# 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**）
❋❋ TÜV ( VDE 0884 ) approved type is also available as an option.

## ■ Features

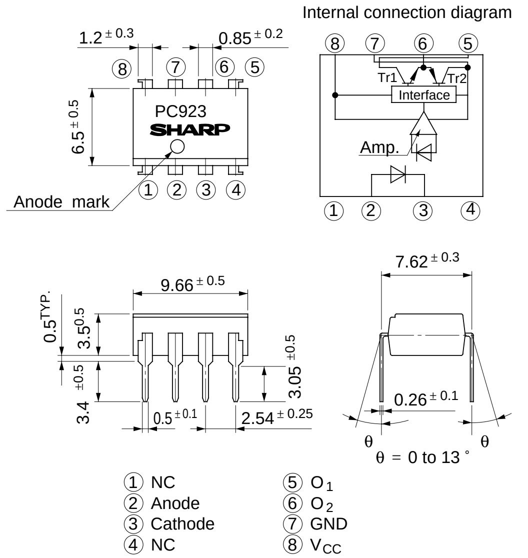
1. Built-in direct drive circuit for MOS-FET/ IGBT drive
   ( $I_{O1P}$, $I_{O2P}$ : 0.4A)
2. High speed response
   ( $t_{PLH}$ , $t_{PHL}$ : MAX. 0.5 μs)
3. Wide operating supply voltage range
   (Vcc : 15 to 30V, Ta = -10 to 60˚C)
4. High noise reduction type
   ( $CM_H$ = MIN. - 1 500V/ μs)
   ( $CM_L$ = 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 |
| | *1 Reverse 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 |
| *3 Isolation voltage | | $V_{iso}$ | 5 000 | $V_{rms}$ |
| Operating temperature | | $T_{opr}$ | - 25 to + 80 | ˚C |
| Storage temperature | | $T_{stg}$ | - 55 to + 125 | ˚C |
| *4 Soldering temperature | | $T_{sol}$ | 260 | ˚C |

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

## ■ Electro-optical Characteristics

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

| Parameter | | Symbol | *5 Conditions | MIN. | TYP. | MAX. | Unit | Fig. |
|---|---|---|---|---|---|---|---|---|
| Input | Forward voltage | $V_{F1}$ | Ta = 25˚C, $I_F$ = 10mA | - | 1.6 | 1.75 | V | - |
| | | $V_{F2}$ | Ta = 25˚C, $I_F$ = 0.2mA | 1.2 | 1.5 | - | V | - |
| | Reverse current | $I_R$ | Ta = 25˚C, $V_R$ = 5V | - | - | 10 | μA | - |
| | Terminal capacitance | $C_t$ | Ta = 25˚C, V = 0, f = 1MHz | - | 30 | 250 | pF | - |
| Output | Operating supply voltage | $V_{CC}$ | Ta = - 10 to 60˚C | 15 | - | 30 | V | - |
| | | | | 15 | - | 24 | V | |
| | $O_1$ low level output voltage | $V_{O1L}$ | $V_{CC1}$ = 12V, $V_{CC2}$ = - 12V, $I_{01}$ = 0.1A, $I_F$ = 5mA | - | 0.2 | 0.4 | V | 1 |
| | $O_2$ high level output voltage | $V_{O2H}$ | $V_{CC}$ = $V_{01}$ = 24V, $I_{02}$ = - 0.1A, $I_F$ = 5mA | 18 | 21 | - | V | 2 |
| | $O_2$ low level output voltage | $V_{O2L}$ | $V_{CC}$ = 24V, $I_{02}$ = 0.1A, $I_F$ = 0 | - | 1.2 | 2.0 | V | 3 |
| | $O_1$ leak current | $I_{O1L}$ | Ta = 25˚C, $V_{CC}$ = $V_{01}$ = 35V, $I_F$ = 0 | - | - | 500 | μA | 4 |
| | $O_2$ leak current | $I_{O2L}$ | Ta = 25˚C, $V_{CC}$ = $V_{02}$ = 35V, $I_F$ = 5mA | - | - | 500 | μA | 5 |
| | High level supply current | $I_{CCH}$ | Ta = 25˚C, $V_{CC}$ = 24V, $I_F$ = 5mA | - | 6 | 10 | mA | 6 |
| | | | $V_{CC}$ = 24V, $I_F$ = 5mA | - | - | 14 | mA | |
| | Low level supply current | $I_{CCL}$ | Ta = 25˚C, $V_{CC}$ = 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˚C, $V_{CC}$ = 24V | 0.3 | 1.5 | 3.0 | mA | 7 |
| | | | $V_{CC}$ = 24V | 0.2 | - | 5.0 | mA | |
| | Isolation resistance | $R_{ISO}$ | Ta = 25˚C, DC = 500V, 40 to 60% RH | $5 \times 10^{10}$ | $10^{11}$ | - | Ω | - |
| | Response time: "Low→High" propagation delay time | $t_{PLH}$ | Ta = 25˚C, $V_{CC}$ = 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˚C, $V_{CM}$ = 600V(peak), $I_F$ = 5mA, $V_{CC}$ = 24V, $\Delta V_{O2H}$ = 2.0V | - | - 30 | - | kV/μs | 9 |
| | Instantaneous common mode rejection voltage "Output : Low level" | $CM_L$ | Ta = 25˚C, $V_{CM}$ = 600V(peak), $I_F$ = 0, $V_{CC}$ = 24V, $\Delta V_{O2L}$ = 2.0V | - | 30 | - | kV/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 $O_2$ 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**

