KOME

# Fusible Resistors

Axial-lead metal film fusible resistors · styles FR1/4W to FR3W

Illustration; not a photograph of a specific part.

## Features

- Fusing time: 1 min. maximum at 16 × wattage
- Metal film on ceramic rod, epoxy resin coating, colour-code marking
- Formed-lead types M, MB, F, FK1, FK2 and FKK
- Taped in ammo boxes (T-26, T-52, T-73) or packed in bulk
- Test methods with reference to JIS-C-5202

| POWER RATING | MAX. WORKING VOLTAGE | RESISTANCE RANGE | FUSING AT 16 × WATTAGE |
|---|---|---|---|
| 1/4W – 3W | 200V – 400V | 0.1E – 1K | 1 min. max. |

## How to order

| KFR | 25 | B | J | 2 | 100 |
|---|---|---|---|---|---|
| Product code<br>Fusible resistor | Rated power<br>1/4W | Packing<br>Bulk | Tolerance<br>±5% | No. of total characters<br>100=10R=2 | Resistance value<br>100=10R |

Ordering example as given on the original sheet; the codes for each position are listed below.

| Product code | |
|---|---|
| KFR | Fusible resistor |

| Rated power ① | |
|---|---|
| Code | Power |
| 12 | 1/6W |
| 25 | 1/4W |
| 50 | 1/2W |
| 125 | 1/8W |
| 100 | 1W |
| 200 | 2W |
| 1WS | 1WS |
| 2WS | 2WS |
| 500 | 5W |
| 700 | 7W |

| Packing ② | |
|---|---|
| T52 | Tape/box |
| T73 | Tape/box |
| B | Bulk |
| R | Tape reel |

| Tolerance ③ | |
|---|---|
| F | ±1% |
| J | ±5% |

| No. of total characters ④ |
|---|
| 100=10R=2 |
| 100R=101=3 |
| 10K=1000=4 |

| Resistance value ④ |
|---|
| 100=10R |
| 100R=101 |
| 10K = 10,000 |

## General

| | |
|---|---|
| **Nominal resistance** | The resistance marked on the resistor body; as a rule given in Ω, KΩ or MΩ. |
| **Resistance tolerance** | Indicated by one capital letter: G (±2%), J (±5%), K (±10%) ③ |
| **Operating temperature range** | -30°C ~ 155°C ⑤ |

## Ratings

| Style | Max. working voltage | Max. overload voltage | Dielectric withstanding voltage (AC) | Resistance value range ⑥ |
|---|---|---|---|---|
| FR1/4W | 200V | 250V | 250V | 0.1E – 1K |
| FR1/2WS | 250V | 300V | 300V | |
| FR1/2W | 250V | 300V | 300V | |
| FR1WS | 300V | 350V | 350V | |
| FR1W | 300V | 350V | 350V | |
| FR2WS | 350V | 400V | 500V | |
| FR2W | 350V | 400V | 500V | |
| FR3WS | 400V | 500V | 500V | |
| FR3W | 400V | 500V | 500V | |

In the taping table, styles ending in S (e.g. FR-1/2WS) are listed under “Miniature”.

## Power rating

Power rating is defined as the maximum power rating, continuously applied under ambient temperature at 70°C. When the ambient temperature exceeds 70°C, use Chart 1.

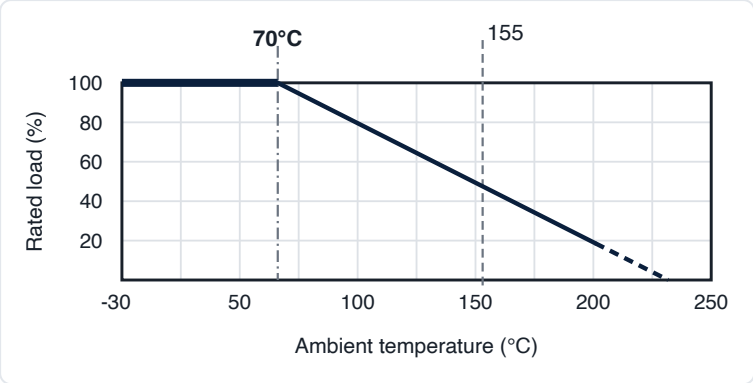



Chart 1: power derating ⑤

### Rated voltage

Rated voltage is the DC or AC voltage (effective value at commercial frequency, for example 50 C/S or 60 C/S) at which the rated power is applied. It is calculated with the following equation:

