

# DATA SHEET

## ANTI-SULFURATED CHIP RESISTORS AUTOMOTIVE GRADE

AF series

5%, 1%, 0.5%

sizes 0100/0201/0402/0603/0805/1206/1210/1218/2010/2512

RoHS compliant & Halogen free



## SCOPE

This specification describes AF0100 to AF2512 chip resistors with anti-sulfuration capabilities.

## APPLICATIONS

- Industrial Equipment
- Power Application
- Networking Application
- High-end Computer & Multimedia Electronics in high sulfur environment
- Automotive electronics

## FEATURES

- AEC-Q200 qualified for size 0201~2512
- Superior resistance against sulfur containing atmosphere
- Halogen free product and production
- RoHS compliant
- Reduces environmentally hazardous waste
- High component and equipment reliability
- Saving of PCB space
- Moisture sensitivity level: MSL 1
- 50ppm available

## ORDERING INFORMATION - GLOBAL PART NUMBER

Part number is identified by the series name, size, tolerance, packaging type, temperature coefficient, taping reel and resistance value.

### GLOBAL PART NUMBER

AF XXXX X X X XX XXXX L  
(1) (2) (3) (4) (5) (6) (7)

#### (1) SIZE

0100/0201/0402/0603/0805/1206/1210/1218/2010/2512

#### (2) TOLERANCE

D =  $\pm 0.5\%$

F =  $\pm 1\%$

J =  $\pm 5\%$  (for jumper ordering, use code of J)

#### (3) PACKAGING TYPE

R = Paper taping reel

K = Embossed plastic tape reel

#### (4) TEMPERATURE COEFFICIENT OF RESISTANCE

– = Base on spec

E =  $\pm 50$  ppm/ $^{\circ}\text{C}$

#### (5) TAPING REEL

07 = 7 inch dia. Reel

13 = 13 inch dia. Reel

7W = 7 inch dia. Reel & 2 x standard power

#### (6) RESISTANCE VALUE

There are 2~4 digits indicated the resistance value. Letter R/K/M is decimal point.

Detailed resistance rules are displayed in the table of "Resistance rule of global part number".

#### (7) DEFAULT CODE

Letter L is system default code for ordering only <sup>(Note)</sup>

| Resistance rule of global part number |                           |
|---------------------------------------|---------------------------|
| Resistance coding rule                | Example                   |
| XXXX                                  | 1R = 1 $\Omega$           |
| (1 to 9.76 $\Omega$ )                 | 1R5 = 1.5 $\Omega$        |
|                                       | 9R76 = 9.76 $\Omega$      |
| XXRX                                  | 10R = 10 $\Omega$         |
| (10 to 97.6 $\Omega$ )                | 97R6 = 97.6 $\Omega$      |
| XXXXR                                 | 100R = 100 $\Omega$       |
| (100 to 976 $\Omega$ )                |                           |
| XKXX                                  | 1K = 1,000 $\Omega$       |
| (1 to 9.76 K $\Omega$ )               | 9K76 = 9760 $\Omega$      |
| XMXX                                  | 1M = 1,000,000 $\Omega$   |
| (1 to 9.76 M $\Omega$ )               | 9M76 = 9,760,000 $\Omega$ |

### ORDERING EXAMPLE

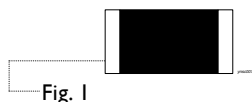
The ordering code for an AF0402 chip resistor, value 100 K $\Omega$  with  $\pm 1\%$  tolerance, supplied in 7-inch tape reel with 10Kpcs quantity is: AF0402FR-07100KL.

### NOTE

1. All our R-Chip products are RoHS compliant and Halogen free. "LFP" of the internal 2D reel label states "Lead-Free Process"
2. On customized label, "LFP" or specific symbol can be printed

**MARKING**

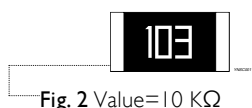
AF0100 / AF0201 / AF0402



No marking

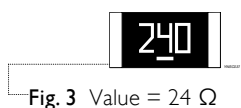
Fig. 1

AF0603 / AF0805 / AF1206 / AF1210 / AF2010 / AF2512

Fig. 2 Value = 10 K $\Omega$ E-24 series: 3 digits,  $\pm 5\%$ ,  $\geq 10\Omega$ 

