



**ELECTRONICS, INC.**  
 44 FARRAND STREET  
 BLOOMFIELD, NJ 07003  
 (973) 748-5089

## NTE3093 Optoisolator NPN Split Darlington Output

**Description:**

The NTE3093 coupler uses a light emitting diode (LED) and an integrated high gain photon detector to provide 3000V DC electrical insulation, 500V/ $\mu$ s common mode transient immunity and extremely high current transfer ratio between input and output. Separate pins for the photodiode and output stage result in TTL compatible saturation voltages and high speed operation. Where desired, the  $V_{CC}$  and  $V_O$  terminals may be tied together to achieve conventional photodarlington operation. A base access terminal allows a gain bandwidth adjustment to be made.

**Features:**

- High Current Transfer Ratio
- Low Input Current Requirement
- TTL Compatible Output
- 3000V DC Withstand Test Voltage
- High Common Mode Rejection
- Base Access Allows Gain Bandwidth Adjustment
- High Output Current
- DC to 1Mbit/s Operation

**Absolute Maximum Ratings:** ( $T_A = +25^\circ\text{C}$  unless otherwise specified)

**Input Diode**

Reverse Voltage, $V_R$ .....	5V
Peak Current (50% Duty Cycle, 1ms Pulse Width), $I_F$ .....	40mA
Peak Transient Current ( $\leq 1\mu\text{s}$ Pulse Width, 300pps), $I_F$ .....	20mA
Power Dissipation, $P_D$ .....	35mW
Derate Linearly Above $50^\circ\text{C}$ .....	0.7mW/ $^\circ\text{C}$

**Output Transistor**

Current (Pin6), $I_O$ .....	60mA
Derate Linearly Above $25^\circ\text{C}$ .....	0.7mA/ $^\circ\text{C}$
Emitter-Base Reverse Voltage (Pin5-7) .....	0.5V
Supply Voltage (Pin8-5), $V_{CC}$ .....	-0.5 to 18V
Output Voltage (Pin6-5), $V_O$ .....	-0.5 to 18V
Power Dissipation, $P_D$ .....	35mW
Derate Linearly Above $50^\circ\text{C}$ .....	0.7mW/ $^\circ\text{C}$

**Total Device**

Operating Temperature Range, $T_{opr}$ .....	$0^\circ$ to $+70^\circ\text{C}$
Storage Temperature Range, $T_{stg}$ .....	$-55^\circ$ to $+125^\circ\text{C}$
Lead Temperature (During Soldering, 1.6mm below seating plane, 10sec Max), $T_L$ .....	$+260^\circ\text{C}$

Note 1. The small junction sizes inherent to the design of this bipolar component increases the component's susceptibility to damage from electrostatic discharge (ESD). It is advised that normal static precautions be taken in handling and assembly of this component to prevent damage and/or degradation which may be induced by ESD.

