



APPROVAL SHEET

WW12E, WW08E, WW06E

±5%, ±1%

Thick film low ohm chip resistors

Size 1206, 0805, 0603

RoHS Exemption free and Halogen free

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



FEATURE

1. High power rating and low range
2. High reliability and stability
3. Suitable for current sensing of small mobile devices
4. RoHS compliant & Lead free
5. Low cost benefit

APPLICATION

- Game equipment
- Mobile phone
- Battery pack
- Power supply
- DSC
- HDD

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.

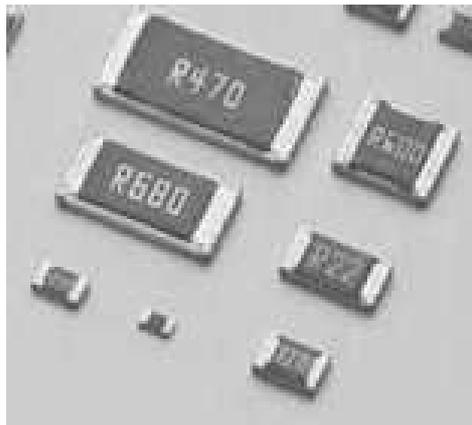


Fig 1. Construction of WWxxE

**QUICK REFERENCE DATA**

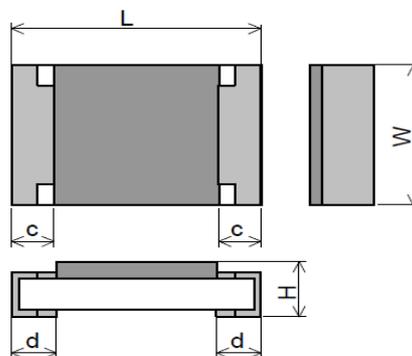
Item	General Specification		
	WW12E	WW08E	WW06E
Series No.	WW12E	WW08E	WW06E
Size code	1206 (3212)	0805 (2012)	0603 (1608)
Resistance Tolerance	±5%, ±1%	±5%, ±1%	±5%, ±1%
Resistance Range	0.010Ω ~ 0.976Ω	0.010Ω ~ 0.976Ω	0.010Ω ~ 0.976Ω
TCR (ppm/°C)			
0.010Ω ~ 0.018Ω	+/- 1500 ppm	+/- 1500 ppm	0.010Ω ~ 0.036Ω: +/- 2000 ppm
0.019Ω ~ 0.047Ω	+/- 1200 ppm	+/- 1200 ppm	0.037Ω ~ 0.091Ω: +/- 1200 ppm
0.048Ω ~ 0.091Ω	+/- 1000 ppm	+/- 1000 ppm	0.093Ω ~ 0.500Ω: +/- 800 ppm
0.093Ω ~ 0.360Ω	+/- 600 ppm	+/- 600 ppm	0.510Ω ~ 0.976Ω: +/- 300 ppm
0.365Ω ~ 0.500Ω	+/- 300 ppm	+/- 300 ppm	
0.510Ω ~ 0.976Ω	+/- 200 ppm	+/- 200 ppm	
Max. dissipation at T _{amb} =70°C	1/2 W	1/4 W	1/10 W
Max. Operation Current	0.7 A ~ 7.0 A	0.5 A ~ 5 A	0.3 A ~ 3.2 A
Operation temperature	-55 ~ +155°C	-55 ~ +155°C	-55 ~ +155°C

1. Max. Operation current : So called RCWC (Rated Continuous Working Current) is determined by

$$RCWC = \sqrt{\text{Rated Power} / \text{Resistance Value}}$$

MECHANICAL DATA (unit: mm)

Symbol	WW08E	WW12E	WW06E
L	2.00 ± 0.10	3.10 ± 0.10	1.60 ± 0.10
W	1.25 ± 0.10	1.60 ± 0.10	0.80 ± 0.10
H	0.50 ± 0.15	0.60 ± 0.15	0.45 ± 0.15
c	0.40 ± 0.20	0.50 ± 0.20	0.30 ± 0.10
d	0.40 ± 0.20	0.45 ± 0.20	0.30 ± 0.20

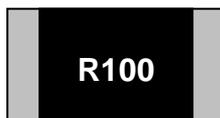




MARKING

For 1206/0805 size, each resistor is marked with a four-digit code on the protective coating to designate the nominal resistance value.

Example: R100 = 0.10Ω
R510 = 0.51Ω



For 0603, each resistor is marked with a three-digit code on the protective coating to designate the nominal resistance value.

