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## Contact us

Tel: +86-755-8981 8866 Fax: +86-755-8427 6832

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Address: A1208, Overseas Decoration Building, #122 Zhenhua RD., Futian, Shenzhen, China



# 6N138

## High Sensitivity, High Speed \*OPIC Photocoupler

### Features

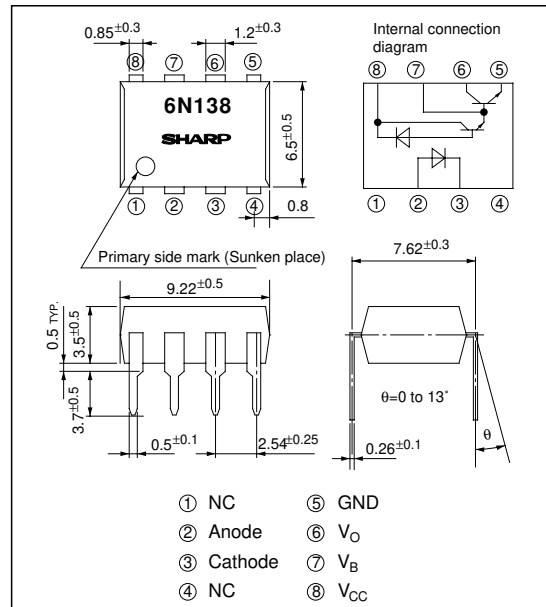
1. High current transfer ratio  
(CTR : MIN. 300% at  $I_F=1.6\text{mA}$  )
2. High speed response  
(  $t_{PHL1}$  : TYP.  $2\mu\text{s}$  at  $R_L=2.2\text{k}\Omega$  )
3. Instantaneous common mode rejection voltage  
(  $CM_H$  : TYP.  $500\text{V}/\mu\text{s}$  )
4. TTL compatible output
5. Recognized by UL, file No. E64380

### Applications

1. Interfaces for computer peripherals
2. 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

(  $T_a=25^\circ\text{C}$  )

	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 +7	V
	Output voltage	$V_O$	-0.5 to +7	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	$V_{iso(rms)}$	2.5	kV
	Operating temperature	$T_{opr}$	0 to +70	$^\circ\text{C}$
	Storage temperature	$T_{sg}$	-55 to +125	$^\circ\text{C}$
	*5 Soldering temperature	$T_{sol}$	260	$^\circ\text{C}$

\*1 50% duty cycle, Pulse width=1ms

\*2 Pulse width $\leq 1\mu\text{s}$ , 300pulse/s

\*3 Decreases at the rate of  $0.7\text{mA}/^\circ\text{C}$  if the external temperature is  $25^\circ\text{C}$  or more.

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

\*5 For 10 seconds

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Internet Internet address for Electronic Components Group <http://www.sharp.co.jp/ecg/>

■ Electro-optical Characteristics

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

Parameter	Symbol	Conditions	MIN.	TYP.	MAX.	Unit
*6 Current transfer ratio	CTR	I <sub>F</sub> =1.6mA, V <sub>O</sub> =0.4V, V <sub>CC</sub> =4.5V	300	1 600	–	%
Logic (0) output voltage	V <sub>OL</sub>	I <sub>O</sub> =4.8mA, V <sub>CC</sub> =4.5V, I <sub>F</sub> =1.6mA	–	0.1	0.4	V
Logic (1) output current	I <sub>OH</sub>	I <sub>F</sub> =0, V <sub>CC</sub> =V <sub>O</sub> =7V	–	0.1	250	μA
Logic (0) supply current	I <sub>CC1</sub>	I <sub>F</sub> =1.6mA, V <sub>CC</sub> =5V, V <sub>O</sub> =open	–	0.5	–	mA
Logic (1) supply current	I <sub>CC2</sub>	I <sub>F</sub> =0, V <sub>CC</sub> =5V, V <sub>O</sub> =open	–	10	–	nA
Input forward voltage	V <sub>F</sub>	I <sub>F</sub> =1.6mA, Ta=25°C	–	1.5	1.7	V
Input forward voltage temperature coefficient	*7	I <sub>F</sub> =1.6mA	–	-1.9	–	mV/°C
Input reverse voltage	BV <sub>R</sub>	I <sub>R</sub> =10μA, Ta=25°C	5.0	–	–	V
Input capacitance	C <sub>IN</sub>	V <sub>F</sub> =0, f=1MHz	–	60	–	pF
*8 Leak current (input-output)	I <sub>I-O</sub>	Ta=25°C, 45%RH, t=5s V <sub>I-O</sub> =3kV DC	–	–	1.0	μA
*8 Isolation resistance (input-output)	R <sub>I-O</sub>	V <sub>I-O</sub> =500V DC	–	10 <sup>12</sup>	–	Ω
*8 Capacitance (input-output)	C <sub>I-O</sub>	f=1MHz	–	0.6	–	pF

