ULN2003A, ULQ2003A

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

Features

- These are Pb−Free Devices

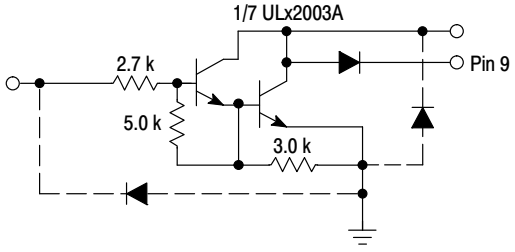
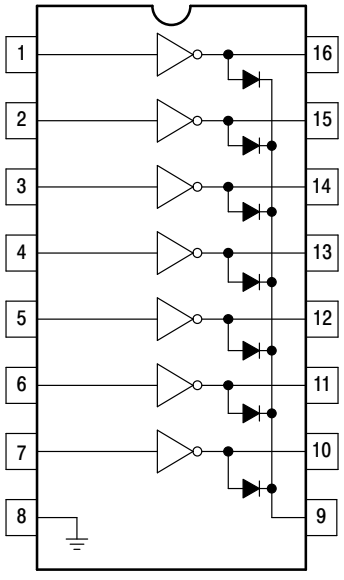


Figure 1. Representative Schematic Diagram

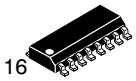


(Top View)

Figure 2. Pin Connections

ON Semiconductor®

http://onsemi.com



16

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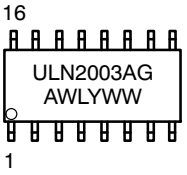
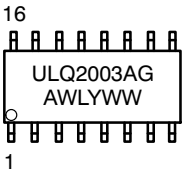
SOIC−16
D SUFFIX
CASE 751B

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.

MAXIMUM RATINGS (T_A = 25°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	°C
Storage Temperature Range	T_{stg}	–55 to +150	°C
Junction Temperature	T_J	150	°C
Thermal Resistance, Junction–to–Ambient Case 751B, D Suffix	$R_{\theta JA}$	 100	°C/W
Thermal Resistance, Junction–to–Case Case 751B, D Suffix	$R_{\theta JC}$	 20	°C/W
Electrostatic Discharge Sensitivity (ESD) Human Body Model (HBM) Machine Model (MM) Charged Device Model (CDM)	ESD	 2000 400 1500	V

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_A = 25°C, unless otherwise noted)

Characteristic		Symbol	Min	Typ	Max	Unit
Output Leakage Current		I_{CEX}				μA
(V_O = 50 V, T_A = +85°C)			–	–	100	
(V_O = 50 V, T_A = +25°C)			–	–	50	
Collector−Emitter Saturation Voltage		$V_{CE(sat)}$				V
(I_C = 350 mA, I_B = 500 μA)			–	1.1	1.6	
(I_C = 200 mA, I_B = 350 μA)			–	0.95	1.3	
(I_C = 100 mA, I_B = 250 μA)			–	0.85	1.1	
Input Current − On Condition		$I_{I(on)}$				mA
(V_I = 3.85 V)			–	0.93	1.35	
Input Voltage − On Condition		$V_{I(on)}$				V
(V_{CE} = 2.0 V, I_C = 200 mA)			–	–	2.4	
(V_{CE} = 2.0 V, I_C = 250 mA)			–	–	2.7	
(V_{CE} = 2.0 V, I_C = 300 mA)			–	–	3.0	
Input Current − Off Condition		$I_{I(off)}$	50	100	–	μA
(I_C = 500 μA, T_A = 85°C)						
DC Current Gain		h_{FE}	1000	–	–	–
(V_{CE} = 2.0 V, I_C = 350 mA)						
Input Capacitance		C_I	–	15	30	pF
Turn−On Delay Time		t_{on}	–	0.25	1.0	μs
(50% E_I to 50% E_O)						
Turn−Off Delay Time		t_{off}	–	0.25	1.0	μs
(50% E_I to 50% E_O)						
Clamp Diode Leakage Current	T_A = +25°C	I_R	–	–	50	μA
(V_R = 50 V)	T_A = +85°C		–	–	100	
Clamp Diode Forward Voltage		V_F	–	1.5	2.0	V
(I_F = 350 mA)						

