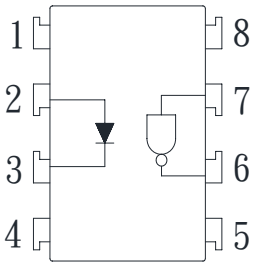
# KPC6N137 Series

**8PIN HIGH-SPEED OUTPUT PHOTOCOUPLER**

## Description

The KPC6N137 series consist of an LED. It is a super high-speed digital output type photocoupler packaged in a 8 pin DIP package and available in wide-lead spacing and SMD option.

## Schematic




| | |
|---|---|
| 1. N.C. | 5. GND |
| 2. Anode | 6. Vo |
| 3. Cathode | 7. $V_E$ |
| 4. N.C. | 8. Vcc |

## Features

1. Pb free and RoHS compliant
2. Super high-speed response (tPLH,tPHL:typ.45ns at RL=350Ω)
3. Instantaneous common mode rejection voltage(CMH:typ. 500V/us)
4. High isolation voltage between input and output (Viso:5000Vrms)
5. Low input current drive (IFHL: Max. 5mA)
6. LSTTL and TTL compatible output
7. MSL class 1
8. Agency Approvals:
   - UL Approved (No. E169586): UL1577
   - c-UL Approved (No. E169586)
   - VDE Approved (No. 40020973): DIN EN60747-5-5

## Applications

- High speed interfaces for computer peripherals, microcomputer systems
- High speed line receivers
- Noise reduction
- Interfaces for data transmission equipment

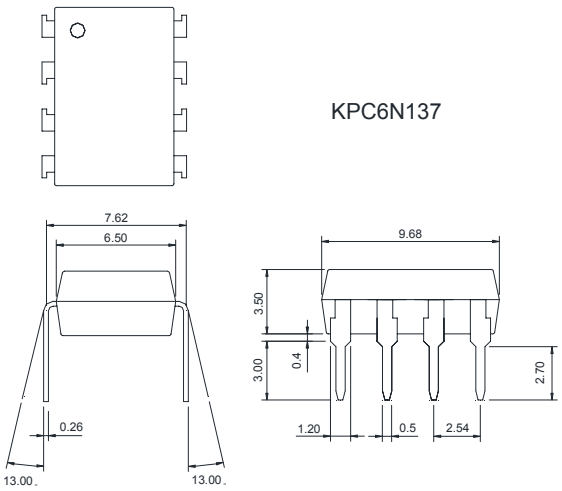
## Truth Table

| Input | Enable | Output |
|---|---|---|
| H | H | L |
| L | H | H |
| H | L | H |
| L | L | H |
| H | NC | L |
| L | NC | H |

