

6N139

High Sensitivity, High Speed OPIC Photocoupler

■ Features

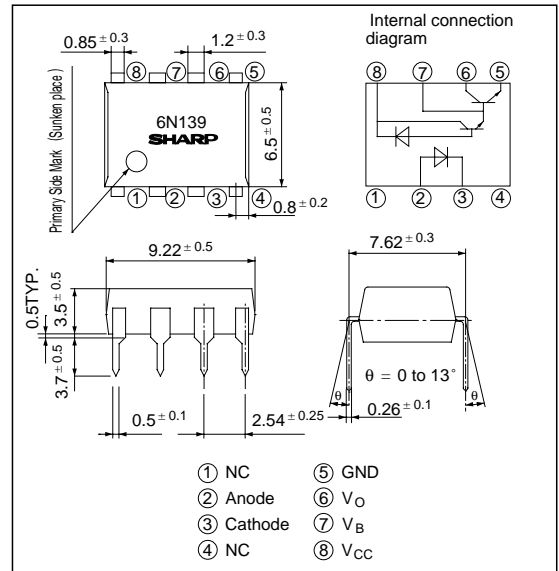
1. High current transfer ratio
(CTR: MIN. 500% at $I_F = 1.6\text{mA}$)
2. High speed response
(t_{PHL} : TYP. $0.2\ \mu\text{s}$ at $R_L = 270\ \Omega$)
3. High common mode rejection voltage
(CM_{IH} : TYP. $500\text{V}/\mu\text{s}$)
4. TTL compatible output
5. Recognized by UL, file No. E64380

■ Applications

1. Interfaces for computer peripherals
2. Computers, measuring instruments, control equipment
3. Telephone sets
4. Signal transmission between circuits of different potentials and impedances

■ 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 = 25°C)

| Parameter | | Symbol | Rating | Unit |
|--------------------------|---|---------------|---------------|-----------|
| Input | Forward current | I_F | 20 | mA |
| | *1 Peak forward current | I_F | 40 | mA |
| | *2 Peak transient forward current | I_{FM} | 1 | A |
| | Reverse voltage | V_R | 5 | V |
| | Power dissipation | P | 35 | mW |
| Output | Supply voltage | V_{CC} | - 0.5 to + 18 | V |
| | Output voltage | V_O | - 0.5 to + 18 | V |
| | Emitter-base reverse withstand voltage (Pin 5 to 7) | V_{EBO} | 0.5 | V |
| | *3 Average output current | I_O | 60 | mA |
| | Power dissipation | P_O | 100 | mW |
| | *4 Isolation voltage | V_{iso} | 2 500 | V_{rms} |
| | Operating temperature | T_{opr} | 0 to + 70 | °C |
| Storage temperature | T_{stg} | - 55 to + 125 | °C | |
| *5 Soldering temperature | T_{sol} | 260 | °C | |

*1 50% duty cycle, Pulse width: 1ms

*2 Pulse width $\leq 1\ \mu\text{s}$, 300pps*3 Decreases at the rate of $0.7\text{mA}/^\circ\text{C}$ if the external temperature is more than 25°C

*4 40 to 60% RH, AC for 1 minute

*5 For 10 seconds

■ Electro-optical Characteristics

(Ta = 0 to + 70°C unless otherwise specified)

