Towards Excellence in *Quality, Service & Innovation*

A S J

DATA SHEET

LED Thick Film Chip Resistor

LD Series

5%, TCR ±100

SIZE: 0805 / 1206

RoHS-Compliant

Product Specification – December 10, 2023 V11

1. SCOPE

1.1 This specification specifies fixed LED thick film chip resistor 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:

LD	32	-	101	-	J	L
Type	**Size (Inch/mm)**		**Nominal Resistance**		**Resistance Tolerance**	**Packaging**
LED Thick Film Chip Resistor	21 (0805) 32 (1206)		5% (3-Digit): Ex. 10Ω = 100, 4.7Ω = 4R7, Jumper = 0 1% (4-Digit): Ex. 10.2Ω = 10R2, 10KΩ = 1002		F = ± 1% J = ± 5% Z = Zero ohm	L= 5,000 pcs Lead Free Y=20,000 pcs Lead Free

3. RATING

3.1 Rated Power

3.1.1 Resistor Rated Power

Product	Rated Power	Maximum Working Voltage	Maximum Overload Voltage
LD21	1/8W	150V	300V
LD32	1/4W	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.

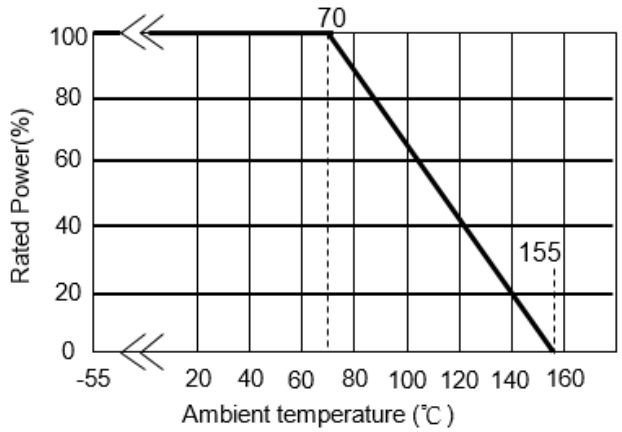


Fig.1 Power Derating Characteristics

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 ± 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 / < 85% RH

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 manufacturing date with control condition.

3.9 ASJ resistors are RoHS-compliant in accordance to RoHS Directive.

3.10 Resistance, Resistance Tolerance and Temperature Coefficient of Resistance.

Type	Rated Power at 70℃	Max. Working Voltage	Max. Overload Voltage	T.C.R (ppm/℃)	Resistance Range		JUMPER Rated Current	JUMPER Resistance Value
					F(±1%) E-24、E-96	J(±5%) E-24	J (±5%)	J (±5%)
LD21 (0805)	1/8W	150V	300V	±200	10Ω≦R≦27MΩ	10Ω≦R≦27MΩ	2A	50mΩ MAX.
				±300	1Ω≦R＜10Ω	1Ω≦R＜10Ω		
LD32 (1206)	1/4W	200V	400V	±200	10Ω≦R≦10MΩ	10Ω≦R≦10MΩ	2A	50mΩ MAX.
				±300	1Ω≦R＜10Ω	1Ω≦R＜10Ω		
Operating Temperature Range				-55℃ ~ +155℃				

3.11 Rated Voltage

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

$$E = \sqrt{PxR}$$

Where E : Rated Voltage (V)
P : Rated Power (W)
R : Nominal Resistance (Ω)

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.

Type		Resistance Range	Tolerance＞1%
Single	**Sizes:** **0805** **1206**	≥1Ω	3-digits Marking
		Jumper=0Ω	1-digit Marking

4.1 Numeric Numbering

4.1.1 5% Tolerance: ***Three Numerals Marking***

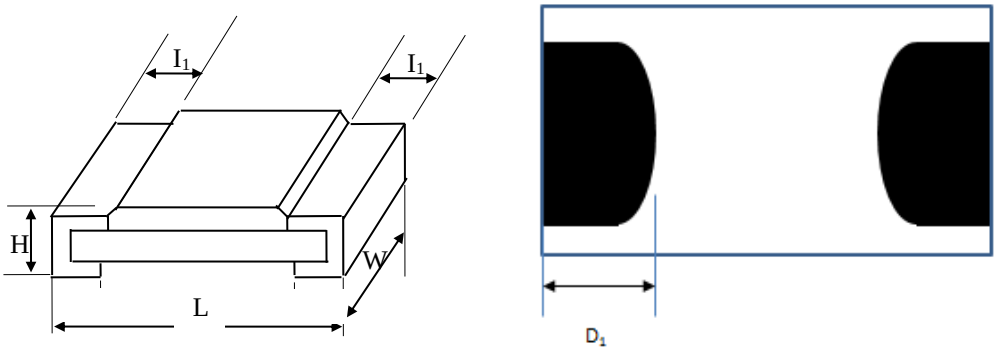
First 2 digits are significant figures; third digit is number of zeros. Letter R is decimal point.

