# PC921 High Power OPIC Photocoupler

T-41-83

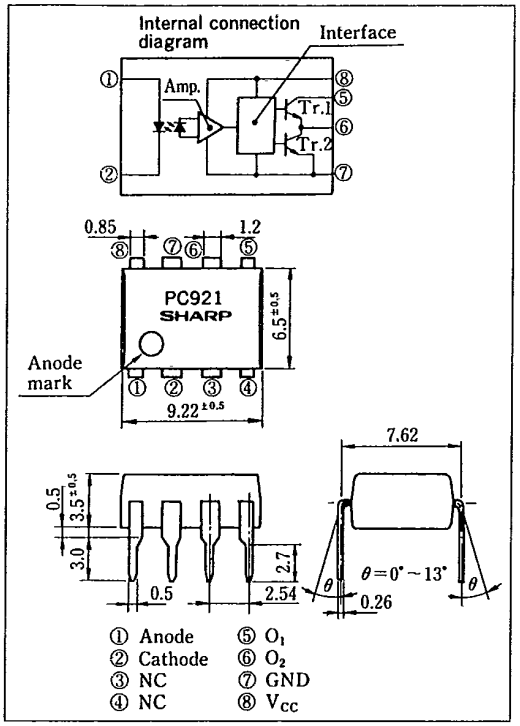
## ■ Features

1. Built-in base amplifier for power transistor drive
2. High power ($I_{O1}$ : MAX. 0.5A (DC))
   ($I_{O2P}$ : MAX. 2.0A (pulse))
3. High speed response
   ($t_{PHL}$, $t_{PLH}$ : MAX. 5μs)
4. High sensitivity ($I_{FLH}$: MAX. 5mA)
5. UL recognized, file No. E64380

## ■ Applications

1. Inverter controlled air conditioners
2. Low capacitance general purpose inverter

## ■ Outline Dimensions (Unit : mm)




※ OPIC is a registered trademark of Sharp and stands for Optical IC. It has a light detecting element and signal processing circuitry integrated onto a single chip.

## ■ Absolute Maximum Ratings (Unless otherwise specified, Ta=$T_{opr}$)

| Parameter | | Symbol | Rating | Unit |
|---|---|---|---|---|
| Input | Forward current | $I_F$ | 25 | mA |
| | *1Reverse voltage | $V_R$ | 6 | V |
| Output | Supply voltage | $V_{CC}$ | 15 | V |
| | $O_1$ output current | $I_{O1}$ | 0.5 | A |
| | *2$O_1$ peak output current | $I_{O1P}$ | 1.0 | A |
| | $O_2$ output current | $I_{O2}$ | 0.6 | A |
| | *2$O_2$ peak output current | $I_{O2P}$ | 2.0 | A |
| | $O_1$ Output voltage | $V_{O1}$ | 15 | V |
| | Power dissipation | $P_O$ | 500 | mW |
| Total power dissipation | | $P_{tot}$ | 550 | mW |
| *3Isolation voltage | | $V_{iso}$ | 2,000 | Vrms |
| Operating temperature | | $T_{opr}$ | −20~+80 | °C |
| Storage temperature | | $T_{stg}$ | −55~+125 | °C |
| *4Soldering temperature | | $T_{sol}$ | 260 | °C |

*1 Ta=25°C
*2 Pulse width≦5μs, Duty ratio=0.01
*3 RH=40~60%, AC for 1 minute, Ta=25°C
*4 For 10 seconds

## ■ Electro-optical Characteristics

(Unless otherwise specified Ta=$T_{opr}$)

