Chip Resistors Selection Guide

■ General Purpose Chip Resistor

SERIES	SIZE/ mm	POWER RATING	MAX WORKING VOLTAGE	TOLERANCE	RESISTANCE RANGE
CR0402	0402 1.00*0.50	1/16W	50V	1%	1Ω-10MΩ
				5%	1Ω-10MΩ
CR0603	0603 1.60*0.80	1/10W	50V	0.5%	10Ω-1MΩ
				1%	1Ω-10MΩ
				5%	1Ω-22MΩ
CR0805	0805 2.00*1.25	1/8W	150V	0.5%	10Ω-1MΩ
				1%	1Ω-10MΩ
				5%	1Ω-22MΩ
CR1206	1206 3.10*1.60	1/4W	200V	0.5%	10Ω-1MΩ
				1%	1Ω-10MΩ
				5%	1Ω-22MΩ
CR1210	1210 3.10*2.50	1/2W	200V	1%	1Ω-10MΩ
				5%	1Ω-22MΩ
CR2010	2010 5.00*2.50	3/4W	200V	1%	1Ω-10MΩ
				5%	1Ω-22MΩ
CR2512	2512 6.25*3.10	1/W	200V	1%	1Ω-10MΩ
				5%	1Ω-22MΩ

■ Zero Ohm Jumper Resistor

SERIES	SIZE	RATED CURRENT	TOLERANCE	RESISTANCE RANGE
CR0402	0402	1A	<0.05Ω	0Ω
CR0603	0603	1A		
CR0805	0805	1.5A		
CR1206	1206	1.9A		
CR1210	1210	2.2A		
CR2010	2010	3A		
CR2512	2512	3A		

■ Chip Resistor Array

SERIES	SIZE/mm	POWER RATING	MAX WORKING VOLTAGE	TOLERANCE	RESISTANCE RANGE
CA022A	0404 1.00*1.00	1/16W	50V	1%	10Ω-1MΩ
				5%	1Ω-1MΩ
CA024A	0804 2.00*1.00	1/16W	50V	1%	10Ω-1MΩ
				5%	1Ω-1MΩ
CA034A	1206 3.20*1.50	1/10W	50V	1%	10Ω-1MΩ
				5%	1Ω-1MΩ

General Purpose Chip Resistors

■ Feature

1. Surface mounted device (SMD), suitable for auto-placement surface mounting application
2. Matte tin plating termination layer for reflow & wave soldering
3. Aluminum oxide ceramic substrate as body, high thermal and mechanical resist

■ Application

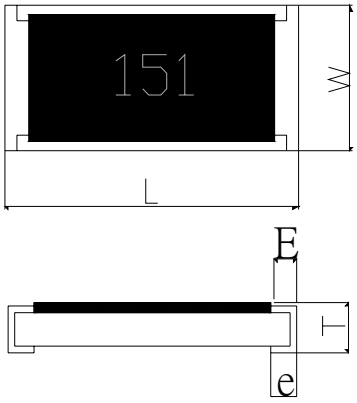
1. For general purpose on electronics circuit board.
2. Computer sector: mother board, notebook, LCD monitor, display card, hard disk
3. Communication sector: mobile phone, telephone
4. Consumer multimedia sector: LCD monitor, DVD player, MP3/4 player, digital camera
5. Power supply sector: DC power, adapter, battery charger
6. General house & industrial electronics equipments: air-conditioner, refrigerator

