



# www.tdled.com **TD303X, TD304X, TD306X, TD308X Series**

## **DIP6, DC Input, Zero-Cross Photo TRIAC Coupler**

### **Description**

The TD303X, TD304X and TD306X and TD308X series combine an AlGaAs infrared emitting diode as the emitter which is optically coupled to a monolithic silicon random-phase photo triac in a plastic DIP6 package with different lead forming options.

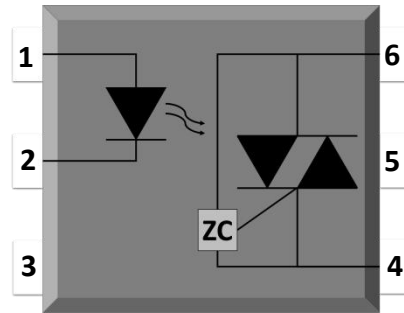
### **Features**

- High isolation 5000 VRMS
- DC input with zero-cross photo triac output
- Operating temperature range - 40 °C to 100 °C
- REACH & RoHS compliance
- MSL class 1
- Regulatory Approvals
  - UL - UL1577
  - VDE - EN60747-5-5(VDE0884-5)
  - CQC – GB4943.1, GB8898

### **Applications**

- Solenoid/valve controls
- Lighting controls
- Motor controls
- Temperature controls
- Static AC power switches
- Solid state relays
- Interfacing microprocessors to 115 to 240VAC peripherals

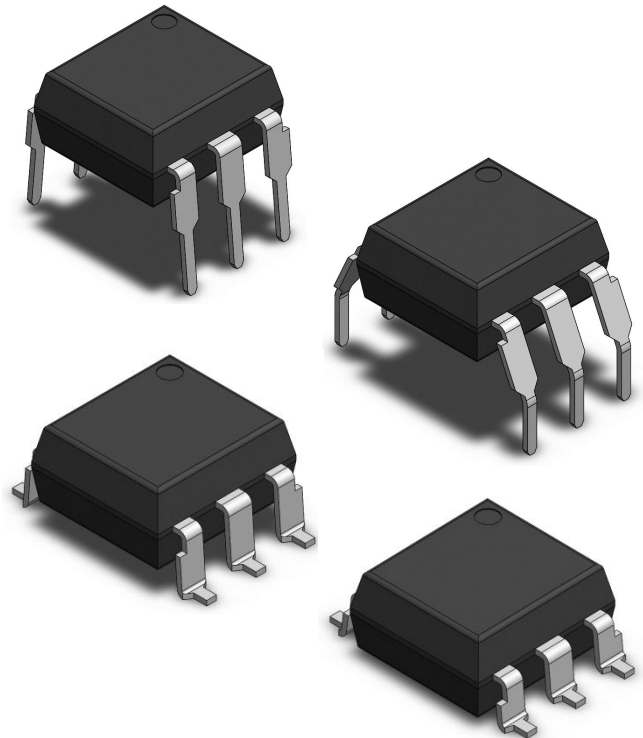
### **SCHEMATIC**



### **PIN DEFINITION**

- |                   |                     |
|-------------------|---------------------|
| <b>1. Anode</b>   | <b>4. Terminal</b>  |
| <b>2. Cathode</b> | <b>5. Substrate</b> |
| <b>3. NC</b>      | <b>6. Terminal</b>  |

### **PACKAGE OUTLINE**





**ABSOLUTE MAXIMUM RATINGS**

PARAMETER	SYMBOL	VALUE	UNIT	NOTE
<b>INPUT</b>				
Forward Current	$I_F$	60	mA	
Reverse Voltage	$V_R$	6	V	
Junction Temperature	$T_j$	125	°C	
Input Power Dissipation	$P_I$	100	mW	
<b>OUTPUT</b>				
Off-state Output Terminal Voltage	TD303X	250	V	
	TD304X	400		
	TD306X	600		
	TD308X	800		
Peak Repetitive Surge Current PW=100μs, 120pps	$I_{TSM}$	1	A	
On-State RMS Current	$I_{T(RMS)}$	100	mA	
Junction Temperature	$T_j$	125	°C	
Output Power Dissipation	$P_O$	300	mW	
<b>COMMON</b>				
Total Power Dissipation	$P_{tot}$	400	mW	
Isolation Voltage	Viso	5000	Vrms	1
Operating Temperature	Topr	-40~100	°C	
Storage Temperature	Tstg	-55~125	°C	
Soldering Temperature	Tsol	260	°C	2

Note 1. AC For 1 Minute, R.H. = 40 ~ 60%

Note 2. For 10 seconds



**ELECTRICAL OPTICAL CHARACTERISTICS at Ta=25°C**

PARAMETER	SYMBOL	MIN.	TYP.	MAX.	UNIT	TEST CONDITION	NOTE
<b>INPUT</b>							
Forward Voltage	V <sub>F</sub>	-	1.24	1.4	V	I <sub>F</sub> =10mA	
Reverse Current	I <sub>R</sub>	-	-	10	μA	V <sub>R</sub> =6V	
Input Capacitance	C <sub>in</sub>	-	8.5	250	pF	V=0, f=1kHz	
<b>OUTPUT</b>							
Peak Off-state Current, Either Direction	I <sub>DRM</sub>	-	-	500	nA	V <sub>DRM</sub> =Rated V <sub>DRM</sub> I <sub>F</sub> =0	3
Peak On-state Current, Either Direction	V <sub>TM</sub>	-	1.59	2.5	V	I <sub>TM</sub> =100mA	
Critical Rate of Rise of Off-state Voltage	dV/dt	1000	-	-	V/μs	V <sub>PEAK</sub> =Rated V <sub>DRM</sub>	4
<b>TRANSFER CHARACTERISTICS</b>							
LED Trigger Current	TD3031,TD3041, TD3061,TD3081	I <sub>FT</sub>	-	-	15	mA	Terminal Voltage = 3V I <sub>TM</sub> =100mA
	TD3032,TD3042, TD3062,TD3082		-	-	10		
	TD3033,TD3043, TD3063,TD3083		-	-	5		
Holding Current	I <sub>H</sub>	-	237	-	μA		
Isolation Resistance	R <sub>iso</sub>	10 <sup>12</sup>	10 <sup>14</sup>	-	Ω	DC500V, 40 ~ 60% R.H.	
Floating Capacitance	C <sub>IO</sub>	-	0.4	-	pF	V=0, f=1MHz	
<b>ZERO-CROSSING CHARACTERISTICS</b>							
Inhibit Voltage	V <sub>INH</sub>	-	-	20	V	I <sub>F</sub> =Rated I <sub>FT</sub>	
Leakage in Inhibited State	I <sub>DRM2</sub>	-	-	500	μA	I <sub>F</sub> =Rated I <sub>FT</sub> V <sub>DRM</sub> =Rated V <sub>DRM</sub>	

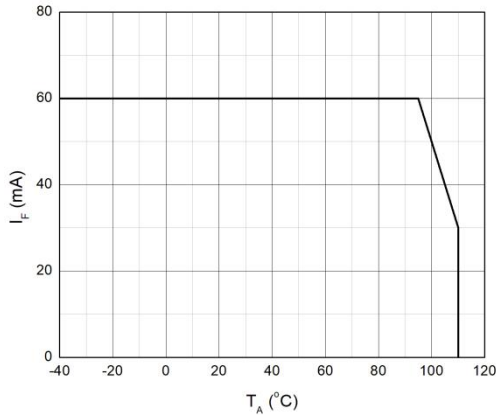
Note3. Test voltage must be applied within dV/dt rating.

