



## 6N137, CT2601

# 10MBit/s High Speed Logic Gate Optocoupler

### Features

- High speed 10MBit/s
- High isolation voltage between input and output (Viso=5000 Vrms )
- Guaranteed performance from -40°C to 85°C
- Wide operating temperature range of -55°C to 100°C
- Regulatory Approvals
  - UL - UL1577 (E364000)
  - VDE - EN60747-5-5(VDE0884-5)
  - CQC – GB4943.1, GB8898
  - IEC60065, IEC60950

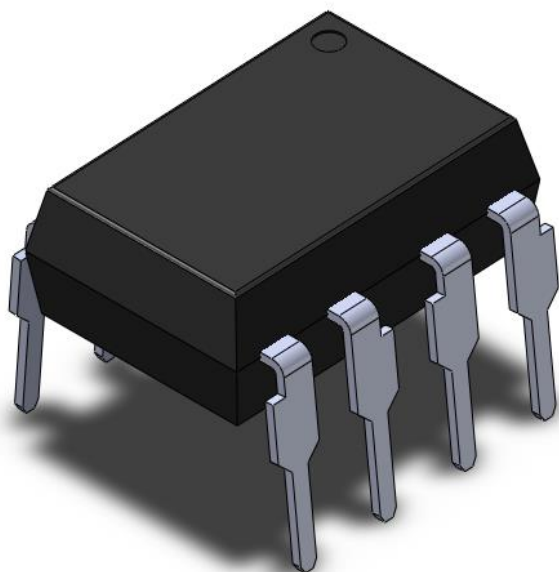
### Description

The 6N137, CT2601 optocouplers consist of a 850 nm AlGaAs LED, optically coupled to a very high speed integrated photo-detector logic gate with a strobable output. This output features an open collector, there by permitting wired OR outputs. The switching parameters are guaranteed over the temperature range of -40°C to +85°C. A maximum input signal of 5mA will provide a minimum output sink current of 13mA (fan out of 8).

### Applications

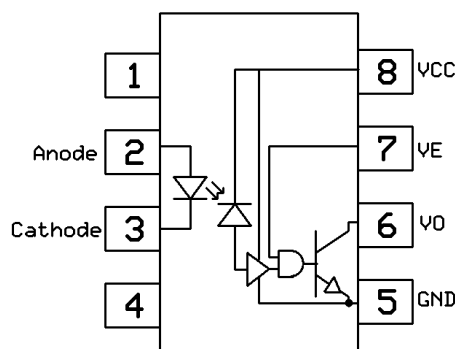
- Line receivers
- Telecommunication equipment
- Feedback loop in switch-mode power supplies
- Home appliances

### Package Outline



Note: Different lead forming options available. See package dimension.

### Schematic



### Truth Table

Input	Enable	Output
H	H	L
L	H	H
H	L	H
L	L	H
H	NC	L
L	NC	H



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### Absolute Maximum Rating at 25°C

<b>Symbol</b>	<b>Parameters</b>	<b>Ratings</b>	<b>Units</b>	<b>Notes</b>
V <sub>ISO</sub>	Isolation voltage	5000	V <sub>RMS</sub>	1
T <sub>OPR</sub>	Operating temperature	-55 ~ +100	°C	
T <sub>STG</sub>	Storage temperature	-55 ~ +125	°C	
T <sub>SOL</sub>	Soldering temperature	260	°C	2
<b>Emitter</b>				
I <sub>F</sub>	Forward current	50	mA	
V <sub>R</sub>	Reverse voltage	5	V	
P <sub>I</sub>	Power dissipation	100	mW	
<b>Detector</b>				
P <sub>O</sub>	Power dissipation	85	mW	
I <sub>O</sub>	Average Output current	50	mA	
V <sub>O</sub>	Output voltage	7.0	V	1min(Max.)
V <sub>CC</sub>	Supply voltage	7.0	V	
V <sub>E</sub>	Enable Input Voltage Not to Exceed VCC by more than 500mV	5.5	V	

#### Notes

1. AC for 1 minute, RH = 40 ~ 60%.
2. For 10 second peak



# 10MBit/s High Speed Logic Gate Optocoupler

## Electrical Characteristics

$T_A = -40 - 85^\circ\text{C}$  (unless otherwise specified). Typical values are measured at  $T_A = 25^\circ\text{C}$  and  $V_{CC} = 5\text{V}$

### Emitter Characteristics

Symbol	Parameters	Test Conditions	Min	Typ	Max	Units	Notes
$V_F$	Forward voltage	$I_F = 10\text{mA}$	-	1.4	1.6	V	
$V_R$	Reverse Voltage	$I_R = 10\mu\text{A}$	5.0	-	-	V	
$\Delta V_F / \Delta T_A$	Temperature coefficient of forward voltage	$I_F = 10\text{mA}$	-	-1.8	-	mV/°C	

### Detector Characteristics

Symbol	Parameters	Test Conditions	Min	Typ	Max	Units	Notes
$I_{CCH}$	Logic High Supply Current	$I_F = 0\text{mA}, V_E = 0.5\text{V}, V_{CC} = 3.3\text{V}$	-	4.0	10	mA	
		$I_F = 0\text{mA}, V_E = 0.5\text{V}, V_{CC} = 5.5\text{V}$	-	6.5	10		
$I_{CCL}$	Logic Low Supply Current	$I_F = 10\text{mA}, V_E = 0.5\text{V}, V_{CC} = 3.3\text{V}$	-	5.5	13	mA	
		$I_F = 10\text{mA}, V_E = 0.5\text{V}, V_{CC} = 5.5\text{V}$	-	8.8	13		
$V_{EH}$	High Level Enable Voltage	$I_F = 10\text{mA}, V_{CC} = 3.3\text{V}$	2.0	-	-	V	
		$I_F = 10\text{mA}, V_{CC} = 5.5\text{V}$	2.0	-	-		
$V_{EL}$	Low Level Enable Voltage	$I_F = 10\text{mA}, V_{CC} = 3.3\text{V}$	-	-	0.8	V	
		$I_F = 10\text{mA}, V_{CC} = 5.5\text{V}$	-	-	0.8		
$I_{EH}$	High Level Enable Current	$V_E = 2.0\text{V}, V_{CC} = 3.3\text{V}$	-	-0.2	-1.6	mA	
		$V_E = 2.0\text{V}, V_{CC} = 5.5\text{V}$	-	-0.53	-1.6		
$I_{EL}$	Low Level Enable Current	$V_E = 0.5\text{V}, V_{CC} = 3.3\text{V}$	-	-0.42	-1.6	mA	
		$V_E = 0.5\text{V}, V_{CC} = 5.5\text{V}$	-	-0.75	-1.6		

### Transfer Characteristics

Symbol	Parameters	Test Conditions	Min	Typ	Max	Units	Notes
$I_{FT}$	Input Threshold Current	$V_{CC} = 3.3\text{V}, V_O = 0.6\text{V}, V_E = 2.0\text{V}, I_O = 13\text{mA}$	-	1.6	5	mA	
		$V_{CC} = 5.5\text{V}, V_O = 0.6\text{V}, V_E = 2.0\text{V}, I_O = 13\text{mA}$	-	2.5	5		



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I <sub>OH</sub>	Logic High Output Current	I <sub>F</sub> =250μA, V <sub>O</sub> =V <sub>CC</sub> =3.3V, V <sub>E</sub> =2.0V	-	7.0	100	μA	
		I <sub>F</sub> =250μA, V <sub>O</sub> =V <sub>CC</sub> =5.5V, V <sub>E</sub> =2.0V	-	2.0	100		
V <sub>OL</sub>	Low Level Output Voltage	I <sub>F</sub> =5mA, V <sub>CC</sub> =3.3V, V <sub>E</sub> =2.0V, I <sub>O</sub> =13mA	-	0.45	0.6	V	
		I <sub>F</sub> =5mA, V <sub>CC</sub> =5.5V, V <sub>E</sub> =2.0V, I <sub>O</sub> =13mA	-	0.35	0.6		

## Electrical Characteristics

T<sub>A</sub> = -40 - 85°C (unless otherwise specified). Typical values are measured at T<sub>A</sub> = 25°C, V<sub>CC</sub>=5V and I<sub>F</sub>= 7.5mA

