



Description

The resistors are constructed in a high grade ceramic body (aluminium 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 within tolerance by laser cutting 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.

**RoHS
Compliant**

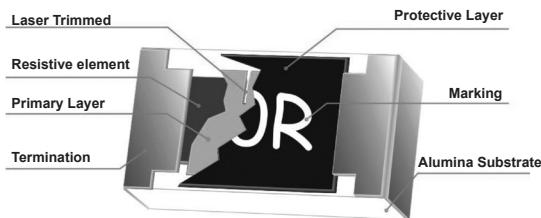
Features

- High power rating and low TCR
- High reliability and stability
- Reduced size of final equipment

Application

- Power supply, PDA, Digital meter
- Computer, Automotives, Battery charger
- DC-DC power converter

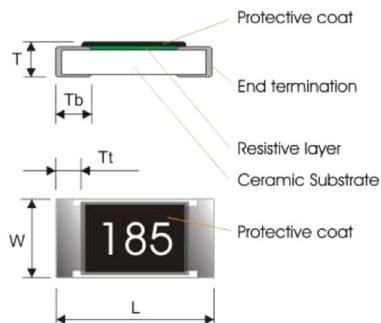
Construction of Chip-R



Quick Reference Data

Item	General Specification					
Series No.	WW25W	WW20W	WW10W	WW12W	WW08W	WW06W
Size code	2512 (6432)	2010 (5025)	1210 (3225)	1206 (3216)	0805 (2012)	0603 (1608)
Resistance Tolerance	$\pm 5\%$, $\pm 1\%$					
Resistance Range	$0.01\Omega \sim 0.91\Omega$, E24					
TCR (ppm/ $^{\circ}\text{C}$)	10 - 20m Ω : ± 1000 22 - 39m Ω : ± 600 40 - 47m Ω : ± 200 50 - 91m Ω : ± 100 100 - 910m Ω : ± 100	10 - 20m Ω : ± 1000 22 - 39m Ω : ± 600 40 - 47m Ω : ± 200 50 - 91m Ω : ± 100 100 - 910m Ω : ± 100	10 - 20m Ω : ± 600 22 - 39m Ω : ± 400 40 - 47m Ω : ± 200 50 - 91m Ω : ± 100 100 - 910m Ω : ± 100	10 - 20m Ω : ± 1000 22 - 39m Ω : ± 600 40 - 47m Ω : ± 200 50 - 91m Ω : ± 100 100 - 910m Ω : ± 100	10 - 20m Ω : ± 1000 22 - 39m Ω : ± 600 40 - 47m Ω : ± 400 50 - 91m Ω : ± 200 100 - 910m Ω : ± 100	$50 - 91\text{m}\Omega$: ± 400 $100 - 910\text{m}\Omega$: ± 200
Max. dissipation @ $T_{\text{amb}} = 70^{\circ}\text{C}$	1W	3/4W	2/3 W	1/3 W	1/4 W	1/8 W
Operation Temperature	$- 55^{\circ}\text{C}$ to $+155^{\circ}\text{C}$					

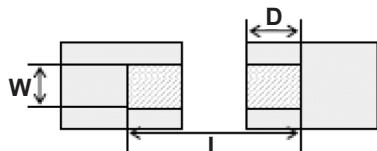
Diagram



Symbol	WW25W	WW20W	WW10W	WW12W	WW08W	WW06W
L	6.3 ± 0.2	5 ± 0.2	3.1 ± 0.1	3.1 ± 0.1	2 ± 0.1	1.6 ± 0.1
W	3.1 ± 0.2	2.5 ± 0.2	2.6 ± 0.1	1.6 ± 0.1	1.25 ± 0.1	0.8 ± 0.1
T	0.6 ± 0.15	0.6 ± 0.1	0.55 ± 0.1	0.55 ± 0.1	0.5 ± 0.1	0.45 ± 0.1
Tt	0.6 ± 0.25	0.6 ± 0.25	0.5 ± 0.25	0.5 ± 0.25	0.4 ± 0.2	0.3 ± 0.2
Tb	0.9 ± 0.25	0.6 ± 0.25	0.5 ± 0.25	0.5 ± 0.25	0.4 ± 0.2	0.3 ± 0.2

Dimensions : Millimetres

Recommended Solder Pad Dimensions



Symbol	WW25W	WW20W	WW10W	WW12W	WW08W	WW06W
W	3.7mm	3mm	3mm	1.8mm	1.3mm	0.9mm
D	1.6mm	1.5mm	1.3mm	1.3mm	1.15mm	1mm
L	7.6mm	6.8mm	4.7mm	4.7mm	3.5mm	3mm

Marking

4-digits marking for 2512, 2010, 1210, 1206, 0805 size

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

3-digits marking for 0603 size

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

Resistance Marking (E-24 Series)

