



## General

- Chip size from 2512 to 5931.
- Resistance value from 0.1mΩ to 5mΩ
- Low thermal EMF.
- Low TCR.
- Lead free, RoHS compliant for global.
- Applications and halogen free.

## Application

- Switching model power supply.
- Battery pack.
- Notebook, personal computer.
- Test Instrument.
- Power Amplifier.
- AEC-Q200 qualified<sup>(1)</sup>.

## Electrical Specifications

| Type | Power Rating at 125℃(W) | Resistance Range (mΩ) | Material   | TCR +25℃~+125℃ (ppm/℃) | Resistance tolerance                   | Operation Temp. Range |
|------|-------------------------|-----------------------|------------|------------------------|----------------------------------------|-----------------------|
| 2512 | 5                       | 0.5、1                 | MnCu       | ±150                   | ±0.5%(D)<br>±1%(F)<br>±2%(G)<br>±5%(J) | -55℃~+170℃            |
|      |                         | 2、3                   | FeCr/Karma | ±75                    |                                        |                       |
| 3921 | 12                      | 0.2                   | MnCu       | ±150                   |                                        |                       |
|      | 9                       | 0.3、0.5、1             |            | Karma                  |                                        |                       |
|      |                         | 5                     | 1、2、3、4、5  |                        |                                        |                       |
|      | 5931                    | 15                    | 0.1        | CuMnSn                 |                                        |                       |
| 0.2  |                         |                       | MnCu       | ±150                   |                                        |                       |
| 10   |                         | 0.3、0.5               |            | FeCr                   |                                        |                       |
|      |                         | 7                     | 2、3        |                        |                                        |                       |

## Part Number information

**SMSAP 39 M 9 F R001 T**

【1】 【2】 【3】 【4】 【5】 【6】 【7】

【1】 Series Name: SART Shunt Type, Automotive grade

【2】 Chip size: 25:2512 39:3921 59:5931

【3】 Material Code: M: MnCu F: FeCr K: Karma S: CuMnSn

【4】 Power Code: 5:5W 7:7W 9:9W 1:10W M:12W N:15W

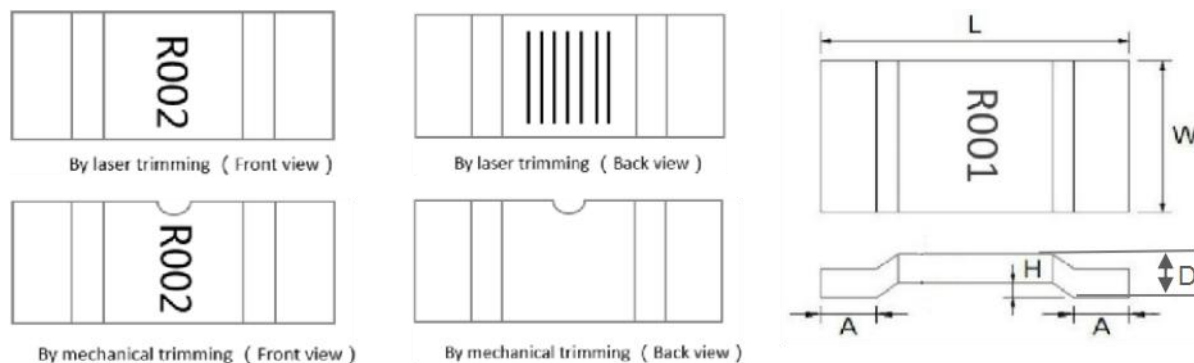
【5】 Resistance Tolerance: D:±0.5% F:±1% G:±2% J:±5%

【6】 Resistance Code: 0L20=0.2mΩ R001=1mΩ

【7】 Packaging Code: T: Tape& Reel B: Bulk Pack

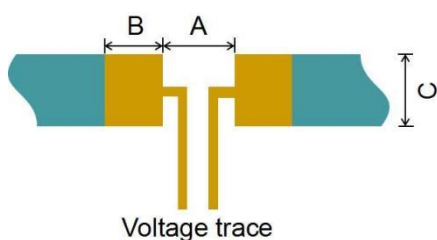
- (1) Flame retardance test may not be applicable to some resistor technologies.  
(2) Resistance test results should be measured at room temperature in accordance with the recommended pad size.