First two digits for significant figure and 3rd digit for number of zeros

AF0603

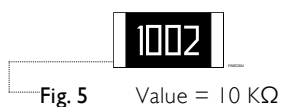
Fig. 3 Value = 24  $\Omega$ E-24 series: 3 digits,  $\pm 1\%$ 

One short bar under marking letter

Fig. 4 Value = 12.4 K $\Omega$ E-96 series: 3 digits,  $\pm 1\%$ 

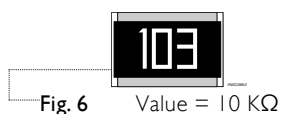
First two digits for E-96 marking rule and 3rd letter for number of zeros

AF0805 / AF1206 / AF1210 / AF2010 / AF2512

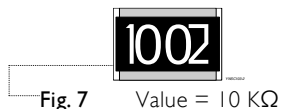
Fig. 5 Value = 10 K $\Omega$ Both E-24 and E-96 series: 4 digits,  $\pm 1\%$ 

First three digits for significant figure and 4th digit for number of zeros

AF1218

Fig. 6 Value = 10 K $\Omega$ E-24 series: 3 digits,  $\pm 5\%$ 

First two digits for significant figure and 3rd digit for number of zeros

Fig. 7 Value = 10 K $\Omega$ Both E-24 and E-96 series: 4 digits,  $\pm 1\%$ 

First three digits for significant figure and 4th digit for number of zeros

**NOTE**

For further marking information, please see special data sheet "Chip resistors marking". Marking of AF series is the same as RC series

## CONSTRUCTION

The resistors are constructed on top of a high grade ceramic body. Internal metal electrodes are added at each end and connected by a resistive glaze. The resistive glaze is covered by a glass.

The composition of the glaze is adjusted to give the approximate required resistance value and laser trimming of this resistive glaze achieves the value within tolerance.

The whole element is covered by a protective overcoat. Size 0603 and bigger is marked with the resistance value on top. Finally, the two external terminations (Ni / matte tin) are added. See fig.8

## DIMENSIONS

Table I For outlines see fig. 8

| TYPE   | L (mm)    | W (mm)    | H (mm)    | I <sub>1</sub> (mm) | I <sub>2</sub> (mm) |
|--------|-----------|-----------|-----------|---------------------|---------------------|
| AF0100 | 0.40±0.02 | 0.20±0.02 | 0.14±0.02 | 0.10±0.03           | 0.10±0.03           |
| AF0201 | 0.60±0.03 | 0.30±0.03 | 0.23±0.03 | 0.12±0.05           | 0.15±0.05           |
| AF0402 | 1.00±0.05 | 0.50±0.05 | 0.35±0.05 | 0.20±0.10           | 0.25±0.10           |
| AF0603 | 1.60±0.10 | 0.80±0.10 | 0.45±0.10 | 0.25±0.15           | 0.25±0.15           |
| AF0805 | 2.00±0.10 | 1.25±0.10 | 0.50±0.10 | 0.35±0.20           | 0.35±0.20           |
| AF1206 | 3.10±0.10 | 1.60±0.10 | 0.55±0.10 | 0.45±0.20           | 0.50±0.20           |
| AF1210 | 3.10±0.10 | 2.60±0.15 | 0.57±0.10 | 0.45±0.20           | 0.50±0.20           |
| AF1218 | 3.10±0.10 | 4.60±0.10 | 0.57±0.10 | 0.45±0.20           | 0.50±0.20           |
| AF2010 | 5.00±0.10 | 2.50±0.15 | 0.57±0.10 | 0.55±0.20           | 0.55±0.20           |
| AF2512 | 6.35±0.10 | 3.20±0.15 | 0.57±0.10 | 0.60±0.20           | 0.60±0.20           |

