

# High Voltage, High Current Darlington Transistor Arrays

## ULN2003A, ULQ2003A

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 kΩ series input resistor is well suited for systems utilizing a 5.0 V TTL or CMOS Logic.

### Features

- These are Pb-Free Devices

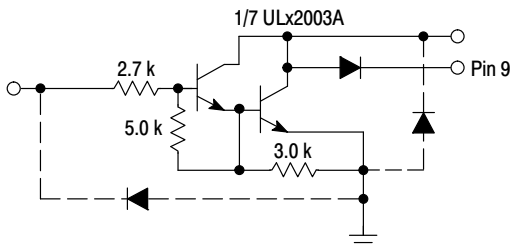


Figure 1. Representative Schematic Diagram

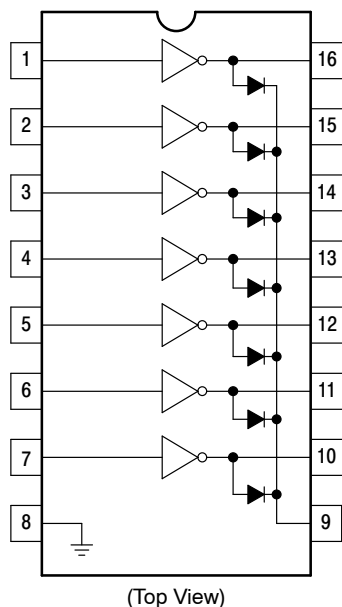
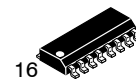
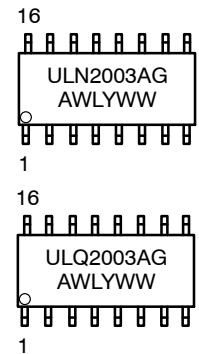


Figure 2. Pin Connections



16  
1  
**SOIC-16**  
**D SUFFIX**  
**CASE 751B**

### MARKING DIAGRAMS



A = Assembly Location  
WL = Wafer Lot  
Y = Year  
WW = Work Week  
G = Pb-Free Package

### ORDERING INFORMATION

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

†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.

## ULN2003A, ULQ2003A

**MAXIMUM RATINGS** ( $T_A = 25\text{ }^\circ\text{C}$ , 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	$V_I$	30	V
Collector Current - Continuous	$I_C$	500	mA
Base Current - Continuous	$I_B$	25	mA
Operating Ambient Temperature Range ULN2003A ULQ2003A	$T_A$	-20 to +85 -40 to +85	$^\circ\text{C}$
Storage Temperature Range	$T_{stg}$	-55 to +150	$^\circ\text{C}$
Junction Temperature	$T_J$	150	$^\circ\text{C}$
Thermal Resistance, Junction-to-Ambient Case 751B, D Suffix	$R_{\theta JA}$	100	$^\circ\text{C}/\text{W}$
Thermal Resistance, Junction-to-Case Case 751B, D Suffix	$R_{\theta JC}$	20	$^\circ\text{C}/\text{W}$
Electrostatic Discharge Sensitivity (ESD) Human Body Model (HBM) Machine Model (MM) Charged Device Model (CDM)	ESD	2000 400 1500	V

Stresses exceeding those listed in the Maximum Ratings table may damage the device. If any of these limits are exceeded, device functionality should not be assumed, damage may occur and reliability may be affected.

