

Varistor: TVG Series

Varistor and Gas Tube Integrated Over-Voltage Protector



■ Features

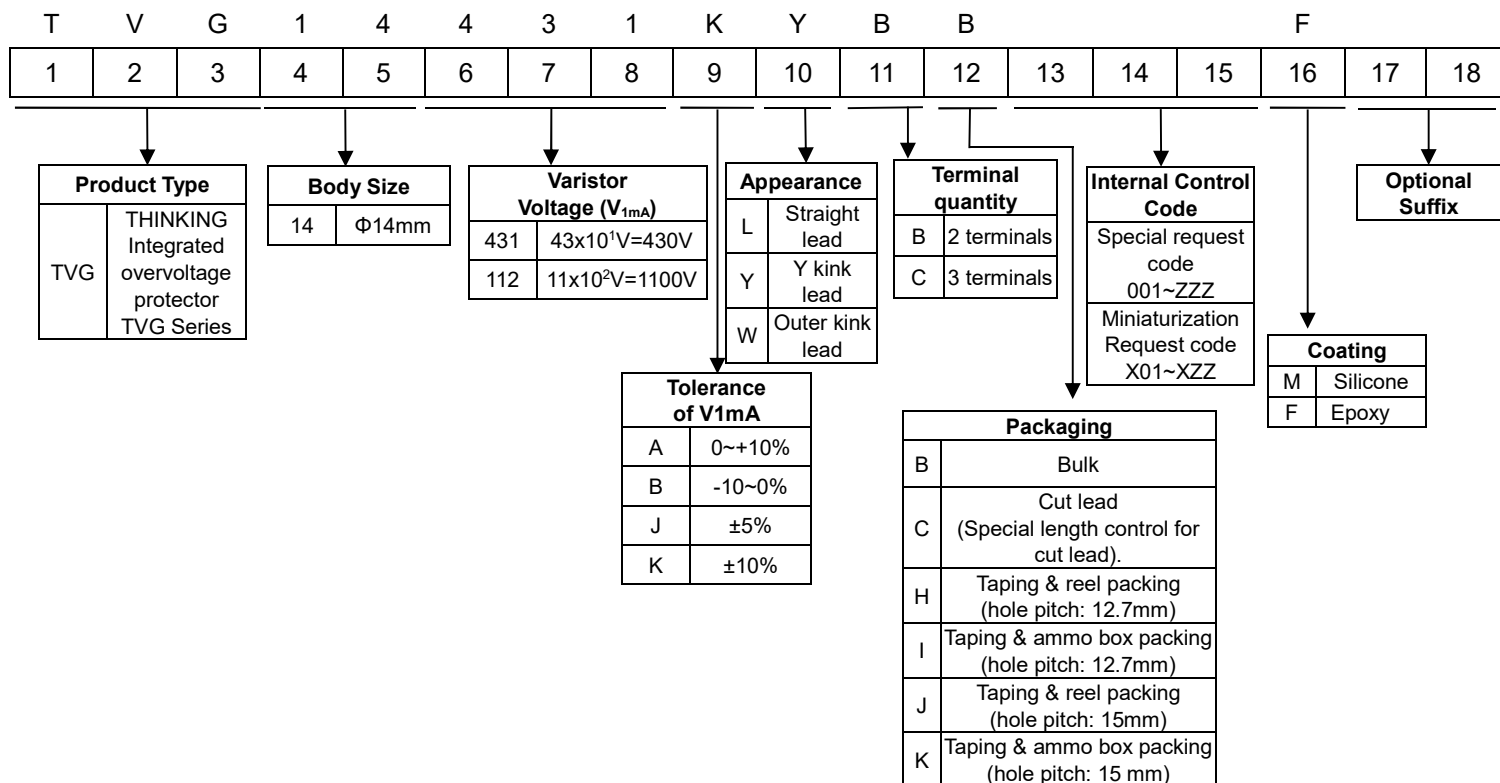
1. Hybrid design
2. Low leakage, low capacitance, and bidirectional protection
3. Body size: $\Phi 14\text{mm}$
4. High performance
(TVG14 is equivalent to TVR14-U Series: I_{max} : 10kA ; I_{n} : 5kA)
5. Agency recognition: TVG14 is approved by UL & TUV
6. RoHS compliant and Halogen-free
7. Operating temperature range: $-40^{\circ}\text{C} \sim +125^{\circ}\text{C}$
8. Storage temperature range: $-40^{\circ}\text{C} \sim +125^{\circ}\text{C}$



