



**HIGH SPEED OPTICALLY
COUPLED ISOLATOR
PHOTODARLINGTON OUTPUT**

APPROVALS

- UL recognised, File No. E91231

DESCRIPTION

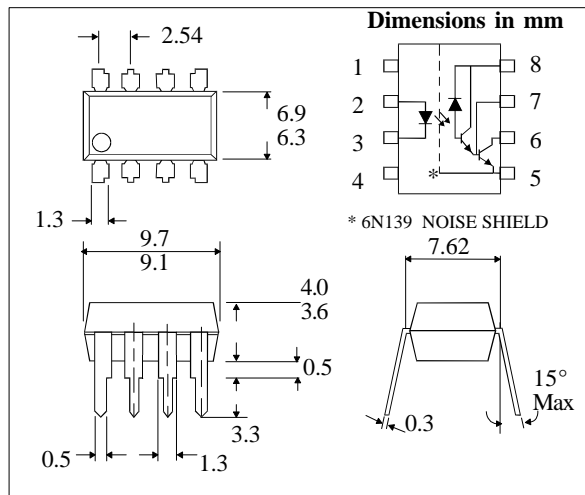
These diode-darlington optocouplers use a light emitting diode and an integrated high gain photon detector to provide 2500Volts_{RMS} electrical isolation between input and output. Separate connection for the photodiode bias and output darlington collector improve the speed up to a hundred times that of a conventional photo-darlington coupler by reducing the base-collector capacitance.

FEATURES

- High speed - DC to 300kBits/s operation
- High Common Mode Transient Immunity 10kV/μs typical
- TTL Compatible - 0.1V V_{OL} typical
- Base access allows Gain Bandwidth Adjustment
- Low Input Current Requirement - 0.5mA
- High Current Transfer Ratio - 1100% typ.
- Open Collector Output
- 2500V_{RMS} Withstand Test Voltage, 1 min
- 6N139 has improved noise shield which gives superior common mode rejection
- Options :-
10mm lead spread - add G after part no.
Surface mount - add SM after part no.
Tape&reel - add SMT&R after part no.
- All electrical parameters 100% tested
- Custom electrical selections available

APPLICATIONS

- Line receivers
- Digital logic ground isolation
- Telephone ring detector
- Current loop receiver



**ABSOLUTE MAXIMUM RATINGS
(25°C unless otherwise specified)**

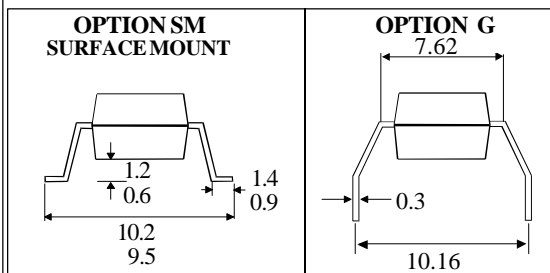
Storage Temperature _____ -55°C to + 125°C
 Operating Temperature _____ -40°C to + 85°C
 Lead Soldering Temperature
 (1/16 inch (1.6mm) from case for 10 secs) 260°C

INPUT DIODE

Average Forward Current _____ 20mA (1)
 Peak Forward Current _____ 40mA
 (50% duty cycle, 1ms pulse width)
 Peak Transient Current _____ 1.0A
 (≤ 1μs P.W., 300 pps)
 Reverse Voltage _____ 5V
 Power Dissipation _____ 35mW (2)

DETECTOR

Output Current _____ 60mA (3)
 Emitter-base Reverse Voltage _____ 0.5V
 Supply and Output Voltage
 6N138 _____ -0.5 to +7V
 6N139 _____ -0.5 to +18V
 Power Dissipation _____ 100mW (4)



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ELECTRICAL CHARACTERISTICS ($T_A = 0^\circ\text{C}$ to 70°C Unless otherwise noted)

