



# ULN2801A, ULN2802A, ULN2803A, ULN2804A

Eight Darlington array

Datasheet – production data

## Features

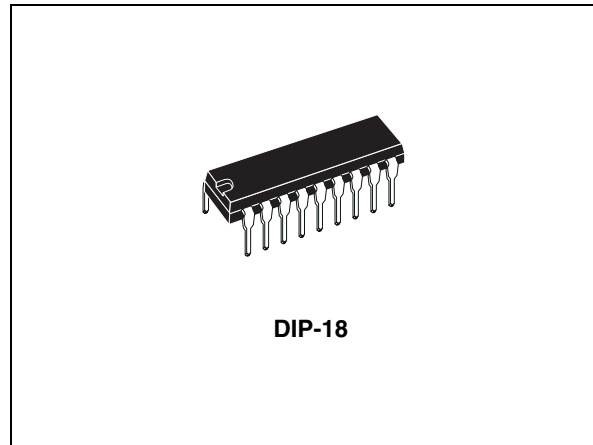
- Eight Darlington transistors with common emitters
- Output current to 500 mA
- Output voltage to 50 V
- Integral suppression diodes
- Versions for all popular logic families
- Output can be paralleled
- Inputs pinned opposite outputs to simplify board layout

## 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 k $\Omega$  input resistor and Zener for 14-25 V PMOS; the ULN2803A has a 2.7 k $\Omega$  input resistor for 5 V TTL and CMOS; the ULN2804A has a 10.5 k $\Omega$  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**

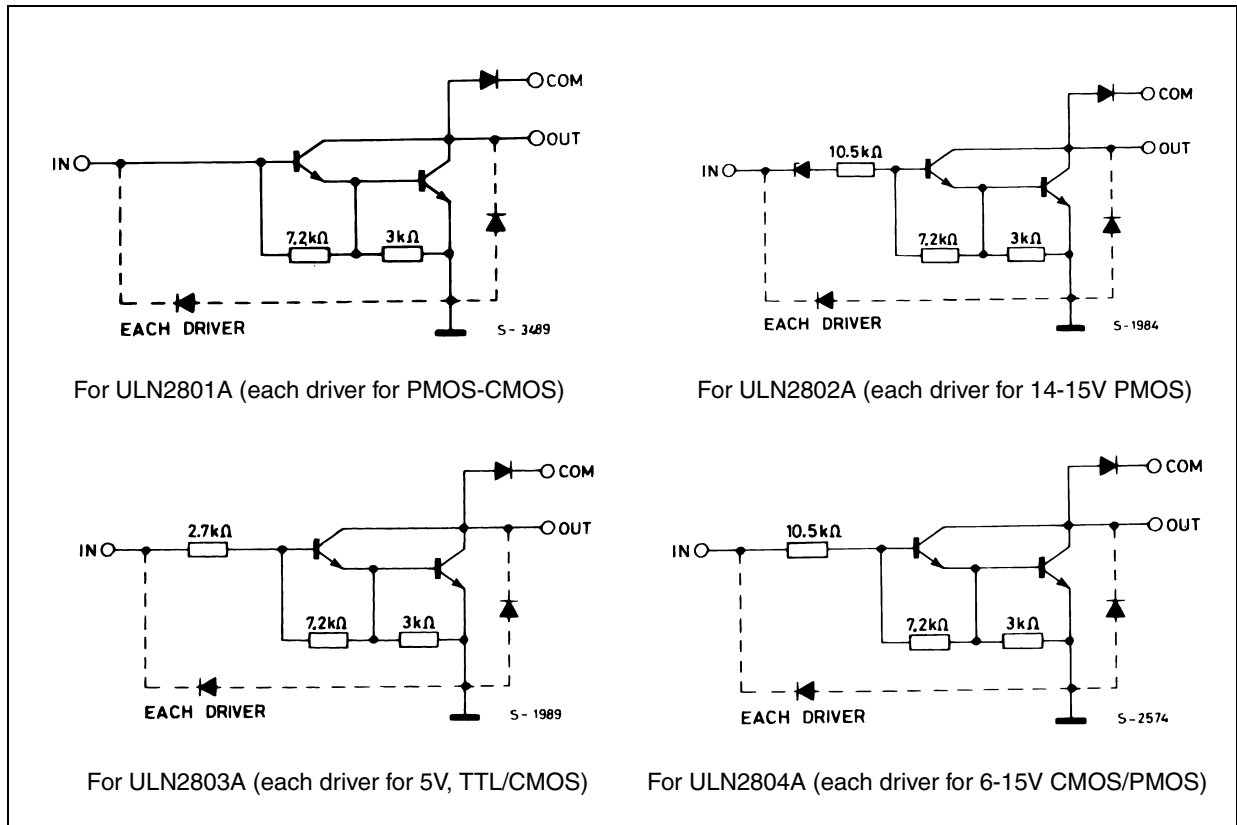
Order codes	Package
ULN2801A	DIP-18
ULN2802A	
ULN2803A	
ULN2804A	

