

DATA SHEET

Mili Ohm Thick Film Chip Resistor

CR Series

1% TO 5%, TCR ± 200 TO ± 1500

SIZE: 0402/0603/0805/1206/1210/2010/2512

RoHs Compliant



MILI OHM THICK FILM CHIP RESISTOR

CR Series

DS-ENG-005

Page: 2 of 16

1. SCOPE

- 1.1 This specification is applicable to lead and halogen free CR series precision thick film chip resistors.
- 1.2 Lead free products mean lead free termination meets RoHS requirement. Pb contained in glass material of resistor element is exempted by RoHS directive.
- 1.3 The products for 0402, 0603, 0805, 1206, 1210, 2010 and 2512 are tested and passed based on the test conditions and methods defined in AEC-Q200.

2. PART NUMBERING SYSTEM

Part Numbering is made in accordance with the following system:

CR	10	-	RXXX	-	F	K
Type	Size (Inch / mm)	Nominal Resistance			Resistance Tolerance	Packaging
Milli Ohm Thick Film Chip Resistors	10 (0402/1005) 16 (0603/1608) 21 (0805/2012) 32 (1206/3216) 40 (1210/3225) 50 (2010/5025) 63 (2512/6432)	Resistors	4 - digit	E96 0.022Ω = R022 0.03Ω = R030	F = ± 1% G = ± 2% J = ± 5%	E = 4000 pcs Lead Free L = 5000 pcs Lead Free K = 10,000 pcs Lead Free Y = 20,000pcs Lead Free

3. RATING

3.1 Rated Power

3.1.1 Resistor Rated Power

Product Type	Rated Power	Maximum Rated Current	Maximum Overload Current
CR10	1/16W	1.58A	3.95A
CR16	1/10W	3.16A	7.91A
CR21	1/8W	3.53A	8.82A
CR32	1/3W	5.77A	14.42A
CR40	1/2W	7.07A	17.67A
CR50	3/4W	8.66A	21.65A
CR63	1W	10A	25A



Product Specification

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3.2 Power Derating Characteristics

Rated Power shall be the load power corresponding to nominal wattage suitable for continuous use at 70°C ambient temperatures. In case the ambient temperature exceeds 70°C, reduce the load power in accordance with Derating curve in Fig. 1.

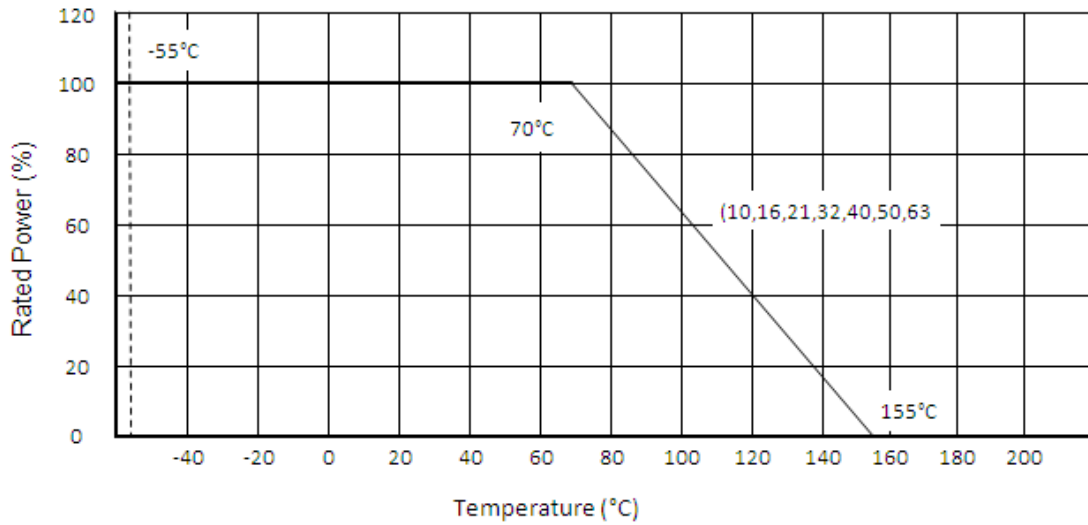


Fig.1 Power Derating Characteristics

3.3 Standard Atmospheric Condition

Unless otherwise specified, the standard range of atmospheric conditions for making measurements and tests is as follows:

Ambient Temperature = + 5°C to +35°C

Relative Humidity = < 85% RH

Air Pressure = 86 kPa to 106kPa

If there may be any doubt about the results, measurement shall be made within the following limits:

Ambient Temperature = 20 ± 2°C

Relative Humidity = 60 to 70% RH

Air Pressure = 86 kPa to 106kPa

3.4 Operating Temperature Range -55°C to +155°C

3.5 Storage Temperature Range -5°C to + 40°C

3.6 Flammability Rating Tested in accordance to UL-94, V-0

3.7 Moisture Sensitivity Level Rating: Level 1

3.8 Product Assurance ASJ resistor shall warranty 24 months from the date of shipment.



MILI OHM THICK FILM CHIP RESISTOR

CR Series

DS-ENG-005

Page: 4 of 16

3.9 ASJ resistors are RoHS compliance in accordance to RoHS Directive 2011/65/EU.

3.10 Resistance, Resistance Tolerance and Temperature Coefficient of Resistance.

Product Type	Power Rating @ 70°C	T.C.R (ppm/°C) Max	Resistance Range E-96, E-24 F(±1%) G(±2%), J(±5%)	Operating Temperature Range
CR10 0402 (1005)	1/16W	±1500	25 mΩ ≤ R < 37 mΩ	-55°C to +155°C
		±1200	37 mΩ ≤ R < 60 mΩ	
		±600	60 mΩ ≤ R < 200 mΩ	
		±300	200 mΩ ≤ R < 400 mΩ	
		±250	400 mΩ ≤ R < 600 mΩ	
		±200	600 mΩ ≤ R < 1000 mΩ	
CR16 0603 (1608)	1/10W	±1500	10 mΩ ≤ R < 37 mΩ	
		±1200	37 mΩ ≤ R < 60 mΩ	
		±600	60 mΩ ≤ R < 100 mΩ	
		±300	100 mΩ ≤ R < 200 mΩ	
		±600	200 mΩ ≤ R < 500 mΩ	
		±400	500 mΩ ≤ R < 1000 mΩ	
CR21 0805 (2012)	1/8W	±1500	10 mΩ ≤ R < 19 mΩ	
		±1200	19 mΩ ≤ R < 33 mΩ	
		±800	33 mΩ ≤ R < 50 mΩ	
		±600	50 mΩ ≤ R < 100 mΩ	
		±200	100 mΩ ≤ R < 1000 mΩ	
CR32 1206 (3216)	1/3W	±1500	10 mΩ ≤ R < 19 mΩ	
		±1200	19 mΩ ≤ R < 25 mΩ	
		±1000	25 mΩ ≤ R < 50 mΩ	
		±600	50 mΩ ≤ R < 100 mΩ	
		±200	100 mΩ ≤ R < 1000 mΩ	
CR40 1210 (3225)	1/2W	±1500	10 mΩ ≤ R < 19 mΩ	
		±1000	19 mΩ ≤ R < 25 mΩ	
		±700	25 mΩ ≤ R < 50 mΩ	
		±400	50 mΩ ≤ R < 100 mΩ	
		±200	100 mΩ ≤ R < 1000 mΩ	
CR50 2010 (5025)	3/4W	±1500	10 mΩ ≤ R < 19 mΩ	
		±1000	19 mΩ ≤ R < 25 mΩ	
		±900	25 mΩ ≤ R < 50 mΩ	
		±500	50 mΩ ≤ R < 100 mΩ	
		±200	100 mΩ ≤ R < 1000 mΩ	
CR63 2512 (6432)	1W	±1500	10 mΩ ≤ R < 19 mΩ	
		±1200	19 mΩ ≤ R < 25 mΩ	
		±900	25 mΩ ≤ R < 50 mΩ	
		±500	50 mΩ ≤ R < 100 mΩ	
		±200	100 mΩ ≤ R < 1000 mΩ	



Product Specification

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3.11 Rated Voltage

The rated voltage is calculated from the rated power and nominal resistance by the following formula:

$$E = \sqrt{P.R}$$

Where E : Rated Voltage (V)

P : Rated Power (W)

R : Nominal Resistance (Ω)

In case the value calculated by the formula exceeds the maximum working voltage given in Section 3.1.2, the maximum working voltage in Section 3.1.2 shall be regarded as the rated voltage.

3.12 All product, product specifications and data are subject to change without notice to improve reliability, function or design or otherwise.

4. MARKING ON PRODUCT

The nominal resistance shall be marked on the surface of each resistor

Part Number	Color	Marking on Product
CR10 (0402)	-	No marking
CR16 (0603)	Light Yellow	1) Tolerance : +/-1.0% (F) ° Four Numerals Marking (E96 Series)
CR21 (0805)	Light Yellow	
CR32 (1206)	Light Yellow / Black	
CR40 (1210)	Light Yellow	
CR50 (2010)	Light Yellow	
CR63 (2512)	Light Yellow	

4.1 Numeric Numbering

4.1.1 1% Tolerance : **Four Numerals Marking**

The Digits after R is significant figures. Letter R is decimal point.

Examples:

Nominal Resistance	Marking	Remarks
22m Ω	R022	$220 \times 10^{-3} = 0.22\Omega$
100m Ω	R100	$100 \times 10^{-3} = 0.1\Omega$
220m Ω	R220	$22 \times 10^{-3} = 0.022\Omega$

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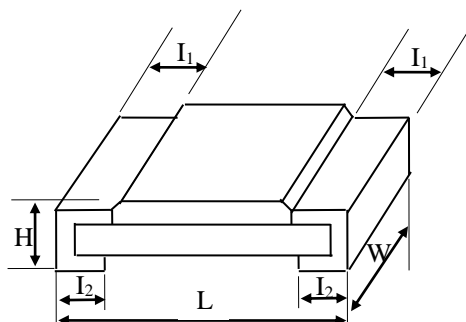
CR Series

DS-ENG-005

Page: 6 of 16

5. DIMENSIONS, CONSTRUCTIONS AND MATERIALS

5.1 Dimensions



Unit: Inches (Millimeters)

