



6N135,6N136,TD450X Series

DIP8, 1Mbit/s High Speed Transistor Photo Coupler

Description

The 6N135, 6N136, TD450X series combine an AlGaAs infrared emitting diode as the emitter which is optically coupled to a silicon high speed photo transistor in a plastic DIP8 package with different lead forming options.

A separate design between photodiode and transistor reduces the base-collector capacitance of the input transistor which improves the speed by several orders of magnitude over conventional phototransistor optocouplers.

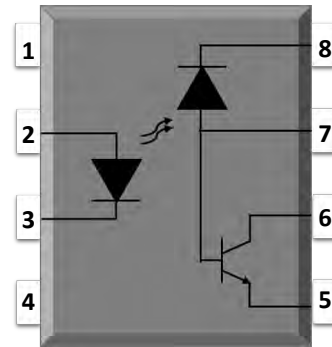
Features

- High isolation 5000 VRMS
- DC input with transistor output
- Operating temperature range - 55 °C to 100 °C
- REACH compliance
- Halogen free (Optional)
- MSL class 1
- Regulatory Approvals
 - UL - UL1577
 - VDE - EN60747-5-5(VDE0884-5)
 - CQC - GB4943.1, GB8898
 - cUL- CSA Component Acceptance Service Notice No. 5A

Applications

- Line receivers
- Telecommunication equipment
- Out interface to CMOS-LSTTL-TTL
- Wide bandwidth analog coupling
- Pulse transformer replacement
- Computer-peripheral interface

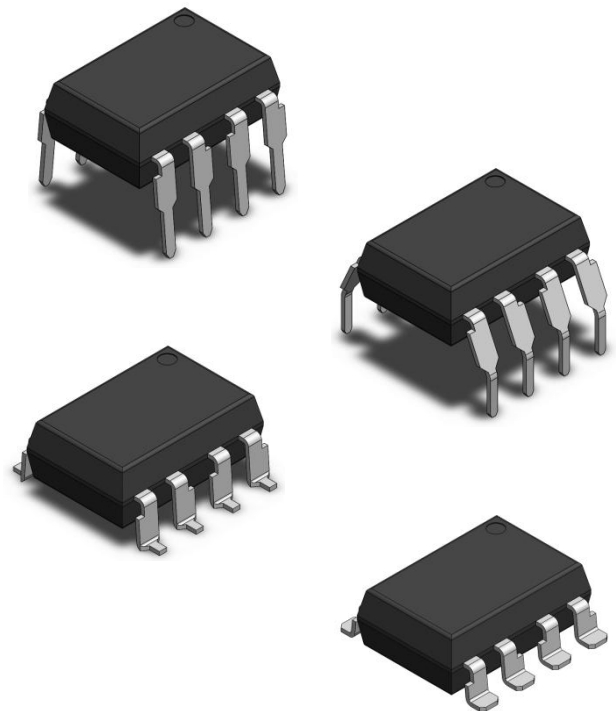
SCHEMATIC



PIN DEFINITION

1.NC	8.VCC
2.Anode	7.VB(for 6N135/6N136) NC(for TD4502/TD4503)
3.Cathode	6.VO
4.NC	5.GND

OUTLINE





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ABSOLUTE MAXIMUM RATINGS

PARAMETER	SYMBOL	VALUE	UNIT	Note
INPUT				
Forward Current	I_F	25	mA	
Peak Forward Current	I_{FP}	50	mA	1
Peak Transient Current	$I_{F(trans)}$	1	A	2
Reverse Voltage	V_R	5	V	
Input Power Dissipation	P_I	100	mW	
OUTPUT				
Supply Voltage	V_{CC}	-0.5~30	V	
Output Voltage	V_O	-0.5~20	V	
Output Current	I_O	50	mA	
Emitter-Base Reverse Voltage	V_{EBR}	5	V	
Base Current	I_B	5	mA	
Output Power Dissipation	P_O	100	mW	
COMMON				
Total Power Dissipation	P_{tot}	200	mW	
Isolation Voltage	V_{iso}	5000	V _{rms}	3
Operating Temperature	T_{opr}	-55~100	°C	
Storage Temperature	T_{stg}	-55~150	°C	
Soldering Temperature	T_{sol}	260	°C	4

Note 1. 50% duty, 1ms P.W

Note 2. $\leq 1\mu s$ P.W,300pps

Note 3. AC For 1 Minute, R.H. = 40 ~ 60%

Note 4. For 10 seconds



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ELECTRICAL OPTICAL CHARACTERISTICS

PARAMETER	SYMBOL	MIN	TYP	MAX	UNIT	TEST CONDITION	NOTE
INPUT(at Ta=0 to 70°C , unless specified otherwise)							
Forward Voltage	V_F	-	1.45	1.8	V	$I_F=16\text{mA}$	
Reverse Current	I_R	-	-	10	μA	$V_R=5\text{V}$	
Input Capacitance	C_{in}	-	60	-	pF	$V=0, f=1\text{MHz}$	
OUTPUT(at Ta=0 to 70°C , unless specified otherwise)							
High Level Supply Current	I_{CCH}	-	0.01	1	μA	$I_F=0\text{mA}, V_O=\text{Open}, V_{CC}=15\text{V}, T_a=25^\circ\text{C}$	
		-	-	2	μA	$I_F=0\text{mA}, V_O=\text{Open}, V_{CC}=15\text{V}$	
Low Level Supply Current	I_{CCL}	-	200	-	μA	$I_F=16\text{mA}, V_O=\text{Open}, V_{CC}=15\text{V}$	
Logic High Output Current	I_{OH}	-	0.001	0.5	μA	$I_F=0\text{mA}, V_O=V_{CC}=5.5\text{V}, T_a=25^\circ\text{C}$	
		-	0.01	1	μA	$I_F=0\text{mA}, V_O=V_{CC}=15\text{V}, T_a=25^\circ\text{C}$	
		-	-	50	μA	$I_F=0\text{mA}, V_O=V_{CC}=15\text{V}$	



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ELECTRICAL OPTICAL CHARACTERISTICS

PARAMETER	SYMBOL	MIN	TYP	MAX	UNIT	TEST CONDITION	NOTE	
TRANSFER CHARACTERISTICS(at Ta=0 to 70°C , unless specified otherwise)								
Current Transfer Ratio	6N135	CTR	7	-	50	%	I _F = 16mA , V _O = 0.4V, V _{CC} =4.5V, Ta=25°C	
	6N136		19	-	50			
	TD4502							
	TD4503							
	6N135		5	-	-			I _F = 16mA , V _O = 0.5V, V _{CC} =4.5V
6N136 TD4502 TD4503	15	-	-					
Logic Low Output Voltage	6N135	V _{OL}	-	0.18	0.4	μA	I _F = 16mA , I _O = 1.1mA, V _{CC} =4.5V, Ta=25°C	
	6N136 TD4502 TD4503		-	0.25	0.4			I _F = 16mA , I _O = 3mA, V _{CC} =4.5V, Ta=25°C
	6N135		-	-	0.5			I _F = 16mA , I _O = 0.8mA, V _{CC} =4.5V
	6N136 TD4502 TD4503		-	-	0.5			I _F = 16mA , I _O = 2.4mA, V _{CC} =4.5V
	Isolation Resistance		R _{iso}	10 ¹²	10 ¹⁴			-
Floating Capacitance	C _{IO}	-	0.3	1	pF	V=0, f=1MHz		



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ELECTRICAL OPTICAL CHARACTERISTICS

