**PC457L0NIP0F Series**

High Speed 1Mb/s, High CMR

*OPIC Photocoupler*

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**Description**

PC457L0NIP0F Series contains a LED optically coupled to an OPIC chip.

It is packaged in a 5 pin Mini-flat.

Input-output isolation voltage(rms) is 3.75 kV.

High speed response (TYP. 1Mb/s) and CMR is MIN. 15 kV/μs.

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**Features**

1. Mini-flat 5 pin package
2. Double transfer mold package
   (Ideal for Flow Soldering)
3. High speed response
   (tPHL : TYP. 0.2 μs, tPLH : TYP. 0.4 μs)
4. High noise immunity due to high instantaneous common mode rejection voltage (CMH : MIN. 15kV/μs, CML : MIN. −15kV/μs)
5. High isolation voltage between input and output
   (Viso(rms) : 3.75 kV)
6. RoHS directive compliant

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**Agency approvals/Compliance**

1. Recognized by UL1577 (Double protection isolation), file No. E64380 (as model No. PC457L)
2. Approved by VDE, DIN EN60747-5-2(*) (as an option), file No. 40009162 (as model No. PC457L)
3. Package resin : UL flammability grade (94V-0)

(*)DIN EN60747-5-2 : successor standard of DIN VDE0884

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**Applications**

1. Programmable controller
2. Inverter

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* "OPIC"(Optical IC) is a trademark of the SHARP Corporation. An OPIC consists of a light-detector element and a signal-processing circuit integrated onto a single chip.

Notice: The content of data sheet is subject to change without prior notice. In the absence of confirmation by device specification sheets, SHARP takes no responsibility for any defects that may occur in equipment using any SHARP devices shown in catalogs, data books, etc. Contact SHARP in order to obtain the latest device specification sheets before using any SHARP device.
**Internal Connection Diagram**

1. Anode
2. Cathode
3. GND
4. $V_O$ (Open collector)
5. $V_{CC}$

---

**Outline Dimensions**

(Unit: mm)

1. Mini-flat Package [ex. PC457L0NIP0F]

   - Anode
   - Cathode
   - GND
   - $V_O$ (Open collector)
   - $V_{CC}$

   Product mass: approx. 0.1g

2. Mini-flat Package (VDE option) [ex. PC457L0YIP0F]

   - Anode
   - Cathode
   - GND
   - $V_O$ (Open collector)
   - $V_{CC}$

   Product mass: approx. 0.1g

Plating material: SnCu (Cu: TYP. 2%)
### Date code (2 digit)

<table>
<thead>
<tr>
<th>1st digit</th>
<th>2nd digit</th>
</tr>
</thead>
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<td>Month of production</td>
</tr>
<tr>
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<td>Mark</td>
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<td>B</td>
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<td>2001</td>
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Repeats in a 20 year cycle

### Factory identification mark

<table>
<thead>
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<tbody>
<tr>
<td>no mark</td>
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<td>![Indonesia mark]</td>
<td>Indonesia</td>
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<td>![China mark]</td>
<td>China</td>
</tr>
</tbody>
</table>

* This factory marking is for identification purpose only. Please contact the local SHARP sales representative to see the actual status of the production.

### Rank mark

There is no rank mark indicator.
### Absolute Maximum Ratings

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Symbol</th>
<th>Rating</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Input</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Forward current</td>
<td>IF</td>
<td>25</td>
<td>mA</td>
</tr>
<tr>
<td>Reverse voltage</td>
<td>VR</td>
<td>5</td>
<td>V</td>
</tr>
<tr>
<td>Power dissipation</td>
<td>P</td>
<td>45</td>
<td>mW</td>
</tr>
<tr>
<td><strong>Output</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Supply voltage</td>
<td>VCC</td>
<td>-0.5 to +30</td>
<td>V</td>
</tr>
<tr>
<td>Output voltage</td>
<td>VO</td>
<td>-0.5 to +20</td>
<td>V</td>
</tr>
<tr>
<td>Output current</td>
<td>IO</td>
<td>8</td>
<td>mA</td>
</tr>
<tr>
<td>Power dissipation</td>
<td>PO</td>
<td>100</td>
<td>mW</td>
</tr>
<tr>
<td>Total power dissipation</td>
<td>Ptot</td>
<td>100</td>
<td>mW</td>
</tr>
<tr>
<td>Operating temperature</td>
<td>T_{opr}</td>
<td>-55 to +85</td>
<td>°C</td>
</tr>
<tr>
<td>Storage temperature</td>
<td>T_{stg}</td>
<td>-55 to +125</td>
<td>°C</td>
</tr>
<tr>
<td>Isolation voltage</td>
<td>V_{iso (rms)}</td>
<td>3.75</td>
<td>kV</td>
</tr>
<tr>
<td>Soldering temperature</td>
<td>T_{sodl}</td>
<td>260</td>
<td>°C</td>
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</table>