CODE	L	W	H	I ₁	I ₂
CR10 (0402)	0.040±0.004 (1.00±0.10)	0.020±0.002 (0.50±0.05)	0.012±0.004 (0.30±0.10)	0.010±0.004 (0.25±0.10)	0.007±0.004 (0.20±0.15)
CR16 (0603)	0.063±0.004 (1.60±0.10)	0.031±0.004 (0.80±0.10)	0.018±0.004 (0.45±0.10)	0.010±0.004 (0.25±0.15)	0.014±0.004 (0.35±0.15)
CR21 (0805)	0.079±0.006 (2.00±0.10)	0.049±0.004 (1.25±0.10)	0.020±0.004 (0.50±0.10)	0.014±0.008 (0.35±0.20)	0.014±0.008 (0.35±0.20)
CR32 (1206)	0.118±0.004 (3.05±0.10)	0.060±0.004 (1.55±0.10)	0.020±0.004 (0.50±0.10)	0.016±0.008 (0.45±0.20)	0.025±0.004 (0.65±0.15)
CR40 (1210)	0.118±0.004 (3.05±0.10)	0.100±0.004 (2.55±0.10)	0.022±0.004 (0.55±0.10)	0.020±0.008 (0.50±0.20)	0.020±0.008 (0.50±0.20)
CR50 (2010)	0.200±0.008 (5.00±0.20)	0.098±0.008 (2.50±0.20)	0.024±0.004 (0.60±0.10)	0.025±0.008 (0.65±0.20)	0.025±0.008 (0.65±0.20)
CR63 (2512)	0.250±0.008 (6.30±0.20)	0.126±0.008 (3.20±0.20)	0.024±0.004 (0.60±0.10)	0.025±0.008 (0.65±0.20)	0.025±0.008 (0.65±0.20)

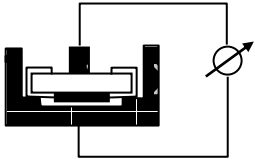
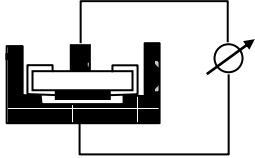
MILI OHM THICK FILM CHIP RESISTOR

CR Series

DS-ENG-005

Page: 7 of 16

6. ELECTRICAL CHARACTERISTICS AND TEST CONDITIONS

CHARACTERISTICS		SPECIFICATIONS	TESTING CONDITIONS
		Resistance	
1	Resistance Temperature Coefficient	Refer Section 3.5 Table 1	<p>MIL-STD-202 Method 304 Measure R at $t_0=25^{\circ}\text{C}$ and after 45 minutes measure R at $t=125^{\circ}\text{C}$. Calculation : $\text{TCR}(\text{ppm}/^{\circ}\text{C}) = \frac{R - R_0}{R_0} \times \frac{1}{t - t_0} \times 10^6$</p>
3	Short Time Overload	1%, 2%, 5%: $\pm(2.0\%+0.001\Omega)$	<p>JIS C 5201-1 4.13 Apply at 2.5 times rated voltage for 5 seconds. Applied voltage shall not exceed maximum overload voltage or current.</p>
4	Insulation Resistance	$> 10\text{G } \Omega$	<p>JIS C 5201-1 4.6 Apply (100 ± 15) VDC for 1 minute. Measured the insulation resistance between electrodes and insulating enclosure or between electrodes and base.</p> 
5	Dielectric Withstanding Voltage	No failure of resistor such as short-circuit, burning, breakdown.	<p>JIS C 5201-1 4.7 Apply 500VAC for 1 minute ± 5secs. for chip ≥ 0805. Apply 300VAC for 1 minute ± 5secs. for chip 0402 & 0603 Apply 50Vac for 1 minute ± 5secs for 0201</p>
		$\pm(5.0\%+0.001\Omega)$	 The variation in relation to the initial resistance shall be within $\pm 1\%$.



Product Specification

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MILI OHM THICK FILM CHIP RESISTOR

CR Series

DS-ENG-005

Page: 8 of 16

6	Intermittent Overload	$\pm(5.0\%+0.001\Omega)$		<p>JIS C 5201-1 4.13 Apply 2.5 times rated voltage for 1 secs ON and 25 secs OFF. Total 10 000⁺⁴⁰⁰₋₀ cycles. Applied voltage/current shall not exceed maximum intermittent overload voltage/current.</p>
7	Noise	1~9 10~99 100~999 1K~9.9K 10K~99.9K 100K~999.9K >1M	-10dB(0.32 μ v/v) - 5 dB(0.52 μ v/v) 0 dB(1.0 μ v/v) 10 dB(3.2 μ v/v) 18 dB(5.6 μ v/v) 20 dB(10 μ v/v) 30 dB(32 μ v/v)	<p>JIS C 5201-1 4.12 $V_0(\text{dB}) = T-f(T-S)-D$</p>
8	Terminal Strength	Test 1 : No evidence of mechanical damage. Test 2 : $\geq 5\text{N}$		<p>JIS C 5201-1 4.16 / AEC Q200-005 Test 1 : The resistor mounted on the board applied 5N pushing force on the sample rear for 10sec. Test 2 : The resistor mounted on the board slowly add force on the sample rear until the sample termination is breakdown.</p>
9	Resistance to Solvent	$\pm(1.0\%+0.001\Omega)$ Passed without any damaged to marking & protective material.		<p>MIL-STD-202 Method 215 Immerse in 25°C\pm5°C Isopropyl Alcohol (IPA) for 5 minutes.</p>
10	Solderability	$\geq 95\%$ Coverage at all terminal		<p>J-STD-002 For both Leaded & SMD. Electrical test not required. Magnification 50 X. Conditions: Leaded: Method A @ 235°C, category 3.</p>
11	Resistance to soldering heat	$\Delta R\%=\pm(1.0\%+0.001\Omega)$		<p>MIL-STD-202 Method 210 Solder bath method Resistor dipped entirely in solder bath of 260\pm5°C for 10₀⁺¹ sec. After which the sample shall be left at ambient temperature for 1~ 2 hrs before measurement.</p>



