

# Varistor: TVG Series

## Varistor and Gas Tube Integrated Over-Voltage Protector



### ■ Features

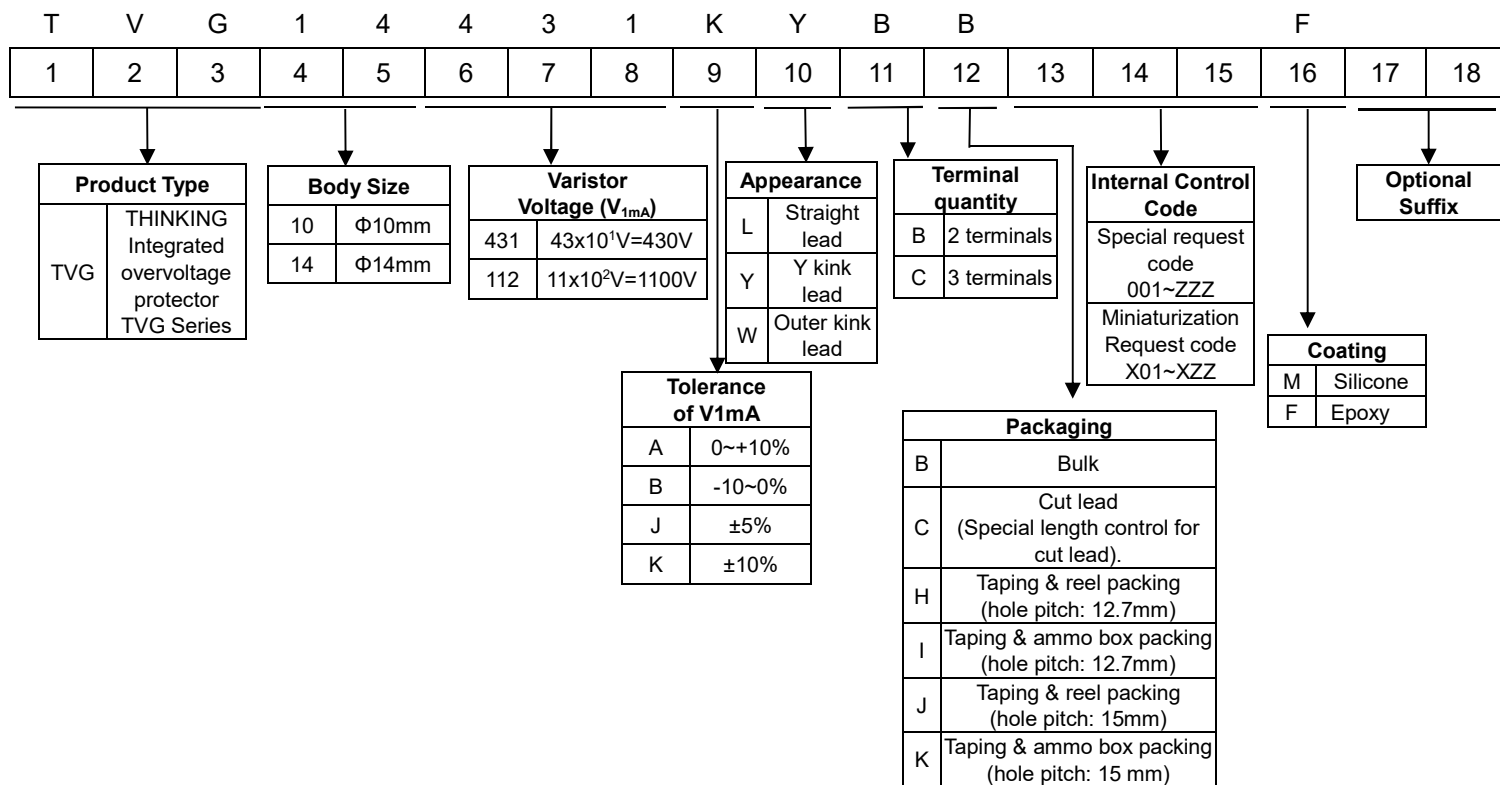
- Hybrid design
- Low leakage, low capacitance, and bidirectional protection
- Body size:  $\Phi 10\text{mm}$  and  $\Phi 14\text{mm}$
- High performance
  - TVG10 is equivalent to TVR10-U Series:  $I_{\text{max}}:6\text{kA}$  ;  $I_{\text{n}}:3\text{kA}$
  - TVG14 is equivalent to TVR14-U Series:  $I_{\text{max}}:10\text{kA}$ ;  $I_{\text{n}}:5\text{kA}$
- Agency recognition: TVG14 is approved by UL & TUV
- RoHS compliant and Halogen-free
- Operating temperature range:  $-40^{\circ}\text{C} \sim +125^{\circ}\text{C}$
- Storage temperature range:  $-40^{\circ}\text{C} \sim +125^{\circ}\text{C}$



