



# 6N135,6N136,TD4502,TD4503 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.

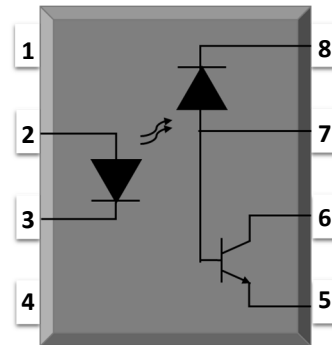
### Features

- 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(Pending Approved)
  - VDE - EN60747-5-5(VDE0884-5)
  - CQC – GB4943.1, GB8898

### Applications

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

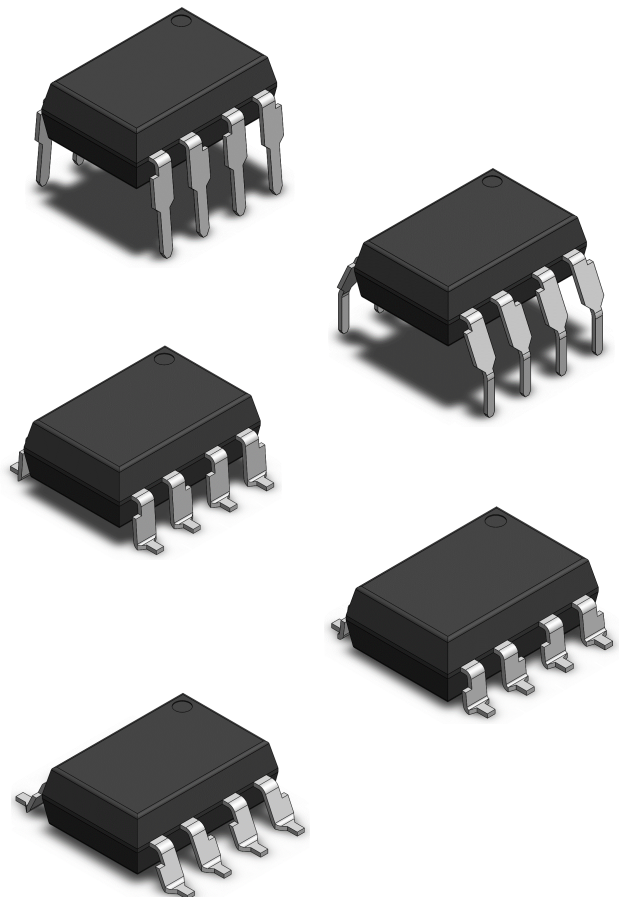
### SCHEMATIC



### 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





# **6N135,6N136,TD4502,TD4503 Series**

## **DIP8, 1Mbit/s High Speed Transistor Photo Coupler**

### **ABSOLUTE MAXIMUM RATINGS**

PARAMETER	SYMBOL	VALUE	UNIT	Note
<b>INPUT</b>				
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	
<b>OUTPUT</b>				
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	
<b>COMMON</b>				
Total Power Dissipation	$P_{tot}$	200	mW	
Isolation Voltage	$V_{iso}$	5000	V <sub>rms</sub>	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



## ***6N135,6N136,TD4502,TD4503 Series***

### ***DIP8, 1Mbit/s High Speed Transistor Photo Coupler***

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



# 6N135,6N136,TD4502,TD4503 Series

## DIP8, 1Mbit/s High Speed Transistor Photo Coupler

### 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	$\mu$ A	$I_F = 16\text{mA}$ , $V_O = 0.4\text{V}$ , $V_{CC}=4.5\text{V}$ , $T_a=25^\circ\text{C}$
	6N136		19	-	50		
	TD4502						
	TD4503						
	6N135		5	-	-		
6N136	15	-	-				
TD4502							
TD4503							
Logic Low Output Voltage	6N135	$V_{OL}$	-	0.18	0.4	$\mu$ A	$I_F = 16\text{mA}$ , $I_O = 1.1\text{mA}$ , $V_{CC}=4.5\text{V}$ , $T_a=25^\circ\text{C}$
	6N136		-	0.25	0.4		
	TD4502						
	TD4503						
	6N135		-	-	-		
6N136	-	-	-	$I_F = 16\text{mA}$ , $I_O = 2.4\text{mA}$ , $V_{CC}=4.5\text{V}$			
TD4502							
TD4503							
Isolation Resistance	Riso	$10^{12}$	$10^{14}$	-	$\Omega$	DC500V, 40 ~ 60% R.H.	
Floating Capacitance	$C_{IO}$	-	0.3	1	pF	$V=0$ , $f=1\text{MHz}$	

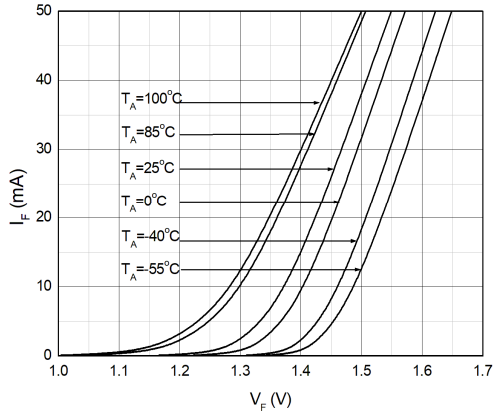


# 6N135, 6N136, TD4502, TD4503 Series

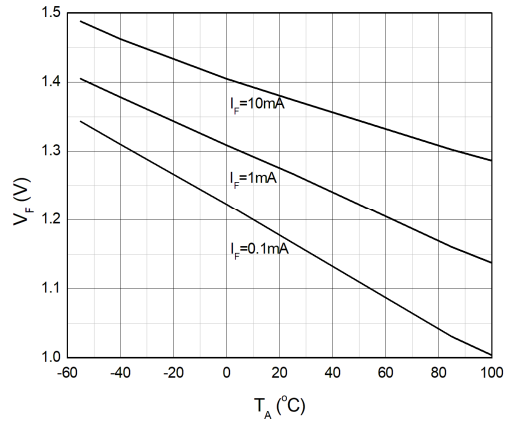
## DIP8, 1Mbit/s High Speed Transistor Photo Coupler

### CHARACTERISTIC CURVES

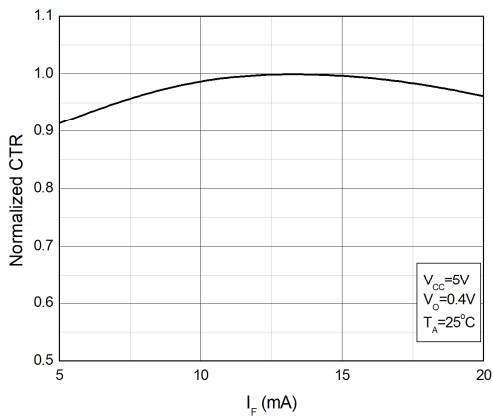
**Fig.1 Forward Current vs. Forward Voltage**