PARAMETER	SYM	DEVICE	MIN	TYP*	MAX	UNITS	TEST CONDITION
Current Transfer Ratio (note 5, 6)	CTR	6N139	400	1100		%	$I_F = 0.5\text{mA}, V_O = 0.4\text{V}$ $V_{CC} = 4.5\text{V}$
		6N139	500	1300		%	$I_F = 1.6\text{mA}, V_O = 0.4\text{V}$ $V_{CC} = 4.5\text{V}$
		6N138	300	1300		%	$I_F = 1.6\text{mA}, V_O = 0.4\text{V}$ $V_{CC} = 4.5\text{V}$
Logic Low Output Voltage (note 6)	V_{OL}	6N139		0.1	0.4	V	$I_F = 1.6\text{mA}, I_O = 8\text{mA}$ $V_{CC} = 4.5\text{V}$
		6N139		0.1	0.4	V	$I_F = 5\text{mA}, I_O = 15\text{mA}$ $V_{CC} = 4.5\text{V}$
		6N139		0.1	0.4	V	$I_F = 12\text{mA}, I_O = 24\text{mA}$ $V_{CC} = 4.5\text{V}$
		6N138		0.1	0.4	V	$I_F = 1.6\text{mA}, I_O = 4.8\text{mA}$ $V_{CC} = 4.5\text{V}$
Logic High Output Current (note 6)	I_{OH}	6N139		0.1	100	μA	$I_F = 0\text{mA}$ $V_O = V_{CC} = 18\text{V}$
		6N138		0.01	250	μA	$I_F = 0\text{mA}$ $V_O = V_{CC} = 7\text{V}$
Logic Low Supply Current (note 6)	I_{CCL}			0.4	1.5	mA	$I_F = 1.6\text{mA}, V_O = \text{open}$ $V_{CC} = 18\text{V}$
Logic High Supply Current (note 6)	I_{CCH}			0.05	10	μA	$I_F = 0\text{mA}, V_O = \text{open}$ $V_{CC} = 18\text{V}$
Input Forward Voltage	V_F			1.45	1.7	V	$I_F = 1.6\text{mA}, T_A = 25^\circ\text{C}$
Temperature Coefficient of Forward Voltage	$\frac{\Delta V_F}{\Delta T_A}$			-1.8		mV/°C	$I_F = 1.6\text{mA}$
Input Reverse Voltage	V_R		5			V	$I_R = 10\mu\text{A}, T_A = 25^\circ\text{C}$
Input Capacitance	C_{IN}			60		pF	$f = 1\text{MHz}, V_F = 0$
Input-output Isolation Voltage	V_{ISO}		2500	5000		V_{RMS}	R.H.equal to or less than 50%, $t = 1\text{min}, T_A = 25^\circ\text{C}$
Resistance (Input to Output) (note 7)	R_{I-O}			10^{12}		Ω	$V_{I-O} = 500\text{V dc}$
Capacitance (Input to Output) (note 7)	C_{I-O}			0.6		pF	$f = 1\text{MHz}$

* All typicals at $T_A = 25^\circ\text{C}$

SWITCHING SPECIFICATIONS AT $T_A = 25^\circ\text{C}$ ($V_{CC} = 5\text{V}$ Unless otherwise noted)

PARAMETER	SYM	DEVICE	MIN	TYP	MAX	UNITS	TESTCONDITION
Propagation Delay Time to Logic Low at Output (fig 1)(note6,8)	t_{PHL}	6N139		5.0	25	μs	$I_F = 0.5\text{mA}, R_L = 4.7\text{k}\Omega$
		6N139		0.2	1	μs	$I_F = 12\text{mA}, R_L = 270\Omega$
		6N138		1.0	10	μs	$I_F = 1.6\text{mA}, R_L = 2.2\text{k}\Omega$
Propagation Delay Time to Logic High at Output (fig 1)(note6,8)	t_{PLH}	6N139		1.0	60	μs	$I_F = 0.5\text{mA}, R_L = 4.7\text{k}\Omega$
		6N139		1.0	7	μs	$I_F = 12\text{mA}, R_L = 270\Omega$
		6N138		4.0	35	μs	$I_F = 1.6\text{mA}, R_L = 2.2\text{k}\Omega$
Common Mode Transient Immunity at Logic High Level Output (fig 2)(note9)	CM_H		1000	10000		$\text{V}/\mu\text{s}$	$I_F = 0\text{mA}, V_{CM} = 10\text{V}_{PP}$ $R_L = 2.2\text{k}\Omega$
Common Mode Transient Immunity at Logic Low Level Output (fig 2)(note9)	CM_L		1000	10000		$\text{V}/\mu\text{s}$	$I_F = 1.6\text{mA}, V_{CM} = 10\text{V}_{PP}$ $R_L = 2.2\text{k}\Omega$

