

# APPROVAL SHEET

**WF25A, WF20A, WF10A,  
WF12A, WF08A, WF06A, WF04A**

$\pm 1\%$ ,  $\pm 5\%$ , Jumper

Thick Film Triple Power Chip Resistors

Size 2512 3W, 2010 1.5W, 1210 3/4W

1206 3/4W, 0805 1/2W, 0603 1/3W, 0402 1/5W

RoHS 2 Compliant with exemption 7C-I

Halogen free

\*Contents in this sheet are subject to change without prior notice.

## FEATURE

1. Small size and light weight
2. High reliability and stability
3. Reduced size of final equipment
4. High power
5. RoHS 2 Compliant with exemption 7C-I and Halogen free products
6. Flammability against UL94-V0

## APPLICATION

- High accuracy dc-power supply
- Digital multi-meter
- Telecommunication
- Computer
- Automotive industry
- Medical and military equipment

## DESCRIPTION

The resistors are constructed in a high grade ceramic body (aluminum oxide). Internal metal electrodes are added at each end and connected by a resistive paste that is applied to the top surface of the substrate. The composition of the paste is adjusted to give the approximate resistance required and the value is trimmed to nominated value within tolerance which controlled by laser trimming of this resistive layer.

The resistive layer is covered with a protective coat. Finally, the two external end terminations are added. For ease of soldering the outer layer of these end terminations is a Tin (lead free) alloy.

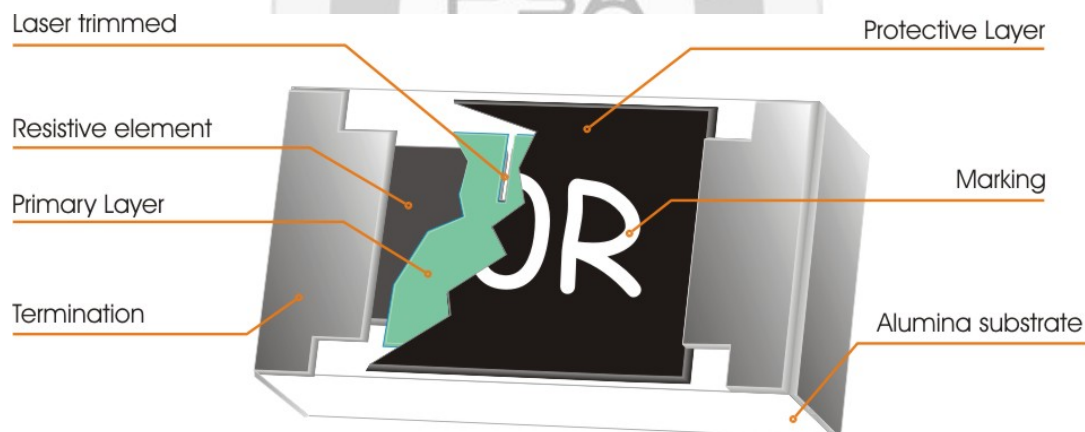


Fig 1. Construction of Chip-R

## QUICK REFERENCE DATA

| Item                                       | General Specification      |                |                |                |                |                |                |
|--------------------------------------------|----------------------------|----------------|----------------|----------------|----------------|----------------|----------------|
| Series No.                                 | WF25A                      | WF20A          | WF10A          | WF12A          | WF08A          | WF06A          | WF04A          |
| Size code                                  | 2512<br>(6432)             | 2010<br>(5025) | 1210<br>(3225) | 1206<br>(3216) | 0805<br>(2012) | 0603<br>(1608) | 0402<br>(1005) |
| Resistance Tolerance                       | ±1% (E24+E96)<br>±5% (E24) |                |                |                |                |                |                |
| Resistance Range                           | 1Ω ~ 1MΩ                   |                |                |                |                |                | 10Ω ~ 1M2Ω     |
| TCR (ppm/°C)                               |                            |                |                |                |                |                |                |
| 1% 10Ω~1M2Ω                                | ±100                       | ±100           | ±100           | ±100           | ±100           | ±100           | ±100           |
| 1% 1~9.76Ω                                 | ±100                       | ±100           | ±100           | ±200           | ±150           | ±200           |                |
| TCR (ppm/°C)                               |                            |                |                |                |                |                |                |
| 5% 1~1M2Ω                                  | ±200                       | ±200           | ±200           | ±200           | ±200           | ±200           | ±100           |
| Max. dissipation at T <sub>amb</sub> =70°C | 3 W                        | 1.5 W          | 3/4 W          | 3/4 W          | 1/2 W          | 1/3 W          | 1/5 W          |
| Max. Operation Voltage                     | 250V                       | 250V           | 250V           | 250V           | 200V           | 75V            | 50V            |
| Max. Overload Voltage                      | 500V                       | 500V           | 500V           | 500V           | 300V           | 125V           | 100V           |
| Operation Temperature                      | - 55~+155°C                |                |                |                |                |                |                |

