

# APPROVAL SHEET

**WK25V, WK20V, WK12V, WK08V, WK06V**

**±5%, ±2%, ±1%**

Thick Film High Voltage Chip Resistors  
Automotive Grade AEC Q200 Compliant  
Size 2512, 2010, 1206, 0805, 0603

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

## FEATURE

1. Special material and design for high working voltage require.
2. Compatible with flow and reflow soldering
3. Suitable for lead free soldering.
4. High limiting voltage
5. Automotive AEC Q200 compliant

## APPLICATION

- Power supply
- Automotive industry
- Measurement instrument
- Back light inverter
- Medical or 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.

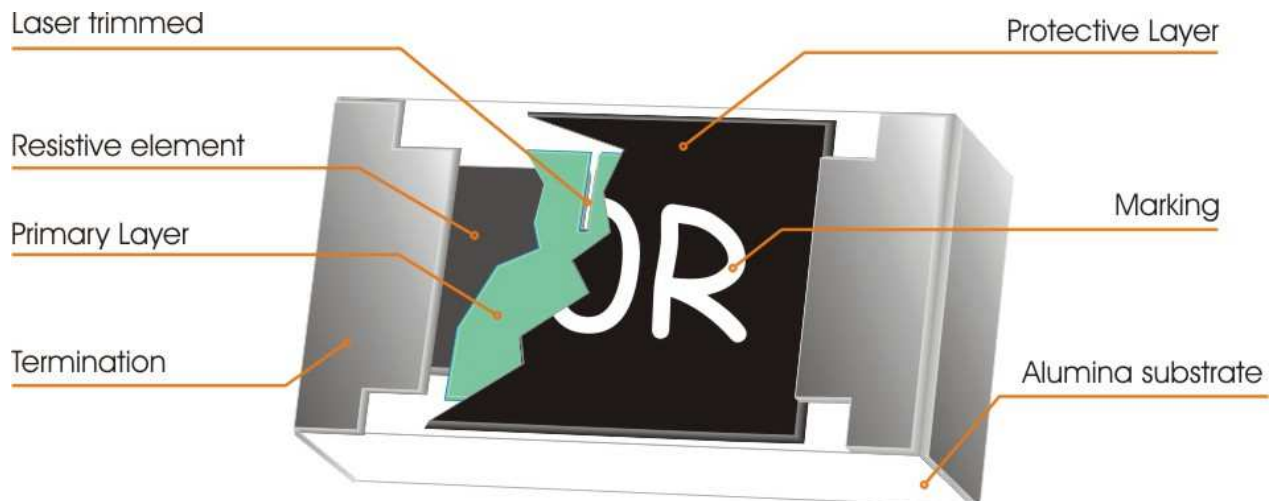


Fig 1. Construction of Chip-R

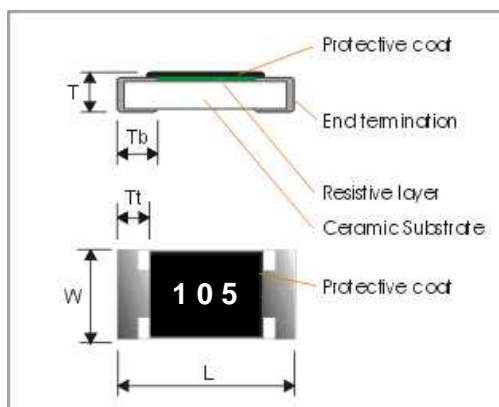
**QUICK REFERENCE DATA**

Item	General Specification				
Series No.	WK25V	WK 20V	WK12V	WK08V	WK06V
Size code	2512(6432 )	2010 ( 5025 )	1206 ( 3216 )	0805 ( 2012 )	0603 (1608)
Resistance Tolerance	±1%, ±2%, ±5%	±1%, ±2%, ±5%	±1%, ±2%, ±5%	±1%, ±2%, ±5%	±1%, ±2%, ±5%
Resistance Range	±5%: 47Ω ~ 51 MΩ ( E24) ±1%, ±2%: 47Ω ~ 10 MΩ (E24+E96)				47Ω ~10 MΩ
TCR (ppm/°C)					
+500~ -200	47Ω ~ 97.6Ω	-	-	-	-
±200	100Ω ~ 549Ω	47Ω ~ 464Ω	47Ω ~ 97.6Ω	47Ω ~ 97.6Ω	47Ω ~ 464Ω
±100	560Ω ~ 51MΩ	470Ω ~ 51MΩ	100Ω ~ 51MΩ	100Ω ~ 51MΩ	470Ω ~ 10MΩ
Max. Dissipation at T <sub>amb</sub> =70°C	1 W	1/2 W	1/4 W	1/8 W	1/10W
Max. Operation Voltage (DC or RMS)	800V	500V	500V	400V	200V
Max. Overload Voltage (DC or RMS)	1600V	1000V	1000V	800V	400V
Climatic category (IEC 60068)	55/155/56				