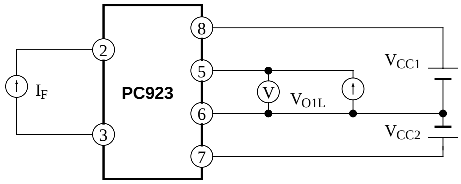



**Fig. 2**

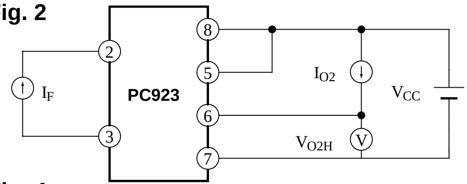



**Fig. 3**

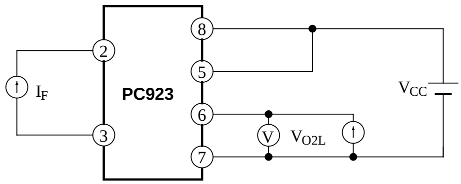



**Fig. 4**

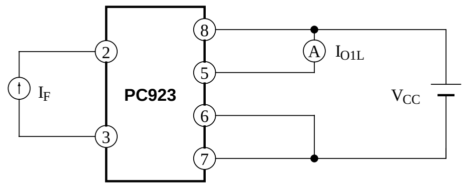



**Fig. 5**

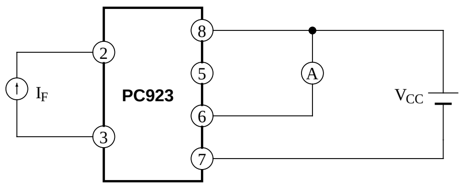



**Fig. 6**

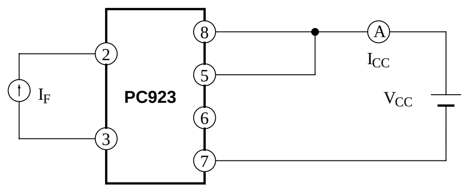