| Parameter | | | Symbol | Conditions | MIN. | TYP. | MAX. | Unit | Fig. |
|---|---|---|---|---|---|---|---|---|---|
| Input | Forward voltage | | $V_{F1}$ | Ta=25°C, $I_F$=5mA | — | 1.1 | 1.4 | V | — |
| | | | $V_{F2}$ | Ta=25°C, $I_F$=0.2mA | 0.6 | 0.9 | — | V | — |
| | Reverse current | | $I_R$ | Ta=25°C, $V_F$=3V | — | — | 10 | μA | — |
| | Terminal capacitance | | $C_t$ | Ta=25°C, V=0, f=1kHz | — | 30 | 250 | pF | — |
| Output | Operating supply voltage | | $V_{CC}$ | ——— | 5.4 | — | 13 | V | — |
| | $O_1$ low level output voltage | | $V_{O1L}$ | $V_{CC}$=6V, $I_{O1}$=0.4A, $R_{L2}$=10Ω, $I_F$=5mA | — | 0.2 | 0.4 | V | 1 |
| | $O_2$ high level output voltage | | $V_{O2H}$ | $V_{CC}$=6V, $I_{O2}$=−0.4A, $I_F$=5mA | 4.5 | 5.0 | — | V | 2 |
| | $O_2$ low level output voltage | | $V_{O2L}$ | $V_{CC}$=6V, $I_{O2}$=0.5A, $I_F$=0 | — | 0.2 | 0.4 | V | 2 |
| | $O_1$ leak current | | $I_{O1L}$ | $V_{CC}$=13V, $I_F$=0 | — | — | 200 | μA | 3 |
| | $O_2$ leak current | | $I_{O2L}$ | $V_{CC}$=13V, $I_F$=5mA | — | — | 200 | μA | 4 |
| | High level supply current | | $I_{CCH}$ | Ta=25°C, $V_{CC}$=6V, $I_F$=5mA | — | 9 | 13 | mA | — |
| | | | | $V_{CC}$=6V, $I_F$=5mA | — | — | 17 | mA | — |
| | Low level supply current | | $I_{CCL}$ | Ta=25°C, $V_{CC}$=6V, $I_F$=0 | — | 11 | 15 | mA | — |
| | | | | $V_{CC}$=6V, $I_F$=0 | — | — | 20 | mA | — |
| Transfer characteristics | *5"Low→High" threshold input current | | $I_{FLH}$ | Ta=25°C, $V_{CC}$=6V, $R_{L1}$=5Ω, $R_{L2}$=10Ω | 0.3 | 1.5 | 3.0 | mA | 5 |
| | | | | $V_{CC}$=6V, $R_{L1}$=5Ω, $R_{L2}$=10Ω | 0.2 | — | 5.0 | mA | 5 |
| | Isolation resistance | | $R_{ISO}$ | Ta=25°C, DC=500V, RH=40~60% | $5\times10^{10}$ | $10^{11}$ | — | Ω | — |
| | Response time | "Low→High" propagation time | $t_{PLH}$ | Ta=25°C, $V_{CC}$=6V, $I_F$=5mA, $R_{L1}$=5Ω, $R_{L2}$=10Ω | — | 2 | 5 | μs | 6 |
| | | "High→Low" propagation time | $t_{PHL}$ | | — | 2 | 5 | μs | |
| | | Rise time | $t_r$ | | — | 0.2 | 1 | μs | |
| | | Fall time | $t_f$ | | — | 0.1 | 1 | μs | |
| | Instantaneous common mode rejection voltage "Output : high level" | | $CM_H$ | Ta=25°C, $V_{CM}$=600$V_{(peak)}$, $I_F$=5mA, $R_{L1}$=470Ω, $R_{L2}$=1kΩ, $\Delta_{O2H}$=0.5V, $V_{CC}$=6V | −1000 | — | — | V/μs | 7 |
| | Instantaneous common mode rejection voltage "Output : low level" | | $CM_L$ | Ta=25°C, $V_{CM}$=600$_{(peak)}$, $I_F$=0, $R_{L1}$=470Ω, $R_{L2}$=1kΩ, $\Delta V_{O2L}$=0.5V, $V_{CC}$=6V | 1000 | — | — | V/μs | 7 |

*5 $I_{FLH}$ represents forward current when output goes from low to high.

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## ■ Truth Table

| Input | Output | Tr.1 | Tr.2 |
|---|---|---|---|
| ON | High level | ON | OFF |
| OFF | Low level | OFF | ON |

