# 6N135/6N136

## General Purpose Type **Photocoupler**

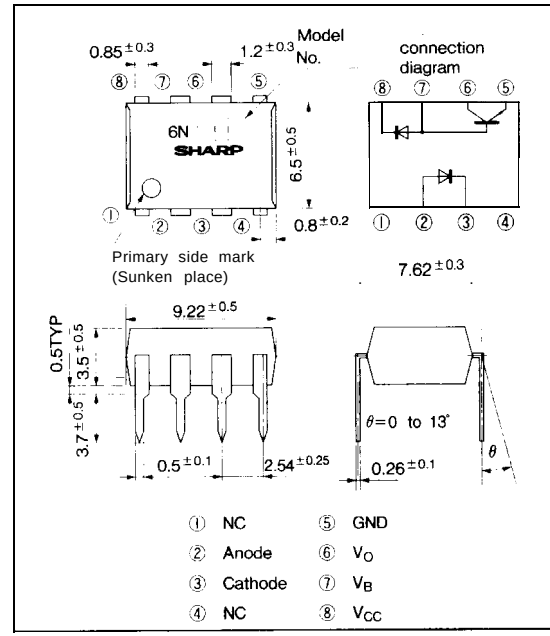
### ■ Features

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

### ■ Applications

1. Computers, measuring instruments, contro 1 equipment
2. High speed line receivers, high speed logic
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 Coloration.
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 | $I_F$ | 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 | 10 | 8 | mA |
| | Peak output current | $I_{OP}$ | 16 | mA |
| | Base current (Pin 7) | $I_B$ | 5 | mA |
| | Power dissipation | P() | 100 | mW |
| | *3 Isolation voltage | $V_{iso}$ | 2 500 | $V_{rms}$ |
| | Operating temperature | $T_{opr}$ | −55 to -100 | ℃ |
| | Storage temperature | $T_{stg}$ | −55 to +125 | ℃ |
| | *4 Soldering temperature | $T_{sol}$ | 260 | ℃ |

*1 50% duty cycle, Pulse width= lms
Decreases at the rate of 1.6mA/℃ if the external temperature is 70℃ or more
*2 Pulse width ≤ 1 μs, 3001,/s
*3 40 tu 60% RH, AC for 1 minute
*4 For 10 seconds

## ■ Electro-optical Characteristics (Ta = O to + 70℃ unless otherwise specified)

| Parameter | | Symbol | Conditions | MIN. | TYP. | MAX | Unit |
|---|---|---|---|---|---|---|---|
| *5Current transfer ratio | 6N135 | CTR(1) | Ta = 25℃, $I_F$ = 16mA | 7.0 | 40 | − | % |
| | 6N136 | CTR(1) | $V_O$ = 0.4V, $V_{CC}$ = 4.5V | 19 | 40 | | % |
| | 6N135 | CTR(2) | $I_F$ = 16mA, $V_O$ = 0.5V | 5.0 | 43 | − | % |
| | 6N136 | CTR(2) | $V_{CC}$ = 4.5V | 15 | 43 | − | % |
| Logic (0) output voltage | | $V_{OL}$ | *7$I_F$ = 16mA, $V_{CC}$ = 4.5V | − | 0.1 | 0.4 | V |
| Logic (1) output current | | $I_{OH}$(1) | $T_a$ = 25℃, $I_F$ = 0<br>$V_{CC}$ = $V_O$ = 5.5V | | 3.0 | 500 | nA |
| | | IOH(2) | $T_a$ = 25℃, $I_F$ = 0<br>$V_{CC}$ = $V_O$ = 15V | − | 0.01 | 1.0 | μA |
| | | IOH (3) | $I_F$ = 0, $V_{CC}$ = $V_O$ = 15V | | | 50 | μA |
| Logic (0) supply current | | $I_{CCL}$ | $I_F$ = 16mA, $V_{CC}$ = 15V<br>$V_O$ = open | − | 200 | − | μA |
| Logic (1) supply current | | $I_{CCH}$(1) | $T_a$ = 25℃, $V_{CC}$ = 15V<br>$V_O$ = open, IF= 0 | − | 0.02 | 1.0 | μA |
| | | $I_{CCH}$(2) | $V_{CC}$ = 15V<br>$V_O$ = open, IF= 0 | | | 2.0 | μA |
| Input forward voltage | | $V_F$ | $T_a$ = 25℃, $I_F$ = 16mA | − | 1.7 | 1.95 | v |
| Input forward voltage temperature coefficient | | $\Delta V_F/\Delta T_a$ | $I_F$ = 16mA | − | −1.9 | - | mV/℃ |
| Input reverse voltage | | BVR | $T_a$ = 25℃, $I_R$ = 10 μA | 5.0 | − | − | v |
| Input capacitance | | $C_{IN}$ | $V_F$ = 0, f = 1 MHz | | 60 | | pF |
| *Leak current (input-output) | | 11.() | $T_a$ = 25℃, 45%RH, t = 5s<br>$V_{I-O}$ = 3kVDC | − | − | 1.0 | μA |
| 'Isolation resistance (input-output) | | $R_{I-O}$ | $V_{I-O}$ = 500VDC | | $10^{12}$ | | Ω |
| 'Capacitance (input-output) | | $C_{I-O}$ | f = 1MHz | | 0.6 | | pF |
| Transistor current amplification factor | | $h_{FE}$ | $V_O$ = 5V, $I_O$ = 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 and 5,6, 7, 8)

