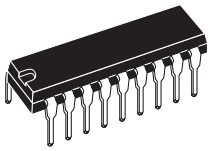
ULN2801A, ULN2802A, ULN2803A, ULN2804A

Eight Darlington arrays

Datasheet - production data



DIP-18

Features

- Eight Darlington transistors with common emitters
- Output current to 500 mA
- Output voltage to 50 V
- Integral suppression diodes
- Versions for all popular logic families
- Output can be paralleled
- Inputs pinned opposite outputs to simplify board layout

Description

The ULN2801A, ULN2802A, ULN2803A and ULN2804A each contain eight Darlington transistors with common emitters and integral suppression diodes for inductive loads. Each Darlington features a peak load current rating of 600 mA (500 mA continuous) and can withstand at least 50 V in the OFF state. Outputs may be paralleled for higher current capability.

Four versions are available to simplify interfacing to standard logic families: the ULN2801A is designed for general purpose applications with a current limit resistor; the ULN2802A has a 10.5 kΩ input resistor and Zener for 14-25 V PMOS; the ULN2803A has a 2.7 kΩ input resistor for 5 V TTL and CMOS; the ULN2804A has a 10.5 kΩ input resistor for 6-15 V CMOS.

All types are supplied in an 18-lead plastic DIP with a copper lead form and feature the convenient input-opposite-output pinout to simplify board layout.

Table 1. Device summary

Order codes	Package
ULN2801A	DIP-18
ULN2802A	
ULN2803A	
ULN2804A	

This is information on a product in full production. www.st.com

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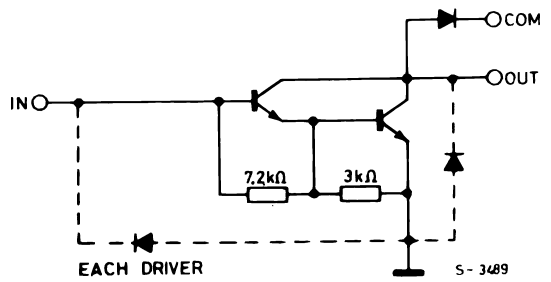
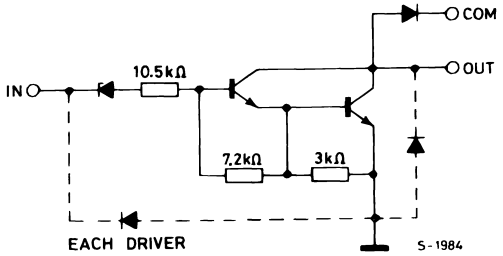
1 Diagram

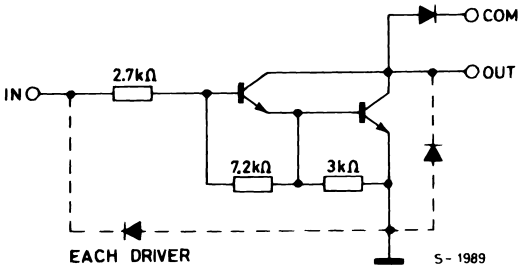
Figure 1. Schematic diagrams



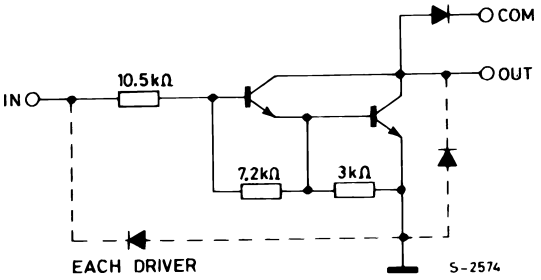
For ULN2801A (each driver for PMOS-CMOS)



For ULN2802A (each driver for 14-15V PMOS)