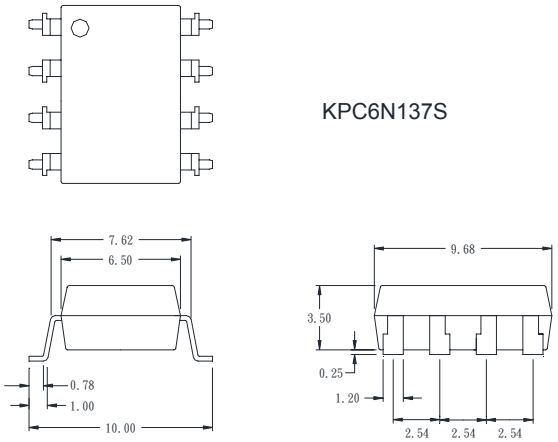
## Outside Dimension

Unit : mm

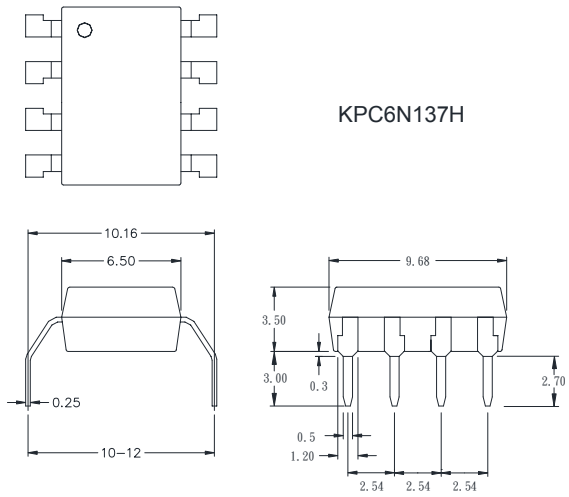
1.Dual-in-line type



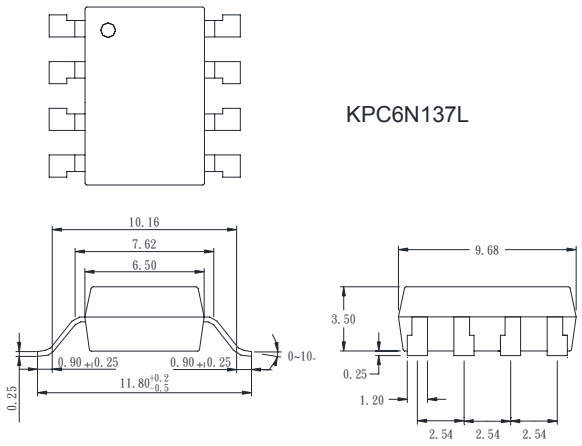

2.Surface mount type




3.Long creepage distance type

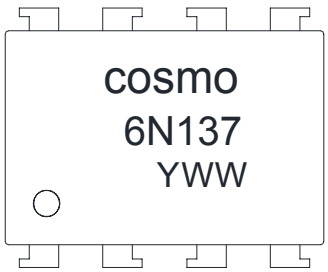



4.Long creepage distance
for surface mount type




TOLERANCE: ±0.2mm

## Device Marking




**Notes:**

cosmo
6N137
YWW Y: Year code / WW: Week code

## ● Absolute Maximum Ratings

(Ta = 25°C)

| Parameter | | Symbol | Rating | Unit |
|---|---|---|---|---|
| Input | Forward current (*1) | $I_F$ | 25 | mA |
| | Peak forward current (*2) | $I_{FM}$ | 40 | mA |
| | Reverse voltage | $V_R$ | 5 | V |
| | Power dissipation | $P_D$ | 45 | mW |
| Output | Supply voltage | Vcc | 7 | V |
| | Enable voltage | $V_E$ | 5.5 | V |
| | High level output voltage | $V_{OIL}$ | 7 | V |
| | Low level output current | $I_{OL}$ | 50 | mA |
| | Output collector power dissipation | $P_C$ | 85 | mW |
| Isolation voltage 1 minute (*3) | | Viso | 5000 | Vrms |
| Operating temperature | | Topr | -40 to +85 | ℃ |
| Storage temperature | | Tstg | -55 to +125 | ℃ |
| Soldering temperature 10 seconds | | Tsol | 260 | ℃ |

## ● Recommended Operating Conditions

| Parameter | Symbol | Min | Max | Unit |
|---|---|---|---|---|
| Low level input current | $I_{FL}$ | 0 | 250 | uA |
| High level input current | $I_{FH}$ | 7.0 | 15 | mA |
| High level enable voltage | $V_{EH}$ | 2.0 | Vcc | V |
| Low level enable voltage | $V_{EL}$ | 0 | 0.8 | V |
| Supply voltage | $V_{CC}$ | 4.5 | 5.5 | V |
| Fanout (TTL load ) | N | - | 8 | - |

## ● Electro-optical Characteristics

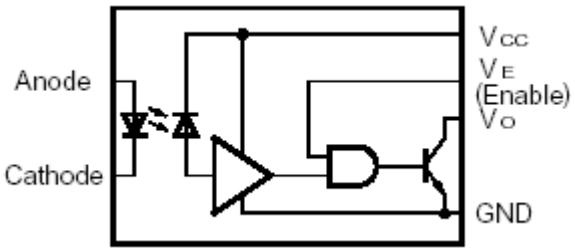
(Ta = 25℃)

| Parameter | Symbol | Conditions | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|
| Input forward voltage (*4) | $V_F$ | $I_F$=10mA,Ta=25℃ | - | 1.6 | 1.75 | V |
| Input reverse voltage | $BV_R$ | $I_R$=10uA,Ta=25℃ | 5 | - | - | V |
| Input capacitance | $C_{IN}$ | $V_F$=0, f=1MHz | - | 60 | - | pF |
| Logic (1) output current | $I_{OH}$ | $V_{CC}$=5.5V,$V_O$=5.5V,$I_F$=250uA,$V_E$=2.0V | - | 2 | 250 | uA |
| Logic (0) output voltage | $V_{OL}$ | $V_{CC}$=5.5V,$V_{EH}$=2V,$I_F$=5mA, $I_{OL}$(Sinking)=13mA | - | 0.4 | 0.6 | V |
| Logic (1) enable current | $I_{EH}$ | $V_{CC}$=5.5V,$V_E$=2.0V | - | -0.8 | - | mA |
| Logic (0) enable current | $I_{EL}$ | $V_{CC}$=5.5V,$V_E$=0.5V | -2.0 | -1.2 | - | mA |
| Logic (1) supply current | $I_{CCH}$ | $V_{CC}$=5.5V,$V_E$=0.5V,$I_F$=0mA | - | 7 | 15 | mA |
| Logic (0) supply current | $I_{CCL}$ | $V_{CC}$=5.5V,$V_E$=0.5V,$I_F$=10mA | - | 13 | 18 | mA |
| Leak current (*5) | $I_{I-O}$ | 45%RH,Ta=25℃,t=5s,$V_{I-O}$=3000VDC | - | - | 1.0 | mA |
| Isolation resistance (input-output) (*5) | $R_{I-O}$ | $V_{I-O}$=500V, Ta=25℃ | - | $10^{12}$ | - | Ω |
| Capacitance (input-output ) (*5) | $C_{I-O}$ | f=1MHz, Ta=25℃ | - | 0.6 | - | pF |