Example

Nominal Resistance	***Marking***	***Remarks***
1 Ω	1R0	$1 \times 10^0 = 1$
10 Ω	100	$10 \times 10^0 = 1\ 0$
100 Ω	101	$10 \times 10^1 = 1\ 00$
4.7K Ω	472	$47 \times 10^2 = 47\ 00$
47K Ω	473	$47 \times 10^3 = 47\ 000$
470K Ω	474	$47 \times 10^4 = 47\ 0000$
44.7M Ω	475	$47 \times 10^{54} = 47\ 00000$

5. DIMENSION, CONSTRUCTION AND MATERIAL

5.1 Dimension

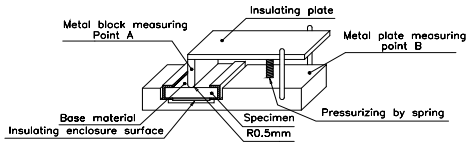


Unit: Inches (Millimeters)

CODE	L	W	H	I_1	D_1
LD21 (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)	0.022±0.0004 (0.55±0.20)
LD32 (1206)	0.122±0.004 (3.10±0.10)	0.063±0.006 (1.60±0.15)	0.022±0.002 (0.55±0.05)	0.024±0.008 (0.60±0.20)	0.033±0.0004 (0.83±0.10)

6. ELECTRICAL CHARACTERISTICS AND TEST CONDITIONS

6.1 Electrical Performance Test

<table>
<tr><th rowspan="2">Item</th><th rowspan="2">Conditions</th><th colspan="2">Specifications</th></tr>
<tr><th>Resistors</th><th>Jumper</th></tr>
<tr><td>Resistance Value</td><td>Application time to be more than 5 secs.
Apply Voltage for resistance measurement:
<table><tr><th>Resistance Range</th><th>V</th></tr><tr><td>R ＜10Ω</td><td>0.1V</td></tr><tr><td>10Ω ≦R ＜99Ω</td><td>0.3V</td></tr><tr><td>100Ω ≦R ＜999Ω</td><td>1.0V</td></tr><tr><td>1KΩ ≦R ＜9.9KΩ</td><td>3.0V</td></tr><tr><td>10KΩ ≦R ＜99.9KΩ</td><td>10.0V</td></tr><tr><td>100KΩ ≦R ＜999.9KΩ</td><td>25.0V</td></tr><tr><td>1MΩ ≦R</td><td>50.0V</td></tr></table>Refer to JIS-C5201-1 4.5</td><td colspan="2">Variance rate on resistance:
1%：△R%=±1.0%
5%：△R%=±5.0%</td></tr>
<tr><td>Temperature Coefficient of Resistance</td><td>$TCR(ppm/^{\circ}C)=\frac{R2-R1}{R1(T2-T1)}x10^{6}$
R1: Resistance at room temperature
R2: Resistance at -55℃or +125℃
T1: Room temperature(25℃)
T2: Kept still in Temperature -55℃or +125℃for 45 minutes.
Refer to MIL-STD-202 Method 304</td><td>Refer to item
3.10 general specifications</td><td>NA</td></tr>
<tr><td>Voltage Coefficient</td><td>Measure R2 at 100%V (rated voltage or limit voltage of element) for 0.5~4.5secs and R1 at 10%V (rated voltage or limit voltage of element) for 4.5 secs.
Calculation :
Vc=$\frac{R_2-R_1}{0.9\times U\times R_1}$
Refer to JIS-C5201-1 4.11</td><td colspan="2">Voltage coefficient ≦100ppm/V</td></tr>
<tr><td>Short Time Overload</td><td>Apply 2.5 times rated voltage for 5 seconds and release the load for more than 30 minutes, then measure its resistance variance rate. (Rated voltage refer to Item 3. general specifications)
Jumper: Applied Maximum overload current
<table><tr><th>Type / Jumper</th><th>LD21 (0805)</th><th>LD32 (1206)</th></tr><tr><td>±5%</td><td>5A</td><td>5A</td></tr></table>Refer to JIS-C5201-1 4.13</td><td>Variance rate on resistance:
1%：△R%=±0.5%
5%：△R%=±1.0%</td><td>Refer to item 3.10</td></tr>
<tr><td>Insulation Resistance</td><td>Put the resistor in the fixture, add 100 ±15V DC to top/bottom terminal for 60 secs then measure the insulation resistance between electrodes and insulating enclosure or between electrodes and base material。
Refer to JIS-C5201-1 4.6
 
