

6N135/6N136

General Purpose Type Photocoupler

■ Features

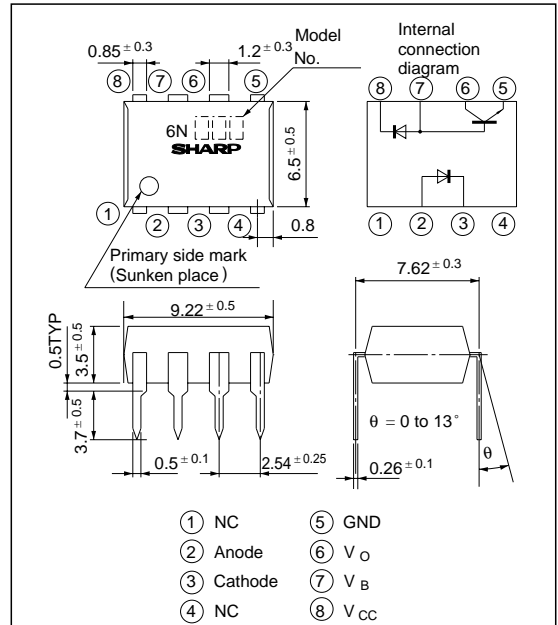
- High speed response t_{PHL} , t_{PLH}
(6N135 : MAX. $1.5 \mu s$ at $R_L = 4.1k\Omega$)
(6N136 : MAX. $0.8 \mu s$ at $R_L = 1.9k\Omega$)
- High common mode rejection voltage
(CM_H : TYP. $1kV/\mu s$)
- Standard dual-in-line package
- Recognized by UL, file No. E64380

■ Applications

- Computers, measuring instruments, control equipment
- High speed line receivers, high speed logic
- Telephone sets
- Signal transmission between circuits of different potentials and impedances

■ Outline Dimensions

(Unit : mm)



■ Absolute Maximum Ratings

(Ta = 25°C)

| Parameter | | Symbol | Rating | Unit |
|--------------------------|---|---------------|---------------|-----------|
| Input | Forward current | I_F | 25 | mA |
| | *1 Peak forward current | I_F | 50 | mA |
| | *2 Peak transient forward current | I_{FM} | 1 | A |
| | Reverse voltage | V_R | 5 | V |
| | Power dissipation | P | 45 | mW |
| Output | Supply voltage | V_{CC} | - 0.5 to + 15 | V |
| | Output voltage | V_O | - 0.5 to + 15 | V |
| | Emitter-base reverse withstand voltage (Pin 5 to 7) | V_{EBO} | 5 | V |
| | Average output current | I_O | 8 | mA |
| | Peak output current | I_{OP} | 16 | mA |
| | Base current (Pin 7) | I_B | 5 | mA |
| | Power dissipation | P_O | 100 | mW |
| | *3 Isolation voltage | V_{iso} | 2 500 | V_{rms} |
| Operating temperature | T_{opr} | - 55 to + 100 | °C | |
| Storage temperature | T_{stg} | - 55 to + 125 | °C | |
| *4 Soldering temperature | T_{sol} | 260 | °C | |

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

Decreases at the rate of $1.6mA/°C$ if the external temperature is $70°C$ or more.*2 Pulse width $\leq 1 \mu s$, 300 p/s

*3 40 to 60% RH, AC for 1 minute

*4 For 10 seconds

* "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.

