

ALTERNATION HISTORY RECORDS 变更记录

Date 日期	Version 版本	Mark 标记	Page 页码	Description 描述	Drafter 制定者	Approver 审批者
2019-10-12	A	/	/	InitialIssue (首次发行)	Doris Chang	/
2025-05-26	B-1	△	P4	Add manual soldering (solder iron)	Doris Chang	Emily Peng
2025-05-26	B-1	△	P6	Add direction of feed	Doris Chang	Emily Peng

1. Part Numbering System:

<u>CL</u>	<u>05</u>	<u>J</u>	<u>B</u>	<u>R22</u>
<u>Series Name</u> CL : Thick Film Normal Low Ohm Chip Resistors	<u>Type</u> Inch (mm) 02-0402(1005) 03-0603(1608) 05-0805(2012) 06-1206(3216) 10-1210(3225) 0A-2010(5025) 12-2512(6432)	<u>Tolerance</u> F= $\pm 1\%$ J= $\pm 5\%$	<u>Package</u> A=4Kpcs/7"Reel B=5Kpcs/7"Reel C=10Kpcs/7"Reel	<u>Resistance</u> R05=0.05 Ω R22=0.22 Ω

2. 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

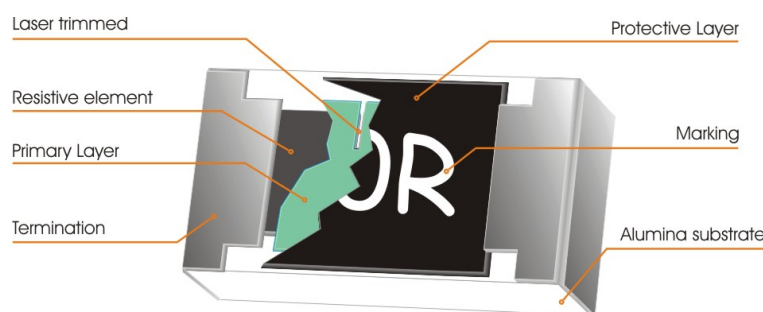
3. APPLICATION

- 1) Power supply
- 2) PDA
- 3) Digital meter
- 4) Computer
- 5) Automotives
- 6) Battery charger
- 7) DC-DC power converter

4. DESCRIPTION

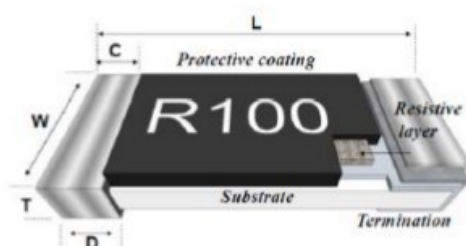
The resistors are constructed in a high grade ceramic body (aluminum oxide). Internal metal electrodes are added at each end and connected by a resistive paste that is applied to the top surface of the substrate. The composition of the paste is adjusted to give the approximate resistance required and 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.



CONSTRUCTION

※ R value $\geq 40\text{mohm}$



※ R value $\leq 39\text{m}\Omega$

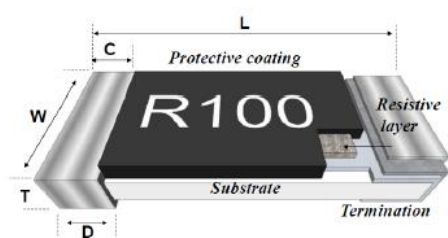


5. QUICK REFERENCE DATA

Item	General Specification					
Series No.	CL12	CL0A	CL10	CL06	CL05	CL03
Size code	2512 (6432)	2010 (5025)	1210 (3225)	1206 (3216)	0805 (2012)	0603 (1608)
Resistance Tolerance	$\pm 5\%$, $\pm 1\%$					
Resistance Range	0.010 Ω ~ 0.910 Ω , E24					0.050 Ω ~ 0.910 Ω , E24
TCR (ppm/°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 - 91m Ω : ± 400 100 - 910m Ω : ± 200
Max. dissipation at T _{amb} =70°C	1 W	3/4W	2/3 W	1/3 W	1/4 W	1/8 W
Rated current	SQRT (Power / Resistance)					
Overload current	SQRT (5 x Power / Resistance)					
Operation temperature	-55 ~ +155°C					

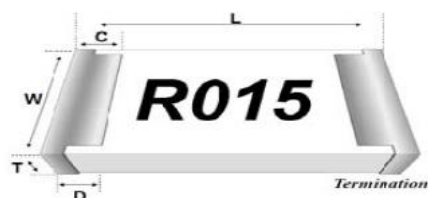
Item	General Specification
Series No.	CL02
Size code	0402
Resistance Tolerance	$\pm 5\%$, $\pm 1\%$
Resistance Range	0.100 Ω ~ 0.910 Ω ,
TCR (ppm/°C)	≤ 600 ppm/°C
Max. dissipation at T _{amb} =70°C	1/16 W
Operation temperature	-55 ~ +155°C