## ■ Test Circuit

**Fig. 1**

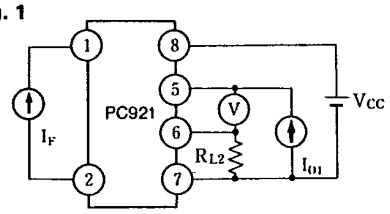



**Fig. 2**

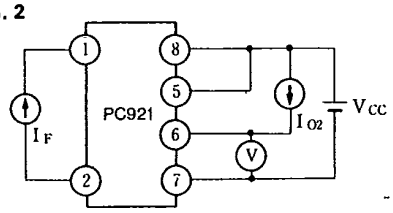



**Fig. 3**

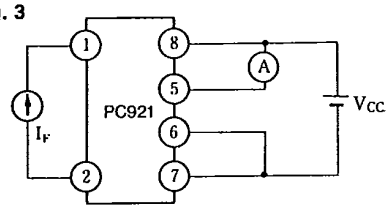



**Fig. 4**

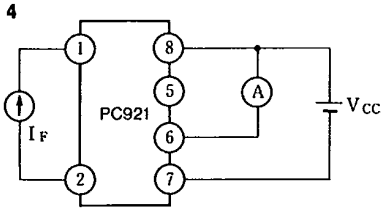



**Fig. 5**

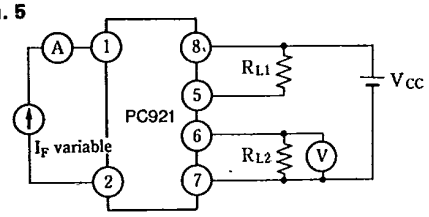
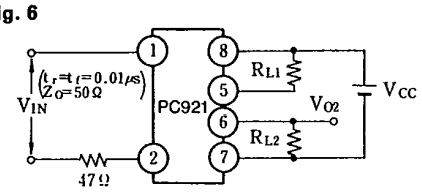



**Fig. 6**



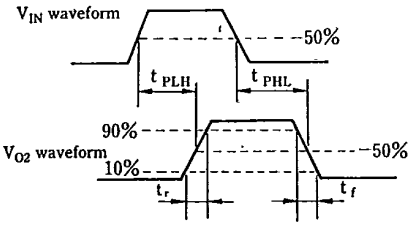
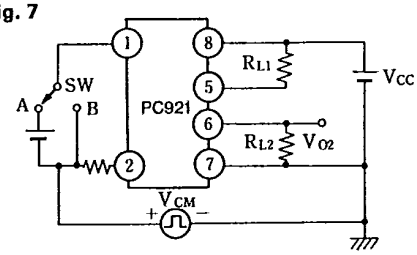




