

# DATA SHEET

## METAL OXIDE VARISTORS POWER SUPPLY

20D series

RoHS compliant & Halogen free



Product specification— February 12, 2019 V.0



## Metal Oxide Varistor (MOV) Data Sheet

### Features

- Wide operating voltage ( $V_{1mA}$ ) range from 18V to 1800V
- Fast responding to transient over-voltage
- Large absorbing transient energy capability
- Low clamping ratio and no follow-on current
- Meets MSL level 1, per J-STD-020
- Operating Temperature:  $-40^{\circ}\text{C} \sim +105^{\circ}\text{C}$
- Storage Temperature:  $-40^{\circ}\text{C} \sim +125^{\circ}\text{C}$
- Safety certification:   UL: E327997  
                                  CSA: 246579  
                                  VDE: 40027827



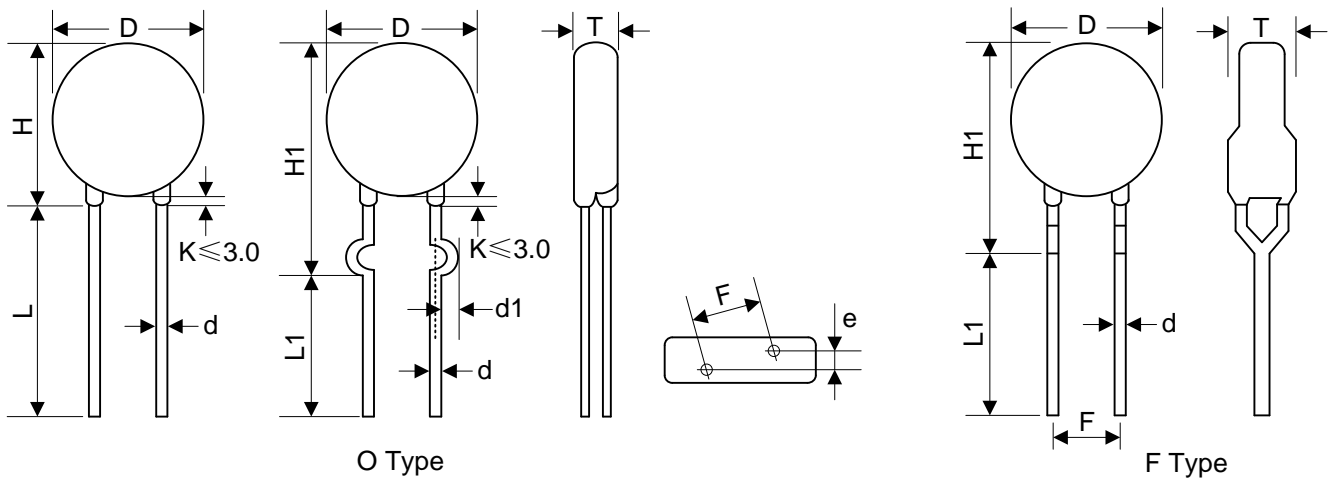
### Applications

- Transistor, diode, IC, thyristor or triac semiconductor protection
- Surge protection in consumer electronics
- Surge protection in industrial electronics
- Surge protection in electronic home appliances, gas and petroleum appliances
- Relay and electromagnetic valve surge absorption

### Part Number Code



Dimensions



O Type

F Type

| Table 1  |                  |
|----------|------------------|
| Unit: mm |                  |
| Symbol   | Dimension        |
| H        | 21.0~26.0        |
| H1       | 24.0~28.0        |
| L(min.)  | 20.0             |
| L1(min.) | 15.0             |
| D        | 20.0~23.0        |
| F        | 7.5±0.8/10.0±1.0 |
| T        | Table 2          |
| e(±0.8)  | Table 2          |
| d(±0.05) | 0.8/1.0          |
| d1(±0.4) | 1.4/1.6          |