PARAMETER	SYMBOL	MIN	TYP	MAX	UNIT	TEST CONDITION	NOTE	
SWITCHING CHARACTERISTICS(at Ta=0 to 70°C, I _F =16mA, V _{CC} =5V, unless specified otherwise)								
Propagation Delay Time to Logic Low	6N135	TPHL	-	0.35	1.5	μs	R _L =4.1kΩ, T _A =25°C	Fig.13
			-	-	2		R _L =4.1kΩ	
	6N136	-	0.35	0.8	R _L =1.9kΩ, T _A =25°C			
	TD4502 TD4503	-	-	1.0	R _L =1.9kΩ			
Propagation Delay Time to Logic High	6N135	TPLH	-	0.5	1.5	μs	R _L =4.1kΩ, T _A =25°C	Fig.13
			-	-	2		R _L =4.1kΩ	
	6N136	-	0.3	0.8	R _L =1.9kΩ, T _A =25°C			
	TD4502 TD4503	-	-	1.0	R _L =1.9kΩ			
Common Mode Transient Immunity at Logic High	6N135	CM _H	1000	-	-	V/μs	I _F = 0mA, V _{CM} =10Vpp, R _L =4.1kΩ, T _A =25°C	Fig.14
	6N136		1000	-	-		I _F = 0mA, V _{CM} =10Vpp, R _L =1.9kΩ, T _A =25°C	
	TD4502		15000	20000	-		I _F = 0mA, V _{CM} =1500Vpp, R _L =1.9kΩ, T _A =25°C	
Common Mode Transient Immunity at Logic Low	6N135	CM _L	1000	-	-	V/μs	I _F = 16mA, V _{CM} =10Vpp, R _L =4.1kΩ, T _A =25°C	Fig.14
	6N136		1000	-	-		I _F = 16mA, V _{CM} =10Vpp, R _L =1.9kΩ, T _A =25°C	
	TD4502		15000	20000	-		I _F = 16mA, V _{CM} =1500Vpp, R _L =1.9kΩ, T _A =25°C	
	TD4503	15000	20000	-	I _F = 16mA, V _{CM} =1500Vpp, R _L =1.9kΩ, T _A =25°C			



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CHARACTERISTIC CURVES

Fig.1 Forward Current vs. Forward Voltage

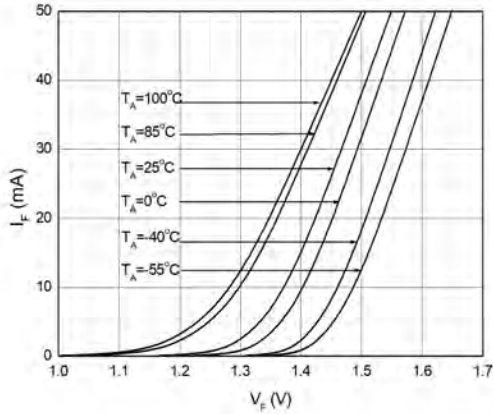


Fig.2 Forward Voltage vs. Ambient Temperature

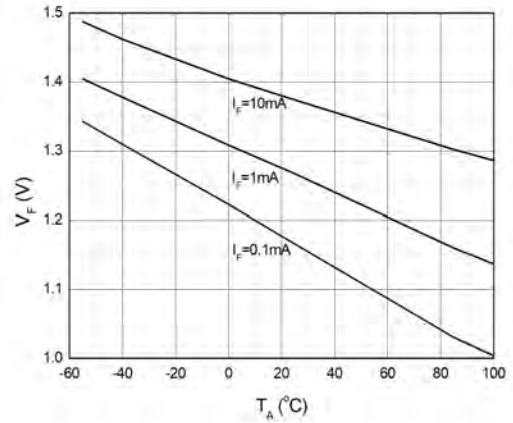


Fig.3 Input Threshold Current vs. Ambient Temperature

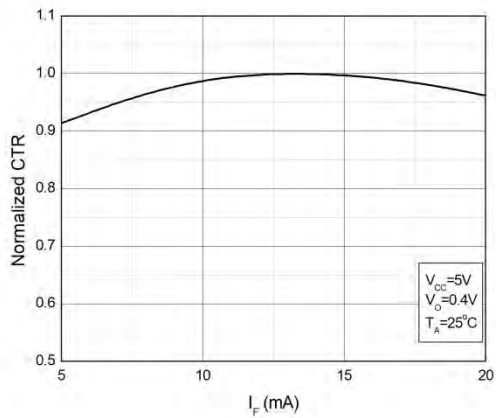


Fig.4 Input Threshold Current vs. Ambient Temperature

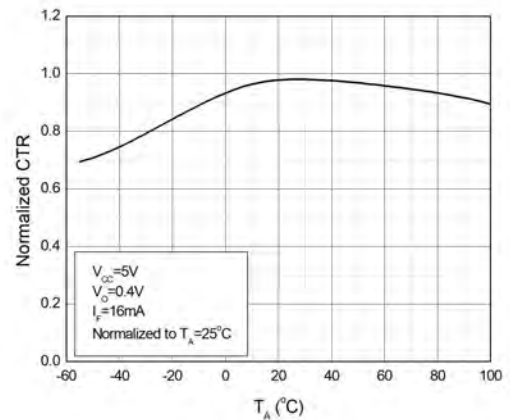


Fig.5 Low Level Output Current vs. Ambient Temperature

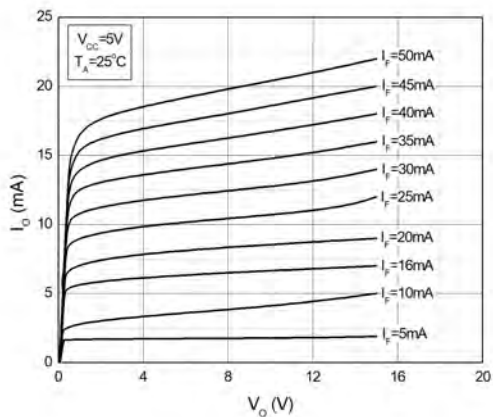
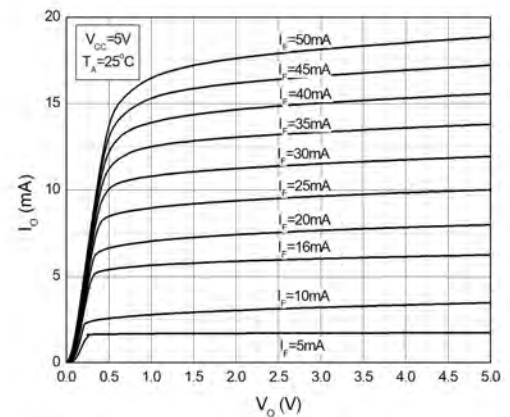


