CHIP TECHNOLOGIES INC.

Chip Resistor Specification

CHIP TECHNOLOGIES INC.

Thick Film Chip Resistors — CR Series (RoHS Compliant)

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Canada, M1S 5A4

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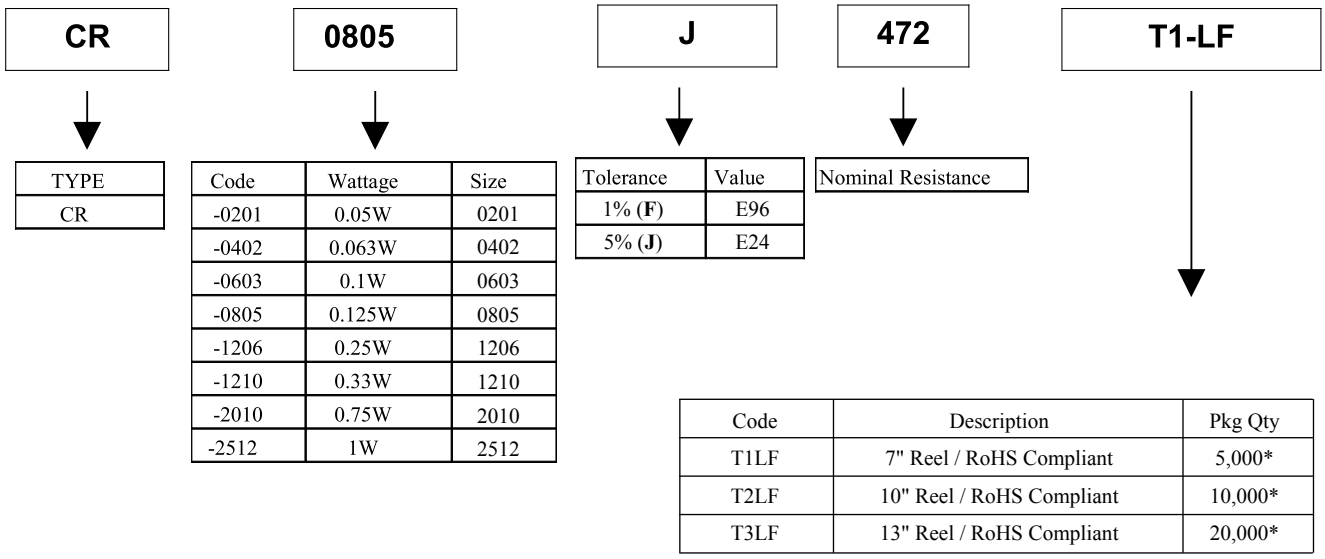
1. Scope

This specification prescribes thick film chip resistors for use in electronics system

2. Designation

Designation is made in accordance with the following system



TYPE
CR

Code	Wattage	Size
-0201	0.05W	0201
-0402	0.063W	0402
-0603	0.1W	0603
-0805	0.125W	0805
-1206	0.25W	1206
-1210	0.33W	1210
-2010	0.75W	2010
-2512	1W	2512

Tolerance	Value
1% (**F**)	E96
5% (**J**)	E24

Nominal Resistance

Code	Description	Pkg Qty
T1LF	7" Reel / RoHS Compliant	5,000*
T2LF	10" Reel / RoHS Compliant	10,000*
T3LF	13" Reel / RoHS Compliant	20,000*

*** 0402 and smaller case size, Pkg Qty x 2 ***

2.1 Remark：

2.1.1 Common code for chip resistors

2.2.2 Normal resistance value：

The first two digitals are significant figures of resistance value and third one denotes the number of zeros following.

Example: 330Ω:331, 4.7KΩ:472

22kΩ:223, 100KΩ:104

3. Rating

3.1 Rated Power (%)

3.1.1 Resistor rated power

TYPE	SIZE	POWER RATING AT 70 ℃ （Watts）	Max. Working Voltage	Max. Overload Voltage	Maximum Intermittent Overload Voltage	STANDARD RESISTANCE VALUES
CR0201	0201	1/20	25V	50V	50V	E-96 E-24
CR0402	0402	1/16	50V	100V	100V	E-96 E-24
CR0603	0603	1/10	50V	100V	100V	E-96 E-24
CR0805	0805	1/8	150V	300V	300V	E-96 E-24
CR1206	1206	1/4	200V	400V	400V	E-96 E-24
CR1210	1210	1/4	200V	400V	400V	E-96 E-24

