

DATA SHEET

Thin Film Chip Resistor

CT Series

0.1% TO 1.0%, TCR ± 10 TO ± 50

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

RoHs Compliant

THIN FILM CHIP RESISTOR

CT Series

DS-ENG-004

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1. SCOPE

1.1 This specification specifies fixed thin film chip resistor (referred to as resistor hereinafter) for use in electronic equipment. In case there are discrepancies in specifications between this specification and the Customer's specifications, the latter shall precede.

2. PART NUMBERING SYSTEM

Part Numbering is made in accordance with the following system:

CT	10	-	XXXX	-	F	K	-	E
----	----	---	------	---	---	---	---	---

Type	Size (Inch / mm)	Nominal Resistance			Resistance Tolerance	Packaging	T.C.R
General Purpose Thin Film Chip Resistors	10 (0402/1005)	Resistors	4-Digit	E96 Series	B = ± 0.1%	E = 4,000 pcs Lead Free	B = ±10ppm/°C
	16 (0603/1608)			10.2Ω=10R2	C = ± 0.25%	L = 5,000 pcs Lead Free	C = ±15ppm/°C
	21 (0805/2012)			10KΩ=1002	D = ± 0.5%	K = 10,000 pcs Lead Free	D = ±25ppm/°C
	32 (1206/3216)				F = ± 1.0%		E = ±50ppm/°C
	40 (1210/3225)						
	50 (2010/5025)						
63 (2512/6432)							

3. RATING

3.1 Rated Power

3.1.1 Resistor Rated Power

Product Type	Rated Power	Maximum Working Voltage	Maximum Overload Voltage
CT10	1/16W	50V	100V
CT16	1/10W	75V	150V
CT21	1/8W	150V	300V
CT32	1/4W	200V	400V
CT40	1/4W	200V	400V
CT50	1/2W	200V	400V
CT63	3/4W	200V	400V

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.

