

05D Series Data Sheet

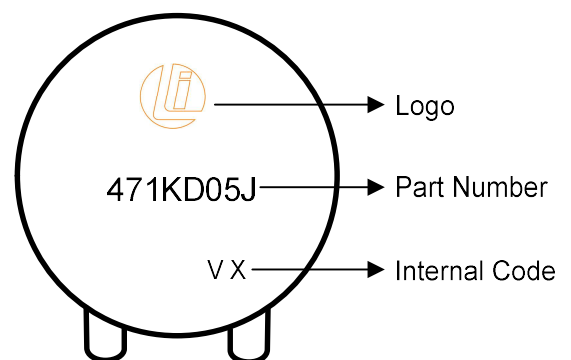
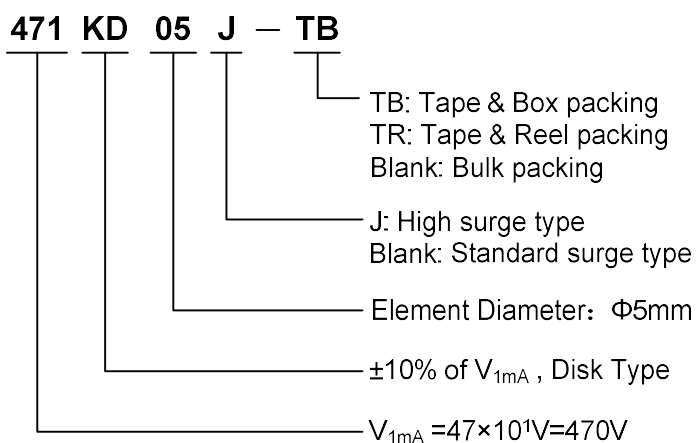
Features

- Wide operating voltage (V_{1mA}) range from 18V to 750V
- Fast responding to transient over-voltage
- Large absorbing transient energy capability
- Low clamping ratio and no follow-on current
- Meets MSL level1, per J-STD-020
- Operating temperature: $-40^{\circ}\text{C} \sim +85^{\circ}\text{C}$
- Storage Temperature: $-40^{\circ}\text{C} \sim +125^{\circ}\text{C}$

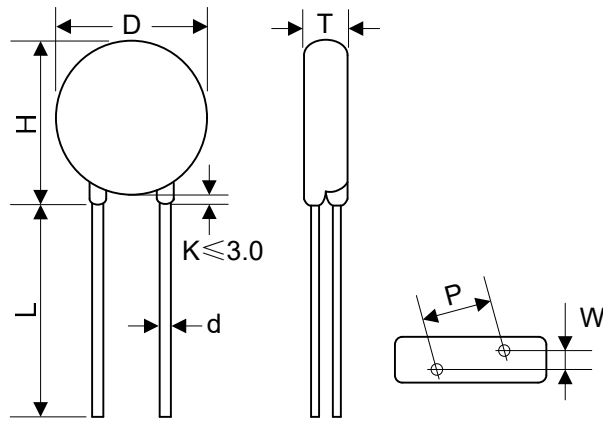
Applications

- Transistor, diode, IC, SCR or SCR 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 and Marking Code



Dimensions



Straight leads

| Item | D | H | L | d | P | T | W |
|----------------|---------|----------|-------|----------|---------|------------------------------|---|
| Dimension (mm) | 5.0~7.5 | 5.5~10.0 | ≥20.0 | 0.6±0.05 | 5.0±0.8 | Refer to the following table | |

| Model | T | W | Model | T | W | Model | T | W |
|-------|---------|---------|-------|---------|---------|-------|---------|---------|
| 180K | 1.5~4.5 | 1.3±0.8 | 121K | 1.9~4.5 | 2.0±0.8 | 391K | 2.5~5.4 | 2.6±0.8 |
| 220K | 1.6~4.6 | 1.4±0.8 | 151K | 1.7~4.8 | 1.6±0.8 | 431K | 2.7~5.7 | 2.8±0.8 |
| 270K | 1.6~4.7 | 1.6±0.8 | 181K | 1.8~4.3 | 1.7±0.8 | 471K | 2.8~6.0 | 3.0±0.8 |
| 330K | 1.7~4.9 | 1.5±0.8 | 201K | 1.9~4.4 | 1.8±0.8 | 511K | 2.9~6.2 | 3.2±0.8 |
| 390K | 1.6~4.8 | 1.6±0.8 | 221K | 2.0~4.5 | 1.9±0.8 | 561K | 3.1~6.5 | 3.4±0.8 |
| 470K | 1.7~4.9 | 1.7±0.8 | 241K | 2.1~4.6 | 2.0±0.8 | 621K | 3.3~6.5 | 3.7±0.8 |
| 560K | 1.8~5.0 | 1.9±0.8 | 271K | 2.1~4.9 | 2.2±0.8 | 681K | 3.5~6.8 | 4.0±0.8 |
| 680K | 1.9~5.2 | 2.2±0.8 | 301K | 2.2~5.0 | 2.3±0.8 | 751K | 3.8~6.9 | 4.1±0.8 |
| 820K | 1.6~4.1 | 1.6±0.8 | 331K | 2.2~5.1 | 2.3±0.8 | | | |
| 101K | 1.9~4.3 | 1.8±0.8 | 361K | 2.4~5.2 | 2.5±0.8 | | | |

