

DATA SHEET

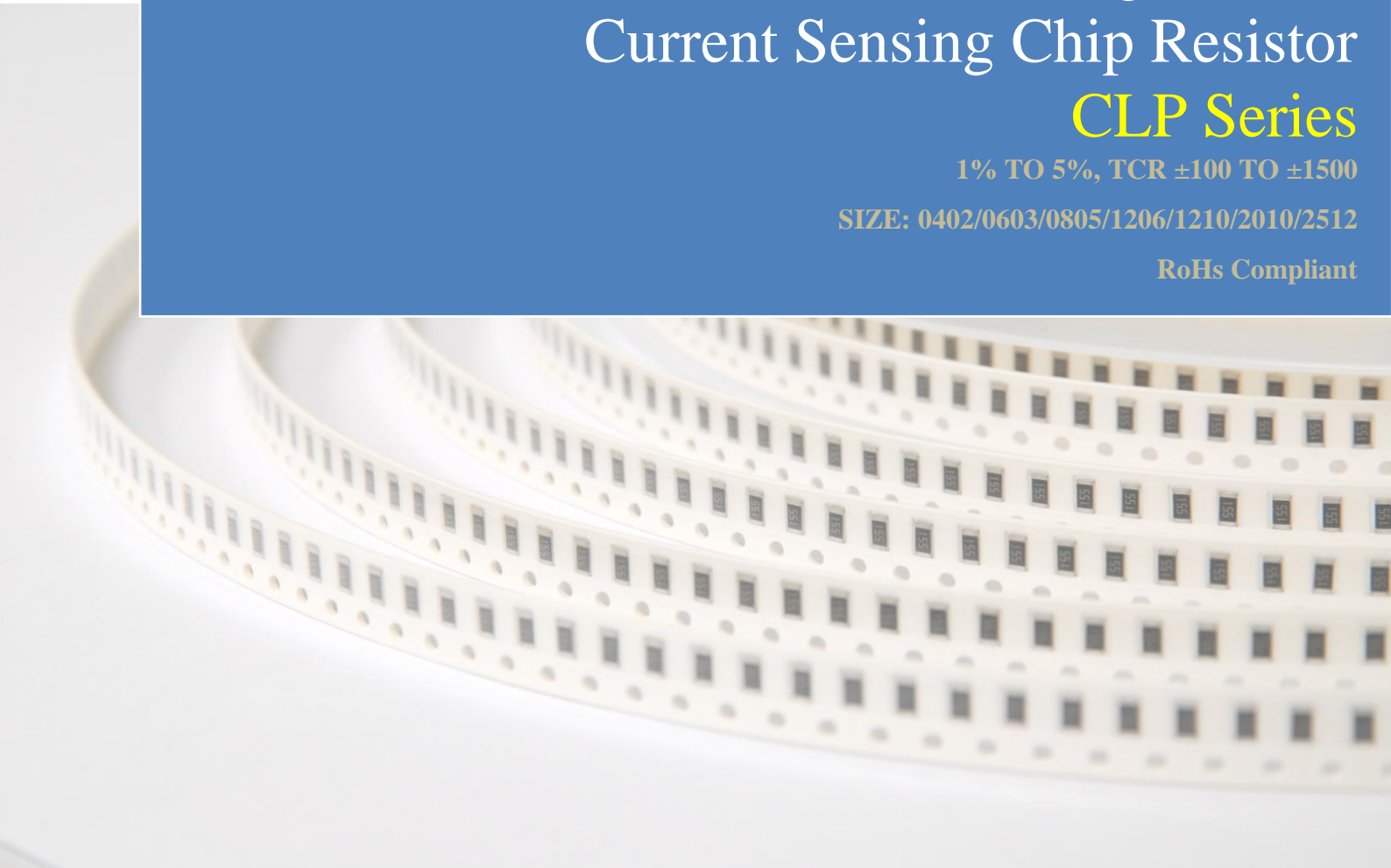
Low Ohmic High Power Current Sensing Chip Resistor

CLP Series

1% TO 5%, TCR ± 100 TO ± 1500

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

RoHs Compliant



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1. SCOPE

- 1.1 This specification is applicable to lead and halogen free CLP series high power 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 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:

CLP	10	-	RXXX	-	F	K
-----	----	---	------	---	---	---

Type	Size (Inch/mm)	Nominal Resistance			Resistance Tolerance	Packaging
Low Ohmic High Power Current Sensing Chip Resistors	10(0402/1005)	Resistors	4-Digit	E24 & E96 Series 0.47Ω=R470 0.499Ω=R499	F = ±1% G = ±2% J = ±5%	E = 4000 pcs Lead Free L = 5000 pcs Lead Free K = 10,000 pcs Lead Free Y = 20,000 pcs Lead Free
	16(0603/1608)					
	21(0805/2012)					
	32(1206/3216)					
	40(1210/3225)					
	50(2010/5025)					
	63(2512/6432)					

3 RATING

3.2 Rated Power

3.1.1 Resistor Rated Power

Product Type	Rated Power	Maximum Rated Current	Maximum Overload Current
CLP10	1/10W	2A	5A
CLP16	1/8W	3.5A	8.84A
CLP21	1/4W	5A	12.5A
CLP32	1/2W	7.07A	17.68A
CLP40	3/4W	8.66A	21.6A
CLP50	1W	10A	25A
CLP63	2W	14.14A	35.36A



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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.

