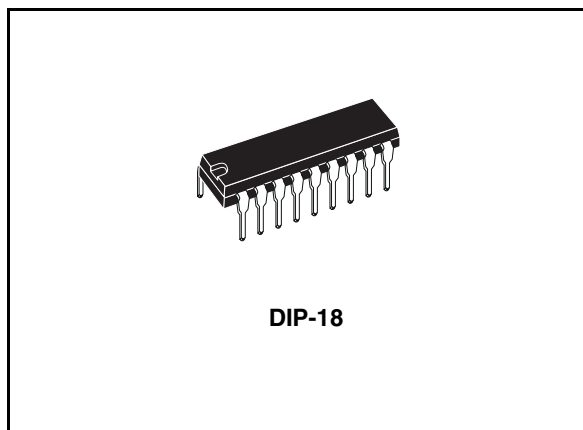


## Eight Darlington array

### Features

- Eight Darlington transistors per package
- Extended temperature range: -40 to 105 °C
- 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 ULQ2801A-ULQ2804A 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.

Five versions are available to simplify interfacing to standard logic families: the ULQ2801A is

designed for general purpose applications with a current limit resistor; the ULQ2802A has a 10.5 kΩ input resistor and zener for 14-25V PMOS; the ULQ2803A has a 2.7 kΩ input resistor for 5 V TTL and CMOS; the ULQ2804A has a 10.5 kΩ input resistor for 6-15 V CMOS.

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

**Table 1. Device summary**

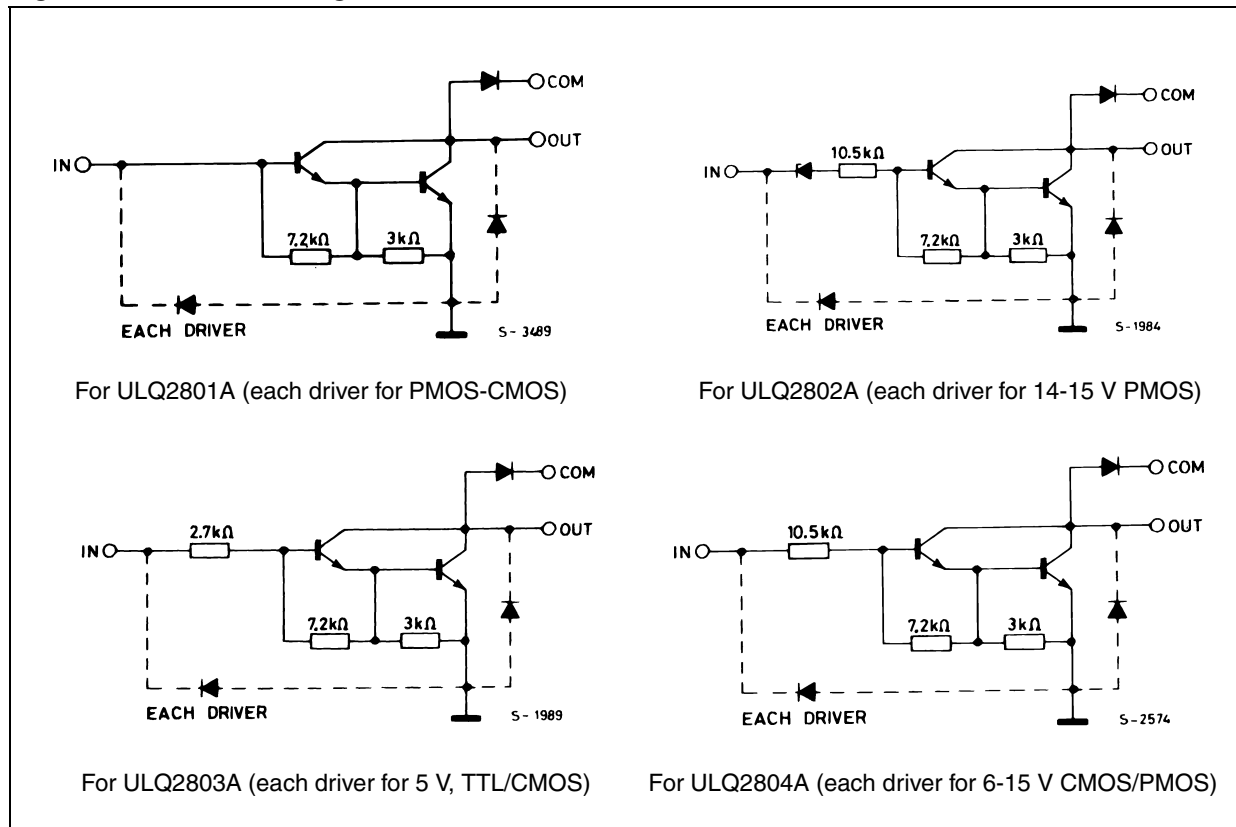
Order codes	Package
ULQ2801A	DIP-18
ULQ2802A	DIP-18
ULQ2803A	DIP-18
ULQ2804A	DIP-18

