**KPC6N138 Series**

8PIN HIGH-SPEED DARLINGTON OUTPUT PHOTOCOUPLER

- **Description**
  
  The KPC6N138 series consist of an LED, optically coupled to a photodarlington and high-speed digital output. It is packaged in a 8 pin DIP package and available in wide-lead spacing and SMD option.

- **Schematic**

  ![Schematic Diagram]

  1. N.C.  
  2. Anode  
  3. Cathode  
  4. N.C.  
  5. GND  
  6. Vo  
  7. VB  
  8. Vcc

- **Features**

  1. Pb free and RoHS compliant
  2. High current transfer ratio (CTR:Min.300% at $I_F=1.6mA$)
  3. High-speed response (tPLH,tPHL: typ.2us at $R_L=2.2K\Omega$)
  4. Instantaneous common mode rejection voltage(CMH:typ. 500V/us)
  5. TTL compatible output
  6. Compact surface mount type package
  7. MSL class 1
  8. Agency Approvals:
     - UL Approved (No. E169586): UL1577
     - c-UL Approved (No. E169586)
     - FIMKO Approved: EN60065, EN60950

- **Applications**

  - Interfaces for computer peripherals
  - Electronic calculators, measuring instruments, control equipment
  - Telephone sets
  - Signal transmission between circuits of different potentials and impedances
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● 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**

6N138

YWW

Y: Year code / WW: Week code
### Absolute Maximum Ratings

**Parameter** | **Symbol** | **Rating** | **Unit**
--- | --- | --- | ---
Input | Forward current | $I_F$ | 20 | mA
*1 Peak forward current | $I_{PF}$ | 40 | mA
*2 Peak transient forward current | $I_{TM}$ | 1 | A
Reverse voltage | $V_R$ | 5 | V
Power dissipation | $P_D$ | 35 | mW
Supply voltage | $V_{CC}$ | -0.5 to 7 | V
Output voltage | $V_O$ | -0.5 to 7 | V
*3 Average output current | $I_O$ | 60 | mA
Power dissipation | $P_O$ | 100 | mW
*4 Isolation voltage 1 minute | $V_{ISO}$ | 5000 | Vrms
Operating temperature | $T_{OPR}$ | -40 to +100 | °C
Storage temperature | $T_{STG}$ | -55 to +125 | °C
*5 Soldering temperature 10 seconds | $T_{SOL}$ | 260 | °C

*1 50% duty cycle, pulse width : 1mS
*2 Pulse width<=1uS,300 pulse/sec
*3 Decreases at the rate of 0.7mA/°C if the external temperature is 25°C or more
*4 40% to 60% RH, AC for 1 minute
*5 For 10 seconds

### Electro-optical Characteristics

**Parameter** | **Symbol** | **Conditions** | **Min.** | **Typ.** | **Max.** | **Unit**
--- | --- | --- | --- | --- | --- | ---
*6 Current transfer ratio | CTR | $I_F=1.6mA, V_O=0.4V, V_{CC}=4.5V$ | 300 | 1600 | - | %
Logic (0) output voltage | $V_{OL}$ | $I_F=1.6mA, I_O=4.8mA, V_{CC}=4.5V$ | - | 0.1 | 0.4 | V
Logic (1) output current | $I_{OH}$ | $I_F=0, V_O=V_{CC}=7V$ | - | 0.1 | 250 | μA
Logic (0) supply current | $I_{CCL}$ | $I_F=1.6mA, V_O=open, V_{CC}=5V$ | - | 0.5 | - | mA
Logic (1) supply current | $I_{CCH}$ | $I_F=0, V_O=open, V_{CC}=5V$ | - | 10 | - | nA
Input forward voltage | $V_F$ | $T_a=25°C, I_R=1.6mA$ | - | 1.5 | 1.7 | V
Input forward voltage temperature coefficient | $\Delta V_F/\Delta T_a$ | $I_F=1.6mA$ | - | -1.9 | - | mV/°C
Input reverse voltage | $B_{VR}$ | $T_a=25°C, I_R=10uA$ | 5.0 | - | - | V
Input capacitance | $C_{IN}$ | $V_F=0, f=1MHz$ | - | 60 | - | pF
*7 Leak current(input-output) | $I_{I-O}$ | $T_a=25°C, 45% RH, V_{I-O}=3kVDC, t=5s$ | - | - | 1.0 | uA
*7 Isolation resistance(input-output) | $R_{I-O}$ | $V_{I-O}=500VDC$ | - | 10$^{12}$ | - | Ω
*7 Capacitance(input-output) | $C_{I-O}$ | $f=1MHz$ | - | 0.6 | - | pF

*6 Current transfer ratio is the ratio is the ratio of input current and output current expressed in %
*7 Measured as 2-pin element (Short 1,2,3,4 and 5,6,7,8)
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## Switching Characteristics