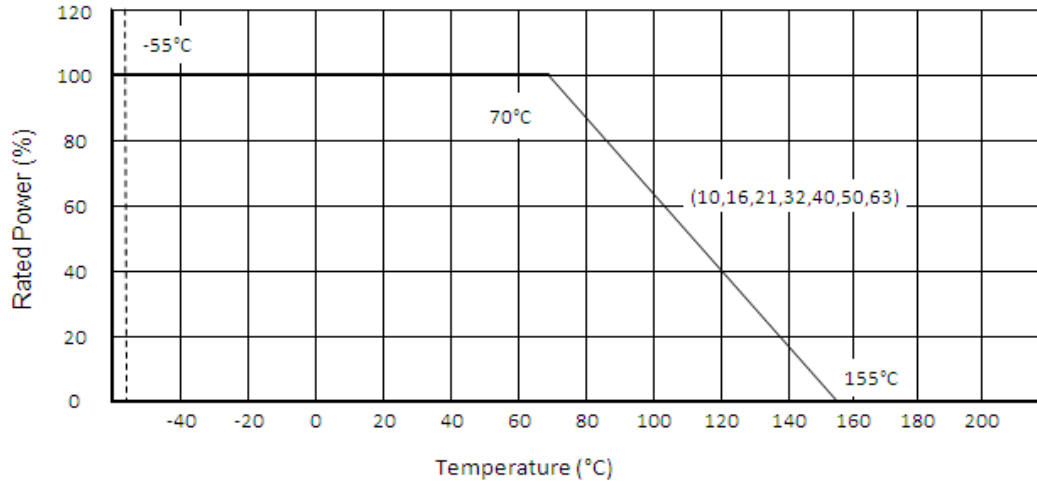


Fig.1 Power Derating Characteristics

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

Relative Humidity = 60 to 70% RH

Air Pressure = 86 kPa to 106kPa

3.4 Operating Temperature Range -55°C to +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 resistors shall warranty 24 months from the date of shipment.



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- 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.

Type	Rated Power at 70°C	T.C.R (ppm/°C)	Resistance Range		Operating Temperature Range
			F(±1%)	G(±2%), J(±5%)	
			E-24, E-96	E-24	
CLP10 (0402)	1/10 W	±1500	25mΩ≤R<37mΩ		-55°C ~ +155°C
		±1200	37mΩ≤R<60mΩ		
		±600	60mΩ≤R<200mΩ		
		±300	200mΩ≤R<400mΩ		
		±250	400mΩ≤R<600mΩ		
		±200	600mΩ≤R<1000mΩ		
CLP16 (0603)	1/8 W	±1500	10mΩ≤R<37mΩ		
		±1200	37mΩ≤R<60mΩ		
		±600	60mΩ≤R<100mΩ		
		±300	100mΩ≤R<200mΩ		
		±600	200mΩ≤R<500mΩ		
		±400	500mΩ≤R<1000mΩ		
CLP21 (0805)	1/4 W	±1500	10mΩ≤R<19mΩ		
		±1200	19mΩ≤R<33mΩ		
		±800	33mΩ≤R<50mΩ		
		±600	50mΩ≤R<100mΩ		
		±200	100mΩ≤R<1000mΩ		
CLP32 (1206)	1/2 W	±1500	10mΩ≤R<19mΩ		
		±1200	19mΩ≤R<25mΩ		
		±1000	25mΩ≤R<50mΩ		
		±600	50mΩ≤R<100mΩ		
		±200	100mΩ≤R<1000mΩ		
CLP40 (1210)	3/4 W	±1000	10mΩ≤R<25mΩ		
		±700	25mΩ≤R<50mΩ		
		±400	50mΩ≤R<100mΩ		
		±200	100mΩ≤R<1000mΩ		
CLP50 (2010)	1 W	±200	50mΩ≤R<150mΩ		
		±100	150mΩ≤R<1000mΩ		
CLP63 (2512)	2 W	±200	50mΩ≤R<150mΩ		
		±100	150mΩ≤R<1000mΩ		

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



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4 MARKING ON PRODUCT

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

Part Number	Color	Marking on Product
CLP 10 (0402)	-	No marking
CLP 16 (0603)	Light Yellow	1) Tolerance : 1%, 2% & 5% ▪ Four Numerals Marking (E96 & E24 Series)
CLP 21 (0805)	Light Yellow	
CLP 32 (1206)	Light Yellow	
CLP 40 (1210)	Light Yellow	
CLP 50 (2010)	Light Yellow	
CLP63 (2512)	Light Yellow	