**Fig. 7**

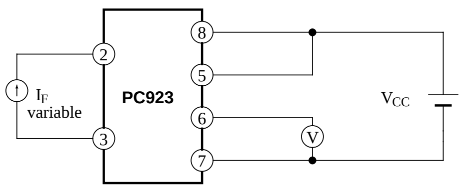



**Fig. 8**

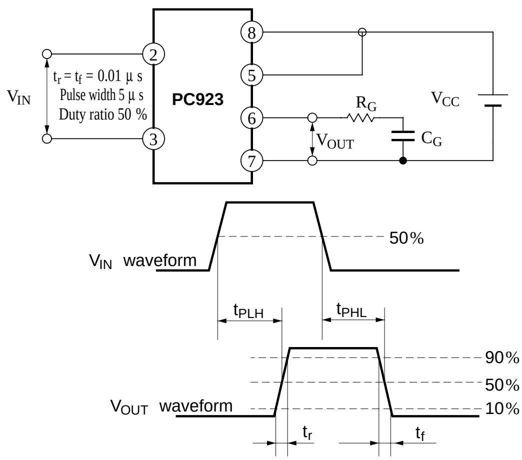
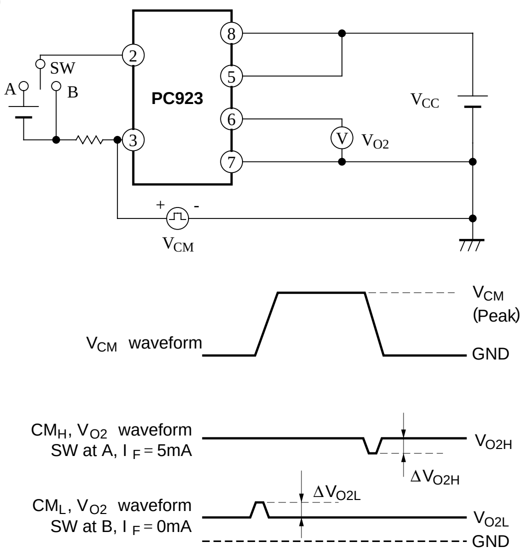
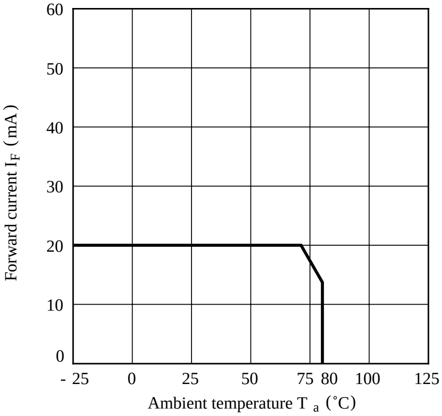


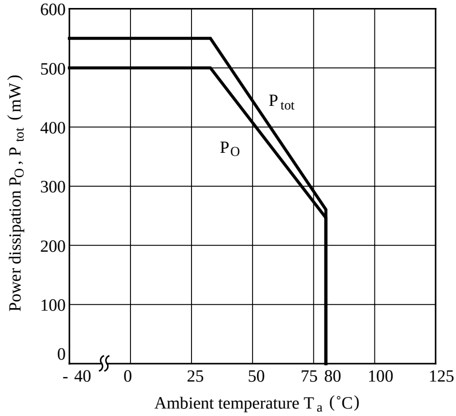

**Fig. 9**



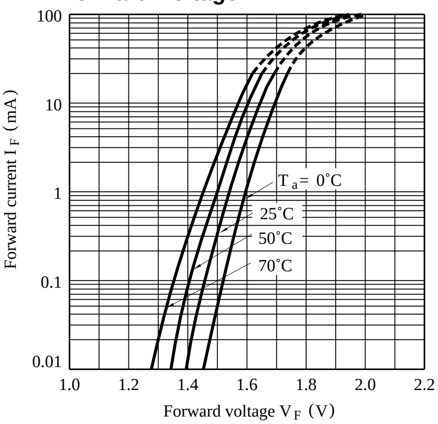
### Fig.10 Forward Current vs. Ambient Temperature