## OUTLINES

For dimensions see Table I

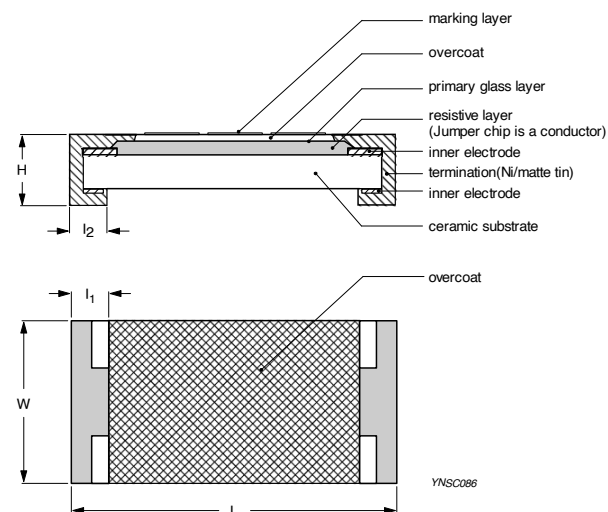


Fig. 8 Chip resistor outlines

## ELECTRICAL CHARACTERISTICS

Table 2

| TYPE   | POWER  | CHARACTERISTICS             |                      |                       |                                 |                                                                        |                                                                                                                                                                                                                                |                                            |
|--------|--------|-----------------------------|----------------------|-----------------------|---------------------------------|------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------|
|        |        | Operating Temperature Range | Max. Working Voltage | Max. Overload Voltage | Dielectric Withstanding Voltage | Resistance Range                                                       | Temperature Coefficient                                                                                                                                                                                                        | Jumper Criteria                            |
| AF0100 | 1/32 W | -55 °C to 125°C             | 15V                  | 30V                   | 30V                             | 5% (E24)<br>$10\Omega \leq R \leq 1M\Omega$                            | $10\Omega \leq R < 100\Omega$<br>$\pm 300 \text{ ppm}/^\circ\text{C}$                                                                                                                                                          | Rated Current<br>0.5A                      |
|        |        |                             |                      |                       |                                 | 1% (E24/E96)<br>$10\Omega \leq R \leq 1M\Omega$<br>Jumper < 50mΩ       | $100\Omega \leq R \leq 1M\Omega$<br>$\pm 200 \text{ ppm}/^\circ\text{C}$                                                                                                                                                       | Max. Current<br>1.0A                       |
| AF0201 | 1/20 W |                             | 25V                  | 50V                   | 50V                             | 5% (E24)<br>$1\Omega \leq R \leq 10M\Omega$                            | $1\Omega \leq R \leq 10\Omega$<br>-100/+350 ppm/°C                                                                                                                                                                             | Rated Current<br>0.5A                      |
|        |        |                             |                      |                       |                                 | 0.5%, 1% (E24/E96)<br>$1\Omega \leq R \leq 10M\Omega$<br>Jumper < 50mΩ | $10\Omega < R \leq 10M\Omega$<br>$\pm 200 \text{ ppm}/^\circ\text{C}$                                                                                                                                                          | Max. Current<br>1.0A                       |
| AF0402 | 1/16 W |                             | 50V                  | 100V                  | 100V                            | 5% (E24)<br>$1\Omega \leq R \leq 22M\Omega$                            | $1\Omega \leq R \leq 10\Omega$<br>$\pm 200 \text{ ppm}/^\circ\text{C}$                                                                                                                                                         | Rated Current<br>1A                        |
|        |        |                             |                      |                       |                                 | 0.5%, 1% (E24/E96)<br>$1\Omega \leq R \leq 10M\Omega$<br>Jumper < 50mΩ | $10\Omega < R \leq 10M\Omega$<br>$\pm 100 \text{ ppm}/^\circ\text{C}$<br>$10M\Omega < R \leq 22M\Omega$<br>$\pm 200 \text{ ppm}/^\circ\text{C}$<br>$100\Omega \leq R \leq 1M\Omega$<br>$\pm 50 \text{ ppm}/^\circ\text{C}$     | Max. Current<br>2A                         |
| AF0603 | 1/8W   |                             | 75V                  | 100V                  | 100V                            | 5% (E24)<br>$1\Omega \leq R \leq 10M\Omega$                            | $1\Omega \leq R < 10\Omega$<br>$\pm 200 \text{ ppm}/^\circ\text{C}$                                                                                                                                                            | Rated Current<br>1A<br>Max. Current<br>2A  |
|        |        |                             |                      |                       |                                 | 0.5%, 1%, (E24/E96)<br>$1\Omega \leq R \leq 10M\Omega$                 | $10\Omega \leq R \leq 10M\Omega$<br>$\pm 100 \text{ ppm}/^\circ\text{C}$                                                                                                                                                       |                                            |
| AF0603 | 1/10 W |                             | 75V                  | 150V                  | 150V                            | 5% (E24)<br>$1\Omega \leq R \leq 22M\Omega$                            | $1\Omega \leq R < 10\Omega$<br>$\pm 200 \text{ ppm}/^\circ\text{C}$                                                                                                                                                            | Rated Current<br>1A<br>Max. Current<br>2A  |
