

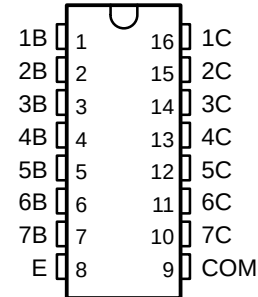
ULN2001A, ULN2002A, ULN2003A, ULN2004A, ULQ2003A, ULQ2004A, HIGH-VOLTAGE HIGH-CURRENT DARLINGTON TRANSISTOR ARRAY

The ULN2001A is obsolete
and is no longer supplied.

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- 500-mA Rated Collector Current (Single Output)
- High-Voltage Outputs . . . 50 V
- Output Clamp Diodes
- Inputs Compatible With Various Types of Logic
- Relay Driver Applications
- Designed to Be Interchangeable With Sprague ULN2001A Series
- Package Options Include Plastic Small Outline (D, NS) Packages, and Plastic DIP (N)

ULN2001A . . . D OR N PACKAGE
ULN2002A . . . N PACKAGE
ULN2003A, ULN2004A . . . D, N, OR NS PACKAGE
ULQ2003A, ULQ2004A . . . D PACKAGE
(TOP VIEW)



description

The ULN2001A, ULN2002A, ULN2003A, ULN2004A, ULQ2003A, and ULQ2004A are high-voltage, high-current Darlington transistor arrays. Each consists of seven npn Darlington pairs that feature high-voltage outputs with common-cathode clamp diodes for switching inductive loads. The collector-current rating of a single Darlington pair is 500 mA. The Darlington pairs can be paralleled for higher current capability. Applications include relay drivers, hammer drivers, lamp drivers, display drivers (LED and gas discharge), line drivers, and logic buffers. For 100-V (otherwise interchangeable) versions of the ULN2003A and ULN2004A, see the SN75468 and SN75469, respectively.

The ULN2001A is a general-purpose array and can be used with TTL and CMOS technologies. The ULN2002A is designed specifically for use with 14-V to 25-V PMOS devices. Each input of this device has a Zener diode and resistor in series to control the input current to a safe limit. The ULN2003A and ULQ2003A have a 2.7-k Ω series base resistor for each Darlington pair for operation directly with TTL or 5-V CMOS devices. The ULN2004A and ULQ2004A have a 10.5-k Ω series base resistor to allow operation directly from CMOS devices that use supply voltages of 6 V to 15 V. The required input current of the ULN/ULQ2004A is below that of the ULN/ULQ2003A, and the required voltage is less than that required by the ULN2002A.

AVAILABLE OPTIONS

T _A	PACKAGES	
	SMALL OUTLINE (D, NS)	PLASTIC DIP (N)
–20°C to 70°C	–	ULN2002AN
	ULN2003AD ULN2003ANS	ULN2003AN
	ULN2004AD ULN2004ANS	ULN2004AN
–40°C to 85°C	ULQ2003AD	–
	ULQ2004AD	ULQ2004AN

The D package is available taped and reeled. Add the suffix R to device type (e.g., ULN2003ADR). The NS package is only available taped and reeled.



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PRODUCTION DATA information is current as of publication date. Products conform to specifications per the terms of Texas Instruments standard warranty. Production processing does not necessarily include testing of all parameters.

**TEXAS
INSTRUMENTS**

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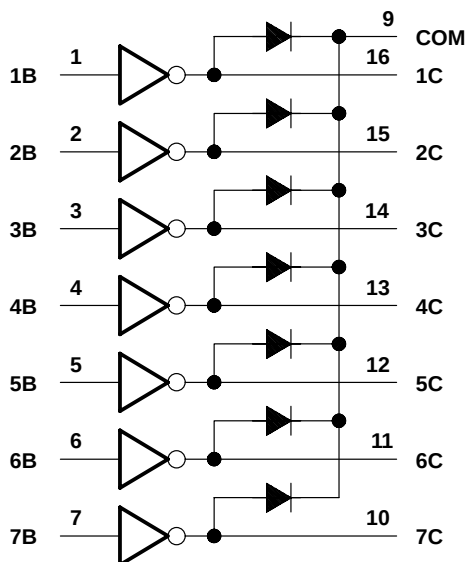
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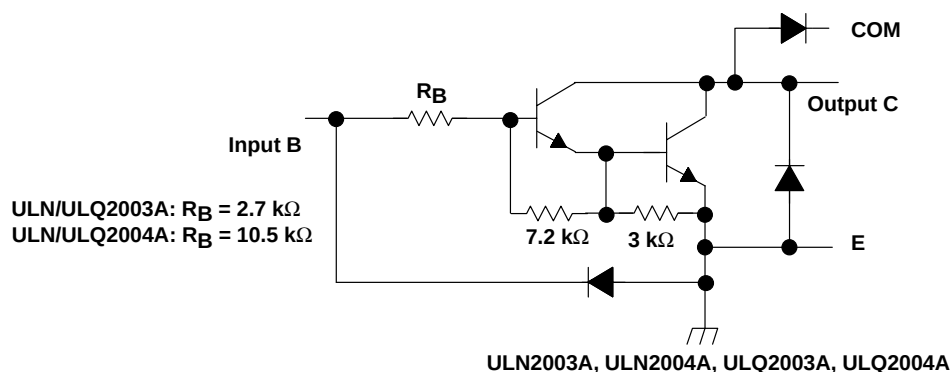
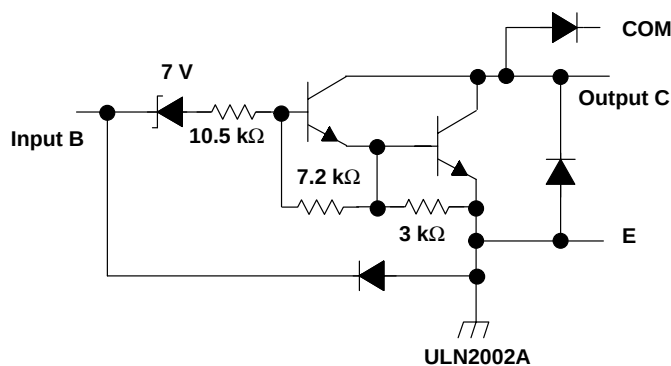
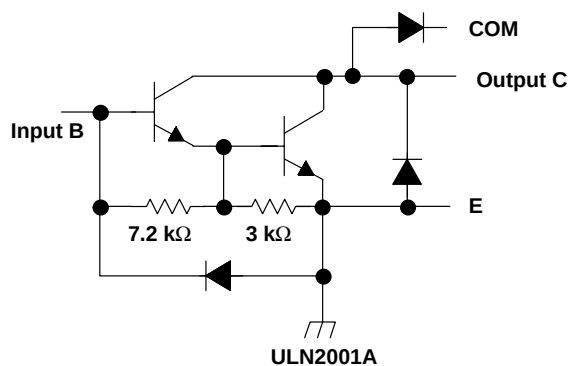
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logic diagram



