

# APPROVAL SHEET

**WF25U, WF20U, WF10U,**

**$\pm 1\%$ ,  $\pm 0.5\%$ ,  $\pm 0.25\%$ ,  $\pm 0.1\%$ ,  $\pm 0.05\%$**

**TC25**

High Precision Thin Film Chip Resistors

Size 2512, 2010, 1210

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

## FEATURE

1. SMD metal film resistor
2. High reliability and stability of 0.5% and below per customer request
3. High performance of TCR: 25 ppm/K and below per customer request
4. Low current noise
5. +/-0.05% is upon the customer request.

## APPLICATION

- Medical equipment
- Measuring instrument
- Communication device
- Computer
- Printer

## 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 layer that is applied to the top surface of the substrate. The composition of the resistive layer 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 environmental soldering issue, the outer layer of these end terminations is a Lead-free solder .

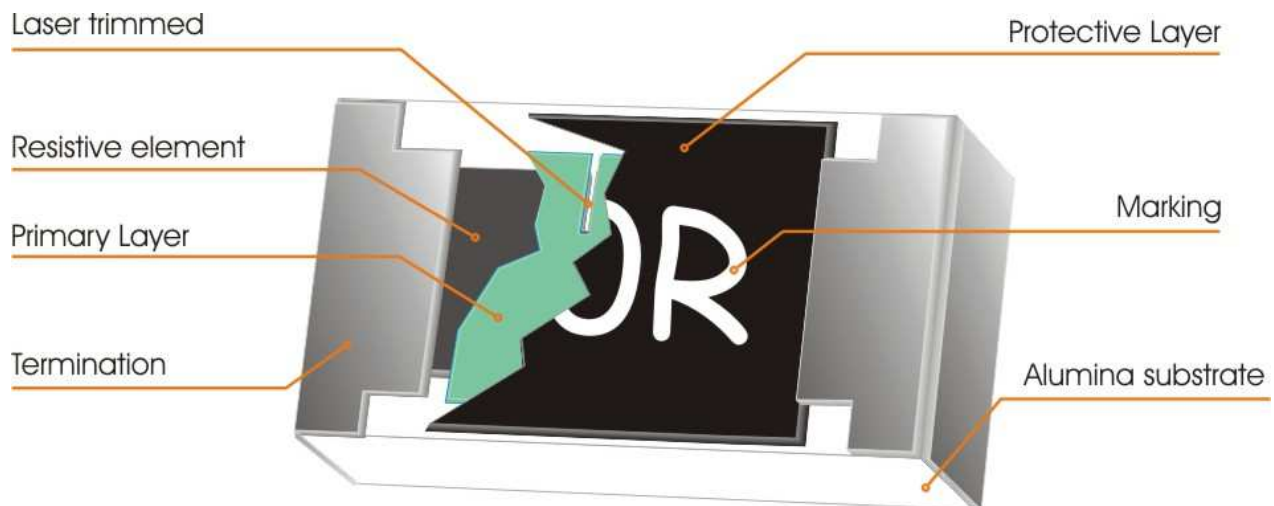


Fig 1. Construction of Chip-R WFxxU

**QUICK REFERENCE DATA**

Item	General Specification		
	WF25U	WF20U	WF10U
Series No.	WF25U	WF20U	WF10U
Size code	2512 ( 6432 )	2010 ( 5025 )	1210 ( 3225 )
Resistance Tolerance	±1%, ±0.5%, ±0.25%, ±0.1%, ±0.05%		
Resistance Range	10Ω ~ 1.5MΩ ( E24 +E192 )	10Ω ~ 1.5MΩ ( E24 +E192 )	10Ω ~ 1MΩ ( E24 +E192 )
TCR (ppm/°C)	+25 ~ -25 ppm/°C		
Max. dissipation at T <sub>amb</sub> =70°C	3/4W	1/2W	1/4W
Max. Operation Voltage (DC or RMS)	200V	200V	200V
Max. Overload Voltage (DC or RMS)	400V	400V	400V
Operation temperature	- 55~ +155°C		