Fig.6 Low Level Output Current vs. Ambient Temperature





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CHARACTERISTIC CURVES

Fig.7 Low Level Output Voltage vs. Ambient Temperature

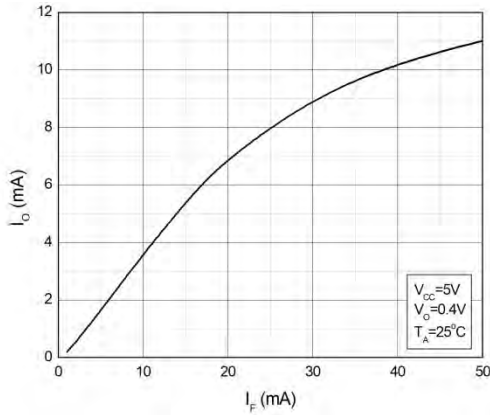


Fig.8 Low Level Output Voltage vs. Ambient Temperature

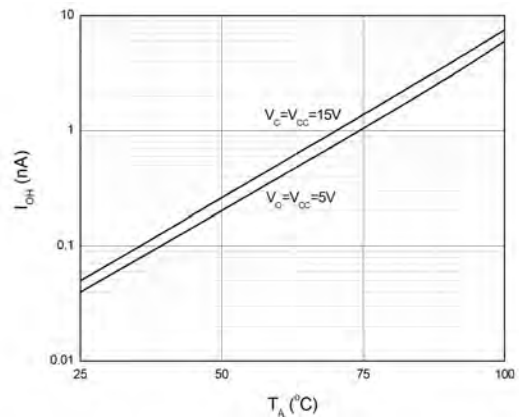


Fig.9 High Level Output Current vs. Ambient Temperature

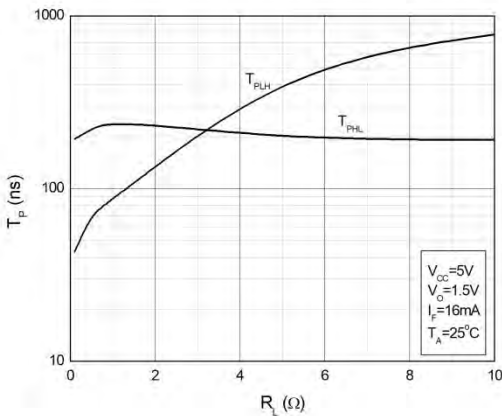


Fig.10 High Level Output Current vs. Ambient Temperature

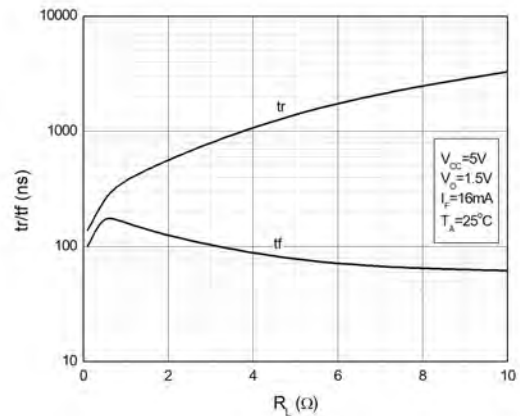


Fig.11 Output Voltage vs. Forward Current

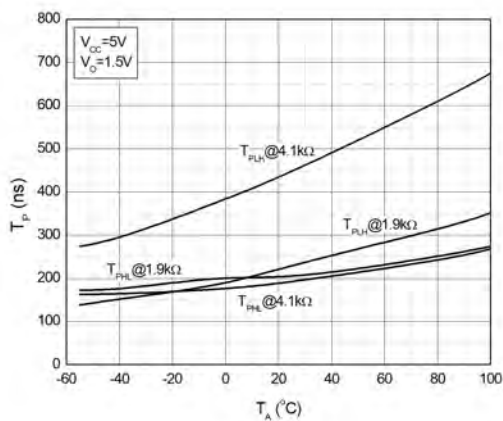
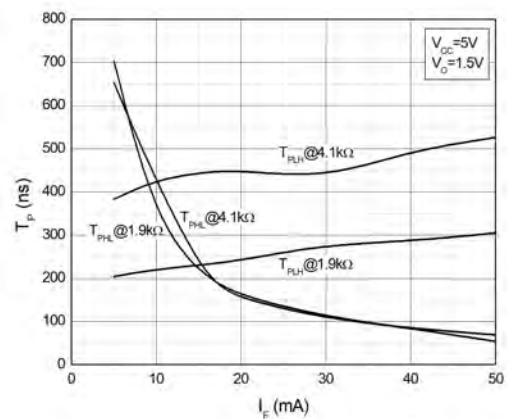


Fig.12 Output Voltage vs. Forward Current



TEST CIRCUITS

Fig.13 Test Circuits for TPHL, TPLH, tr, tf

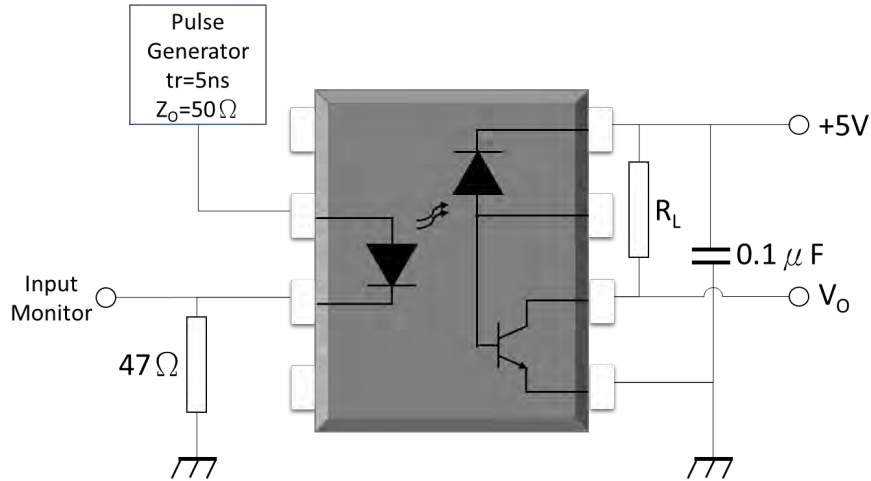
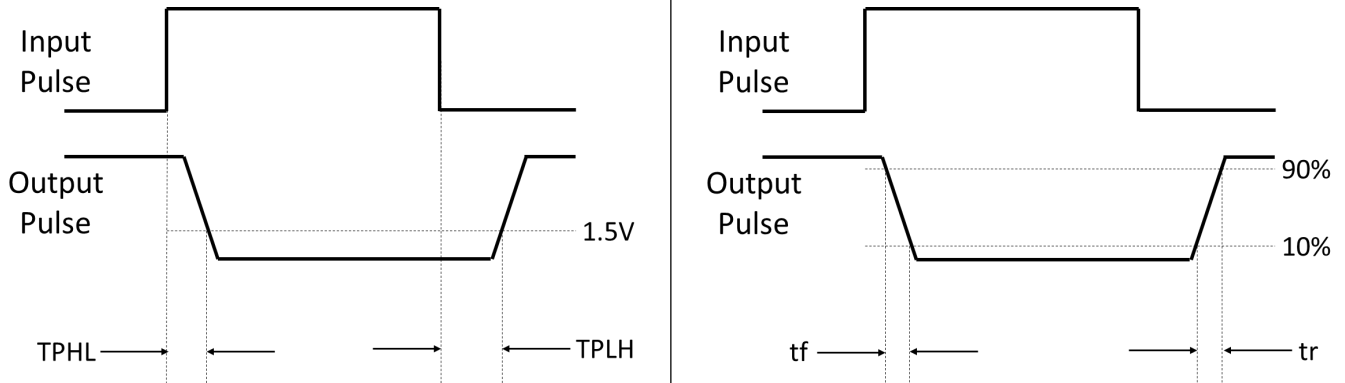


Fig.14 Waveforms of TPHL, TPLH, tr, tf



TEST CIRCUITS

Fig.15 Test Circuits for Common Mode Transient Immunity

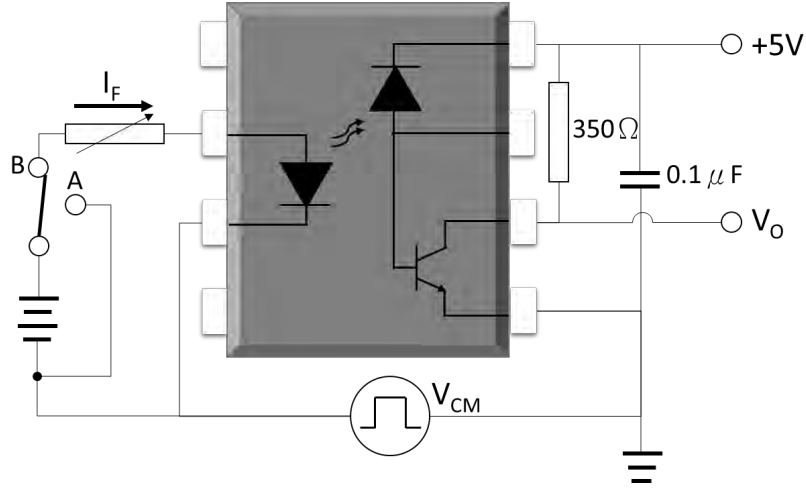
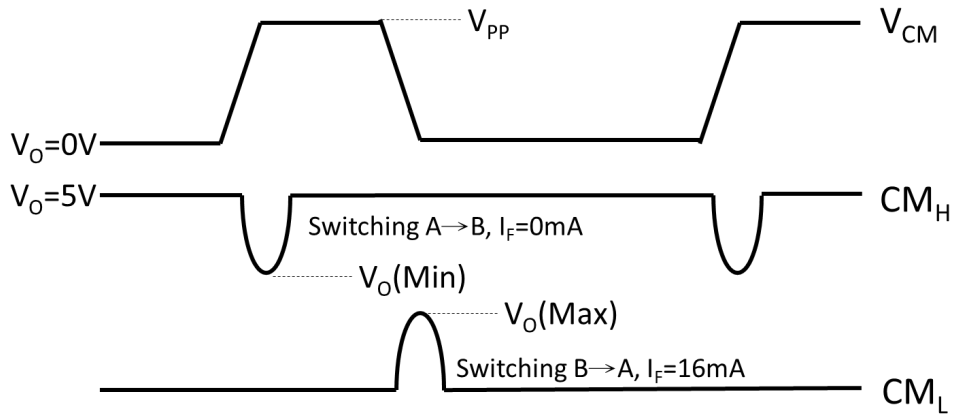


