

## 1Mbit/s High Speed Transistor Photo Coupler

### Description

The 6N135, 6N136, SL450X 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.

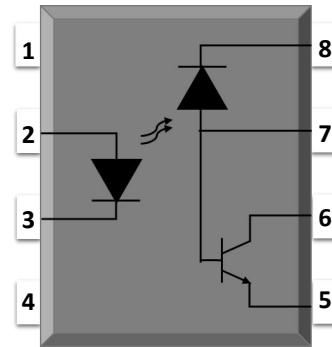
### Features

- 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

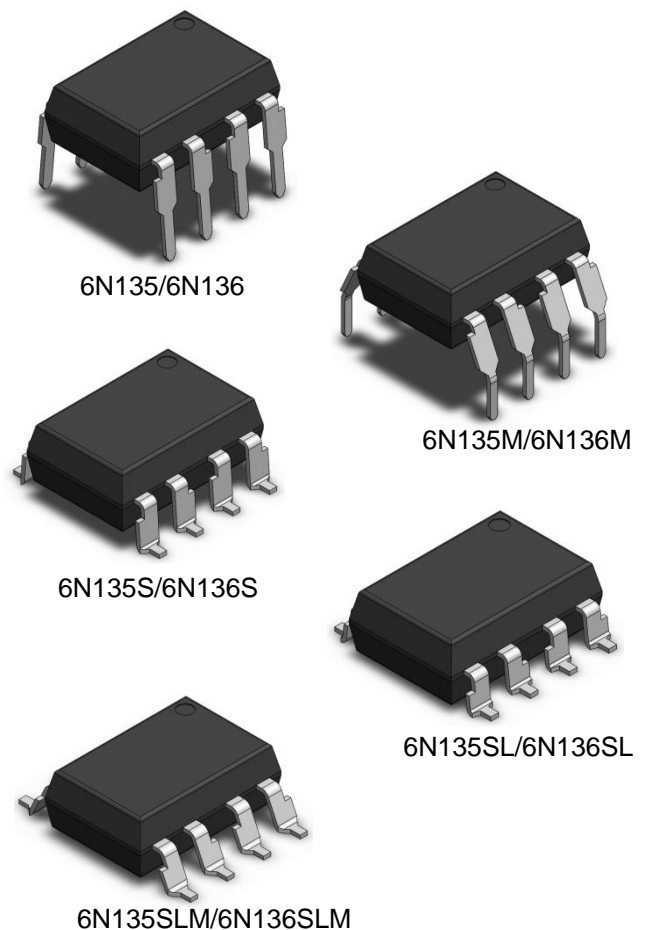
### SCHEMATIC



### PIN DEFINITION

<b>1.NC</b>	<b>8.VCC</b>
<b>2.Anode</b>	<b>7.VB(for 6N135/6N136)</b> <b>NC(for SL4502/SL4503)</b>
<b>3.Cathode</b>	<b>6.VO</b>
<b>4.NC</b>	<b>5.GND</b>

### OUTLINE



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 <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

## 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 <sub>F</sub>	-	1.45	1.8	V	I <sub>F</sub> =16mA	
Reverse Current	I <sub>R</sub>	-	-	10	μA	V <sub>R</sub> =5V	
Input Capacitance	C <sub>in</sub>	-	60	-	pF	V=0, f=1MHz	
OUTPUT(at Ta=0 to 70°C , unless specified otherwise)							
High Level Supply Current	I <sub>CCH</sub>	-	0.01	1	μA	I <sub>F</sub> =0mA, V <sub>O</sub> =Open, V <sub>CC</sub> =15V, Ta=25°C	
		-	-	2	μA	I <sub>F</sub> =0mA, V <sub>O</sub> =Open, V <sub>CC</sub> =15V	
Low Level Supply Current	I <sub>CCL</sub>	-	200	-	μA	I <sub>F</sub> =16mA, V <sub>O</sub> =Open, V <sub>CC</sub> =15V	
Logic High Output Current	I <sub>OH</sub>	-	0.001	0.5	μA	I <sub>F</sub> =0mA, V <sub>O</sub> =V <sub>CC</sub> =5.5V, Ta=25°C	
		-	0.01	1	μA	I <sub>F</sub> =0mA, V <sub>O</sub> =V <sub>CC</sub> =15V, Ta=25°C	
		-	-	50	μA	I <sub>F</sub> =0mA, V <sub>O</sub> =V <sub>CC</sub> =15V	

## ELECTRICAL OPTICAL CHARACTERISTICS

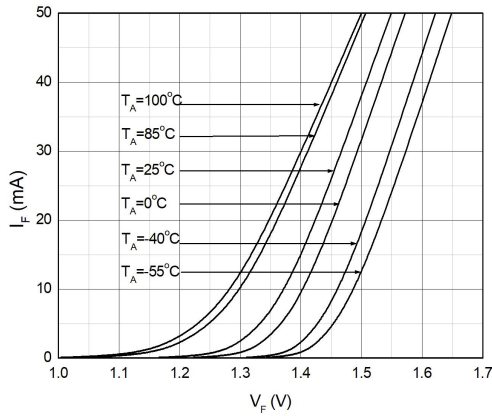
PARAMETER	SYMBOL	MIN	TYP	MAX	UNIT	TEST CONDITION	NOTE	
TRANSFER CHARACTERISTICS(at Ta=0 to 70°C , unless specified otherwise)								
Current Transfer Ratio	6N135	7	-	50	μA	I <sub>F</sub> = 16mA ,V <sub>O</sub> = 0.4V, V <sub>CC</sub> =4.5V, Ta=25°C		
	6N136 SL4502 SL4503	19	-	50				
	6N135	5	-	-			I <sub>F</sub> = 16mA ,V <sub>O</sub> = 0.5V, V <sub>CC</sub> =4.5V	
	6N136 SL4502 SL4503	15	-	-				
Logic Low Output Voltage	6N135	-	0.18	0.4	μA	I <sub>F</sub> = 16mA ,I <sub>O</sub> = 1.1mA, V <sub>CC</sub> =4.5V, Ta=25°C		
	6N136 SL4502 SL4503	-	0.25	0.4			I <sub>F</sub> = 16mA ,I <sub>O</sub> = 3mA, V <sub>CC</sub> =4.5V, Ta=25°C	
	6N135	-	-	-			I <sub>F</sub> = 16mA ,I <sub>O</sub> =0.8mA, V <sub>CC</sub> =4.5V	
	6N136 SL4502 SL4503	-	-	-			I <sub>F</sub> = 16mA ,I <sub>O</sub> =2.4mA, V <sub>CC</sub> =4.5V	
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>	-	0.3	1	pF	V=0, f=1MHz		