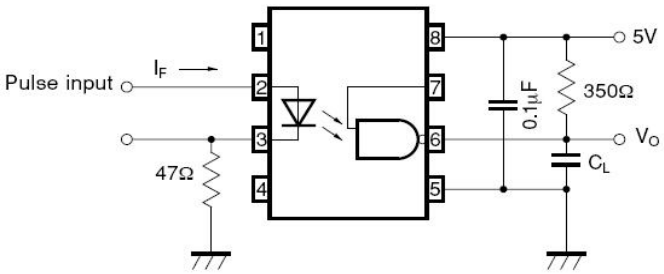
| | | | | | | |
|---|---|---|---|---|---|---|
| Propagation delay time Output (0)→(1) (*7) | $t_{PLH}$ | $I_F$=7.5mA,$V_{CC}$=5V,$R_L$=350Ω, $C_L$=15pF,Ta=25℃ | - | 45 | 75 | ns |
| Propagation delay time Output (1)→(0) (*7) | $t_{PHL}$ | | - | 45 | 75 | ns |
| Output rise-fall time (10 to 90%) | tr,tf | $I_F$=7.5mA,VCC=5V,$R_L$=350Ω,$C_L$=15pF | - | 30 | - | ns |
| Enable propagation delay time Output (1)→(0) (*8) | $t_{ELH}$ | $I_F$=7.5mA,$R_L$=350Ω,$C_L$=15pF, $V_{EH}$=3.0V, $V_{EL}$=0.5V | - | 40 | - | ns |
| Enable propagation delay time Output (0)→(1) (*8) | $t_{EHL}$ | | - | 15 | - | ns |
| Instantaneous common mode rejection voltage “output(0)” (*9) | $C_{MH}$ | $I_F$=0mA, $V_{CM}$=10V,$V_O$(Min)=2.0V $R_L$=350Ω | - | 500 | - | V/us |
| Instantaneous common mode rejection voltage “output(1)” (*9) | $C_{ML}$ | $I_F$=5mA, $V_{CM}$=10V,$V_O$(Max)=0.8V $R_L$=350Ω | - | -500 | - | V/us |

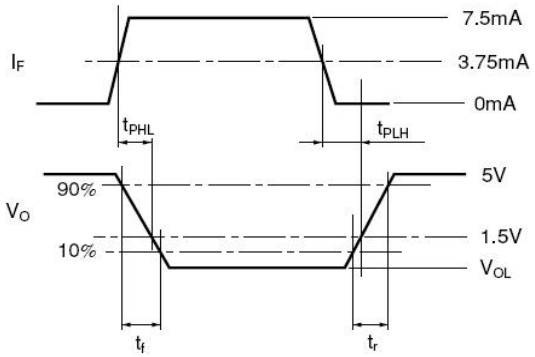
Note ) Typical values are all at Vcc = 5V, Ta= 25°C
*1 Ta=0 to 70°C.
*2 Pulse width <= 1ms
*3 40 to 80%RH AC for 1 minute ,f=60HZ.
*4 At Iin =10mA, $V_F$ decreases at the rate of 1.6mV/°C if the temperature goes up.*6 Ta=0 to 70°C.
*5 Measured as 2-pin element. Connect pins 2 and 3, connect pins 5, 6, 7 and 8.
*6 DC current transfer ratio is defined as the ratio of output collector current to forward bias input current.
*7 Refer to the Fig. 1.
*8 Refer to the Fig. 2.
*9 $C_{MH}$ represents a common mode voltage ignorable rise time ratio that can hold logic (1) state in output.
$C_{ML}$ represents a common mode voltage ignorable fall time ratio that can hold logic (0) state in output.

## ● Circuit Block Diagram

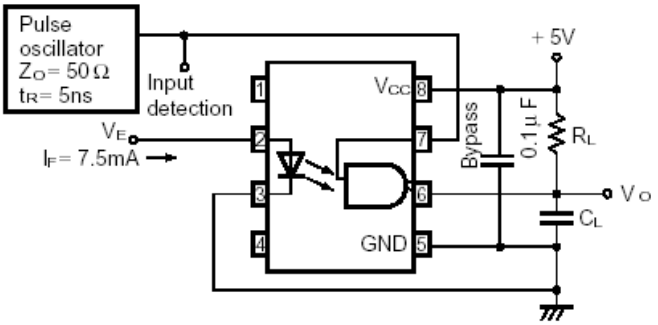


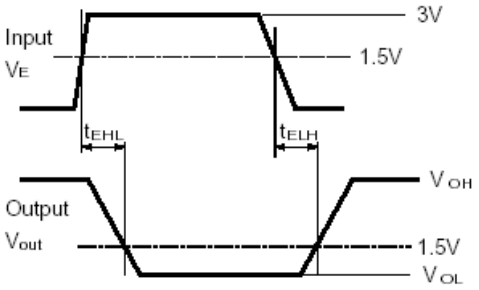
## Test Circuit for Propagation Delay time



