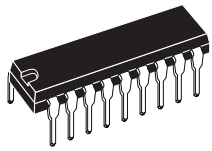
ULN2801A, ULN2802A, ULN2803A, ULN2804A

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



DIP-18

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.

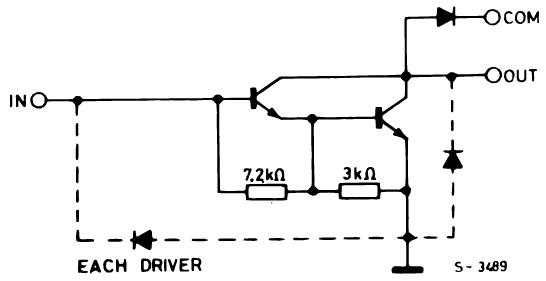
Table 1. Device summary

Order codes	Package
ULN2801A	DIP-18
ULN2802A	
ULN2803A	
ULN2804A	

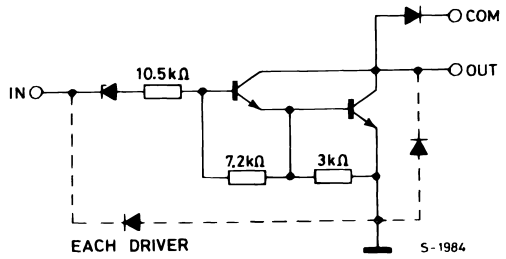
Contents

1 Diagram

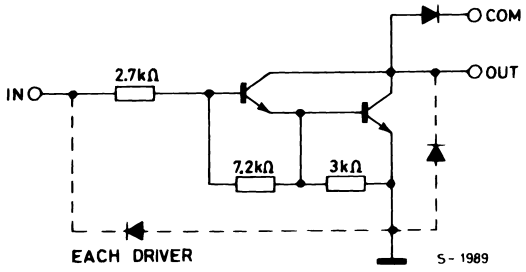
Figure 1. Schematic diagrams



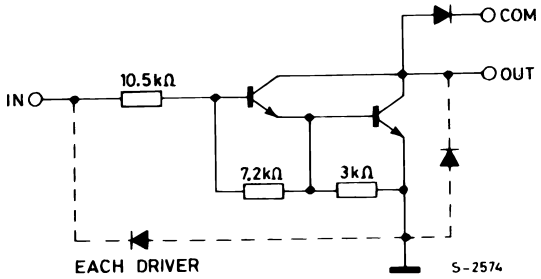
For ULN2801A (each driver for PMOS-CMOS)



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



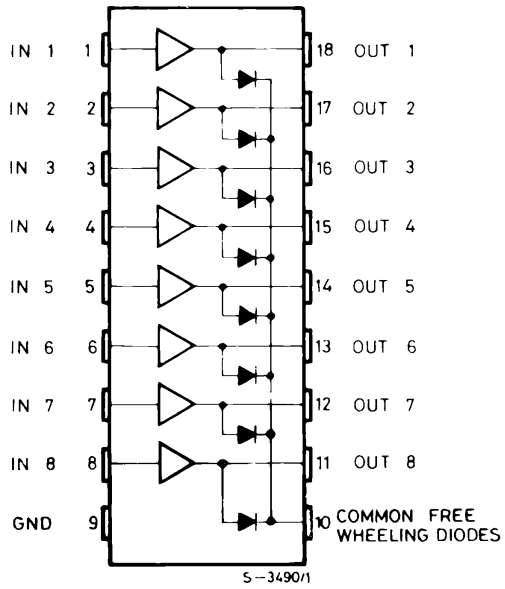
For ULN2803A (each driver for 5V, TTL/CMOS)



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}= 50V (*Figure 3*)			50	
		T_A = 70°C for ULN2802A, V_{CE}= 50V, V_I = 6V (*Figure 4*)			100	
		T_A = 70°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 = 250µA		0.9	1.1	V
		I_C = 200mA, I_B= 350µA		1.1	1.3	
		I_C = 350mA, I_B= 500µA		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°C, I_C = 500µA	50	65		µA
$V_{I(ON)}$	Input voltage (*Figure 8*)	V_{CE}= 2V, for ULN2802A I_C = 300mA for ULN2803A I_C = 200mA I_C = 250mA I_C = 300mA for ULN2804A I_C = 125mA I_C = 200mA I_C = 275mA I_C = 350mA			13 2.4 2.7 3 5 6 7 8	V
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	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 = 50V			50	µA
		T_A = 70°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