schematics (each Darlington pair)



All resistor values shown are nominal.

ULN2001A, ULN2002A, ULN2003A, ULN2004A, ULQ2003A, ULQ2004A, HIGH-VOLTAGE HIGH-CURRENT DARLINGTON TRANSISTOR ARRAY

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absolute maximum ratings at 25°C free-air temperature (unless otherwise noted)[†]

Collector-emitter voltage	50 V
Clamp diode reverse voltage (see Note 1)	50 V
Input voltage, V_I (see Note 1)	30 V
Peak collector current (see Figures 14 and 15)	500 mA
Output clamp current, I_{OK}	500 mA
Total emitter-terminal current	–2.5 A
Continuous total power dissipation	See Dissipation Rating Table
Package thermal impedance, θ_{JA} (see Note 2): D package	73°C/W
N package	67°C/W
NS package	64°C/W
Operating free-air temperature range, T_A , ULN200xA	–20°C to 70°C
ULQ200xA	–40°C to 85°C
Lead temperature 1,6 mm (1/16 inch) from case for 10 seconds	260°C
Storage temperature range, T_{stg}	–65°C to 150°C

[†] Stresses beyond those listed under “absolute maximum ratings” may cause permanent damage to the device. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those indicated under “recommended operating conditions” is not implied. Exposure to absolute-maximum-rated conditions for extended periods may affect device reliability.

- NOTES: 1. All voltage values are with respect to the emitter/substrate terminal E, unless otherwise noted.
2. The package thermal impedance is calculated in accordance with JESD 51-7.

DISSIPATION RATING TABLE

PACKAGE	$T_A = 25^\circ\text{C}$ POWER RATING	DERATING FACTOR ABOVE $T_A = 25^\circ\text{C}$	$T_A = 85^\circ\text{C}$ POWER RATING
D	950 mW	7.6 mW/°C	494 mW
N	1150 mW	9.2 mW/°C	598 mW

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

PARAMETER	TEST FIGURE	TEST CONDITIONS	ULN2001A			ULN2002A			UNIT
			MIN	TYP	MAX	MIN	TYP	MAX	
$V_{I(on)}$ On-state input voltage	6	$V_{CE} = 2\text{ V}$, $I_C = 300\text{ mA}$						13	V
$V_{CE(sat)}$ Collector-emitter saturation voltage	5	$I_I = 250\text{ }\mu\text{A}$, $I_C = 100\text{ mA}$	0.9	1.1		0.9	1.1		V
		$I_I = 350\text{ }\mu\text{A}$, $I_C = 200\text{ mA}$	1	1.3		1	1.3		
		$I_I = 500\text{ }\mu\text{A}$, $I_C = 350\text{ mA}$	1.2	1.6		1.2	1.6		
V_F Clamp forward voltage	8	$I_F = 350\text{ mA}$	1.7	2		1.7	2		V
I_{CEX} Collector cutoff current	1	$V_{CE} = 50\text{ V}$, $I_I = 0$			50			50	μA
	2	$V_{CE} = 50\text{ V}$, $T_A = 70^\circ\text{C}$, $V_I = 6\text{ V}$, $I_I = 0$			100			100	
								500	
$I_{I(off)}$ Off-state input current	3	$V_{CE} = 50\text{ V}$, $T_A = 70^\circ\text{C}$, $I_C = 500\text{ }\mu\text{A}$	50	65		50	65		μA
I_I Input current	4	$V_I = 17\text{ V}$				0.82	1.25		mA
I_R Clamp reverse current	7	$V_R = 50\text{ V}$, $T_A = 70^\circ\text{C}$			100			100	μA
		$V_R = 50\text{ V}$			50			50	
h_{FE} Static forward current transfer ratio	5	$V_{CE} = 2\text{ V}$, $I_C = 350\text{ mA}$	1000						
C_i Input capacitance		$V_I = 0$, $f = 1\text{ MHz}$	15	25		15	25		pF