Note4. Refer to Fig.15 & Fig.16

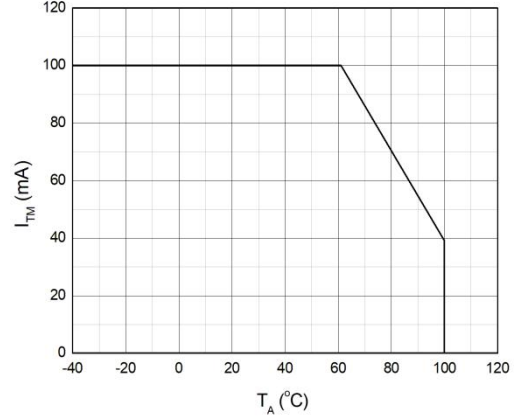


**CHARACTERISTIC CURVES**

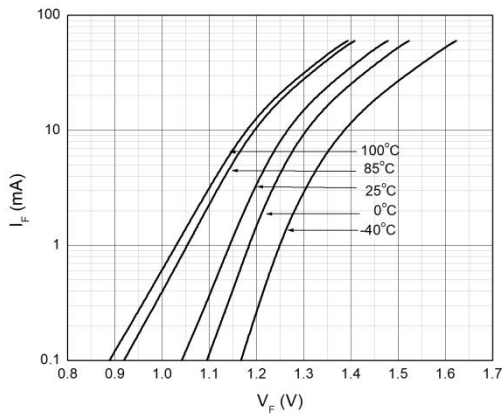
**Fig.1 Forward Current vs. Ambient Temperature**



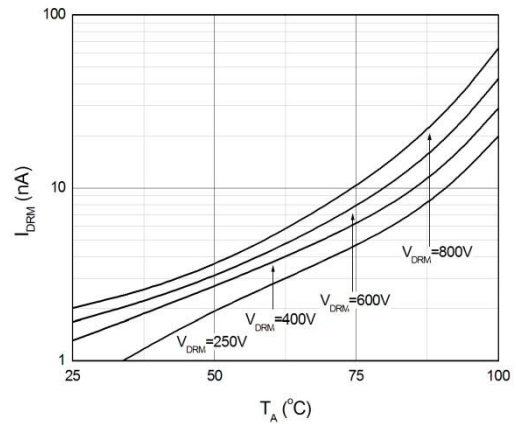
**Fig.2 On-state Terminal Current vs. Ambient Temperature**



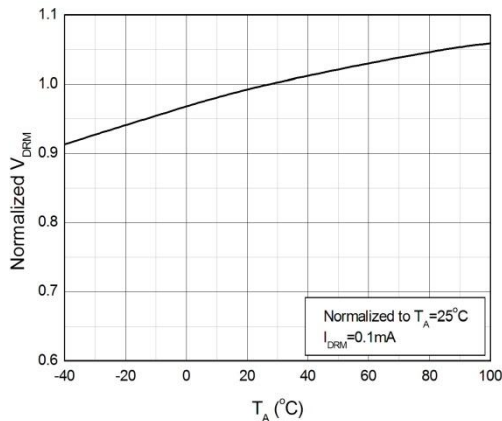
**Fig.3 Forward Current vs. Forward Voltage**



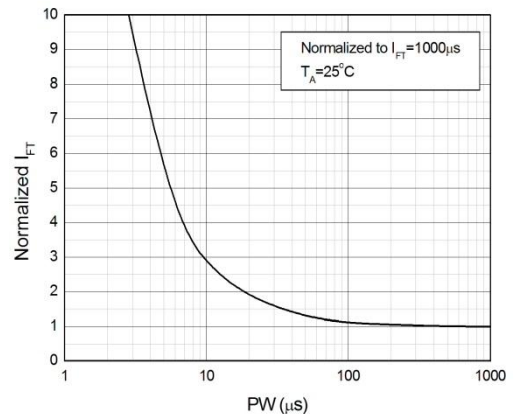
**Fig.4 Off-state Terminal Current vs. Ambient Temperature**



**Fig.5 Normalized Off-state Terminal Voltage vs. Ambient Temperature**



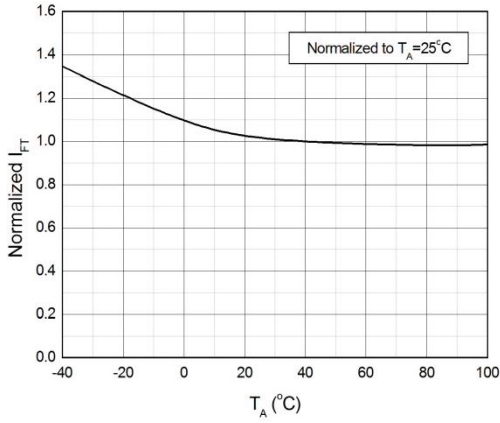
**Fig.6 Normalized Trigger Current vs. LED Trigger Pulse Width**



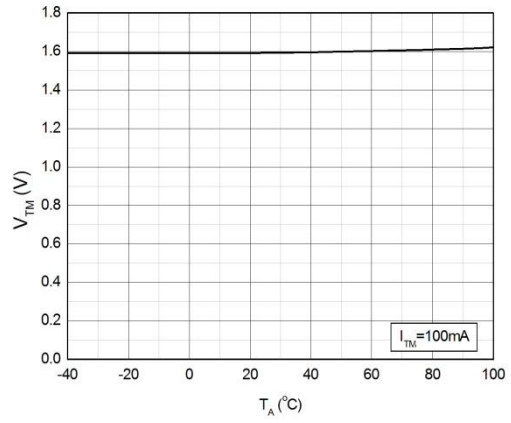


**CHARACTERISTIC CURVES**

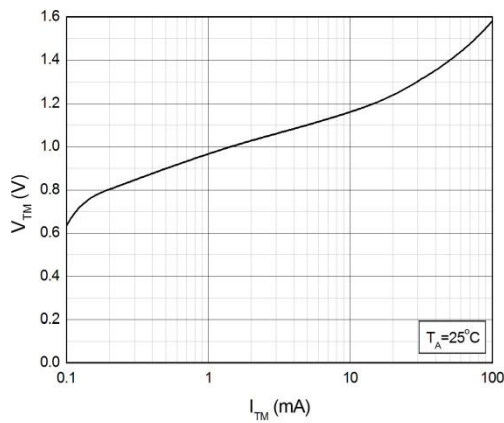
**Fig.7 Normalized Trigger Current vs. Ambient Temperature**



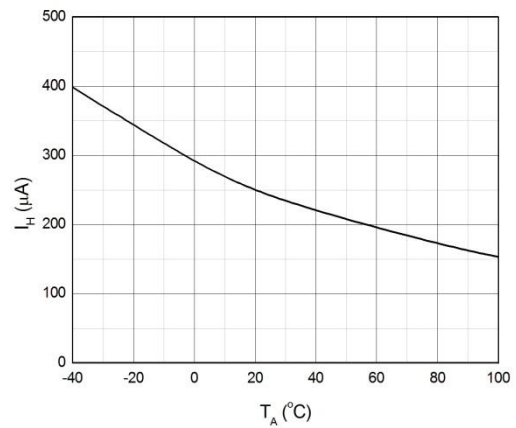
**Fig.8 On-state Terminal Voltage vs. Ambient Temperature**