## ELECTRICAL OPTICAL CHARACTERISTICS

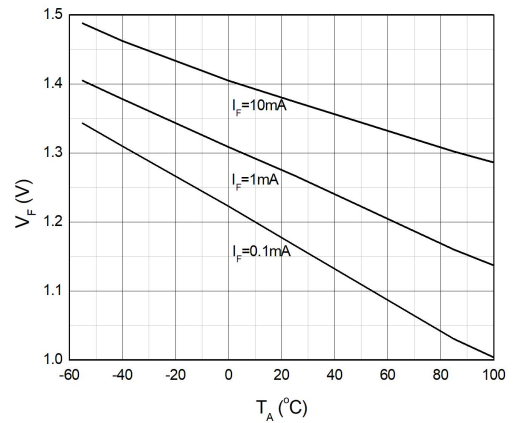
PARAMETER	SYMBOL	MIN	TYP	MAX	UNIT	TEST CONDITION	NOTE	
SWITCHING CHARACTERISTICS(at Ta=0 to 70°C, I <sub>F</sub> =16mA, V <sub>CC</sub> =5V, unless specified otherwise)								
Propagation Delay Time to Logic Low	6N135	TPHL	-	0.35	1.5	μs	R <sub>L</sub> =4.1kΩ, T <sub>A</sub> =25°C	Fig.13
			-	-	2		R <sub>L</sub> =4.1kΩ	
	6N136 SL4502		-	0.35	0.8		R <sub>L</sub> =1.9kΩ, T <sub>A</sub> =25°C	
	SL4503		-	-	1.0		R <sub>L</sub> =1.9kΩ	
Propagation Delay Time to Logic High	6N135	TPLH	-	0.5	1.5	μs	R <sub>L</sub> =4.1kΩ, T <sub>A</sub> =25°C	Fig.13
			-	-	2		R <sub>L</sub> =4.1kΩ	
	6N136 SL4502		-	0.3	0.8		R <sub>L</sub> =1.9kΩ, T <sub>A</sub> =25°C	
	SL4503		-	-	1.0		R <sub>L</sub> =1.9kΩ	
Common Mode Transient Immunity at Logic High	6N135	CM <sub>H</sub>	1000	-	-	V/μs	I <sub>F</sub> = 0mA, V <sub>CM</sub> =10Vpp, R <sub>L</sub> =4.1kΩ, T <sub>A</sub> =25°C	Fig.14
	6N136 SL4502		1000	-	-		I <sub>F</sub> = 0mA, V <sub>CM</sub> =10Vpp, R <sub>L</sub> =1.9kΩ, T <sub>A</sub> =25°C	
	SL4503		15000	20000	-		I <sub>F</sub> = 0mA, V <sub>CM</sub> =1500Vpp, R <sub>L</sub> =1.9kΩ, T <sub>A</sub> =25°C	
Common Mode Transient Immunity at Logic Low	6N135	CM <sub>L</sub>	1000	-	-	V/μs	I <sub>F</sub> = 16mA, V <sub>CM</sub> =10Vpp, R <sub>L</sub> =4.1kΩ, T <sub>A</sub> =25°C	Fig.14
	6N136 SL4502		1000	-	-		I <sub>F</sub> = 16mA, V <sub>CM</sub> =10Vpp, R <sub>L</sub> =1.9kΩ, T <sub>A</sub> =25°C	
	SL4503		15000	20000	-		I <sub>F</sub> = 16mA, V <sub>CM</sub> =1500Vpp, R <sub>L</sub> =1.9kΩ, T <sub>A</sub> =25°C	

## CHARACTERISTIC CURVES

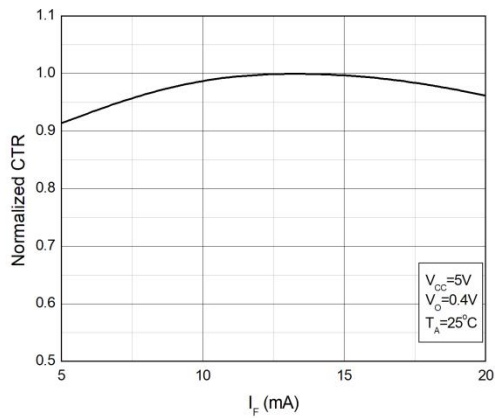
**Fig.1 Forward Current vs. Forward Voltage**



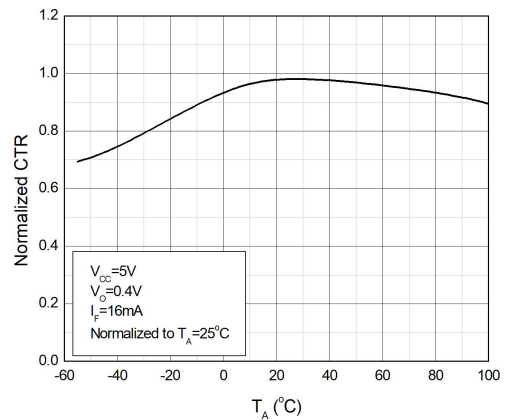
**Fig.2 Forward Voltage vs. Ambient Temperature**



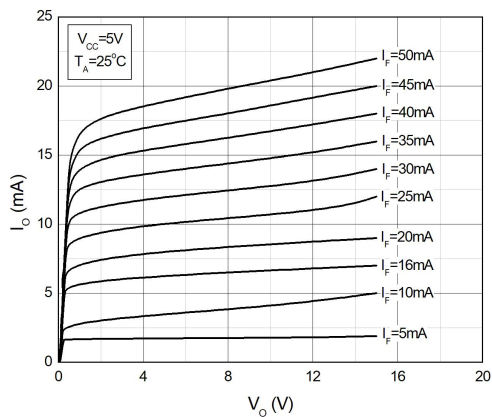
**Fig.3 Input Threshold Current vs. Ambient Temperature**



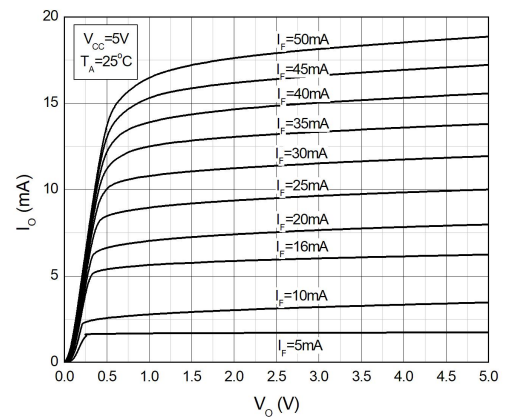
**Fig.4 Input Threshold Current vs. Ambient Temperature**



