Data Sheet

Customer:	
Product:	Thick Film Chip Resistor - CR Series
Size:	01005/0201/0402/0603/0805/1206/1210/2010/2512
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Edition:	REV.A3

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Thick Film Chip Resistor

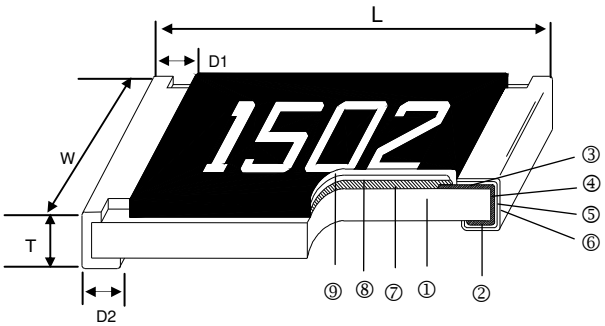
■Scope

– This specification applies to all sizes of rectangular-type fixed chip resistors with Ruthenium-base as material.

■Features

– Small size and light weight
– Highly reliable multilayer electrode construction
– Compatible with all soldering process
– Long side terminations

■Construction



①	Alumina Substrate	④	Edge Electrode	⑦	Resistor Layer
②	Bottom Electrode	⑤	Barrier Layer	⑧	Primary Overcoat
③	Top Electrode	⑥	External Electrode	⑨	Secondary Overcoat

■Applications

– Telecommunication Equipments
– Radio and Tape Recorders, TV Tuners
– Digital Cameras, Watches, Pocket Calculators
– Computers, Instruments
– Medical and Military Equipment

■Dimensions

Type	Size (Inch)	L (mm)	W (mm)	T (mm)	D1 (mm)	D2 (mm)	Weight (g) (1000pcs)
CR-E5	01005	0.40±0.02	0.20±0.02	0.13±0.03	0.10±0.03	0.10±0.03	0.037
CR-01	0201	0.60±0.03	0.30±0.03	0.23±0.03	0.15±0.05	0.15±0.05	0.150
CR-02	0402	1.00±0.05	0.50±0.05	0.30±0.05	0.20±0.10	0.25±0.10	0.620
CR-03	0603	1.60±0.10	0.80±0.10	0.45±0.10	0.30±0.20	0.30±0.20	2.042
CR-05	0805	2.00±0.10	1.25±0.15	0.50±0.10	0.30±0.20	0.40±0.20	4.368
CR-06	1206	3.20±0.20	1.60±0.15	0.55±0.10	0.50±0.20	0.50±0.20	8.947
CR-10	1210	3.20±0.20	2.50±0.20	0.55±0.10	0.50±0.20	0.50±0.20	15.959
CR-0A	2010	5.00±0.20	2.50±0.20	0.55±0.10	0.60±0.20	0.60±0.20	24.241
CR-12	2512	6.30±0.20	3.20±0.20	0.55±0.10	0.60±0.20	0.60±0.20	39.448

■Part Numbering

Part Number：CR-03FL7---10R
Part Number：CR-03JL7----0R

CR-	03	F	L	7	-	-	-	1	0	R
CR-	03	J	L	7	-	-	-	-	0	R

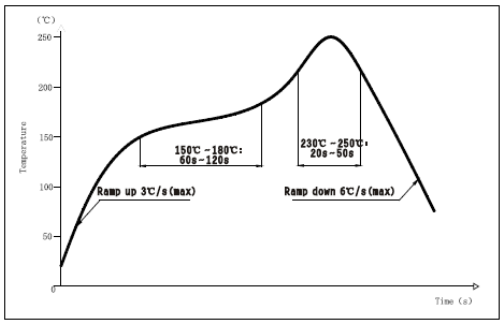
Product Type	Dimensions	Resistance Tolerance	Function Code	Packaging Code	Resistance
CR-	E5: 01005 01: 0201 02: 0402 03: 0603 05: 0805 06: 1206 10: 1210 0A: 2010 12: 2512	F: ±1% J: ±5%	L: Standard	0: 7” Reel 15Kpcs 4: 7” Reel 4Kpcs 5: 7” Reel 20Kpcs 6: 7” Reel 10Kpcs 7: 7” Reel 5Kpcs	- - - 1R2: 1.2Ω - - - 3K3: 3.3KΩ - - - 10K: 10KΩ - - 100K: 100KΩ “-“ to fill up 6 spaces

