

## 10Mbit/s High Speed Logic Gate Photo Coupler

### Description

The 6N137, SL2601,SL2611 series combine an AlGaAs infrared emitting diode as the emitter which is optically coupled to a silicon high speed integrated photo-detector logic gate with a strobable output in a plastic DIP8 package with different lead forming options.

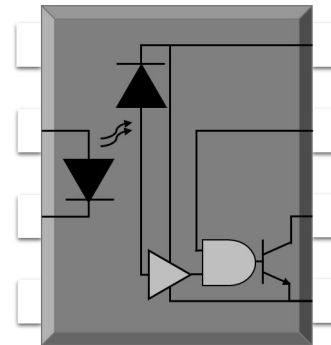
### Features

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

### Applications

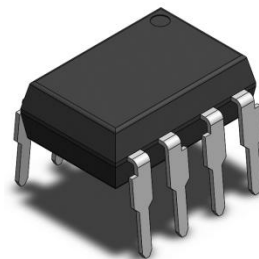
- Ground loop elimination
- LSTTL to TTL, LSTTL or CMOS
- Line receiver, data transmission
- Data multiplexing
- Switching power supply
- Pulse transformer replacement
- Computer-peripheral interface

### SCHEMATIC

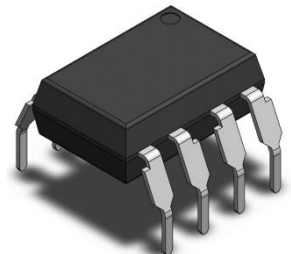


### PIN DEFINITION

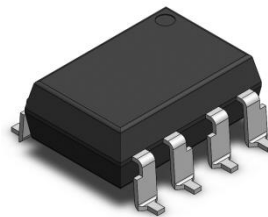
<b>1.NC</b>	<b>8.VCC</b>
<b>2.Anode</b>	<b>7.VE</b>
<b>3.Cathode</b>	<b>6.VO</b>
<b>4.NC</b>	<b>5.GND</b>



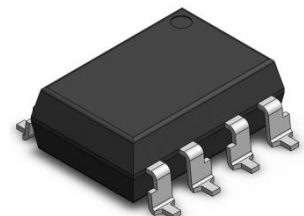
6N137



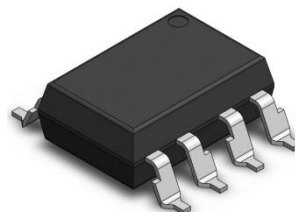
6N137M



6N137SL



6N137S



6N137SLM

## 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	
Enable Voltage	$V_E$	VCC+0.5	V	
Input Power Dissipation	$P_I$	100	mW	
OUTPUT				
Supply Voltage	$V_{CC}$	7	V	
Output Voltage	$V_O$	7	V	
Output Current	$I_O$	50	mA	
Output Power Dissipation	$P_O$	85	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	$T_{stg}$	-55~125	°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

## RECOMMENDED OPERATION CONDITIONS

PARAMETER	SYMBOL	MIN.	MAX.	UNIT
Operating Temperature	TA	-40	100	°C
Supply Voltage	VCC	2.7	3.6	V
	VCC	4.5	5.5	V
Low Level Input Current	IFL	0	250	µA
High Level Input Current	IFH	5	15	mA
Low Level Enable Voltage	VEL	0	0.8	V
High Level Enable Voltage	VEH	2	VCC	V
Output Pull-up Resistor	RL	330	4k	Ω
Fan Out (at RL=1kΩ per channel)	N	-	5	TTL Loads

## ELECTRICAL OPTICAL CHARACTERISTICS at Ta=25°C

PARAMETER	SYMBOL	MIN.	TYP.	MAX.	UNIT	TEST CONDITION	NOTE
INPUT							
Forward Voltage	V <sub>F</sub>	-	1.38	1.8	V	I <sub>F</sub> =10mA	
Reverse Current	I <sub>R</sub>	-	-	10	µA	V <sub>R</sub> =5V	
Input Capacitance	C <sub>in</sub>	-	13	-	pF	V=0, f=1MHz	
OUTPUT							
High Level Supply Current	I <sub>CCH</sub>	-	6.3	10	mA	I <sub>F</sub> =0mA, V <sub>E</sub> =0.5V, V <sub>CC</sub> =5.5V	
Low Level Supply Current	I <sub>CCL</sub>	-	8.3	13	mA	I <sub>F</sub> =10mA, V <sub>CC</sub> =5.5V	
High Level Enable Current	I <sub>EH</sub>	-	-0.52	-1.6	mA	V <sub>E</sub> =2.0V, V <sub>CC</sub> =5.5V	
Low Level Enable Current	I <sub>EL</sub>	-	-0.75	-1.6	mA	V <sub>E</sub> =0.5V, V <sub>CC</sub> =5.5V	
High Level Enable Voltage	V <sub>EH</sub>	2.0	-	-	V	I <sub>F</sub> =10mA, V <sub>CC</sub> =5.5V	
Low Level Enable Voltage	V <sub>EL</sub>	-	-	0.8	V	I <sub>F</sub> =10mA, V <sub>CC</sub> =5.5V	
TRANSFER CHARACTERISTICS (Ta=-40 to 85°C)							
High Level Output Current	I <sub>OH</sub>	-	0.73	100	µA	V <sub>CC</sub> =5.5V, V <sub>O</sub> =5.5V, I <sub>F</sub> =250µA, V <sub>E</sub> =2.0V	
Low Level Output Voltage	V <sub>OL</sub>	-	0.28	0.6	V	V <sub>CC</sub> =5.5V, I <sub>F</sub> =5mA, V <sub>E</sub> =2.0V, I <sub>CL</sub> =13mA	
Input Threshold Current	I <sub>FT</sub>	-	2.5	5	mA	V <sub>CC</sub> =5.5V, V <sub>O</sub> =0.6V, V <sub>E</sub> =2.0V, I <sub>OL</sub> =13mA	
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>	-	1.0	-	pF	V=0, f=1MHz	

## ELECTRICAL OPTICAL CHARACTERISTICS

PARAMETER	SYMBOL	MIN.	TYP.	MAX.	UNIT	TEST CONDITION	NOTE
SWITCHING CHARACTERISTICS (Ta=-40 to 85°C, V <sub>CC</sub> =5V, I <sub>F</sub> =7.5mA unless specified otherwise)							
Propagation Delay Time to Output Low Level	TPHL	-	35	75	ns	C <sub>L</sub> =15pF, R <sub>L</sub> =350Ω, Ta=25°C	
Propagation Delay Time to Output High Level	TPLH	-	40	75	ns	C <sub>L</sub> =15pF, R <sub>L</sub> =350Ω, Ta=25°C	
Pulse Width Distortion	TPHL-TPLH	-	5	35	ns	C <sub>L</sub> =15pF, R <sub>L</sub> =350Ω	
Rise Time	tr	-	27	-	ns	C <sub>L</sub> =15pF, R <sub>L</sub> =350Ω	
Fall Time	tf	-	7	-	ns	C <sub>L</sub> =15pF, R <sub>L</sub> =350Ω	
Enable Propagation Delay Time to Output Low Level	TEHL	-	15	-	ns	I <sub>F</sub> =7.5mA, V <sub>EH</sub> =3.5V, C <sub>L</sub> =15pF, R <sub>L</sub> =350Ω	
Enable Propagation Delay Time to Output High Level	TELH	-	15	-	ns	I <sub>F</sub> =7.5mA, V <sub>EH</sub> =3.5V, C <sub>L</sub> =15pF, R <sub>L</sub> =350Ω	
Common Mode Transient Immunity at Logic High	6N137	-	-	-	V/μs	I <sub>F</sub> = 7.5mA , V <sub>OH</sub> =2.0V, R <sub>L</sub> =350Ω, Ta=25°C V <sub>CM</sub> =10Vp-p	
	SL2601	5000	-	-		I <sub>F</sub> = 7.5mA , V <sub>OH</sub> =2.0V, R <sub>L</sub> =350Ω, Ta=25°C V <sub>CM</sub> =50Vp-p	
	SL2611	10000	-	-		I <sub>F</sub> = 7.5mA , V <sub>OH</sub> =2.0V, R <sub>L</sub> =350Ω, Ta=25°C V <sub>CM</sub> =400Vp-p	
Common Mode Transient Immunity at Logic Low	6N137	-	-	-	V/μs	I <sub>F</sub> = 0mA , V <sub>OH</sub> =0.8V, R <sub>L</sub> =350Ω, Ta=25°C V <sub>CM</sub> =10Vp-p	
	SL2601	5000	-	-		I <sub>F</sub> = 0mA , V <sub>OH</sub> =0.8V, R <sub>L</sub> =350Ω, Ta=25°C V <sub>CM</sub> =50Vp-p	
	SL2611	10000	-	-		I <sub>F</sub> = 0mA , V <sub>OH</sub> =0.8V, R <sub>L</sub> =350Ω, Ta=25°C V <sub>CM</sub> =400Vp-p	