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# 1 Diagram

Figure 1. Schematic diagrams



For ULN2801A (each driver for PMOS-CMOS)

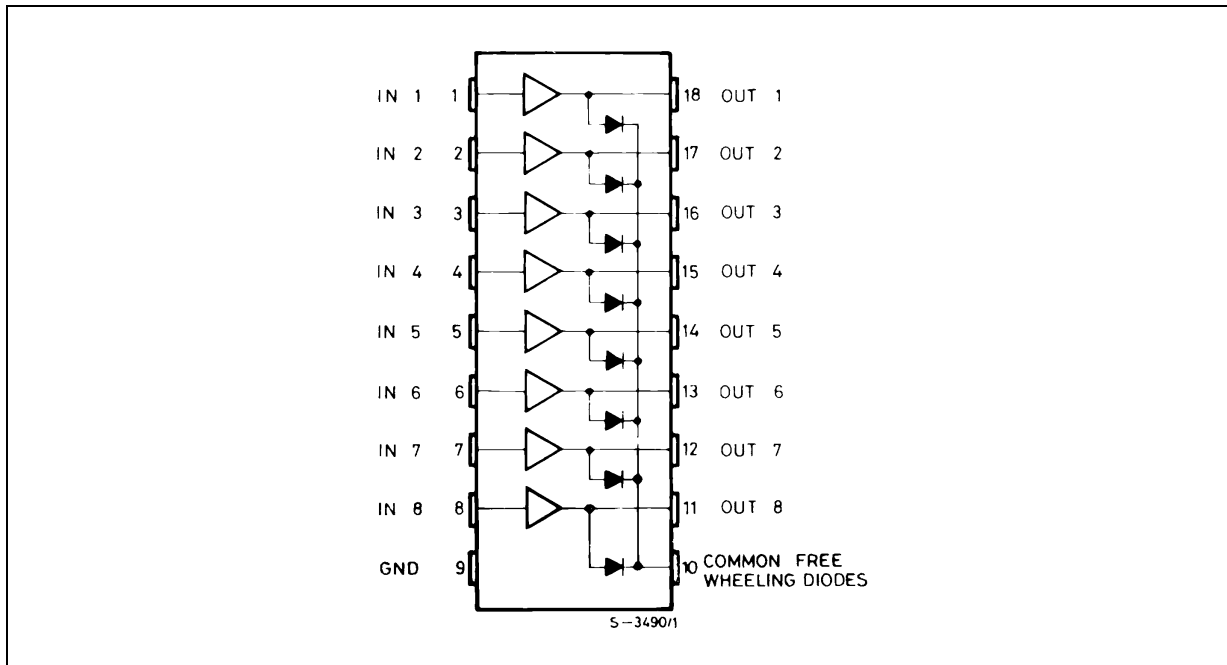
For ULN2802A (each driver for 14-15V PMOS)

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

$T_A = 25\text{ °C}$  unless otherwise specified.

**Table 4. Electrical characteristics**

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

## 5 Test circuits

Figure 3. Output leakage current

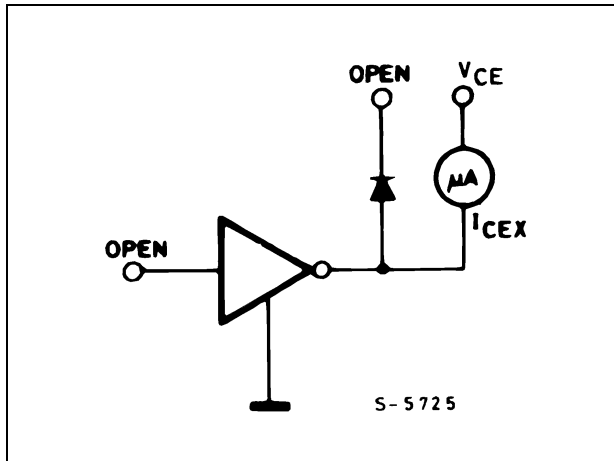


Figure 4. Output leakage current (for ULN2802A only)