Product Specification

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MILI OHM THICK FILM CHIP RESISTOR

CR Series

DS-ENG-005

Page: 9 of 16

12	Vibration	1%,2%,5%: $\pm(1.0\%+0.001\Omega)$	JIS-C5201-1 4.22 The resistor shall be mounted by its terminal leads to the supporting terminals on the solid table. The entire frequency range: from 10 Hz to 55 Hz and return to 10 Hz, shall be transferred in 1 min. Amplitude :1.5 mm This motion shall be applied for a period of 2 hours in each 3 mutually perpendicular directions (a total of 6 hrs)
13	Low Temperature Operation	1%, 2%, 5%: $\pm(1.0\%+0.001\Omega)$	MIL-R-55342D 4.7.4 Put the tested resistor in the chamber at room temperature 25°C. Decreasing the temperature to -55°C and keep the temperature at -55°C for 1 hour. Then load the rated voltage for 45 minutes on, and 15 minutes off. Then leaving the tested resistor in room temperature for 8±1 hours, and measure its resistance variance rate.
14	Resistance Dry Heat	1%, 2%, 5%: $\pm(1.0\%+0.001\Omega)$	JIS-C5201-1 4.25 Put tested resistor in chamber under temperature 155±5°C for 1000 +48/-0 hours. Then leaving the tested resistor in room temperature for 60 minutes, and measure its resistance variance rate.
15	Loadlife	1%, 2%, 5%: $\pm(2.0\%+0.001\Omega)$	MIL-STD-202 Method 108 At 70±2°C Apply DC rated voltage at 90minutes On, 30minutes Off for 1000 hours Sample shall be left at ambient temperature for 1~ 2 hrs after test before measuring final resistance.
16	Loading Life in Moisture	1%, 2%, 5%: $\pm(2.0\%+0.001\Omega)$	JIS-C5201-1 4.24 Put the tested resistor in the chamber under temperature 40±2°C, relative humidity 90~95% and load the rated voltage for 90 minutes on, 30 minutes off, total 1000 hours. Then leaving the tested resistor in room temperature for 60 minutes, and measure its resistance variance rate.