*1 When ambient temperature goes above 70°C, the power dissipation goes down at 0.8mA/°C. (Fig.3)

*2 When ambient temperature goes above 70°C, the power dissipation goes down at 1.5mW/°C. (Fig.4)

*3 When ambient temperature goes above 70°C, the power dissipation goes down at 1.8mW/°C. (Fig.4)

*4 40 to 60%RH, AC for 1 minute, f=60Hz

*5 For 10s

### Electro-optical Characteristics

<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><strong>Input</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Forward voltage</td>
<td>V_{F}</td>
<td>I_{F}=16mA</td>
<td>–</td>
<td>1.7</td>
<td>1.95</td>
<td>V</td>
</tr>
<tr>
<td>Reverse current</td>
<td>I_{R}</td>
<td>V_{R}=5V</td>
<td>–</td>
<td>–</td>
<td>10</td>
<td>µA</td>
</tr>
<tr>
<td>Terminal capacitance</td>
<td>C_{t}</td>
<td>V=0, f=1MHz</td>
<td>–</td>
<td>60</td>
<td>250</td>
<td>pF</td>
</tr>
<tr>
<td>High level output current</td>
<td>I_{OH (1)}</td>
<td>I_{F}=0, VCC=5.5V, V_{O}=5.5V</td>
<td>–</td>
<td>3</td>
<td>500</td>
<td>nA</td>
</tr>
<tr>
<td>High level output current</td>
<td>I_{OH (2)}</td>
<td>I_{F}=0, VCC=15V, V_{O}=15V</td>
<td>–</td>
<td>1.0</td>
<td>–</td>
<td>µA</td>
</tr>
<tr>
<td>High level output current</td>
<td>I_{OH (3)}</td>
<td>I_{F}=0, VCC=15V, V_{O}=OPEN</td>
<td>–</td>
<td>–</td>
<td>50</td>
<td>µA</td>
</tr>
<tr>
<td>High level supply current</td>
<td>I_{CH (1)}</td>
<td>I_{F}=0, VCC=15V, V_{O}=OPEN</td>
<td>–</td>
<td>0.02</td>
<td>1.0</td>
<td>µA</td>
</tr>
<tr>
<td>High level supply current</td>
<td>I_{CH (2)}</td>
<td>–</td>
<td>–</td>
<td>2.0</td>
<td>–</td>
<td>µA</td>
</tr>
<tr>
<td>Low level supply current</td>
<td>I_{CL}</td>
<td>I_{F}=16mA, VCC=15V, V_{O}=OPEN</td>
<td>–</td>
<td>120</td>
<td>–</td>
<td>µA</td>
</tr>
<tr>
<td>Low level output voltage</td>
<td>V_{OL}</td>
<td>I_{F}=16mA, VCC=4.5V, I_{O}=2.4mA</td>
<td>19</td>
<td>–</td>
<td>50</td>
<td>%</td>
</tr>
<tr>
<td>Current transfer ratio (1)</td>
<td>CTR (1)</td>
<td>I_{F}=16mA, VCC=4.5V, V_{O}=0.4V, R_{L}=1.9kΩ</td>
<td>15</td>
<td>–</td>
<td>–</td>
<td>%</td>
</tr>
<tr>
<td>Current transfer ratio (2)</td>
<td>CTR (2)</td>
<td>DC500V, 40 to 60%RH</td>
<td>5×10³</td>
<td>10¹¹</td>
<td>–</td>
<td>Ω</td>
</tr>
<tr>
<td>Floating capacitance</td>
<td>C_{t}</td>
<td>V=0, f=1MHz</td>
<td>–</td>
<td>0.6</td>
<td>1.0</td>
<td>pF</td>
</tr>
<tr>
<td>“High→Low” propagation delay time</td>
<td>I_{HL}</td>
<td>I_{F}=16mA, VCC=5V</td>
<td>–</td>
<td>0.2</td>
<td>0.8</td>
<td>µs</td>
</tr>
<tr>
<td>&quot;Low→High&quot; propagation delay time</td>
<td>I_{HL}</td>
<td>I_{F}=16mA, VCC=5V</td>
<td>–</td>
<td>0.4</td>
<td>0.8</td>
<td>µs</td>
</tr>
<tr>
<td>Instantaneous common mode rejection voltage (High level output)</td>
<td>CM_{H}</td>
<td>I_{F}=0, VCC=5V, V_{CM}=1.0kV(p-p), R_{L}=1.9kΩ</td>
<td>15</td>
<td>30</td>
<td>–</td>
<td>kV/µs</td>
</tr>
<tr>
<td>Instantaneous common mode rejection voltage (Low level output)</td>
<td>CM_{L}</td>
<td>I_{F}=16mA, VCC=5V, V_{CM}=1.0kV(p-p), R_{L}=1.9kΩ</td>
<td>–15</td>
<td>–30</td>
<td>–</td>
<td>kV/µs</td>
</tr>
</tbody>
</table>