**Electrical Characteristics:** ( $T_A = 0^\circ$  to  $+70^\circ\text{C}$ , Note 2 unless otherwise specified)

Parameter	Symbol	Test Conditions	Min	Typ	Max	Unit
Current Transfer Ratio	CTR	$I_F = 0.5\text{mA}$ , $V_O = 0.4\text{V}$ , $V_{CC} = 4.5\text{V}$ , Note 3, Note 4	400	800	–	%
		$I_F = 1.6\text{mA}$ , $V_O = 0.4\text{V}$ , $V_{CC} = 4.5\text{V}$ , Note 3, Note 4	500	900	–	%
Logic Low Output Voltage	$V_{OL}$	$I_F = 1.6\text{mA}$ , $I_O = 6.4\text{mA}$ , $V_{CC} = 4.5\text{V}$ , Note 4	–	0.1	0.4	V
		$I_F = 5\text{mA}$ , $I_O = 15\text{mA}$ , $V_{CC} = 4.5\text{V}$ , Note 4	–	0.1	0.4	V
		$I_F = 12\text{mA}$ , $I_O = 24\text{mA}$ , $V_{CC} = 4.5\text{V}$ , Note 4	–	0.2	0.4	V
Logic High Output Current	$I_{OH}$	$I_F = 0$ , $V_O = V_{CC} = 18\text{V}$ , Note 4	–	0.05	100	$\mu\text{A}$
Logic Low Supply Current	$I_{CCL}$	$I_F = 1.6\text{mA}$ , $V_O = \text{Open}$ , $V_{CC} = 5\text{V}$ , Note 4	–	0.2	–	mA
Logic High Supply Current	$I_{CCH}$	$I_F = 0\text{mA}$ , $V_O = \text{Open}$ , $V_{CC} = 5\text{V}$ , Note 4	–	10	–	nA
Input Forward Voltage	$V_F$	$I_F = 1.6\text{mA}$ , $T_A = +25^\circ\text{C}$	–	1.4	1.7	V
Input Reverse Breakdown Voltage	$V_{(BR)R}$	$I_F = 10\mu\text{A}$ , $T_A = +25^\circ\text{C}$	5	–	–	V
Temperature Coefficient of Forward Voltage	$\frac{\Delta V_F}{\Delta T_A}$	$I_F = 1.6\text{mA}$	–	–1.8	–	$\text{mV}/^\circ\text{C}$
Input Capacitance	$C_{IN}$	$f = 1\text{MHz}$ , $V_F = 0$	–	60	–	pF
Input–Output Insulation Leakage Current	$I_{IO}$	45% Relative Humidity, $T_A = +25^\circ\text{C}$ , $t = 5\text{s}$ , $V_{IO} = 3\text{KVdc}$ , Note 5	–	–	1.0	$\mu\text{A}$
Resistance	$R_{IO}$	$V_{IO} = 500\text{Vdc}$ , Note 5	–	$10^{11}$	–	$\Omega$
Capacitance	$C_{IO}$	$f = 1\text{MHz}$ , Note 5	–	0.6	–	pF

Note 2. All typicals at  $T_A = +25^\circ\text{C}$ ,  $V_{CC} = 5\text{V}$  unless otherwise specified.

Note 3. DC Current Transfer Ratio is defined as the ratio of output collector current ( $I_O$ ) to the forward LED input current ( $I_F$ ) times 100%.

Note 4. Pin7 Open.

Note 5. Device considered a two–terminal device (Pins 1, 2, 3 and 4 shorted together and Pins 5, 6, 7 and 8 shorted together).

**Switching Characteristics:** ( $T_A = +25^\circ\text{C}$  unless otherwise specified)

Parameter	Symbol	Test Conditions	Min	Typ	Max	Unit
Propagation Delay Time	$t_{PHL}$	$I_F = 0.5\text{mA}$ , $R_L = 4.7\text{k}\Omega$ , Note 3, Note 6	–	5	25	$\mu\text{s}$
		$I_F = 12\text{mA}$ , $R_L = 270\Omega$ , Note 3, Note 6	–	0.2	1.0	$\mu\text{s}$
	$t_{PLH}$	$I_F = 0.5\text{mA}$ , $R_L = 4.7\text{k}\Omega$ , Note 3, Note 6	–	5	60	$\mu\text{s}$
		$I_F = 12\text{mA}$ , $R_L = 270\Omega$ , Note 3, Note 6	–	1	7	$\mu\text{s}$
Common Mode Transient Immunity	$CM_H$	$I_F = 0$ , $R_L = 2.2\text{k}\Omega$ , $R_{CC} = 0$ , $ V_{CM}  = 10\text{V}_{P-P}$ , Note 7, Note 8	–	500	–	$\text{V}/\mu\text{s}$
	$CM_L$	$I_F = 1.6\text{mA}$ , $R_L = 2.2\text{k}\Omega$ , $R_{CC} = 0$ , $ V_{CM}  = 10\text{V}_{P-P}$ , Note 7, Note 8	–	–500	–	$\text{V}/\mu\text{s}$

Note 3. DC Current Transfer Ratio is defined as the ratio of output collector current ( $I_O$ ) to the forward LED input current ( $I_F$ ) times 100%.

Note 6. Use of a resistor between Pin5 and Pin7 will decrease gain and delay time.

Note 7. 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)  $dc_{cm}/dt$  on the trailing edge of the common mode pulse signal ( $V_{CM}$ ) to assure that the output will remain in a Logic Low state (i.e.  $V_O = 0.8\text{V}$ ).

Note 8. In applications where  $dV/dt$  may exceed  $50,000\text{V}/\mu\text{s}$  (such as static discharge) a series resistor ( $R_{CC}$ ) should be included to protect the detector IC from destructively high surge currents. The recommended value is:

$$R_{CC} = \frac{1\text{V}}{0.15 I_F (\text{mA})} \text{ k}\Omega$$

### Pin Connection Diagram