■Standard Electrical Specifications

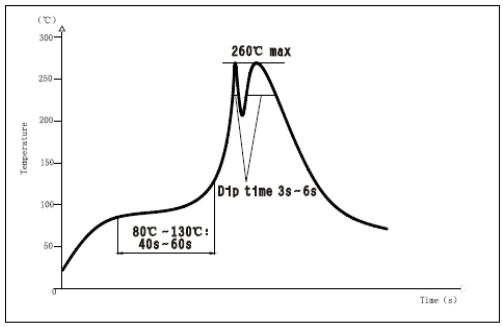
Item / Type	Power Rating at 70°C Jumper Rated Current	Operating Temp. Range	Max. Operating Voltage	Max. Overload Voltage	Max. Overload Current of Jumper	Resistance Range ±1%(E24、E96)	Resistance Range ±5%(E24)	TCR (PPM/°C)
CR-E5 (01005)	1/32W	-55 ~ +125°C	15V	30V	-	10Ω – 97.6Ω 100Ω - 1MΩ		±300 ±250
	Jumper: 0.5A		-	-	1A	-	0Ω (≤50mΩ)	-
CR-01 (0201)	1/20W	-55 ~ +125°C	25V	50V	-	1Ω – 9.76Ω 10Ω - 1MΩ 1.02MΩ - 10MΩ		±400 ±200 ±400
	Jumper: 0.5A		-	-	1A	-	0Ω (≤50mΩ)	-
CR-02 (0402)	1/16W	-55 ~ +155°C	50V	100V	-	1Ω - 9.76Ω 10Ω - 1MΩ 1.02MΩ - 10MΩ		±400 ±200 ±400
	Jumper: 1A		-	-	2A	-	0Ω (≤50mΩ)	-
CR-03 (0603)	1/10W	-55 ~ +155°C	75V	150V	-	1Ω - 9.76Ω 10Ω - 1MΩ 1.02MΩ - 10MΩ		±250 ±100 ±250
	Jumper: 1A		-	-	3A	-	0Ω (≤50mΩ)	-
CR-05 (0805)	1/8W	-55 ~ +155°C	150V	300V	-	1Ω - 9.76Ω 10Ω - 1MΩ 1.02MΩ - 10MΩ		±250 ±100 ±250
	Jumper: 2A		-	-	5A	-	0Ω (≤50mΩ)	-
CR-06 (1206)	1/4W	-55 ~ +155°C	200V	400V	-	1Ω - 9.76Ω 10Ω - 1MΩ 1.02MΩ - 10MΩ		±250 ±100 ±250
	Jumper: 2A		-	-	5A	-	0Ω (≤50mΩ)	-
CR-10 (1210)	1/3W	-55 ~ +155°C	200V	400V	-	1Ω - 9.76Ω 10Ω - 1MΩ 1.02MΩ - 10MΩ		±250 ±100 ±250
	Jumper: 2A		-	-	5A	-	0Ω (≤50mΩ)	-
CR-0A (2010)	3/4W	-55 ~ +155°C	200V	400V	-	1Ω - 9.76Ω 10Ω - 1MΩ 1.02MΩ - 10MΩ		±250 ±100 ±250
	Jumper: 2A		-	-	5A	-	0Ω (≤50mΩ)	-
CR-12 (2512)	1W	-55 ~ +155°C	200V	500V	-	1Ω - 9.76Ω 10Ω - 1MΩ 1.02MΩ - 10MΩ		±250 ±100 ±250
	Jumper: 2A		-	-	5A	-	0Ω (≤50mΩ)	-