# ULN2003A, ULQ2003A

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

Characteristic	Symbol	Min	Typ	Max	Unit
Output Leakage Current (V <sub>O</sub> = 50 V, T <sub>A</sub> = +85 °C) (V <sub>O</sub> = 50 V, T <sub>A</sub> = +25 °C)	I <sub>CEX</sub>	– –	– –	100 50	μA
Collector-Emitter Saturation Voltage (I <sub>C</sub> = 350 mA, I <sub>B</sub> = 500 μA) (I <sub>C</sub> = 200 mA, I <sub>B</sub> = 350 μA) (I <sub>C</sub> = 100 mA, I <sub>B</sub> = 250 μA)	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 <sub>CE</sub> = 2.0 V, I <sub>C</sub> = 200 mA) (V <sub>CE</sub> = 2.0 V, I <sub>C</sub> = 250 mA) (V <sub>CE</sub> = 2.0 V, I <sub>C</sub> = 300 mA)	V <sub>I(on)</sub>	– – –	– – –	2.4 2.7 3.0	V
Input Current - Off Condition (I <sub>C</sub> = 500 μA, T <sub>A</sub> = 85 °C)	I <sub>I(off)</sub>	50	100	–	μA
DC Current Gain (V <sub>CE</sub> = 2.0 V, I <sub>C</sub> = 350 mA)	h <sub>FE</sub>	1000	–	–	–
Input Capacitance	C <sub>I</sub>	–	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
Clamp Diode Leakage Current (V <sub>R</sub> = 50 V)	I <sub>R</sub>	– –	– –	50 100	μA
Clamp Diode Forward Voltage (I <sub>F</sub> = 350 mA)	V <sub>F</sub>	–	1.5	2.0	V