# Contents

1	Diagrams .....	3
2	Pin configuration .....	4
3	Maximum ratings .....	5
4	Electrical characteristics .....	6
5	Test circuits .....	7
6	Package mechanical data .....	10
7	Revision history .....	12

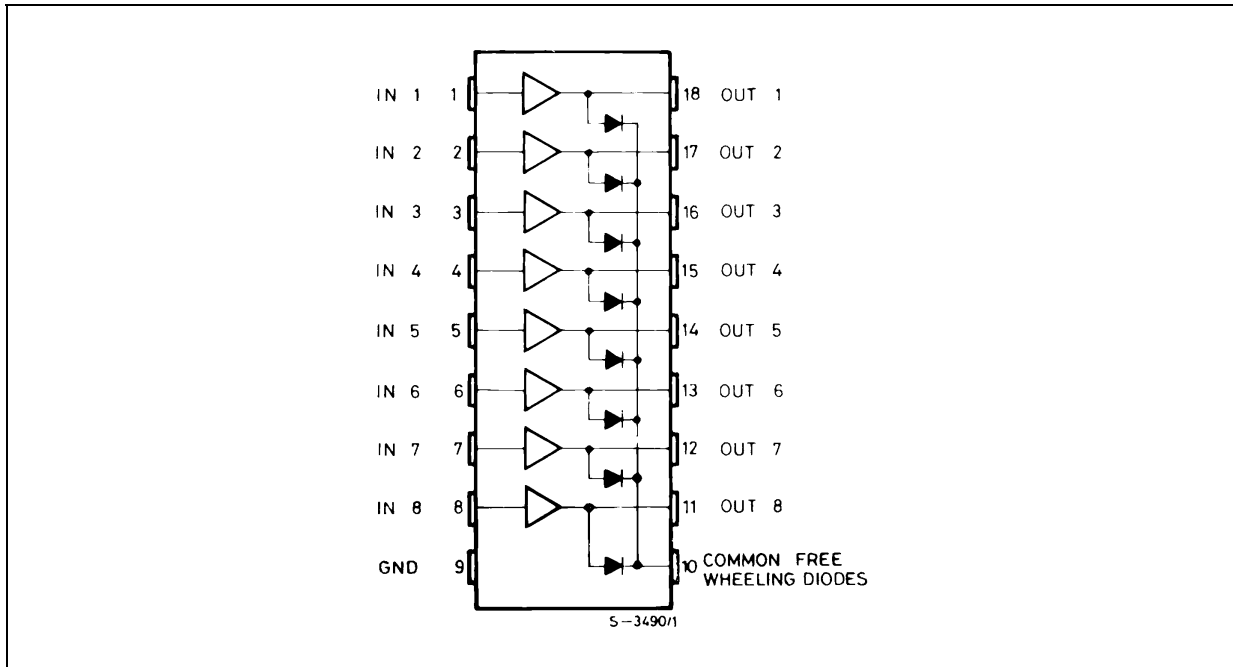
# 1 Diagrams

Figure 1. Schematic diagrams



## 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 ULQ2802A - ULQ2803A - ULQ2804A)	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	- 40 to 85	°C
$T_{STG}$	Storage temperature range	- 55 to 150	°C