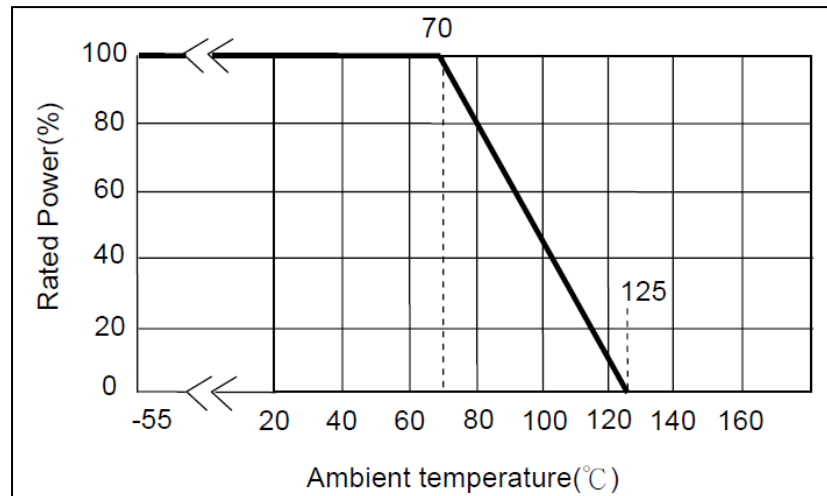


Fig.1 Power Derating Characteristics

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 = $20 \pm 2^\circ\text{C}$

Relative Humidity = 60 to 70% RH

Air Pressure = 86 kPa to 106kPa

3.4 Operating Temperature Range -55°C to +125°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.

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				Operating Temperature Range
			B(±0.1%)	C(±0.25%)	D(±0.5%)	F(±1%)	
			E-96, E24	E-96, E24	E-96, E24	E-96, E24	
CT10 0402(1005)	1/16 W	±10, ±15	20Ω ~ 70KΩ		---		-55°C + 125°C
		±25	4.7Ω ~ 240KΩ				
		±50	4.7Ω ~ 240KΩ				
CT16 0603(1608)	1/10 W	±10, ±15	4.7Ω ~ 332KΩ		---		
		±25	1Ω ~ 1MΩ				
		±50	1Ω ~ 1MΩ				
CT21 0805(2012)	1/8 W	±10, ±15	4.7Ω ~ 800KΩ		---		
		±25	1Ω ~ 1.5MΩ				
		±50	1Ω ~ 1.5MΩ				
CT32 1206(3216)	1/4 W	±10, ±15	5.6Ω ~ 1MΩ				
		±25	1Ω ~ 1.5MΩ				
		±50	1Ω ~ 1.5MΩ				
CT40 1210(3225)	1/4 W	±10, ±15	4.7Ω ~ 100KΩ		---		
		±25	4.7Ω ~ 1MΩ				
		±50	4.7Ω ~ 1MΩ				
CT50 2010(5025)	1/2 W	±10, ±15	4.7Ω ~ 100KΩ		---		
		±25	4.7Ω ~ 1MΩ				
		±50	4.7Ω ~ 1MΩ				
CT63 2512(6432)	3/4 W	±10, ±15	4.7Ω ~ 100KΩ		---		
		±25	4.7Ω ~ 1MΩ				
		±50	4.7Ω ~ 1MΩ				

3.11 Rated Voltage

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

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

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 Document review period: every 3 months

4. MARKING ON PRODUCT

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

Part Number	Color	Marking on Product
CT10 (0402)	-	No marking
CT16 (0603)	Light Yellow	1) Tolerance : $\pm 1.0\%$ (F) ° Four Numerals Marking (E96 Series)
CT21 (0805)	Light Yellow	
CT32 (1206)	Light Yellow	
CT40 (1210)	Light Yellow	
CT50 (2010)	Light Yellow	
CT63 (2512)	Light Yellow	

4.1 Numeric Numbering

4.1.1 1% Tolerance : *Four Numerals Marking*

First 3 digits are significant figures; fourth digit is number of zeros.

Examples:

<i>Nominal Resistance</i>	<i>Marking</i>	<i>Remarks</i>
1 Ω	1R00	$1 \times 10^0 = 1$
10 Ω	10R0	$10 \times 10^0 = 10$
100 Ω	1000	$100 \times 10^0 = 100$
4.7K Ω	4701	$470 \times 10^1 = 4700$
47K Ω	4702	$470 \times 10^2 = 47000$
470K Ω	4703	$470 \times 10^3 = 470000$
1M Ω	1004	$100 \times 10^4 = 1000000$

THIN FILM CHIP RESISTOR

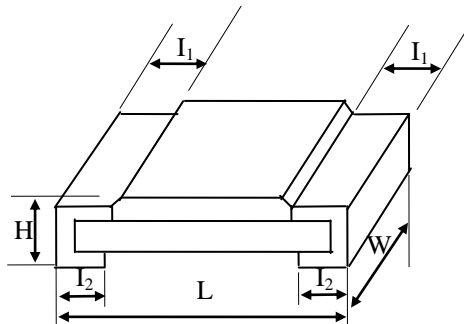
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5. DIMENSIONS, CONSTRUCTIONS AND MATERIALS

5.1 Dimensions



Unit: Inches (Millimeters)

Type	Dimensions				
	Millimeters				
	L	W	H	I1	I2
CT10 0402	0.040±0.004 (1.00±0.10)	0.020±0.002 (0.50±0.05)	0.012±0.002 (0.30±0.05)	0.008±0.004 (0.20±0.10)	0.010±0.004 (0.25±0.10)
CT16 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)	0.012±0.006 (0.30±0.15)	0.012±0.006 (0.30±0.15)
CT21 0805	0.079±0.004 (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±0.006 (0.35±0.15)
CT32 1206	0.120 ± 0.004 (3.05 ± 0.10)	0.061 ± 0.004 (1.55 ± 0.10)	0.022 +0.004/-0.002 (0.55 +0.10/-0.05)	0.018 ± 0.008 (0.45 ± 0.20)	0.014 ± 0.006 (0.35 ± 0.15)
CT40 1210	0.120±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)
CT50 2010	0.200±0.008 (5.00±0.20)	0.098 ± 0.008 (2.50 ± 0.20)	0.022±0.004 (0.55±0.10)	0.024±0.008 (0.60±0.20)	0.024±0.008 (0.60±0.20)
CT63 2512	0.248±0.008 (6.30±0.20)	0.126±0.008 (3.20±0.20)	0.022±0.004 (0.55±0.10)	0.024±0.008 (0.60±0.20)	0.024±0.008 (0.60±0.20)