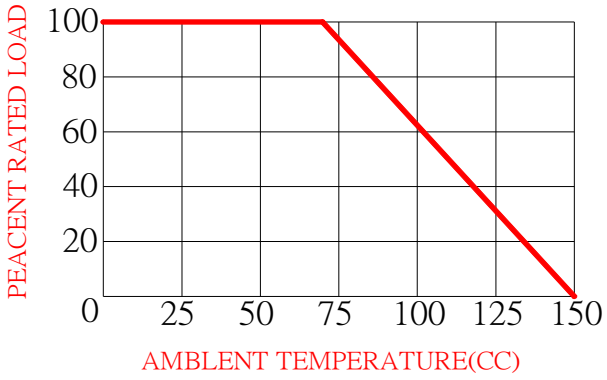
CR2010	2010	1/2	200V	400V	400V	E-96 E-24
CR2512	2512	1	200V	400V	400V	E-96 E-24

3.1.2 Zero Ohm Jumper Rated Power

TYPE	SIZE	POWER RATING AT 70 ℃ （Watts）	Max. Working Current	Max. Overload Current	Resistance Tolerance	STANDARD RESISTANCE VALUES
CR0201	0201	1/20	1A	2.5A	<50mΩ	E-96 E-24
CR0402	0402	1/16	1A	2.5A	<50mΩ	E-96 E-24
CR0603	0603	1/10	2A	5A	<50mΩ	E-96 E-24
CR0805	0805	1/8	2A	5A	<50mΩ	E-96 E-24
CR1206	1206	1/4	2A	5A	<50mΩ	E-96 E-24
CR1210	1210	1/4	2A	5A	<50mΩ	E-96 E-24
CR2010	2010	1/2	2A	5A	<50mΩ	E-96 E-24
CR2512	2512	1	3A	7.5A	<50mΩ	E-96 E-24

3.2 Power – Temperature Derating

Rated power shall be load power corresponding to normal wattage suitable for continuous use at 70℃ ambient temperature in case the ambient temperature exceeds 70℃ reduce the load power in accordance with derating curve shown as below



3.3 Resistance, Resistance Tolerance and Temperature Coefficient of Resistance

Thick Film Chip Resistors — CR Series (RoHS Compliant)

TYPE	SIZE	POWER RATING AT 70℃ (Watts)	RESISTANCE TOLERANCE	RESISTANCE RANGE	TEMPERATURE COEFFICIENT (TCR; ppm / ℃)	STANDARD RESISTANCE VALUES
CR0201	0201	1/20	±5% (J) ±5% (J) ±1% (F) ±1% (F)	10Ω~91Ω 100Ω~1M 10Ω~97.6Ω 100Ω~1M	±300ppm/℃ ±200ppm/℃ ±300ppm/℃ ±200ppm/℃	E-96 E-24
CR0402	0402	1/16	±5% (J) ±5% (J) ±1% (F)	1.0Ω~9.1Ω 10Ω~10M 10Ω~10M	±350ppm/℃ ±200ppm/℃ ±200ppm/℃	E-96 E-24
CR0603	0603	1/10	±5% (J) ±5% (J) ±5% (J) ±1% (F)	1.0Ω~9.1Ω 10Ω~10M 1.1M~22M 1.0Ω~10M	±350ppm/℃ ±200ppm/℃ ±350ppm/℃ ±100ppm/℃	E-96 E-24
CR0805	0805	1/8	±5% (J) ±5% (J) ±5% (J) ±1% (F) ±1% (F)	1.0Ω~9.1Ω 10Ω~10M 1.1M~22M 1.0Ω~1M 1.02M~10M	±350ppm/℃ ±200ppm/℃ ±350ppm/℃ ±100ppm/℃ ±350ppm/℃	E-96 E-24
CR1206	1206	1/4	±5% (J) ±5% (J) ±5% (J) ±1% (F) ±1% (F)	1.0Ω~9.1Ω 10Ω~1M 1.1M~22M 1.0Ω~1M 1.02M~10M	±350ppm/℃ ±200ppm/℃ ±350ppm/℃ ±100ppm/℃ ±350ppm/℃	E-96 E-24
CR1210	1210	1/4	±5% (J) ±5% (J) ±5% (J) ±1% (F)	1.0Ω~9.1Ω 10Ω~1M 1.1M~22M 0.1~10M	±350ppm/℃ ±200ppm/℃ ±350ppm/℃ ±100ppm/℃	E-96 E-24
CR2010	2010	1/2	±5% (J) ±5% (J) ±1% (F)	1.0Ω~9.1Ω 10Ω~22M 0.1Ω~10M	±350ppm/℃ ±200ppm/℃ ±100ppm/℃	E-96 E-24
CR2512	2512	1	±5% (J) ±5% (J) ±1% (F)	1.0Ω~9.1Ω 10Ω~22M 0.1Ω~1M	±350ppm/℃ ±200ppm/℃ ±100ppm/℃	E-96 E-24
CR0201 CR0402 CR0603 CR0805 CR1206	0201 0402 0603 0805 1206	JUMPER	0.050-OHM MAX. DC RESISTANCE,			

3.4 Standard Atmospheric Condition

Ambient Temperature = +5℃ to +35℃

Relative Humidity = < 85% RH

Air Pressure = 86 to 106kPa

3.5 Operating Temperature Range -55℃ to +125℃

3.6 Moisture Sensitivity Level Rating： Level 1

3.7 Product Assurance

The resistors shall warranty 12 months from the date of shipment.