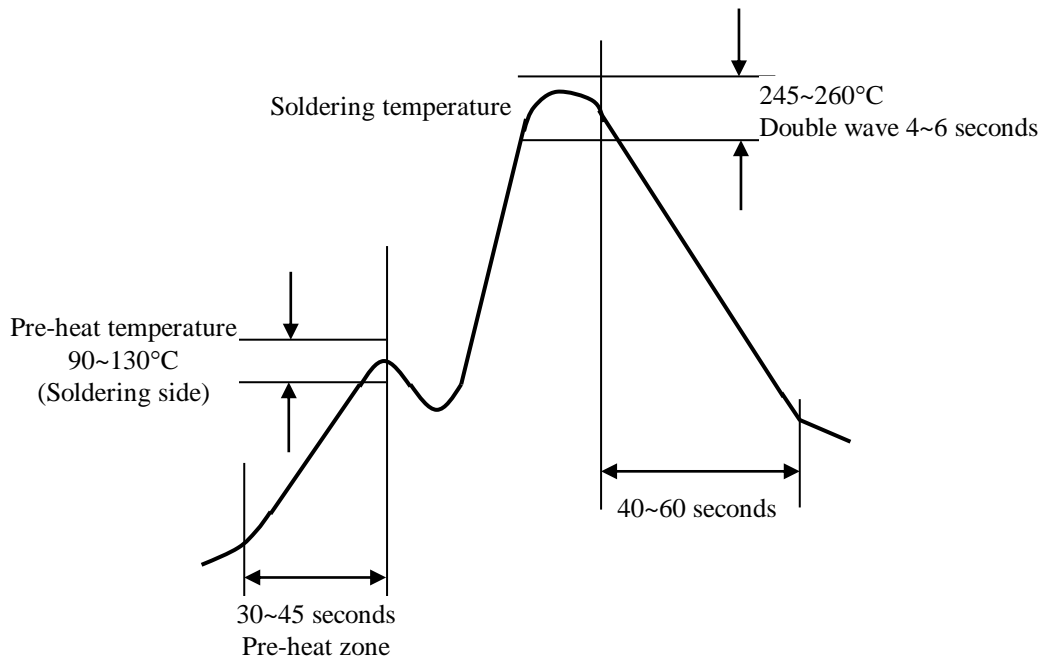


Product Specification

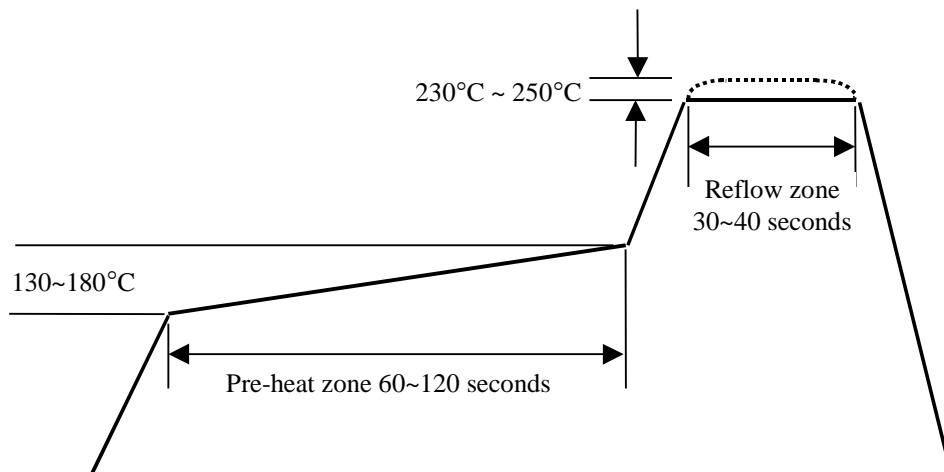
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6.1 Soldering Profile

