

## 1. Part Numbering System):

<u>GR</u>	<u>03</u>	<u>J</u>	<u>A</u>	<u>10K</u>
<u>Series Name</u> Chip Resistor: GR:Thick Film High Ohm Chip-Resistor	<u>Type</u> Inch (mm) 02-0402(1005) 03-0603(1608) 05-0805(2012) 06-1206(3216)	<u>Tolerance</u> B= ± 0.1% D= ± 0.5% F= ± 1% J= ± 5 % P : Jumper	<u>Package</u> A=4Kpcs/7"Reel B=5Kpcs/7"Reel C=10Kpcs/7"Reel M=15Kpcs/7"Reel D=10Kpcs/10"Reel E=20Kpcs/10"Reel	<u>Resistance</u> 1R2=1.2Ω 10K=10KΩ 10K5=10.5KΩ 100K=100KΩ 1M2=1.2MΩ

## 2.FEATURE

- 1) Small size and light weight
- 2) High reliability and stability
- 3) Reduced size of final equipment
- 4) Higher component and equipment reliability
- 5) RoHS compliant and lead free products.

## 3.APPLICATION

- Power supply
- PDA
- Digital meter
- Computer
- Palmtop computers

#### 4. 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.

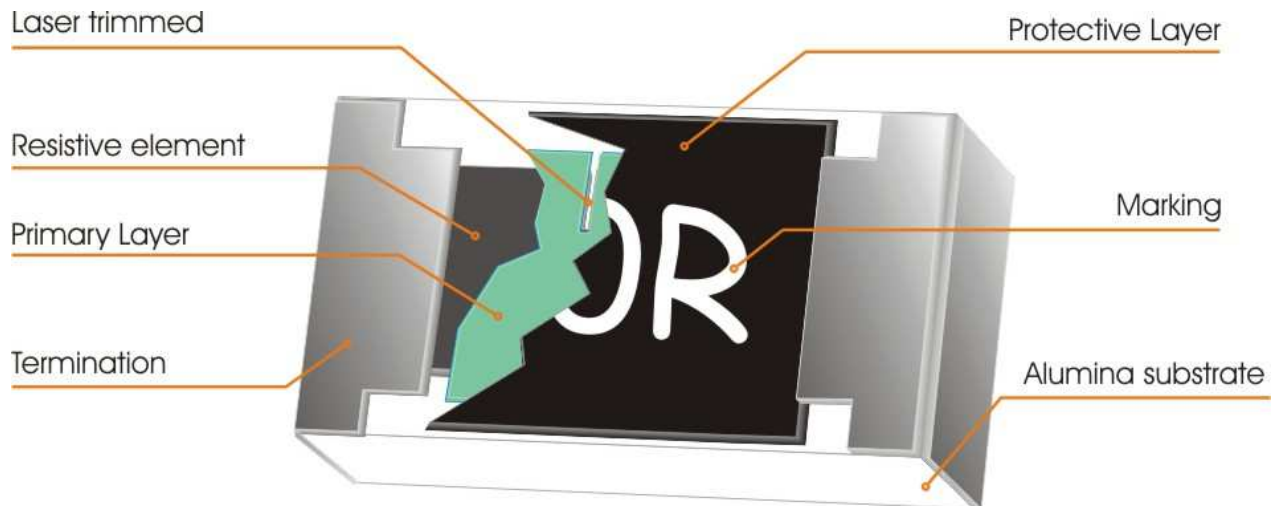


Fig 1. Construction of Chip-R

## 5. QUICK REFERENCE DATA

Item	General Specification			
Series No.	GR06	GR05	GR03	GR02
Size code	1206	0 805	0603	0402
Resistance Tolerance	$\pm 1\%$ , $\pm 5\%$			
Resistance Range	$10\text{M}\Omega < R \leq 100\text{M}\Omega$			$10\text{M}\Omega < R \leq 30\text{M}\Omega$ (E24 series)
TCR (ppm/°C)	$\leq \pm 200 \text{ ppm/}^\circ\text{C}$			$\leq \pm 300 \text{ ppm/}^\circ\text{C}$
Max. dissipation at $T_{\text{amb}}=70^\circ\text{C}$	1/4 W	1/8 W	1/10 W	1/16W
Max. Operation Voltage (DC or RMS)	200V	150V	50V	50V
Climatic category (IEC 60068)	55/155/56			