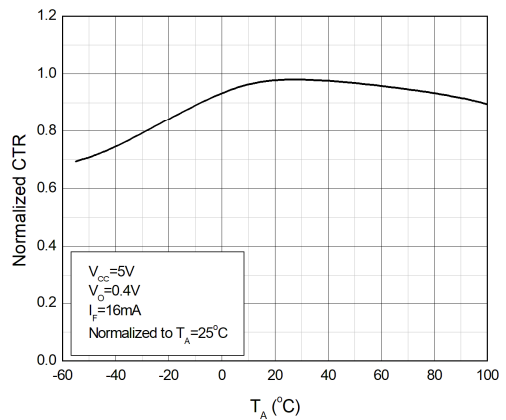
**Fig.2 Forward Voltage vs. Ambient Temperature**



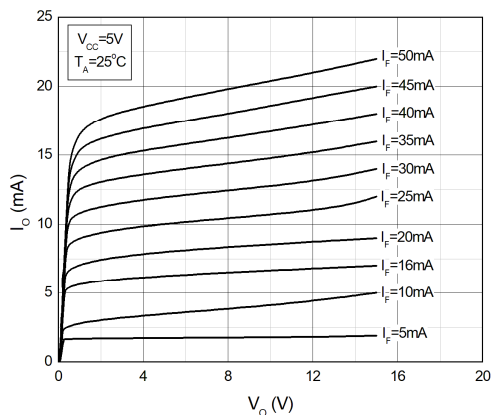
**Fig.3 Input Threshold Current vs. Ambient Temperature**



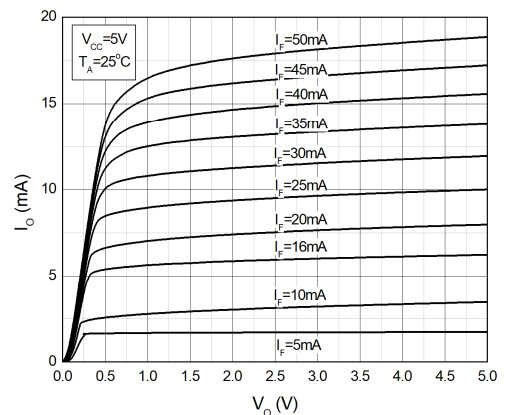
**Fig.4 Input Threshold Current vs. Ambient Temperature**



**Fig.5 Low Level Output Current vs. Ambient Temperature**



**Fig.6 Low Level Output Current vs. Ambient Temperature**



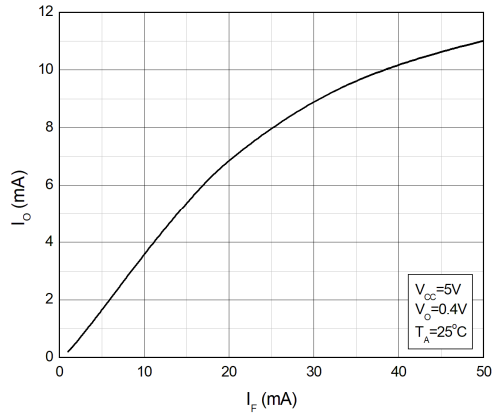


# 6N135, 6N136, TD4502, TD4503 Series

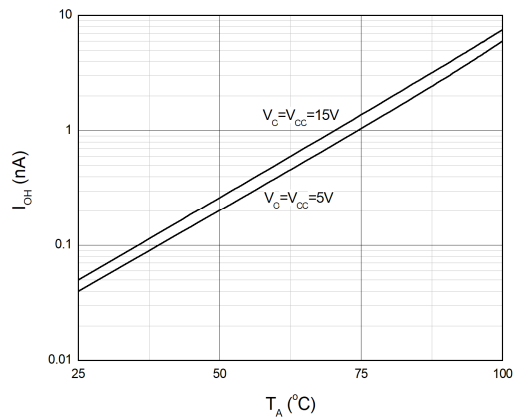
## DIP8, 1Mbit/s High Speed Transistor Photo Coupler

### CHARACTERISTIC CURVES

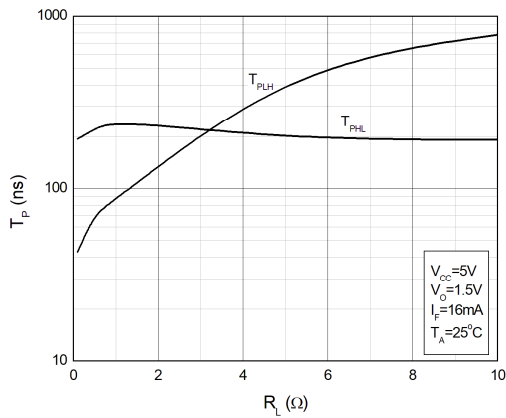
**Fig.7 Low Level Output Voltage vs. Ambient Temperature**



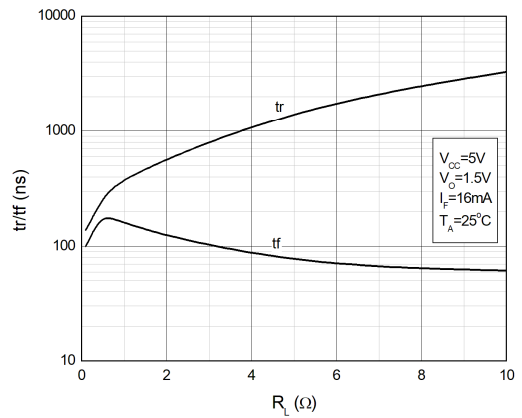
**Fig.8 Low Level Output Voltage vs. Ambient Temperature**



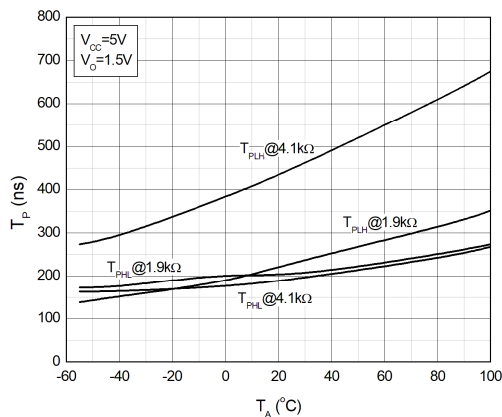
**Fig.9 High Level Output Current vs. Ambient Temperature**



