

## NTE2011/NTE2012/NTE2013/NTE2014/NTE2015 Integrated Circuit 7-Channel Darlington Array/Driver

### **Description:**

The NTE2011 through NTE2015 are high-voltage, high-current Darlington arrays in a 16-Lead DIP type package and are comprised of seven silicon NPN Darlington pairs on a common monolithic substrate. All units have open-collector outputs and integral diodes for inductive load transient suppression.

Peak inrush currents to 600mA (NTE2011, NTE2013, NTE2014) or 750mA (NTE2012, NTE2015) are permissible, making them ideal for driving tungsten filament lamps.

The NTE2011 is a general purpose array that may be used with standard bi-polar digital logic using external current limiting, or with most PMOS or CMOS directly. This device is pinned with outputs opposite inputs to facilitate printed wiring board layouts.

The NTE2012 is designed for use with 14V to 25V PMOS devices. Each input has a Zener diode and resistor in series to limit the input current to a safe value in that application. The Zener diode also gives this device excellent noise immunity.

The NTE2013 has a 2.7k $\Omega$  series base resistor for each Darlington pair, allowing operation directly with TTL or CMOS operating at a supply voltage of 5V. This device will handle numerous interface needs – particularly those beyond the capabilities of standard logic buffers.

The NTE2014 has a 10.5k $\Omega$  series input resistor that permits operation directly from CMOS or PMOS outputs utilizing supply voltages of 6V to 15V. The required input current is below that of the NTE2013, while the required input voltage is less than that required by the NTE2012.

The NTE2015 is designed for use with standard TTL and Schottky TTL, with which higher output currents are required and loading of the logic output is not a concern. This device will sink a minimum of 350mA when driven from a “totem pole” logic output.

### **Absolute Maximum Ratings:** ( $T_A = +25^{\circ}\text{C}$ for any one Darlington pair unless otherwise specified)

|                                            |                                         |
|--------------------------------------------|-----------------------------------------|
| Output Voltage, $V_{CE}$                   | 50V                                     |
| Input Voltage, $V_{IN}$                    |                                         |
| NTE2012, NTE2013, NTE2014                  | 30V                                     |
| NTE2015                                    | 15V                                     |
| Continuous Collector Current, $I_C$        |                                         |
| NTE2011, NTE2013, NTE2014                  | 500mA                                   |
| NTE2012, NTE2015                           | 600mA                                   |
| Continuous Input Current, $I_{IN}$         | 25mA                                    |
| Power Dissipation, $P_D$                   |                                         |
| One Darlington Pair                        | 1W                                      |
| Total Device (Note 1)                      | 2W                                      |
| Operating Ambient Temperature Range, $T_A$ | $-20^{\circ}$ to $+85^{\circ}\text{C}$  |
| Storage Temperature Range, $T_{stg}$       | $-55^{\circ}$ to $+150^{\circ}\text{C}$ |

Note 1. The **NTE2015** is a **discontinued** device and no longer available.

Note 2. Derate at the rate of 16.6mW/ $^{\circ}\text{C}$  above  $+25^{\circ}\text{C}$ .

Note 3. Under normal operating conditions, these devices will sustain 350mA per output with  $V_{CE(sat)} = 1.6\text{V}$  at  $+70^{\circ}\text{C}$  with a pulse width of 20ms and a duty cycle of 34%.

