

# APPROVAL SHEET

**WW25P, WW20P, WW10P, WW12P,  
WW08P, WW06P, WW04P**

**±1%, ±5% 100mΩ~976mΩ**

Thick Film High Power Low Ohm Chip Resistors

Size 2512 2W, 2010 1W, 1210 1/2W, 1206 1/2W  
0805 1/4W ; 0603 1/8W, 0402 1/8W

(Automotive & Anti-sulfuration)

RoHS 2 Compliant with exemption 7C-1  
Halogen free

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

## FEATURE

1. High power rating and compact size
2. Automotive AEC Q-200 Compliant
3. RoHS 2 Compliant with exemption 7C-1 and Halogen free.
4. Anti-sulfuration ASTM B-809-95 compliant

## 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.

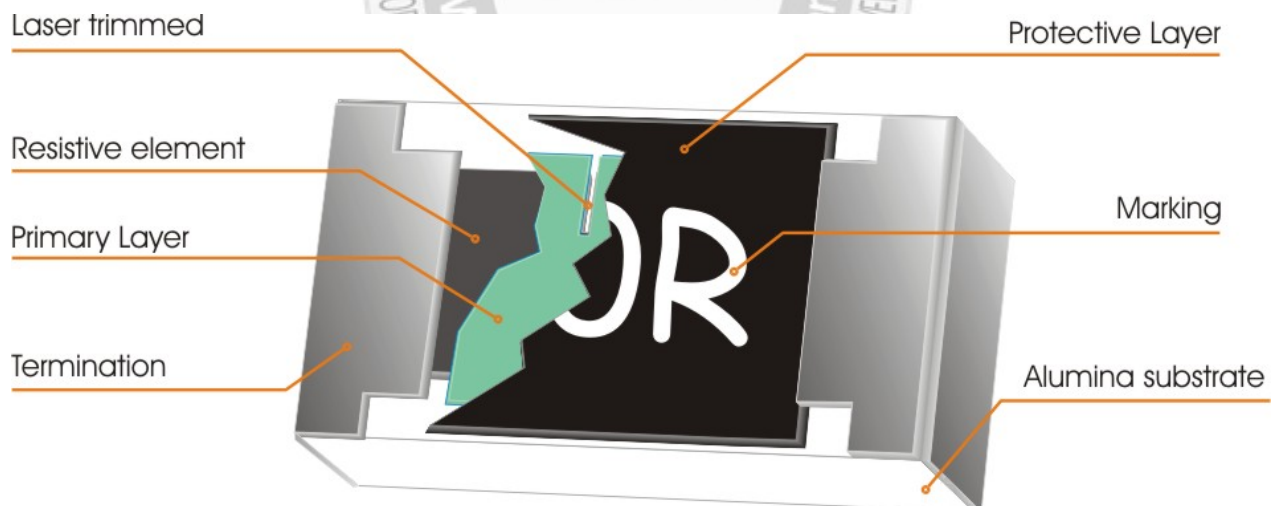


Fig 1. Construction of Chip-R

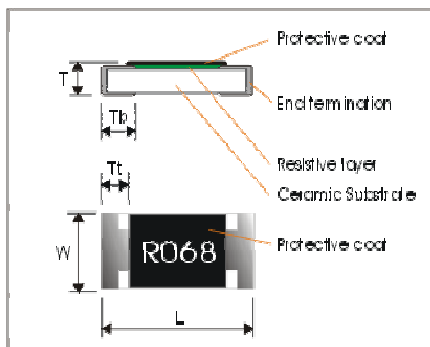
## QUICK REFERENCE DATA

Item	General Specification						
Series No.	WW25P	WW20P	WW10P	WW12P	WW08P	WW06P	WW04P
Size code	2512 (6432)	2010 (5025)	1210 (3225)	1206 (3216)	0805 (2012)	0603 (1608)	0402 (1005)
Resistance Tolerance	±1% ( E24+E96), ±5%						
Resistance Range	0.10Ω ~ 0.976Ω						
TCR (ppm/°C) 0.10ohm~0.96ohm	±150ppm				±200ppm	±250ppm	±300ppm
Max. dissipation at T <sub>amb</sub> =70°C	2 W	1W	1/2W	1/2w	1/4 W	1/8 W	1/8 W
Max. Operation Current (DC or RMS)	4.5~1.5A	3.2~1.0A	2.3~0.75A	2.2~0.7A	1.6~0.5A	1.1~0.35A	1.1~0.35A
Max. Overload Current (DC or RMS)	9.0~3.0A	6.4~2.0A	4.6~1.5A	4.4~1.4A	3.2~1.0A	2.2~0.7A	2.2~0.7A
Operation temperature	-55 ~ +155°C						

Note :