$E = \sqrt{(P \times R)}$ ⑦

| | |
|---|---|
| E | Rated voltage |
| P | Rated power (watts) |
| R | Nominal resistance value (Ω) |

When the calculated rated voltage exceeds the maximum usable voltage value shown in Chart 1, the maximum usable voltage is defined as the voltage according to the derating curve shown in Chart 1 ⑦.

## Fusing time

| Power ⑧ | Fusing time |
|---|---|
| | Maximum |
| 16 × wattage | 1 min. |
| 20 | 40 sec. |
| 24 | 30 sec. |
| 28 | 20 sec. |
| 32 | 15 sec. |

### Notes

After the voltage is applied, a resistance change rate in excess of 100 times is regarded as open.

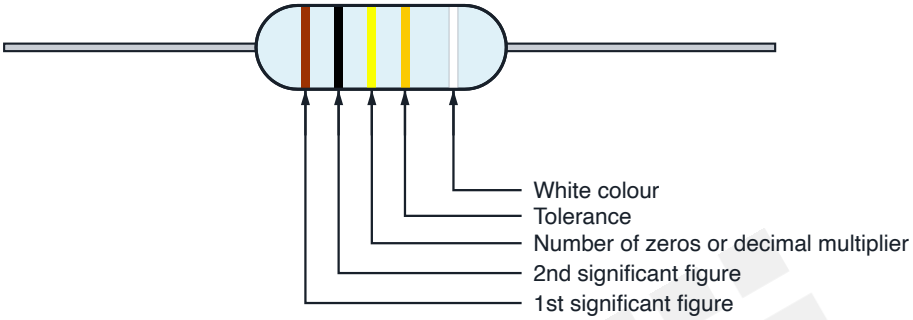
Operating temperature range: -30°C ~ 155°C ⑤.

## Performance specification

| Item | Performance and/or quality acceptance | Standard | Test method |
|---|---|---|---|
| **Resistance value vs. temperature characteristics** | ±200PPM/°C | JIS-C-5202 5.2 | Measure the resistance ($R_0$, ohm) at room temperature ($T_0$ °C). Measure it again at 100°C above room temperature. PPM = $(R - R_0) / R_0 \times 1 / ((T_0 + 100) - T_0) \times 10^6$ ⑨ |
| **Short-time overload** | Resistance change within ±(2%+0.05Ω); no mechanical breakage | JIS-C-5202 5.5 | Apply a DC voltage of 2.5 times the rated voltage for 5 seconds. Then leave at room temperature for 30 minutes and measure. Max. overload voltage: 0.50W-400V (DC) ⑩ |
| **Insulation resistance** | 10,000MΩ or more | JIS-C-5202 5.6 | Place the resistor on a 90° metal V-block, apply 100 V DC between the resistor lead and the V-block for one minute and measure. |
| **Voltage endurance** | Resistance change within ±(1%-0.05Ω) ⑪; no mechanical breakage | JIS-C-5202 5.7 | Place the resistor on the 90° metal V-block and apply the rated AC voltage for one minute. Test voltage: no value given ⑪ |
| **Terminal strength** | Resistance change within ±(1%+0.05Ω); no mechanical breakage | — | Pull test: apply a force of 2.5kg.force to the lead in the direction of the lead axis for 30±5 seconds. |
| **Resistance to soldering heat** | Resistance change within ±(1%+0.05Ω); no mechanical breakage | JIS-C-5202 7.10 ⑫ | Dip the lead into a solder bath at 350°C±10°C up to 4±0.8mm from the resistor body and hold for 3±0.5 seconds. Leave the resistor at room temperature for 3 hours after the test, then measure. |
| **Solderability** | More than 95% of the lead surface shall be covered with new solder after the leads are dipped in the solder | JIS-C-5202 6.5 | Dip the lead into a solder bath at 260°C±5°C up to 4±0.8mm from the resistor body, hold for 5±0.5 seconds, then inspect. |