Electrical Characteristics

| Model | Varistor Voltage | Maximum Allowable Voltage | | Maximum Clamping Voltage | | Surge Current | Maximum Energy (10/1000 μ s) | Maximum Leakage Current @83% of V_{1mA} | Rated Power | Typical Capacitance (Reference) |
|----------|------------------|---------------------------|--------------|--------------------------|-----------|---------------|----------------------------------|---|-------------|---------------------------------|
| | V_{1mA} (V) | V_{AC} (V) | V_{DC} (V) | I_P (A) | V_C (V) | I (A) | E (J) | I_R (μ A) | P (W) | @1KHz (pF) |
| 180KD05 | 18(15~21.6) | 11 | 14 | 1 | 40 | 100 | 0.4 | 50 | 0.01 | 1400 |
| 180KD05J | 18(15~21.6) | 11 | 14 | 1 | 40 | 250 | 0.6 | 50 | 0.01 | 1400 |
| 220KD05 | 22(19.5~26) | 14 | 18 | 1 | 48 | 100 | 0.5 | 50 | 0.01 | 1150 |
| 220KD05J | 22(19.5~26) | 14 | 18 | 1 | 48 | 250 | 0.7 | 50 | 0.01 | 1150 |
| 270KD05 | 27(24~31) | 17 | 22 | 1 | 60 | 100 | 0.6 | 50 | 0.01 | 930 |
| 270KD05J | 27(24~31) | 17 | 22 | 1 | 60 | 250 | 0.9 | 50 | 0.01 | 930 |
| 330KD05 | 33(29.5~36.5) | 20 | 26 | 1 | 73 | 100 | 0.8 | 50 | 0.01 | 760 |
| 330KD05J | 33(29.5~36.5) | 20 | 26 | 1 | 73 | 250 | 1.1 | 50 | 0.01 | 760 |
| 390KD05 | 39(35~43) | 25 | 31 | 1 | 80 | 100 | 0.9 | 50 | 0.01 | 640 |
| 390KD05J | 39(35~43) | 25 | 31 | 1 | 80 | 250 | 1.2 | 50 | 0.01 | 640 |
| 470KD05 | 47(42~52) | 30 | 38 | 1 | 104 | 100 | 1.1 | 50 | 0.01 | 530 |
| 470KD05J | 47(42~52) | 30 | 38 | 1 | 104 | 250 | 1.5 | 50 | 0.01 | 530 |
| 560KD05 | 56(50~62) | 35 | 45 | 1 | 123 | 100 | 1.3 | 50 | 0.01 | 450 |
| 560KD05J | 56(50~62) | 35 | 45 | 1 | 123 | 250 | 1.8 | 50 | 0.01 | 450 |
| 680KD05 | 68(61~75) | 40 | 56 | 1 | 145 | 100 | 1.6 | 50 | 0.01 | 370 |
| 680KD05J | 68(61~75) | 40 | 56 | 1 | 145 | 250 | 2.2 | 50 | 0.01 | 370 |
| 820KD05 | 82(74~90) | 50 | 65 | 5 | 150 | 400 | 2.5 | 25 | 0.1 | 300 |
| 820KD05J | 82(74~90) | 50 | 65 | 5 | 150 | 800 | 4.0 | 25 | 0.1 | 300 |
| 101KD05 | 100(90~110) | 60 | 85 | 5 | 177 | 400 | 3.0 | 25 | 0.1 | 250 |
| 101KD05J | 100(90~110) | 60 | 85 | 5 | 177 | 800 | 4.1 | 25 | 0.1 | 250 |
| 121KD05 | 120(108~132) | 75 | 100 | 5 | 210 | 400 | 4.0 | 25 | 0.1 | 210 |
| 121KD05J | 120(108~132) | 75 | 100 | 5 | 210 | 800 | 4.9 | 25 | 0.1 | 210 |
| 151KD05 | 150(135~165) | 95 | 125 | 5 | 260 | 400 | 4.1 | 25 | 0.1 | 165 |
| 151KD05J | 150(135~165) | 95 | 125 | 5 | 260 | 800 | 6.5 | 25 | 0.1 | 165 |
| 181KD05 | 180(162~198) | 115 | 150 | 5 | 320 | 400 | 4.9 | 25 | 0.1 | 140 |
| 181KD05J | 180(162~198) | 115 | 150 | 5 | 320 | 800 | 7.5 | 25 | 0.1 | 140 |
| 201KD05 | 200(180~220) | 130 | 170 | 5 | 355 | 400 | 6.5 | 25 | 0.1 | 125 |
| 201KD05J | 200(180~220) | 130 | 170 | 5 | 355 | 800 | 8.5 | 25 | 0.1 | 125 |

