

# General Purpose Thick Film Resistors (CR Series)



## Features:

- RoHS Compliant (9/10) and Halogen Free
- TCR as low as  $\pm 100\text{ppm}$
- Available Sizes 01005 to 2512
- Stable over temperature range
- Good power dissipation capabilities (Rated power is conservatively rated)
- 100% matte Tin over Nickel with wrap around termination for excellent solderability
- Some values available for conductive epoxy application (suitable for MRI applications)

## Part Number Structure

CR Series	1206 Size	8W Power Rating	103 Resistance	J Tolerance	Termination	T Packaging	Optional Reel Identifier						
	01005 0201 0402 0603 0805 1206 1210 2010 2512	32W = 0.031W 20W = 0.05W 16W = 0.063W 10W = 0.10W 8W = 0.125W 4W = 0.25W 2W = 0.50W 1W = 1W 2W = 2W	<table border="1"> <tr> <td>3 DIGIT (J TOL.)</td> <td>2R2=2.2Ω 103=10KΩ</td> </tr> <tr> <td>4 DIGIT (D &amp; F TOL.)</td> <td>10R2=10.2Ω 1002=10KΩ</td> </tr> <tr> <td>Jumper</td> <td>3 zeros</td> </tr> </table> <p>Note: 1% E24 values may be marked with a 3 digit code.</p>	3 DIGIT (J TOL.)	2R2=2.2Ω 103=10KΩ	4 DIGIT (D & F TOL.)	10R2=10.2Ω 1002=10KΩ	Jumper	3 zeros	D = $\pm 0.5\%$ F = $\pm 1\%$ J = $\pm 5\%$  No tolerance specified for the zero ohm  Leave blank for zero ohm value	Leave blank for standard termination.  P = Palladium Silver Termination (PdAg)	T = Tape & Reel	Leave blank if standard Reel size.  Add "-13" if 13" Reel is required
3 DIGIT (J TOL.)	2R2=2.2Ω 103=10KΩ												
4 DIGIT (D & F TOL.)	10R2=10.2Ω 1002=10KΩ												
Jumper	3 zeros												

**Example P/N:** CR1206-8W-103JT

Standard termination finish is 100% matte Tin (Sn) over Nickel.

## Dimensions

Size	L	W	T	C <sub>1</sub>	C <sub>2</sub>
01005	0.016 ± 0.0008 (0.4 ± 0.02)	0.008 ± 0.0008 (0.2 ± 0.02)	0.005 ± 0.0008 (0.13 ± 0.02)	0.003 ± 0.001 (0.08 ± 0.03)	0.003 ± 0.001 (0.08 ± 0.03)
0201	0.024 ± 0.002 (0.6 ± 0.05)	0.012 ± 0.001 (0.3 ± 0.02)	0.010 ± 0.002 (0.25 ± 0.05)	0.020 ± 0.008 (0.50 ± 0.20)	0.006 ± 0.002 (0.15 ± 0.05)
0402	0.040 ± 0.002 (1.0 ± 0.05)	0.020 ± 0.001 (0.5 ± 0.02)	0.014 ± 0.002 (0.35 ± .05)	0.008 ± 0.004 (0.2 ± 0.1)	0.008 ± 0.004 (0.2 ± 0.1)
0603	0.063 ± 0.004 (1.6 ± 0.1)	0.031 ± 0.004 (0.8 ± 0.1)	0.018 ± 0.004 (0.45 ± 0.1)	0.012 ± 0.006 (0.30 ± 0.15)	0.012 ± 0.006 (0.30 ± 0.15)
0805	0.079 ± 0.006 (2.0 ± 0.15)	0.050 ± 0.006 (1.25 ± 0.15)	0.018 ± 0.006 (0.45 ± 0.15)	0.014 ± 0.006 (0.35 ± 0.15)	0.014 ± 0.006 (0.35 ± 0.15)
1206	0.126 ± 0.006 (3.2 ± 0.15)	0.063 ± 0.006 (1.6 ± 0.15)	0.022 ± 0.006 (0.56 ± 0.15)	0.020 ± 0.008 (0.50 ± 0.20)	0.020 ± 0.008 (0.50 ± 0.20)
1210	0.126 ± 0.006 (3.2 ± 0.15)	0.098 ± 0.006 (2.50 ± 0.15)	0.022 ± 0.006 (0.56 ± 0.15)	0.020 ± 0.008 (0.50 ± 0.20)	0.020 ± 0.008 (0.50 ± 0.20)
2010	0.197 ± 0.006 (5.0 ± 0.15)	0.098 ± 0.006 (2.50 ± 0.15)	0.022 ± 0.006 (0.56 ± 0.15)	0.026 ± 0.008 (0.65 ± 0.25)	0.024 ± 0.008 (0.60 ± 0.20)
2512 (1W)	0.248 ± 0.006 (6.3 ± 0.15)	0.126 ± 0.006 (3.2 ± 0.15)	0.022 ± 0.006 (0.56 ± 0.15)	0.026 ± 0.008 (0.65 ± 0.25)	0.024 ± 0.008 (0.60 ± 0.20)
2512 (2W)	0.248 ± 0.006 (6.3 ± 0.15)	0.126 ± 0.006 (3.2 ± 0.15)	0.024 ± 0.008 (0.60 ± 0.20)	0.024 ± 0.008 (0.60 ± 0.20)	0.020 ± 0.008 (0.50 ± 0.20)

