

# APPROVAL SHEET

## WFxxL\_J

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

Thick Film Power Chip Resistor  
Wide Termination  
Size 0612, 1225

Automotive AEC Q200 Compliant  
RoHS 2 Compliant with exemption 7C-I  
Halogen free

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

## FEATURE

1. High power rating to 2W and compact size
2. High reliability and high precision (1%)
3. Compatible with wave and reflow soldering
4. Suitable for lead free soldering
5. Automotive AEC-Q200 compliant
6. RoHS 2 compliant with exemption 7C-I and Halogen free products

## APPLICATION

- Power supply
- Industry controller
- Digital meter, Consumer electronics, M/B
- LED Lighting
- Automotive devices

## 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 at longer sides. For ease of soldering the outer layer of these end terminations is Tin (lead free) alloy.

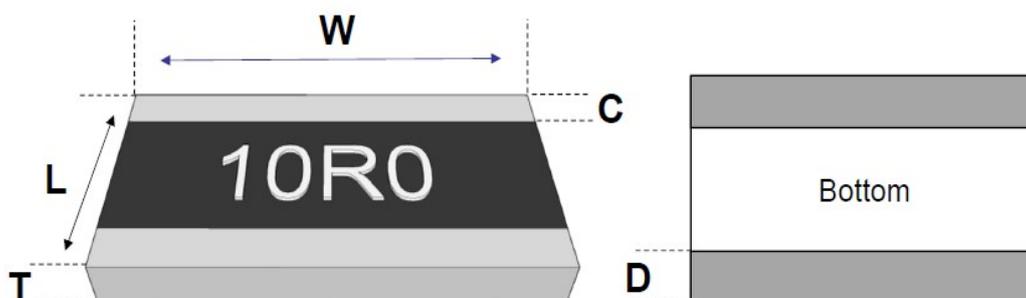


Fig 1. Construction of Chip-R

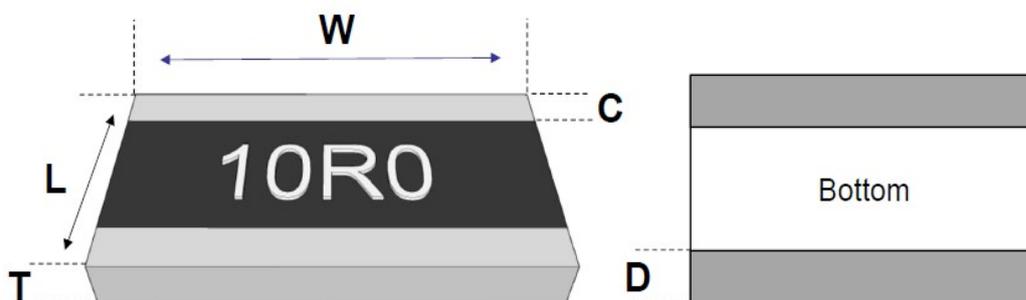
### QUICK REFERENCE DATA

Type	Size	Rating at 70°C (W)	Max. Work (V)	Max. Overload (V)	Resistance Tolerance	Temperature Coefficient (ppm/°C)	Resistance		Standard Resistance Values
							Min. (Ω)	Max. (Ω)	
WF25L	1225	2W	200V	400V	±1%(F)	±200	1	4.64	E24/E96
					±1%(F)	±100	4.7	1M	E24/E96
					±5%(J)	±200	1	4.3	E24
					±5%(J)	±100	4.7	1M	E24
WF12L	0612	1W	200V	400V	±1%(F)	±200	1	4.64	E24/E96
					±1%(F)	±100	4.7	1M	E24/E96
					±5%(J)	±200	1	4.3	E24
					±5%(J)	±100	4.7	1M	E24

Note:

- (i)  $E = \sqrt{P * R}$  or Max. Working Voltage whichever is lower.
- (ii) E : Working Voltage(V) , P : Rated Power (W) , R : Resistance Value(Ω)
- (iii) Solder-pad and trace size influences should be evaluated, and board surface temperature should keep not exceed 105°C when working

### MECHANICAL DATA



Unit : mm

Type	L	W	C	D	T
WF25L	3.10±0.20	6.30±0.20	0.45±0.20	0.75±0.20	0.60±0.15
WF12L	1.60±0.20	3.20±0.20	0.25±0.20	0.40±0.20	0.60±0.15

## MARKING

Each resistor is marked with a four-digit code on the protective coating to designate the nominal resistance value