- 2W loading with total solder-pad and trace size of 300 mm<sup>2</sup>
- Resistance value will be changed by soldering condition and design of soldering pad, please design products in consideration of this change of resistance value

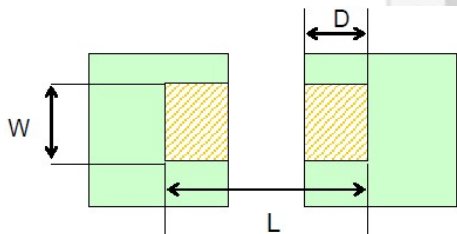
## MECHANICAL DATA (Unit: mm)



Unit: mm

Symbol	WW25P	WW20P	WW10P	WW12P	WW08P	WW06P	WW04P
L	6.30 ± 0.20	5.00 ± 0.20	3.10 ± 0.10	3.10 ± 0.15	2.00 ± 0.10	1.60 ± 0.10	1.00 ± 0.05
W	3.10 ± 0.20	2.50 ± 0.20	2.50 ± 0.10	1.60 ± 0.15	1.25 ± 0.10	0.80 ± 0.10	0.50 ± 0.05
T	0.60 ± 0.15	0.60 ± 0.10	0.55 ± 0.10	0.55 ± 0.10	0.50 ± 0.15	0.45 ± 0.15	0.35 ± 0.05
Tt	0.60 ± 0.25	0.60 ± 0.25	0.50 ± 0.25	0.50 ± 0.25	0.40 ± 0.20	0.30 ± 0.10	0.20 ± 0.10
Tb	1.80 ± 0.25	0.60 ± 0.25	0.50 ± 0.25	0.50 ± 0.25	0.40 ± 0.20	0.30 ± 0.15	0.25 ± 0.10

## Recommended Solder Pad Dimensions



Type	W	D	L
WW25P	3.7mm	2.45mm	7.6mm

## MARKING

For 0603 above size, each resistor is marked with a four-digit for 1% tolerance and three-digit for 5% tolerance on the protective coating to designate the nominal resistance value.

For 0402, no marking !

For Jumper, 2512/2010 defines 0000, 1206/0805/0603 defines 000.

Example:

102 = 1kΩ



16R0 = 16Ω



## 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 curve

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

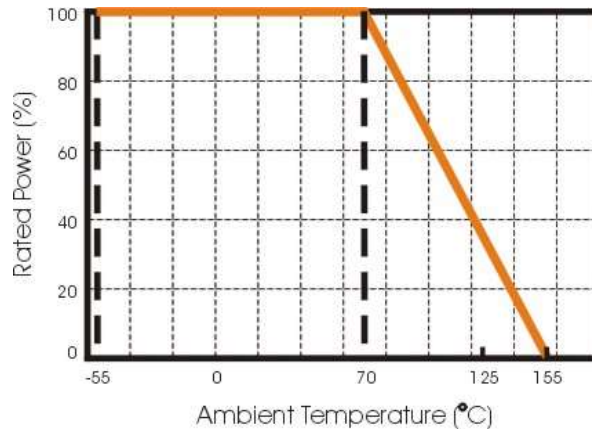


Figure 2 Maximum dissipation in percentage of rated power as a function of the ambient temperature

## 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.

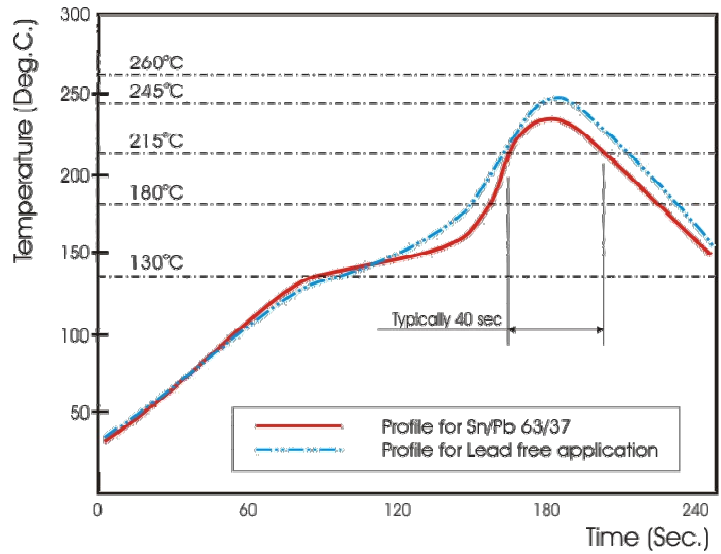


Fig 3. Infrared soldering profile for Chip Resistors

### CATALOGUE NUMBERS

The resistors have a catalogue number starting with.