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

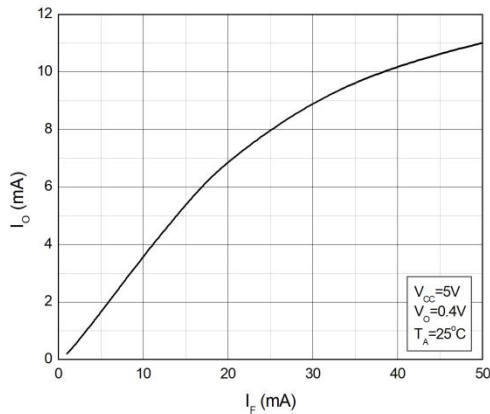


**Fig.6 Low Level Output Current vs. Ambient Temperature**

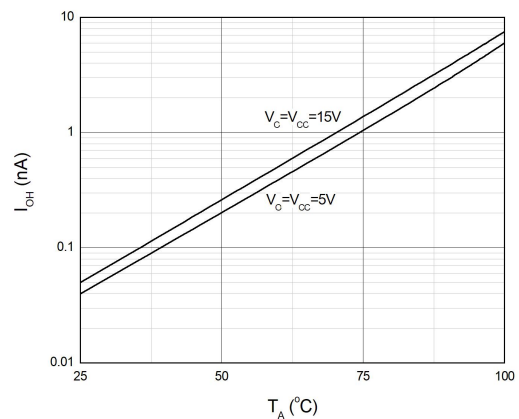


## CHARACTERISTIC CURVES

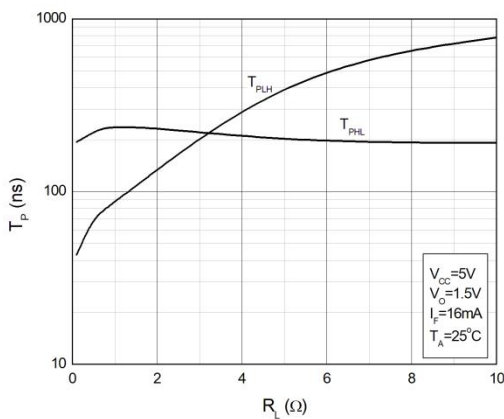
**Fig.7 Low Level Output Voltage vs. Ambient Temperature**



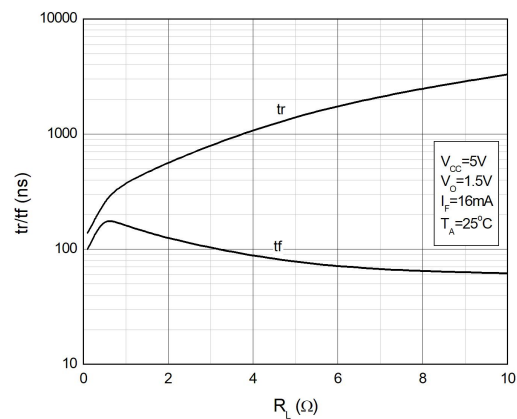
**Fig.8 Low Level Output Voltage vs. Ambient Temperature**



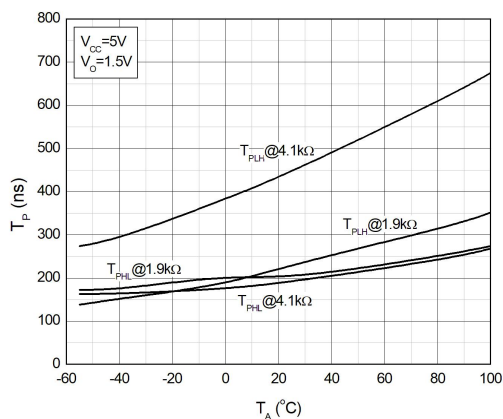
**Fig.9 High Level Output Current vs. Ambient Temperature**



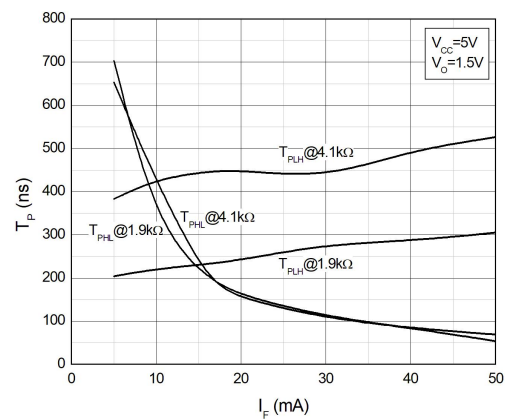
**Fig.10 High Level Output Current vs. Ambient Temperature**