Rated Voltage=$\sqrt{}$(P*R) or Max. Operating Voltage listed above, whichever is lower.
Current of DC or AC RMS value

■Soldering Condition

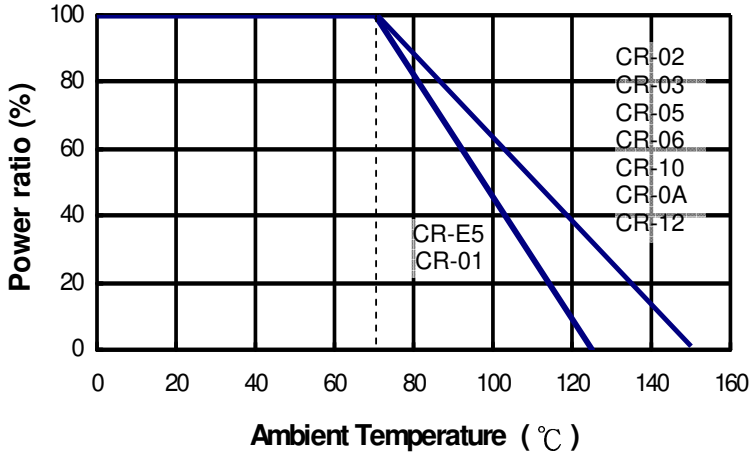


IR Reflow Soldering

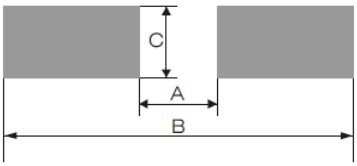


Wave Soldering (Flow Soldering)

■Derating Curve



■Recommend Solder Pad Size



Type	A (mm)	B (mm)	C (mm)
CR-E5	0.17	0.60	0.22
CR-01	0.23	0.84	0.38
CR-02	0.45	1.45	0.60
CR-03	0.80	2.50	0.95
CR-05	1.05	3.25	1.40
CR-06	1.90	4.50	1.75
CR-10	2.00	4.60	2.70
CR-0A	3.50	6.50	2.70
CR-12	4.80	7.80	3.40