### ■ Recommended Applications

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

### ■ Part Number Code



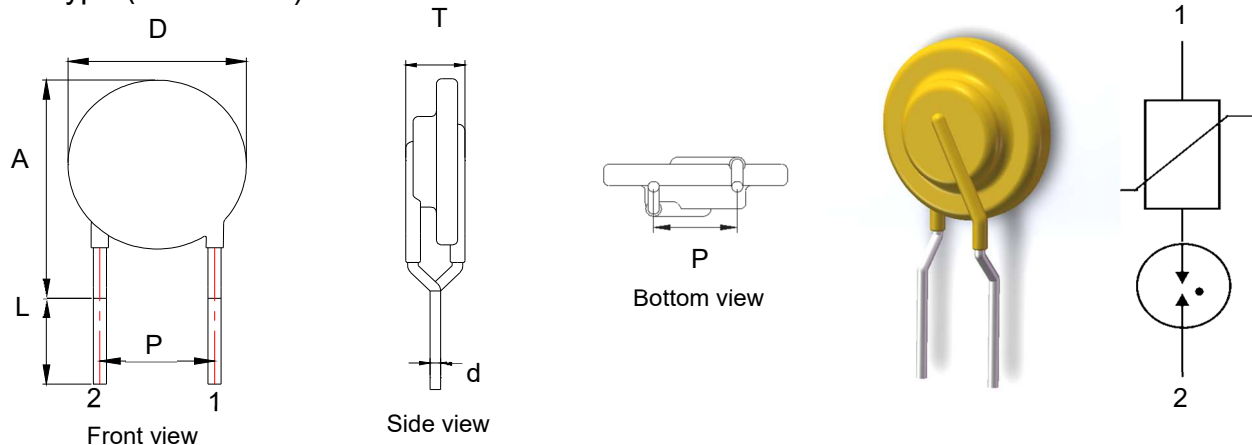
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### ■ Structure and Dimensions (Coating Structure)

- Y type (Y kink lead)



(Unit:mm)

Series	D	Amax	P	$\Phi d$	Lmin	Tmax
TVG10*KY*	13±2	21	7.5±1	0.8±0.05	16	Please Refer to Electrical Characteristics
TVG14*KY*	16.5±2	23	7.5±1	1.0±0.05	16	

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### ■ Electrical Characteristics

#### 10mm 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 <sub>c</sub> (8/20µs)		Combination wave 1.2/50-8/20µs 6kV/3kA	Max. Energy (10/1000µs)	Max. Capacitance (1MHz)	Dimension
	AC (rms)	DC	V <sub>1mA</sub>	V <sub>100V/S</sub>	I <sub>n/15 times</sub>	I <sub>max/1 time</sub>	VC	IC	Time	W <sub>max</sub>	C	T <sub>max</sub>
	(V)	(V)	(V)	(V)	(A)	(A)	(V)	(A)	--	(J)	(pF)	(mm)
TVG10201	150	200	200	600	3000	6000	340	50	40	84	4	8.9
TVG10221	175	225	220	600	3000	6000	360	50	40	91	4	9.1
TVG10241	195	250	240	600	3000	6000	395	50	40	98	4	9.1
TVG10271	215	275	270	600	3000	6000	455	50	40	112	4	9.3
TVG10301	230	300	300	600	3000	6000	500	50	40	123	4	9.4
TVG10331	250	320	330	600	3000	6000	550	50	40	133	4	9.6
TVG10361	275	350	360	600	3000	6000	595	50	40	147	4	9.7
TVG10391	300	385	390	600	3000	6000	650	50	40	161	4	9.8
TVG10431	320	420	430	600	3000	6000	710	50	40	182	4	10.1
TVG10471	350	450	470	1000	3000	6000	775	50	40	196	4	10.3
TVG10511	395	510	510	1000	3000	6000	845	50	40	210	4	10.5
TVG10561	420	560	560	1000	3000	6000	930	50	40	231	4	10.7
TVG10621	465	615	620	1000	3000	6000	1020	50	40	252	4	11.1
TVG10681	510	670	680	1000	3000	6000	1120	50	40	266	4	11.4
TVG10751	550	745	750	1000	3000	6000	1235	50	40	280	4	11.2

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### 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 <sub>c</sub> (8/20µs)		Combination wave 1.2/50-8/20µs 10kV/5kA	Max. Energy (10/1000µs)	Max. Capacitance (1MHz)	Dimension
	AC (ms)	DC					V <sub>c</sub>	I <sub>c</sub>				
	(V)	(V)	V <sub>1mA</sub>	V <sub>100V/S</sub>	In/ 15 times	I <sub>max/ 1 time</sub>			Time	W <sub>max</sub>	C	T <sub>max</sub>
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