| Table 2  |         |     |       |          |     |
|----------|---------|-----|-------|----------|-----|
| Unit: mm |         |     |       |          |     |
| Model    | T       | e   | Model | T        | e   |
| 180K     | 2.1~4.3 | 1.7 | 361K  | 3.0~5.4  | 2.9 |
| 220K     | 2.2~4.4 | 1.8 | 391K  | 3.1~5.5  | 3.0 |
| 270K     | 2.2~4.6 | 2.0 | 431K  | 3.3~5.7  | 3.2 |
| 330K     | 2.3~4.8 | 1.9 | 471K  | 3.4~6.0  | 3.4 |
| 390K     | 2.2~4.5 | 2.0 | 511K  | 3.5~6.2  | 3.6 |
| 470K     | 2.3~4.7 | 2.1 | 561K  | 3.7~6.5  | 3.8 |
| 560K     | 2.4~5.0 | 2.3 | 621K  | 3.9~6.8  | 4.1 |
| 680K     | 2.5~5.3 | 2.6 | 681K  | 4.1~7.1  | 4.4 |
| 820K     | 2.2~4.5 | 2.0 | 751K  | 4.4~7.5  | 4.5 |
| 101K     | 2.5~4.6 | 2.2 | 781K  | 4.5~7.7  | 4.6 |
| 121K     | 2.5~4.8 | 2.4 | 821K  | 4.7~7.9  | 4.8 |
| 151K     | 2.3~4.5 | 2.0 | 911K  | 4.9~8.1  | 5.2 |
| 181K     | 2.4~4.6 | 2.1 | 102K  | 5.5~8.6  | 5.2 |
| 201K     | 2.5~4.7 | 2.2 | 112K  | 5.9~9.1  | 5.6 |
| 221K     | 2.6~4.8 | 2.3 | 122K  | 6.0~9.7  | 6.0 |
| 241K     | 2.7~4.9 | 2.4 | 142K  | 7.0~11.2 | 6.8 |
| 271K     | 2.7~5.0 | 2.6 | 162K  | 7.5~11.8 | 7.6 |
| 301K     | 2.8~5.0 | 2.7 | 182K  | 7.7~12.8 | 8.4 |
| 331K     | 2.8~5.2 | 2.7 |       |          |     |

