% of the circumferential area is covered with new solder to the point of immersion.			Comply with 8.4. Test method: method 1 Depth of immersion into solder: For styles 92 and 98: 1.5 to 2 mm from root of termination For style 76: 10±0.8 mm from end of termination If there is no dispute on decision, thermal screen is not necessarily be used.	Conditioning of termination: Allow it to stand in boiling distilled water for 60 min. Flux: ethanol solution of colophony (25 wt%) Solder: H60A, H60S, or H63A Temperature of solder: 235±5°C Duration of immersion: 2±0.5 s Speed of immersion: 25±2.5 mm/s

Table 11. (continued)

No.	Item	Performance			Test method (JIS C 5102)	Informative reference (Essential point of JIS C 5102)	
		Grades C and X	Grade B	Grade E			
10	Resistance to soldering heat	Appearance	No remarkable abnormality and marking shall be legible.			Comply with 8.5. Immersing conditions: condition D Depth of immersion into solder: For styles 92 and 98: 1.5 to 2 mm from root of termination For style 76: 10±0.8 mm from end of termination If there is no dispute on decision, thermal screen is not necessarily be used.	Flux: ethanol solution of colophony (25 wt%) Solder: H60A, H60S or H63A Temperature of solder: 350±10°C Duration of immersion into solder: 3.5±0.5 s Speed of immersion: 25±2.5 mm/s
		Voltage proof (between terminations)	To satisfy No. 1. Not applied.				
		Insulation resistance (between terminations)	To satisfy at least 30% of the value specified in No. 2.				
		Tangent of loss angle	To satisfy No. 4.				
		Capacitance change	±0.5% of the value before test or ±5 pF whichever is the greater.				
11	Resistance to solvent	No remarkable abnormality on appearance and marking shall be easily legible.			Comply with 8.7. Test method: method 1 Kind of solvent: isopropyl alcohol	Visually examine the specimen after immersion into solvent (20°C to 25°C) for 30±5 s.	
12	Resistance to cold	Appearance	Not applied.	No remarkable abnormality and marking shall be legible.	Comply with 9.1. Test temperature: -55±3°C	Duration of test: 2 ⁺¹ h	

Table 11. (continued)

No.	Item	Performance			Test method (JIS C 5102)	Informative reference (Essential point of JIS C 5102)
		Grades C and X	Grade B	Grade E		
13	Resistance to dry heat	Appearance (Insulation resistance between terminations)	No remarkable abnormality and marking shall be legible.		Comply with 9.2. Test temperature: upper category temperature $\pm 2^{\circ}\text{C}$ Duration of test: Grades C and X: $2 \pm 1^{\text{h}}$ Grades B and E: $16 \pm 1 \text{ h}$	—
			To satisfy at least 60% of the value specified in No. 2.	Nominal capacitance less than 10000 pF: 10000 MΩ min. Nominal capacitance not less than 10000 pF: $\frac{100}{C_R^{(2)}} \text{ M}\Omega \text{ min.}$		
			Not applied.	Nominal capacitance less than 10000 pF: 5000 MΩ min. Nominal capacitance not less than 10000 pF: $\frac{50}{C_R^{(2)}} \text{ M}\Omega \text{ min.}$		
			125°C			
14	Change of temperature and immersion (cyclic)	Appearance	No remarkable abnormality and marking shall be legible.		Comply with 9.18. Temperature of clear water: $65 \pm 5^{\circ}\text{C}$	Temperature cycle
		Voltage proof (between terminations)	To satisfy No. 1.			
		Insulation resistance (between terminations)	To satisfy at least 30% of the value specified in No. 2.			
		Tangent of loss angle	Not exceed 150% of the value specified in No. 4.			
		Capacitance change	$\pm 3\%$ of the value before test or $\pm 1 \text{ pF}$ whichever is the greater.			
						Number of cycles: 5

Note (2) C_R means the numerical value of nominal capacitance expressed in μF .

Table 11. (continued)

No.	Item		Performance			Test method (JIS C 5102)	Informative reference (Essential point of JIS C 5102)
			Grades C and X	Grade B	Grade E		
15	Change of temperature	Appearance	Not applied.		No re-markable abnormality and marking shall be legible.	Comply with 9.3.	
16	Resistance to damp heat (steady state)	Appearance	No remarkable abnormality and marking shall be legible.			Comply with 9.5. Test temperature: 40±2°C Relative humidity: 90% to 95% Duration of test: Grades C and X: 240±8 h Grades B and E: 500 ⁺²⁴ ₀ h	Recovery: Within 15 min after removal from the chamber, apply rated voltage between terminations for 1 min. Allow the specimen to stand for 1 h to 2 h and then carry out the measurement.
		Voltage proof (between terminations)	To satisfy No. 1.				
		Insulation resistance (between terminations)	To satisfy at least 30% of No. 2.	Nominal capacitance not exceeding 10000 pF: 25000 MΩ min. Nominal capacitance exceeding 10000 pF: $\frac{250}{C_R^{(2)}}$ MΩ min.			
		Tangent of loss angle	Not exceed 120% of the value specified in No. 4.	The specified value in No. 4 or 120% of the value before test whichever is the greater.			
		Capacitance change	±3% of the value before test or ±1 pF whichever is the greater.	±0.5% of the value before test or ±0.5 pF whichever is the greater.			

Note (2) C_R means the numerical value of nominal capacitance expressed in pF.