### Notes:

1. RCWV is Rated Voltage,  $V = \sqrt{P \cdot R}$  or Max. Working Voltage whichever is lower.
2. V : Working Voltage(V) · P : Rated Power (W) · R : Resistance Value(Ω)
3. Please consider the resistance variance from soldering pad/trace/amount, and keep the surface temperature do not exceed 105°C when working.

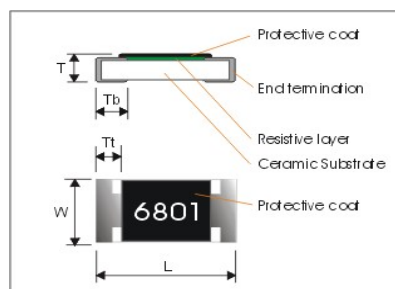
## High Current Power Jumpers (0Ω)

| Item                                         | General Specification                    |                |                |                |                |                |                |
|----------------------------------------------|------------------------------------------|----------------|----------------|----------------|----------------|----------------|----------------|
| Series No.                                   | WF25A                                    | WF20A          | WF10A          | WF12A          | WF08A          | WF06A          | WF04A          |
| Size code                                    | 2512<br>(6432)                           | 2010<br>(5025) | 1210<br>(3225) | 1206<br>(3216) | 0805<br>(2012) | 0603<br>(1608) | 0402<br>(1005) |
| Resistance Range                             | ≤ 10mΩ                                   | ≤ 10mΩ         | ≤ 10mΩ         | ≤ 10mΩ         | ≤ 10mΩ         | ≤ 10mΩ         | ≤ 20mΩ         |
| TCR (ppm/°C)                                 | TCR is not applicable for Jumper product |                |                |                |                |                |                |
| Max. dissipation<br>@ T <sub>amb</sub> =70°C | 3 W                                      | 1.5 W          | 3/4 W          | 3/4 W          | 1/2 W          | 1/3 W          | 1/5 W          |
| Max Rated Current                            | 14 A                                     | 12 A           | 9 A            | 9 A            | 7 A            | 6 A            | 3 A            |
| Max Overload Current                         | 28 A                                     | 24 A           | 18 A           | 18 A           | 14 A           | 12 A           | 6 A            |
| Operation temperature                        | - 55~+155°C                              |                |                |                |                |                |                |

### Notes:

Max.rated (Rated Current ) /Overload current (Peak Current) and resistance listed above, TCR is not applicable of Jumper products, and keep the surface temperature do not exceed 105°C when working.

## DIMENSIONS (unit : mm)



| Series | WF25A       | WF20A       | WF10A       | WF12A       | WF08A       | WF06A       | WF04A       |
|--------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|
| L      | 6.40 ± 0.20 | 5.00 ± 0.20 | 3.10 ± 0.10 | 3.10 ± 0.10 | 2.00 ± 0.10 | 1.60 ± 0.10 | 1.00 ± 0.05 |
| W      | 3.20 ± 0.25 | 2.50 ± 0.20 | 2.60 ± 0.10 | 1.60 ± 0.10 | 1.25 ± 0.10 | 0.80 ± 0.10 | 0.50 ± 0.05 |
| T      | 1.10 ± 0.20 | 0.60 ± 0.10 | 0.55 ± 0.10 | 0.55 ± 0.10 | 0.50 ± 0.10 | 0.45 ± 0.10 | 0.35 ± 0.05 |
| Tt     | 0.45 ± 0.25 | 0.65 ± 0.25 | 0.50 ± 0.25 | 0.50 ± 0.25 | 0.40 ± 0.20 | 0.30 ± 0.20 | 0.20 ± 0.10 |
| Tb     | 1.80 ± 0.25 | 0.60 ± 0.25 | 0.50 ± 0.25 | 0.50 ± 0.25 | 0.40 ± 0.20 | 0.30 ± 0.20 | 0.25 ± 0.10 |