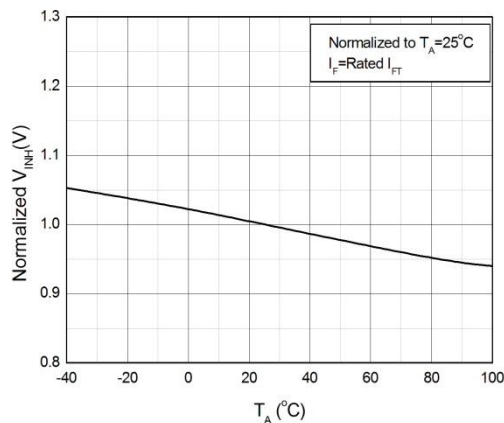
**Fig.9 On-state Terminal Voltage vs. On-state Terminal Current**



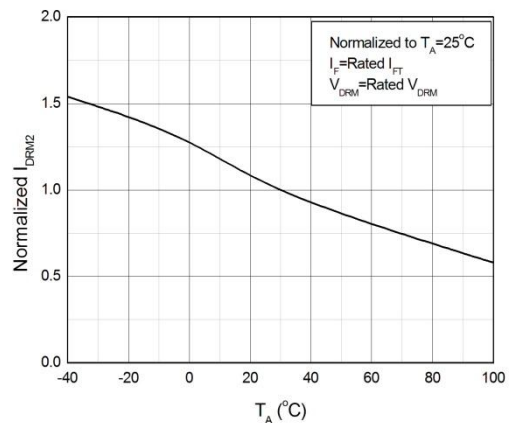
**Fig.10 Holding Current vs. Ambient Temperature**



**Fig.11 Normalized Inhibit Voltage vs. Ambient Temperature**

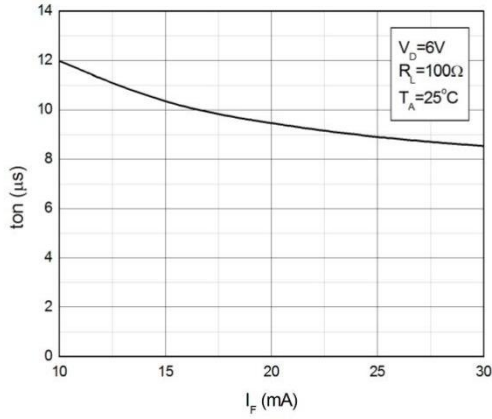


**Fig.12 Normalized Leakage in Inhibit State vs. Ambient Temperature**

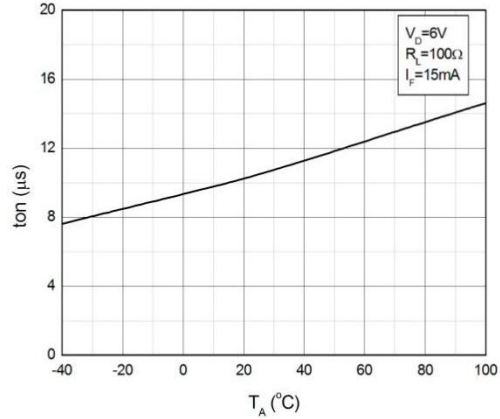


**CHARACTERISTIC CURVES**

**Fig.13 Turn On Time vs. Forward Current**

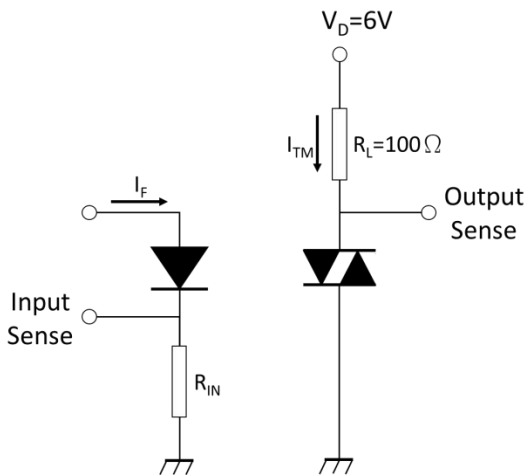


**Fig.14 Turn On Time vs. Ambient Temperature**

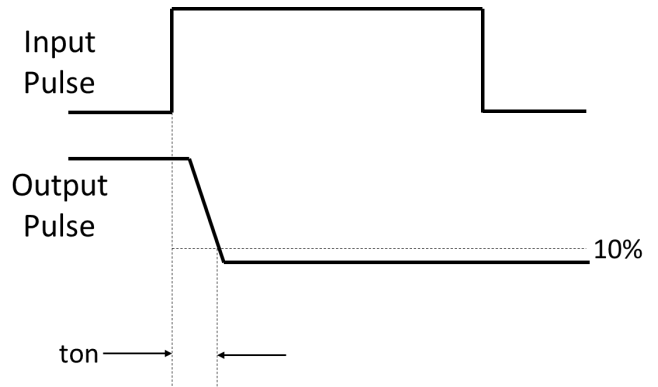


**TEST CIRCUITS**

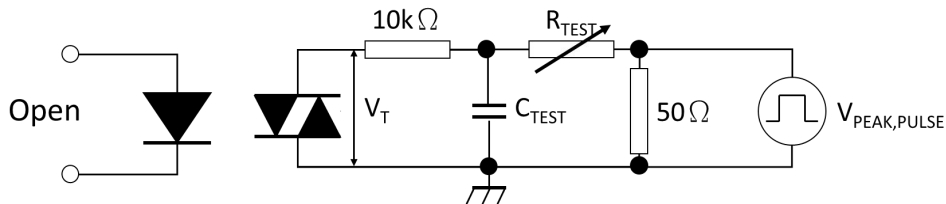
**Fig.15 Test Circuits of Turn On Time**