3.8 Rated Voltage

The rated voltage is calculated form the rated power and normal resistance by the following formula： $E=\sqrt{RP}$

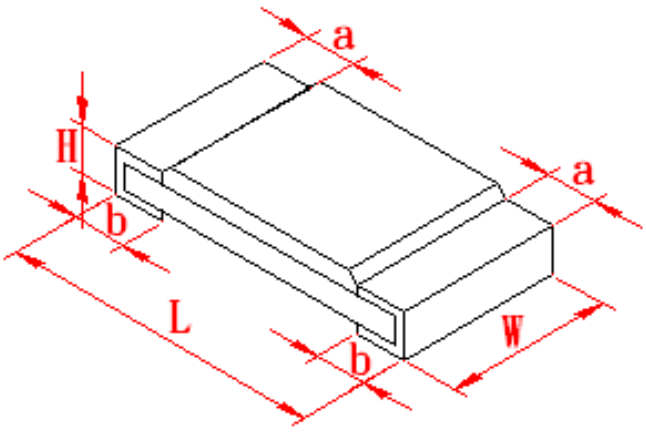
Where- E：Rated Voltage (V)

P：Rated Power (W)

R：Normal Resistance (ohm)

In case the value calculated by the formula exceeds the maximum working voltage as 3.1.1 and 3.1.2 the maximum working voltage shall be regarded as rated

4. Dimension

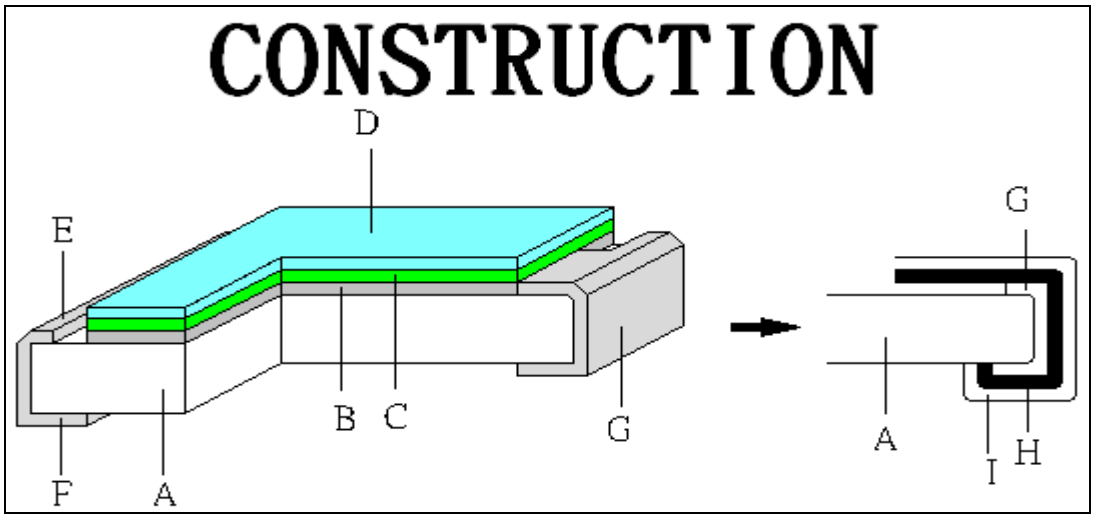


SIZE：mm

TYPE	SIZE	POWER RATING	L	W	H	a	b
CR0201	0201	1/20W	0.6 ± 0.03	0.3 ± 0.03	0.23 ± 0.03	0.1 ± 0.05	0.15 + 0.05
CR0402	0402	1/16W	1.0 ± 0.05	0.5 ± 0.05	0.35 ± 0.05	0.2 ± 0.1	0.25 + 0.05 - 0.1
CR0603	0603	1/10W	1.6 ± 0.1	0.85 ± 0.1	0.45 ± 0.05	0.3 ± 0.2	0.2 + 0.2 - 0.1