6.1.1 Wave Soldering



6.1.2 Reflow Soldering



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CR Series

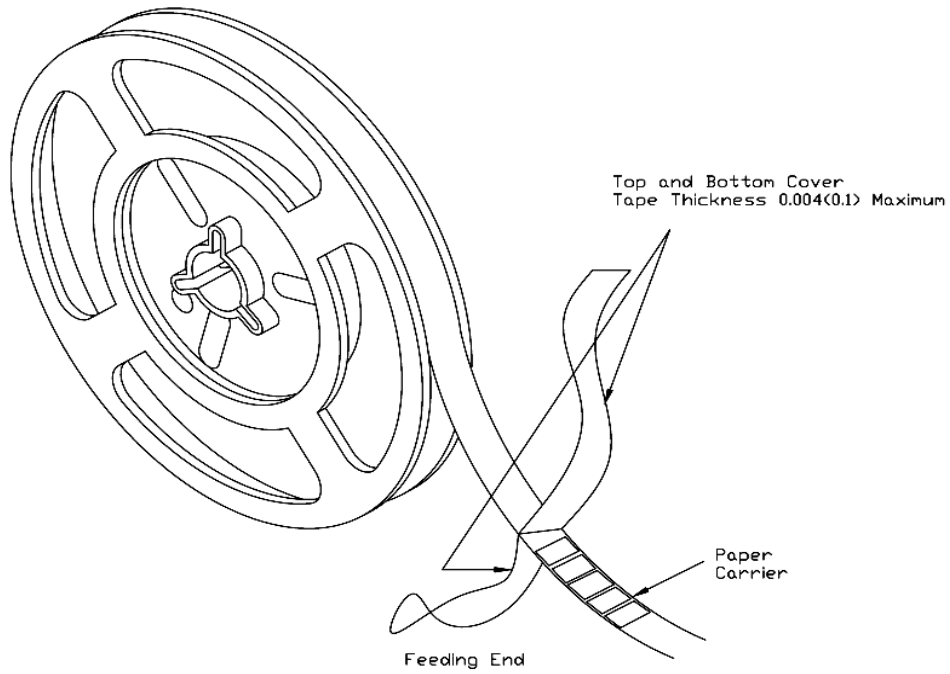
DS-ENG-005

Page: 11 of 16

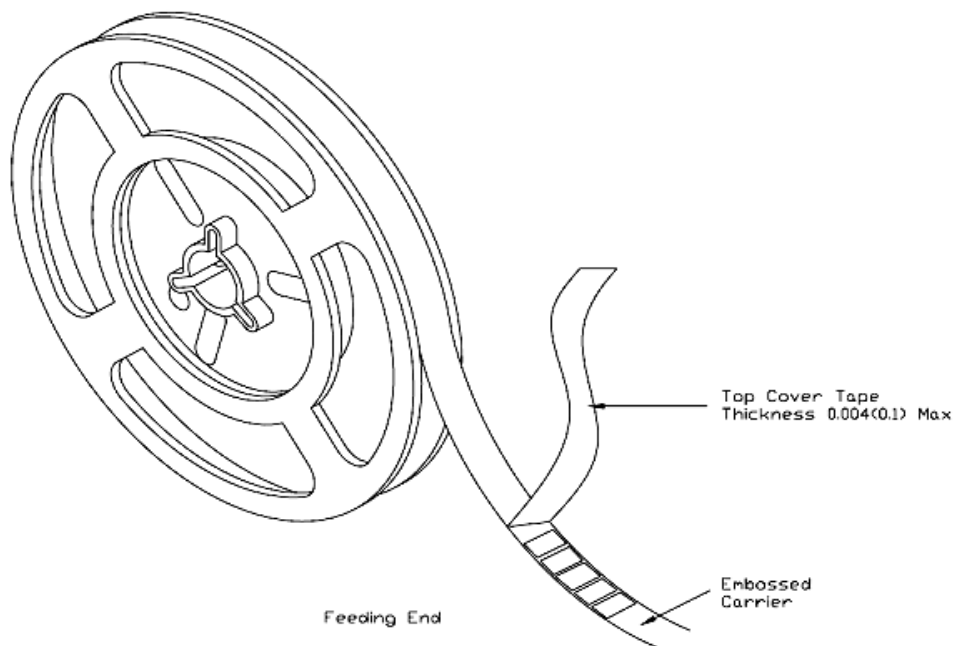
7. TAPING

7.1 Structure of Taping

Paper Carrier



Embossed Plastic Carrier



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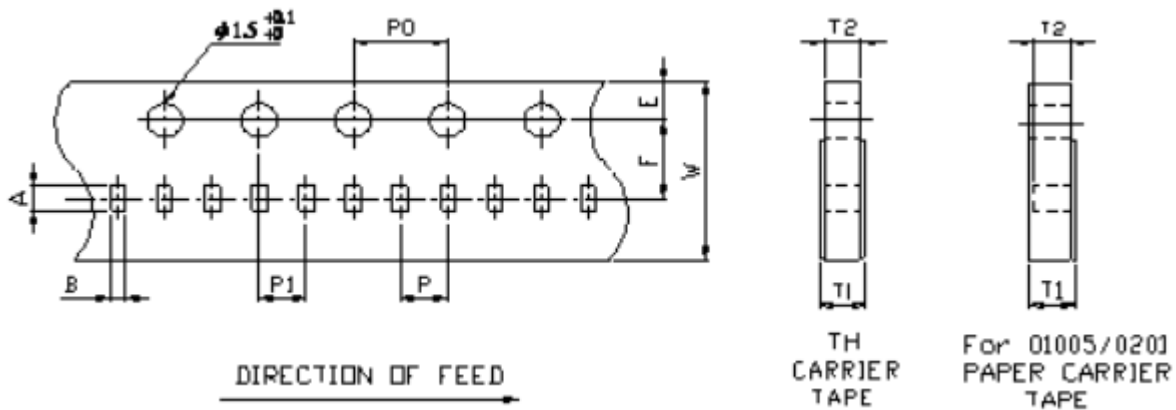
CR Series

DS-ENG-005

Page: 12 of 16

7.2 Dimension

7.2.1 Dimension of Punched Paper Tape Carrier System (CR -10)



Remark : Pitch tolerance over any 10 pitches of Po is ± 0.2 mm

Dimension of Punched Paper Tape Carrier System (CR- 10)

(Unit : mm)

Code	A	B	W	E	F	T1
CR10	1.15 \pm 0.05	0.65 \pm 0.05	8.00 \pm 0.20	1.75 \pm 0.10	3.50 \pm 0.05	0.42 $\begin{smallmatrix} +0.1 \\ -0 \end{smallmatrix}$

Code	T2	P	P0	10xP0	P1
CR10	0.40 \pm 0.05	2.00 \pm 0.10	4.00 \pm 0.05	40.0 \pm 0.20	2.00 \pm 0.05

7.2.2 Dimension of Punched Paper Tape Carrier System /Plastic Embossed Carrier System (CR16, 21, 32, 40, 50, 63)

Code	A	B	W	E	F	T1	T2	P	P0	P1
CR16	1.9 \pm 0.10	1.1 \pm 0.10	8.0 \pm 0.20	1.75 \pm 0.10	3.50 \pm 0.05	0.60 $\begin{smallmatrix} +0.2 \\ -0 \end{smallmatrix}$	0.60 \pm 0.10	4.0 \pm 0.10	4.0 \pm 0.05	2.0 \pm 0.05
CR21	2.4 \pm 0.10	1.65 \pm 0.1	8.0 \pm 0.20	1.75 \pm 0.10	3.50 \pm 0.05	0.75 $\begin{smallmatrix} +0.2 \\ -0 \end{smallmatrix}$	0.75 \pm 0.10	4.0 \pm 0.10	4.0 \pm 0.05	2.0 \pm 0.05
CR32	3.5 \pm 0.1	1.9 \pm 0.10	8.0 \pm 0.20	1.75 \pm 0.10	3.50 \pm 0.05	0.75 $\begin{smallmatrix} +0.2 \\ -0 \end{smallmatrix}$	0.75 \pm 0.10	4.0 \pm 0.10	4.0 \pm 0.05	2.0 \pm 0.05
CR40	3.5 \pm 0.2	2.8 \pm 0.2	8.0 \pm 0.20	1.75 \pm 0.10	3.50 \pm 0.05	0.75 $\begin{smallmatrix} +0.2 \\ -0 \end{smallmatrix}$	0.75 \pm 0.10	4.0 \pm 0.10	4.0 \pm 0.05	2.0 \pm 0.05

Dimension of Punched Paper Tape Carrier System (CR - 16, 21, 32, 40)