**Table 3. Thermal data**

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

## 4 Electrical characteristics

**Table 4. Electrical characteristics**

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

Symbol	Parameter	Test condition	Min.	Typ.	Max.	Unit
$I_{CEX}$	Output leakage current	$V_{CE} = 50V$ , ( <i>Figure 7</i> )			50	$\mu A$
		$T_A = 105\text{ °C}$ , $V_{CE} = 50V$ ( <i>Figure 7</i> )			100	
		$T_A = 105\text{ °C}$ for ULQ2802A, $V_{CE} = 50V$ , $V_I = 6V$ ( <i>Figure 8</i> )			500	
		$T_A = 105\text{ °C}$ for ULQ2804A, $V_{CE} = 50V$ , $V_I = 1V$ ( <i>Figure 8</i> )			500	
$V_{CE(SAT)}$	Collector-emitter saturation voltage ( <i>Figure 9</i> )	$I_C = 100mA$ , $I_B = 250\mu A$		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 ( <i>Figure 6</i> )	for ULQ2802A, $V_I = 17V$		0.82	1.25	mA
		for ULQ2803A, $V_I = 3.85V$		0.93	1.35	
		for ULQ2804A, $V_I = 5V$		0.35	0.5	
		$V_I = 12V$		1	1.45	
$I_{I(OFF)}$	Input current ( <i>Figure 7</i> )	$T_A = 105\text{ °C}$ , $I_C = 500\mu A$	50	65		$\mu A$
$V_{I(ON)}$	Input voltage ( <i>Figure 8</i> )	$V_{CE} = 2V$ , for ULQ2802A			13	V
		$I_C = 300mA$				
		for ULQ2803A				
		$I_C = 200mA$			2.4	
		$I_C = 250mA$			2.7	
		$I_C = 300mA$			3	
		for ULQ2804A				
		$I_C = 125mA$			5	
$I_C = 200mA$			6			
$I_C = 275mA$			7			
$I_C = 350mA$			8			
$h_{FE}$	DC forward current gain ( <i>Figure 5</i> )	for ULQ2801A, $V_{CE} = 2V$ , $I_C = 350mA$	1000			
$C_I$	Input capacitance			15	25 <sup>(1)</sup>	pF
$t_{PLH}$	Turn-on delay time	$0.5 V_I$ to $0.5V_O$		0.25	1 <sup>(1)</sup>	$\mu s$
$t_{PHL}$	Turn-off delay time	$0.5 V_I$ to $0.5V_O$		0.25	1 <sup>(1)</sup>	$\mu s$
$I_R$	Clamp diode leakage current ( <i>Figure 9</i> )	$V_R = 50V$			50	$\mu A$
		$T_A = 105\text{ °C}$ , $V_R = 50V$			100	
$V_F$	Clamp diode forward voltage ( <i>Figure 10</i> )	$I_F = 350mA$		1.7	2	V