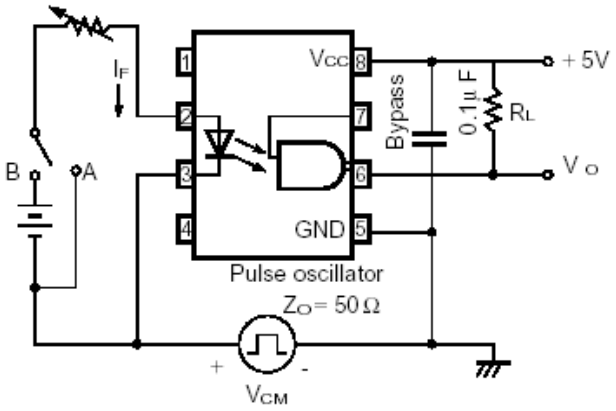



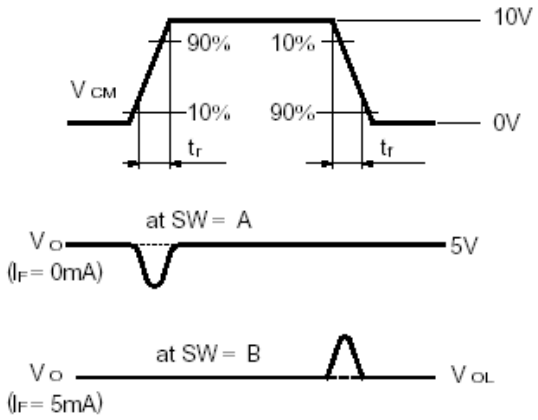

## Test Circuit for Enable Propagation Delay Time



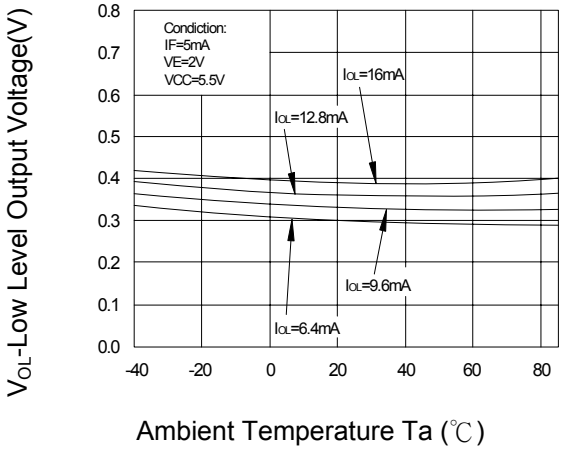




## Test Circuit for Instantaneous Common Mode Rejection Voltage

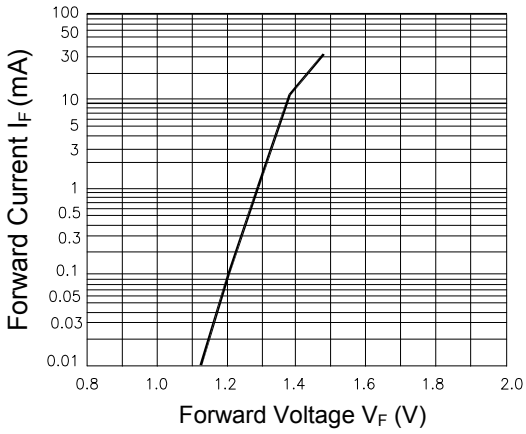


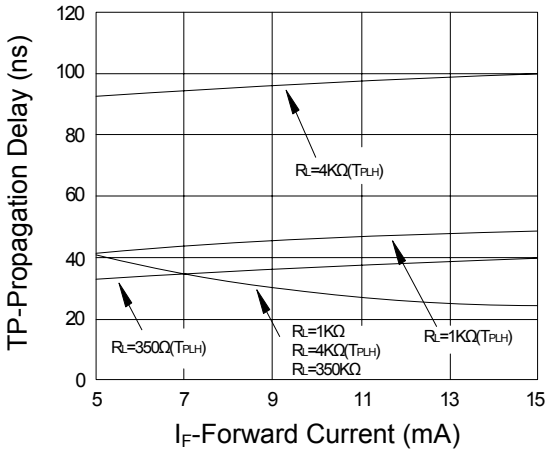
## Fig.1 Low Level Output Voltage vs. Ambient Temperature