4 digit marking for $\pm 1\%$, $\pm 5\%$. 0805, 1206, 1210, 2010, 2512

Examples. **R150 = 150m Ω** , **R20 = 20m Ω**

3 digit marking for $\pm 1\%$, $\pm 5\%$ 0603

Example. **R12 = 120m Ω** , **R50 = 500m Ω**

3 digit marking for $\pm 1\%$, $\pm 5\%$ 0603 (47m Ω ~ 91m Ω)

Examples. **20M = 20m Ω**

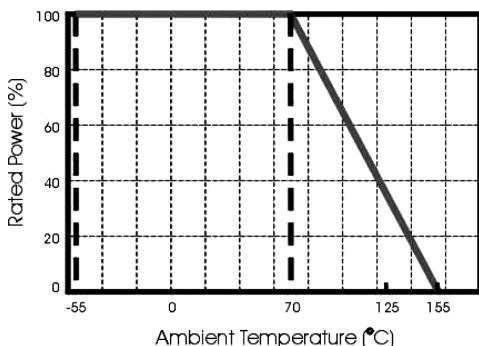
Functional Description

Product characterization

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

Derating

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



Mounting

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

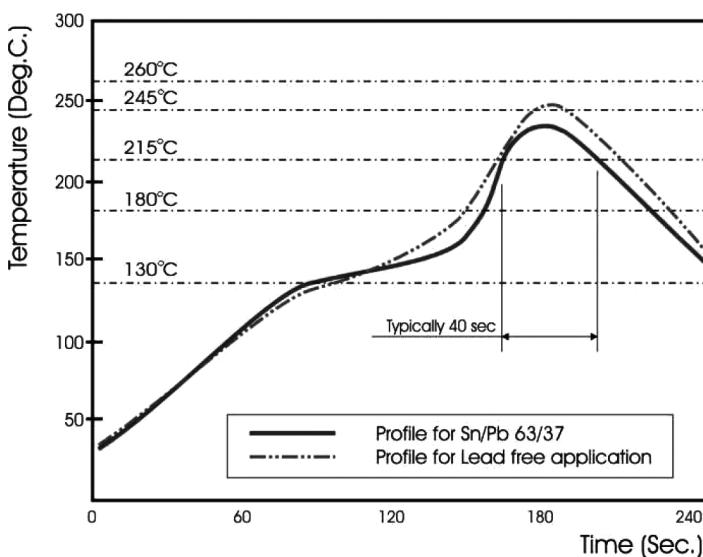
Chip placement can be on ceramic substrates and printed-circuit boards (PCBs).

Electrical connection to the circuit is by individual soldering condition.

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 Figure below.



Infrared soldering profile

Catalogue Numbers

The resistors have a catalogue number starting with

WW12	W	R020	J	T	L
Size code WW25 : 2512 WW20 : 2010 WW10 : 1210 WW12 : 1206 WW08 : 0805 WW06 : 0603	Type code W : Thick film Power low ohm low TCR	Resistance code 0.020W = R020 0.510W = R510 0.025W = R025	Tolerance J : $\pm 5\%$ F : $\pm 1\%$	Packaging code T : 7" Reel taping Q : 10" Reel taping G : 13" Reel taping	Termination code L = Sn base (lead free)

Tape packaging

WW10, WW12, WW08, WW06 : 8mm width paper taping

5,000pcs per 7" reel;

10,000pcs per 10" reel;

20,000pcs per 13" reel.

WW25, WW20: 12mm width emboss taping

4,000pcs per 7" reel;

8,000pcs per 10" reel;

16,000pcs per 13" reel.