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6. ELECTRICAL CHARACTERISTICS AND TEST CONDITIONS

CHARACTERISTICS		SPECIFICATIONS	TESTING CONDITIONS
		Resistance	
1	Resistance Temperature Coefficient	Refer to Clause 3.10	JIS-C5201-1 4.8 At +25/-55 ⁰ C and +25/+125 ⁰ C. <i>Formula:</i> $TCR = \frac{R_2 - R_1}{R_1 (t_2 - t_1)} \times 10^6$ (ppm/ ⁰ C) Where $t_1 = +25^0C$ or specified room temperature $t_2 = -55^0C$ or +125 ⁰ C test temperature R_1 = resistance at reference temperature in ohms R_2 = resistance at test temperature in ohms
2	Short Time Overload	±(0.5%+0.05Ω)	JIS-C5201-1 4.13 Applied 2.5 times rated voltage for 5 seconds and ± (0.5% + 0.05Ω) release the load for about 30 minutes , then measure its resistance variance rate. (Rated voltage refer to item 3. general specifications)
3	Insulation Resistance	≥10 GΩ	JIS-C5201-1 4.6 Put the resistor in the fixture, add 100 VDC in +, - terminal for 60 sec then measured the insulation resistance between electrodes and insulating enclosure or between electrodes and base material.
4	Dielectric Withstand Voltage	No short or burned on the appearance.	JIS-C5201-1 4.7 Put the resistor in the fixture, add VAC (see SPEC below) in +, - terminal for. CT10, CT16 apply 300 VAC 1 minute. CT21, CT32, CT40, CT50, CT63 apply 500 VAC 1 minute.
5	Intermittent Overload	±(0.5%+0.05Ω)	JIS-C5201-1 4.13 Put the tested resistor in chamber under temperature 25± 2 ⁰ C ± (0.5% + 0.05Ω) and load the rated DC voltage for 1 sec on , 25 sec off , 10000 +400/-0 test cycles, then it be left at no-load for 1 hour ,then measure its resistance variance rate.