### Dimensions



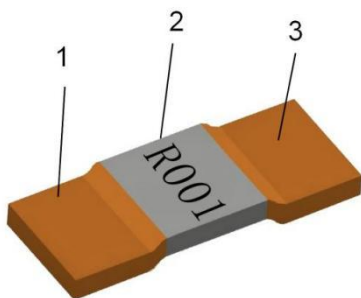
| Type | Resistance range (mΩ) | L (mm)     | W (mm)    | A (mm)    | H (mm)    | D (mm) |
|------|-----------------------|------------|-----------|-----------|-----------|--------|
| 2512 | 0.5~3                 | 6.40±0.30  | 3.20±0.30 | 1.50±0.50 | 0.50±0.10 | ≤1.50  |
| 3921 | 0.2~5                 | 10.00±0.30 | 5.20±0.30 | 2.00±0.30 | 0.50±0.10 | ≤2.40  |
| 5931 | 0.1                   | 15.00±0.30 | 8.20±0.30 | 4.50±0.30 | 0.50±0.30 | ≤2.20  |
|      | 0.2~3                 | 15.00±0.30 | 7.70±0.30 | 4.20±0.30 | 0.50±0.10 | ≤2.20  |

### Recommended Land Patterns



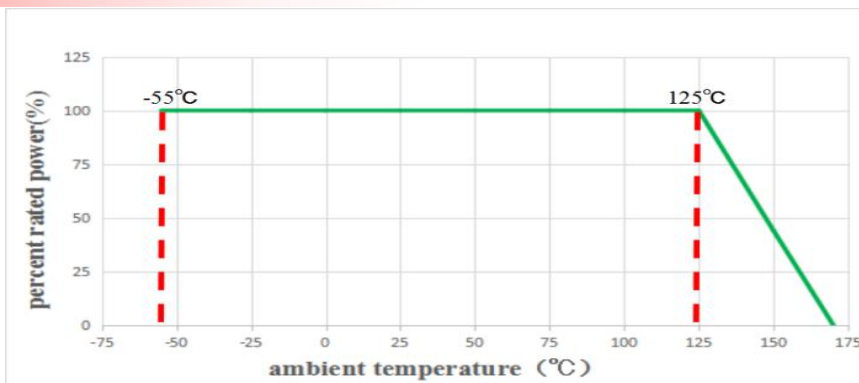
| Type | A (mm) | B (mm) | C (mm) |
|------|--------|--------|--------|
| 2512 | 3.40   | 1.80   | 3.40   |
| 3921 | 5.60   | 2.70   | 6.20   |
| 5931 | 5.60   | 5.20   | 8.75   |

