# PC923

## High Speed Photocoupler for MOS-FET / IGBT Drive

※ Lead forming type (I type) and taping reel type (P type) are also available. (**PC923I/PC923P**) (Page 656)

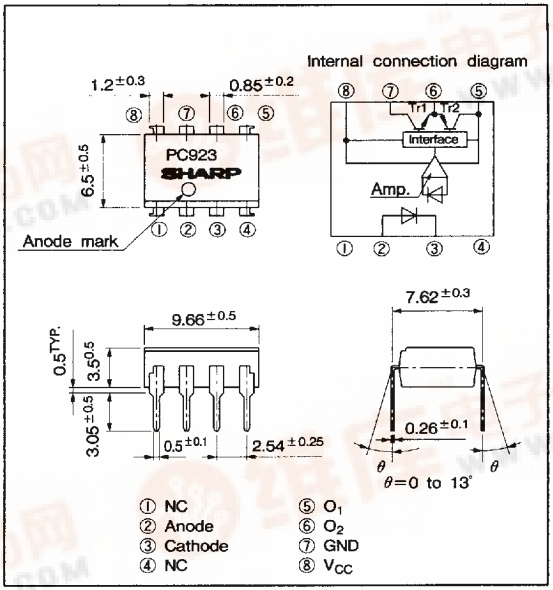
### ■ Features

1. Built-in direct drive circuit for MOS-FET/ IGBT drive
   ($I_{O1P}$, $I_{O2P}$ : 0.4A)
2. High speed response
   ($t_{PLH}$, $t_{PHL}$ : MAX. 0.5 μs)
3. Wide operating supply voltage range
   (Vcc : 15 to 30V, Ta = −10 to 60℃)
4. High noise reduction type
   ($CM_H$ = MIN. −1 500V/μs)
   ($CM_L$ = MIN. 1 500V/μs)
5. Recognized by UL, file No. E64380
6. High isolation voltage between input and output ($V_{ISO}$ = 5 000 $V_{rms}$)

### ■ Applications

1. Inverter controlled air conditioners

### ■ 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.

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

| | Parameter | Symbol | Rating | Unit |
|---|---|---|---|---|
| Input | Forward current | $I_F$ | 20 | mA |
| | *1Reverse voltage | $V_R$ | 6 | V |
| Output | Supply voltage | $V_{CC}$ | 35 | V |
| | $O_1$ output current | $I_1$ | 0.1 | A |
| | *2$O_1$ peak output current | $I_{O1P}$ | 0.4 | A |
| | $O_2$ output current | $I_{O2}$ | 0.1 | A |
| | *2$O_2$ peak output current | $I_{O2P}$ | 0.4 | A |
| | $O_1$ output voltage | $V_{O1}$ | 35 | V |
| | Power dissipation | $P_O$ | 500 | mW |
| Total power dissipation | | $P_{tot}$ | 550 | mW |
| *3Isolation voltage | | $V_{iso}$ | 5 000 | $V_{rms}$ |
| Operating temperature | | $T_{opr}$ | −25 to +80 | ℃ |
| Storage temperature | | $T_{stg}$ | −55 to +125 | ℃ |
| *4Soldering temperature | | $T_{sol}$ | 260 | ℃ |

*1 Ta = 25℃
*2 Puise width ≦ 0.15 μs, Duty ratio = 0.01
*3 40 to 60%RH, AC for 1 minute, Ta = 25℃
*4 For 10 seconds