(Ta=25°C, Vcc=5V)

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Symbol</th>
<th>Conditions</th>
<th>Min.</th>
<th>Typ.</th>
<th>Max.</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>*8 Propagation delay time Output (1)-&gt;(0)</td>
<td>t_{PHL}</td>
<td>R_L=2.2kΩ, I_F=1.6mA</td>
<td>-</td>
<td>2</td>
<td>10</td>
<td>uS</td>
</tr>
<tr>
<td>*8 Propagation delay time Output (0)-&gt;(1)</td>
<td>t_{PLH}</td>
<td>R_L=2.2kΩ, I_F=1.6mA</td>
<td>-</td>
<td>7</td>
<td>35</td>
<td>uS</td>
</tr>
<tr>
<td>*9 Instantaneous common mode rejection voltage &quot;Output (1)&quot;</td>
<td>C_{MH}</td>
<td>I_F=0, V_{CM}=10Vp-p, R_L=2.2kΩ</td>
<td>-</td>
<td>500</td>
<td>-</td>
<td>V/μS</td>
</tr>
<tr>
<td>*9 Instantaneous common mode rejection voltage &quot;Output (0)&quot;</td>
<td>C_{ML}</td>
<td>I_F=1.6mA, V_{CM}=10Vp-p, R_L=2.2kΩ</td>
<td>-</td>
<td>-500</td>
<td>-</td>
<td>V/μS</td>
</tr>
</tbody>
</table>

*9 Instantaneous common mode rejection voltage "Output (1)" represents a common mode voltage variation that can hold the output above (1) level (Vo > 2.0V)

*10 Instantaneous common mode rejection voltage "Output (0)" represents a common mode voltage variation that can hold the output above (0) level (Vo < 0.8V)

*8 Test Circuit Propagation Delay Time

*10 Test Circuit for Instantaneous Common Mode Rejection Voltage
Fig. 1 Forward Current vs. Forward Voltage

Fig. 2 Forward Current vs. Ambient Temperature

Fig. 3 Response and Fall Time vs. Load Resistance

Fig. 4 Current Transfer Ratio vs. Forward Current

Fig. 5 Current Transfer Ratio vs. Base-Emitter Resistance

Fig. 6 Output Current vs. Output Voltage
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**8PIN HIGH-SPEED DARLINGTON OUTPUT PHOTOCouPLER**

**Fig.7 Output Current vs. Forward Current**

![Graph showing the relationship between Output Current and Forward Current with curves for different temperatures and supply voltages.]

**Fig.8 Logic Low Supply Current vs. Forward Current**

![Graph showing the relationship between Logic Low Supply Current and Forward Current with curves for different supply voltages.]

**Fig.9 Propagation Delay vs. Forward Current**

![Graph showing the relationship between Propagation Delay and Forward Current for different load resistors at 25°C.]

**Fig.10 Propagation Delay to Logic Low vs. Pulse Period**

![Graph showing the relationship between Propagation Delay to Logic Low and Input Pulse Period for a fixed forward current and load resistor at 25°C.]

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**Cosmo Electronics Corp.**

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**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](image)

(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.
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8PIN HIGH-SPEED DARLINGTON OUTPUT PHOTOCOUPLER

- Numbering System

KPC6N138 X (Y)

Notes:
KPC6N138 = Part No.
X = Lead form option (blank, S, H, L)
Y = Tape and reel option (TL, TR, TLD, TRU)

<table>
<thead>
<tr>
<th>Option</th>
<th>Description</th>
<th>Packing quantity</th>
</tr>
</thead>
<tbody>
<tr>
<td>S (TL)</td>
<td>surface mount type package + TL tape &amp; reel option</td>
<td>1000 units per reel</td>
</tr>
<tr>
<td>S (TR)</td>
<td>surface mount type package + TR tape &amp; reel option</td>
<td>1000 units per reel</td>
</tr>
<tr>
<td>L (TLD)</td>
<td>long creepage distance for surface mount type package + TLD tape &amp; reel option</td>
<td>800 units per reel</td>
</tr>
<tr>
<td>L (TRU)</td>
<td>long creepage distance for surface mount type package + TRU tape &amp; reel option</td>
<td>800 units per reel</td>
</tr>
</tbody>
</table>

- Recommended Pad Layout for Surface Mount Lead Form

1. Surface mount type

2. Long creepage distance for surface mount type

Unit: mm
8-pin SMD Carrier Tape & Reel

Direction of feed from reel

Quantity: 1000pcs/reel
KPC6N138 Series
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- 8-pin L Carrier Tape & Reel

TLD

TRU

Direction of feed from reel

Direction of feed from reel

TOLERANCE : ±0.2mm

Quantity : 800pcs/reel
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