CR0805	0805	1/8W	2.05 ± 0.1	1.3 ± 0.1	0.45 + 0.1 -0.05	0.4 ± 0.2	0.3 + 0.2 - 0.1
CR1206	1206	1/4W	3.1± 0.1	1.6 ± 0.1	0.55 + 0.1 - 0.05	0.45 ± 0.25	0.4 + 0.2 - 0.1
CR1210	1210	1/4W	3.2 ± 0.2	2.6 ± 0.2	0.55± 0.1	0.50 ± 0.25	0.5 ± 0.2
CR2010	2010	1/2W	5.0 ± 0.2	2.5 ± 0.2	0.55± 0.1	0.6 ± 0.25	0.5± 0.2
CR2512	2512	1W	6.35± 0.2	3.2 ± 0.2	0.55± 0.1	0.6 ± 0.25	0.5 ± 0.2

5. Construction and materials



5.1 Material

		Construction	Row Material	Thickness
Substrate	A	Ceramic Substrate	Aluminum substrate	-
Resistor Film (Not for zero ohm)	B	Resistor	Ruthenium oxide	-
Coating Film	C	Glass coating	Glass	-
	D	Epoxy coating	Epoxy	-
-		Marking	Epoxy	-
Terminations	E	Front Conduct	Silver & Palladium	30±2μm(wet)
	F	Back Conduct	Silver & Palladium	30±2μm(wet)
	G	Terminal coating	Silver	>0.1mm
Electroplating	H	Nickel plating	Nickel	3~12μm
	I	Tin plating	Tin	3~12μm

6 Package

6.1Taping

6.1.1 Taping Materials

1. Every taping shall consist of materials as shown in table6.1
2. Every taping shall not adversely affect the mechanical, electrical and solderability performances.
3. Materials of taping shall generate no static
4. The tape products are stored at a temperature –5 to +40℃ and a relative humidity of 40 to 50% without exposing to direct sunlight and after such condition, the tape shall show no deterioration in performances such as change in adhesion force or peel forces.

Table 6.1 Materials of Taping

	Carrier tape	Top cover tape	Bottom cover tape
Material	Paper	Thermal adhesion polyester	Thermal adhesion paper

6.1.2 Lead and Trailer Tape

1. Leader Tape:

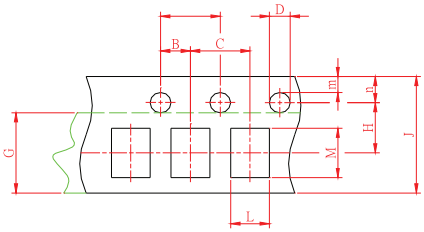
   The length of leader tape shall be at least 400mm including 40or more or rectangular holes (component compartments) in witch no component is placed. (This applies to full reels only)

   NOTE: The 40 or more empty components compartments shall be sealed with the top cover tape

2. Trailer Tape:

   The trailer tape at the hub of reel shall be least 15 mm in length including carrier tape with empty component. The empty component compartments shall be sealed with the top cover tape.

6.1.3 Tapping Specification



SIZE:mm

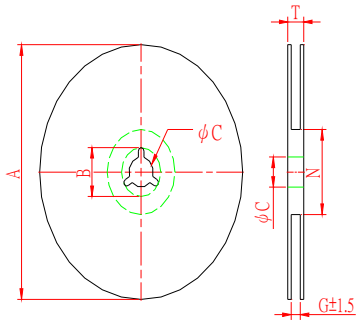
TYPE	A	B	C	D	F	G	H	J	L	M	Thickness
CR0201	4.00±0.05	4.00±0.05	2.00±0.05	1.50 +0.1 -0	1.75±0.10	5.00±0.05	3.50±0.05	8.00±0.20	0.65±0.10	1.15±0.10	0.55±0.10
CR0402	4.00±0.05	4.00±0.05	2.00±0.05	1.50 +0.1 -0	1.75±0.10	5.00±0.05	3.50±0.05	8.00±0.20	0.65±0.10	1.15±0.10	0.55±0.10

CR0603	4.00±0.05	2.00±0.05	4.00±0.10	1.50 $^{+0.1}_{-0}$	1.75±0.10	5.00±0.05	3.50±0.05	8.00±0.20	1.1±0.10	1.90±0.10	0.70±0.10
CR0805	4.00±0.05	2.00±0.05	4.00±0.10	1.50 $^{+0.1}_{-0}$	1.75±0.10	5.00±0.05	3.50±0.05	8.00±0.20	1.65±0.10	2.40±0.10	0.90±0.10
CR1206	4.00±0.05	2.00±0.05	4.00±0.10	1.50 $^{+0.1}_{-0}$	1.75±0.10	5.00±0.05	3.50±0.05	8.00±0.20	1.90±0.10	3.50±0.10	0.90±0.10
CR1210	4.00±0.05	2.00±0.05	4.00±0.10	1.50 $^{+0.1}_{-0}$	1.75±0.10	5.00±0.05	3.50±0.05	8.00±0.20	2.80±0.10	3.50±0.10	0.90±0.10
CR2010	4.00±0.05	2.00±0.05	4.00±0.10	1.50 $^{+0.1}_{-0}$	1.75±0.10	5.00±0.05	5.50±0.05	12.50±0.20	2.90±0.10	5.30±0.10	1.00±0.10
CR2512	4.00±0.05	2.00±0.05	4.00±0.10	1.50 $^{+0.1}_{-0}$	1.75±0.10	5.00±0.05	5.50±0.05	12.50±0.20	3.40±0.10	6.60±0.10	1.00±0.10

