

# PC942

## High Power Output Type OPIC Photocoupler

### ■ Features

1. Built-in base amplifier for inverter drive
2. High power ( $I_{O1}$  : MAX. 0.5A (DC))  
( $I_{O2P}$  : MAX. 2.0A (pulse))
3. High isolation voltage ( $V_{iso}$  : 5 000Vrms)
4. High speed response ( $t_{PHL}, t_{PLH}$  : MAX. 5 $\mu$ s)

### ■ Applications

1. Inverter controlled air conditioners
2. Small capacitance general purpose inverters

### ■ Absolute Maximum Ratings

( $T_a = T_{opr}$  unless otherwise specified)

|                            | Parameter                             | Symbol    | Rating    | Unit                   |
|----------------------------|---------------------------------------|-----------|-----------|------------------------|
| Input                      | *1 Forward current                    | $I_F$     | 25        | mA                     |
|                            | *2 Reverse voltage                    | $V_R$     | 6         | V                      |
| Output                     | Supply voltage                        | $V_{CC}$  | 18        | V                      |
|                            | O <sub>1</sub> output current         | $I_{O1}$  | 0.5       | A                      |
|                            | *3 O <sub>1</sub> peak output current | $I_{O1P}$ | 1.0       | A                      |
|                            | O <sub>2</sub> output current         | $I_{O2}$  | 0.6       | A                      |
|                            | *3 O <sub>2</sub> peak output current | $I_{O2P}$ | 2.0       | A                      |
|                            | O <sub>1</sub> output voltage         | $V_{O1}$  | 18        | V                      |
|                            | *4 Power dissipation                  | $P_O$     | 500       | mW                     |
| *5 Total power dissipation |                                       |           | $P_{tot}$ | 550 mW                 |
| *6 Isolation voltage       |                                       |           | $V_{iso}$ | 5 000 V <sub>rms</sub> |
| Operating temperature      |                                       |           | $T_{opr}$ | -20 to +80 °C          |
| Storage temperature        |                                       |           | $T_{stg}$ | -55 to +125 °C         |
| *7 Soldering temperature   |                                       |           | $T_{sol}$ | 260 °C                 |

\*1 The derating factors of absolute maximum ratings due to ambient temperature are shown in Fig.8

\*2  $T_a = 25^\circ\text{C}$

\*3 Pulse width  $\leq 5\mu\text{s}$ , Duty ratio: 0.01

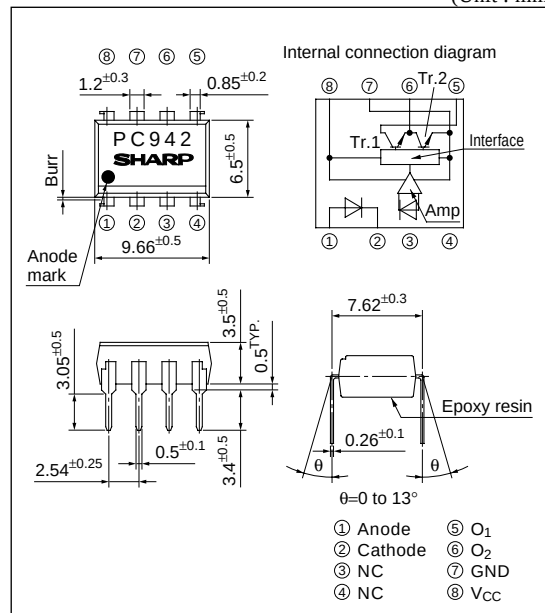
\*4, 5 The derating factors of absolute maximum ratings due to ambient temperature are shown in Fig.9

\*6 AC for 1min, 40 to 60%RH  $T_a = 25^\circ\text{C}$

\*7 For 10s

### ■ Outline Dimensions

(Unit : mm)



\* "OPIC" (Optical IC) is a trademark of the SHARP Corporation.