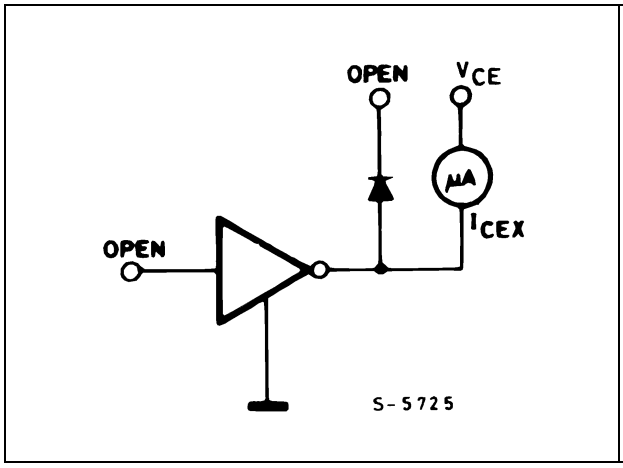


Figure 4. Output leakage current (for ULN2802A only)

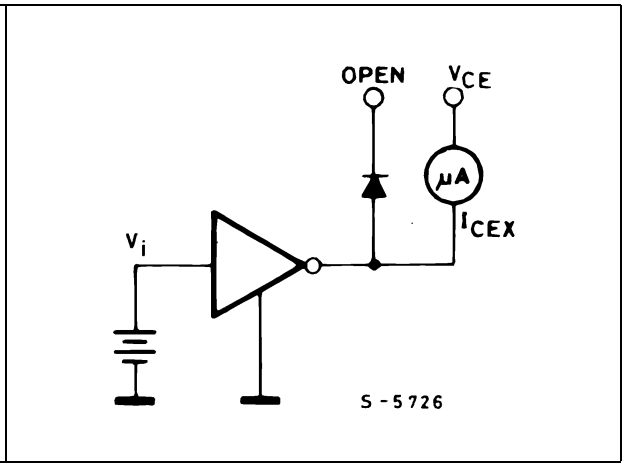


Figure 5. Collector-emitter saturation voltage

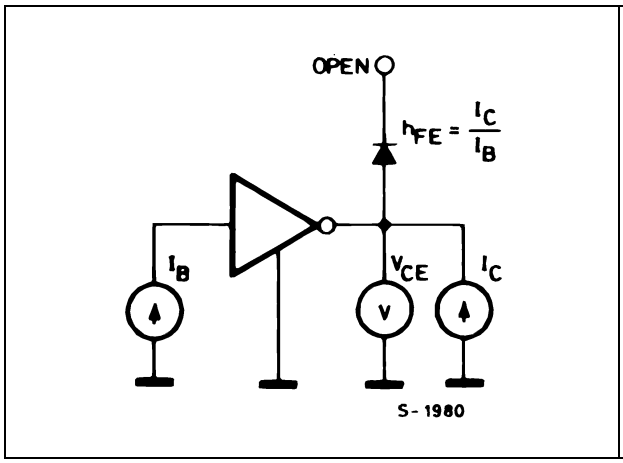


Figure 6. Input current (ON)

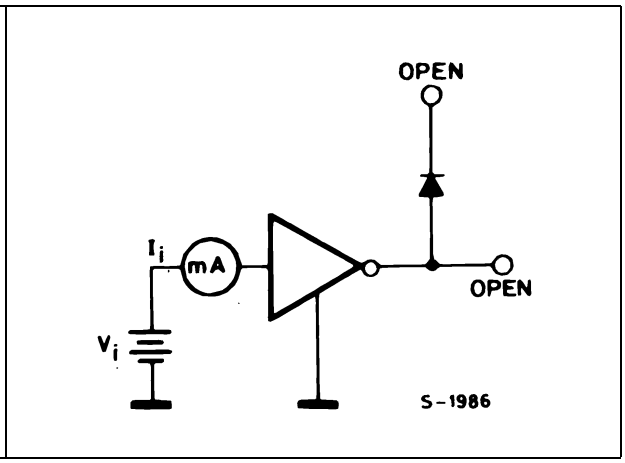


Figure 7. Input current (OFF)

