Towards Excellence in *Quality, Service & Innovation*

ASJ

DATA SHEET

Wide Terminal Metal Alloy Low-Resistance Resistor

CLE Series

0.5% TO 5%, TCR ±50 TO ±400

SIZE: 0306/0508/0612

RoHS-Compliant

1. SCOPE

1.1. This specification is applicable to Lead-free and Halogen-free of RoHS Directive for CLE Series Wide Terminal Metal Alloy Low-Resistance Resistor.

1.2. The product is for general electronic purpose.

2. PART NUMBERING SYSTEM

Part Numbering is made in accordance with the following system:

CLE	32W	1	-	R003		-	F	L	-	4
Type	Size (mm/inch)	Power Rating		Nominal Resistance			Resistance Tolerance	Packaging		Number of Terminal
Metal Alloy Low Resistance Resistors	16W(0306) 21W(0508) 32W(0612)	A=1/2 W B=1.5 W C=3/4 W 1=1 W		Resistors	Resistance (4~6 Digit) R003 = 3mΩ R0005 = 0.50mΩ R00075 =0.75mΩ		D=±0.5% F=±1.0% G=±2.0% J=±5.0%	L=5,000 pcs		2: 2 terminals 4; 4 terminals (Leave blank if 2 terminal)

3. RATING

3.1. Rated Power

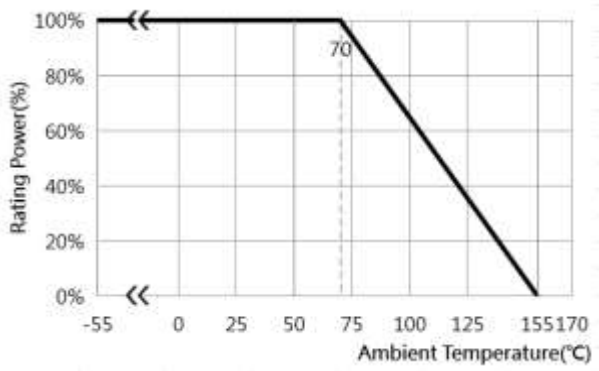
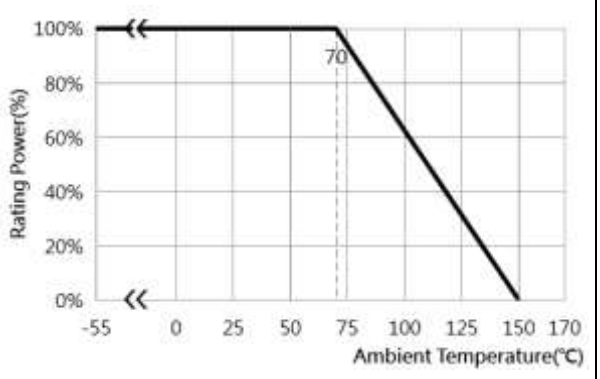
3.1.1 Resistor Rated Power

Type	# of Terminals	Rating Power	Rating Current	Overload Current
CLE16W	2	1/2 W	$Ir=\sqrt{P/R}$ Ir：Rating Current (A) P：Rating Power (W) R：R value(Ω)	$Io=\sqrt{4P/R}$ Io：Overload Current (A) P：Rating Power (W) R：R value(Ω)
	4	1/2 W		
CLE21W	2	3/4 W 1 W		
CLE32W	2	1 W		
		1.5 W		
CLE32W	4	1 W		
		1.5 W		

3.2 Power Derating Curve

Operating Temperature Range: - 55 ~+155 ℃

For resistors operated in ambient temperatures 70°C, power rating shall be derated in accordance with the curve below:

Type	CLE16W-4T	Others
Temperature Range	-55℃~+155℃	-55℃~+150℃
Description	For resistors operated in ambient temperatures 70℃~155℃, power rating shell be derated in accordance with the curve below.	For resistors operated in ambient temperatures 70℃~150℃, power rating shell be derated in accordance with the curve below.
Power derate curve		

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 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 to 106kPa