*7 **6N135** : $I_O$ = 1.1mA, **6N136** : $I_O$ = 2.4mA

Note) Typical volue : at Ta= 25℃

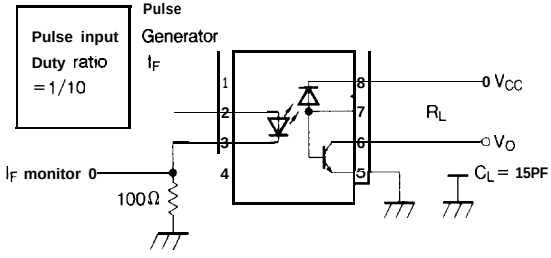
## ■ Switching Characteristics

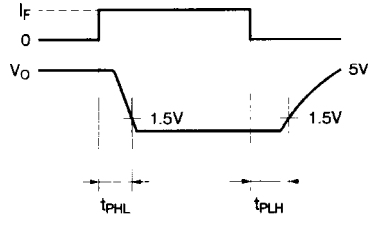
(Ta = 25℃, $V_{CC}$ = 5V, $I_F$ = 16mA)

| Parameter | | Symbol | Conditions | MIN. | TYP. | MAX. | Unit |
|---|---|---|---|---|---|---|---|
| *8Propagation *9delay time Output (1)→(0) | 6N135 | $t_{PHL}$ | $R_L$ = 4.1kΩ | — | 0.3 | 1.5 | μs |
| | 6N136 | $t_{PHL}$ | $R_L$ = 1.9kΩ | | 0.3 | 0.8 | μs |
| *8Propagation *9delay time Output (0)→(1) | 6N135 | $t_{PLH}$ | $R_L$ = 4.1kΩ | — | 0.4 | 1.5 | μs |
| | 6N136 | $t_{PLH}$ | $R_L$ = 1.9kΩ | | 0.3 | 0.8 | μs |
| *10,11Instantaneous common mode rejection voltage "output (1)" | | $CM_H$ | *12$I_F$ = 0, $V_{CM}$ = 10$V_{P-P}$ | — | 1 000 | — | V/μs |
| *10,11Instantaneous common mode rejection voltage "output (0)" | | CML | *12$V_{CM}$ = 10$V_{P-P}$, $I_F$ = 16mA | — | −1 000 | — | V/μs |
| *13Bandwidth | | BW | $R_L$ = 100Ω | — | 2.0 | — | MHz |