NOTES:-

- Derate linearly above 50°C free air temperature at a rate of $0.4 \text{ mA}/^\circ\text{C}$.
- Derate linearly above 50°C free air temperature at a rate of $0.7 \text{ mW}/^\circ\text{C}$.
- Derate linearly above 25°C free air temperature at a rate of $0.7 \text{ mA}/^\circ\text{C}$.
- Derate linearly above 25°C free air temperature at a rate of $2.0 \text{ mW}/^\circ\text{C}$.
- CURRENT TRANSFER RATIO is defined as the ratio of output collector current, I_O , to the forward LED input current, I_F , multiplied by 100%.
- Pin 7 open.
- Device considered a two-terminal device: pins 1,2,3, and 4 shorted together and pins 5,6,7 and 8 shorted together.
- Use of a resistor between pin 5 and 7 will decrease gain and delay time.
- Common mode transient immunity in Logic High level is the maximum tolerable (positive) dV_{CM}/dt on the leading edge of the common mode pulse V_{CM} to assure that the output will remain in a Logic High state (i.e. $V_O > 2.0\text{V}$). Common mode transient immunity in Logic Low level is the maximum tolerable (negative) dV_{CM}/dt on the trailing edge of the common mode pulse signal, V_{CM} to assure that the output will remain in Logic Low state (i.e. $V_O < 0.8\text{V}$).

FIG.1 SWITCHING TEST CIRCUIT

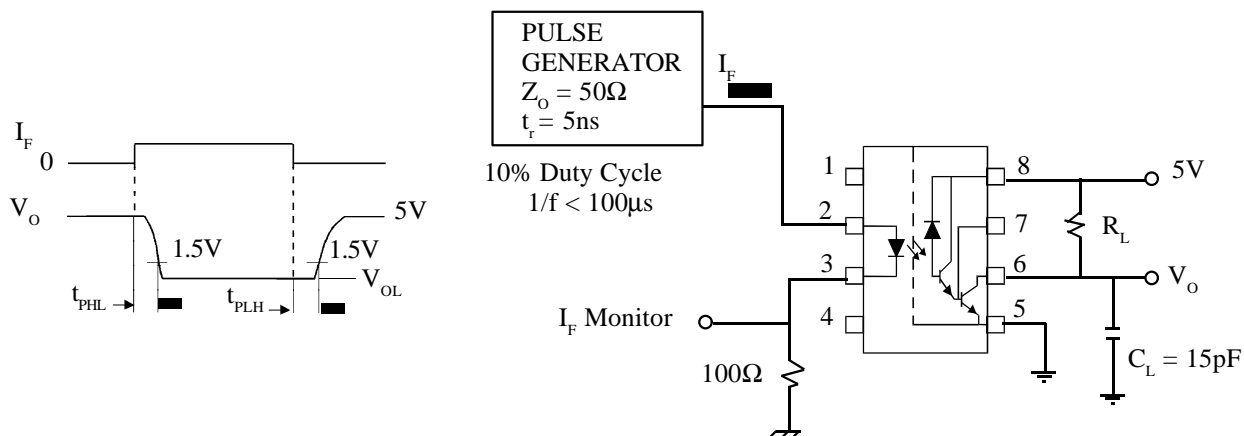


FIG. 2 TEST CIRCUIT FOR TRANSIENT IMMUNITY AND TYPICAL WAVEFORMS