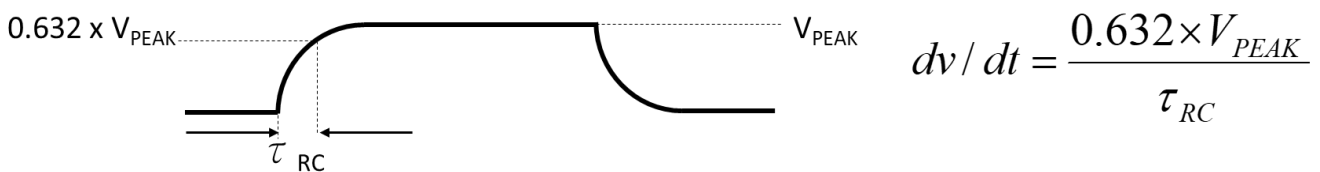
**Fig.16 Waveforms of Turn On Time**



**Fig.17 Test Circuits of dV/dt**

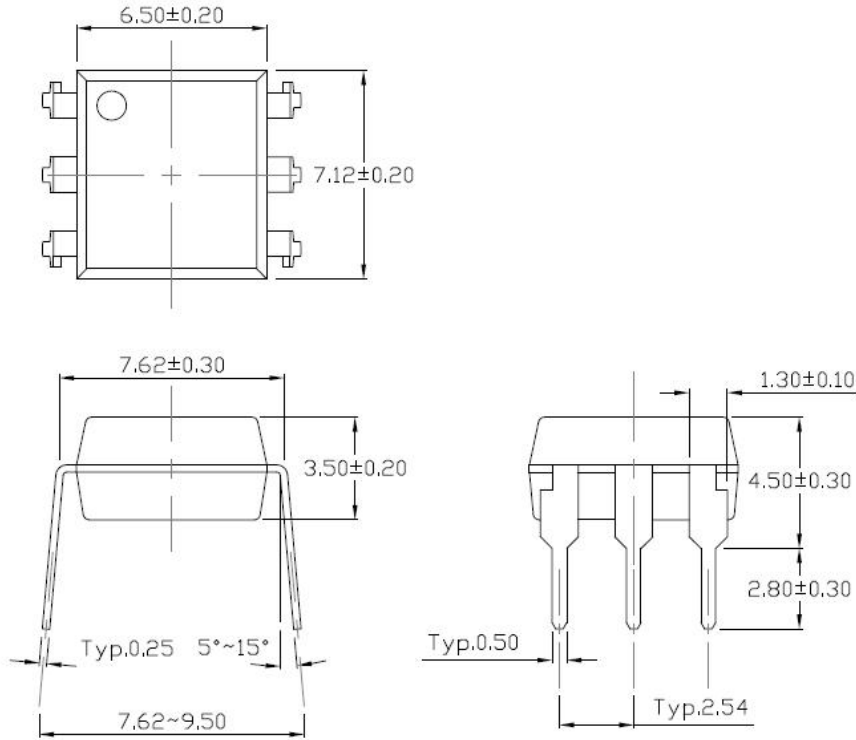


**Fig.18 Waveforms of dV/dt**

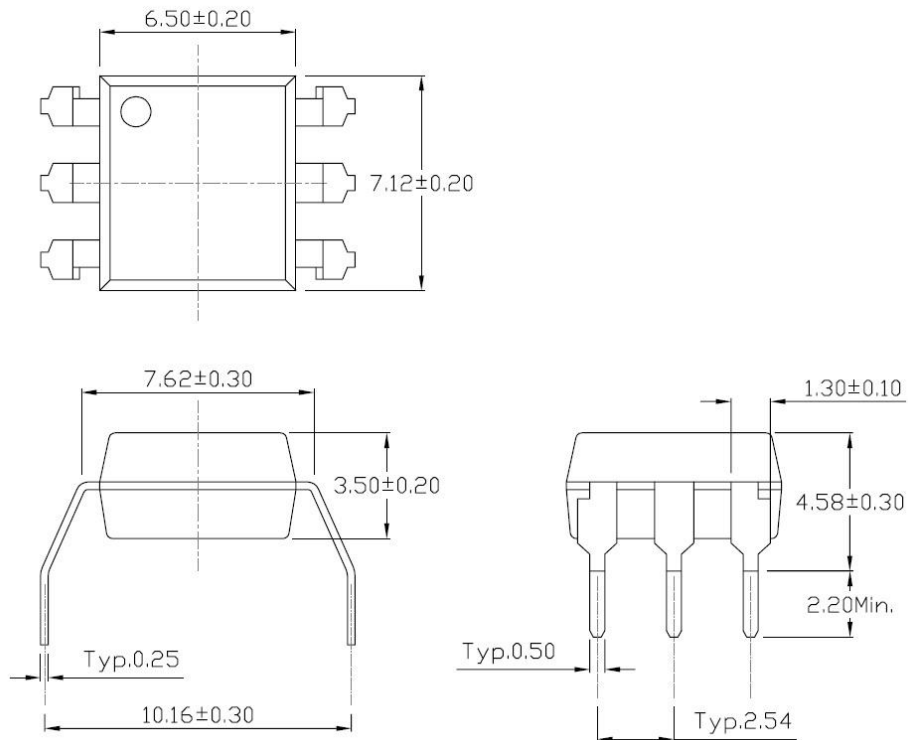


**PACKAGE DIMENSIONS (Dimensions in mm unless otherwise stated)**

**Standard DIP – Through Hole (DIP Type)**

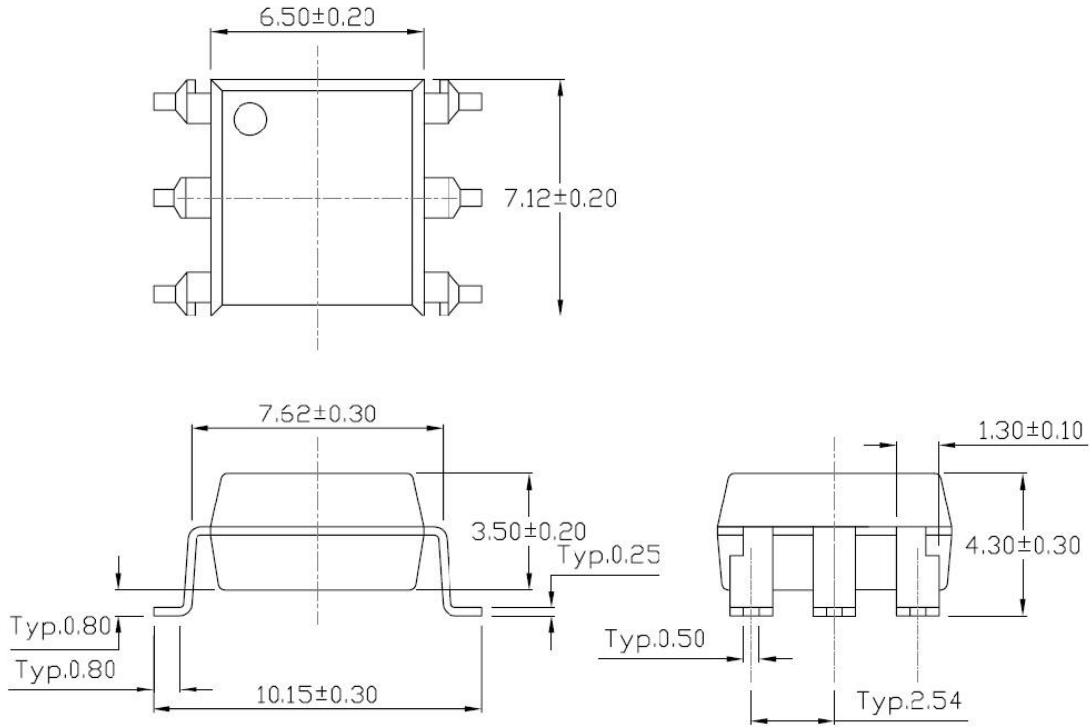


**Gullwing (400mil) Lead Forming – Through Hole (M Type)**

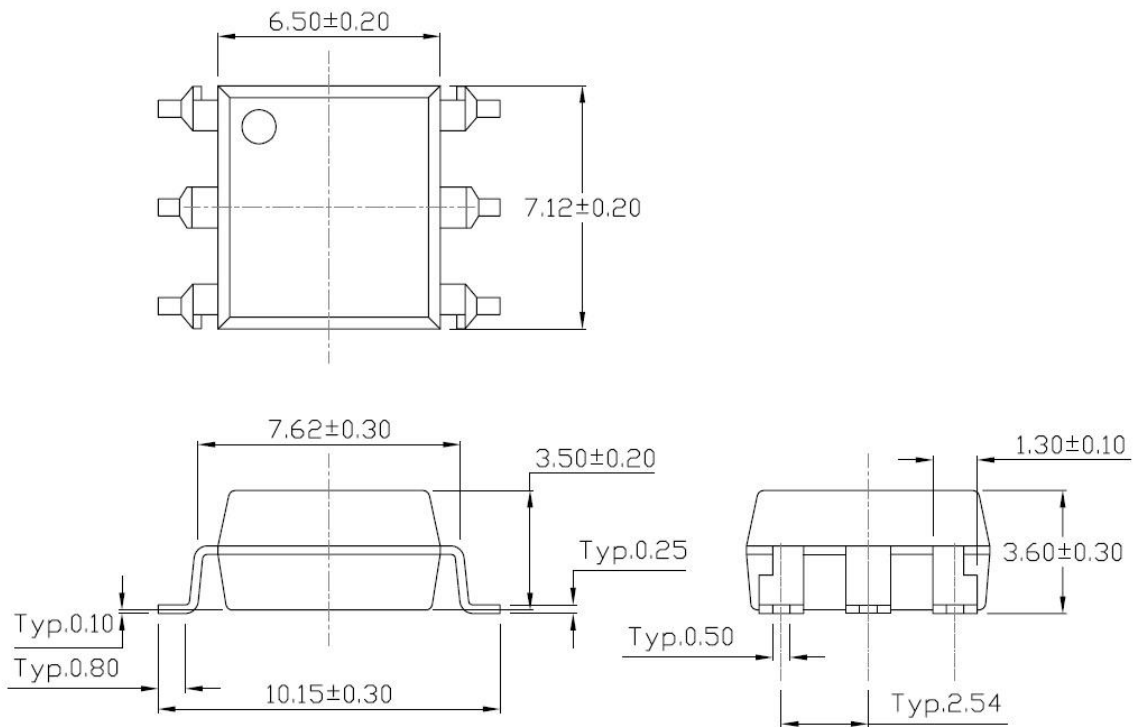