Fig.16 Waveforms of Common Mode Transient Immunity



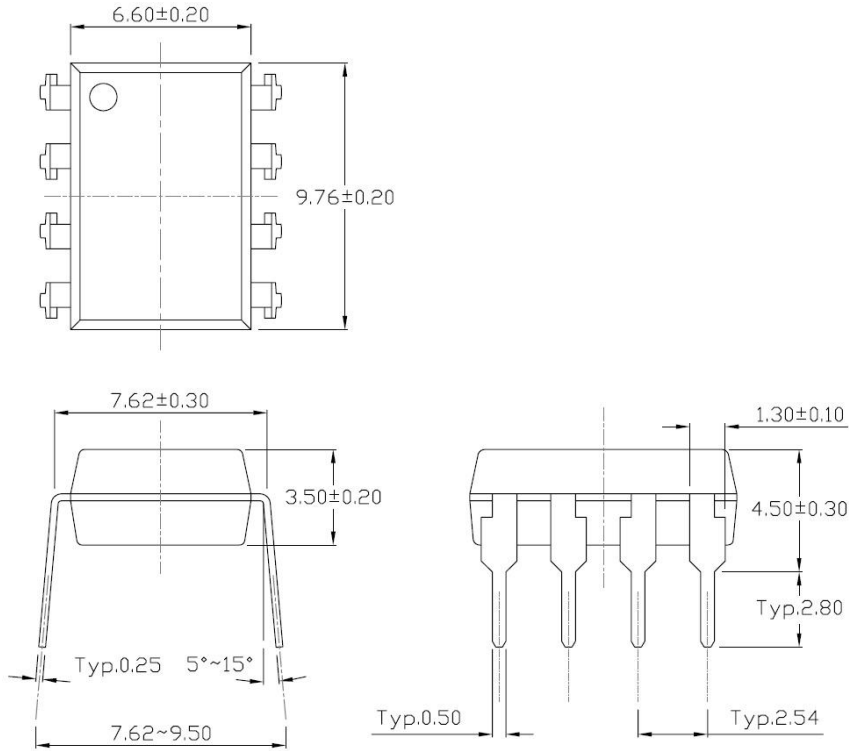


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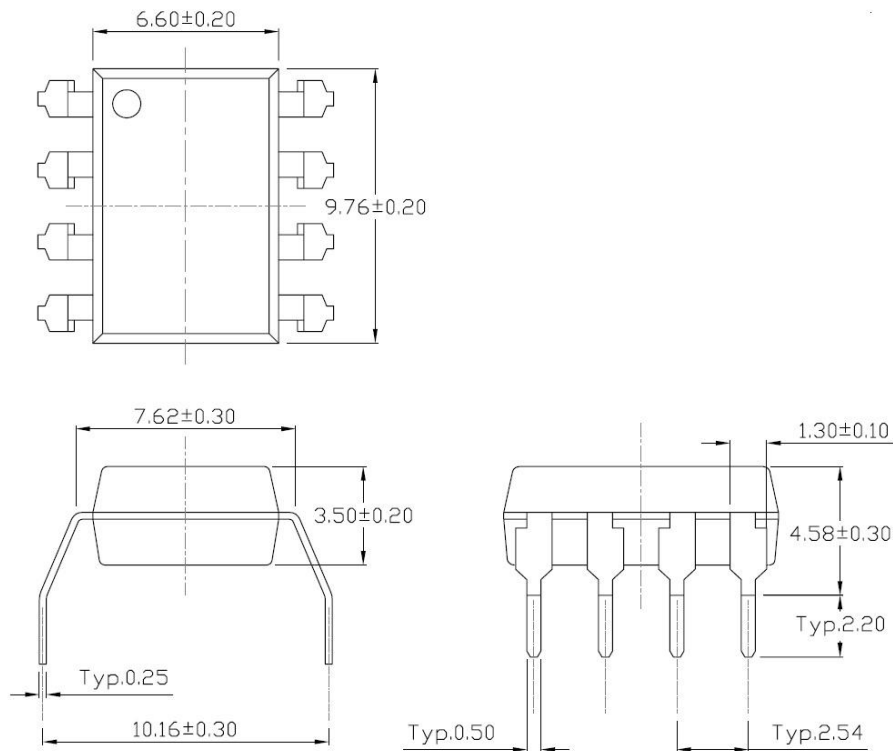
DIP8, 1Mbit/s High Speed Transistor Photo Coupler

PACKAGE DIMENSIONS (Dimensions in mm unless otherwise stated)

Standard DIP – Through Hole (DIP Type)

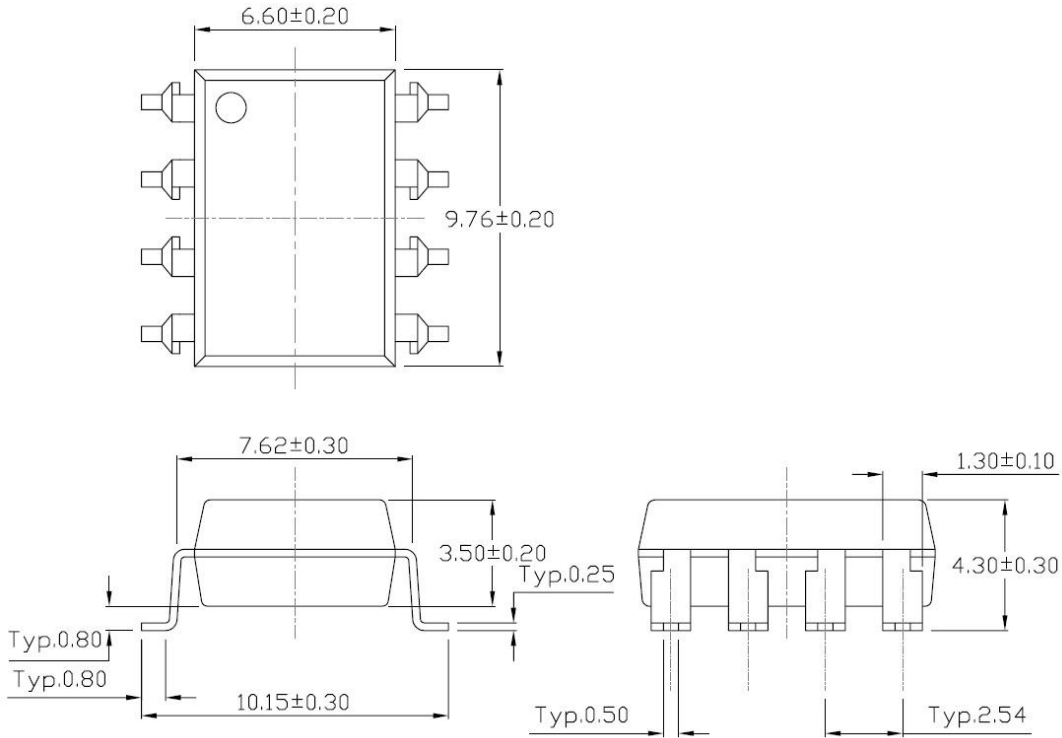


Gullwing (400mil) Lead Forming – Through Hole (M Type)

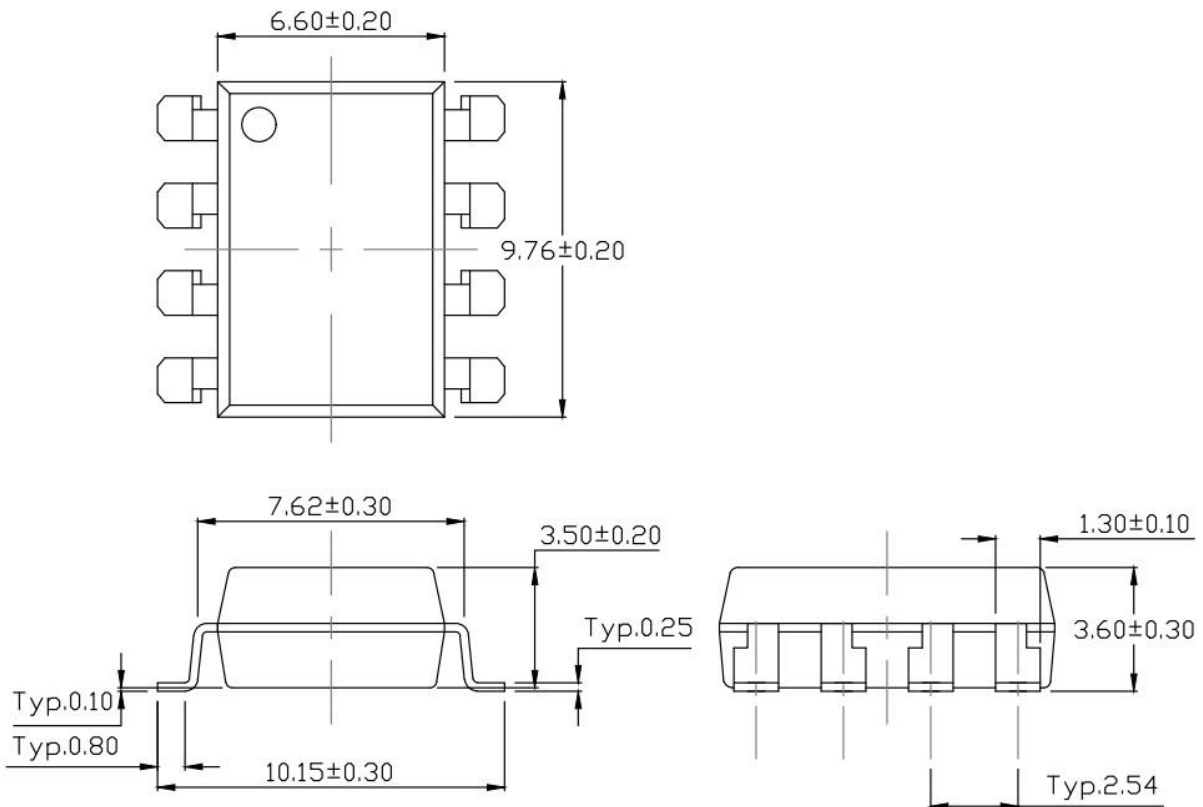


PACKAGE DIMENSIONS (Dimensions in mm unless otherwise stated)