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

$$RCWV = \sqrt{\text{Rated Power} \times \text{Resistance Value}} \text{ or Max. RCWV listed above, whichever is lower.}$$

**MECHANICAL DATA (unit : mm)**

Symbol	WK25V	WK20V	WK12V	WK08V	WK06V
L	6.30 ± 0.15	5.00 ± 0.15	3.20 ± 0.15	2.00 ± 0.10	1.60 ± 0.10
W	3.20 ± 0.15	2.50 ± 0.150	1.60 ± 0.15	1.25 ± 0.10	0.80 +0.15/-0.05
T	0.55 ± 0.15	0.55 ± 0.15	0.55 ± 0.10	0.55 ± 0.10	0.45 ± 0.10
Tt	0.60 ± 0.20	0.60 ± 0.20	0.50 ± 0.25	0.40 ± 0.20	0.30 ± 0.10
Tb	0.60 ± 0.20	0.60 ± 0.20	0.50 ± 0.25	0.40 ± 0.20	0.30 ± 0.10

## MARKING

For E24 series, Each resistor is marked with a three–digit code on the protective coating to designate the nominal resistance value.

For E96 series, Each resistor is marked with a four–digit code on the protective coating to designate the nominal resistance value. **WK06V E96 has no marking!**

Example:

$$105 = 1M\Omega$$

## FUNCTIONAL DESCRIPTION

### Product characterization

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

### Derating curve

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

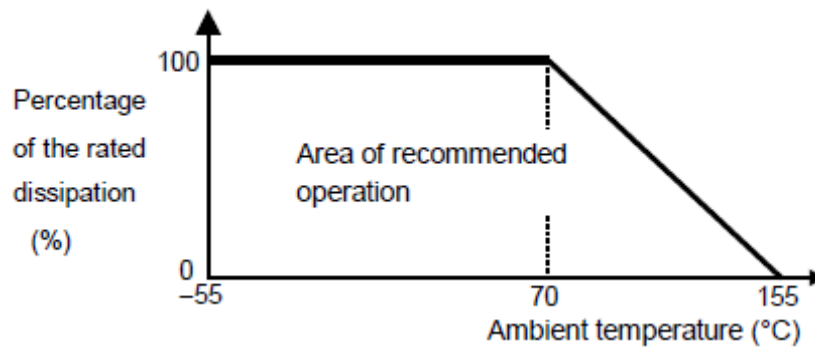


Figure 2 Maximum dissipation in percentage of rated power as a function of the ambient temperature

## MOUNTING

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. 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.

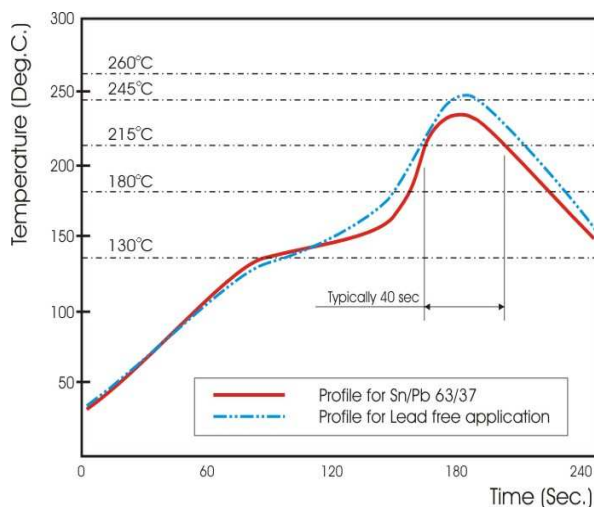


Fig 3. Infrared soldering profile

### CATALOGUE NUMBERS

The resistors have a catalogue number starting with .