Electrical Characteristics

| Model | Varistor Voltage | Maximum Allowable Voltage | | Maximum Clamping Voltage | | Surge Current | Maximum Energy (10/1000 μ s) | Maximum Leakage Current @83% of V_{1mA} | Rated Power | Typical Capacitance (Reference) |
|----------|------------------|---------------------------|--------------|--------------------------|-----------|---------------|----------------------------------|---|-------------|---------------------------------|
| | V_{1mA} (V) | V_{AC} (V) | V_{DC} (V) | I_P (A) | V_C (V) | I (A) | E (J) | I_R (μ A) | P (W) | @1KHz (pF) |
| 221KD05 | 220(198~242) | 140 | 180 | 5 | 380 | 400 | 7.5 | 25 | 0.1 | 110 |
| 221KD05J | 220(198~242) | 140 | 180 | 5 | 380 | 800 | 9.0 | 25 | 0.1 | 110 |
| 241KD05 | 240(216~264) | 150 | 200 | 5 | 415 | 400 | 8.0 | 25 | 0.1 | 100 |
| 241KD05J | 240(216~264) | 150 | 200 | 5 | 415 | 800 | 10.5 | 25 | 0.1 | 100 |
| 271KD05 | 270(243~297) | 175 | 225 | 5 | 475 | 400 | 8.5 | 25 | 0.1 | 95 |
| 271KD05J | 270(243~297) | 175 | 225 | 5 | 475 | 800 | 11.0 | 25 | 0.1 | 95 |
| 301KD05 | 300(270~330) | 190 | 250 | 5 | 520 | 400 | 9.0 | 25 | 0.1 | 85 |
| 301KD05J | 300(270~330) | 190 | 250 | 5 | 520 | 800 | 12.0 | 25 | 0.1 | 85 |
| 331KD05 | 330(297~363) | 210 | 275 | 5 | 570 | 400 | 9.5 | 25 | 0.1 | 75 |
| 331KD05J | 330(297~363) | 210 | 275 | 5 | 570 | 800 | 13.0 | 25 | 0.1 | 75 |
| 361KD05 | 360(324~396) | 230 | 300 | 5 | 620 | 400 | 10.0 | 25 | 0.1 | 70 |
| 361KD05J | 360(324~396) | 230 | 300 | 5 | 620 | 800 | 16.0 | 25 | 0.1 | 70 |
| 391KD05 | 390(351~429) | 250 | 320 | 5 | 675 | 400 | 12.0 | 25 | 0.1 | 65 |
| 391KD05J | 390(351~429) | 250 | 320 | 5 | 675 | 800 | 17.0 | 25 | 0.1 | 65 |
| 431KD05 | 430(387~473) | 275 | 350 | 5 | 745 | 400 | 13.0 | 25 | 0.1 | 60 |
| 431KD05J | 430(387~473) | 275 | 350 | 5 | 745 | 800 | 20.0 | 25 | 0.1 | 60 |
| 471KD05 | 470(423~517) | 300 | 385 | 5 | 810 | 400 | 15.0 | 25 | 0.1 | 55 |
| 471KD05J | 470(423~517) | 300 | 385 | 5 | 810 | 800 | 21.0 | 25 | 0.1 | 55 |
| 511KD05 | 510(459~561) | 320 | 415 | 5 | 845 | 400 | 16.0 | 25 | 0.1 | 50 |
| 511KD05J | 510(459~561) | 320 | 415 | 5 | 845 | 800 | 22.5 | 25 | 0.1 | 50 |
| 561KD05 | 560(504~616) | 350 | 460 | 5 | 920 | 400 | 16.8 | 25 | 0.1 | 45 |
| 561KD05J | 560(504~616) | 350 | 460 | 5 | 920 | 800 | 24.0 | 25 | 0.1 | 45 |
| 621KD05 | 620(558~682) | 385 | 505 | 5 | 1025 | 400 | 17.7 | 25 | 0.1 | 40 |
| 621KD05J | 620(558~682) | 385 | 505 | 5 | 1025 | 800 | 25.0 | 25 | 0.1 | 40 |
| 681KD05 | 680(612~748) | 420 | 560 | 5 | 1120 | 400 | 21.0 | 25 | 0.1 | 35 |
| 681KD05J | 680(612~748) | 420 | 560 | 5 | 1120 | 800 | 29.0 | 25 | 0.1 | 35 |
| 751KD05 | 750(675~825) | 460 | 615 | 5 | 1240 | 400 | 22.4 | 25 | 0.1 | 30 |
| 751KD05J | 750(675~825) | 460 | 615 | 5 | 1240 | 800 | 32.0 | 25 | 0.1 | 30 |

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. | | To meet the Specified value | |
| 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. Applied waveform: 8/20μs | | | |
| Surge Current | The maximum current within the varistor voltage change of ±10% with the standard impulse current (8/20μs) applied one time. | | | |
| Energy | The maximum energy within the varistor voltage change of ±10% when one impulse of 10/1000μs is applied. | | | |
| Leakage Current | The current through the varistor when 0.83V _{1mA} is applied to both end. | | | |
| Rated Power | The maximum average power that can be applied within the specified ambient temperature. | | | |
| 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 $ | | ≤0.05%/°C | |
| | $\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 $ | | | |
| Surge Life | The change of V _{1mA} shall be measured after the impulse listed below which is applied 10,000 times continuously with the interval of ten seconds at room temperature. | | ΔV _{1mA} /V _{1mA} ≤10% | |
| | 05D series | 180K to 680K | | 10A (8/20μs) |
| | | 820K to 751K | | 20A (8/20μs) |