**PACKAGE DIMENSIONS (Dimensions in mm unless otherwise stated)**

**Surface Mount Lead Forming (S Type)**



**Surface Mount (Low Profile) Lead Forming (SL Type)**

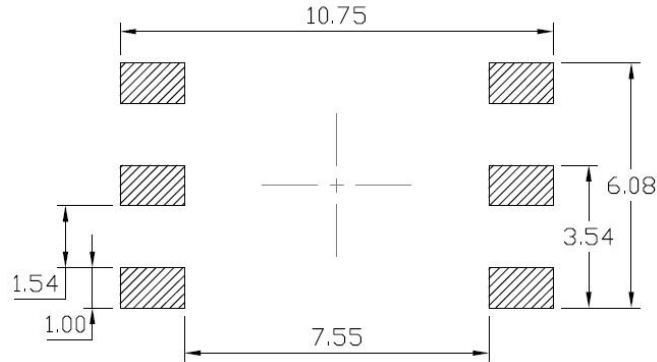




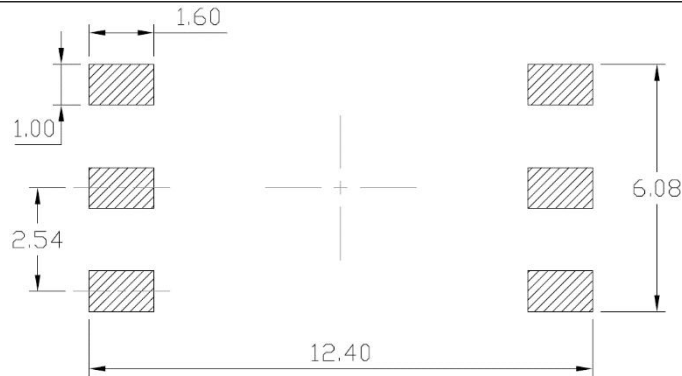


**RECOMMENDED SOLDER MASK (Dimensions in mm unless otherwise stated)**

**Surface Mount Lead Forming & Surface Mount (Low Profile) Lead Forming**

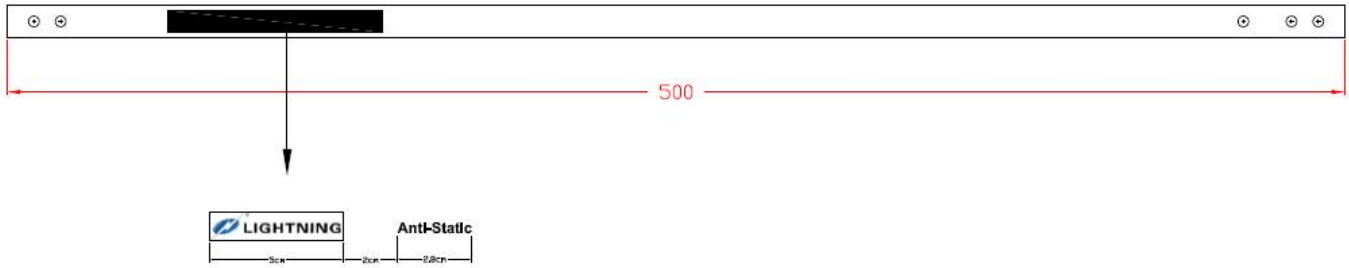
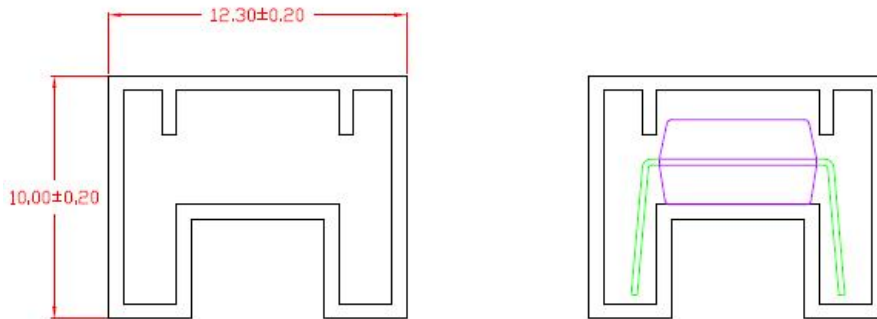