## ■ Electro-optical Characteristics

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

| Parameter | | Symbol | *5Conditions | MIN. | TYP. | MAX. | Unit | Fig. |
|---|---|---|---|---|---|---|---|---|
| Input | Forward voltage | $V_{F1}$ | Ta=25℃, $I_F$=10mA | – | 1.6 | 1.75 | V | – |
| | | $V_{F2}$ | Ta=25℃, $I_F$=0.2mA | 1.2 | 1.5 | – | V | – |
| | Reverse current | $I_R$ | Ta=25℃, $V_R$=5V | – | – | 10 | μA | – |
| | Terminal capacitance | $C_t$ | Ta=25℃, V=0, f=1MHz | – | 30 | 250 | pF | – |
| Output | Operating supply voltage | $V_{CC}$ | Ta=−10 to 60℃ | 15 | – | 30 | V | – |
| | | | | 15 | – | 24 | V | |
| | $O_1$ low level output voltage | $V_{O1L}$ | $V_{CC1}$=12V, $V_{CC2}$=−12V, $I_{O1}$=0.1A, $I_F$=5mA | – | 0.2 | 0.4 | V | 1 |
| | $O_2$ high level output voltage | $V_{O2H}$ | $V_{CC}$=$V_{O1}$=24V, $I_{O2}$=−0.1A, $I_F$=5mA | 18 | 21 | – | V | 2 |
| | $O_2$ low level output voltage | $V_{O2L}$ | $V_{CC}$=24V, $I_{O2}$=0.1A, $I_F$=0 | – | 1.2 | 2.0 | V | 3 |
| | $O_1$ leak current | $I_{O1L}$ | Ta=25℃, $V_{CC}$=$V_{O1}$=35V, $I_F$=0 | – | – | 500 | μA | 4 |
| | $O_2$ leak current | $I_{O2L}$ | Ta=25℃, $V_{CC}$=$V_{O2}$=35V, $I_F$=5mA | – | – | 500 | μA | 5 |
| | High level supply current | $I_{CCH}$ | Ta=25℃, $V_{CC}$=24V, $I_F$=5mA | – | 6 | 10 | mA | 6 |
| | | | $V_{CC}$=24V, $I_F$=5mA | – | – | 14 | mA | |
| | Low level supply current | $I_{CCL}$ | Ta=25℃, $V_{CC}$=24V, $I_F$=0 | – | 8 | 13 | mA | |
| | | | $V_{CC}$=24V, $I_F$=0 | – | – | 17 | mA | |
| Transfer characteristics | *6 "Low→High" threshold input current | $I_{FLH}$ | Ta=25℃, $V_{CC}$=24V | 0.3 | 1.5 | 3.0 | mA | 7 |
| | | | $V_{CC}$=24V | 0.2 | – | 5.0 | mA | |
| | Isolation resistance | $R_{ISO}$ | Ta=25℃, DC=500V, 40 to 60%RH | $5\times10^{10}$ | $10^{11}$ | – | Ω | – |
| | Response time "Low→High" propagation delay time | $t_{PLH}$ | Ta=25℃, $V_{CC}$=24V, $I_F$=5mA, $R_C$=47Ω, $C_G$=3 000pF | – | 0.3 | 0.5 | μs | 8 |
| | Response time "High→Low" propagation delay time | $t_{PHL}$ | | – | 0.3 | 0.5 | μs | |
| | Response time Rise time | $t_r$ | | – | 0.2 | 0.5 | μs | |
| | Response time Fall time | $t_f$ | | – | 0.2 | 0.5 | μs | |
| | Instantaneous common mode rejection voltage "Output : High level" | $CH_M$ | Ta=25℃, $V_{CM}$=600V(peak), $I_F$=5mA, $V_{CC}$=24V, $\Delta V_{O2H}$=2.0V | −1500 | – | – | V/μs | 9 |
| | Instantaneous common mode rejection voltage "Output : Low level" | $CM_L$ | Ta=25℃, $V_{CM}$=600V(peak), $I_F$=0, $V_{CC}$=24V, $\Delta V_{O2L}$=2.0V | 1500 | – | – | V/μs | |

*5 When measuring output and transfer characteristics, connect a by-pass capacitor (0.01 μF or more) between $V_{CC}$ and GND near the **PC923**.

*6 $I_{FLH}$ represents forward current when output goes from low to high.