# ULN2003A, ULQ2003A

TYPICAL PERFORMANCE CURVES -  $T_A = 25^\circ\text{C}$

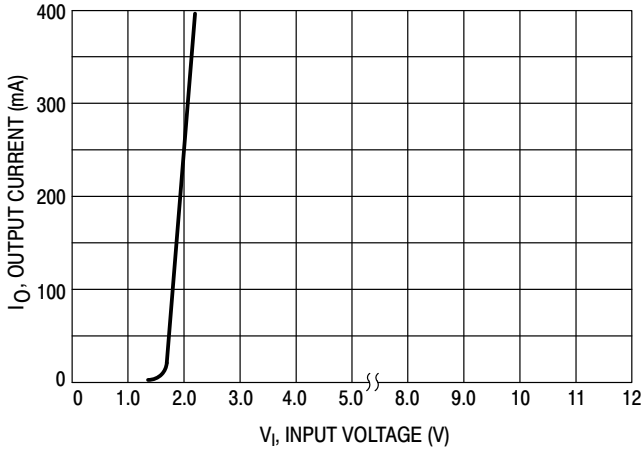


Figure 3. Output Current versus Input Voltage

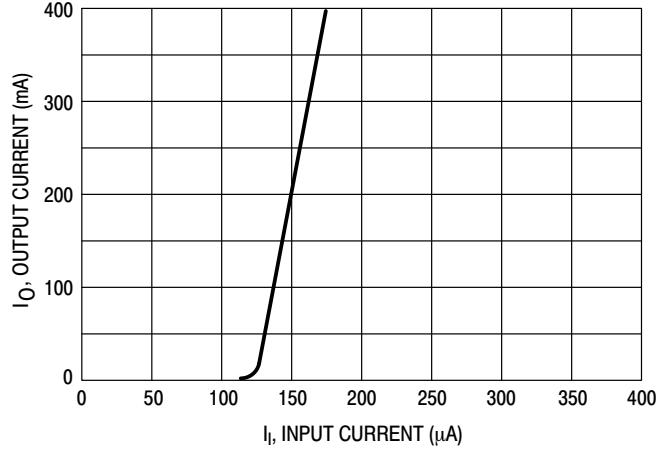


Figure 4. Output Current versus Input Current

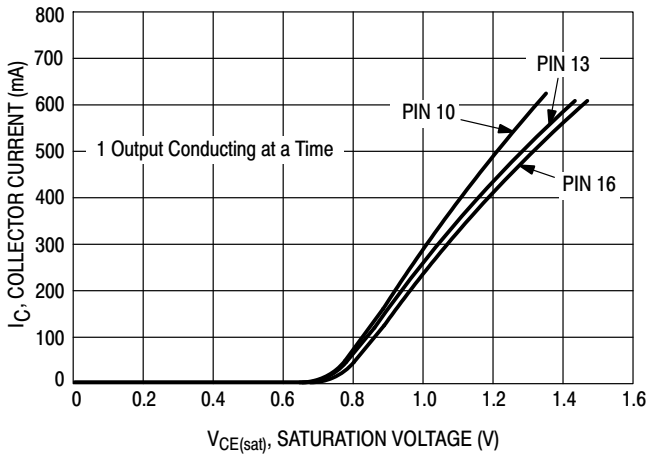


Figure 5. Typical Output Characteristics

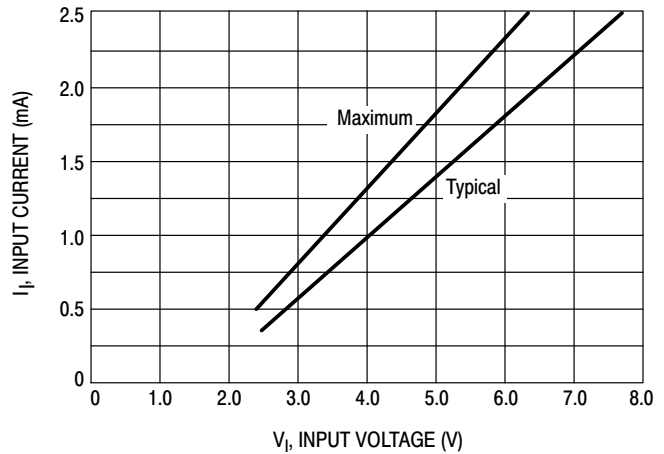


Figure 6. Input Characteristics

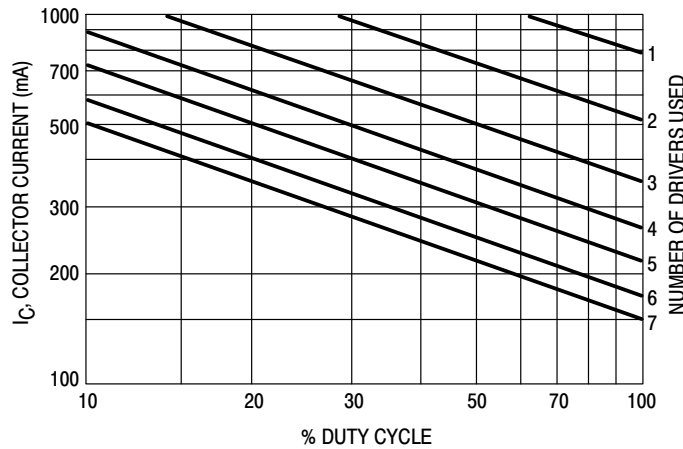


Figure 7. Maximum Collector Current versus Duty Cycle (and Number of Drivers in Use)

# ULN2003A, ULQ2003A

## REVISION HISTORY

Revision	Description of Changes	Date
1	Rebranded the Data Sheet to <b>onsemi</b> format.	6/3/2025