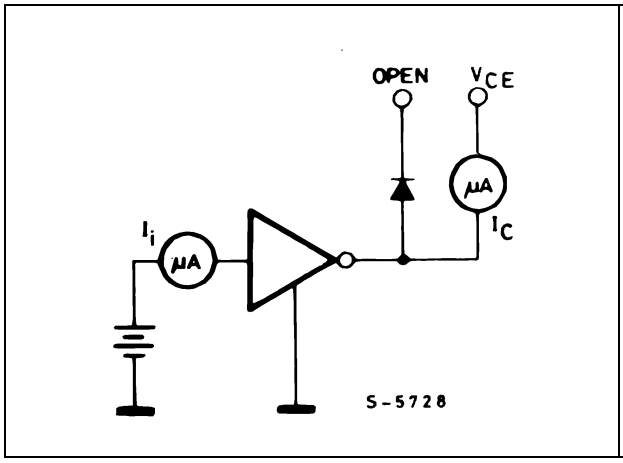


Figure 8. Input voltage

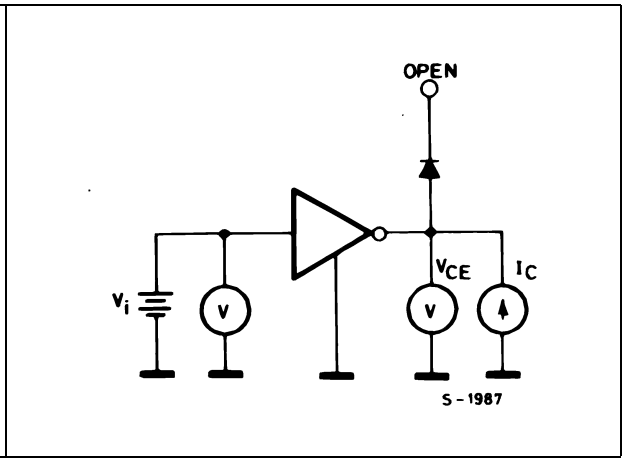


Figure 9. Clamp diode leakage current

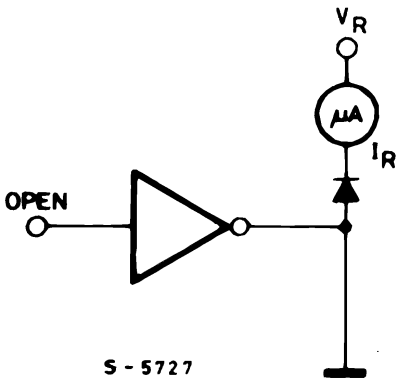
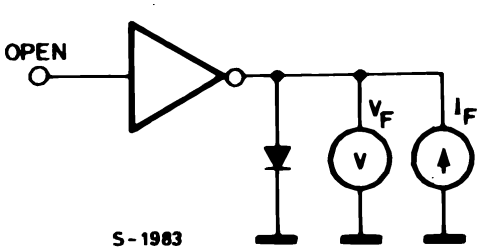