*4 T_{sodl} to 70°C

*5 It shall connect a by-pass capacitor of 0.01µF or more between V_{CC} (pin 6) and GND (pin 4) near the device, when it measures transfer characteristics and the output side characteristics.

*6 Ta=0 to 70°C

*7 It shall connect a by-pass capacitor of 0.01µF or more between V_{CC} (pin 6) and GND (pin 4) near the device, when it measures transfer characteristics and the output side characteristics.
### Model Line-up

<table>
<thead>
<tr>
<th>Package</th>
<th>Taping</th>
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<tbody>
<tr>
<td>DIN EN60747-5-2</td>
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<td>Approved</td>
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<tr>
<td>Model No.</td>
<td>PC457L0NIP0F</td>
<td>PC457L0YIP0F</td>
</tr>
</tbody>
</table>

Please contact a local SHARP sales representative to inquire about production status.
Fig. 1 Test Circuit for Propagation Delay Time

Fig. 2 Test Circuit for Instantaneous Common Mode Rejection Voltage

Fig. 3 Forward Current vs. Ambient Temperature

Fig. 4 Power Dissipation vs. Ambient Temperature
Fig.5 Forward Current vs. Forward Voltage

![Forward Current vs. Forward Voltage Graph](image)

**Fig.6 Relative Current Transfer Ratio vs. Forward Current**

![Relative Current Transfer Ratio vs. Forward Current Graph](image)

**Fig.7 Output Current vs. Output Voltage**

![Output Current vs. Output Voltage Graph](image)

**Fig.8 Relative Current Transfer Ratio vs. Ambient Temperature**

![Relative Current Transfer Ratio vs. Ambient Temperature Graph](image)

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

![High Level Output Current vs. Ambient Temperature Graph](image)

**Fig.10 Propagation Delay Time vs. Ambient Temperature**

![Propagation Delay Time vs. Ambient Temperature Graph](image)

Remarks: Please be aware that all data in the graph are just for reference and not for guarantee.
Design Considerations

**Recommended operating conditions**

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Symbol</th>
<th>MIN.</th>
<th>TYP.</th>
<th>MAX.</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Input current</td>
<td>$I_F$</td>
<td>7</td>
<td>–</td>
<td>16</td>
<td>mA</td>
</tr>
<tr>
<td>Supply voltage</td>
<td>$V_{CC}$</td>
<td>–</td>
<td>5</td>
<td>–</td>
<td>V</td>
</tr>
<tr>
<td>Fan out (TTL load)</td>
<td>$N$</td>
<td>–</td>
<td>–</td>
<td>5</td>
<td>–</td>
</tr>
<tr>
<td>Operating temperature</td>
<td>$T_{oper}$</td>
<td>0</td>
<td>–</td>
<td>+70</td>
<td>°C</td>
</tr>
</tbody>
</table>

**Notes about static electricity**

Transistor of detector side in bipolar configuration may be damaged by static electricity due to its minute design.

When handling these devices, general countermeasure against static electricity should be taken to avoid breakdown of devices or degradation of characteristics.

**Design guide**

In order to stabilize power supply line, we should certainly recommend to connect a by-pass capacitor of $0.01\mu F$ or more between $V_{CC}$ and GND near the device.

In case that some sudden big noise caused by voltage variation is provided between primary and secondary terminals of photocoupler some current caused by it is floating capacitance may be generated and result in false operation since current may go through LED or current may change.

If the photocoupler may be used under the circumstances where noise will be generated we recommend to use the bypass capacitors at the both ends of LED.

The detector which is used in this device, has parasitic diode between each pins and GND.

There are cases that miss operation or destruction possibly may be occurred if electric potential of any pin becomes below GND level even for instant.

Therefore it shall be recommended to design the circuit that electric potential of any pin does not become below GND level.

This product is not designed against irradiation and incorporates non-coherent LED.

**Degradation**

In general, the emission of the LED used in photocouplers will degrade over time.

In the case of long term operation, please take the general LED degradation (50% degradation over 5 years) into the design consideration.

