

# PC924

## OPIC Photocoupler for IGBT Drive of Inverter

- \* Lead forming type ( I type ) and taping reel type ( P type ) are also available. ( PC924I/PC924P )
- \*\* TÜV ( VDE 0884 ) approved type is also available as an option.

### ■ Features

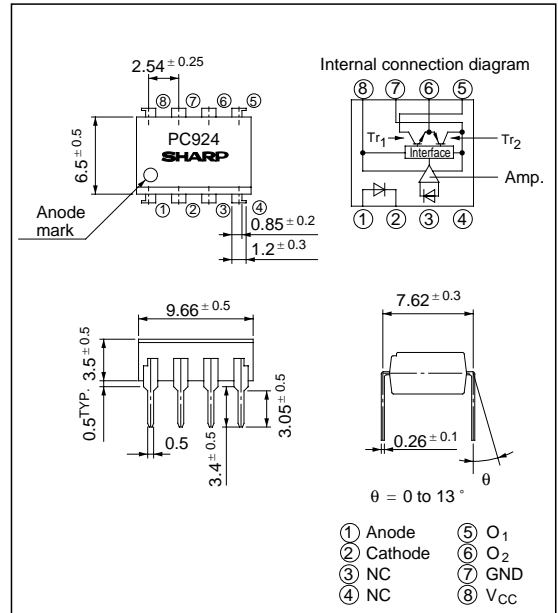
1. Built-in direct drive circuit for IGBT drive  
(  $I_{O1P}$ ,  $I_{O2P}$  : 0.4A )
2. High speed response (  $t_{PLH}$ ,  $t_{PHL}$  : MAX. 2.0  $\mu$ s )
3. Wide operating supply voltage range  
(  $V_{CC}$  : 15 to 30V at  $T_a = -10$  to 60°C )
4. High noise resistance type  
 $CM_H$  : MIN. - 1 500V/ $\mu$ s  
 $CM_L$  : MIN. 1 500V/ $\mu$ s
5. High isolation voltage (  $V_{iso}$  : 5 000V<sub>rms</sub> )

### ■ Applications

1. IGBT drive for inverter control

### ■ 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

(Unless specified,  $T_a = T_{opr}$ )

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

- \*<sup>1</sup> Pulse width  $\leq 0.15 \mu$ s,  
Duty ratio : 0.01
- \*<sup>2</sup> 40 to 60% RH, AC for  
1 minute,  $T_a = 25^\circ$ C
- \*<sup>3</sup> For 10 seconds