WK25	V	105	J	T	L	J
<b>Size code</b>	<b>Type code</b>	<b>Resistance code</b>	<b>Tolerance</b>	<b>Packaging code</b>	<b>Termination code</b>	<b>Special code</b>
WK25 : 2512 WK20 : 2010 WK12 : 1206 WK08 : 0805 WK06 : 0603	V :High Voltage	5%, E24: 2 significant digits followed by no. of zeros  100Ω = 101_ 10KΩ = 103  1%, E24+E96: 3 significant digits followed by no. of zeros  100Ω =1000 37.4KΩ =3742	J : ±5% G : ±2% F : ±1%	T : 7" inch reel  1206:paper tape, 5kpcs/reel  2010,2512 :plastic tape, 4kpcs/reel	L = Sn base (lead free)	J = Automotive grade AEC Q200 compliant

Tape packaging WK12, WK08, WK06 : 8mm width paper taping 5,000pcs per reel.

WK25 ; WK20: 12mm width plastic taping 4,000pcs per reel.

Marking code : For E24 series , 3 digit marking code for J tol.. E96 series, 4 digit marking code for F tol.

**TEST AND REQUIREMENTS – refer to AEC Q200 test standard**

Table-4(1)

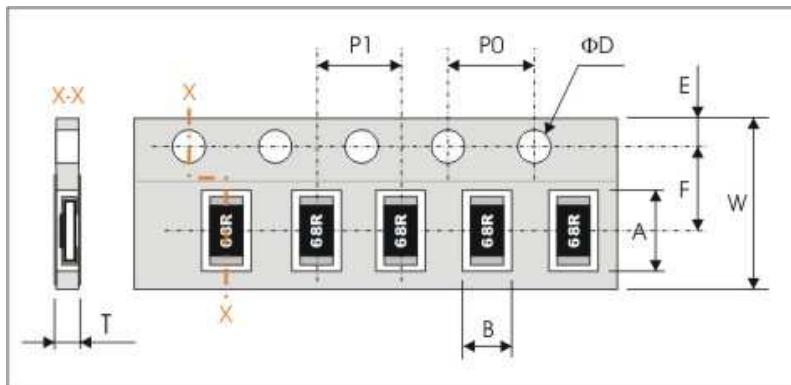
No.	Test items	Condition of test	Performance requirements
1	High temperature exposure AEC Q200 - No.3	MIL-STD-202 Method 108 Ambient temperature: 155±2°C, Condition: Without load, Duration: 1000 <sup>+48</sup> <sub>0</sub> h Interval measurements: 250 h and 500 h	ΔR/R: Within ± (3%+0.1Ω) No visible damage
2	Temperature cycling AEC Q200 - No.4	JESD22 Method JA-104 Temperature: -55±3°C / 125±2°C, Dwell time: 30min maximum at each temp. Transition time: 1 min. max. Number of cycles: 1000 cycles. Interval measurements: 250 cy and 500 cy	ΔR/R: Within ± (1%+0.05Ω) No visible damage
3	Bias humidity AEC Q200 – No.7	MIL-STD-202 Method 103 Condition: 85°C & 85% R.H. Test power: 10% of rated power shall be applied for continuously. Duration: 1,000 <sup>+48</sup> <sub>0</sub> h Interval measurements: 250 h and 500 h The voltage coefficient shall be also measured.	ΔR/R: Within ± (3%+0.1Ω) No visible damage
4	Operational life AEC Q200 – No.8	MIL-STD-202 Method 108 Ambient temperature: 125±2°C The applied voltage shall be the voltage to be calculated at 35% of rated dissipation or the limiting element voltage whichever is the smaller. Condition: The voltage shall be applied for continuously. Duration: 1000 <sup>+48</sup> <sub>0</sub> h Interval measurements: 250 h and 500 h The voltage coefficient shall be also measured.	ΔR/R: Within ± (3%+0.1Ω) No visible damage
5	Dimensions AEC Q200 – No.10	JESD22 Method JB-100	As in Table-3
6	Resistance to Solvents AEC Q200 – No.12	MIL-STD-202 Method 215 Solvent: 2-propanol at 25°C Immersion time: 3 min Brush: 10 times brushing Immersion and brush cycle: 3cycle	ΔR/R: Within ± (1%+0.05Ω) No visible damage
7	Mechanical Shock AEC Q200 – No.13	MIL-STD-202 Method 213 Waveform: half sine, Peak value 100G, Normal duration 6ms Condition: XX'YY'ZZ', 10times each	ΔR/R: Within ± (1%+0.05Ω) No visible damage
8	Vibration AEC Q200 – No.14	MIL-STD-202 Method 204 Peak acceleration and Sweep time: 5 g/s for 20 min , Frequency 10Hz to 2000Hz, Condition: 12 cycles each of 3 orientations	ΔR/R: Within ± (1%+0.05Ω) No visible damage
9	Resistance to soldering heat AEC Q200 - No.15	MIL-STD-202 Method 210 Solder bath temp: 260±5°C Immersed time: 10±1s	ΔR/R: Within ± (1%+0.05Ω) No visible damage