### Materials

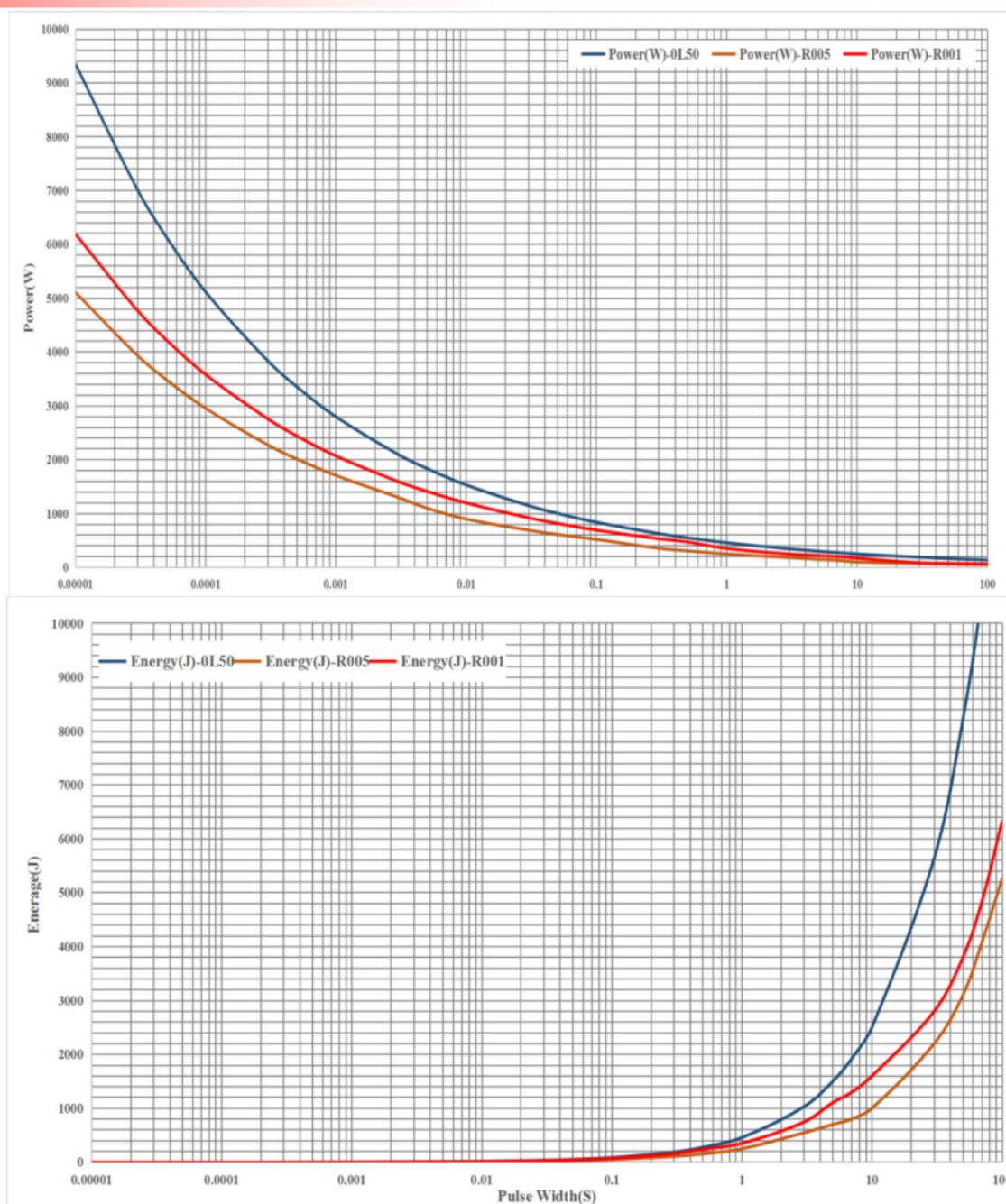


| No. | Materials              |
|-----|------------------------|
| 1   | Copper electrode       |
| 2   | MnCu/FeCr/Karma/CuMnSn |
| 3   | Copper electrode       |

## Power Derating Curve



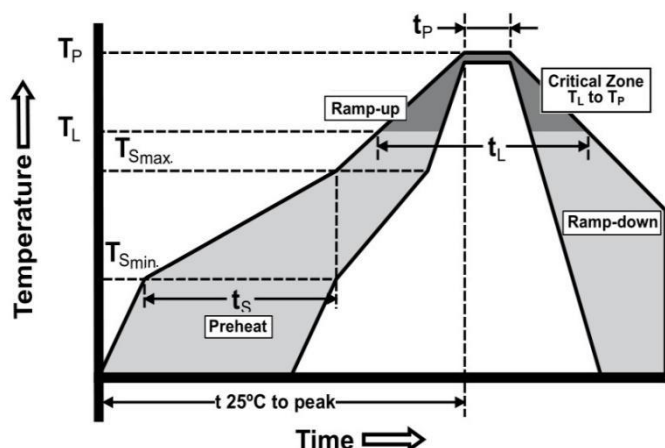
## Maximum Pulse Power and Pulse Energy



## Recommended Solder Curve

### 1. Infrared Reflow

- Temperature: 260℃
- Time: 5s Max.
- Recommend Reflow profile:



| Profile Feature                                                                                                                          | Pb-Free Assembly         |
|------------------------------------------------------------------------------------------------------------------------------------------|--------------------------|
| Average Ramp-up Rate<br>(T <sub>Smax</sub> to T <sub>P</sub> )                                                                           | 3℃/s Max.                |
| Preheat<br>Temperature Min.(T <sub>Smin</sub> )<br>Temperature Max.(T <sub>Smax</sub> )<br>Time(T <sub>Smin</sub> to T <sub>Smax</sub> ) | 150℃<br>200℃<br>60s~120s |
| Peak Temperature(T <sub>P</sub> )                                                                                                        | 260℃                     |
| Time within 5℃ of actual Peak Temperature(T <sub>P</sub> )                                                                               | 5s                       |
| Melting tin time(t <sub>L</sub> )                                                                                                        | 20s~30s                  |
| Ramp-down Rate                                                                                                                           | 6℃/s Max.                |
| Time 25℃ to peak Temperature                                                                                                             | 8 min Max.               |

### 2. Hand Soldering

- Temperature: 350℃
- Time: 10s Max.