| Item | Performance and/or quality acceptance | Standard | Test method |
|---|---|---|---|
| **Load test** | Resistance change within ±(5%+0.05Ω); no mechanical breakage | JIS-C-5202 7.10 ⑫ | In a constant-temperature chamber at 70°C±2°C, apply the rated DC voltage for 1.5 hours and switch it off for 0.5 hour; repeat this cycle for 1000 hours. Leave at room temperature for 1 hour after the test, then measure. |
| **Humidity load test** | Resistance change within ±(5%+0.05Ω); no mechanical breakage | JIS-C-5202 7.9 | In a temperature chamber at 40°C±2°C and 90-95% relative humidity, apply the rated voltage for 1.5 hours and switch it off for 0.5 hour; repeat this cycle for 1000 hours. Leave at room temperature for 1 hour after the test, then measure. |

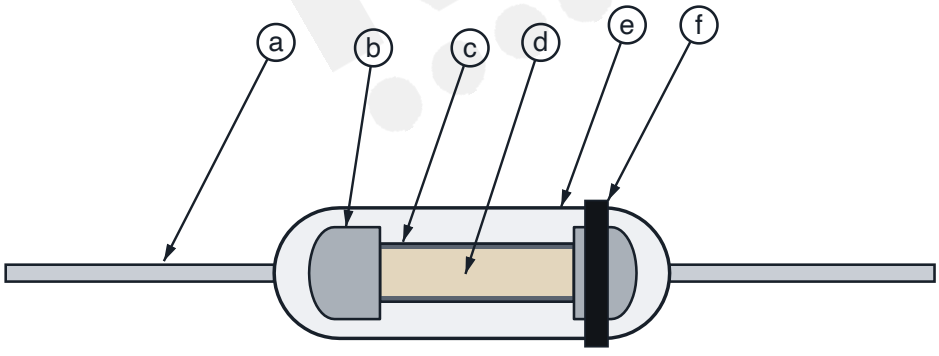
## Marking




### Colour code

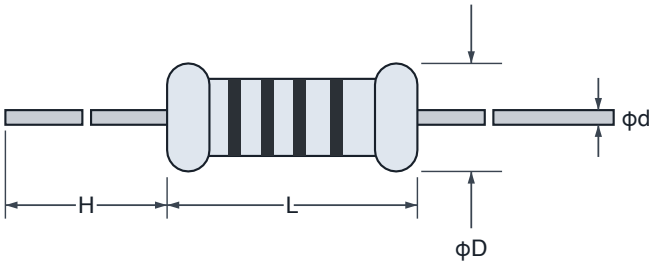
| Colour | 1st band | 2nd band | 3rd band | 4th band | 5th band |
|---|---|---|---|---|---|
| **Black** | 0 | 0 | $10^0$ | | White colour |
| **Brown** | 1 | 1 | $10^1$ | | |
| **Red** | 2 | 2 | $10^2$ | ±2% | |
| **Orange** | 3 | 3 | $10^3$ | | |
| **Yellow** | 4 | 4 | $10^4$ | | |
| **Green** | 5 | 5 | $10^5$ | | |
| **Blue** | 6 | 6 | $10^6$ | | |
| **Violet** | 7 | 7 | $10^7$ | | |
| **Grey** | 8 | 8 | $10^8$ | | |
| **White** | 9 | 9 | $10^9$ | | |
| **Gold** | | | $10^{-1}$ | ±5% | |
| **Silver** | | | $10^{-2}$ | ±10% | |

## Construction




| | Part |
|---|---|
| a | Lead wire |
| b | End cap |
| c | Metal film |
| d | Ceramic rod |
| e | Epoxy resin |
| f | Colour code |