## Switching Characteristics

Symbol	Parameters	Test Conditions	Min	Typ	Max	Units	Notes	
T <sub>PHL</sub>	Output Propagation Delay High to Low	C <sub>L</sub> = 15pF, R <sub>L</sub> = 350Ω V <sub>CC</sub> =3.3V	-	34	75	ns		
		C <sub>L</sub> = 15pF, R <sub>L</sub> = 350Ω V <sub>CC</sub> =5.5V	-	34	75			
T <sub>PLH</sub>	Output Propagation Delay Low to High	C <sub>L</sub> = 15pF, R <sub>L</sub> = 350Ω V <sub>CC</sub> =3.3V	-	50	75	ns		
		C <sub>L</sub> = 15pF, R <sub>L</sub> = 350Ω V <sub>CC</sub> =5.5V	-	39	75			
P <sub>WD</sub>	Pulse Width Distortion	C <sub>L</sub> = 15pF, R <sub>L</sub> = 350Ω V <sub>CC</sub> =3.3V	-	16	34	ns		
		C <sub>L</sub> = 15pF, R <sub>L</sub> = 350Ω V <sub>CC</sub> =5.5V	-	5	34			
T <sub>r</sub>	Output Rise Time	C <sub>L</sub> = 15pF, R <sub>L</sub> = 350Ω V <sub>CC</sub> =3.3V	-	37	-	ns		
		C <sub>L</sub> = 15pF, R <sub>L</sub> = 350Ω V <sub>CC</sub> =5.5V	-	37	-			
T <sub>f</sub>	Output Fall Time	C <sub>L</sub> = 15pF, R <sub>L</sub> = 350Ω V <sub>CC</sub> =3.3V	-	10	-	ns		
		C <sub>L</sub> = 15pF, R <sub>L</sub> = 350Ω V <sub>CC</sub> =5.5V	-	10	-			
T <sub>ELH</sub>	Enable Propagation Delay Low To High	V <sub>EH</sub> = 3.5V, C <sub>L</sub> = 15pF, R <sub>L</sub> = 350Ω	-	15	-	ns		
T <sub>EHL</sub>	Enable Propagation Delay High To Low		-	15	-	ns		
CM <sub>H</sub>	Common Mode Transient Immunity at Logic High	I <sub>F</sub> = 0mA, V <sub>CM</sub> = 50Vp-p, V <sub>OH</sub> = 2.0V, R <sub>L</sub> = 350Ω	6N137	-	10000	-	V/μs	
			CT2601	5000	10000	-		



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## 10MBit/s High Speed Logic Gate Optocoupler

CML	Common Mode Transient Immunity at Logic Low	I <sub>F</sub> =7.5mA, V <sub>CM</sub> = 50Vp-p, V <sub>OL</sub> = 0.8V, R <sub>L</sub> = 350Ω	6N137	-	10000	-	V/μs	
			CT2601	5000	10000	-		



### Typical Characteristic Curves

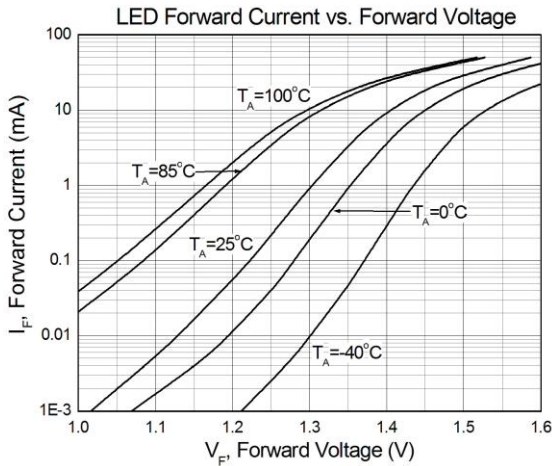


Figure 1

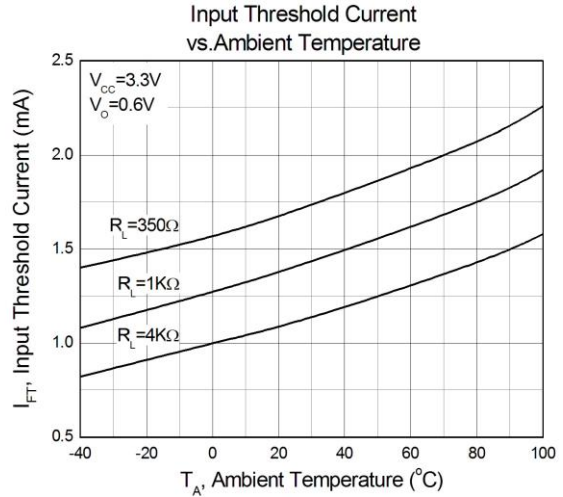


Figure 2

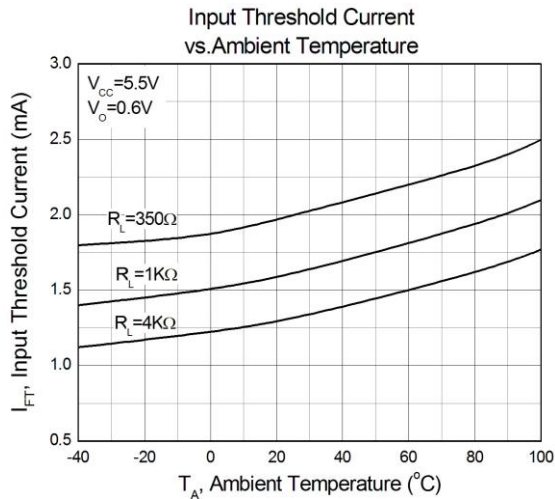


Figure 3

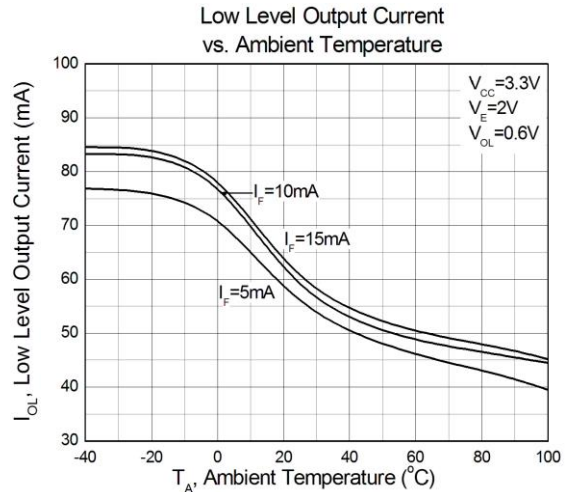


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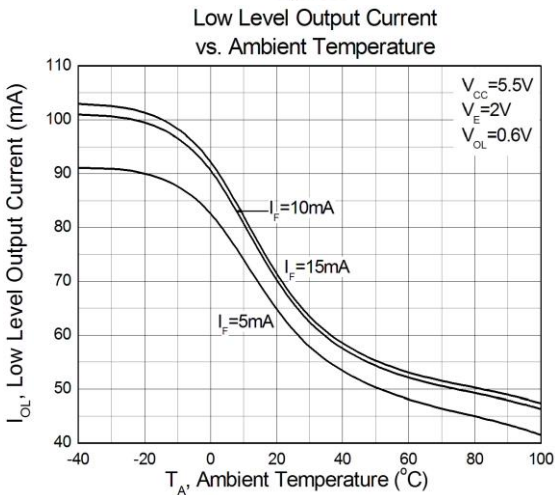


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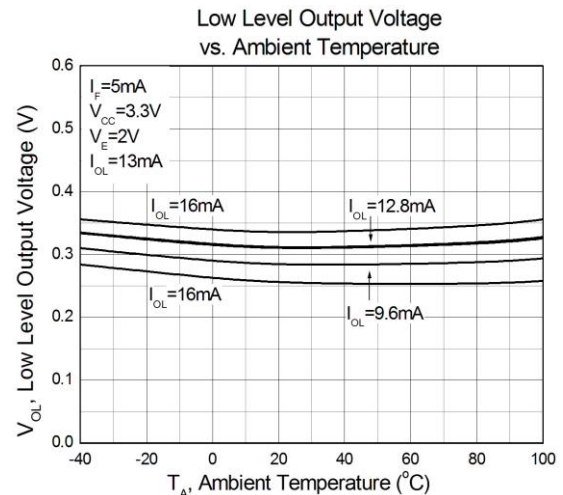