## ELECTRICAL OPTICAL CHARACTERISTICS at Ta=25°C

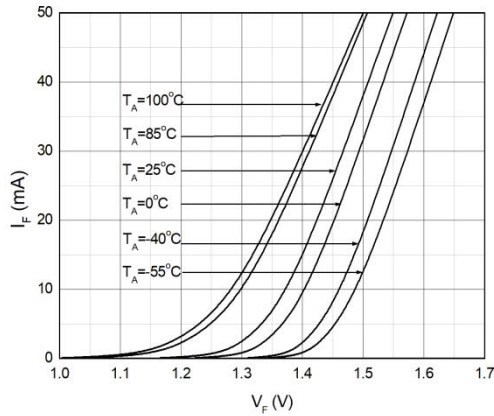
PARAMETER	SYMBOL	MIN.	TYP.	MAX.	UNIT	TEST CONDITION	NOTE
INPUT							
Forward Voltage	V <sub>F</sub>	-	1.38	1.8	V	I <sub>F</sub> =10mA	
Reverse Current	I <sub>R</sub>	-	-	10	μA	V <sub>R</sub> =5V	
Input Capacitance	C <sub>in</sub>	-	13	-	pF	V=0, f=1MHz	
OUTPUT							
High Level Supply Current	I <sub>CCH</sub>	-	4.3	10	mA	I <sub>F</sub> =0mA, V <sub>E</sub> =0.5V, V <sub>CC</sub> =3.3V	
Low Level Supply Current	I <sub>CCL</sub>	-	6.4	13	mA	I <sub>F</sub> =10mA, V <sub>CC</sub> =3.3V	
High Level Enable Current	I <sub>EH</sub>	-	-0.21	-1.6	mA	V <sub>E</sub> =2.0V, V <sub>CC</sub> =3.3V	
Low Level Enable Current	I <sub>EL</sub>	-	-0.42	-1.6	mA	V <sub>E</sub> =0.5V, V <sub>CC</sub> =3.3V	
High Level Enable Voltage	V <sub>EH</sub>	2.0	-	-	V	I <sub>F</sub> =10mA, V <sub>CC</sub> =3.3V	
Low Level Enable Voltage	V <sub>EL</sub>	-	-	0.8	V	I <sub>F</sub> =10mA, V <sub>CC</sub> =3.3V	
TRANSFER CHARACTERISTICS (Ta=-40 to 85°C)							
High Level Output Current	I <sub>OH</sub>	-	4.1	100	μA	V <sub>CC</sub> =3.3V, V <sub>O</sub> =3.3V, I <sub>F</sub> =250μA, V <sub>E</sub> =2.0V	
Low Level Output Voltage	V <sub>OL</sub>	-	0.29	0.6	V	V <sub>CC</sub> =3.3V, I <sub>F</sub> =5mA, V <sub>E</sub> =2.0V, I <sub>CL</sub> =13mA	
Input Threshold Current	I <sub>FT</sub>	-	2.2	5	mA	V <sub>CC</sub> =3.3V, V <sub>O</sub> =0.6V, V <sub>E</sub> =2.0V, I <sub>OL</sub> =13mA	
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>	-	1.0	-	pF	V=0, f=1MHz	

## ELECTRICAL OPTICAL CHARACTERISTICS

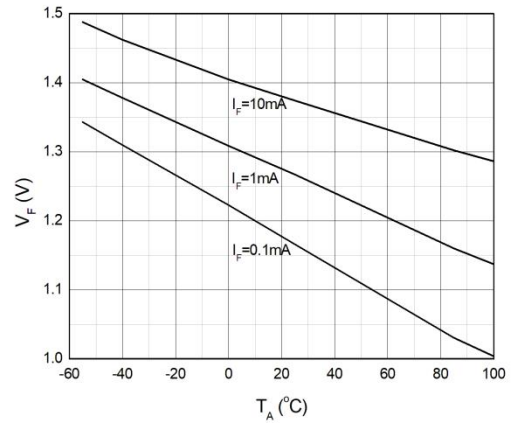
PARAMETER		SYMBOL	MIN.	TYP.	MAX.	UNIT	TEST CONDITION	NOTE
SWITCHING CHARACTERISTICS (Ta=-40 to 85°C, V <sub>CC</sub> =3.3V, I <sub>F</sub> =7.5mA unless specified otherwise)								
Propagation Delay Time to Output Low Level		TPHL	-	35	75	ns	C <sub>L</sub> =15pF, R <sub>L</sub> =350Ω, Ta=25°C	
Propagation Delay Time to Output High Level		TPLH	-	47	75	ns	C <sub>L</sub> =15pF, R <sub>L</sub> =350Ω, Ta=25°C	
Pulse Width Distortion		TPHL-TPLH	-	12	35	ns	C <sub>L</sub> =15pF, R <sub>L</sub> =350Ω	
Rise Time		tr	-	30	-	ns	C <sub>L</sub> =15pF, R <sub>L</sub> =350Ω	
Fall Time		tf	-	8.5	-	ns	C <sub>L</sub> =15pF, R <sub>L</sub> =350Ω	
Enable Propagation Delay Time to Output Low Level		TEHL	-	15	-	ns	I <sub>F</sub> =7.5mA, V <sub>EH</sub> =3.3.3V, C <sub>L</sub> =15pF, R <sub>L</sub> =350Ω	
Enable Propagation Delay Time to Output High Level		TELH	-	15	-	ns	I <sub>F</sub> =7.5mA, V <sub>EH</sub> =3.3.3V, C <sub>L</sub> =15pF, R <sub>L</sub> =350Ω	
Common Mode Transient Immunity at Logic High	6N137	CMH	-	-	-	V/μs	I <sub>F</sub> = 7.5mA , V <sub>OH</sub> =2.0V, R <sub>L</sub> =350Ω, Ta=25°C V <sub>CM</sub> =10Vp-p	
	SL2601		5000	-	-		I <sub>F</sub> = 7.5mA , V <sub>OH</sub> =2.0V, R <sub>L</sub> =350Ω, Ta=25°C V <sub>CM</sub> =50Vp-p	
	SL2611		10000	-	-		I <sub>F</sub> = 7.5mA , V <sub>OH</sub> =2.0V, R <sub>L</sub> =350Ω, Ta=25°C V <sub>CM</sub> =400Vp-p	
Common Mode Transient Immunity at Logic Low	6N137	CML	-	-	-	V/μs	I <sub>F</sub> = 0mA , V <sub>OH</sub> =0.8V, R <sub>L</sub> =350Ω, Ta=25°C V <sub>CM</sub> =10Vp-p	
	SL2601		5000	-	-		I <sub>F</sub> = 0mA , V <sub>OH</sub> =0.8V, R <sub>L</sub> =350Ω, Ta=25°C V <sub>CM</sub> =50Vp-p	
	SL2611		10000	-	-		I <sub>F</sub> = 0mA , V <sub>OH</sub> =0.8V, R <sub>L</sub> =350Ω, Ta=25°C V <sub>CM</sub> =400Vp-p	

## CHARACTERISTIC CURVES

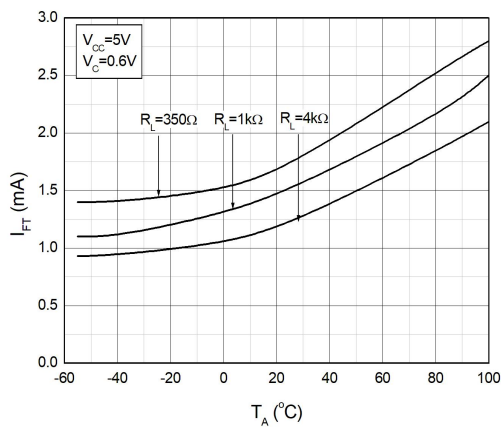
**Fig.1 Forward Current vs. Forward Voltage**



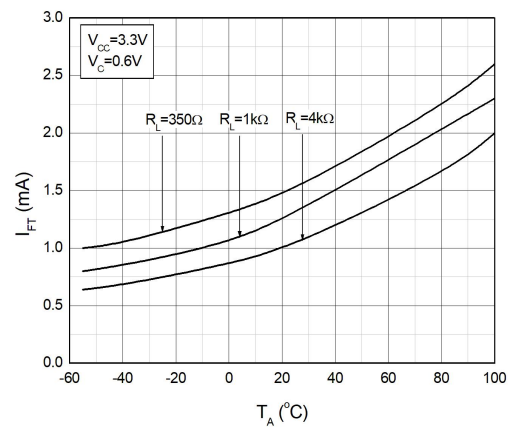
**Fig.2 Forward Voltage vs. Ambient Temperature**