An OPIC consists of a light-detecting element and signal-processing circuit integrated onto a single chip.

## ■ Electro-optical Characteristics

(Ta=T<sub>opr</sub> unless otherwise specified)

| Parameter                |                                                                   | Symbol                            | Conditions                                                                                                                                | MIN.               | TYP.               | MAX. | Unit  |
|--------------------------|-------------------------------------------------------------------|-----------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------|--------------------|--------------------|------|-------|
| Input                    | Forward voltage                                                   | V <sub>F1</sub>                   | Ta=25°C, I <sub>F</sub> =5mA                                                                                                              | —                  | 1.1                | 1.4  | V     |
|                          |                                                                   | V <sub>F2</sub>                   | Ta=25°C, I <sub>F</sub> =0.2mA                                                                                                            | 0.6                | 0.9                | —    | V     |
|                          | Reverse current                                                   | I <sub>R</sub>                    | Ta=25°C, V <sub>R</sub> =3V                                                                                                               | —                  | —                  | 10   | μA    |
|                          | Terminal capacitance                                              | C <sub>t</sub>                    | Ta=25°C, V=0, f=1kHz                                                                                                                      | —                  | 30                 | 250  | pF    |
| Output                   | Operating supply voltage                                          | V <sub>CC</sub>                   |                                                                                                                                           | 5.4                | —                  | 13   | V     |
|                          | O <sub>1</sub> low level output voltage                           | V <sub>O1L</sub>                  | V <sub>CC</sub> =6V, I <sub>O1</sub> =0.4A,<br>R <sub>L2</sub> =10Ω, I <sub>F</sub> =5mA                                                  | —                  | 0.2                | 0.4  | V     |
|                          | O <sub>2</sub> high level output voltage                          | V <sub>O2H</sub>                  | V <sub>CC</sub> =6V, I <sub>O2</sub> =-0.4A, I <sub>F</sub> =5mA                                                                          | 4.5                | 5.0                | —    | V     |
|                          | O <sub>2</sub> low level output voltage                           | V <sub>O2L</sub>                  | V <sub>CC</sub> =6V, I <sub>O2</sub> =0.5A, I <sub>F</sub> =0                                                                             | —                  | 0.2                | 0.4  | V     |
|                          | O <sub>1</sub> leak current                                       | I <sub>O1L</sub>                  | V <sub>CC</sub> =13V, I <sub>F</sub> =0                                                                                                   | —                  | —                  | 200  | μA    |
|                          | O <sub>2</sub> leak current                                       | I <sub>O2L</sub>                  | V <sub>CC</sub> =13V, I <sub>F</sub> =5mA                                                                                                 | —                  | —                  | 200  | μA    |
|                          | High level supply current                                         | I <sub>CCH</sub>                  | Ta=25°C, V <sub>CC</sub> =6V, I <sub>F</sub> =5mA                                                                                         | —                  | 9                  | 13   | mA    |
|                          |                                                                   |                                   | V <sub>CC</sub> =6V, I <sub>F</sub> =5mA                                                                                                  | —                  | —                  | 17   | mA    |
|                          | Low level supply current                                          | I <sub>CCL</sub>                  | Ta=25°C, V <sub>CC</sub> =6V, I <sub>F</sub> =0                                                                                           | —                  | 11                 | 15   | mA    |
|                          |                                                                   |                                   | V <sub>CC</sub> =6V, I <sub>F</sub> =0                                                                                                    | —                  | —                  | 20   | mA    |
| Transfer characteristics | *8 "Low→High" threshold input current                             | I <sub>FLH</sub>                  | Ta=25°C, V <sub>CC</sub> =6V,<br>R <sub>L1</sub> =5Ω, R <sub>L2</sub> =10Ω                                                                | 0.3                | 1.5                | 3.0  | mA    |
|                          |                                                                   |                                   | V <sub>CC</sub> =6V, R <sub>L1</sub> =5Ω<br>R <sub>L2</sub> =10Ω                                                                          | 0.2                | —                  | 5.0  | mA    |
|                          | Isolation resistance                                              | R <sub>ISO</sub>                  | Ta=25°C, DC=500V, 40 to 60%RH                                                                                                             | 5×10 <sup>10</sup> | 1×10 <sup>11</sup> | —    | Ω     |
|                          | Response time                                                     | "Low→High" propagation delay time | Ta=25°C, V <sub>CC</sub> =6V<br>I <sub>F</sub> =5mA, R <sub>L1</sub> =5Ω<br>R <sub>L2</sub> =10Ω                                          | —                  | 2                  | 5    | μs    |
|                          |                                                                   | "High→Low" propagation delay time |                                                                                                                                           | —                  | 2                  | 5    | μs    |
|                          |                                                                   | Rise time                         |                                                                                                                                           | —                  | 0.2                | 1    | μs    |
|                          |                                                                   | Fall time                         |                                                                                                                                           | —                  | 0.1                | 1    | μs    |
|                          | Instantaneous common mode rejection voltage "Output : High level" | CM <sub>H</sub>                   | Ta=25°C, V <sub>CM</sub> =600V(peak)<br>I <sub>F</sub> =5mA, R <sub>L1</sub> =470Ω, R <sub>L2</sub> =1kΩ,<br>ΔV <sub>O2H</sub> =0.5V(max) | -10                | —                  | —    | kV/μs |
|                          | Instantaneous common mode rejection voltage "Output : Low level"  | CM <sub>L</sub>                   | Ta=25°C, V <sub>CM</sub> =600V(peak)<br>I <sub>F</sub> =0, R <sub>L1</sub> =470Ω, R <sub>L2</sub> =1kΩ,<br>ΔV <sub>O2L</sub> =0.5V(max)   | 10                 | —                  | —    | kV/μs |