3.4 Operating Temperature Range -55°C to +150°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 conditions.

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

3.10 Resistance, Resistance Tolerance and Temperature Coefficient of Resistance

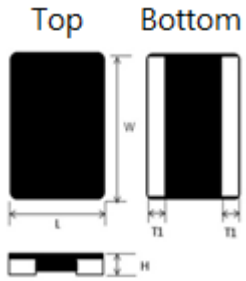
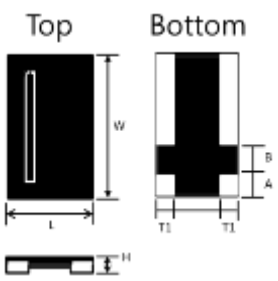
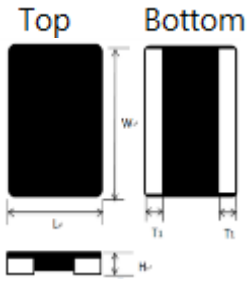
Type	# of Terminals	Rating Power	Rating Current	Overload Current	T.C.R. (ppm/°C)	Resistance Range (mΩ)		Operating Temperature Range
						D (±0.5%)	F (±1%) G (±2%) J (±5%)	
CLE16W	2	1/2W	$Ir=\sqrt{P/R}$ Ir：Rating Current (A) P：Rating Power (W) R：R value(Ω)	$Io=\sqrt{4P/R}$ Io：Overload Current (A) P：Rating Power (W) R：R value(Ω)	≦±300	---	1≦R＜5	-55~+150°C
					≦±100	---	5≦R≦10	
	4	1/2W			≦±150	---	1≦R＜6	-55~+155°C
					≦±50	---	6≦R≦10	
CLE21W	2	3/4W 1W			≦±100	----	1≦R＜2	-55~+150°C
					≦±50	---	2≦R≦14	
CLE32W	2	1 W			≦±100		0.5≦R≦0.75	
					≦±100	---	1≦R＜5	
					≦±50	---	5≦R≦25	
		1 .5W			≦±100	---	1≦R＜5	
					≦±50	---	5≦R≦10	
CLE32W	4	1 W			≦±200		0.75	
					≦±75	---	1≦R＜5	
					≦±50	---	5≦R≦15	
		1.5W			≦±75	---	1≦R≦5	

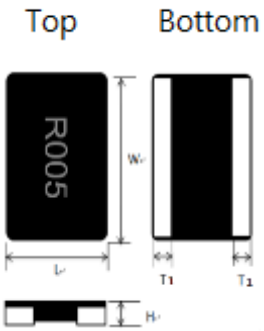
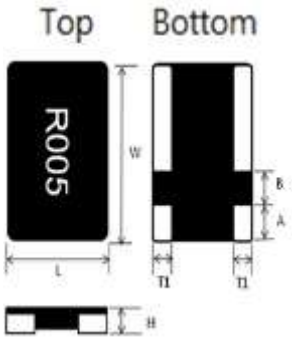
3.11 Rated Current
The resistor shall have a DC continuous working current or a RMS(Root Mean Square). AC continuous working current at commercial-line frequency and wave form corresponding to the power rating, as determined from the following:

$$I=\sqrt{P/R}$$

I=Rating Current(A)
P= Rating Power(W)
R=Resistance(Ω)

4. DIMENSION

CLE16W	CLE16W-4T	CLE21W
		

CLE32W	CLE32W-4T
	

Type	Maximum Power Rating (Watts)	Resistance Range (mΩ)	Dimensions - in inches (millimeters)					
			L	**W**	**H**	**T1**	**A**	**B**
CLE16W	1/2	1~10	0.033±0.004 (0.85±0.10)	0.063±0.004 (1.60±0.10)	0.014±0.004 (0.35±0.10)	0.008±0.004 (0.20±0.10)	---	---
CLE16W-4T	1/2	1~10	0.033±0.004 (0.85±0.10)	0.063±0.004 (1.60±0.10)	0.014±0.004 (0.35±0.10)	0.008±0.004 (0.20±0.10)	0.012±0.004 (0.30±0.1)	0.012±0.004 (0.30±0.1)
CLE21W	3/4 1	1 ~14	0.05±0.008 (1.270±0.20)	0.08±0.008 (2.032±0.20)	0.014±0.004 (0.35±0.10)	0.014±0.006 (0.35±0.15)	---	---
CLE32W	1	0.5~0.75 1 ~ 25	0.063±0.008 (1.60±0.20)	0.126±0.008 (3.20±0.20)	0.014±0.004 (0.35±0.10)	0.014±0.006 (0.35±0.15)	---	---
	1.5	1 ~10	0.063±0.008 (1.60±0.20)	0.126±0.008 (3.20±0.20)	0.014±0.004 (0.35±0.10)	0.014±0.006 (0.35±0.15)	---	---
CLE32W-4T	1	0.75 1 ~15	0.063±0.008 (1.60±0.20)	0.126±0.008 (3.20±0.20)	0.014±0.004 (0.35±0.10)	0.016±0.006 (0.40±0.15)	0.020±0.006 (0.50±0.15)	0.020±0.006 (0.50±0.15)
	1.5	1 ~5	0.063±0.008 (1.60±0.20)	0.126±0.008 (3.20±0.20)	0.014±0.004 (0.35±0.10)	0.016±0.006 (0.40±0.15)	0.020±0.006 (0.50±0.15)	0.020±0.006 (0.50±0.15)

4.1 Material of Alloy

Type	Watts	Material	Resistance
CLE16W	1/2W	Copper-Manganese Alloy	1mΩ ≤ R ≤ 4mΩ
		Iron-Chromium Aluminium Alloy	5mΩ ≤ R ≤ 10mΩ
CLE16W-4T	1/2W	Copper-Manganese Alloy	1mΩ ≤ R ≤ 5mΩ
		Iron-Chromium Aluminium Alloy	6mΩ ≤ R ≤ 10mΩ
CLE21W	3/4W 1W	Copper-Manganese Alloy	1mΩ ≤ R ≤ 4mΩ
		Iron-Chromium Aluminium Alloy	5mΩ ≤ R ≤ 14mΩ
CLE32W	1W	Copper-Manganese Alloy	0.5mΩ ≤ R ≤ 4mΩ
		Iron-Chromium Aluminium Alloy	5mΩ ≤ R ≤ 25mΩ
	1.5W	Copper-Manganese Alloy	1mΩ ≤ R ≤ 4mΩ
		Iron-Chromium Aluminium Alloy	5mΩ ≤ R ≤ 10mΩ
CLE32W-4T	1W	Copper-Manganese Alloy	0.75mΩ ≤ R ≤ 4mΩ
		Iron-Chromium Aluminium Alloy	5mΩ ≤ R ≤ 15mΩ
	1.5W	Copper-Manganese Alloy	1mΩ ≤ R ≤ 4mΩ
		Iron-Chromium Aluminium Alloy	5mΩ