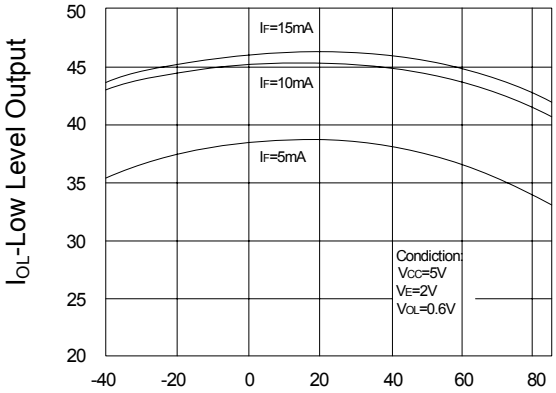

## Fig.2 Forward Current vs. Input Diode Forward Voltage



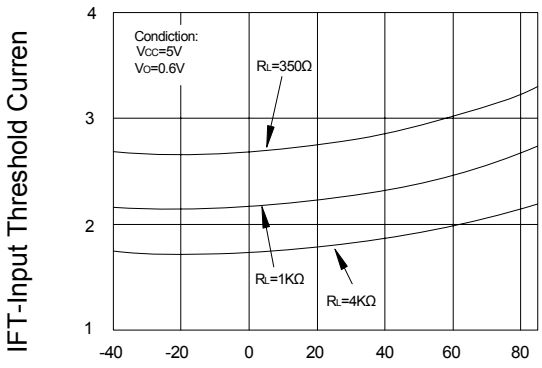

## Fig.3 Switching Time vs. Forward Current



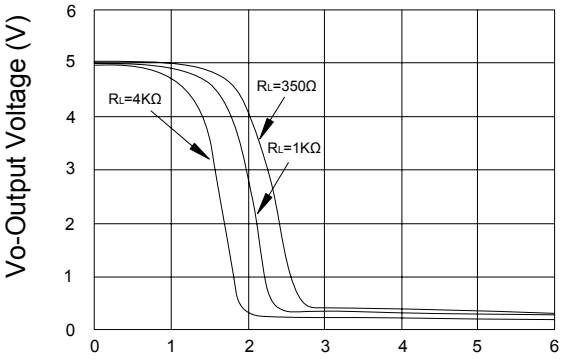

## Fig.4 Low Level Output Current vs. Ambient Temperature



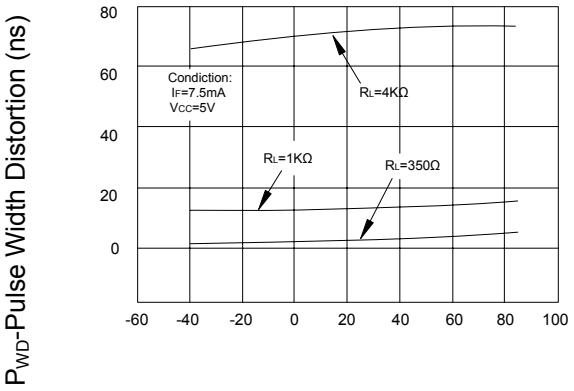

## Fig.5 Input Threshold Current vs. Ambient Temperature



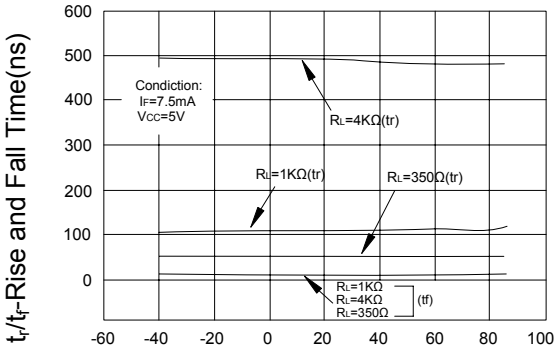

## Fig.6 Output Voltage vs. Input Forward Current



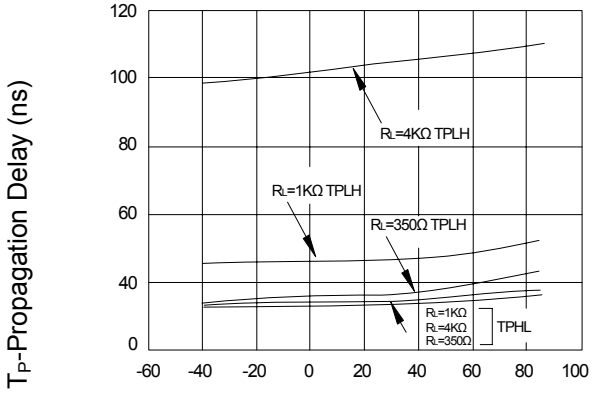
## Fig.7 Pulse Width Distortion vs. Ambient Temperature