Table-4(2)

No	Test items	Condition of test	Performance requirements
10	ESD test AEC Q200 – No.17	AEC-Q200-002 Human body model, 2 Kohm, 150 pF, Test voltage: 0603: 600V, 0805: 1500V 1206/2010/2512: 3000V	$\Delta R/R$ : Within $\pm (1\%+0.05\Omega)$ No visible damage
11	Solderability AEC Q200 – No.18	J-STD-002 a) Bake the sample for 155 °C dwell time 4h / solder dipping 235°C/ 5s. Solder: Sn96.5-Ag3-Cu0.5 b) Category 3, Solder dipping 215°C/ 5s. Solder: Sn63Pb37 c) Category 3, Solder dipping 260°C/ 7s.	The surface of terminal immersed shall be min. of 95% covered with a new coating of solder.
12	Electrical Characterization AEC Q200 - No.19	1. D.C. Resistance 2. Temperature Coefficient of Resistance -55 °C / +20 °C +20 °C / +155°C	1. The resistance value shall correspond with the rated resistance taking into account the specified tolerance. 2. As in Table-1
13	Bending strength AEC Q200 – No.21	AEC-Q200-005 Bending value 2mm Holding time: 60sec.	$\Delta R/R$ : Within $\pm (1\%+0.05\Omega)$ No visible damage
14	Adhesion AEC Q200 – No.22	AEC-Q200-006 Pressurizing force: 0603: 10N, 0805/1206/2010/2512: 17.7N. time: 60sec	$\Delta R/R$ : Within $\pm (1\%+0.05\Omega)$ No remarkable damage or removal of the terminations

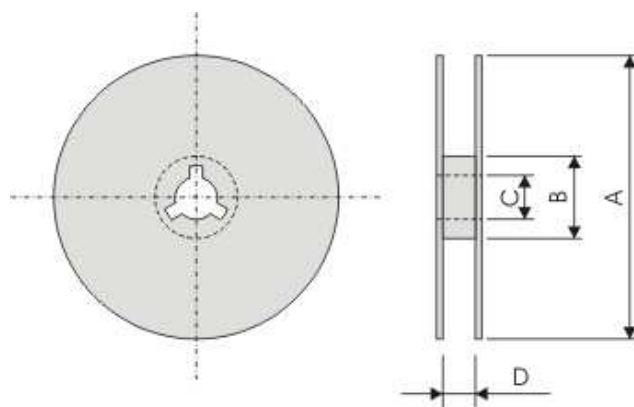
**PACKAGING**

Tape specifications (unit :mm)



Series No.	A	B	W	F	E
WK25V	6.90±0.20	3.60±0.20	12.00±0.30	5.50±0.10	1.75±0.10
WK20V	5.50±0.20	3.10±0.20			
WK12V	3.60±0.20	2.00±0.15	8.00±0.30	3.50±0.20	1.75±0.10
WK08V	2.50±0.20	1.65±0.15	8.00±0.30	3.50±0.20	1.75±0.10
WK06V	1.90±0.20	1.15±0.15	8.00±0.30	3.50±0.20	1.75±0.10
Series No.	P1	P0	ΦD	T	
WK25V	4.00±0.10	4.00±0.10	Φ1.50 <sup>+0.1</sup> <sub>-0.0</sub>	1.1±0.15	
WK20V					
WK12V				Max. 1.0	
WK08V					
WK06V				Max. 0.8	

**Reel dimensions**



(unit : mm)

Reel / Tape	A	B	C	D
7" reel for 12mm tape	Φ180.0+0/-1.5	Φ60.0+1/0	13.0±0.2	13+1/0
7" reel for 8mm tape				9+1/0



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