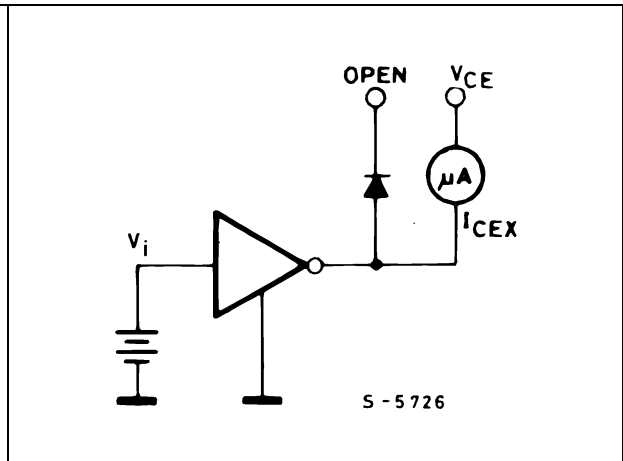


Figure 5. Collector-emitter saturation voltage

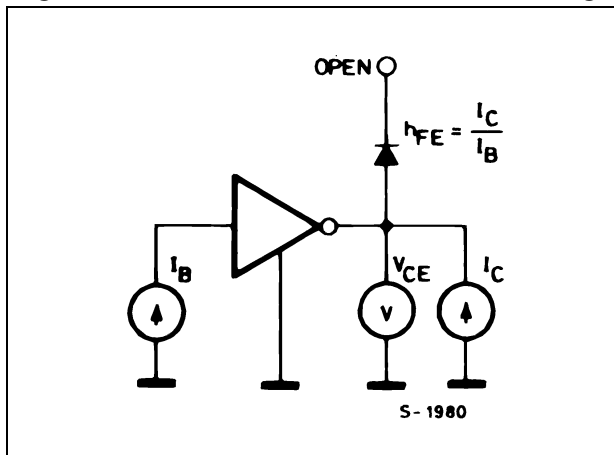


Figure 6. Input current (ON)

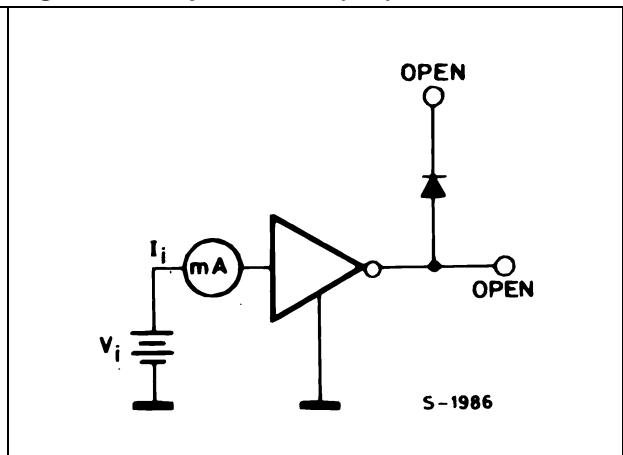


Figure 7. Input current (OFF)