■ Recommended Applications

1. Solar inverter, energy storage system, EV charging station
2. Premium power supply, uninterruptable power supply (UPS), power distribution system, battery-powered equipment
3. Industrial equipment, smart meter, smart motor drive and control
4. Smart home appliance, high-end consumer electronics
5. Telecommunication equipment, power line communication system

■ Part Number Code



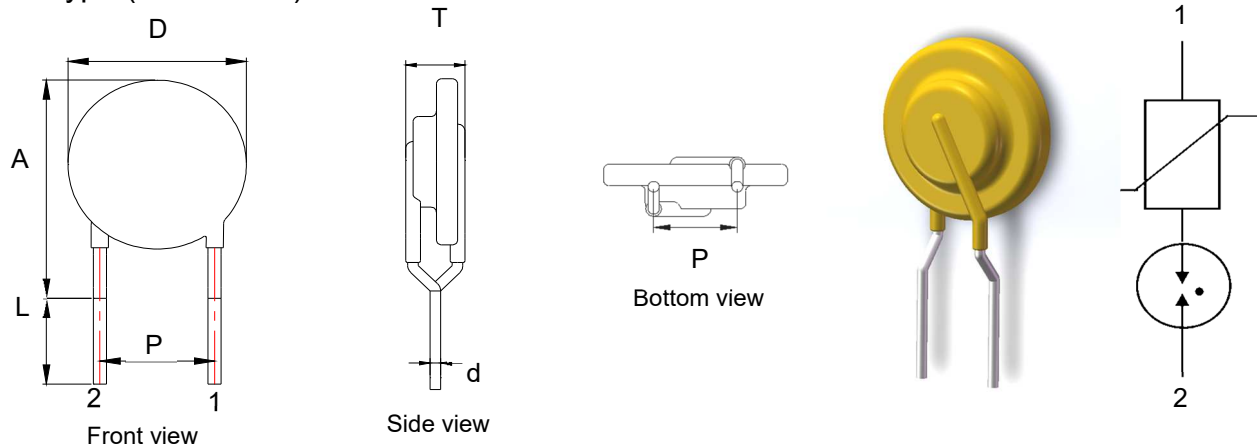
Varistor: TVG Series

Varistor and Gas Tube Integrated Over-Voltage Protector



■ Structure and Dimensions (Coating Structure)

- Y type (Y kink lead)



(Unit:mm)

| Series | D | Amax | P | Φd | Lmin | Tmax |
|-----------|--------|------|-------|----------|------|--|
| TVG14*KY* | 16.5±2 | 23 | 7.5±1 | 1.0±0.05 | 16 | Please Refer to Electrical Characteristics |

Varistor: TVG Series

Varistor and Gas Tube Integrated Over-Voltage Protector



■ Electrical Characteristics 14mm Series (Coating structure)



| Part No. | Max. Continuous Voltage | | Varistor Voltage (±10%) | GDT Voltage (±20%) | Nominal Discharge Current (8/20µs) | Max Discharge Current (8/20µs) | Max. Clamping Voltage@ I _c (8/20µs) | | Combination wave 1.2/50-8/20µs 10kV/5kA | Max. Energy (10/1000µs) | Max. Capacitance (1MHz) | Dimension |
|----------|-------------------------|-----|-------------------------|---------------------|------------------------------------|--------------------------------|--|----------------|---|-------------------------|-------------------------|------------------|
| | AC (ms) | DC | V _{1mA} | V _{100V/S} | I _n /15 times | I _{max} /1 time | V _c | I _c | Time | W _{max} | C | T _{max} |
| | (V) | (V) | (V) | (V) | (A) | (A) | (V) | (A) | -- | (J) | (pF) | (mm) |
| TVG14201 | 150 | 200 | 200 | 600 | 5000 | 10000 | 340 | 100 | 40 | 140 | 4 | 8.7 |
| TVG14221 | 175 | 225 | 220 | 600 | 5000 | 10000 | 360 | 100 | 40 | 154 | 4 | 8.9 |
| TVG14241 | 195 | 250 | 240 | 600 | 5000 | 10000 | 395 | 100 | 40 | 168 | 4 | 8.9 |
| TVG14271 | 215 | 275 | 270 | 600 | 5000 | 10000 | 455 | 100 | 40 | 190 | 4 | 9.1 |
| TVG14301 | 230 | 300 | 300 | 600 | 5000 | 10000 | 500 | 100 | 40 | 210 | 4 | 9.2 |
| TVG14331 | 250 | 320 | 330 | 600 | 5000 | 10000 | 550 | 100 | 40 | 228 | 4 | 9.4 |
| TVG14361 | 275 | 350 | 360 | 600 | 5000 | 10000 | 595 | 100 | 40 | 255 | 4 | 9.5 |
| TVG14391 | 300 | 385 | 390 | 600 | 5000 | 10000 | 650 | 100 | 40 | 275 | 4 | 9.6 |
| TVG14431 | 320 | 420 | 430 | 600 | 5000 | 10000 | 710 | 100 | 40 | 303 | 4 | 9.9 |
| TVG14471 | 350 | 450 | 470 | 1000 | 5000 | 10000 | 775 | 100 | 40 | 350 | 4 | 10.1 |
| TVG14511 | 395 | 510 | 510 | 1000 | 5000 | 10000 | 845 | 100 | 40 | 382 | 4 | 10.3 |
| TVG14561 | 420 | 560 | 560 | 1000 | 5000 | 10000 | 930 | 100 | 40 | 382 | 4 | 10.5 |
| TVG14621 | 465 | 615 | 620 | 1000 | 5000 | 10000 | 1020 | 100 | 40 | 382 | 4 | 10.9 |
| TVG14681 | 510 | 670 | 680 | 1000 | 5000 | 10000 | 1120 | 100 | 40 | 382 | 4 | 11.2 |
| TVG14751 | 550 | 745 | 750 | 1000 | 5000 | 10000 | 1235 | 100 | 40 | 420 | 4 | 11.0 |