Mechanical Characteristics and Reliability

| Items | Test conditions / Methods | | Specifications | |
|-------------------------------|---|------------------|---|--|
| Tensile Strength of Terminals | Gradually applying the force specified and keeping the unit fixed for 10±1 sec. | | No visible damage $ \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 | | |
| 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. | | No visible damage $ \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 | | |
| Vibration | Frequency range: 10~55 Hz Amplitude: 0.75mm or 98m/s ² Direction: 3 mutually perpendicular directions, 2hrs each. | | No visible damage $ \Delta V_{1mA}/V_{1mA} \leq 5\%$ | |
| | Solder Temp: 245±5°C Dipping Time: 2±0.5 sec | | | |
| Solder ability | Solder Temp: 245±5°C 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 Dipping Time: 10±1 sec | | No visible damage $ \Delta V_{1mA}/V_{1mA} \leq 10\%$ | |
| High Temperature Storage | Ambient Temp: 125±2°C Duration: 1000hrs | | $ \Delta V_{1mA}/V_{1mA} \leq 5\%$ | |
| Low Temperature Storage | Ambient Temp: -40±2°C Duration: 1000hrs | | $ \Delta V_{1mA}/V_{1mA} \leq 5\%$ | |
| Humidity | Ambient Temp: 40±2°C, 90~95% R.H. Duration: 1000hrs | | $ \Delta V_{1mA}/V_{1mA} \leq 5\%$ | |
| Temperature Cycle | The conditions shown below shall be repeated 5 cycles | | | No visible damage $ \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 | |
| High Temperature Load | Ambient Temp: 85±2°C Duration: 1000hrs Load: Max. Allowable Voltage In AC eara. | | $ \Delta V_{1mA}/V_{1mA} \leq 10\%$ | |
| | Ambient Temp: 40±2°C, 90~95% R.H. Duration: 1000hrs Load: Max. Allowable Voltage | | | |
| Damp Heat Load | Ambient Temp: 40±2°C, 90~95% R.H. Duration: 1000hrs Load: Max. Allowable Voltage | | No visible damage $ \Delta V_{1mA}/V_{1mA} \leq 10\%$ | |
| Voltage Proof | Metal balls method, 2500Vac 1 min. | | No visible damage | |

Soldering Recommendation

Wave Lead Free Soldering Recommendation



Peak Temperature: 265°C
 Dipping Time: 10 seconds (max.)
 Soldering: 1 time

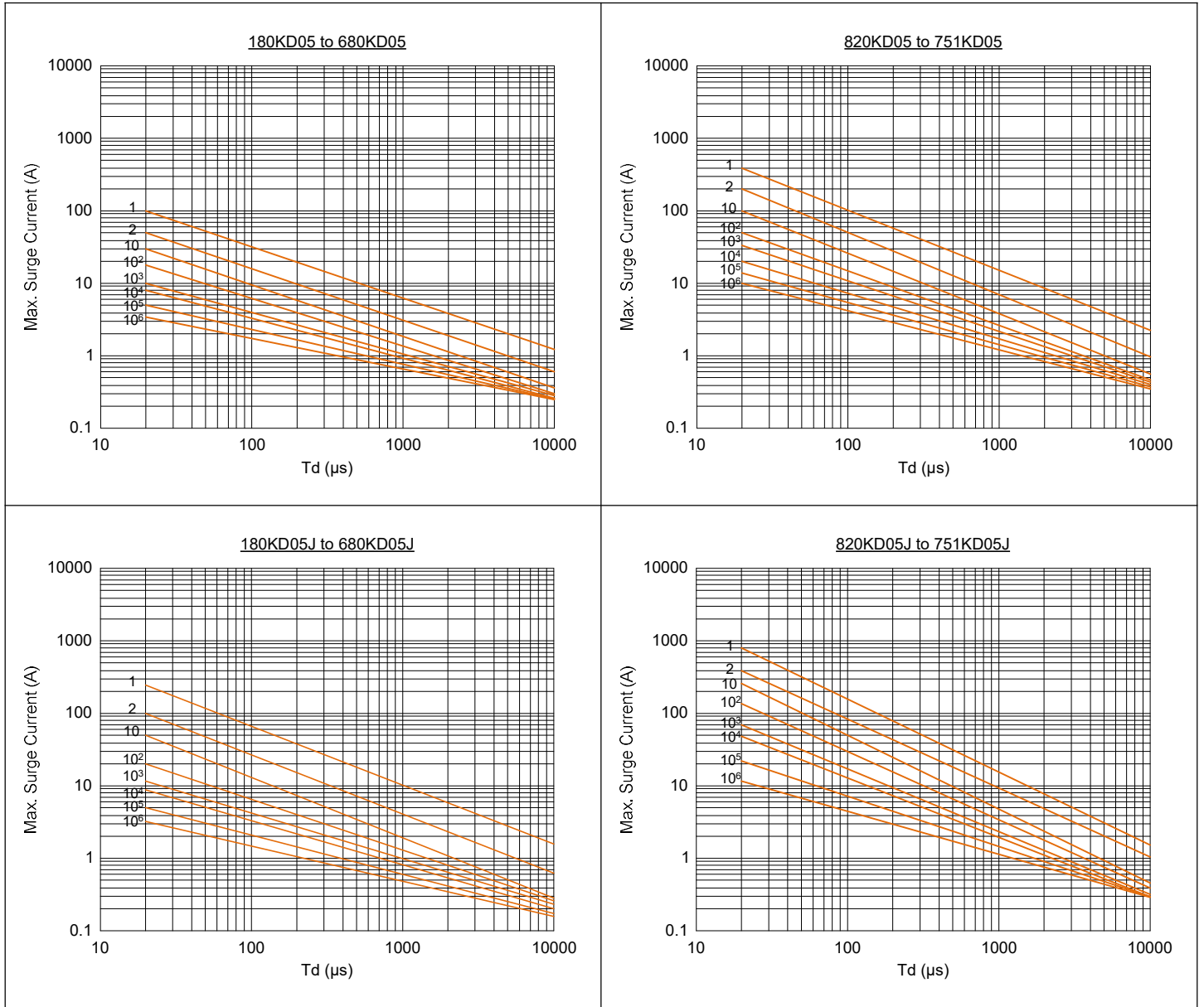
Recommendation Reworking Conditions with Soldering Iron