## CATALOGUE NUMBERS

The resistors have a catalogue number starting with.

| WF06                                                                                                               | A                                                                                                                                           | 510_                                                                                                                                                                                                                                                                               | J                                                    | T                                                                                | L                                                     |
|--------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------|----------------------------------------------------------------------------------|-------------------------------------------------------|
| <b>Size code</b><br>WF25: 2512<br>WF20: 2010<br>WF10: 1210<br>WF12: 1206<br>WF08: 0805<br>WF06: 0603<br>WF04: 0402 | <b>Type code</b><br>A : Triple Power<br>2512 = 3W<br>2010 = 1.5W<br>1210 = 3/4W<br>1206 = 3/4W<br>0805 = 1/2W<br>0603 = 1/3W<br>0402 = 1/5W | <b>Resistance code</b><br>5% E24:<br>2 significant digits followed<br>by No. of zeros & a blank<br>e.g.:<br>3ohm = 3R0_<br>10ohm = 100_<br>56Kohm = 563_<br>(" " means a blank)<br>1% E24+E96:<br>3 significant digits followed<br>by No. of zeros<br>100Ω = 1000<br>37.4KΩ = 3742 | <b>Tolerance</b><br>J : ±5%<br>F : ±1%<br>P : Jumper | <b>Packaging code</b><br>T : 7" Reeled taping<br>Z : 7" Reeled taping<br>(WF25A) | <b>Termination code</b><br>L = Sn base<br>(lead free) |

### ■ Reeled packaging

WF25A 12mm width pc emboss taping 3,000pcs per 7" reel

WF20A 12mm width pc emboss taping 4,000pcs per 7" reel

WF10A, WF12A, WF08A, WF06A 8mm width paper taping 5,000pcs per 7" reel

WF04A 8mm width paper taping 10,000pcs per 7" reel

## MARKING

| Size \ Nr. Of digit of code\tolerance | $\pm 1\%, \pm 5\%$                                         |
|---------------------------------------|------------------------------------------------------------|
| 2512/2010/1210/1206/0805              | $\pm 1\%$ : 4 digits marking; $\pm 5\%$ : 3 digits marking |
| 0603                                  | 3 digits marking                                           |
| 0402                                  | No marking                                                 |

| Size \ Nr. Of digit of code\tolerance | Jumper (0 $\Omega$ ) |
|---------------------------------------|----------------------|
| 2512/2010                             | 4 digits marking     |
| 1210/1206/0805/0603                   | 3 digits marking     |
| 0402                                  | No marking           |

### 3 digits marking ( $\pm 5\%$ 2512,2010,1210,1206,0805,0603)

Each resistor is marked with a three digits code on the protective coating to designate the nominal resistance value.