The nominal resistance shall be marked in 3 digits (E24 and/or E96) and marked on over coat side.

- 100mΩ-910mΩ, E24 series: "R" followed by 2 significant digits if the 4th digit is "0"
(Example) "R22" → 220 [mΩ] → 0.22 [Ω]
- 100mΩ-976mΩ, E96 series: The 1st two digit codes are referring to the code on the table, the 3rd code is the index of resistance value: "Z"(10⁻³)
(Example) "25Z" → 178 [mΩ] → 0.178[Ω]
"34Z" → 221 [mΩ] → 0.221[Ω]
- 1mΩ-99mΩ: The 3rd code is the index of resistance value: "M".
"M" = "m", means 1/1000
(Example) "75M" → 75 [mΩ] → 0.75[Ω]
"02M" → 2 [mΩ] → 0.02[Ω]

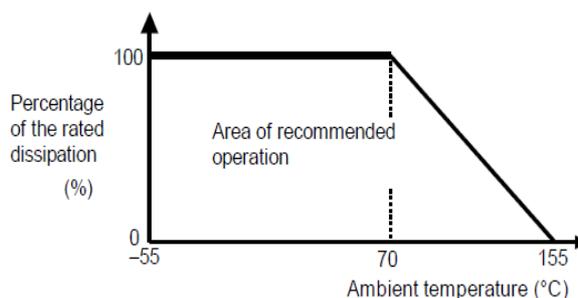
6.2.1 Symbol for E96 series of resistance value

E96	Symbol								
100	01	162	21	261	41	422	61	681	81
102	02	165	22	267	42	432	62	698	82
105	03	169	23	274	43	442	63	715	83
107	04	174	24	280	44	453	64	732	84
110	05	178	25	287	45	464	65	750	85
113	06	182	26	294	46	475	66	768	86
115	07	187	27	301	47	487	67	787	87
118	08	191	28	309	48	499	68	806	88
121	09	196	29	316	49	511	69	825	89
124	10	200	30	324	50	523	70	845	90
127	11	205	31	332	51	536	71	866	91
130	12	210	32	340	52	549	72	887	92
133	13	215	33	348	53	562	73	909	93
137	14	221	34	357	54	576	74	931	94
140	15	226	35	365	55	590	75	953	95
143	16	232	36	374	56	604	76	976	96
147	17	237	37	388	57	619	77		
150	18	243	38	392	58	634	78		
154	19	249	39	402	59	649	79		
158	20	255	40	412	60	665	80		

FUNCTIONAL DESCRIPTION

De-rating curve

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





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 245°C during 3 seconds within lead-free solder bath. 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.

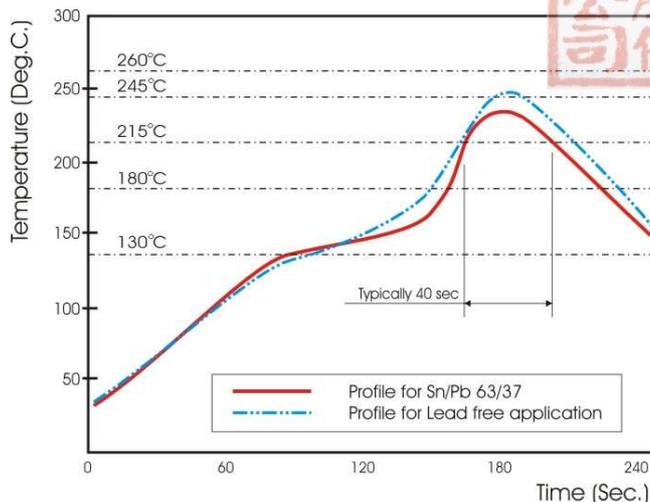


Fig 3. Infrared soldering profile for chip resistor

CATALOGUE NUMBERS

The resistors have a catalogue number starting with .

WW08	E	R050	F	T	L
Size code	Type code	Resistance code	Tolerance	Packaging code	Termination code
WW08 : 0805 WW12 : 1206 WW06 : 0603	E : Low cost	E96 +E24: R is first digit followed by 3 significant digits. 0.010Ω = R010 0.025Ω = R025 0.100Ω = R100	J : ±5% F : ±1%	T : 7" Reel taping	L = Sn base (lead free)

- Reeled tape packaging 8mm width paper taping 4mm pitch, 5,000pcs per reel.