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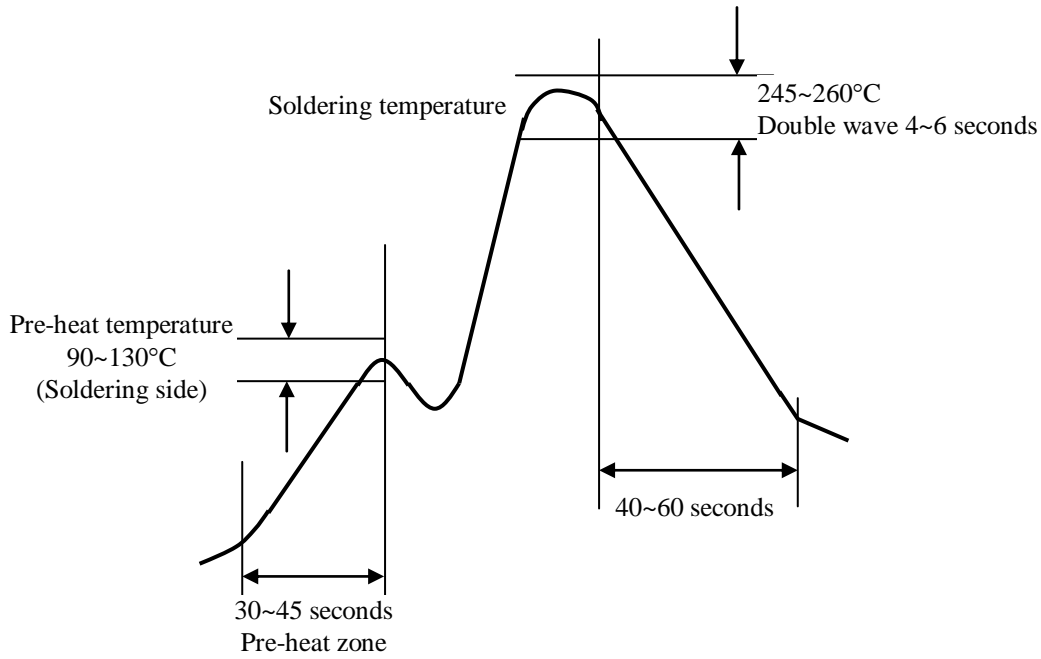
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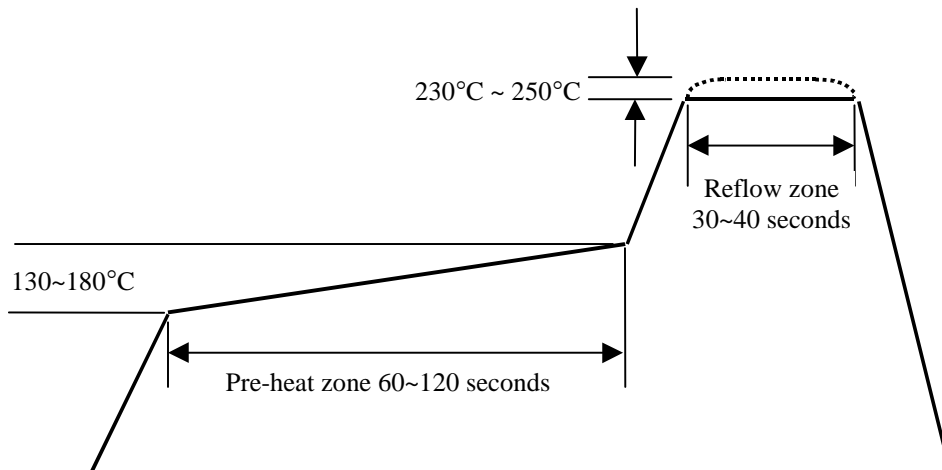
7	Terminal strength	Test1: No evidence of mechanical damage. Test2: $\geq 5N$	JIS-C5201-1 4.16 Test1: The resistor mounted on the board applied 5N pushing force on the sample rear for 10 sec. Test2: The resistor mounted on the board slowly, add force on the sample rear until the sample termination is breakdown.
8	Board Flex / Bending	$\pm(0.5\%+0.05\Omega)$ No visible damage	JIS-C5201-1 4.33 Solder tested resistor on to PC board add force in the middle down, and under load measured its resistance variance rate. D: CT10, CT16, CT21=5mm CT32, 12=3mm CT40, 25=2mm
9	Low Temperature Operation	$\pm(0.5\%+0.05\Omega)$ No visible damage	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.
10	Leaching Test	1. Solder coverage over 95%. 2. The underlying material (such as ceramic) shall not be visible at the crest corner area of the electrode.	The tested resistor be immersed into molten solder of 260± 5°C for 30 seconds. Then the resistor is left as placed under microscope to observe its solder area.
11	Dielectric Withstanding Voltage	No short or burned on the appearance.	JIS-C5201-1 4.7 Put the resistor in the fixture, add VAC (see SPEC below) in +, - terminal for. CT10, CT16 apply 300 VAC 1 minute. CT21, CT32, CT40, CT50, CT63 apply 500 VAC 1 minute.
12	Solderability	Solder coverage over 95%	JIS-C5201-1 4.17 Put the tested resistor in the apparatus of PCT, at a temperature of 105°C, humidity of 100% RH, and pressure of 1.22× 10 ⁵ Pa for a duration of 4 hours. Then after left the tested resistor in room temperature for 2 hours or more. Test method: The resistor be immersed into solder pot in temperature 235± 5°C for 2 sec, then the resistor is left as placed under microscope to observed its solder area.