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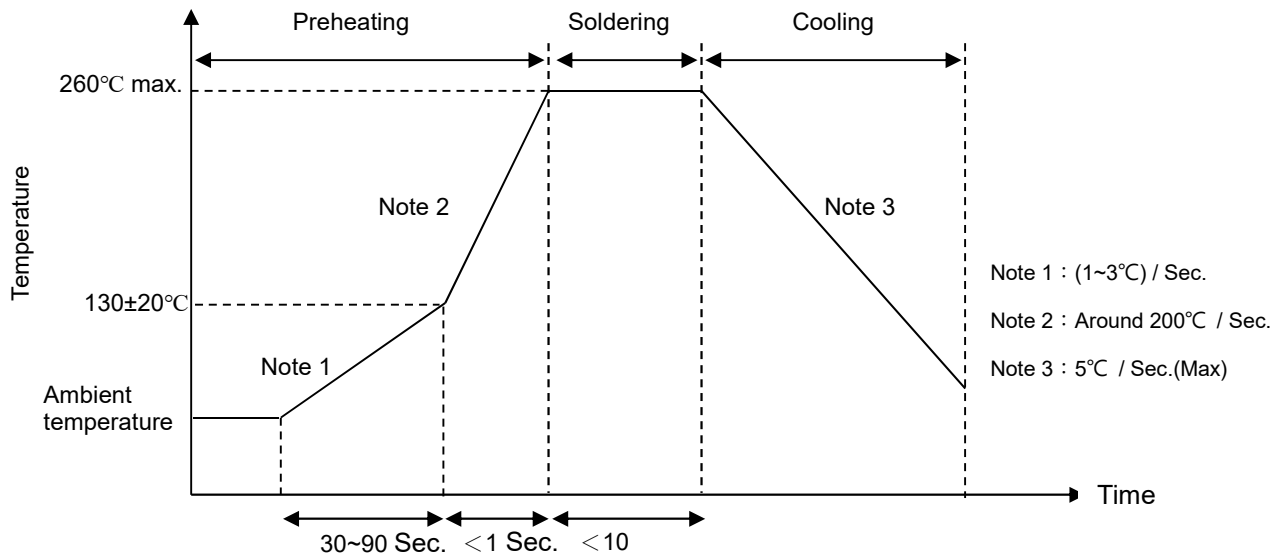


### ■ Safety Approvals

Certified Model No.	Agency	
		
	UL1449 5 <sup>th</sup> & 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	$360^\circ\text{C}$ (max.)
Soldering Time	3 Sec. (max.)
Distance from Varistor	2 mm (min.)

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### ■ 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.  Terminal diameter (mm)                      Force (Kg) ----- 0.5<d≤0.8                                      1.0 0.8<d≤1.25                                      2.0	ΔV/V <sub>c</sub> ≤±5% No visible damage															
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.  Terminal diameter (mm)                      Force (Kg) ----- 0.5<d≤0.8                                      0.5 0.8<d≤1.25                                      1.0	ΔV/V <sub>c</sub> ≤±5% No visible damage															
Voltage Proof	IEC61051-1	Metal balls method, 2500 V <sub>ac</sub> , 1min	No breakdown															
High Temp. Load	IEC61051-1	+125°C, 1000±24hrs at V <sub>DC</sub> or V <sub>rms</sub> (Max. Operating Voltage)	ΔV/V <sub>c</sub> ≤±10% No visible damage															
High Temperature Storage	IEC60068-2	125±2°C x 1000± 24 hrs	ΔV/V <sub>c</sub> ≤±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%V <sub>dc</sub> , 1344 hrs	ΔV/V <sub>c</sub> ≤±5% No visible damage															
Vibration	IEC61051-1 (IEC60068-2)	Frequency range:10~55Hz Amplitude:0.75mm or 98m/S <sup>2</sup> Direction: 3 mutually perpendicular directions, 2hrs each.	ΔV/V <sub>c</sub> ≤±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/V <sub>c</sub> ≤±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/V <sub>c</sub> ≤±5% No visible damage															
Rapid Change of Temperature	IEC61051-1 (IEC60068-2)	The conditions shown below shall be repeated 5 cycles  <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°C</td> <td>30±3 min</td> </tr> <tr> <td>2</td> <td>Room temperature</td> <td>≤ 3</td> </tr> <tr> <td>3</td> <td>125±2°C</td> <td>30±3 min</td> </tr> <tr> <td>4</td> <td>Room temperature</td> <td>≤ 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/V <sub>c</sub> ≤±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																

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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 $\mu$ S Nominal Discharge Test	UL1449	8/20 $\mu$ s waveform, In, 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	6kV/3kA (TVG10) or 10kV/5kA (TVG14), coupled with the maximum Vac, interval 60S, +5 times, -times, 40 times (at 0, 90,180, and 270 degree)	No visible damage