TYPICAL PERFORMANCE CURVES – T_A = 25°C

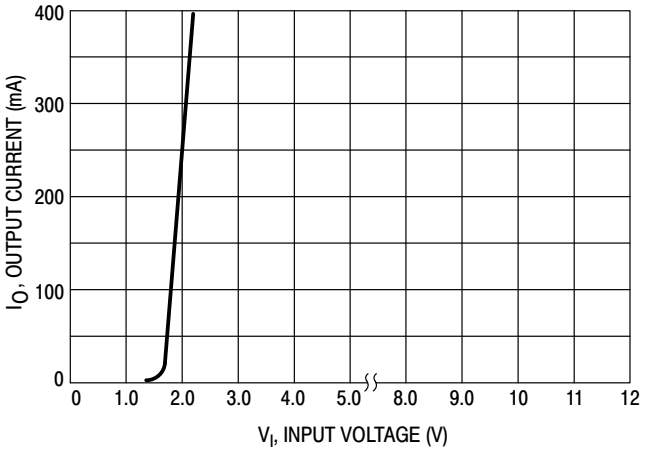


Figure 3. Output Current versus Input Voltage

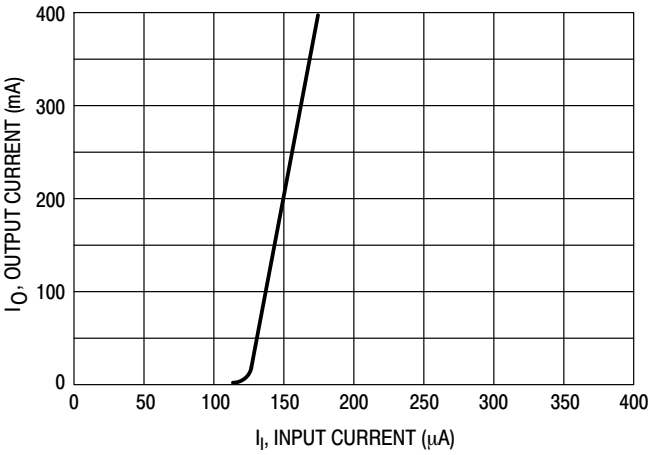


Figure 4. Output Current versus Input Current

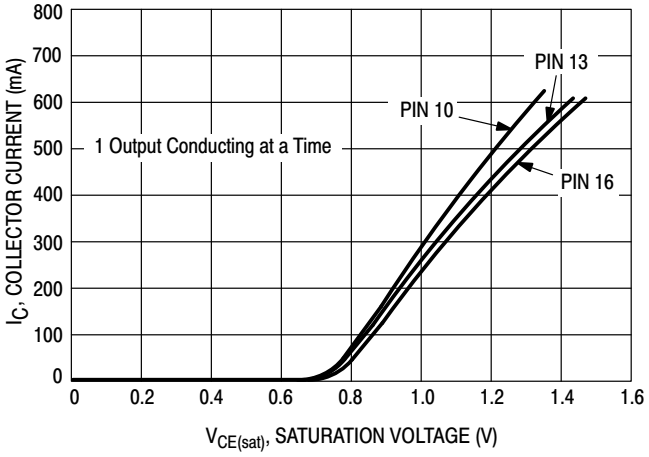


Figure 5. Typical Output Characteristics

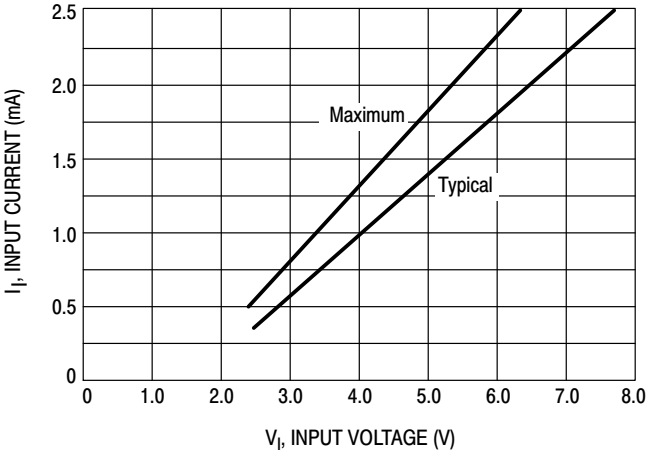


Figure 6. Input Characteristics

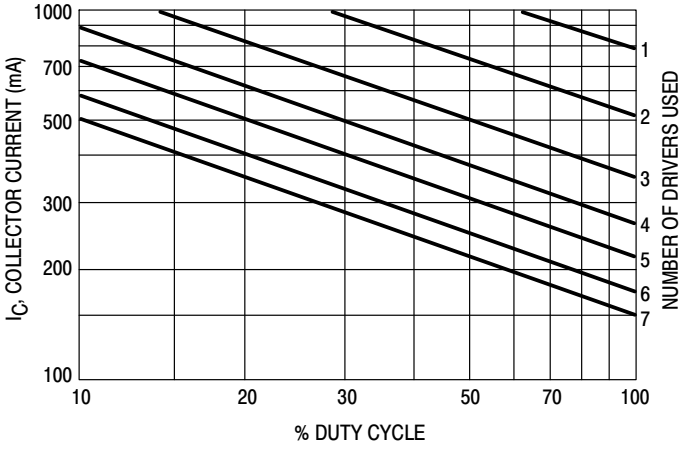
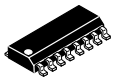


Figure 7. Maximum Collector Current versus Duty Cycle (and Number of Drivers in Use)

MECHANICAL CASE OUTLINE
PACKAGE DIMENSIONS



SCALE 1:1

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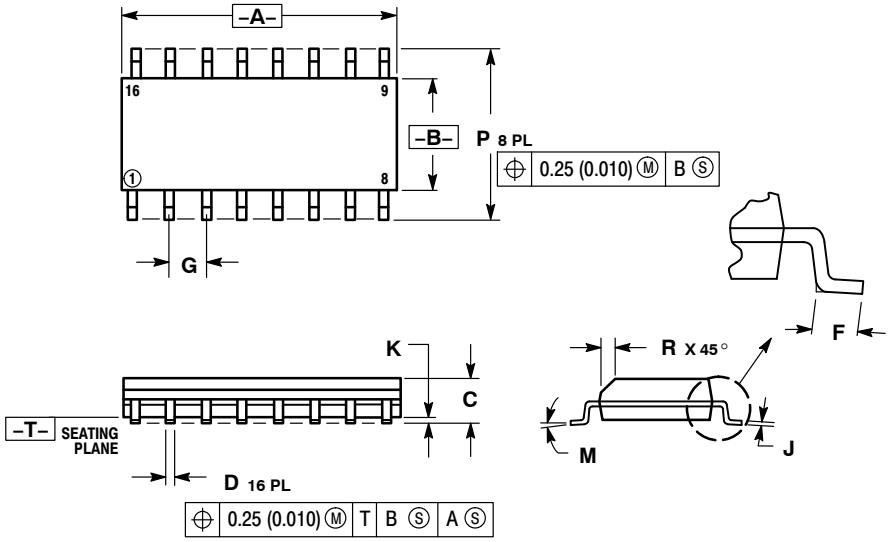
ISSUE K

DATE 29 DEC 2006



NOTES:
1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: MILLIMETER.