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

PARAMETER	TEST FIGURE	TEST CONDITIONS		ULN2003A			ULN2004A			UNIT
				MIN	TYP	MAX	MIN	TYP	MAX	
$V_{I(on)}$ On-state input voltage	6	$V_{CE} = 2\text{ V}$	$I_C = 125\text{ mA}$						5	V
			$I_C = 200\text{ mA}$			2.4			6	
			$I_C = 250\text{ mA}$			2.7				
			$I_C = 275\text{ mA}$						7	
			$I_C = 300\text{ mA}$			3				
			$I_C = 350\text{ mA}$						8	
$V_{CE(sat)}$ Collector-emitter saturation voltage	5	$I_I = 250\text{ }\mu\text{A}$, $I_C = 100\text{ mA}$		0.9	1.1		0.9	1.1		V
		$I_I = 350\text{ }\mu\text{A}$, $I_C = 200\text{ mA}$		1	1.3		1	1.3		
		$I_I = 500\text{ }\mu\text{A}$, $I_C = 350\text{ mA}$		1.2	1.6		1.2	1.6		
I_{CEX} Collector cutoff current	1	$V_{CE} = 50\text{ V}$, $I_I = 0$				50			50	μA
	2	$V_{CE} = 50\text{ V}$, $T_A = 70^\circ\text{C}$, $I_I = 0$				100			100	
		$V_I = 1\text{ V}$							500	
V_F Clamp forward voltage	8	$I_F = 350\text{ mA}$			1.7	2		1.7	2	V
$I_{I(off)}$ Off-state input current	3	$V_{CE} = 50\text{ V}$, $T_A = 70^\circ\text{C}$, $I_C = 500\text{ }\mu\text{A}$		50	65		50	65		μA
I_I Input current	4	$V_I = 3.85\text{ V}$			0.93	1.35				mA
		$V_I = 5\text{ V}$						0.35	0.5	
		$V_I = 12\text{ V}$						1	1.45	
I_R Clamp reverse current	7	$V_R = 50\text{ V}$				50			50	μA
		$V_R = 50\text{ V}$, $T_A = 70^\circ\text{C}$				100			100	
C_i Input capacitance		$V_I = 0$, $f = 1\text{ MHz}$			15	25		15	25	pF

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electrical characteristics over recommended operating conditions (unless otherwise noted)

PARAMETER		TEST FIGURE	TEST CONDITIONS		ULQ2003A			ULQ2004A			UNIT
					MIN	TYP	MAX	MIN	TYP	MAX	
V _{I(on)}	On-state input voltage	6	V _{CE} = 2 V	I _C = 125 mA						5	V
				I _C = 200 mA			2.7			6	
				I _C = 250 mA			2.9				
				I _C = 275 mA						7	
				I _C = 300 mA			3				
				I _C = 350 mA						8	
V _{CE(sat)}	Collector-emitter saturation voltage	5	I _I = 250 μA, I _C = 100 mA		0.9	1.2		0.9	1.1	V	
			I _I = 350 μA, I _C = 200 mA		1	1.4		1	1.3		
			I _I = 500 μA, I _C = 350 mA		1.2	1.7		1.2	1.6		
I _{CEX}	Collector cutoff current	1	V _{CE} = 50 V, I _I = 0			100			50	μA	
		2	V _{CE} = 50 V	I _I = 0					100		
				V _I = 1 V					500		
V _F	Clamp forward voltage	8	I _F = 350 mA			1.7	2.2		1.7	2	V
I _{I(off)}	Off-state input current	3	V _{CE} = 50 V, I _C = 500 μA		30	65		50	65		μA
I _I	Input current	4	V _I = 3.85 V			0.93	1.35				mA
			V _I = 5 V						0.35	0.5	
			V _I = 12 V						1	1.45	
I _R	Clamp reverse current	7	V _R = 50 V, T _A = 25°C			100			50	μA	
			V _R = 50 V			100			100		
C _i	Input capacitance		V _I = 0, f = 1 MHz			15	25		15	25	pF

switching characteristics, $T_A = 25^\circ\text{C}$

PARAMETER	TEST CONDITIONS	ULN2001A, ULN2002A, ULN2003A, ULN2004A			UNIT
		MIN	TYP	MAX	
t_{PLH} Propagation delay time, low- to high-level output	See Figure 9		0.25	1	μs
t_{PHL} Propagation delay time, high- to low-level output			0.25	1	μs
V_{OH} High-level output voltage after switching	$V_S = 50\text{ V}$, $I_O \approx 300\text{ mA}$, See Figure 10	$V_S - 20$			mV

switching characteristics over recommended operating conditions (unless otherwise noted)

PARAMETER	TEST CONDITIONS	ULQ2003A, ULQ2004A			UNIT
		MIN	TYP	MAX	
t_{PLH} Propagation delay time, low- to high-level output	See Figure 9		1	10	μs
t_{PHL} Propagation delay time, high- to low-level output			1	10	μs
V_{OH} High-level output voltage after switching	$V_S = 50\text{ V}$, $I_O \approx 300\text{ mA}$, See Figure 10	$V_S - 500$			mV



ULN2001A, ULN2002A, ULN2003A, ULN2004A, ULQ2003A, ULQ2004A, HIGH-VOLTAGE HIGH-CURRENT DARLINGTON TRANSISTOR ARRAY

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PARAMETER MEASUREMENT INFORMATION

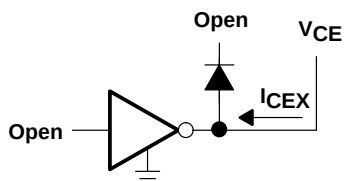


Figure 1. I_{CEX} Test Circuit

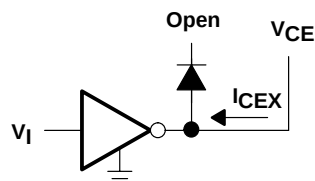


Figure 2. I_{CEX} Test Circuit

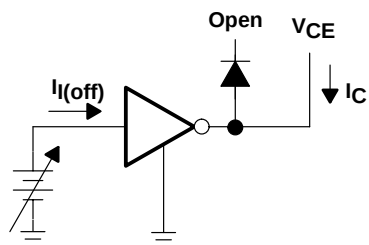


Figure 3. $I_{I(off)}$ Test Circuit

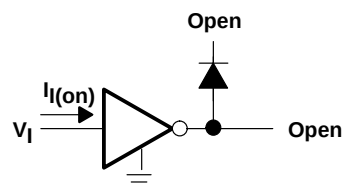
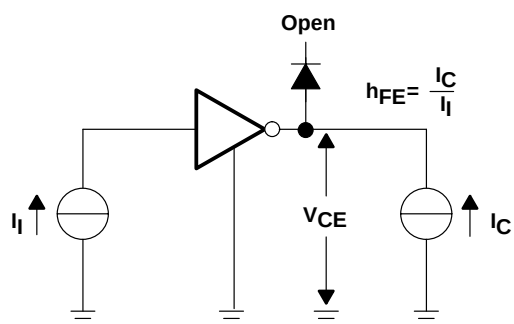


Figure 4. I_I Test Circuit



NOTE: I_I is fixed for measuring $V_{CE(sat)}$, variable for measuring h_{FE} .