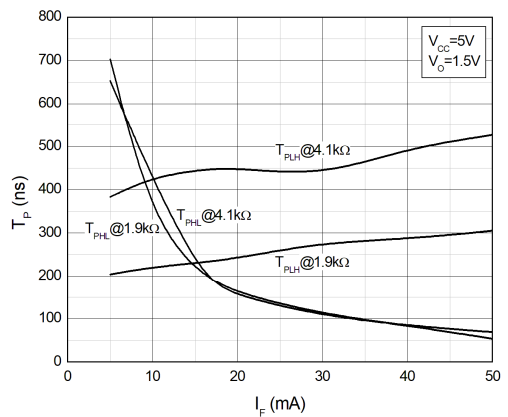
**Fig.10 High Level Output Current vs. Ambient Temperature**



**Fig.11 Output Voltage vs. Forward Current**

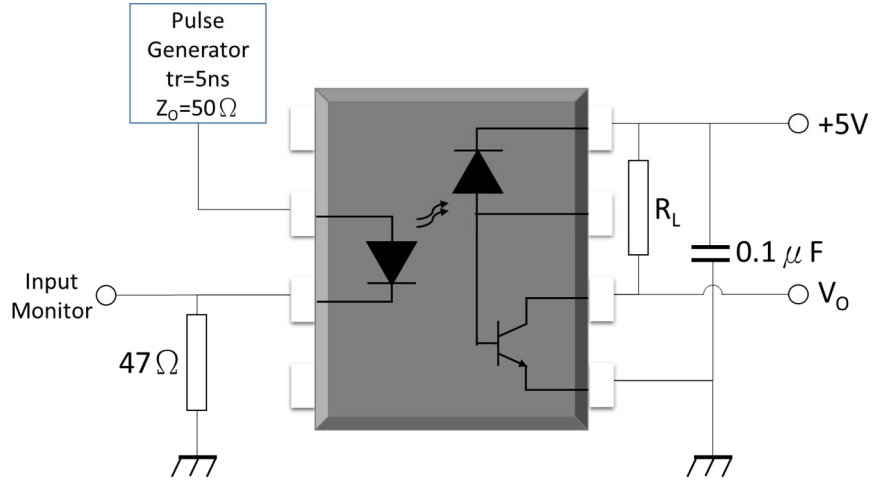


**Fig.12 Output Voltage vs. Forward Current**

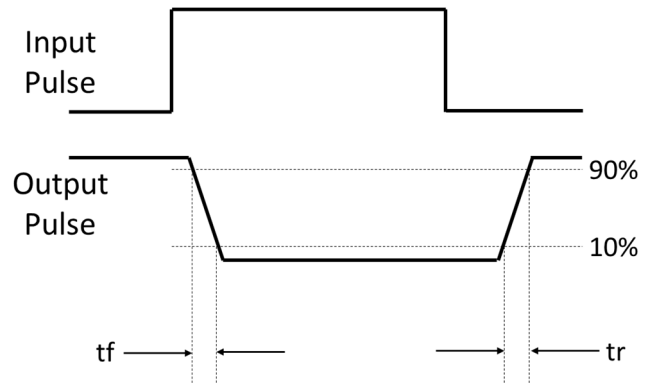
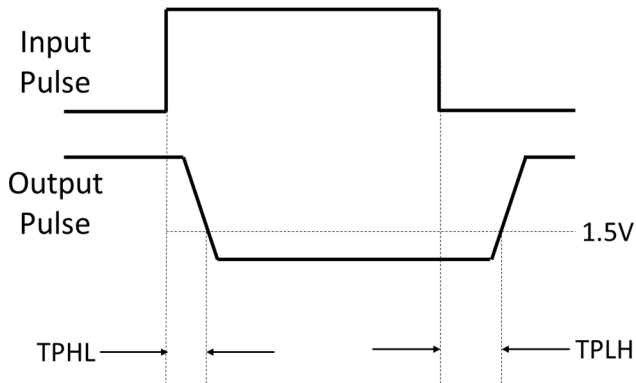


