

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
2019-5-10	A	/	P10	In release	Doris	/
2020-09-05	A	△	P8~P9	Added resistance marking for special customers	Doris	Martin
2021-08-06	A	△	P8	Modify E24 0603±1% printing mark	Doris	Emily

1. Part Numbering System):

CR	03	J	A	10K
<u>Series Name</u> Chip Resistor: CR: Thick Film chip resistors	<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

- High reliability and stability
- Reduced size of final equipment
- Lower assembly costs
- Higher component and equipment reliability
- RoHS 2 compliant and Halogen free products

3. APPLICATION

- Consumer electrical equipment
- EDP, Computer application
- Telecom application

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 within tolerance by laser cutting 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.

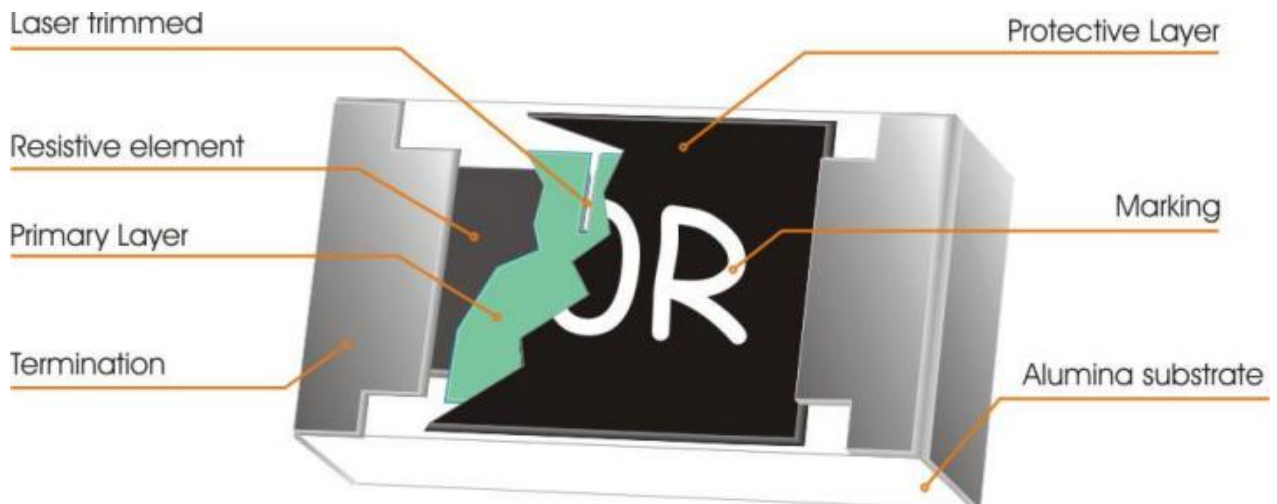


Fig 1. Construction of Chip-R

5. QUICK REFERENCE DATA

Item	General Specification							
Series No.	CR06		CR05		CR03		CR02	
Size code	1206		0805		0603		0402	
Resistance Range	1Ω~10MΩ (±5% tolerance), Jumper 1Ω~10MΩ (±1% tolerance), 10Ω ~ 1MΩ (±0.5%, ±0.1% tolerance)							
Resistance Tolerance	E96/E24	E24	E96/E24	E24	E96/E24	E24	E96/E24	E24
TCR (ppm/°C) 10MΩ ≥R > 10Ω R ≤ 10Ω	≤ ± 100 -200~+400							
Max. dissipation @ T _{amb} =70°C	1/4 W		1/8 W		1/10 W		1/16 W	
Max. Operation Voltage (DC or RMS)	200V		150V		75V		50V	
Max. Overload Voltage (DC or RMS)	400V		300V		150V		100V	
Operating Temperature	-55 ~ +155°C							

TEST CONDITION FOR JUMPER (0 Ω)

Item	CR06	CR05	CR03	CR02
Power Rating At 70°C	1/4W	1/8W	1/10W	1/16W
Resistance	MAX.50mΩ			
Rated Current	2A	1.5A	1A	1A
Peak Current	5A	3.5A	3A	2A
Operating Temperature	-55 ~ +155°C			