Figure 5. h_{FE} , $V_{CE(sat)}$ Test Circuit

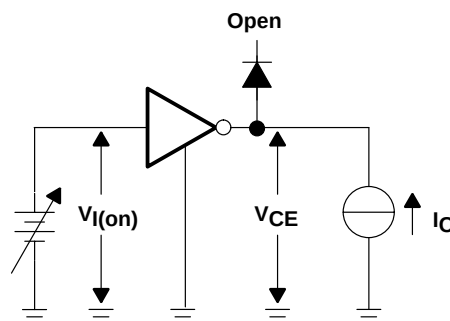


Figure 6. $V_{I(on)}$ Test Circuit

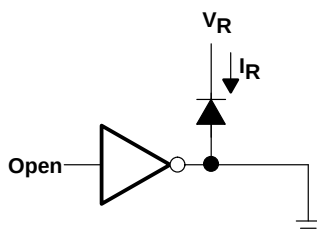


Figure 7. I_R Test Circuit

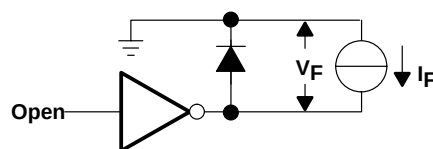


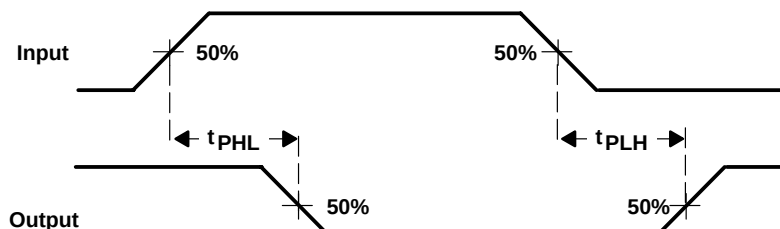
Figure 8. V_F Test Circuit

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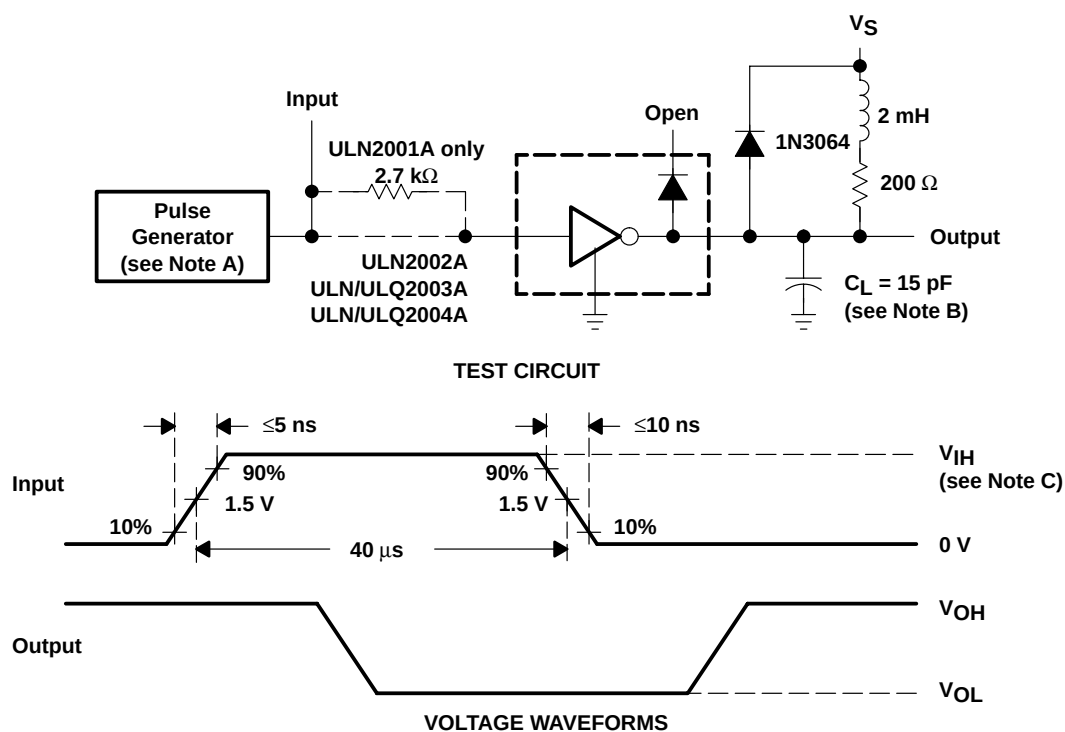
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PARAMETER MEASUREMENT INFORMATION



VOLTAGE WAVEFORMS

Figure 9. Propagation Delay-Time Waveforms



- NOTES: A. The pulse generator has the following characteristics: PRR = 12.5 kHz, $Z_O = 50 \Omega$.
B. C_L includes probe and jig capacitance.
C. For testing the ULN2001A, the ULN2003A, and the ULQ2003A, $V_{IH} = 3 \text{ V}$; for the ULN2002A, $V_{IH} = 13 \text{ V}$; for the ULN2004A and the ULQ2004A, $V_{IH} = 8 \text{ V}$.