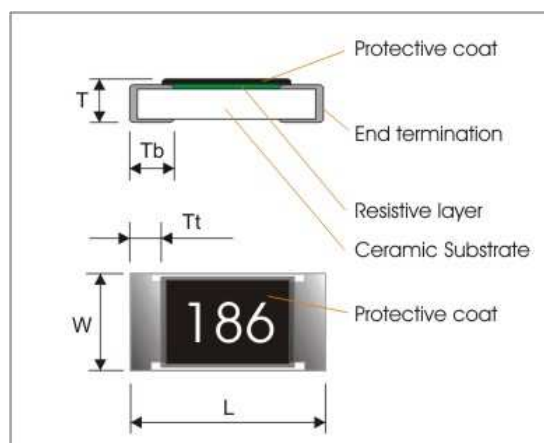
Note :

- 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

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

## 6. DIMENSIONS(unit : mm)

series	GR06	GR05	GR03	GR02
<b>L</b>	$3.10 \pm 0.15$	$2.00 \pm 0.10$	$1.60 \pm 0.10$	$1.00 \pm 0.05$
<b>W</b>	$1.60 \pm 0.15$	$1.25 \pm 0.10$	$0.80 \pm 0.10$	$0.50 \pm 0.05$
<b>Tt</b>	$0.50 \pm 0.25$	$0.40 \pm 0.20$	$0.30 \pm 0.10$	$0.20 \pm 0.10$
<b>Tb</b>	$0.50 \pm 0.25$	$0.40 \pm 0.20$	$0.30 \pm 0.15$	$0.25 \pm 0.10$
<b>T</b>	$0.55 \pm 0.10$	$0.50 \pm 0.15$	$0.45 \pm 0.15$	$0.35 \pm 0.05$



## 7. FUNCTIONAL DESCRIPTION

### 7.1 Product characterization

Standard values of nominal resistance are taken from the E96 & E24 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".

### 7.2 Derating

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

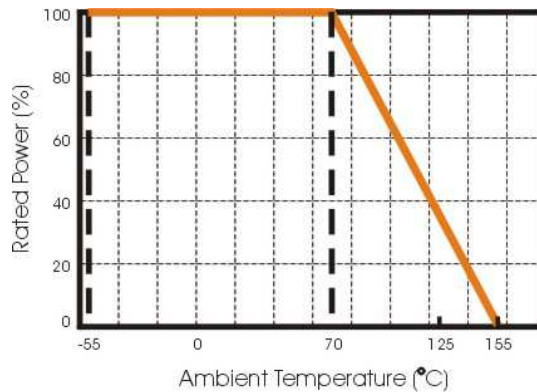


Figure 2. Maximum dissipation in percentage of rated power  
As a function of the ambient temperature

### 7.3 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 below. GR02 is not guaranteed with wave soldering process due to its 0402 size.

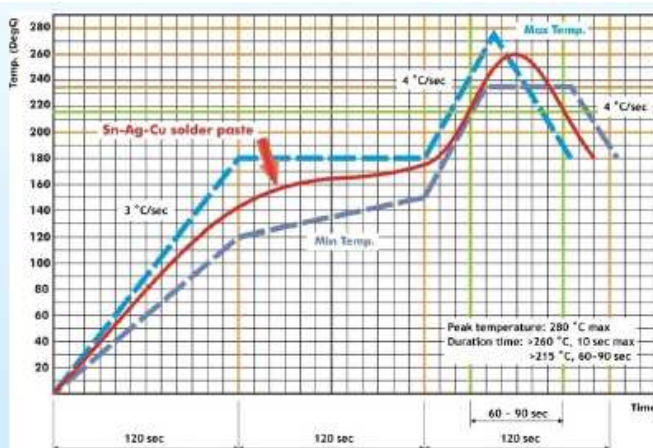


Fig. 1 Recommended IR reflow soldering profile for SMT process with SnAgCu series solder paste.