Figure 6



Typical Characteristic Curves

Low Level Output Voltage vs. Ambient Temperature

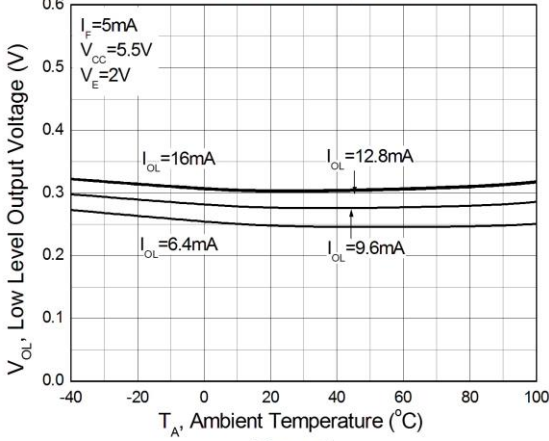


Figure 7

High Level Output Current vs. Ambient Temperature

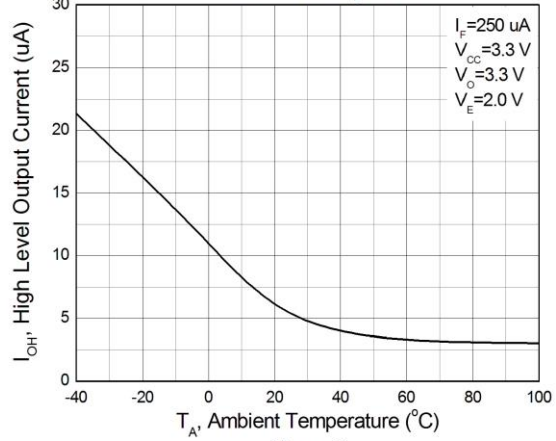


Figure 8

High Level Output Current vs. Ambient Temperature

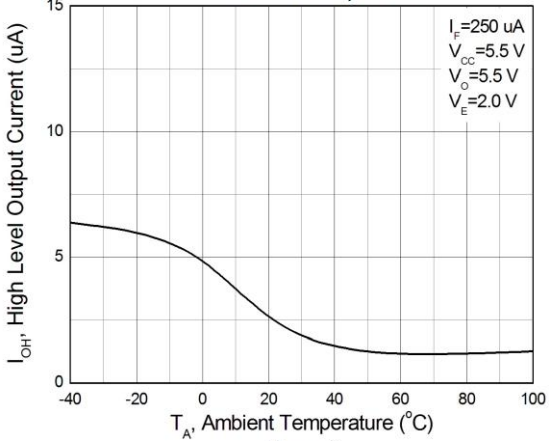


Figure 9

Output Voltage vs. Forward Current

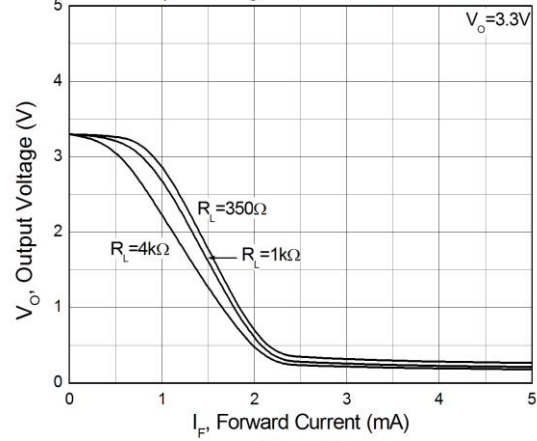


Figure 10

Output Voltage vs. Forward Current

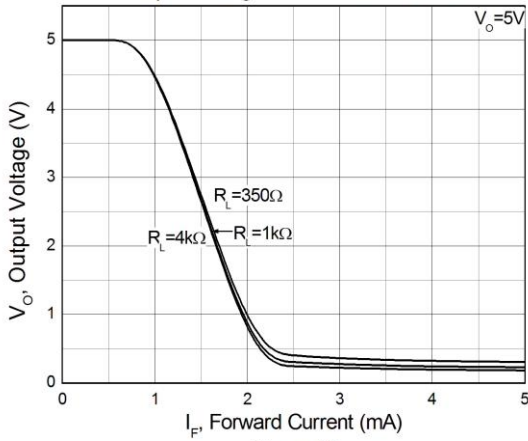


Figure 11

Propagation Delay vs. Forward Current

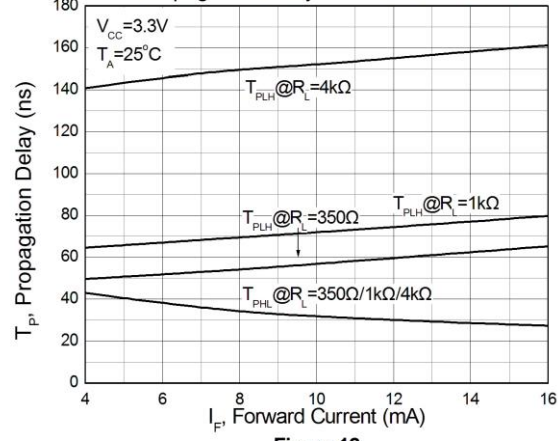


Figure 12



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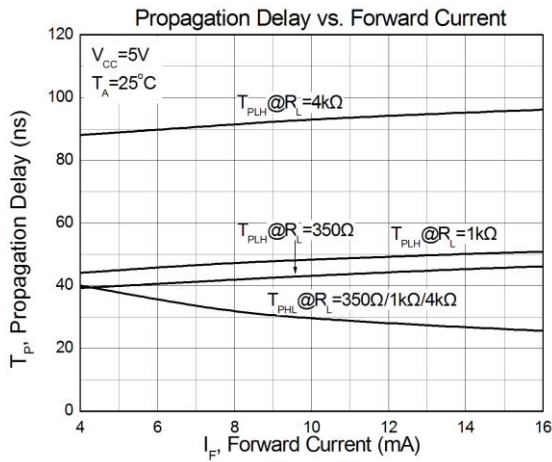


