

APPROVAL SHEET

WW25W, WW20W, WW10W, WW12W, WW08W, WW06W

±1%, ±5%

Thick Film Normal Low Ohm Chip Resistors RoHS Exemption free and Lead free Size 2512, 2010, 1210, 1206, 0805, 0603

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



FEATURE

- 1. High power rating and low TCR
- 2. High reliability and stability
- 3. Reduced size of final equipment
- 4. RoHS exemption free and Lead free products

APPLICATION

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

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 Tin (lead free) alloy.

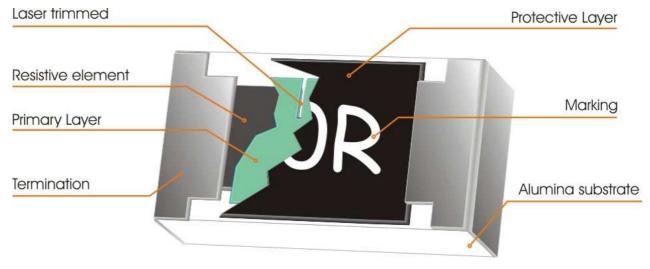


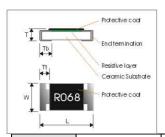
Fig 1. Construction of Chip-R



QUICK REFERENCE DATA

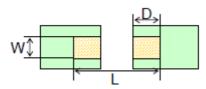
Item	General Specification					
Series No.	WW25W	WW20W	WW10W	WW12W	WW08W	WW06W
Size code	2512 (6432)	2010 (5025)	1210 (3225)	1206 (3216)	0805 (2012)	0603 (1608)
Resistance			±5%	o, ±1%		
Tolerance						
Resistance			0.010Ω ~ 0.910Ω,			$0.050\Omega \sim 0.910\Omega$,
Range			E24			E24
TCR (ppm/°C)						
	10 - 20mΩ: ±1000	10 - 20mΩ: ±1000	10 - 20mΩ: ±600	10 - 20mΩ: ±1000	10 - 20m Ω : ±1000	50 - 91mΩ: ±400
	22 - 39mΩ: ±600	22 - 39mΩ: ±600	22 - 39mΩ: ±400	22 - 39mΩ: ±600	22 - $39m\Omega$: ± 600	100 - 910mΩ: ±200
	40 - 47mΩ: ±200	40 - 47mΩ: ±200	40 - 47mΩ: ±200	40 - 47mΩ: ±200	40 - 47mΩ: ±400	
	50 - 91mΩ: ±100	50 - 91mΩ: ±100	50 - 91mΩ: ±100	50 - 91mΩ: ±100	50 - 91mΩ: ±200	
	100 - 910mΩ: ±100	100 - 910mΩ: ±100	100 - 910mΩ: ±100	100 - 910mΩ: ±100	100 - 910m Ω : ±100	
Max. dissipation	4.107	0/414	0/0.14/	4/0.14/	4/438/	4/0.14/
at T _{amb} =70°C	1 W	3/4W	2/3 W	1/3 W	1/4 W	1/8 W
Operation	-55 ∼ +155'C					
temperature	-55 ~ +155 C					

MECHANICAL DATA



Symbol	WW25W	WW20W	WW10W	WW12W	WW08W	WW06W
L	6.30 ± 0.20	5.00 ± 0.20	3.10 ± 0.10	3.10 ± 0.10	2.00 ± 0.10	1.60 ± 0.10
W	3.10 ± 0.20	2.50 ± 0.20	2.60 ± 0.10	1.60 ± 0.10	1.25 ± 0.10	0.80 ± 0.10
Т	0.60 ± 0.15	0.60 ± 0.10	0.55 ± 0.10	0.55 ± 0.10	0.50 ± 0.10	0.45 ± 0.10
Tt	0.60 ± 0.25	0.60 ± 0.25	0.50 ± 0.25	0.50 ± 0.25	0.40 ± 0.20	0.30 ± 0.20
Tb	0.90 ± 0.25	0.60 ± 0.25	0.50 ± 0.25	0.50 ± 0.25	0.40 ± 0.20	0.30 ± 0.20

RECOMMENDED SOLDERING PAD



Symbol	WW25W	WW20W	WW10W	WW12W	WW08W	WW06W
WL	3.70mm	3.00mm	3.00mm	1.80mm	1.30mm	0.90mm
D	1.60mm	1.50mm	1.30mm	1.30mm	1.15mm	1.00mm
L	7.60mm	6.80mm	4.70mm	4.70mm	3.50mm	3.00mm



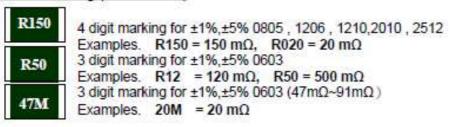
MARKING

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)





FUNCTIONAL DESCRIPTION

Product characterization

Standard values of nominal resistance are taken from the E24 series for resistors with a tolerance of $\pm 5\%$ & $\pm 1\%$. The values of the E24 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

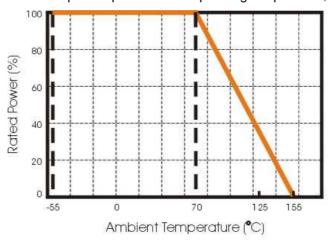


Figure 2 Maximum dissipation in percentage of rated power as a function of the ambient temperature

MOUNTING

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. 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.