4.2 Plating Thickness :

4.2.1 Ni : ≥ 2 μm

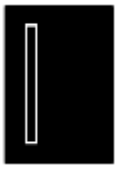
4.2.2 Sn (Tin) : ≥ 3 μm

4.2.3 Sn (Tin) : Matte Sn

5. MARKING FORMAT

5.1 CLE16W, CLE21W No Marking

5.2 CLE16W-4T Marking is rectangle and by laser.



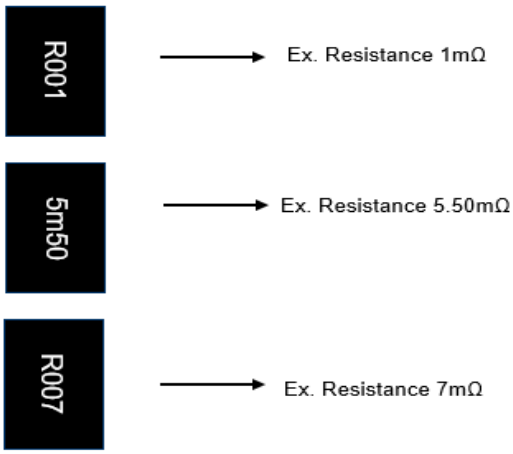
5.3 CLE32W, CLE32W-4T:

Product resistance is indicated by using two marking notation styles:

a. "R" designated the decimal location in ohms, e.g.
   - For 1mΩ the product marking is R001;
   - For 7mΩ the product marking is R007;

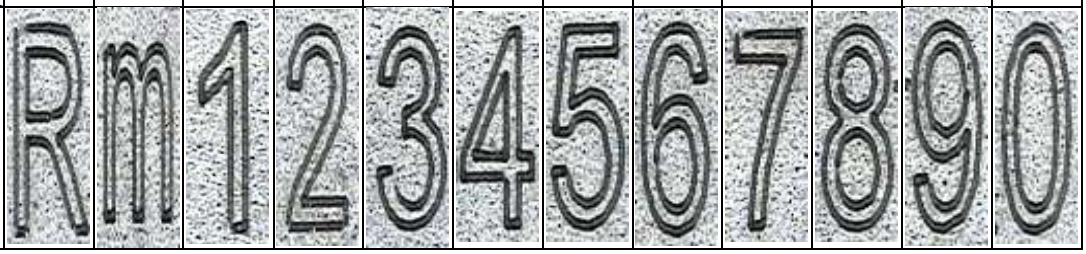
b. "m" designated the decimal location in milliohm, e.g.
   - For 0.25mΩ the product marking is 0m25;
   - For 0.5mΩ the product marking is 0m50;
   - For 5.5mΩ the product marking is 5m50

5.4 CLE32W



5.5 CLE32W-4Terminal

5.6 Marking styles by Laser: (For CLE32W and CLE32W-4Terminal)

Marking / Type	R	m	1	2	3	4	5	6	7	8	9	0
CLE32W CLE32W-4T												

6. RELIABILITY PERFORMANCE

6.1 Electrical Performance Test

<table>
<tr><th>Test Item</th><th>Conditions of Test</th><th>Test Limits</th></tr>
<tr><td>Temperature Coefficient of Resistance (TCR)</td><td>Refer to JIS C 5201-1 4.8
$TCR(ppm/^{\circ}C) = \frac{(R2-R1)}{R1(T2-T1)} x10^{6}$
● R1: resistance of room temperature
● R2: resistance of 150 °C
● T1: Room temperature
● T2: Temperature at 150 °C</td><td>Refer to Paragraph 3.10</td></tr>
<tr><td>Short Time Overload</td><td>Refer to JIS C 5201-1 4.8
Applied Overload for 5 seconds and release the load for about 30 minutes, then measure its resistance variance rate. (Overload condition refer to below):
<table>
<tr><th>Type</th><th># of terminal</th><th>Power (W)</th><th># of rated power</th></tr>
<tr><td>CLE16W</td><td>2</td><td>1/2</td><td>4 times</td></tr>
<tr><td>CLE16W</td><td>4</td><td>1/2</td><td>4 times</td></tr>
<tr><td>CLE21W</td><td>2</td><td>3/4, 1</td><td>4 times</td></tr>
<tr><td>CLE32W</td><td>2</td><td>1, 1.5</td><td>4 times</td></tr>
<tr><td>CLE32W</td><td>4</td><td>1</td><td>4 times</td></tr>
</table></td><td>CLE16W-4T/CLE32W：≦±1.0%
Others：≦±0.5%
No evidence of mechanical damage</td></tr>
<tr><td>Insulation Resistance</td><td>Refer to JIS-C5201-1 4.6
Put the resistor in the fixture, add 100 VDC in + ,- terminal for 60secs then measured the insulation resistance between electrodes and insulating enclosure or between electrodes and base material.</td><td>≧$10^{8}\Omega$</td></tr>
<tr><td>Dielectric Withstanding Voltage</td><td>Refer to JIS-C5201-1 4.7
Applied 300VAC for 1 minute, and Limit surge current 50 mA (max.)</td><td>No short or burned on the appearance.</td></tr>
</table>