**TEST CIRCUITS**

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

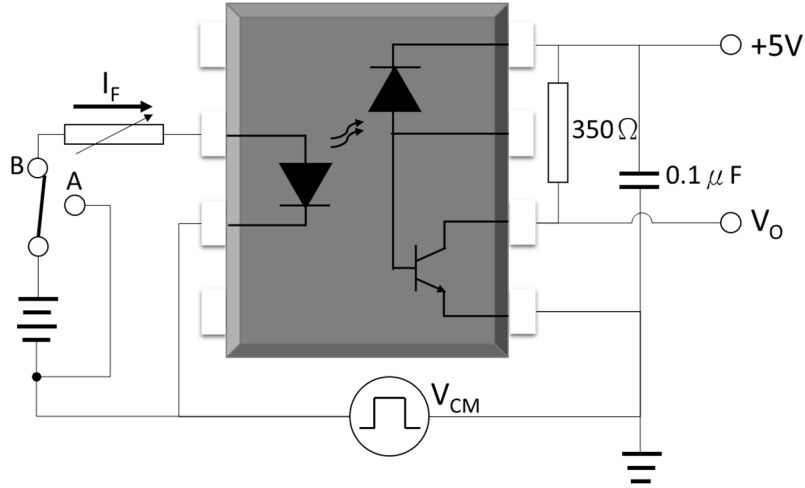


**Fig.14 Waveforms of TPHL, TPLH, tr, tf**

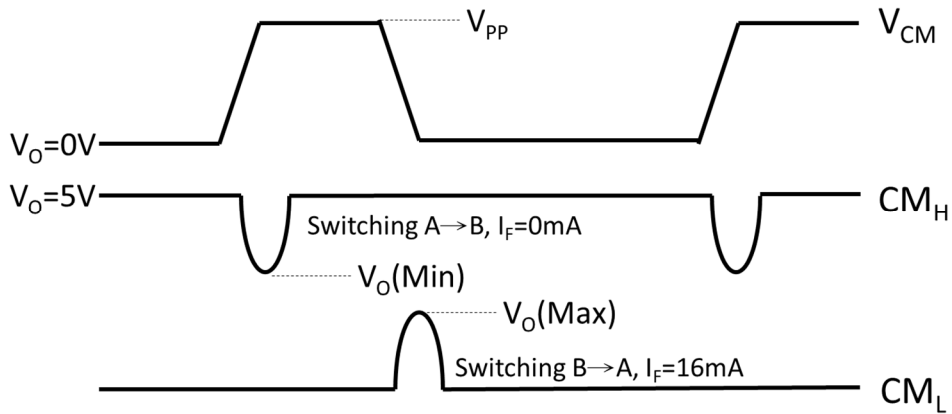


**TEST CIRCUITS**

**Fig.15 Test Circuits for Common Mode Transient Immunity**



**Fig.16 Waveforms of Common Mode Transient Immunity**





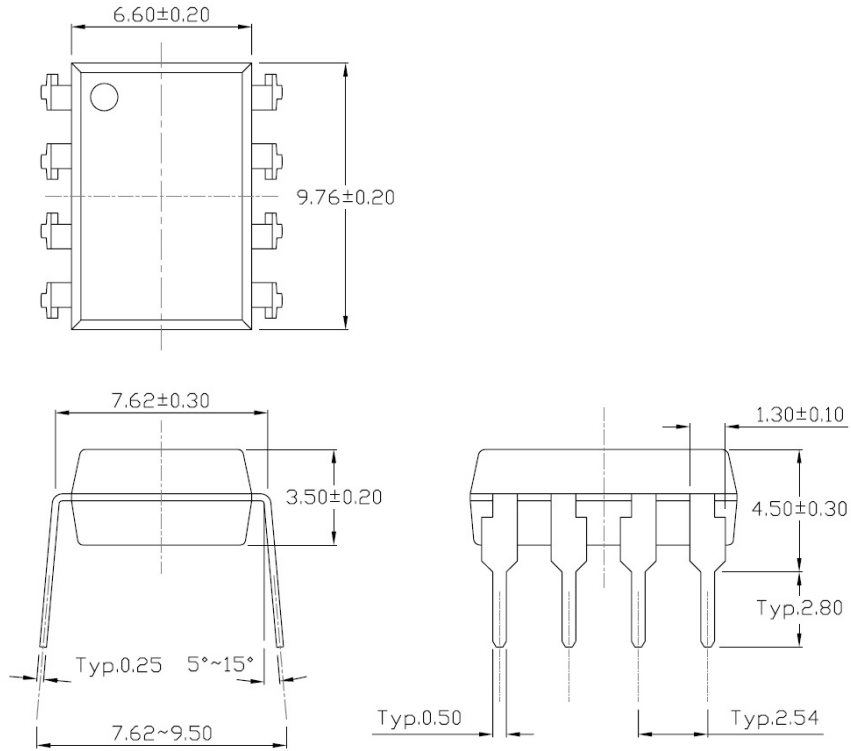


# 6N135, 6N136, TD4502, TD4503 Series

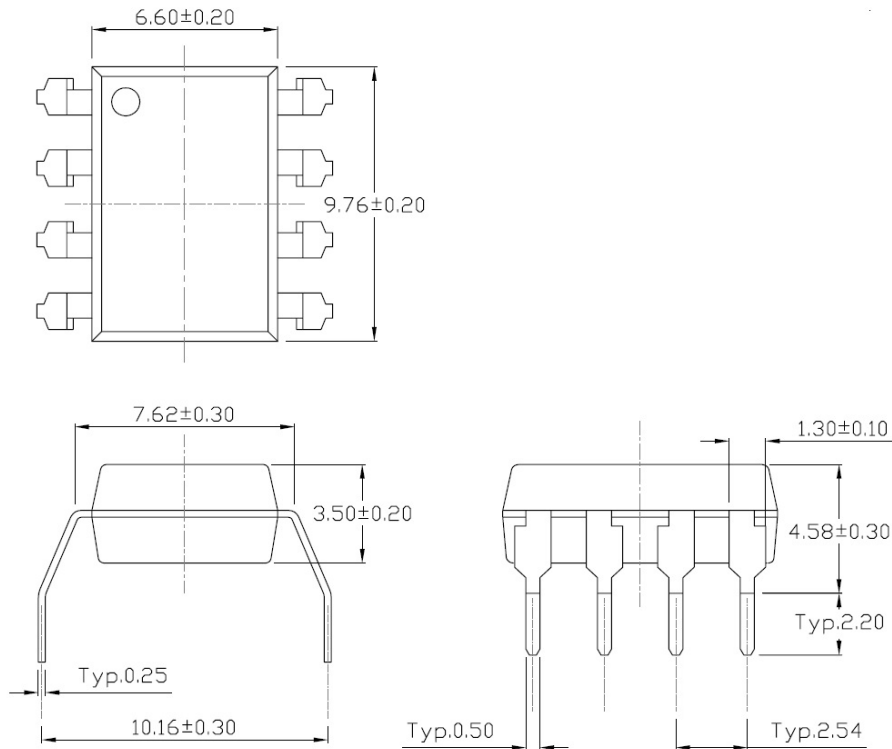
## DIP8, 1Mbit/s High Speed Transistor Photo Coupler