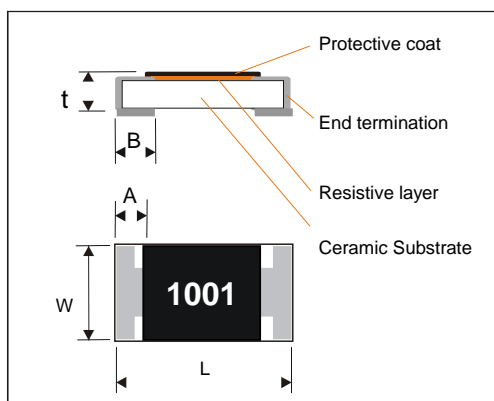
Note :

- This is the maximum voltage that may be continuously supplied to the resistor element, see "IEC publication 60115-8"
- Max. Operation Voltage : So called RCWV (Rated Continuous Working Voltage) is determined by  

$$RCWV = \sqrt{\text{Rated Power} \times \text{Resistance Value}}$$
or Max. RCWV listed above, whichever is lower.
- 1MΩ to 2 MΩ of WF10U is upon the customer request.
- 1MΩ to 3 MΩ of WF25U and WF20U is upon the customer request

**DIMENSIONS:( unit:mm)**

Type	WF25U	WF20U	WF10U
<b>L</b>	<b>6.35 ± 0.10</b>	<b>5.00 ± 0.10</b>	<b>3.10 ± 0.10</b>
<b>W</b>	<b>3.20 ± 0.15</b>	<b>2.50 ± 0.15</b>	<b>2.60 ± 0.15</b>
<b>A</b>	<b>0.60 ± 0.20</b>	<b>0.60 ± 0.20</b>	<b>0.50 ± 0.20</b>
<b>B</b>	<b>0.90 ± 0.25</b>	<b>0.60 ± 0.25</b>	<b>0.50 ± 0.20</b>
<b>t</b>	<b>0.55 ± 0.10</b>	<b>0.55 ± 0.10</b>	<b>0.55 ± 0.10</b>



## MARKING

- **4-digits marking for 2512, 2010, 1210 size**

For E24/E96 series, each resistor is marked with a four digits code on the protective coating to designate the nominal resistance value. For non E24/E96 series, no marking is applied!

### Example

<b>RESISTANCE</b>	10Ω	12Ω	100Ω	6800Ω	47000Ω
<b>4-digits marking</b>	10R0	12R0	1000	6801	4702

## FUNCTIONAL DESCRIPTION

### Product characterization

Standard values of nominal resistance are taken from the E24/E192 series for resistors with a tolerance of  $\pm 1\%$ ,  $\pm 0.5\%$ ,  $\pm 0.25\%$ ,  $\pm 0.1\%$ ,  $\pm 0.05\%$ . The values of the E24/E192 series are in accordance with "IEC publication 60063".

### Derating

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

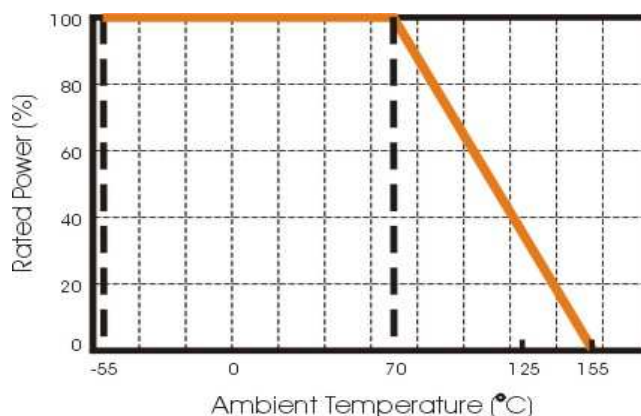


Fig.2 Maximum dissipation in percentage of rated power  
As a function of the ambient temperature