**Surface Mount (Gullwing) Lead Forming**

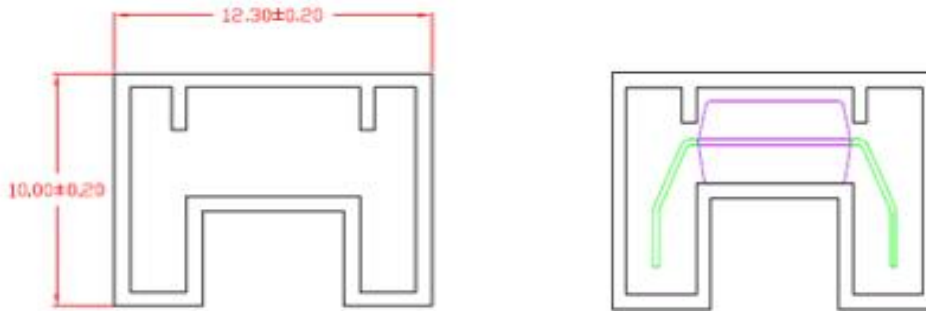


**TUBE SPECIFICATIONS (Dimensions in mm unless otherwise stated)**

**Standard DIP**



**Option M**



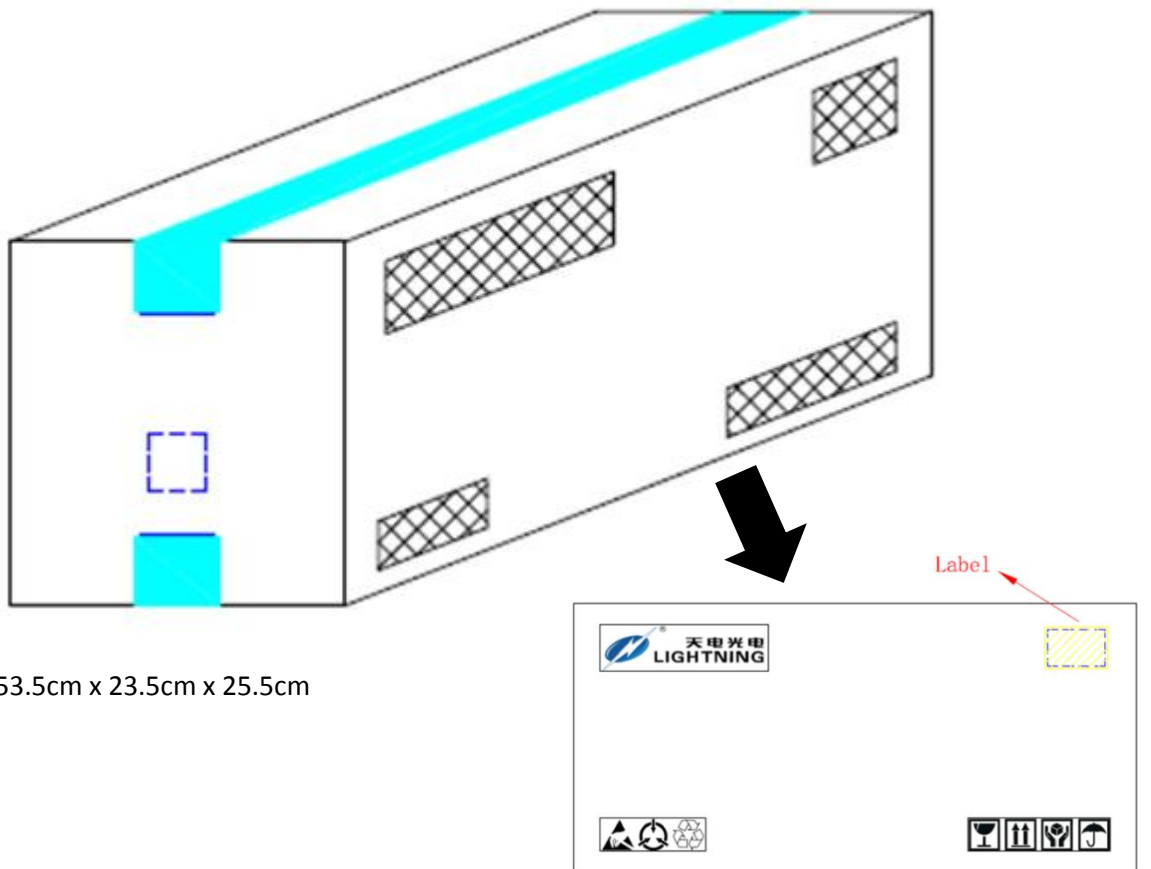
**BOX SPECIFICATIONS (Tube Type)**

**Inner Box**



- L x W x H = 52.5cm x 10.7cm x 4.7cm

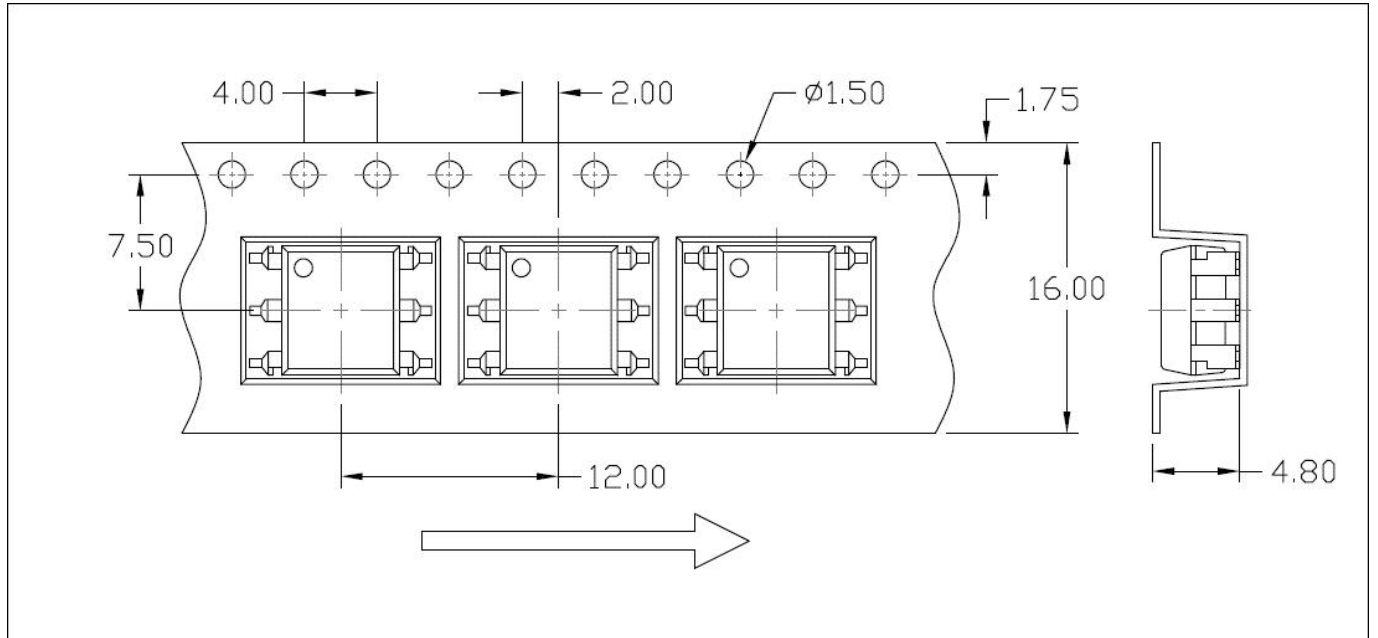
**Outer Box**



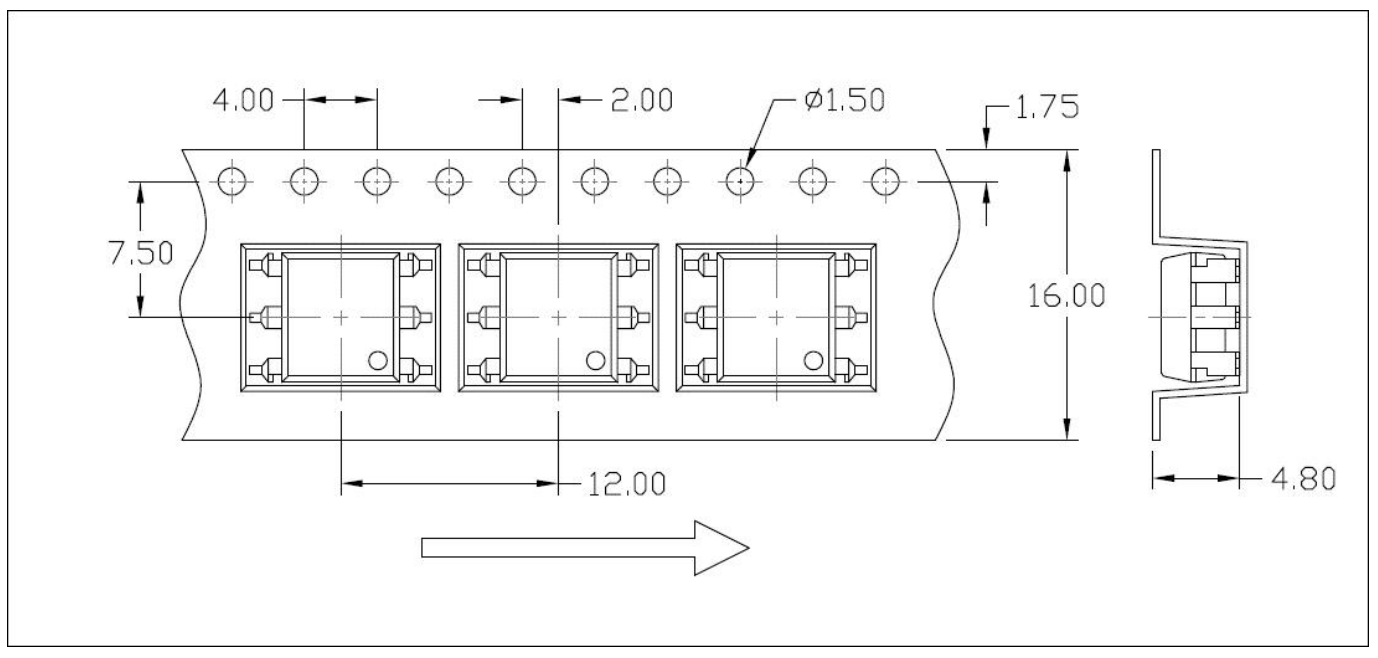
- L x W x H = 53.5cm x 23.5cm x 25.5cm

**CARRIER TAPE SPECIFICATIONS (Dimensions in mm unless otherwise stated)**

**Option S(T1) & SL(T1)**



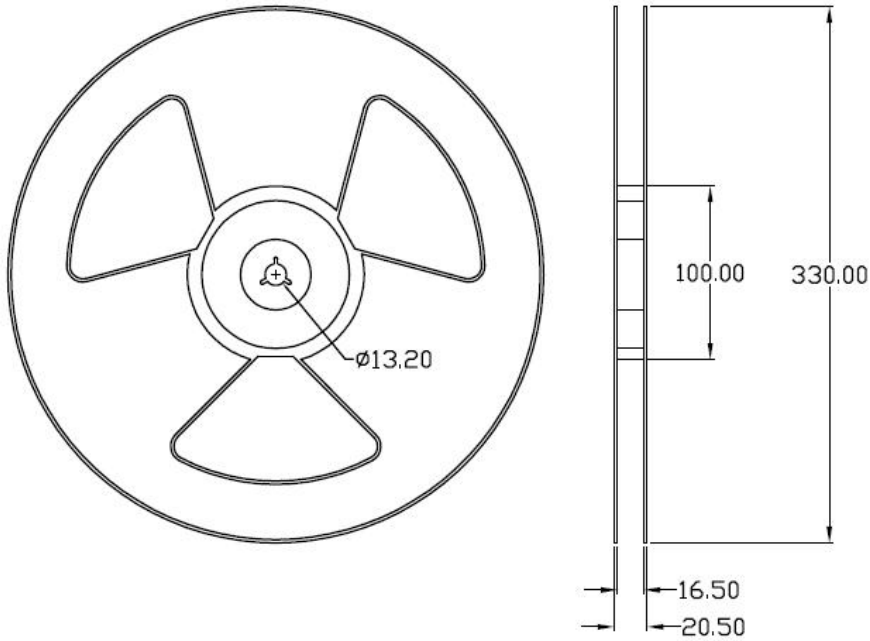