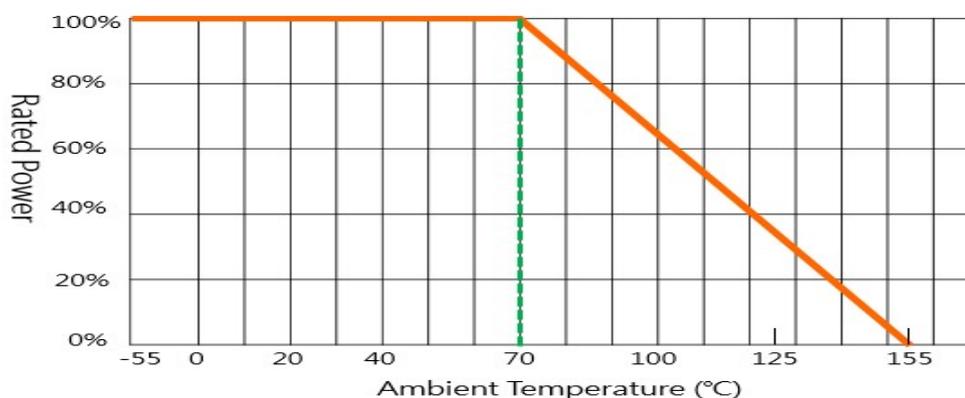
Example : **1000** →  $100 \times 10^0 = 100\Omega$

Example : **4R70** →  $4.7 \times 10^0 = 4.7\Omega$

## FUNCTIONAL DESCRIPTION

### Derating curve

The power that the resistor can dissipate depends on the operating temperature.



## CATALOGUE NUMBERS

The resistors have a catalogue number starting with

WF12	L	10R0	F	T	L	J
<b>Size code</b> WF25 : 1225 WF12 : 0612	<b>Type code</b> L: wide termination	<b>Resistance code</b> ±5%, E24: 2 significant digits followed by no. of zeros and a blank  220Ω = 221_ (“_” means a blank) ±1%, E24+E96: 3 significant digits followed by no. of zeros E24: 102Ω = 1020 E96: 37.4KΩ = 3742	<b>Tolerance</b> J : ±5% F : ±1%	<b>Packaging code</b> T : 7" reeled in tape Q: 10" Reeled taping G: 13" Reeled taping	<b>Termination code</b> L = Sn base (lead free)	<b>Special code</b> J = AEC-Q200 compliant

