High Sensitivity, High Speed Photocoupler

6N139 Series

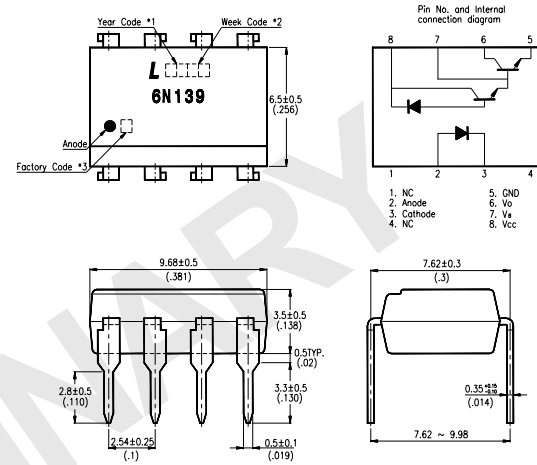
Features

- High current transfer ratio
  (CTR : MIN. 500% at I_F = 1.6mA)
- High speed response
  (t_{PHL} : TYP. 0.2 μ s at R_L = 270 Ω)
- Instantaneous common mode rejection voltage
  (CM_H : TYP. 500V/ μ s)
- TTL compatible output
- Options Available :
  - Leads with 0.4" (10.16mm) Spacing (M Type)
  - Lead Bends for Surface Mounting (S Type)
  - Tape and Reel of Type I for SMD (Add "-TA" Suffix)
  - Tape and Reel of Type II for SMD (Add "-TA1" Suffix)
  - VDE 0884 Approvals (Add "-V" Suffix)

Applications

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

Package Dimensions



NOTES :

1. Year date code.
2. 2-digit work week.
3. Factory code shall be marked (Z : Taiwan, Y : Thailand).
4. All dimensions are in millimeters (inches).
5. Tolerance is $\pm$ 0.25mm (.010") unless otherwise noted.
6. Specifications are subject to change without notice.

Ordering Information

Part Number	Package	Application part number
6N139 6N139M 6N139S 6N139S-TA 6N139S-TA1	8-pin DIP 8-pin (leads with 0.4" spacing) 8-pin (lead bends for surface mount) 8-pin (tape and reel packaging of type I) 8-pin (tape and reel packaging of type II)	6N139
6N139-V 6N139M-V 6N139S-V 6N139STA-V 6N139STA1-V	8-pin DIP 8-pin (leads with 0.4" spacing) 8-pin (lead bends for surface mount) 8-pin (tape and reel packaging of type I) 8-pin (tape and reel packaging of type II)	6N139

Ratings and Characteristics
Absolute Maximum Ratings

(Ta=25℃)

Parameter		Symbol	Rating	Unit
Input	Forward Current	I_F	20	mA
	Reverse Voltage	V_R	5	V
	Power Dissipation	P	35	mW
Output	Supply Voltage	V_{CC}	-0.5~+18	V
	Output Voltage	V_O	-0.5~+18	V
	Emitter-base Reverse Withstand Voltage (pin 5 to 7)	V_{EBO}	0.5	V
	Average Output Current	I_O	60	mA
	Power Dissipation	P_O	100	mW
*1.Isolation Voltage		V_{iso}	2,500	Vrms
Operating Temperature		T_{opr}	0~+70	℃
Storage Temperature		T_{stg}	-55~+125	℃
*2.Soldering Temperature		T_{sol}	260	℃

*1. AC for 1 minute, R.H. = 40 ~ 60%
Isolation voltage shall be measured using the following method.
(1) Short between anode and cathode on the primary side and between collector and emitter on the secondary side.
(2) The isolation voltage tester with zero-cross circuit shall be used.
(3) The waveform of applied voltage shall be a sine wave.
*2. For 10 seconds

Electrical / Optical Characteristics

(Ta = 0 ~ +70℃ unless otherwise specified)

Parameter	Symbol	Min.	Typ.	Max.	unit	Conditions
Input Forward Voltage	V_F	–	–	1.7	V	Ta=25℃, I_F=1.6mA
Input Forward Voltage Temperature Coefficient	$\triangle V_F / \triangle T_a$	–	-1.9	–	mV/℃	I_F=1.6mA
Input Reverse Voltage	BV_R	5.0	–	–	V	Ta=25℃, I_R=10 μA
Input Capacitance	C_{IN}	–	60	–	pF	V_F=0, f=1MHz
*1 Current Transfer Ratio	CTR	400	1800	–	%	I_F=0.5mA, V_O=0.4V V_{CC}=4.5V
		500	1600	–	%	I_F=1.6mA, V_O=0.4V V_{CC}=4.5V
Logic (0) Output Voltage	V_{OL}	–	0.1	0.4	V	I_F=1.6mA V_{CC}=4.5V I_O=6.4mA
		–	0.1	0.4	V	I_F=5mA V_{CC}=4.5V I_O=15mA
		–	0.1	0.4	V	I_F=12mA V_{CC}=4.5V I_O=24mA
Logic (1) Output Current	I_{OH}	–	0.05	100	μA	I_F=0, V_{CC}=V_O=18V
Logic (0) Supply Current	I_{CCL}	–	0.5	1.5	mA	I_F=1.6mA, V_{CC}=5V V_O=open
Logic (1) Supply Current	I_{CCH}	–	0.01	10	μA	I_F=0, V_{CC}=5V V_O=open
*2 Leak Current (Input-Output)	I_{I-O}	–	–	1.0	μA	Ta=25℃, 45%RH, t=5s, V_{I-O}=3kV DC
*2 Isolation Resistance (Input-Output)	R_{I-O}	–	10^{12}	–	Ω	V_{I-O}=500VDC
Capacitance (Input-Output)	C_{I-O}	–	0.6	–	pF	f=1MHz