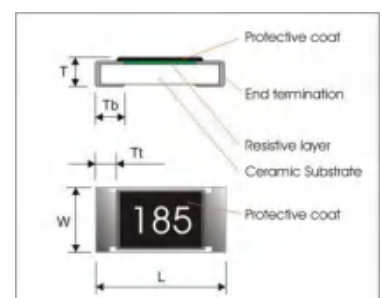
Note :

1. This is the maximum voltage that may be continuously supplied to the resistor element, see “IEC publication 60115-8”
2. Max. Operation Voltage : So called RCWV (Rated Continuous Working Voltage) is determined by

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

6.DIMENSIONS (unit : mm)

	CR06	CR05	CR03	CR02
L	3.10 ± 0.10	2.00 ± 0.10	1.60 ± 0.10	1.00 ± 0.05
W	1.60 ± 0.10	1.25 ± 0.10	0.80 ± 0.10	0.50 ± 0.05
T	0.60 ± 0.15	0.50 ± 0.15	0.45 ± 0.15	0.35 ± 0.05
Tb	0.45 ± 0.20	0.40 ± 0.20	0.30 ± 0.15	0.25 ± 0.10
Tt	0.50 ± 0.20	0.40 ± 0.20	0.30 ± 0.10	0.20 ± 0.10



7.FUNCTIONAL DESCRIPTION

7.1 Product characterization

Standard values of nominal resistance are taken from the E24&E96 series for resistors with a tolerance of $\pm 0.1\%$, $\pm 0.5\%$, $\pm 1\%$, $\pm 5\%$, 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

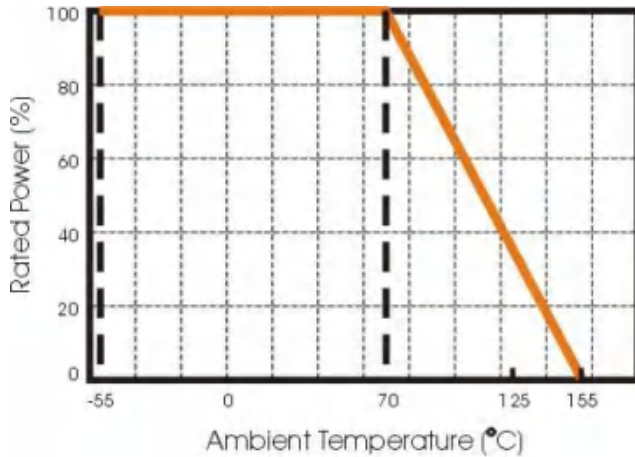


Figure 2 Maximum dissipation in percentage of rated power as a function of the ambient temperature for CR06 , CR05, CR03, CR02

7.3 Storage and Handling Conditions:

1. Products are recommended to be used up within two years since operation date as ensured shelf life. Check solderability in case shelf life extension is needed.
2. To store products with following condition:
Temperature :5 to 40°C
Humidity :20 to 70% relative humidity
3. Caution:
 - a. Don't store products in a corrosive environment such as sulfide, chloride gas, or acid.
It may cause oxidization of electrode, which easily be resulted in poor soldering
 - b. To store products on the shelf and avoid exposure to moisture.
 - c. Don't expose products to excessive shock, vibration, direct sunlight and so on

7.4 SOLDERING CONDITION follows J-STD-020D

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.