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

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



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



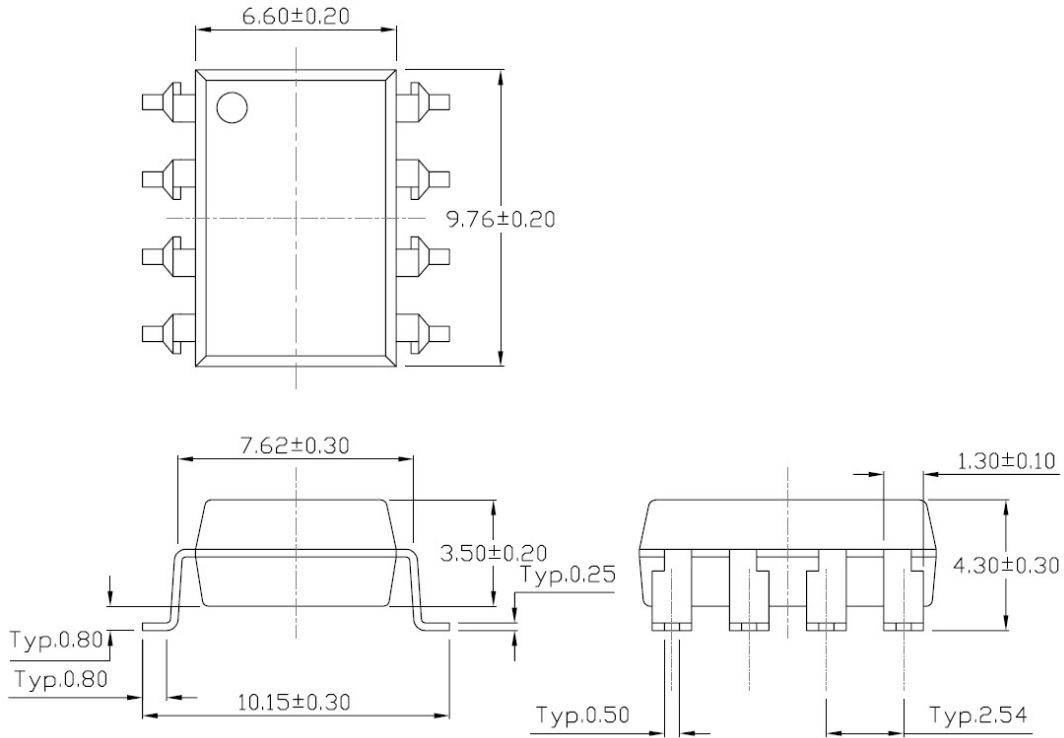


# 6N135,6N136,TD4502,TD4503 Series

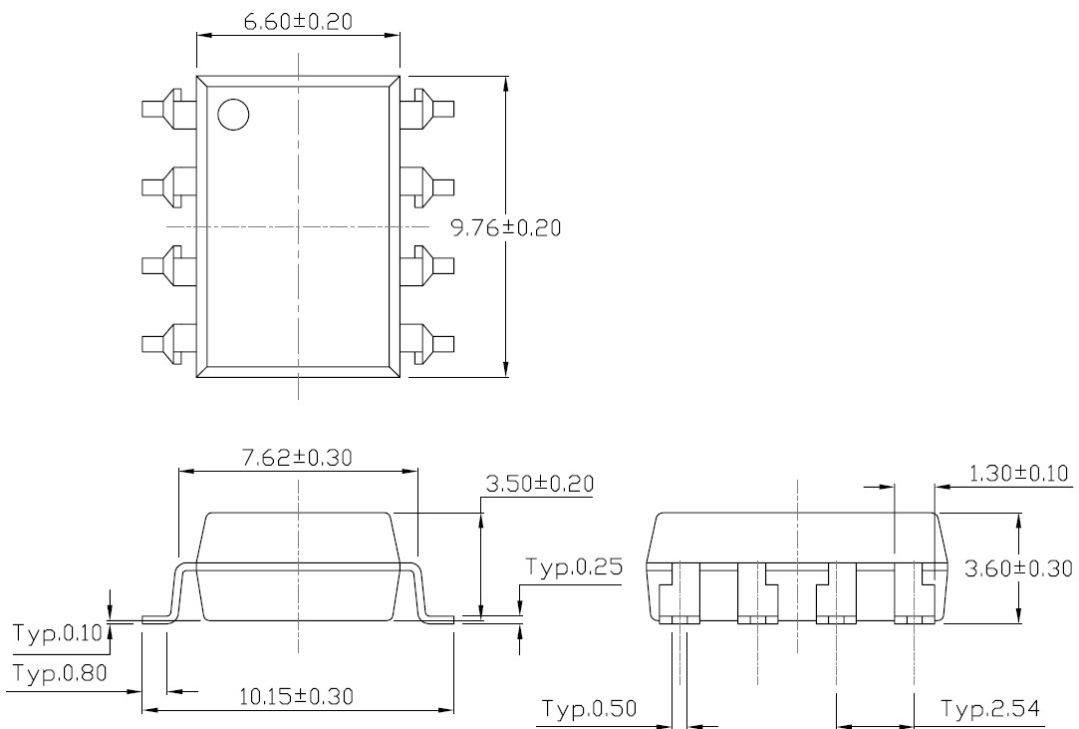
## DIP8, 1Mbit/s High Speed Transistor Photo Coupler

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

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



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

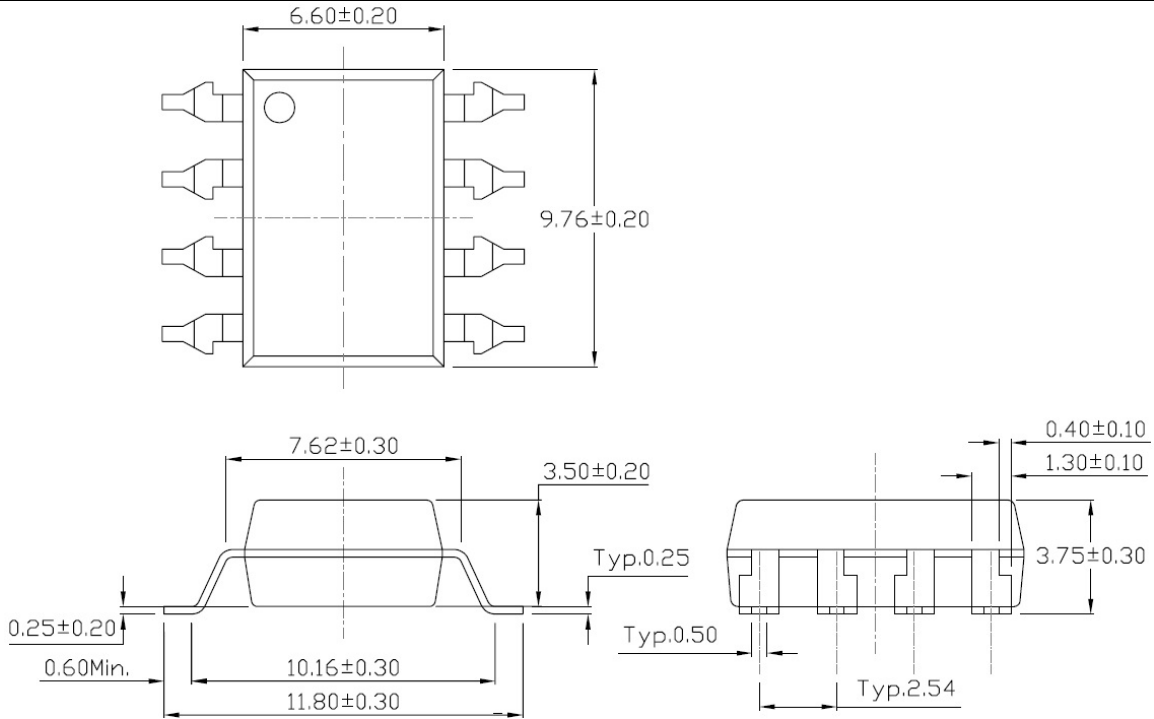




**6N135,6N136,TD4502,TD4503 Series**  
**DIP8, 1Mbit/s High Speed Transistor Photo Coupler**

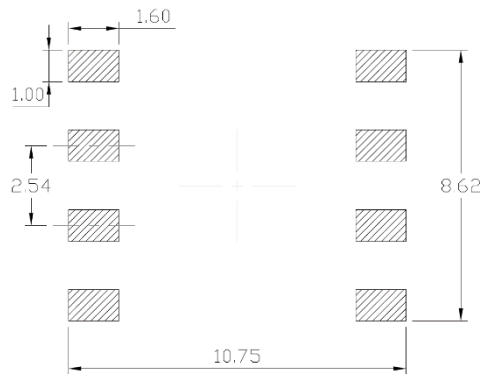
**PACKAGE DIMENSIONS (Dimensions in mm unless otherwise stated)**