6. MECHANICAL DATA



R value $\geq 40\text{mohm}$

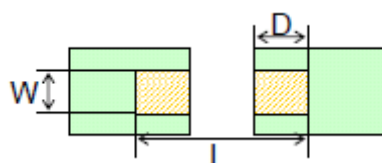
Symbol	CL12	CL0A	CL10	CL06	CL05	CL03	CL02
L	6.30 $\pm$ 0.20	5.00 $\pm$ 0.20	3.10 $\pm$ 0.10	3.10 $\pm$ 0.10	2.00 $\pm$ 0.10	1.60 $\pm$ 0.10	1.00 $\pm$ 0.05
W	3.10 $\pm$ 0.20	2.50 $\pm$ 0.20	2.60 $\pm$ 0.10	1.60 $\pm$ 0.10	1.25 $\pm$ 0.10	0.80 $\pm$ 0.10	0.50 $\pm$ 0.05
T	0.60 $\pm$ 0.15	0.60 $\pm$ 0.10	0.55 $\pm$ 0.10	0.55 $\pm$ 0.10	0.50 $\pm$ 0.10	0.45 $\pm$ 0.10	0.35 $\pm$ 0.05
C	0.60 $\pm$ 0.25	0.60 $\pm$ 0.25	0.50 $\pm$ 0.25	0.50 $\pm$ 0.25	0.40 $\pm$ 0.20	0.30 $\pm$ 0.20	0.20 $\pm$ 0.10
D	0.90 $\pm$ 0.25	0.60 $\pm$ 0.25	0.50 $\pm$ 0.25	0.50 $\pm$ 0.25	0.40 $\pm$ 0.20	0.30 $\pm$ 0.20	0.25 $\pm$ 0.10



R value $\leq 39m\Omega$

Symbol	CL12	CL0A	CL10	CL06	CL05
L	6.40 ± 0.20	5.00 ± 0.20	3.10 ± 0.15	3.10 ± 0.15	2.00 ± 0.10
W	3.10 ± 0.20	2.50 ± 0.20	2.60 ± 0.10	1.60 ± 0.10	1.25 ± 0.10
T	0.60 ± 0.15	0.60 ± 0.10	0.60 ± 0.10	0.55 ± 0.10	0.60 ± 0.10
C	0.25 ± 0.25	0.25 ± 0.25	0.25 ± 0.25	0.25 ± 0.20	0.25 ± 0.20
D	1.80 ± 0.30	1.10 ± 0.25	0.90 ± 0.25	0.90 ± 0.25	0.65 ± 0.20

6.1 RECOMMENDED SOLDERING PAD



Symbol	CL12	CL0A	CL10	CL06	CL05	CL03	CL02
WL	3.70mm	3.00mm	3.00mm	1.80mm	1.30mm	0.90mm	0.60mm
D	1.60mm	1.50mm	1.30mm	1.30mm	1.15mm	1.00mm	0.60mm
L	7.60mm	6.80mm	4.70mm	4.70mm	3.50mm	3.00mm	1.60mm

7. FUNCTIONAL DESCRIPTION

7.1 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".

7.2 Derating curve

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

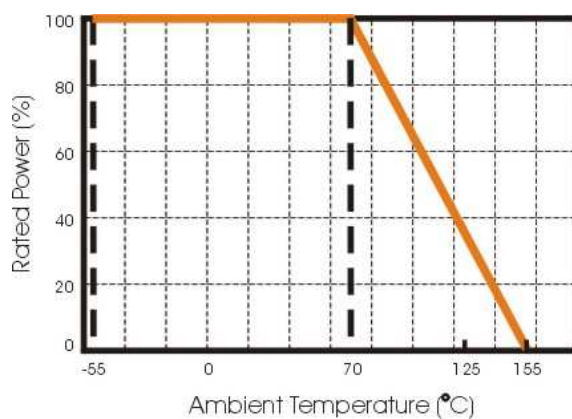


Figure 2 Maximum dissipation in percentage of rated power as a function of the ambient temperature

7.3 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.

7.4 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.