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

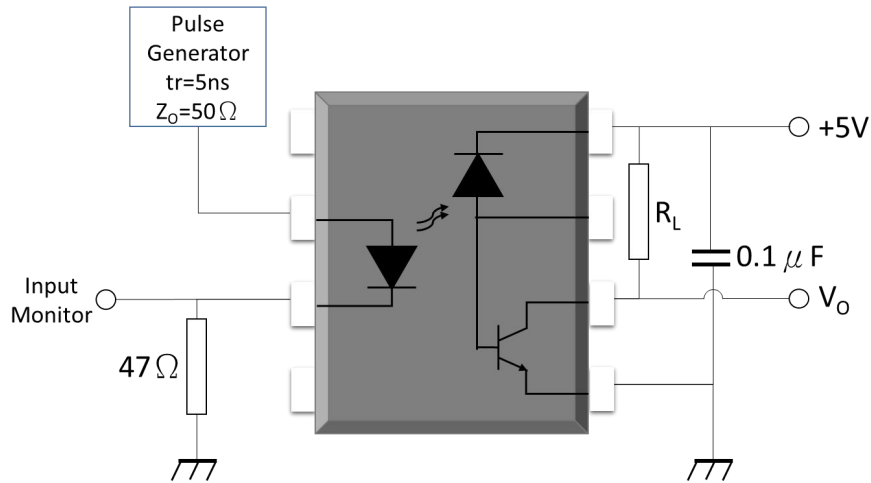


**Fig.12 Output Voltage vs. Forward Current**

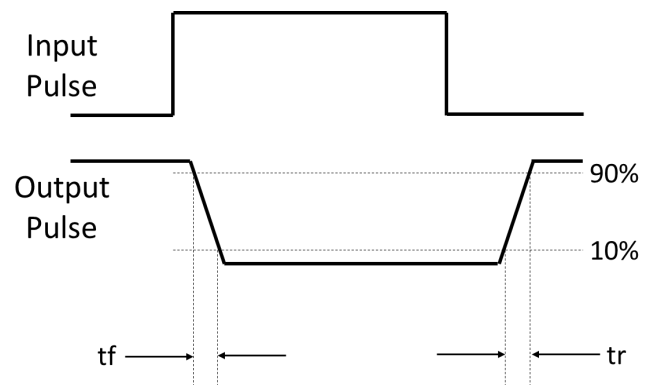
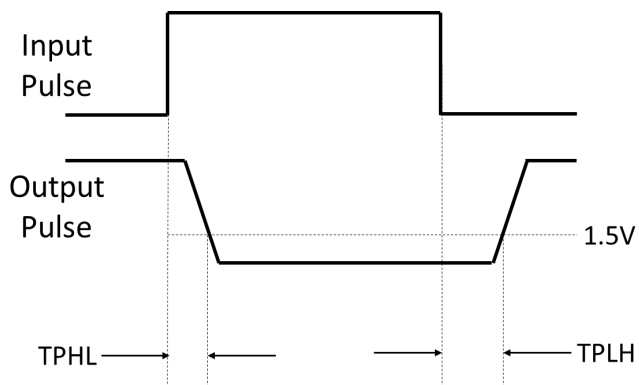


## TEST CIRCUITS

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



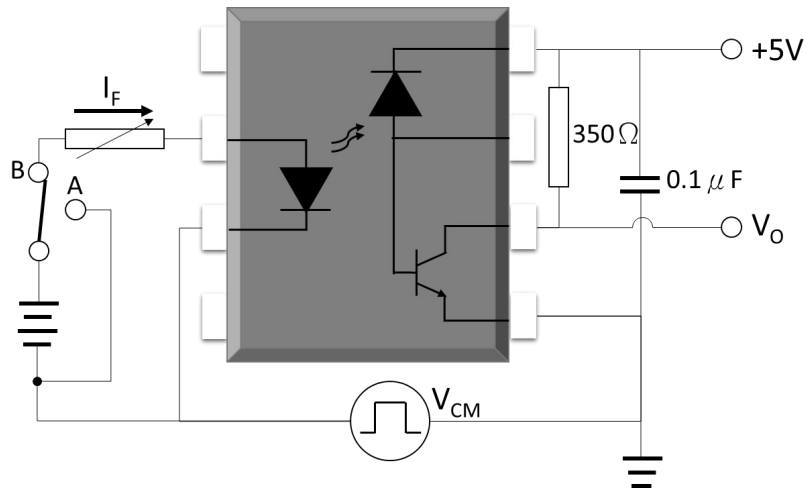
**Fig.14 Waveforms of TPHL, TPLH, tr, tf**