Figure 10. Latch-Up Test Circuit and Voltage Waveforms

ULN2001A, ULN2002A, ULN2003A, ULN2004A, ULQ2003A, ULQ2004A, HIGH-VOLTAGE HIGH-CURRENT DARLINGTON TRANSISTOR ARRAY

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The ULN2001A is obsolete
and is no longer supplied.

TYPICAL CHARACTERISTICS

COLLECTOR-EMITTER
SATURATION VOLTAGE
vs
COLLECTOR CURRENT
(ONE DARLINGTON)

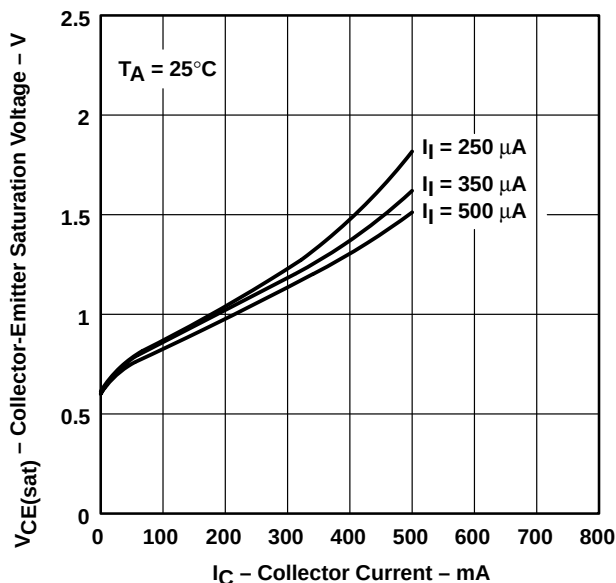


Figure 11

COLLECTOR-EMITTER
SATURATION VOLTAGE
vs
TOTAL COLLECTOR CURRENT
(TWO DARLINGTONS IN PARALLEL)

