

watts electronics private limited

AUTOMOTIVE GRADE THICK FILM CHIP RESISTORS

INTRODUCTION:

The CR-A series Automotive Grade Thick Film Chip Resistors are manufactured by screening a metal glaze layer on a high grade ceramic body. The different resistance values are obtained by using different compositions of metal glaze. The end contacts are made to ensure optimum solderability and terminal strength. The resistive layers are given a non-flammable protective coating. The CR-A series is AEC-Q200 compliant.

The CR-A series offer a wide range of power ratings from 1/20W to 1W and are available in tolerance ranges of $\pm 1\%$ and $\pm 5\%$ with insulation Resistance $\geq 1000M\Omega$. Miniature size, excellent mechanical strength and electrical stability ensures reduced costs and enhances dependability.

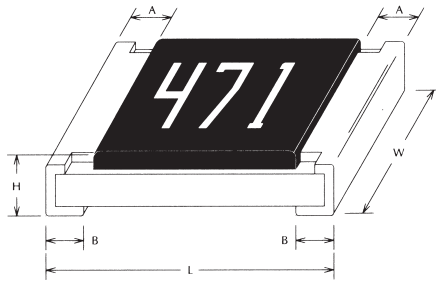
SPECIFICATIONS

Type No.	CR-01	CR-02	CR-03	CR-05
Power Rating	1/20 W	1/16 W	1/10 W	1/8 W
Operating Temp. Range	-55°C ~ +125°C	-55°C ~ +125°C	-55°C ~ +155°C	-55°C ~ +155°C
Maximum Working Voltage	15 V	50 V	50 V	150 V
Maximum Overload Voltage	30 V	100 V	100 V	300 V
Dielectric Withstand Voltage	30 V	100 V	100 V	300 V
Jumper Rated Current	0.5 A	1 A	1 A	2 A
R Value & Tol. % & TCR (ppm/°C)	$\pm 1\%$ $\pm 5\%$	$\pm 1\%$ $\pm 5\%$	$\pm 1\%$ $\pm 5\%$	$\pm 1\%$ $\pm 5\%$
1 Ω ~ 9.9 Ω	-	± 200	± 200	± 200
10 Ω ~ 1 M Ω	± 200	$\pm 100, \pm 200$	± 100	± 100
1.1 M Ω ~ 10 M Ω	-	± 200	± 200	± 200
Jumper (0 Ω)	< 50 m Ω			

SPECIFICATIONS - cont.

Type No.	CR-06	CR-10	CR-0A	CR-12
Power Rating	1/4 W	1/3 W	1/2 W	1 W
Operating Temp. Range	-55°C ~ +155°C	-55°C ~ +155°C	-55°C ~ +155°C	-55°C ~ +155°C
Maximum Working Voltage	200 V	200 V	200 V	200 V
Maximum Overload Voltage	400 V	400 V	400 V	400 V
Dielectric Withstand Voltage	500 V	500 V	500 V	500 V
Jumper Rated Current	2 A	2 A	2 A	2 A
R Value & Tol. % & TCR (ppm/°C)	$\pm 1\%$ $\pm 5\%$	$\pm 1\%$ $\pm 5\%$	$\pm 1\%$ $\pm 5\%$	$\pm 1\%$ $\pm 5\%$
1 Ω ~ 9.9 Ω	$\pm 25, \pm 50, \pm 100, \pm 200$	$\pm 25, \pm 50, \pm 100, \pm 200$	$\pm 25, \pm 50, \pm 100, \pm 200$	$\pm 25, \pm 50, \pm 100, \pm 200$
10 Ω ~ 1 M Ω	$\pm 25, \pm 50, \pm 100, \pm 200$	$\pm 25, \pm 50, \pm 100, \pm 200$	$\pm 25, \pm 50, \pm 100, \pm 200$	$\pm 25, \pm 50, \pm 100, \pm 200$
1.1 M Ω ~ 10 M Ω	$\pm 25, \pm 50, \pm 100, \pm 200$	$\pm 25, \pm 50, \pm 100, \pm 200$	$\pm 25, \pm 50, \pm 100, \pm 200$	$\pm 25, \pm 50, \pm 100, \pm 200$
Jumper (0 Ω)	< 50 m Ω			

DIMENSIONS (in mm)