4.1 Numeric Numbering

4.1.1 1%, 2% & 5% 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 X 10 ⁰ = 1



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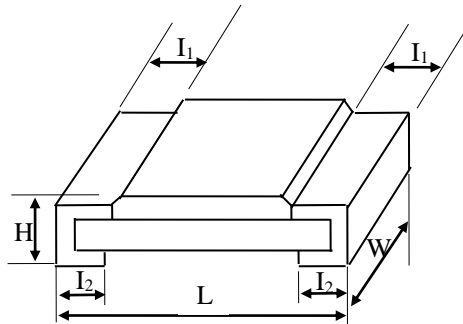
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5 DIMENSIONS, CONSTRUCTIONS AND MATERIALS

5.1 Dimensions



Unit: Inches(Millimeters)

CODE	L	W	H	I ₁	I ₂
CLP10 (0402)	0.040±0.004 (1.00±0.10)	0.020±0.004 (0.50±0.10)	0.014±0.004 (0.35±0.10)	0.010±0.004 (0.25±0.10)	0.008±0.006 (0.20±0.15)
CLP16 (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±0.006 (0.25±0.15)	0.014±0.006 (0.35±0.15)
CLP21 (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±0.008 (0.35±0.20)
CLP32 (1206)	0.120±0.004 (3.05±0.10)	0.061±0.004 (1.55±0.10)	0.020±0.004 (0.50±0.10)	0.018±0.008 (0.45±0.20)	0.026±0.006 (0.65±0.15)
CLP40 (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)
CLP50 (2010)	0.195±0.004 (4.95±0.10)	0.096±0.004 (2.45±0.10)	0.028±0.004 (0.70±0.10)	0.026±0.008 (0.65±0.20)	0.028±0.008 (0.70±0.20)
CLP63 (2512)	0.252±0.008 (6.40±0.20)	0.129±0.008 (3.20±0.20)	0.027±0.004 (0.70±0.10)	0.028±0.008 (0.72±0.20)	0.049±0.008 (1.25±0.20)

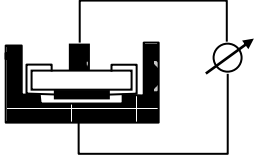
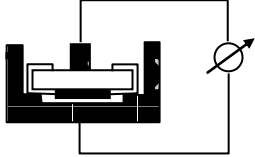
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6 ELECTRICAL CHARACTERISTICS AND TEST CONDITIONS

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 \pm15) 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 \pm 5secs. for chip \geq 0805. Apply 300VAC for 1 minute \pm 5secs. for chip 0402 & 0603 Apply 50Vac for 1 minute \pm 5secs for 0201</p> 
		$\pm(5.0\%+0.001\Omega)$	



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6	Intermittent Overload	$\pm(5.0\%+0.001\Omega)$		<p>JIS C 5201-1 4.13 Apply 4 times rated voltage for 1 secs ON and 25 secs OFF. Total 10 000 $_{-0}^{+400}$ 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	$\pm(1.0\%+0.001\Omega)$		<p>JIS-C5201-1 4.29 The tested resistor be immersed into isopropyl alcohol of 20~25°C for 5 minutes, then the resistor is left in the room for 48 hrs, and measured its resistance variance rate.</p>
		No evidence of mechanical damage. No G2 over coating and Sn layer by leaching.		
10	Solderability	$\geq 95\%$ Coverage at all terminal		<p>JIS-C5201-1 4.17 Preconditioning: Put the tested resistor in the apparatus of PCT, at a temperature of 105°C, humidity of 100% RH, and pressure of 1.22$\times 10^5$ 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$\pm 5^\circ\text{C}$ for 2 sec, then the resistor is left as placed under microscope to observed its solder area.</p>
11	Resistance to soldering heat	$\Delta R\% = \pm(1.0\%+0.001\Omega)$		<p>JIS-C5201-1 4.18 Solder bath method Resistor dipped entirely in solder bath of 260$\pm 5^\circ\text{C}$ for 10 sec. After which the sample shall be left at ambient temperature for 1~ 2 hrs before measurement.</p>