6.1.4 Quantity Tape and Reels

Type	Quantity	Remarks
CR0201	10,000pcs	
CR0402	10,000pcs	
CR0603	5,000pcs	10,000 or 20,000pcs on request
CR0805	5,000pcs	10,000 or 20,000pcs on request
CR1206	5,000pcs	10,000 or 20,000pcs on request
CR1210	5,000pcs	
CR2010	4,000pcs	
CR2512	4.000pcs	

6.1.5 REEL DIMENSIONS：

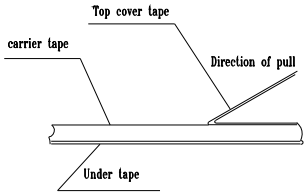


SIZE:mm

Type	CR0402、CR0603、CR0805、CR1206、CR1210	CR2010、CR2512
A	Ø180 +0 -3	Ø180 +0 -3
B	21.0±0.2	21.0±0.2
∮C	Ø 13.0±0.2	Ø 13.0±0.2
G	10.0±1.5	14.0±1.5
N	Ø 60.0 +1 -0	Ø 60.0 +1 -0
T	11.4±1.5	15.4±1.5

6.1.6 Peel force of top cover tape

The peel force of the top cover tape shall be 10 to 70 g, when the top cover tape is pulled at a speed of 200 mm/min with the angle between the tape during peel and the direction of unreeling maintained at 165 to 180 degree.



6.2 Packing

6.2.1 Identification

Production label that indicates the 12 digits lot number, product type, resistance value and tolerance shall be pasted on the surface of each reel.

Example of lot number: P XXXXX XXXXXX

Packing List Number Running number

6.2.2 Packing Reel Box

Dimension	Reel Box	Number of Reels
185×60×186mm	25K Box	5
185×120×186mm	50K Box	10

7 Characteristics And Test Methods

7.1 Electrical Performance Test

7.1.1 Resistance Value

Measurement of resistance takes place by the bridge methods or by use of a measuring instrument corresponding accuracy, its accuracy being fully reliable with respect to tolerances on resistance. The applied voltage for measurement shall be as specified in Table as following.

Resistance (R)	Voltage applied (V)

2.2Ω~100Ω	0.3V
100Ω~1KΩ	1V
1KΩ~10KΩ	3V
10KΩ~100KΩ	10V
100KΩ~1MΩ	25V
1MΩ~10MΩ	50V
10MΩ~aboveΩ	100V

7.1.2 Temperature Coefficient of Resistance

In accordance with 7.1.1 measure initial of resistor mounted on the test board, Then keep the temperature at each step as following table, hold for 30 minutes after reaching a given temperature and measure resistance under the same condition as initial-value measurement. The temperature coefficient of resistance calculated from these measured values by the following formula shall be accordance with 3.1 T.C.R. spec limit.

Temperature coefficient (PPM/℃) = $\frac{R - R_0}{R} * \frac{1}{t - t_0} * 10^6$

Where R = Resistance value at tested temperature R_0 = Initial resistance value

t = Actual measurement of tested temperature(-55℃ or125℃)

t^0 = Initial temperature(25℃)

7.1.3 Short-Time Overload

In accordance with 7.1.1 measure the initial of resistor mounted on the test socket, then apply to the resistor the voltage corresponding to 2.5 times rated voltage. However, in case the voltage corresponding to 2.5 times the rated voltage exceeds the maximum overload voltage, the maximum overload voltage shall be regarded as test voltage. Eliminate the voltage, leave aside with no load for 30 minutes and then measure resistance under the same condition as in initial-value measurement, at this time, the variation in relation to initial resistance shall be less than ±(1%+0.05Ω)

7.1.4 Insulation Resistance test

Measure the resistance value between terminal and coating must be over 1,000MΩ minimum, apply a 100V DC. For 1 minute without mechanical damage.