6.1 Soldering Profile

6.1.1 IR Reflow



6.1.2 Wave Soldering



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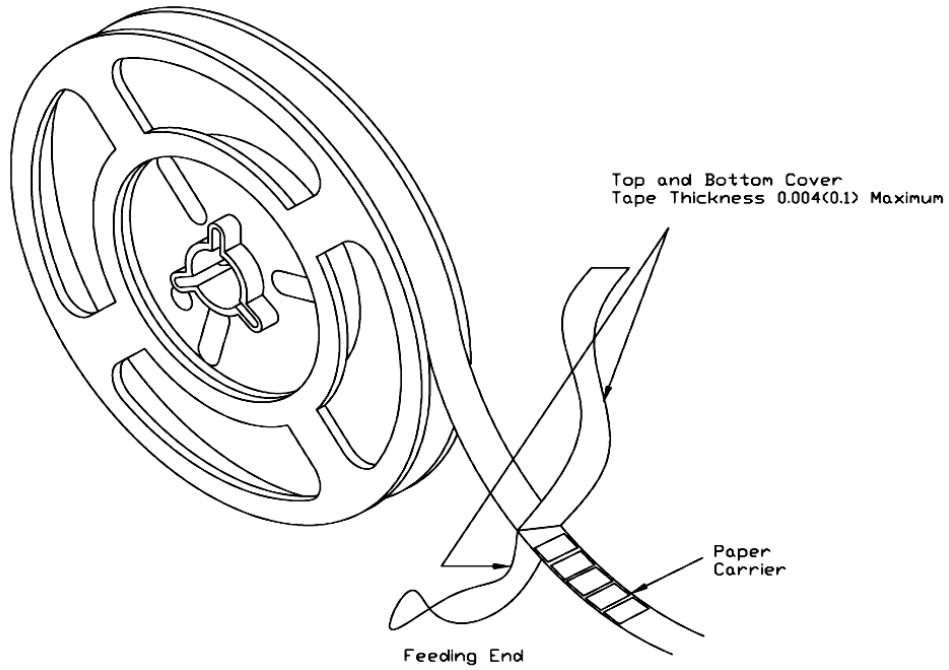
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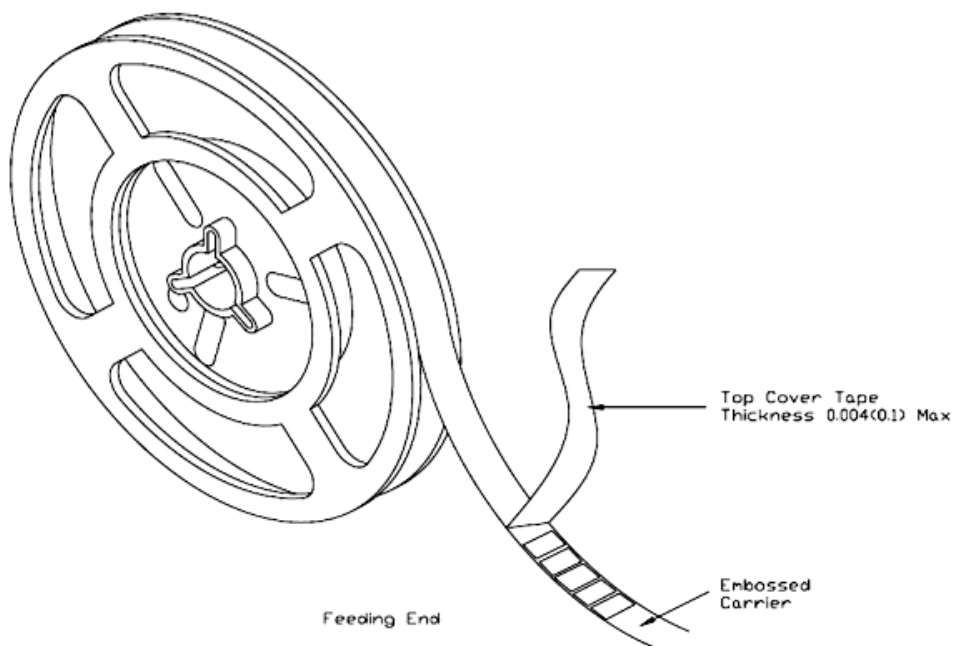
7. TAPING