■Environmental Characteristics

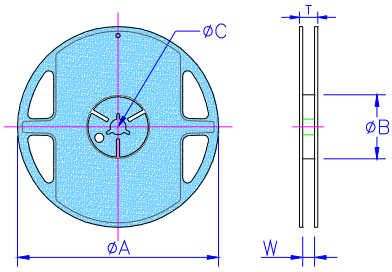
Item	Requirement			Test Method
	±1%	±5%	Jumper	
Temperature Coefficient of Resistance (T.C.R.)	As Spec.			**IEC-60115-1 4.8** -55°C~+125°C, 20°C is the reference temperature
Short Time Overload	01005 size: ±(2.0%+0.05Ω)		≤50mΩ	**IEC-60115-1 4.13** Rated voltage*2.5 or Max. Overload Voltage whichever is lower for 5 seconds Jumper: Max. overload current for 5 seconds
	Other sizes: ±(1.0%+0.05Ω)	Other sizes: ±(2.0%+0.05Ω)		
Insulation Resistance	>1G			**IEC-60115-1 4.6** Apply DC100V±15V between substrate and terminations for 1 minute, then check insulation resistance
Endurance	01005 size: ±(3.0%+0.05Ω)		≤100mΩ	**IEC-60115-1 4.25.1** 70±2°C, rated voltage or operating voltage whichever is lower(Jumper : Rated current) for 1000 hrs with 1.5 hrs “ON” and 0.5 hr “OFF”
	Other sizes: ±(1.0%+0.05Ω)	Other sizes: ±(2.0%+0.05Ω)		
Damp Heat with Load	01005 size: ±(3.0%+0.05Ω)		≤100mΩ	**IEC-60115-1 4.24** 40±2°C, 93±3% R.H., rated voltage or operating voltage whichever is lower (Jumper : Rated current) for 1000 hrs with 1.5 hrs “ON” and 0.5 hr “OFF”
	Other sizes: ±(1.0%+0.05Ω)	Other sizes: ±(2.0%+0.05Ω)		
Endurance at Upper Category Temperature	01005 size: ±(3.0%+0.05Ω)		≤100mΩ	**IEC-60115-1 4.25.3** 01005, 0201 sizes: at +125±2°C for 1000 hrs Other sizes: at +155±2°C for 1000 hrs
	Other sizes: ±(1.0%+0.05Ω)	Other sizes: ±(2.0%+0.05Ω)		
Bending Strength	±(1.0%+0.05Ω)	±(1.0%+0.05Ω)	≤50mΩ	**IEC-60115-1 4.33** Bending once for 60±5 seconds 01005 size: 3mm； 0201, 0402, 0603, 0805 sizes: 5mm 1206, 1210 sizes: 4mm；2010, 2512 sizes: 2mm
Solderability	95% min. coverage			**IEC-60115-1 4.17** 245±5°C for 3±0.3 seconds
Resistance to Soldering Heat	±(1.0%+0.05Ω)	±(1.0%+0.05Ω)	≤50mΩ	**IEC-60115-1 4.18** 270±5°C for 10±1 seconds
Voltage Proof	No breakdown or flashover			**IEC-60115-1 4.7** Apply max. overload of AC RMS at a rated of approximately 100V/s between substrate and terminations for 60±1 seconds
Shear Test	No mechanical damage			**IEC-60115-1 4.32** Applying force: 0201 size: 2N；0402, 0603 sizes: 5N ；0805 size: 9N 1206, 1210 sizes: 25N；2010, 2512 sizes: 45N Duration: 10±1 seconds
Rapid Change of Temperature	01005 size: ±(1.0%+0.05Ω)		≤50mΩ	**IEC-60115-1 4.19** 01005, 0201 sizes: -55°C to +125°C, 300 cycles Other sizes: -55°C to +155°C, 300 cycles
	Other sizes: ±(0.5%+0.05Ω)	Other sizes: ±(1.0%+0.05Ω)		
Operation at Low Temperature	01005 size: ±(2.0%+0.05Ω)		≤50mΩ	**IEC-60115-1 4.36** -55±5°C, 1hr without load, rated voltage or operating voltage whichever is lower(Jumper: Rated current) for 45minute, 15minute without load
	Other sizes: ±(1.0%+0.05Ω)	Other sizes: ±(2.0%+0.05Ω)		
Component Solvent Resistance	±(1.0%+0.05Ω)	±(1.0%+0.05Ω)	≤50mΩ	**IEC-60115-1 4.29** Iso-propyl alcohol (IPA), 23±5°C, 10hrs

