

# JIS

**JAPANESE INDUSTRIAL STANDARD**

**Fixed metal oxide film  
resistors for use in  
electronic equipment**

**JIS C 6409**—1994

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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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J I S

Fixed metal oxide film resistors  
for use in electronic equipment

C 6409-1994

1. **Scope** This Japanese Industrial Standard specifies the fixed metal oxide film resistors mainly used in electronic equipment (hereafter referred to as "resistors"), according to JIS C 5201.

Remarks 1. The standards cited in this Standard are as follows:

- |            |                                                                                                                                               |
|------------|-----------------------------------------------------------------------------------------------------------------------------------------------|
| JIS C 0802 | Colour code for fixed resistors for electronic equipment                                                                                      |
| JIS C 0805 | Packaging of electronic components on continuous tapes (components with axial type and radial wire lead terminals)                            |
| JIS C 3102 | Annealed copper wires for electrical purposes                                                                                                 |
| JIS C 5201 | General rules of fixed resistors for use in electronic equipment                                                                              |
| JIS C 5202 | Test methods of fixed resistors for electronic equipment                                                                                      |
| JIS C 5602 | Glossary of passive components for electronic equipment                                                                                       |
| 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 as follows:
- |                    |                                                                                                                                                  |
|--------------------|--------------------------------------------------------------------------------------------------------------------------------------------------|
| IEC 62 (1974)      | Marking codes for resistors and capacitors                                                                                                       |
| IEC 63 (1963)      | Preferred number series for resistors and capacitors                                                                                             |
| IEC 115-1 (1982)   | Fixed resistors for use in electronic equipment. Part 1: Generic specification                                                                   |
| IEC 115-2 (1982)   | Fixed resistors for use in electronic equipment. Part 2: Sectional specification: Fixed low-power non-wirewound resistors                        |
| IEC 115-2-1 (1982) | Fixed resistors for use in electronic equipment. Part 2: Blank detail specification: Fixed low-power non-wirewound resistors. Assessment level E |
| IEC 115-4 (1982)   | Fixed resistors for use in electronic equipment. Part 4: Sectional specification: Fixed power resistors                                          |

2. **Definitions** For the purposes of this Standard, the definitions specified in JIS C 5201 and JIS C 5602 apply.

### 3. Type designation

3.1 Structure of type designation The type designation shall be arranged as given in the following example.

|                                                 |                                   |                                                  |                                                  |                                                           |
|-------------------------------------------------|-----------------------------------|--------------------------------------------------|--------------------------------------------------|-----------------------------------------------------------|
| Symbol<br>denoting kind<br>of resistor<br>3.2.1 | Symbol<br>denoting style<br>3.2.2 | Symbol<br>denoting char-<br>acteristics<br>3.2.3 | Symbol<br>denoting rated<br>dissipation<br>3.2.4 | Symbol denoting<br>nominal resis-<br>tance value<br>3.2.5 |
|-------------------------------------------------|-----------------------------------|--------------------------------------------------|--------------------------------------------------|-----------------------------------------------------------|

Example:

|                                                                 |                                     |                                                     |                                                             |     |
|-----------------------------------------------------------------|-------------------------------------|-----------------------------------------------------|-------------------------------------------------------------|-----|
| RS                                                              | 14                                  | B                                                   | 3A                                                          | 103 |
| Symbol denoting<br>tolerances on re-<br>sistance value<br>3.2.6 | Symbol denot-<br>ing grade<br>3.2.7 | Symbol denot-<br>ing failure<br>rate level<br>3.2.8 | Symbol denoting<br>classification by<br>processing<br>3.2.9 |     |

Example:

J                      E                      X                      T

### 3.2 Symbols

3.2.1 Kind of resistor The symbol which expresses the kind of resistor shall be RS based on 4.2.1 of JIS C 5201.

3.2.2 Style The symbols which express styles shall be as given in Table 1 based on 4.2.2 of JIS C 5201.

Table 1. Style

| Symbol | Style                                                                                               |
|--------|-----------------------------------------------------------------------------------------------------|
| 14     | Cylindrical, non-metallic enclosure, opposite-directional lead wire terminations                    |
| 12     | Cylindrical, non-metallic enclosure, same-directional lead wire terminations, self-standing forming |

3.2.3 Characteristics The symbol denoting characteristics shall be expressed by one English capital letter, based on 4.2.3 of JIS C 5201. Two symbols shall be used, according to Table 5, 4.2 and 12 of Table 7, Fig. 2 and Fig. 3. It shall be expressed by B and S.

3.2.4 Rated dissipation The symbol denoting the rated dissipation shall be shown in Table 2 based on 4.2.4 of JIS C 5201.