Surface Mount Lead Forming (S Type)



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

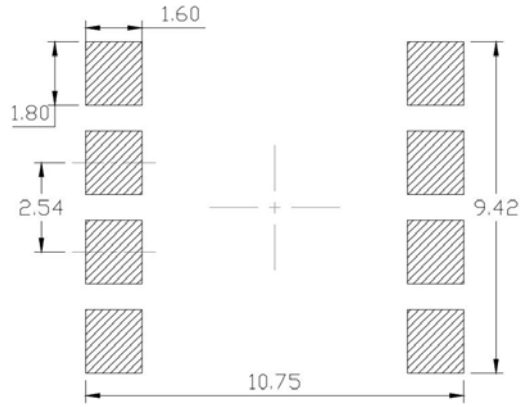




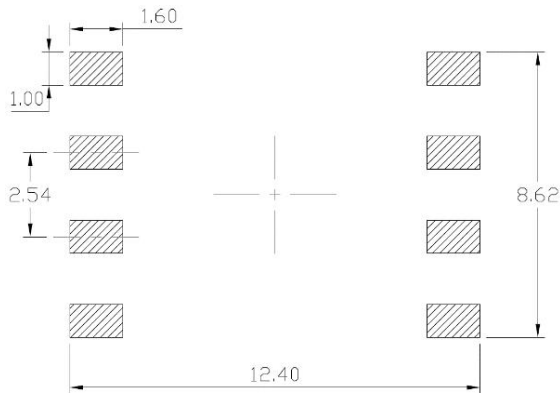
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Recommended Solder Mask (Dimensions in mm unless otherwise stated)

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



Surface Mount (Gullwing) Lead Forming

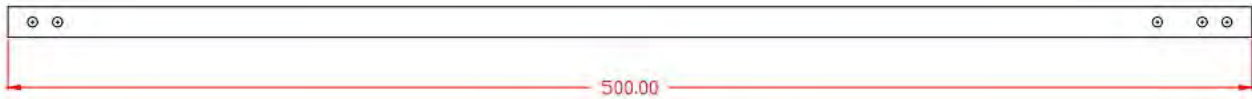
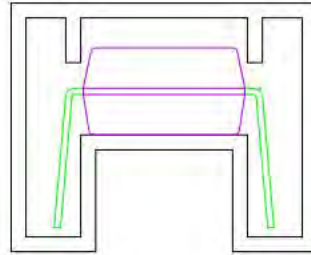
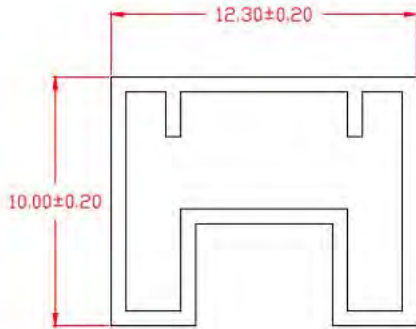




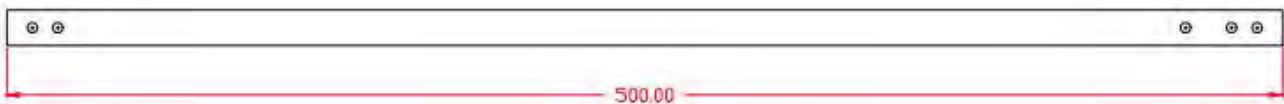
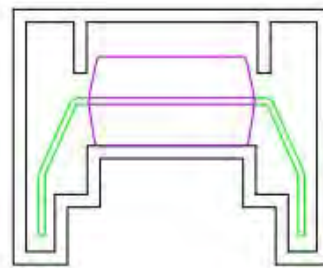
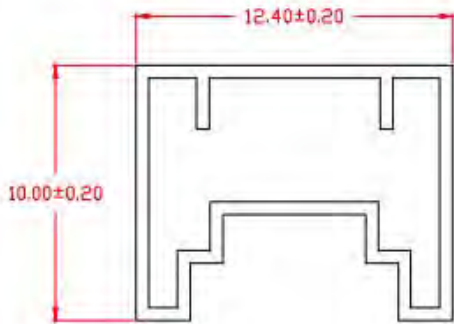
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TUBE SPECIFICATIONS (Dimensions in mm unless otherwise stated)

Standard DIP

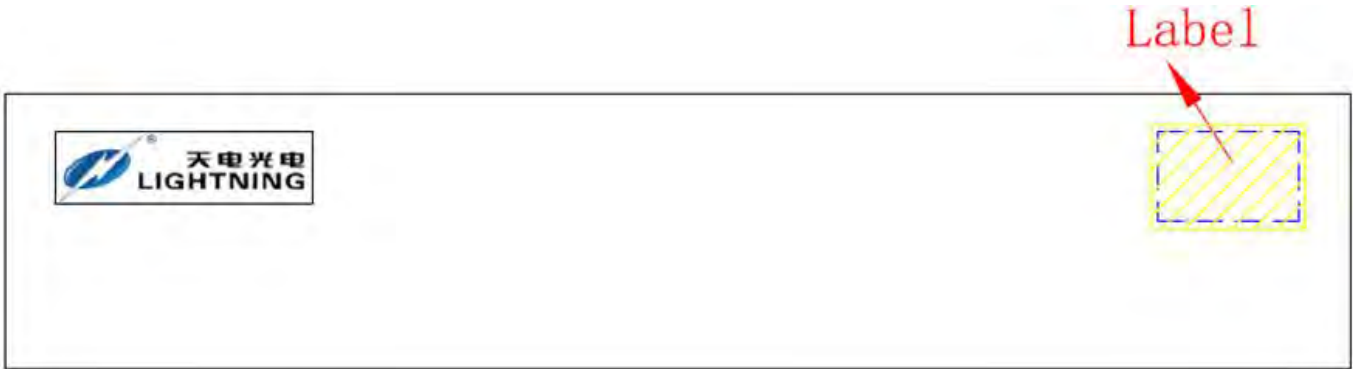


Option M



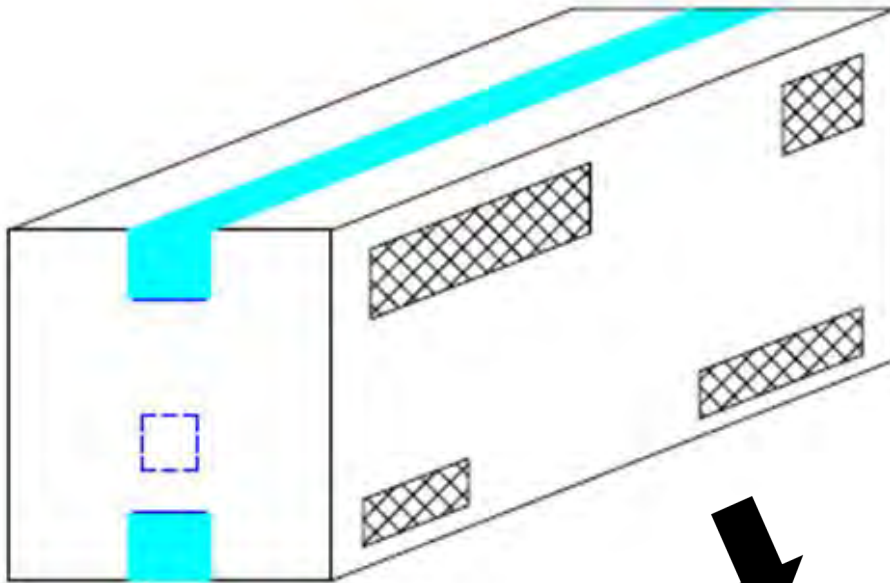
BOX SPECIFICATIONS (Tube Type)