**Surface Mount (Gullwing) Lead Forming (SLM Type)**

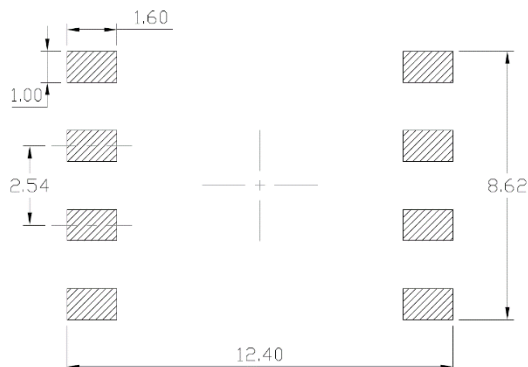


**Recommended Solder Mask (Dimensions in mm unless otherwise stated)**

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



**Surface Mount (Gullwing) Lead Forming**

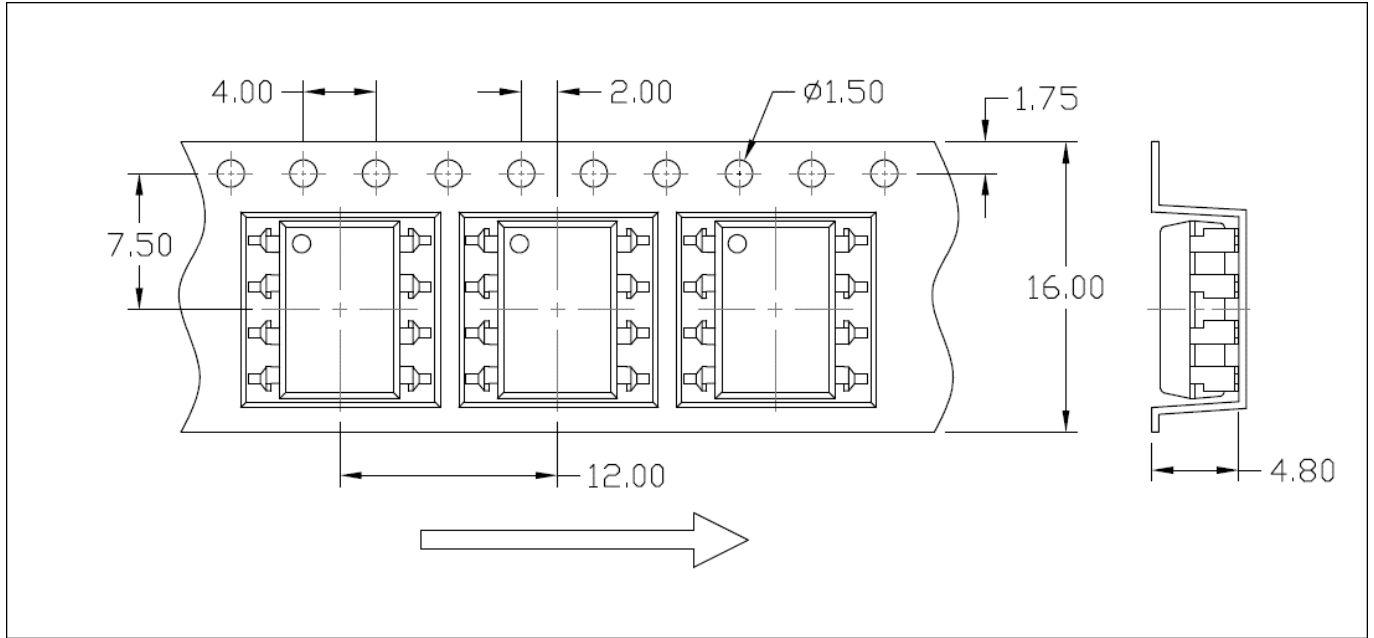




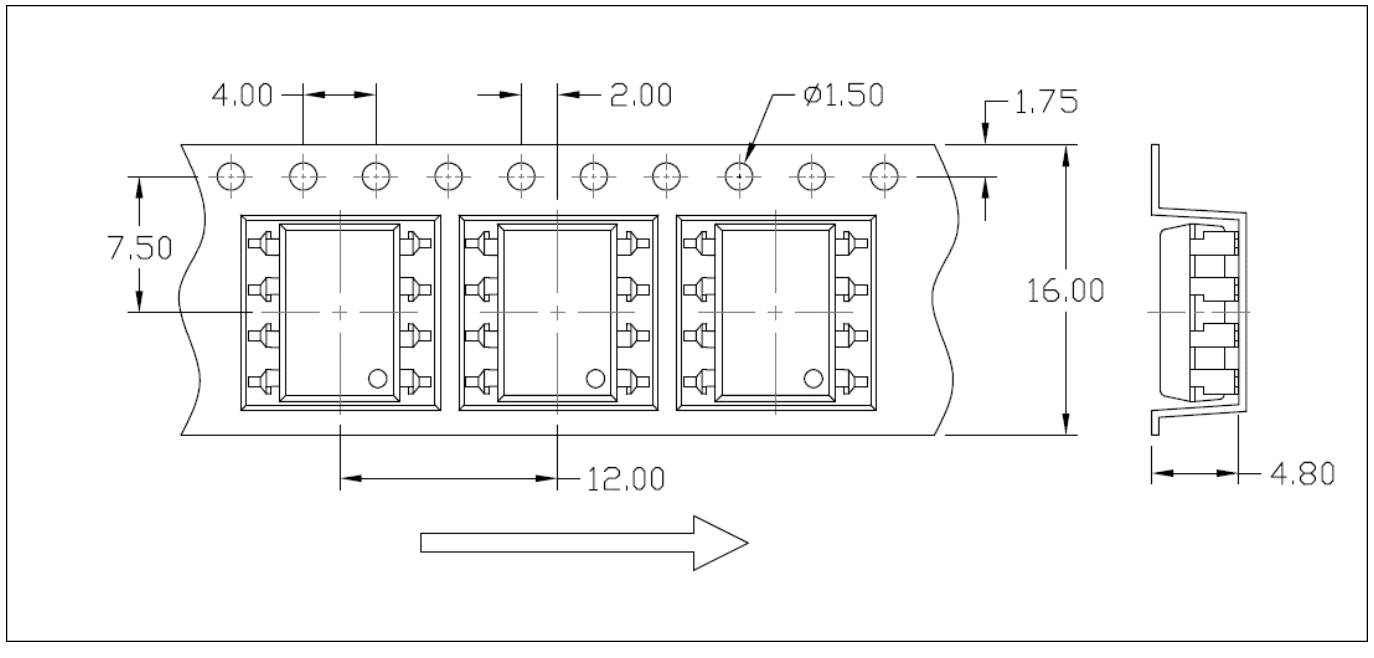
# 6N135,6N136,TD4502,TD4503 Series DIP8, 1Mbit/s High Speed Transistor Photo Coupler