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12	Vibration	1%,2%,5%: $\pm(1.0\%+0.001\Omega)$	<p>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)</p>
13	Low Temperature Operation	1%, 2%, 5%: $\pm(1.0\%+0.001\Omega)$	<p>MIL-R-55342D 4.7.4 Put the tested resistor in the chamber at room temperature 25⁰C. Decreasing the temperature to -55⁰C and keep the temperature at -55⁰C 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\pm1 hours, and measure its resistance variance rate.</p>
14	Resistance Dry Heat	1%, 2%, 5%: $\pm(1.0\%+0.001\Omega)$	<p>JIS-C5201-1 4.25 Put tested resistor in chamber under temperature 155\pm5⁰C for 1000 +48/-0 hours. Then leaving the tested resistor in room temperature for 60 minutes, and measure its resistance variance rate.</p>
15	Loadlife	1%, 2%, 5%: $\pm(2.0\%+0.001\Omega)$	<p>JIS-C5201-1 4.25 At 70\pm2⁰C 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.</p>
16	Loading Life in Moisture	1%, 2%, 5%: $\pm(2.0\%+0.001\Omega)$	<p>JIS-C5201-1 4.24 Put the tested resistor in the chamber under temperature 40\pm2⁰C, 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.</p>



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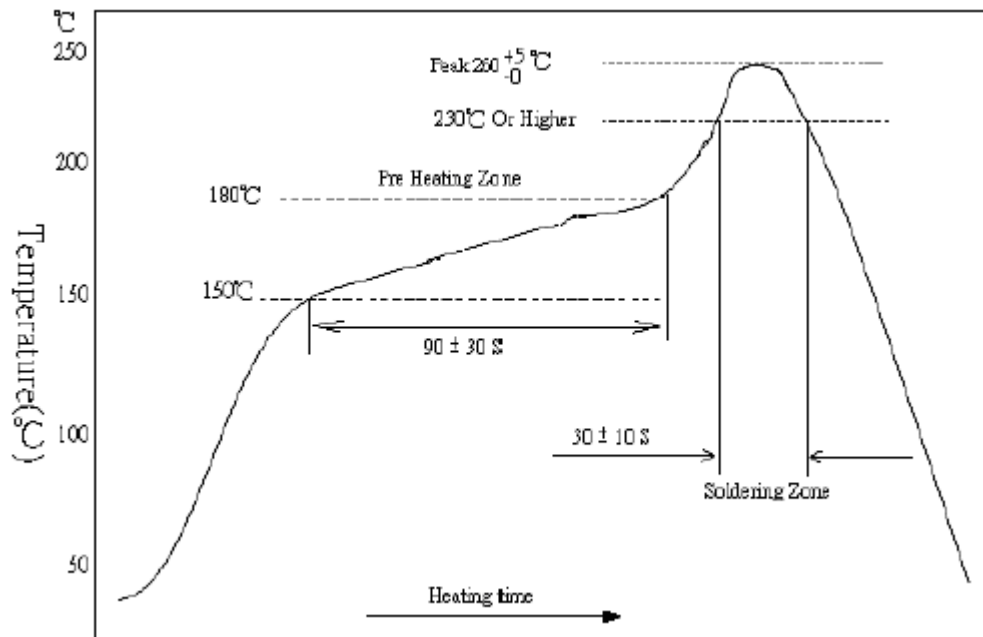
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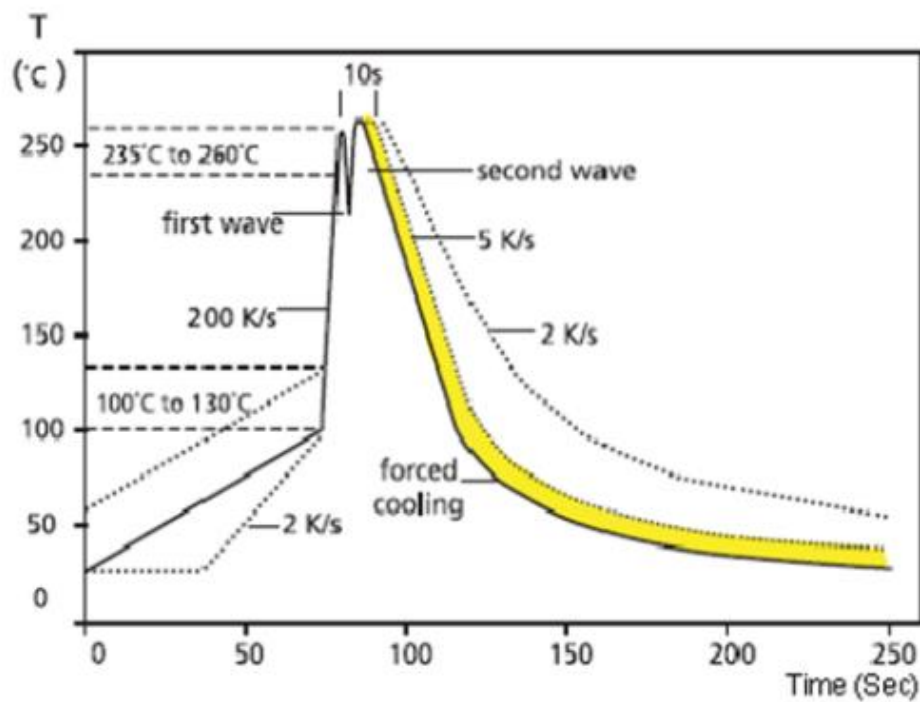
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6.1 Soldering Profile

