

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

Features

- These are Pb-Free Devices

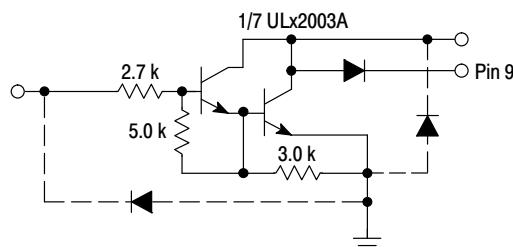


Figure 1. Representative Schematic Diagram

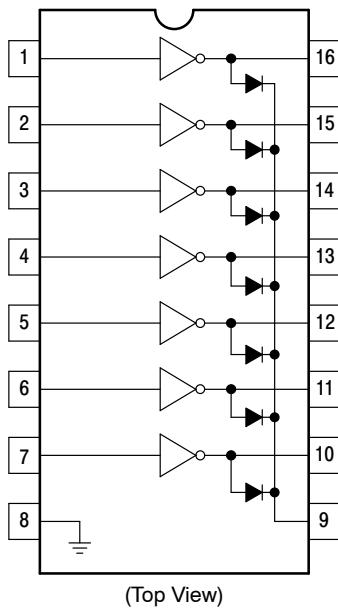
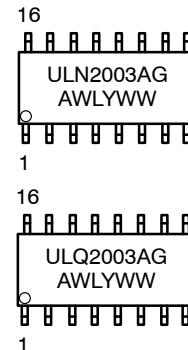


Figure 2. Pin Connections



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.

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

Characteristic	Symbol	Min	Typ	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_{CEX}	—	—	100 50	μA
Collector-Emitter Saturation Voltage ($I_C = 350\text{ mA}$, $I_B = 500\text{ }\mu\text{A}$) ($I_C = 200\text{ mA}$, $I_B = 350\text{ }\mu\text{A}$) ($I_C = 100\text{ mA}$, $I_B = 250\text{ }\mu\text{A}$)	$V_{CE(\text{sat})}$	— — —	1.1 0.95 0.85	1.6 1.3 1.1	V
Input Current - On Condition ($V_I = 3.85\text{ V}$)	$I_{I(\text{on})}$	—	0.93	1.35	mA
Input Voltage - On Condition ($V_{CE} = 2.0\text{ V}$, $I_C = 200\text{ mA}$) ($V_{CE} = 2.0\text{ V}$, $I_C = 250\text{ mA}$) ($V_{CE} = 2.0\text{ V}$, $I_C = 300\text{ mA}$)	$V_{I(\text{on})}$	— — —	—	2.4 2.7 3.0	V
Input Current - Off Condition ($I_C = 500\text{ }\mu\text{A}$, $T_A = 85^\circ\text{C}$)	$I_{I(\text{off})}$	50	100	—	μA
DC Current Gain ($V_{CE} = 2.0\text{ V}$, $I_C = 350\text{ mA}$)	h_{FE}	1000	—	—	—
Input Capacitance	C_I	—	15	30	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 ($V_R = 50\text{ V}$)	I_R	— —	—	50 100	μA
Clamp Diode Forward Voltage ($I_F = 350\text{ mA}$)	V_F	—	1.5	2.0	V