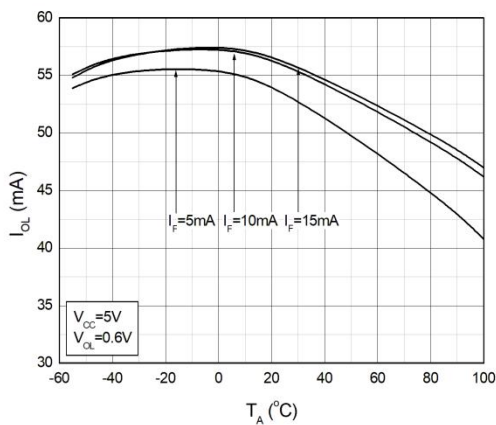
**Fig.3 Input Threshold Current vs. Ambient Temperature**



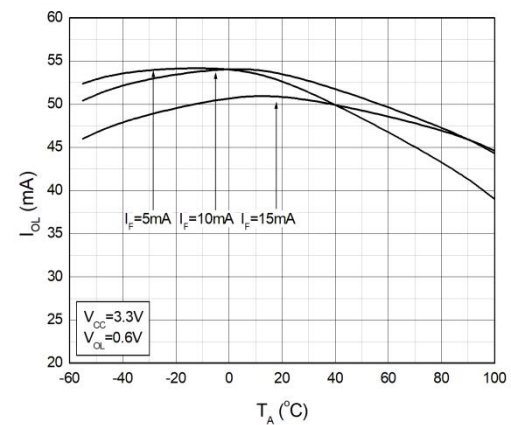
**Fig.4 Input Threshold Current vs. Ambient Temperature**



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

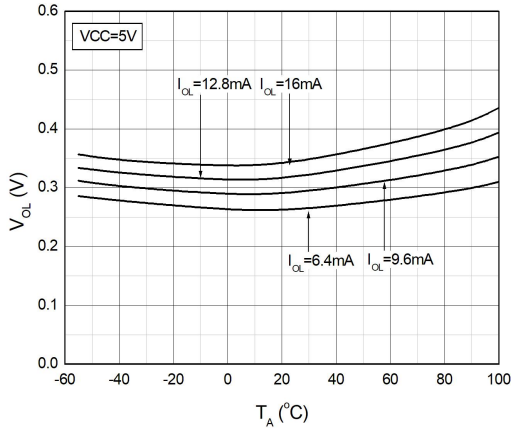


**Fig.6 Low Level Output Current vs. Ambient Temperature**

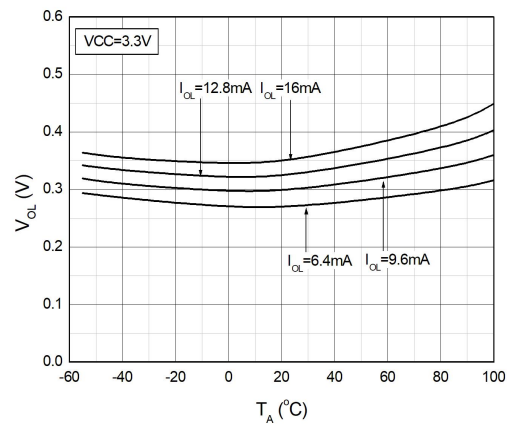


## CHARACTERISTIC CURVES

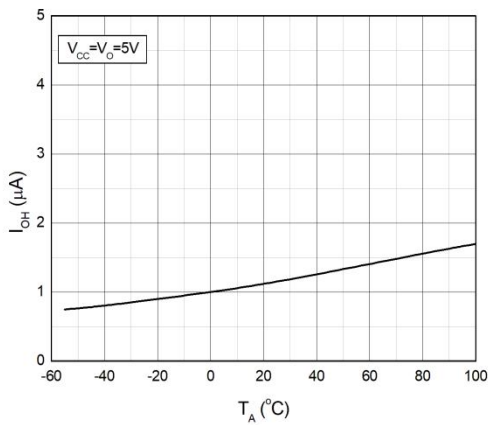
**Fig.7 Low Level Output Voltage vs. Ambient Temperature**



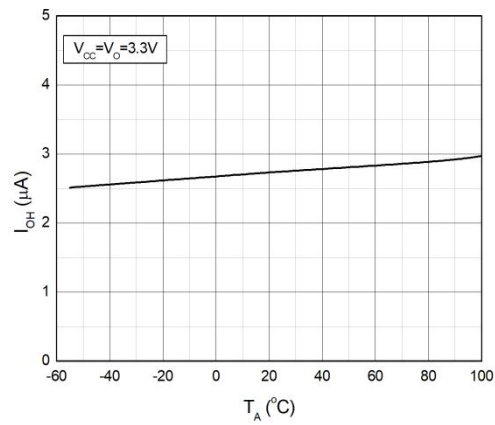
**Fig.8 Low Level Output Voltage vs. Ambient Temperature**



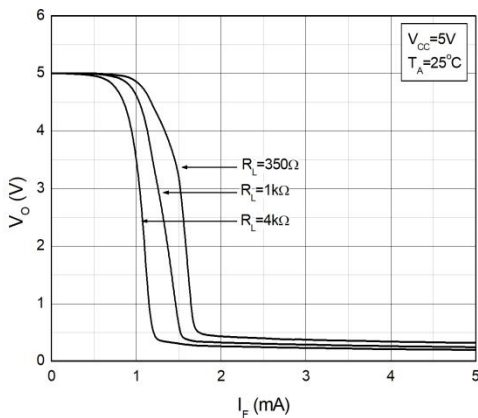
**Fig.9 High Level Output Current vs. Ambient Temperature**



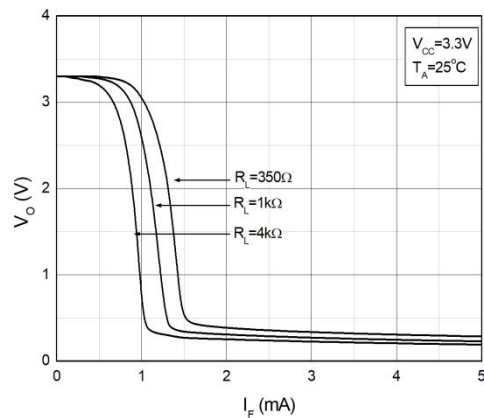
**Fig.10 High Level Output Current vs. Ambient Temperature**



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



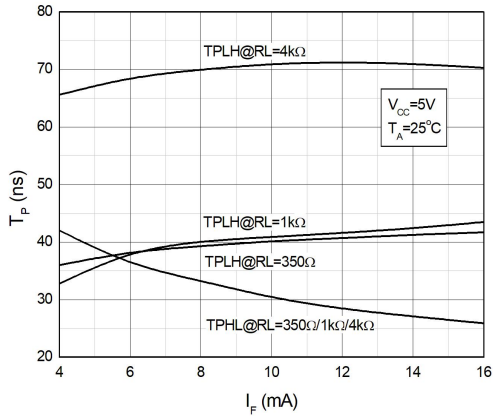
**Fig.12 Output Voltage vs. Forward Current**



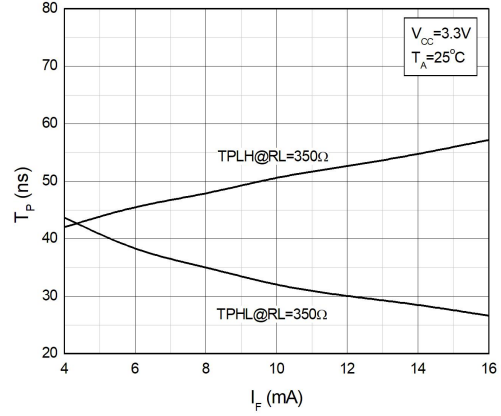


## CHARACTERISTIC CURVES

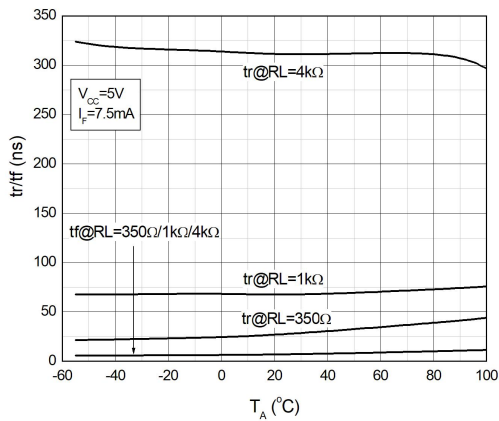
**Fig.13 Propagation Delay vs. Forward Current**



