



MOTOROLA

Octal High Voltage, High Current Darlington Transistor Arrays

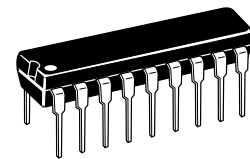
The eight NPN Darlington connected transistors in this family of arrays are ideally suited for interfacing between low logic level digital circuitry (such as TTL, CMOS or PMOS/NMOS) and the higher current/voltage requirements of lamps, relays, printer hammers or other similar loads for a broad range of computer, industrial, and consumer applications. All devices feature open-collector outputs and free wheeling clamp diodes for transient suppression.

The ULN2803 is designed to be compatible with standard TTL families while the ULN2804 is optimized for 6 to 15 volt high level CMOS or PMOS.

ULN2803 ULN2804

OCTAL PERIPHERAL DRIVER ARRAYS

SEMICONDUCTOR TECHNICAL DATA



A SUFFIX
PLASTIC PACKAGE
CASE 707

MAXIMUM RATINGS ($T_A = 25^\circ\text{C}$ and rating apply to any one device in the package, unless otherwise noted.)

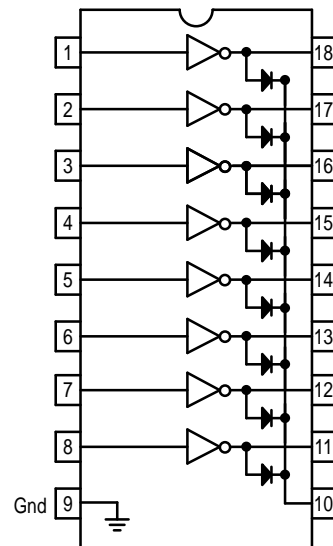
Rating	Symbol	Value	Unit
Output Voltage	V_O	50	V
Input Voltage (Except ULN2801)	V_I	30	V
Collector Current – Continuous	I_C	500	mA
Base Current – Continuous	I_B	25	mA
Operating Ambient Temperature Range	T_A	0 to +70	$^\circ\text{C}$
Storage Temperature Range	T_{stg}	-55 to +150	$^\circ\text{C}$
Junction Temperature	T_J	125	$^\circ\text{C}$

$R_{\theta JA} = 55^\circ\text{C/W}$
Do not exceed maximum current limit per driver.

ORDERING INFORMATION

Device	Characteristics		
	Input Compatibility	$V_{CE(\text{Max})}/I_{C(\text{Max})}$	Operating Temperature Range
ULN2803A ULN2804A	TTL, 5.0 V CMOS 6 to 15 V CMOS, PMOS	50 V/500 mA	$T_A = 0$ to $+70^\circ\text{C}$

PIN CONNECTIONS



ULN2803 ULN2804

ELECTRICAL CHARACTERISTICS ($T_A = 25^\circ\text{C}$, unless otherwise noted)