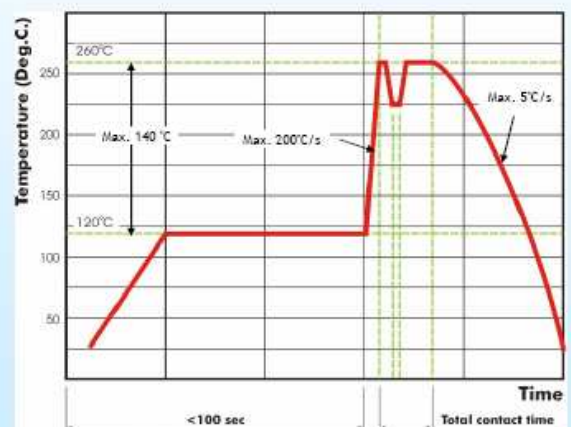


Fig. 2 Recommended wave soldering profile for SMT process with SnAgCu series solder.

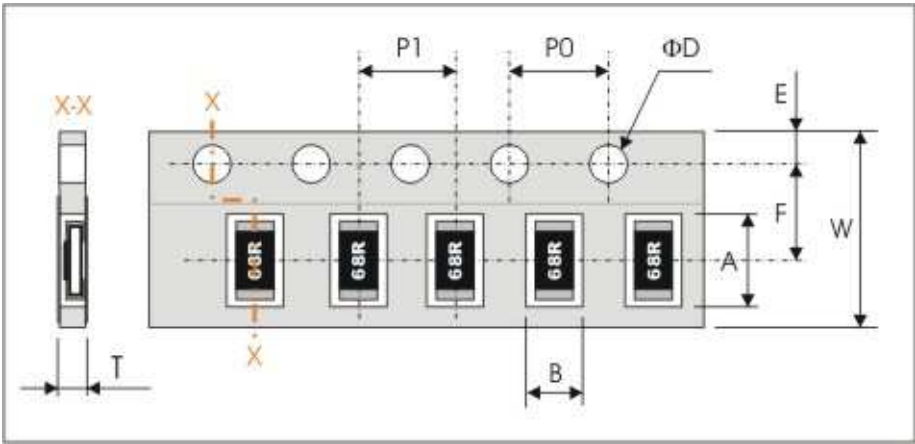


**TEST AND REQUIREMENTS(JIS C 5201-1 : 1998)**

TEST	PROCEDURE	REQUIREMENT
Temperature Coefficient of Resistance (T.C.R) <b>Clause 4.8</b>	Natural resistance change per change in degree centigrade. $\frac{R_2 - R_1}{R_1(t_2 - t_1)} \times 10^6 \text{ (ppm/}^\circ\text{C)}$ <p>R<sub>1</sub> : Resistance at reference temperature  R<sub>2</sub> : Resistance at test temperature  t<sub>1</sub> : 20°C+5°C-1°C  t<sub>2</sub> : Test temperature.</p>	Refer to quick reference data for T.C.R specification.
Short time overload (S.T.O.L) <b>Clause 4.13</b>	Permanent resistance change after a 5 second application of a voltage 2.5xU <sub>R</sub> or max. Overload voltage, whichever is less.	No visible damage. $\Delta R/R \text{ max. J: } \leq \pm(2\%+0.1\Omega)$ $F: \leq \pm(1\%+0.05\Omega)$
Solderability <b>Clause 4.17</b>	Un-mounted chips completely immersed for 2±0.5 second in a SAC solder bath at 235°C±5°C.	good tinning (>95% covered) no visible damage
Resistance to soldering heat(R.S.H) <b>Clause 4.18</b>	Un-mounted chips completely immersed for 10±1second in a SAC solder bath at 260°C±5°C	No visible damage. $\Delta R/R \text{ max. J: } \leq \pm(1\%+0.1\Omega)$ $F: \leq \pm(0.5\%+0.05\Omega)$
Temperature cycling <b>Clause 4.19</b>	1. 30 minutes at -55°C±3°C, 2. 2~3 minutes at 20°C+5°C-1°C, 3. 30 minutes at +155°±3°C, 4. 2~3 minutes at 20°C+5°C-1°C, Total 5 continuous cycles.	No visible damage. $R/R \text{ max. J} \leq \pm(1\%+0.1\Omega)$ $F \leq \pm(0.5\%+0.05\Omega)$