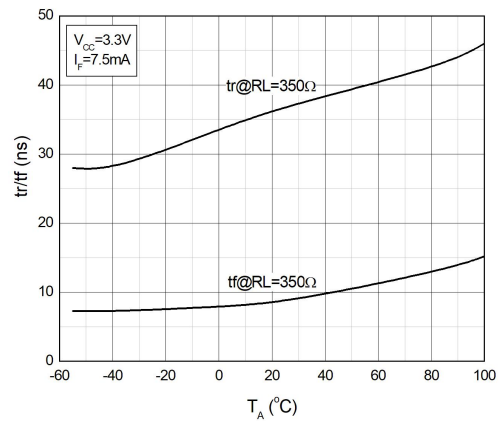
**Fig.14 Propagation Delay vs. Forward Current**



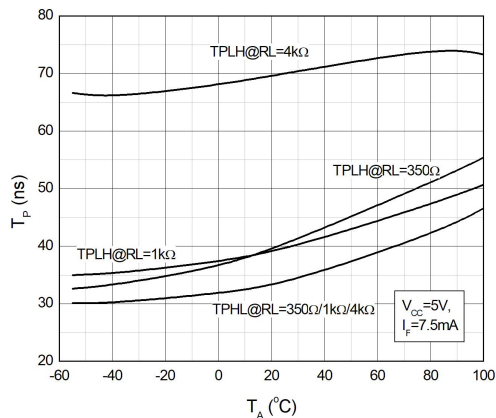
**Fig.15 Rise and Fall Time vs. Ambient Temperature**



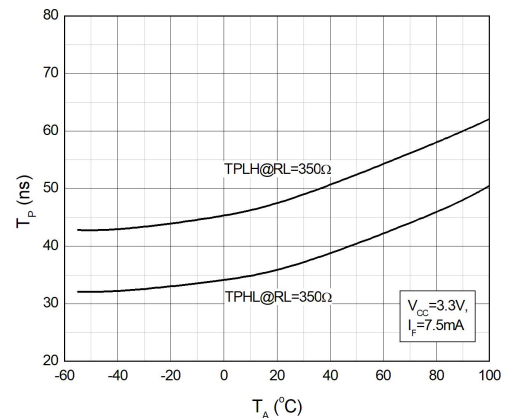
**Fig.16 Rise and Fall Time vs. Ambient Temperature**



**Fig.17 Propagation Delay vs. Ambient Temperature**

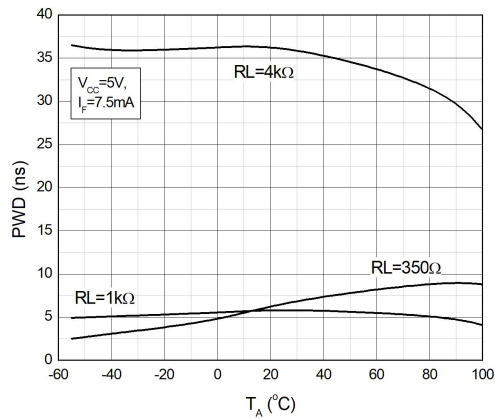


**Fig.18 Propagation Delay vs. Ambient Temperature**

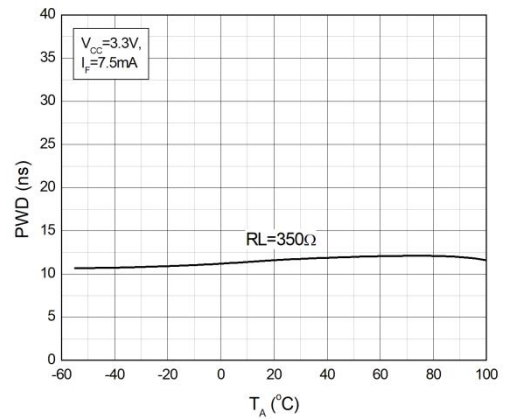


## CHARACTERISTIC CURVES

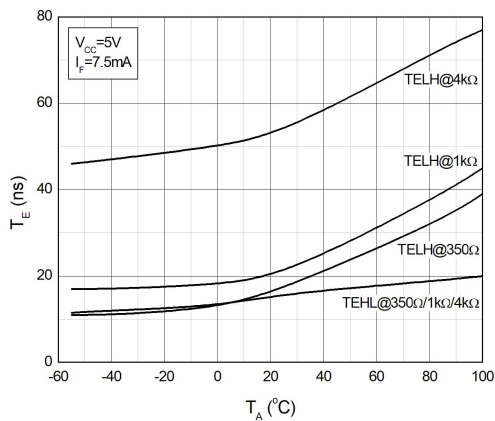
**Fig.19 Pulse Width Distortion vs. Ambient Temperature**



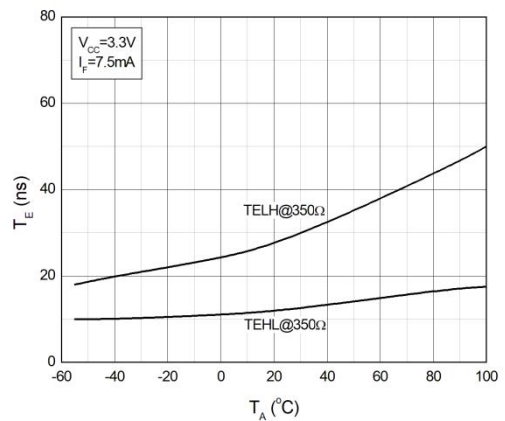
**Fig.20 Pulse Width Distortion vs. Ambient Temperature**



**Fig.21 Enable Propagation Delay vs. Ambient Temperature**

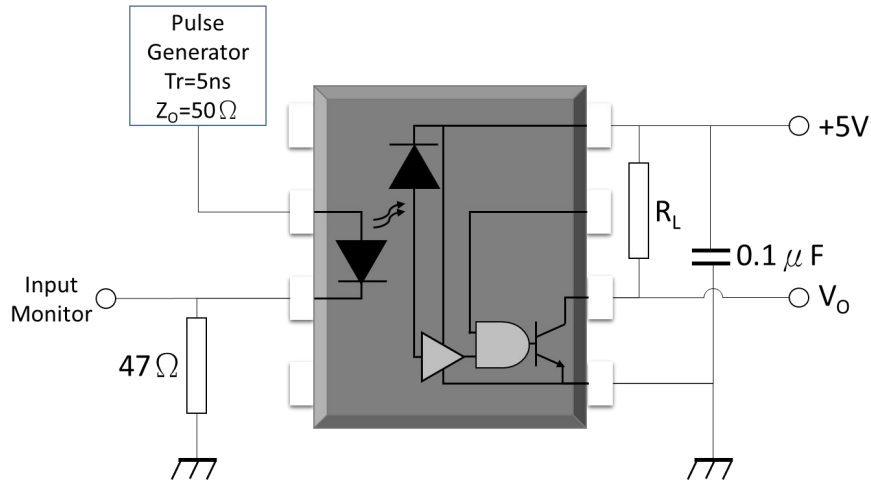


**Fig.22 Enable Propagation Delay vs. Ambient Temperature**

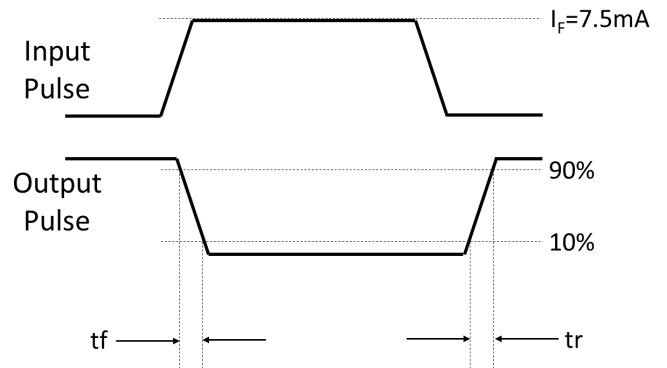
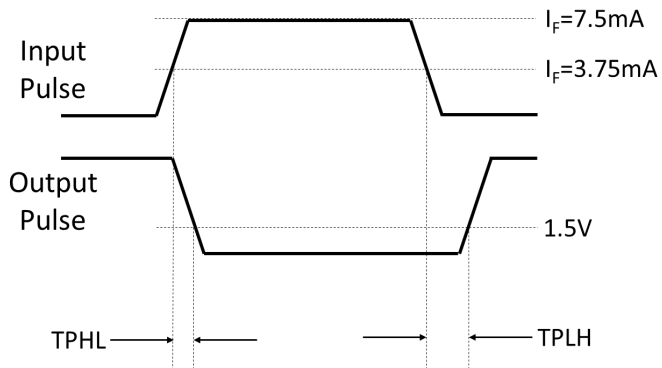