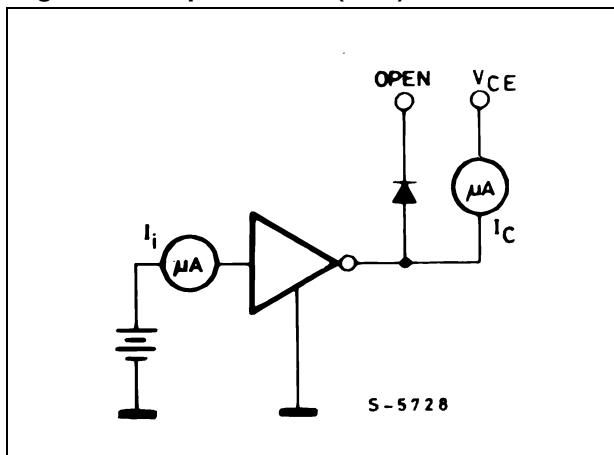


Figure 8. Input voltage

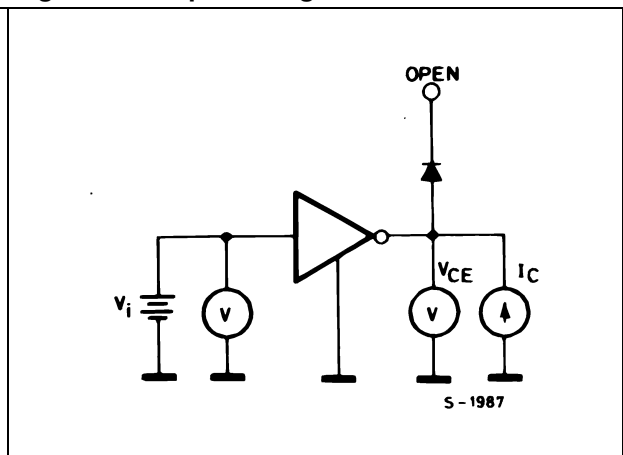


Figure 9. Clamp diode leakage current

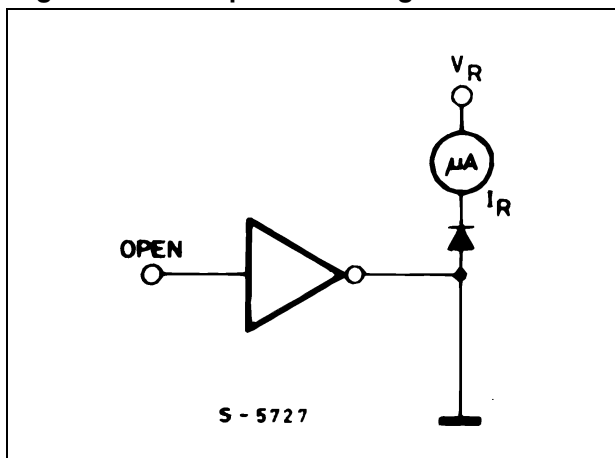
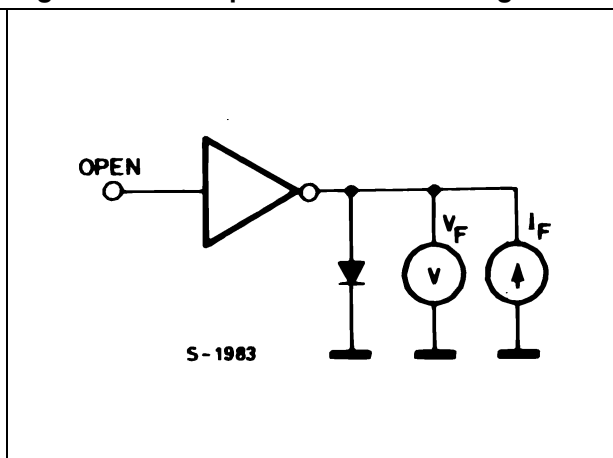