Figure 13

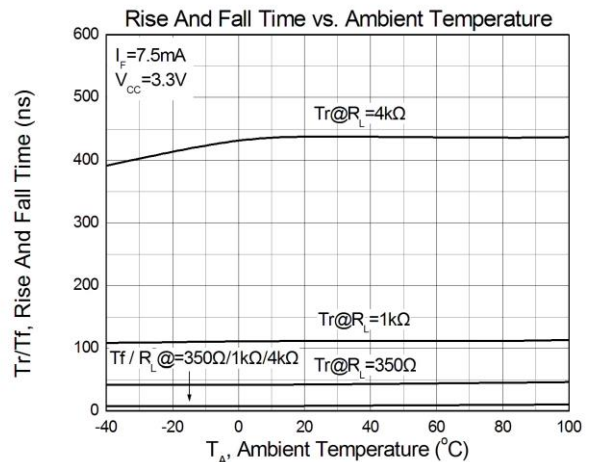


Figure 14

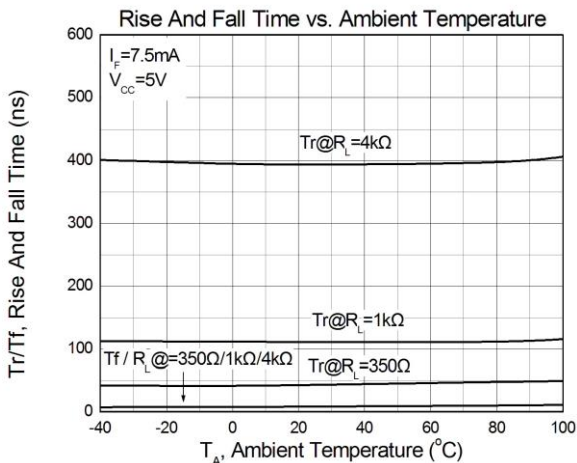


Figure 15

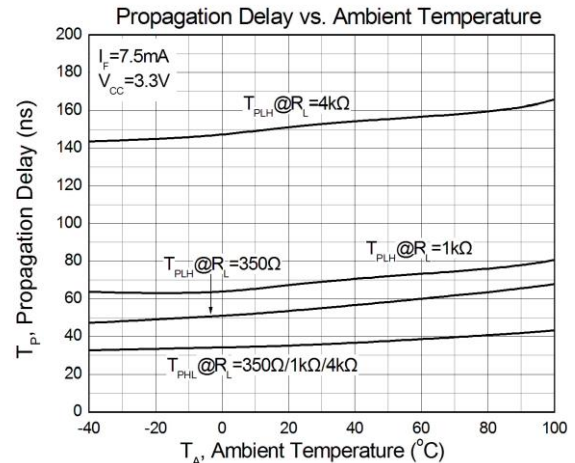


Figure 16

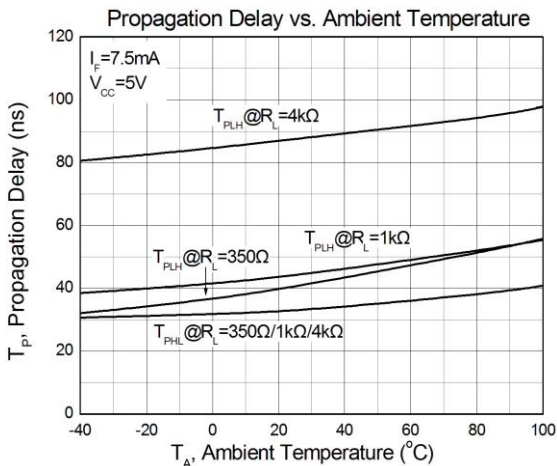


Figure 17

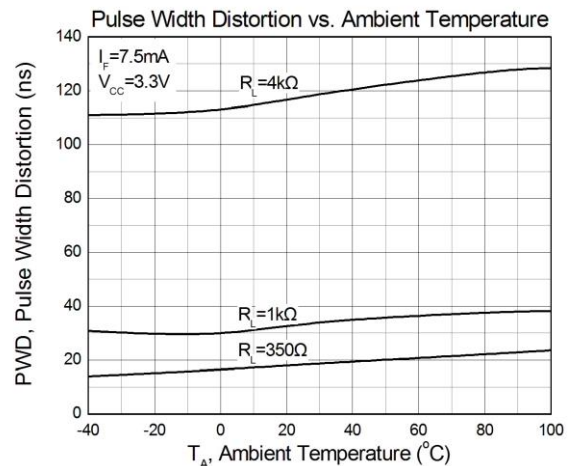
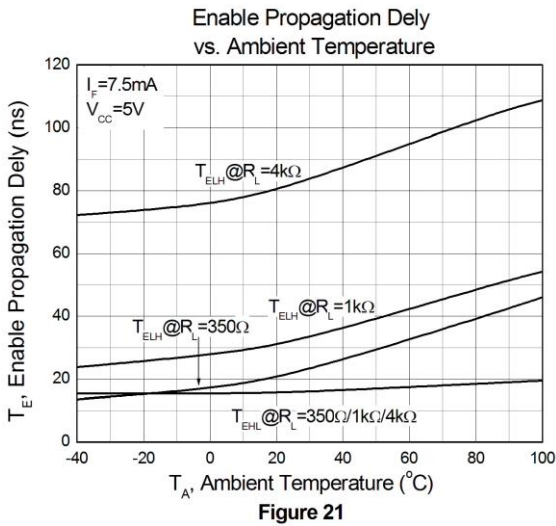
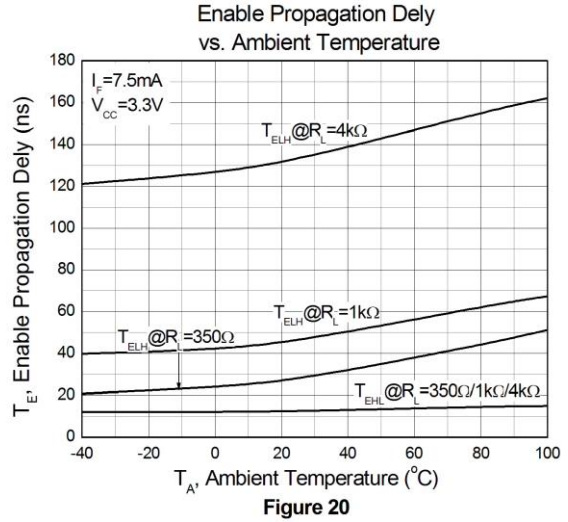
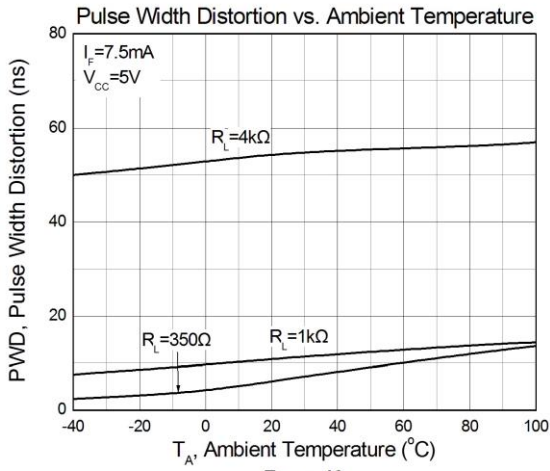


Figure 18



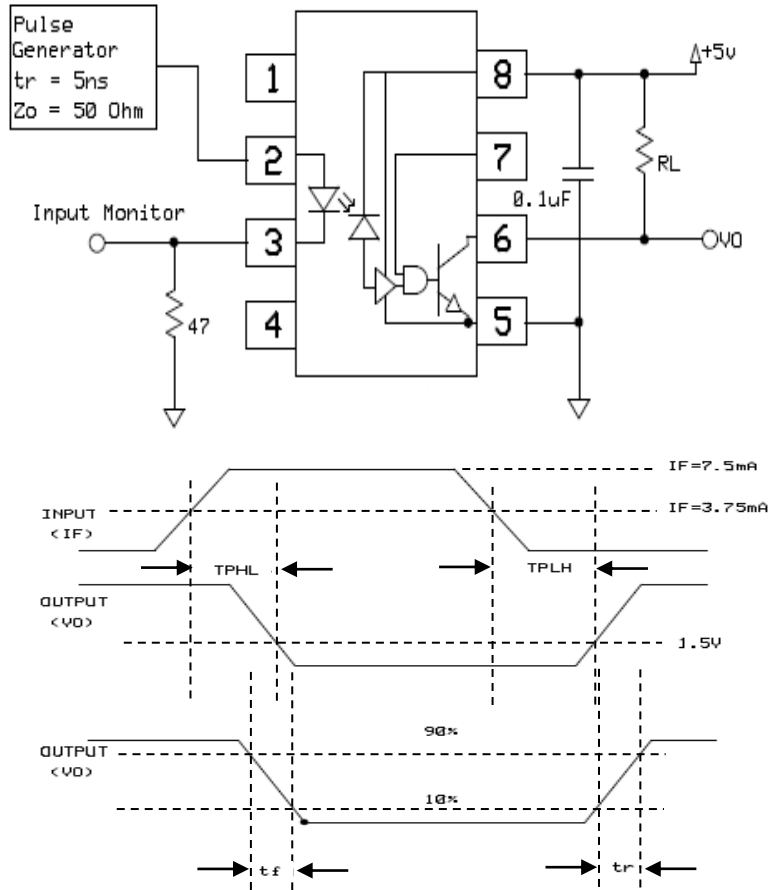


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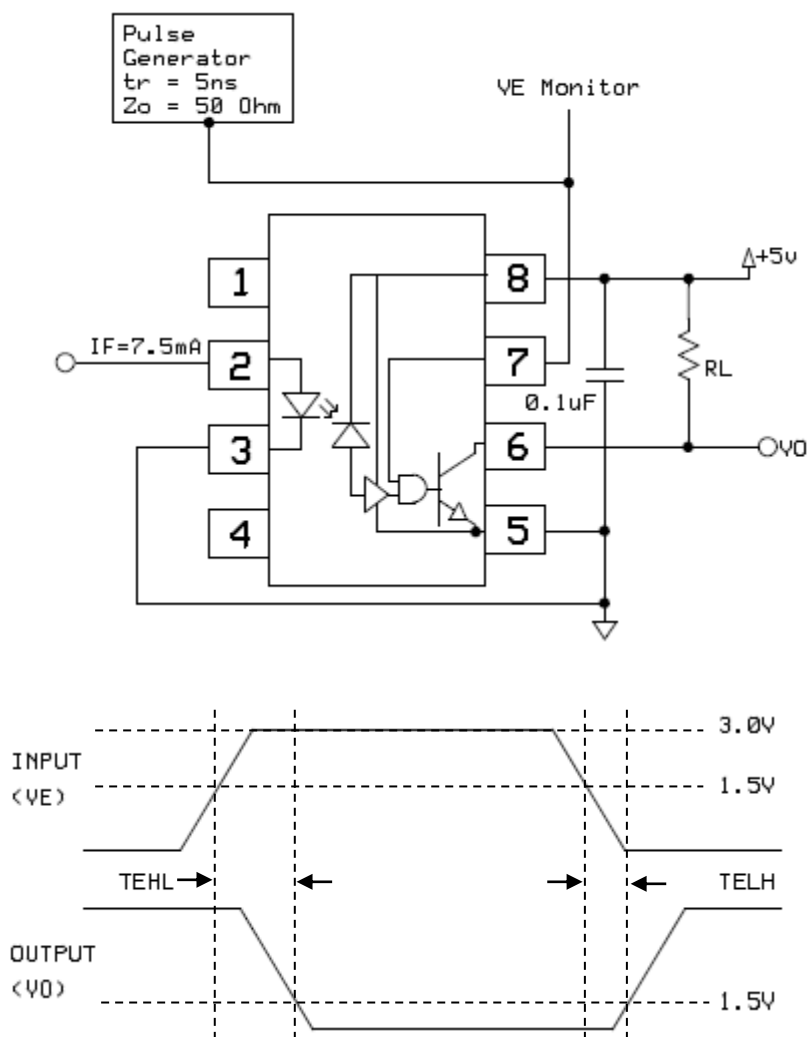
Test Circuits