*1. Current transfer ratio is the ratio of input current and output current expressed in %.
*2. Measured as 2-pin element (Short 1, 2, 3, 4 and 5, 6, 7, 8)

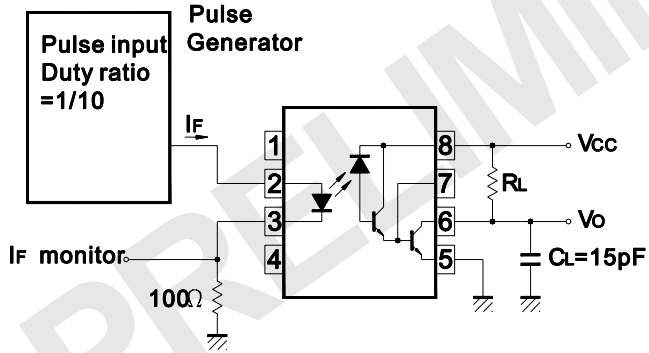
● Electrical / Optical Characteristics

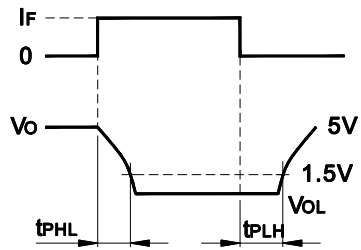
(Ta = 25℃ V_{CC} = 5V)

Parameter	Symbol	Min.	Typ.	Max.	Unit	Conditions
Propagation Delay time Output (1)➡(0)	t_{PHL}	–	5	25	μs	I_F=0.5mA, R_L=4.7kΩ
		–	0.5	1	μs	I_F=12mA, R_L=270Ω
Propagation Delay time Output (0)➡(1)	t_{PLH}	–	10	60	μs	I_F=0.5mA, R_L=4.7kΩ
		–	1.5	7	μs	I_F=12mA, R_L=270Ω
*3 Instantaneous common mode rejection voltage "output(1)"	CM_H	–	500	–	V/μs	I_F=0, V_{CM}=10V_{P-P1} R_L=2.2kΩ
*3 Instantaneous common mode rejection voltage "output(0)"	CM_L	–	-500	–	V/μs	V_{CM}=10V_{P-P}, I_F=1.6mA R_L=2.2kΩ

*3 Instantaneous common mode rejection voltage "output (1)" represents a common mode voltage variation that can hold the output above (1) level (Vo>2.0V).
Instantaneous common mode rejection voltage "output (0)" represents a common mode voltage variation that can hold the output above (0) level (Vo<0.8V).

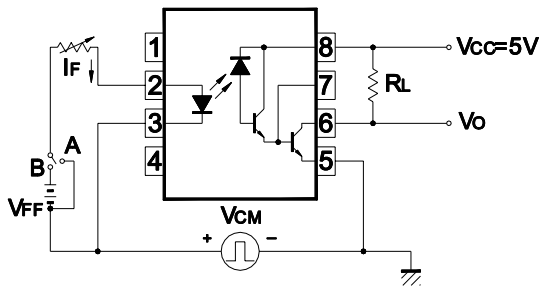
Test Circuit for Propagation Delay Time

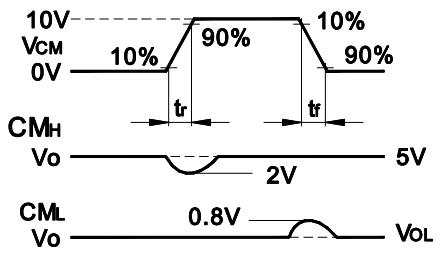




Test Circuit for Instantaneous Common Mode Rejection Voltage

t_r=t_f=16ns





Typical Electrical/Optical Characteristic Curves (25℃Ambient Temperature Unless Otherwise Noted)