6.1.1 IR Reflow



6.1.2 Wave Soldering



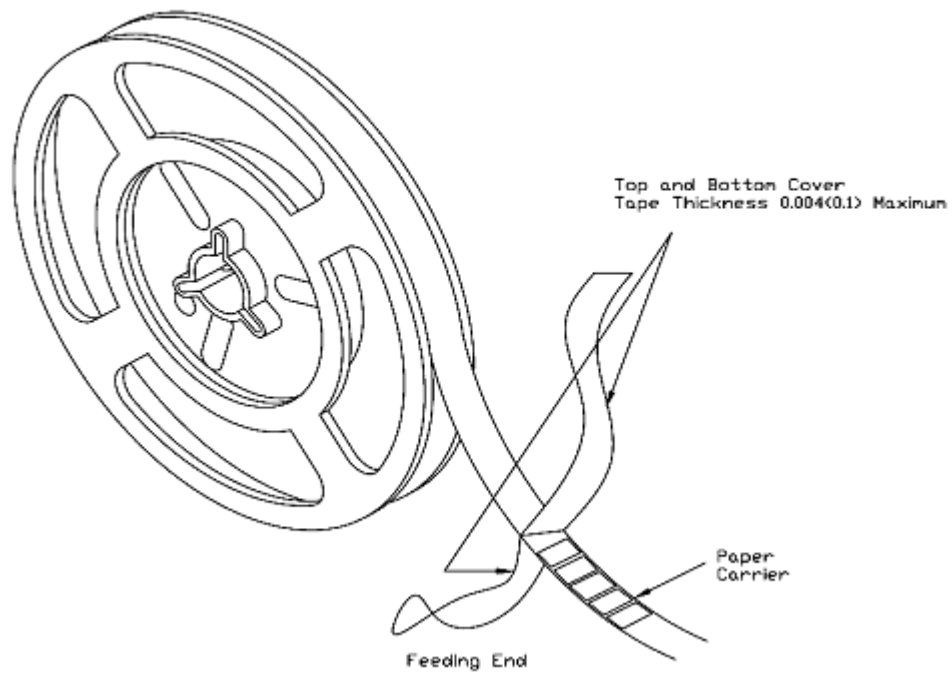
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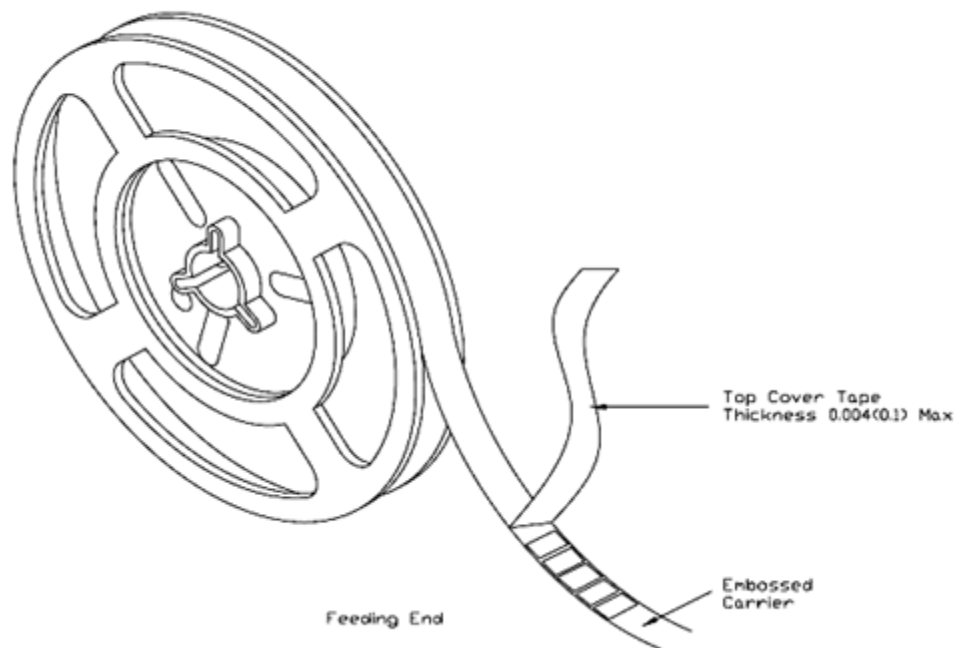
7 TAPING