6.2 Mechanical Performance Test

Test Item	Conditions of Test	Test Limits
Resistance to Solder Heat	***Refer to JIS-C5201-1 4.18*** The tested resistor be immersed 25 mm/sec into molten solder of 260±5℃ for 10±1secs. Then the resistor is left in the room for 1 hour, and measured its resistance variance rate.	≦±0.5% No evidence of mechanical damage
Solderability	***Refer to JIS-C5201-1 4.17*** Add flux into tested resistors, immersion into solder bath in temperature 245±5℃ for 3±0.5secs.	Solder coverage over 95%
Vibration	***Refer to 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 : 1.5mm This motion shall be applied for a period of 4 hours in each 3 mutually perpendicular directions (a total of 12hrs)	≦±0.5% No evidence of mechanical damage
Resistance to solvent	***Refer to JIS-C5201-1 4.29*** The tested resistor be immersed into isopropyl alcohol of 20~25℃ for 60secs, then the resistor is left in the room for 48 hrs.	≦±0.5% No evidence of mechanical damage

6.3 Environmental Performance

Test Item	Conditions of Test	Test Limits
Low Temperature Exposure (Storage)	***Refer to JIS-C5201-1 4.23.4*** Put the tested resistor in chamber under temperature -55±2℃ for 1,000 hours. Then leaving the tested resistor in room temperature for 60 minutes, and measure its resistance variance rate.	≦±0.5% No evidence of mechanical damage
High Temperature Exposure (Storage)	***Refer to JIS-C5201-1 4.23.2*** Put tested resistor in chamber under temperature 150±5℃ (CLE16W-4T 155±5℃) for 1,000 hours. Then leaving the tested resistor in room temperature for 60 minutes, and measure its resistance variance rate.	≦±1.0% No evidence of mechanical damage
Temperature Cycling (Rapid Temperature Change)	***Refer to JIS-C5201-1 4.19*** Put the tested resistor in the chamber under the temperature cycling which shown in the following table shall be repeated 300 times consecutively. Then leaving the tested resistor in the room temperature for 60 minutes, and measure its resistance variance rate. Testing Condition Lowest Temperature: -55 +0/-10℃ Highest Temperature: 150 +10/-0℃	≦±1.0% No evidence of mechanical damage
Moisture Resistance (Climatic Sequence)	***Refer to MIL-STD 202 Method 106*** Put the tested resistor in chamber and subject to 10 cycles of damp heat and without power. Each one of which consists of the steps 1 to 7 (Figure 1). Then leaving the tested resistor in room temperature for 24 hr, and measure its resistance variance rate.	≦±0.5% No evidence of mechanical damage
Bias Humidity	***Refer to JIS-C5201-1 4.24*** Put the tested resistor in chamber under 85± 5℃and 85± 5%RH with 10% bias and load the rated voltage for 90 minutes on, 30 minutes off, total 1,000 hours. Then leaving the tested resistor in room temperature for 60 minutes, and measure its resistance variance rate.	≦±1.0% No evidence of mechanical damage

6.4 Operational life Endurance

Test Item	Conditions of Test	Test Limits
Load Life	Put the tested resistor in chamber under temperature 70± 2℃ 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. Refer to JIS-C5201-1 4.25	≦±1.0% No evidence of mechanical damage