7.1 Structure of Taping

Paper Carrier

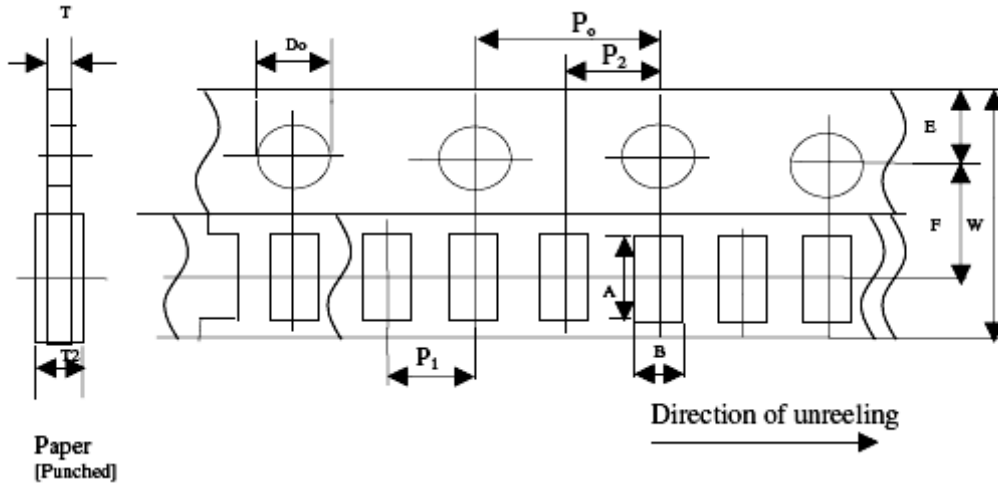


Embossed Plastic Carrier



7.2 Dimension

7.5.1 Dimension of Punched Paper Tape Carrier System (CT -10)



Remark : Pitch tolerance over any 10 pitches of P₀ is ± 0.2 mm

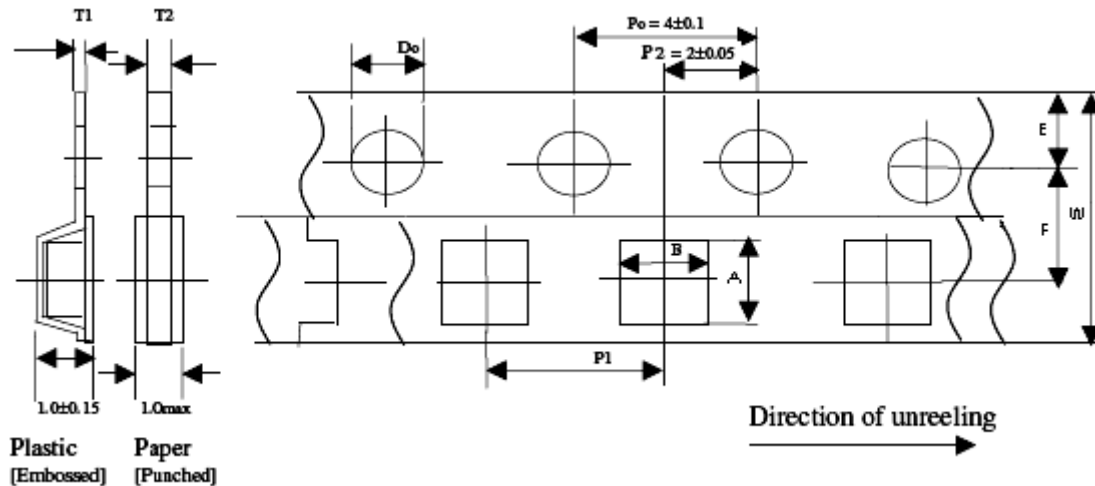
Dimension of Punched Paper Tape Carrier System (CT-10)

(unit : mm)

Code	A	B	W	E	F	P ₁
CT10	1.15 ± 0.1	0.65 ± 0.05	8.0 ± 0.2	1.75 ± 0.1	3.5 ± 0.05	2.0 ± 0.05

Code	P ₂	P ₀	D ₀	T ₂	T
CT10	2.0 ± 0.05	4.0 ± 0.1	1.5	0.35 ± 0.1	-

7.5.2 Dimension of Punched Paper Tape Carrier System /Plastic Embossed Carrier System
(CT16, 21, 32, 40, 50, 63)



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

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

Code	A	B	W	E	F	P1	Do	T2
CT16	1.9 ± 0.1	1.1 ± 0.1	8.0 ± 0.2	1.75 ± 0.1	3.5 ± 0.05	4.0 ± 0.1	$1.5 \pm 0.1^{0.1}$	0.60 ± 0.1
CT21	2.4 ± 0.1	1.65 ± 0.1						0.75 ± 0.1
CT32	3.5 ± 0.1	1.9 ± 0.1						0.75 ± 0.1
CT40	3.5 ± 0.1	2.8 ± 0.1						0.75 ± 0.1