### 3 digits marking ( $\pm 1\%$ 0603)

| Nominal resistance | Description                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                  |                  |                 |                 |                 |                 |                 |                 |                  |     |     |            |                  |                  |                  |                 |                 |                 |                 |                 |                 |                 |            |       |       |      |      |      |      |      |                  |     |     |     |     |     |     |     |
|--------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------|------------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|------------------|-----|-----|------------|------------------|------------------|------------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|------------|-------|-------|------|------|------|------|------|------------------|-----|-----|-----|-----|-----|-----|-----|
| 1.E24 series       | 2 significant digits followed by No. of zeros .As 0603 WR06X ±5%<br>Example<br><table><tr><td>RESISTANCE</td><td>4.7Ω</td><td>47Ω</td><td>470Ω</td><td>4K70</td><td>47K0</td><td>470K</td><td>4M70</td></tr><tr><td>3 digits marking</td><td>4R7</td><td>470</td><td>471</td><td>472</td><td>473</td><td>474</td><td>475</td></tr></table>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | RESISTANCE       | 4.7Ω             | 47Ω             | 470Ω            | 4K70            | 47K0            | 470K            | 4M70            | 3 digits marking | 4R7 | 470 | 471        | 472              | 473              | 474              | 475             |                 |                 |                 |                 |                 |                 |            |       |       |      |      |      |      |      |                  |     |     |     |     |     |     |     |
| RESISTANCE         | 4.7Ω                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | 47Ω              | 470Ω             | 4K70            | 47K0            | 470K            | 4M70            |                 |                 |                  |     |     |            |                  |                  |                  |                 |                 |                 |                 |                 |                 |                 |            |       |       |      |      |      |      |      |                  |     |     |     |     |     |     |     |
| 3 digits marking   | 4R7                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | 470              | 471              | 472             | 473             | 474             | 475             |                 |                 |                  |     |     |            |                  |                  |                  |                 |                 |                 |                 |                 |                 |                 |            |       |       |      |      |      |      |      |                  |     |     |     |     |     |     |     |
| 2.E96 series       | The 1st two digit codes are referring to the CODE on the table, the 3rd code is the index of resistance value.<br>Repeat values between E24 and E96 series, whose marking are based on the E96 CODE table.<br><table><tr><td>Code</td><td>Z</td><td>Y</td><td>X</td><td>A</td><td>B</td><td>C</td><td>D</td><td>E</td><td>F</td><td>G</td></tr><tr><td>Multiplier</td><td>10<sup>-3</sup></td><td>10<sup>-2</sup></td><td>10<sup>-1</sup></td><td>10<sup>0</sup></td><td>10<sup>1</sup></td><td>10<sup>2</sup></td><td>10<sup>3</sup></td><td>10<sup>4</sup></td><td>10<sup>5</sup></td><td>10<sup>6</sup></td></tr></table><br>Example<br><table><tr><td>RESISTANCE</td><td>1.78Ω</td><td>17.8Ω</td><td>178Ω</td><td>1K78</td><td>17K8</td><td>178K</td><td>1M78</td></tr><tr><td>3 digits marking</td><td>25Y</td><td>25X</td><td>25A</td><td>25B</td><td>25C</td><td>25D</td><td>25E</td></tr></table> | Code             | Z                | Y               | X               | A               | B               | C               | D               | E                | F   | G   | Multiplier | 10 <sup>-3</sup> | 10 <sup>-2</sup> | 10 <sup>-1</sup> | 10 <sup>0</sup> | 10 <sup>1</sup> | 10 <sup>2</sup> | 10 <sup>3</sup> | 10 <sup>4</sup> | 10 <sup>5</sup> | 10 <sup>6</sup> | RESISTANCE | 1.78Ω | 17.8Ω | 178Ω | 1K78 | 17K8 | 178K | 1M78 | 3 digits marking | 25Y | 25X | 25A | 25B | 25C | 25D | 25E |
| Code               | Z                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | Y                | X                | A               | B               | C               | D               | E               | F               | G                |     |     |            |                  |                  |                  |                 |                 |                 |                 |                 |                 |                 |            |       |       |      |      |      |      |      |                  |     |     |     |     |     |     |     |
| Multiplier         | 10 <sup>-3</sup>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | 10 <sup>-2</sup> | 10 <sup>-1</sup> | 10 <sup>0</sup> | 10 <sup>1</sup> | 10 <sup>2</sup> | 10 <sup>3</sup> | 10 <sup>4</sup> | 10 <sup>5</sup> | 10 <sup>6</sup>  |     |     |            |                  |                  |                  |                 |                 |                 |                 |                 |                 |                 |            |       |       |      |      |      |      |      |                  |     |     |     |     |     |     |     |
| RESISTANCE         | 1.78Ω                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | 17.8Ω            | 178Ω             | 1K78            | 17K8            | 178K            | 1M78            |                 |                 |                  |     |     |            |                  |                  |                  |                 |                 |                 |                 |                 |                 |                 |            |       |       |      |      |      |      |      |                  |     |     |     |     |     |     |     |
| 3 digits marking   | 25Y                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | 25X              | 25A              | 25B             | 25C             | 25D             | 25E             |                 |                 |                  |     |     |            |                  |                  |                  |                 |                 |                 |                 |                 |                 |                 |            |       |       |      |      |      |      |      |                  |     |     |     |     |     |     |     |
| 3. Remark          | There is no marking for the items not under E24 and E96 series.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                  |                  |                 |                 |                 |                 |                 |                 |                  |     |     |            |                  |                  |                  |                 |                 |                 |                 |                 |                 |                 |            |       |       |      |      |      |      |      |                  |     |     |     |     |     |     |     |