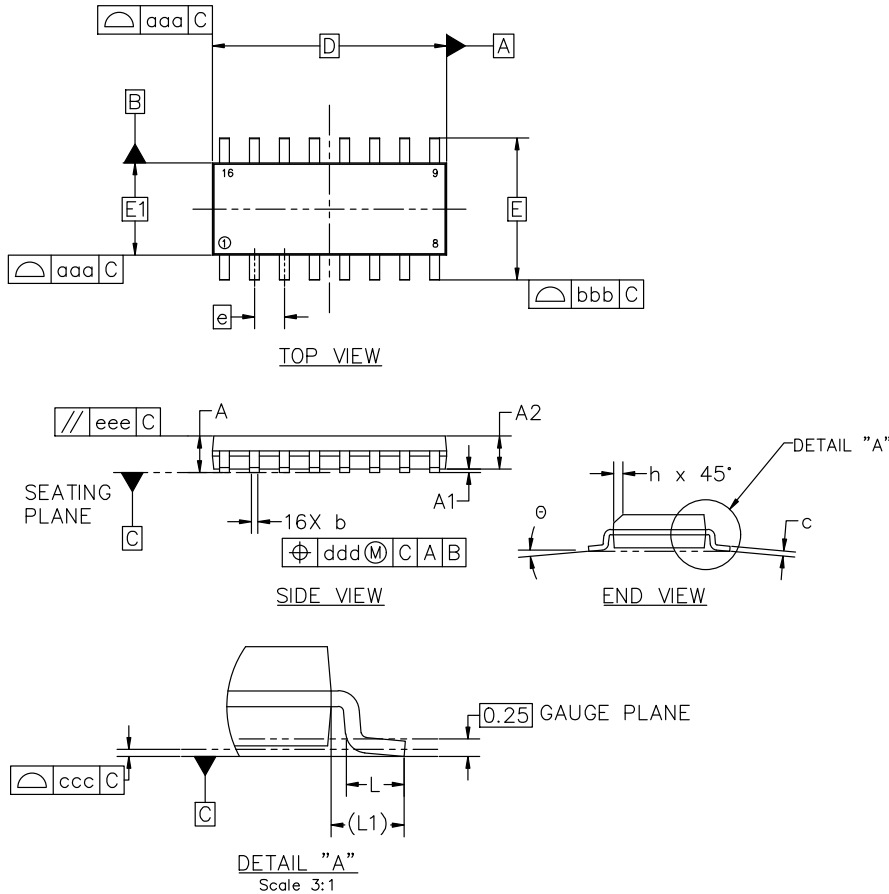


**SOIC-16 9.90x3.90x1.37 1.27P**  
**CASE 751B**  
**ISSUE M**

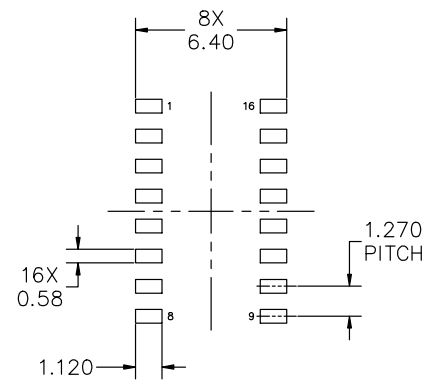
DATE 18 OCT 2024

NOTES:

1. DIMENSIONING AND TOLERANCING PER ASME Y14.5M, 2018.
2. DIMENSION IN MILLIMETERS. ANGLE IN DEGREES.
3. DIMENSIONS D AND E1 DO NOT INCLUDE MOLD PROTRUSION.
4. MAXIMUM MOLD PROTRUSION 0.15mm PER SIDE.
5. DIMENSION b DOES NOT INCLUDE DAMBAR PROTRUSION. ALLOWABLE DAMBAR PROTRUSION SHALL BE 0.127mm TOTAL IN EXCESS OF THE b DIMENSION AT MAXIMUM MATERIAL CONDITION.



MILLIMETERS			
DIM	MIN	NOM	MAX
A	1.35	1.55	1.75
A1	0.10	0.18	0.25
A2	1.25	1.37	1.50
b	0.35	0.42	0.49
c	0.19	0.22	0.25
D	9.90 BSC		
E	6.00 BSC		
E1	3.90 BSC		
e	1.27 BSC		
h	0.25	---	0.50
L	0.40	0.83	1.25
L1	1.05 REF		
theta	0°	---	7°
TOLERANCE OF FORM AND POSITION			
aaa	0.10		
bbb	0.20		
ccc	0.10		
ddd	0.25		
eee	0.10		



RECOMMENDED MOUNTING FOOTPRINT

\*FOR ADDITIONAL INFORMATION ON OUR PB-FREE STRATEGY AND SOLDERING DETAILS, PLEASE DOWNLOAD THE onsemi SOLDERING AND MOUNTING TECHNIQUES REFERENCE MANUAL, SOLDERRM/D

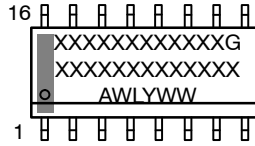
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<b>DESCRIPTION:</b>	<b>SOIC-16 9.90X3.90X1.37 1.27P</b>	<b>PAGE 1 OF 2</b>

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**SOIC-16 9.90x3.90x1.37 1.27P**  
**CASE 751B**  
**ISSUE M**

DATE 18 OCT 2024

**GENERIC  
MARKING DIAGRAM\***



XXXXX = Specific Device Code  
A = Assembly Location  
WL = Wafer Lot  
Y = Year  
WW = Work Week  
G = Pb-Free Package

\*This information is generic. Please refer to device data sheet for actual part marking. Pb-Free indicator, "G" or microdot "•", may or may not be present. Some products may not follow the Generic Marking.