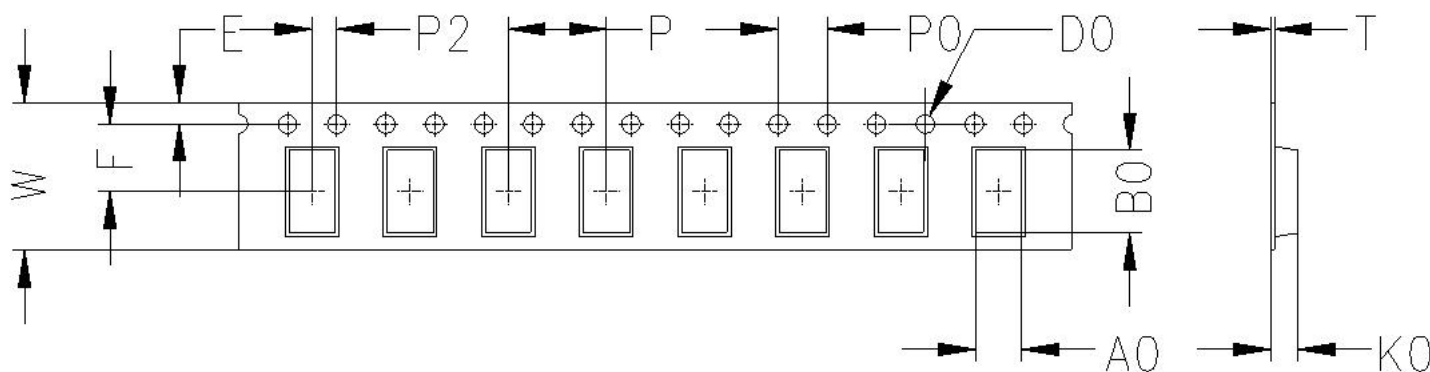
## Product Characteristics

| Item                                  | Test condition/ Methods                                                                           | Performance                 | Standard                  |
|---------------------------------------|---------------------------------------------------------------------------------------------------|-----------------------------|---------------------------|
| Resistance                            | Measuring resistance value at room temperature<br>25℃±5℃                                          | Refer to SART Spec          | IEC60115-1 4.5            |
| Temperature coefficient of resistance | $TCR = \frac{(R - R_0)}{R_0} \frac{(T_2 - T_1)}{T_1} \times 10^6$<br>Test temperature: +25℃~+125℃ | Refer to SART Spec          | MIL-STD-202<br>Method 304 |
| Short time Overload                   | 5 times the rated power for 5 s                                                                   | $ \Delta R  \leq \pm 1\%$   | IEC 60115-1 4.13          |
| Solderability                         | Solder bath method (245 ± 5) °C<br>(10 ± 2) s                                                     | 95% coverage Min            | J-STD-002                 |
| Resistance to Soldering Heat          | 260℃± 5℃ 10 s ± 0.5 s                                                                             | $ \Delta R  \leq \pm 1\%$   | MIL-STD-202<br>Method 210 |
| Temperature Cycling                   | -55℃ (15min)/+150℃(15min), 1000 cycles                                                            | $ \Delta R  \leq \pm 1\%$   | JESD22<br>Method JA-104   |
| High Temperature Storage              | 170℃ for 1000hours, No power                                                                      | $ \Delta R  \leq \pm 1\%$   | MIL-STD-202<br>Method 108 |
| Temperature Humidity Bias Test        | +85℃, 85% RH, 10%bias, 1000 hours                                                                 | $ \Delta R  \leq \pm 0.5\%$ | MIL-STD-202<br>Method103  |
| Mechanical shock                      | 100 g's ,6 ms, 5 pulses                                                                           | $ \Delta R  \leq \pm 0.5\%$ | MIL-STD-202<br>Method 213 |