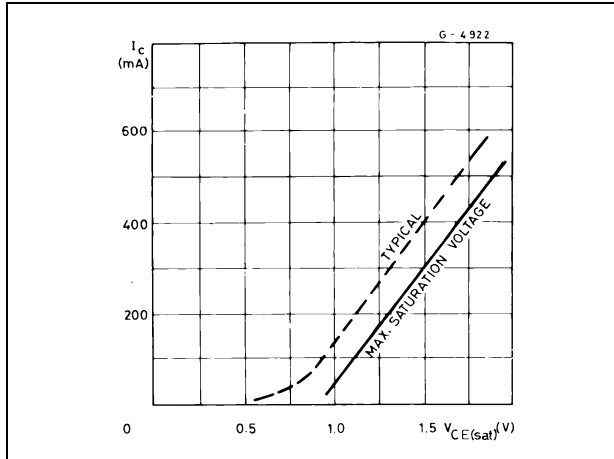
Figure 10. Clamp diode forward voltage



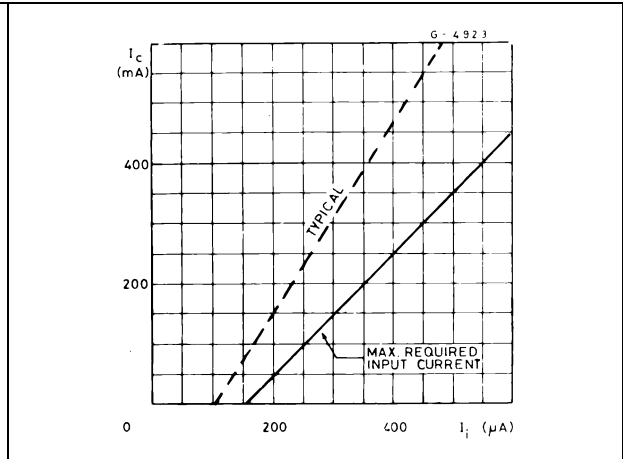


# 6 Typical performance characteristics

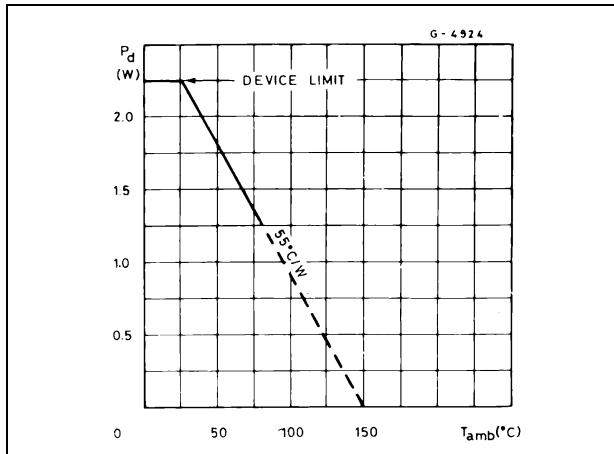
**Figure 11. Collector current as a function of saturation voltage**



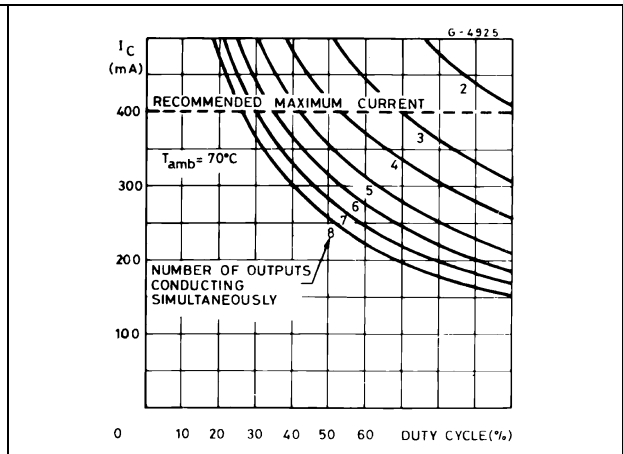
**Figure 12. Collector current as a function of input current**



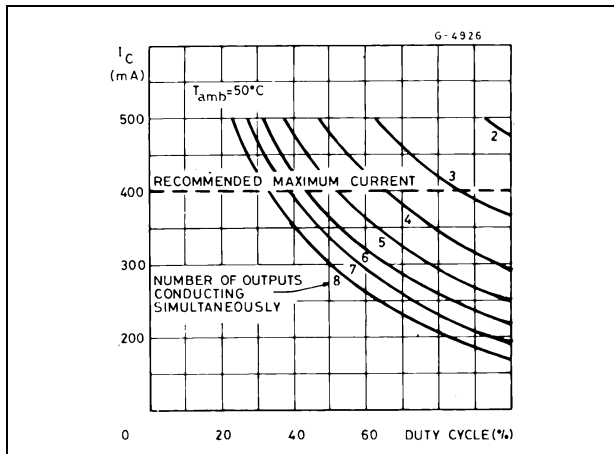
**Figure 13. Allowable average power dissipation as a function of  $T_A$**



**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)**

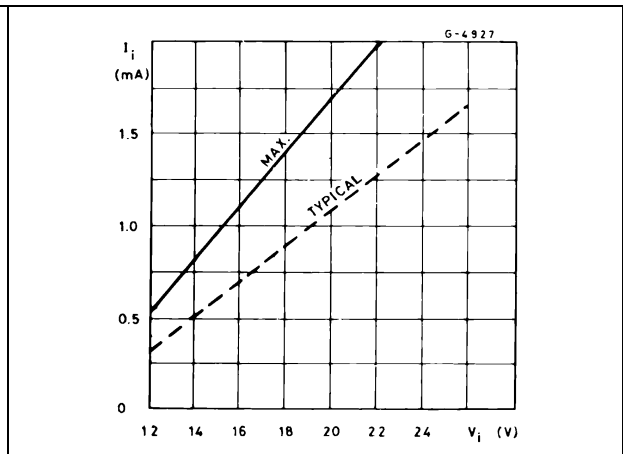


Figure 17. Input current as a function of input voltage (for ULN2804A)