**Option S(T2) & SL(T2)**





**REEL SPECIFICATIONS (Dimensions in mm unless otherwise stated)**

**Option S & Option SL**



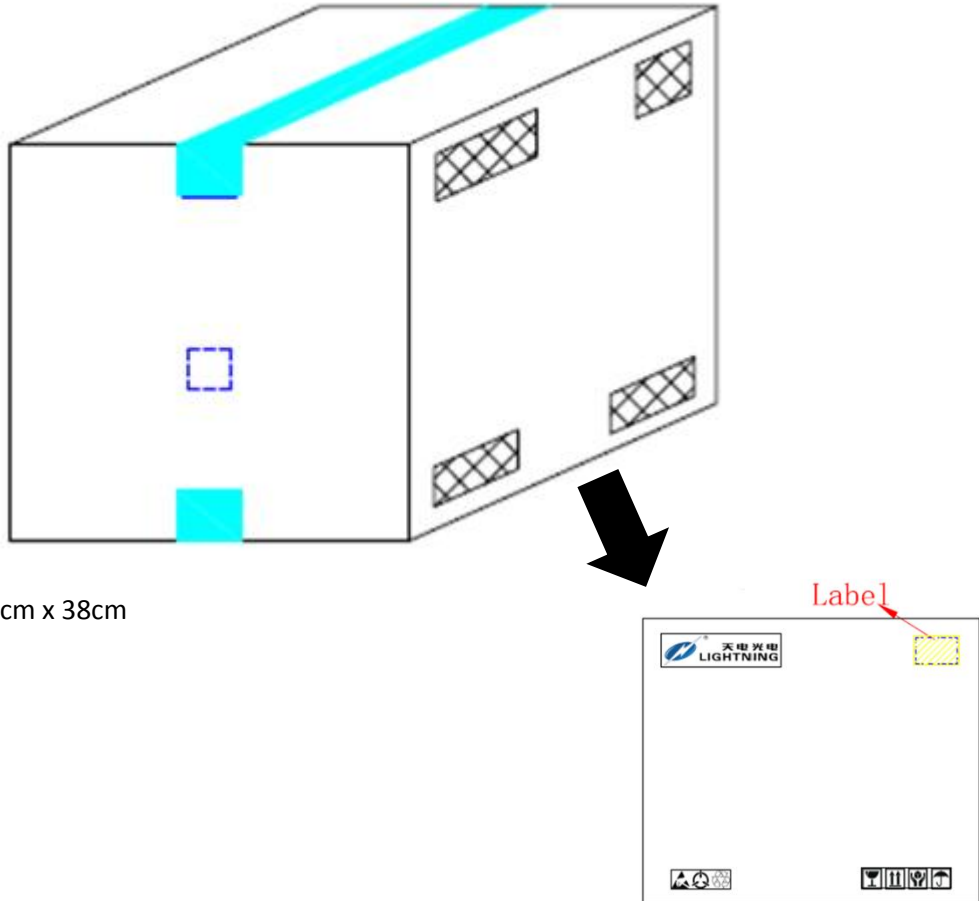
**BOX SPECIFICATIONS (Reel Type)**

**Inner Box**



- L x W x H = 36cm x 36cm x 6.9cm

**Outer Box**

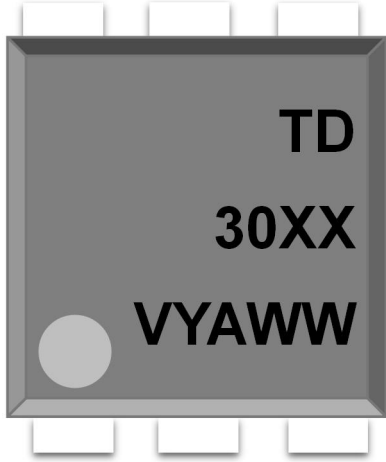


- L x W x H = 45cm x 38cm x 38cm



**ORDERING AND MARKING INFORMATION**

**MARKING INFORMATION**



TD : Company Abbr.  
 30XX : Part Number & Rank  
 V : VDE Option  
 Y : Fiscal Year  
 A : Manufacturing Code  
 WW : Work Week