\*8 I<sub>FLH</sub> represents forward current when output goes from "Low" to "High".

## ■ Truth Table

| Input | O <sub>2</sub> Output | Tr. 1 | Tr. 2 |
|-------|-----------------------|-------|-------|
| ON    | High level            | ON    | OFF   |
| OFF   | Low level             | OFF   | ON    |

# Test Circuit

Fig. 1

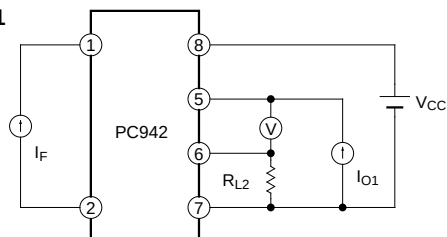


Fig. 3

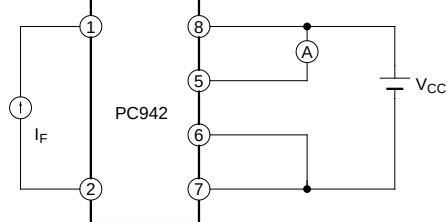


Fig. 5

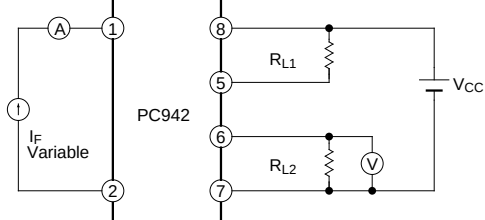


Fig. 7

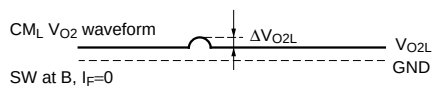
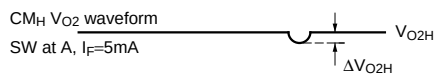
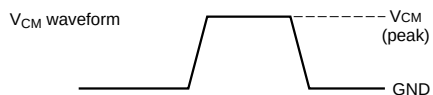
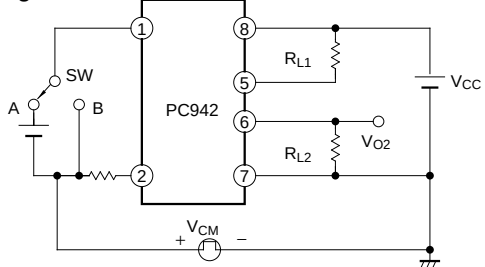