1. Guaranteed by design.

# 5 Test circuits

Figure 3. Output leakage current

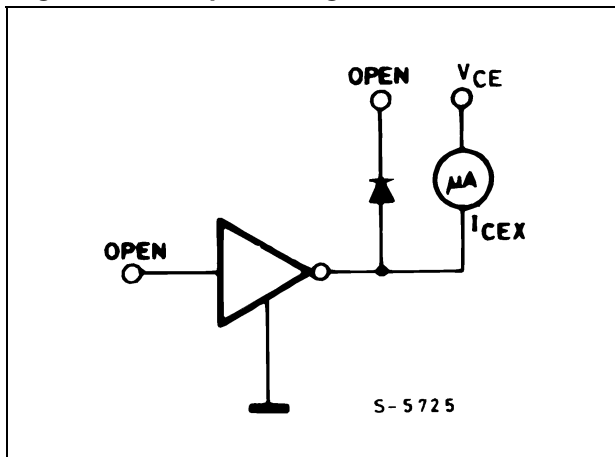


Figure 4. Output leakage current

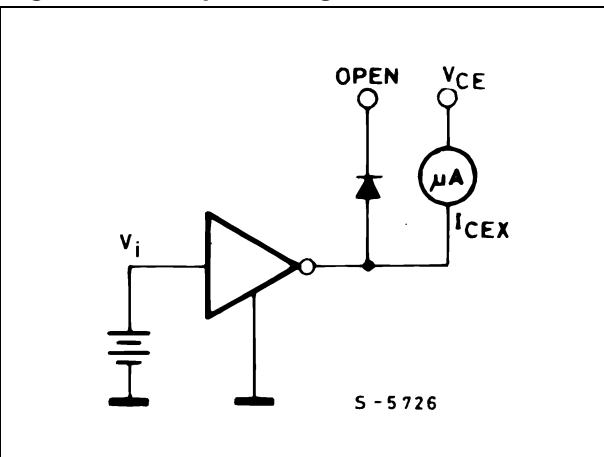


Figure 5. Collector-emitter saturation voltage

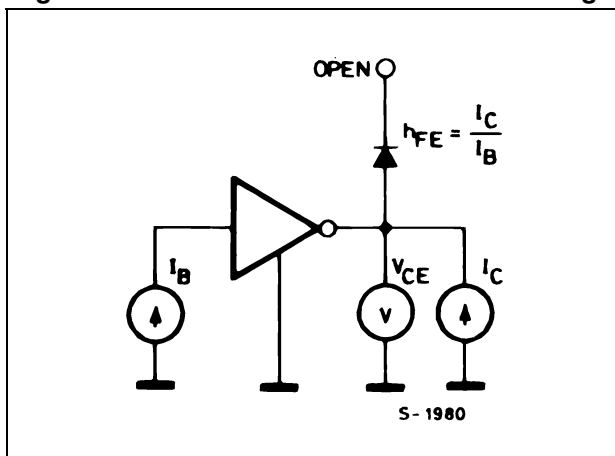


Figure 6. Input current (ON)

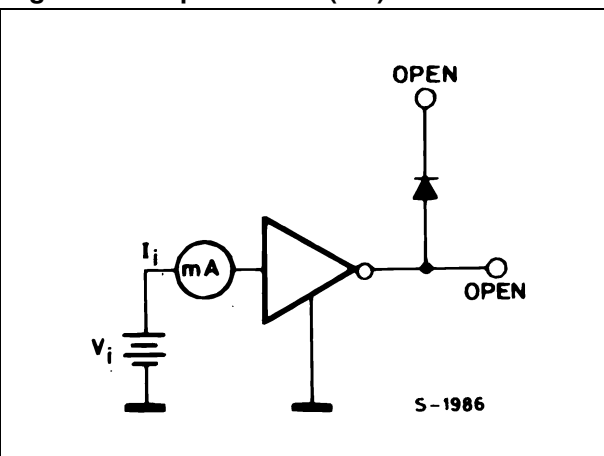


Figure 7. Input current (OFF)