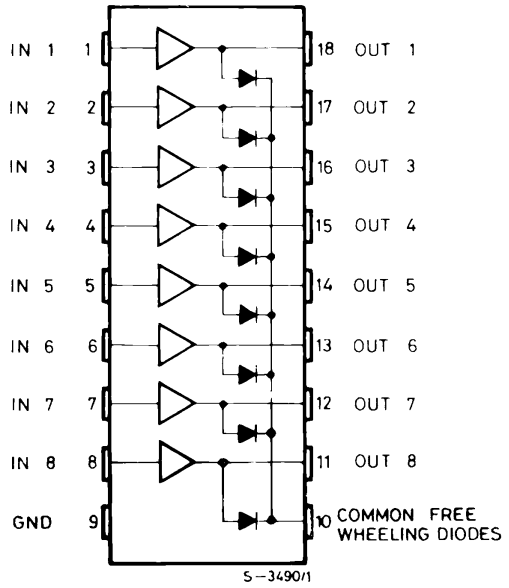
For ULN2803A (each driver for 5V, TTL/CMOS)



For ULN2804A (each driver for 6-15V CMOS/PMOS)

2 Pin configuration

Figure 2. Pin connections (top view)



3 Maximum ratings

Table 2. Absolute maximum ratings

Symbol	Parameter	Value	Unit
V_O	Output voltage	50	V
V_I	Input voltage (for ULN2802A - ULN2803A - ULN2804A)	30	V
I_C	Continuous collector current	500	mA
I_B	Continuous base current	25	mA
P_{TOT}	Power Dissipation (one Darlington pair)	1	W
	Power Dissipation (total package)	2.25	
T_A	Operating ambient temperature range	- 20 to 85	°C
T_{STG}	Storage temperature range	- 55 to 150	°C
T_J	Junction temperature	-20 to 150	°C

Table 3. Thermal data

Symbol	Parameter	Value	Unit
R_{thJA}	Thermal resistance junction-ambient	55	°C/W

4 Electrical characteristics

T_A = 25 °C unless otherwise specified.

Table 4. Electrical characteristics

Symbol	Parameter	Test condition	Min.	Typ.	Max.	Unit
I_{CEX}	Output leakage current	V_{CE} = 50V				µA
		T_A = 70 °C, V_{CE} = 50 V (*Figure 3*)			50	
		T_A = 70°C for ULN2802A, V_{CE} = 50 V, V_I = 6 V (*Figure 4*)			100	
		T_A = 70°C for ULN2804A, V_{CE} = 50 V, V_I = 1 V (*Figure 4*)			500	
$V_{CE(SAT)}$	Collector-emitter saturation voltage (*Figure 5*)	I_C = 100 mA, I_B = 250 µA		0.9	1.1	V
		I_C = 200 mA, I_B = 350 µA		1.1	1.3	
		I_C = 350 mA, I_B = 500 µA		1.3	1.6	
$I_{I(ON)}$	Input current (*Figure 6*)	for ULN2802A, V_I = 17 V		0.82	1.25	mA
		for ULN2803A, V_I = 3.85 V		0.93	1.35	
		for ULN2804A, V_I = 5 V		0.35	0.5	
		V_I = 12 V		1	1.45	
$I_{I(OFF)}$	Input current (*Figure 7*)	T_A = 70 °C, I_C = 500 µA	50	65		µA
$V_{I(ON)}$	Input voltage (*Figure 8*)	V_{CE}= 2V, for ULN2802A I_C = 300 mA for ULN2803A I_C = 200 mA I_C = 250 mA I_C = 300 mA for ULN2804A I_C = 125 mA I_C = 200 mA I_C = 275 mA I_C = 350 mA			13 2.4 2.7 3 5 6 7 8	V
h_{FE}	DC Forward current gain (*Figure 5*)	for ULN2801A, V_{CE} = 2 V, I_C = 350 mA	1000			
C_I	Input capacitance			15	25	pF
t_{PLH}	Turn-on delay time	0.5 V_I to 0.5V_O		0.25	1	µs
t_{PHL}	Turn-off delay time	0.5 V_I to 0.5V_O		0.25	1	µs
I_R	Clamp diode leakage current (*Figure 9*)	V_R = 50 V			50	µA
		T_A = 70 °C, V_R = 50 V			100	
V_F	Clamp diode forward voltage (*Figure 10*)	I_F = 350 mA		1.7	2	V

5 Test circuits

Figure 3. Output leakage current

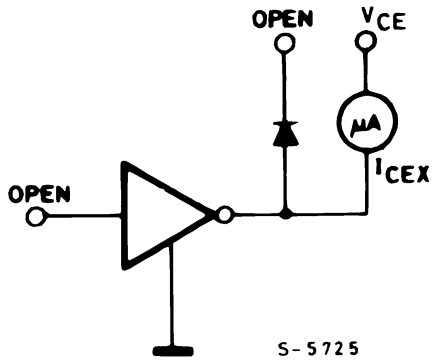


Figure 4. Output leakage current (for ULN2802A only)