Fig. 2

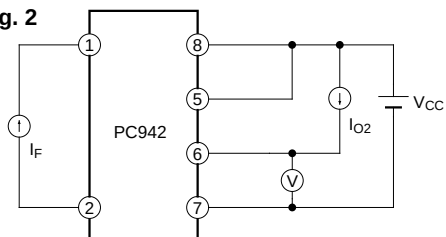


Fig. 4

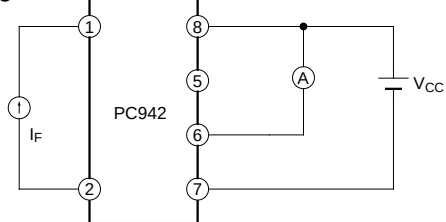
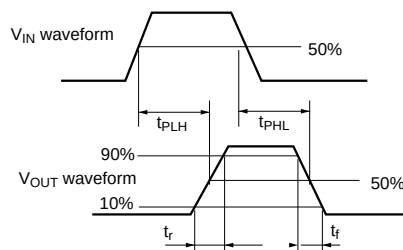
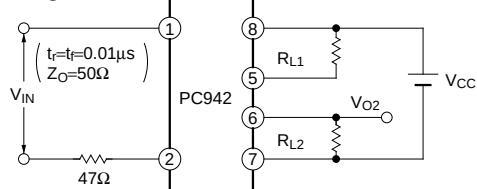
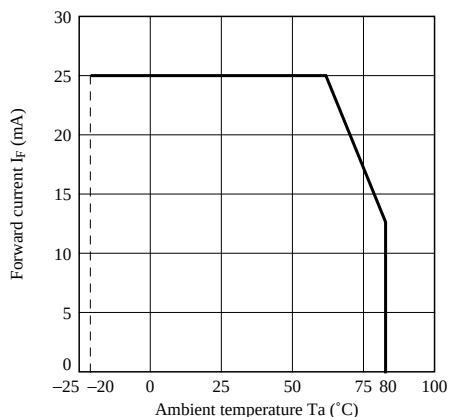


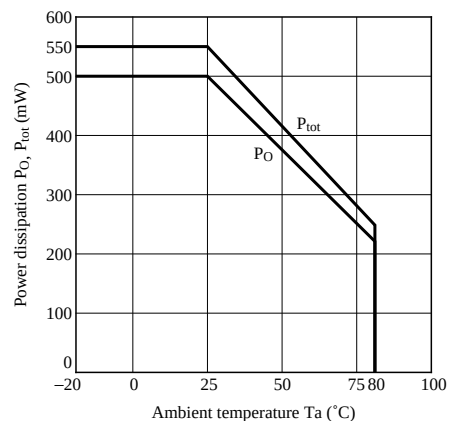
Fig. 6



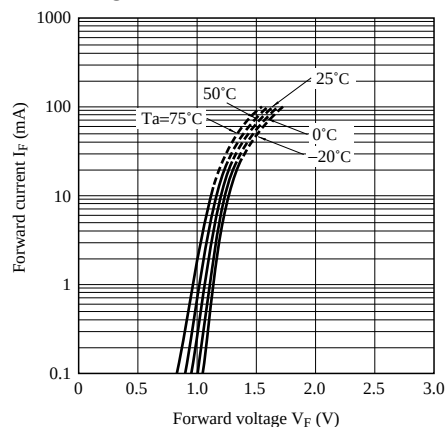
**Fig.8 Forward Current vs. Ambient Temperature**