■Storage Temperature: 5~30°C; Humidity: 30~70%RH

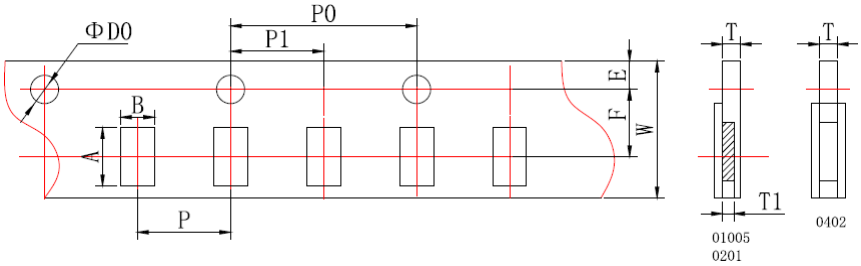
■Packaging

Reel Specifications & Packaging Quantity

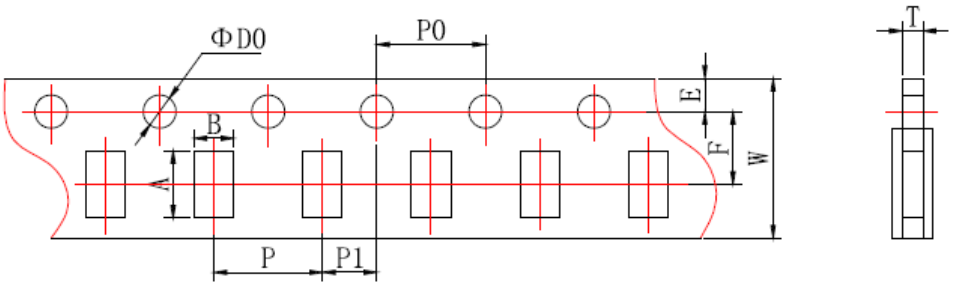
Type	Packaging Quantity		Tape Width	Reel Diameter	ΦA (mm)	ΦB (mm)	ΦC (mm)	W (mm)	T (mm)
CR-E5	Paper	20K	8mm	7 inch	178±2	58.0±2	13.0±0.5	9.5±1.0	12.5±1.5
CR-01	Paper	15K	8mm	7 inch	178±2	58.0±2	13.0±0.5	9.5±1.0	12.5±1.5
CR-02	Paper	10K	8mm	7 inch	178±2	58.0±2	13.0±0.5	9.5±1.0	12.5±1.5
CR-03 CR-05 CR-06 CR-10	Paper	5K	8mm	7 inch	178±2	58.0±2	13.0±0.5	9.5±1.0	12.5±1.5
CR-0A CR-12	Embossed	4K	12mm	7 inch	178±2	57.0±2	13.0±0.5	13.0±0.5	15.5±1.5



Paper Tape Specifications

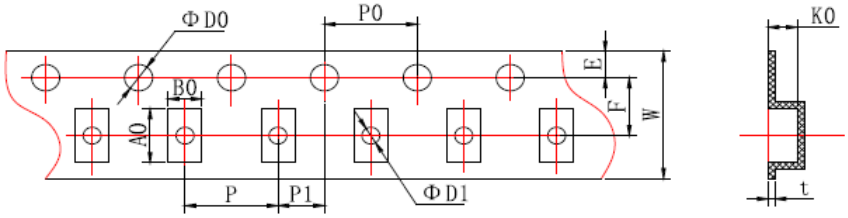


Type	A (mm)	B (mm)	W (mm)	E (mm)	F (mm)	P (mm)	P_0 (mm)	P_1 (mm)	$ΦD_0$ (mm)	T (mm)	T1 (mm)
CR-E5	0.45±0.02	0.25±0.02	8.0±0.02	1.75±0.05	3.50±0.05	2.00±0.05	4.00±0.10	2.00±0.05	1.55±0.02	0.31±0.20	0.17±0.02
CR-01	0.70±0.10	0.40±0.10	8.0±0.20	1.75±0.10	3.50±0.05	2.00±0.05	4.00±0.10	2.00±0.05	1.55±0.10	0.42±0.05	0.28±0.05
CR-02	1.20±0.10	0.70±0.10	8.0±0.20	1.75±0.10	3.50±0.05	2.00±0.05	4.00±0.10	2.00±0.05	1.55±0.10	-	0.42±0.05



Type	A (mm)	B (mm)	W (mm)	E (mm)	F (mm)	P (mm)	P_0 (mm)	P_1 (mm)	$ΦD_0$ (mm)	T (mm)
CR-03	1.85±0.10	1.10±0.10	8.0±0.20	1.75±0.10	3.50±0.05	4.00±0.10	4.00±0.10	2.00±0.05	1.50±0.10	0.60±0.10
CR-05	2.35±0.10	1.65±0.10	8.0±0.20	1.75±0.10	3.50±0.05	4.00±0.10	4.00±0.10	2.00±0.05	1.50±0.10	0.75±0.10
CR-06	3.50±0.20	1.90±0.20	8.0±0.20	1.75±0.10	3.50±0.05	4.00±0.10	4.00±0.10	2.00±0.05	1.50±0.10	0.75±0.10
CR-10	3.50±0.20	2.80±0.20	8.0±0.20	1.75±0.10	3.50±0.05	4.00±0.10	4.00±0.10	2.00±0.05	1.50±0.10	0.75±0.10