Remark : Pitch tolerance over any 10 pitches of Po is ± 0.2 mm



Product Specification

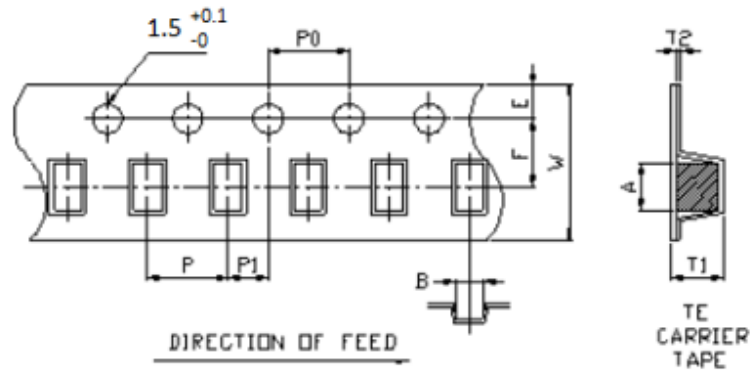
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MIL OHM THICK FILM CHIP RESISTOR

CR Series

DS-ENG-005

Page: 13 of 16



Dimension of Plastic Embossed Carrier System (CR - 50, 63)

Code	A	B	W	E	F	T1	T2	P	P0	P1
CR50	5.5±0.20	2.8±0.20	12.0±0.20	1.75±0.10	5.50±0.05	1.10±0.15	0.23±0.15	4.0±0.10	4.0±0.05	2.0±0.05
CR63	6.7±0.20	3.4±0.20	12.0±0.20	1.75±0.10	5.50±0.05	1.10±0.15	0.23±0.15	4.0±0.10	4.0±0.05	2.0±0.05

7.3 Packaging

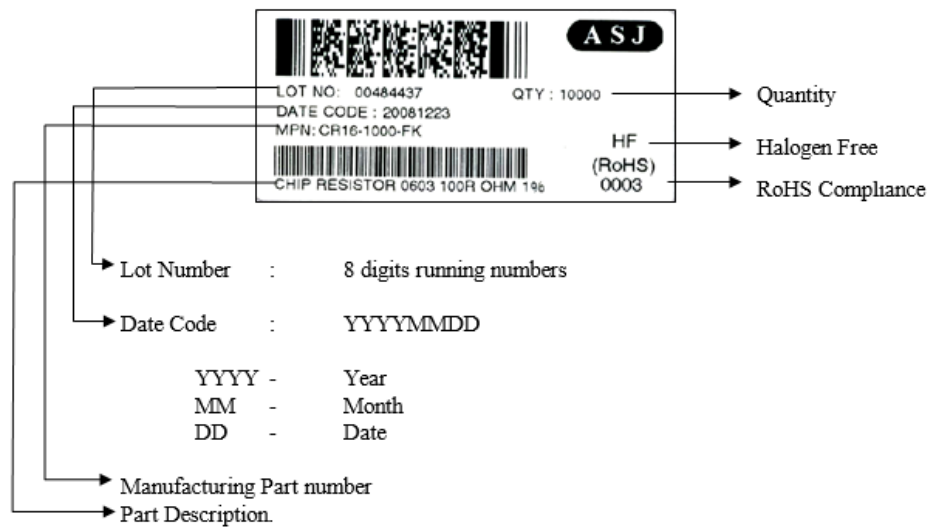
7.3.1 Taping

7.3.2 Quantity – Tape and Reels

Code	Quantity	Model	Remarks
CR10	10000 pcs	7" Reel	10" Reel upon request
CR16	5000 pcs	7" Reel	10" & 13" Reel for 10 000 or 20 000 pcs on request
CR21			
CR32			
CR40	5000 pcs	7" Reel	-
CR50	4000 pcs	7" Reel	-
CR63	4000 pcs	7" Reel	-

7.3.3 Identification

Production label that indicates the 8 digits lot number, product type, resistance value and tolerance shall be pasted on the surface of each reel.