7.1.5 Intermittent Overload test

Apply 3 times of rating voltage but not exceeding the max. overload voltage for 1 second on, 25 second off. which test 10,000 cycles .The specimen is allowed to stand without load for 30minutes or more after removal of voltage, then the resistance is measured and the variation in the resistance value is calculated. Resistance shall be below ± (5%+0.1Ω) no mechanical damage.

7.2 Mechanical Performance Test

7.2.1 Resistance to Soldering Heat

In accordance with 7.1.1, measure the initial value of a resistor Dip it in a soldering bath at 260℃ for 10 seconds and take out at room temperature. Then, leave it aside for about 1 hour and measure resistance under the same condition as in initial value

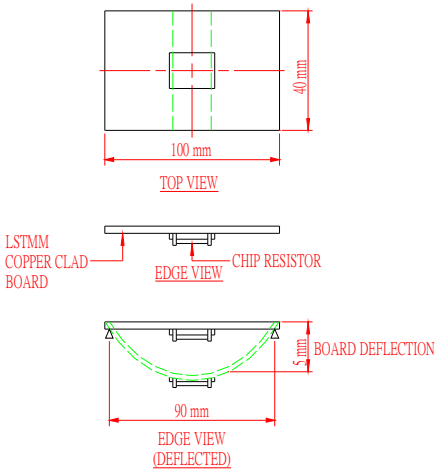
measurement. The variation in relation to the initial resistance shall be below ± (1% +0.05Ω), there being no failure in appearance and mechanical damage.

7.2.2 Solderability

Dip the terminal in a flux (methanol solution containing rosin approx. 25% in weight) for one to two sec. And then dip into a soldering bath at 260℃ for 3±0.5sec. The soldering area shall be over 95% of full coverage.

7.2.3 Bending strength test

Bond chip resistor with epoxy resin to center of 100 × 40 × 1.57 mm test substrate. Solder terminals, cool, and then bend in 5 mm from horizontal plane for a period of 10 seconds. Following the bending test, the change in resistance shall be within ±(1%+0.05Ω) from initial measured value with no evidence of mechanical damage.



7.3 Environmental Test

7.3.1 Temperature Cycle

In accordance with 7.1.1,measure initial value of the resistor mounted on test substrate and then repeats five cycles continuously with four steps of heat cycle in following Table regarded as on cycle. Take it-out room temperature, leave aside for 1~2 hours, and then measure resistance under the same condition as in initial-valve measurement At this time, the variation in relation to the initial resistance shall be below ±(1%+0.05Ω),there being no mechanical injury.

Conditions of Heat Cycle Test

Step	Temperature(℃)	Time (min)
1	-65±3	30
2	Room temperature	3
3	150±3	30
4	Room temperature	3

7.3.2 Endurance for Humidity

In accordance with 7.1.1, measure the initial value of a resistor mounted on the test substrate. Then, leave it in a thermal and humidity chamber having 40±2℃ temperature and 90~95% relative humidity with no load for 1000 $^{+48}/_{-0}$ hours. Take it out room temperature, leave aside for about one hour, and then measure resistance under the same condition as in initial-value measurement. At this time the variation in relation in to the initial resistance shall be below ± (3%+0.1Ω), initial-value, there being no mechanical damage.

7.3.3 Moisture Resistance

In accordance with 7.1.1, measure the initial value of a resistor mounted on the test substrate Then, apply the rated D.C. voltage in article 3.4 for 90 min. in a thermal and humidity chamber having 40±2℃ temperature and 90~95% relative humidity and repeat the 30 min. Pause cycle for 1000 $^{+48}/_{-0}$ hours. Then, take it out at room temperature, leave aside for about one hour, and measure resistance under the same condition as in initial-value measurement. At this time, the variation in relation to the initial resistance shall be below ± (3%+0.1Ω), there being no mechanical damage.