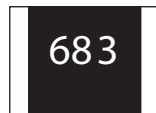
Unit : mm

	Inch	Metri c	L	W	H	A	B
CR-01	0201	0603	0.60 ± 0.03	0.30 ± 0.03	0.23 ± 0.03	0.15 ± 0.05	0.15 ± 0.05
CR-02	0402	1005	1.00 ± 0.05	0.50 ± 0.05	0.35 ± 0.05	0.20 ± 0.10	0.25 ± 0.15
CR-03	0603	1608	1.60 ± 0.10	0.80 ± 0.10	0.45 ± 0.10	0.30 ± 0.20	0.30 ± 0.20
CR-05	0805	2012	2.00 ± 0.10	1.25 ± 0.10	0.50 ± 0.10	0.35 ± 0.20	0.40 ± 0.20
CR-06	1206	3216	3.10 ± 0.10	1.55 ± 0.10	0.55 ± 0.10	0.50 ± 0.25	0.50 ± 0.20
CR-10	1210	3225	3.20 ± 0.20	2.60 ± 0.15	0.55 ± 0.10	0.50 ± 0.25	0.50 ± 0.20
CR-0A	2010	5025	5.00 ± 0.20	2.50 ± 0.15	0.55 ± 0.10	0.60 ± 0.25	0.50 ± 0.20
CR-12	2512	6332	6.35 ± 0.20	3.20 ± 0.15	0.55 ± 0.10	0.60 ± 0.25	0.50 ± 0.20

EXPLANATIONS OF ORDERING CODE

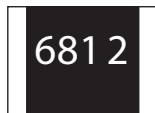
CR-05	J	TP	--- 10K
Code 1 ~ 5 Series Name CR-01 CR-02 CR-03 CR-05 CR-06 CR-0A CR-10 CR-12	Code 6 Tolerance B = ±0.1% C = ±0.25% D = ±0.5% F = ±1% G = ±2% J = ±5%	Code 8 ~ 9 Packing Method TH= 2 mm Pitch Paper(Taping) 10000 pcs TP= 4 mm Pitch Paper(Taping) 5000 pcs TE= 4 mm Pitch Emboss(Taping) 4000 pcs	Code 10 ~ 15 Resistance Value - 0 R 0 4 7 : 0.047Ω - - - 1 R 2 : 1.2Ω - - - 3 K 3 : 3.3KΩ - - - 1 0 K : 10KΩ - - 3 3 K 2 : 33.2KΩ - - 1 0 0 K : 100KΩ - - - 1 M 2 : 1.2MΩ “-” to fill up 6 spaces

MARKING



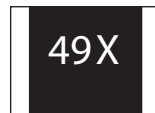
CR 03/05/06
CR 10/0A/12

68K ± 5%
(1)



CR 05/06
CR 10/0A/12

68.1K ± 1%
(2)



CR 03

(E-96 Series)
31.6 Ω ± 1%
(3)



CR 03/05/06
CR 10/0A/12

Jumper
(4)



CR 02/01

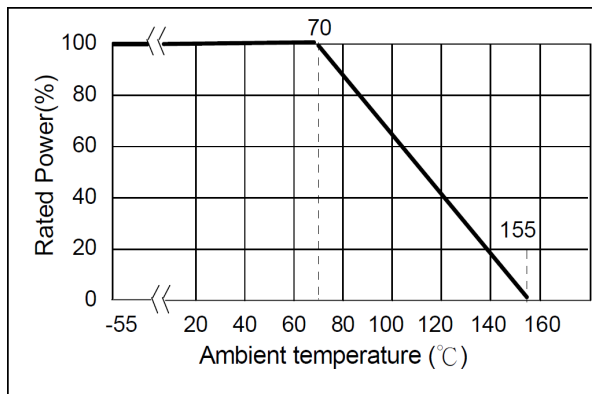
No Marking
± 1% ± 5%
(5)

EXPLANATION

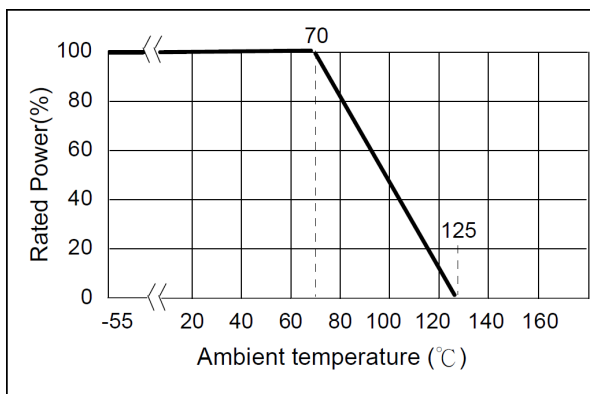
- 5% tolerance: 3 digits, first two digits are significant figures. Third digit is number of zeros. Letter "R" is decimal point.
- 1% tolerance: 4 digits, first three digits are significant figures. Fourth digit is number of zeros. Letter "R" is decimal point.
- CR 03 1% Chip Resistor 1% follows E96 series using EIAJ-96 marking system. (see table)
- Letter "0" : For all sizes denotes jumper.
- CR 02/01/CN 22: No marking.

POWER DERATING CURVE:

For CR-02, CR-03, CR-05, CR-06, CR-10, CR-0A & CR-12 at operating temperature of -55~+155°C.



For CR-01 at operating temperature of -55~+125°C.