7.1 Structure of Taping

Paper Carrier

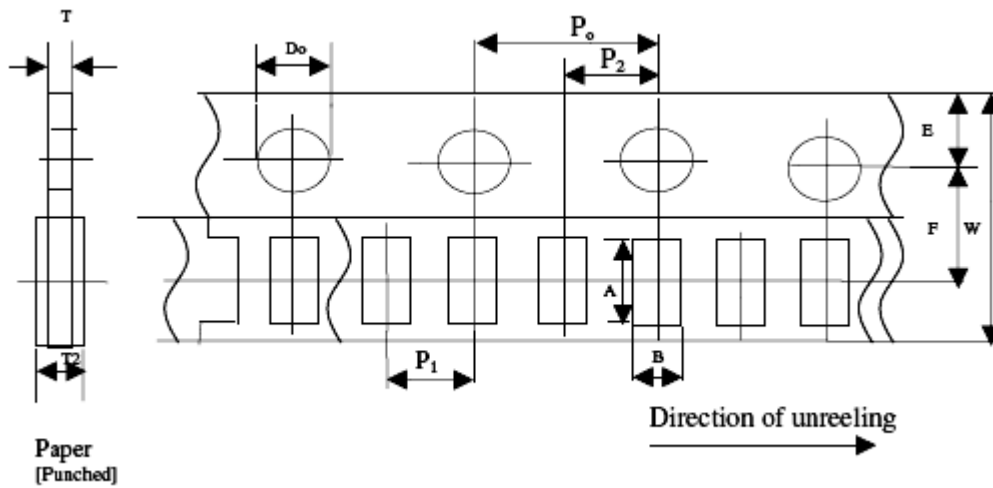


Embossed Plastic Carrier



7.2 Dimension

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



Remark : Pitch tolerance over any 10 pitches of P_0 is ± 0.2 mm

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

(Unit: mm)

Code	A	B	W	E	F	P_1
CLP10	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
CLP10	2.0 ± 0.05	4.0 ± 0.1	1.5	0.35 ± 0.1	-

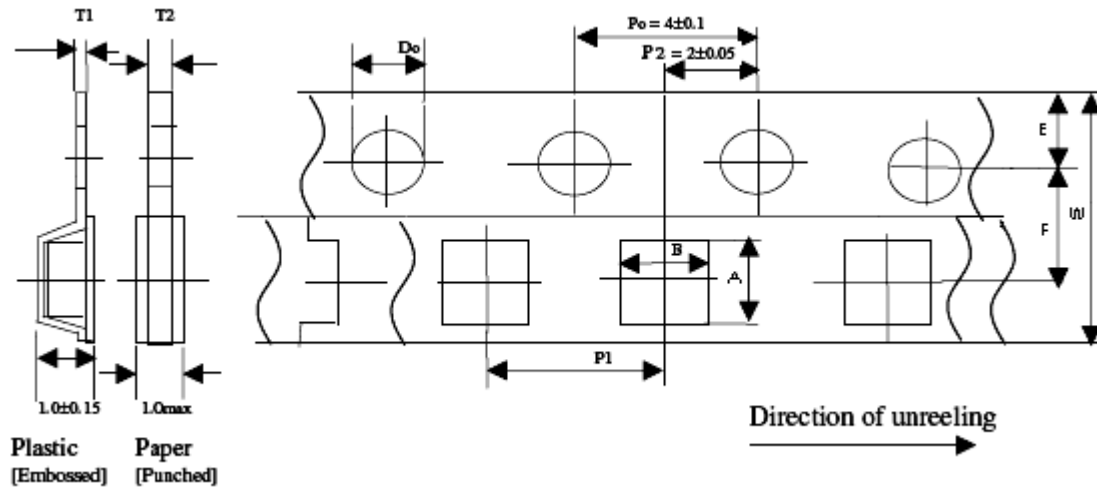
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7.5.2 Dimension of Punched Paper Tape Carrier System /Plastic Embossed Carrier System (CLP16, 21, 32, 40, 50, 63)



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

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

Code	A	B	W	E	F	P1	Do	T2
CLP16	1.9 ± 0.1	1.1 ± 0.1	8.0 ± 0.2	1.75 ± 0.1	3.5 ± 0.05	4.0 ± 0.1	$1.5 \pm 0^{0.1}$	0.60 ± 0.1
CLP21	2.4 ± 0.1	1.65 ± 0.1						0.75 ± 0.1
CLP32	3.5 ± 0.1	1.9 ± 0.1						0.75 ± 0.1
CLP40	3.5 ± 0.1	2.8 ± 0.1						0.75 ± 0.1

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

Code	A	B	W	E	F	P1	Do	T1
CLP50	5.4 ± 0.2	2.9 ± 0.2	12 ± 0.2	1.75 ± 0.1	5.5 ± 0.05	4.0 ± 0.1	$1.5 \pm 0^{0.1}$	0.2 ± 0.10
CLP63	6.6 ± 0.2	3.6 ± 0.1						