</td><td colspan="2">≧10^{9}Ω</td></tr>
</table>

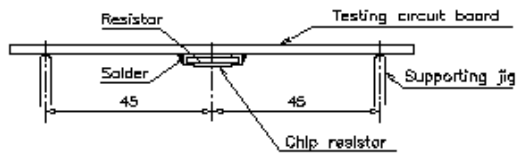
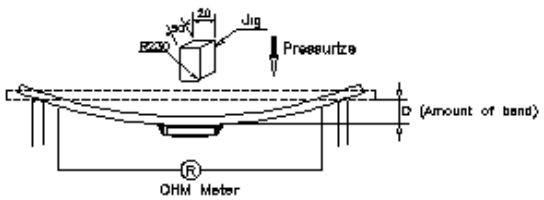
<table>
<tr><th rowspan="2">Item</th><th rowspan="2">Conditions</th><th colspan="2">Specifications</th></tr>
<tr><th>Resistors</th><th>Jumper</th></tr>
<tr><td>Dielectric Withstand Voltage</td><td>Put the resistor in the fixture, add 500 VAC to top/bottom terminal for 5secs.

Refer to JIS-C5201-1 4.7</td><td>Variance rate on resistance:
1%：△R%=±1.0%
5%：△R%=±5.0%
No evidence of mechanical damage.
No short or burned on the appearance.</td><td>Refer to item 3.10</td></tr>
<tr><td>Intermittent Overload</td><td>Test item1:
Put the tested resistor in chamber under temperature 25±2℃ and load 2.5 times rated DC voltage for 1 sec on, 25 sec off, test cycles, then take out and keep still for 1 hour, then measure its resistance variance rate.
Refer to JIS-C5201-1 4.13

Test item2:
Put the resistor in chamber under temperature 25±2℃ and load 4.0 times rated DC voltage for 1 sec on, 25 sec off, test cycles, then take out and keep still for 1 hour , then measure its resistance variance rate.
Refer to JIS-C5201-1 4.39</td><td>Variance rate on resistance:
△R%=±5.0%</td><td>Refer to item 3.10</td></tr>
<tr><td>Noise</td><td>V_0(dB) = T-f(T-S)-D

Refer to JIS C 5201-1 4.12</td><td><table><tr><td>1~9</td><td>-10dB(0.32μv/v)</td></tr><tr><td>10~99</td><td>- 5 dB(0.52μv/v)</td></tr><tr><td>100~999</td><td>0 dB(1.0μv/v)</td></tr><tr><td>1K~9.9K</td><td>10 dB(3.2μv/v)</td></tr><tr><td>10K~99.9K</td><td>18 dB(5.6μv/v)</td></tr><tr><td>100K~999.9K</td><td>20 dB(10μv/v)</td></tr><tr><td>>1M</td><td>30 dB(32μv/v)</td></tr></table></td><td>NA</td></tr>
</table>

