

## NTE2016/NTE2017/NTE2018/NTE2019/NTE2020 Integrated Circuit 8–Channel Darlington Array/Driver

### **Description:**

Ideally suited for interfacing between low–level digital logic circuitry and high–power peripheral loads, the NTE2011 through NTE2015 are high–voltage, high–current Darlington arrays in an 18–Lead DIP type package and feature peak load current ratings to 600mA (NTE2016, NTE2019) or 750mA (NTE2017, NTE2018, NTE2020) for each of the eight drivers in each device. Under the proper conditions, high–power loads up to 4A at 50V (200W at 23% duty cycle) or 3.2A at 95V (304W at 33% duty cycle) can be controlled. Typical loads include relays, solenoids, stepping motors, multiplexed LED and incandescent displays, and heaters. All devices feature open collector outputs and integral diodes for inductive load transient suppression.

The NTE2016 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 NTE2017 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 NTE2018 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 NTE2019 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 NTE2018, while the required input voltage is less than that required by the NTE2017.

The NTE2020 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, $V_{IN}$	
NTE2017, NTE2018, NTE2019	30V
NTE2020	15V
Continuous Collector Current, $I_C$	
NTE2016, NTE2019	500mA
NTE2017, NTE2018, NTE2020	600mA
Continuous Base Current, $I_B$	25mA
Power Dissipation, $P_D$	
One Darlington Pair	1W
Total Device (Note 1)	2.25W
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. Derate at the rate of 18.18mW/ $^{\circ}\text{C}$  above  $+25^{\circ}\text{C}$ .

Note 2. Under normal operating conditions, these devices will sustain 350mA per output with  $V_{CE(sat)} = 1.6\text{V}$  at  $+50^{\circ}\text{C}$  with a pulse width of 20ms and a duty cycle of 40%.

**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	$\mu A$
		NTE2017	$V_{CE} = 50V, T_A = +70^\circ C, V_{IN} = 6V$	–	–	500	$\mu A$
		NTE2019	$V_{CE} = 50V, T_A = +70^\circ C, V_{IN} = 1V$	–	–	500	$\mu A$
Collector–Emitter Saturation Voltage	$V_{CE(sat)}$	NTE2016 NTE2019	$I_C = 100mA, I_B = 250\mu A$	–	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
		NTE2017 NTE2018 NTE2020	$I_C = 200mA, I_B = 350\mu A$	–	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	$I_{IN(ON)}$	NTE2017	$V_{IN} = 17V$	–	0.82	1.25	mA
		NTE2018	$V_{IN} = 3.85V$	–	0.93	1.35	mA
		NTE2019	$V_{IN} = 5V$	–	0.35	0.50	mA
			$V_{IN} = 12V$	–	1.0	1.45	mA
		NTE2020	$V_{IN} = 3V$	–	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	$V_{IN(ON)}$	NTE2017	$V_{CE} = 2V, I_C = 500mA$	–	–	17	V
			$V_{CE} = 2V, I_C = 250mA$	–	–	2.7	V
			$V_{CE} = 2V, I_C = 300mA$	–	–	3.0	V
			$V_{CE} = 2V, I_C = 500mA$	–	–	3.5	V
		NTE2019	$V_{CE} = 2V, I_C = 125mA$	–	–	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
		NTE2020	$V_{CE} = 2V, I_C = 350mA$	–	–	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
		NTE2017 NTE2018 NTE2020	$I_F = 500mA$	–	2.1	2.5	V

### Pin Connection Diagram