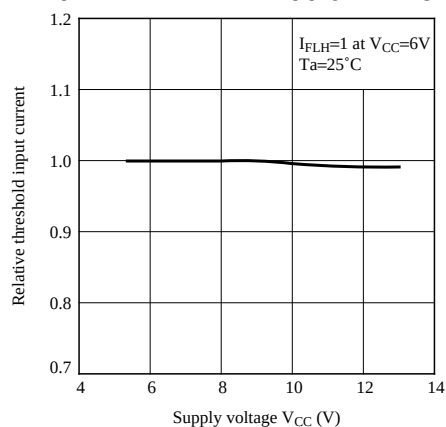
**Fig.9 Power Dissipation vs. Ambient Temperature**



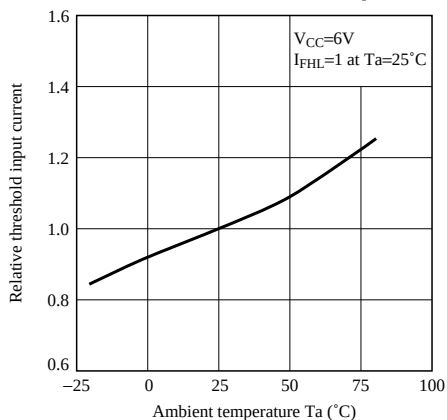
**Fig.10 Forward Current vs. Forward Voltage**



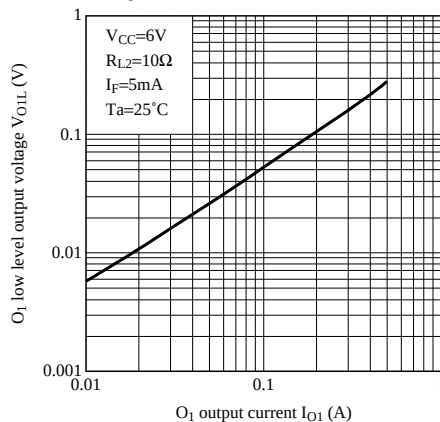
**Fig.11 "Low→High" Relative Threshold Input Current vs. Supply Voltage**



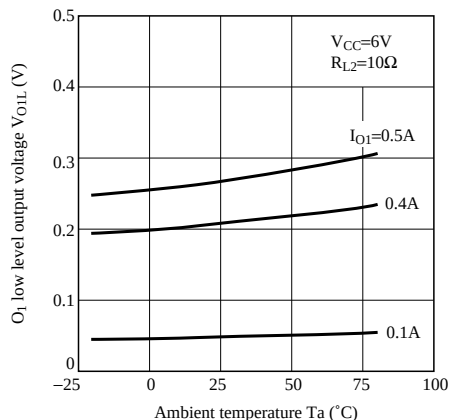
**Fig.12 "Low→High" Relative Threshold Input Current vs. Ambient Temperature**



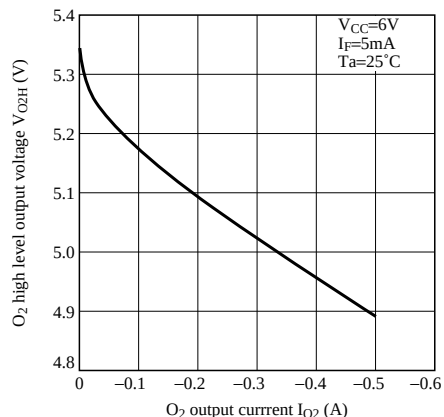
**Fig.13 O<sub>1</sub> Low Level Output Voltage vs. O<sub>1</sub> Output Current**