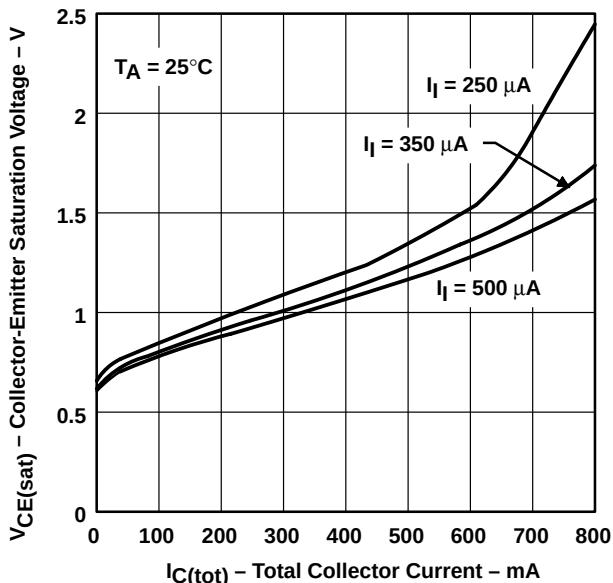


Figure 12

COLLECTOR CURRENT
vs
INPUT CURRENT

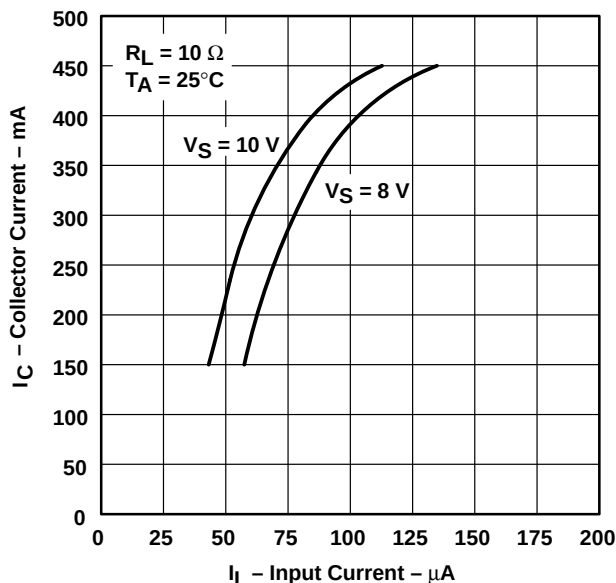


Figure 13

ULN2001A, ULN2002A, ULN2003A, ULN2004A, ULQ2003A, ULQ2004A,
HIGH-VOLTAGE HIGH-CURRENT DARLINGTON
TRANSISTOR ARRAY

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THERMAL INFORMATION

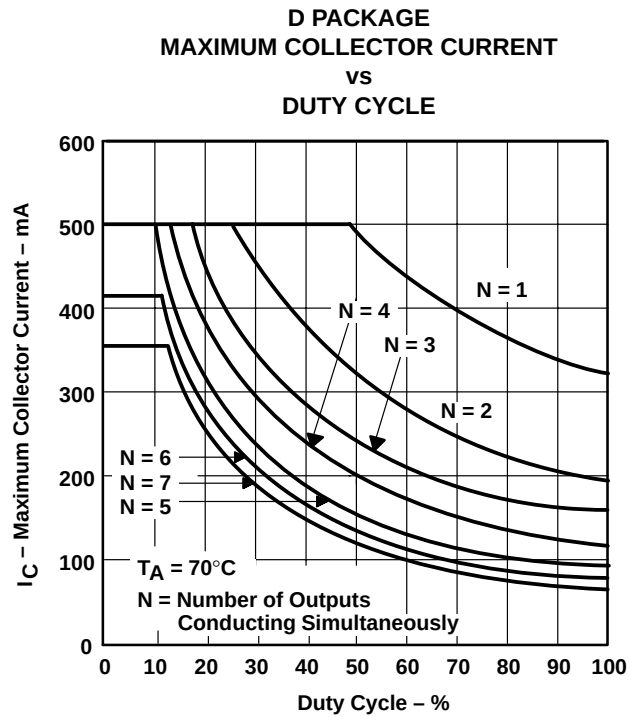


Figure 14

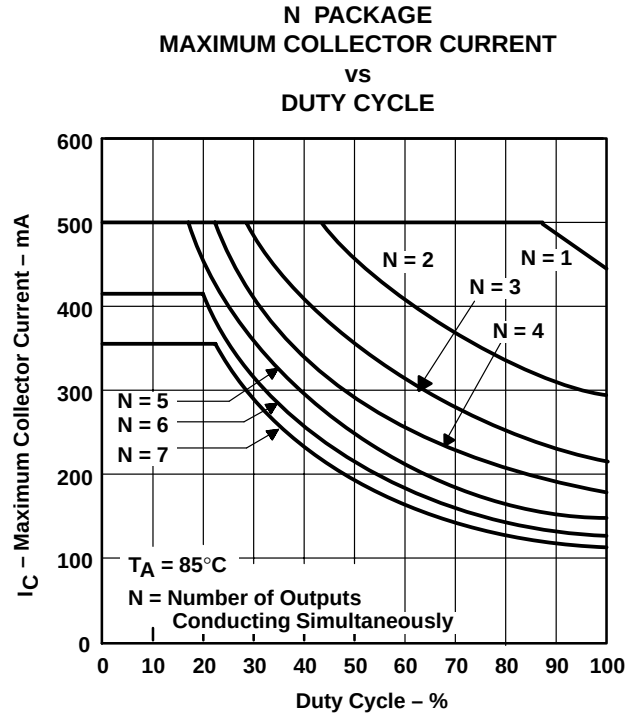


Figure 15

ULN2001A, ULN2002A, ULN2003A, ULN2004A, ULQ2003A, ULQ2004A, HIGH-VOLTAGE HIGH-CURRENT DARLINGTON TRANSISTOR ARRAY

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The ULN2001A is obsolete
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APPLICATION INFORMATION