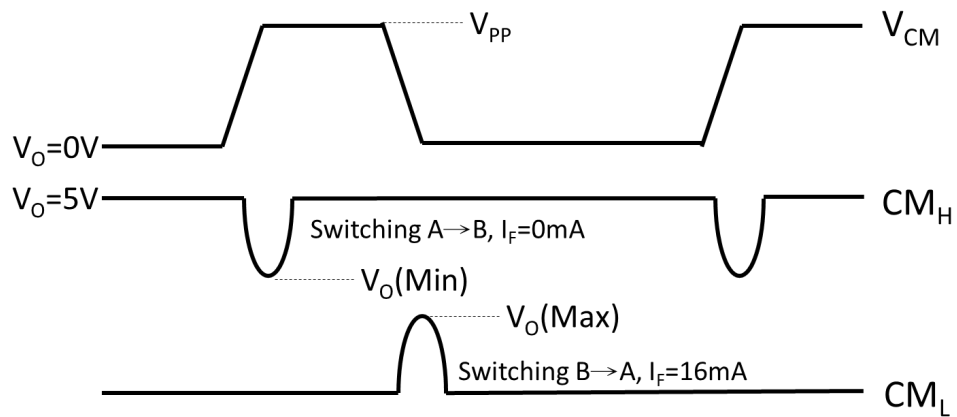


## TEST CIRCUITS

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

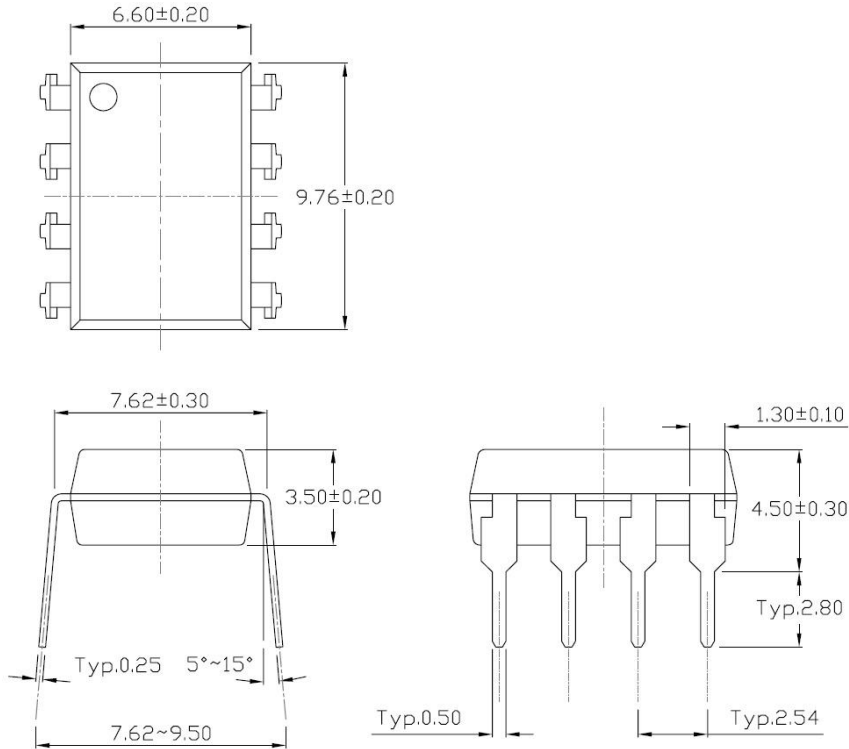


**Fig.16 Waveforms of Common Mode Transient Immunity**

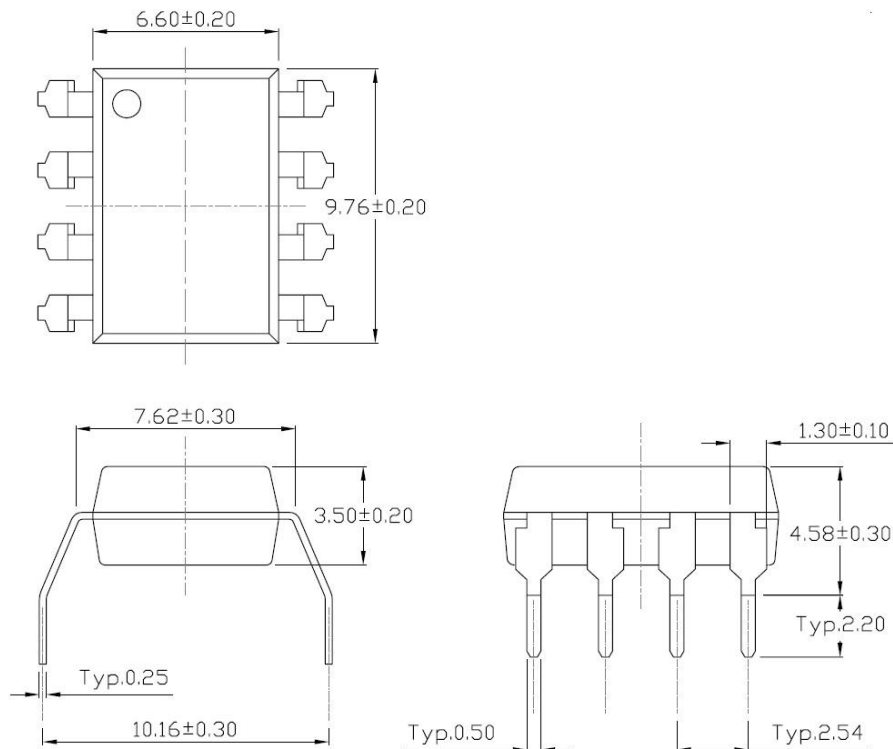


## PACKAGE DIMENSIONS (Dimensions in mm unless otherwise stated)

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

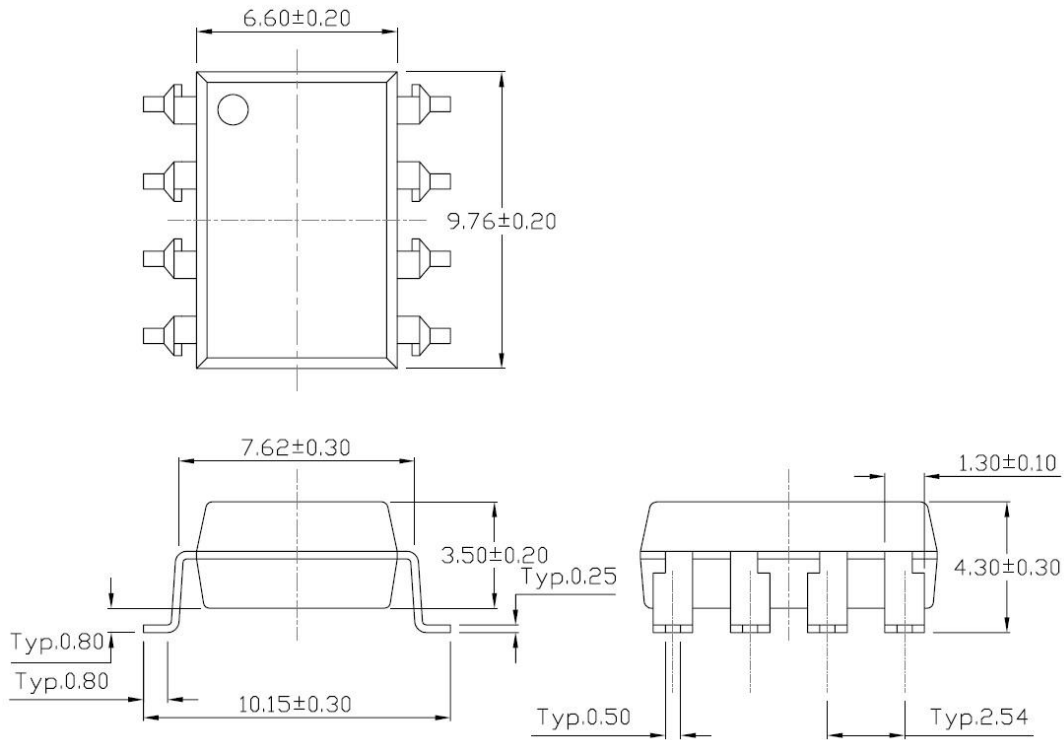