\*6 Current transfer ratio is the ratio of input current and output current expressed in %.

Note) Type value : at Ta=25°C

\*7 ΔV<sub>F</sub> / ΔT<sub>a</sub>

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

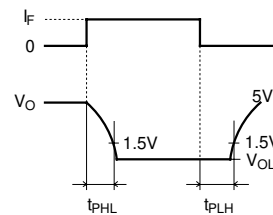
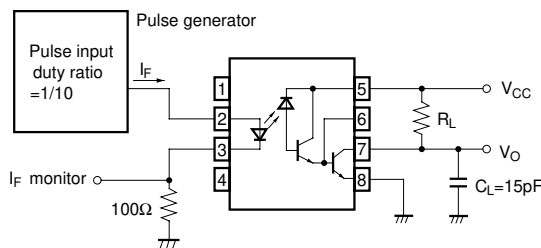
■ Switching Characteristics

(Ta=25°C, V<sub>CC</sub> =5V)

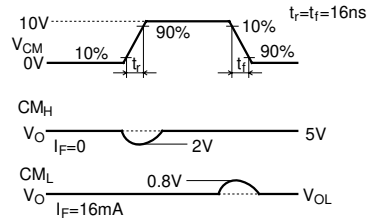
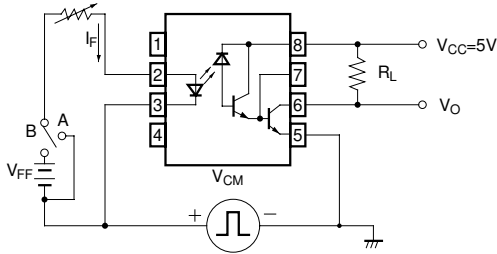
Parameter	Symbol	Conditions	MIN.	TYP.	MAX.	Unit
*9 Propagation delay time Output (1) → (0)	t <sub>PHL</sub>	I <sub>F</sub> =1.6mA R <sub>L</sub> =2.2kΩ	–	2	10	μs
*9 Propagation delay time Output (0) → (1)	t <sub>PLH</sub>	I <sub>F</sub> =1.6mA R <sub>L</sub> =2.2kΩ	–	7	35	μs
*10 Instantaneous common mode rejection voltage " output (1) "	CM <sub>H</sub>	I <sub>F</sub> =0, V <sub>CM</sub> =10V P-P R <sub>L</sub> =2.2kΩ	–	500	–	V/μs
*10 Instantaneous common mode rejection voltage " output (0) "	CM <sub>L</sub>	I <sub>F</sub> =1.6mA, V <sub>CM</sub> =10V P-P R <sub>L</sub> =2.2kΩ	–	-500	–	V/μs

\*10 Instantaneous common mode rejection voltage " output (1) " represents  
a common mode voltage variation that can hold the output above (1) level (V<sub>O</sub>>2.0V)  
Instantaneous common mode rejection voltage " output (0) " represents  
a common mode voltage variation that can hold the output above (0) level (V<sub>O</sub><0.8V)