## Dimensions

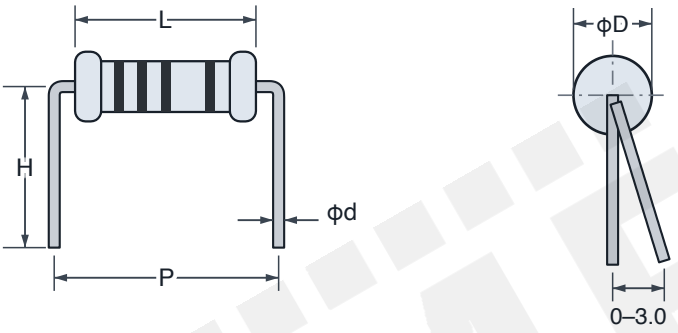



| Watts | L | D | H | d±0.05mm |
|---|---|---|---|---|
| 1/4W | 6.0±0.5 | 2.3±0.3 | 28.0±2.0 | 0.45 |
| 1/2WS | | | | |
| 1/2W | 9.0±0.5 | 3.2±0.3 | 26.0±2.0 | 0.52 |
| 1WS | | | | |
| 1W | 11.0±1.0 | 4.2±0.5 | 35.0±3.0 | 0.65 |
| 2WS | | | | |
| 2W | 15.0±1.0 | 5.0±0.5 | 33.0±3.0 | 0.72 |
| 3WS | | | | |

No unit is printed for L, D and H ⑬.

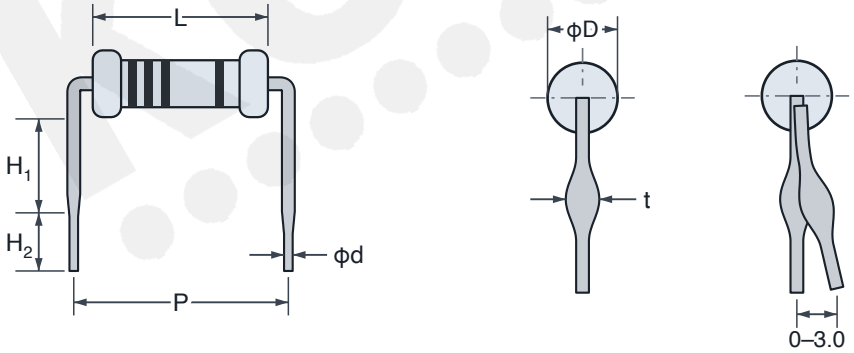
## Formed dimensions

### M-type



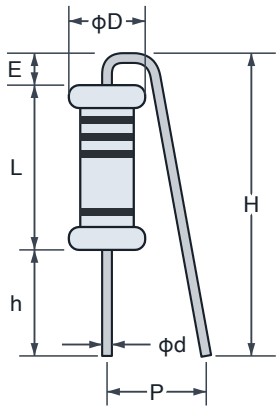

| Watts | Dimensions (mm) | | | | |
|---|---|---|---|---|---|
| | L | P±1.0 | D | d±0.05 | H±1.0 |
| 1/4W/1/2WS | 6.0±0.5 | 10 | 2.3±0.3 | 0.45 | 8 |
| 1/2W/1WS | 9.0±0.5 | 12.5/15 | 3.2±0.3 | 0.52 | 8 |
| 1W/2WS | 11.0±1.0 | 15 | 4.2±0.5 | 0.65 | 10 |
| 2W/3WS | 15.0±1.0 | 20 | 5.0±0.5 | 0.72 | 10 |

### MB-type




| Watts | Dimensions (mm) | | | | | | |
|---|---|---|---|---|---|---|---|
| | L | P±1.0 | D | d±0.05 | H1±1.0 | H2±1.0 | t±0.2 |
| 1/2W/1WS | 9.0±0.5 | 12.5 | 3.2±0.3 | 0.52 | 10.5 | 5.0 | 1.0 |
| 1W/2WS | 11.0±1.0 | 15 | 4.2±0.5 | 0.65 | 10.5 | 5.0 | 1.25 |
| 2W/3WS | 15.0±1.0 | 20 | 5.0±0.5 | 0.72 | 10.5 | 5.0 | 1.25 |