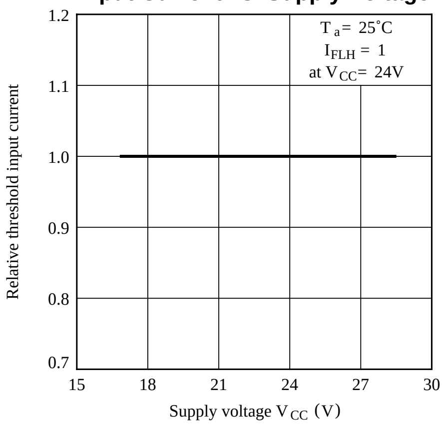

### Fig.11 Power Dissipation vs. Ambient Temperature



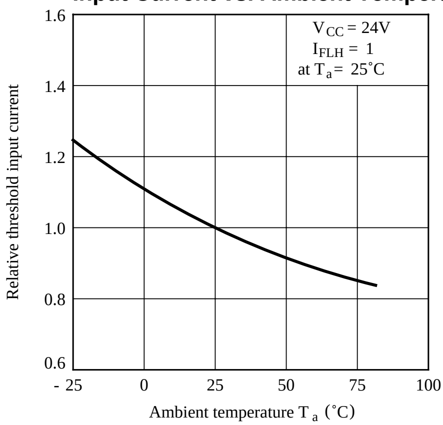

### Fig.12 Forward Current vs. Forward Voltage



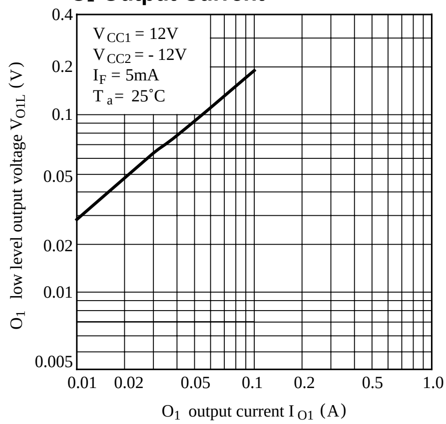

### Fig.13 " Low→High " Relative Threshold Input Current vs. Supply Voltage



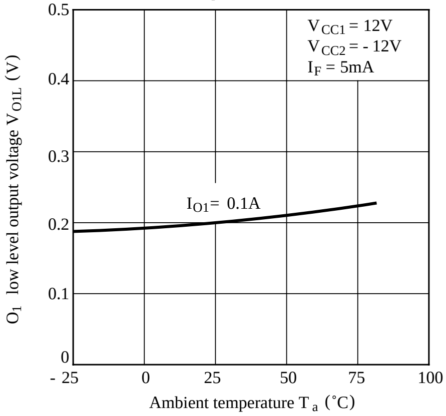

### Fig.14 " Low→High " Relative Threshold Input Current vs. Ambient Temperature



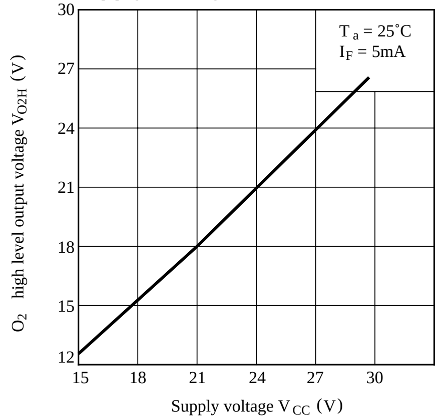

### Fig.15 $O_1$ Low Level Output Voltage vs. $O_1$ Output Current



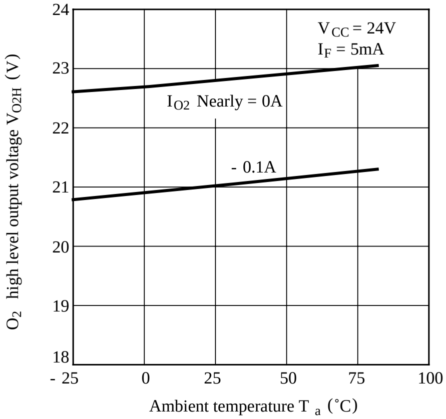
### Fig.16 $O_1$ Low Level Output Voltage vs. Ambient Temperature