|        |        |                             |                      |                       |                                 | 0.5%, 1% (E24/E96)<br>$1\Omega \leq R \leq 10M\Omega$<br>Jumper < 50mΩ | $10\Omega \leq R \leq 10M\Omega$<br>$\pm 100 \text{ ppm}/^\circ\text{C}$<br>$10M\Omega < R \leq 22M\Omega$<br>$\pm 200 \text{ ppm}/^\circ\text{C}$<br>$100\Omega \leq R \leq 10M\Omega$<br>$\pm 50 \text{ ppm}/^\circ\text{C}$ |                                            |
| AF0805 | 1/5 W  | -55 °C to 155 °C            | 75V                  | 150V                  | 150V                            | 5% (E24)<br>$1\Omega \leq R \leq 10M\Omega$                            | $1\Omega \leq R < 10\Omega$<br>$\pm 200 \text{ ppm}/^\circ\text{C}$                                                                                                                                                            | Rated Current<br>2A<br>Max. Current<br>5A  |
|        |        |                             |                      |                       |                                 | 0.5%, 1%, (E24/E96)<br>$1\Omega \leq R \leq 10M\Omega$                 | $10\Omega \leq R \leq 10M\Omega$<br>$\pm 100 \text{ ppm}/^\circ\text{C}$                                                                                                                                                       |                                            |
| AF0805 | 1/8 W  |                             | 150V                 | 300V                  | 300V                            | 5% (E24)<br>$1\Omega \leq R \leq 22M\Omega$                            | $1\Omega \leq R < 10\Omega$<br>$\pm 200 \text{ ppm}/^\circ\text{C}$                                                                                                                                                            | Rated Current<br>2A<br>Max. Current<br>10A |
|        |        |                             |                      |                       |                                 | 0.5%, 1% (E24/E96)<br>$1\Omega \leq R \leq 10M\Omega$<br>Jumper < 50mΩ | $10\Omega \leq R \leq 10M\Omega$<br>$\pm 100 \text{ ppm}/^\circ\text{C}$<br>$10M\Omega < R \leq 22M\Omega$<br>$\pm 200 \text{ ppm}/^\circ\text{C}$<br>$100\Omega \leq R \leq 10M\Omega$<br>$\pm 50 \text{ ppm}/^\circ\text{C}$ |                                            |
| AF1206 | 1/4 W  |                             | 150V                 | 300V                  | 300V                            | 5% (E24)<br>$1\Omega \leq R \leq 10M\Omega$                            | $1\Omega \leq R < 10\Omega$<br>$\pm 200 \text{ ppm}/^\circ\text{C}$                                                                                                                                                            | Rated Current<br>2A<br>Max. Current<br>10A |
|        |        |                             |                      |                       |                                 | 0.5%, 1%, (E24/E96)<br>$1\Omega \leq R \leq 10M\Omega$                 | $10\Omega \leq R \leq 10M\Omega$<br>$\pm 100 \text{ ppm}/^\circ\text{C}$                                                                                                                                                       |                                            |
| AF1206 | 1/4 W  |                             | 200V                 | 400V                  | 500V                            | 5% (E24)<br>$1\Omega \leq R \leq 22M\Omega$                            | $1\Omega \leq R < 10\Omega$<br>$\pm 200 \text{ ppm}/^\circ\text{C}$                                                                                                                                                            | Rated Current<br>2A<br>Max. Current<br>10A |
|        |        |                             |                      |                       |                                 | 0.5%, 1% (E24/E96)<br>$1\Omega \leq R \leq 10M\Omega$<br>Jumper < 50mΩ | $10\Omega \leq R \leq 10M\Omega$<br>$\pm 100 \text{ ppm}/^\circ\text{C}$<br>$10M\Omega < R \leq 22M\Omega$<br>$\pm 200 \text{ ppm}/^\circ\text{C}$<br>$100\Omega \leq R \leq 10M\Omega$<br>$\pm 50 \text{ ppm}/^\circ\text{C}$ |                                            |
| AF1206 | 1/2 W  |                             | 200V                 | 400V                  | 500V                            | 5% (E24)<br>$1\Omega \leq R \leq 10M\Omega$                            | $1\Omega \leq R < 10\Omega$<br>$\pm 200 \text{ ppm}/^\circ\text{C}$                                                                                                                                                            | Rated Current<br>2A<br>Max. Current<br>10A |
|        |        |                             |                      |                       |                                 | 0.5%, 1%, (E24/E96)<br>$1\Omega \leq R \leq 10M\Omega$                 | $10\Omega \leq R \leq 10M\Omega$<br>$\pm 100 \text{ ppm}/^\circ\text{C}$                                                                                                                                                       |                                            |