6.2 Mechanical Performance Test

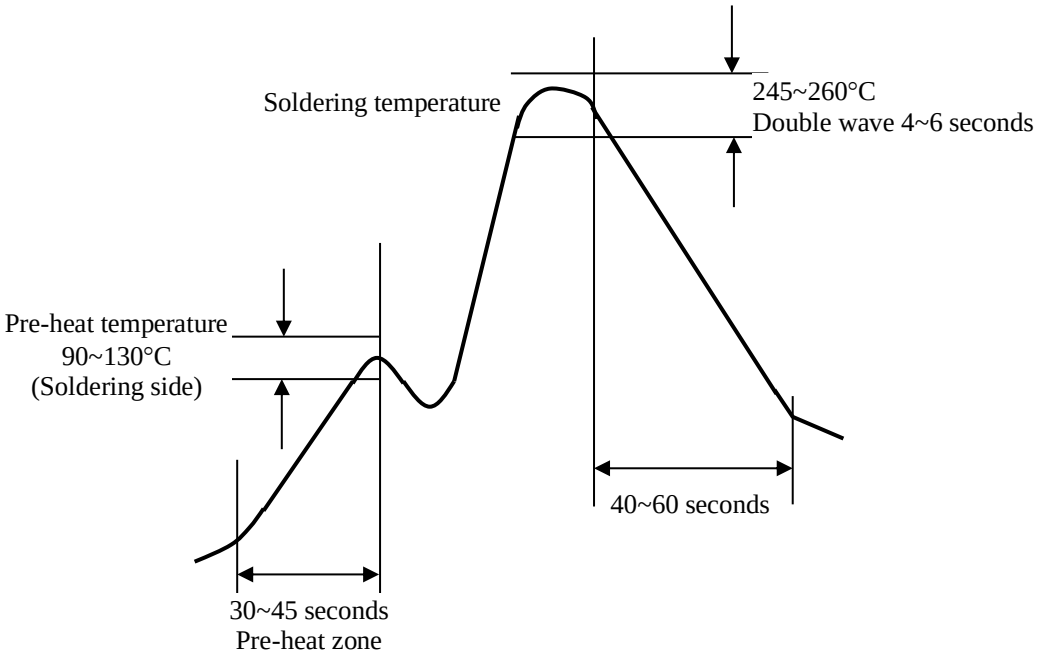
Item	Conditions	Specifications	
		Resistors	Jumper
Terminal Strength	Test item1:Bending Test Solder tested resistor on to PC board add force in the middle down, and under load measured its resistance variance rate. D:LD21=5mm LD32=3mm   Refer to JIS-C5201-1 4.33 Test item2:Pull Test Refer to JIS-C5201-1 4.16 Test item3:Push Test Refer to JIS-C5201-1 4.16.2	No evidence of mechanical damage. Variance rate on resistance Test item1:△R%=±0.5% Test item2:△R%=±1.0% Test item3:△R%=±1.0%	Refer to item 3.10
Resistance to Solvent	Immerse into 25°C ± 5°C Isopropyl Alcohol (IPA) for 3± 0.5 minutes Refer to MIL-STD-202 Method 215	No evidence of mechanical damage. No leaching of G2 overcoat and Sn plating	
Solderability	For both Leaded & SMD. Electrical test not required. Magnification 50 X. Conditions: Test item1(Leaded):@ 235°C for 3 secs. Test item2((SMD):dry @ 155°C for 4 hrs; @ 235°C for 3 secs. Test item3((SMD):@ 215°C for 3 secs. Test item4((SMD):@ 260°C for 3 secs. Refer to J-STD-002	Solder coverage over 95%	
Resistance to Soldering Heat	◎Solder bath method: Resistor dipped entirely in solder bath of 260 ± 5°C for 10 secs. After which the sample shall be left at ambient temperature for 60~120 minutes before measurement. Refer toMIL-STD-202Method 210	Variance rate on resistance: 1%：△R%=±0.5% 5%：△R%=±5.0%	Refer to item 3.10