Embossed Plastic Tape Specifications



Type	A0 (mm)	B0 (mm)	W (mm)	E (mm)	F (mm)	P (mm)	P_0 (mm)	P_1 (mm)	ΦD_0 (mm)	ΦD_1 (mm)	K0 (mm)	t (mm)
CR-0A	5.50±0.15	2.82±0.15	12.0±0.10	1.75±0.10	5.5±0.10	4.00±0.10	4.00±0.10	2.00±0.05	1.50+0.1	1.50±0.10	0.84±0.10	0.25±0.05
CR-12	6.78±0.15	3.45±0.15	12.0±0.10	1.75±0.10	5.5±0.10	4.00±0.10	4.00±0.10	2.00±0.05	1.50+0.1	1.50±0.10	0.81±0.10	0.25±0.05

■Marking

No Marking for 01005, 0201 and 0402

Jumper for all: Letter "0"

0603, 0805, 1206, 2512 for Example: 

1210, 2010 for Example: 

1% for 0805/1206/1210/2010/2512: 4 digits marking

Example:

Resistance	100Ω	2.2KΩ	10KΩ	49.9KΩ	100KΩ
Marking	1000	2201	1002	4992	1003

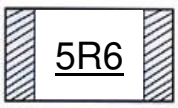
5% for 0603/0805/1206/1210/2010/2512: 3 digits marking in E24

Example: 101=100Ω 102=1KΩ (1^{st} and 2^{nd} are E24 code and 3^{rd} code is multiplier)

E24 code	10	11	12	13	15	16	18	20	22	24	27	30	33	36	39	43	47	51	56	62	68	75	82	91

1% for 0603(E24): 3 digits marking in E24

Example: one short bar under marking letter



1% for 0603(E96): 3 digits marking in E96

3 digits marking for Example: 14C=13K7Ω 13C=13K3Ω

68B=4K99Ω 68X=49.9Ω

The decimal point should be expressed by "R"

Example:

Marking Table

Code	E96	Code	E96	Code	E96	Code	E96
01	100	**25**	178	**49**	316	**73**	562
02	102	**26**	182	**50**	324	**74**	576
03	105	**27**	187	**51**	332	**75**	590
04	107	**28**	191	**52**	340	**76**	604
05	110	**29**	196	**53**	348	**77**	619
06	113	**30**	200	**54**	357	**78**	634
07	115	**31**	205	**55**	365	**79**	649
08	118	**32**	210	**56**	374	**80**	665
09	121	**33**	215	**57**	383	**81**	681
10	124	**34**	221	**58**	392	**82**	698
11	127	**35**	226	**59**	402	**83**	715
12	130	**36**	232	**60**	412	**84**	732
13	133	**37**	237	**61**	422	**85**	750
14	137	**38**	243	**62**	432	**86**	768
15	140	**39**	249	**63**	442	**87**	787
16	143	**40**	255	**64**	453	**88**	806
17	147	**41**	261	**65**	464	**89**	825
18	150	**42**	267	**66**	475	**90**	845
19	154	**43**	274	**67**	487	**91**	866
20	158	**44**	280	**68**	499	**92**	887
21	162	**45**	287	**69**	511	**93**	909
22	165	**46**	294	**70**	523	**94**	931
23	169	**47**	301	**71**	536	**95**	953
24	174	**48**	309	**72**	549	**96**	976

Code	A	B	C	D	E	F	G	X	Y		
Multiplier	10^0	10^1	10^2	10^3	10^4	10^5	10^6	10^{-1}	10^{-2}		