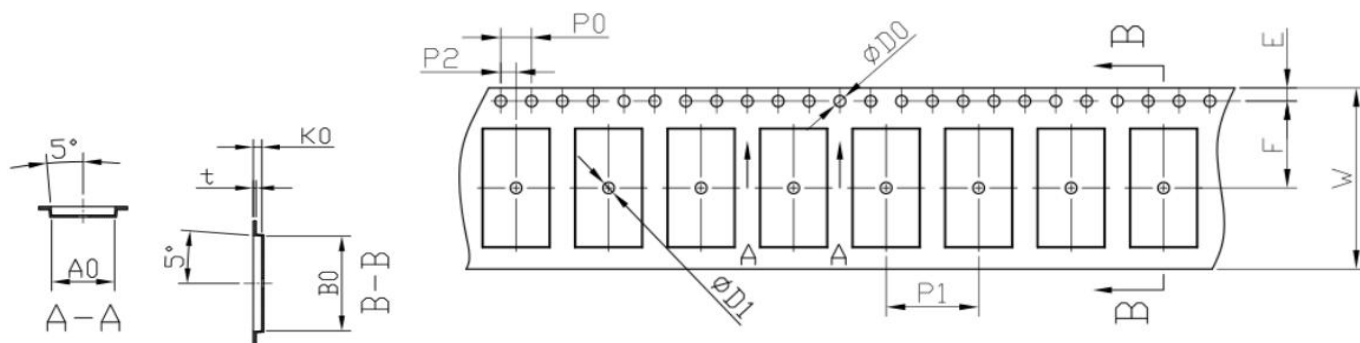
|                     |                                                                                         |                             |                        |
|---------------------|-----------------------------------------------------------------------------------------|-----------------------------|------------------------|
| Vibration           | Frequency: 10Hz ~2000Hz acceleration: 5g's for 20 min, 12 cycles each of 3 orientations | $ \Delta R  \leq \pm 0.5\%$ | MIL-STD-202 Method 204 |
| Load life           | 125°C $\pm$ 2°C for 1000 hours, Rated power                                             | $ \Delta R  \leq \pm 1\%$   | MIL-STD-202 Method 108 |
| Moisture resistance | MIL-STD-202, method 106, No power, 7b not required                                      | $ \Delta R  \leq \pm 1\%$   | MIL-STD-202 Method 106 |
| Board Flex          | Bending amplitude 2mm for 60s                                                           | $ \Delta R  \leq \pm 1\%$   | AEC Q200-005           |
| Terminal Strength   | Applying force 17.7N for 60 s                                                           | $ \Delta R  \leq \pm 1\%$   | AEC-Q200-006           |

## Packaging

### 1. Embossed Tape Dimensions

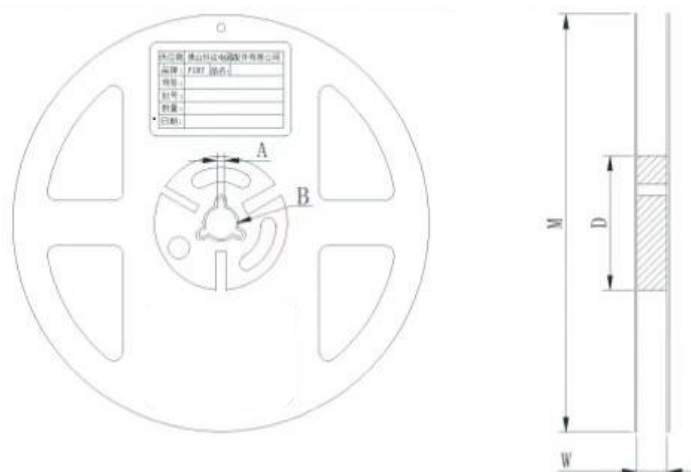


| Type | A0 (mm)         | B0 (mm)         | W (mm)           | E (mm)          | F (mm)          | D0 (mm)         |
|------|-----------------|-----------------|------------------|-----------------|-----------------|-----------------|
| 2512 | 3.50 $\pm$ 0.20 | 6.85 $\pm$ 0.20 | 12.00 $\pm$ 0.30 | 1.75 $\pm$ 0.10 | 5.50 $\pm$ 0.10 | 1.50 $\pm$ 0.10 |
| Type | T (mm)          | K0 (mm)         | P (mm)           | P0 (mm)         | P2 (mm)         | /               |
| 2512 | 0.25 $\pm$ 0.05 | 1.35 $\pm$ 0.10 | 4.00 $\pm$ 0.10  | 4.00 $\pm$ 0.10 | 2.00 $\pm$ 0.10 | /               |