E96 CODE table:

| CODE | R value | CODE | R-value | CODE | R-Value | CODE | R-value | CODE | R-value | CODE | R-value | CODE | R-value | CODE | R-value |
|------|---------|------|---------|------|---------|------|---------|------|---------|------|---------|------|---------|------|---------|
| 01   | 100     | 13   | 133     | 25   | 178     | 37   | 237     | 49   | 316     | 61   | 422     | 73   | 562     | 85   | 750     |
| 02   | 102     | 14   | 137     | 26   | 182     | 38   | 243     | 50   | 324     | 62   | 432     | 74   | 576     | 86   | 768     |
| 03   | 105     | 15   | 140     | 27   | 187     | 39   | 249     | 51   | 332     | 63   | 442     | 75   | 590     | 87   | 787     |
| 04   | 107     | 16   | 143     | 28   | 191     | 40   | 255     | 52   | 340     | 64   | 453     | 76   | 604     | 88   | 806     |
| 05   | 110     | 17   | 147     | 29   | 196     | 41   | 261     | 53   | 348     | 65   | 464     | 77   | 619     | 89   | 825     |
| 06   | 113     | 18   | 150     | 30   | 200     | 42   | 267     | 54   | 357     | 66   | 475     | 78   | 634     | 90   | 845     |
| 07   | 115     | 19   | 154     | 31   | 205     | 43   | 274     | 55   | 365     | 67   | 487     | 79   | 649     | 91   | 866     |
| 08   | 118     | 20   | 158     | 32   | 210     | 44   | 280     | 56   | 374     | 68   | 499     | 80   | 665     | 92   | 887     |
| 09   | 121     | 21   | 162     | 33   | 215     | 45   | 287     | 57   | 383     | 69   | 511     | 81   | 681     | 93   | 909     |
| 10   | 124     | 22   | 165     | 34   | 221     | 46   | 294     | 58   | 392     | 70   | 523     | 82   | 698     | 94   | 931     |
| 11   | 127     | 23   | 169     | 35   | 226     | 47   | 301     | 59   | 402     | 71   | 536     | 83   | 715     | 95   | 953     |
| 12   | 130     | 24   | 174     | 36   | 232     | 48   | 309     | 60   | 412     | 72   | 549     | 84   | 732     | 96   | 976     |

### 4 digits marking ( $\pm 1\%$ 2512,2010,1210,1206,0805)

Each resistor is marked with a four digits code on the protective coating to designate the nominal resistance value. For values below 97 $\Omega$ 6 the R is used as a digit. For values of 100 $\Omega$  or greater, the first 3 digits are significant, and the fourth digit indicates the number of multiple to follow.

#### Example

| RESISTANCE                                                                                | Jumper (0 $\Omega$ ) | 4.7 $\Omega$ | 10 $\Omega$ | 12 $\Omega$ | 100 $\Omega$ | 6800 $\Omega$ | 47000 $\Omega$ | 470000 $\Omega$ |
|-------------------------------------------------------------------------------------------|----------------------|--------------|-------------|-------------|--------------|---------------|----------------|-----------------|
| 3 digits marking<br>$\pm 5\%$ 2512,2010,1210,1206,0805,0603<br>Jumper 1210,1206,0805,0603 | 000                  | 4R7          | 100         | 120         | 101          | 682           | 473            | 474             |
| 4 digits marking<br>$\pm 1\%$ 2512,1210,1206,0805<br>Jumper 2512,2010                     | 0000                 | 4R70         | 10R0        | 12R0        | 1000         | 6801          | 4702           | 4703            |

## FUNCTIONAL DESCRIPTION

### Product characterization

Standard values of nominal resistance are taken from the E96&E24 series for resistors with a tolerance of  $\pm 1\%$ ,  $\pm 5\%$ . The values of the E96/E24 series are in accordance with "IEC publication 60063".

### Derating

The power that the resistor can dissipate depends on the operating temperature; see Fig.2

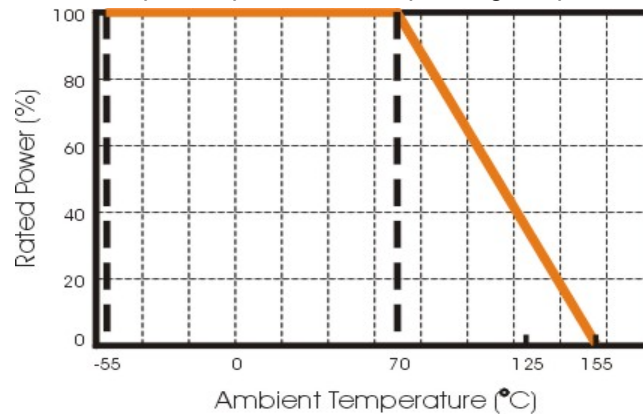


Fig.2 Maximum dissipation in percentage of rated power  
As a function of the ambient temperature

## MOUNTING

Due to their rectangular shapes and small tolerances, Surface Mountable Resistors are suitable for handling by automatic placement systems.