Characteristic		Symbol	Min	Typ	Max	Unit
Output Leakage Current (Figure 1) ($V_O = 50\text{ V}$, $T_A = +70^\circ\text{C}$) ($V_O = 50\text{ V}$, $T_A = +25^\circ\text{C}$) ($V_O = 50\text{ V}$, $T_A = +70^\circ\text{C}$, $V_I = 6.0\text{ V}$) ($V_O = 50\text{ V}$, $T_A = +70^\circ\text{C}$, $V_I = 1.0\text{ V}$)	All Types All Types ULN2802 ULN2804	I_{CEX}	– – – –	– – – –	100 50 500 500	μA
Collector–Emitter Saturation Voltage (Figure 2) ($I_C = 350\text{ mA}$, $I_B = 500\text{ }\mu\text{A}$) ($I_C = 200\text{ mA}$, $I_B = 350\text{ }\mu\text{A}$) ($I_C = 100\text{ mA}$, $I_B = 250\text{ }\mu\text{A}$)	All Types All Types All Types	$V_{CE(sat)}$	– – –	1.1 0.95 0.85	1.6 1.3 1.1	V
Input Current – On Condition (Figure 4) ($V_I = 17\text{ V}$) ($V_I = 3.85\text{ V}$) ($V_I = 5.0\text{ V}$) ($V_I = 12\text{ V}$)	ULN2802 ULN2803 ULN2804 ULN2804	$I_{I(on)}$	– – – –	0.82 0.93 0.35 1.0	1.25 1.35 0.5 1.45	mA
Input Voltage – On Condition (Figure 5) ($V_{CE} = 2.0\text{ V}$, $I_C = 300\text{ mA}$) ($V_{CE} = 2.0\text{ V}$, $I_C = 200\text{ mA}$) ($V_{CE} = 2.0\text{ V}$, $I_C = 250\text{ mA}$) ($V_{CE} = 2.0\text{ V}$, $I_C = 300\text{ mA}$) ($V_{CE} = 2.0\text{ V}$, $I_C = 125\text{ mA}$) ($V_{CE} = 2.0\text{ V}$, $I_C = 200\text{ mA}$) ($V_{CE} = 2.0\text{ V}$, $I_C = 275\text{ mA}$) ($V_{CE} = 2.0\text{ V}$, $I_C = 350\text{ mA}$)	ULN2802 ULN2803 ULN2803 ULN2803 ULN2804 ULN2804 ULN2804 ULN2804	$V_{I(on)}$	– – – – – – – –	– – – – – – – –	13 2.4 2.7 3.0 5.0 6.0 7.0 8.0	V
Input Current – Off Condition (Figure 3) ($I_C = 500\text{ }\mu\text{A}$, $T_A = +70^\circ\text{C}$)	All Types	$I_{I(off)}$	50	100	–	μA
DC Current Gain (Figure 2) ($V_{CE} = 2.0\text{ V}$, $I_C = 350\text{ mA}$)	ULN2801	h_{FE}	1000	–	–	–
Input Capacitance		C_I	–	15	25	pF
Turn–On Delay Time (50% E_I to 50% E_O)		t_{on}	–	0.25	1.0	μs
Turn–Off Delay Time (50% E_I to 50% E_O)		t_{off}	–	0.25	1.0	μs
Clamp Diode Leakage Current (Figure 6) ($V_R = 50\text{ V}$)	$T_A = +25^\circ\text{C}$ $T_A = +70^\circ\text{C}$	I_R	–	–	50 100	μA
Clamp Diode Forward Voltage (Figure 7) ($I_F = 350\text{ mA}$)		V_F	–	1.5	2.0	V

ULN2803 ULN2804

TEST FIGURES

(See Figure Numbers in Electrical Characteristics Table)

Figure 1.

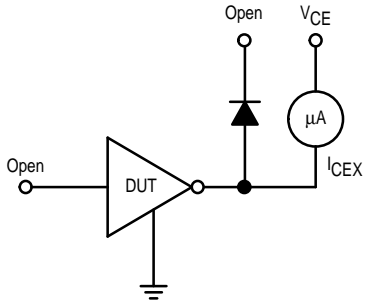


Figure 2.

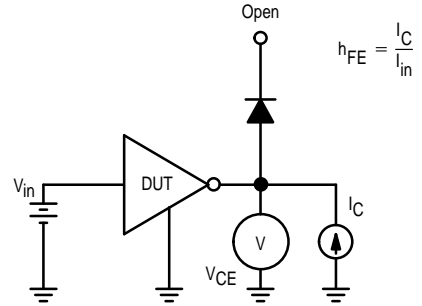


Figure 3.

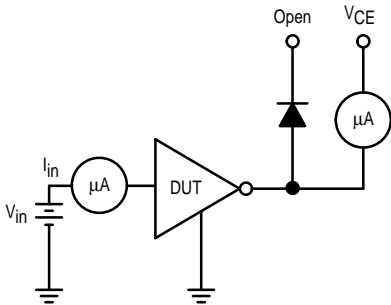


Figure 4.

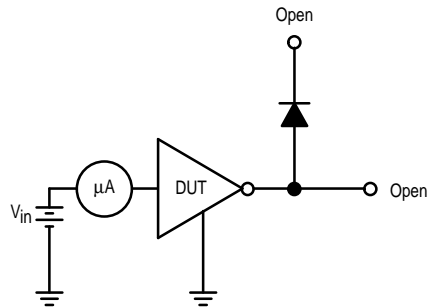


Figure 5.