## 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 3 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.

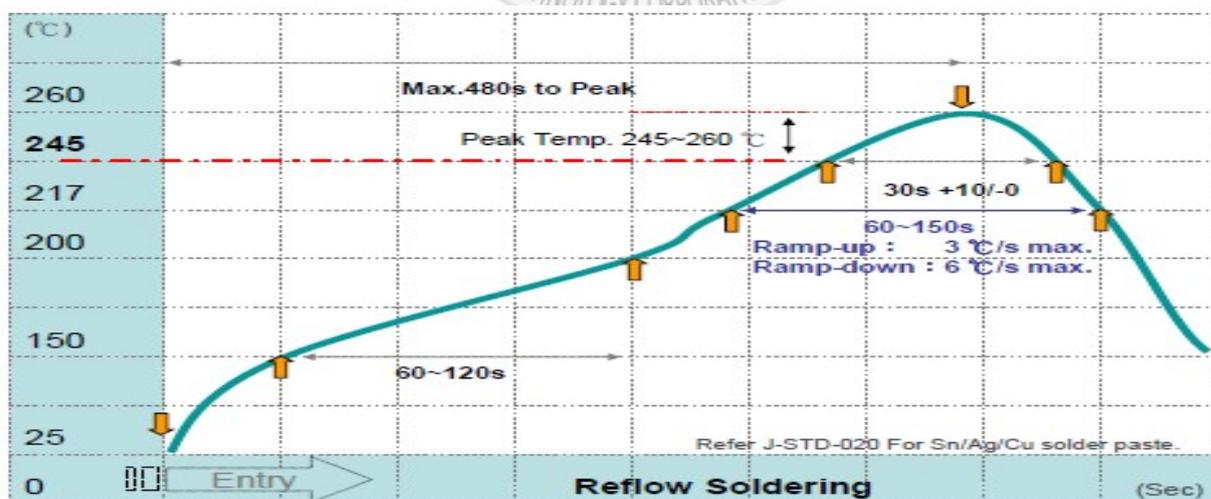
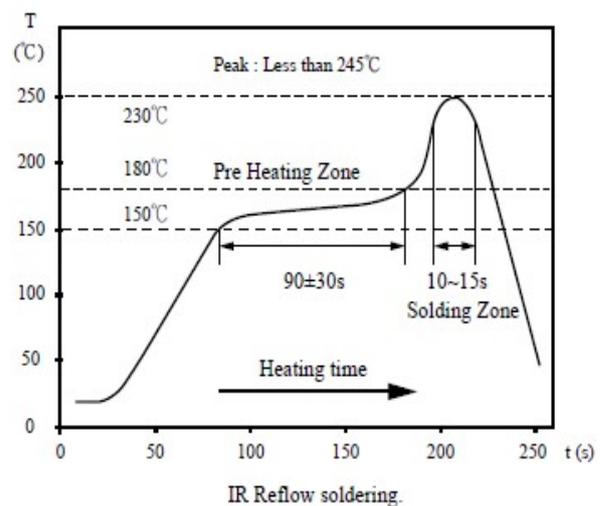
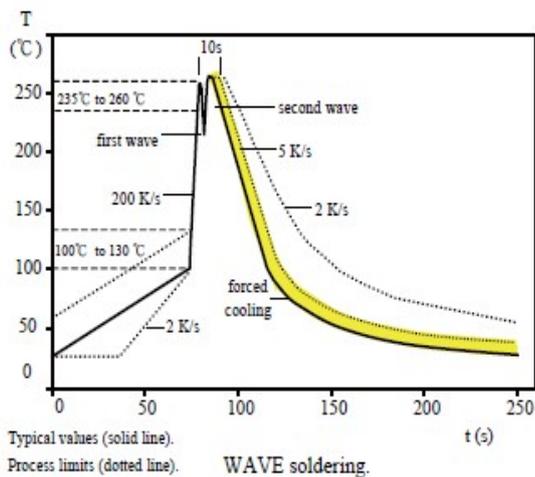


Fig 3. Infrared soldering profile for Chip Resistors

## TEST AND REQUIREMENTS ( AEC Q200 )

Test	Specification	Refer Methods (AEC-Q200. IEC 60115)
DC Resistance	J : $\pm 5\%$ F : $\pm 1\%$	<b>AEC-Q200 TABLE 7.1</b> <b>IEC 60115-1 / JIS C 5201-1, Clause 4.5</b> Measure the resistance Value.
High Temperature Exposure (Storage)	J : $\Delta R \leq \pm(3\%+0.1\Omega)$ F : $\Delta R \leq \pm(1\%+0.1\Omega)$	<b>AEC-Q200 TABLE 7.3</b> 1000 hrs. @ T=155°C. Unpowered. Measure at 24 $\pm 2$ hours after test end.
Temperature Cycling	J : $\Delta R \leq \pm(1\%+0.05\Omega)$ F : $\Delta R \leq \pm(0.5\%+0.05\Omega)$ No mechanical damage.	<b>AEC-Q200 TABLE 7.4</b> 1000 Cycles (-55°C to +125°C). Measure at 24 $\pm 2$ hours after test end.
Moisture Resistance	J : $\Delta R \leq \pm(1\%+0.05\Omega)$ F : $\Delta R \leq \pm(0.5\%+0.05\Omega)$	<b>AEC-Q200 TABLE 7.6</b> Test 65°C /80~100%RH/10Cycles. Measure at 24 $\pm 2$ hours after test end. (24hrs/cycle).
Biased Humidity	J : $\Delta R \leq \pm(3\%+0.1\Omega)$ F : $\Delta R \leq \pm(1\%+0.1\Omega)$	<b>AEC-Q200 TABLE 7.7</b> 1000 hours 85°C/85%RH, 10% of operating power. Measure at 24 $\pm 2$ hours after test end.
Operational Life	J : $\Delta R \leq \pm(3\%+0.1\Omega)$ F : $\Delta R \leq \pm(1\%+0.1\Omega)$	<b>AEC-Q200 TABLE 7.8</b> Test 1000hr @ TA=125°C at specified rated power. Measurement at 24 $\pm 2$ hours after test end.
External Visual	No visual damage and refer marking code.	<b>AEC-Q200 TABLE 7.9</b> Inspect appearance, marking and workmanship.
Physical Dimension	Within the spec.	<b>AEC-Q200 TABLE 7.10</b> Verify physical dimensions to the applicable device detail specification.
Mechanical Shock	Within product specification tolerance and no visible damage.	<b>AEC-Q200 TABLE 7.13</b> Test Peak value: 100g's, Wave: Half-sine, Duration: 6ms, Velocity: 12.3ft/sec.
Vibration	No mechanical damage.	<b>AEC-Q200 TABLE 7.14</b> 5 g's for 20 min., 12 cycles each of 3 orientations. Test from 10-2000 Hz.
Resistance to Solder Heat	J : $\Delta R \leq \pm(1\%+0.05\Omega)$ F : $\Delta R \leq \pm(0.5\%+0.05\Omega)$ No mechanical damage.	<b>AEC-Q200 TABLE 7.15</b> Solder dipping @ 260°C $\pm 5^\circ\text{C}$ for 10sec. $\pm 1$ sec.