Load life (endurance) <b>Clause 4.25</b>	1000 +48/-0 hours, loaded with RCWV or Vmax in chambe controller 70±2°C, 1.5 hours on and 0.5 hours off	No visible damage. $R/R \text{ max. J} \leq \pm(3\%+0.1\Omega)$ $F \leq \pm(1\%+0.05\Omega)$
Load life in Humidity <b>Clause 4.24</b>	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	No visible damage. $R/R \text{ max. J} \leq \pm(3\%+0.1\Omega)$ $F \leq \pm(1\%+0.05\Omega)$
Bending strength <b>Clause 4.33</b>	Resistors mounted on a 90mm glass epoxy resin PCB(FR4); bending : 3 mm, once for 10 seconds	$R/R \text{ max. } \pm(1\%+0.10\Omega)$
Adhesion <b>Clause 4.32</b>	Pressurizing force: 5N, Test time: 10±1sec.	No remarkable damage or removal of the terminations.
Insulation Resistance <b>Clause 4.6</b>	Apply the maximum overload voltage (DC) for 1minute	$\geq 10G\Omega$
Dielectric Withstand Voltage <b>Clause 4.7</b>	Apply the maximum overload voltage (AC) for 1 minute	No breakdown or flashover

8. PACKAGING

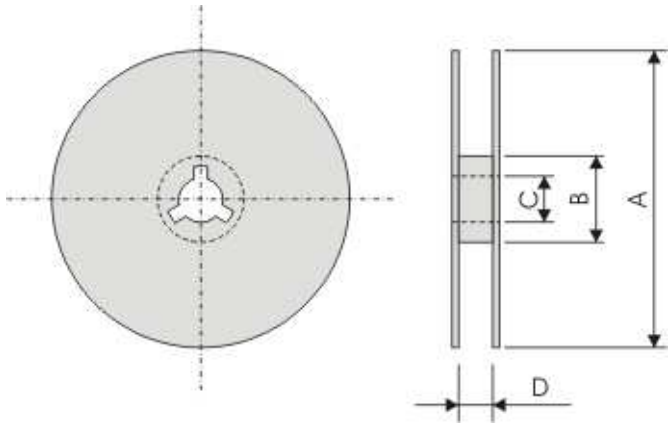
8.1 Paper Tape specifications (unit :mm)



Series No.	A	B	W	F	E
GR06	3.60±0.20	2.00±0.20	8.00±0.30	3.50±0.2	1.75±0.10
GR05	2.40±0.20	1.65±0.20	8.00±0.30	3.50±0.2	1.75±0.10
GR03	1.90±0.20	1.10±0.20	8.00±0.30	3.50±0.2	1.75±0.10
GR02	1.20±0.10	0.70±0.10	8.00±0.30	3.50±0.2	1.75±0.10

Series No.	P1	P0	ΦD	T
GR06	4.00±0.10	4.00±0.10	Φ1.50 <sup>+0.1</sup> <sub>-0.0</sub>	Max. 1.0
GR05	4.00±0.10	4.00±0.10		0.65±0.1
GR03	4.00±0.10	4.00±0.10		0.40±0.05
GR02	2.00±0.10	4.00±0.10		