## Electro-optical Characteristics

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

Parameter		Symbol	*4 Conditions	MIN.	TYP.	MAX.	Unit	Fig.		
Input	Forward voltage	$V_{F1}$	$T_a = 25^\circ\text{C}, I_F = 20\text{mA}$	-	1.2	1.4	V	-		
		$V_{F2}$	$T_a = 25^\circ\text{C}, I_F = 0.2\text{mA}$	0.6	0.9	-	V	-		
	Reverse current	$I_R$	$T_a = 25^\circ\text{C}, V_R = 4\text{V}$	-	-	10	$\mu\text{A}$	-		
	Terminal capacitance	$C_t$	$T_a = 25^\circ\text{C}, V = 0, f = 1\text{kHz}$	-	30	250	pF	-		
Output	Operating supply voltage	$V_{CC}$	$T_a = -10 \text{ to } 60^\circ\text{C}$	15	-	30	V	-		
				15	-	24	V			
	O <sub>1</sub> low level output voltage	$V_{O1L}$	$V_{CC1} = 12\text{V}, V_{CC2} = -12\text{V}$ $I_{O1} = 0.1\text{A}, I_F = 10\text{mA}$	-	0.2	0.4	V	1		
	O <sub>2</sub> high level output voltage	$V_{O2H}$	$V_{CC} = V_{O1} = 24\text{V}, I_{O2} = -0.1\text{A}, I_F = 10\text{mA}$	18	21	-	V	2		
	O <sub>2</sub> low level output voltage	$V_{O2L}$	$V_{CC} = 24\text{V}, I_{O2} = 0.1\text{A}, I_F = 0$	-	1.2	2.0	V	3		
	O <sub>1</sub> leak current	$I_{O1L}$	$T_a = 25^\circ\text{C}, V_{CC} = V_{O1} = 35\text{V}, I_F = 0$	-	-	500	$\mu\text{A}$	4		
	O <sub>2</sub> leak current	$I_{O2L}$	$T_a = 25^\circ\text{C}, V_{CC} = V_{O2} = 35\text{V}, I_F = 10\text{mA}$	-	-	500	$\mu\text{A}$	5		
	High level supply current	$I_{CCH}$	$T_a = 25^\circ\text{C}, V_{CC} = 24\text{V}, I_F = 10\text{mA}$	-	6	10	mA	6		
$V_{CC} = 24\text{V}, I_F = 10\text{mA}$			-	-	14	mA				
$T_a = 25^\circ\text{C}, V_{CC} = 24\text{V}, I_F = 0$			-	8	13	mA				
Low level supply current	$I_{CCL}$	$T_a = 25^\circ\text{C}, V_{CC} = 24\text{V}, I_F = 0$	-	-	17	mA	6			
		$V_{CC} = 24\text{V}, I_F = 0$	-	-	17	mA				
Transfer characteristics	*5 "Low→High" threshold input current	$I_{FLH}$	$T_a = 25^\circ\text{C}, V_{CC} = 24\text{V}$	1.0	4.0	7.0	mA	7		
			$V_{CC} = 24\text{V}$	0.6	-	10.0	mA			
	Isolation resistance	$R_{ISO}$	$T_a = 25^\circ\text{C}, \text{DC} = 500\text{V}, 40 \text{ to } 60\% \text{RH}$	$5 \times 10^{10}$	$10^{11}$	-	$\Omega$	-		
	Response time		$T_a = 25^\circ\text{C}, V_{CC} = 24\text{V}, I_F = 10\text{mA}$ $R_C = 47\Omega, C_G = 3,000\text{pF}$	"Low→High" propagation delay time	$t_{PLH}$	-	1.0	2.0	$\mu\text{s}$	8
				"High→Low" propagation delay time	$t_{PHL}$	-	1.0	2.0	$\mu\text{s}$	
				Rise time	$t_r$	-	0.2	0.5	$\mu\text{s}$	
				Fall time	$t_f$	-	0.2	0.5	$\mu\text{s}$	
	Instantaneous common mode rejection voltage "Output: High level"	$CM_H$	$T_a = 25^\circ\text{C}, V_{CM} = 600\text{V}(\text{peak})$ $I_F = 10\text{mA}, V_{CC} = 24\text{V}, \Delta V_{O2H} = 2.0\text{V}$	-	-30	-	kV/ $\mu\text{s}$	9		
Instantaneous common mode rejection voltage "Output: Low level"				$CM_L$	$T_a = 25^\circ\text{C}, V_{CM} = 600\text{V}(\text{peak})$ $I_F = 0, V_{CC} = 24\text{V}, \Delta V_{O2L} = 2.0\text{V}$	-	30		-	kV/ $\mu\text{s}$

\*4 When measuring output and transfer characteristics, connect a by-pass capacitor ( 0.01  $\mu\text{F}$  or more ) between  $V_{CC}$  and GND near the device.

