# High Voltage, High Current Darlington Transistor Arrays

The seven NPN Darlington connected transistors in these arrays are well suited for driving lamps, relays, or printer hammers in a variety of industrial and consumer applications. Their high breakdown voltage and internal suppression diodes insure freedom from problems associated with inductive loads. Peak inrush currents to 500 mA permit them to drive incandescent lamps.

The ULx2003A with a 2.7 k $\Omega$  series input resistor is well suited for systems utilizing a 5.0 V TTL or CMOS Logic.

## **Features**

• These are Pb-Free Devices

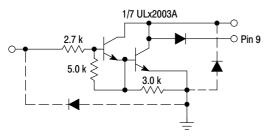


Figure 1. Representative Schematic Diagram

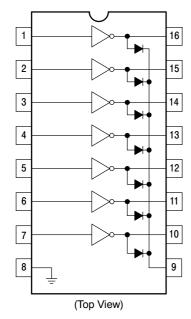
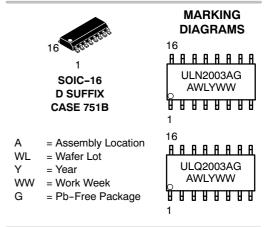


Figure 2. Pin Connections



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## **ORDERING INFORMATION**

Device	Package	Shipping <sup>†</sup>
ULN2003ADR2G	SOIC-16 (Pb-Free)	2500 Tape & Reel
ULQ2003ADR2G	SOIC-16 (Pb-Free)	2500 Tape & Reel

<sup>†</sup>For information on tape and reel specifications, including part orientation and tape sizes, please refer to our Tape and Reel Packaging Specifications Brochure, BRD8011/D.

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

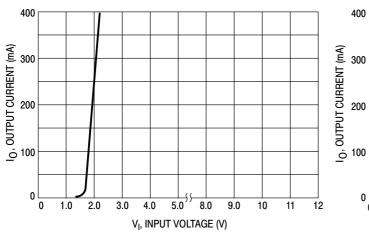
Rating	Symbol	Value	Unit
Output Voltage	V <sub>O</sub>	50	V
Input Voltage	VI	30	V
Collector Current - Continuous	I <sub>C</sub>	500	mA
Base Current - Continuous	Ι <sub>Β</sub>	25	mA
Operating Ambient Temperature Range ULN2003A ULQ2003A	T <sub>A</sub>	-20 to +85 -40 to +85	°C
Storage Temperature Range	T <sub>stg</sub>	-55 to +150	°C
Junction Temperature	TJ	150	°C
Thermal Resistance, Junction-to-Ambient Case 751B, D Suffix	$R_{ heta JA}$	100	°C/W
Thermal Resistance, Junction-to-Case Case 751B, D Suffix	$R_{ heta JC}$	20	°C/W
Electrostatic Discharge Sensitivity (ESD) Human Body Model (HBM) Machine Model (MM) Charged Device Model (CDM)	ESD	2000 400 1500	٧

Stresses exceeding Maximum Ratings may damage the device. Maximum Ratings are stress ratings only. Functional operation above the Recommended Operating Conditions is not implied. Extended exposure to stresses above the Recommended Operating Conditions may affect device reliability.

# **ELECTRICAL CHARACTERISTICS** (T<sub>A</sub> = 25°C, unless otherwise noted)

Characteristic	Symbol	Min	Тур	Max	Unit
Output Leakage Current $(V_O = 50 \text{ V}, T_A = +85^{\circ}\text{C})$ $(V_O = 50 \text{ V}, T_A = +25^{\circ}\text{C})$	I <sub>CEX</sub>	- -	- -	100 50	μΑ
Collector–Emitter Saturation Voltage ( $I_C$ = 350 mA, $I_B$ = 500 $\mu$ A) ( $I_C$ = 200 mA, $I_B$ = 350 $\mu$ A) ( $I_C$ = 100 mA, $I_B$ = 250 $\mu$ A)	V <sub>CE(sat)</sub>	- - -	1.1 0.95 0.85	1.6 1.3 1.1	V
Input Current – On Condition (V <sub>I</sub> = 3.85 V)	I <sub>I(on)</sub>	-	0.93	1.35	mA
Input Voltage – On Condition $ (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 <sub>I(on)</sub>	- - -	- - -	2.4 2.7 3.0	V
Input Current – Off Condition ( $I_C = 500 \mu A, T_A = 85^{\circ}C$ )	I <sub>I(off)</sub>	50	100	-	μΑ
DC Current Gain ( $V_{CE} = 2.0 \text{ V}, I_{C} = 350 \text{ mA}$ )	h <sub>FE</sub>	1000	-	-	-
Input Capacitance	Cl	-	15	30	pF
Turn-On Delay Time (50% E <sub>I</sub> to 50% E <sub>O</sub> )	t <sub>on</sub>	-	0.25	1.0	μs
Turn-Off Delay Time (50% E <sub>I</sub> to 50% E <sub>O</sub> )	t <sub>off</sub>	-	0.25	1.0	μs
$ \begin{array}{c} \text{Clamp Diode Leakage Current} & \text{T}_{A} = +25^{\circ}\text{C} \\ \text{(V}_{R} = 50 \text{ V)} & \text{T}_{A} = +85^{\circ}\text{C} \\ \end{array} $	I <sub>R</sub>	- -	-	50 100	μΑ
Clamp Diode Forward Voltage (I <sub>F</sub> = 350 mA)	V <sub>F</sub>	-	1.5	2.0	V