■ Electrical Characteristics

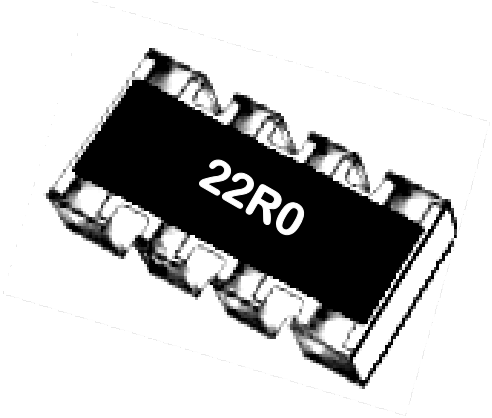
SERIES		CR0402	CR0603	CR0805	CR1206	CR1210	CR2010	CR2512
Size Code in Inch(mm)		0402(1005)	0603(1608)	0805(2012)	1206(3216)	1210(3225)	2010(5025)	2512(6432)
Operating Temperature		-55^{0}C~+125^{0}C	-55^{0}C~+125^{0}C	-55^{0}C~+125^{0}C	-55^{0}C~+125^{0}C	-55^{0}C~+125^{0}C	-55^{0}C~+125^{0}C	-55^{0}C~+125^{0}C
Power Rating @T_{amb}=70^{0}C		1/16W	1/10W	1/8W	1/4W	1/2W	3/4W	1W
Maximum Working Voltage		50V	50V	150V	200V	200V	200V	200V
Maximum Overload Voltage		100V	100V	300V	400V	400V	400V	400V
Dielectric Withstand Voltage		50V	100V	300V	500V	500V	500V	500V
Resistance Range	0.5%		10Ω-1MΩ	10Ω-1MΩ	10Ω-1MΩ			
	1%(E96)	1Ω-10MΩ	1Ω-10MΩ	1Ω-10MΩ	1Ω-10MΩ	1Ω-10MΩ	1Ω-10MΩ	1Ω-10MΩ
	5%(E24)	1Ω-10MΩ	1Ω-22MΩ	1Ω-22MΩ	1Ω-22MΩ	1Ω-22MΩ	1Ω-22MΩ	1Ω-22MΩ
	<0.05Ω	0Ω	0Ω	0Ω	0Ω	0Ω	0Ω	0Ω
Temperature Coefficient	1Ω-10Ω	-250 ~+500 ppm/^{0}C	-250 ~+500 ppm/^{0}C	-250 ~+500 ppm/^{0}C	-250 ~+500 ppm/^{0}C	-250 ~+500 ppm/^{0}C	-250 ~+500 ppm/^{0}C	-250 ~+500 ppm/^{0}C
	>10Ω-22MΩ	±200ppm/^{0}C	±200ppm/^{0}C	±200ppm/^{0}C	±200ppm/^{0}C	±200ppm/^{0}C	±200ppm/^{0}C	±200ppm/^{0}C
	>10Ω-1MΩ for 0.5%	±100ppm/^{0}C	±100ppm/^{0}C	±100ppm/^{0}C	±100ppm/^{0}C	±100ppm/^{0}C	±100ppm/^{0}C	±100ppm/^{0}C
	>10Ω-10MΩ for 1%	±100ppm/^{0}C	±100ppm/^{0}C	±100ppm/^{0}C	±100ppm/^{0}C	±100ppm/^{0}C	±100ppm/^{0}C	±100ppm/^{0}C
Rated Continue Working Voltage= √rated power(W) x Resistance value(Ω) or Maximum Working Voltage listed above, whichever is lower								
Zero Ohm Jumper Rated Current		1A	1A	1.5A	1.9A	2.2A	3A	3A

■ Dimension (in mm)

SERIES	CR0402	CR0603	CR0805	CR1206	CR1210	CR2010	CR2512
L	1.00±0.05	1.60±0.15	2.00±0.15	3.10±0.15	3.10±0.15	5.00±0.20	6.25±0.20
W	0.50±0.05	0.80±0.10	1.25±0.15	1.60±0.15	2.50±0.15	2.50±0.20	3.10±0.20
T	0.35±0.05	0.45±0.10	0.50±0.10	0.55±0.10	0.55±0.15	0.55±0.15	0.55±0.15
E	0.15±0.10	0.20±0.20	0.35±0.20	0.45±0.25	0.45±0.25	0.65±0.25	0.85±0.25
e	0.20±0.10	0.30±0.20	0.40±0.20	0.40±0.25	0.60±0.35	0.60±0.25	0.95±0.25