Unit: inches (mm)

## Structure

1	Alumina Substrate	6	Tin Plating
2	Backside Electrode	7	Primary Coating
3	Topside Electrode	8	Secondary Layer
4	Edge Electrode	9	Resistive layer
5	Nickel Plating	10	Marking

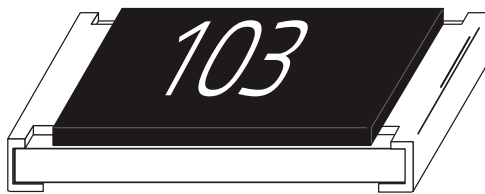
# General Purpose Thick Film Resistors (CR Series)

## Electrical Specifications and Range

	Size	01005	0201	0402		0603		0805		1206		1210		2010		2512	
<b>Power Rating at 70°C (W)</b>		0.03W (1/32W)	0.05W (1/20W)	0.063W (1/16W)	0.10W (1/10W)	0.063W (1/16W)	0.10W (1/10W)	0.10W (1/10W)	0.125W (1/8W)	0.125W (1/8W)	0.25W (1/4W)	0.25W (1/4W)	0.50W (1/2W)	0.50W (1/2W)	1.0W	1.0W	2.0W
<b>Max. Working Voltage</b>		$\sqrt{PR}$ or 15V whichever is less	$\sqrt{PR}$ or 25V whichever is less	$\sqrt{PR}$ or 50V whichever is less		$\sqrt{PR}$ or 75V whichever is less		$\sqrt{PR}$ or 150V whichever is less		$\sqrt{PR}$ or 200V whichever is less		$\sqrt{PR}$ or 200V whichever is less		$\sqrt{PR}$ or 200V whichever is less		$\sqrt{PR}$ or 200V whichever is less	
<b>*Max. Overload Voltage</b>		30V	50V	100V		150V		300V		400V		400V		400V		500V	
<b>Operating Temp. Range</b>		-55°C to +125°C	-55°C to +125°C	-55°C to +155°C		-55°C to +155°C		-55°C to +155°C		-55°C to +155°C		-55°C to +155°C		-55°C to +155°C		-55°C to +155°C	
<b>Zero Ohm (Jumper)</b>	<b>Current Rating</b>	0.5A	0.5A	1A		1A		2A		2A		2.5A		3.5A		4A	
<b>Zero Ohm (Jumper)</b>	<b>Resistance</b>	50 mΩ (max)	50 mΩ (max)	50 mΩ (max)		50 mΩ (max)		50 mΩ (max)		50 mΩ (max)		50 mΩ (max)		50 mΩ (max)		50 mΩ (max)	