Chip placement can be on ceramic substrates and printed-circuit boards (PCBs).

Electrical connection to the circuit is by individual soldering condition.

The end terminations guarantee a reliable contact.

## Storage and Handling Conditions:

- Products are recommended to be used up within two years since operation date as ensured shelf life. Check solderability in case shelf life extension is needed.
- To store products with following condition:
  - Temperature :5 to 40°C
  - Humidity :20 to 70% relative humidity
- Caution:
  - Don't store products in a corrosive environment such as sulfide, chloride gas, or acid.  
It may cause oxidation of electrode, which easily be resulted in poor soldering.
  - To store products on the shelf and avoid exposure to moisture.
  - Don't expose products to excessive shock, vibration, direct sunlight and so on



## SOLDERING CONDITION

The robust construction of chip resistors allows them to be completely immersed in a solder bath of 260°C for 10 seconds. Therefore, it is possible to mount Surface Mount Resistors on one side of a PCB and other discrete components on the reverse (mixed PCBs).

Surface Mount Resistors are tested for solderability at 235°C during 2 seconds. The test condition for no leaching is 260°C for 30 seconds. Typical examples of soldering processes that provide reliable joints without any damage are given in Fig 3.

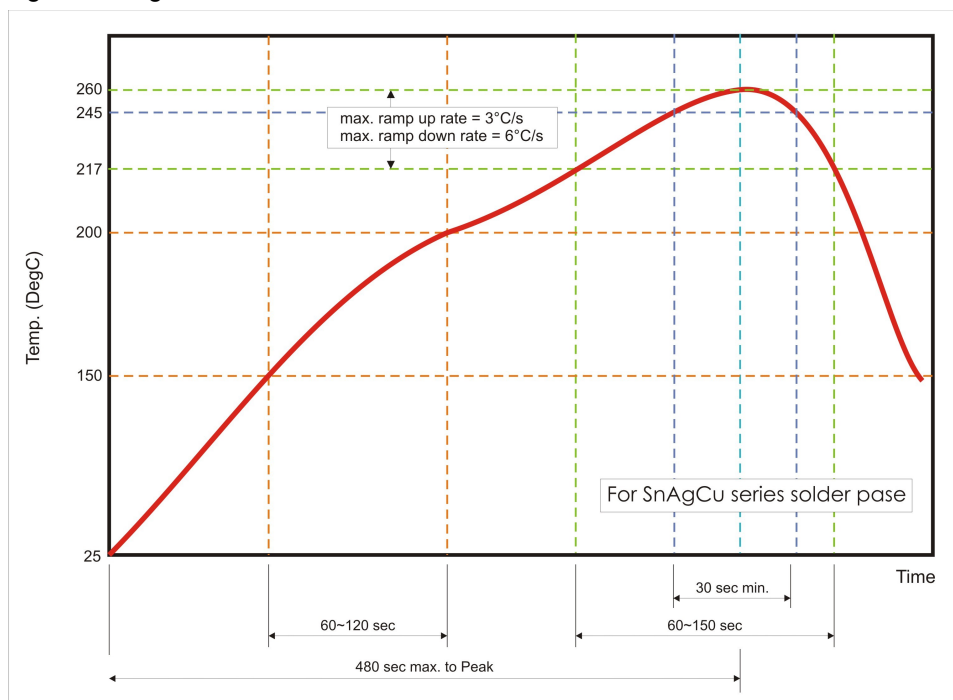
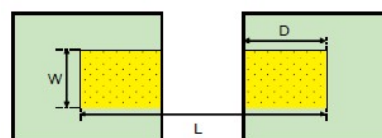


Fig 3. Recommended IR reflow soldering profile for SMT process with SnAgCu series solder paste

## RECOMMENDED SOLDERING PAD DIMENSIONS:

| Series No. | W    | D    | L    |
|------------|------|------|------|
| WF25A      | 3.70 | 2.45 | 7.60 |
| WF20A      | 3.00 | 1.50 | 6.80 |
| WF10A      | 3.00 | 1.30 | 4.70 |
| WF12A      | 1.80 | 1.30 | 4.70 |
| WF08A      | 1.30 | 1.15 | 3.50 |
| WF06A      | 0.90 | 1.00 | 3.00 |
| WF04A      | 0.60 | 0.50 | 1.50 |