■ Electro-optical Characteristics

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

| Parameter | Symbol | Conditions | MIN. | TYP. | MAX. | Unit | |
|---|--------------|---|------------------------------------|------------------|------|-------|---|
| *5 Current transfer ratio | 6N135 | CTR(1) | Ta = 25 °C, IF = 16mA | 7.0 | 40 | - | % |
| | 6N136 | CTR(1) | | 19 | 40 | - | % |
| | 6N135 | CTR(2) | IF = 16mA, VO = 0.5V VCC = 4.5V | 5.0 | 43 | - | % |
| | 6N136 | CTR(2) | | 15 | 43 | - | % |
| Logic (0) output voltage | VOL | *7IF = 16mA, VCC = 4.5V | - | 0.1 | 0.4 | V | |
| Logic (1) output current | IOH(1) | Ta = 25 °C, IF = 0 VCC = VO = 5.5V | - | 3.0 | 500 | nA | |
| | IOH(2) | Ta = 25 °C, IF = 0 VCC = VO = 15V | - | 0.01 | 1.0 | μA | |
| | IOH(3) | IF = 0, VCC = VO = 15V | - | - | 50 | μA | |
| Logic (0) supply current | ICCL | IF = 16mA, VCC = 15V VO = open | - | 200 | - | μA | |
| Logic (1) supply current | ICCH(1) | Ta = 25 °C, VCC = 15V VF = open, IO = 0 | - | 0.02 | 1.0 | μA | |
| | ICCH(2) | VCC = 15V VO = open, IF = 0 | - | - | 2.0 | μA | |
| Input forward voltage | VF | Ta = 25 °C, IF = 16mA | - | 1.7 | 1.95 | V | |
| Input forward voltage temperature coefficient | ΔVF/ΔTa | IF = 16mA | - | -1.9 | - | mV/°C | |
| Input reverse voltage | BVR | Ta = 25 °C, IR = 10 μA | 5.0 | - | - | V | |
| Input capacitance | CIN | VF = 0, f = 1MHz | - | 60 | - | pF | |
| *6 Leak current (input-output) | ILO | Ta = 25 °C, 45 % RH, t = 5s VI-O = 3kVDC | - | - | 1.0 | μA | |
| *6 Isolation resistance (input-output) | RI-O | VI-O = 500VDC | - | 10 ¹² | - | Ω | |
| *6 Capacitance (input-output) | CI-O | f = 1MHz | - | 0.6 | - | pF | |
| Transistor current amplification factor | hFE | VO = 5V, IO = 3mA | - | 70 | - | | |

*5 Current transfer ratio is the ratio of input current and output current expressed in % .

*6 Measured as 2-pin element (Short 1, 2, 3, 4)

*7 **6N135** : IO = 1.1mA, **6N136** : IO = 2.4mA

Note) Typical value : at Ta = 25 °C

■ Switching Characteristics

($T_a = 25^\circ\text{C}$, $V_{CC} = 5\text{V}$, $I_F = 16\text{mA}$)

| Parameter | Symbol | Conditions | MIN. | TYP. | MAX. | Unit |
|--|---------------------------|--|------|---------|------|-----------------|
| *8 Propagation delay time Output (1)→(0) | 6N135 t_{PHL} | $R_L = 4.1\text{k}\Omega$ | - | 0.3 | 1.5 | μs |
| | 6N136 t_{PHL} | $R_L = 1.9\text{k}\Omega$ | - | 0.3 | 0.8 | μs |
| *8 Propagation delay time Output (0)→(1) | 6N135 t_{PLH} | $R_L = 4.1\text{k}\Omega$ | - | 0.4 | 1.5 | μs |
| | 6N136 t_{PLH} | $R_L = 1.9\text{k}\Omega$ | - | 0.3 | 0.8 | μs |
| *10,11 Instantaneous common mode rejection voltage “output (1)” | CM_H | *12 $I_F = 0$, $V_{CM} = 10V_{P-P}$ | - | 1 000 | - | $V/\mu\text{s}$ |
| *10,11 Instantaneous common mode rejection voltage “output (0)” | CM_L | *12 $V_{CM} = 10V_{P-P}$, $I_F = 16\text{mA}$ | - | - 1 000 | - | $V/\mu\text{s}$ |
| *13 Bandwidth | BW | $R_L = 100\Omega$ | - | 2.0 | - | MHz |

*8 $R_L = 4.1\text{k}\Omega$ is equivalent to one LSTTL and $6.1\text{k}\Omega$ pull-up resistor. $R_L = 1.9\text{k}\Omega$ is equivalent to one TTL and $5.6\text{k}\Omega$ pull-up resistor.