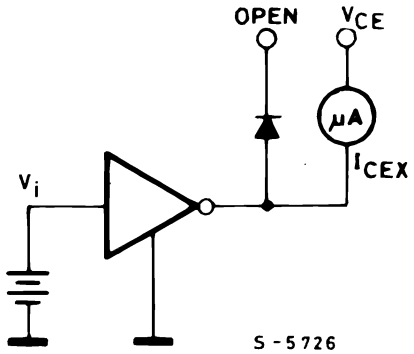


Figure 5. Collector-emitter saturation voltage

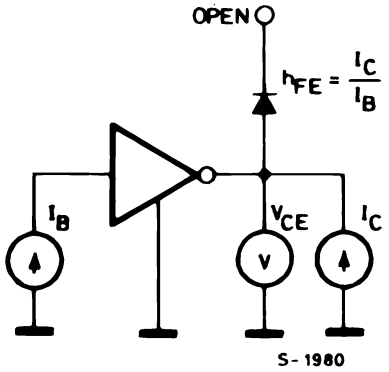


Figure 6. Input current (ON)

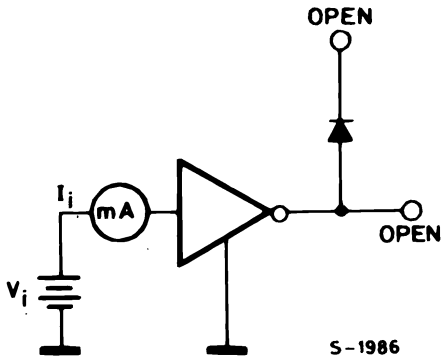


Figure 7. Input current (OFF)

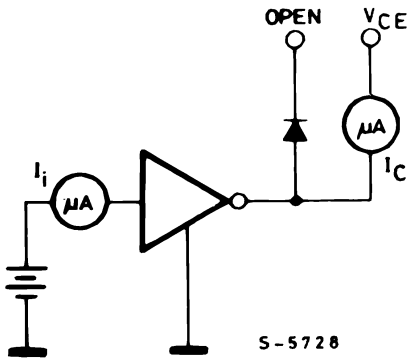


Figure 8. Input voltage

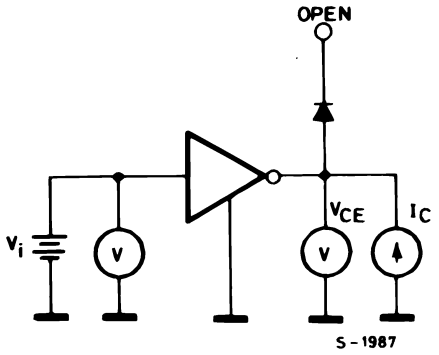


Figure 9. Clamp diode leakage current

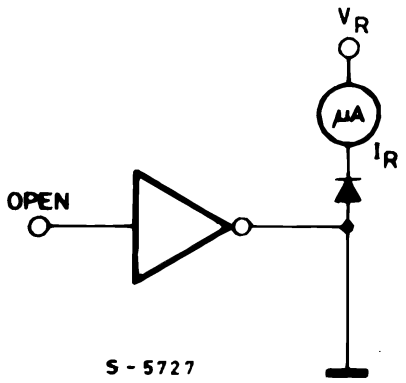
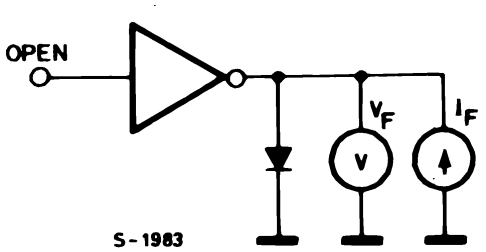