**METAL OXIDE VARISTORS**

20D

**Electrical Characteristics**

| Part Number |            | Maximum Allowable Voltage |                     | Varistor Voltage     | Maximum Clamping Voltage |                    | Withstanding Surge Current |                  | Maximum Energy (10/1000µs) |                | Rated Power | Typical Capacitance (Reference) |
|-------------|------------|---------------------------|---------------------|----------------------|--------------------------|--------------------|----------------------------|------------------|----------------------------|----------------|-------------|---------------------------------|
| Standard    | High Surge | V <sub>AC</sub> (V)       | V <sub>DC</sub> (V) | V <sub>1mA</sub> (V) | I <sub>P</sub> (A)       | V <sub>C</sub> (V) | I (A) Standard             | I (A) High Surge | (J) Standard               | (J) High Surge | (W)         | @1KHz (pf)                      |
| 180KD20     | 180KD20J   | 11                        | 14                  | 18(15~21.6)          | 20                       | 36                 | 2000                       | 3000             | 11                         | 13             | 0.2         | 28500                           |
| 220KD20     | 220KD20J   | 14                        | 18                  | 22(19.5~26)          | 20                       | 43                 | 2000                       | 3000             | 14                         | 16             | 0.2         | 18500                           |
| 270KD20     | 270KD20J   | 17                        | 22                  | 27(24~31)            | 20                       | 53                 | 2000                       | 3000             | 16                         | 19             | 0.2         | 13000                           |
| 330KD20     | 330KD20J   | 20                        | 26                  | 33(29.5~36.5)        | 20                       | 65                 | 2000                       | 3000             | 23                         | 24             | 0.2         | 11500                           |
| 390KD20     | 390KD20J   | 25                        | 31                  | 39(35~43)            | 20                       | 77                 | 2000                       | 3000             | 26                         | 28             | 0.2         | 8500                            |
| 470KD20     | 470KD20J   | 30                        | 38                  | 47(42~52)            | 20                       | 93                 | 2000                       | 3000             | 30                         | 34             | 0.2         | 7400                            |
| 560KD20     | 560KD20J   | 35                        | 45                  | 56(50~62)            | 20                       | 110                | 2000                       | 3000             | 38                         | 44             | 0.2         | 6500                            |
| 680KD20     | 680KD20J   | 40                        | 56                  | 68(61~75)            | 20                       | 135                | 2000                       | 3000             | 41                         | 49             | 0.2         | 5800                            |
| 820KD20     | 820KD20J   | 50                        | 65                  | 82(74~90)            | 100                      | 135                | 6500                       | 10000            | 45                         | 56             | 1.0         | 4900                            |
| 101KD20     | 101KD20J   | 60                        | 85                  | 100(90~110)          | 100                      | 165                | 6500                       | 10000            | 50                         | 70             | 1.0         | 4000                            |
| 121KD20     | 121KD20J   | 75                        | 100                 | 120(108~132)         | 100                      | 200                | 6500                       | 10000            | 55                         | 85             | 1.0         | 3300                            |
| 151KD20     | 151KD20J   | 95                        | 125                 | 150(135~165)         | 100                      | 250                | 6500                       | 10000            | 70                         | 106            | 1.0         | 2700                            |
| 181KD20     | 181KD20J   | 115                       | 150                 | 180(162~198)         | 100                      | 300                | 6500                       | 10000            | 85                         | 130            | 1.0         | 2200                            |
| 201KD20     | 201KD20J   | 130                       | 170                 | 200(180~220)         | 100                      | 340                | 6500                       | 10000            | 95                         | 140            | 1.0         | 2000                            |
| 221KD20     | 221KD20J   | 140                       | 180                 | 220(198~242)         | 100                      | 360                | 6500                       | 10000            | 100                        | 155            | 1.0         | 1800                            |
| 241KD20     | 241KD20J   | 150                       | 200                 | 240(216~264)         | 100                      | 395                | 6500                       | 10000            | 108                        | 168            | 1.0         | 1650                            |
| 271KD20     | 271KD20J   | 175                       | 225                 | 270(243~297)         | 100                      | 455                | 6500                       | 10000            | 127                        | 190            | 1.0         | 1500                            |