**Fig. 7**



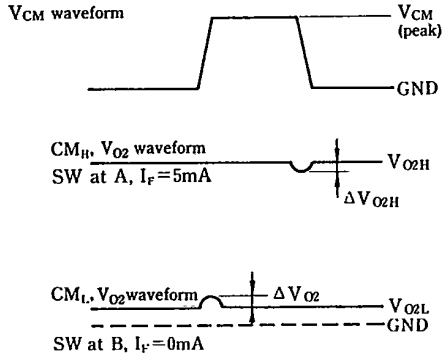




**Fig. 8 Forward Current vs. Ambient Temperature**

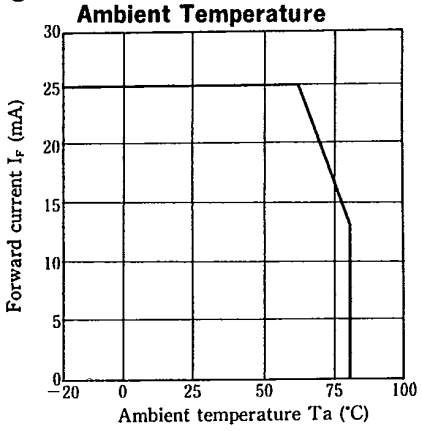


**Fig. 9 Output Power Dissipation vs. Ambient Temperature**

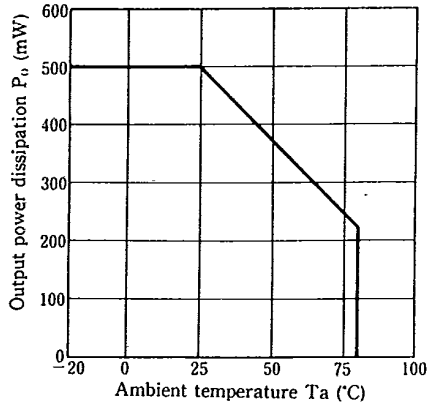



**Fig. 10 Total Power Dissipation vs. Ambient Temperature**

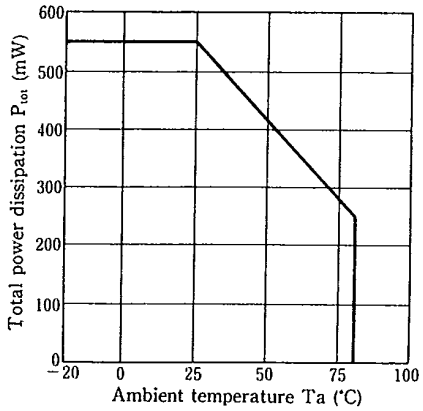



**Fig. 11 Forward Current vs. Forward Voltage**

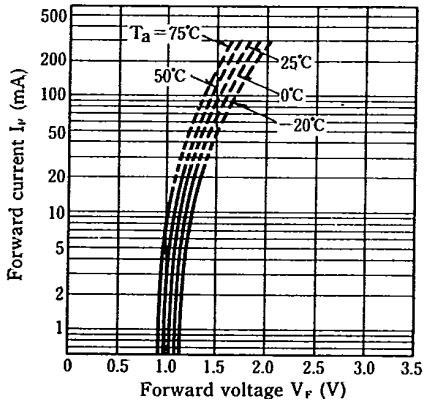



**Fig. 12 "Low →High" Relative Threshold Input Current vs. Supply Voltage**

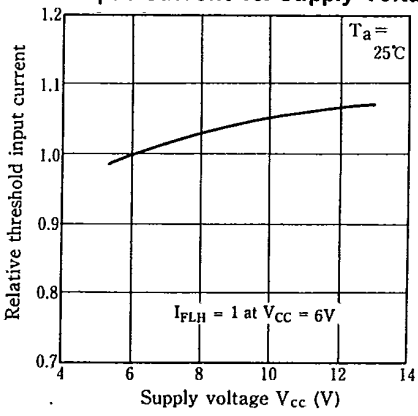



**Fig. 13 "Low→High" Relative Threshold Input Current vs. Ambient Temperature**

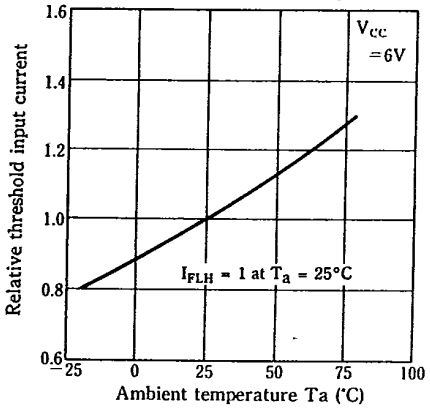



**Fig. 14 $O_1$ Low Level Output Voltage vs. $O_1$ Output Current**

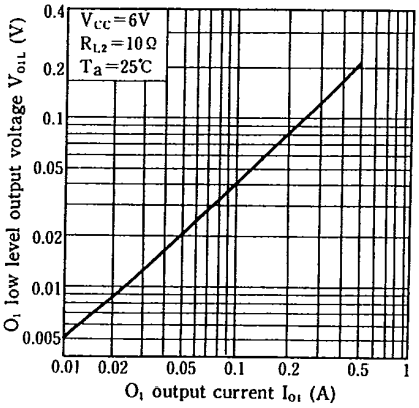



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**Fig. 15 $O_1$ Low Level Output Voltage vs. Ambient Temperature**