## ■ Truth Table

| Input | $O_2$ Output | Tr. 1 | Tr. 2 |
|---|---|---|---|
| ON | High level | ON | OFF |
| OFF | Low level | OFF | ON |

## ■ Test Circuit

**Fig. 1**

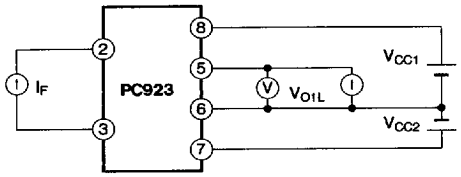



**Fig. 2**

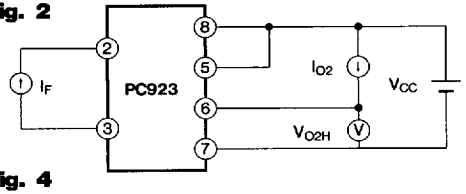



**Fig. 3**

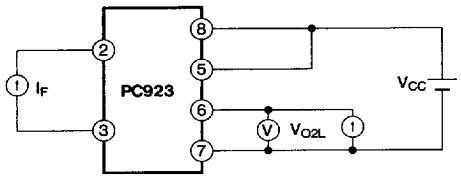



**Fig. 4**

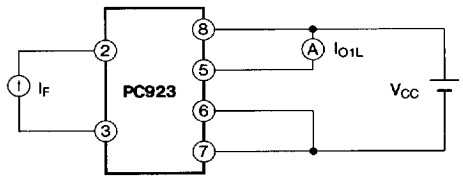



**Fig. 5**

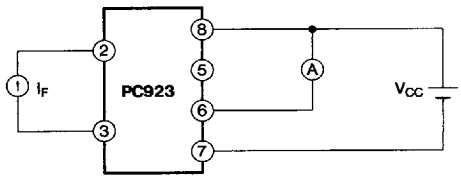



**Fig. 6**

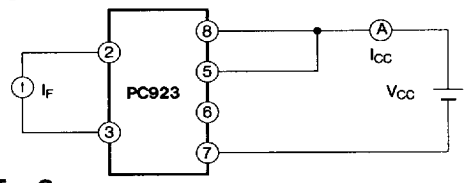



**Fig. 7**

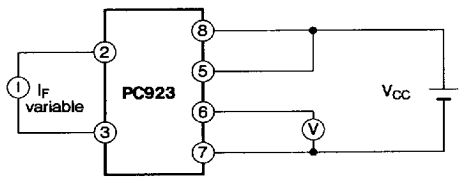
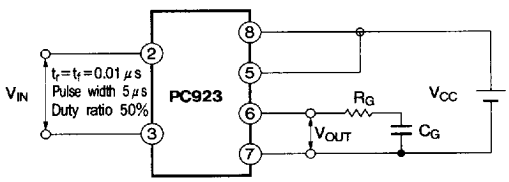



**Fig. 8**



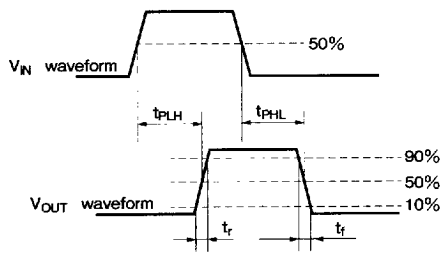
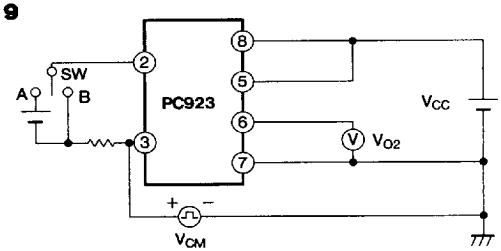
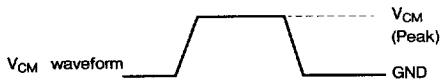