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

Code	A	B	W	E	F	P1	Do	T1
CT50	5.4 ± 0.2	2.9 ± 0.2	12 ± 0.2	1.75 ± 0.1	5.5 ± 0.05	4.0 ± 0.1	$1.5 \pm 0.1^{0.1}$	0.2 ± 0.10
CT63	6.6 ± 0.1	3.6 ± 0.2						

7.7 Packaging

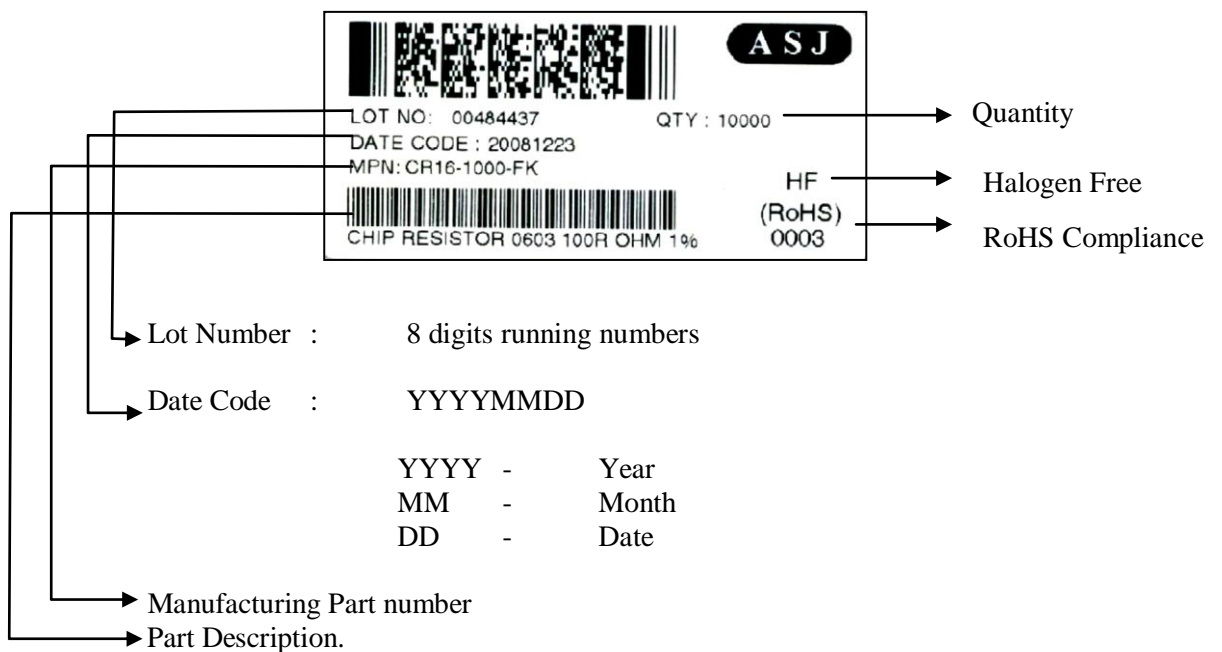
7.7.1 Taping

7.7.1.1 Quantity – Tape and Reels

Code	Quantity	Model	Remarks
CT10	10000 pcs	7" Reel	10" Reel upon request
CT16	5000 pcs	7" Reel	10 000 or 20 000 pcs on request
CT21			
CT32			
CT40	5000 pcs	7" Reel	-
CT50	4000 pcs	7" Reel	-
CT63	4000 pcs	7" Reel	-

7.7.2 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.