\*5  $I_{FLH}$  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

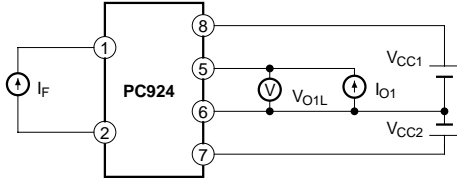


Fig. 3

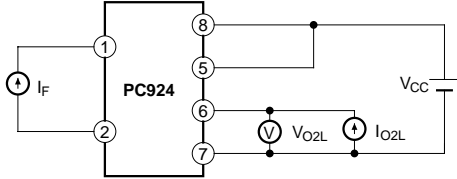


Fig. 5

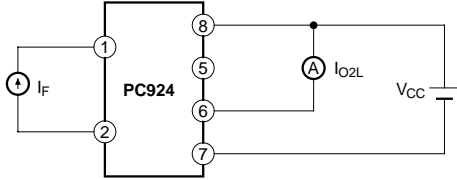


Fig. 7

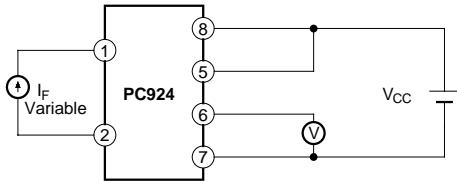


Fig. 9

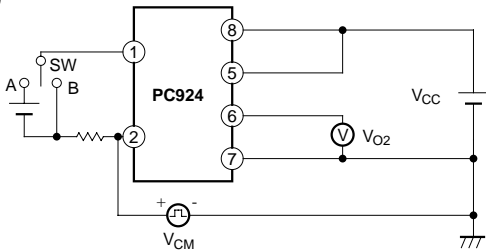


Fig. 2

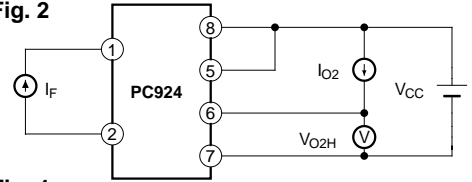


Fig. 4

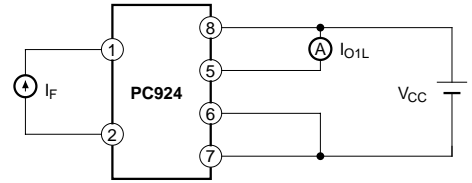


Fig. 6

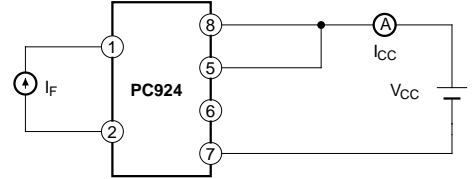
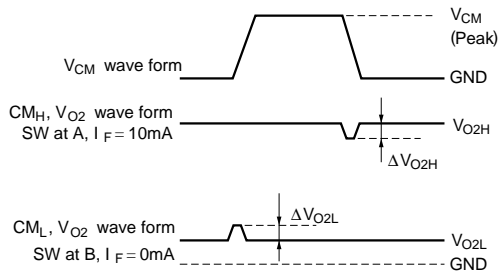
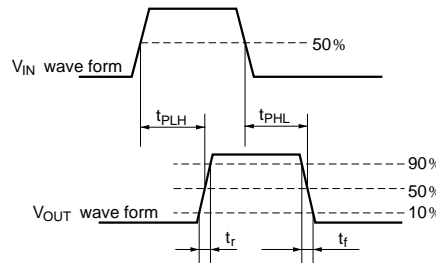
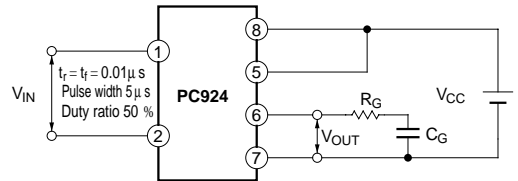
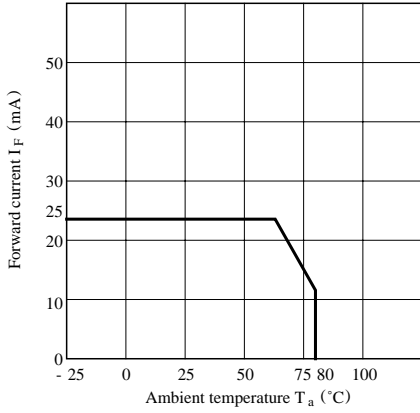


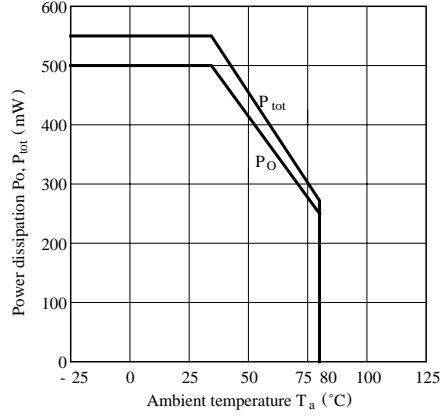
Fig. 8



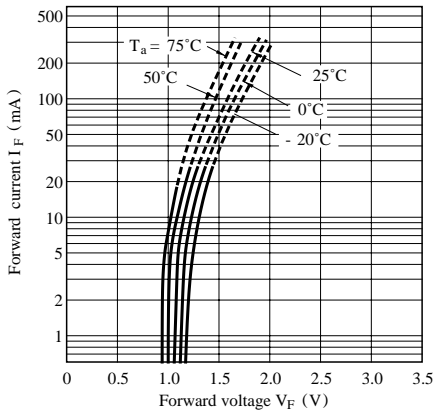
**Fig.10 Forward Current vs. Ambient Temperature**



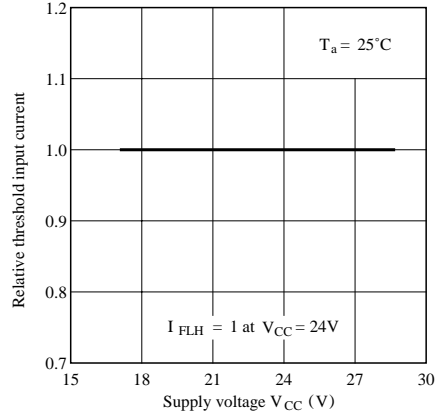
**Fig.11 Power Dissipation vs. Ambient Temperature**