Switching Time Test Circuit



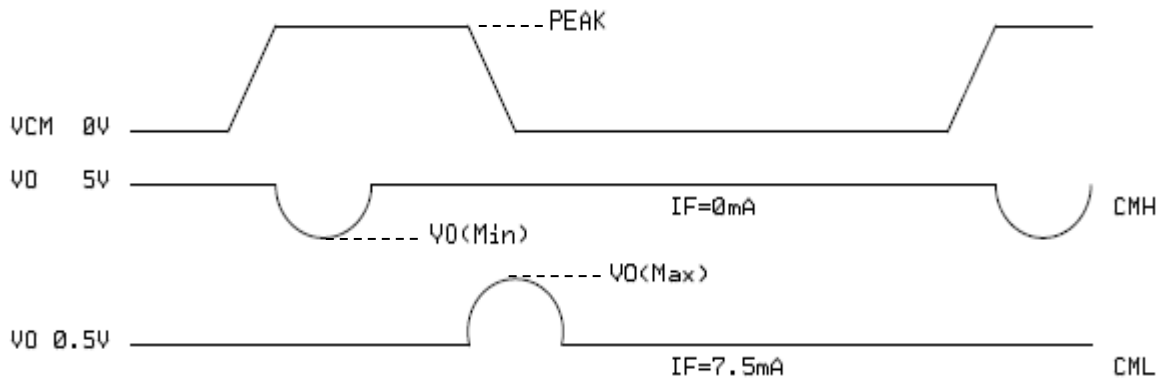
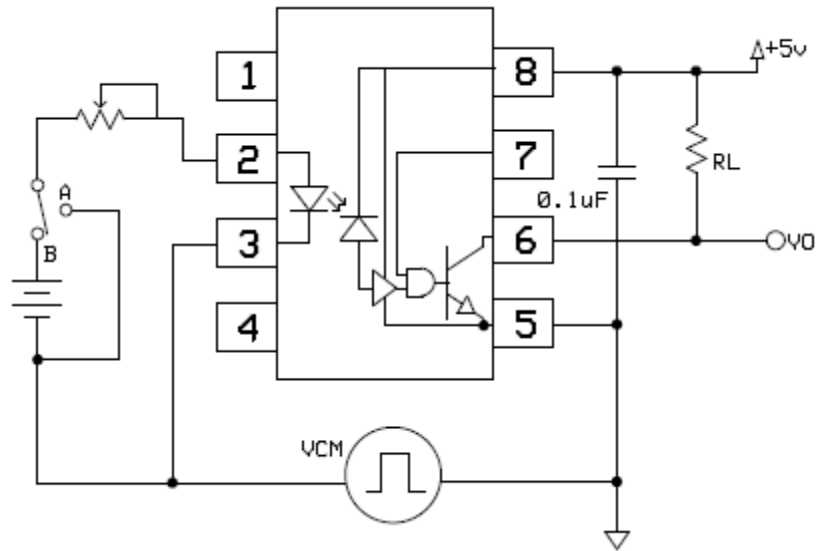
Test Circuits



Enable Switching Time Test Circuit



Test Circuits



CMR Test Circuit

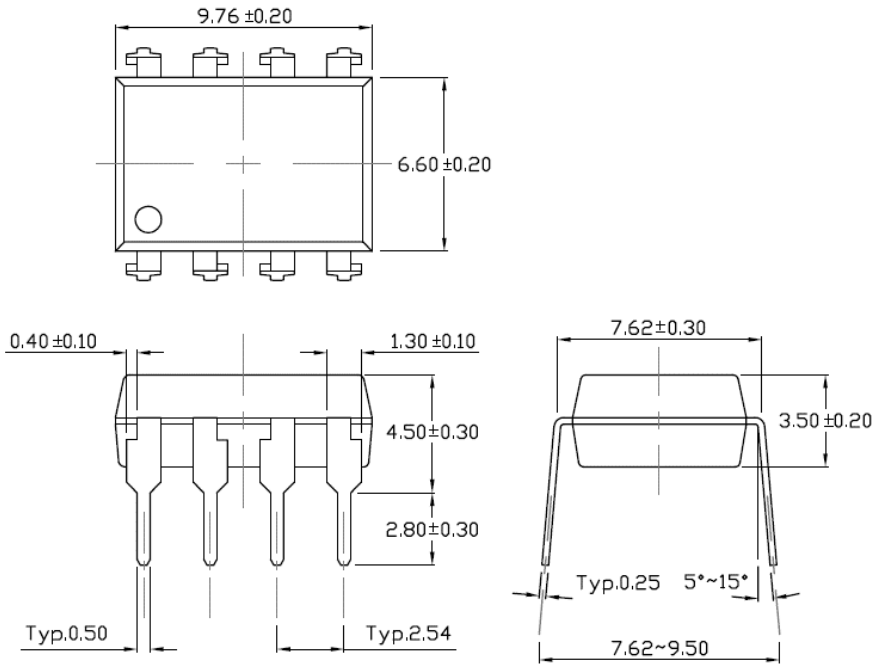


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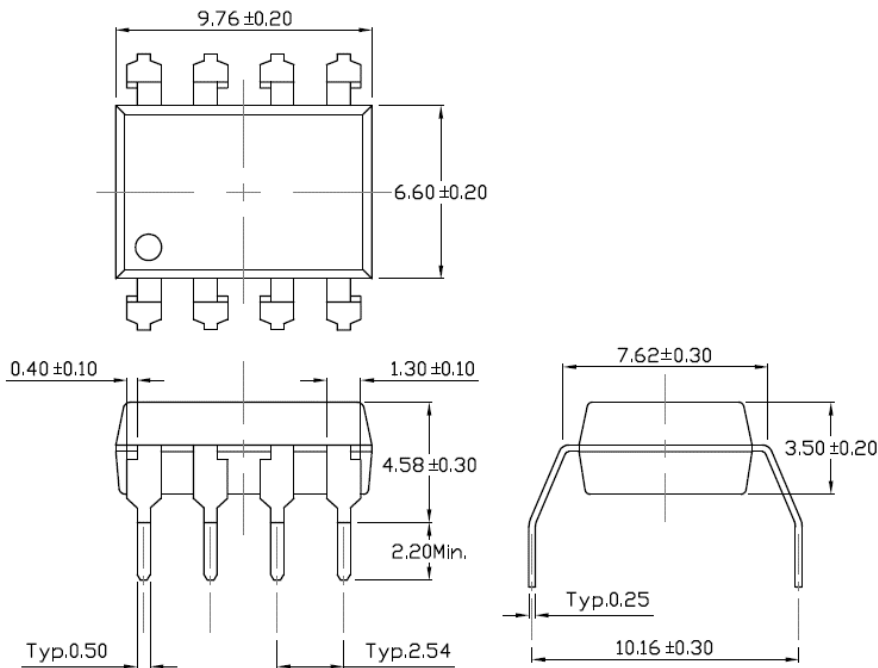
# 10MBit/s High Speed Logic Gate Optocoupler