**Recommended Foot Print (reference)**

(Unit: mm)

For additional design assistance, please review our corresponding Optoelectronic Application Notes.
Manufacturing Guidelines

Soldering Method

Reflow Soldering:
- Reflow soldering should follow the temperature profile shown below.
- Soldering should not exceed the curve of temperature profile and time.
- Please don't solder more than twice.

Flow Soldering:
- Due to SHARP's double transfer mold construction submersion in flow solder bath is allowed under the below listed guidelines.

- Flow soldering should be completed below 260°C and within 10s.
- Preheating is within the bounds of 100 to 150°C and 30 to 80s.
- Please don't solder more than twice.

Hand soldering
- Hand soldering should be completed within 3s when the point of solder iron is below 400°C.
- Please don't solder more than twice.

Other notices
- Please test the soldering method in actual condition and make sure the soldering works fine, since the impact on the junction between the device and PCB varies depending on the tooling and soldering conditions.
● Cleaning instructions
Solvent cleaning:
   Solvent temperature should be 45˚C or below Immersion time should be 3 minutes or less

Ultrasonic cleaning:
   The impact on the device varies depending on the size of the cleaning bath, ultrasonic output, cleaning time, size of PCB and mounting method of the device.
   Therefore, please make sure the device withstands the ultrasonic cleaning in actual conditions in advance of mass production.

Recommended solvent materials:
   Ethyl alcohol, Methyl alcohol and Isopropyl alcohol
   In case the other type of solvent materials are intended to be used, please make sure they work fine in actual using conditions since some materials may erode the packaging resin.

● Presence of ODC
   This product shall not contain the following materials.
   And they are not used in the production process for this product.
   Regulation substances : CFCs, Halon, Carbon tetrachloride, 1.1.1-Trichloroethane (Methylchloroform)

   Specific brominated flame retardants such as the PBBOs and PBBs are not used in this product at all.

   This product shall not contain the following materials banned in the RoHS Directive (2002/95/EC).
   •Lead, Mercury, Cadmium, Hexavalent chromium, Polybrominated biphenyls (PBB), Polybrominated diphenyl ethers (PBDE).
**Package specification**

- **Tape and Reel package**

  **Package materials**
  - Carrier tape: A-PET (with anti-static material)
  - Cover tape: PET (three layer system)
  - Reel: PS

  **Carrier tape structure and Dimensions**

  ![Diagram](image)

  **Dimensions List** (Unit: mm)

<table>
<thead>
<tr>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
<th>E</th>
<th>F</th>
<th>G</th>
</tr>
</thead>
<tbody>
<tr>
<td>12.0±0.3</td>
<td>5.5±0.1</td>
<td>1.75±0.1</td>
<td>8.0±0.1</td>
<td>2.0±0.1</td>
<td>4.0±0.1</td>
<td>φ1.5±0.1</td>
</tr>
<tr>
<td>H</td>
<td>I</td>
<td>J</td>
<td>K</td>
<td></td>
<td></td>
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<tr>
<td>7.4±0.1</td>
<td>0.3±0.05</td>
<td>3.1±0.1</td>
<td>4.0±0.1</td>
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</table>

  **Reel structure and Dimensions**

  ![Diagram](image)

  **Dimensions List** (Unit: mm)

<table>
<thead>
<tr>
<th>a</th>
<th>b</th>
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<th>d</th>
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</thead>
<tbody>
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<td>370</td>
<td>13.5±1.5</td>
<td>80±1.0</td>
<td>13±0.5</td>
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<tr>
<td>e</td>
<td>f</td>
<td>g</td>
<td></td>
</tr>
<tr>
<td>21±1.0</td>
<td>2.0±0.5</td>
<td>2.0±0.5</td>
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</tr>
</tbody>
</table>

  **Direction of product insertion**

  ![Diagram](image)

  [Packing: 3,000pcs/reel]
■ Important Notices

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(i) The devices in this publication are designed for use in general electronic equipment designs such as:
--- Personal computers
--- Office automation equipment
--- Telecommunication equipment [terminal]
--- Test and measurement equipment
--- Industrial control
--- Audio visual equipment
--- Consumer electronics

(ii) Measures such as fail-safe function and redundant design should be taken to ensure reliability and safety when SHARP devices are used for or in connection with equipment that requires higher reliability such as:
--- Transportation control and safety equipment (i.e., aircraft, trains, automobiles, etc.)
--- Traffic signals
--- Gas leakage sensor breakers
--- Alarm equipment
--- Various safety devices, etc.

(iii) SHARP devices shall not be used for or in connection with equipment that requires an extremely high level of reliability and safety such as:
--- Space applications
--- Telecommunication equipment [trunk lines]
--- Nuclear power control equipment
--- Medical and other life support equipment (e.g., scuba).

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