## TEST CIRCUITS

**Fig.23 Test Circuits for TPHL, TPLH, tr, tf**

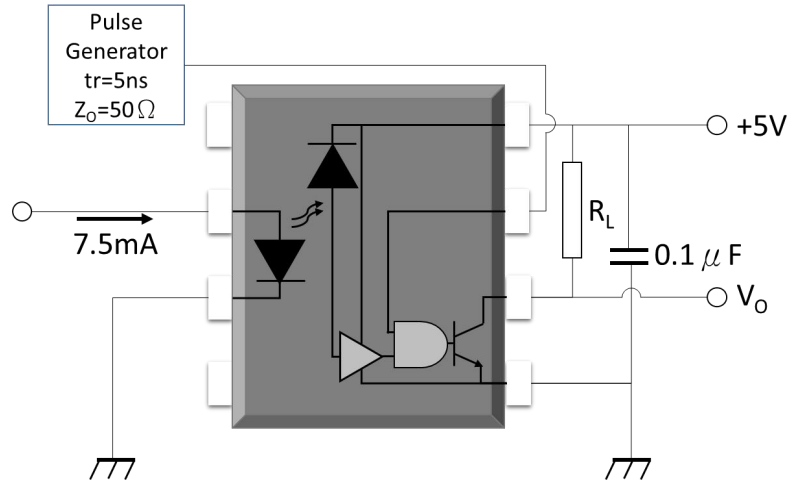


**Fig.24 Waveforms of TPHL, TPLH, tr, tf**

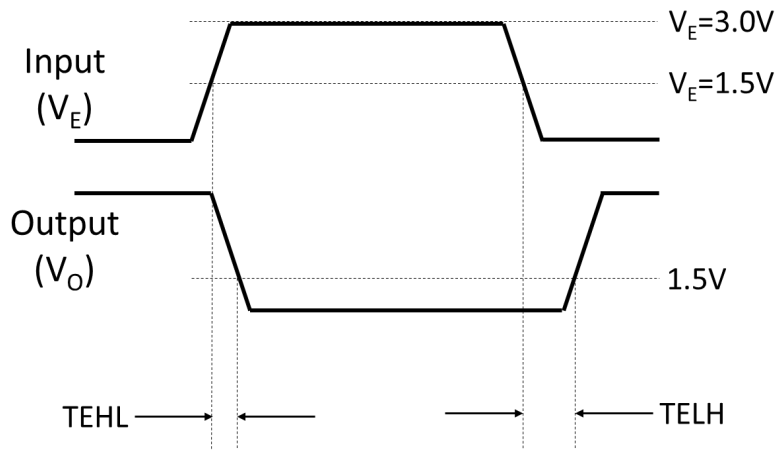


## TEST CIRCUITS

**Fig.25 Test Circuits for TEHL, TELH**

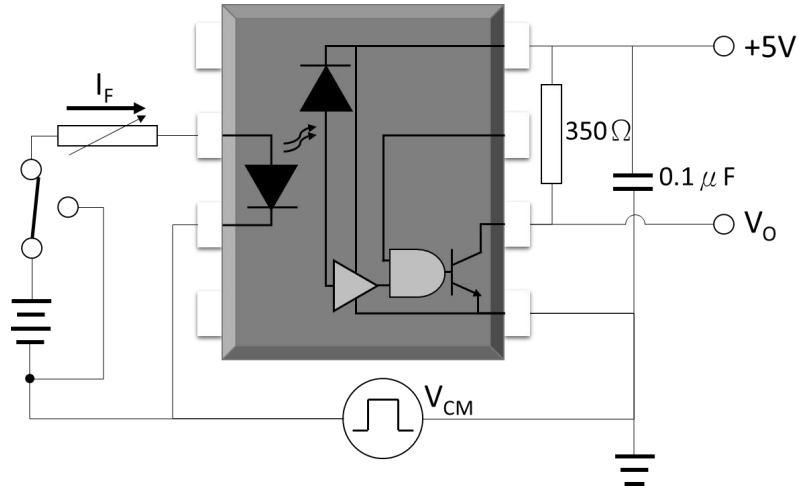


**Fig.26 Waveforms of TEHL, TELH**

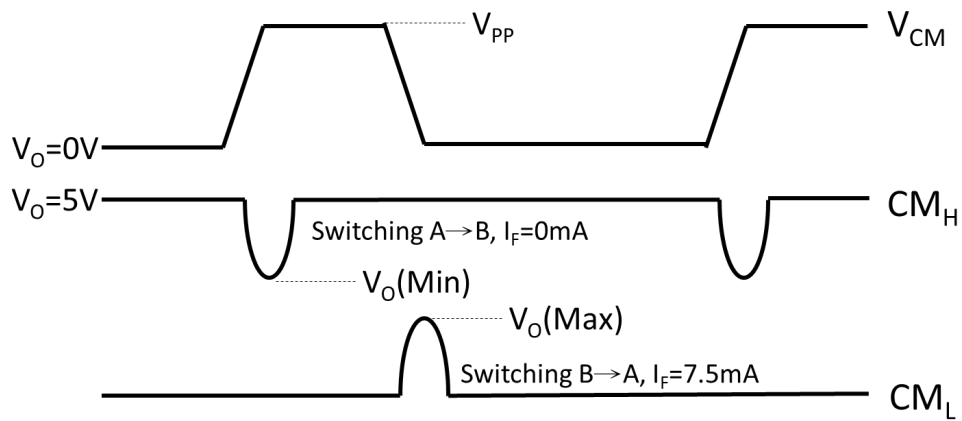


## TEST CIRCUITS

**Fig.25 Test Circuits for Common Mode Transient Immunity**

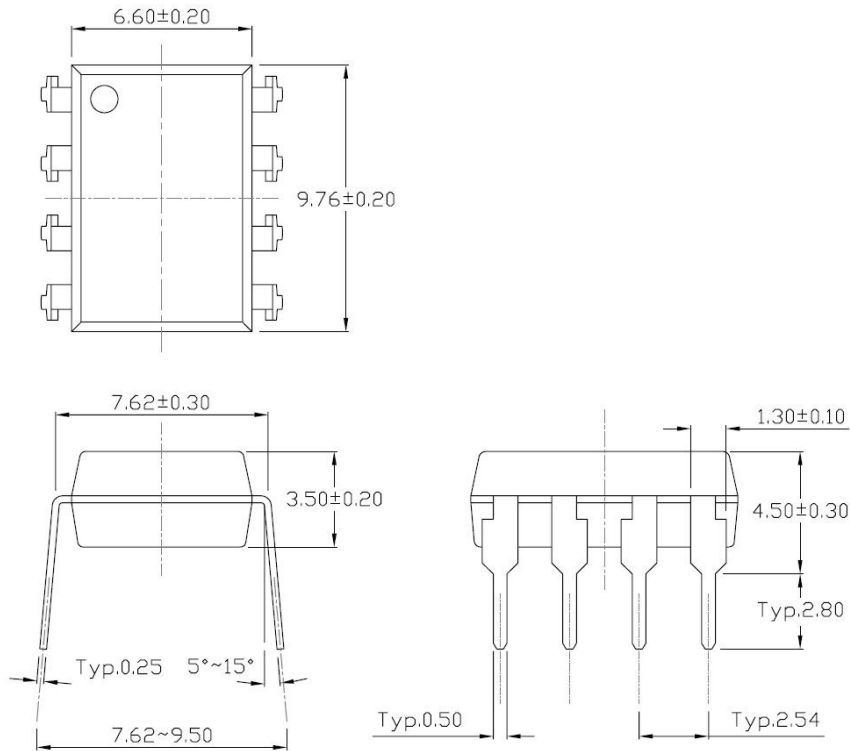


**Fig.26 Waveforms of Common Mode Transient Immunity**

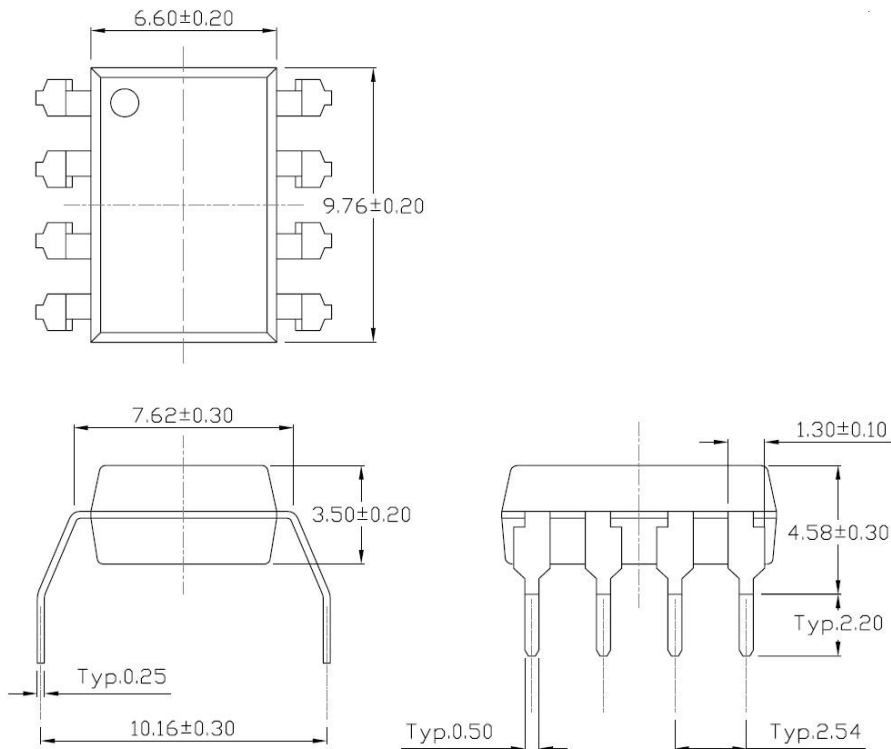