| 301KD20     | 301KD20J   | 190                       | 250                 | 300(270~330)         | 100                      | 500                | 6500                       | 10000            | 136                        | 210            | 1.0         | 1300                            |
| 331KD20     | 331KD20J   | 210                       | 275                 | 330(297~363)         | 100                      | 550                | 6500                       | 10000            | 150                        | 228            | 1.0         | 1200                            |
| 361KD20     | 361KD20J   | 230                       | 300                 | 360(324~396)         | 100                      | 595                | 6500                       | 10000            | 163                        | 255            | 1.0         | 1100                            |
| 391KD20     | 391KD20J   | 250                       | 320                 | 390(351~429)         | 100                      | 650                | 6500                       | 10000            | 180                        | 275            | 1.0         | 1000                            |
| 431KD20     | 431KD20J   | 275                       | 350                 | 430(387~473)         | 100                      | 710                | 6500                       | 10000            | 190                        | 305            | 1.0         | 930                             |
| 471KD20     | 471KD20J   | 300                       | 385                 | 470(423~517)         | 100                      | 775                | 6500                       | 10000            | 204                        | 350            | 1.0         | 850                             |
| 511KD20     | 511KD20J   | 320                       | 415                 | 510(459~561)         | 100                      | 845                | 6500                       | 10000            | 210                        | 360            | 1.0         | 780                             |
| 561KD20     | 561KD20J   | 350                       | 460                 | 560(504~616)         | 100                      | 925                | 6500                       | 10000            | 215                        | 380            | 1.0         | 710                             |
| 621KD20     | 621KD20J   | 385                       | 505                 | 620(558~682)         | 100                      | 1025               | 6500                       | 10000            | 224                        | 390            | 1.0         | 650                             |
| 681KD20     | 681KD20J   | 420                       | 560                 | 680(612~748)         | 100                      | 1120               | 6500                       | 10000            | 230                        | 400            | 1.0         | 600                             |
| 751KD20     | 751KD20J   | 460                       | 615                 | 750(675~825)         | 100                      | 1240               | 6500                       | 10000            | 255                        | 420            | 1.0         | 530                             |
| 781KD20     | 781KD20J   | 485                       | 640                 | 780(702~858)         | 100                      | 1290               | 6500                       | 10000            | 265                        | 440            | 1.0         | 510                             |
| 821KD20     | 821KD20J   | 510                       | 670                 | 820(738~902)         | 100                      | 1355               | 6500                       | 10000            | 282                        | 460            | 1.0         | 500                             |
| 911KD20     | 911KD20J   | 550                       | 745                 | 910(819~1001)        | 100                      | 1500               | 6500                       | 10000            | 310                        | 510            | 1.0         | 440                             |
| 102KD20     | 102KD20J   | 625                       | 825                 | 1000(900~1100)       | 100                      | 1650               | 6500                       | 10000            | 342                        | 565            | 1.0         | 400                             |
| 112KD20     | 112KD20J   | 680                       | 895                 | 1100(990~1210)       | 100                      | 1815               | 6500                       | 10000            | 383                        | 620            | 1.0         | 360                             |
| 122KD20     | 122KD20J   | 750                       | 990                 | 1200(1080~1320)      | 100                      | 1980               | 6500                       | 10000            | 408                        | 660            | 1.0         | 350                             |
| 142KD20     | 142KD20J   | 880                       | 1140                | 1400(1260~1540)      | 100                      | 2310               | 6500                       | 10000            | 532                        | 784            | 1.0         | 340                             |
| 162KD20     | 162KD20J   | 1000                      | 1280                | 1600(1440~1760)      | 100                      | 2640               | 6500                       | 10000            | 606                        | 896            | 1.0         | 330                             |
| 182KD20     | 182KD20J   | 1100                      | 1465                | 1800(1620~1980)      | 100                      | 2970               | 6500                       | 10000            | 625                        | 990            | 1.0         | 320                             |