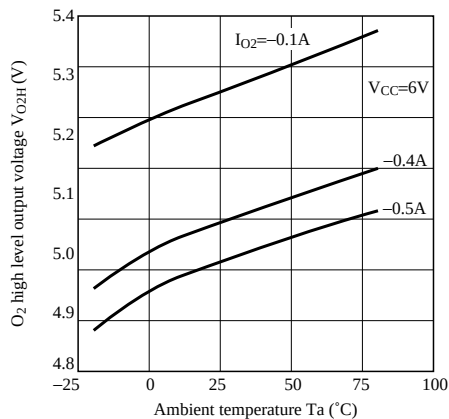
**Fig.14 O<sub>1</sub> Low Level Output Voltage vs. Ambient Temperature**



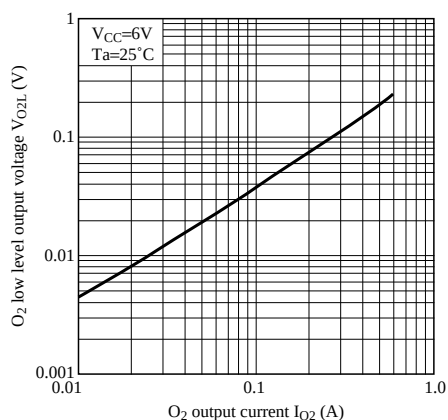
**Fig.15 O<sub>2</sub> High Level Output Voltage vs. O<sub>2</sub> Output Current**



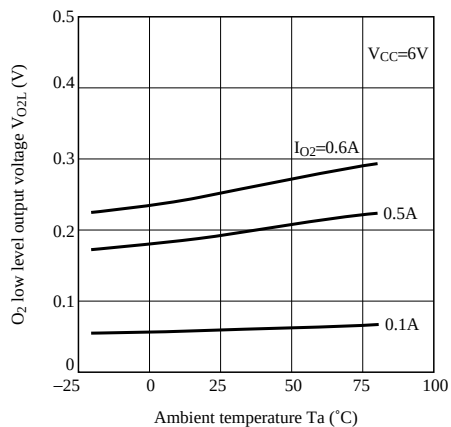
**Fig.16 O<sub>2</sub> High Level Output Voltage vs. Ambient Temperature**



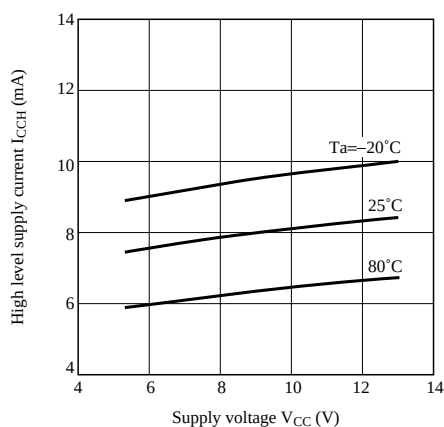
**Fig.17 O<sub>2</sub> Low Level Output Voltage vs. O<sub>2</sub> Output Current**



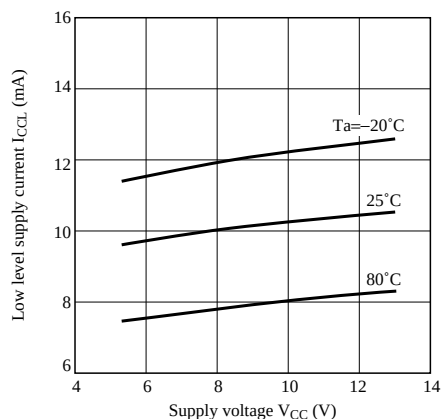
**Fig.18 O<sub>2</sub> Low Level Output Voltage vs. Ambient Temperature**



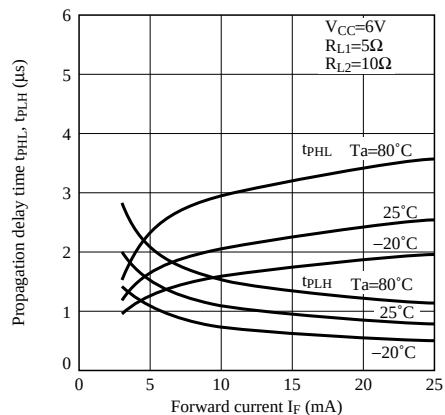
**Fig.19 High Level Supply Current vs. Supply Voltage**