<b>Tolerance</b>	<b>TCR</b>	<b>Resistance Range</b>	<b>Resistance Range</b>	<b>Resistance Range</b>		<b>Resistance Range</b>		<b>Resistance Range</b>		<b>Resistance Range</b>		<b>Resistance Range</b>		<b>Resistance Range</b>		<b>Resistance Range</b>	
±0.5% (D)	±100ppm	-	-	10Ω - 1MΩ	-	10Ω - 1MΩ	10Ω - 1MΩ	10Ω - 1MΩ	10Ω - 1MΩ	-	-	-	-	-	-	-	-
	±200ppm	-	-	1.02MΩ - 10MΩ	-	1.02MΩ - 10MΩ	1.02MΩ - 10MΩ	1.02MΩ - 10MΩ	1.02MΩ - 10MΩ	-	-	-	-	-	-	-	-
±1% (F)	±100ppm	-	-	10Ω - 10MΩ	10Ω - 1MΩ	10Ω - 10MΩ	10Ω - 10MΩ	10Ω - 10MΩ	10Ω - 10MΩ	10Ω - 1MΩ	10Ω - 1MΩ	10Ω - 1MΩ	10Ω - 1MΩ	10Ω - 1MΩ	10Ω - 1MΩ	10Ω - 1MΩ	10Ω - 1MΩ
	±200ppm	-	10Ω - 10MΩ	1Ω - 9.76Ω; 10.2MΩ - 20MΩ	1Ω - 9.76Ω; 1.02MΩ - 10MΩ	1Ω - 9.76Ω; 10.2MΩ - 21.5MΩ	1Ω - 9.76Ω; 10.2MΩ - 21.5MΩ	1Ω - 9.76Ω; 10.2MΩ - 21.5MΩ	1Ω - 9.76Ω; 10.2MΩ - 21.5MΩ	1Ω - 9.76Ω; 1.02MΩ - 20MΩ	1Ω - 9.76Ω; 1.02MΩ - 20MΩ	1Ω - 9.76Ω; 1.02MΩ - 20MΩ	1Ω - 9.76Ω; 1.02MΩ - 20MΩ	1Ω - 9.76Ω; 1.02MΩ - 20MΩ	1Ω - 9.76Ω; 1.02MΩ - 20MΩ	1Ω - 9.76Ω; 1.02MΩ - 20MΩ	1Ω - 9.76Ω; 1.02MΩ - 20MΩ
	±250ppm	100Ω - 1MΩ	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	±300ppm	10Ω - 99Ω	-	-	-	-	-	-	-	20.5MΩ - 21.5MΩ	-	20.5MΩ - 21.5MΩ	-	-	-	-	-
±5% (J)	±100ppm	-	-	-	-	-	-	-	-	10Ω - 1MΩ		10Ω - 1MΩ		10Ω - 1MΩ		10Ω - 1MΩ	
	±200ppm	-	1Ω - 10MΩ	1Ω - 10MΩ	1Ω - 10MΩ	1Ω - 10MΩ	1Ω - 10MΩ	1Ω - 10MΩ	1Ω - 10MΩ	1Ω - 9.76Ω; 1.02MΩ - 20MΩ	1Ω - 9.76Ω; 1.02MΩ - 20MΩ	1Ω - 9.76Ω; 1.02MΩ - 20MΩ	1Ω - 9.76Ω; 1.02MΩ - 20MΩ	1Ω - 9.76Ω; 1.02MΩ - 20MΩ	1.1MΩ - 20MΩ	1Ω - 9.76Ω; 1.02MΩ - 20MΩ	1Ω - 9.76Ω; 1.02MΩ - 20MΩ
	±250ppm	100Ω - 1MΩ	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	±300ppm	10Ω - 99Ω	-	-	-	-	-	-	-	20.5MΩ - 21.5MΩ	-	20.5MΩ - 21.5MΩ	-	-	-	-	-
	±350ppm	-	-	-	-	10MΩ - 22MΩ	10MΩ - 22MΩ	10MΩ - 22MΩ	10MΩ - 22MΩ	-	-	-	-	-	-	-	-