WW25	P	R100	J	T	L	V
<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>
WW25 : 2512	P :Power	E96 +E24:	J : ±5%	T : 7" Reel taping	L = Sn base (lead free)	<b>V =</b>
WW20 : 2010	2512 size = 2W	"R" is first digit followed by 3 significant digits.	F : ±1%	G : 13" Reel taping		1. AEC Q200 Compliant
WW10 : 1210	2010 size = 1W	e.g.:				2. Anti-Sulfuration ASTM B-809-95 compliant 60°C x 480hrs
WW12 : 1206	1206 size = 1/2W	0.1ohm = R100				3. 100% CCD visual inspection
WW08 : 0805	1210 size = 1/2W	0.56ohm = R560				
WW06 : 0603	0805 size = 1/4W					
WW04 : 0402	0603 size = 1/8W					
	0402 size = 1/8W					

Tape packaging WW12, WW10, WW08, WW06 : 8mm width paper taping 5,000pcs per reel.  
 WW04: 8mm width paper taping 10,000pcs per reel.  
 WW25, WW20: 12mm width plastic taping 4,000pcs per reel.

## TEST AND REQUIREMENTS

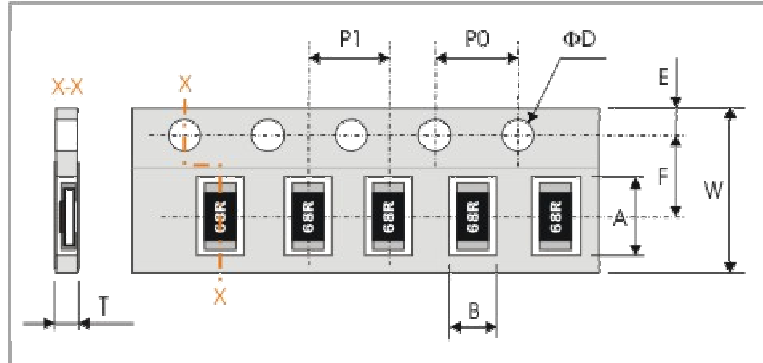
TEST	PROCEDURE / TEST METHOD	REQUIREMENT
		Resistor
Electrical Characteristics  <b>JISC5201-1: 1998</b> Clause 4.8	- DC resistance values measurement - Temperature Coefficient of Resistance (T.C.R) Natural resistance change per change in degree centigrade. $\frac{R_2 - R_1}{R_1(t_2 - t_1)} \times 10^6 \text{ (ppm/}^\circ\text{C)} \quad t_1: 20^\circ\text{C}+5^\circ\text{C}-1^\circ\text{C}$ R <sub>1</sub> : Resistance at reference temperature R <sub>2</sub> : Resistance at test temperature	Within the specified tolerance Refer to "QUICK REFERENCE DATA"
Resistance to soldering heat(R.S.H) <b>MIL-STD-202 method 210</b>	Un-mounted chips completely immersed for 10±1second in a SAC solder bath at 270°C±5°C	ΔR/R max. ±(1.0%+0.005Ω) no visible damage
Solderability <b>J-STD-002</b>	a) Bake the sample for 155°C dwell time 4hrs/ solder dipping 235°C/ 5sec. b) Steam the sample dwell time 8 hour/ solder dipping 215°C/ 5sec. c) Steam the sample dwell time 8 hour/ solder dipping 260°C/ 7sec.	95% coverage min., good tinning and no visible damage
Temperature cycling <b>JESD22 Method JA-104</b>	1000 cycles, -55°C ~ +155°C, dwell time 30min maximum.	ΔR/R max. ±(1.0%+0.005Ω) No visible damage
Moisture Resistance <b>MIL-STD-202 method 106</b>	65±2°C, 80~100% RH, 10 cycles, 24 hours/ cycle	ΔR/R max. ±(1.0%+0.005Ω) No visible damage
Bias Humidity <b>MIL-STD-202 method 103</b>	1000+48/-0 hours; 85°C, 85% RH, 10% of operation power	ΔR/R max. ±(2.0%+0.005Ω) No visible damage
Operational Life <b>MIL-STD-202 method 108</b>	1000+48/-0 hours; 35% of operation power, 125±2°C	ΔR/R max. ±(2.0%+0.005Ω) No visible damage
High Temperature Exposure <b>MIL-STD-202 Method 108</b>	1000+48/-0 hours; without load in a temperature chamber controlled 155±3°C	ΔR/R max. ±(2%+0.005Ω) No visible damage
Board Flex <b>AEC-Q200-005</b>	Resistors mounted on a 90mm glass epoxy resin PCB(FR4),bending once 2mm for 60sec.	ΔR/R max. ±(1.0%+0.005Ω) No visible damage
Terminal strength <b>AEC-Q200-006</b>	Pressurizing force: 1.8Kg, Test time: 60±1sec.	No remarkable damage or removal of the terminations