8.2 Reel dimensions



Symbol	A	B	C	D
(unit : mm)	Φ178.0±2.0	Φ60.0±1.0	13.0±0.2	9.0±0.5

#### 8.4 Taping Quantity:

Tape	Paper Tape						Embossed Tape	Bulk Cassette
	4mm pitch			2mm pitch			4mm pitch	
	7"	10"	13"	7"	10"	13"	7"	
0201	-	-	-	15000	-	-	-	-
0402	-	-	-	10000	20000	40000	-	50000
0603	5000	10000	20000	10000	20000	-	-	20000
0805	5000	10000	20000	-	-	-	-	10000
1206	5000	10000	20000	-	-	-	-	5000

#### 9. Performance of Taping :

##### 9.1. Strength of Carrier Tape and Top Cover Tape

###### -Carrier Tape

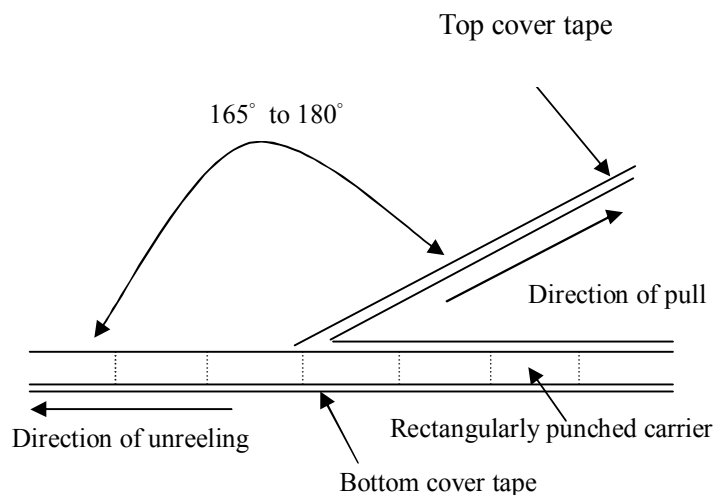
When a tensile force 1.02kgf is applied in the direction of unreeling the tape, the tape shall withstand this force.

###### -Top cover Tape

When a tensile force 1.02kgf is applied to the tape, the tape shall withstand this force.









##### 9.2 Peel Force of Top Cover Tape

Unless otherwise specified, the peel force of top cover tape shall be 10.2 to 71.4 g f when the top cover tape is pulled at a speed of 300mm/min with the angle between the taped during peel and the direction of unreeling maintained at 165 to 180° as illustrated in Fig.



## 10. Resistance Marking Explanation:

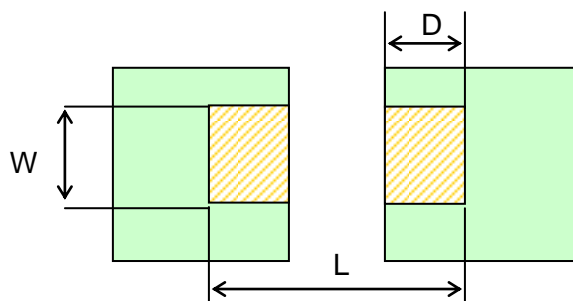
1206 (3216)	3-digits marking
0805 (2012)	3-digits marking
0603 (1608)	3-digits marking
0402(1005)	3-digits marking

Size	E-24	E-96
0402		
0603		
0805		
1206		

### Example

RESISTANCE	6800000 $\Omega$	68000000 $\Omega$
3-digits marking	685	686

## 11. Recommended Solder Pad Dimensions



Type	W (mm)	L (mm)	D (mm)
01(0201)	0.25~0.3	0.7~0.9	0.3~0.4
02(0402)	0.5~0.6	1.4~1.6	0.4~0.6
03(0603)	0.7~0.9	2.0~2.2	0.8~1.0
05(0805)	1.0~1.4	3.2~3.8	0.9~1.4
06(1206)	2.0~2.4	4.4~5.0	1.2~1.8

### Note :

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.