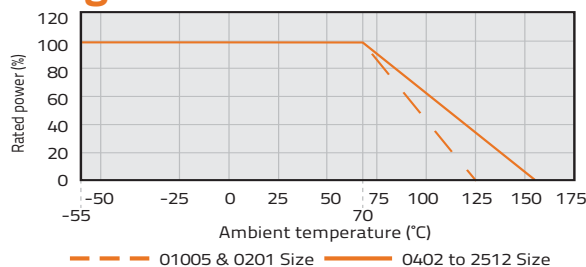
\* Note: Max OverLoad Voltage =  $2.5 * (P \times R)^{1/2}$  or Max. overload voltage listed above, whichever is lower.

## Marking Code



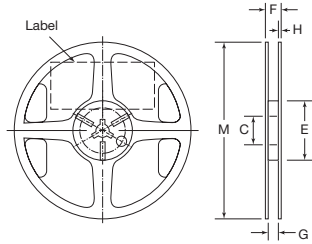
- 1% E-24 values for 0603 size and larger are typically marked with the standard 3 digit marking code.
- 1% E-96 values for 0805 size and larger may or may not be marked with the standard 4 digit marking code.
- 5% E-24 values for 0603 size and larger, will be marked with standard 3 digit marking code.
- 0603 -1% E-96 values will be marked with a standard 3 digit alpha numeric code (Please see page 61 for alpha numeric codes).
- 01005, 0201 and 0402 cannot be marked.
- 5% E-24 values for 1210-2512, may be marked with 4 digit marking code.
- E-192 values will not typically be marked.

## Derating Curve



# General Purpose Thick Film Resistors (CR Series)

## Reel Specifications

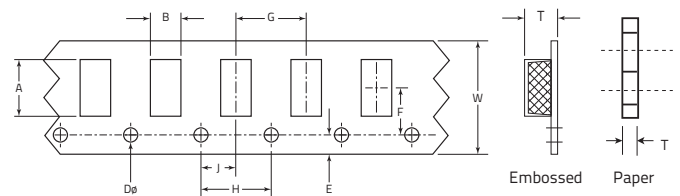


Unit: mm (inch)

C	E	F	G	H	M
13.0 ± 0.2 (0.51 ± 0.008)	60.0 ± 1.0 (2.36 ± 0.03)	11.4 ± 1.0 (0.45 ± 0.04)	9.0 ± .3 (0.35 ± 0.012)	1.5 ± .3 (0.06 ± 0.012)	180 ± 2.0 (7.09 ± 0.08)

Minimum of 30 empty pockets at the beginning of reel, 65 minimum empty pockets at the end.

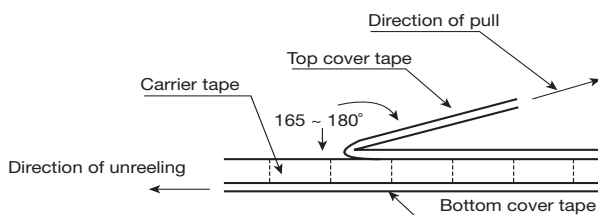
## Tape Specifications



All dimensions in mm.