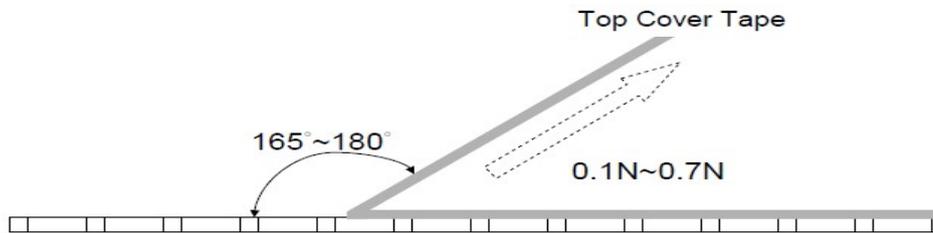
Test	Specification	Refer Methods (AEC-Q200. IEC 60115)
Thermal Shock	J : $\Delta R \leq \pm(1\%+0.05\Omega)$ F : $\Delta R \leq \pm(0.5\%+0.05\Omega)$ No mechanical damage.	<b>AEC-Q200 TABLE 7.16</b> -55 to 155°C, dwell time 15min. Max transfer time 20sec, 300cycles.
ESD	$\Delta R \leq \pm 5\%$ No mechanical damage.	<b>AEC-Q200-002</b> Test contact min. 2KV.
Solder Ability	Over 95% of termination must be covered with solder.	<b>AEC-Q200 TABLE 7.18</b> a) Baking 155°C 4H, dipping 235°C 5s b) Steam 1H, dipping 215°C 5s c) Steam 1H, dipping 260°C 7s
Flammability	Refer UL-94.	<b>AEC-Q200 TABLE 7.20</b> UL-94 V-0 or V-1 are acceptable.
Board Flex	J : $\Delta R \leq \pm(1\%+0.05\Omega)$ F : $\Delta R \leq \pm(0.5\%+0.05\Omega)$ No mechanical damage.	<b>AEC-Q200 TABLE 7.21</b> Bending 2mm.
Terminal Strength	No mechanical damage	<b>AEC-Q200 TABLE 7.22</b> Force 1.8 Kg for 60 seconds.
Short Time Overload	J : $\Delta R \leq \pm(2\%+0.5m\Omega)$ F : $\Delta R \leq \pm(1\%+0.5m\Omega)$	<b>IEC 60115-1, Clause 4.13</b> 5 × Rated power for 5 seconds
Temperature Coefficient of Resistance	TCR within the spec. (ppm/°C)	<b>IEC 60115-1, Clause 4.8</b> Test temperature : (T1)25°C~(T2)+155°C $TCR(ppm/°C) = (R_2-R_1)/R_1 \times 1 / (T_2-T_1) \times 10^6$