Varistor: TVG Series

Varistor and Gas Tube Integrated Over-Voltage Protector

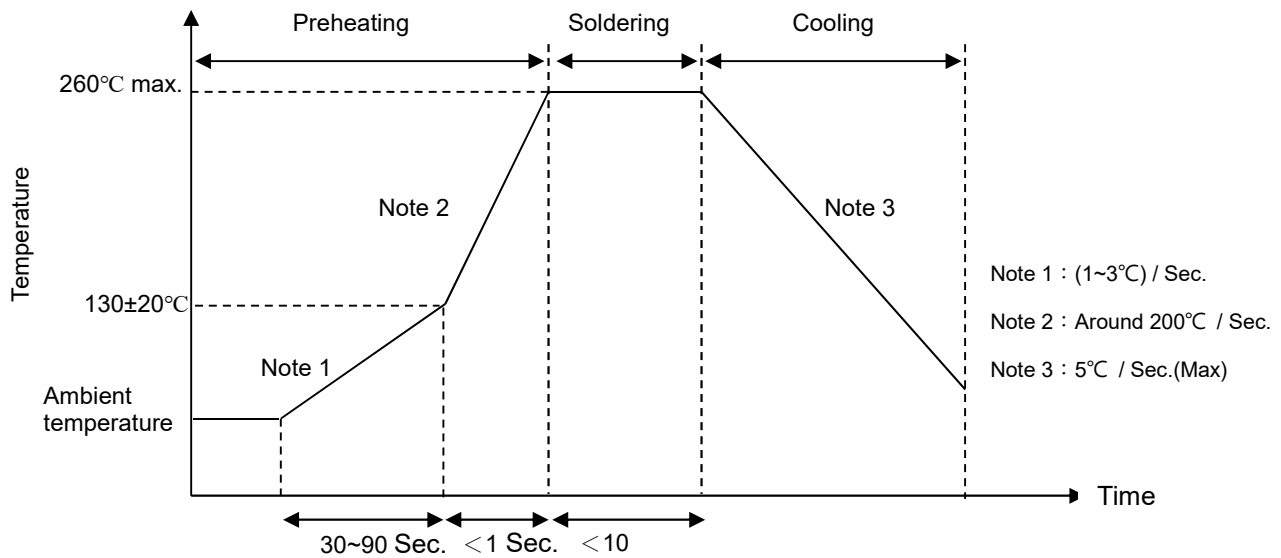


■ Safety Approvals

| Certified Model No. | Agency | |
|---------------------|---|---|
| |  |  |
| | UL1449 5 th & cUL | EN IEC 61051-1:2018 IEC 61051-2-2:1991+A1 IEC 61051-2:2021 EN IEC 61051-2:2021 |
| | E314979 | J50626170 |
| TVG14201 | | √ |
| TVG14221 | | √ |
| TVG14241 | √ | √ |
| TVG14271 | √ | √ |
| TVG14301 | √ | √ |
| TVG14331 | √ | √ |
| TVG14361 | √ | √ |
| TVG14391 | √ | √ |
| TVG14431 | √ | √ |
| TVG14471 | √ | √ |
| TVG14511 | √ | √ |
| TVG14561 | √ | √ |
| TVG14621 | √ | √ |
| TVG14681 | √ | √ |
| TVG14751 | √ | √ |