## 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).

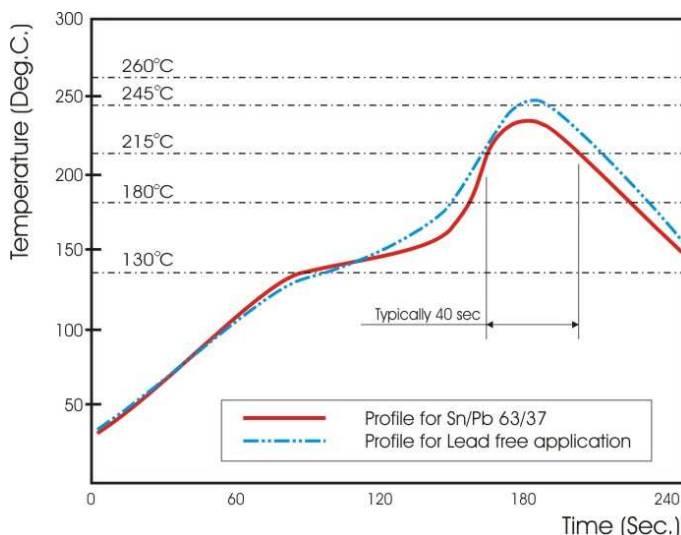
Electrical connection to the circuit is by individual soldering condition.

The end terminations guarantee a reliable contact.

### 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 within lead-free solder bath. 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.



### CATALOGUE NUMBERS

The resistors have a catalogue number starting with .

WF25	U	xxxx	D	T	L
<b>Size code</b> WF25: 2512 WF20: 2010 WF10: 1210	<b>Type code</b> U: TCR 25ppm	<b>Resistance code</b> E192+E24: 3 significant digits followed by no. of zeros 102Ω =1020 37.4KΩ =3742 220Ω =2200	<b>Tolerance</b> F : ±1.0% D : ±0.5% C : ±0.25% B : ±0.1% A : ±0.05%	<b>Packaging code</b> T : Reeled	<b>Termination code</b> L = Sn base (lead free)

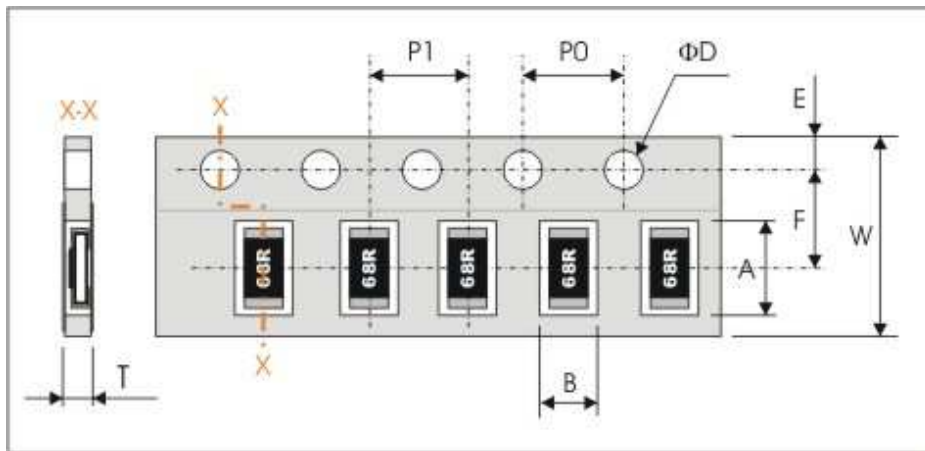
1. Reeled tape packaging: 8mm width paper taping for WF10U, 12mm width plastic taping for WF25U, WF20U  
4,000pcs/reel for WF25U, WF20U; 5,000pcs/reel for WF10U