Fig.1 Forward Current vs. Ambient Temperature

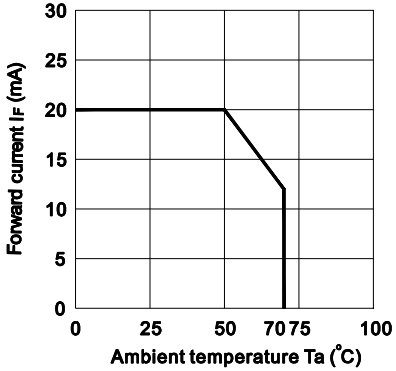


Fig.2 Power Dissipation vs. Ambient Temperature

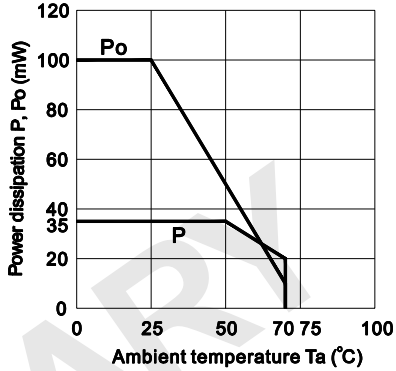


Fig.3 Forward Current vs. Forward Voltage

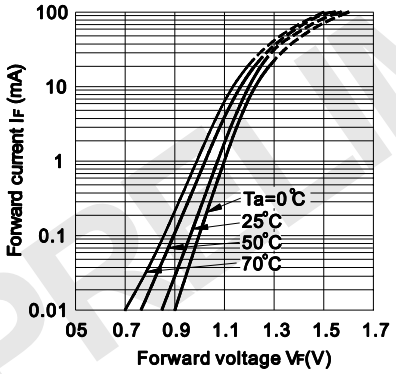


Fig.4 Relative Current Transfer Ratio vs. Forward Current

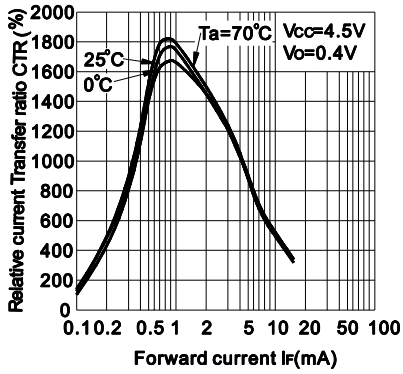


Fig.5 Output Current vs. Output Voltage

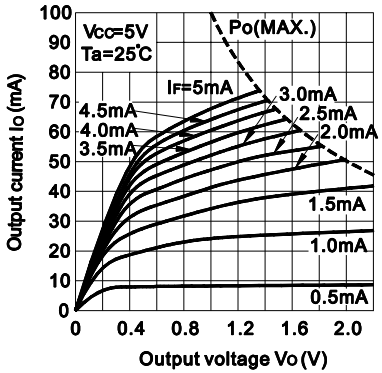


Fig.6 Output Current vs. Forward Current

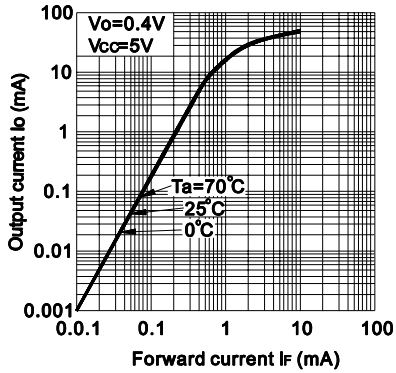


Fig.7-a Propagation Delay Time vs. Ambient Temperature

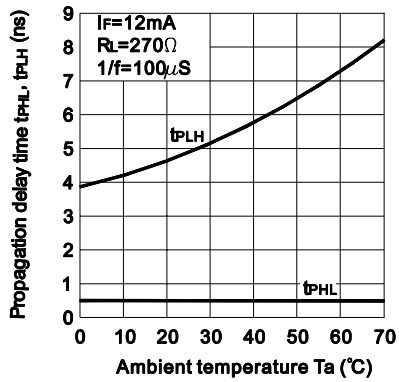


Fig.7-b Propagation Delay Time vs. Ambient Temperature

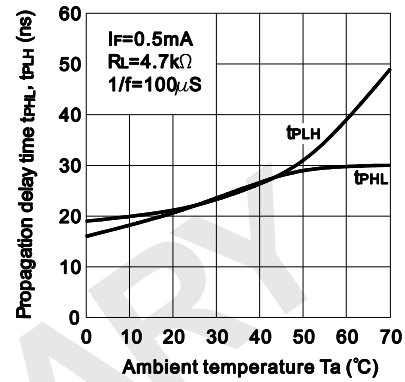


Fig.8 Rise Time, Fall Time vs. Load Resistance

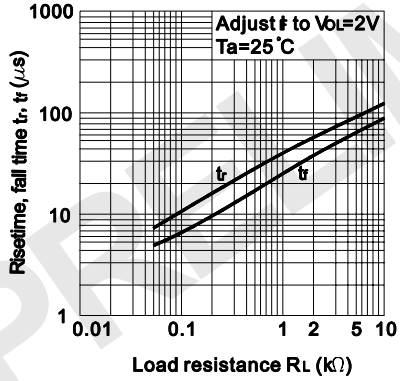


Fig.9 Logic (1) Supply Current vs. Ambient Temperature