## ELECTRICAL CHARACTERISTICS

Table 2

| TYPE   | POWER | CHARACTERISTICS             |                      |                       |                                 |                                                                                                                       |                                                                                                                                                                                                                             |                                            |
|--------|-------|-----------------------------|----------------------|-----------------------|---------------------------------|-----------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------|
|        |       | Operating Temperature Range | Max. Working Voltage | Max. Overload Voltage | Dielectric Withstanding Voltage | Resistance Range                                                                                                      | Temperature Coefficient                                                                                                                                                                                                     | Jumper Criteria                            |
| AF1210 | 1/2 W | -55 °C to 155 °C            | 200V                 | 500V                  | 500V                            | 5% (E24)<br>$1\Omega \leq R \leq 10M\Omega$<br>0.5%, 1% (E24/E96)<br>$1\Omega \leq R \leq 10M\Omega$<br>Jumper < 50mΩ | $1\Omega \leq R < 10\Omega$<br>$\pm 200 \text{ ppm}/^\circ\text{C}$<br>$10\Omega \leq R \leq 10M\Omega$<br>$\pm 100 \text{ ppm}/^\circ\text{C}$<br>$100\Omega \leq R \leq 1M\Omega$<br>$\pm 50 \text{ ppm}/^\circ\text{C}$  | Rated Current<br>2A<br>Max. Current<br>10A |
|        | 1 W   |                             |                      |                       |                                 | 5% (E24)<br>$1\Omega \leq R \leq 10M\Omega$<br>0.5%, 1% (E24/E96)<br>$1\Omega \leq R \leq 10M\Omega$                  | $1\Omega \leq R < 10\Omega$<br>$\pm 200 \text{ ppm}/^\circ\text{C}$<br>$10\Omega \leq R \leq 10M\Omega$<br>$\pm 100 \text{ ppm}/^\circ\text{C}$                                                                             |                                            |
| AF1218 | 1 W   | -55 °C to 155 °C            | 200V                 | 500V                  | 500V                            | 5% (E24)<br>$1\Omega \leq R \leq 1M\Omega$<br>0.5%, 1% (E24/E96)<br>$1\Omega \leq R \leq 1M\Omega$<br>Jumper < 50mΩ   | $1\Omega \leq R < 10\Omega$<br>$\pm 200 \text{ ppm}/^\circ\text{C}$<br>$10\Omega \leq R \leq 1M\Omega$<br>$\pm 100 \text{ ppm}/^\circ\text{C}$<br>$100\Omega \leq R \leq 2.2M\Omega$<br>$\pm 50 \text{ ppm}/^\circ\text{C}$ | Rated Current<br>2A<br>Max. Current<br>10A |
|        | 1.5 W |                             |                      |                       |                                 | 5% (E24)<br>$1\Omega \leq R \leq 1M\Omega$<br>0.5%, 1% (E24/E96)<br>$1\Omega \leq R \leq 1M\Omega$                    | $1\Omega \leq R < 10\Omega$<br>$\pm 200 \text{ ppm}/^\circ\text{C}$<br>$10\Omega \leq R \leq 1M\Omega$<br>$\pm 100 \text{ ppm}/^\circ\text{C}$                                                                              |                                            |
| AF2010 | 3/4 W | -55 °C to 155 °C            | 200V                 | 500V                  | 500V                            | 5% (E24)<br>$1\Omega \leq R \leq 10M\Omega$<br>0.5%, 1% (E24/E96)<br>$1\Omega \leq R \leq 10M\Omega$<br>Jumper < 50mΩ | $1\Omega \leq R < 10\Omega$<br>$\pm 200 \text{ ppm}/^\circ\text{C}$<br>$10\Omega \leq R \leq 10M\Omega$<br>$\pm 100 \text{ ppm}/^\circ\text{C}$<br>$100\Omega \leq R \leq 10M\Omega$<br>$\pm 50 \text{ ppm}/^\circ\text{C}$ | Rated Current<br>2A<br>Max. Current<br>10A |
|        | 1.25W |                             |                      |                       |                                 | 5% (E24)<br>$1\Omega \leq R \leq 10M\Omega$<br>0.5%, 1% (E24/E96)<br>$1\Omega \leq R \leq 10M\Omega$                  | $1\Omega \leq R < 10\Omega$<br>$\pm 200 \text{ ppm}/^\circ\text{C}$<br>$10\Omega \leq R \leq 10M\Omega$<br>$\pm 100 \text{ ppm}/^\circ\text{C}$                                                                             |                                            |
| AF2512 | 1 W   | -55 °C to 155 °C            | 200V                 | 500V                  | 500V                            | 5% (E24)<br>$1\Omega \leq R \leq 10M\Omega$<br>0.5%, 1% (E24/E96)<br>$1\Omega \leq R \leq 10M\Omega$<br>Jumper < 50mΩ | $1\Omega \leq R < 10\Omega$<br>$\pm 200 \text{ ppm}/^\circ\text{C}$<br>$10\Omega \leq R \leq 10M\Omega$<br>$\pm 100 \text{ ppm}/^\circ\text{C}$<br>$100\Omega \leq R \leq 10M\Omega$<br>$\pm 50 \text{ ppm}/^\circ\text{C}$ | Rated Current<br>2A<br>Max. Current<br>10A |
|        | 2 W   |                             |                      |                       |                                 | 5% (E24)<br>$1\Omega \leq R \leq 10M\Omega$<br>0.5%, 1% (E24/E96)<br>$1\Omega \leq R \leq 10M\Omega$                  | $1\Omega \leq R < 10\Omega$<br>$\pm 200 \text{ ppm}/^\circ\text{C}$<br>$10\Omega \leq R \leq 10M\Omega$<br>$\pm 100 \text{ ppm}/^\circ\text{C}$                                                                             |                                            |