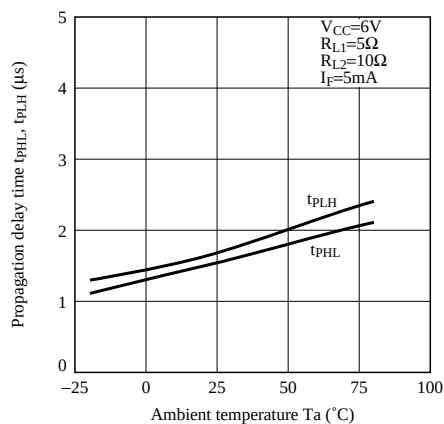
**Fig.20 Low Level Supply Current vs. Supply Voltage**



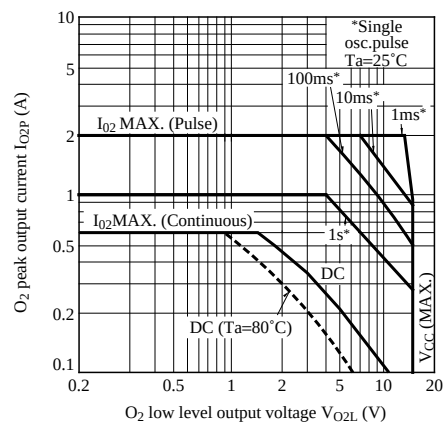
**Fig.21 Propagation Delay Time vs. Forward Current**



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

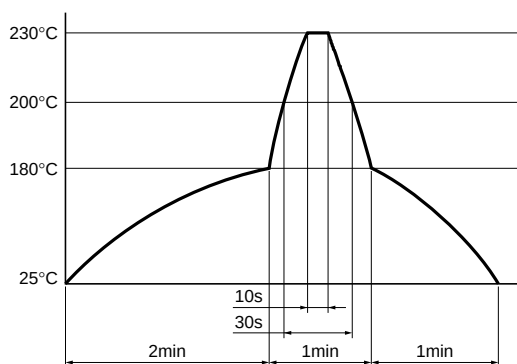


**Fig.23 O<sub>2</sub> Peak Output Current vs. O<sub>2</sub> Low Level Output Voltage**

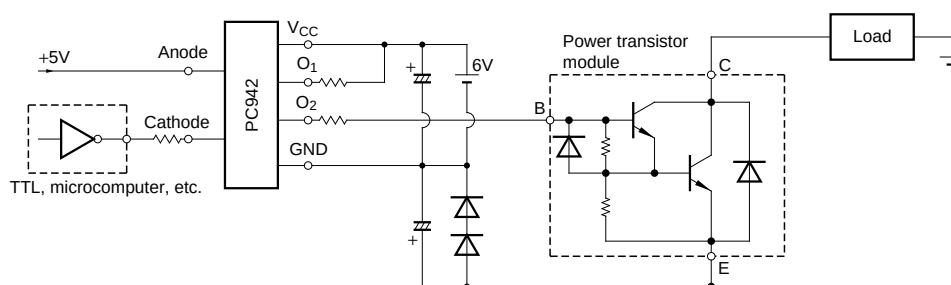


**Fig.24 Reflow Soldering**

Only one time soldering is recommended within the temperature profile shown below.



## ■ Application Circuit



## ■ Precautions for Use

1. It is recommended that a by-pass capacitor of more than  $0.01\mu\text{F}$  is added between  $V_{CC}$  and GND near the device in order to stabilize power supply line.
2. Handle this product the same as with other integrated circuits against static electricity.
3. As for other general cautions, refer to the chapter "Precautions for Use".

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