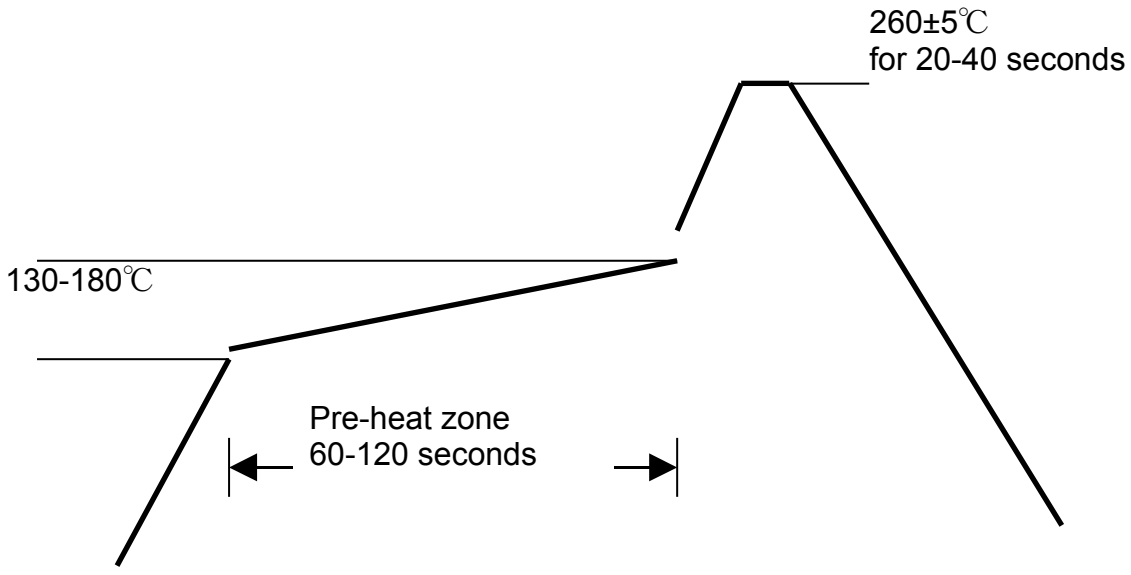
7.3.4 Rated load test

In accordance with 7.1.1 measure the initial value of the resistor mounted on test substrate. Then, it shall be standard to test chip type resistors at their paragraph 3.4 E= $\sqrt{PR}$ rated voltage, 1.5 hours on and 0.5 hour off, for a total elapsed time of 1000 hours at 70±2℃. Resistors shall be mounted on PC board test pattern. Resistance determinations shall be made initially and the end of the first half-hour-off period after 250,500 and 1000 hours of test. Resistance shall be below ± (3%+0.1Ω).

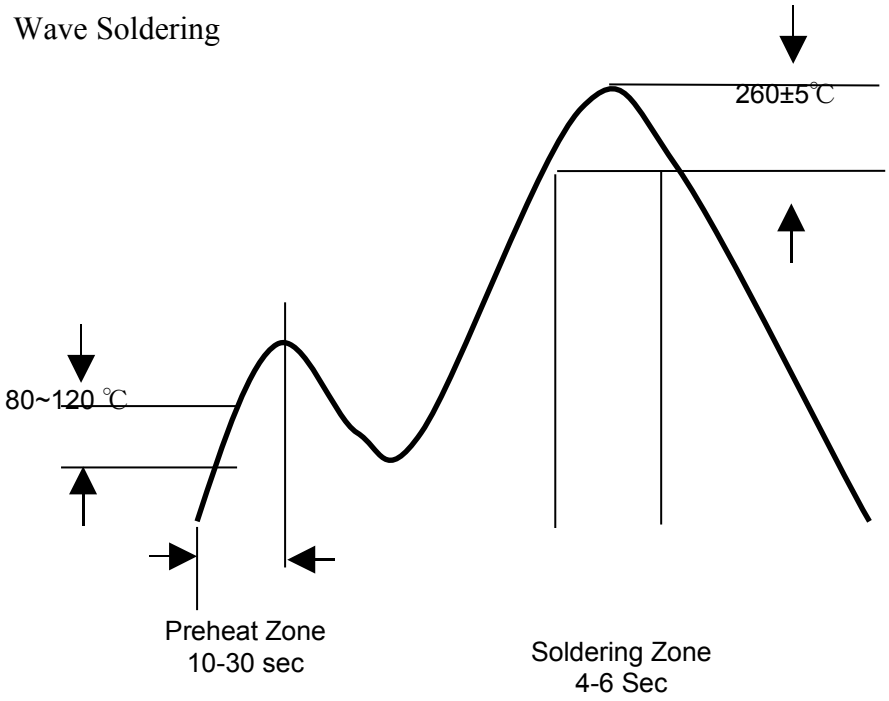
7.4 Application Condition

7.4.1 Reflow Profile

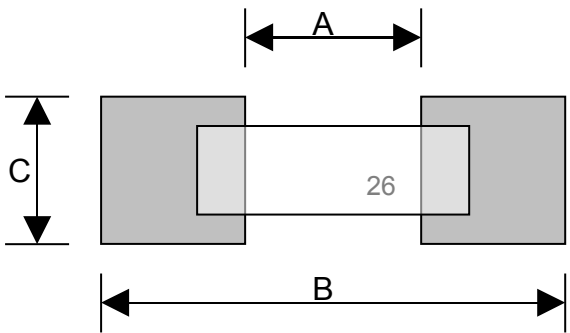
IR Reflow Soldering



Wave Soldering



7.4.2 Dimensions of Footprints



CR

Type	*Land Dimension*		
	A	***B***	***C***
CR0201	0.25mm	0.8mm	0.4-0.5mm
CR0402	0.5mm	1.5mm	0.5-0.6mm
CR0603	1.0mm	2.7mm	0.5-0.9mm
CR0805	1.2mm	3.5mm	1.1-1.3mm
CR1206	2.2mm	5.0mm	1.4-1.8mm
CR1210	2.2mm	5.0mm	2.1-3.0mm
CR2010	3.9mm	8.4mm	2.1-3.0mm
CR2512	5.2mm	10.5mm	2.5-4.8mm