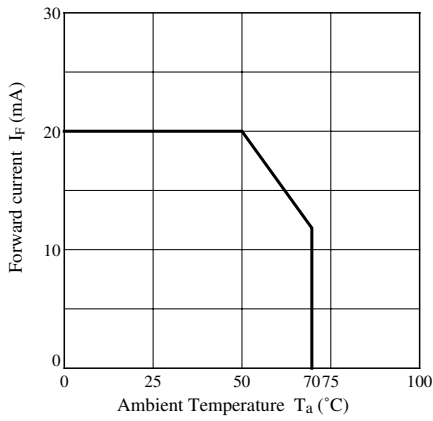
\*9 Test Circuit for Propagation Delay Time



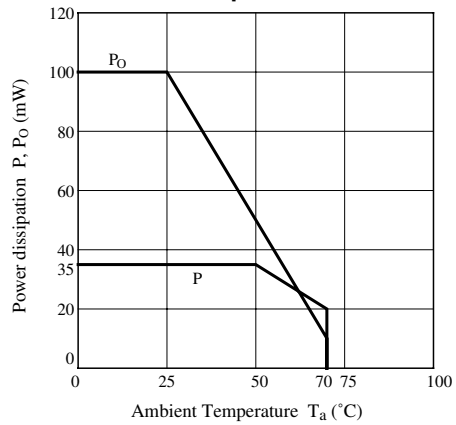
**\*11 Test Circuit for Instantaneous Common Mode Rejection Voltage**



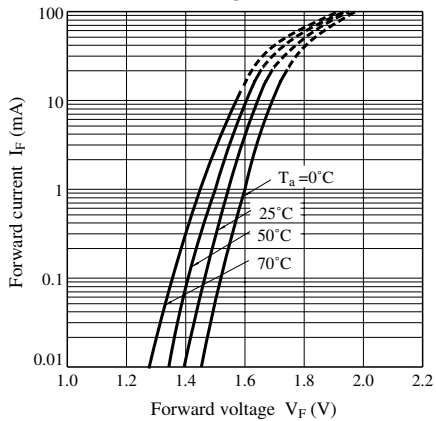
**Fig. 1 Forward Current vs. Ambient Temperature**



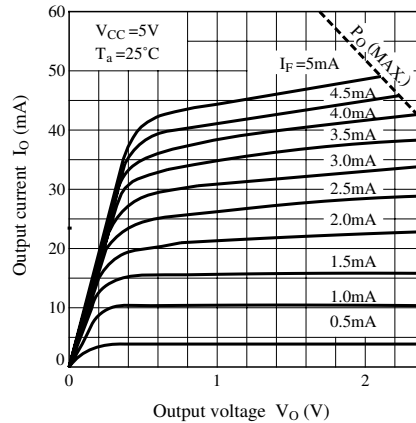
**Fig. 2 Power Dissipation vs. Ambient Temperature**



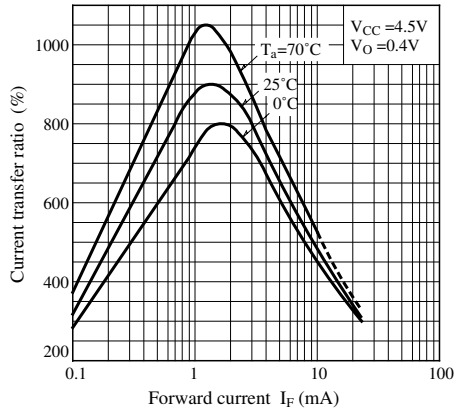
**Fig. 3 Forward Current vs. Forward Voltage**



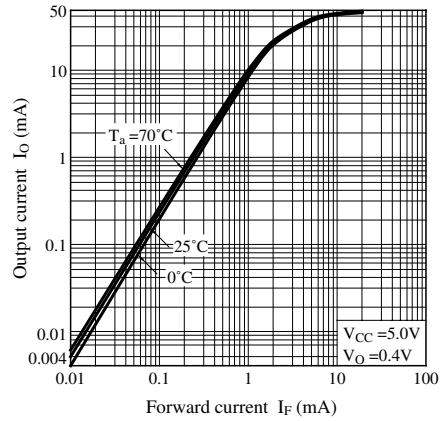
**Fig. 4 Output Current vs. Output Voltage**