### Gullwing (400mil) Lead Forming – Through Hole (M Type)

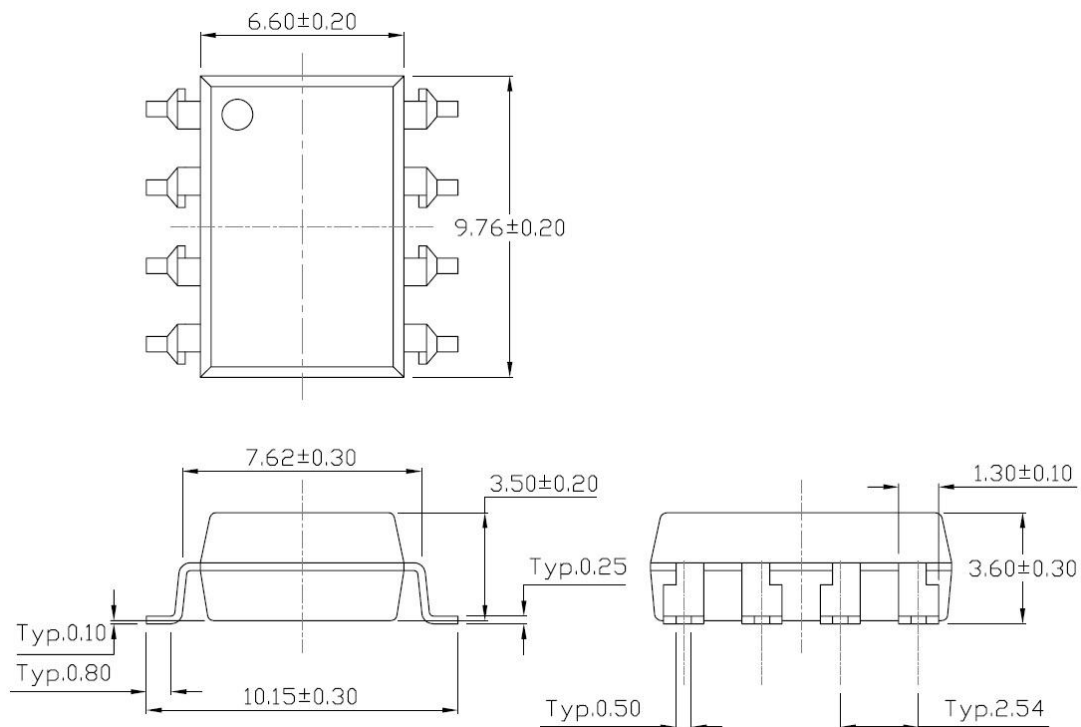


## PACKAGE DIMENSIONS (Dimensions in mm unless otherwise stated)

### Surface Mount Lead Forming (S Type)

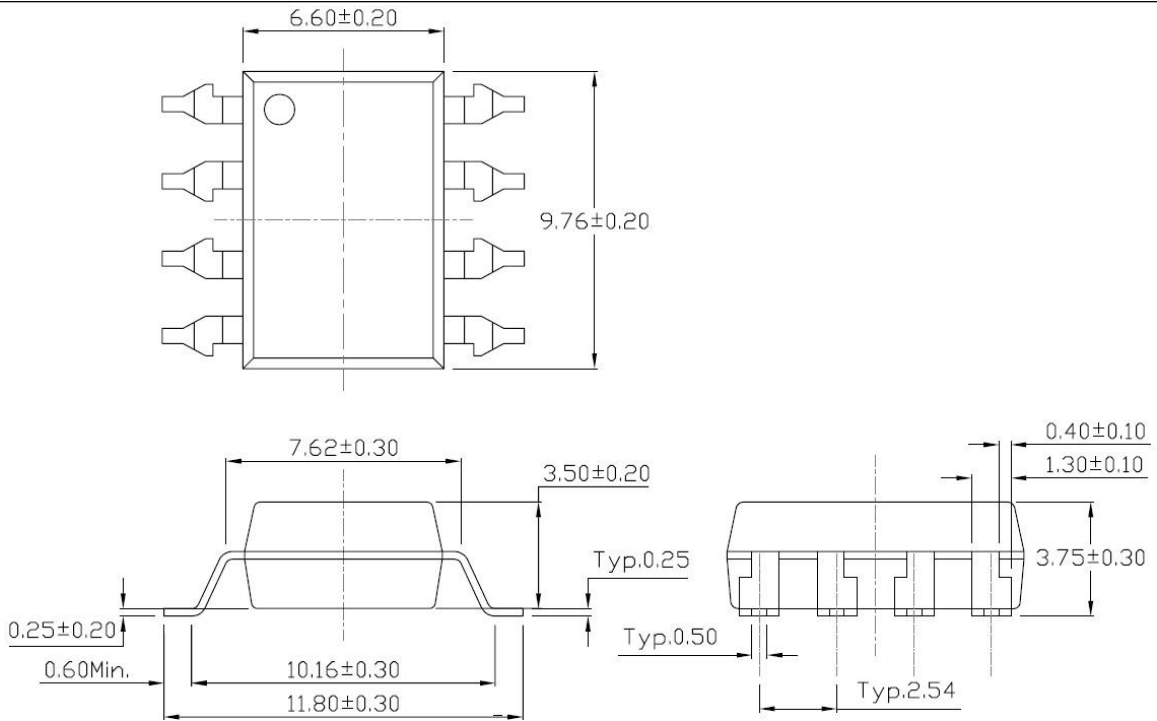


### Surface Mount (Low Profile) Lead Forming (SL Type)



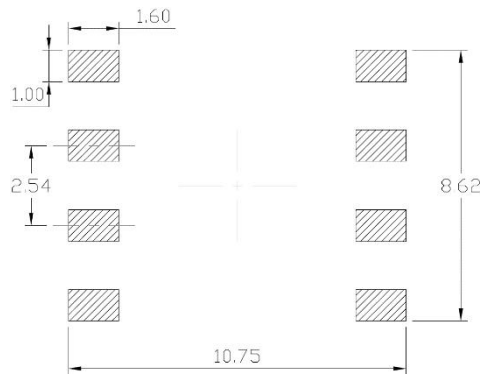
## PACKAGE DIMENSIONS (Dimensions in mm unless otherwise stated)