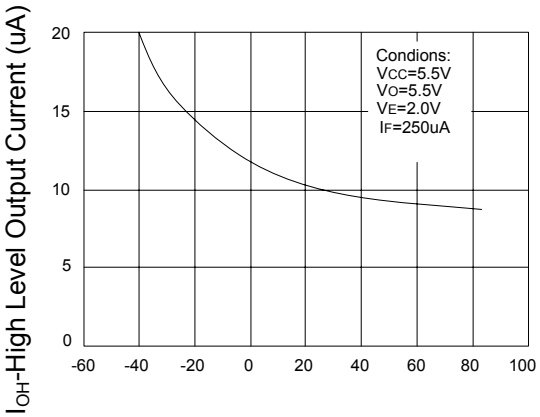

## Fig.8 Rise and Fall Time vs. Ambient Temperature




## Fig.9 Switch Time vs. Ambient Temperature




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

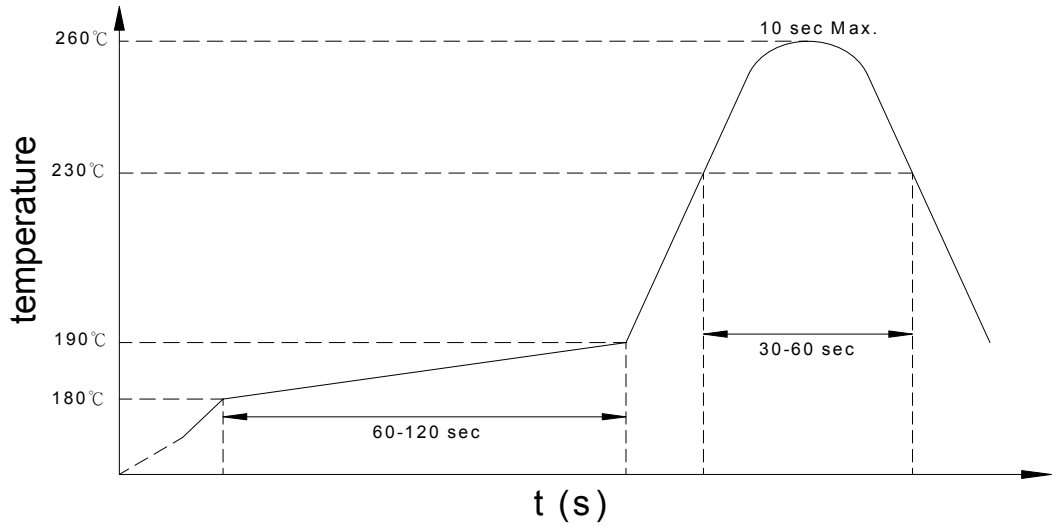


## Recommended Soldering Conditions

**(a) Infrared reflow soldering：**

- Peak reflow soldering： 260℃ or below (package surface temperature)
- Time of peak reflow temperature： 10 sec
- Time of temperature higher than 230℃： 30-60 sec
- Time to preheat temperature from 180~190℃： 60-120 sec
- Time(s) of reflow： Two
- Flux： Rosin flux containing small amount of chlorine (The flux with a maximum chlorine content of 0.2 Wt% is recommended.)

**Recommended Temperature Profile of Infrared Reflow**




**(b) Wave soldering：**

- Temperature： 260℃ or below (molten solder temperature)
- Time： 10 seconds or less
- Preheating conditions： 120℃ or below (package surface temperature)
- Time(s) of reflow： One
- Flux： Rosin flux containing small amount of chlorine (The flux with a maximum chlorine content of 0.2 Wt% is recommended.)

**(c) Cautions：**

- Fluxes： Avoid removing the residual flux with freon-based and chlorine-based cleaning solvent.
- Avoid shorting between portion of frame and leads.

## ● Numbering System

**KPC6N137 X (Y)**

**Notes:**

KPC6N137 = Part No.

X = Lead form option (blank、S、H、L )

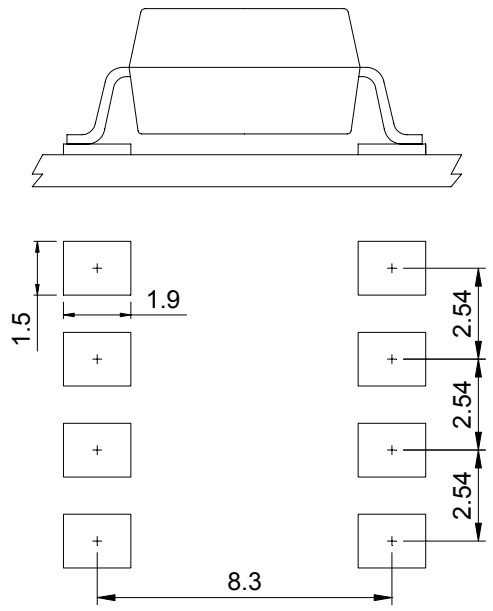
Y = Tape and reel option (TL、TR、TLD、TRU)

| Option | Description | Packing quantity |
|---|---|---|
| S (TL) | surface mount type package + TL tape & reel option | 1000 units per reel |
| S (TR) | surface mount type package + TR tape & reel option | 1000 units per reel |
| L (TLD) | long creepage distance for surface mount type package + TLD tape & reel option | 800 units per reel |
| L (TRU) | long creepage distance for surface mount type package + TRU tape & reel option | 800 units per reel |