7.3.4 Packaging Reel Box

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

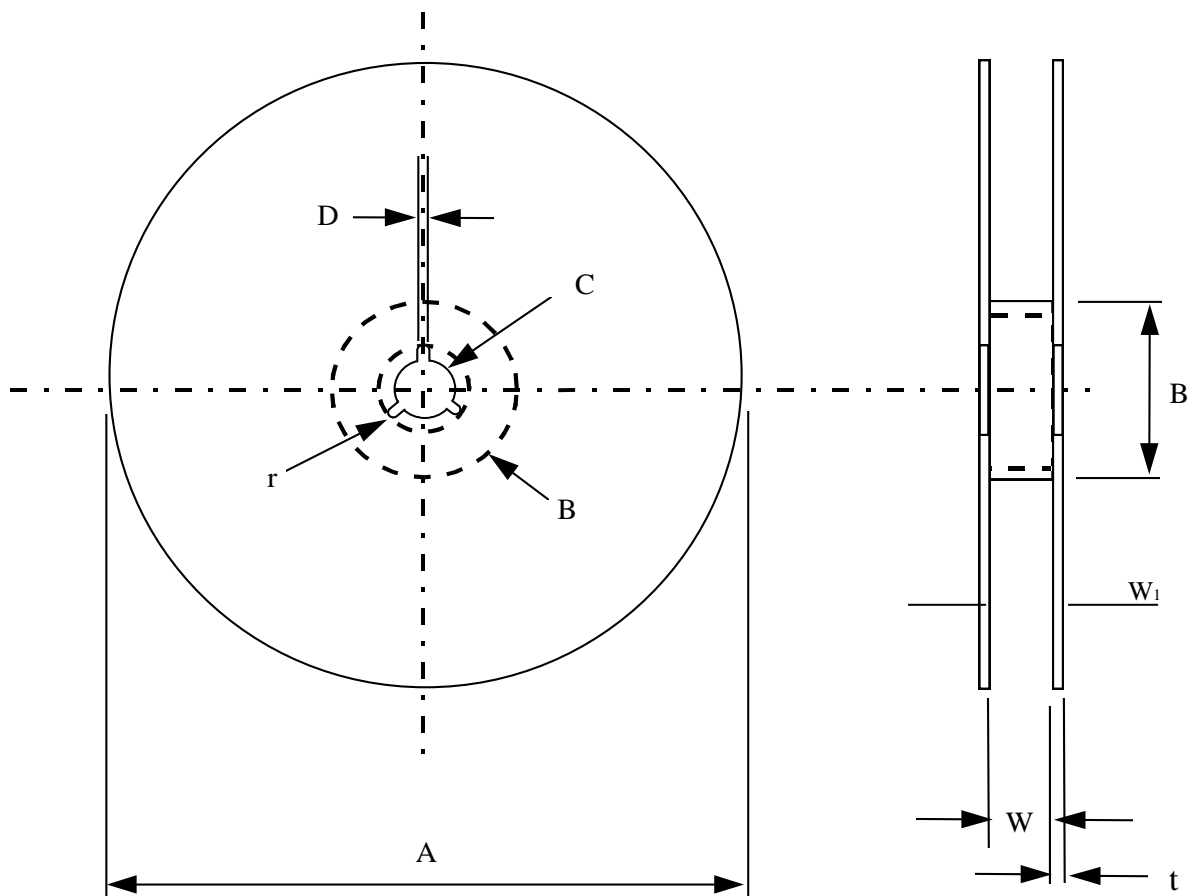
MILI OHM THICK FILM CHIP RESISTOR

CR Series

DS-ENG-005

Page: 15 of 16

7.3.5 Reel Dimensions



Model	A	B	C	D	W	W ₁	t	r
7" Reel (5K) (except 0402 10K)	φ178±2.0	φ60min	13±0.2	φ2.0±0.5	11±0.1	14.4 max	1.0±0.1	1.0
7" Reel (4K)	φ178±2.0	φ60min	13±0.2	φ2.0±0.5	13±1.0	14.4 max	1.2±0.1	1.0
10" Reel (10K)	φ254±2.0	φ60min	13±0.2	φ2.0±0.5	11±1.0	14.4 max	1.5±0.1	1.0
13" Reel (20K, 50K)	φ330±2.0	φ60min	13±0.2	φ2.0±0.5	11±1.0	14.4 max	2.1±0.1	-
13" Reel (20K)	φ330±1.0	φ100±1	13.5±0.5	2~3±0.5	10±0.5	-	-	-



Product Specification

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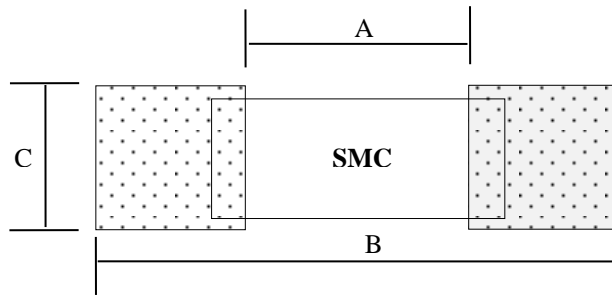
MILI OHM THICK FILM CHIP RESISTOR

CR Series

DS-ENG-005

Page: 16 of 16

8. SURFACE MOUNT LAND PATTERNS



Product (Type)	Land Dimension		
	A	B	C
CR05 (0201)	0.012 [0.3]	0.04 [1.0]	0.016 [0.4]
CR10 (0402)	0.020 [0.5]	0.059 [1.5]	0.024 [0.6]
CR16 (0603)	0.031 [0.8]	0.083 [2.1]	0.035 [0.9]
CR21 (0805)	0.047 [1.2]	0.118 [3.0]	0.051 [1.3]
CR32 (1206)	0.087 [2.2]	0.165 [4.2]	0.063 [1.6]
CR40 (1210)	0.087 [2.2]	0.165 [4.2]	0.110 [2.8]
CR50 (2010)	0.138 [3.5]	0.240 [6.1]	0.110 [2.8]
CR63 (2512)	0.149 [3.8]	0.315 [8.0]	0.137 [3.5]

9. REVISION HISTORY

REVISION	DATE	CHANGE NOTIFICATION	DESCRIPTION
Version. 1	February 13,2015		Initial Release
Version. 2	June 11,2015		Revise Clause 3.1.1, Power Rating : - CR32 1/4W - CR40 1/3W
Version 3	February 6,2017		Typo error in clause 2 “Part Numbering System” Typo error in clause 6.1.1, 6.1.2, change IR Reflow to Wave Soldering, change wave to Reflow Soldering Update clause 7.2 dimension information Update clause 7.3.5, insert 13” reel information
		Refer to PCN-ECO :01/2016	