- Notes: 1. The tolerance of varistor voltage between 18V and 27V is more than 10%.  
 2. Varistor voltage  $\geq 1200V$ , structure diagram is F type.  
 3. Leakage Current (@83% of V<sub>1mA</sub>): IR $\leq 50\mu A$  (180K~680K) ; IR $\leq 25\mu A$  (820K~182K)

**Electrical Ratings**

| Items                              | Test Condition/Description  | Requirement   |               |               |              |               |  |
|------------------------------------|---|---------------|---------------|---------------|--------------|---------------|--|
| Varistor Voltage                   | The voltage between two terminals with the specified measuring current 1mA.DC applied is called Vb.   |               |               |               |              |               |  |
| Maximum Allowable Voltage          | The recommended maximum sine wave voltage (RMS) or the Maximum DC voltage can be applied continuously.  |               |               |               |              |               |  |
| Maximum Clamping Voltage           | The maximum voltage between two terminals with the specification standard impulse current.<br>Applied waveform: 8/20µs<br>   |               |               |               |              |               |  |
| Rated Wattage                      | The maximum average power that can be applied within the specified ambient temperature.   |               |               |               |              |               |  |
| Energy                             | The maximum energy within the varistor voltage change of ±10% when one impulse of 10/1000µs or 2ms is applied.  |               |               |               |              |               |  |
| Withstanding Surge Current         | The maximum current within the varistor voltage change of ±10% with the standard impulse current (8/20µs) applied one time.   |               |               |               |              |               |  |
| Varistor Voltage Temp. Coefficient | $\left  \frac{V_{1mA@85^{\circ}C} - V_{1mA@25^{\circ}C}}{V_{1mA@25^{\circ}C}} \times \frac{1}{60} \times 100\% (\%/^{\circ}C) \right $<br>$\left  \frac{V_{1mA@-40^{\circ}C} - V_{1mA@25^{\circ}C}}{V_{1mA@25^{\circ}C}} \times \frac{1}{65} \times 100\% (\%/^{\circ}C) \right $   | ≤0.05%/°C     |               |               |              |               |  |
| Surge Life                         | The change of Vb shall be measured after the impulse listed below which is applied 10,000 times continuously with the interval of ten seconds at room temperature. <table border="1" style="margin: 10px auto; width: 80%;"> <tr> <td rowspan="2" style="text-align: center;">20Φ series</td> <td style="text-align: center;">180K to 680K</td> <td style="text-align: center;">100A (8/20µs)</td> </tr> <tr> <td style="text-align: center;">820K to 182K</td> <td style="text-align: center;">200A (8/20µs)</td> </tr> </table> | 20Φ series    | 180K to 680K  | 100A (8/20µs) | 820K to 182K | 200A (8/20µs) | $\frac{\Delta V_b}{V_b} \leq \pm 10\%$ |
| 20Φ series                         | 180K to 680K  |               | 100A (8/20µs) |               |              |               |  |
|                                    | 820K to 182K  | 200A (8/20µs) |               |               |              |               |  |

**Soldering Recommendation**

Wave Lead Free Soldering Recommendation



| Item             | Conditions        |
|------------------|-------------------|
| Peak Temperature | 265°C             |
| Dipping Time     | 10 seconds (max.) |
| Soldering        | 1 time            |

Recommendation Reworking Conditions with Soldering Iron

| Item                              | Conditions       |
|-----------------------------------|------------------|
| Temperature of Soldering Iron-tip | 360°C (max.)     |
| Soldering Time                    | 3 seconds (max.) |
| Distance from Varistor            | 2mm (min.)       |