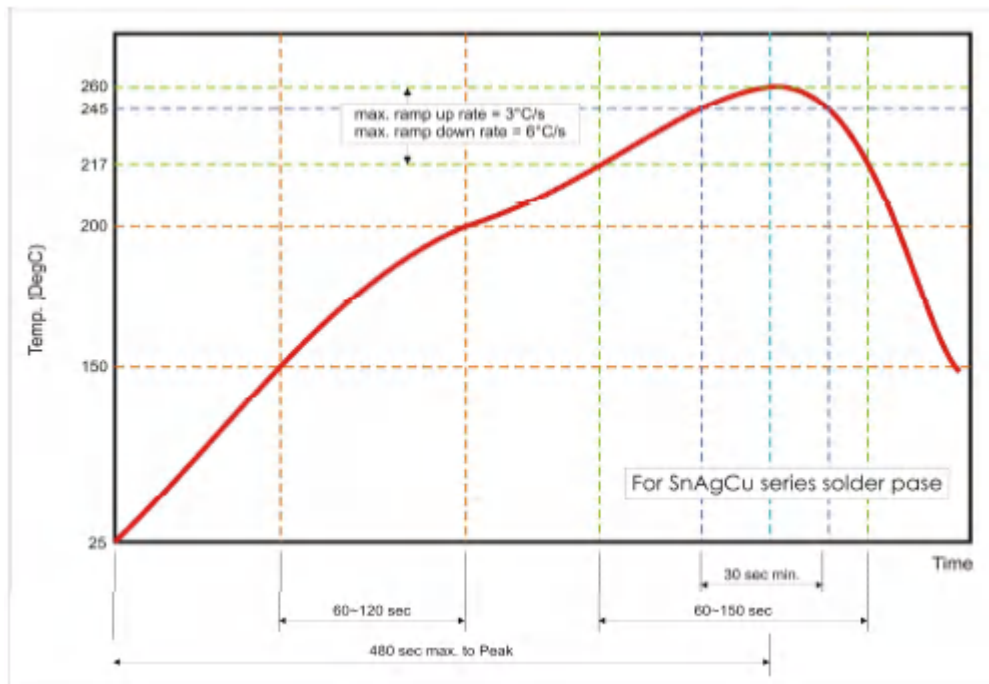


Fig 3. Infrared soldering profile for Chip Resistors

7.5 TEST AND REQUIREMENTS

Essentially all tests are carried out according to the schedule of IEC publication 115-8, category **LCT/UCT/56**(rated temperature range : **L**ower **C**ategory **T**emperature, **U**pper **C**ategory **T**emperature; damp heat, long term, 56 days). The testing also meets the requirements specified by EIA, EIAJ and JIS.

The tests are carried out in accordance with IEC publication 68, "Recommended basic climatic and mechanical robustness testing procedure for electronic components" and under standard atmospheric conditions according to IEC 60068-1, subclause 5.3. Unless otherwise specified, the following value supplied :

Temperature: 15°C to 35°C.

Relative humidity: 45% to 75%.

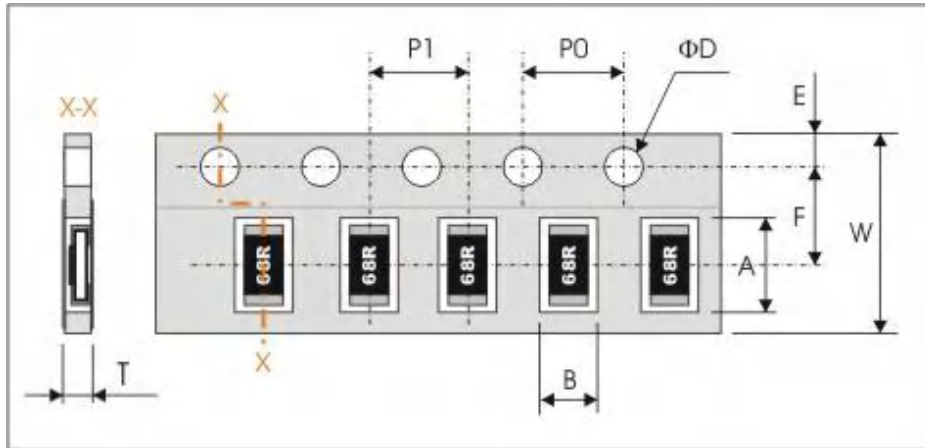
Air pressure: 86kPa to 106 kPa (860 mbar to 1060 mbar).

All soldering tests are performed with mildly activated flux.