**Electrical Characteristics:** ( $T_A = +25^\circ$  unless otherwise specified)

| Parameter                            | Symbol        | Device                        | Test Conditions                                | Min  | Typ  | Max  | Unit    |
|--------------------------------------|---------------|-------------------------------|------------------------------------------------|------|------|------|---------|
| Output Leakage Current               | $I_{CEX}$     | All                           | $V_{CE} = 50V, T_A = +25^\circ C$              | –    | –    | 50   | $\mu A$ |
|                                      |               |                               | $V_{CE} = 50V, T_A = +70^\circ C$              | –    | –    | 100  | $\mu A$ |
|                                      |               | NTE2012                       | $V_{CE} = 50V, T_A = +70^\circ C, V_{IN} = 6V$ | –    | –    | 500  | $\mu A$ |
|                                      |               | NTE2014                       | $V_{CE} = 50V, T_A = +70^\circ C, V_{IN} = 1V$ | –    | –    | 500  | $\mu A$ |
| Collector–Emitter Saturation Voltage | $V_{CE(sat)}$ | NTE2011<br>NTE2013<br>NTE2014 | $I_C = 100mA, I_B = 250\mu A$                  | –    | 0.9  | 1.1  | V       |
|                                      |               |                               | $I_C = 200mA, I_B = 350\mu A$                  | –    | 1.1  | 1.3  | V       |
|                                      |               |                               | $I_C = 350mA, I_B = 500\mu A$                  | –    | 1.3  | 1.6  | V       |
|                                      |               | NTE2012<br>NTE2015            | $I_C = 200mA, I_B = 350\mu A$                  | –    | 1.1  | 1.3  | V       |
|                                      |               |                               | $I_C = 350mA, I_B = 500\mu A$                  | –    | 1.3  | 1.6  | V       |
|                                      |               |                               | $I_C = 500mA, I_B = 600\mu A$                  | –    | 1.7  | 1.9  | V       |
| Input Current                        | $I_{IN(ON)}$  | NTE2012                       | $V_{IN} = 17V$                                 | –    | 0.82 | 1.25 | mA      |
|                                      |               | NTE2013                       | $V_{IN} = 3.85V$                               | –    | 0.93 | 1.35 | mA      |
|                                      |               | NTE2014                       | $V_{IN} = 5V$                                  | –    | 0.35 | 0.50 | mA      |
|                                      |               |                               | $V_{IN} = 12V$                                 | –    | 1.0  | 1.45 | mA      |
|                                      |               | NTE2015                       | $V_{IN} = 3V$                                  | –    | 1.5  | 2.4  | mA      |
|                                      | $I_{IN(OFF)}$ | All                           | $I_C = 500\mu A, T_A = +70^\circ C$            | 50   | 60   | –    | $\mu A$ |
| Input Voltage                        | $V_{IN(ON)}$  | NTE2012                       | $V_{CE} = 2V, I_C = 500mA$                     | –    | –    | 17   | V       |
|                                      |               |                               | $V_{CE} = 2V, I_C = 200mA$                     | –    | –    | 2.4  | V       |
|                                      |               |                               | $V_{CE} = 2V, I_C = 250mA$                     | –    | –    | 2.7  | V       |
|                                      |               |                               | $V_{CE} = 2V, I_C = 300mA$                     | –    | –    | 3.0  | V       |
|                                      |               | NTE2014                       | $V_{CE} = 2V, I_C = 125mA$                     | –    | –    | 5.0  | V       |
|                                      |               |                               | $V_{CE} = 2V, I_C = 200mA$                     | –    | –    | 6.0  | V       |
|                                      |               |                               | $V_{CE} = 2V, I_C = 275mA$                     | –    | –    | 7.0  | V       |
|                                      |               |                               | $V_{CE} = 2V, I_C = 350mA$                     | –    | –    | 8.0  | V       |
|                                      |               | NTE2015                       | $V_{CE} = 2V, I_C = 350mA$                     | –    | –    | 2.6  | V       |
| DC Forward Current Transfer Ratio    | $h_{FE}$      | NTE2011                       | $V_{CE} = 2V, I_C = 350mA$                     | 1000 | –    | –    |         |
| Input Capacitance                    | $C_{IN}$      | All                           |                                                | –    | 15   | 25   | pF      |
| Turn–On Delay                        | $t_{PLH}$     | All                           | $0.5 E_{in}$ to $0.5 E_{out}$                  | –    | 0.25 | 1.0  | $\mu s$ |
| Turn–Off Delay                       | $t_{PHL}$     | All                           | $0.5 E_{in}$ to $0.5 E_{out}$                  | –    | 0.25 | 1.0  | $\mu s$ |
| Clamp Diode Leakage Current          | $I_R$         | All                           | $V_R = 50V, T_A = +25^\circ C$                 | –    | –    | 50   | $\mu A$ |
|                                      |               |                               | $V_R = 50V, T_A = +70^\circ C$                 | –    | –    | 100  | $\mu A$ |
| Clamp Diode Forward Voltage          | $V_F$         | All                           | $I_F = 350mA$                                  | –    | 1.7  | 2.0  | V       |

### Pin Connection Diagram