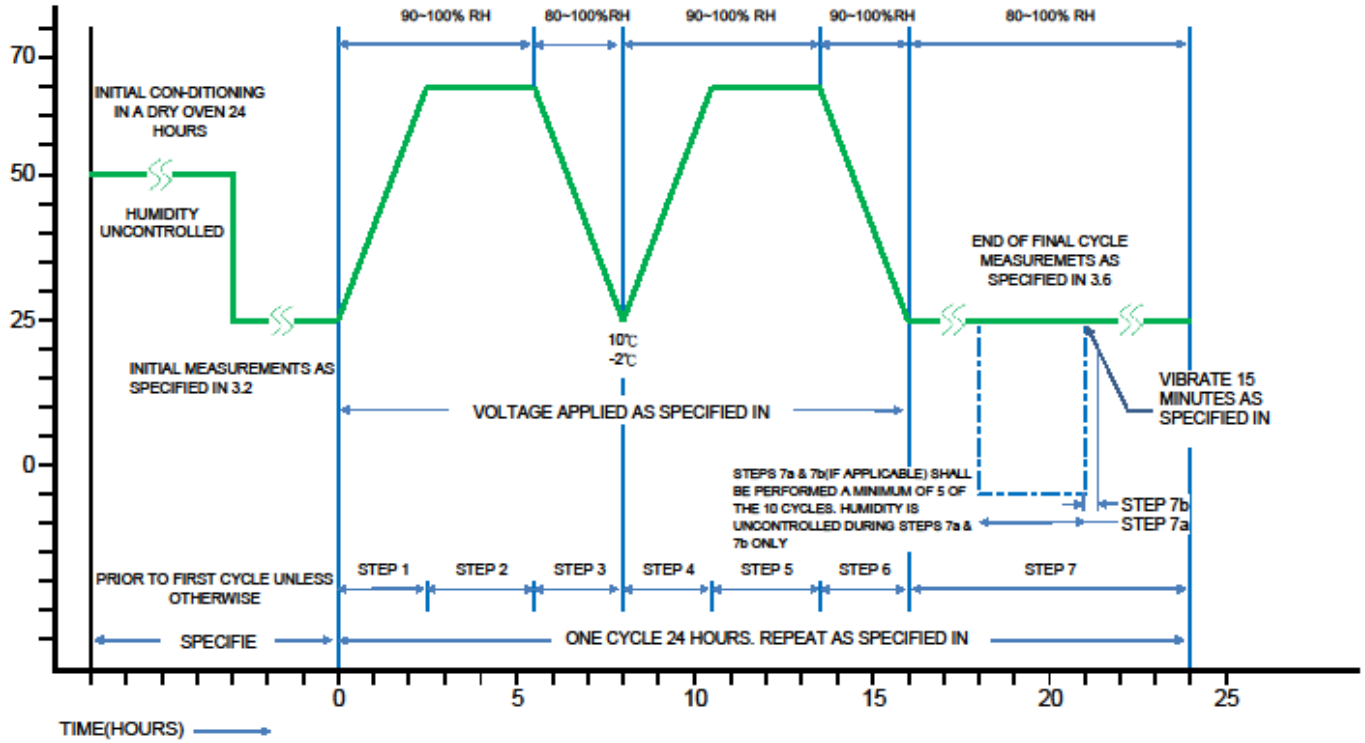

90~100% RH
80~100%RH
90~100% RH
90~100%RH
80~100% RH
70
50
25
0
INITIAL CON-DITIONING IN A DRY OVEN 24 HOURS
HUMIDITY UNCONTROLLED
INITIAL MEASUREMENTS AS SPECIFIED IN 3.2
10℃ -2℃
VOLTAGE APPLIED AS SPECIFIED IN
END OF FINAL CYCLE MEASUREMETS AS SPECIFIED IN 3.6
VIBRATE 15 MINUTES AS SPECIFIED IN
STEPS 7a & 7b(IF APPLICABLE) SHALL BE PERFORMED A MINIMUM OF 5 OF THE 10 CYCLES. HUMIDITY IS UNCONTROLLED DURING STEPS 7a & 7b ONLY
STEP 7b
STEP 7a
PRIOR TO FIRST CYCLE UNLESS OTHERWISE
STEP 1
STEP 2
STEP 3
STEP 4
STEP 5
STEP 6
STEP 7
SPECIFIE
ONE CYCLE 24 HOURS. REPEAT AS SPECIFIED IN
0
5
10
15
20
25
TIME(HOURS)

Figure 1

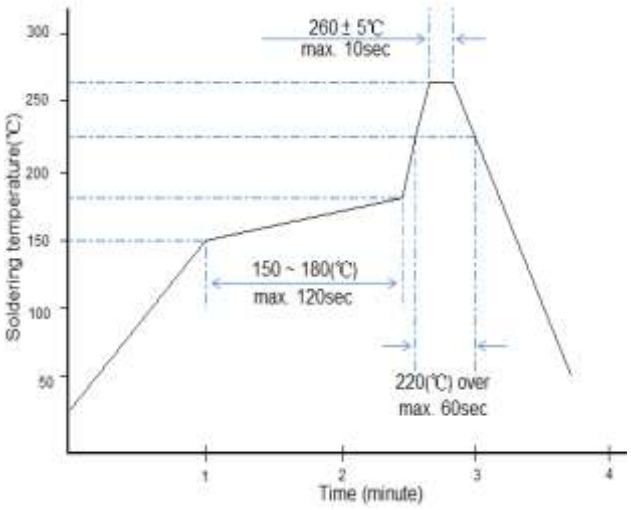
6.5 Recommended Soldering Method

Technical application notes: This is for recommendation, customer please perform adjustment according to actual application.