ENVIRONMENTAL CHARACTERISTICS:

Item	Requirement			Test Method
	±1% and Below	±5%	Jumper	
Temperature Coefficient of Resistance (T.C.R.)	As Spec.			JIS-C-5201-1 4.8 IEC-60115-1 4.8 -55°C~+125°C, 25°C is the reference temperature
Short Time Overload	±(1.0%+0.05Ω)	±(2.0%+0.05Ω)	<50mΩ	JIS-C-5201-1 4.13 IEC-60115-1 4.13 RCWV*2.5 or Max. Overload Voltage whichever is lower for 5 seconds
Insulation Resistance	≥10G			JIS-C-5201-1 4.6 IEC-60115-1 4.6 Max. Overload Voltage for 1 minute
Endurance	±(1.0%+0.10Ω)	±(2.0%+0.10Ω)	<100mΩ	JIS-C-5201-1 4.25 IEC-60115-1 4.25.1 MIL-STD-202 Method 108 70±2°C, RCWV for 1000 hrs with 1.5 hrs "ON" and 0.5 hr "OFF"
Biased Humidity	±(1.0%+0.10Ω)	±(2.0%+0.10Ω)	<100mΩ	MIL-STD-202 Method 103 1000 hrs 85°C/85%RH 10% of operating power

Item	Requirement			Test Method
	±1% and Below	±5%	Jumper	
High Temperature Exposure	±(1.0%+0.05Ω)	±(1.5%+0.10Ω)	<50mΩ	MIL-STD-202 Method 108 at +155°C for 1000 hrs
Board Flex	±(1.0%+0.05Ω)	±(1.0%+0.05Ω)	<50mΩ	AEC-Q200-005 Bending once for 60 seconds 2010, 2512 sizes: 2mm Other sizes: 3mm
Solderability	95% min. coverage			JIS-C-5201-1 4.17 IEC-60115-1 4.17 J-STD-002 245±5°C for 3 seconds
Resistance to Soldering Heat	±(0.5%+0.05Ω)	±(1.0%+0.05Ω)	<50mΩ	MIL-STD-202 Method 210 260±5°C for 10 seconds
Voltage Proof	No breakdown or flashover			JIS-C-5201-1 4.7 IEC-60115-1 4.7 1.42 times Max. Operating Voltage for 1 minute
Leaching	Individual leaching area ≤5% Total leaching area ≤ 10%			JIS-C-5201-1 4.18 IEC-60068-2-58 8.2.1 260±5°C for 30 seconds
Temperature Cycling	±(0.5%+0.05Ω)	±(1.5%+0.05Ω)	<50mΩ	JESD22 Method JA-104 -55°C to +125°C, 1000 cycles
Mechanical Shock	±(0.25%+0.05Ω)	±(1.0%+0.05Ω)	<50mΩ	MIL-STD-202 Method 213 Wave Form: Tolerance for half sine shock pulse. Peak value is 100g's. Normal duration (D) is 6.
Vibration	±(0.5%+0.05Ω)	±(1.0%+0.05Ω)	<50mΩ	MIL-STD-202 Method 204 5 g's for 20 min., 12 cycles each of 3 orientations, 10-2000 Hz
ESD	±(1%+0.05Ω)			AEC-Q200-002 Human body, 2KV
Resistance to Solvents	No visible damage on appearance and marking.			MIL-STD-202 Method 215 Add Aqueous wash chemical - OKEM Clean or equivalent. Do not use banned solvents.
Terminal Strength	No broken			AEC-Q200-006 Force of 1.8kg for 60 seconds.
Flammability	No ignition of the tissue paper or scorching or the pinewood board			UL-94 V-0 or V-1 are acceptable. Electrical test not required.

RCWV(Rated Continuous Working Voltage)=√(P*R) or Max. Operating Voltage whichever is lower.

STANDARD RESISTANCE VALUES

E 24 Series

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

E 96 Series

100	102	105	107	110	113	115	118	121	124	127	130	133	137	140	143
147	150	154	158	162	165	169	174	178	182	187	191	196	200	205	210
215	221	226	232	237	243	249	255	261	267	274	280	287	294	301	309
316	324	332	340	348	357	365	374	383	392	402	412	422	432	442	453
464	475	487	499	511	523	536	549	562	576	590	604	619	634	649	665
681	698	715	732	750	768	787	806	825	845	866	887	909	931	953	976

EIAJ-96 MARKING SYSTEM

This table shows the first two digits for three-digits EIAJ-96 part marking scheme.

The third character is a letter multiplier:

Code	Ω	Code	Ω	Code	Ω	Code	Ω	Code	Ω	Code	Ω	Code	Ω	Code	Ω
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

Y=10⁻² X=10⁻¹ A =10⁰ B =10¹ C=10² D =10³ E=10⁴ F=10⁵