Figure 10. Clamp diode forward voltage



6 Typical performance characteristics

Figure 11. Collector current as a function of saturation voltaget

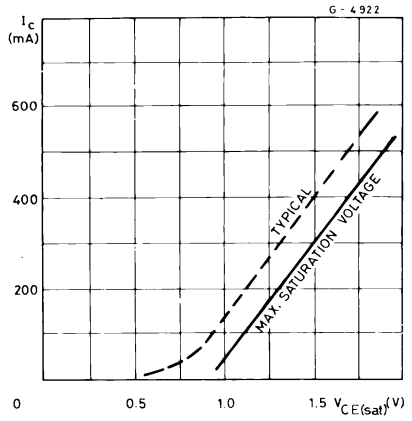


Figure 12. Collector current as a function of input current

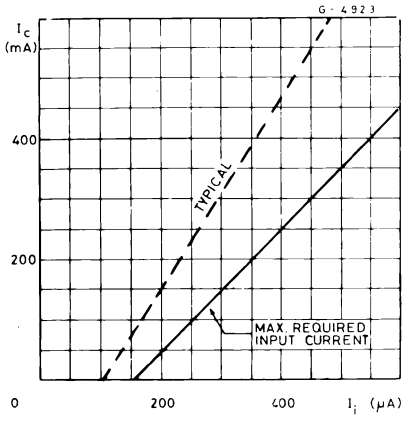


Figure 13. Allowable average power dissipation as a function of T_A

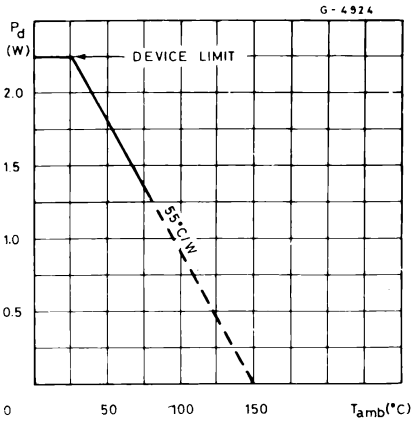


Figure 14. Peak collector current as a function of duty cycle

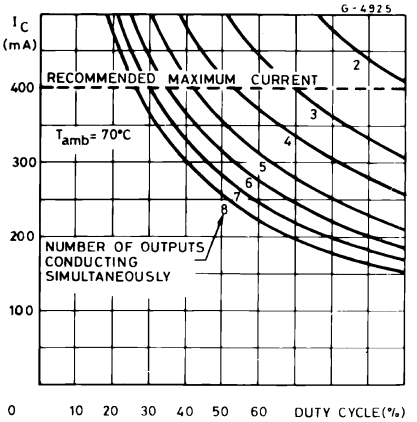


Figure 15. Peak collector current as a function of duty cycle

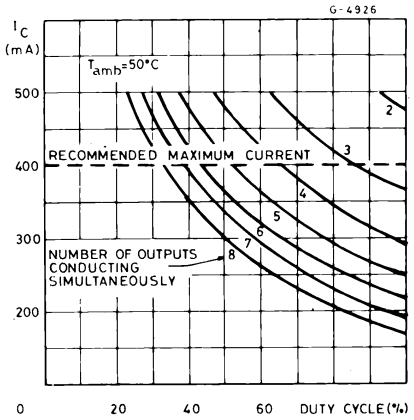


Figure 16. Input current as a function of input voltage (for ULN2802A)

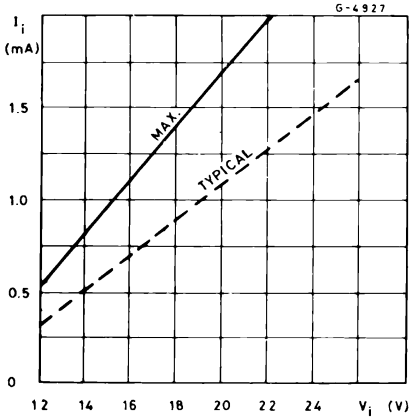


Figure 17. Input current as a function of input voltage (for ULN2804A)