**Fig. 9**



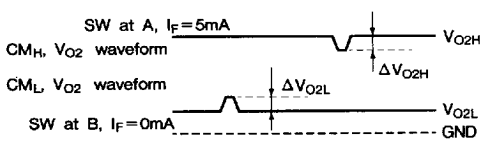



**Fig.10 Forward Current vs. Ambient Temperature**

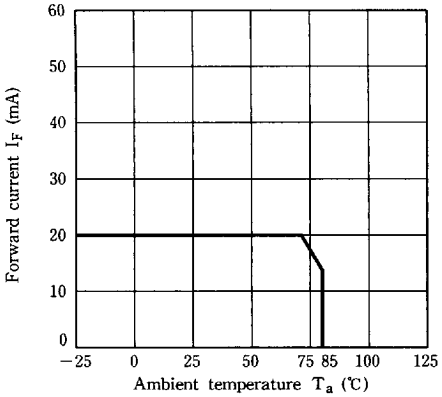



**Fig.11 Power Dissipation vs. Ambient Temperature**

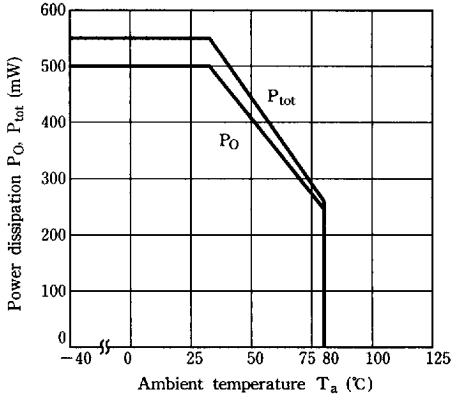



**Fig.12 Forward Current vs. Forward Voltage**

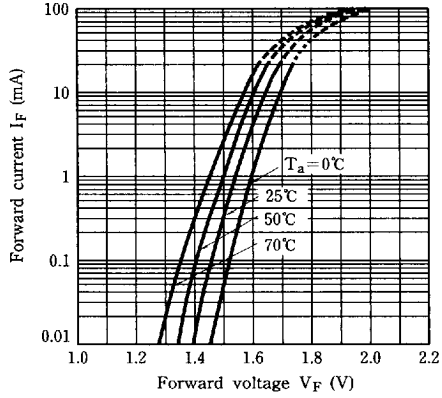



**Fig.13 "Low→High" Relative Threshold Input Current vs. Supply Voltage**

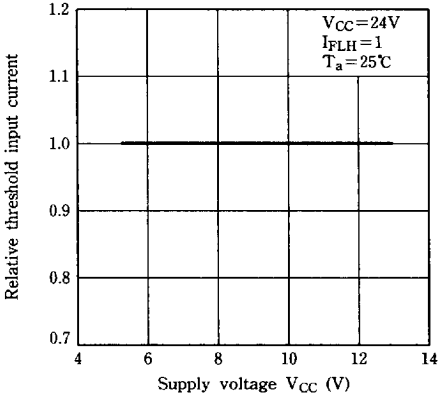



**Fig.14 "Low→High" Relative Threshold Input Current vs. Ambient Temperature**

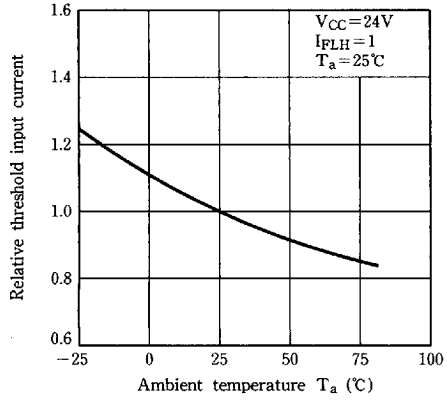