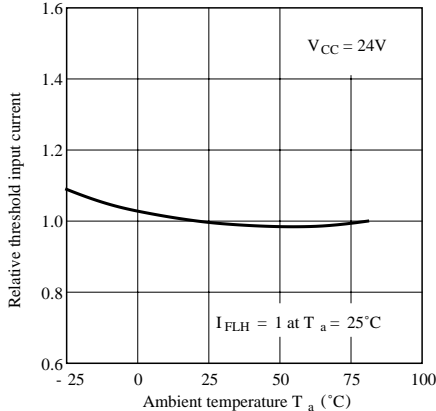
**Fig.12 Forward Current vs. Forward Voltage**



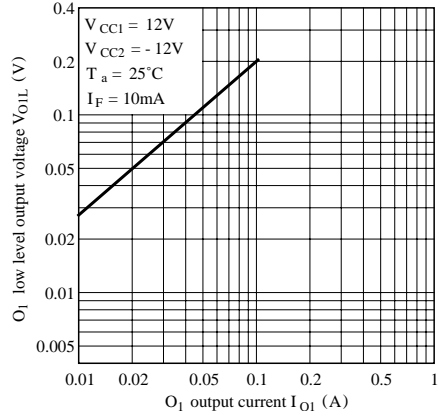
**Fig.13 Relative Threshold Input Current vs. Supply Voltage**



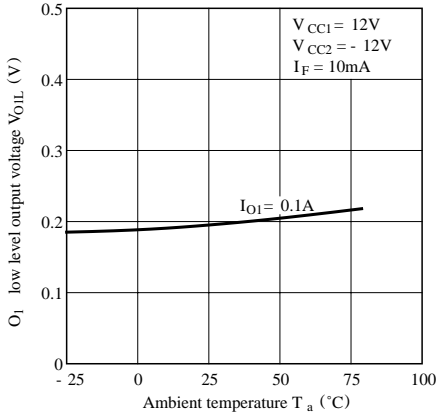
**Fig.14 Relative Threshold Input Current vs. Ambient Temperature**



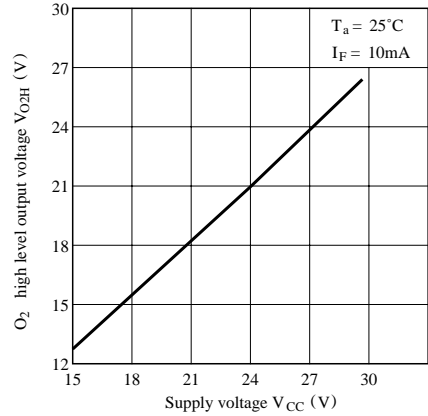
**Fig.15 O<sub>1</sub> Low Level Output Voltage vs. O<sub>1</sub> Output Current**



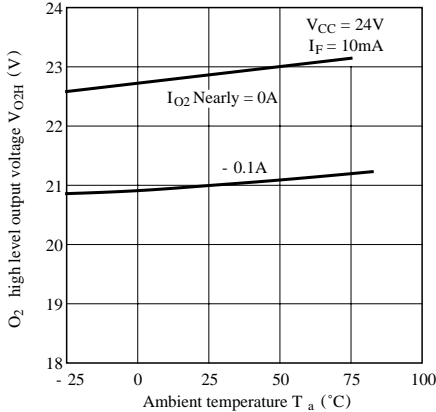
**Fig.16 O<sub>1</sub> Low Level Output Voltage vs. Ambient Temperature**



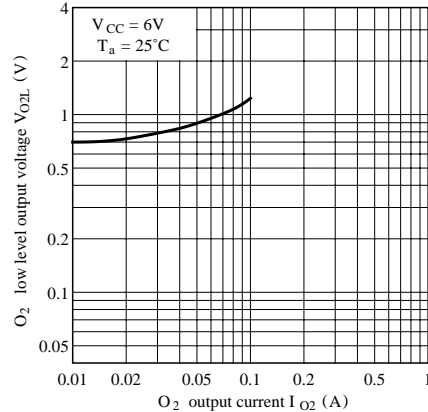
**Fig.17 O<sub>2</sub> High Level Output Voltage vs. Supply Voltage**



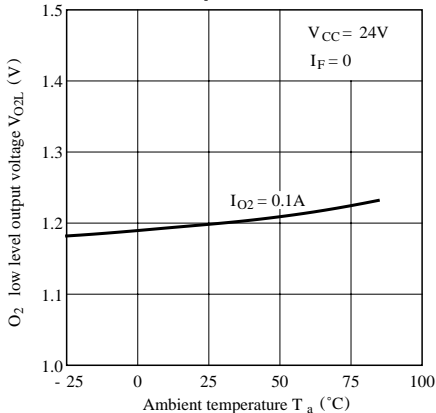
**Fig.18 O<sub>2</sub> High Level Output Voltage vs. Ambient Temperature**