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7.7 Packaging

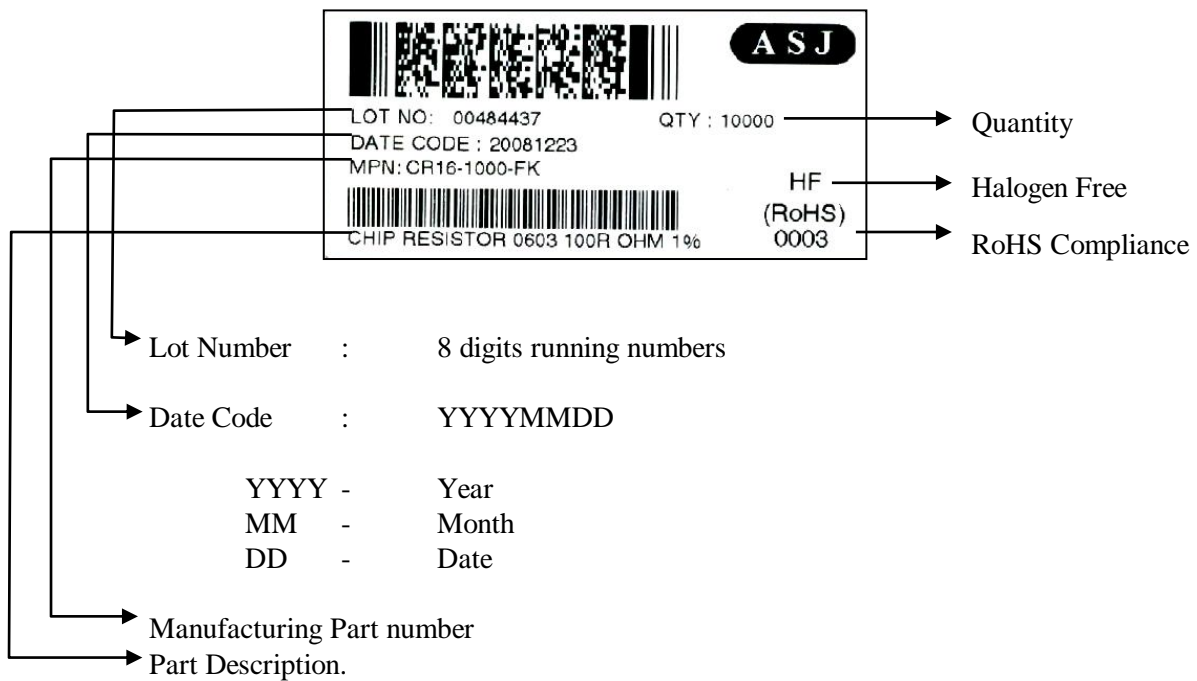
7.7.1 Taping

7.7.1.1 Quantity – Tape and Reels

Code	Quantity	Remarks
CLP10	10000 pcs	20 000 or 50 000 pcs on request
CLP16	5000 pcs	10 000 or 20 000 pcs on request
CLP21		
CLP32		
CLP40	5000 pcs	-
CLP50	4000 pcs	-
CLP63	4000 pcs	-

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.



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



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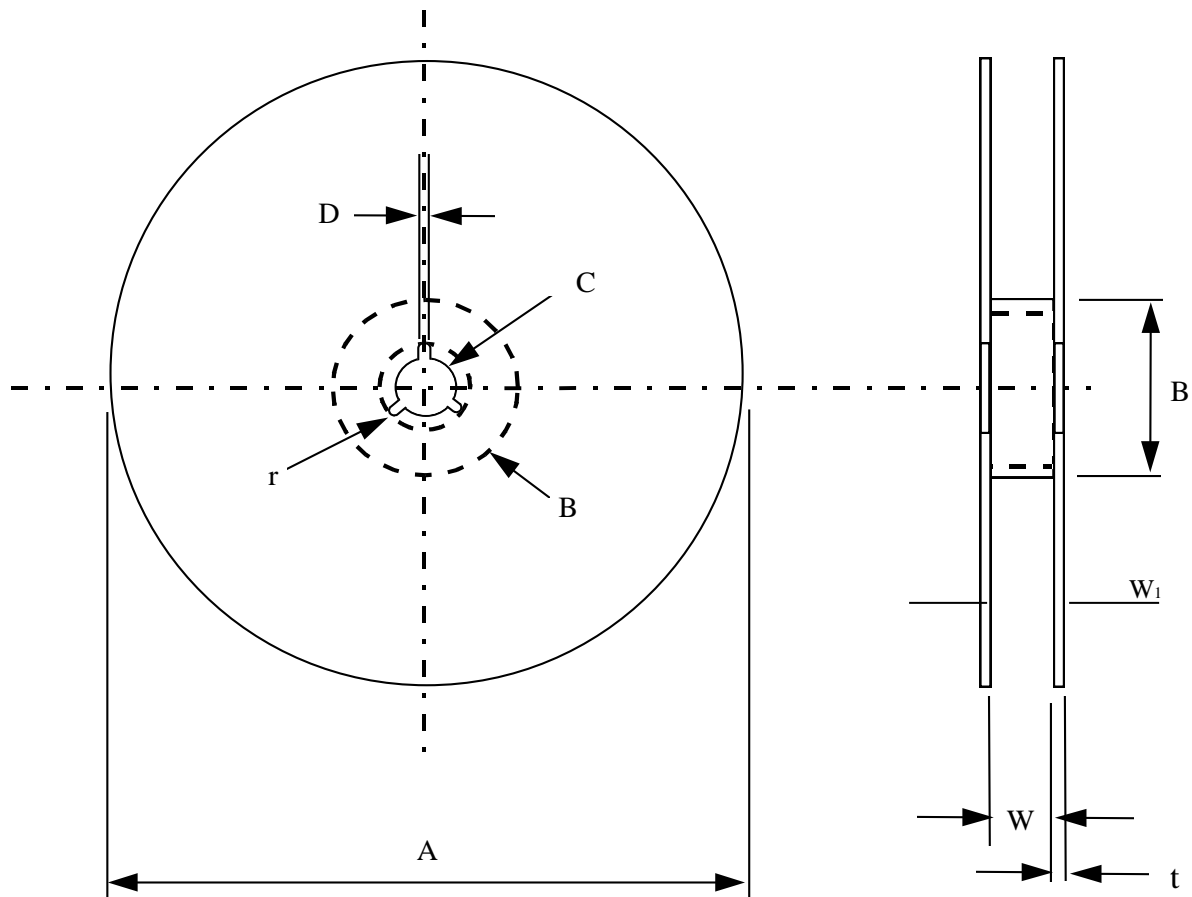
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7.7.4 Reel Dimensions