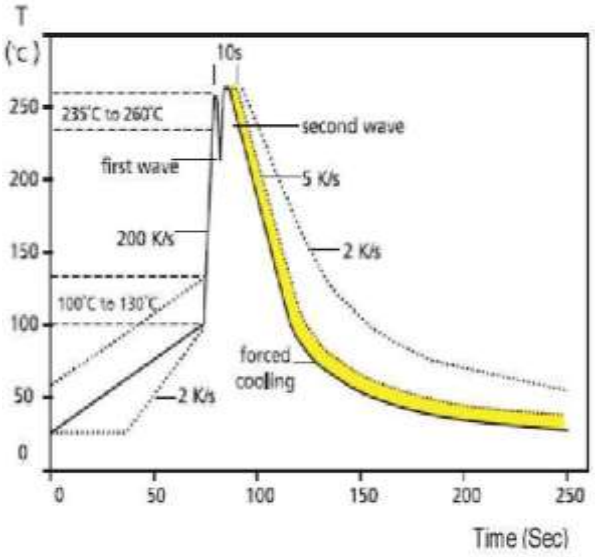
6.5.2 This product is applicable to IR-reflow process only.(Infrared Reflow)

6.5.3 Surface-mount components are tested for solderability at a temperature of 245 °C for 3 seconds

6.5.4 Typical examples of soldering processes that provides reliable joints without any damage are given below:



Recommended IR Reflow Soldering Profile
MEET J-STD-020D



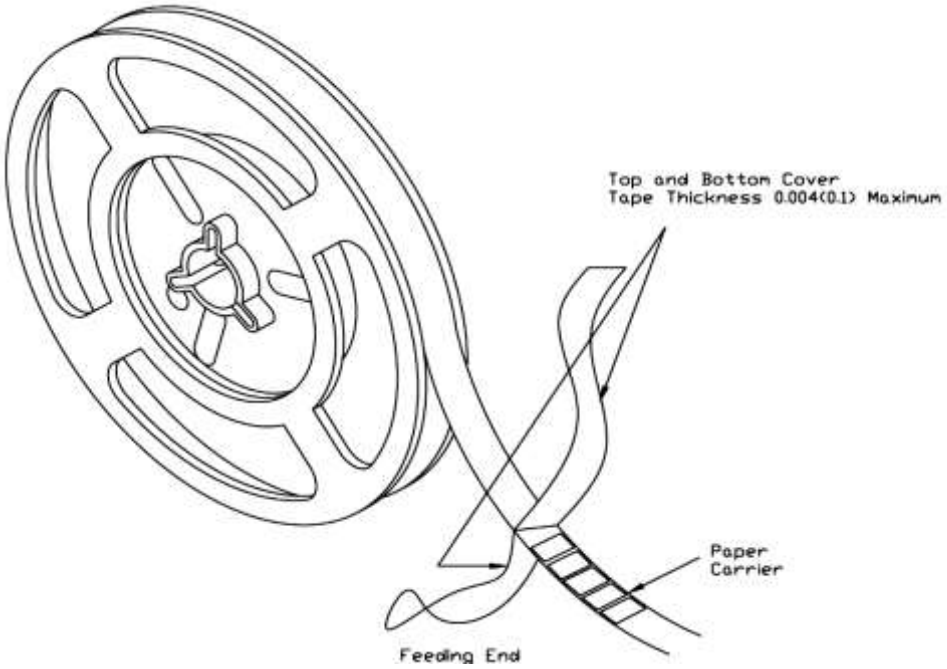
Recommended Double-Wave Soldering Profile
Typical values (solid line)
Process limits (dotted line)