Unit: mm



## TEST AND REQUIREMENTS

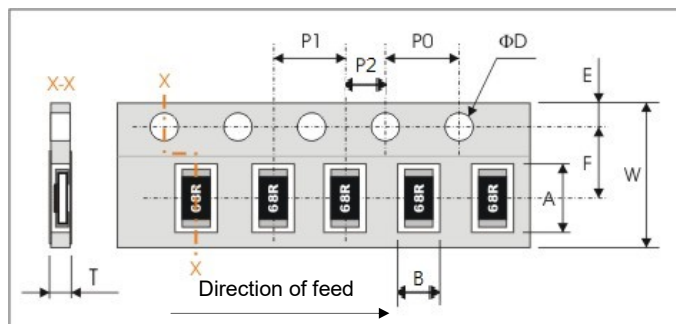
Basic specification : JIS C 5201-1 : 1998

| TEST                                                              | PROCEDURE                                                                                                                                                                                                                                                     | REQUIREMENT                                                                                                                           |
|-------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------|
| <b>Clause 4.8</b><br>Temperature Coefficient of Resistance (TCR ) | Natural resistance change per change in degree centigrade.<br>$\frac{R_2 - R_1}{R_1(t_2 - t_1)} \times 10^6 \text{ (ppm/}^\circ\text{C)}$<br>$R_1$ : Resistance at reference temperature<br>$R_2$ : Resistance at test temperature<br>$t_1$ : 25°C +1°C -1°C. | Refer to quick reference data for T.C.R specification                                                                                 |
| <b>Clause 4.18</b><br>Resistance to soldering heat(R.S.H)         | Un-mounted chips completely immersed for 10±1second in a SAC solder bath at 260°C±5°C.                                                                                                                                                                        | No visible damage<br>J: ΔR/R max. : ≤ ±(1%+0.05Ω)<br>F: ΔR/R max. : ≤ ±(0.5%+0.05Ω)<br>0402 Jumper : ≤ 20mΩ<br>Others Jumper : ≤ 10mΩ |
| <b>Clause 4.17</b><br>Solderability                               | Un-mounted chips completely immersed for 3±0.5 second in a SAC solder bath at 245°C±2°C.                                                                                                                                                                      | Good tinning (>95% covered)<br>No visible damage                                                                                      |
| <b>Clause 4.33</b><br>Bending strength                            | Resistors mounted on a 90mm glass epoxy resin PCB(FR4); bending :<br>0402: 3 mm once for 10 seconds.<br>Others: 2 mm, once for 10 seconds.                                                                                                                    | No visible damage<br>J: ΔR/R max. : ≤ ±(1%+0.05Ω)<br>F: ΔR/R max. : ≤ ±(0.5%+0.05Ω)<br>0402 Jumper : ≤ 20mΩ<br>Others Jumper : ≤ 10mΩ |
| <b>Clause 4.13</b><br>Short time overload                         | 5 × Rated power for 5 sec. Measure resistance after 30 minutes.                                                                                                                                                                                               | J: ΔR/R max.: ≤ ±(2%+0.05Ω)<br>F: ΔR/R max. : ≤ ±(1%+0.05Ω)<br>0402 Jumper : ≤ 20mΩ<br>Others Jumper : ≤ 10mΩ                         |
| <b>Clause 4.25</b><br>Load life (endurance)                       | 1000 +48/-0 hours, loaded with RCWV or Vmax in chamber controller 70±2°C, 1.5 hours on and 0.5 hours off.                                                                                                                                                     | No visible damage<br>J: ΔR/R max. : ≤ ±(3%+0.05Ω)<br>F: ΔR/R max. : ≤ ±(1%+0.05Ω)<br>0402 Jumper : ≤ 20mΩ<br>Others Jumper : ≤ 10mΩ   |
| <b>Clause 4.24</b><br>Load life in Humidity                       | 1000 +48/-0 hours, loaded with RCWV or Vmax in humidity chamber controller at 40°C±2°C and 90~95% relative humidity, 1.5 hours on and 0.5 hours off.                                                                                                          | No visible damage<br>J: ΔR/R max. : ≤ ±(3%+0.05Ω)<br>F: ΔR/R max. : ≤ ±(1%+0.05Ω)<br>0402 Jumper : ≤ 20mΩ<br>Others Jumper : ≤ 10mΩ   |
| <b>Clause 4.19</b><br>Temperature cycling                         | 1. 30 minutes at -55°C±3°C,<br>2. 2~3 minutes at 25°C+5°C-1°C,<br>3. 30 minutes at +155°C±3°C,<br>4. 2~3 minutes at 25°C+5°C-1°C,<br>Total 5 continuous cycles.                                                                                               | No visible damage<br>J: ΔR/R max. : ≤ ±(1%+0.05Ω)<br>F: ΔR/R max. : ≤ ±(0.5%+0.05Ω)<br>0402 Jumper : ≤ 20mΩ<br>Others Jumper : ≤ 10mΩ |
| <b>Clause 4.6</b><br>Insulation Resistance                        | Apply the insulation voltage 100+15Vdc for 1minute.                                                                                                                                                                                                           | $R \geq 1\text{G}\Omega$                                                                                                              |