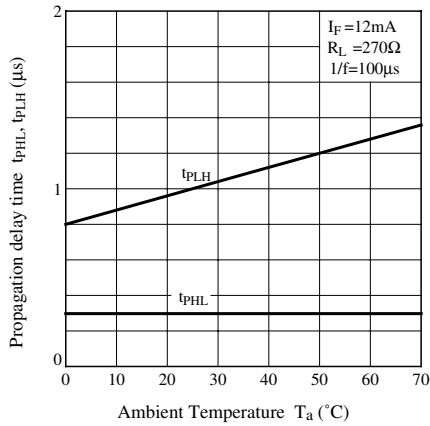
**Fig. 5 Current Transfer Ratio vs. Forward Current**



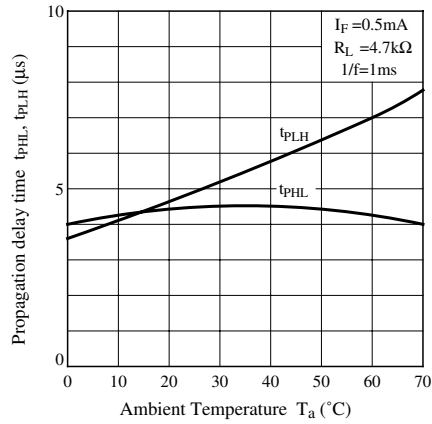
**Fig. 6 Output Current vs. Forward Current**



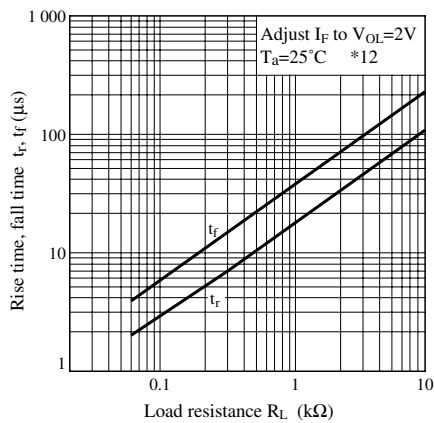
**Fig. 7-a Propagation Delay Time vs. Ambient Temperature**



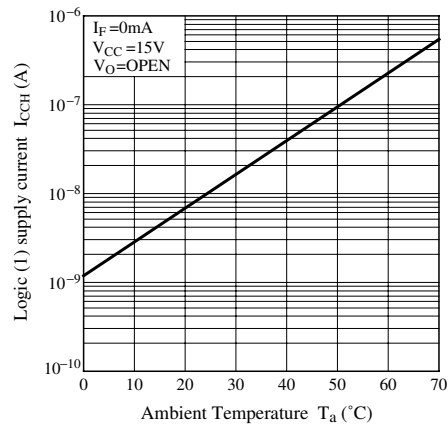
**Fig. 7-b Propagation Delay Time vs. Ambient Temperature**



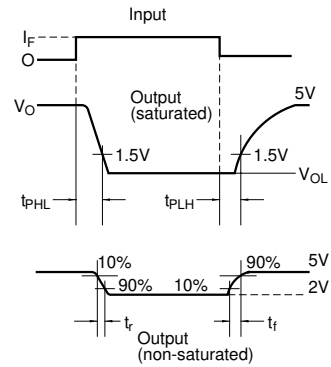
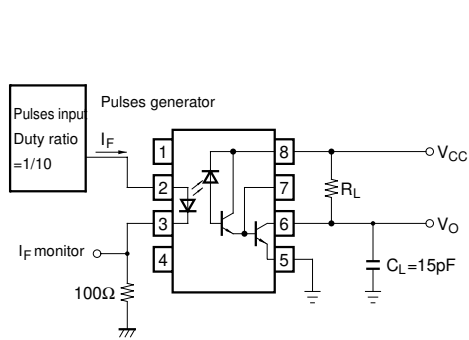
**Fig. 8 Rise Time, Fall Time vs. Load Resistance**



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



### \*12 Test Circuit for Rise Time, Fall Time vs. Load Resistance



#### ■ Precaution 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.



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