Figure 10. Clamp diode forward voltage



6 Typical performance characteristics

Figure 11. Collector current as a function of saturation voltage

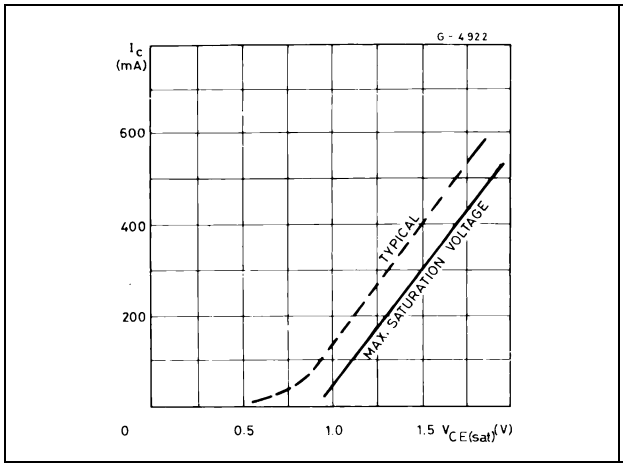


Figure 12. Collector current as a function of input current

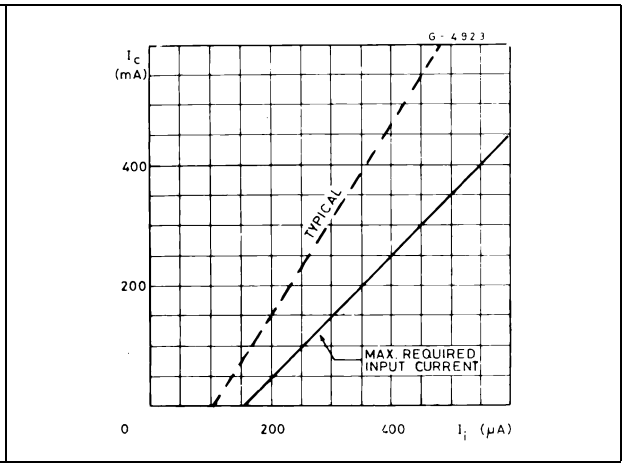


Figure 13. Allowable average power dissipation as a function of T_A

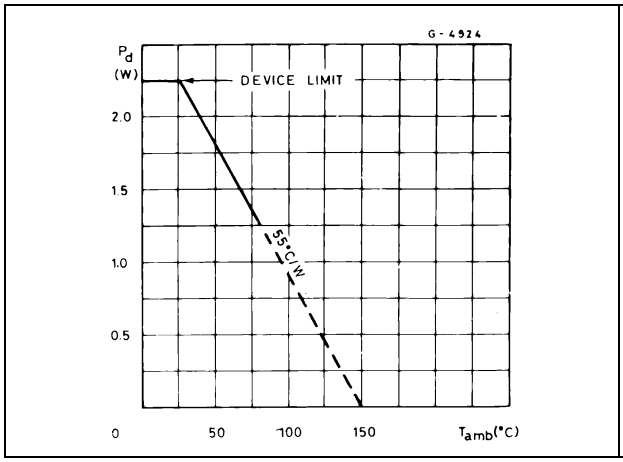


Figure 14. Peak collector current as a function of duty cycle

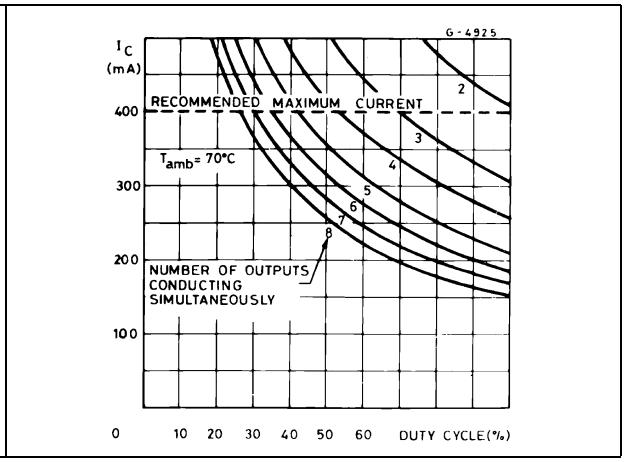


Figure 15. Peak collector current as a function of duty cycle

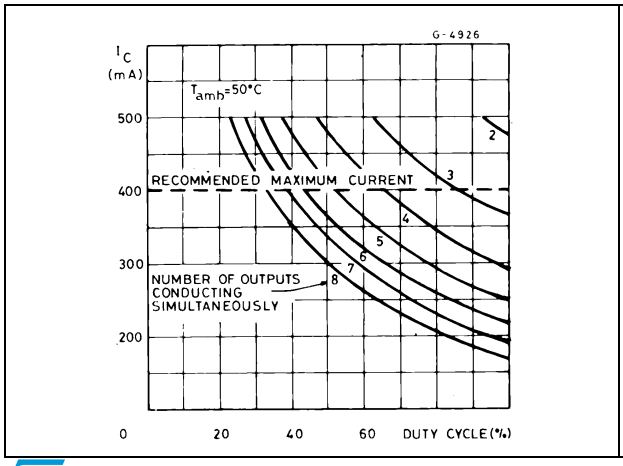


Figure 16. Input current as a function of input voltage (for ULN2802A)

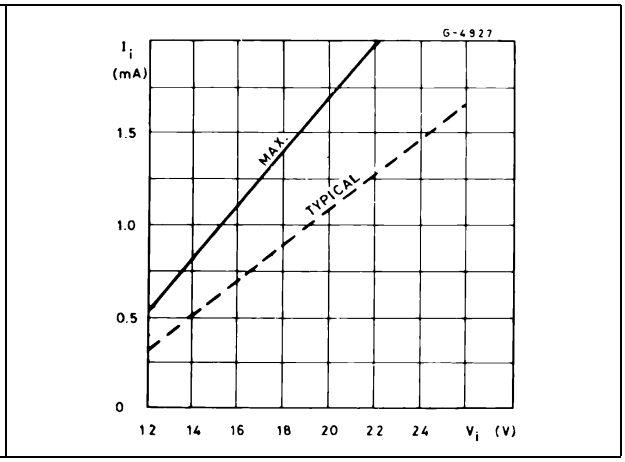


Figure 17. Input current as a function of input voltage (for ULN2804A)