TEST AND REQUIREMENTS

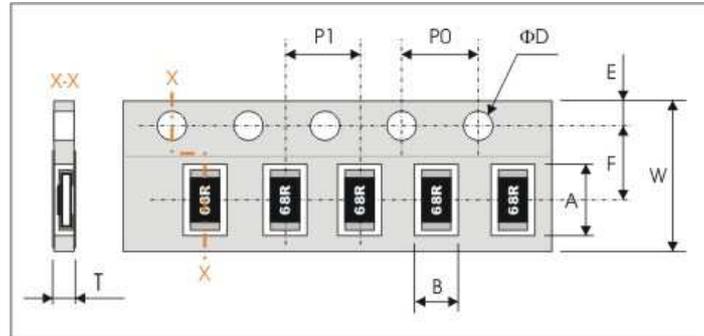
TEST	PROCEDURE	REQUIREMENT
Temperature Coefficient of Resistance (TCR)	Natural resistance change per change in degree centigrade. $\frac{R_2 - R_1}{R_1(t_2 - t_1)} \times 10^6 \text{ (ppm/}^\circ\text{C)}$ R ₁ : Resistance at reference temperature R ₂ : Resistance at test temperature t ₁ : 25°C	Test temperature +155°C As defined in P.3
Short time overload (STOL) Sub-Clause 4.13	Permanent resistance change after 2 second application of a current 2.5 times RCWC specified.	ΔR/R max. ±2% no visible damage
Resistance to soldering heat Sub-clause 4.18	Un-mounted chips 10±0.5 seconds, 260±5°C	no visible damage Δ R/R max. ±1%
Solderability Sub-clause 4.17	Termination Sn base (lead free) : Un-mounted chip completely immersed in a lead free solder bath, 235°C±5°C, 2±0.5 sec	good tinning (>95% covered) no visible damage
Temperature cycling Sub-clause 4.19	1. 30 minutes at -55°C±3°C, 2. 2~3 minutes at room temperature, 3. 30 minutes at +155°C±3°C, 4. 2~3 minutes at room temperature, Total 5 continuous cycles	no visible damage ΔR/R max. ±1%
Load life (endurance) Sub-clause 4.25.1	70±2°C, 1000 hours, loaded with rated current, 1.5 hours on and 0.5 hours off	ΔR/R max. ±3% no visible damage
Load life in Humidity Sub-clause 4.24	rated current applied 1.5hr ON, 0.5hr OFF at 40°C±2°C and 90~95% relative humidity, test period: 1000hours	ΔR/R max. ±3% no visible damage
Bending strength Sub-clause 4.33	Resistors mounted on a 90mm glass epoxy resin PCB(FR4); bending : 3 mm,	ΔR/R max. ±1% no visible damage
Adhesion Sub-clause 4.32	5N, 10±1s	No visible damage
Insulation resistance	0603/0805: 100Vdc, 1min 1206: 400Vdc, 1min	R > 10Gohm
Dielectric withstanding voltage	0603/0805: 100Vdc, 1min 1206: 400Vdc, 1min	No flash over, fire and breakdown



PACKAGING

Paper Tape specifications

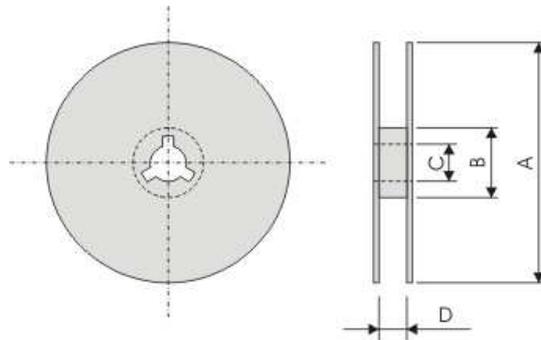
(unit: mm)



Series No.	A	B	W	F	E
WW08E	2.40±0.20	1.65±0.20	8.00±0.20	3.50±0.05	1.75±0.10
WW12E	3.60±0.20	2.00±0.15	8.00±0.20	3.50±0.05	1.75±0.10
WW06E	1.90±0.20	1.10±0.20	8.00±0.20	3.50±0.05	1.75±0.10

Series No.	P1	P0	ΦD	T
WW08E	4.00±0.10	4.00±0.10	Φ1.50 ^{+0.1} _{-0.0}	Max. 1.0
WW12E	4.00±0.10	4.00±0.10	Φ1.50 ^{+0.1} _{-0.0}	Max. 1.0
WW06E	4.00±0.10	4.00±0.10	Φ1.50 ^{+0.1} _{-0.0}	0.65±0.05

Reel dimensions



Symbol	A	B	C	D
(unit : mm)	Φ180 +0/ -1.5	Φ60+1.0/-0	13.0±0.2	9.0+1.0