Model	A	B	C	D	W	W ₁	t	r
7" Reel (5K) (except 0402 10K)	$\phi 178 \pm 2.0$	$\phi 80 \text{min}$	13 ± 0.2	$\phi 2.0 \pm 0.5$	11 ± 0.1	14.4 max	1.0 ± 0.1	1.0
7" Reel (4K)	$\phi 178 \pm 2.0$	$\phi 60 \text{min}$	13 ± 0.2	$\phi 2.0 \pm 0.5$	13 ± 1.0	14.4 max	1.2 ± 0.1	1.0
7" Reel (2K) (for 2512)	$\phi 178 \pm 2.0$	$\phi 60 \text{min}$	13.5 ± 0.5	$\phi 2.0 \pm 0.5$	13.8 ± 0.5	14.4 max	1.2 ± 0.1	1.0
10" Reel (10K)	$\phi 254 \pm 2.0$	$\phi 60 \text{min}$	13 ± 0.2	$\phi 2.0 \pm 0.5$	11 ± 1.0	14.4 max	1.5 ± 0.1	1.0
13" Reel (20K, 50K)	$\phi 330 \pm 2.0$	$\phi 60 \text{min}$	13 ± 0.2	$\phi 2.0 \pm 0.5$	11 ± 1.0	14.4 max	2.1 ± 0.1	-



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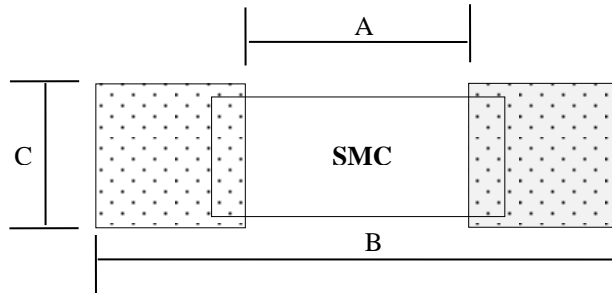
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8 SURFACE MOUNT LAND PATTERNS



Product (Type)	Land Dimension		
	A	B	C
CLP10 (0402)	0.020 [0.50]	0.059 [1.50]	0.024 [0.60]
CLP16 (0603)	0.031 [0.80]	0.083 [2.10]	0.035 [0.90]
CLP21 (0805)	0.047 [1.20]	0.118 [3.00]	0.051 [1.30]
CLP32 (1206)	0.087 [2.20]	0.165 [4.20]	0.063 [1.60]
CLP40 (1210)	0.087 [2.20]	0.165 [4.20]	0.110 [2.80]
CLP50 (2010)	0.138 [3.50]	0.240 [6.10]	0.110 [2.80]
CLP63 (2512)	0.150 [3.80]	0.315 [8.00]	0.138 [3.50]

9 REVISION HISTORY

REVISION	DATE	CHANGE NOTIFICATION	DESCRIPTION
Version. 1	February 13,2015		Initial Release
Version. 2	December 15,2015		Surface Mount Land Pattern Updated
Version. 3	May 16,2016		Remove CLP05 Surface Mount Land Pattern Dimension
Version. 4	May 23,2016	ECO No. : 002/2016	Revise clause 2 and 7.7.1.1, change CLP63 packaging from 2000 pcs to 4000 pcs, Revise clause 5.1, change CLP63(H) dimension from 1.05±0.1 to 0.70±0.1



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