## Package Dimension *Dimensions in mm unless otherwise stated*

### Standard DIP – Through Hole



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

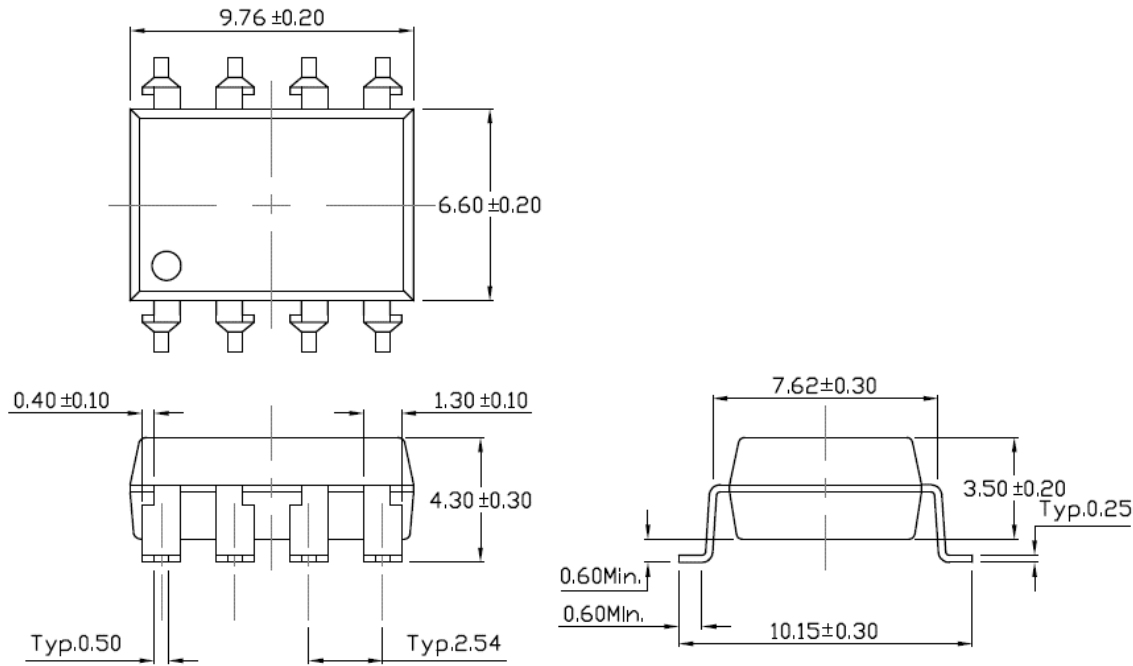




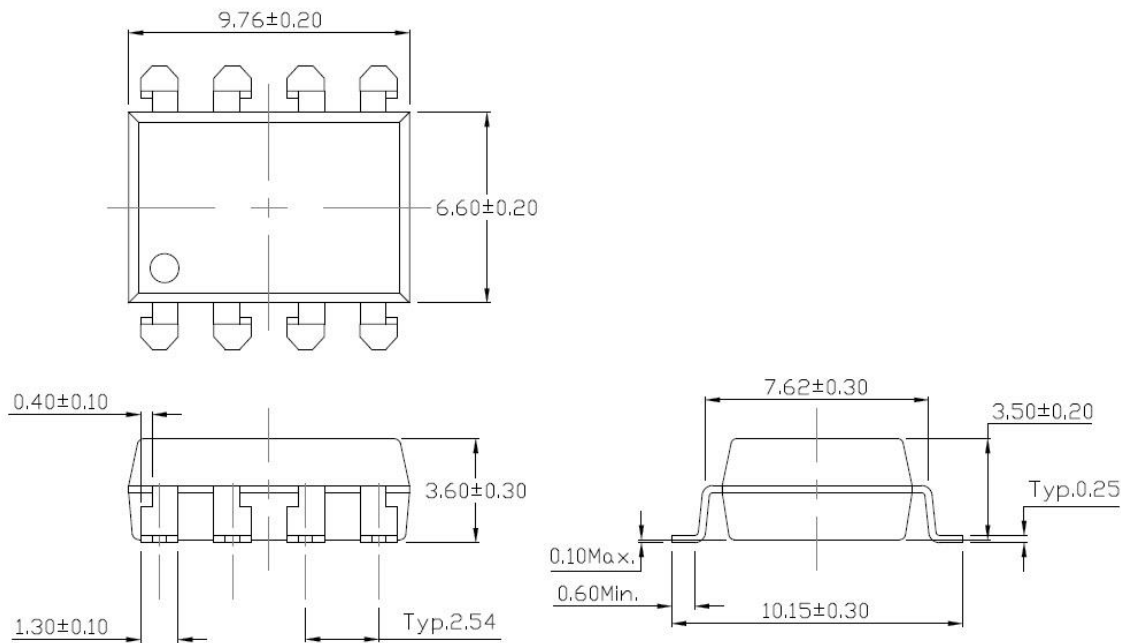
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# 10MBit/s High Speed Logic Gate Optocoupler

## Surface Mount Lead Forming (S Type)



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

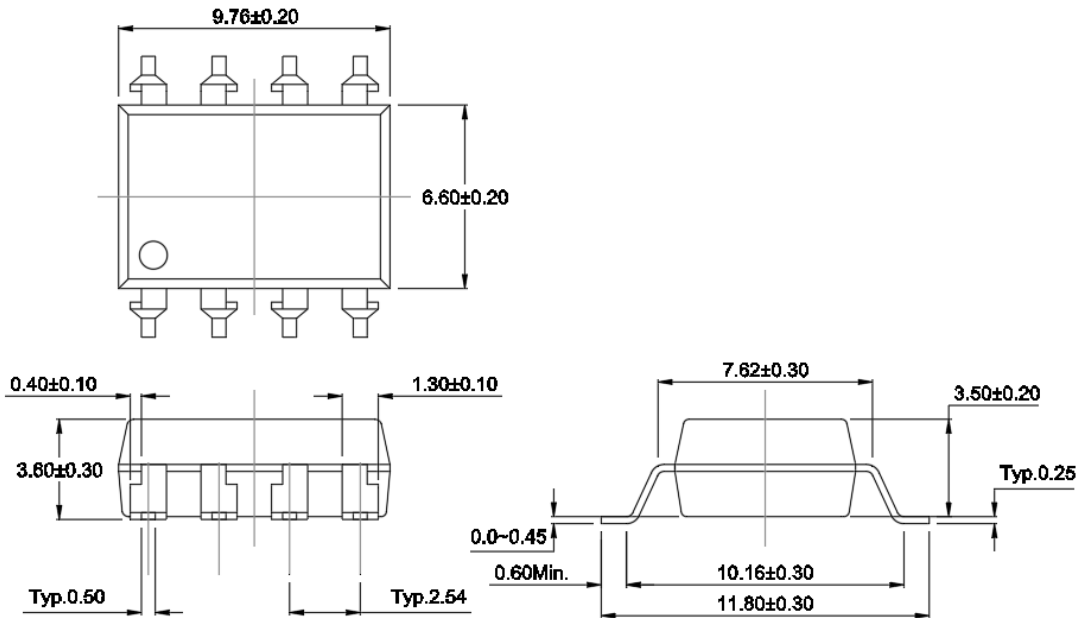




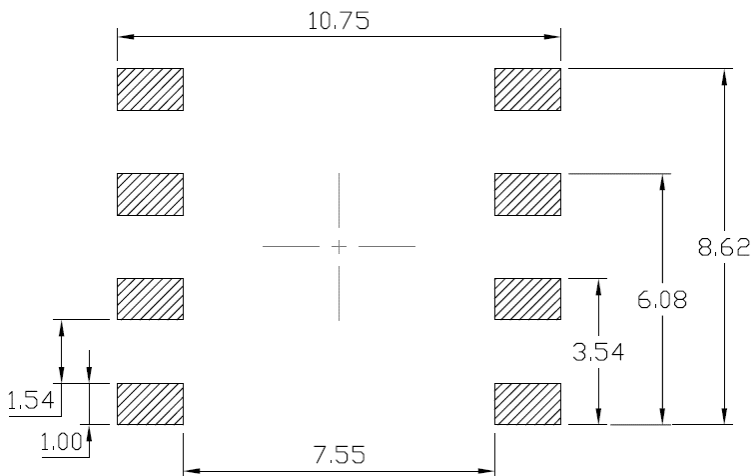
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# 10MBit/s High Speed Logic Gate Optocoupler

## Wide Surface Mount Forming (Low Profile) – SLM Type



## Recommended Solder Mask *Dimensions in mm unless otherwise stated*



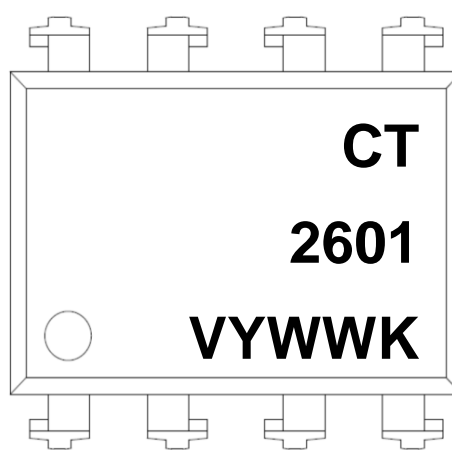
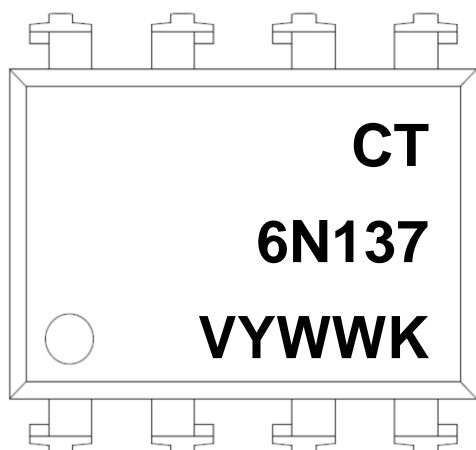


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## 10MBit/s High Speed Logic Gate Optocoupler

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### Device Marking



**Note:**

CT : Denotes “CT Micro”

6N137 : Product Number

2601 : Product Number

V : VDE Option

Y : Fiscal Year

WW : Work Week

K : Production Code

### Ordering Information

6N137(V)(Y)(Z)-G ; CT2601(V)(Y)(Z)-G

CT = Denotes “CT Micro”

6N137 = Part Number

2601 = Part Number

V = VDE Option ( V or None)

Y = Lead form option (S, SL, M , SLM or none)

Z = Tape and reel option (T1, T2 or none)

G = Material option (G: Green, None: Non-green)





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**10MBit/s High Speed Logic Gate Optocoupler**

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<b><i>Option</i></b>	<b><i>Description</i></b>	<b><i>Quantity</i></b>
None	Standard 8 Pin Dip	40 Units/Tube
M	Gullwing (400mil) Lead Forming	40 Units/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 (Low Profile) Lead Forming– With Option 1 Taping	1000 Units/Reel
SL(T2)	Surface Mount (Low Profile) Lead Forming– With Option 2 Taping	1000 Units/Reel
SLM(T1)	Surface Mount (Gullwing) Lead Forming– With Option 1 Taping	1000 Units/Reel
SLM(T2)	Surface Mount (Gullwing) Lead Forming – With Option 2 Taping	1000 Units/Reel