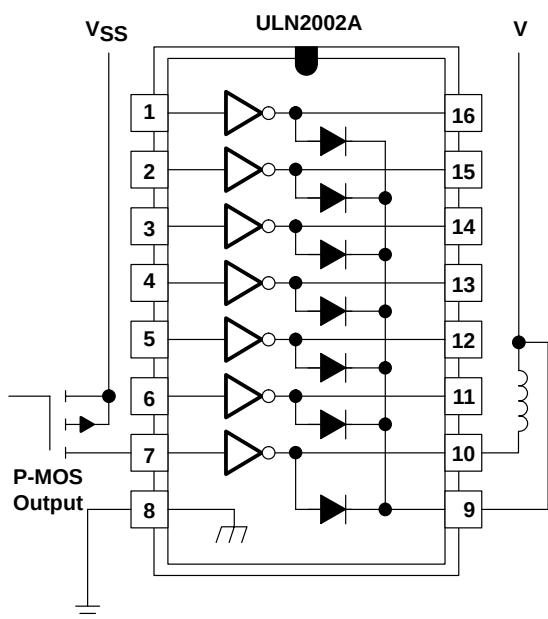


Figure 16. P-MOS to Load

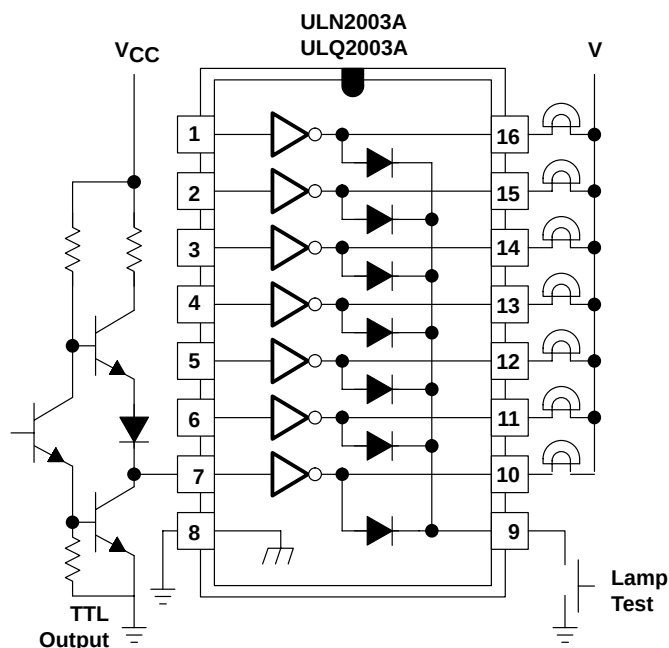


Figure 17. TTL to Load

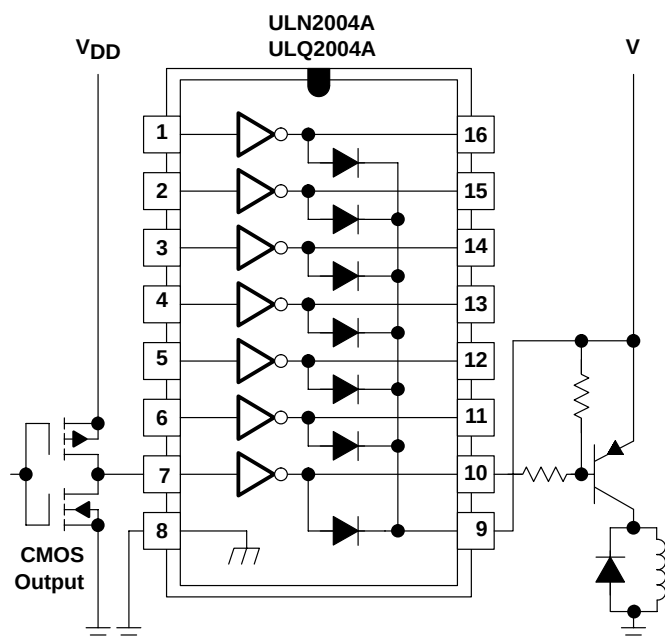


Figure 18. Buffer for Higher Current Loads

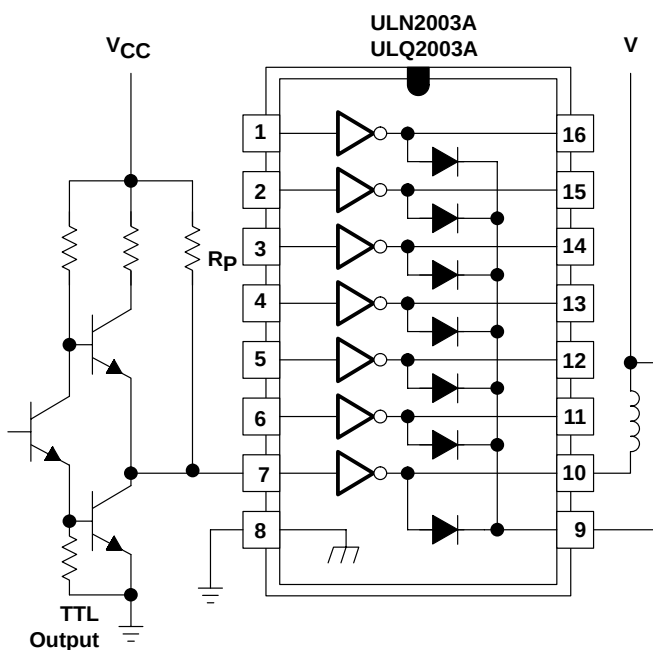


Figure 19. Use of Pullup Resistors to
Increase Drive Current

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ULN2003A, High-Voltage, High-Current Darlington Transistor Arrays

 DEVICE STATUS: **ACTIVE**

PARAMETER NAME	ULN2003A	ULQ2003A
Output Voltage (max) (V)	50	50
Switching Voltage (max) (V)	50	50
Peak Output Current (mA)	500	500
Drivers Per Package	7	7
Output Clamp Diodes	YES	YES
Input Compatibility	CMOS,TTL	CMOS,TTL
Delay Time (typ) (ns)	250	1000

FEATURES
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- 500-mA Rated Collector Current (Single Output)
- High-Voltage Outputs . . . 50 V
- Output Clamp Diodes
- Inputs Compatible With Various Types of Logic
- Relay Driver Applications
- Designed to Be Interchangeable With Sprague ULN2001A Series
- Package Options Include Plastic Small Outline (D, NS) Packages, and Plastic DIP (N)

The ULN2001A is obsolete and is no longer supplied.

DESCRIPTION
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The ULN2001A, ULN2002A, ULN2003A, ULN2004A, ULQ2003A, and ULQ2004A are high-voltage, high-current Darlington transistor arrays. Each consists of seven npn Darlington pairs that feature high-voltage outputs with common-cathode clamp diodes for switching inductive loads. The collector-current rating of a single Darlington pair is 500 mA. The Darlington pairs can be paralleled for higher current capability. Applications include relay drivers, hammer drivers, lamp drivers, display drivers (LED and gas discharge), line drivers, and logic buffers. For 100-V (otherwise interchangeable) versions of the ULN2003A and ULN2004A, see the SN75468 and SN75469, respectively.

The ULN2001A is a general-purpose array and can be used with TTL and CMOS technologies. The ULN2002A is designed specifically for use with 14-V to 25-V PMOS devices. Each input of this device has a Zener diode and resistor in series to control the input current to a safe limit. The ULN2003A and ULQ2003A have a 2.7-k Ω series base resistor for each Darlington pair for operation directly with TTL or 5-V CMOS devices. The ULN2004A and ULQ2004A have a 10.5-k Ω series base resistor to allow operation directly from CMOS devices that use supply voltages of 6 V to 15 V. The required input current of the ULN/ULQ2004A is below that of the ULN/ULQ2003A, and the required voltage is less than that required by the ULN2002A.

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DATASHEET
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 Full datasheet in Acrobat PDF: [uln2003a.pdf](#) (180 KB,Rev.D) (Updated: 07/16/2002)

- [Enhanced Plastic Portfolio Brochure](#) (SGZB004, 385 KB - Updated: 08/19/2002)
- [Military Analog Selection Guide](#) (SGLB002, 318 KB - Updated: 11/09/2000)
- [Military Semiconductors Selection Guide 2002 \(Rev. B\)](#) (SGYC003B, 1648 KB - Updated: 04/22/2002)
- [Standard Linear Products Cross Reference](#) (SLYT017, 586 KB - Updated: 05/03/2000)

SAMPLES							▲Back to Top
ORDERABLE DEVICE		PACKAGE INDUSTRY (TI)	PINS	TEMP (°C)	STATUS	PRODUCT CONTENT	SAMPLES
ULN2003AD		SOP (D)	16		ACTIVE	View Product Content	Request Samples
ULN2003AN		PDIP (N)	16		ACTIVE	View Product Content	Request Samples