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

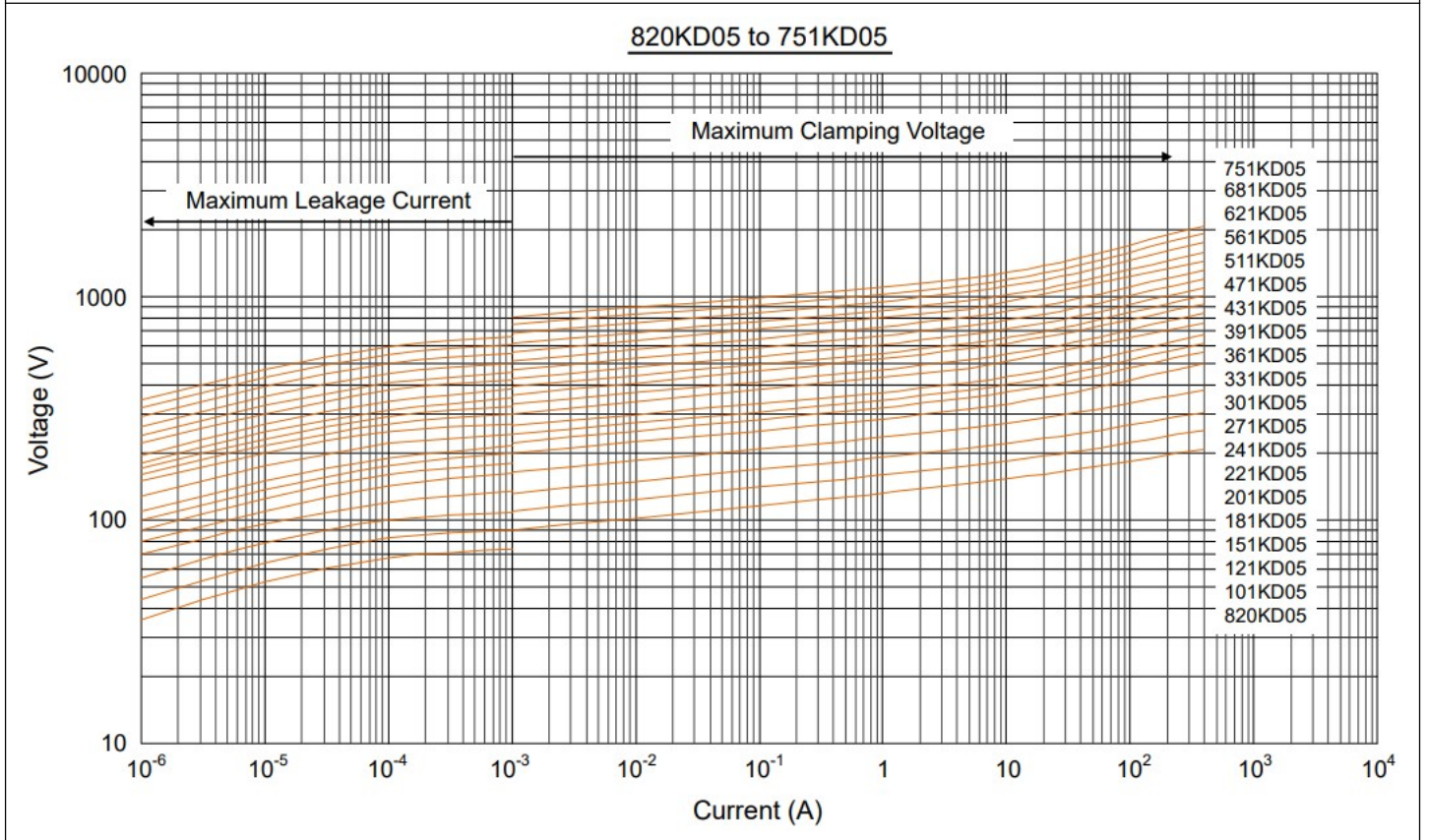
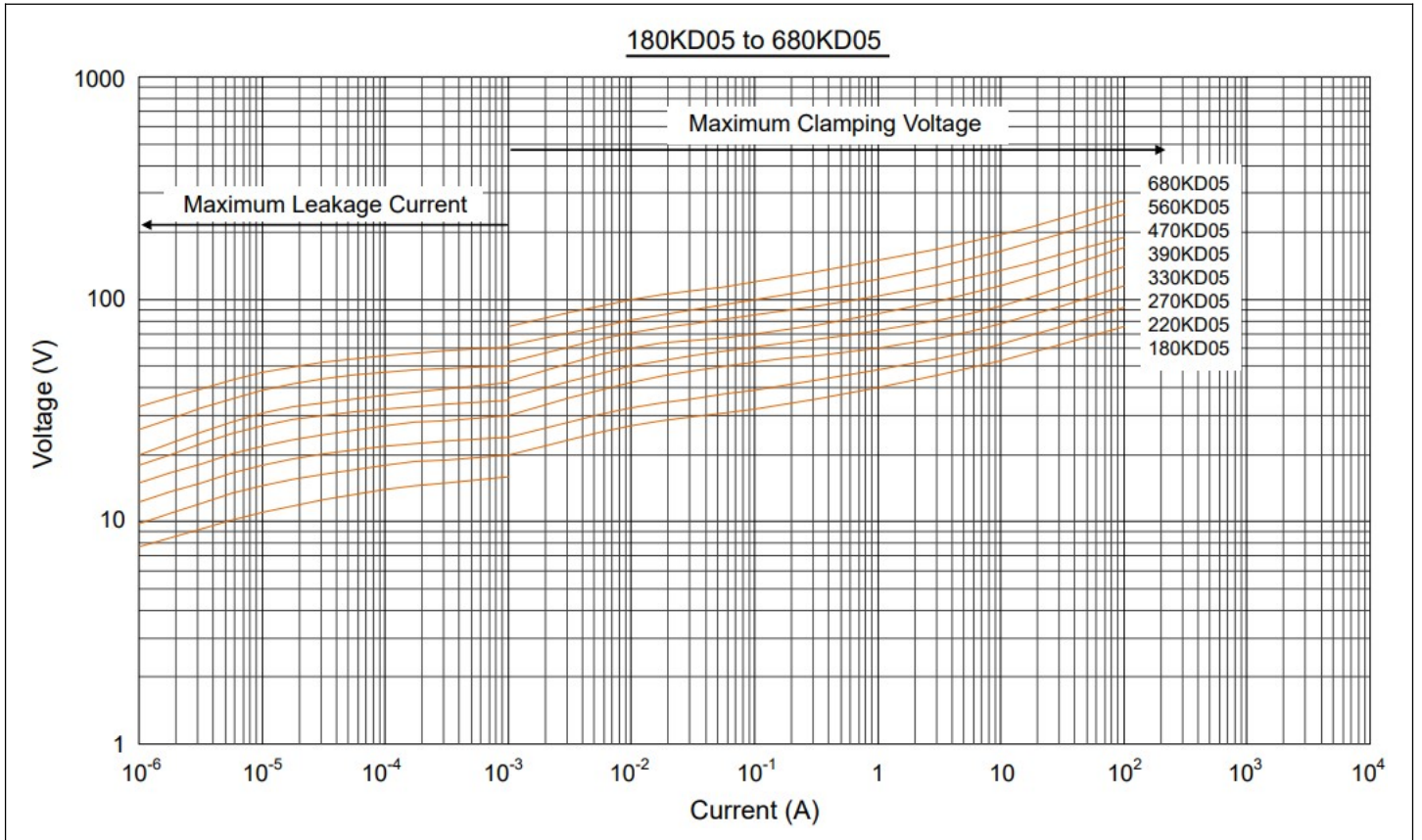
Power Derating Curve