| Parameter | Symbol | Conditions | MIN. | TYP. | MAX. | Unit |
|---|-------------|---|------|-----------|------|----------------------------|
| *1 Current transfer ratio | CTR(1) | $I_F = 0.5\text{mA}$, $V_O = 0.4\text{V}$, $V_{CC} = 4.5\text{V}$ | 400 | 1 800 | - | % |
| | CTR(2) | $I_F = 1.6\text{mA}$, $V_O = 0.4\text{V}$, $V_{CC} = 4.5\text{V}$ | 500 | 1 600 | - | % |
| Logic (0) output voltage | $V_{OL(1)}$ | $I_O = 6.4\text{mA}$, $V_{CC} = 4.5\text{V}$, $I_F = 1.6\text{mA}$ | - | 0.1 | 0.4 | V |
| | $V_{OL(2)}$ | $I_O = 15\text{mA}$, $V_{CC} = 4.5\text{V}$, $I_F = 5\text{mA}$ | - | 0.1 | 0.4 | V |
| | $V_{OL(2)}$ | $I_O = 24\text{mA}$, $V_{CC} = 4.5\text{V}$, $I_F = 12\text{mA}$ | - | 0.1 | 0.4 | V |
| Logic (1) output current | I_{OH} | $I_F = 0$, $V_{CC} = V_O = 18\text{V}$ | - | 0.05 | 100 | μA |
| Logic (0) supply current | I_{CCL} | $I_F = 1.6\text{mA}$, $V_{CC} = 5\text{V}$, $V_O = \text{open}$ | - | 0.5 | - | mA |
| Logic (1) supply current | I_{CCH} | $I_F = 0$, $V_{CC} = 5\text{V}$, $V_O = \text{open}$ | - | 10 | - | nA |
| Input forward voltage | V_F | $I_F = 1.6\text{mA}$, $T_a = 25^\circ\text{C}$ | - | 1.5 | 1.7 | V |
| Input forward voltage temperature coefficient | *2 | $I_F = 1.6\text{mA}$ | - | - 1.9 | - | $\text{mV}/^\circ\text{C}$ |
| Input reverse voltage | BV_R | $I_R = 10\mu\text{A}$, $T_a = 25^\circ\text{C}$ | 5.0 | - | - | V |
| Input capacitance | C_{IN} | $V_F = 0$, $f = 1\text{MHz}$ | - | 60 | - | pF |
| *3 Leak current (input-output) | I_{I-O} | $T_a = 25^\circ\text{C}$, 45% RH, $t = 5\text{s}$ $V_{I-O} = 3\text{kV DC}$ | - | - | 1.0 | μA |
| *3 Isolation resistance (input-output) | R_{I-O} | $V_{I-O} = 500\text{V DC}$ | - | 10^{12} | - | Ω |
| *3 Capacitance (input-output) | C_{I-O} | $f = 1\text{MHz}$ | - | 0.6 | - | pF |

*1 Current transfer ratio is a ratio of input current and output current expressed in % .

Note) Typical value : at $T_a = 25^\circ\text{C}$, $V_{CC} = 5\text{V}$

*2 $\Delta V_F / \Delta T_a$

*3 Measured as 2-pin element (Short 1,2,3,4 and 5, 6, 7, 8.)

■ Switching Characteristics

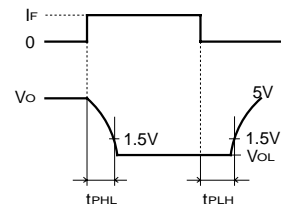
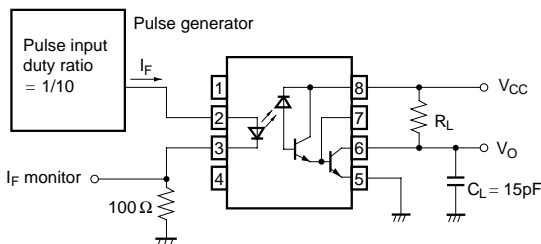
(Ta = 25°C, V_{CC} = 5V)

| Parameter | Symbol | Conditions | MIN. | TYP. | MAX. | Unit |
|--|-----------|---|------|-------|------|------------------------|
| *4 Propagation delay time Output (1) → (0) | t_{PHL} | $R_L = 4.7\text{k}\Omega$, $I_F = 0.5\text{mA}$ | - | 5 | 25 | μs |
| | | $R_L = 270\Omega$, $I_F = 12\text{mA}$ | - | 0.3 | 1 | μs |
| *4 Propagation delay time Output (0) → (1) | t_{PLH} | $R_L = 4.7\text{k}\Omega$, $I_F = 0.5\text{mA}$ | - | 10 | 60 | μs |
| | | $R_L = 270\Omega$, $I_F = 12\text{mA}$ | - | 1.5 | 7 | μs |
| *5 Instantaneous common mode rejection voltage " Output (1) " | CM_H | $I_F = 0$, $V_{CM} = 10\text{V}_{P-P}$ $R_L = 2.2\text{k}\Omega$ | - | 500 | - | $\text{V}/\mu\text{s}$ |
| *6 Instantaneous common mode rejection voltage " Output (0) " | CM_L | $I_F = 1.6\text{mA}$, $V_{CM} = 10\text{V}_{P-P}$ $R_L = 2.2\text{k}\Omega$ | - | - 500 | - | $\text{V}/\mu\text{s}$ |

*5 Instantaneous common mode rejection voltage " output (1) " represents a common mode voltage variation that can hold the output above (1) level ($V_O > 2.0\text{V}$).

*6 Instantaneous common mode rejection voltage " output (0) " represents a common mode voltage variation that can hold the output above (0) level ($V_O < 0.8\text{V}$).