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

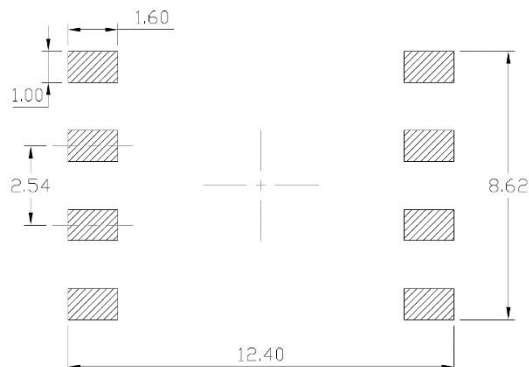


## Recommended Solder Mask (Dimensions in mm unless otherwise stated)

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

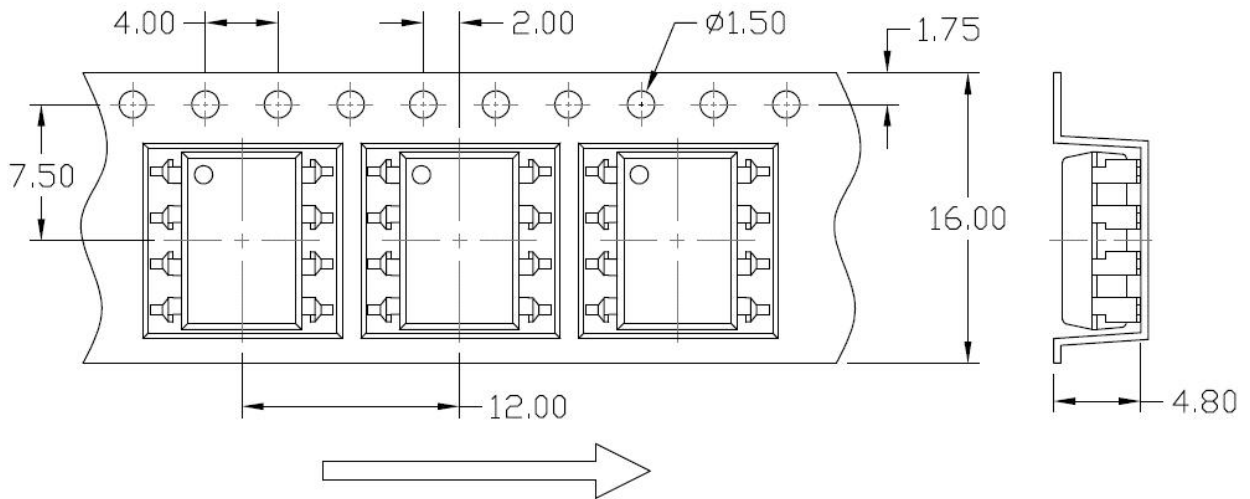


### Surface Mount (Gullwing) Lead Forming

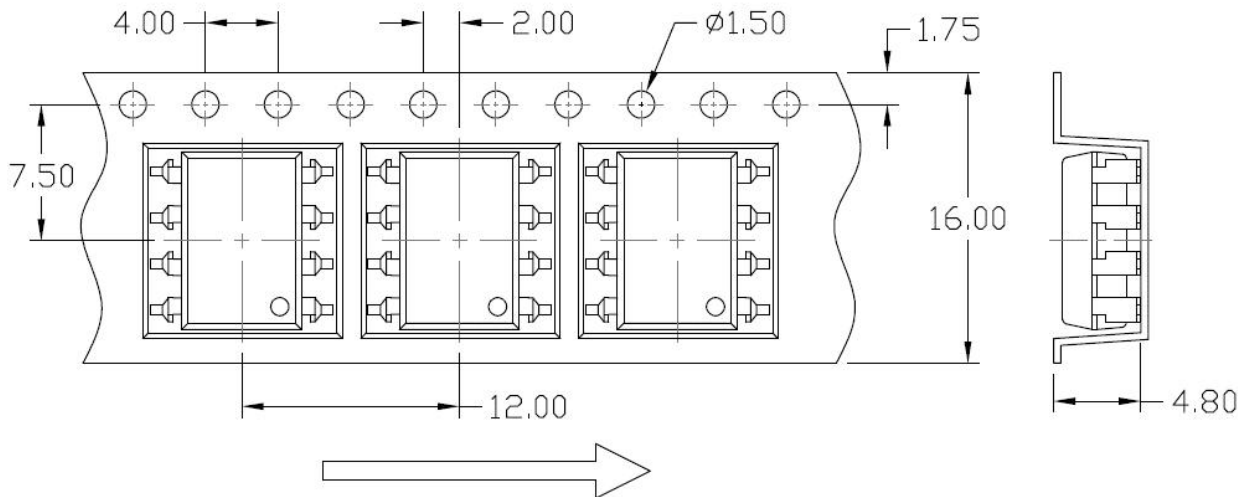


## Carrier Tape Specifications (Dimensions in mm unless otherwise stated)

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

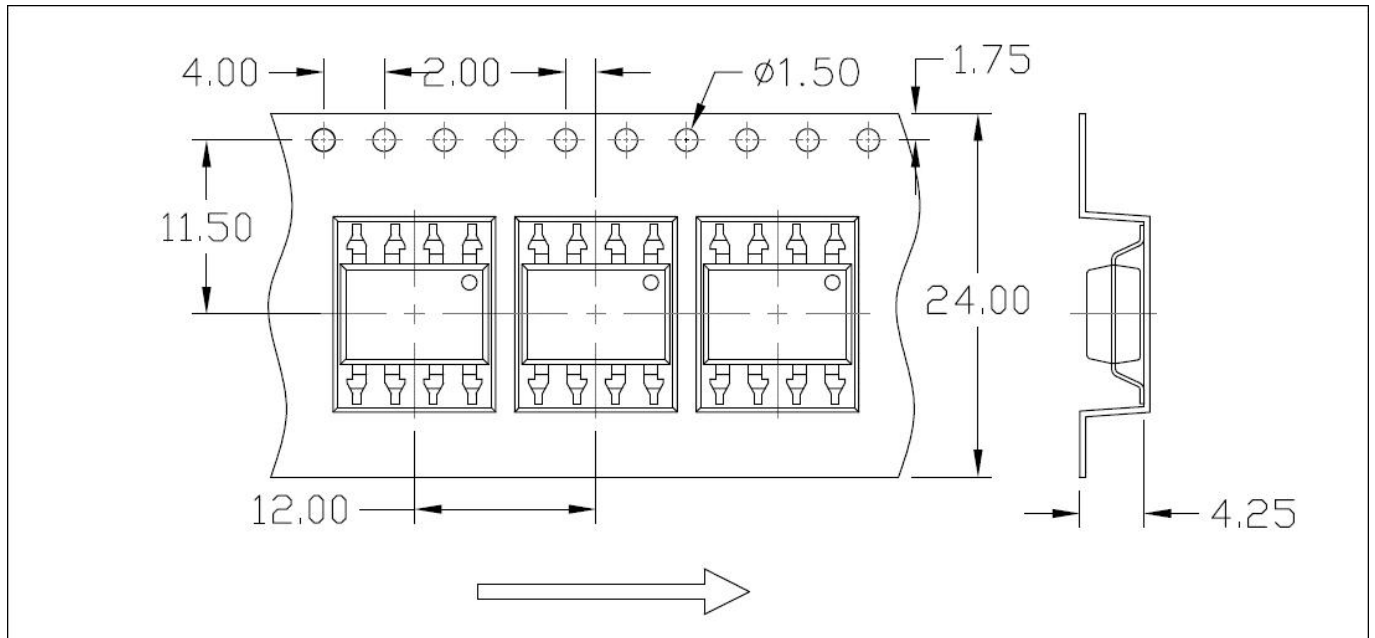