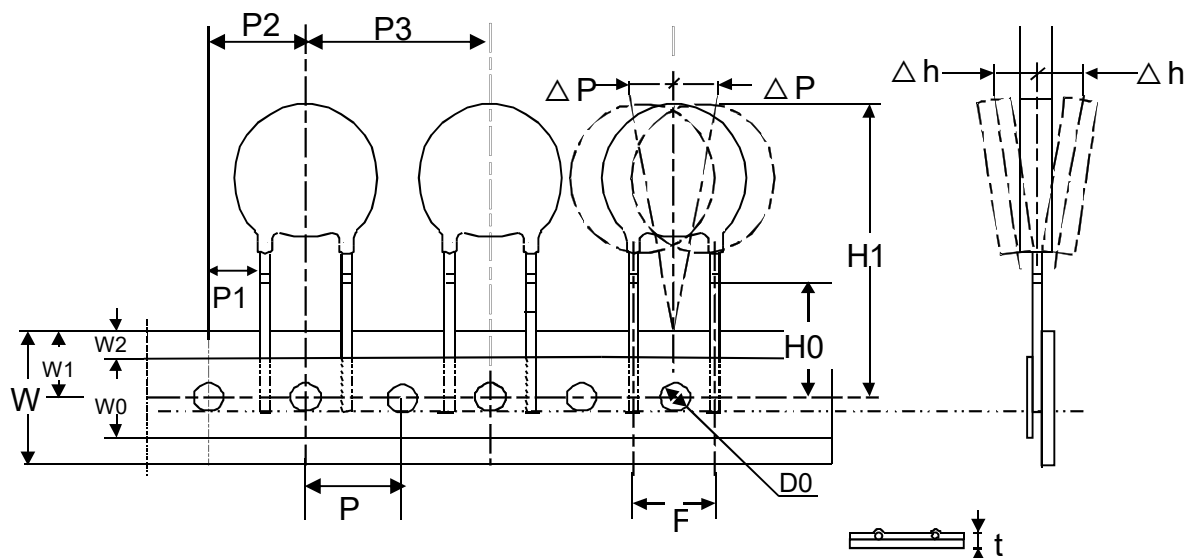
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### ■ Packaging

#### ● 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
TVG10	AR	12.7	7.5	8.55	12.7	25.4	16	38	12	9	3	18	1.0	2.0	4	0.8	0.6
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

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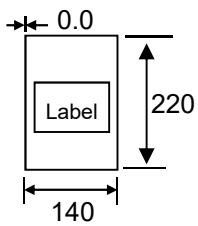


### Quantity

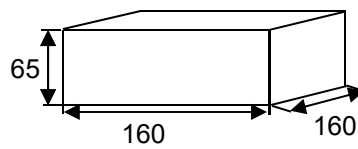
#### Bulk Packing

Series	pcs/bag	bag /box	box /case	pcs /carton
TVG10	50	3	8	1200
TVG14	50	3	8	1200

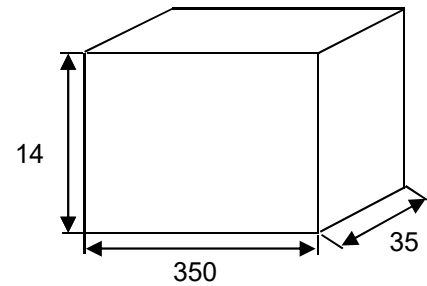
#### Inner bag



#### Inner box



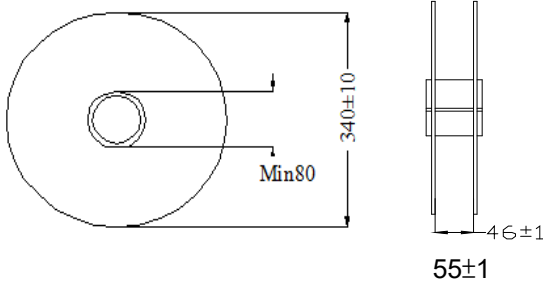
#### Carton



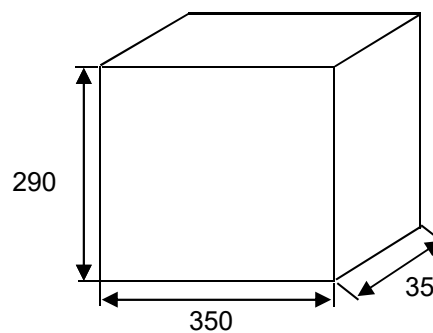
#### Reel Packing

Series	A (mm)	QTY (pcs/reel)	reel/carton
TVG10	46	500	5
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