TEST	PROCEDURE / TEST METHOD	REQUIREMENT	
		Resistor	0Ω
Electrical Characteristics JISC5201-1: 1998 Clause 4.8	- DC resistance values measurement - Temperature Coefficient of Resistance (T.C.R) Natural resistance change per change in degree centigrade. $\frac{R_2 - R_1}{R_1(t_2 - t_1)} \times 10^6 \text{ (ppm/}^\circ\text{C)}$ $t_1 : 20^\circ\text{C}+5^\circ\text{C}-1^\circ\text{C}; t_2 : -55^\circ\text{C or }+155^\circ\text{C}$ R_1 : Resistance at reference temperature (20°C+5°C/-1°C) R_2 : Resistance at test temperature (-55°C or +155°C)	Within the specified tolerance Refer to "QUICK REFERENCE DATA"	<50mΩ
Resistance to soldering heat(R.S.H) JISC5201-1:1998 Clause 4.18	Un-mounted chips completely immersed for 10±1second in a SAC solder bath at 260°C ±5°C	±5%:ΔR/Rmax.±(1%+0.05Ω) ±1%:ΔR/Rmax.±(0.5%+0.05Ω) no visible damage	<50mΩ
Solderability JISC5201-1: 1998 Clause 4.17	Un-mounted chips completely immersed for 2±0.5 second in a SAC solder bath at 235°C ±5°C	95% coverage min., good tinning and no visible damage	
Temperature cycling JISC5201-1: 1998 Clause 4.19	30 minutes at -55°C±3°C, 2~3 minutes at 20°C+5°C-1°C, 30 minutes at +155°C±3°C, 2~3 minutes at 20°C+5°C-1°C, total 5 continuous cycles	±5%: ΔR/R max. ±(1%+0.05Ω) ±1%:ΔR/Rmax.±(0.5%+0.05Ω) No visible damage	<50mΩ
High Temperature Exposure MIL-STD-202 method 108	1000+48/-0 hours; without load in a temperature chamber controlled 155±3°C	±5%:ΔR/Rmax.±(2%+0.1Ω) ±1%:ΔR/Rmax.±(1%+0.1Ω) No visible damage	<50mΩ
Bending strength JISC5201-1: 1998 Clause 4.33	Resistors mounted on a 90mm glass epoxy resin PCB(FR4), bending once 3mm for 10sec, 5mm for CR02	±5%:ΔR/Rmax.±(1%+0.05Ω) ±1%:ΔR/Rmax.±(1%+0.05Ω) No visual damaged	<50mΩ
Adhesion JISC5201-1: 1998 Clause 4.32	Pressurizing force: 5N, Test time: 10±1sec.	No remarkable damage or removal of the terminations	
Short Time Overload (STOL) JISC5201-1: 1998 Clause 4.13	2.5 times RCWV or max. overload voltage, for 5seconds	±5%: ΔR/R max. ±(2%+0.05Ω) ±1%: ΔR/R max. ±(1%+0.05Ω) No visible damage	<50mΩ
Load life in Humidity JISC5201-1: 1998 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	±5%: ΔR/R max. ±(2%+0.1Ω) ±1%: ΔR/R max. ±(1%+0.1Ω) No visible damage	<50mΩ
Load life (endurance) JISC5201-1: 1998 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	±5%: ΔR/R max. ±(3%+0.1Ω) ±1%: ΔR/R max. ±(1%+0.1Ω) No visible damage	<50mΩ
Insulation Resistance JISC5201-1: 1998 Clause 4.6	Apply the maximum overload voltage (DC) for 1minute	R ≥ 10GΩ	
Dielectric Withstand Voltage JISC5201-1: 1998 Clause 4.7	Apply the maximum overload voltage (AC) for 1 minute	No breakdown or flashover	

8.PACKAGING

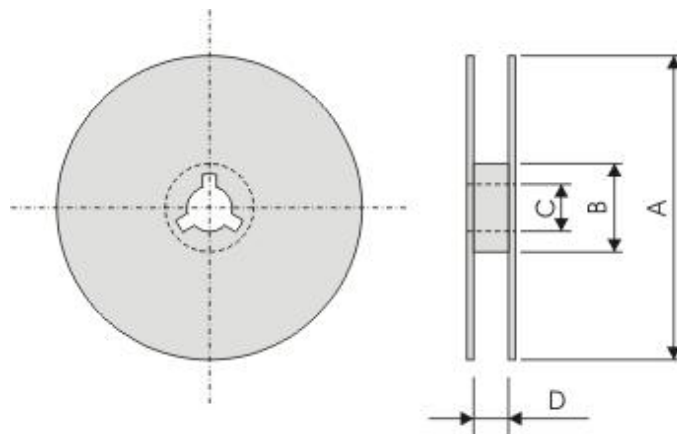
8.1 Paper Tape specifications (unit :mm)