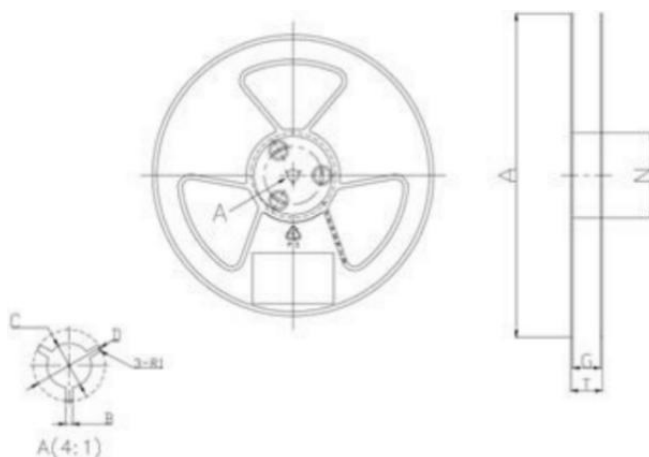


| Type | A0<br>(mm) | B0<br>(mm) | E<br>(mm)  | F<br>(mm)  | W<br>(mm)  | t<br>(mm)           |
|------|------------|------------|------------|------------|------------|---------------------|
| 3921 | 6.00±0.20  | 10.60±0.20 | 1.75±0.10  | 11.50±0.10 | 24.00±0.30 | 0.40±0.05           |
| 5931 | 8.60±0.20  | 15.60±0.20 | 1.75±0.10  | 11.50±0.10 | 24.00±0.30 | 0.40±0.05           |
| Type | P0<br>(mm) | P1<br>(mm) | P2<br>(mm) | D0<br>(mm) | D1<br>(mm) | K0<br>(mm)          |
| 3921 | 4.00±0.10  | 8.00±0.10  | 2.00±0.05  | 1.50±0.10  | 1.50±0.10  | 1.20±0.10/2.50±0.10 |
| 5931 | 4.00±0.10  | 12.00±0.10 | 2.00±0.05  | 1.50±0.10  | 1.50±0.10  | 1.20±0.10/2.35±0.10 |

## 2. Reel Dimensions



| Type | W<br>(mm)  | M<br>(mm)   | A<br>(mm) | B<br>(mm)  | D<br>(mm)  |
|------|------------|-------------|-----------|------------|------------|
| 2512 | 12.80±0.50 | 178.00±1.00 | 2.40±1.00 | 13.50±1.00 | 60.00±2.00 |

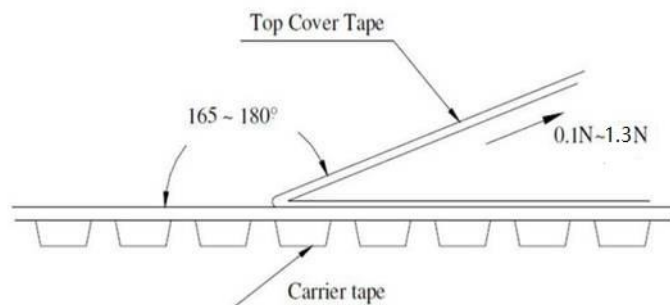


| Type | A<br>(mm)   | N<br>(mm)   | C<br>(mm)  | D<br>(mm)  | B<br>(mm) | G<br>(mm)  | T<br>(mm)  |
|------|-------------|-------------|------------|------------|-----------|------------|------------|
| 3921 | 330.00±2.00 | 100.00±1.50 | 13.00±0.50 | 21.00±0.50 | 2.30±0.50 | 24.50±1.50 | 28.50±2.00 |
| 5931 | 330.00±2.00 | 100.00±1.50 | 13.00±0.50 | 21.00±0.50 | 2.30±0.50 | 24.50±1.50 | 28.50±2.00 |

### 3. Quantity of Package

| Type | Resistance Range<br>(mΩ) | Quantity<br>(pcs) |
|------|--------------------------|-------------------|
| 2512 | 0.5、1、2、3                | 2000              |
| 3921 | 2、3、4、5                  | 2500              |
|      | 0.2、0.3、0.5、1            | 1500              |
| 5931 | 0.5、2、3                  | 2000              |
|      | 0.1、0.2、0.3、1            | 1000              |

### 4. Peeling Test



## Storage

- The ambient temperature shall between 5℃~30℃.
- The relative humidity recommended for storage is between 25%~60%.
- Sealed plastic bags with desiccant shall be used to reduce the oxidation of the termination and shall only be opened prior to use.
- The products shall not be stored in areas where harmful gases containing sulfur or chlorine are present.