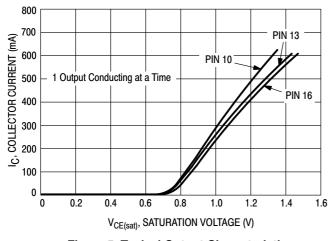
## TYPICAL PERFORMANCE CURVES – $T_A = 25^{\circ}C$



400 (VE) 300 200 0 50 100 150 200 250 300 350 400 II, INPUT CURRENT (μA)

Figure 3. Output Current versus Input Voltage

**Figure 4. Output Current versus Input Current** 



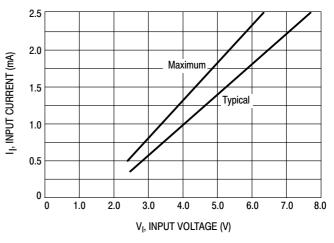


Figure 5. Typical Output Characteristics

Figure 6. Input Characteristics

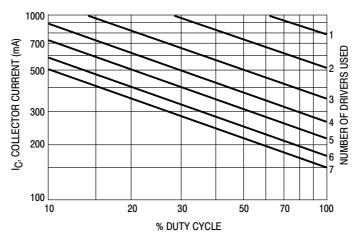
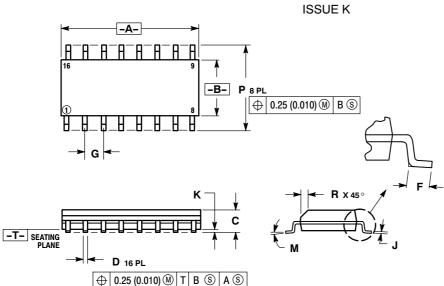


Figure 7. Maximum Collector Current versus Duty Cycle (and Number of Drivers in Use)

### PACKAGE DIMENSIONS

# SOIC-16 **D SUFFIX** CASE 751B-05

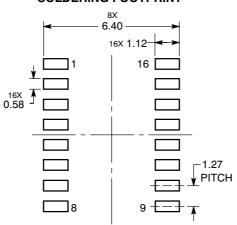


#### NOTES

- DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
- CONTROLLING DIMENSION: MILLIMETER.
  DIMENSIONS A AND B DO NOT INCLUDE MOLD
- PROTRUSION.
- MAXIMUM MOLD PROTRUSION 0.15 (0.006) PER SIDE. DIMENSION D DOES NOT INCLUDE DAMBAR PROTRUSION. ALLOWABLE DAMBAR PROTRUSION SHALL BE 0.127 (0.005) TOTAL IN EXCESS OF THE D DIMENSION AT MAXIMUM MATERIAL CONDITION.

	MILLIMETERS		INCHES		
DIM	MIN	MAX	MIN	MAX	
Α	9.80	10.00	0.386	0.393	
В	3.80	4.00	0.150	0.157	
С	1.35	1.75	0.054	0.068	
D	0.35	0.49	0.014	0.019	
F	0.40	1.25	0.016	0.049	
G	1.27 BSC		0.050 BSC		
J	0.19	0.25	0.008	0.009	
K	0.10	0.25	0.004	0.009	
M	0 °	7°	0°	7°	
P	5.80	6.20	0.229	0.244	
R	0.25	0.50	0.010	0.019	

## **SOLDERING FOOTPRINT\***



**DIMENSIONS: MILLIMETERS** 

\*For additional information on our Pb-Free strategy and soldering details, please download the ON Semiconductor Soldering and Mounting Techniques Reference Manual, SOLDERRM/D.

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