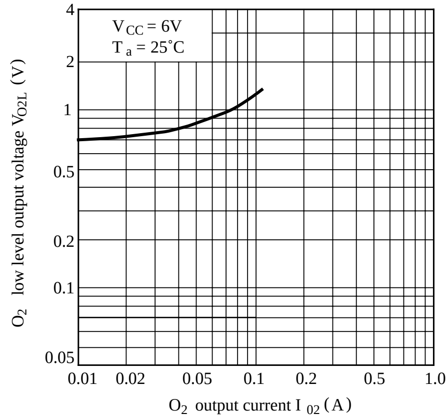

### Fig.17 $O_2$ High Level Output Voltage vs. Supply Voltage



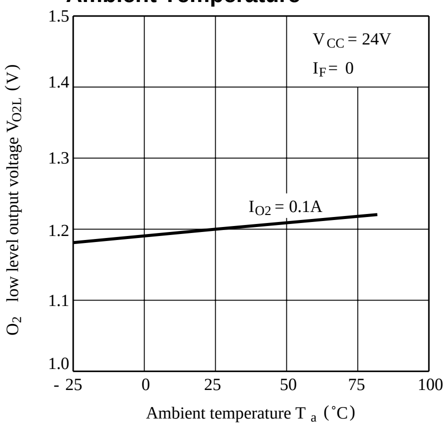

### Fig.18 $O_2$ High Level Output Voltage vs. Ambient Temperature




### 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

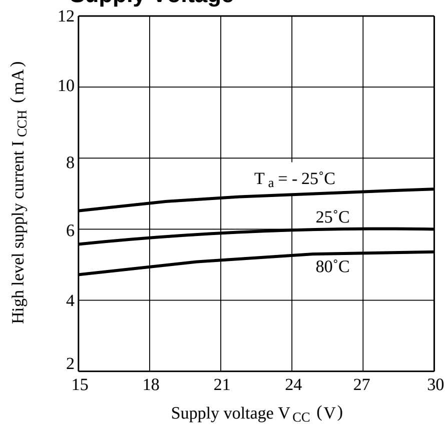


**Fig.22 Low Level Supply Current vs. Supply Voltage**

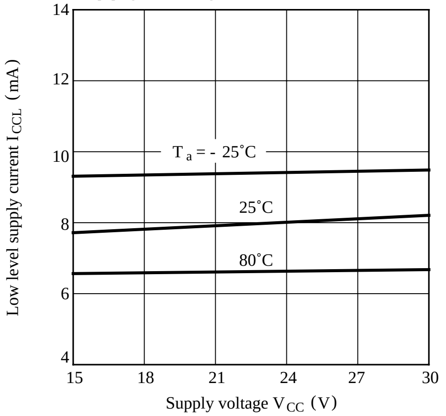



**Fig.23 Propagation Delay Time vs. Forwrad current**

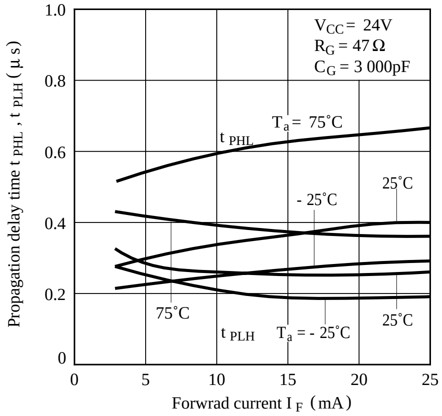
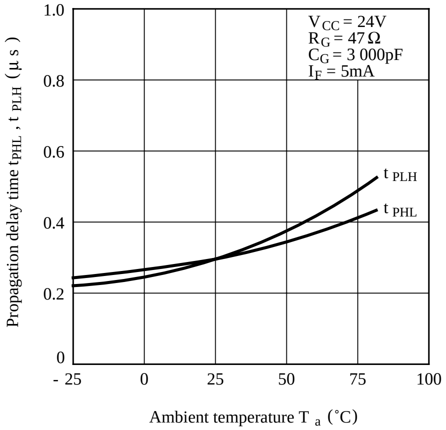
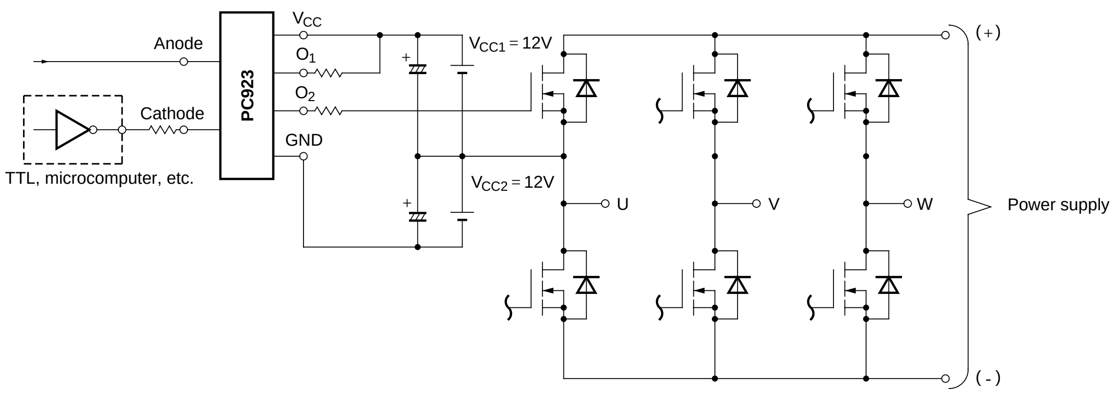



**Fig.24 Propagation Delay Time vs. Ambient Temperature**




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




● Please refer to the chapter "Precautions for Use."