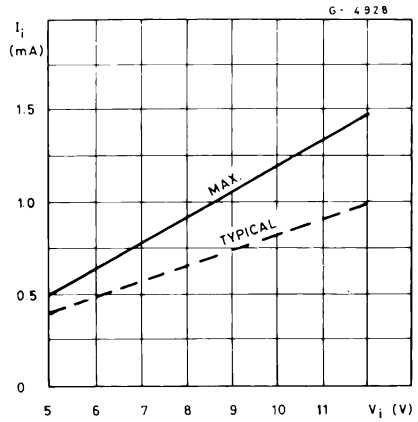
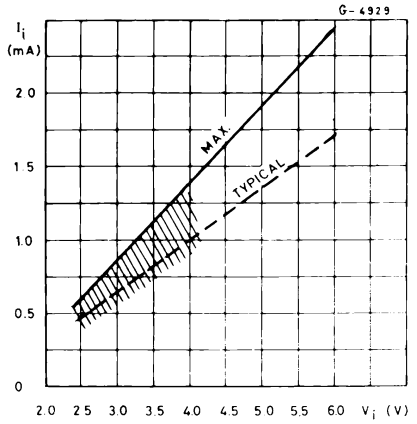


Figure 18. Input current as a function of input voltage (for ULN2803A)



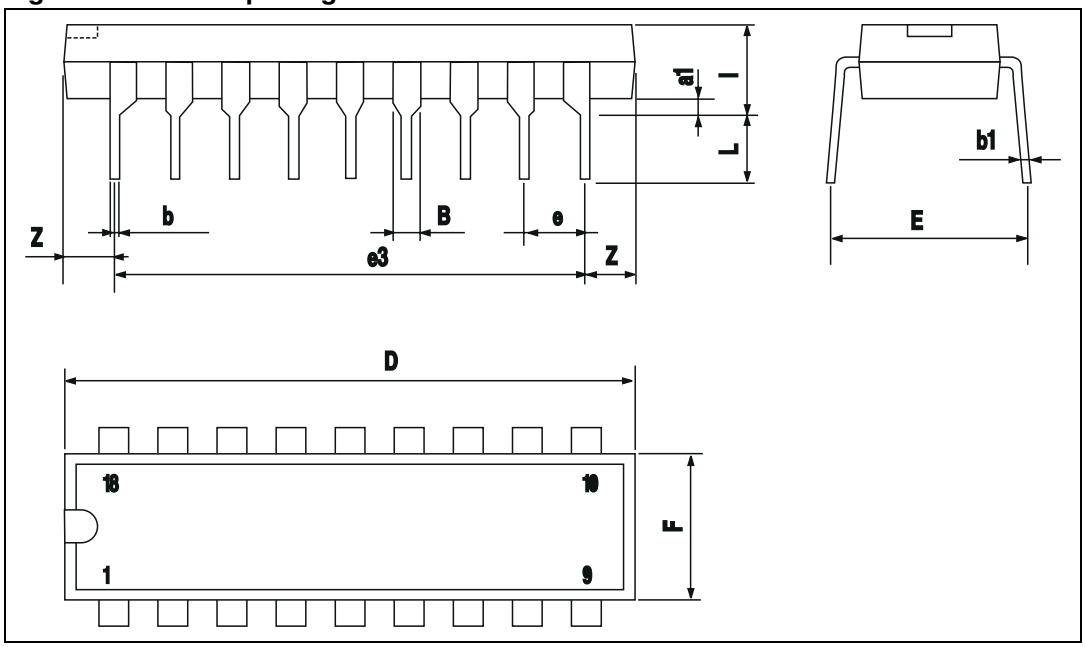
7 Package mechanical data

In order to meet environmental requirements, ST offers these devices in different grades of ECOPACK® packages, depending on their level of environmental compliance. ECOPACK® specifications, grade definitions and product status are available at: *www.st.com*. ECOPACK® 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 *Table 4 on page 6*.