Inner Box

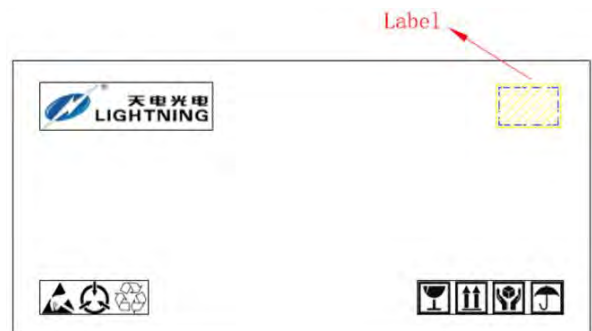


L x W x H = 52.5cm x 10.7cm x 4.7cm

Outer Box



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

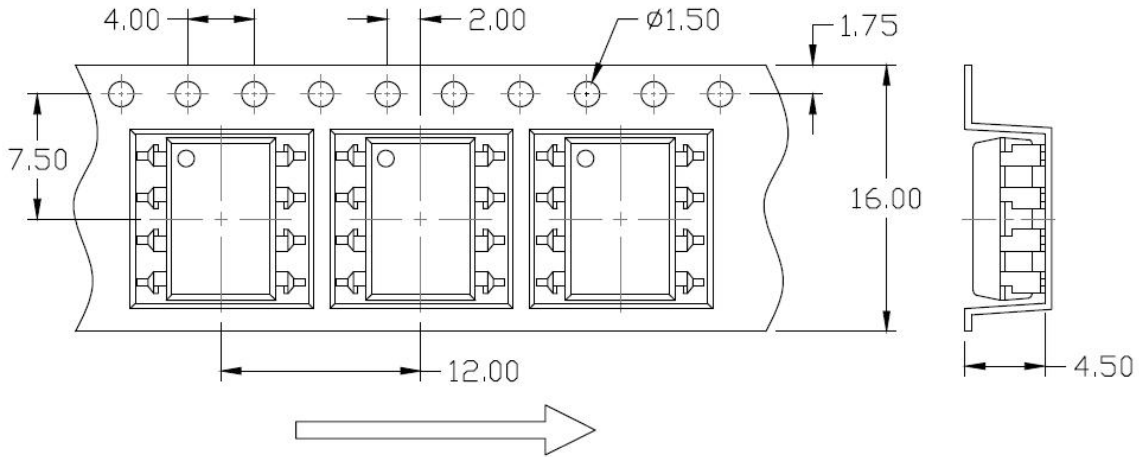




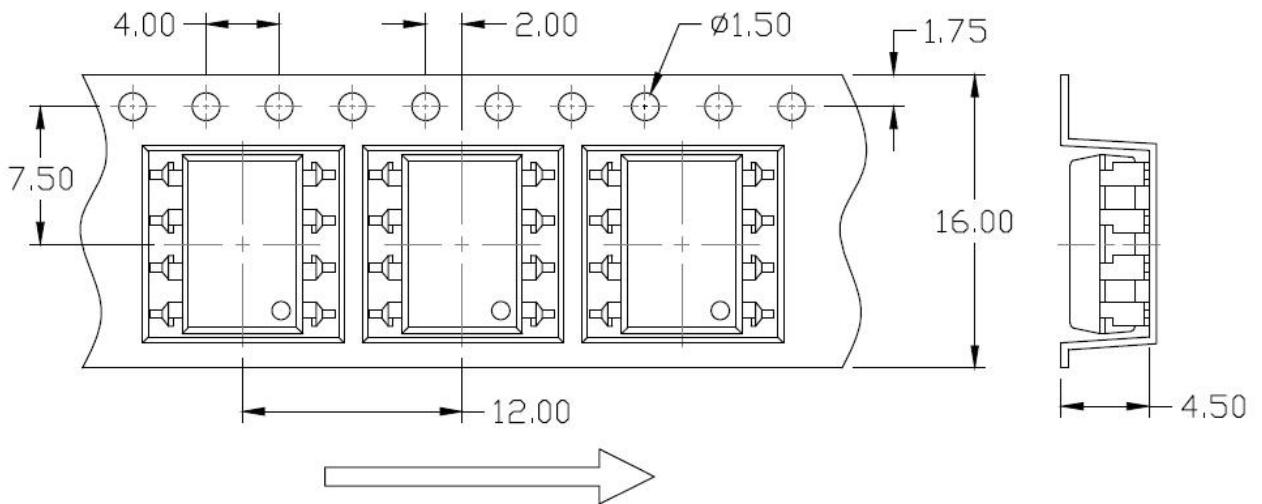
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Carrier Tape Specifications (Dimensions in mm unless otherwise stated)

Option S(T1)



Option S(T2)



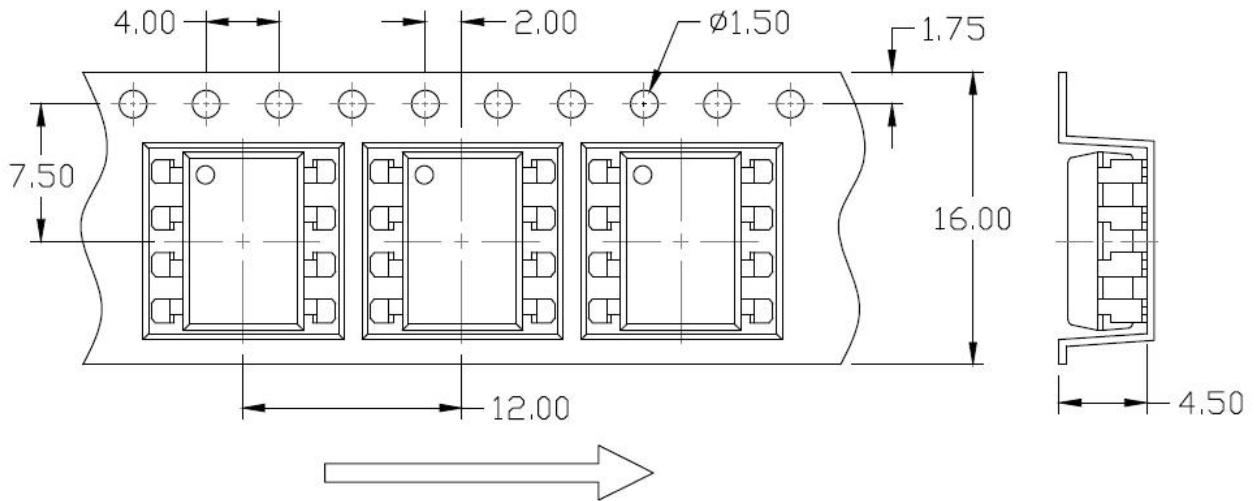


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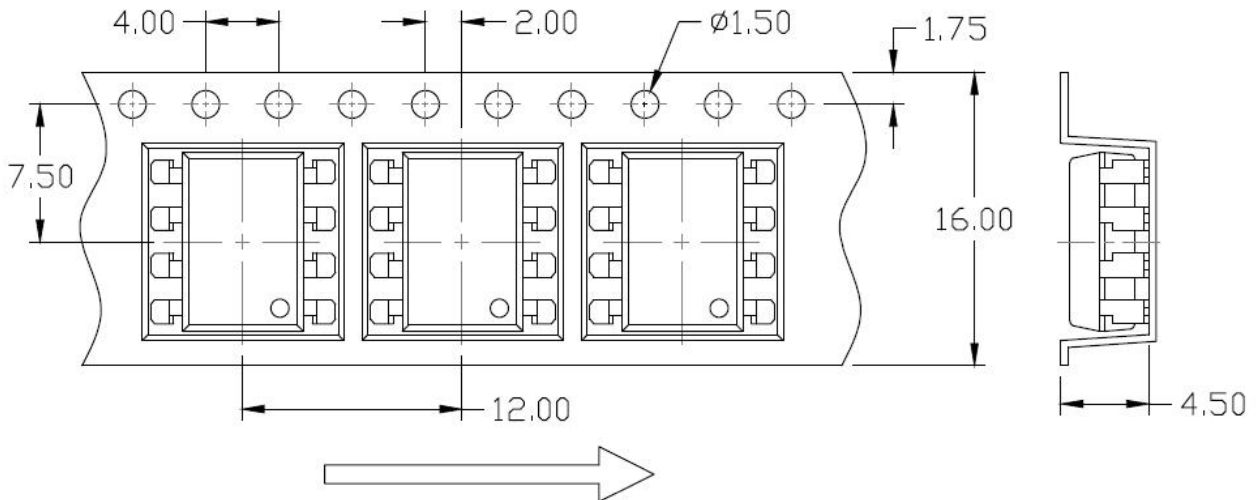
DIP8, 1Mbit/s High Speed Transistor Photo Coupler