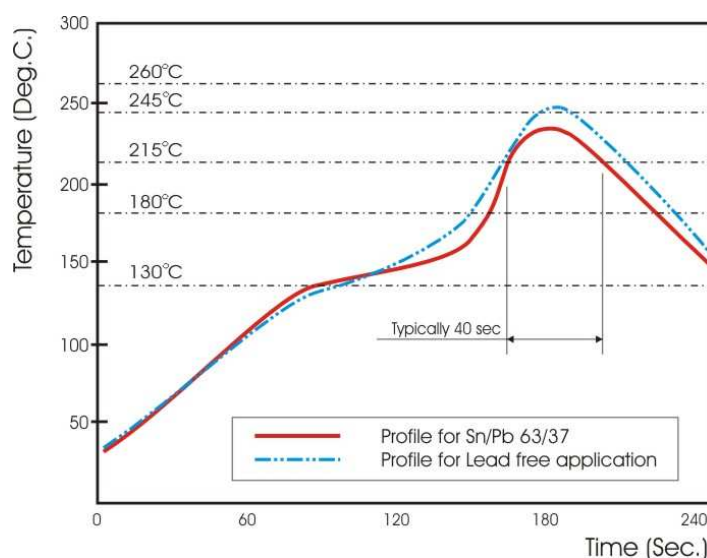
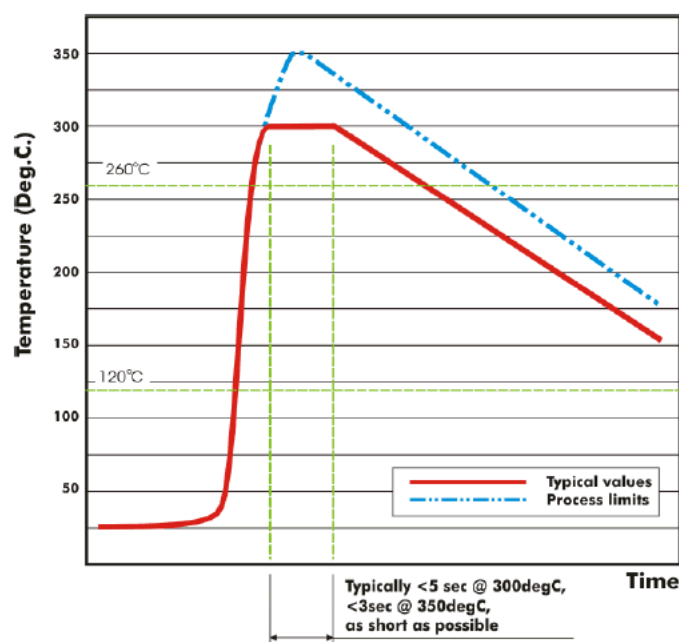


Fig 3. Infrared soldering profile

7.5 Manual soldering (solder iron)



7.6 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. $\frac{R_2 - R_1}{R_1(t_2 - t_1)} \times 10^6 \text{ (ppm/}^\circ\text{C)}$ $t_1 : 25^\circ\text{C}$ R_1 : Resistance at reference temperature 25°C R_2 : Resistance at test temperature 155°C	Refer to "QUICK REFERENCE DATA"
Short time overload (S.T.O.L) Clause 4.13	Permanent resistance change after a 5second application of a 5 times rated power.	J: $\Delta R/R$ max. $\pm(2\%+0.5\text{m}\Omega)$ F: $\Delta R/R$ max. $\pm(1\%+0.5\text{m}\Omega)$ CL02: $\Delta R/R$ max. $\pm(2\%+10\text{m}\Omega)$
Solderability Clause 4.17	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) Clause 4.18	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. $\pm(1\%+0.5\text{m}\Omega)$ F: $\Delta R/R$ max. $\pm(0.5\%+0.5\text{m}\Omega)$ CL02: $\Delta R/R$ max. $\pm(1\%+10\text{m}\Omega)$
Temperature cycling Clause 4.19	30 minutes at $-55^\circ\text{C}\pm 3^\circ\text{C}$, 2~3 minutes at $20^\circ\text{C}+5^\circ\text{C}-1^\circ\text{C}$, 30 minutes at $+155^\circ\text{C}\pm 3^\circ\text{C}$, 2~3 minutes at $20^\circ\text{C}+5^\circ\text{C}-1^\circ\text{C}$, total 5 continuous cycles	no visible damage J: $\Delta R/R$ max. $\pm(1\%+0.5\text{m}\Omega)$ F: $\Delta R/R$ max. $\pm(0.5\%+0.5\text{m}\Omega)$ CL02: $\Delta R/R$ max. $\pm(1\%+10\text{m}\Omega)$
Load life (endurance) Clause 4.25	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. $\pm(3\%+0.5\text{m}\Omega)$ F: $\Delta R/R$ max. $\pm(1\%+0.5\text{m}\Omega)$
Load life in Humidity Clause 4.24	1000 +48/-0 hours, loaded with RCWV or Vmax in humidity chamber controller at $40^\circ\text{C}\pm 2^\circ\text{C}$ and 90~95% relative humidity, 1.5hours on and 0.5 hours off	J: $\Delta R/R$ max. $\pm(3\%+0.5\text{m}\Omega)$ F: $\Delta R/R$ max. $\pm(1\%+0.5\text{m}\Omega)$ CL02: $\Delta R/R$ max. $\pm(5\%+10\text{m}\Omega)$
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: $\Delta R/R$ max. $\pm(1\%+0.5\text{m}\Omega)$ F: $\Delta R/R$ max. $\pm(0.5\%+0.5\text{m}\Omega)$ CL02: $\Delta R/R$ max. $\pm(1\%+10\text{m}\Omega)$
Adhesion Clause 4.32	Pressurizing force: 5N, Test time: $10\pm 1\text{sec}$.	No remarkable damage or removal of the terminations
Insulation Resistance Clause 4.6	Test voltage: $100\pm 15\text{V}$	$I.R \geq 1\text{G}\Omega$