Chip Resistor Array



■ Feature

1. Chip integrated, surface mounted device (SMD), suitable for auto-placement surface mounting application
2. Matte tin plating termination layer for reflow & wave soldering
3. Aluminum oxide ceramic substrate as body, high thermal and mechanical resist

■ Application

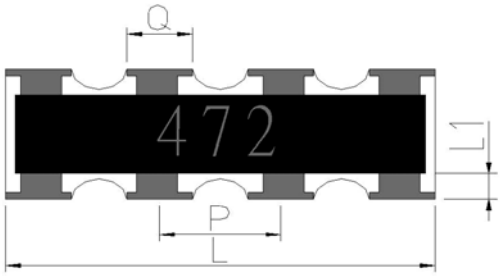
1. For SMT efficiency, circuit board space minimize & cost saving, suitable for: Telecom, Mobile Phone, Notebook computer, all-in-one Mother Boards, Hard-disk, etc.
2. Termination pitch matched with fine pitch of IC, reduces PC board space and improves wiring layout

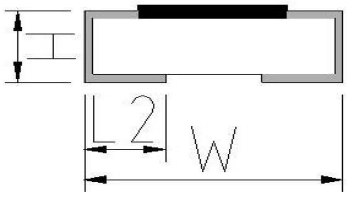
■ Electrical Characteristics

SERIES		CA022A	CA024A	CA034A
Size Code in Inch(mm)		0402x2(1005x2)	0402x4(1005x4)	0603x4(1608x4)
Operating Temperature		-55^{0}C~+125^{0}C	-55^{0}C~+125^{0}C	-55^{0}C~+125^{0}C
Power Rating @T_{amb}=70^{0}C		1/16W	1/16W	1/10W
Maximum Working Voltage		50V	50V	50V
Maximum Overload Voltage		100V	100V	100V
Dielectric Withstand Voltage		50V	50V	100V
Resistance Range	1%(E96)	10Ω-1MΩ	10Ω-1MΩ	10Ω-1MΩ
	5%(E24)	1Ω-1MΩ	1Ω-1MΩ	1Ω-1MΩ
	<0.05Ω	0Ω	0Ω	0Ω
Temperature Coefficient	1Ω-10Ω	-250 ~+500 ppm/^{0}C	-250 ~+500 ppm/^{0}C	-250 ~+500 ppm/^{0}C
	>10Ω-1MΩ	±200ppm/^{0}C	±200ppm/^{0}C	±200ppm/^{0}C
Rated Continue Working Voltage= √rated power(W) x Resistance value(Ω) or Maximum Working Voltage listed above, whichever is lower				
Zero Ohm Jumper Rated Current		0.63A	0.63A	1A

■ Dimension (in mm)

SERIES	CA022A	CA024A	CA034A
L	1.00±0.10	2.00±0.10	3.20±0.20
W	1.00±0.10	1.00±0.10	1.50±0.20
H	0.35±0.05	0.40±0.05	0.55±0.05
L1	0.19±0.10	0.18±0.10	0.30±0.15
L2	0.28±0.10	0.26±0.10	0.30±0.20
P	0.67±0.10	0.67±0.10	0.80±0.15
Q	0.33±0.10	0.33±0.10	0.50±0.15

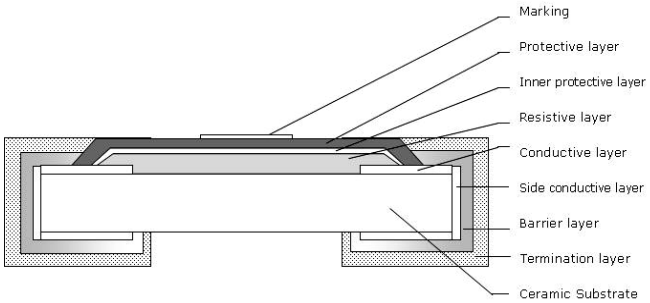




Chip Resistor General Data

■ Structure

Chip Resistor constructed by a aluminum oxide ceramic substrate as body, resistive layer formed on ceramic surface. The resistor value is adjusted by laser trimming. Resistive layer is covered by protective layer. Termination is plated by nickel layer as barrier layer and matte tin as termination layer.