Carrier Tape Specifications (Dimensions in mm unless otherwise stated)

Option SL(T1)

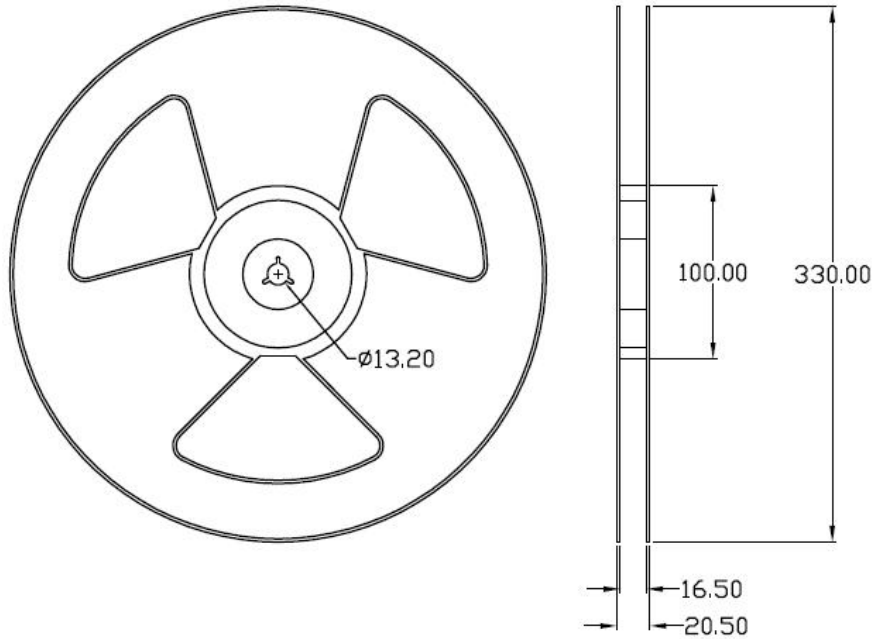


Option SL(T2)



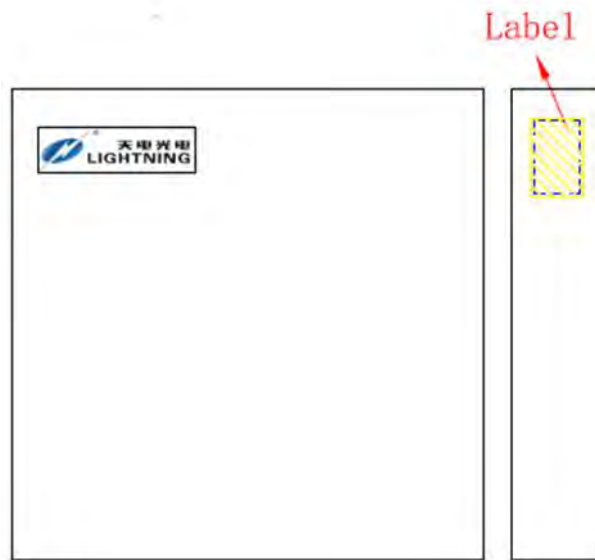
REEL SPECIFICATIONS (Dimensions in mm unless otherwise stated)

Option S & Option SL



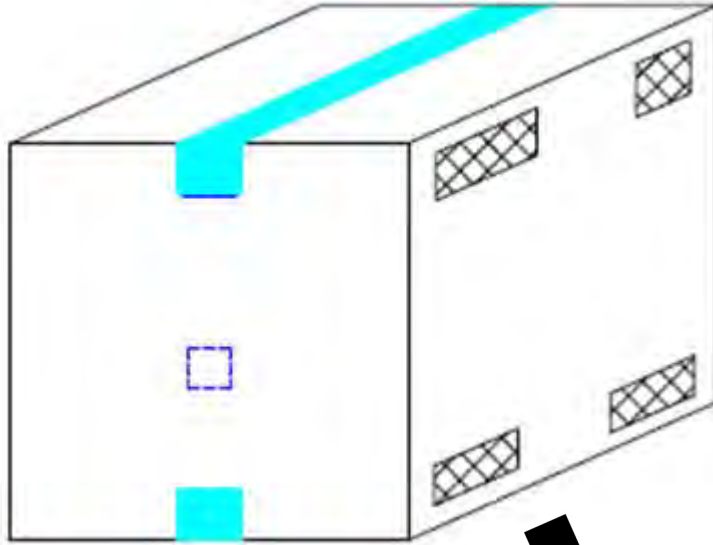
BOX SPECIFICATIONS (Reel Type)

Inner Box

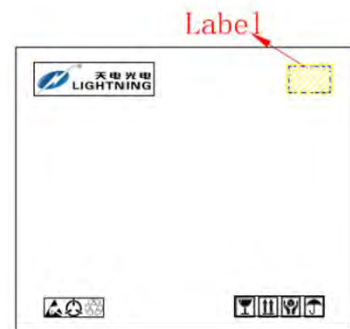


- L x W x H = 36cm x 36cm x 6.9cm

Outer Box



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



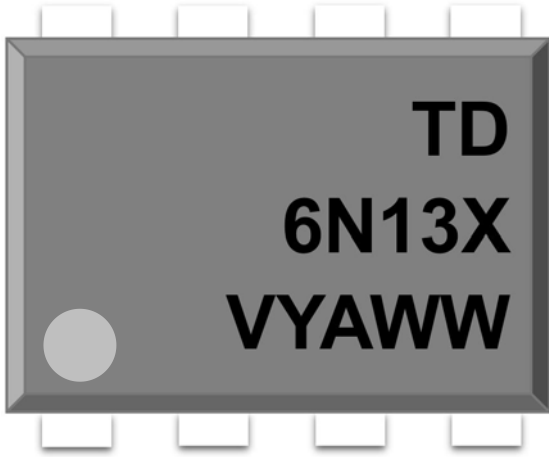


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ORDERING AND MARKING INFORMATION

MARKING INFORMATION



TD : Company Abbr.
6N13X : Part Number
V : VDE Option
Y : Fiscal Year
A : Manufacturing Code
WW : Work Week

ORDERING INFORMATION

6N13X(Y)(Z)-GV

6N13X – Part Number (X=5 or 6)
 Y – Lead Form Option
 (M/S/SL/None)
 Z – Tape and Reel Option (T1/T2)
 G – Material Option
 (G: Green, None: Non-Green)
 V – VDE Option (V or None)

LABEL INFORMATION



PACKING QUANTITY

Option	Quantity	Quantity – Inner box	Quantity – Outer box
None	45 Units/Tube	32 Tubes/Inner box	10 Inner box/Outer box = 14.4k Units
M	45 Units/Tube	32 Tubes/Inner box	10 Inner box/Outer box = 14.4k 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

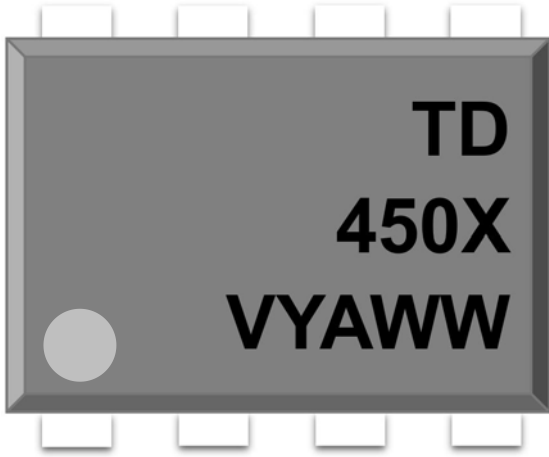


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ORDERING AND MARKING INFORMATION

MARKING INFORMATION



TD : Company Abbr.
450X : Part Number & Rank
V : VDE Option
Y : Fiscal Year
A : Manufacturing Code
WW : Work Week

ORDERING INFORMATION

TD450X(Y)(Z)-GV

TD – Company Abbr.
 450X – Rank (X=2 or 3)
 Y – Lead Form Option
 (M/S/SL/None)
 Z – Tape and Reel Option (T1/T2)
 G – Material Option
 (G: Green, None: Non-Green)
 V – VDE Option (V or None)