6.3 Environmental Test

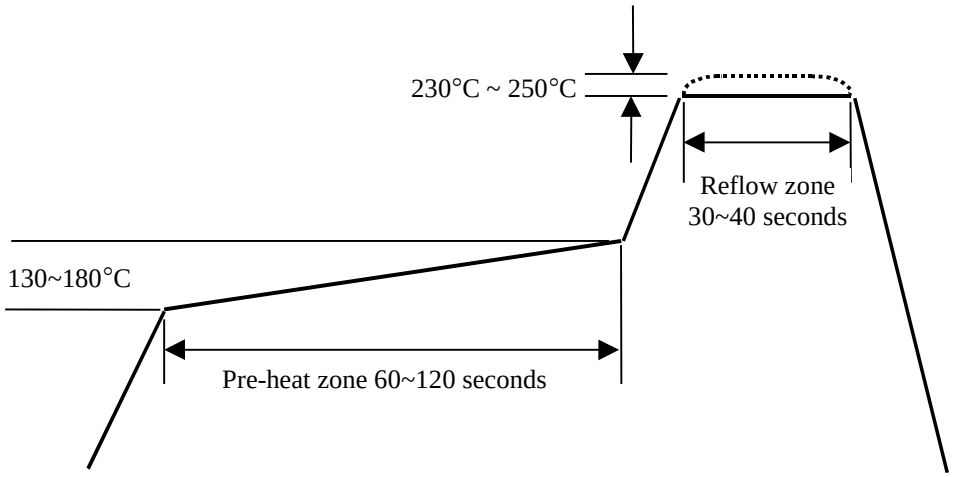
Item	Conditions	Specifications	
		Resistors	Jumper
High Temperature	Put resistor in chamber under temperature 155±5℃ for 1000 hours. Then leave the tested resistor in room temperature for 24±2 hours, and measure its resistance variance. Refer to MIL-STD 202 Method 108	Variance rate on resistance: 1%：△R%=±0.5% 5%：△R%=±1.0%	Refer to item 3.10
Loading Life in Moisture	Put the resistor in the chamber under temperature 40±2℃, relative humidity 90~95% and load 10% of rated voltage for 90 minutes on, 30 minutes off, 1000 hours totally. Then leave the tested resistor in room temperature for 24±2hrs, and measure its resistance variance rate. Refer to MIL-STD 202 Method 103	Variance rate on resistance: 1%：△R%=±1.0% 5%：△R%=±5.0%	Refer to item 3.10
Load Life	Put the resistor in chamber under temperature 70±3℃ and load the rated voltage for 90 minutes on, 30 minutes off, 1000 hours totally. Then leave the tested resistor in room temperature for 60~120 minutes, and measure its resistance variance rate. Refer to MIL-STD 202 Method 108	Variance rate on resistance: 1%：△R%=±1.0% 5%：△R%=±2.0%	Refer to item 3.10
Salt Spray	Place the resistor in the environment of 5±1 Wt% salt water for 96±4 hours at 35±2℃ Refer to MIL-STD 202 Method 101	Variance rate on resistance: 1%：△R%=±3.0% 5%：△R%=±5.0%	Refer to item 3.10
Mounting Quality Test	Solder Paste: Sn-3Ag-0.5Cu Reflow soldering method Peak : 250 +5°C and 230+5°C for 60sec. Refer to JESD 22 B102E	Visual check for solder joint wetting condition, resistor body damages	