Tape	Size (inches)	A	B	W	E	F	T	G	H	J	Dø
Paper	01005	0.45 ± 0.03	0.25 ± 0.03	8.0 ± 0.2	1.75 ± 0.1	3.5 ± 0.05	0.40 ± 0.10	2.0 ± 0.05	4.0 ± 0.1	2.0 ± 0.05	1.5 + 0.1-0
	0201	0.7 ± 0.08	0.4 ± 0.08	8.0 ± 0.2	1.75 ± 0.1	3.5 ± 0.05	0.42 ± 0.20	2.0 ± 0.05	4.0 ± 0.1	2.0 ± 0.05	1.5 + 0.1-0
	0402	1.15 ± 0.1	0.65 ± 0.1	8.0 ± 0.2	1.75 ± 0.1	3.5 ± 0.05	0.45 ± 0.10	2.0 ± 0.05	4.0 ± 0.1	2.0 ± 0.05	1.5 + 0.1-0
	0603	1.9 ± 0.1	1.1 ± 0.1	8.0 ± 0.2	1.75 ± 0.1	3.5 ± 0.05	0.70 ± 0.10	4.0 ± 0.1	4.0 ± 0.1	2.0 ± 0.05	1.5 + 0.1-0
	0805	2.4 ± 0.1	1.65 ± 0.1	8.0 ± 0.2	1.75 ± 0.1	3.5 ± 0.05	0.85 ± 0.10	4.0 ± 0.1	4.0 ± 0.1	2.0 ± 0.05	1.5 + 0.1-0
	1206	3.5 ± 0.1	1.9 ± 0.1	8.0 ± 0.2	1.75 ± 0.1	3.5 ± 0.05	0.85 ± 0.10	4.0 ± 0.1	4.0 ± 0.1	2.0 ± 0.05	1.5 + 0.1-0
	1210	3.5 ± 0.1	2.8 ± 0.1	8.0 ± 0.2	1.75 ± 0.1	3.5 ± 0.05	0.85 ± 0.10	4.0 ± 0.1	4.0 ± 0.1	2.0 ± 0.05	1.5 + 0.1-0
Embossed	2010	5.4 ± 0.2	2.9 ± 0.2	12.0 ± 0.1	1.75 ± 0.1	5.5 ± 0.5	1.2	4.0 ± 0.1	4.0 ± 0.1	2.0 ± 0.05	1.5 + 0.1-0
	2512	6.9 ± 0.2	3.6 ± 0.2	12.0 ± 0.1	1.75 ± 0.1	5.5 ± 0.5	1.2	8.0 ± 0.1	4.0 ± 0.1	2.0 ± 0.05	1.5 + 0.1-0

## Peel Back Force and Direction Diagram



Peel back force and direction of peel back angle should follow EIA481-1-A. Peel back force should be between 0.1N – 1.3N and peel back angle of 165° – 180°.

# General Purpose Thick Film Resistors (CR Series)

## Environmental Test Criteria

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~+12°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, 2 seconds for high power series
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 70±2°C, RCWV for 1000 hrs with 1.5 hrs 'ON' and 0.5 hr 'OFF'
Damp Heat with Load	±(1.0%+0.10Ω)	±(2.0%+0.10Ω)	<100mΩ	JIS-C-5201-1 4.24 IEC-60115-1 4.24 40±2°C, 90~95% R.H., RCWV for 1000 hrs with 1.5 hrs 'ON' and 0.5 hr 'OFF'
Dry Heat	±(1.0%+0.05Ω)	±(1.5%+0.10Ω)	<50mΩ	JIS-C-5201-1 4.23 IEC-60115-1 4.23.2 at +125/+155°C for 1000 hrs
Bending Strength	±(1.0%+0.05Ω)	±(1.0%+0.05Ω)	<50mΩ	JIS-C-5201-1 4.33 IEC-60115-1 4.33 Bending once for 5 seconds 2010, 2512 sizes: 2mm Other sizes: 3mm
Solderability	95% min. coverage			JIS-C-5201-1 4.17 IEC-60115-1 4.17 245±5°C for 3 seconds
Resistance to Soldering Heat	±(0.5%+0.05Ω)	±(1.0%+0.05Ω)	<50mΩ	JIS-C-5201-1 4.18 IEC-60115-1 4.18 260±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
Rapid Change of Temperature	±(0.5%+0.05Ω)	±(1.0%+0.05Ω)	<50mΩ	JIS-C-5201-1 4.19 IEC-60115-1 4.19 -55°C to +125/+155°C, 5 cycles
RCWV(Rated Continuous Working Voltage)=V(P*R) or Max. Operating Voltage whichever is lower.				
■ Storage Temperature: 15~28°C; Humidity < 80%RH				