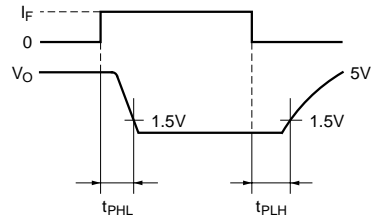
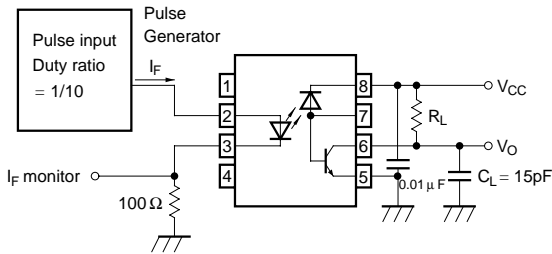
*10 Instantaneous common mode rejection voltage “output (1)” represents a common mode voltage variation that can hold the output above (1) level ($V_O > 2.0\text{V}$).

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

*12 **6N135**: $R_L = 4.1\text{k}\Omega$ **6N136**: $R_L = 1.9\text{k}\Omega$

*13 Bandwidth represents a point where AC input goes down by 3dB.

*9 Test Circuit for Propagation Delay Time



*11 Test Circuit for Instantaneous Common Mode Rejection Voltage

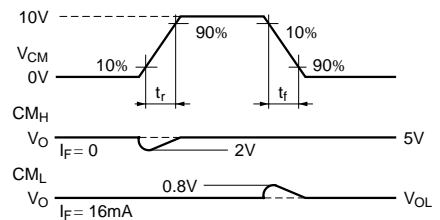
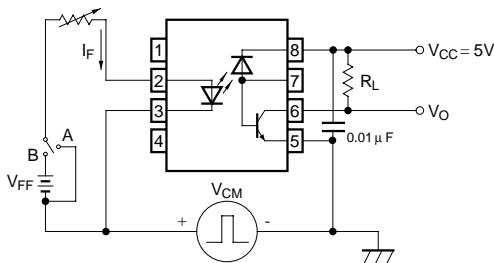