Table 2. Rated dissipation

| Symbol | Rated dissipation W |
|--------|---------------------|
| 2H     | 0.5                 |
| 3A     | 1                   |
| 3D     | 2                   |
| 3F     | 3                   |
| 3G     | 4                   |
| 3H     | 5                   |

**3.2.5 Nominal resistance value** The symbol denoting the nominal resistance value shall be expressed by three numerals based on 4.2.5 of JIS C 5201. The first and second numerals shall represent the significant figures in ohm ( $\Omega$ ), and the third numeral shall represent the number of zeros following the significant figures.

|         |                          |                          |
|---------|--------------------------|--------------------------|
| Example | 100 ..... 10 $\Omega$    | 150 ..... 15 $\Omega$    |
|         | 101 ..... 100 $\Omega$   | 151 ..... 150 $\Omega$   |
|         | 102 ..... 1 k $\Omega$   | 152 ..... 1.5 k $\Omega$ |
|         | 103 ..... 10 k $\Omega$  | 153 ..... 15 k $\Omega$  |
|         | 104 ..... 100 k $\Omega$ | 154 ..... 150 k $\Omega$ |

**3.2.6 Tolerances on resistance value** The symbol denoting tolerances on resistance value shall be expressed by one English capital letter based on 4.2.6 of JIS C 5201 as shown in Table 3.

Table 3. Tolerances on resistance value

| Symbol                           | G       | J       |
|----------------------------------|---------|---------|
| Tolerances on resistance value % | $\pm 2$ | $\pm 5$ |

**3.2.7 Grade** The symbol denoting the grade shall be based on 4.2.7 of JIS C 5201, and shall be expressed by one English capital letter or one English capital letter with one subscript numeral, as shown in Table 4.

Table 4. Grade

| Symbol         | Grade <sup>(1)</sup>                                                                |
|----------------|-------------------------------------------------------------------------------------|
| E              | A grade that requires quality assessment whose level is "general level II"          |
| E <sub>1</sub> | A grade that requires quality assessment level which is severer than E              |
| E <sub>2</sub> | A grade that requires quality assessment level which is severer than E <sub>1</sub> |

Note <sup>(1)</sup> The quality assessment level is described in Annex 2 and Annex 3.

Informative reference: The grade E corresponds to the assessment level E which is specified in IEC 115-2.

**3.2.8 Failure rate level** The symbol denoting the failure rate level shall be based on 4.2.8 of JIS C 5201, and shall be expressed by one English capital letter, X (which means that no failure rate level is specified).

**3.2.9 Classification by processing** The symbol denoting the classification by processing shall be based on 4.2.10 of JIS C 5201, and shall be expressed by one English capital letter T. The resistors which are not processed by taping shall omit this symbol.

#### 4. Ratings

**4.1 Rated dissipation** The rated dissipation shall be as shown in Table 5. However, for a resistor with a nominal resistance value exceeding its critical resistance value, the rated dissipation shall be the dissipation which corresponds to the maximum working voltage.

The rated ambient temperature shall be 70°C.

Table 5. Ratings

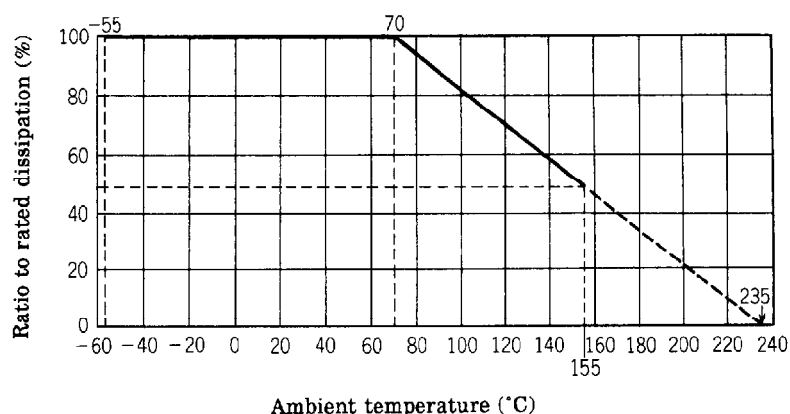
| Rated dissipation |         | Characteristics | Maximum working voltage | Maximum overload voltage | Maximum intermittent overload voltage | Withstand voltage | Range of nominal resistance value |
|-------------------|---------|-----------------|-------------------------|--------------------------|---------------------------------------|-------------------|-----------------------------------|
| Symbol            | Power W |                 | V                       | V                        | V                                     | V                 |                                   |
| 2H                | 0.5     | B               | 250                     | 400                      | 500                                   | 250               | 10 Ω to 47 kΩ                     |
| 3A                | 1       |                 | 350                     | 600                      | 750                                   | 350               | 10 Ω to 68 kΩ                     |
| 3D                | 2       |                 |                         |                          |                                       |                   | 10 Ω to 100 kΩ                    |
| 3F                | 3       |                 | 500                     | 800                      | 1500                                  | 500               | 10 Ω to 120 kΩ                    |
| 3G                | 4       |                 |                         |                          |                                       |                   | 10 Ω to 200 kΩ                    |
| 3H                | 5       |                 | 750                     | 1000                     | 2000                                  | 750               | 10 Ω to 240 kΩ                    |