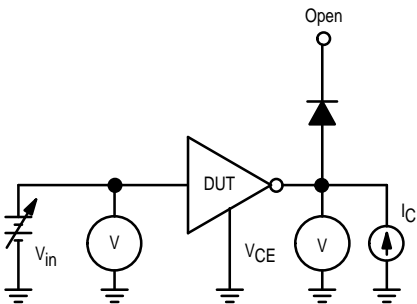


Figure 6.

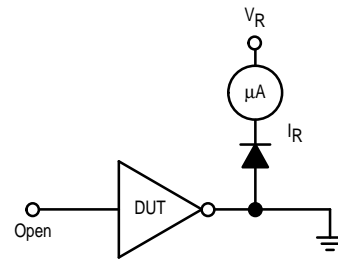
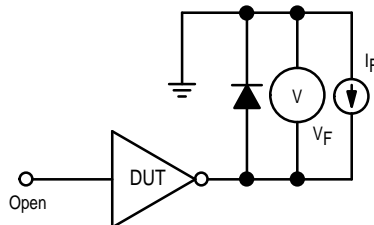


Figure 7.



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TYPICAL CHARACTERISTIC CURVES – $T_A = 25^\circ\text{C}$, unless otherwise noted
Output Characteristics

Figure 8. Output Current versus Saturation Voltage

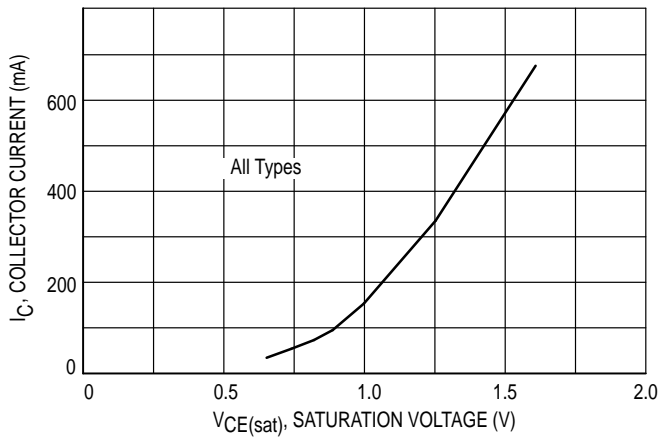
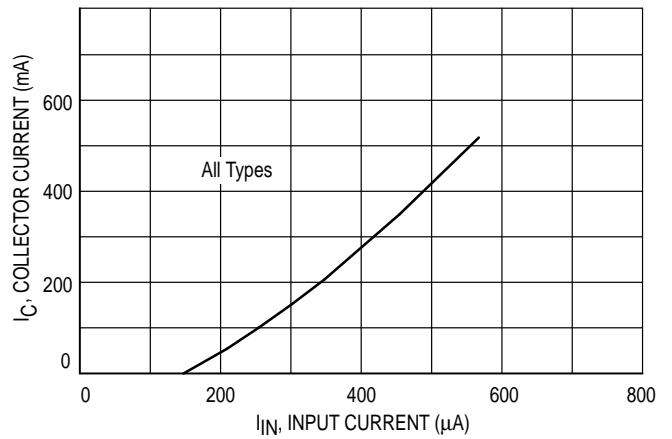