*4 Test circuit for Propagation Delay Time



* 6 Test Circuit for Instantaneous Common Mode Rejection Voltage

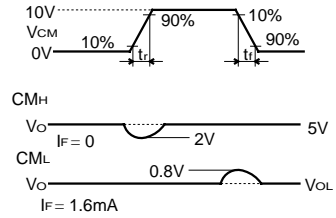
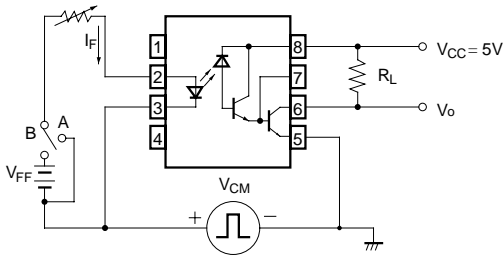


Fig. 1 Forward Current vs. Ambient Temperature

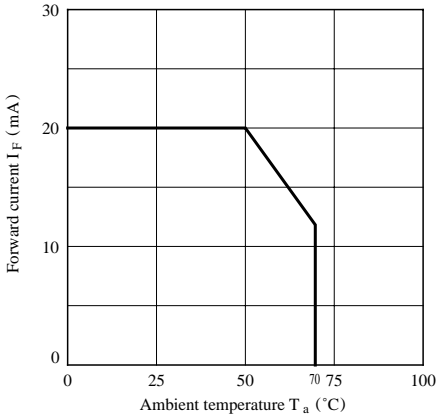


Fig. 2 Power Dissipation vs. Ambient Temperature

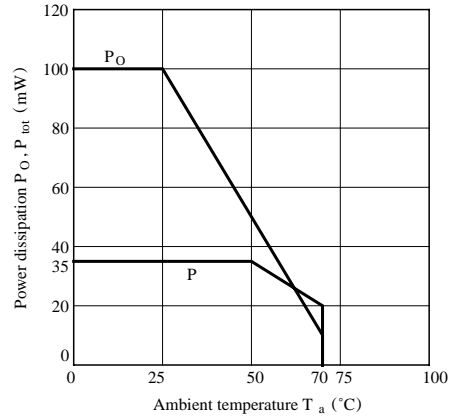


Fig. 3 Forward Current vs. Forward Voltage

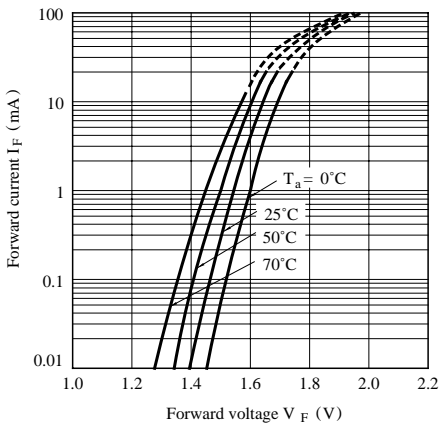


Fig. 4 Output Current vs. Output Voltage

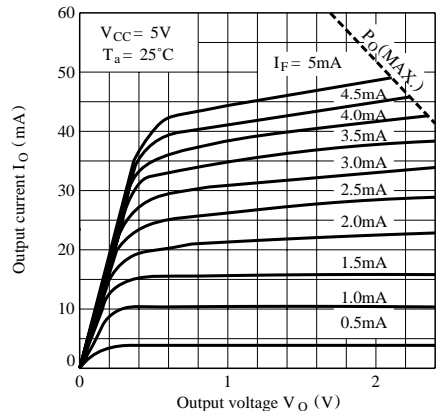


Fig. 5 Current Transfer Ratio vs. Forward Current

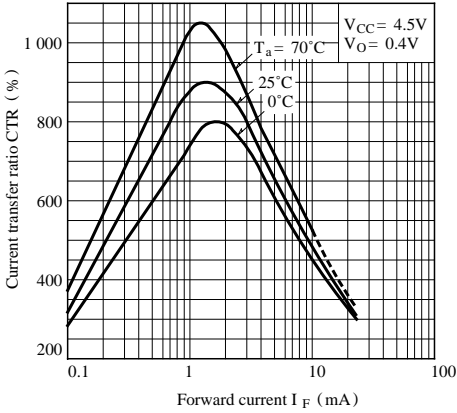


Fig. 6 Output Current vs. Forward Current

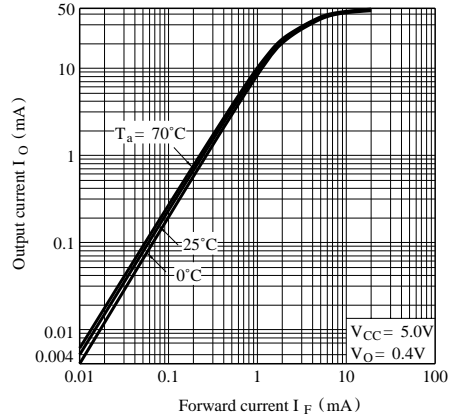


Fig. 7-a Propagation Delay Time vs. Ambient Temperature

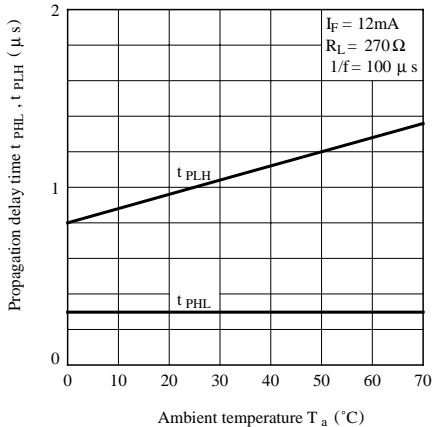


Fig. 7-b Propagation Delay Time vs. Ambient Temperature

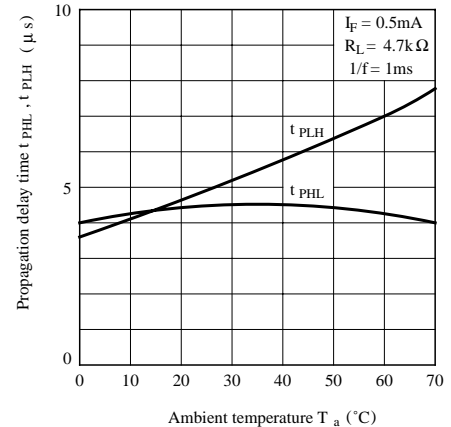