**ORDERING INFORMATION**

**LABEL INFORMATION**

**TD30XX(Y)(Z)-GV**



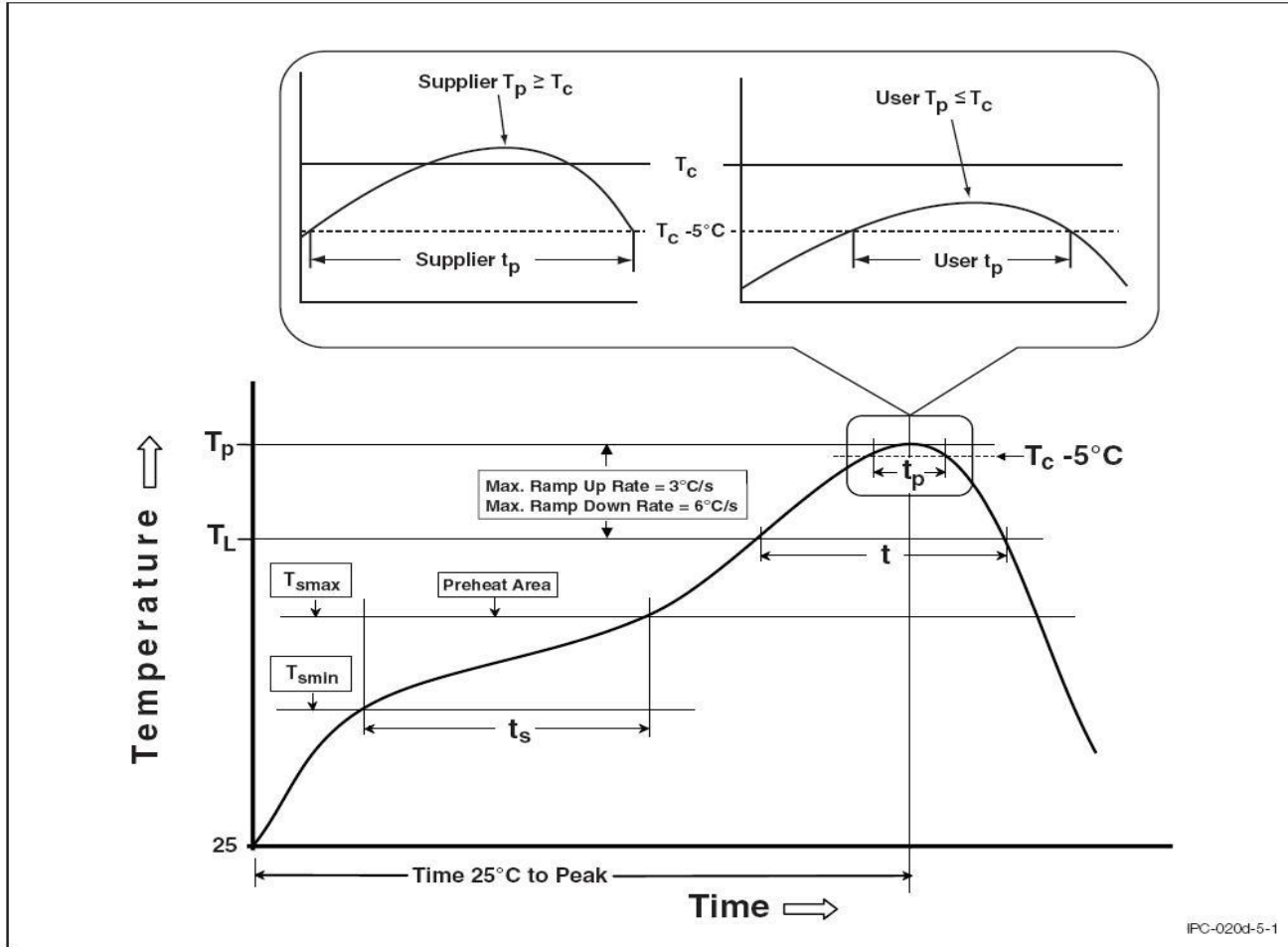
TD – Company Abbr.  
 30XX – Part Number  
 (31/32/33/41/42/43/61/62/63)  
 Y – Lead Form Option (M/S/SL/None)  
 Z – Tape and Reel Option (T1/T2)  
 G – Green Option (G or None)  
 V – VDE Option (V or None)

**Packing Quantity**

Option	Quantity	Quantity – Inner box	Quantity – Outer box
None	50 Units/Tube	32 Tubes/Inner box	10 Inner box/Outer box = 16k Units
M	50 Units/Tube	32 Tubes/Inner box	10 Inner box/Outer box = 16k Units
S(T1)	1000 Units/Reel	3 Reels/Inner box	5 Inner box/Outer box = 15k Units
S(T2)	1000 Units/Reel	3 Reels/Inner box	5 Inner box/Outer box = 15k Units
SL(T1)	1000 Units/Reel	3 Reels/Inner box	5 Inner box/Outer box = 15k Units
SL(T2)	1000 Units/Reel	3 Reels/Inner box	5 Inner box/Outer box = 15k Units

**REFLOW INFORMATION**

**REFLOW PROFILE**



IPC-020d-5-1

Profile Feature	Sn-Pb Assembly Profile	Pb-Free Assembly Profile
Temperature Min. ( $T_{smin}$ )	100	150°C
Temperature Max. ( $T_{smax}$ )	150	200°C
Time ( $t_s$ ) from ( $T_{smin}$ to $T_{smax}$ )	60-120 seconds	60-120 seconds
Ramp-up Rate ( $t_L$ to $t_P$ )	3°C/second max.	3°C/second max.
Liquidous Temperature ( $T_L$ )	183°C	217°C
Time ( $t_L$ ) Maintained Above ( $T_L$ )	60 – 150 seconds	60 – 150 seconds
Peak Body Package Temperature	235°C +0°C / -5°C	260°C +0°C / -5°C
Time ( $t_P$ ) within 5°C of 260°C	20 seconds	30 seconds
Ramp-down Rate ( $T_P$ to $T_L$ )	6°C/second max	6°C/second max
Time 25°C to Peak Temperature	6 minutes max.	8 minutes max.





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- The products shown in this publication are designed for the general use in electronic applications such as office automation, equipment, communications devices, audio/visual equipment, electrical application and instrumentation purpose, non-infringement and merchantability.
- This product is not intended to be used for military, aircraft, automotive, medical, life sustaining or lifesaving applications or any other application which can result in human injury or death.
- Please contact LIGHTNING sales agent for special application request.
- Immerge unit's body in solder paste is not recommended.
- Parameters provided in datasheets may vary in different applications and performance may vary over time. All operating parameters, including typical parameters, must be validated in each customer application by the customer's technical experts. Product specifications do not expand or otherwise modify LIGHTNING's terms and conditions of purchase, including but not limited to the warranty expressed therein.
- Discoloration might be occurred on the package surface after soldering, reflow or long-time use. It neither impacts the performance nor reliability.