## FOOTPRINT AND SOLDERING PROFILES

For recommended footprint and soldering profiles of AF-series is the same as RC-series. Please see the special data sheet "Chip resistors mounting".

## PACKING STYLE AND PACKAGING QUANTITY

Table 3 Packing style and packaging quantity

| PACKING STYLE            | REEL<br>DIMENSION | AF0100 | AF0201        | AF0402        | AF0603<br>AF0805<br>AF1206 | AF1210 | AF1218<br>AF2010<br>AF2512 |
|--------------------------|-------------------|--------|---------------|---------------|----------------------------|--------|----------------------------|
| Paper taping reel (R)    | 7" (178 mm)       | 20,000 | 10,000/20,000 | 10,000/20,000 | 5,000                      | 5,000  | --                         |
|                          | 13" (330 mm)      | --     | 50,000        | 50,000        | 20,000                     | 20,000 | --                         |
| Embossed taping reel (K) | 7" (178 mm)       | --     | --            | --            | --                         | --     | 4,000                      |

### NOTE

I. For paper/embossed tape and reel specification/dimensions, please see the special data sheet "Chip resistors packing".

## FUNCTIONAL DESCRIPTION

### OPERATING TEMPERATURE RANGE

AF0100 Range: -55°C to + 125°C

AF0201 - AF2512 Range: -55°C to + 155°C

### POWER RATING

Each type rated power at 70°C:

AF0100=1/32W (0.03125W)

AF0201=1/20W (0.05W)

AF0402=1/16 W (0.0625W); 1/8W (0.125W)

AF0603=1/10 W (0.1W); 1/5W (0.2W)

AF0805=1/8 W (0.125W); 1/4W (0.25W)

AF1206=1/4 W (0.25W); 1/2W (0.5W)

AF1210=1/2W (0.5W); 1W

AF1218=1W; 1.5W

AF2010=3/4W (0.75W); 1.25W

AF2512=1W, 2W

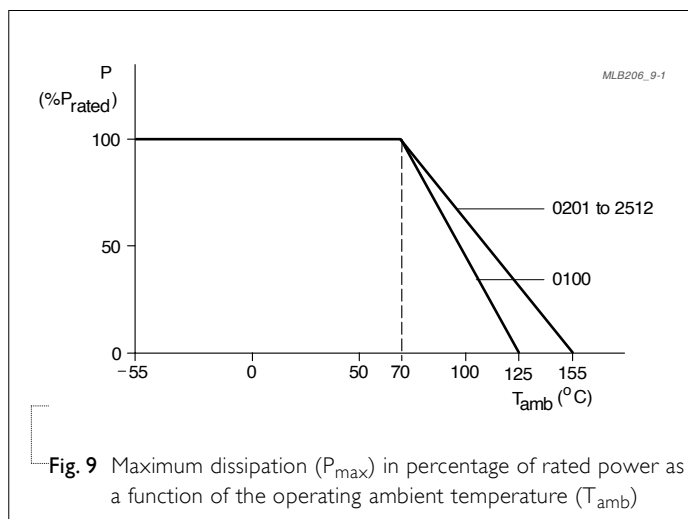


Fig. 9 Maximum dissipation ( $P_{max}$ ) in percentage of rated power as a function of the operating ambient temperature ( $T_{amb}$ )