6.4 Soldering Profile

6.4.1 Wave Soldering

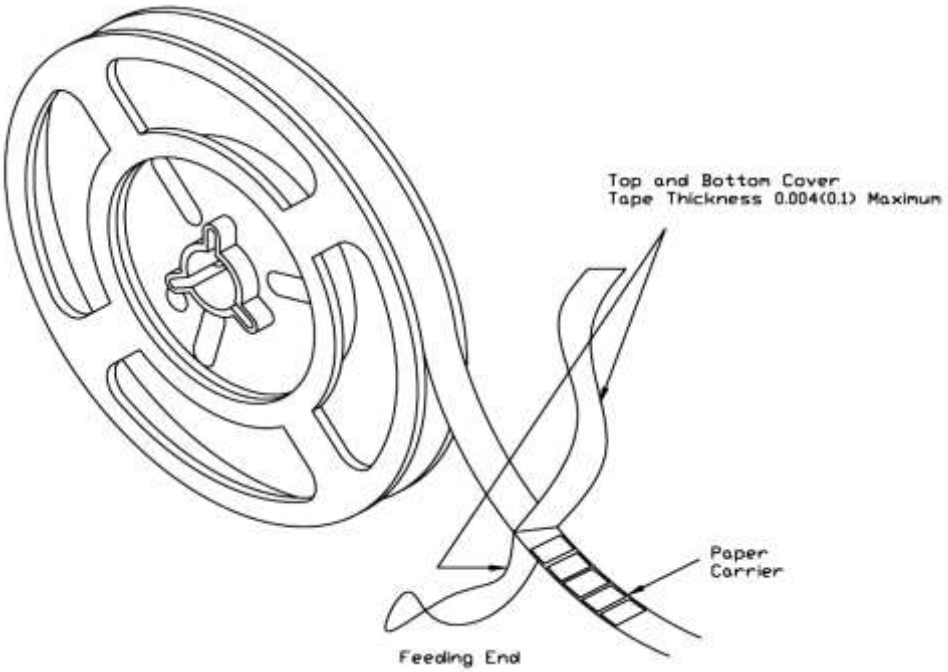


6.4.2 Reflow Soldering



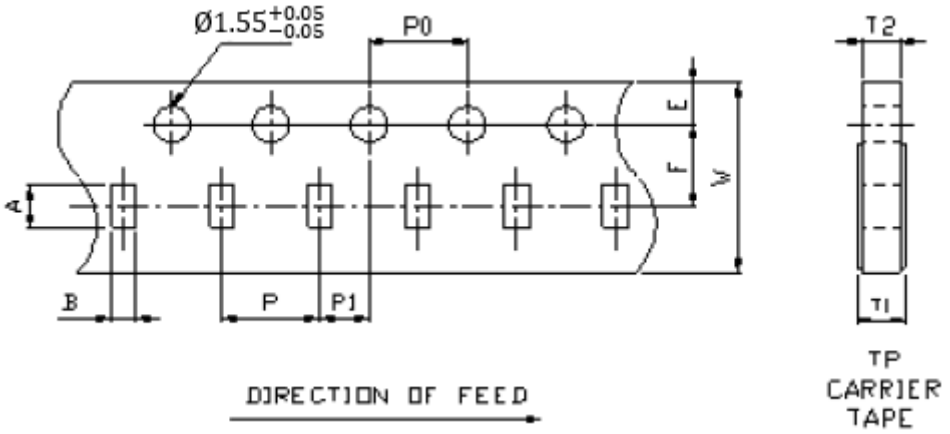
7. TAPING

Paper Carrier



7.1 Dimension

7.1.1. Dimension of Punched Paper Tape Carrier System (LD21,LD32)



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

Dimension of Punched Paper Tape Carrier System (LD21,LD32)

Code	A	B	W	E	F	T1	T2	P	P0	P1	10P0
LD21	2.33±0.05	1.58±0.05	8.0±0.10	1.75±0.10	3.50±0.05	$0.75^{+0.2}_{-0}$	$0.75^{+0.03}_{-0.05}$	4.00±0.05	4.00±0.10	2.00±0.05	40.0±0.20
LD32	3.30±0.05	1.90±0.05	8.00±0.10	1.75±0.10	3.50±0.05	$0.75^{+0.2}_{-0}$	$0.75^{+0.03}_{-0.05}$	4.00±0.05	4.00±0.10	2.00±0.05	40.0±0.20