■ Recommended Soldering Conditions

● Wave Soldering Profile



● Recommended Reworking Conditions with Soldering Iron

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

Varistor: TVG Series

Varistor and Gas Tube Integrated Over-Voltage Protector



■ Reliability

| Item | Standard | Test conditions / Methods | Specifications | | | | | | | | | | | | | | | |
|------------------------------------|----------------------------|--|---|------------------|------------------|-----|------------|----------|---------------------------------|------------------|-----|---|---------|----------|---|------------------|-----|----------------------------------|
| Tensile Strength of Lead Terminals | IEC61051-1 (IEC60068-2) | Gradually apply the specified force and keep the unit fixed for 10±1 sec. <table border="1" style="margin-left: auto; margin-right: auto;"> <tr> <td style="text-align: center;">Terminal diameter (mm)</td> <td style="text-align: center;">Force (Kg)</td> </tr> <tr> <td style="text-align: center;">0.5<d≤0.8</td> <td style="text-align: center;">1.0</td> </tr> <tr> <td style="text-align: center;">0.8<d≤1.25</td> <td style="text-align: center;">2.0</td> </tr> </table> | Terminal diameter (mm) | Force (Kg) | 0.5<d≤0.8 | 1.0 | 0.8<d≤1.25 | 2.0 | ΔV/V ≤ ±5% No visible damage | | | | | | | | | |
| Terminal diameter (mm) | Force (Kg) | | | | | | | | | | | | | | | | | |
| 0.5<d≤0.8 | 1.0 | | | | | | | | | | | | | | | | | |
| 0.8<d≤1.25 | 2.0 | | | | | | | | | | | | | | | | | |
| Bending Strength of Terminals | IEC61051-1 (IEC60068-2) | 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. <table border="1" style="margin-left: auto; margin-right: auto;"> <tr> <td style="text-align: center;">Terminal diameter (mm)</td> <td style="text-align: center;">Force (Kg)</td> </tr> <tr> <td style="text-align: center;">0.5<d≤0.8</td> <td style="text-align: center;">0.5</td> </tr> <tr> <td style="text-align: center;">0.8<d≤1.25</td> <td style="text-align: center;">1.0</td> </tr> </table> | Terminal diameter (mm) | Force (Kg) | 0.5<d≤0.8 | 0.5 | 0.8<d≤1.25 | 1.0 | ΔV/V ≤ ±5% No visible damage | | | | | | | | | |
| Terminal diameter (mm) | Force (Kg) | | | | | | | | | | | | | | | | | |
| 0.5<d≤0.8 | 0.5 | | | | | | | | | | | | | | | | | |
| 0.8<d≤1.25 | 1.0 | | | | | | | | | | | | | | | | | |
| Voltage Proof | IEC61051-1 | Metal balls method, 2500 V _{ac} , 1min | No breakdown | | | | | | | | | | | | | | | |
| High Temp. Load | IEC61051-1 | +125°C, 1000±24hrs at V _{DC} or V _{rms} (Max. Operatng Voltage) | ΔV/Vc ≤ ±10% No visible damage | | | | | | | | | | | | | | | |
| High Temperature Storage | IEC60068-2 | 125±2°C x 1000± 24 hrs | ΔV/Vc ≤ ±5% No visible damage | | | | | | | | | | | | | | | |
| Damp Heat, Steady State | IEC61051-1 (IEC60068-2) | Testing divided into two groups: a. and b. groups. a. 40±2°C, 90 ~ 95 % RH, 1344 hrs b. 40±2°C, 90 ~ 95 % RH, at 10%Vdc, 1344 hrs | ΔV/Vc ≤ ±5% No visible damage | | | | | | | | | | | | | | | |
| Vibration | IEC61051-1 (IEC60068-2) | Frequency range:10~55Hz Amplitude:0.75mm or 98m/S2 Direction: 3 mutually perpendicular directions, 2hrs each. | ΔV/Vc ≤ ±5% No visible damage | | | | | | | | | | | | | | | |
| 10/1000μs Surge Life | IEC61051-1 (IEC60060-2) | Single current pulse with 2ms rectangular wave shape or 10/1000μs wave shape | ΔV/Vc ≤ ±10% No visible damage | | | | | | | | | | | | | | | |
| Solderability | IEC61051-1 | 245±3°C, 3±0.3 sec | At least 95% of terminal electrode is covered by new solder | | | | | | | | | | | | | | | |
| Resistance to Soldering Heat | IEC61051-1 | 260°C ± 5°C, 10 ± 1 sec | ΔV/Vc ≤ ±5% No visible damage | | | | | | | | | | | | | | | |
| Rapid Change of Temperature | IEC61051-1 (IEC60068-2) | The conditions shown below shall be repeated 5 cycles <table border="1" style="margin-left: auto; margin-right: auto;"> <thead> <tr> <th>Step</th> <th>Temperature (°C)</th> <th>Period (minutes)</th> </tr> </thead> <tbody> <tr> <td style="text-align: center;">1</td> <td style="text-align: center;">-40±3°C</td> <td style="text-align: center;">30±3 min</td> </tr> <tr> <td style="text-align: center;">2</td> <td style="text-align: center;">Room temperature</td> <td style="text-align: center;">≤ 3</td> </tr> <tr> <td style="text-align: center;">3</td> <td style="text-align: center;">125±2°C</td> <td style="text-align: center;">30±3 min</td> </tr> <tr> <td style="text-align: center;">4</td> <td style="text-align: center;">Room temperature</td> <td style="text-align: center;">≤ 3</td> </tr> </tbody> </table> | Step | Temperature (°C) | Period (minutes) | 1 | -40±3°C | 30±3 min | 2 | Room temperature | ≤ 3 | 3 | 125±2°C | 30±3 min | 4 | Room temperature | ≤ 3 | ΔV/Vc ≤ ±5% No visible damage |
| Step | Temperature (°C) | Period (minutes) | | | | | | | | | | | | | | | | |
| 1 | -40±3°C | 30±3 min | | | | | | | | | | | | | | | | |
| 2 | Room temperature | ≤ 3 | | | | | | | | | | | | | | | | |
| 3 | 125±2°C | 30±3 min | | | | | | | | | | | | | | | | |
| 4 | Room temperature | ≤ 3 | | | | | | | | | | | | | | | | |