## PACKAGE DIMENSIONS (Dimensions in mm unless otherwise stated)

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

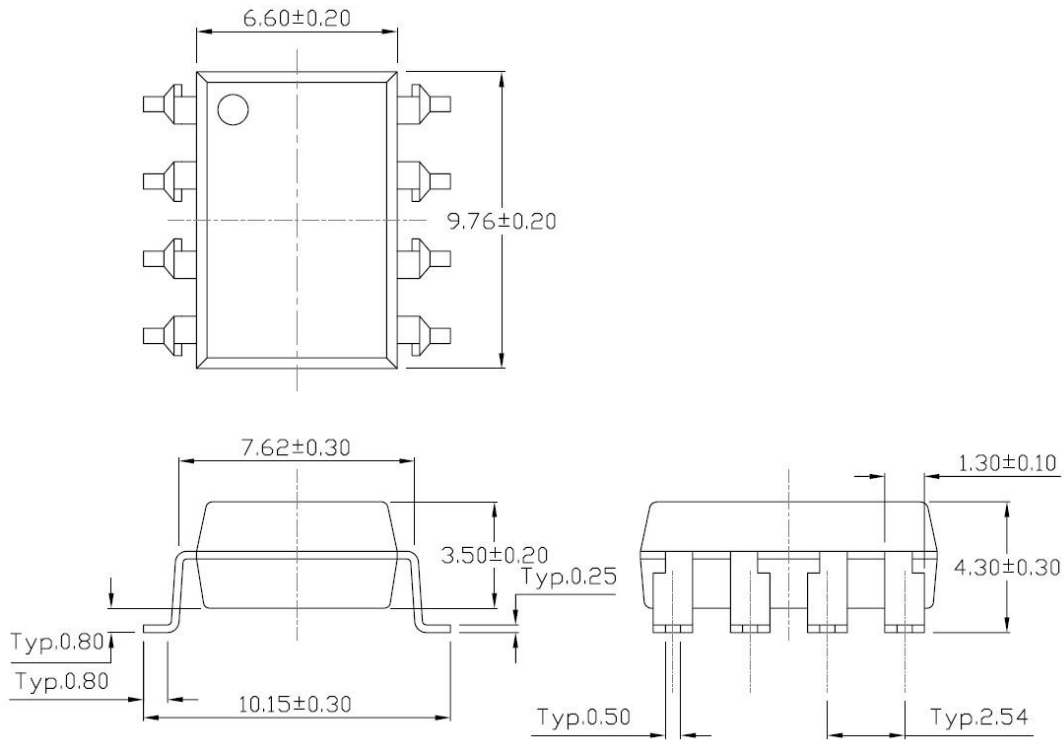


### Gullwing (400mil) Lead Forming – Through Hole (M Type)

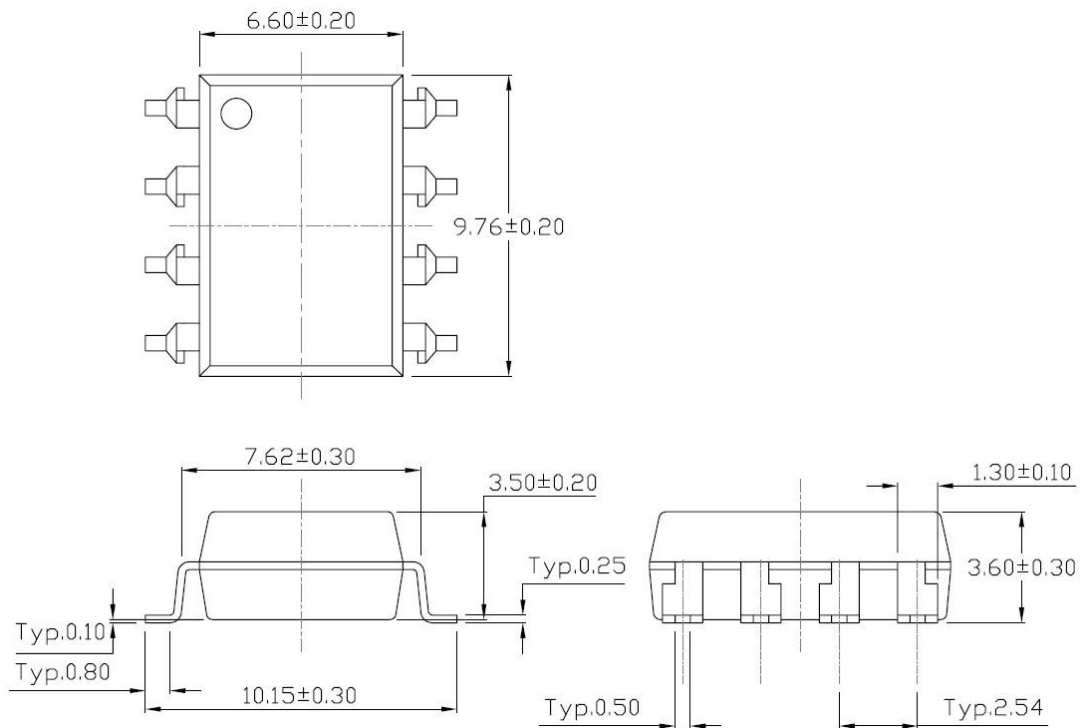


## PACKAGE DIMENSIONS (Dimensions in mm unless otherwise stated)

### Surface Mount Lead Forming (SLType)

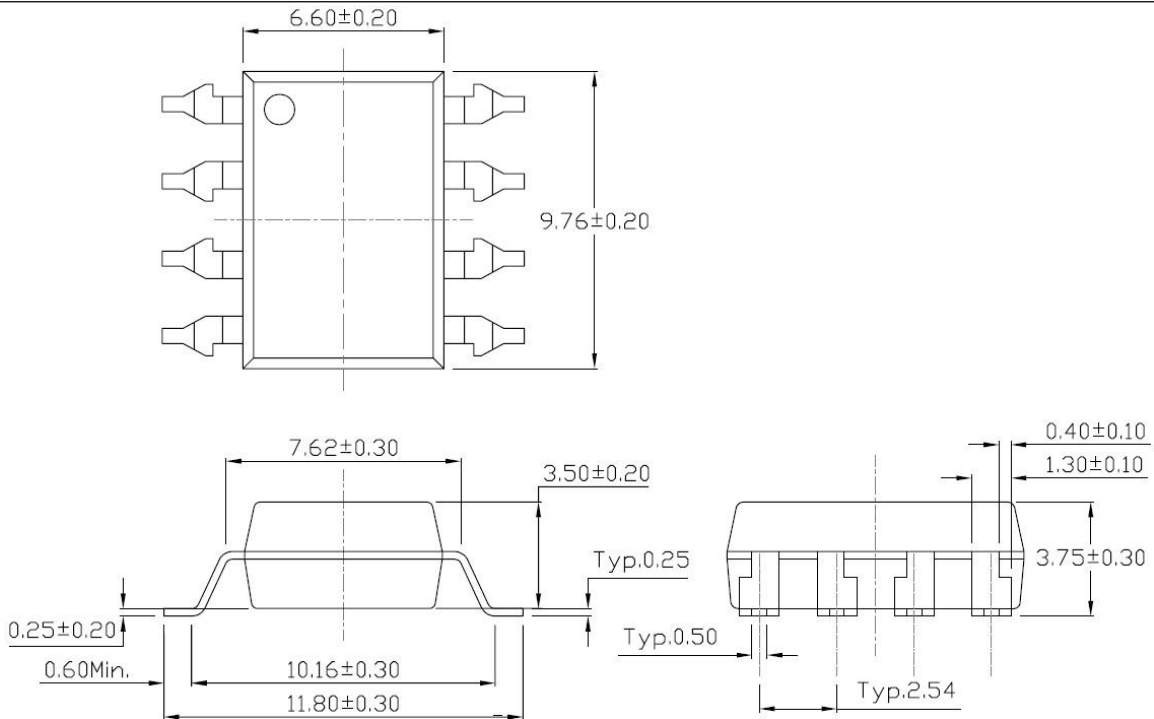


### Surface Mount (Low Profile) Lead Forming (S Type)



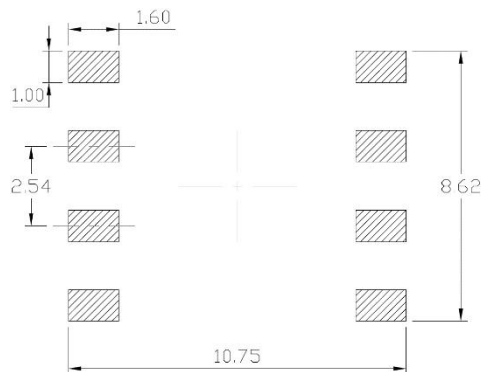
## PACKAGE DIMENSIONS (Dimensions in mm unless otherwise stated)