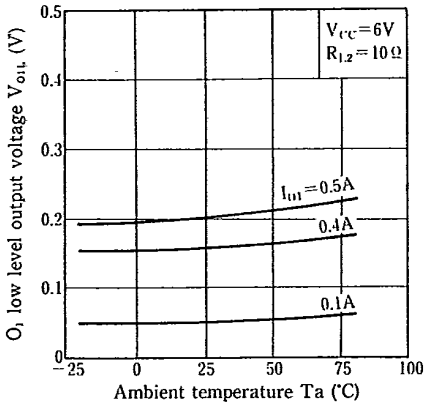



**Fig. 16 $O_2$ High Level Output Voltage vs. $O_2$ Output Current**

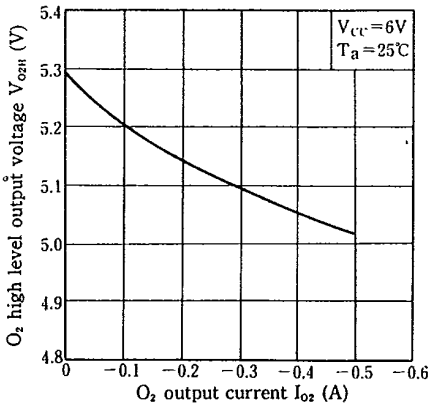



**Fig. 17 $O_2$ High Level Output Voltage vs. Ambient Temperature**

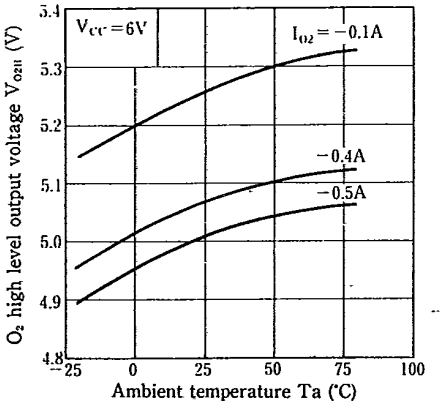



**Fig. 18 $O_2$ Low Level Output Voltage vs. $O_2$ Output Current**

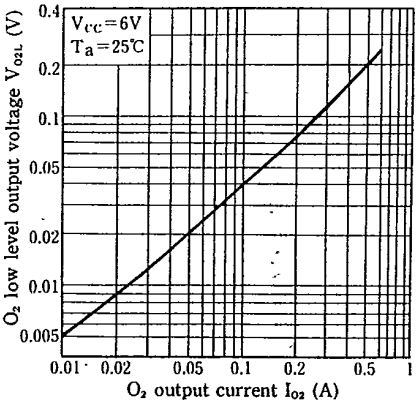



**Fig. 19 $O_2$ Low Level Output Voltage vs. Ambient Temperature**

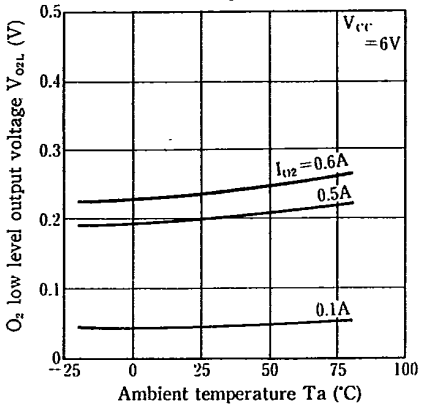



**Fig. 20 High Level Supply Current vs. Supply Voltage**

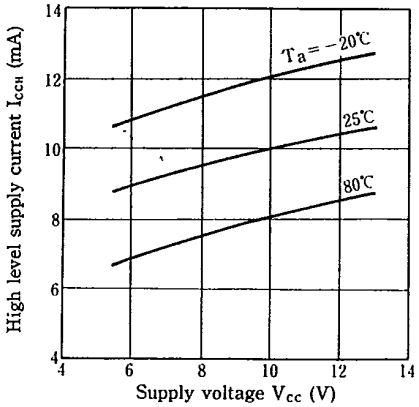


**Fig. 21 Low Level Supply Current vs. Supply Voltage**

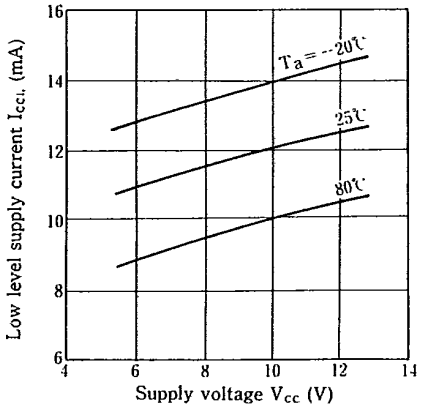



**Fig. 22 Propagation Time vs. Forward Current**

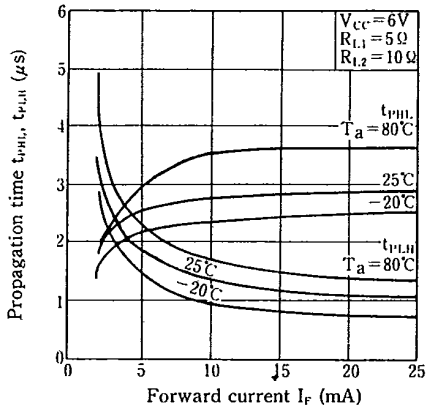



**Fig. 23 Propagation Time vs. Ambient Temperature**

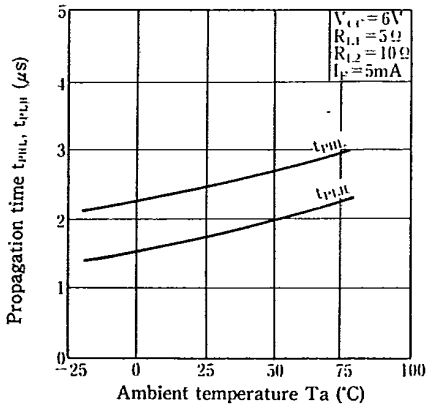
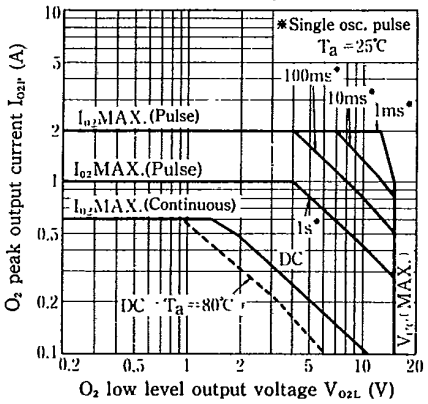



**Fig. 24 $O_2$ Peak Output Current vs. $O_2$ Low Level Output Voltage**

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