7.2 Packaging

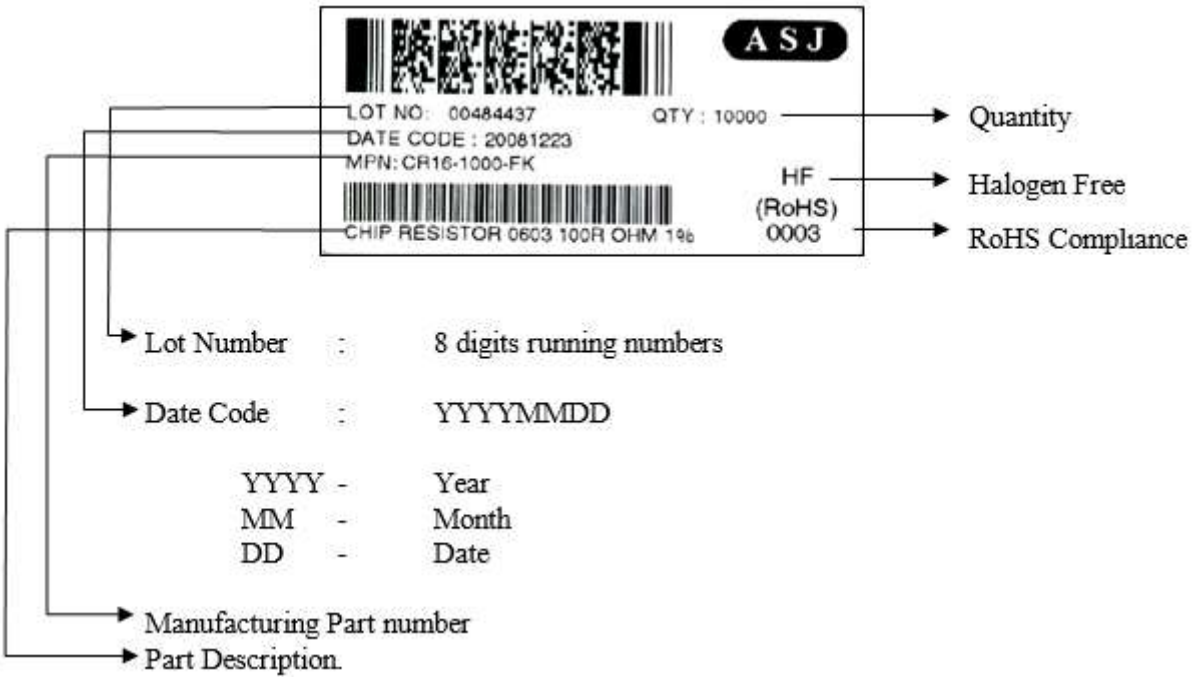
7.2.1 Taping

7.2.1.1. Quantity – Tape and Reels

Code	Quantity	Model	Remarks
LD21 LD32	5000 pcs	7" Reel	-
	20000 pcs	13" Reel	-

7.2.2. Identification

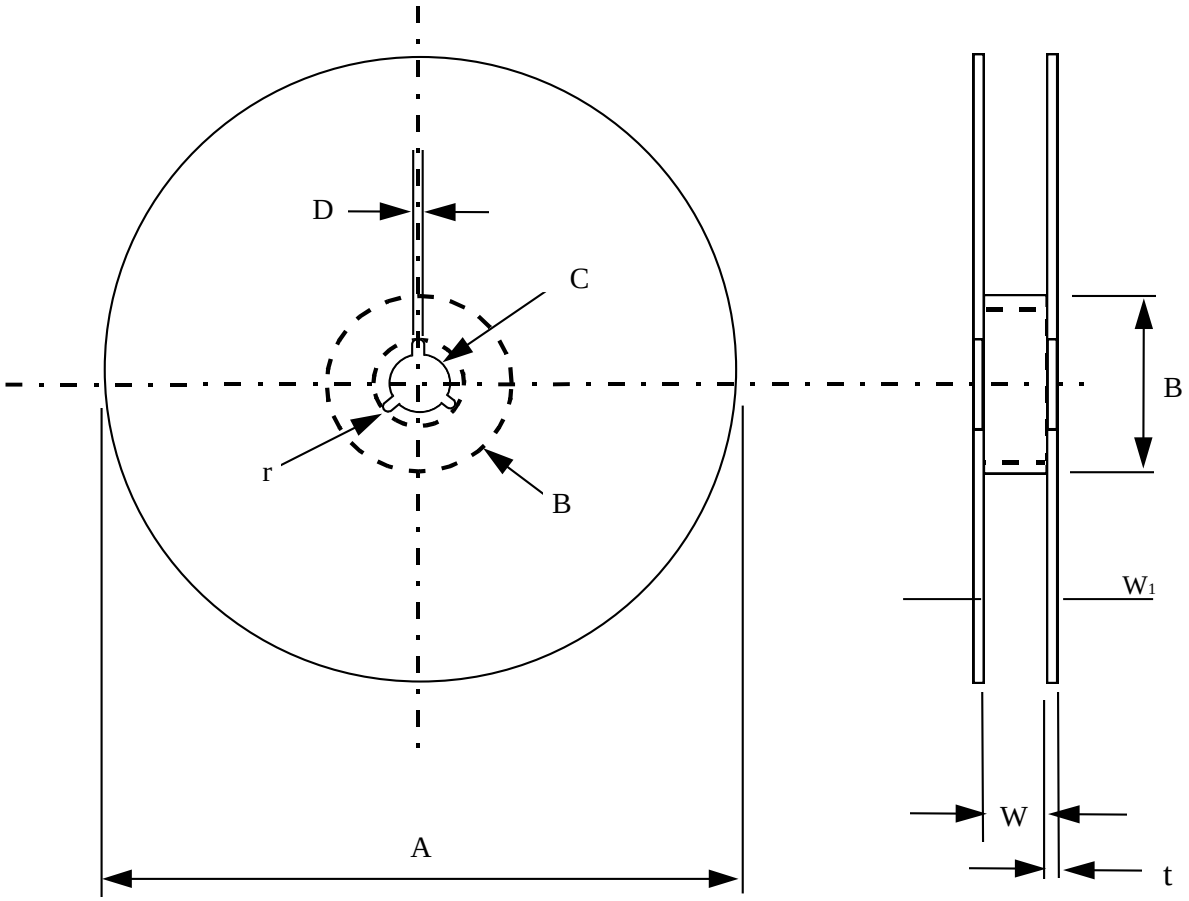
Production label that indicates the 8 digits lot number, product type, resistance value and tolerance shall be pasted on the surface of each reel.