### Option S(T2) & SL(T2)

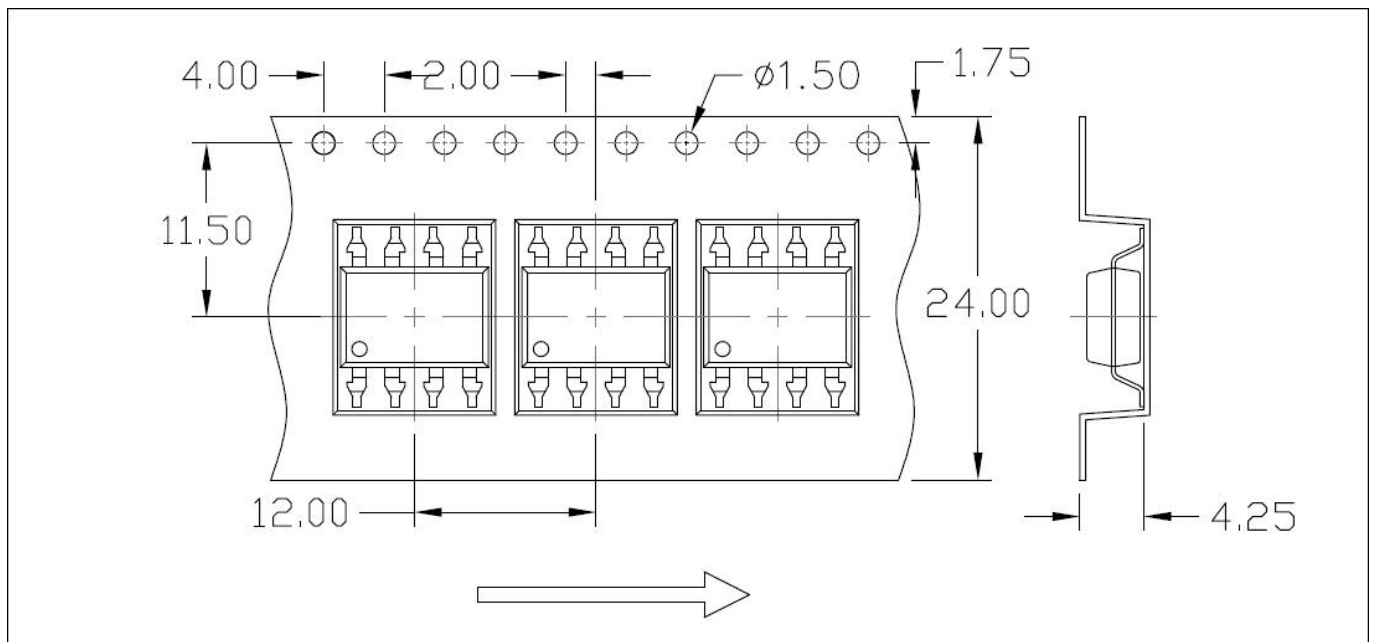


## Carrier Tape Specifications (Dimensions in mm unless otherwise stated)

### Option SLM(T1)

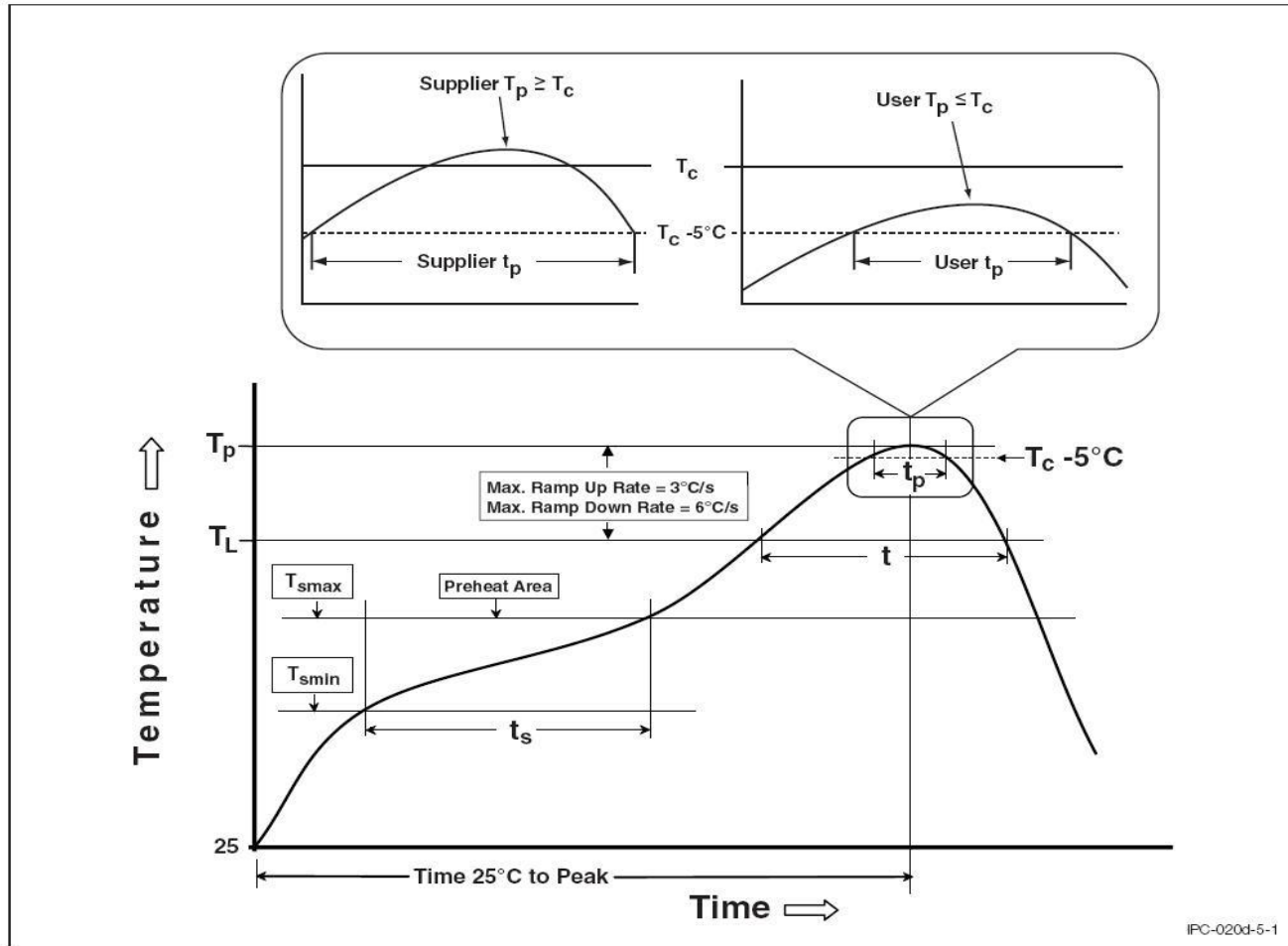


### Option SLM(T2)



## REFLOW INFORMATION

### REFLOW PROFILE



Profile Feature	Sn-Pb Assembly Profile	Pb-Free Assembly Profile
Temperature Min. (Tsmmin)	100	150°C
Temperature Max. (Tsmmax)	150	200°C
Time (ts) from (Tsmmin to Tsmmax)	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.