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

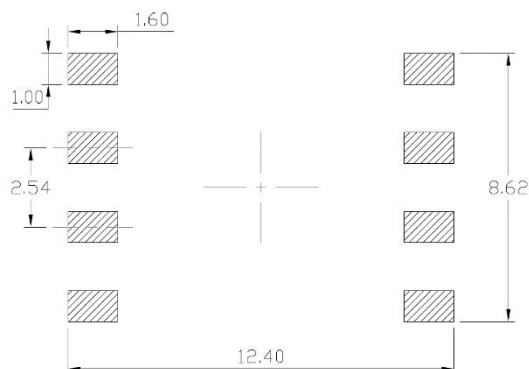


## Recommended Solder Mask (Dimensions in mm unless otherwise stated)

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



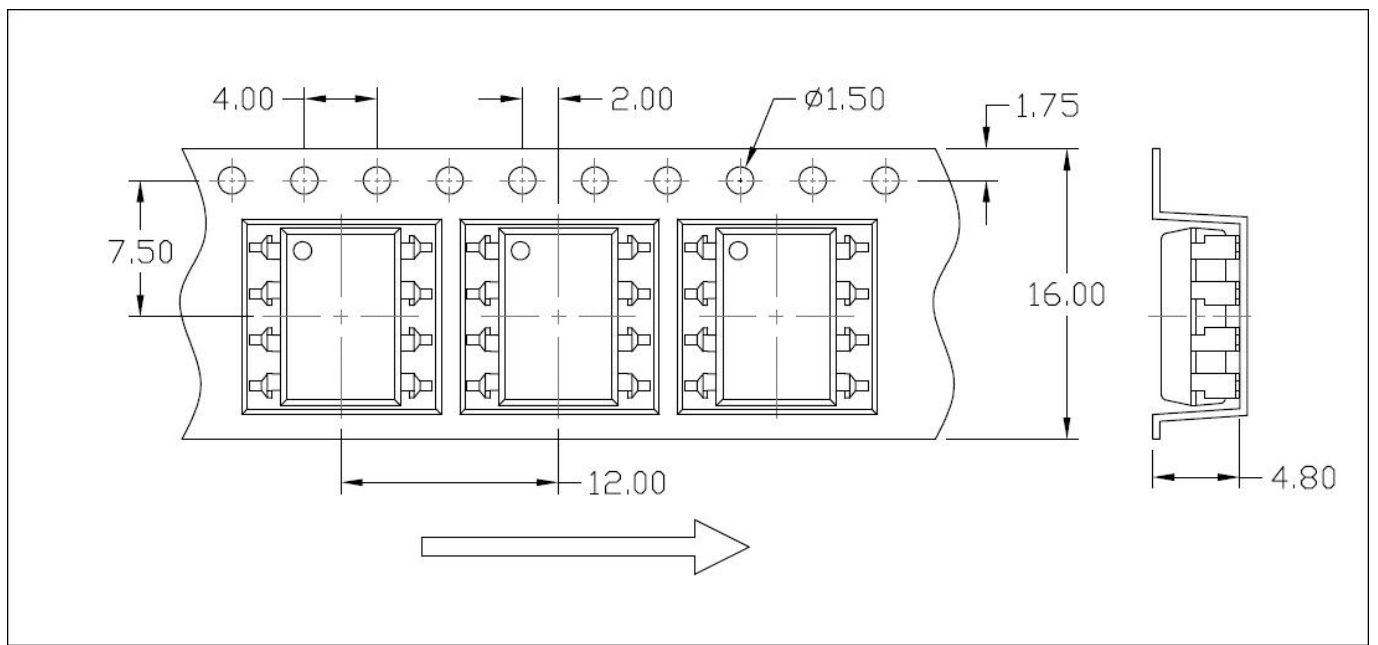
### Surface Mount (Gullwing) Lead Forming