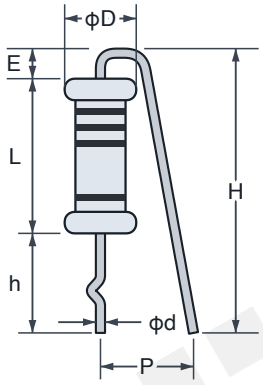
### F-type



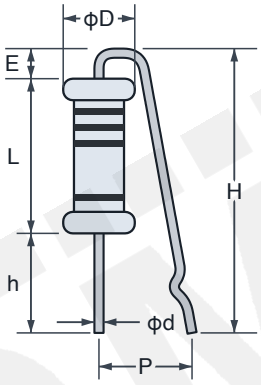

| Watts | Dimensions (mm) | | | | | | |
|---|---|---|---|---|---|---|---|
| | L | P±1.0 | D | d±0.05 | h±1.0 | H±1.0 | Emax |
| 1/4W/1/2WS | 6.0±0.5 | 6-8 | 2.3±0.3 | 0.45 | 8 | 14 | 3 |
| 1/2W/1WS | 9.0±0.5 | 6-8 | 3.2±0.3 | 0.52 | 8 | 18 | 3.5 |
| 1W/2WS | 11.0±1.0 | 6-8 | 4.2±0.5 | 0.65 | 8 | 20 | 3.5 |
| 2W/3WS | 15.0±1.0 | 6-8 | 5.0±0.5 | 0.72 | 8 | 25 | 3.5 |

### FK1-type, FK2-type, FKK-type ⑭

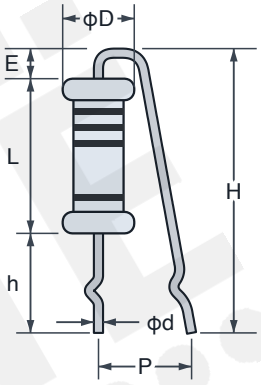
**FK1-type**




**FK2-type**

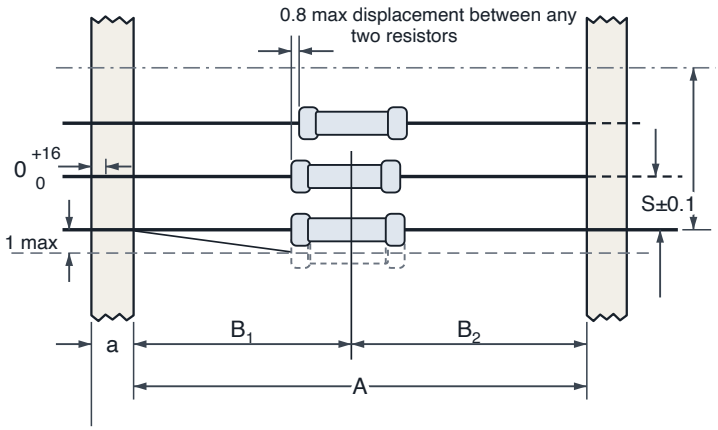



**FKK-type**




| Watts | Dimensions (mm) | | | | | | |
|---|---|---|---|---|---|---|---|
| | L | P±1.0 | D | d±0.05 | h +1/-0 | H±1.0 | Emax |
| 1/2W/1WS | 9.0±0.5 | 5-7 | 3.2±0.5 | 0.52 | 8 | 18 | 3.5 |
| 1W/2WS | 11.0±1.0 | 5-9 | 4.2±0.5 | 0.65 | 8 | 20 | 3.5 |
| 2W/3WS | 15.0±1.0 | 5-9 | 5.0±0.5 | 0.72 | 8 | 25 | 3.5 |

## Taping




Dimensions in mm. Small labels of the original drawing are partly illegible ⑮.