8. Explanation of Part Number For 0603 ±1%

8.1 STANDARD RESISTANCE VALUES FOR THE 10 TO 100 DECADE

RESISTANCE TOLERANCE （ ±% ）								E-96			
1%	#	1%	#	1%	#	1%	#	1%	#	1%	#
10.0	01	14.7	17	21.5	33	31.6	49	46.4	65	68.1	81
10.2	02	15.0	18	22.1	34	32.4	50	47.5	66	69.8	82
10.5	03	15.4	19	22.6	35	33.2	51	48.7	67	71.5	83
10.7	04	15.8	20	23.2	36	34.0	52	49.9	68	73.2	84
11.0	05	16.2	21	23.7	37	34.8	53	51.1	69	75.0	85
11.3	06	16.5	22	24.3	38	35.7	54	52.3	70	76.8	86
11.5	07	16.9	23	24.9	39	36.5	55	53.6	71	78.7	87
11.8	08	17.4	24	25.5	40	37.4	56	54.9	72	80.6	88
12.1	09	17.8	25	26.1	41	38.3	57	56.2	73	82.5	89
12.4	10	18.2	26	26.7	42	39.2	58	57.6	74	84.5	90
12.7	11	18.7	27	27.4	43	40.2	59	59.0	75	86.6	91
13.0	12	19.1	28	28.0	44	41.2	60	60.4	76	88.7	92
13.3	13	19.6	29	28.7	45	42.2	61	61.9	77	90.9	93
13.7	14	20.0	30	29.4	46	43.2	62	63.4	78	93.1	94
14.0	15	20.5	31	30.1	47	44.2	63	64.9	79	95.3	95
14.3	16	21.0	32	30.9	48	45.3	64	66.5	80	97.6	96

By combining a specific two-digit number and a letter code you have a series of

Numeric/Alpha digits that give you the complete（E96）R-Value Codes for part marking.

8.2 LETTER MULTIPLIER CROSS REFERENCE

Y — 0.1　　X — 1

A — 10　　B — 100

C — 1,000　　D — 10,000

E — 100,000　　F — 1,000,000

8.3 EXAMPLE：

0603 （ ±1 % ）

Chip Marking

01B　　01 means 10.0 and B = 100 （ 10.0 ×100 = 1K ohm）

25C　　25 means 17.8 and C = 1,000 （ 17.8 ×1,000 = 17.8K ohm）

93D　　93 means 90.9 and D = 10,000 （ 90.9 ×10,000 = 909K ohm）

9. Management Standards for the Restrictively Used Substances

Included in Parts and Devices

In order to meet products environmental protection requirement, except the products contain none of the prohibited substances in 「Management Standards for the Restrictively-used Substances Included in Parts and Devices」. Following materials shall not be higher than the limit of density (weight %).

Test Item	Regulations	Prohibition Usage	Weight%	Conformance methods
Cadmium (Cd)/ Cadmium Compounds	1. EN1122-2001, 91/338/EEC, 91/57/EEC, 93/86/EEC, 2. CAS# 7440-43-9	Absolutely Prohibited	＜0.0025	Inspection Report (SGS)
PBB/PBDE	83/264/EEC	Absolutely Prohibited	—	Inspection Report (SGS)
Polychlorinated Biphenyls (PCBS)	USEPA8082, 89/677/EEC	Absolutely Prohibited	＜0.0010	Inspection Report (SGS)
Polychlorinated Naphthalene category	—	Absolutely Prohibited	—	Inspection Report (SGS)
Chlorinated paraffin (C10~C13)	—	Absolutely Prohibited	—	Inspection Report (SGS)
Organic tin compounds (Tributyltin Compound & Triphenyltin Compound)	89/677/EEC	Absolutely Prohibited	—	Inspection Report (SGS)
Asbestos	83/478/EEC 85/610/EEC	Absolutely Prohibited	—	Inspection Report (SGS)

	91/659/EEC			
AZO compounds	1. German 2. CAS# 18540-29-9	Absolutely Prohibited	＜0.0010	Inspection Report (SGS)