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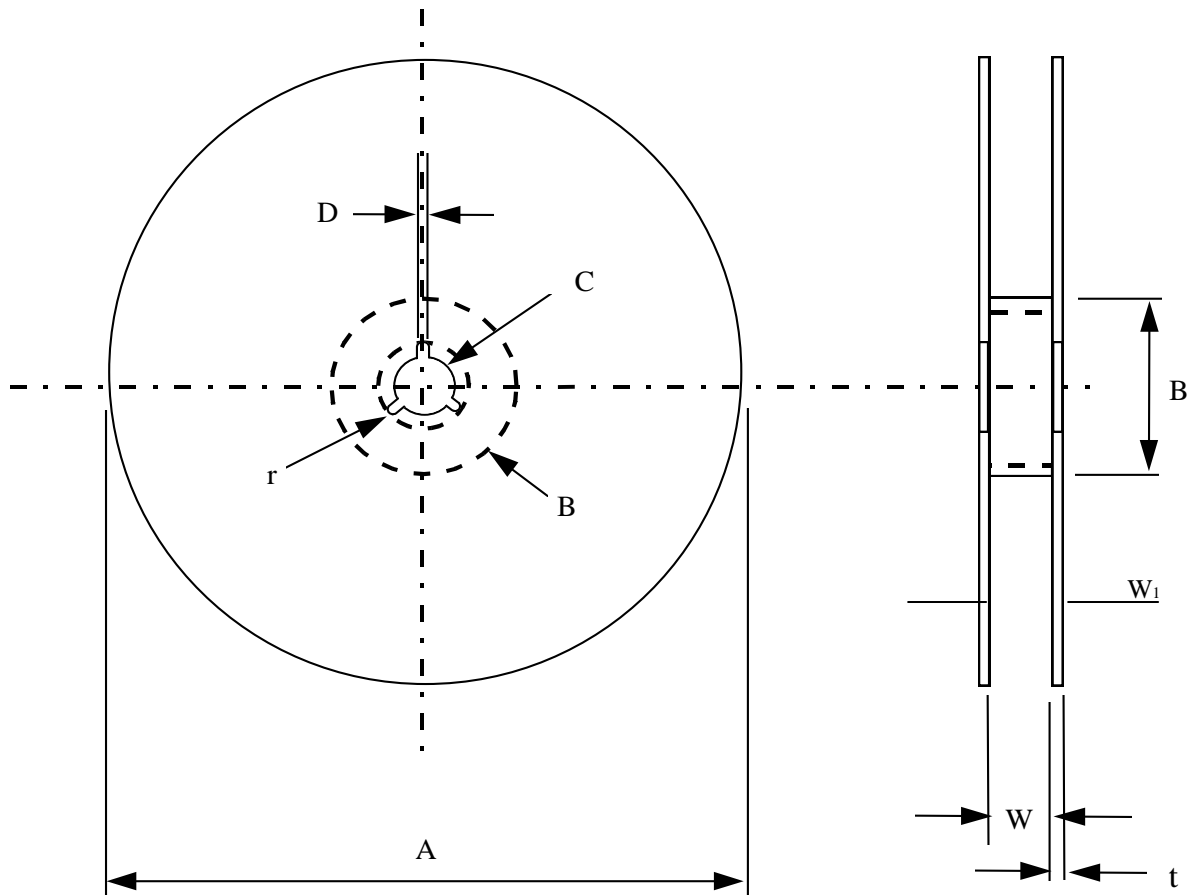
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7.7.3 Packaging Reel Box

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

7.7.4 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	-



Product Specification

Towards Excellence in Quality, Service & Innovation

THIN FILM CHIP RESISTOR

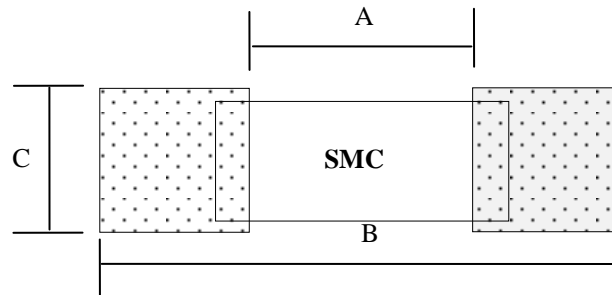
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8. SURFACE MOUNT LAND PATTERNS



Product (Type)	Land Dimension		
	A	B	C
CT10 (0402)	0.020 [0.5]	0.059 [1.5]	0.024 [0.6]
CT16 (0603)	0.031 [0.8]	0.083 [2.1]	0.035 [0.9]
CT21 (0805)	0.047 [1.2]	0.118 [3.0]	0.051 [1.3]
CT32 (1206)	0.087 [2.2]	0.165 [4.2]	0.063 [1.6]
CT40 (1210)	0.087 [2.2]	0.165 [4.2]	0.110 [2.8]
CT50 (2010)	0.138 [3.5]	0.240 [6.1]	0.110 [2.8]
CT63 (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	December 15,2015		Operating Temperature Range and Resistance range review