PRICING/AVAILABILITY/PKG							▲Back to Top	TI INVENTORY STATUS AS OF 4:00 PM GMT, 26 Sep 2002					REPORTED DISTRIBUTOR INVENTORY AS OF 4:00 PM GMT, 26 Sep 2002		
DEVICE INFORMATION								IN STOCK	IN PROGRESS QTY DATE	LEAD TIME			DISTRIBUTOR COMPANY REGION	IN STOCK	PURCHASE
ULN2003AD	ACTIVE	SOP (D) 16		View Contents	1KU 0.29	40		N/A*	920 30 Sep	3 WKS			Avnet AMERICA	> 1k	BUY NOW
									1536 01 Oct				DigiKey AMERICA	393	BUY NOW
									> 10k 07 Oct						
									> 10k 08 Oct						
									> 10k 14 Oct						
ULN2003ADR	ACTIVE	SOP (D) 16		View Contents	1KU 0.29	2500		N/A*	> 10k 30 Sep	2 WKS			Avnet AMERICA	> 1k	BUY NOW
									1103 01 Oct				DigiKey AMERICA	> 1k	BUY NOW
									> 10k 03 Oct						
									> 10k 07 Oct						
									> 10k 08 Oct						
ULN2003AJ	OBSOLETE	CDIP (J) 16	-55 TO 125	View Contents	1KU			N/A*		Not Available					
ULN2003AN	ACTIVE	PDIP (N) 16		View Contents	1KU 0.29	25		1000	> 10k 23 Sep	2 WKS			Avnet AMERICA	> 1k	BUY NOW
									4920 30 Sep				DigiKey AMERICA	> 1k	BUY NOW
									> 10k 04 Oct						

								>10k 07 Oct				
								>10k 11 Oct				
ULN2003ANSR	ACTIVE	SOP (NS) 16		View Contents	1KU 0.35	2000	N/A*	>10k 30 Sep	2 WKS			
								>10k 04 Oct				
								2302 11 Oct				

Table Data Updated on: 9/26/2002


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 | [RELATED DOCUMENTS](#)
ULN2004A, High-Voltage, High-Current Darlington Transistor Array

 DEVICE STATUS: **ACTIVE**

PARAMETER NAME	ULN2004A	ULQ2004A
Output Voltage (max) (V)	50	50
Switching Voltage (max) (V)	50	50
Peak Output Current (mA)	500	500
Drivers Per Package	7	7
Output Clamp Diodes	YES	YES
Input Compatibility	CMOS	CMOS
Delay Time (typ) (ns)	250	1000

FEATURES
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- 500-mA Rated Collector Current (Single Output)
- High-Voltage Outputs . . . 50 V
- Output Clamp Diodes
- Inputs Compatible With Various Types of Logic
- Relay Driver Applications
- Designed to Be Interchangeable With Sprague ULN2001A Series
- Package Options Include Plastic Small Outline (D, NS) Packages, and Plastic DIP (N)

The ULN2001A is obsolete and is no longer supplied.

DESCRIPTION
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The ULN2001A, ULN2002A, ULN2003A, ULN2004A, ULQ2003A, and ULQ2004A are high-voltage, high-current Darlington transistor arrays. Each consists of seven npn Darlington pairs that feature high-voltage outputs with common-cathode clamp diodes for switching inductive loads. The collector-current rating of a single Darlington pair is 500 mA. The Darlington pairs can be paralleled for higher current capability. Applications include relay drivers, hammer drivers, lamp drivers, display drivers (LED and gas discharge), line drivers, and logic buffers. For 100-V (otherwise interchangeable) versions of the ULN2003A and ULN2004A, see the SN75468 and SN75469, respectively.

The ULN2001A is a general-purpose array and can be used with TTL and CMOS technologies. The ULN2002A is designed specifically for use with 14-V to 25-V PMOS devices. Each input of this device has a Zener diode and resistor in series to control the input current to a safe limit. The ULN2003A and ULQ2003A have a 2.7-k Ω series base resistor for each Darlington pair for operation directly with TTL or 5-V CMOS devices. The ULN2004A and ULQ2004A have a 10.5-k Ω series base resistor to allow operation directly from CMOS devices that use supply voltages of 6 V to 15 V. The required input current of the ULN/ULQ2004A is below that of the ULN/ULQ2003A, and the required voltage is less than that required by the ULN2002A.

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- [Standard Linear Products Cross Reference](#) (SLYT017, 586 KB - Updated: 05/03/2000)

SAMPLES

ORDERABLE DEVICE	PACKAGE INDUSTRY (TI)	PINS	TEMP (°C)	STATUS	PRODUCT CONTENT	SAMPLES
ULN2004AN	PDIP (N)	16	-20 TO 85	ACTIVE	View Product Content	Request Samples

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DEVICE INFORMATION							TI INVENTORY STATUS AS OF 4:00 PM GMT, 26 Sep 2002			REPORTED DISTRIBUTOR INVENTORY AS OF 4:00 PM GMT, 26 Sep 2002		
ORDERABLE DEVICE	STATUS	PACKAGE TYPE PINS	TEMP (°C)	PRODUCT CONTENT	BUDGETARY PRICING QTY \$US	STD PACK QTY	IN STOCK	IN PROGRESS QTY DATE	LEAD TIME	DISTRIBUTOR COMPANY REGION	IN STOCK	PURCHASE
ULN2004AD	ACTIVE	SOP (D) 16	-20 TO 85	View Contents	1KU 0.29	40	N/A*	1000 24 Sep	4 WKS	Avnet AMERICA	> 1k	BUY NOW
								2735 03 Oct				
								> 10k 07 Oct				
								8000 09 Oct				
								2960 10 Oct				
ULN2004ADR	ACTIVE	SOP (D) 16	-20 TO 85	View Contents	1KU 0.29	2500	N/A*	> 10k 23 Sep	2 WKS	Avnet AMERICA	> 1k	BUY NOW
								> 10k 03 Oct				
								10k 04 Oct				
								> 10k 07 Oct				
								2500 08 Oct				
ULN2004AN	ACTIVE	PDIP (N) 16	-20 TO 85	View Contents	1KU 0.29	25	N/A*	> 10k 30 Sep	2 WKS	Avnet AMERICA	> 1k	BUY NOW
								1475 03 Oct		DigiKey AMERICA	> 1k	BUY NOW
								> 10k 07 Oct				
								> 10k 08 Oct				
								> 10k 14 Oct				

ULN2004ANSR	ACTIVE	SOP (NS) 16		View Contents	1KU 0.35	2000	N/A*	2000 27 Sep	5 WKS			
								>10k 04 Oct				
								2302 11 Oct				
								7051 18 Oct				

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