6.5.4 Soldering Iron: temperature 350℃±10℃ , dwell time shall be less than 3 sec.

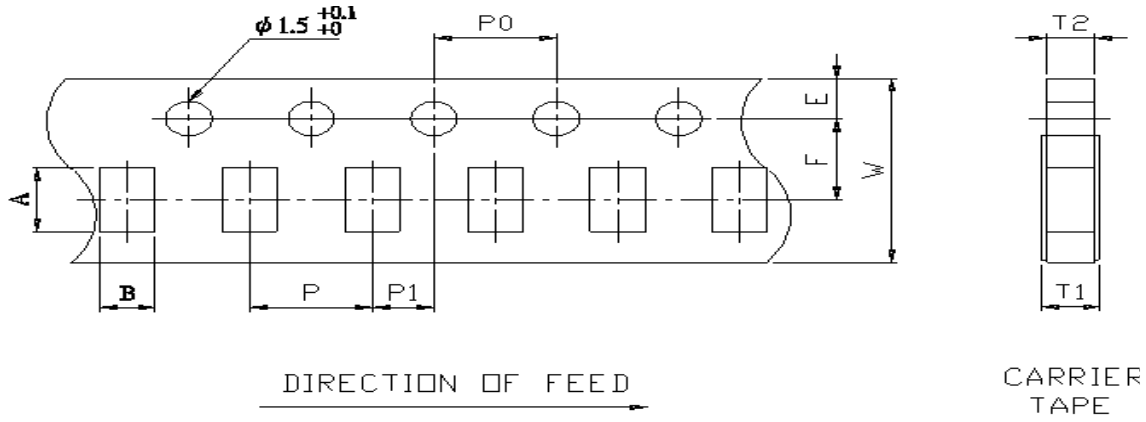
7. TAPING

7.1 Structure of Taping

Paper Carrier



7.2 Tape Dimension



Unit: mm

DIM / Item	A	B	W	E	F	T1	T2	P	P0	10*P0	P1
CLE16W	1.80±0.10	1.00±0.10	8.0±0.20	1.75±0.10	3.5±0.05	$0.40^{+0.2}_{-0}$	0.40±0.10	4.0±0.10	4.0±0.10	40.0±0.20	2.0±0.05
CLE16W-4T	1.80±0.10	1.00±0.10	8.0±0.20	1.75±0.10	3.5±0.05	$0.40^{+0.2}_{-0}$	0.40±0.10	4.0±0.10	4.0±0.10	40.0±0.20	2.0±0.05
CLE21W	2.30±0.10	1.55±0.10	8.0±0.20	1.75±0.10	3.5±0.05	$0.40^{+0.2}_{-0}$	0.40±0.05	4.0±0.10	4.0±0.10	40.0±0.20	2.0±0.05
CLE32W	3.50±0.20	1.90±0.20	8.0±0.20	1.75±0.10	3.5±0.05	$0.60^{+0.2}_{-0}$	0.60±0.05	4.0±0.10	4.0±0.10	40.0±0.20	2.0±0.05
CLE32W-4T	3.50±0.20	1.90±0.20	8.0±0.20	1.75±0.10	3.5±0.05	$0.60^{+0.2}_{-0}$	0.60±0.05	4.0±0.10	4.0±0.10	40.0±0.20	2.0±0.05

7.3 Packaging

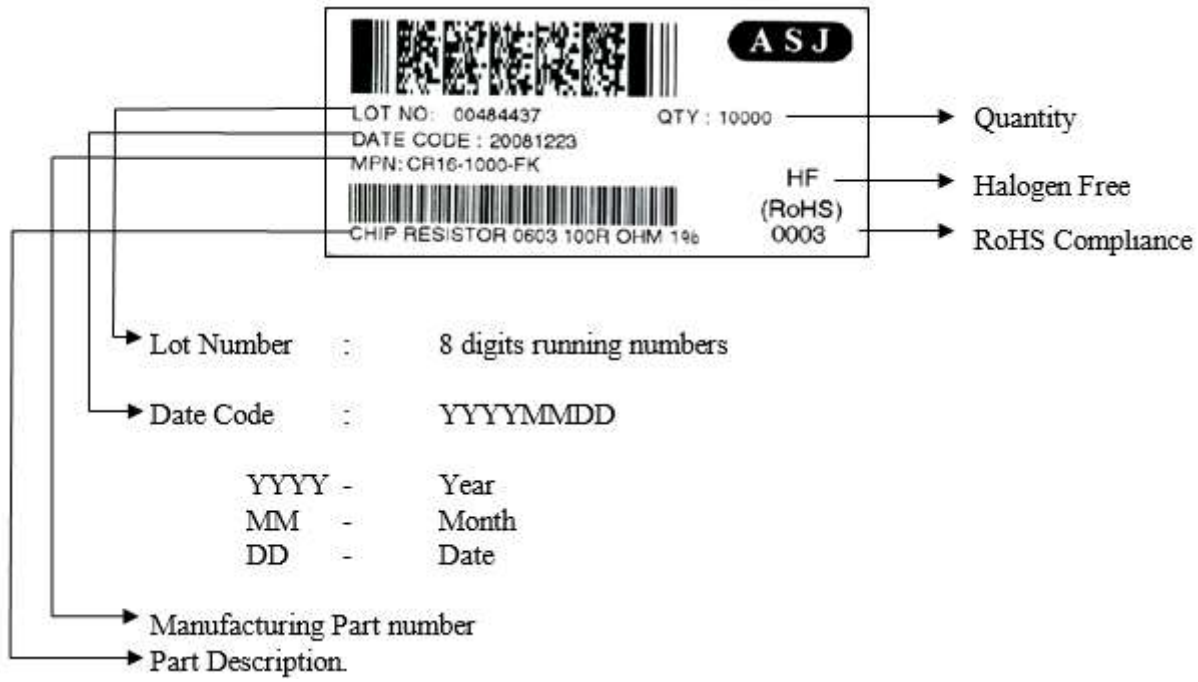
7.3.1 Taping

Quantity – Tape and Reels

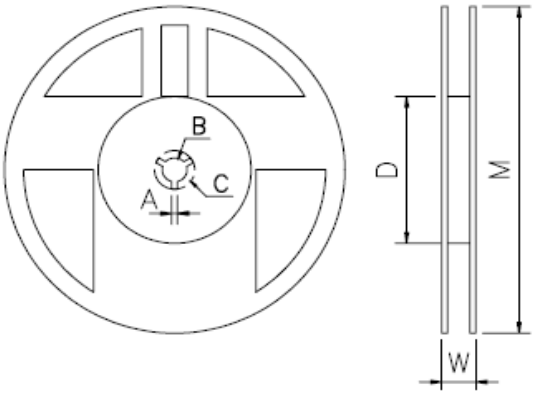
Type	# of terminal	Tape width	Max. Packaging Quantity (pcs/reel)
			4 mm pitch
CLE16W	2	8 mm	5,000pcs
CLE16W	4	8 mm	5,000pcs
CLE21W	2	8 mm	5,000pcs
CLE32W	2	8 mm	5,000pcs
CLE32W	4	8 mm	5,000pcs

7.3.2 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.