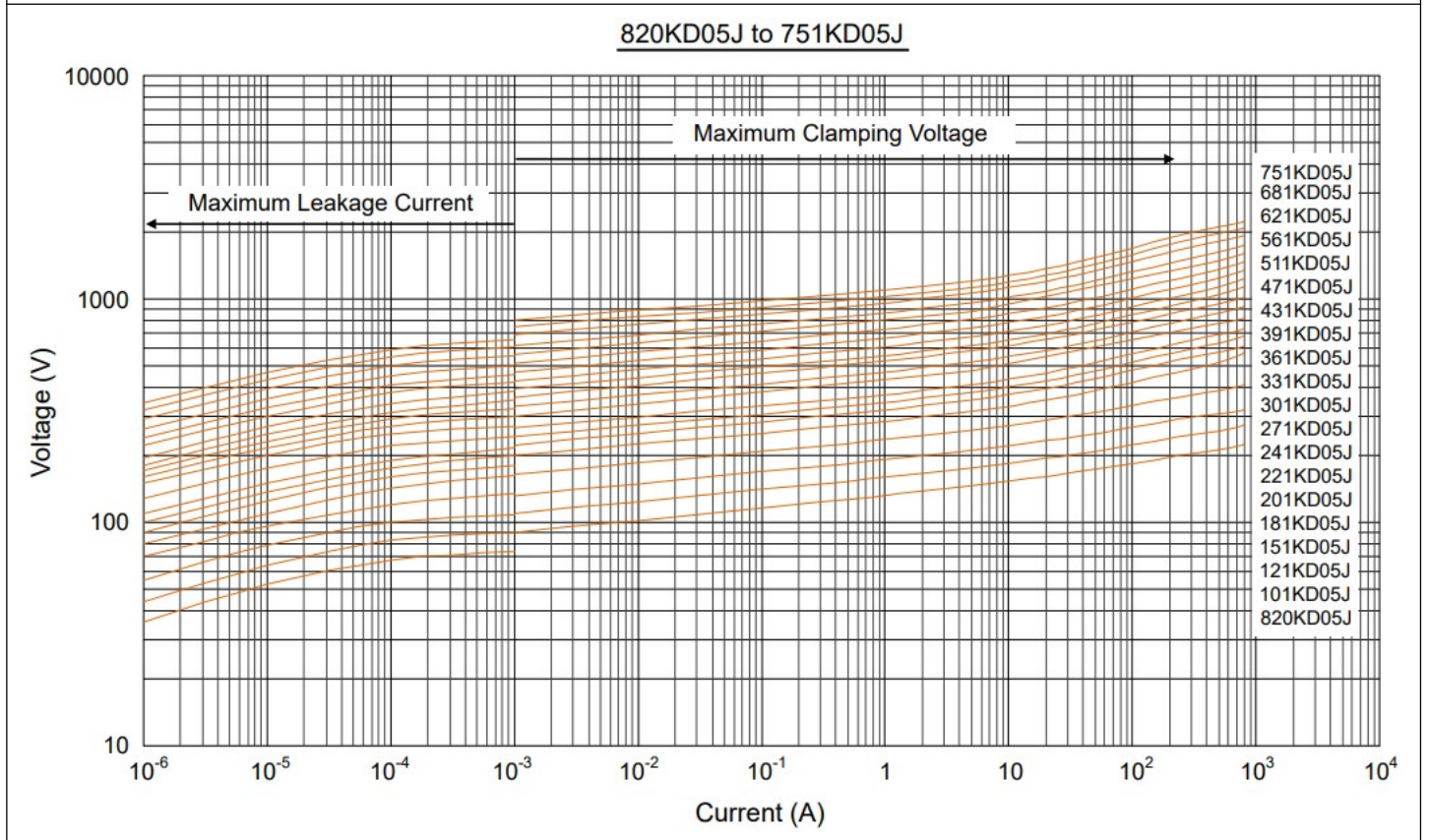