## PACKAGING

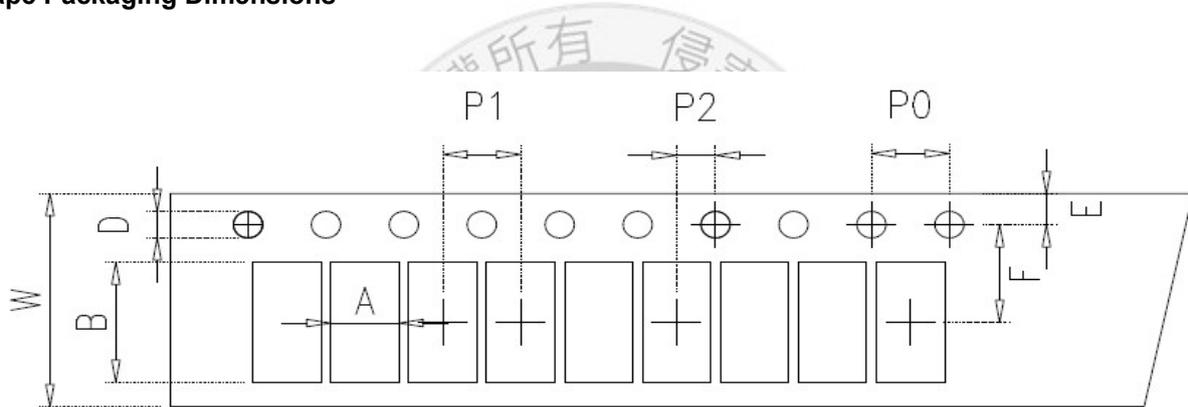
### Peel Strength of Top Cover Tape

The peel speed shall be about 300 mm/min

The peel force of top cover tape shall between 0.1 to 0.7N



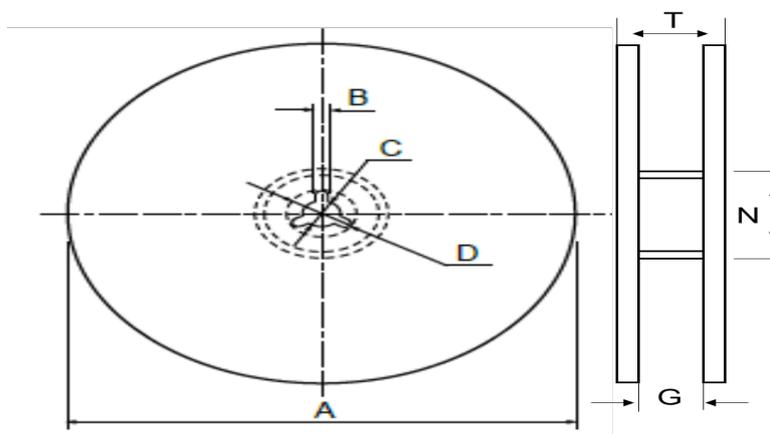
### Tape Packaging Dimensions



unit:mm

Size	A	B	W	F	E	P1	P2	P0	D
0612	2.00±0.20	3.60±0.20	8.00±0.30	3.50±0.05	1.75±0.10	4.00±0.10	2.00±0.05	4.00±0.10	1.50+0.10/-0
1225	3.50±0.20	6.70±0.20	12.00±0.30	5.50±0.05	1.75±0.10	4.00±0.10	2.00±0.05	4.00±0.10	1.50+0.10/-0

## Reel dimensions



unit:mm

Size	Packaging Q'ty	A	N	C	D	B	G	T
0612	5kpcs/Reel	178.0±2.0	60.0±0.5	13.0±0.5	20(Min.)	2.0±0.5	10.0±1.5	14.9max.
	10kpcs/Reel	254.0±2.0	100.0±1.0	13.5±0.5	20(Min.)	2.0±0.5	10.0±1.5	14.9max.
	20kpcs/Reel	330.0±2.0	100.0±1.0	13.5±0.5	20(Min.)	2.0±0.5	10.0±1.5	14.9max.
1225	4kpcs/Reel	178.0±2.0	60.0±0.5	13.0±0.5	20(Min.)	2.0±0.5	13.8±1.5	16.7max.
	8kpcs/Reel	254.0±2.0	100.0±0.5	13.5±0.5	20(Min.)	2.0±0.5	13.8±1.5	20.0max.
	16kpcs/Reel	330.0±2.0	100.0±1.0	13.5±0.5	20(Min.)	2.0±0.5	13.8±1.5	20.0max.

## Storage & Handling

Products are recommended to be used up within one year as ensured shelf life.

Check solder ability in case shelf life extension is needed.

To store products with following condition:

Temperature:5 to 40°C ; Humidity: 20 to 70% relative humidity.

### Precaution for use :

The AEC-Q200 series resistors is mainly used on general automotive equipment without safety considerations. Please contact our company in advanced if you intend to use resistor for designing the equipment which may damage itself and the safety of third party. If necessary, please consider to add the protect circuit in devising process and obtaining fully safety evaluation. The contents of the acknowledgment is only used for our parent company, marketing subsidiaries and official marketing agents who purchase our products. Not applicable for the other nonofficial channels.

※ All product specification and data are subject to change without notice