7.3.3 Reel Dimension

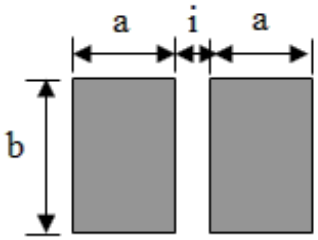
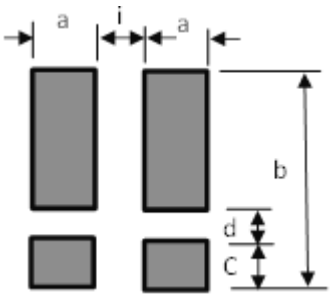


(Unit: mm)

Reel Type/ Tape	W	M	A	B	C	D
7" reel for 8 mm tape	12.0 ± 0.5	178 ± 1.0	2.0 ± 0.5	13.2 ± 0.5	17.7 ± 0.5	60.0 ± 1.0

8. RECOMMENDED LAND PATTERN

When a component is soldered, the resistance after soldering changes slightly depending on the size of the soldering area and the amount of soldering. When designing a circuit, it is necessary to consider the effect of a decrease or increase in its resistance.

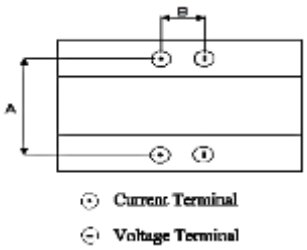
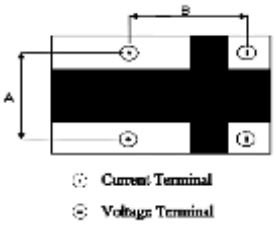
CLE16W / CLE21W / CLE32W	CLE16W-4T / CLE32W-4T
	

Type	Maximum Power Rating (Watts)	Resistance Range (mΩ)	Dimensions (millimeters)				
			a	b	c	d	i
CLE16W	1/2	1~10	0.40	1.80	---	---	0.40
CLE16W-4T	1/2	1~10	0.50	1.90	0.40	0.25	0.20
CLE21W	3/4,1	1 ~ 14	1.45	2.20	---	---	0.50
CLE32W	1, 1.5	0.5 ~ 25	1.00	3.50	---	---	0.50
CLE32W-4T	1	0.75 ~ 15	1.00	3.50	0.80	0.40	0.50

9. MEASUREMENT POINT

Bottom electrode

Unit : mm

2T	4T	DIM / TYPE	A	B
		**CLE16W**	0.63±0.05	0.33±0.05
		CLE16W-4T	0.65±0.05	0.95±0.05
		CLE21W	0.90±0.05	0.46±0.05
		CLE32W	1.20±0.05	0.46±0.05
		CLE32W-4T	1.20±0.05	1.78±0.05

10. REVISION HISTORY

REVISION	DATE	CHANGE NOTIFICATION	DESCRIPTION
Version.1	13.2.2018		Initial Release
Version.2	14.01.2019		Update datasheet
Version.3	01.10.2019		Add clause 6.3.1 Operational life Endurance
Version.4	05.10.2020		Revise clause 3.1.1 Resistor rated power Revise clause 3.5 storage temp. range Revise clause 3.9 Revise clause 3.10 TCR table Revise clause 4 dimension Revise clause 6.1 item short time overload Revise clause 7.2 tape dimension Revise clause 8 Land pattern dimension Revise clause 9 measurement point dimension
Version.5	06.04.2021		Delete CLE16W-4T information Revise clause 2 Part Numbering System Revise clause 3.1.1 Resistor Rated Power Revise clause 3.10 TCR table Revise clause 4 Dimension Add clause 4.1 Material of Alloy Delete clause 5.0.2 CLE16W 4 terminal marking information Revise clause 6.1 item Short time Overload Revise clause 7.2 tape dimension Revise clause 7.3.1.1 Tape and reel Revise clause 8 Recommend Land Pattern Revise clause 9 Measurement Point
Version.6	18.01.2022		Revise clause 3.10 TCR table Revise clause 4 dimension Revise clause 4.1 material of alloy Revise clause 8 Land pattern
Version 7	20.6.2023		Add CLE21W 1W resistance range 1~14mR, CLE32W 1.5W 1mR≤R≤2mR, 3mR≤R≤4mR, 5mR≤R≤6mR, 7mR≤R≤10mR resistance, and CLE32W 1W 0.50mR & 0.75mR resistance Revise clause 3.1.1 Resistor Rated Power Revise clause 3.8 Product Assurance Revise clause 3.10 table Revise clause 4 table Revise clause 4.1 table Revise clause 6.1 Test Item Short Time Overload Revise clause 8 table

REVISION	DATE	CHANGE NOTIFICATION	DESCRIPTION
Version 8	26.12.2023		Revise clause 3.1.1 Resistor Rated Power table. Revise clause 3.2 Power Derating Curve table. Revise clause 3.10 table. Revise clause 4 Dimension table. Revise clause 4.1 Material of Alloy table. Add clause 5.2 for CLE16W-4T type. Revise clause 6.1 Test Item Short Time Overload. Revise clause 6.3 Test Item High Temperature Exposure (Storage). Revise clause 7.2 Tape Dimension table. Revise clause 7.3.1 Taping table. Revise clause 8 Recommended Land Pattern table. Revise clause 9 Measurement Point table.