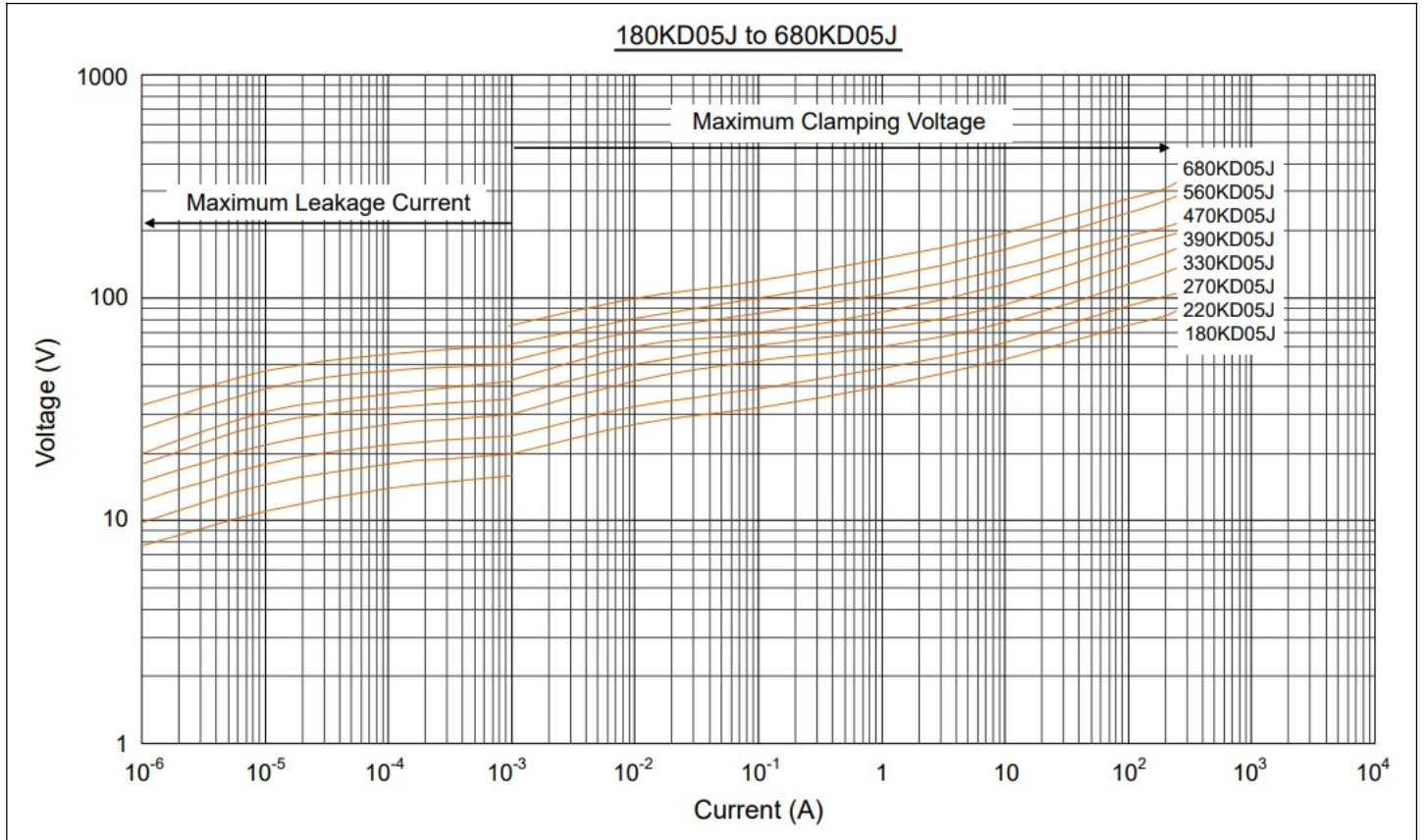
Maximum Surge Current Derating Curve