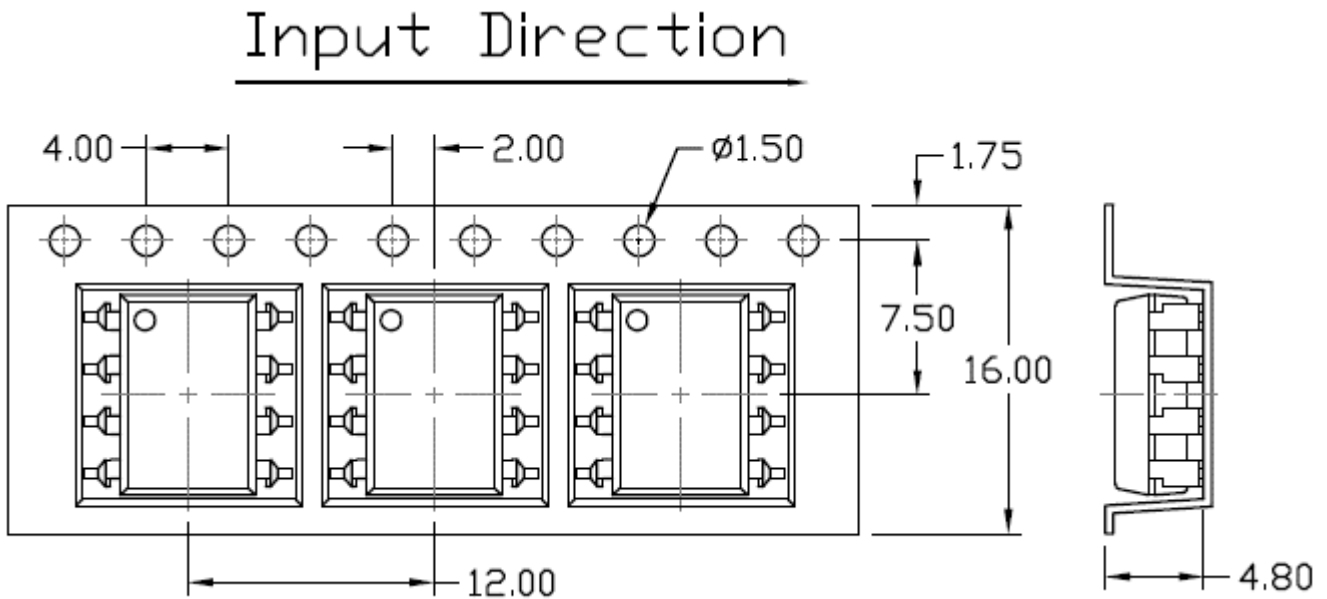


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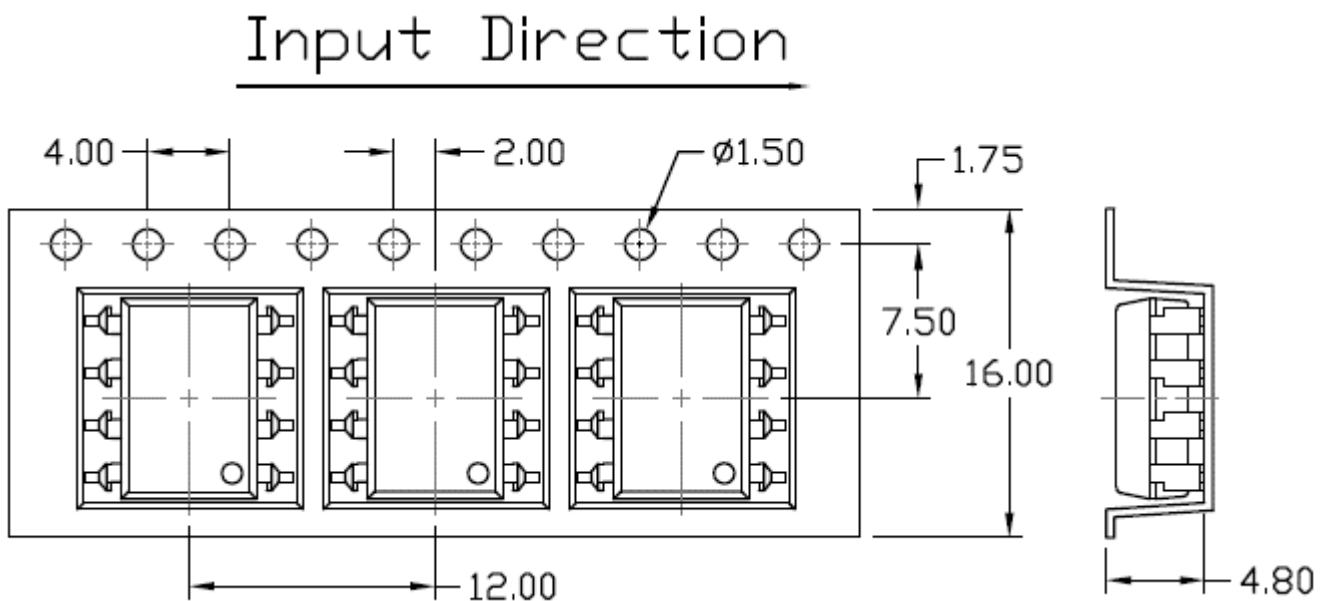
# 10MBit/s High Speed Logic Gate Optocoupler