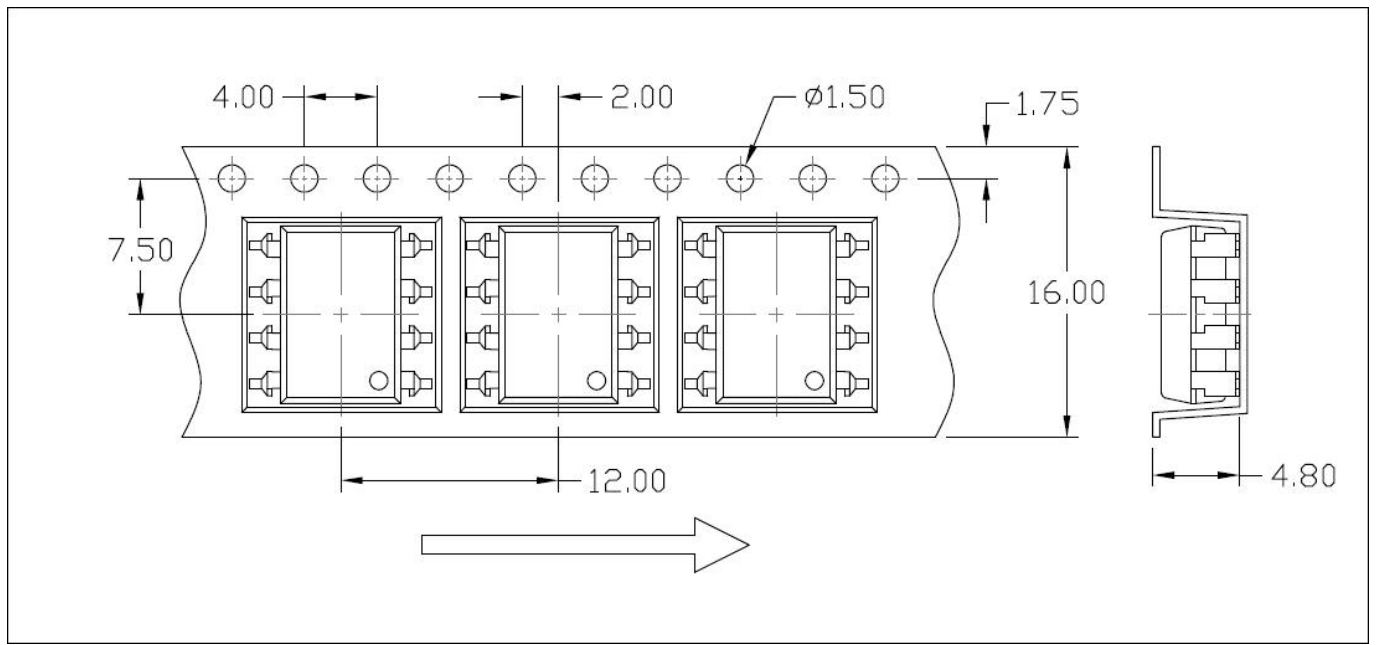


## Carrier Tape Specifications (Dimensions in mm unless otherwise stated)

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

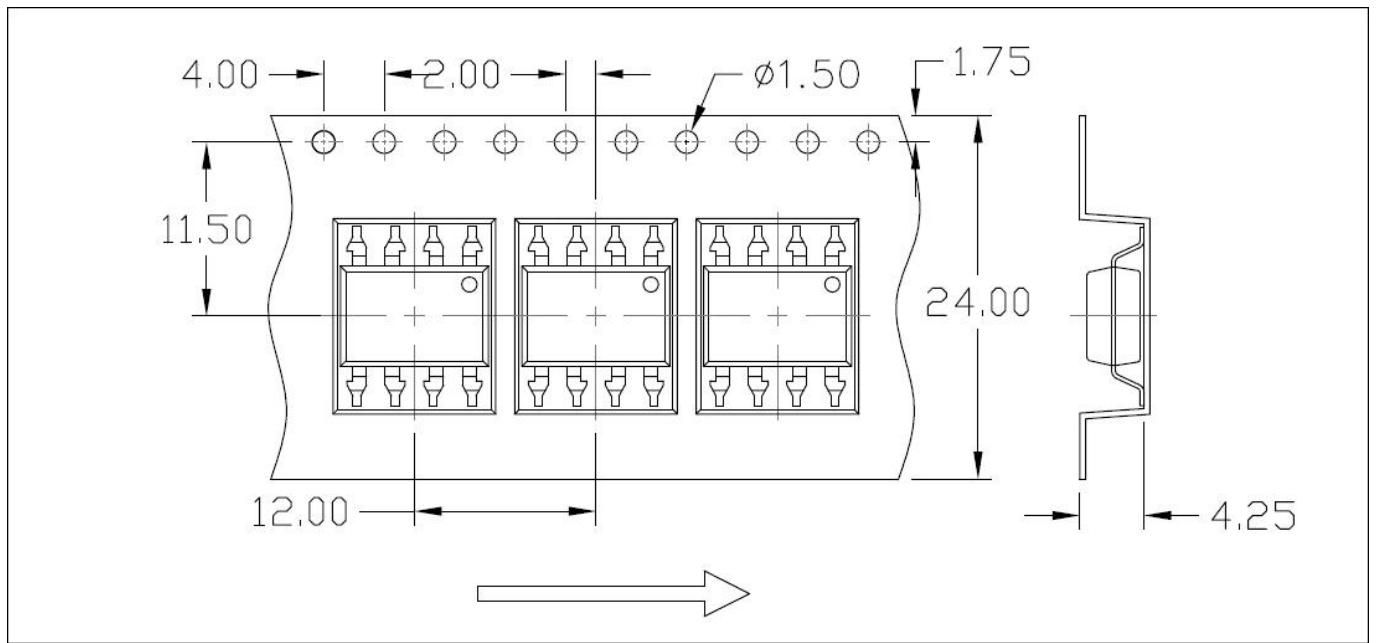


### Option S(T2) & SL(T2)

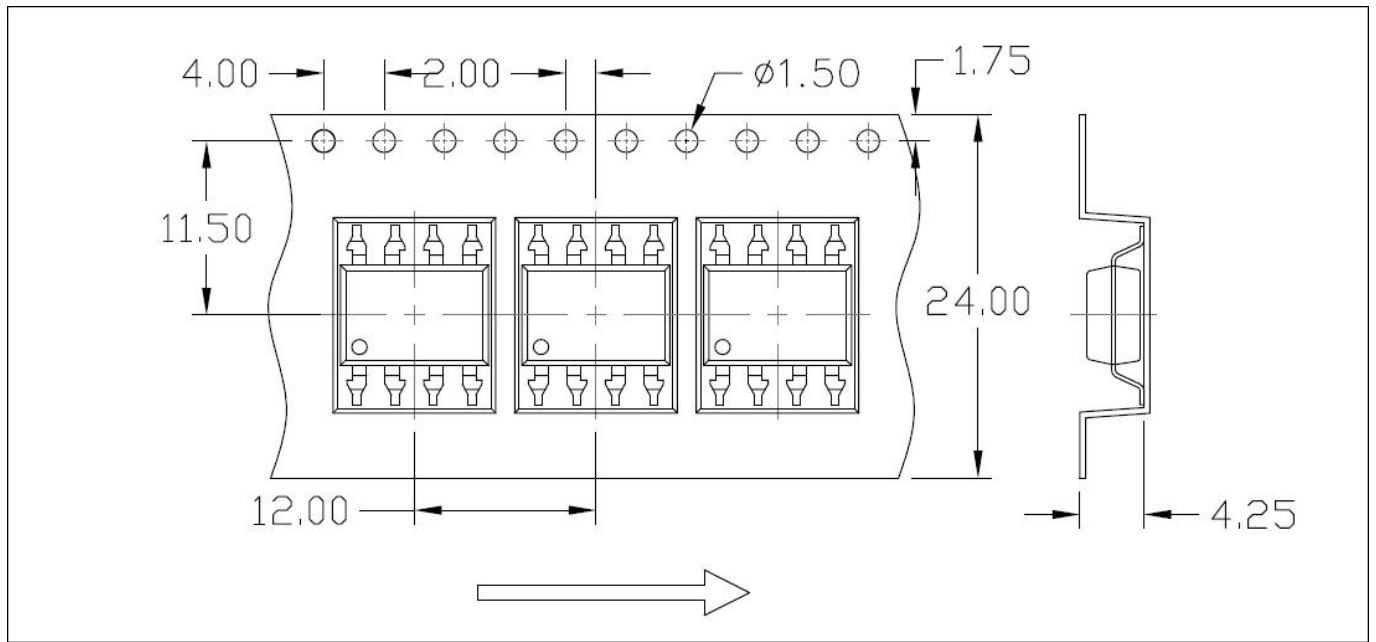


## Carrier Tape Specifications (Dimensions in mm unless otherwise stated)

### Option SLM(T1)

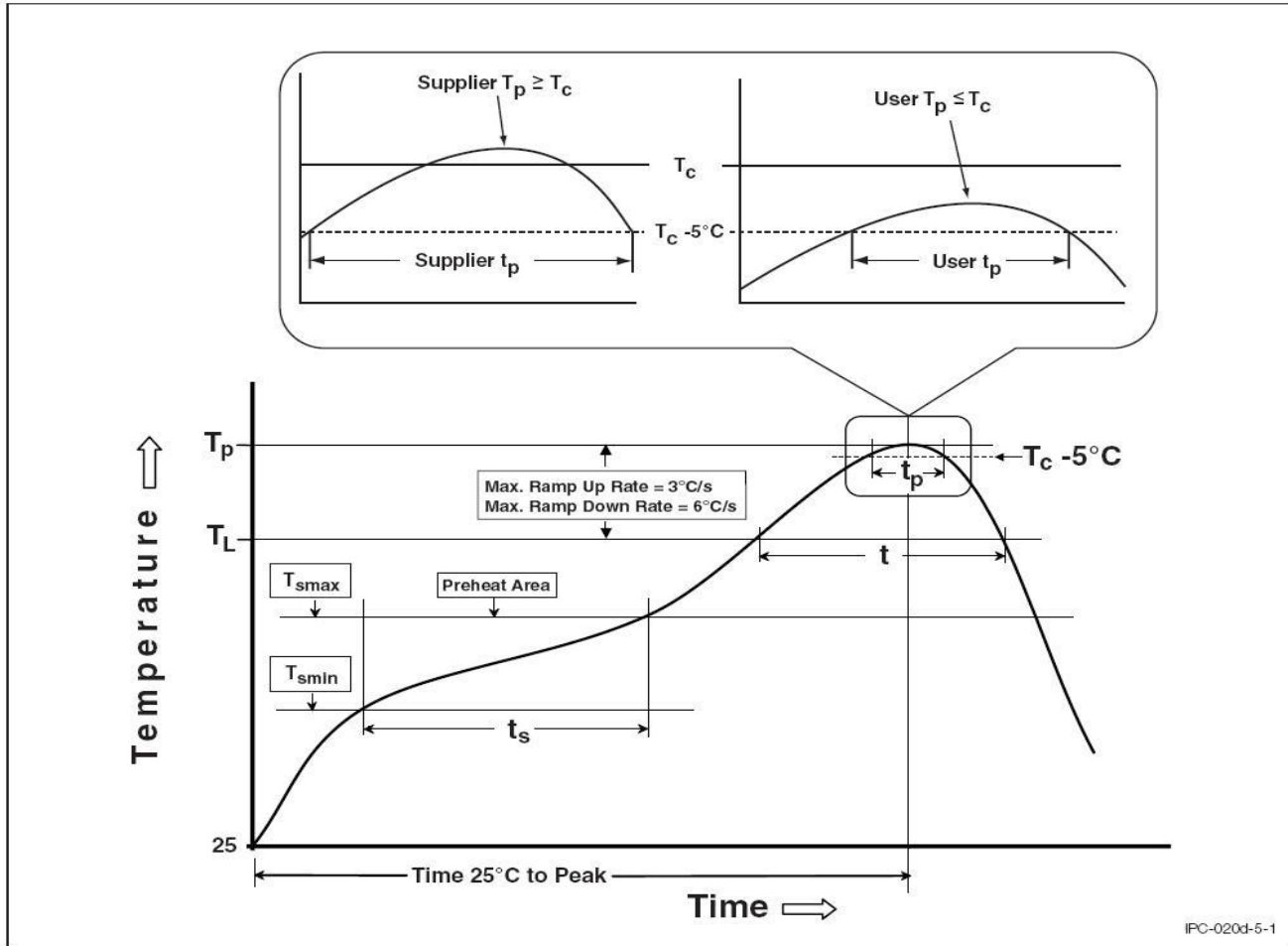


### Option SLM(T2)



## REFLOW INFORMATION

### REFLOW PROFILE



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.