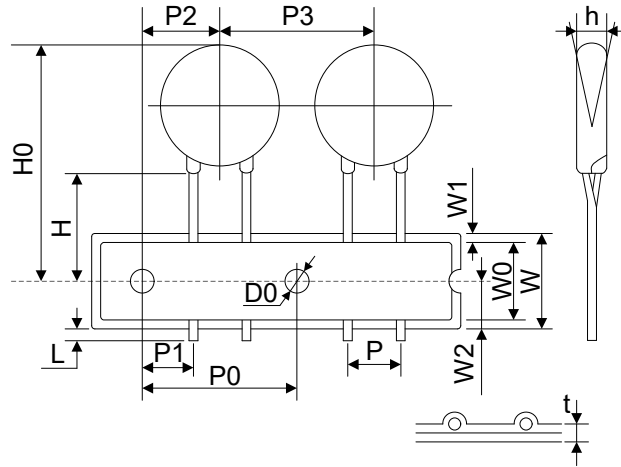
Maximum Leakage Current and Maximum Clamping Voltage Curve



Maximum Leakage Current and Maximum Clamping Voltage Curve

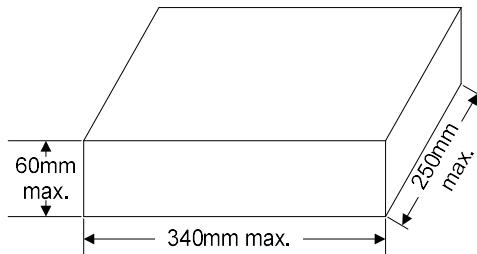


Taping Packaging

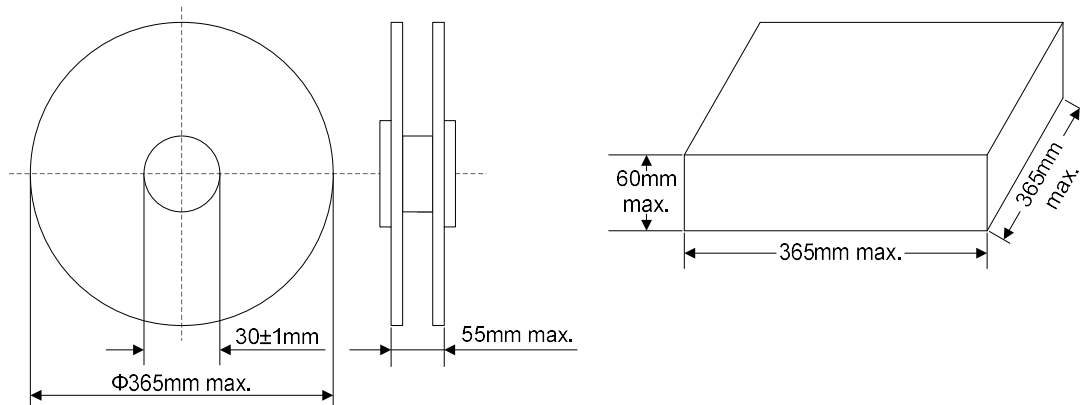


| | | | | | | | | |
|----------------|---------|----------|----------|----------|----------|----------|----------|---------|
| Item | P | P0 | P1 | P2 | P3 | W | W0 | W1 |
| Dimensions(mm) | 5.0±0.8 | 12.7±0.3 | 3.85±0.7 | 6.35±1.3 | 12.7±1.0 | 18.0±1.0 | 12.0±1.0 | 3.0max. |
| Item | W2 | H | H0 | D0 | L | h | t | |
| Dimensions(mm) | 9.0±0.5 | 20.0±2.0 | 32max. | 4.0±0.2 | 1.0max. | 0±2 | 0.6±0.3 | |

Tape & Box



Tape & Reel



Quantity

| Packaging | Model | Quantity | |
|-------------|-----------|--------------|------------|
| Bulk | 180K~751K | 1000pcs/bag | 2 bags/box |
| Tape & Box | 180K~391K | 1500pcs/box | / |
| | 431K~751K | 1000pcs/box | / |
| Tape & Reel | 180K~391K | 2000pcs/reel | 1 reel/box |
| | 431K~751K | 1500pcs/reel | 1 reel/box |

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