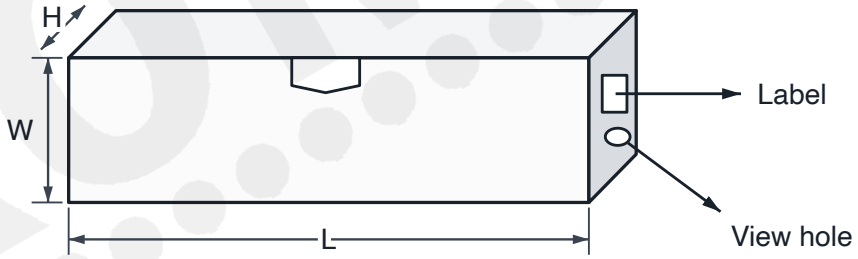
| Style | | Dimensions (mm) | | | | |
|---|---|---|---|---|---|---|
| Normal | Miniature | a | A | $B_1$–$B_2$ | S (spacing) | T (max. deviation of spacing) |
| FR-1/6W | FR-1/4WS | 6±0.5 | 52.5±1.5 | 1.2 | 5 | 1 mm per 10 spacings<br>0.5mm per 5 spacings |
| | | | 26.0±1.5 | — | | |
| FR-1/4W | FR-1/2WS | 6±0.5 | 52.5±1.5 | 1.2 | 5 | |
| | | | 26.0±1.5 | 1.0 | | |
| FR-1/2W | FR-1WS | 6±0.5 | 52.5±1.5 | 1.2 | 5 | |
| FR-1W | FR-2WS | 6±0.5 | 73.0±1.5 | 1.5 | 5 | |
| FR-2W | FR-3WS | 6±0.5 | 73.0±1.5 | 1.5 | 10 | |

— : cell struck through on the original (no value).

## Packing

### Taping type (ammo box)

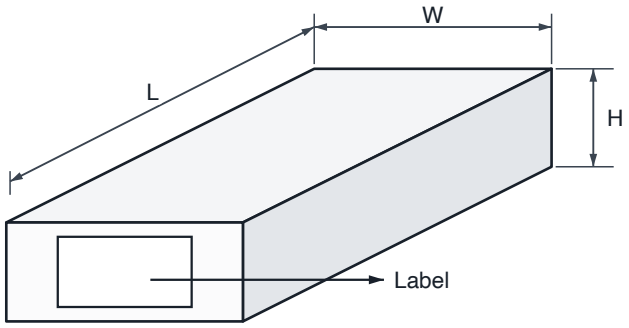
| Label specification | |
|---|---|
| 1 | Type |
| 2 | Wattage, tolerance ⑯ |
| 3 | Resistance, quantity ⑯ |
| 4 | P/N |
| 5 | Lot No. |




| Type | Watts | W (mm) | H (mm) | L (mm) | Qty (pcs) |
|---|---|---|---|---|---|
| T-26 | 1/6W, 1/8W, 1/16W, 1/4WS | 50 | 67 | 260 | 5000 |
| | 1/4W / 1/2WS | 50 | 100 | 260 | 5000 |
| T-52 | 1/6W, 1/8W, 1/16W, 1/4WS | 80 | 72 | 260 | 5000 |
| | 1/4W / 1/2WS | 80 | 100 | 260 | 5000 |
| | 1/2W / 1WS | 80 | 85 | 260 | 2000 |
| T-73 | 1W / 2WS | 110 | 80 | 270 | 1000 |
| | 2WS / 3WS | 110 | 92 | 270 | 1000 |

Watts pairings and the low-power styles are printed as shown ⑰.