## Carrier Tape Specifications *Dimensions in mm unless otherwise stated*

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



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

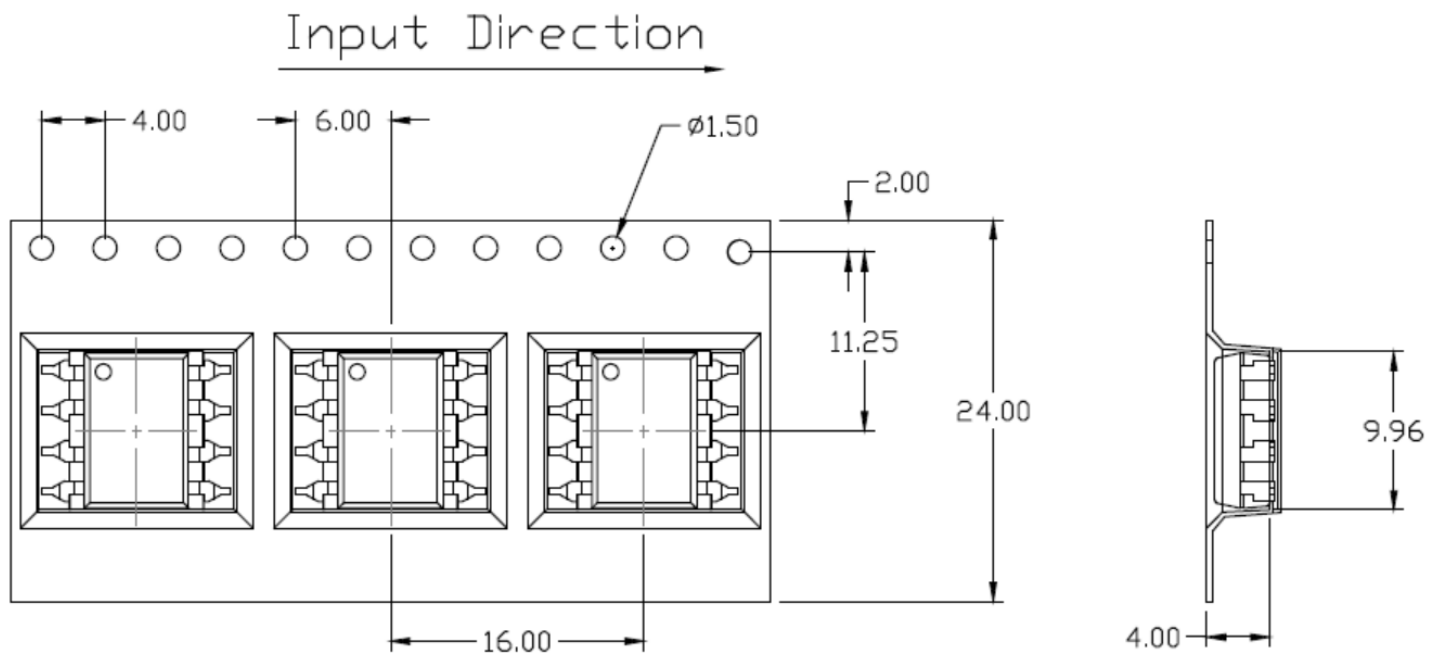




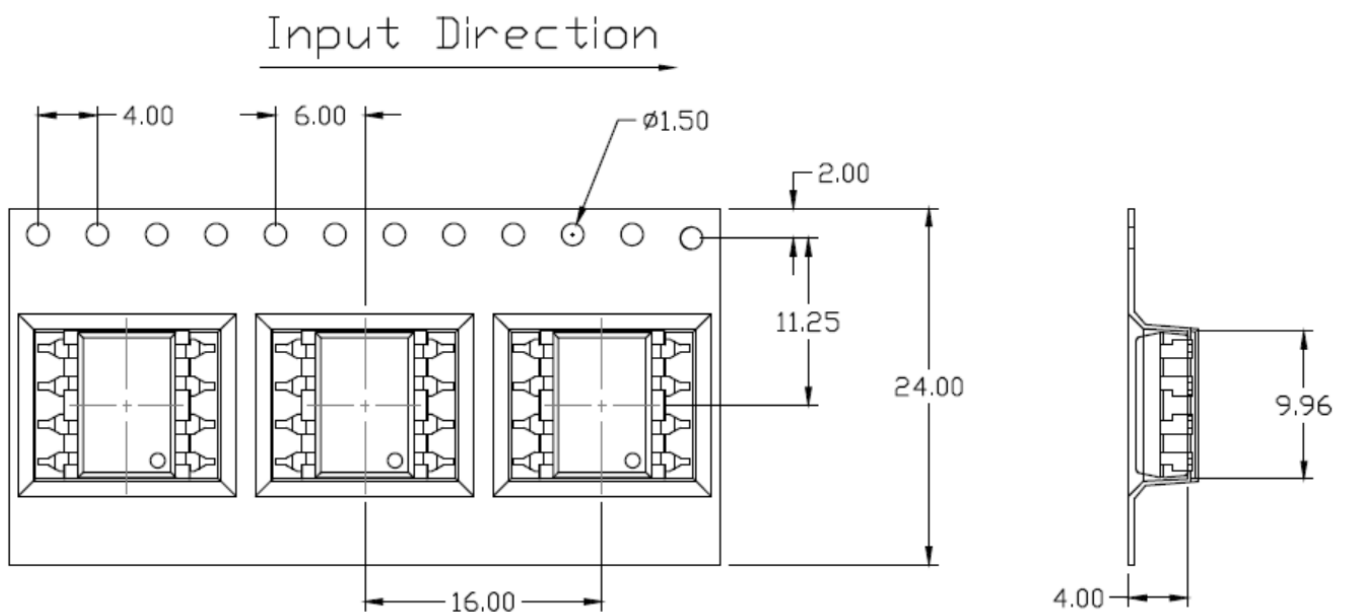
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# 10MBit/s High Speed Logic Gate Optocoupler

## Option SLM(T1)



## Option SLM(T2)





### Wave soldering (follow the JEDEC standard JESD22-A111)

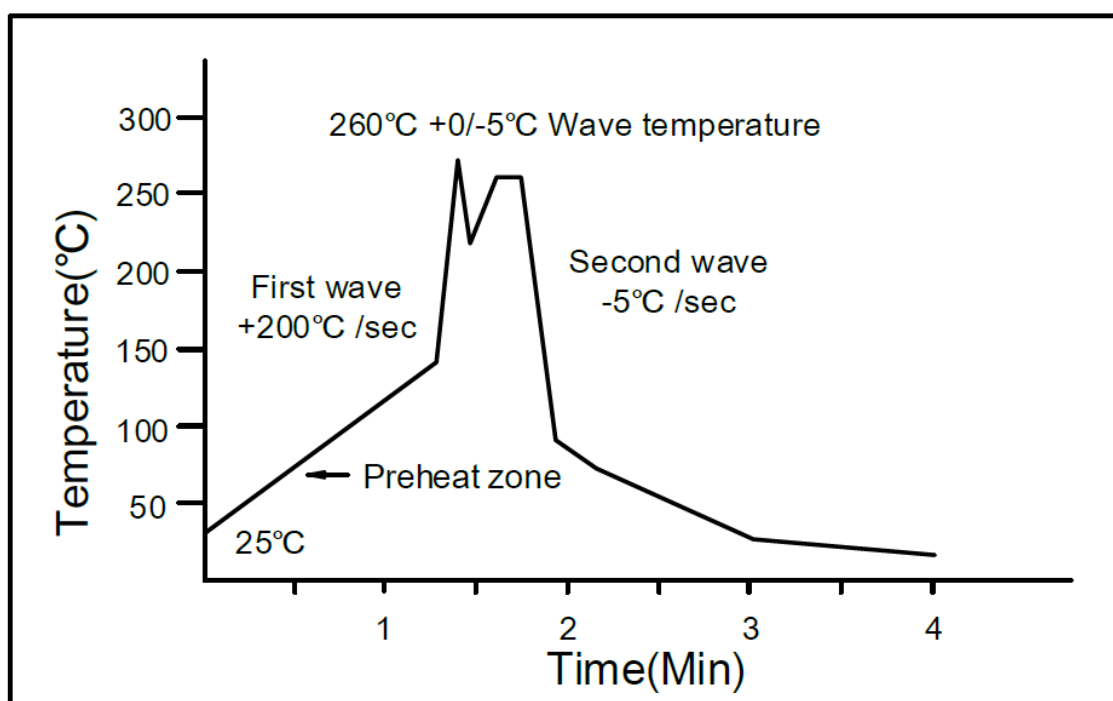
One time soldering is recommended within the condition of temperature.

Temperature:  $260 \pm 5^\circ\text{C}$ .

Time: 10 sec.

Preheat temperature: 25 to  $140^\circ\text{C}$ .

Preheat time: 30 to 80 sec.



### Iron soldering (follow the standard MIL-STD 202G, Method 210F)

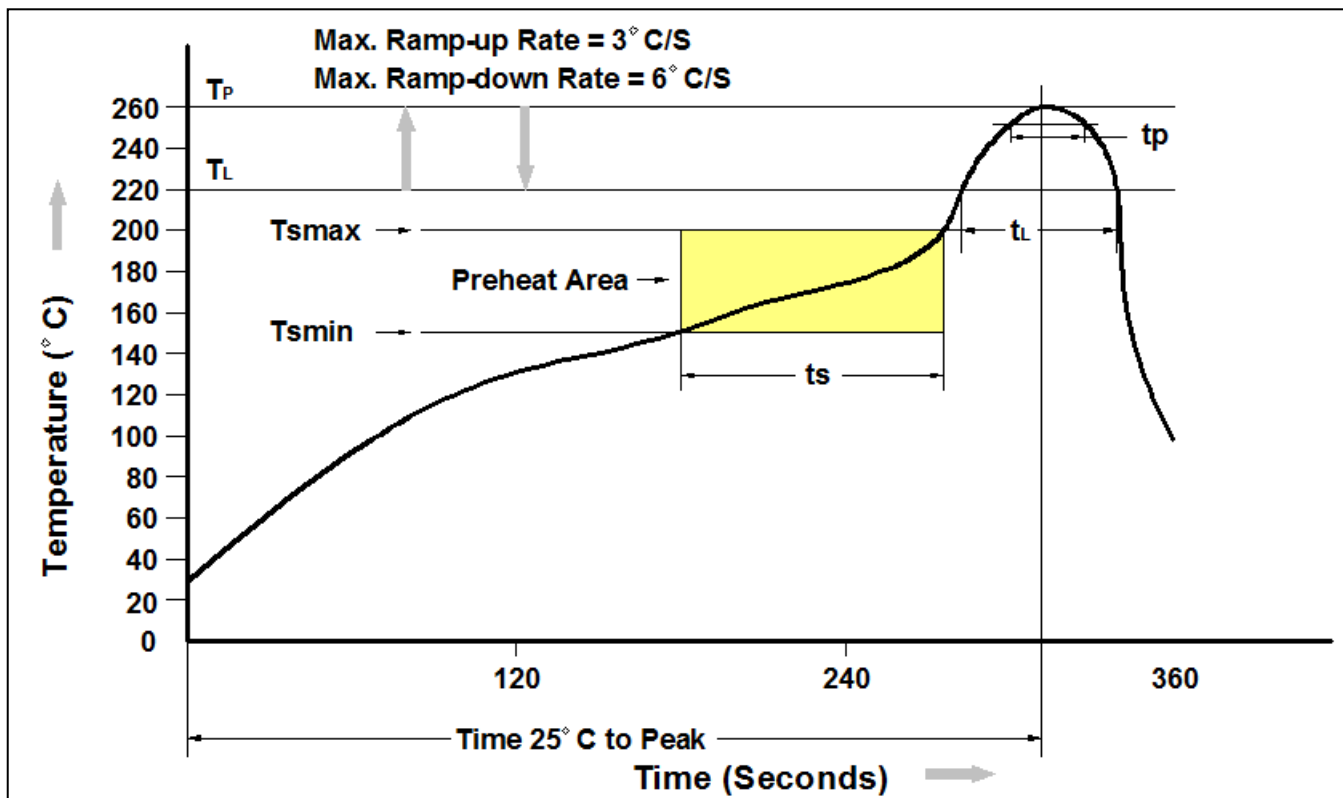
Allow single lead soldering in every single process.

One time soldering is recommended. Temperature:  $350 \pm 10^\circ\text{C}$

Time: 5 sec max.



**Reflow Profile**



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



## 10MBit/s High Speed Logic Gate Optocoupler

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- 2. A critical component is any component of a life support device or system whose failure to perform can be reasonably expected to cause the failure of the life support device or system, or to affect its safety or effectiveness.*