ULN2003A, ULQ2003A

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

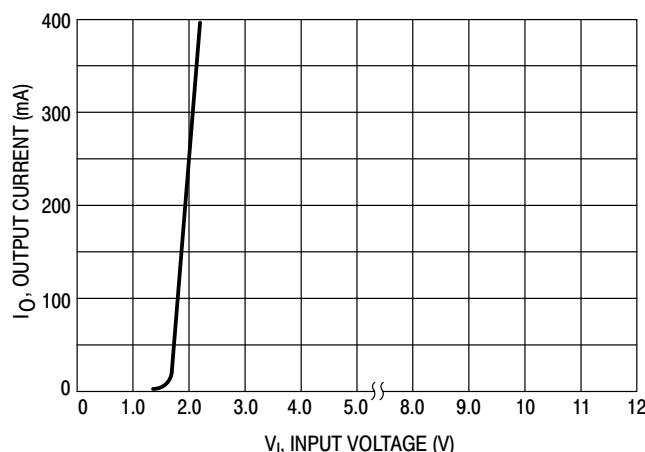


Figure 3. Output Current versus Input Voltage

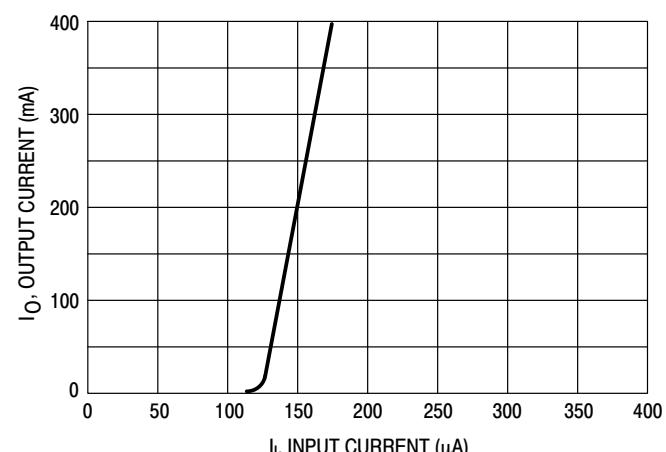


Figure 4. Output Current versus Input Current

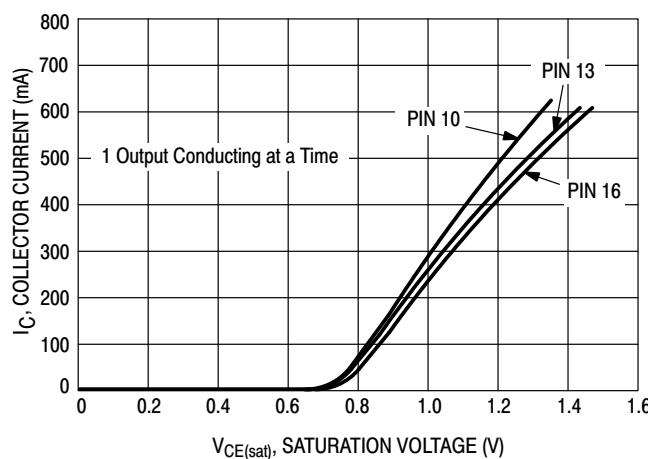


Figure 5. Typical Output Characteristics

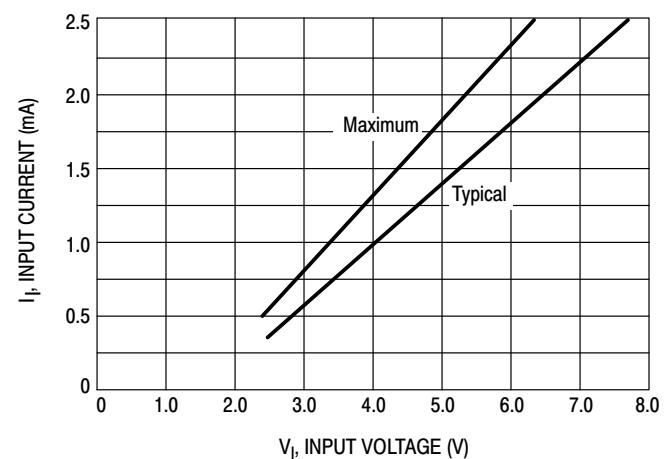


Figure 6. Input Characteristics

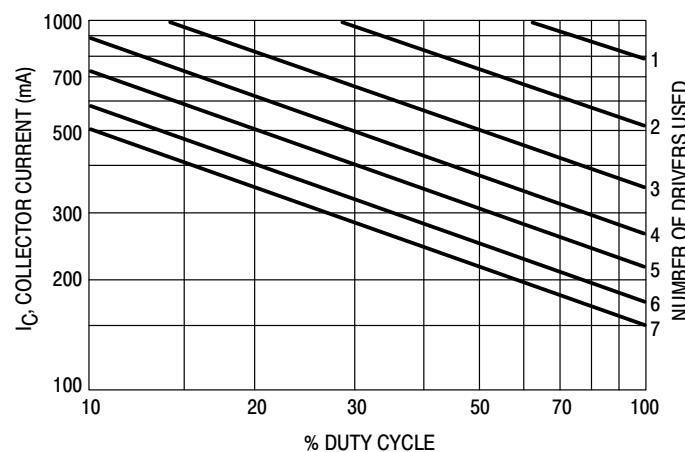


Figure 7. Maximum Collector Current versus Duty Cycle (and Number of Drivers in Use)