Series No.	A	B	W	F	E
CR06	3.60±0.20	2.00±0.20	8.00±0.30	3.50±0.20	1.75±0.10
CR05	2.40±0.20	1.65±0.20			
CR03	1.90±0.20	1.10±0.20			
CR02	1.20±0.10	0.70±0.10			

Series No.	P1	P0	ΦD	T
CR06/CR05	4.00±0.10	4.00±0.10	Φ1.50 ^{+0.1} _{-0.0}	Max. 1.0
CR03				0.65±0.05
CR02	2.00±0.10			0.40±0.05

8.2 Reel dimensions



Symbol	A	B	C	D
7" reel	Φ178.0±2.0	Φ60.0±1.0	13.0±0.2	9.0±0.5
10" reel	Φ254.0±2.0	Φ100.0±1.0	13.0±0.2	9.0±0.5
13" reel	Φ330.0±2.0	Φ100.0±1.0	13.0±0.2	9.0±0.5

8.3 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

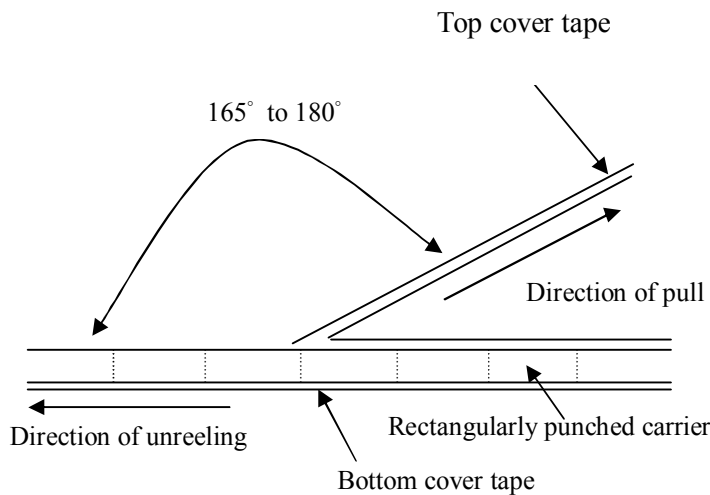
When a tensile force 1.02kgf is applied in the direction of unreeling the tape, the tape shall withstand this force.

-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: 


10.1 General customer

Size \ Nr. Of digit of code\tolerance	$\pm 5\%$	$\pm 1\%$
1206 (3216)	3-digits marking	4-digits marking
0805 (2012)	3-digits marking	4-digits marking
0603 (1608)	3-digits marking	3-digits marking
0402(1005)	NO MARKING	

10.1.1 3-digits marking ($\pm 5\%$: 1206 & 0805 & 0603)

Each resistor is marked with a three digits code on the protective coating to designate the nominal resistance value.

10.1.2 3-digits marking ($\pm 1\%$: 0603)

Nominal resistance	Description														
1.E-24 series	$\pm 1\%$ One short bar under marking letter. 														
2.E-24 series	$\pm 5\%$.														
3.E-96 series	The 1st two digit codes are referring to the CODE on the table, the 3rd code is the index of resistance value : $Y=10^{-2}$, $X=10^{-1}$, $A=10^0$, $B=10^1$, $C=10^2$, $D=10^3$, $E=10^4$, $F=10^5$ EX : 17.8 Ω =25X, 178 Ω =25A, 1K78 =25B 17K8=25C, 178K=25D, 1M78=25E														
3. Remark	There is no marking for the items are not under E-24 and E-96 series														
CODE	R_value	CODE	R_value	CODE	R_value	CODE	R_value	CODE	R_value	CODE	R_value	CODE	R_value	CODE	R_value
01	100	13	133	25	178	37	237	49	316	61	422	73	562	85	750
02	102	14	137	26	182	38	243	50	324	62	432	74	576	86	768
03	105	15	140	27	187	39	249	51	332	63	442	75	590	87	787
04	107	16	143	28	191	40	255	52	340	64	453	76	604	88	806
05	110	17	147	29	196	41	261	53	348	65	464	77	619	89	825
06	113	18	150	30	200	42	267	54	357	66	475	78	634	90	845
07	115	19	154	31	205	43	274	55	365	67	487	79	649	91	866
08	118	20	158	32	210	44	280	56	374	68	499	80	665	92	887
09	121	21	162	33	215	45	287	57	383	69	511	81	681	93	909
10	124	22	165	34	221	46	294	58	392	70	523	82	698	94	931
11	127	23	169	35	226	47	301	59	402	71	536	83	715	95	953
12	130	24	174	36	232	48	309	60	412	72	549	84	732	96	976