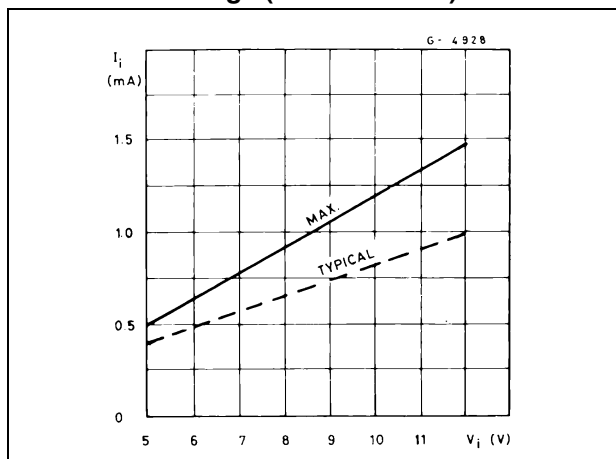
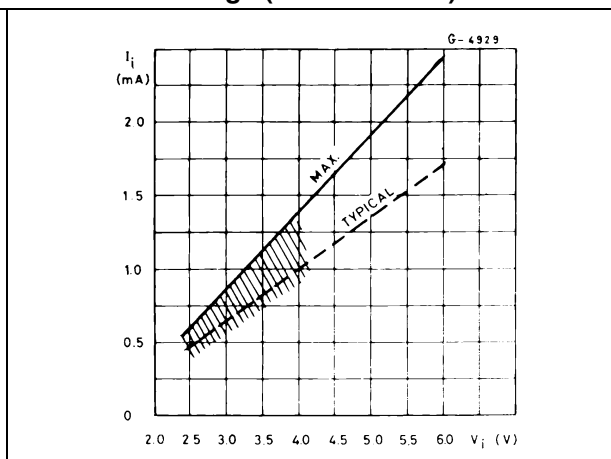


Figure 18. Input current as a function of input voltage (for ULN2803A)



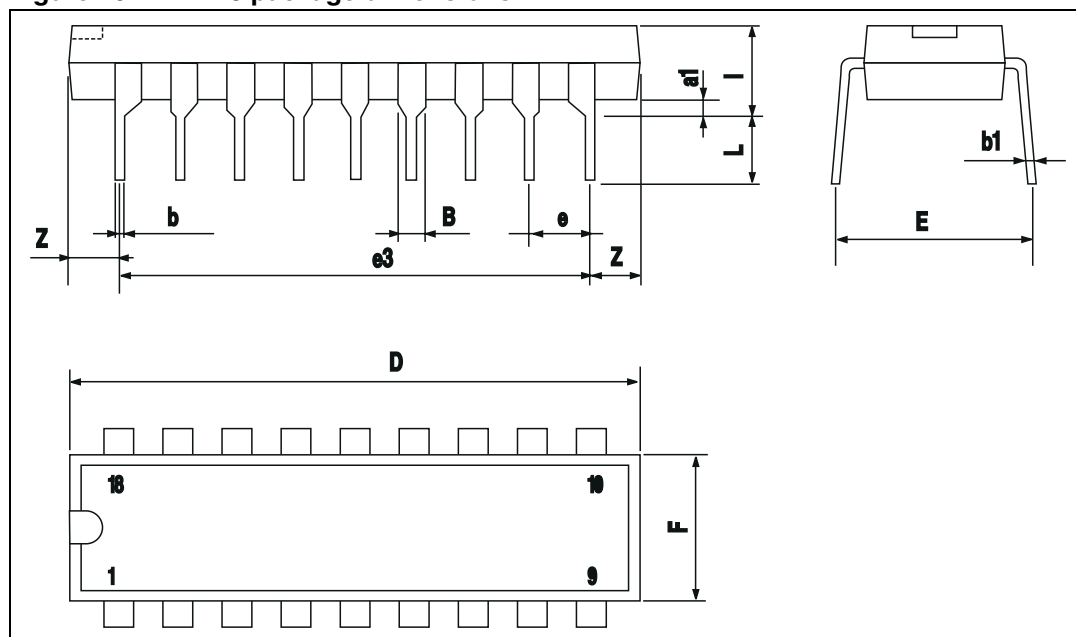
## 7 Package mechanical data

In order to meet environmental requirements, ST offers these devices in different grades of ECOPACK<sup>®</sup> packages, depending on their level of environmental compliance. ECOPACK<sup>®</sup> specifications, grade definitions and product status are available at: [www.st.com](http://www.st.com). ECOPACK<sup>®</sup> is an ST trademark.

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 <a href="#">Table 4 on page 6</a> .

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