■ Marking

no marking for size 0402 product

For 5% (E24) product, 3 digits marking: 2D as resistance value & 1D as multiplier

Example 220: $22x10^0 = 22\Omega$

For size 0603 1%(E96) product, 3 digits marking by EIA-96 code: 2D code as resistance value & 1alphabet as multiplier.

Example 30X: $200x10^{-1} = 20\Omega$

For others 1%(E96) product except size 0603, 3 digits marking: 2D as resistance value & 1D as multiplier

Example 2201: $220x10^1 = 2200\Omega$

E-96 Marking Rule

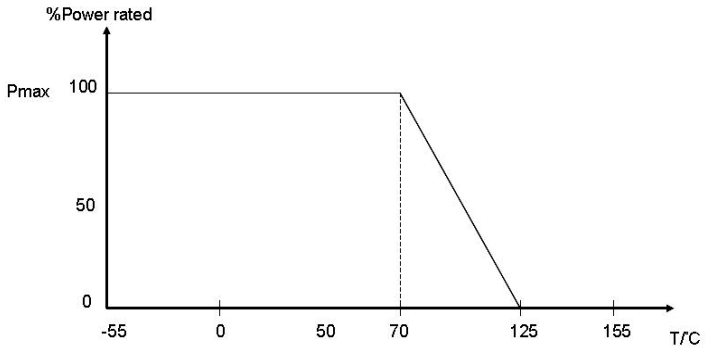
CODE	VALUE	CODE	VALUE	CODE	VALUE	CODE	VALUE	CODE	VALUE	CODE	VALUE	CODE	VALUE	CODE	VALUE
01	100	13	133	25	178	37	237	49	316	61	422	73	562	85	750
02	102	14	137	26	182	38	243	50	324	62	432	74	576	86	768
03	105	15	140	27	187	39	249	51	332	63	442	75	590	87	787
04	107	16	143	28	191	40	255	52	340	64	453	76	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	223	48	309	60	412	72	549	84	732	96	976

First 2 digits represented the 3 digits value of E-96 series, the third alphabet as multiplier
$Y=10^{-2}$, $X=10^{-1}$, $A=10^0$, $B=10^1$, $C=10^2$, $D=10^3$, $E=10^4$, $F=10^5$

Chip Resistor General Data

■ Power Rating

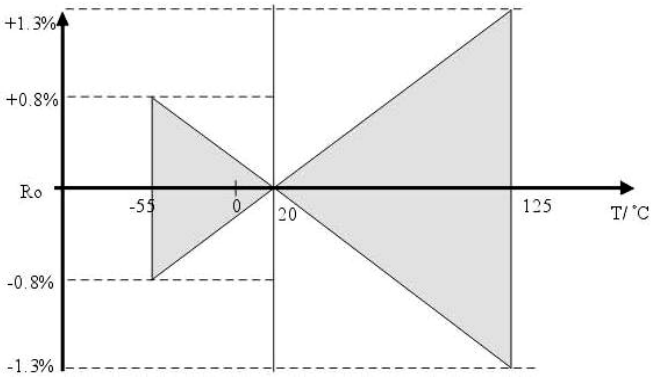
IEC 60115-8 Definition on power rating. Maximum dissipation (P_{max}) in percentage of rated power as a function of the ambient temperature (T_{amb}). For resistor which operating under ambient temperature over 70^0C, power rating may derated as temperature increase.