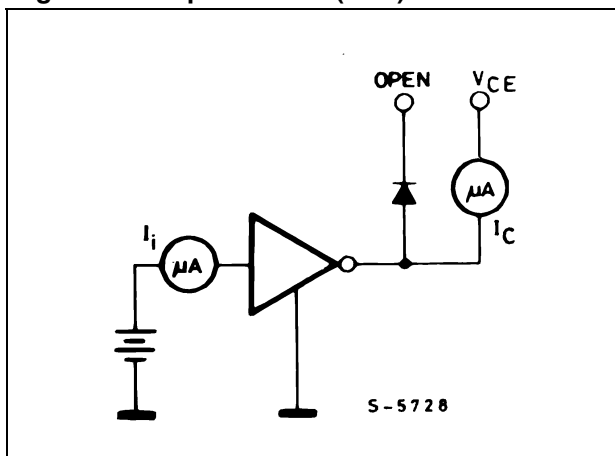


Figure 8. Input voltage

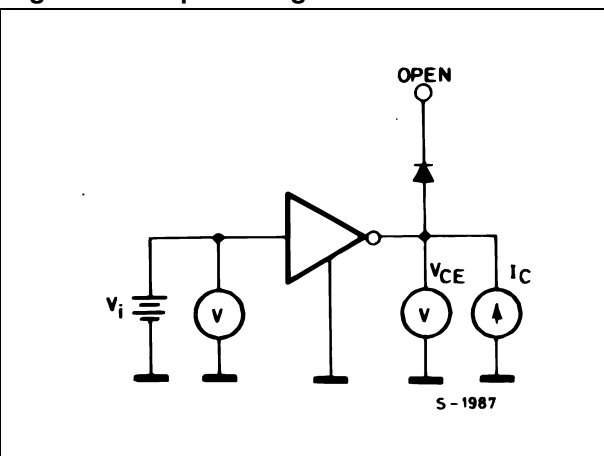


Figure 9. Clamp diode leakage current

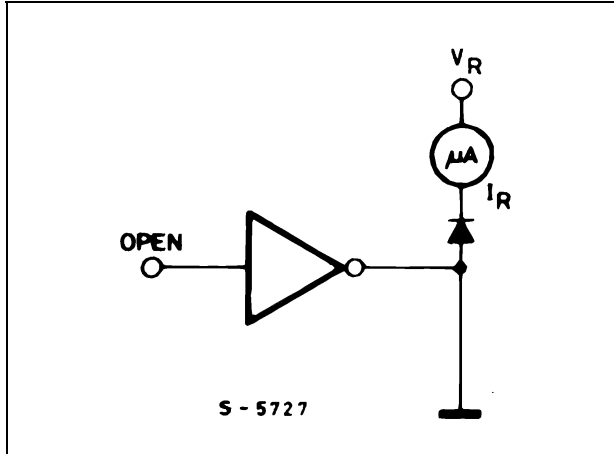


Figure 10. Clamp diode forward voltage

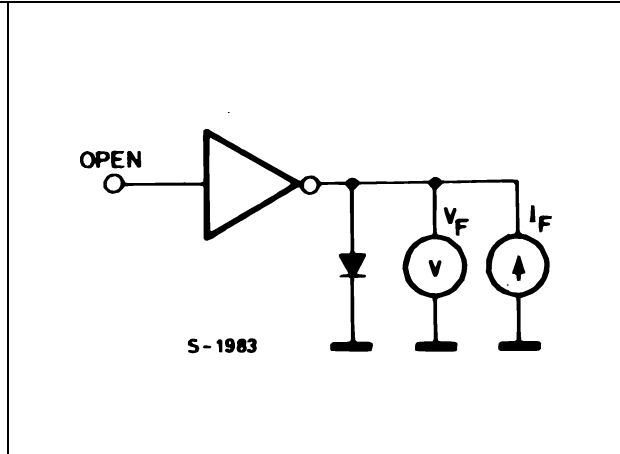


Figure 11. Collector current as a function of saturation voltage

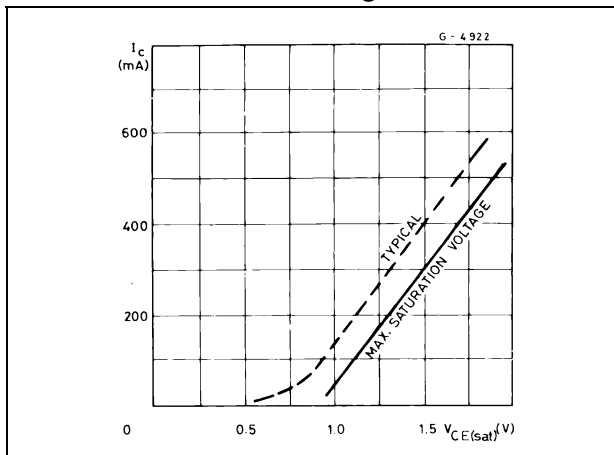


Figure 12. Collector current as a function of input current