### RATED VOLTAGE

The DC or AC (rms) continuous working voltage corresponding to the rated power is determined by the following formula:

$$V = \sqrt{P \times R}$$

Where

V = Continuous rated DC or AC (rms) working voltage (V)

P = Rated power (W)

R = Resistance value ( $\Omega$ )

## TESTS AND REQUIREMENTS

Table 4 Test condition, procedure and requirements

| TEST                         | TEST METHOD                                                   | PROCEDURE                                                                                                                                                                      | REQUIREMENTS                                                                                                                                                                                                         |
|------------------------------|---------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| High Temperature Exposure    | AEC-Q200 Test 3                                               | 0100: 1,000 hours at 125°C                                                                                                                                                     | 0100: $\pm(2.0\%+0.05\Omega)$                                                                                                                                                                                        |
|                              | MIL-STD-202 Method 108                                        | Others: 1,000 hours at 155 $\pm$ 3°C unpowered                                                                                                                                 | <50 m $\Omega$ for Jumper<br>Others: $\pm(1.0\%+0.05\Omega)$<br><100 m $\Omega$ for Jumper                                                                                                                           |
| Moisture Resistance          | MIL-STD-202 Method 106                                        | Each temperature / humidity cycle is defined at 8 hours (method 106F), 3 cycles / 24 hours for 10d. with 25 °C / 65 °C 95% R.H., without steps 7a & 7b, unpowered              | 0100: $\pm(2.0\%+0.05\Omega)$<br><50 m $\Omega$ for Jumper<br>Others:<br>$\pm(0.5\%+0.05\Omega)$ for 0.5%, 1% tol.<br>$\pm(1.0\%+0.05\Omega)$ for 5% tol.<br><100 m $\Omega$ for Jumper                              |
| Biased Humidity              | AEC-Q200 Test 7<br>MIL-STD-202 Method 103                     | 1,000 hours; 85 °C / 85% RH<br>10% of operating power<br>Measurement at 24 $\pm$ 4 hours after test conclusion.                                                                | 0100: $\pm(5\%+0.05\Omega)$<br><50 m $\Omega$ for Jumper<br>Others:<br>$1\Omega \leq R \leq 1M\Omega$ : $\pm(3\%+0.05\Omega)$<br>$1M\Omega < R \leq 10M\Omega$ : $\pm(5\%+0.05\Omega)$<br><100 m $\Omega$ for Jumper |
| Operational Life             | AEC-Q200 Test 8<br>IEC 60115-1 4.25<br>MIL-STD-202 Method 108 | 1,000 hours at 70°C for 01005, 125 °C for others, derated voltage applied for 1.5 hours on, 0.5 hour off, still-air required                                                   | $\pm(3.0\%+0.05\Omega)$<br><100 m $\Omega$ for Jumper                                                                                                                                                                |
| Resistance to Soldering Heat | AEC-Q200 Test 15<br>MIL-STD-202 Method 210                    | Condition B, no pre-heat of samples<br>Lead-free solder, 260 $\pm$ 5 °C, 10 $\pm$ 1 seconds immersion time<br>Procedure 2 for SMD: devices fluxed and cleaned with isopropanol | 0100: $\pm(1.0\%+0.05\Omega)$<br>Others:<br>$\pm(0.5\%+0.05\Omega)$ for 0.5%, 1% tol.<br>$\pm(1.0\%+0.05\Omega)$ for 5% tol.<br><50 m $\Omega$ for Jumper<br>No visible damage                                       |
| Thermal Shock                | MIL-STD-202 Method 107                                        | -55/+125 °C<br>Number of cycles is 300. Devices mounted<br>Maximum transfer time is 20 seconds.<br>Dwell time is 15 minutes. Air – Air                                         | 0100: $\pm(1.0\%+0.05\Omega)$<br><50 m $\Omega$ for Jumper<br>Others:<br>$\pm(0.5\%+0.05\Omega)$ for 0.5%, 1% tol.<br>$\pm(1\%+0.05\Omega)$ for 5% tol.<br><100 m $\Omega$ for Jumper                                |
| ESD                          | AEC-Q200 Test 17<br>AEC-Q200-002                              | Human Body Model,<br>1 pos. + 1 neg. discharges<br>0201: 500V<br>0402/0603: 1KV<br>0805 and above: 2KV                                                                         | $\pm(3.0\%+0.05\Omega)$<br><50 m $\Omega$ for Jumper                                                                                                                                                                 |