**Fig.15 $O_1$ Low Level Output Voltage vs. $O_1$ Output Current**

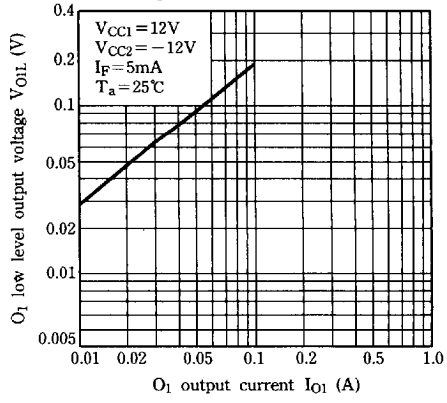


**Fig.16 $O_1$ Low Level Output Voltage vs. Ambient Temperature**

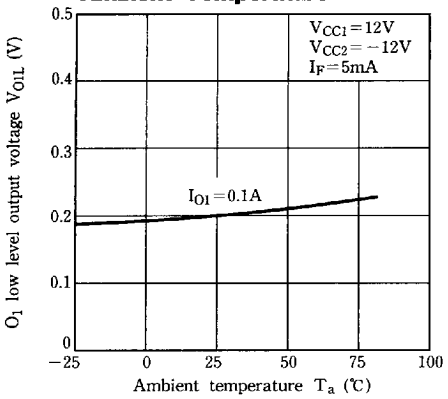



**Fig.17 $O_2$ High Level Output Voltage vs. Supply Voltage**

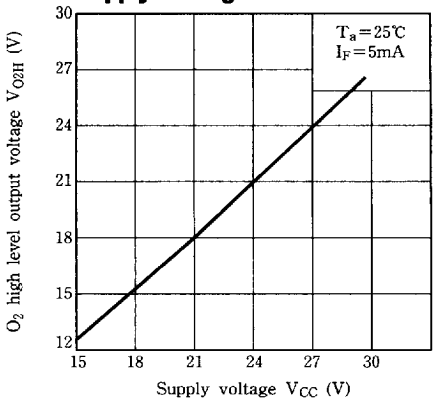



**Fig.18 $O_2$ High Level Output Voltage vs. Ambient Temperature**

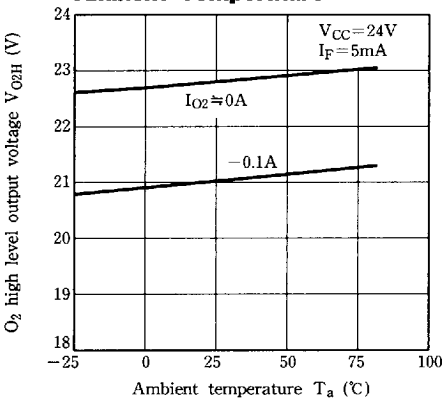



**Fig.19 $O_2$ Low Level Output Voltage vs. $O_2$ Output Current**

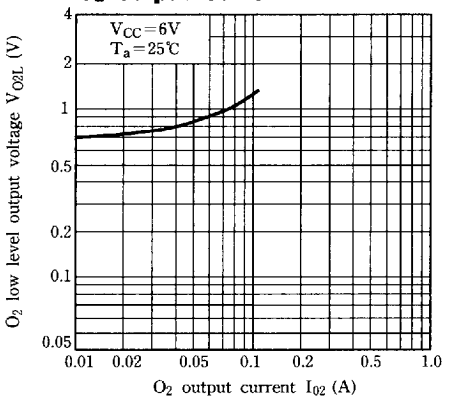



**Fig.20 $O_2$ Low Level Output Voltage vs. Ambient Temperature**

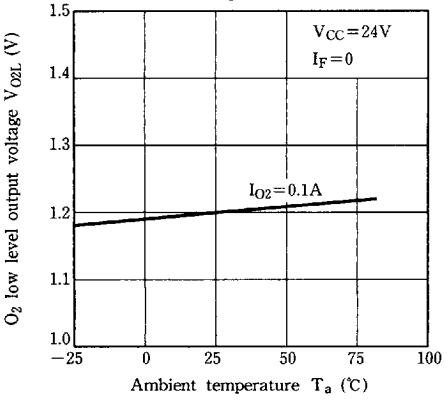