3. DIMENSIONS A AND B DO NOT INCLUDE MOLD PROTRUSION.
4. MAXIMUM MOLD PROTRUSION 0.15 (0.006) PER SIDE.
5. 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
A	9.80	10.00	0.386	0.393
B	3.80	4.00	0.150	0.157
C	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

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

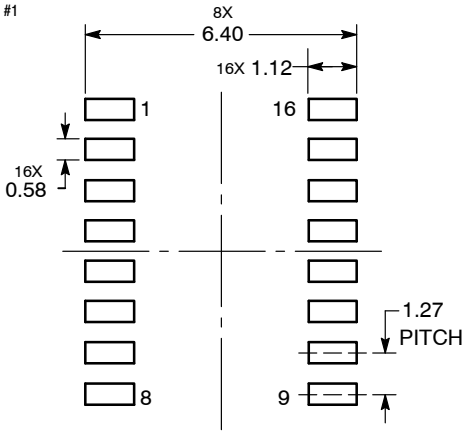
STYLE 4:
PIN 1.	COLLECTOR, DYE #1
2.	COLLECTOR, #1
3.	COLLECTOR, #2
4.	COLLECTOR, #2
5.	COLLECTOR, #3
6.	COLLECTOR, #3
7.	COLLECTOR, #4
8.	COLLECTOR, #4
9.	BASE, #4
10.	EMITTER, #4
11.	BASE, #3
12.	EMITTER, #3
13.	BASE, #2
14.	EMITTER, #2
15.	BASE, #1
16.	EMITTER, #1

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

RECOMMENDED SOLDERING FOOTPRINT*



DIMENSIONS: MILLIMETERS

*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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