Fig. 1 Forward Current vs. Ambient Temperature

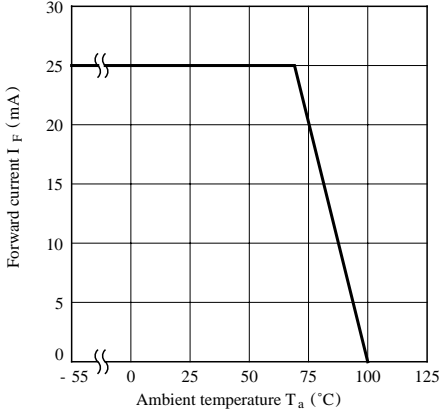


Fig. 2 Power Dissipation vs. Ambient Temperature

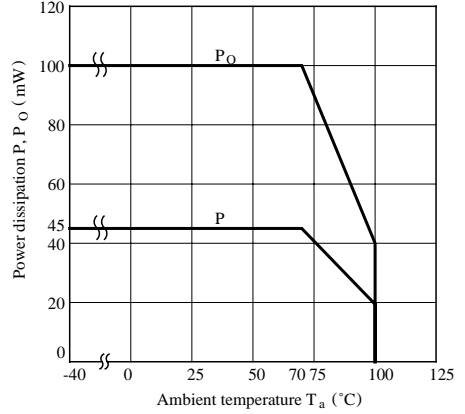


Fig. 3 Forward Current vs. Forward Voltage

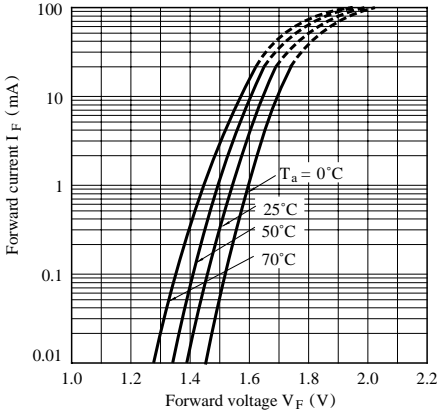


Fig. 4 Relative Current Transfer Ratio vs. Forward Current

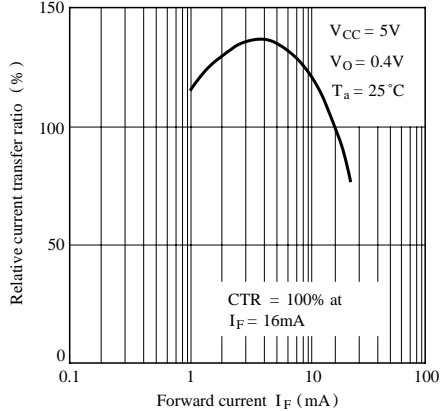


Fig. 5 Output Current vs. Output Voltage

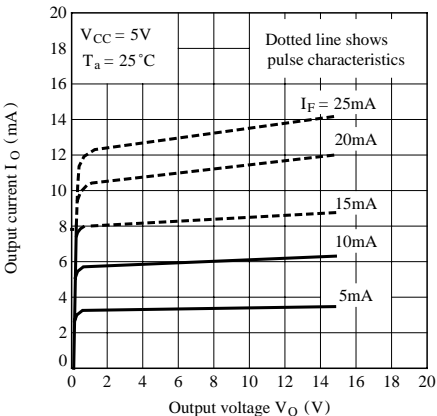


Fig. 6 Relative Current Transfer Ratio vs. Ambient Temperature

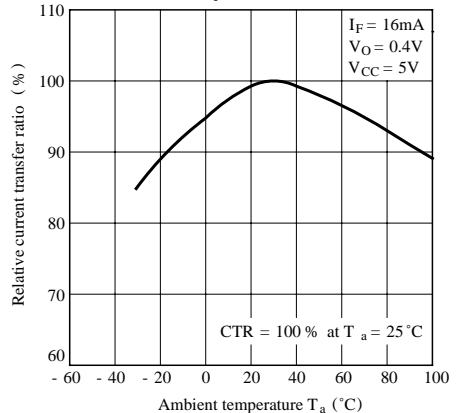


Fig. 7 Propagation Delay Time vs. Ambient Temperature

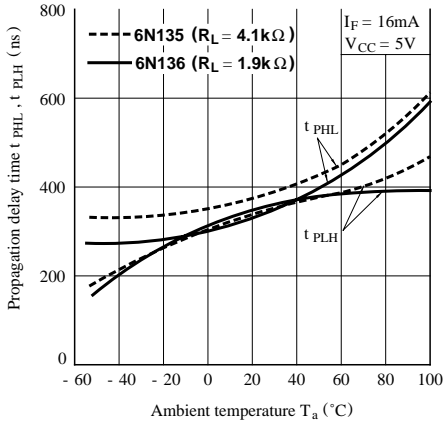


Fig. 8 High Level Output Current vs. Ambient Temperature

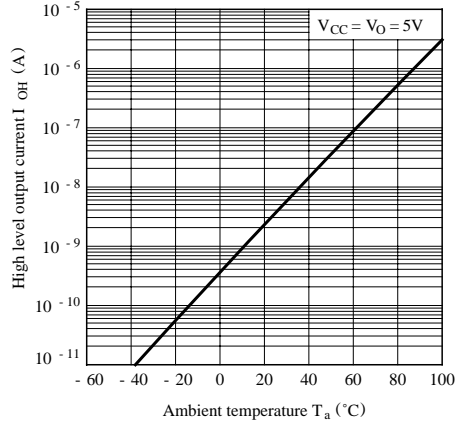
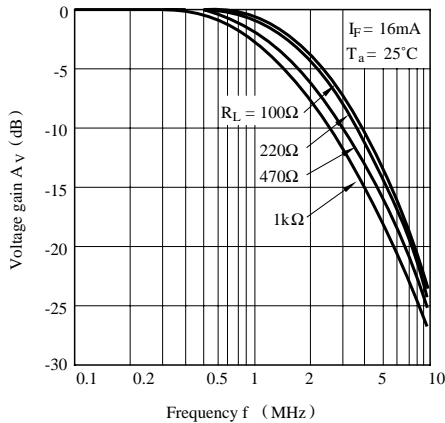
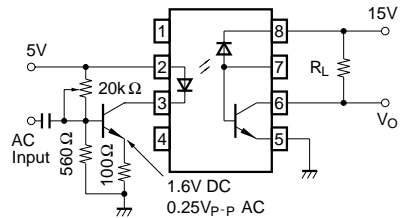


Fig. 9 Frequency Response



Test Circuit for Frequency Characteristic



■ Precautions for Use

- (1) It is recommended that a by-pass capacitor of more than 0.01μ 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.
- As for other general cautions, please refer to the chapter “ Precautions for Use ” .
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