## Mechanical Characteristics

| Items                         | Test conditions / Methods   | Specifications  |            |           |     |            |     |        |     |  |
|-------------------------------|---|---|------------|-----------|-----|------------|-----|--------|-----|--|
| Tensile Strength of Terminals | Gradually applying the force specified and keeping the unit fixed for 10±1 sec.<br><br><table border="1"> <thead> <tr> <th>Terminal diameter (mm)</th> <th>Force (kg)</th> </tr> </thead> <tbody> <tr> <td>0.5&lt;d≤0.8</td> <td>1.0</td> </tr> <tr> <td>0.8&lt;d≤1.25</td> <td>2.0</td> </tr> <tr> <td>1.25&lt;d</td> <td>4.0</td> </tr> </tbody> </table>   | Terminal diameter (mm)                                      | Force (kg) | 0.5<d≤0.8 | 1.0 | 0.8<d≤1.25 | 2.0 | 1.25<d | 4.0 | No visible damage<br>$ \Delta V_{1mA}/V_{1mA}  \leq 5\%$ |
| Terminal diameter (mm)        | Force (kg)  |   |            |           |     |            |     |        |     |  |
| 0.5<d≤0.8                     | 1.0   |   |            |           |     |            |     |        |     |  |
| 0.8<d≤1.25                    | 2.0   |   |            |           |     |            |     |        |     |  |
| 1.25<d                        | 4.0   |   |            |           |     |            |     |        |     |  |
| Bending Strength of Terminals | Hold specimen and apply the force specified below to each lead. Bend the specimen to 90°, then return to the original position. Repeat the procedure in the opposite direction.<br><br><table border="1"> <thead> <tr> <th>Terminal diameter (mm)</th> <th>Force (kg)</th> </tr> </thead> <tbody> <tr> <td>0.5&lt;d≤0.8</td> <td>0.5</td> </tr> <tr> <td>0.8&lt;d≤1.25</td> <td>1.0</td> </tr> <tr> <td>1.25&lt;d</td> <td>2.0</td> </tr> </tbody> </table> | Terminal diameter (mm)                                      | Force (kg) | 0.5<d≤0.8 | 0.5 | 0.8<d≤1.25 | 1.0 | 1.25<d | 2.0 | No visible damage<br>$ \Delta V_{1mA}/V_{1mA}  \leq 5\%$ |
| Terminal diameter (mm)        | Force (kg)  |   |            |           |     |            |     |        |     |  |
| 0.5<d≤0.8                     | 0.5   |   |            |           |     |            |     |        |     |  |
| 0.8<d≤1.25                    | 1.0   |   |            |           |     |            |     |        |     |  |
| 1.25<d                        | 2.0   |   |            |           |     |            |     |        |     |  |
| Vibration                     | Frequency range: 10~55 Hz<br>Amplitude: 0.75mm or 98m/s <sup>2</sup><br>Direction: 3 mutually perpendicular directions, 2hrs each.  | No visible damage<br>$ \Delta V_{1mA}/V_{1mA}  \leq 5\%$    |            |           |     |            |     |        |     |  |
| Solder ability                | Solder Temp: 245±5°C<br>Dipping Time: 2±0.5 sec   | At least 95% of terminal electrode is covered by new solder |            |           |     |            |     |        |     |  |
| Resistance to Soldering Heat  | Solder Temp: 260±5°C<br>Dipping Time: 10±1 sec  | No visible damage<br>$ \Delta V_{1mA}/V_{1mA}  \leq 10\%$   |            |           |     |            |     |        |     |  |

## Reliability

| Items                    | Test conditions / Methods   | Specifications  |                  |                  |   |       |      |   |                  |      |   |       |      |   |                  |      |  |
|--------------------------|---|---|------------------|------------------|---|-------|------|---|------------------|------|---|-------|------|---|------------------|------|--|
| High Temperature Storage | Ambient Temp: 125±2°C<br>Duration: 1000hrs  | $ \Delta V_{1mA}/V_{1mA}  \leq 5\%$                       |                  |                  |   |       |      |   |                  |      |   |       |      |   |                  |      |  |
| Low Temperature Storage  | Ambient Temp: -40±2°C<br>Duration: 1000hrs  | $ \Delta V_{1mA}/V_{1mA}  \leq 5\%$                       |                  |                  |   |       |      |   |                  |      |   |       |      |   |                  |      |  |
| Humidity                 | Ambient Temp: 40±2°C, 90~95% R.H.<br>Duration: 1000hrs  | $ \Delta V_{1mA}/V_{1mA}  \leq 5\%$                       |                  |                  |   |       |      |   |                  |      |   |       |      |   |                  |      |  |
| Temperature Cycle        | The conditions shown below shall be repeated 5 cycles<br><table border="1"> <thead> <tr> <th>Step</th> <th>Temperature (°C)</th> <th>Period (minutes)</th> </tr> </thead> <tbody> <tr> <td>1</td> <td>-40±3</td> <td>30±3</td> </tr> <tr> <td>2</td> <td>Room temperature</td> <td>15±3</td> </tr> <tr> <td>3</td> <td>125±3</td> <td>30±3</td> </tr> <tr> <td>4</td> <td>Room temperature</td> <td>15±3</td> </tr> </tbody> </table> | Step  | Temperature (°C) | Period (minutes) | 1 | -40±3 | 30±3 | 2 | Room temperature | 15±3 | 3 | 125±3 | 30±3 | 4 | Room temperature | 15±3 | No visible damage<br>$ \Delta V_{1mA}/V_{1mA}  \leq 5\%$ |
| Step                     | Temperature (°C)  | Period (minutes)  |                  |                  |   |       |      |   |                  |      |   |       |      |   |                  |      |  |
| 1                        | -40±3   | 30±3  |                  |                  |   |       |      |   |                  |      |   |       |      |   |                  |      |  |
| 2                        | Room temperature  | 15±3  |                  |                  |   |       |      |   |                  |      |   |       |      |   |                  |      |  |
| 3                        | 125±3   | 30±3  |                  |                  |   |       |      |   |                  |      |   |       |      |   |                  |      |  |
| 4                        | Room temperature  | 15±3  |                  |                  |   |       |      |   |                  |      |   |       |      |   |                  |      |  |
| High Temperature Load    | Ambient Temp: 105±2°C      Duration: 1000hrs<br>Load: Max. Allowable Voltage In AC eara.  | $ \Delta V_{1mA}/V_{1mA}  \leq 10\%$                      |                  |                  |   |       |      |   |                  |      |   |       |      |   |                  |      |  |
| Damp Heat Load           | Ambient Temp: 40±2°C, 90~95% R.H.<br>Duration: 1000hrs      Load: Max. Allowable Voltage  | No visible damage<br>$ \Delta V_{1mA}/V_{1mA}  \leq 10\%$ |                  |                  |   |       |      |   |                  |      |   |       |      |   |                  |      |  |
| Voltage Proof            | Metal balls method, 2500Vac 1 min.  | No visible damage   |                  |                  |   |       |      |   |                  |      |   |       |      |   |                  |      |  |