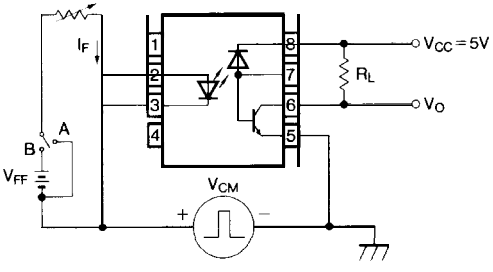
*8 $R_L$ = 4.1kΩ is equivalent to one LSTTL and 6.1kΩ pull-up resistor.
*10 Instantaneous common mode rejection voltage "output (1)" represents a common mode voltage variation that can hold the output above (1) level ($V_O$ > 2.0V). Instantaneous common mode rejection voltage "output (0)" represents a common mode voltage variation that can hold the output above (0) level ($V_O$ < 0.8V).
*12 **6N135** : $R_L$ = 4.1kΩ 6N136: $R_L$ = 1.9kΩ
*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



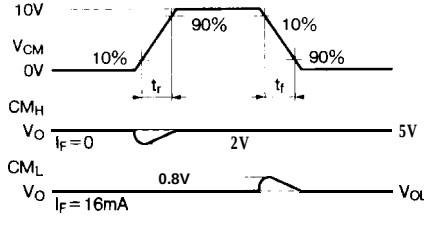



**Fig. 1 Forward Current vs. Ambient Temperature**

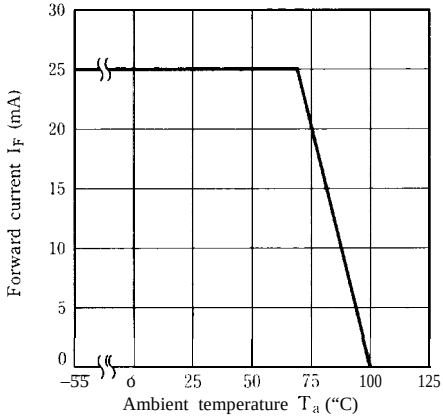



**Fig. 2 Power Dissipation vs. Ambient Temperature**

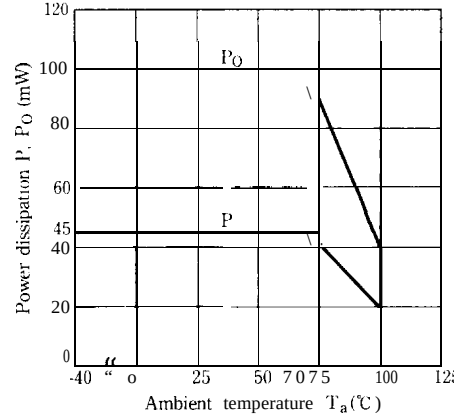



Fig. 3 Forward **Current vs. Forward Voltage**

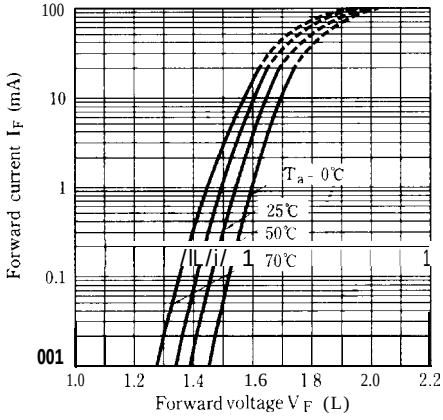