7.2.3. Packaging Reel Box

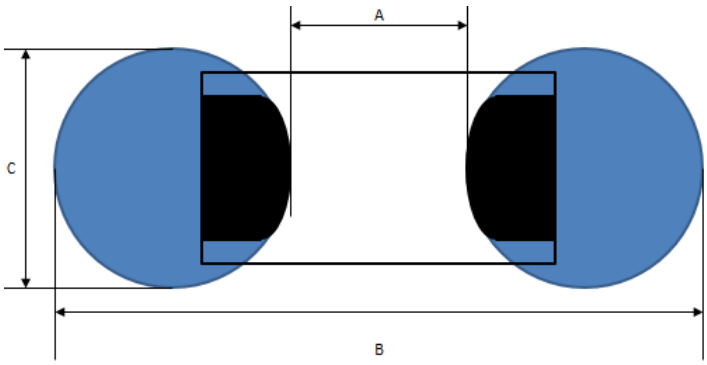
Dimension	Reel Box	Number of Reels
185 × 60 × 186 mm	25K Box	5
185 × 120 × 186 mm	50K Box	10

7.2.4. Reel Dimensions



Model	A	B	C	D	W	W_1	t	r
7''Reel (5K)	ϕ178±2.0	ϕ60min	13± 0.2	ϕ2.0± 0.5	11± 0.1	14.4 max	1.0± 0.1	1.0
13"Reel (20K)	ϕ330±2.0	ϕ60min	13± 0.2	ϕ2.0± 0.5	11± 1.0	14.4 max	2.1± 0.1	-
13"Reel (20K, 50K)	ϕ330±1.0	ϕ100±1	13.5±0.5	2~3±0.5	10±0.5	-	-	-

8. SURFACE MOUNT LAND PATTERNS



(Inches/mm)

Product (Type)	Land Dimension		
	A	B	C
LD21 (0805)	0.047 [1.20]	0.118 [3.00]	0.051 [1.30]
LD32 (1206)	0.087 [2.20]	0.165 [4.20]	0.063 [1.60]

9. REVISION HISTORY

REVISION	DATE	CHANGE NOTIFICATION	DESCRIPTION
Version.1	21.01.2016		Initial Release
Version.2	14.07.2016		i).Revise clause 1.2, delete clause. ii). Revise clause 2, add in Y=20,000 pcs Lead Free into table iii).Revise clause 6, characteristics 7, remove test conditions AEC Q200-005 ii). Revise clause 6.1.1, typo error, change IRV Reflow to Wave Soldering iii). Revise clause 6.1.2, typo error, change Wave Soldering to Wave Soldering iv). Revise clause 7.7.1, add in 20,000 pcs and 13" Reel into table v). Revise clause 7.7.4, Delete 7"(4K) and 10"(10K) Reel information
Version.3	19.12.2016	PCN-ECO : 01/2016	Typo error in clause 5.1 Add in 13" reel information Update clause 5.1, D1 Dimension
Version.4	03.04.2017		Update clause 8, Surface Mount Land Pattern Dimension
Version.5	21.07.2017		Typo error in clause 2, remove 1% tol from Part Numbering System
Version.6	06.11.2017		Remove 1% Tol in clause 3.10, update resistance range Remove 1% Tol, Four Numeric Marking in clause 4.1.2
Version.7	07.10.2019		1、Revise clause 2 Part Numbering System 2、Revise clause 3.1.1 Resistor rated power 3、Revise clause 3.9 4、Revise clause 3.10 TCR table 5、Revise clause 6 (6.0.1~6.0.3)reliability test table 6、Revise clause 7, delete Embossed plastic carrier 7、Revise clause 7.1.1 tape dimension
Version.8	25.09.2020		Revise clause 3.5 Revise clause 6.01 ~ 6.03 reliability test
Version.9	18.11.2021		Revise clause 4 marking on product
Version.10	03.11.2022		Revise clause 3.8 Product Assurance
Version 11	10.12.2023		Revise clause 2 Part Numbering System table. Revise clause 3.1.1 Resistor Rated Power table. Revise clause 3.10 table. Revise clause 5.1 Dimension table. Revise clause 6.1 Item Short Time Overload. Revise clause 7.1.1 table. Revise clause 8 Surface Mount Land Patterns table.