ULN2003A, ULQ2003A

REVISION HISTORY

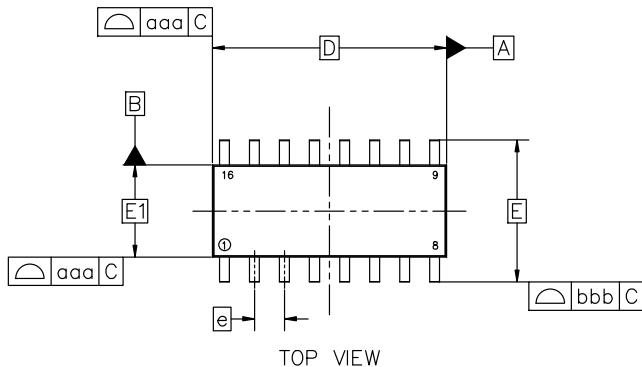
Revision	Description of Changes	Date
1	Rebranded the Data Sheet to onsemi format.	6/3/2025


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

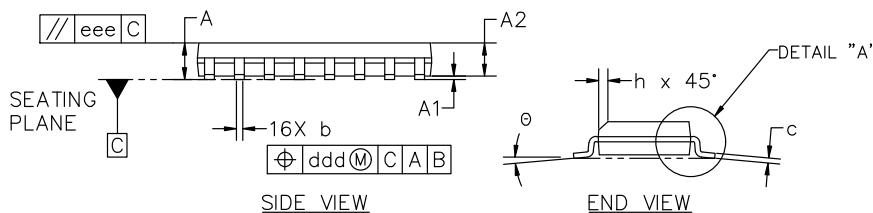
DATE 18 OCT 2024

NOTES:

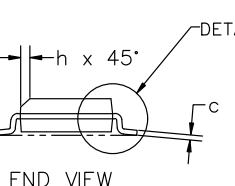
1. DIMENSIONING AND TOLERANCING PER ASME Y14.5M, 2018.
2. DIMENSION IN MILLIMETERS. ANGLE IN DEGREES.
3. DIMENSIONS D AND E1 DO NOT INCLUDE MOLD PROTRUSION.
4. MAXIMUM MOLD PROTRUSION 0.15mm PER SIDE.
5. DIMENSION b DOES NOT INCLUDE DAMBAR PROTRUSION. ALLOWABLE DAMBAR PROTRUSION SHALL BE 0.127mm TOTAL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



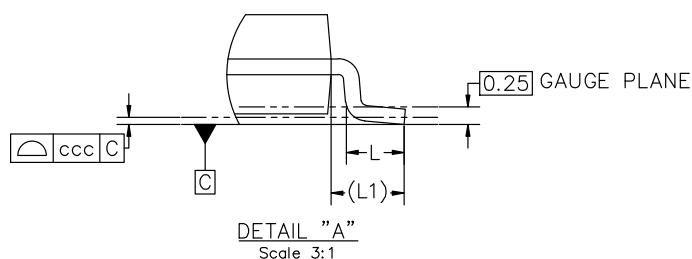
TOP VIEW



SIDE VIEW



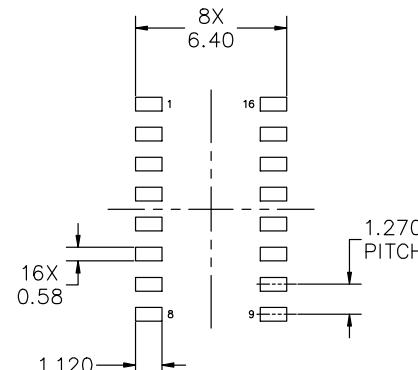
END VIEW

DETAIL "A"
Scale 3:1

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		
θ	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, SODERRM/D

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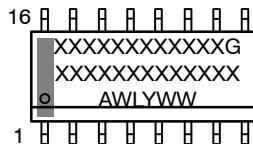
SOIC-16 9.90x3.90x1.37 1.27P

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.

STYLE 1:
 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

STYLE 2:

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

STYLE 3:

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

STYLE 4:

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

STYLE 5:

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

STYLE 6:

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

STYLE 7:

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

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