**Fig. 4 Relative Current Transfer Ratio** ve. Forward **Current**

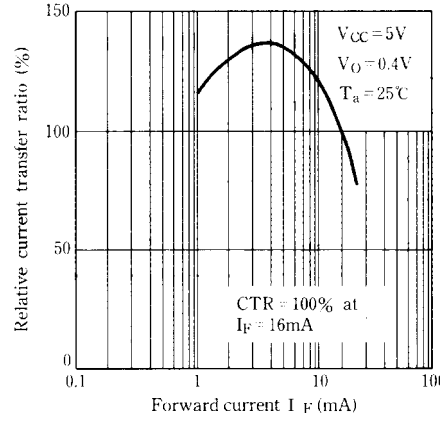



**Fig. 5 Output Current vs. Output Voltage**

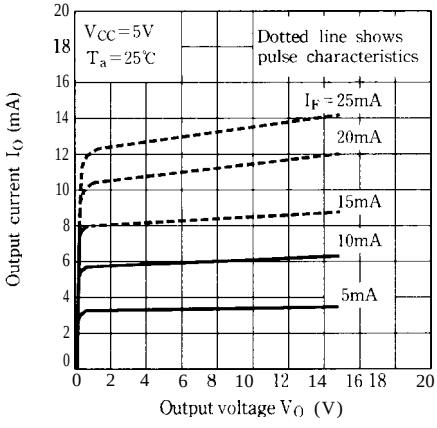



**Fig. 6 Relative Currant Transfer Ratio vs. Ambient Temperature**

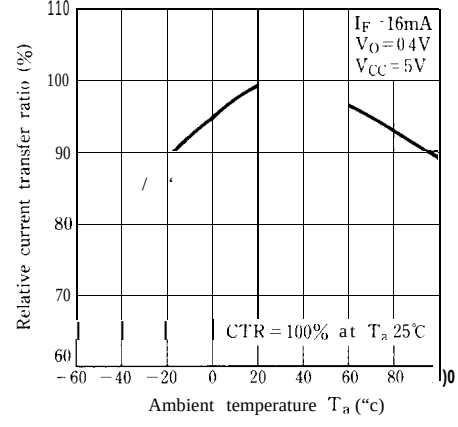


Fig. 7 **Propagation Delay Time vs. Ambient Temperature**

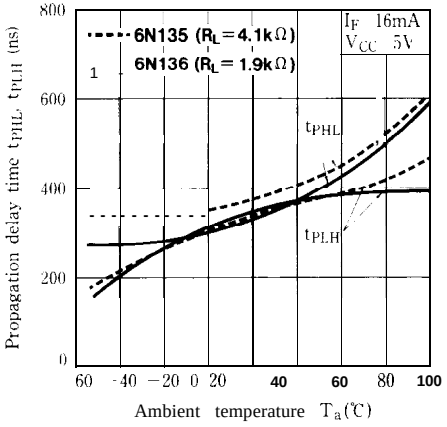



**Fig. 8 High Level Output Current vs. Ambient Temperature**

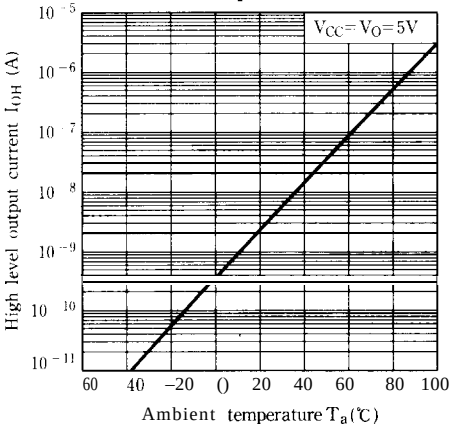
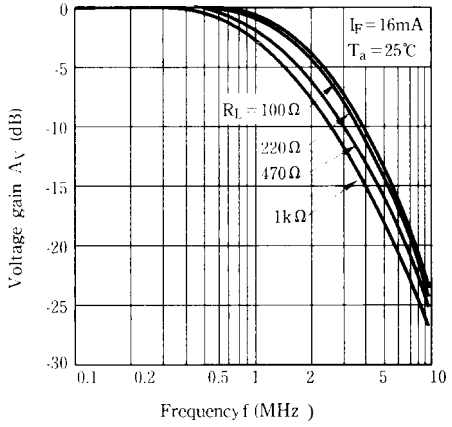
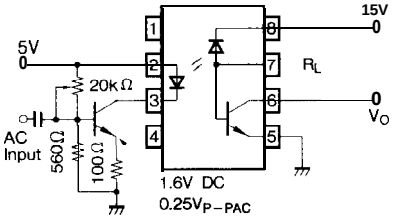



**Fig. 9 Frequency Response**




**Test Circuit for Frequency Characteristic**




## ■ Precautions for Use

(1) It is recommended that a by-pass capacitor of more than 0.01 μF be added between $V_{CC}$ and GND near the device in order to stabilize power supply line.

(2) Transistor or 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" (Page 78 to 93)