**Maximum Surge Current Derating Curve**





**Maximum Leakage Current and Maximum Clamping Voltage Curve**



Maximum Leakage Current and Maximum Clamping Voltage Curve



Maximum Leakage Current and Maximum Clamping Voltage Curve



**Marking Code**

- ① Brightking Logo
- ② Varistor Voltage
- ③ UL Accreditation Logo
- ④ CSA Accreditation Logo
- ⑤ VDE Accreditation Logo
- ⑥ “J” is High Surge Code, no “J” is Standard Surge
- ⑦ Disk Size
- ⑧ Product Line Code (“Y” may be A(a) thru Z(z))
- ⑨ Date Code

**Taping Dimensions**

| Symbol | Dimensions (mm)  |
|--------|------------------|
| P      | 25.4±1.0         |
| P0     | 12.7±1.0         |
| P1     | 8.95/7.7±0.7     |
| P2     | 12.7±1.3         |
| F      | 7.5±0.8/10.0±1.0 |
| h      | 0±4              |
| W      | 18.0±1.0         |
| W0     | 12.0±1.0         |
| W1     | 9.0±0.5          |
| W2     | 3.0max           |
| H      | 20.0±2.0         |
| I      | 1.0max           |
| D0     | 4.0±0.2          |
| t      | 0.6±0.3          |
| B      | 45max            |

**Quantity**

| Packaging Dimensions (Unit: mm)  | Quantity                               |
|--|--|
| <p>Exposure in bulk</p>       | 250pcs/bag<br>4bags/box<br>(180K~301K) |
|  | 200pcs/bag<br>4bags/box<br>(331K~561K) |
|  | 150pcs/bag<br>4bags/box<br>(621K~112K) |
|  | 100pcs/bag<br>4bags/box<br>(122K~182K) |
| <p>Cut the feet in bulk</p>  | 250pcs/bag<br>2bags/box<br>(180K~301K) |
|  | 200pcs/bag<br>2bags/box<br>(331K~561K) |
|  | 150pcs/bag<br>2bags/box<br>(621K~112K) |
|  | 100pcs/bag<br>2bags/box<br>(122K~182K) |
| <p>Tape &amp; Box</p>       | 400pcs/box<br>(180K~301K)              |
|  | 300pcs/box<br>(331K~561K)              |
| <p>Tape &amp; Reel</p>     | 400pcs/box<br>(180K~301K)              |
|  | 300pcs/box<br>(331K~561K)              |