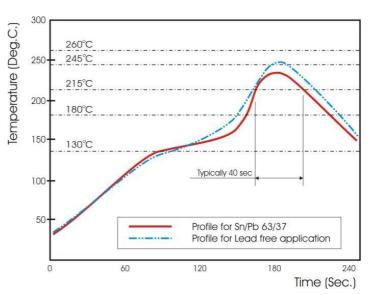


Fig 3. Infrared soldering profile



CATALOGUE NUMBERS

The resistors have a catalogue number starting with:

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

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.

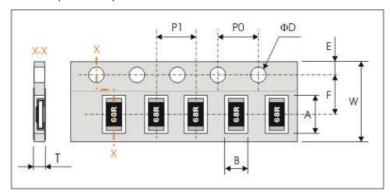


TEST AND REQUIREMENTS(JIS C 5201-1: 1998)

TEST	PROCEDURE	REQUIREMENT
Temperature Coefficient of Resistance(T.C.R) Clause 4.8	Natural resistance change per change in degree centigrade. $\frac{R_2-R_1}{R_1(t_2-t_1)}\!\!\times\!10^6 \; \text{(ppm/°C)} \text{$t_1:25°C$}$	Refer to "QUICK REFERENCE DATA"
	R_1 : Resistance at reference temperature 25°C R_2 : Resistance at test temperature 155°C	
Short time overload (S.T.O.L) Clause 4.13	Permanent resistance change after a 5second application of a 5 times rated power.	J: Δ R/R max. \pm (2%+0.5m Ω) F: Δ R/R max. \pm (1%+0.5m Ω)
Solderability Clause 4.17	Un-mounted chips completely immersed for 3±0.5 second in a SAC solder bath at 245°C ±2°C	good tinning (>95% covered) no visible damage
Resistance to soldering heat(R.S.H) Clause 4.18	Un-mounted chips completely immersed for 10±1 second in a SAC solder bath at 260 $^{\circ}\!C$ ±5 $^{\circ}\!C$	no visible damage J: Δ R/R max. \pm (1%+0.5m Ω) F: Δ R/R max. \pm (0.5%+0.5m Ω)
Temperature cycling Clause 4.19	30 minutes at -55°C±3°C, 2~3 minutes at 20℃+5℃-1℃, 30 minutes at +155°C±3°C, 2~3 minutes at 20℃+5℃-1℃, total 5 continuous cycles	no visible damage J: Δ R/R max. \pm (1%+0.5m Ω) F: Δ R/R max. \pm (0.5%+0.5m Ω)
Load life (endurance) Clause 4.25	1000 +48/-0 hours, loaded with RCWV or Vmax in chamber controller 70±2°C, 1.5 hours on and 0.5 hours off	J: Δ R/R max. ±(3%+0.5m Ω) F: Δ R/R max. ±(1%+0.5m Ω)
Load life in Humidity Clause 4.24	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	J: Δ R/R max. \pm (3%+0.5m Ω) F: Δ R/R max. \pm (1%+0.5m Ω)
Bending strength Clause 4.33	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: Δ R/R max. \pm (1%+0.5m Ω) F: Δ R/R max. \pm (0.5%+0.5m Ω)
Adhesion Clause 4.32	Pressurizing force: 5N, Test time: 10±1sec.	No remarkable damage or removal of the terminations
Insulation Resistance Clause 4.6	Test voltage: 100+/-15V	I.R≧1GΩ

PACKAGING

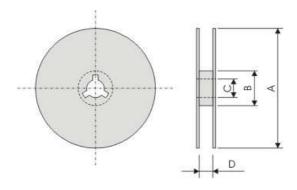
Paper Tape specifications (unit :mm)



Series No.	А	В	W	F	E
WW25W	6.70±0.20	3.50±0.20	12.00±0.30		
WW20W	5.50±0.20	2.80±0.20	12.00±0.30		
WW10W	3.60±0.20	3.00±0.20		3.50±0.20	1.75±0.10
WW12W	3.60±0.20	2.00±0.20	8.00±0.30	3.30±0.20	1.73±0.10
WW08W	2.40±0.20	1.65±0.20	8.00±0.30		
WW06W	1.90±0.20	1.10±0.20			

Series No.	P1	P0	ΦD	Т
WW25W				Max. 1.2
WW20W	4.00±0.10	4.00±0.10	Φ 1.50 $^{+0.1}_{-0.0}$	Max. 1.2
WW10W				Max. 1.0
WW12W				Max. 1.0
WW08W				Max. 1.0
WW06W				Max. 0.8

Reel dimensions



Symbol	А	В	С	D
7" reel	Φ178.0±2.0	Φ60.0±1.0		10.0.1 F (0mm tone)
10" reel	Φ254.0±2.0	Φ100.0±1.0	13.0±0.5	10.0±1.5 (8mm tape) 13.8±1.5 (12mm tape)
13: reel	Ф330.0±2.0	Φ100.0±1.0		13.0±1.3 (12111111 tape)

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