| TEST                                                 | TEST METHOD                      | PROCEDURE                                                                                                                                                                                                                                                                                                                                                                           | REQUIREMENTS                                                                           |
|------------------------------------------------------|----------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------|
| Solderability<br>- Wetting                           | AEC-Q200 Test 18<br>J-STD-002    | Electrical Test not required Magnification 50X<br>SMD conditions:<br>(a) Method B, aging 4 hours at 155 °C dry heat,<br>dipping at 235±3 °C for 5±0.5 seconds.<br>(b) Method B, steam aging 8 hours, dipping at<br>215±3 °C for 5±0.5 seconds.<br>(c) Method D, steam aging 8 hours, dipping at<br>260±3 °C for 30±0.5 seconds.                                                     | Well tinned (≥95% covered)<br>No visible damage                                        |
| Board Flex                                           | AEC-Q200 Test 21<br>AEC-Q200-005 | Chips mounted on a 100mm x 40mm glass<br>epoxy resin PCB (FR4)<br>Bending for 0201/0402: 5 mm<br>0603/0805: 3 mm<br>1206 and above: 2 mm<br>Holding time: minimum 60 seconds                                                                                                                                                                                                        | ±(1.0%+0.05Ω)<br><50 mΩ for Jumper                                                     |
| Temperature<br>Coefficient of<br>Resistance (T.C.R.) | MIL-STD-202 Method 304           | At +25/-55 °C and +25/+125 °C<br><br><b>Formula:</b><br>$T.C.R = \frac{R_2 - R_1}{R_1(t_2 - t_1)} \times 10^6 \text{ (ppm/°C)}$<br>Where<br>t <sub>1</sub> = +25 °C or specified room temperature<br>t <sub>2</sub> = -55 °C or +125 °C test temperature<br>R <sub>1</sub> = resistance at reference temperature in ohms<br>R <sub>2</sub> = resistance at test temperature in ohms | Refer to table 2                                                                       |
| Short Time<br>Overload                               | IEC60115-1 8.1                   | 2.5 times of rated voltage or maximum<br>overload voltage whichever is less for 5 sec<br>at room temperature                                                                                                                                                                                                                                                                        | 0100: ±(2.0%+0.05Ω)<br>Others: ±(1.0%+0.05Ω)<br><50 mΩ for Jumper<br>No visible damage |
| FOS                                                  | ASTM-B-809-95*<br>* Modified     | Sulfur 750 hours, 105°C, unpowered                                                                                                                                                                                                                                                                                                                                                  | 0100: ±(5.0%+0.05Ω)<br>Others: ±(4.0%+0.05Ω)<br><100 mΩ for Jumper                     |

REVISION HISTORY

| REVISION  | DATE          | CHANGE NOTIFICATION | DESCRIPTION                                                                           |
|-----------|---------------|---------------------|---------------------------------------------------------------------------------------|
| Version 9 | Jan. 03, 2023 | -                   | - 10ohm TCR upgrade to 100ppm, for 0603~2512 normal power and 0402~2512 double power. |
| Version 8 | Mar. 26, 2021 | -                   | - Add TCR 50ppm and size 01005 extend                                                 |
| Version 7 | Nov. 1, 2019  | -                   | - Add in AF double power                                                              |
| Version 6 | Sep. 05, 2019 | -                   | - Updated dimensions                                                                  |
| Version 5 | Jun. 21, 2016 | -                   | - Update test and requirement                                                         |
| Version 4 | Dec. 24, 2015 | -                   | - Update Dielectric Withstanding Voltage& Resistance value                            |
| Version 3 | Apr. 01, 2015 | -                   | - Modified test and requirements                                                      |
| Version 2 | Nov. 20, 2014 | -                   | - Tests and requirement update                                                        |
| Version 1 | Sep. 27, 2013 | -                   | - Size 0201/1210/1218/2010/2512 extend                                                |
| Version 0 | Jan 07, 2011  | -                   | - First issue of this specification                                                   |

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