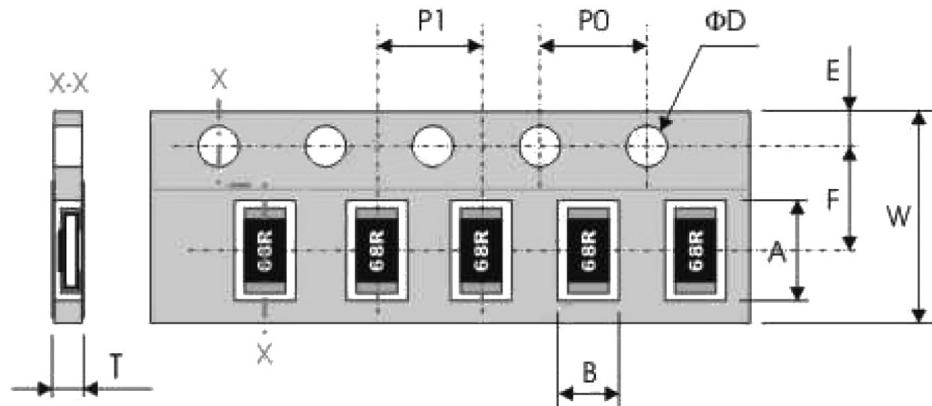
Test and Requirements

Basic specification : JIS C 5201-1 : 1998

Test	Procedure / Test Method	Requirement
Temperature Coefficient of Resistance (TCR)	<p>Natural resistance change per change in degree centigrade.</p> $\frac{R_2 - R_1}{R_1 (t_2 - t_1)} \times 10^6 \text{ (ppm/}^\circ\text{C)}$ <p style="text-align: center;">$t_1 : 25^\circ\text{C}$</p> <p>R_1 : Resistance at reference temperature R_2 : Resistance at test temperature</p>	<p>Refer to "Quick Reference Data"</p>
Short time overload (S.T.O.L)	Permanent resistance change after a 5 second application of a 5 times rated power.	J: $\Delta R/R$ max. $\pm(2\%+0.5m\Omega)$ F: $\Delta R/R$ max. $\pm(1\%+0.5m\Omega)$
Solderability	Un-mounted chips completely immersed for 3 ± 0.5 second in a SAC solder bath at $245^\circ\text{C} \pm 2^\circ\text{C}$	good tinning ($>95\%$ covered) no visible damage
Resistance to soldering heat(R.S.H)	Un-mounted chips completely immersed for 10 ± 1 second in a SAC solder bath at $260^\circ\text{C} \pm 5^\circ\text{C}$	no visible damage J: $\Delta R/R$ max. $\pm(1\%+0.5m\Omega)$ F: $\Delta R/R$ max. $\pm(0.5\%+0.5m\Omega)$
Temperature cycling	30 minutes at $-55^\circ\text{C} \pm 3^\circ\text{C}$, 2~3 minutes at $20^\circ\text{C} \pm 5^\circ\text{C} \pm 1^\circ\text{C}$, 30 minutes at $+155^\circ\text{C} \pm 3^\circ\text{C}$, 2~3 minutes at $20^\circ\text{C} \pm 5^\circ\text{C} \pm 1^\circ\text{C}$, total 5 continuous 9cycles	no visible damage J: $\Delta R/R$ max. $\pm(1\%+0.5m\Omega)$ F: $\Delta R/R$ max. $\pm(0.5\%+0.5m\Omega)$
Load life (endurance)	1000 $+48/-0$ hours, loaded with RCWV or Vmax in chamber controller $70\pm 2^\circ\text{C}$, 1.5 hours on and 0.5 hours off	J: $\Delta R/R$ max. $\pm(3\%+0.5m\Omega)$ F: $\Delta R/R$ max. $\pm(1\%+0.5m\Omega)$

Test	Procedure / Test Method	Requirement
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	J: ΔR/R max. ±(3%+0.5mΩ) F: ΔR/R max. ±(1%+0.5mΩ)
Bending strength	Resistors mounted on a 90mm glass epoxy resin PCB(FR4); bending : 3mm for 0603/0805, 2mm for 1206 and above sizes, once for 10 seconds	no visible damage J: ΔR/R max. ±(1%+0.5mΩ) F: ΔR/R max. ±(0.5%+0.5mΩ)
Adhesion	Pressurizing force: 5N, Test time: 10±1sec.	No remarkable damage or removal of the terminations
Insulation Resistance	Test voltage: 100+/-15V	I.R≥1GΩ

Packaging

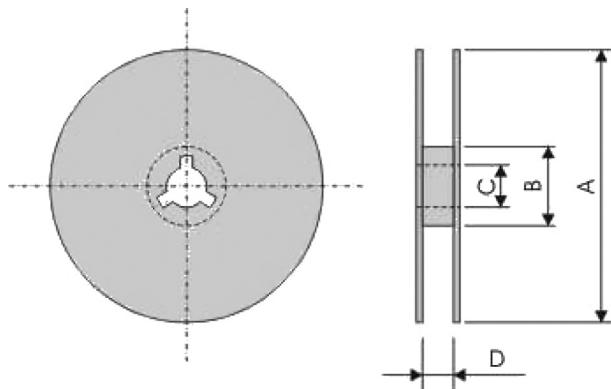


Series No.	A	B	W	F	E
WW25W	6.7 ±0.2	3.5 ±0.2			
WW20W	5.5 ±0.2	2.8 ±0.2	12 ±0.3		
WW10W	3.6 ±0.2	3 ±0.2			
WW12W	3.6 ±0.2	2 ±0.2			
WW08W	2.4 ±0.2	1.65 ±0.2	8 ±0.3	3.5 ±0.2	1.75 ±0.1
WW06W	1.9 ±0.2	1.1 ±0.2			

Series No.	P1	P0	ØD	T
WW25W				Max. 1.2
WW20W				Max. 1.2
WW10W				Max. 1
WW12W	4 ±0.1	4 ±0.1	1.5 ^{+0.1} _{-0.0}	Max. 1
WW08W				Max. 1
WW06W				Max. 0.8

Dimensions : Millimetres

Reel Dimensions



Symbol	A	B	C	D
7" reel	$\varnothing 178 \pm 2$	$\varnothing 60 \pm 1$	13 ± 0.5	10 ± 1.5 (8mm tape) 13.8 ± 1.5 (12mm tape)
10" reel	$\varnothing 254 \pm 2$	$\varnothing 100 \pm 1$		
13: reel	$\varnothing 330 \pm 2$	$\varnothing 100 \pm 1$		

Dimensions : Millimetres

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