Table 5. (continued)

| Rated dissipation |         | Charac-<br>teristics | Maximum<br>working<br>voltage | Maximum<br>overload<br>voltage | Maximum<br>intermittent<br>overload<br>voltage | Withstand<br>voltage | Range of nominal<br>resistance value |
|-------------------|---------|----------------------|-------------------------------|--------------------------------|------------------------------------------------|----------------------|--------------------------------------|
| Symbol            | Power W |                      | V                             | V                              | V                                              | V                    |                                      |
| 2H                | 0.5     | S                    | 250                           | 400                            | 500                                            | 250                  | 10 $\Omega$ to 22 k $\Omega$         |
| 3A                | 1       |                      | 350                           | 600                            | 750                                            | 350                  | 10 $\Omega$ to 68 k $\Omega$         |
| 3D                | 2       |                      |                               |                                |                                                |                      | 10 $\Omega$ to 100 k $\Omega$        |
| 3F                | 3       |                      |                               |                                |                                                |                      |                                      |
| 3H                | 5       |                      | 500                           | 800                            | 1500                                           | 500                  |                                      |

**4.2 Maximum dissipation** When temperatures do not exceed the rated ambient temperature, the maximum dissipation shall have the same value as that of rated dissipation. When temperatures exceed the rated ambient temperature, the maximum dissipation shall have the values obtained by reducing the rated dissipation by means of the derating curve of Fig. 1.

Fig. 1. Derating curve



**4.3 Category temperature range** The category temperature range shall be  $-55^{\circ}\text{C}$  to  $+155^{\circ}\text{C}$ .

**4.4 Nominal resistance values** The nominal resistance values shall be in the unit of ohm ( $\Omega$ ), and shall be the numerical values given in Table 6 multiplied by  $10^n$  (where  $n$  is an integer). However, it is preferable to use the values in bold-face in Table 6 with priority, which belong to E12 series numbers.

The range of nominal resistance values are specified as shown in Table 5, corresponding to each characteristic and rated dissipation.

Table 6. Standard numbers of nominal resistance values  
(E24 series numbers)

|            |            |            |            |            |            |
|------------|------------|------------|------------|------------|------------|
| <b>1.0</b> | <b>1.5</b> | <b>2.2</b> | <b>3.3</b> | <b>4.7</b> | <b>6.8</b> |
| 1.1        | 1.6        | 2.4        | 3.6        | 5.1        | 7.5        |
| <b>1.2</b> | <b>1.8</b> | <b>2.7</b> | <b>3.9</b> | <b>5.6</b> | <b>8.2</b> |
| 1.3        | 2.0        | 3.0        | 4.3        | 6.2        | 9.1        |

4.5 Tolerances on resistance value The tolerances on resistance value shall be expressed in percent (%), as shown in Table 3.

4.6 Rated voltage The rated voltage shall be the d.c. or a.c. (r.m.s. at power frequency) corresponding to the rated dissipation, and the value of which is calculated from the formula below. If the rated voltage so obtained exceeds the maximum working voltage given in Table 5, this maximum working voltage shall be taken as the rated voltage.

$$E = \sqrt{P \cdot R}$$

where,  $E$  : rated voltage (V)  
 $P$  : rated dissipation (W)  
 $R$  : nominal resistance value ( $\Omega$ )

5. Testing methods and performance The testing methods shall be as specified in JIS C 5202 and Table 7. The performance shall be as specified in Table 7.

Table 7. Testing methods and performance

| No.                   | Item                                                   | Performance                                                                                                                                  | Testing method (JIS C 5202)                                                                                                                                                                                                                                                                                                                                                                                                                               |
|-----------------------|--------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1                     | Appearance and marking                                 | The appearance shall show no abnormalities such as remarkable scratch and crack.<br>The marking as specified in 11. shall be marked clearly. | Comply with 4.1 and 4.2.                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| 2<br>( <sup>2</sup> ) | 2.1 Dimension                                          | Requirements as specified in 6.2 shall be met.                                                                                               | Comply with 4.3.                                                                                                                                                                                                                                                                                                                                                                                                                                          |
|                       | 2.2 Resistance                                         | Within the tolerances specified in 3.2.6.                                                                                                    | Comply with 5.1.<br>Classification of applied voltage shall be A in Table 2.                                                                                                                                                                                                                                                                                                                                                                              |
| 3                     | Withstand voltage<br>(voltage proof) (normal pressure) | No abnormalities such as flash-over, burning, dielectric breakdown.                                                                          | Comply with 5.7.<br>(1) Mounting condition: A<br>(2) Test voltage: withstand voltage specified in Table 4.                                                                                                                                                                                                                                                                                                                                                |
| 4<br>( <sup>2</sup> ) | Solderability                                          | At least 95 % of surface area immersed shall be wetted by new solder.                                                                        | Comply with 6.5.<br>(1) Preconditioning shall be omitted.<br>(2) Temperature of solder: $235 \pm 5^\circ\text{C}$<br>(3) Duration of immersion into solder: $5 \pm 0.5$ s<br>(4) Immerse each termination of style 14 successively. Immerse both terminations of style 12 at the same time.<br><br>The depth of immersion for style 12 shall be as shown in the following figure. This depth, $H_2$ , is specified in this Standard (JIS C 6409), Fig. 3. |