**Fig.21 High Level Supply Current vs. Supply Voltage**

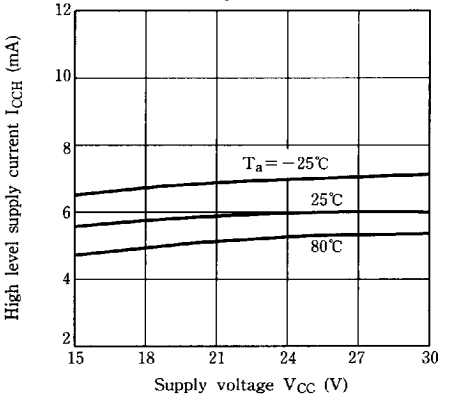


**Fig.22 Low Level Supply Current vs. Supply Voltage**

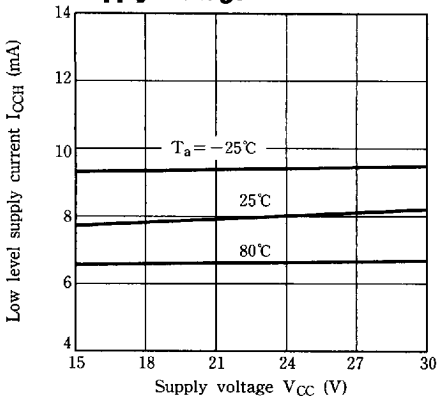



**Fig.23 Propagation Delay Time vs. Forwrad current**

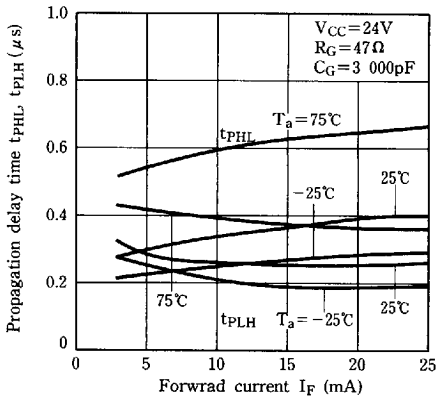
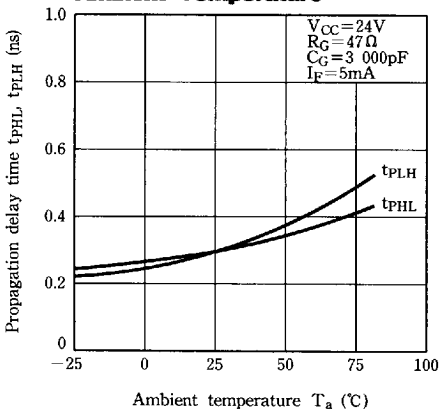
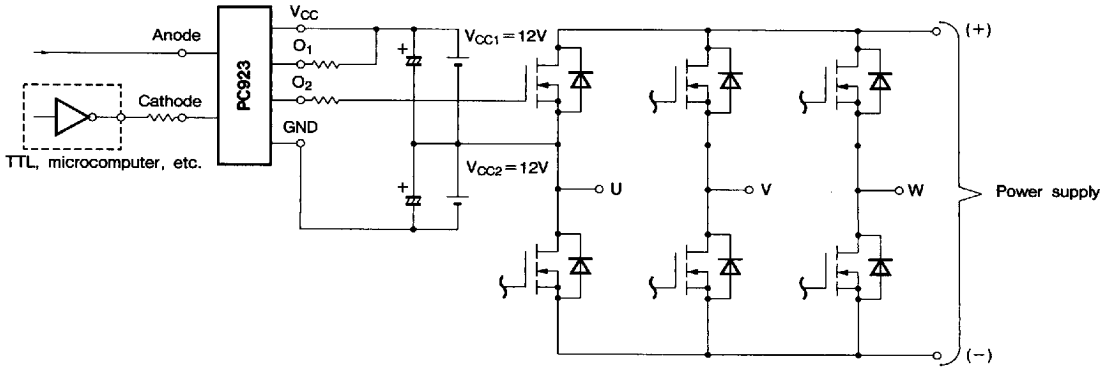



**Fig.24 Propagation Delay Time vs. Ambient Temperature**




## ■ Application Circuit (For Power MOS-FET Driving Inverter)




● Please refer to the chapter "Precautions for Use." (Page 78 to 93)