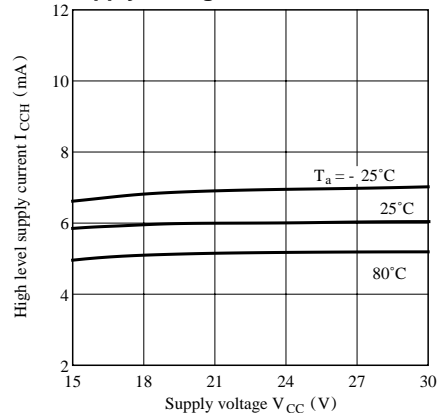
**Fig.19 O<sub>2</sub> Low Level Output Voltage vs. O<sub>2</sub> Output Current**



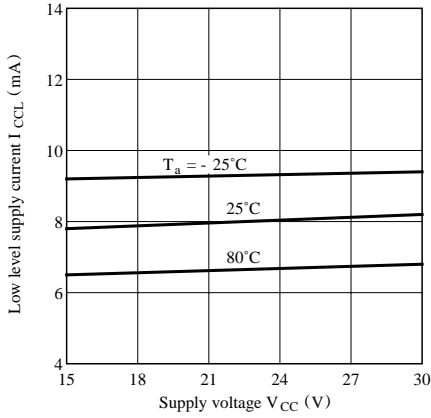
**Fig.20 O<sub>2</sub> Low Level Output Voltage vs. Ambient Temperature**



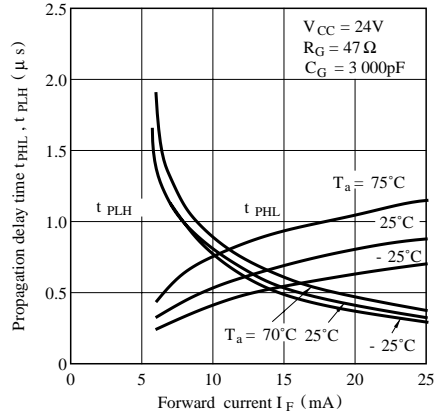
**Fig.21 High Level Supply Current vs. Supply Voltage**



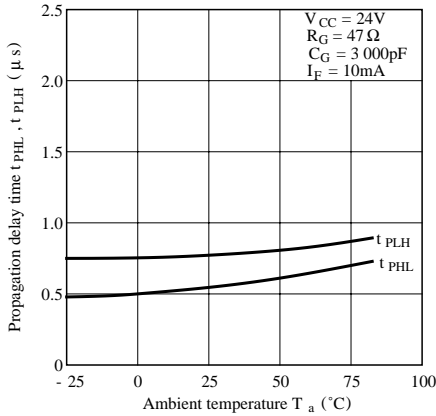
**Fig.22 Low Level Supply Current vs. Supply Voltage**



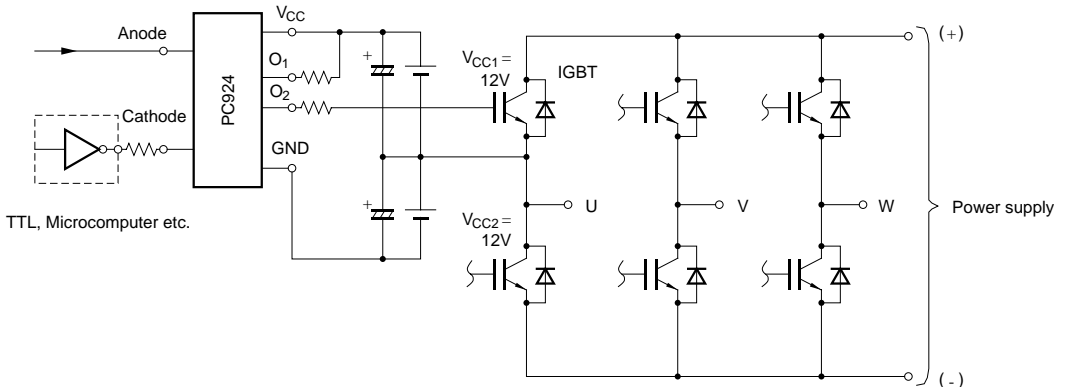
**Fig.23 Propagation Delay Time vs. Forward Current**



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



■ **Application Circuit (IGBT Drive for Inverter)**



● Please refer to the chapter “Precautions for Use”