7.7 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.

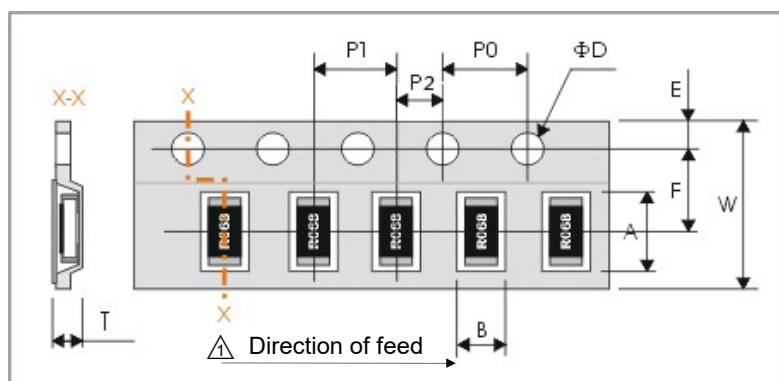
- **3-digits marking for 0603 size**
- Each resistor is marked with a three -digit code on the protective coating to designate the nominal resistance value.

Resistance Marking (E-24 Series)

R150	4 digit marking for $\pm 1\%, \pm 5\%$ 0805 , 1206 , 1210,2010 , 2512 Examples. R150 = 150 m Ω , R020 = 20 m Ω
R50	3 digit marking for $\pm 1\%, \pm 5\%$ 0603 Examples. R12 = 120 m Ω , R50 = 500 m Ω
47M	3 digit marking for $\pm 1\%, \pm 5\%$ 0603 (47m Ω ~91m Ω) Examples. 20M = 20 m Ω

8. PACKAGING

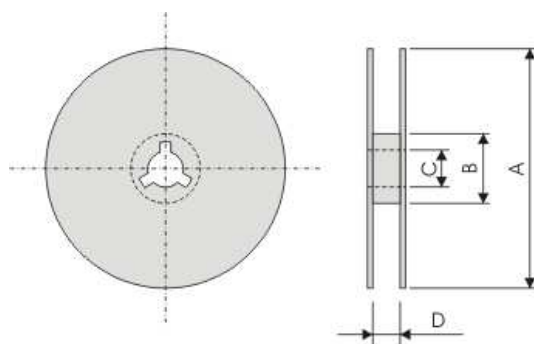
8.1 Paper Tape specifications (unit :mm)



Series No.	A	B	W	F	E
CL12	6.70±0.20	3.50±0.20	12.00±0.30	3.50±0.20	1.75±0.10
CL0A	5.50±0.20	2.80±0.20	12.00±0.30		
CL10	3.60±0.20	3.00±0.20	8.00±0.30		
CL06	3.60±0.20	2.00±0.20			
CL05	2.40±0.20	1.65±0.20			
CL03	1.90±0.20	1.10±0.20			
CL02	1.20±0.10	0.70±0.10			

Series No.	P1	P0	P2	ΦD	T
CL12	4.00±0.10	4.00±0.10	2.00±0.10	$\Phi 1.50^{+0.1}_{-0.0}$	Max. 1.2
CL0A					Max. 1.2
CL10					Max. 1.0
CL06					Max. 1.0
CL05					Max. 1.0
CL03					Max. 0.8
CL02					Max. 0.6

8.2 Reel dimensions



Symbol	A	B	C	D
7" reel	$\Phi 178.0 \pm 2.0$	$\Phi 60.0 \pm 1.0$	13.0±0.5	10.0±1.5 (8mm tape)
10" reel	$\Phi 254.0 \pm 2.0$	$\Phi 100.0 \pm 1.0$		13.8±1.5 (12mm tape)
13" reel	$\Phi 330.0 \pm 2.0$	$\Phi 100.0 \pm 1.0$		