Varistor: TVG Series

Varistor and Gas Tube Integrated Over-Voltage Protector



| | | | |
|-------------------------------------|------------|--|---|
| Flammability Test | IEC61051-1 | Perform needle flame test: 1) The flame is positioned on: the vertical of the resistor. 2) Flame duration: 10s. | Permissible duration: 5 sec Max. |
| 8/20 μ S Nominal Discharge Test | UL1449 | 8/20 μ s waveform, 1n, 15 times (Surges should be applied in 3 groups of 5 surges, interval 1min between surges, after each group of 5 surges, the sample shall rest for 30 min.) | $\Delta V/V_c \leq \pm 10\%$ No visible damage |
| Combination pulse | IEC61051-1 | 10kV/5kA coupled with the maximum Vac, interval 60S, ± 5 times, 40 times in total (at 0, 90, 180, and 270 degree) | No visible damage |

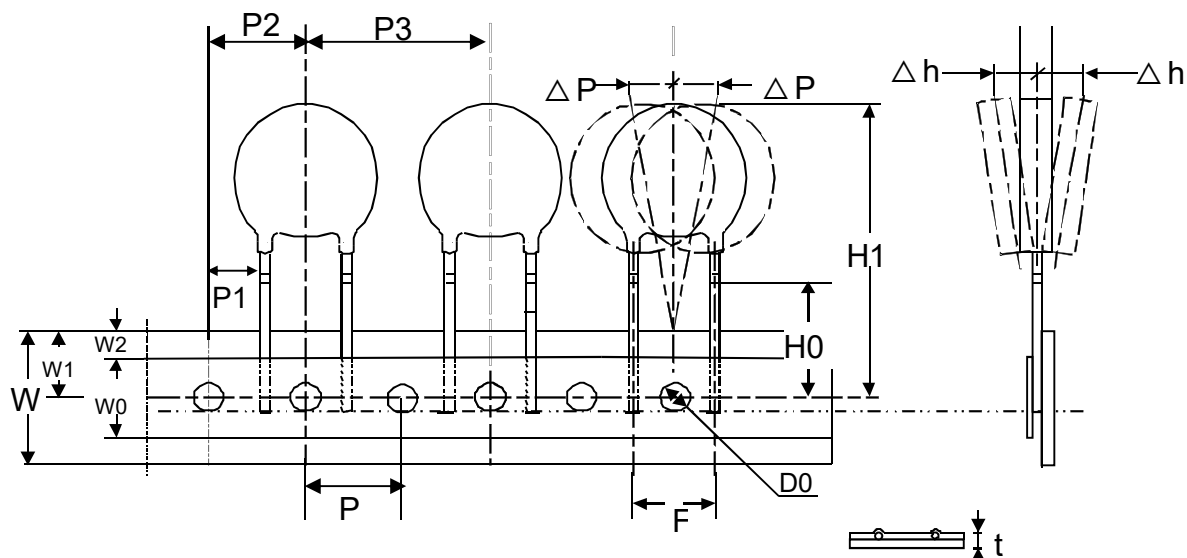
Varistor: TVG Series

Varistor and Gas Tube Integrated Over-Voltage Protector



■ Packaging

● Taping Specification



(Unit: mm)

| Taping Code | Body Size | P0 | F | P1 | P2 | P3 | H0 | H1 | W0 | W1 | W2 | W | ΔP | Δh | D0 | D | t |
|-------------|-----------|------|-----|------|------|------|------|-----|------|----------------|-----|----|-----|-----|------|-------|------|