<p><b>STYLE 1:</b></p> <p>PIN 1. COLLECTOR  2. BASE  3. EMITTER  4. NO CONNECTION  5. EMITTER  6. BASE  7. COLLECTOR  8. COLLECTOR  9. BASE  10. EMITTER  11. NO CONNECTION  12. EMITTER  13. BASE  14. COLLECTOR  15. EMITTER  16. COLLECTOR</p>	<p><b>STYLE 2:</b></p> <p>PIN 1. CATHODE  2. ANODE  3. NO CONNECTION  4. CATHODE  5. CATHODE  6. NO CONNECTION  7. ANODE  8. CATHODE  9. CATHODE  10. ANODE  11. NO CONNECTION  12. CATHODE  13. CATHODE  14. NO CONNECTION  15. ANODE  16. CATHODE</p>	<p><b>STYLE 3:</b></p> <p>PIN 1. COLLECTOR, DYE #1  2. BASE, #1  3. EMITTER, #1  4. COLLECTOR, #1  5. COLLECTOR, #2  6. BASE, #2  7. EMITTER, #2  8. COLLECTOR, #2  9. COLLECTOR, #3  10. BASE, #3  11. EMITTER, #3  12. COLLECTOR, #3  13. COLLECTOR, #4  14. BASE, #4  15. EMITTER, #4  16. COLLECTOR, #4</p>	<p><b>STYLE 4:</b></p> <p>PIN 1. COLLECTOR, DYE #1  2. COLLECTOR, #1  3. COLLECTOR, #2  4. COLLECTOR, #2  5. COLLECTOR, #3  6. COLLECTOR, #3  7. COLLECTOR, #4  8. COLLECTOR, #4  9. BASE, #4  10. EMITTER, #4  11. BASE, #3  12. EMITTER, #3  13. BASE, #2  14. EMITTER, #2  15. BASE, #1  16. EMITTER, #1</p>
<p><b>STYLE 5:</b></p> <p>PIN 1. DRAIN, DYE #1  2. DRAIN, #1  3. DRAIN, #2  4. DRAIN, #2  5. DRAIN, #3  6. DRAIN, #3  7. DRAIN, #4  8. DRAIN, #4  9. GATE, #4  10. SOURCE, #4  11. GATE, #3  12. SOURCE, #3  13. GATE, #2  14. SOURCE, #2  15. GATE, #1  16. SOURCE, #1</p>	<p><b>STYLE 6:</b></p> <p>PIN 1. CATHODE  2. CATHODE  3. CATHODE  4. CATHODE  5. CATHODE  6. CATHODE  7. CATHODE  8. CATHODE  9. ANODE  10. ANODE  11. ANODE  12. ANODE  13. ANODE  14. ANODE  15. ANODE  16. ANODE</p>	<p><b>STYLE 7:</b></p> <p>PIN 1. SOURCE N-CH  2. COMMON DRAIN (OUTPUT)  3. COMMON DRAIN (OUTPUT)  4. GATE P-CH  5. COMMON DRAIN (OUTPUT)  6. COMMON DRAIN (OUTPUT)  7. COMMON DRAIN (OUTPUT)  8. SOURCE P-CH  9. SOURCE P-CH  10. COMMON DRAIN (OUTPUT)  11. COMMON DRAIN (OUTPUT)  12. COMMON DRAIN (OUTPUT)  13. GATE N-CH  14. COMMON DRAIN (OUTPUT)  15. COMMON DRAIN (OUTPUT)  16. SOURCE N-CH</p>	

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