Figure 9. Output Current versus Input Current



Input Characteristics

Figure 10. ULN2803 Input Current versus Input Voltage

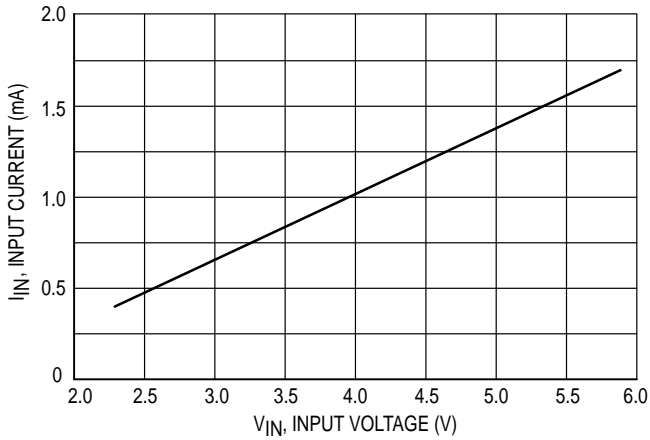


Figure 11. ULN2804 Input Current versus Input Voltage

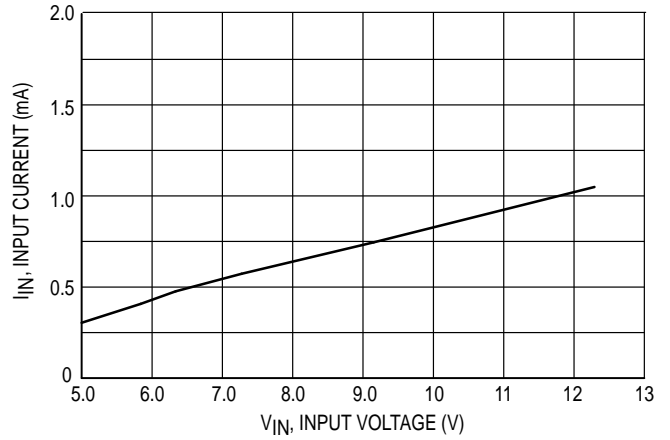
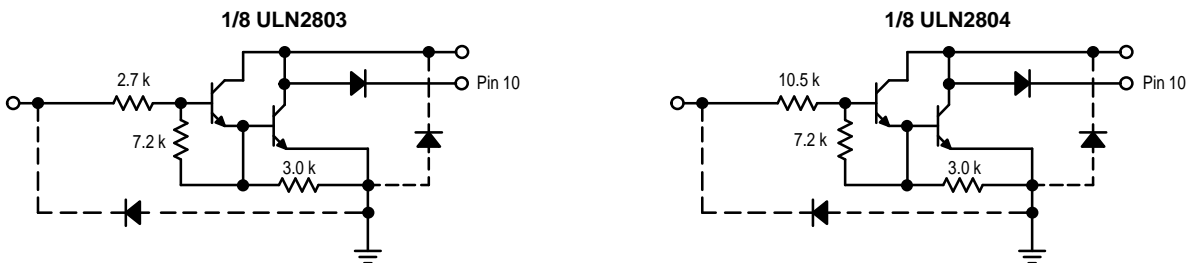


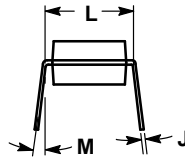
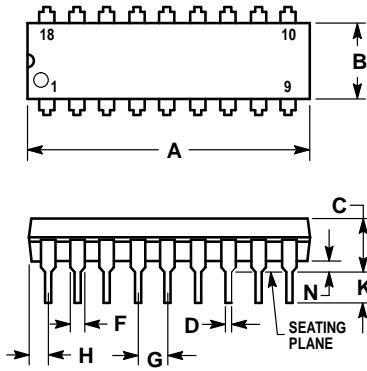
Figure 12. Representative Schematic Diagrams



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OUTLINE DIMENSIONS

A SUFFIX
 PLASTIC PACKAGE
 CASE 707-02
 ISSUE C



NOTES:

1. POSITIONAL TOLERANCE OF LEADS (D), SHALL BE WITHIN 0.25 (0.010) AT MAXIMUM MATERIAL CONDITION, IN RELATION TO SEATING PLANE AND EACH OTHER.
2. DIMENSION L TO CENTER OF LEADS WHEN FORMED PARALLEL.
3. DIMENSION B DOES NOT INCLUDE MOLD FLASH.

DIM	MILLIMETERS		INCHES	
	MIN	MAX	MIN	MAX
A	22.22	23.24	0.875	0.915
B	6.10	6.60	0.240	0.260
C	3.56	4.57	0.140	0.180
D	0.36	0.56	0.014	0.022
F	1.27	1.78	0.050	0.070
G	2.54 BSC		0.100 BSC	
H	1.02	1.52	0.040	0.060
J	0.20	0.30	0.008	0.012
K	2.92	3.43	0.115	0.135
L	7.62 BSC		0.300 BSC	
M	0°	15°	0°	15°
N	0.51	1.02	0.020	0.040

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ULN2803/D