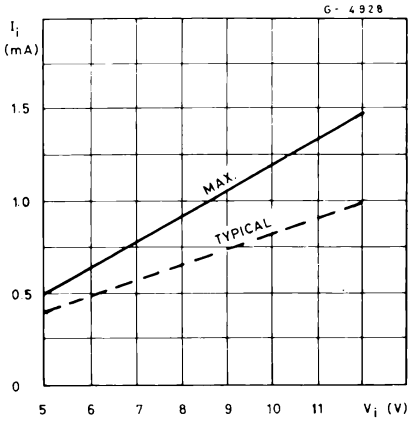
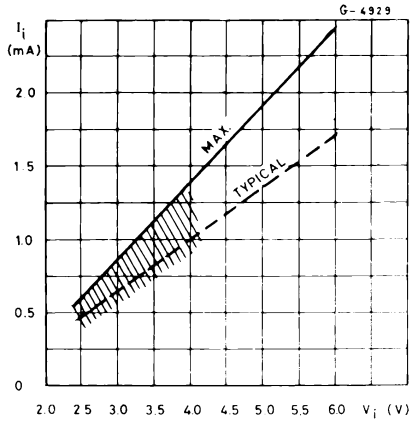


Figure 18. Input current as a function of input voltage (for ULN2803A)



7 Package mechanical data

In order to meet environmental requirements, ST offers these devices in different grades of ECOPACK® packages, depending on their level of environmental compliance. ECOPACK® specifications, grade definitions and product status are available at: *www.st.com*.
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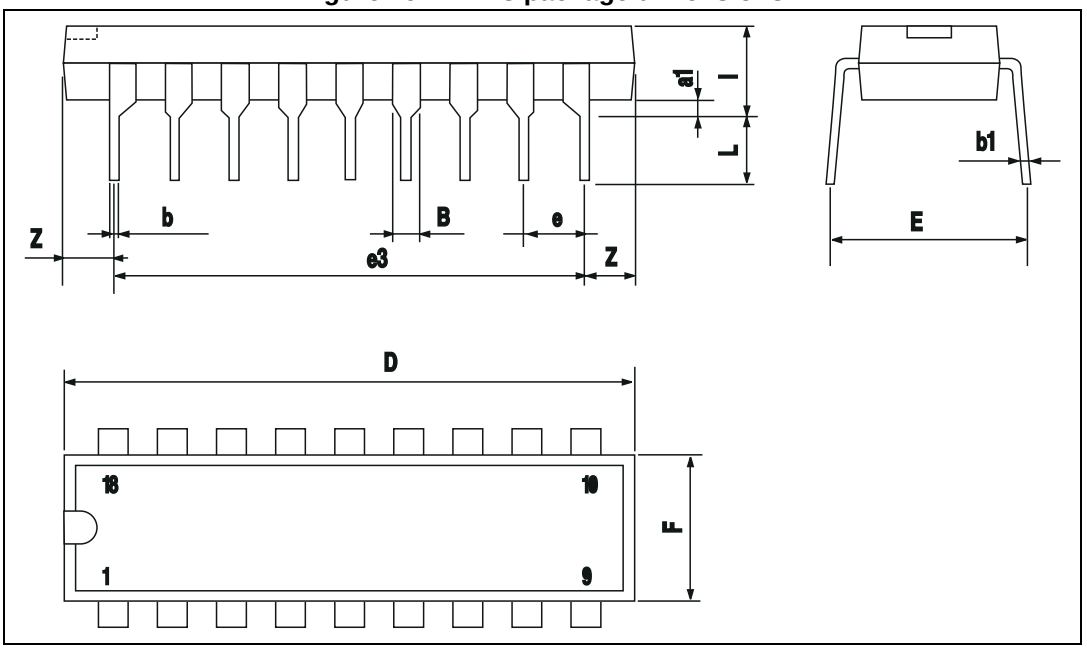
Table 5. DIP-18 mechanical data

Dim.	mm.		
	Min.	Typ.	Max.
a1	0.254		
B	1.39		1.65
b		0.46	
b1		0.25	
D			23.24
E		8.5	
e		2.54	
e3		20.32	
F			7.1
I			3.93
L		3.3	
Z		1.27	1.59

Figure 19. DIP-18 package dimensions



8 Revision history

Table 6. Document revision history

Date	Revision	Changes
18-Sep-2003	1	First release
10-Mar-2010	2	Updated package mechanical data
19-Nov-2012	3	Modified input voltage values Table 4 on page 6.
27-Jun-2018	4	Updated: $I_{I(ON)}$ test condition in *Table 4: Electrical characteristics*.

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