## PACKAGING

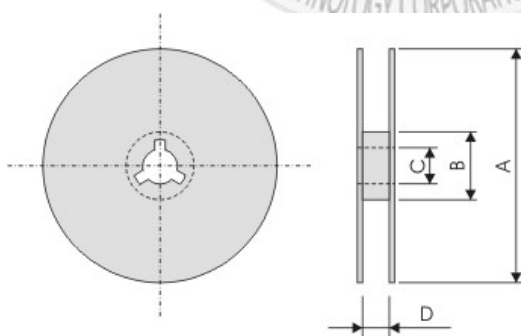
### Tape specifications (unit :mm)



| Series No. | A         | B         | W          | F         | E         |
|------------|-----------|-----------|------------|-----------|-----------|
| WF25A      | 6.70±0.20 | 3.50±0.20 | 12.00±0.30 | 5.50±0.05 | 1.75±0.10 |
| WF20A      | 5.50±0.20 | 2.80±0.20 | 12.00±0.30 | 5.50±0.05 | 1.75±0.10 |
| WF10A      | 3.60±0.20 | 3.00±0.20 | 8.00±0.30  | 3.50±0.05 | 1.75±0.10 |
| WF12A      | 3.60±0.20 | 2.00±0.20 | 8.00±0.30  | 3.50±0.05 | 1.75±0.10 |
| WF08A      | 2.40±0.20 | 1.65±0.20 | 8.00±0.30  | 3.50±0.05 | 1.75±0.10 |
| WF06A      | 1.90±0.20 | 1.10±0.20 | 8.00±0.30  | 3.50±0.05 | 1.75±0.10 |
| WF04A      | 1.20±0.10 | 0.70±0.10 | 8.00±0.30  | 3.50±0.20 | 1.75±0.10 |

| Series No. | P1        | P0        | P2        | ΦD                                    | T         |
|------------|-----------|-----------|-----------|---------------------------------------|-----------|
| WF25A      | 4.00±0.10 | 4.00±0.10 | 2.00±0.10 | Φ1.50 <sup>+0.1</sup> <sub>-0.0</sub> | Max. 1.50 |
| WF20A      | 4.00±0.10 | 4.00±0.10 | 2.00±0.10 | Φ1.50 <sup>+0.1</sup> <sub>-0.0</sub> | Max. 1.00 |
| WF10A      | 4.00±0.10 | 4.00±0.10 | 2.00±0.10 | Φ1.50 <sup>+0.1</sup> <sub>-0.0</sub> | Max. 1.00 |
| WF12A      | 4.00±0.10 | 4.00±0.10 | 2.00±0.10 | Φ1.50 <sup>+0.1</sup> <sub>-0.0</sub> | Max. 1.00 |
| WF08A      | 4.00±0.10 | 4.00±0.10 | 2.00±0.10 | Φ1.50 <sup>+0.1</sup> <sub>-0.0</sub> | Max. 1.00 |
| WF06A      | 4.00±0.10 | 4.00±0.10 | 2.00±0.10 | Φ1.50 <sup>+0.1</sup> <sub>-0.0</sub> | Max. 0.80 |
| WF04A      | 2.00±0.10 | 4.00±0.10 | 2.00±0.10 | Φ1.50 <sup>+0.1</sup> <sub>-0.0</sub> | 0.40±0.05 |

### Reel dimensions



unit: mm

| Symbol       | A          | B         | C        | D        |
|--------------|------------|-----------|----------|----------|
| 7" 8mm tape  | Φ178.0±2.0 | Φ60.0±1.0 | 13.0±0.2 | 9.0+1/-0 |
| 7" 12mm tape | Φ178.0±2.0 | Φ60.0±1.0 | 13.0±0.5 | 13.8±1.5 |