## ● Recommended Pad Layout for Surface Mount Lead Form

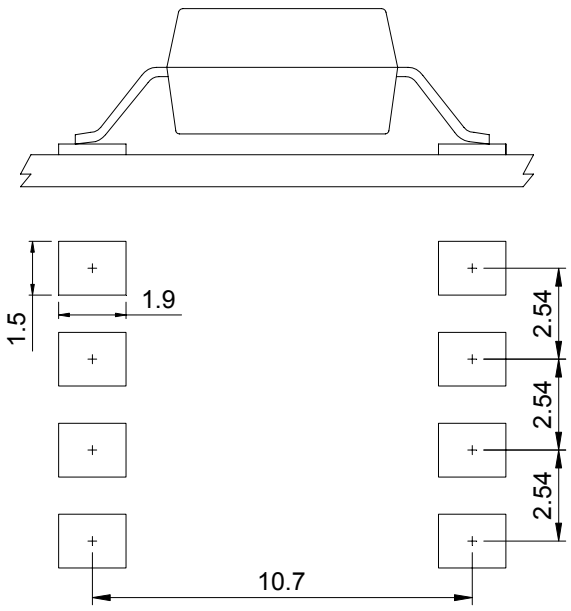
### 1.Surface mount type

**8-pin SMD**




### 2.Long creepage distance for surface mount type

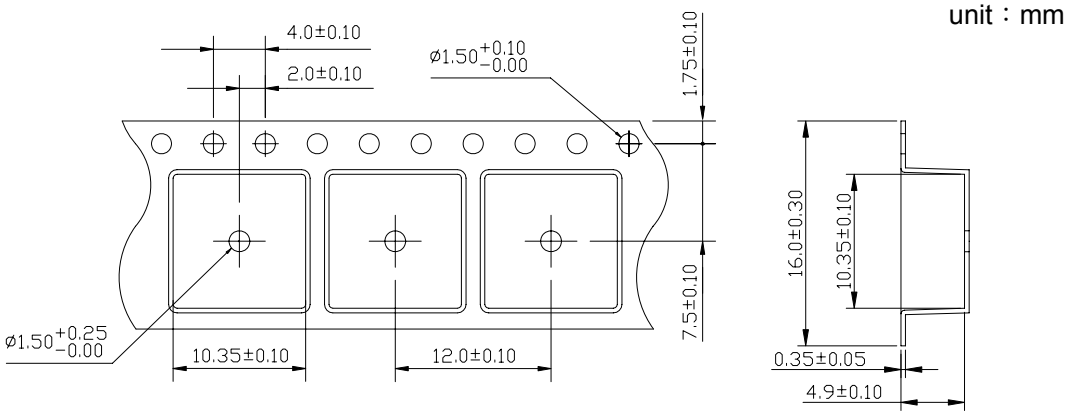
**8-pin L**



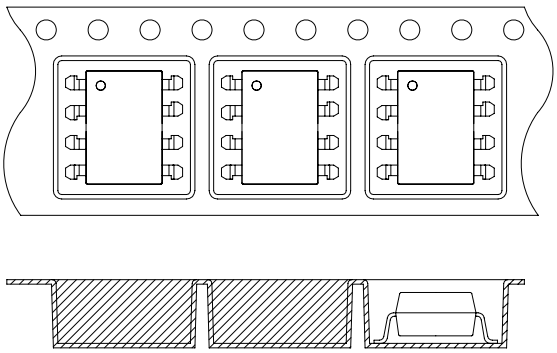

Unit :mm

## ● 8-pin SMD Carrier Tape & Reel

unit：mm

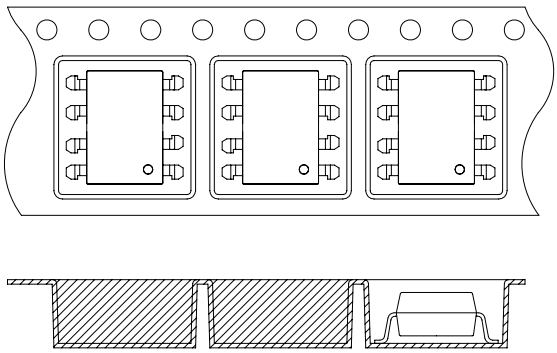



TL

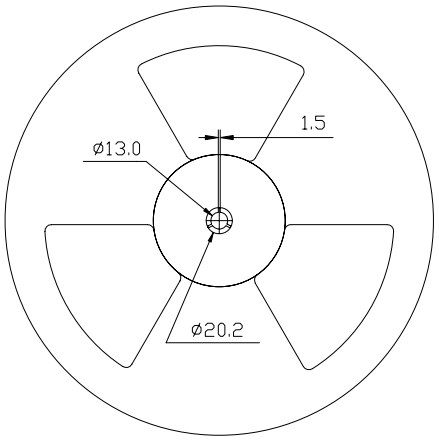


Direction of feed from reel

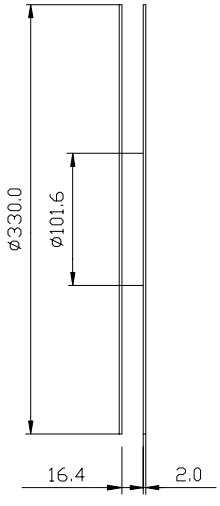
TR



Direction of feed from reel

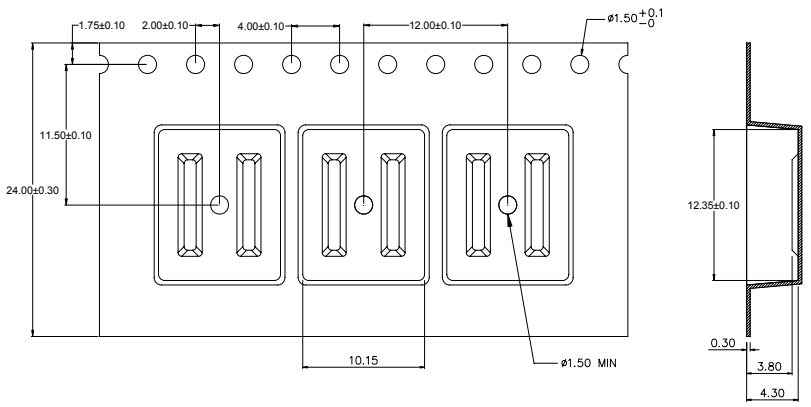



Quantity：1000pcs/reel



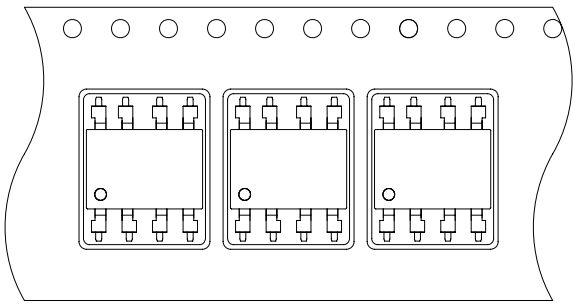
## ● 8-pin L Carrier Tape & Reel

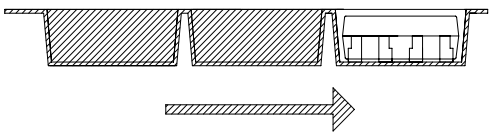
Unit:mm




TOLERANCE：±0.2mm

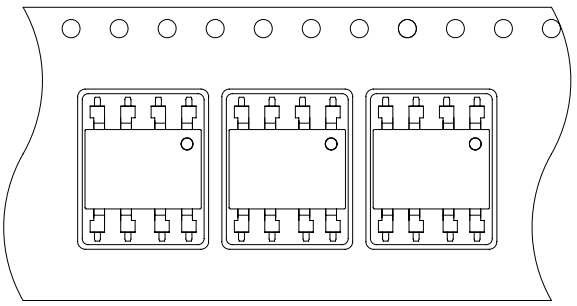
TLD

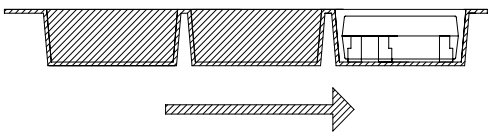




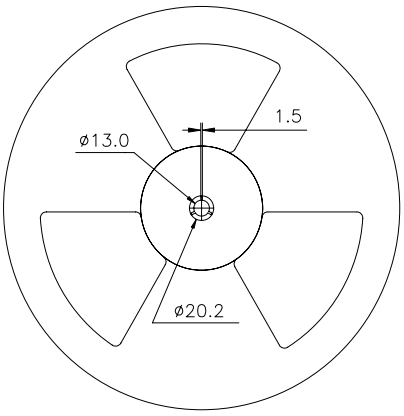
Direction of feed from reel

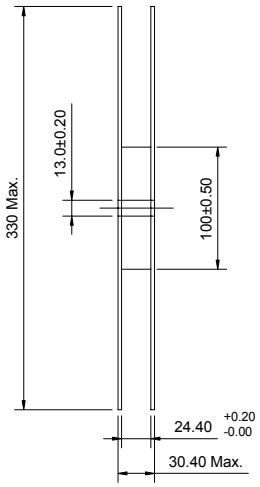
TRU





Direction of feed from reel




Quantity：800pcs/reel

## Application Notice

The content of datasheet is the guidance for product use only. cosmo takes no responsibility to the accuracy of the information provided here. For continuously improving all of products, including quality, reliability, function...etc., cosmo reserves the right to change the specification, characteristics, data, materials, and structure of products without notice. Please contact with cosmo to obtain the latest specification.

It would be required to comply with the absolute maximum ratings listed in the specification. cosmo has no liability and responsibility to the damage caused by improper use of the products.

cosmo products are intended to be designed for use in general electronics application list below:

a. Personal computer
b. OA machine
c. Audio / Video
d. Instrumentation
e. Electrical application
f. Measurement equipment
g. Consumer electronics
h. Telecommunication

cosmo devices shall not be used or related with equipment requiring higher level of quality / reliability, or malfunction, or failure which may cause loss of human life, bodily injury, includes, without limitation:

a. Medical and other life supporting equipments
b. Space application
c. Telecommunication equipment (trunk lines)
d. Nuclear power control
e. Equipment used for automotive vehicles, trains, ships...etc.