## Bulk




| Watts | | Type | L (mm) | W (mm) | H (mm) | Poly bag | Box (pcs) |
|---|---|---|---|---|---|---|---|
| 1/6W<br>1/8W | 1/16W<br>1/4WS | P | 240 | 140 | 76 | 1000 | 20000 |
| 1/4W | 1/2WS | P | 240 | 140 | 76 | 500 | 10000 |
| 1/2W | 1WS | P | 240 | 140 | 76 | 500 | 5000 |
| 1W | 2WS | P | 240 | 140 | 76 | 200 | 2000 |
| 2W | 3WS | P | 240 | 140 | 76 | 100 | 1500 |

① How to order, rated power: 25S = 1/4WS, 50S = 1/2WS, 300 = 3W and 500 = 5W; small-size ratings are ordered as written (1WS, 2WS, 3WS, 5WS, 7WS) (not listed on the manufacturer's sheet; added on supplementary confirmation). A code does not mean the rating is available in this series. 1/6W and 1/16W have no small-size (S) version; not every power rating has one. As printed: the code “12 / 1/6W” is printed twice (shown once). Codes are given for 1/6W, 1/8W, 5W and 7W, which have no ratings or dimensions; 1/16W appears only in the packing tables — subject to manufacturer confirmation.

② How to order, packing: codes T52, T73, B and R are given; the packing table lists T-26, T-52 and T-73, so T-26 has no code, and no reel (R) packing is specified — subject to manufacturer confirmation.

③ Tolerance: How to order gives F (±1%) and J (±5%); the general text gives G (±2%), J (±5%) and K (±10%); the colour code gives ±2% (red), ±5% (gold) and ±10% (silver) — subject to manufacturer confirmation.

④ How to order: the examples are printed as shown; “10K” is given as 1000 under No. of total characters and as 10,000 under Resistance value — subject to manufacturer confirmation.

⑤ Operating temperature range is printed “-30C,.. 155C.” (no degree signs). Chart 1 marks 155 with a dashed line, but the load line there is still at about 50% and reaches 0% only at about 230 (no value printed); “-30” is printed under the left edge of the chart, where the 50-unit spacing of the other labels would give 0 — subject to manufacturer confirmation.

⑥ Ratings: the resistance value range is printed once for all styles as “0.1E——1K”, without the Ω symbol — subject to manufacturer confirmation.

⑦ Rated voltage: the equation is printed “E= √P×R”, with the bar of the radical sign ending before P, and is shown here as √(P × R). Chart 1 shows no voltage values; the maximum working voltage of each style is given under Ratings — subject to manufacturer confirmation.

⑧ Fusing time: only the first row is printed “16×wattage”; the following rows give 20, 24, 28 and 32 without “×wattage” — subject to manufacturer confirmation.

⑨ Temperature characteristics: parts of the test-method text are struck through on the original, and the formula is printed in a broken layout — subject to manufacturer confirmation.

⑩ Short-time overload: the max. overload voltage is printed as “0.50W-400V(DC)”, whereas the Ratings table gives a max. overload voltage for each style (FR1/2W: 300V) — subject to manufacturer confirmation.

⑪ Voltage endurance: the limit is printed “±(1%-0.05ohm)” (all other limits “+0.05ohm”), and the test method ends with “Test voltage” without a value; the Ratings table gives a dielectric withstanding voltage (AC) for each style — subject to manufacturer confirmation.

⑫ JIS-C-5202 7.10 is cited both for resistance to soldering heat and for the load test — subject to manufacturer confirmation.

⑬ Dimensions: no unit is printed for L, D and H (the d column is given in mm, the formed-dimension tables in mm) — subject to manufacturer confirmation.

⑭ FK-types: the table has no caption on the original and is assigned to the FK-type drawings by its position; it gives D “3.2±0.5” for 1/2W/1WS, where all other tables give 3.2±0.3 — subject to manufacturer confirmation.

⑮ Taping: on the drawing, “0.8” may read 0.6, and the left label read as “0” with “+16” over “0” may be “D” and “+1.6”. The table lists FR-1/6W and FR-1/4WS, which have no ratings or dimensions — subject to manufacturer confirmation.

⑯ Label specification: items 2 and 3 are printed “WATTS TOLERANCE” and “RESISTANT QUANTITY”; they are read as wattage and tolerance, and resistance and quantity — subject to manufacturer confirmation.

⑰ Taping-type packing: the last row is printed “2WS/ 3WS”, while elsewhere 2WS is paired with 1W and 3WS with 2W; 1/6W, 1/8W and 1/16W have no ratings or dimensions — subject to manufacturer confirmation.