LABEL INFORMATION

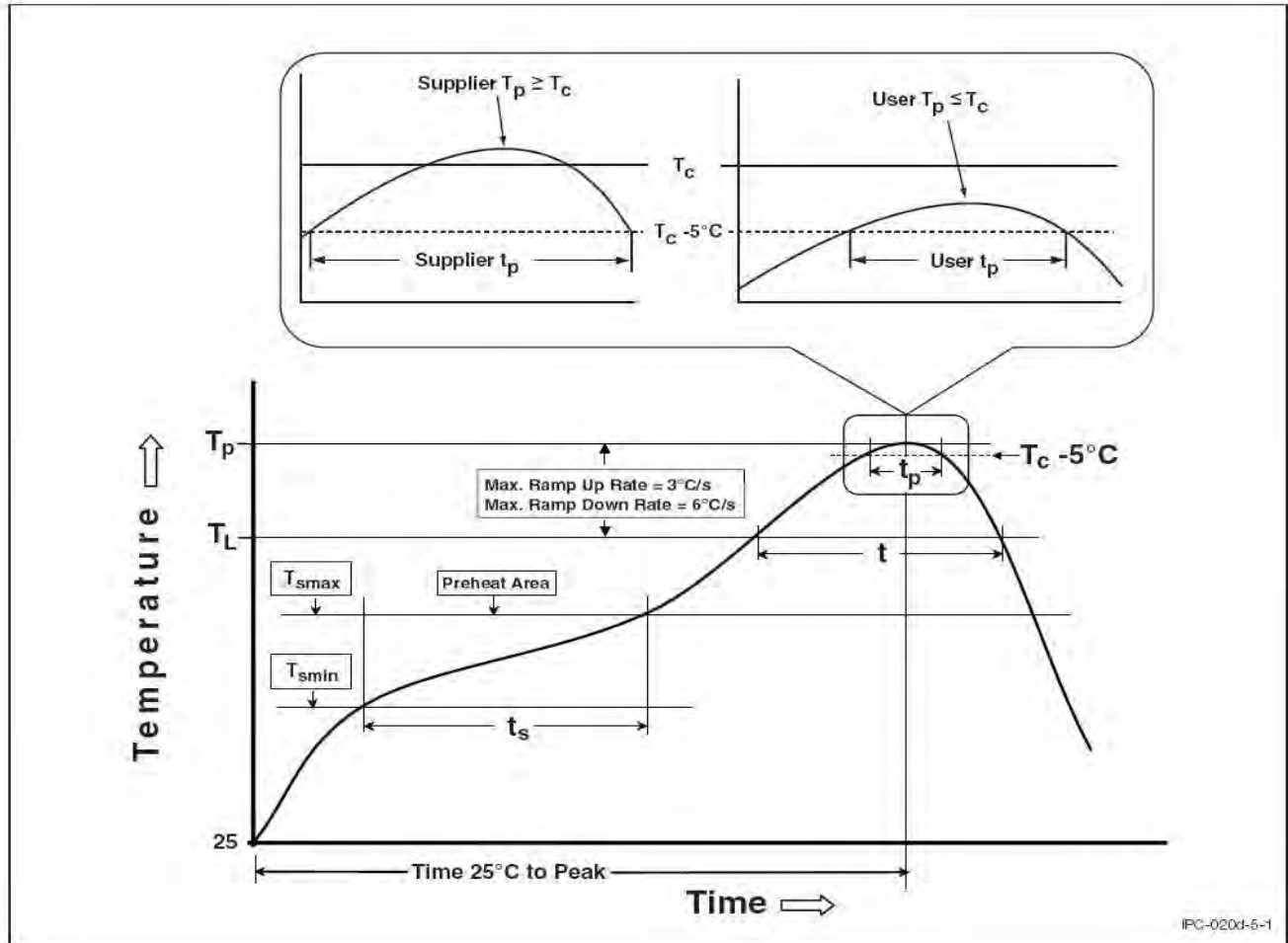


PACKING QUANTITY

Option	Quantity	Quantity – Inner box	Quantity – Outer box
None	45 Units/Tube	32 Tubes/Inner box	10 Inner box/Outer box = 14.4k Units
M	45 Units/Tube	32 Tubes/Inner box	10 Inner box/Outer box = 14.4k 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

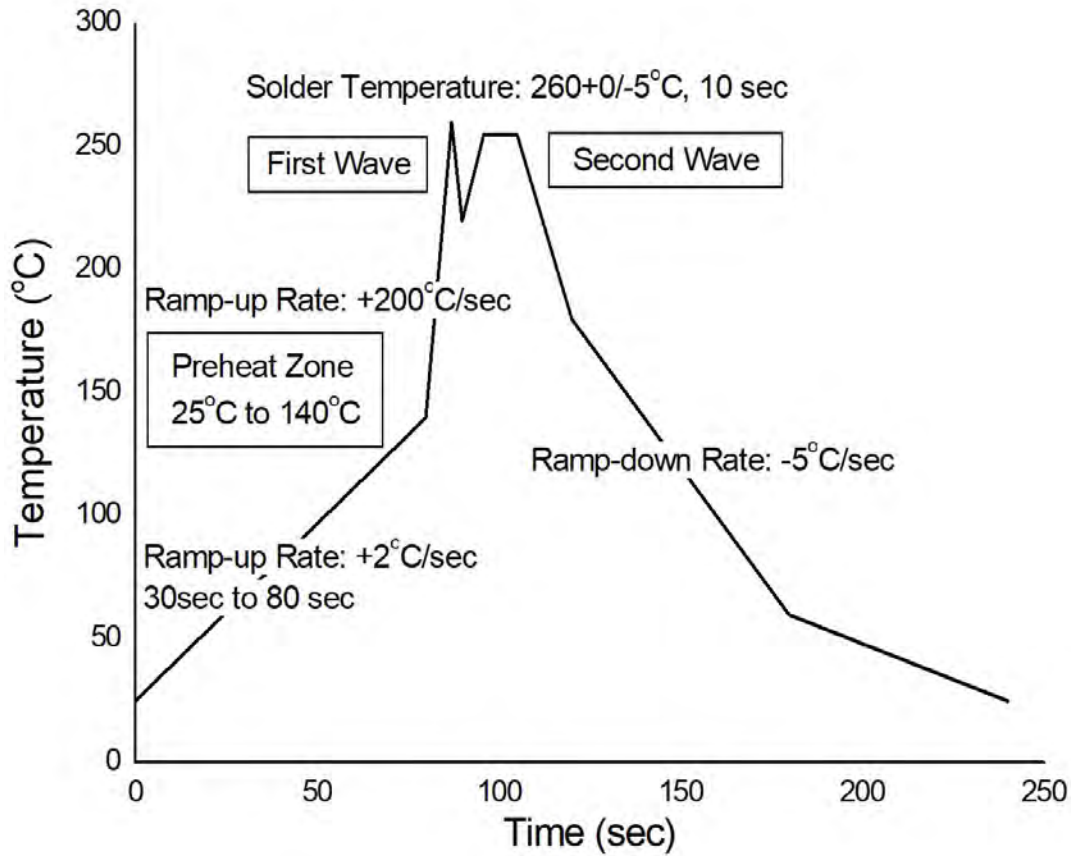
Profile Feature	Sn-Pb Assembly Profile	Pb-Free Assembly Profile
Temperature Min. (T_{smin})	100	150°C
Temperature Max. (T_{smax})	150	200°C
Time (t_s) from (T_{smin} to T_{smax})	60-120 seconds	60-120 seconds
Ramp-up Rate (t_L to t_P)	3°C/second max.	3°C/second max.
Liquidous Temperature (T_L)	183°C	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.



6N135,6N136,TD450X Series
DIP8, 1Mbit/s High Speed Transistor Photo Coupler

TEMPERATURE PROFILE OF SOLDERING

WAVE SOLDERING (JESD22-A111 COMPLIANT)



HAND SOLDERING BY SOLDERING IRON

Soldering Temperature	380+0/-5°C
Soldering Time	3 sec max.

- One time soldering is recommended for all soldering method.
- Do not solder more than three times for IR reflow soldering.



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DISCLAIMER

- LIGHTNING is continually improving the quality, reliability, function and design. LIGHTNING reserves the right to make changes without further notices.
- The characteristic curves shown in this datasheet are representing typical performance which are not guaranteed.
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- 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.