Example E-24 series



10.1.3 4-digits marking ($\pm 1\%$: 1206/0805)

Each resistor is marked with a four digits code on the protective coating to designate the nominal resistance value.

Example

RESISTANCE	10 Ω	12 Ω	100 Ω	6800 Ω	47000 Ω
3-digits marking (1206 & 0805 & 0603 $\pm 5\%$)	100	120	101	682	473
4-digits marking	10R0	12R0	1000	6801	4702

10.2 Special customer (foreign customers) \triangle

10.2.1 No Marking

The Rated resistance of 0402 should not be marked.

10.2.2 0805 1206 1210 2010 2512

The nominal resistance shall be marked in 3 digits or 4 digits and marked on over coat side.

- E24 series: 3 digits, E96 series: 4 digits

In case of the resistance value that E96 overlaps with E24, It is marked by either.

Marking example	Contents	Application
123	$12 \times 10^3 [\Omega] \rightarrow 12 [k\Omega]$	0805 1206 1210 2010 2512
2R2	2.2 $[\Omega]$	Less than 10W of 1206 1210 2010 2512
2.2	2.2 $[\Omega]$	Less than 10 Ω of 0805
5623	$562 \times 10^3 [\Omega] \rightarrow 562 [k\Omega]$	0805 1206 1210 2010 2512
12R7	12.7 $[\Omega]$	0805 1206 1210 2010 2512

10.2.3 0603

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

No marking in the E96 series

In case of the resistance value that E96 overlaps with E24, there is a case to mark in E96.

Marking example		Contents	Application
Malaysia	China		
123	123	$12 \times 10^3 [\Omega] \rightarrow 12 [k\Omega]$	E24
2R2	2R2	2.2 $[\Omega]$	E24
No marking	02C	$102 \times 10^2 [\Omega] \rightarrow 10.2 [k\Omega]$	E96
No marking	51X	$332 \times 10^{-1} [\Omega] \rightarrow 33.2 [\Omega]$	E96

10.2.3.1 Symbol for E96 series of resistance value

E96	Symbol	E96	Symbol	E96	Symbol	E96	Symbol	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		

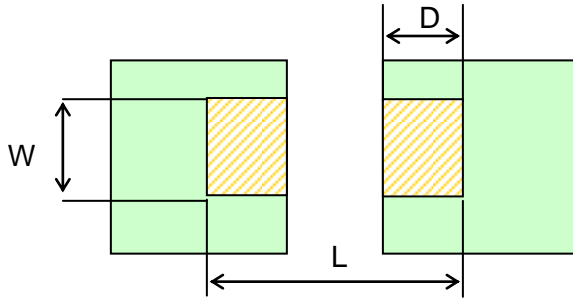
10.2.3.2 Symbol of multipliers

Symbol	Y	X	A	B	C	D	E	F
Multipliers	10^{-2}	10^{-1}	10^0	10^1	10^2	10^3	10^4	10^5

10.2.4 Marking example of Jumper Chip

Marking example	Contents	Application
○ or 000	JP	0603
○		0805 1206
000		1210 2010 2512

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
10(1210)	2.0~2.4	4.4~5.0	2.3~3.5
0A(2010)	3.3~3.7	5.7~6.5	2.3~3.5
12(2512)	3.6~4.0	7.8~8.6	2.3~3.5

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.