## Carrier Tape Specifications (Dimensions in mm unless otherwise stated)

### Option S(T1) & SL(T1)



### Option S(T2) & SL(T2)



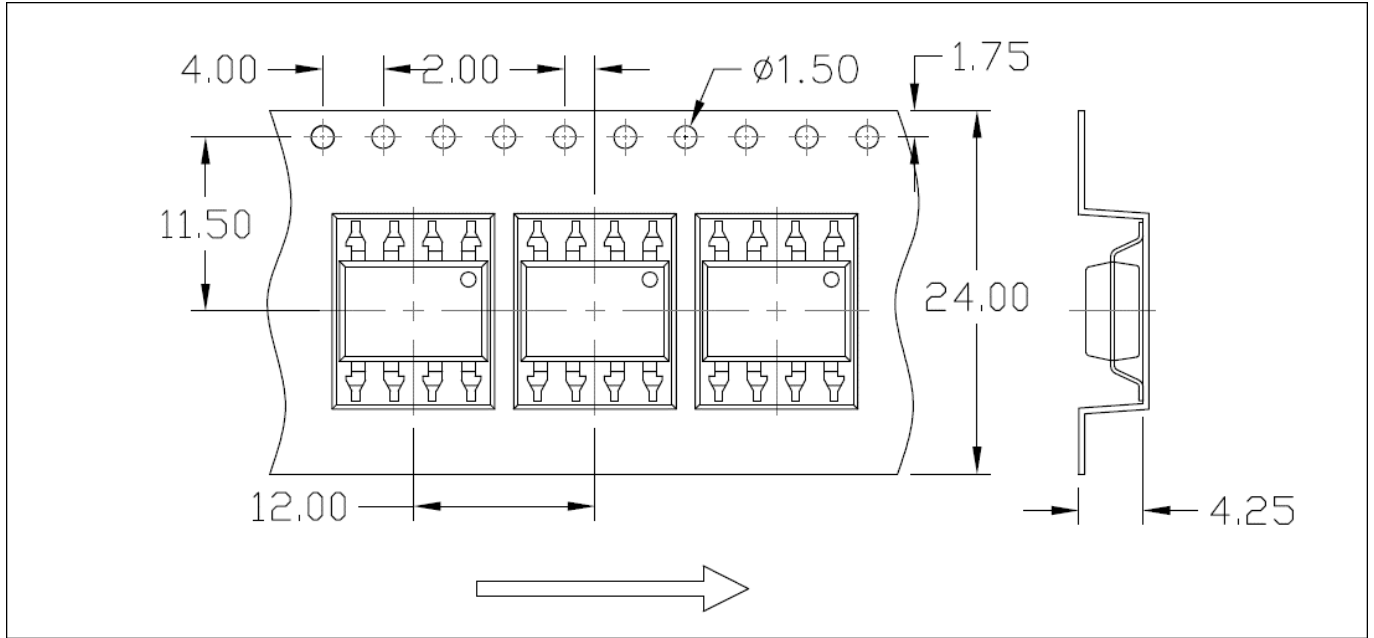


# 6N135,6N136,TD4502,TD4503 Series

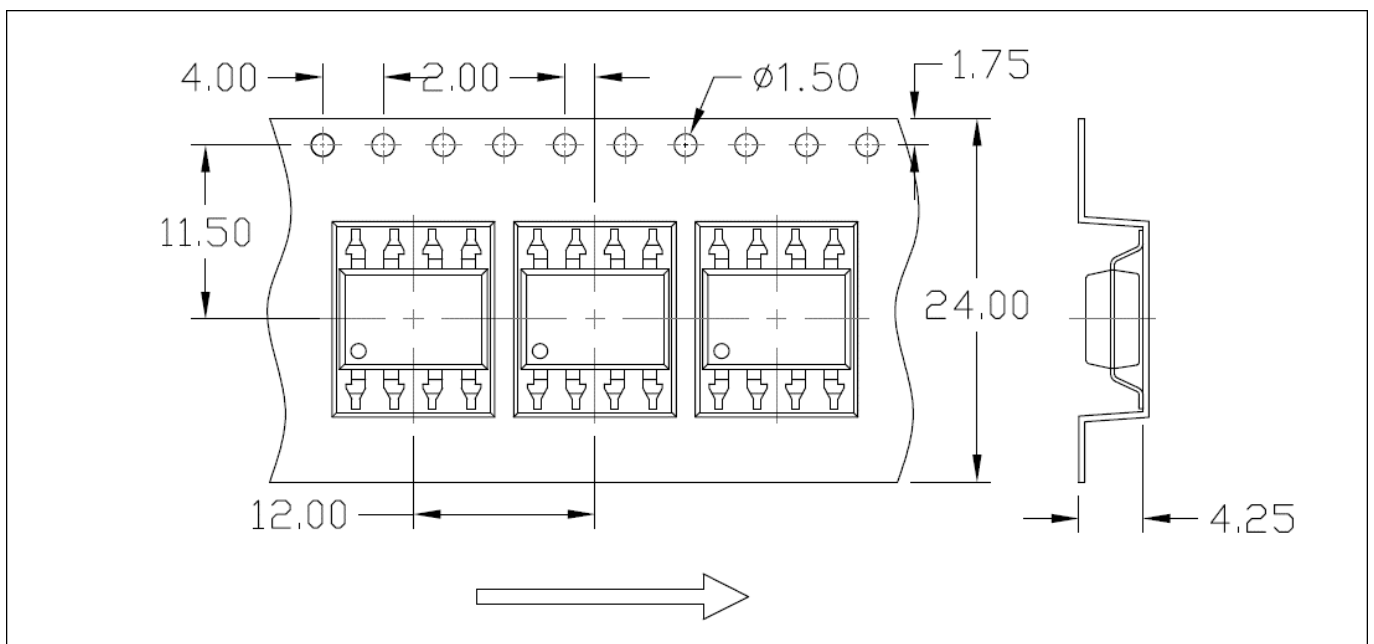
## DIP8, 1Mbit/s High Speed Transistor Photo Coupler

### Carrier Tape Specifications (Dimensions in mm unless otherwise stated)

#### Option SLM(T1)



#### Option SLM(T2)





**6N135,6N136,TD4502,TD4503 Series**  
**DIP8, 1Mbit/s High Speed Transistor Photo Coupler**

**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/SLM/None)  
 Z – Tape and Reel Option (T1/T2)  
 G – Material Option (G: Green, None: Non-Green)  
 V – VDE Option (V or None)

**PACKING QUANTITY**

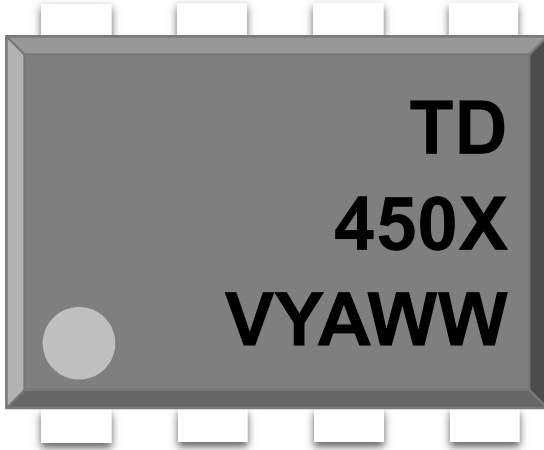
Option	Description	Quantity
None	Standard 8 Pin Dip	50Units/Tube
M	Gullwing(400mil) Lead Forming	50Units/Tube
S(T1)	Surface Mount Lead Forming – With Option 1 Taping	1000 Units/Reel
S(T2)	Surface Mount Lead Forming – With Option 2 Taping	1000 Units/Reel
SL(T1)	Surface Mount Lead Forming(Low Profile) – With Option 1 Taping	1000 Units/Reel
SL(T2)	Surface Mount Lead Forming(Low Profile) – With Option 2 Taping	1000 Units/Reel