Thermal shock <b>MIL-STD-202</b> <b>method 107</b>	Test -55 to 155°C / dwell time 15min/ Max transfer time 20sec 300cycles	$\Delta R/R$ max. $\pm(1.0\%+0.005\Omega)$ No visible damage
ESD <b>AEC-Q200-002</b>	Test contact 1KV (0.5KV for 0402 only)	$\Delta R/R$ max. $\pm(1.0\%+0.005\Omega)$ No visible damage
Short Time Overload <b>JISC5201-1: 1998</b> <b>Clause 4.13</b>	2.5 times RCWV or max. overload voltage, for 5seconds	$\Delta R/R$ max. $\pm(2.0\%+0.10\Omega)$ No visible damage
Mechanical Shock <b>MIL-STD-202</b> <b>method 213</b>	Test ½ Sine Pulse, Peak value: 100g, normal duration: 6ms, Velocity change:12.3ft/sec. Three shocks in each direction, total 18 shocks.	Within product specification tolerance and no visible damage.
Vibration <b>MIL-STD-202</b> <b>method 204</b>	Test 5g's for 20 min., 12 cycles each of 3 orientations.	$\Delta R/R$ max. $\pm(0.5\%+0.005\Omega)$ and no visible damage.
Resistance to Solvents : <b>MIL-STD-202</b> <b>Method 215</b>	Solvent is Isopropyl alcohol, immersion 3mins at 25°C and brush 10 strokes with a toothbrush with a handle made of a non-reactive material (wet bristle), immersion and brush 3 times and then air blow dry.	No superficial defect on marking, encapsulation, coating, appearance. Electrical characteristics within products specification and tolerance. Inspect at 3X max. for marking, inspect at 10X for part damage.
External Visual <b>MIL-STD-883</b> <b>method 2009</b>	Electrical test not required. Inspect device construction, marking and workmanship	No visual damage and refer WTC marking code.
Physical Dimension <b>JESD22</b> <b>method JB-100</b>	Verify physical dimensions(L, W, T, Tb, Tt)	Within the specified tolerance for WTC.
Sulfuration test ASTM B-809-95	ASTM B-809 60°C 480hrs	$\Delta R/R$ max. $\pm(2.0\%+0.10\Omega)$ No visible damage



## PACKAGING

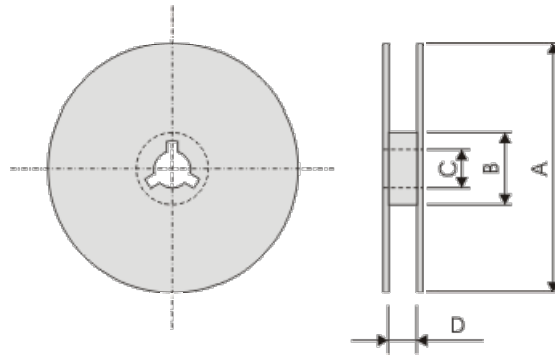
Paper Tape specifications (unit :mm)



Series No.	A	B	W	F	E
WW25P	6.90±0.20	3.60±0.20	12.00±0.30	5.50±0.10	1.75±0.10
WW20P	5.50±0.20	2.80±0.20			
WW10P	3.60±0.20	3.00±0.20	8.00±0.30	3.50±0.20	
WW12P	3.60±0.20	2.00±0.20	8.00±0.30	3.50±0.20	
WW08P	2.40±0.20	1.65±0.20	8.00±0.30	3.50±0.20	
WW06P	1.90±0.20	1.10±0.20	8.00±0.30	3.50±0.20	
WW04P	1.20±0.10	0.70±0.10	8.00±0.30	3.50±0.20	

Series No.	P1	P0	ΦD	T
WW25P	4.00±0.10	4.00±0.10	Φ1.50 <sup>+0.1</sup> <sub>-0.0</sub>	Max.1.2
WW20P				
WW10P	4.00±0.10	4.00±0.10	Φ1.50 <sup>+0.1</sup> <sub>-0.0</sub>	Max.1.0
WW12P				
WW08P				
WW06P	4.00±0.10	4.00±0.10	Φ1.50 <sup>+0.1</sup> <sub>-0.0</sub>	0.65±0.05
WW04P	2.00±0.05	4.00±0.10		0.40±0.05

### Reel dimensions



(unit : mm)

Reel / Tape	A	B	C	D
7" reel for 8mm tape	Φ178.0±2.0	Φ60.0±1.0	13.0±0.2	9.00±0.50
7" reel for 12mm tape				12.4±1.00
13" reel for 8mm tape	Φ330.0±2.00	Φ100.0±1.00	13.0±0.2	9.00±0.50