■ Temperature Coefficient

$$TC = \frac{R2 - R1}{R1\ (t2 - t1)} \times 10^6 (PPM/℃)$$

Example: TC=100 (100ppm/℃)



■ Test & Requirement

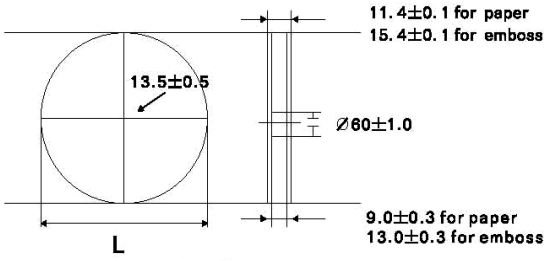
Description	Test Methods	Procedure
Temperature Coefficient	JIS C5202 5.2	Keep the sample at upper temperature for 30 minutes and measure the resistance value. Resistance value change in temperature coefficient term within spec.
Short Time Overload	JIS C5202 5.5	Apply 2.5 times rated voltage on sample (if 2.5 times rated voltage exceeds the maximum overload voltage, the maximum overload voltage shall be applied as test voltage). Resistance value change within spec.
Dielectric withstand voltage	MIL-STD-202F-method 301	Applied test voltage form 0 V to maximum withstand voltage with DC voltage across electrode and the center of body for 60±5seconds. No failure on burning or breakdown.
Resistance to Soldering Heat	JIS C5202 6.4	Dip sample in a soldering bath at 260±5℃ for 10±0.5 seconds Resistance value change within spec and no visual damage.
Solderability	JIS C5202 6.4	Dip sample in flux (methanol solution containing rosin approx. 25% in weight) for 2sec. and then dip into a soldering bath at 245±5℃ for 2±0.5sec. Termination tinning ≧95% and no visual damage.
Bending	JIS C5202 6.1.4	Bend to 1,2 or 5mm according product type for 5s. Resistance value change within spec and no visual damage.
Load Life	JIS C5202 7.10; MIL-STD-202F METHOD 108A	At 70±2℃ and rated working voltage for 1000 +24/-0 hours(42day). Resistance value change within spec and no visual damage.
Load Life Humidity	JIS C5202 7.5	At 40±2℃ and 90~95% relative humidity, and subject to a voltage cycle consisting of rated working voltage of 1.5hrs on and 0.5hrs off for 1000 +24/-0 hours(42day). Resistance value change within spec and no visual damage.

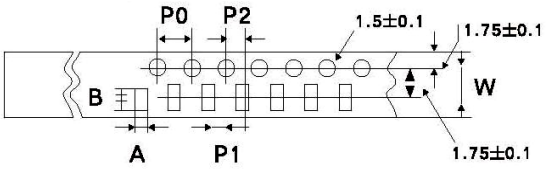
Packing Data

■ Tape & Reel Packing

Tape & reel packing according IEC 60286-3 specification

Series	A	B	W	P0	P1	P2
CR0402	0.65±0.10	1.15±0.10	8.00±0.20	4.00±0.10	2.00±0.10	2.00±0.05
CR0603	1.10±0.10	1.90±0.10	8.00±0.20	4.00±0.10	4.00±0.10	2.00±0.05
CR0805	1.65±0.20	2.40±0.20	8.00±0.20	4.00±0.10	4.00±0.10	2.00±0.05
CR1206	2.00±0.20	3.60±0.20	8.00±0.50	4.00±0.10	4.00±0.10	2.00±0.05
CR1210	2.80±0.10	3.50±0.10	12.0±0.10	4.00±0.10	4.00±0.10	2.00±0.05
CR2010	2.90±0.20	5.40±0.20	12.0±0.10	4.00±0.10	4.00±0.10	2.00±0.05
CR2512	3.60±0.20	6.90±0.20	0.50±0.05	4.00±0.10	4.00±0.10	2.00±0.05
CA022A (0402*2)	1.15±0.20	1.15±0.20	8.00±0.20	4.00±0.10	2.00±0.10	2.00±0.05
CA024A (0402*4)	1.20±0.10	2.20±0.10	8.00±0.20	4.00±0.10	2.00±0.10	2.00±0.05
CA034A (0603*4)	1.90±0.15	2.40±0.20	8.00±0.20	4.00±0.10	4.00±0.10	2.00±0.05