**6N135,6N136,TD4502,TD4503 Series**  
**DIP8, 1Mbit/s High Speed Transistor Photo Coupler**

**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**

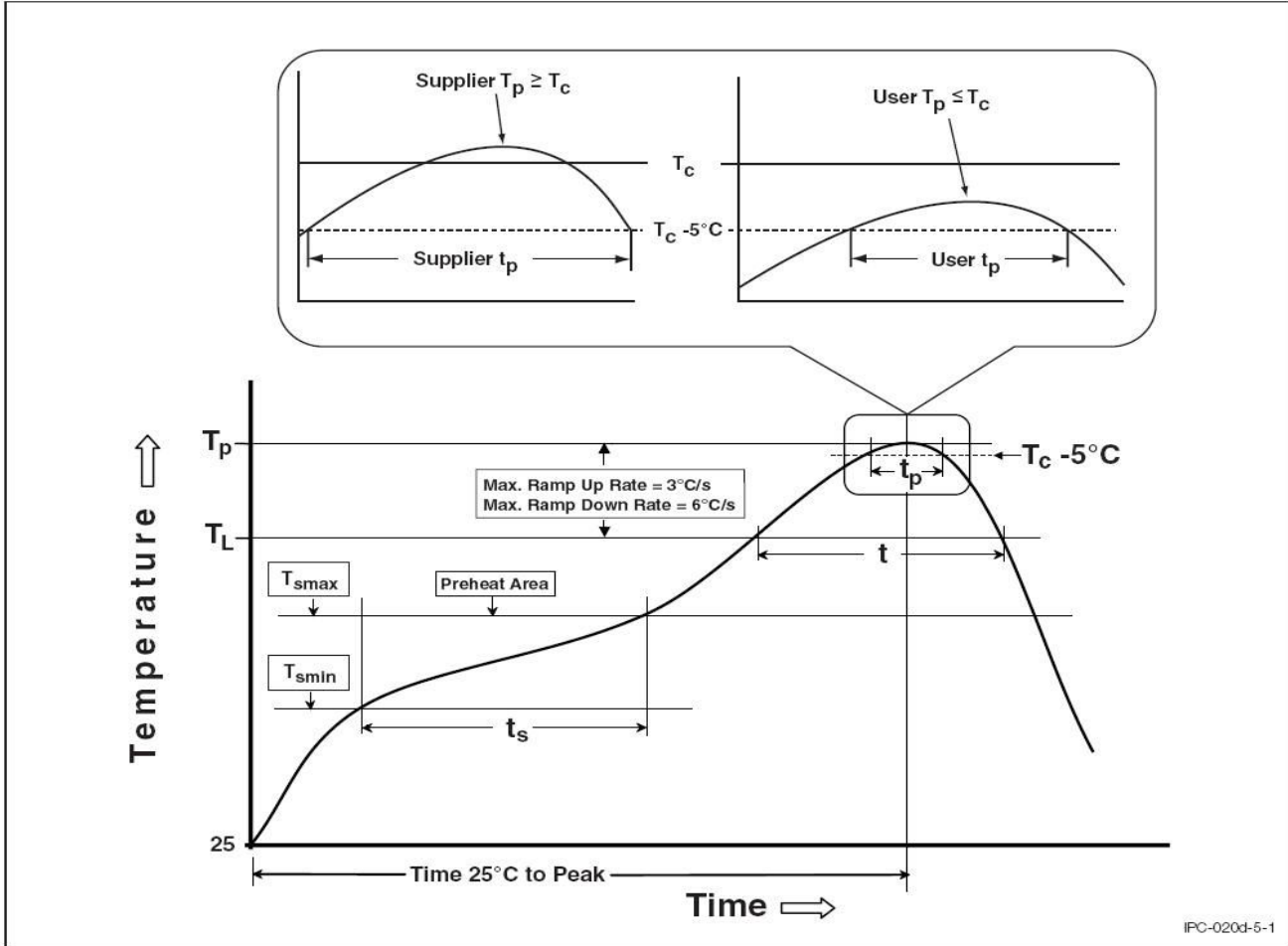
TD – Company Abbr.  
 450X – Rank (X=2 or 3)  
 Y – Lead Form Option (M/S/SL/SLM/None)  
 Z – Tape and Reel Option (T1/T2)  
 G – Material Option (G: Green, None: Non-Green)  
 V – VDE Option (V or None)

**PACKING QUANTITY**

Option	Description	Quantity
None	Standard 8 Pin Dip	50Units/Tube
M	Gullwing(400mil) Lead Forming	50Units/Tube
S(T1)	Surface Mount Lead Forming – With Option 1 Taping	1000 Units/Reel
S(T2)	Surface Mount Lead Forming – With Option 2 Taping	1000 Units/Reel
SL(T1)	Surface Mount Lead Forming(Low Profile) – With Option 1 Taping	1000 Units/Reel
SL(T2)	Surface Mount Lead Forming(Low Profile) – With Option 2 Taping	1000 Units/Reel

**REFLOW INFORMATION**

**REFLOW PROFILE**



Profile Feature	Sn-Pb Assembly Profile	Pb-Free Assembly Profile
Temperature Min. (Tsmin)	100	150°C
Temperature Max. (Tsmax)	150	200°C
Time (ts) from (Tsmin to Tsmax)	60-120 seconds	60-120 seconds
Ramp-up Rate (tL to tP)	3°C/second max.	3°C/second max.
Liquidous Temperature (TL)	183°C	217°C
Time (tL) Maintained Above (TL)	60 – 150 seconds	60 – 150 seconds
Peak Body Package Temperature	235°C +0°C / -5°C	260°C +0°C / -5°C
Time (tP) within 5°C of 260°C	20 seconds	30 seconds
Ramp-down Rate (TP to TL)	6°C/second max	6°C/second max
Time 25°C to Peak Temperature	6 minutes max.	8 minutes max.





## ***6N135,6N136,TD4502,TD4503 Series*** ***DIP8, 1Mbit/s High Speed Transistor Photo Coupler***

### **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.
- LIGHTNING makes no warranty, representation or guarantee regarding the suitability of the products for any particular purpose or the continuing production of any product. To the maximum extent permitted by applicable law, LIGHTNING disclaims (a) any and all liability arising out of the application or use of any product, (b) any and all liability, including without limitation special, consequential or incidental damages, and (c) any and all implied warranties, including warranties of fitness for particular
- 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.