**TEST AND REQUIREMENTS (JIS C 5201-1 : 1998)**

TEST	PROCEDURE	REQUIREMENT
		Resistor
DC resistance <b>Clause 4.5</b>	DC resistance values measured at the test voltages specified below : <10Ω@0.1V, <100Ω@0.3V, <1KΩ@1.0V, <10KΩ@3V, <100KΩ@10V, <1MΩ@25V, <10MΩ@30V	Within the specified tolerance
Temperature Coefficient of Resistance(T.C.R) <b>Clause 4.8</b>	Natural resistance change per change in degree centigrade. $\frac{R_2 - R_1}{R_1(t_2 - t_1)} \times 10^6 \text{ (ppm/}^\circ\text{C)}$ R <sub>1</sub> : Resistance at reference temperature R <sub>2</sub> : Resistance at test temperature t <sub>1</sub> : 20°C+5°C-1°C t <sub>2</sub> : 125°C+5°C-1°C or -55°C+5°C-1°C	Refer to "QUICK REFERENCE DATA"
Short time overload (S.T.O.L) <b>Clause 4.13</b>	Permanent resistance change after a 5second application of a voltage 2.5 times RCWV or the maximum overload voltage specified in the above list, whichever is less.	ΔR/R max. ±(0.5%+0.05Ω)
Resistance to soldering heat(R.S.H) <b>Clause 4.18</b>	Un-mounted chips completely immersed for 10±1second in a SAC solder bath at 260°C±5°C	no visible damage Δ R/R max. ±(0.1%+0.05Ω)
Solderability <b>Clause 4.17</b>	Un-mounted chips completely immersed for 2±0.5 second in a SAC solder bath at 235°C±5°C	good tinning (>95% covered) no visible damage
Temperature cycling <b>Clause 4.19</b>	30 minutes at -55°C±3°C, 2~3 minutes at 20°C+5°C-1°C, 30 minutes at +155°C±3°C, 2~3 minutes at 20°C+5°C-1°C, total 5 continuous cycles	no visible damage ΔR/R max. ±(0.25%+0.05Ω)
Load life (endurance) <b>Clause 4.25</b>	1000 +48/-0 hours, loaded with RCWV or Vmax in chamber controller 70±2°C, 1.5 hours on and 0.5 hours off	ΔR/R max. ±(0.5%+0.05Ω)
Load life in Humidity <b>Clause 4.24</b>	1000 +48/-0 hours, loaded with RCWV or Vmax in humidity chamber controller at 40°C±2°C and 90~95% relative humidity, 1.5hours on and 0.5 hours off	ΔR/R max. ±(0.5%+0.05Ω)
Bending strength <b>Clause 4.33</b>	Resistors mounted on a 90mm glass epoxy resin PCB(FR4); bending : 3 mm, once for 10 seconds.	ΔR/R max. ±(0.1%+0.05Ω)
Adhesion <b>Clause 4.32</b>	Pressurizing force: 5N, Test time: 10±1sec.	No remarkable damage or removal of the terminations.
Insulation Resistance <b>Clause 4.6</b>	Apply the maximum overload voltage (DC) for 1minute	R ≥ 10G Ω
Dielectric Withstand Voltage <b>Clause 4.7</b>	Apply the maximum overload voltage (AC) for 1 minute	No breakdown or flashover

**PACKAGING**

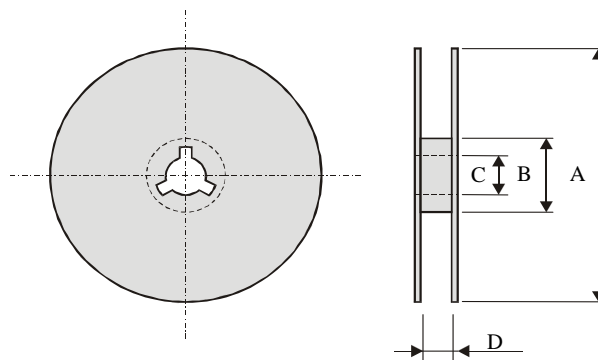
Paper Tape specifications (unit :mm)



Series No.	A	B	W	F	E
WF25	6.90±0.20	3.60±0.20	12.00±0.30	5.50±0.10	1.75±0.10
WF20	5.50±0.20	2.80±0.20	12.00±0.30	5.50±0.10	1.75±0.10
WF10	3.60±0.20	3.00±0.20	8.00±0.30	3.50±0.20	1.75±0.10

Series No.	P1	P0	ΦD	T
WF25	4.00±0.10	4.00±0.10	Φ1.50 <sup>+0.1</sup> <sub>-0.0</sub>	MAX1.2
WF20	4.00±0.10	4.00±0.10	Φ1.50 <sup>+0.1</sup> <sub>-0.0</sub>	MAX1.2
WF10	4.00±0.10	4.00±0.10	Φ1.50 <sup>+0.1</sup> <sub>-0.0</sub>	Max. 1.0

**Reel dimensions**



Symbol	A	B	C	D
(unit : mm)	Φ178.0±2.0	Φ60.0±1.0	13.0±0.2	9.0±0.5

**Taping quantity**

- Chip resistors 4,000 pcs per reel ( WF25U, WF20U )
- Chip resistors 5,000 pcs per reel ( WF10U )