| | | ±0.3 | ±1 | ±1 | ±1.3 | ±1 | ±0.5 | Max | ±1.5 | +0.75 /-0.5 | Max | ±1 | Max | Max | ±0.2 | ±0.05 | ±0.2 |
| TVG14 | AR | 12.7 | 7.5 | 8.45 | 12.7 | 25.4 | 16 | 40 | 12 | 9 | 3 | 18 | 1.0 | 2.0 | 4 | 1.0 | 0.6 |

Varistor: TVG Series

Varistor and Gas Tube Integrated Over-Voltage Protector

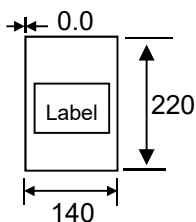


Quantity

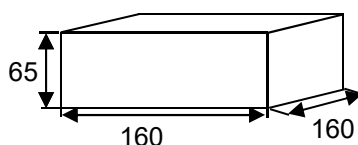
Bulk Packing

| Series | pcs/bag | bag /box | box /case | pcs /carton |
|--------|---------|----------|-----------|-------------|
| TVG14 | 50 | 3 | 8 | 1200 |

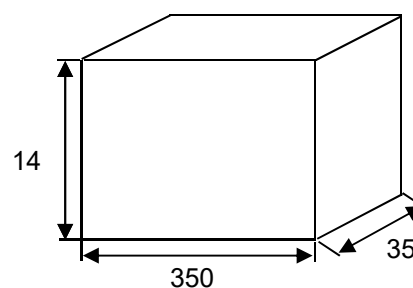
Inner bag



Inner box



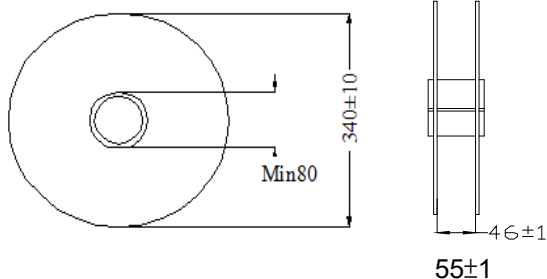
Carton



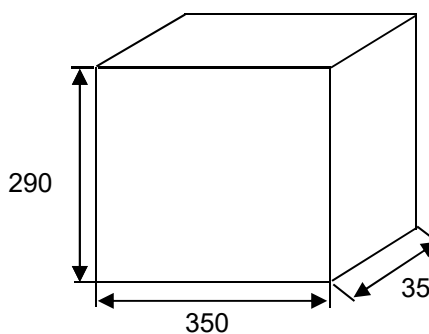
Reel Packing

| Series | A (mm) | QTY (pcs/reel) | reel/carton |
|--------|--------|----------------|-------------|
| TVG14 | 55 | 500 | 4 |

Inner box



Carton



Warehouse Storage Conditions of Products

Storage Conditions:

1. Storage temperature: $-10^{\circ}\text{C}\sim+40^{\circ}\text{C}$
2. Relative humidity: $\leq 75\%RH$
3. Keep away from corrosive atmosphere and sunlight.

Period of Storage : 1 year