Fig. 8 Rise Time, Fall Time vs. Load Resistance

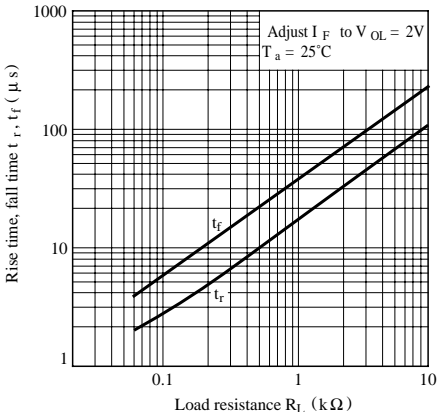
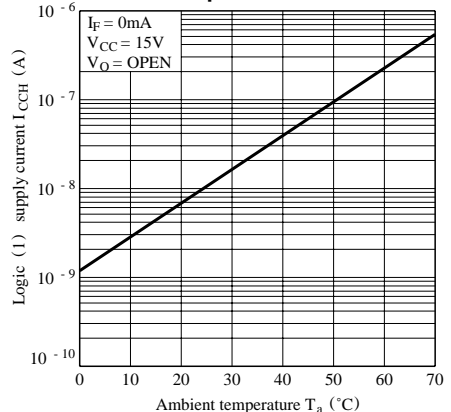
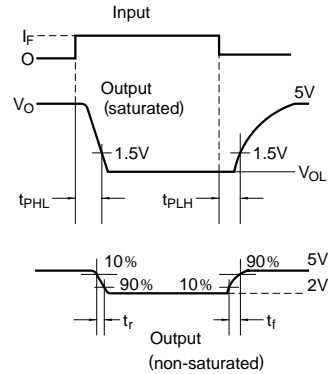
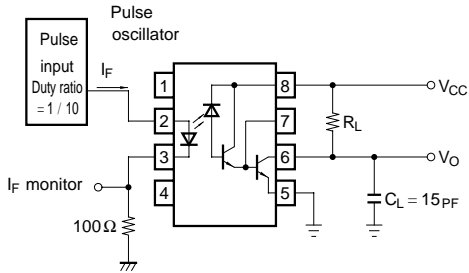


Fig. 9 Logic (1) Supply Current vs. Ambient Temperature



*7 Test Circuit for Rise Time, Fall Time vs. Load Resistance



■ Precautions for Use

- (1) It is recommended that a by-pass capacitor of more than $0.01\mu\text{F}$ be added between V_{CC} and GND near the device in order to stabilize power supply line.
- (2) Transistor of detector side in bipolar configuration is apt to be affected by static electricity for its minute design. When handling them, general counterplan against static electricity should be taken to avoid breakdown of devices or degradation of characteristics.
- (3) As for other general cautions, please refer to the chapter "Precautions for Use".