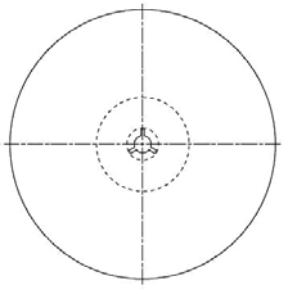




■ Tape & Reel Packing

Tape & reel packing according IEC 60286-3 specification

Series	Quantity per Reel	Reel Size
CR0402	10,000	7" (Φ178mm)
CR0603	5,000	
CR0805	5,000	
CR1206	5,000	
CR1210	5,000	
CR2010	4,000	
CR2512	4,000	
CA022A (0402*2)	10,000	
CA024A (0402*4)	10,000	
CA034A (0603*4)	5,000	



Environmental Data

■ **Environmental Characteristic**

1. Compliance to EU RoHS Directive 2002/95/EC
2. Compliance to CHINA RoHS SJ/T 11363-2006
3. Compliance to LeadFree Specification
4. Compliance to Halogen control
5. Homogenous material of resistor may contain lead in glass, which belong to EU RoHS exemption

	Hazardous Substance or Element / ppm					
	Pb	**Cd**	**Hg**	**Cr^{6+}**	**PBB**	**PBDE**
	<1000	<100	<1000	<1000	<1000	<1000

	Halogen Substance / ppm				
	F	**Cl**	**Br**	**I**	**Total**
	<900	<900	<900	<900	<1500

Storage, Handling & Soldering Data

■ Storage & Handling Condition

1. Storage condition: Temperature 5-40^{0}C; Humidity 30-75%RH
   (Refer to IEC 61760-2, Clause 5 Storage Condition/ IEC 60721-3-1, class 1K2)
2. Keep in chemical & dust free environment, avoid acid gas like sulfide & chloride gas
3. Avoid expose direct to sunlight

■ Recommended Soldering Condition

Recommended Profile Condition	Sn-Pb Soldering	Leadfree Soldering	Wave Soldering
Ramp-up rate (from pre-heat stage)	<3ºC/s	<3ºC/s	△T<150ºC
Pre-heat Temperature & Time	100-150 ºC 60-120s	150-200 ºC 60-180s	100-150 ºC 60-120s
Soldering Temperature & Time	183 ºC 60-150s	217 ºC 60-150s	260±5ºC 5±2ºC
Peak Temperature	230±5ºC	245±5ºC	260±5ºC
Time within 5ºC of peak temperature	10-30s	20-40s	-
Ramp-down rate	<6ºC/s	<6ºC/s	<6ºC/s
Time 25ºC to peak temperature	<6min	<8min	-
Manual Soldering: Approx. 350ºC for 3s, avoid solder iron tip direct touch the components body			

Part Number

Chip Resistor & Chip Resistor Array

CR	0805	J	8	0472	G
Product Series CR: Chip Resistor CA: Chip Resistor Array	**Size Code** 0402 0603 0805 1206 1210 2010 2512 022A: 0402x2 024A: 0402x4 034A: 0603x4	**Tolerance** B: ±0.1% C: ±0.25% D: ±0.5% F: ±1% G: ±2% J: ±5% K: ±10% O: 0Ω Jumper	**Power Rating** 1: 1W 2: 1/2W 3: 1/3W 4: 1/4W 8: 1/8W A: 1/10W F: 1/16W H: 1/32W -: Ignore	**Resistance Value** 49R9=49.9 0472=4K7 0103=10K 0564=560K	**Special Code** G: Reel V: Bulk D: Special Req