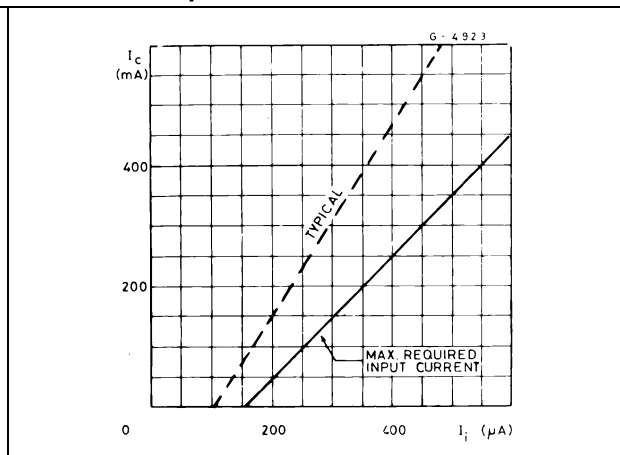


Figure 13. Allowable average power dissipation as a function of T\_A

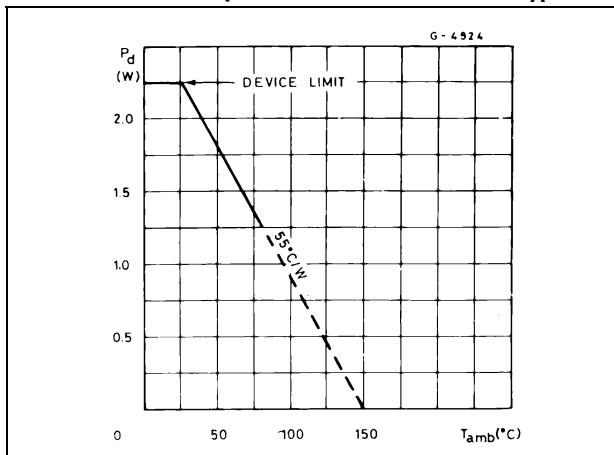


Figure 14. Peak collector current as a function of duty cycle

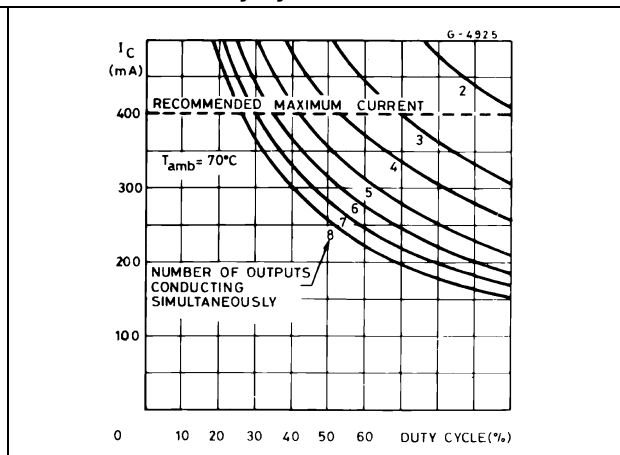




Figure 15. Peak collector current as a function of duty

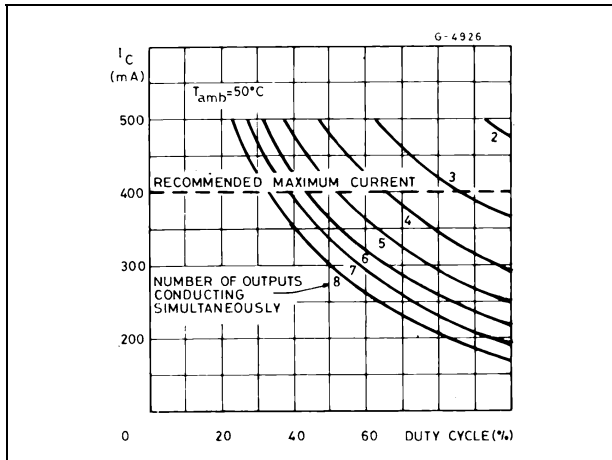


Figure 16. Input current as a function of input voltage (for ULQ2802A)

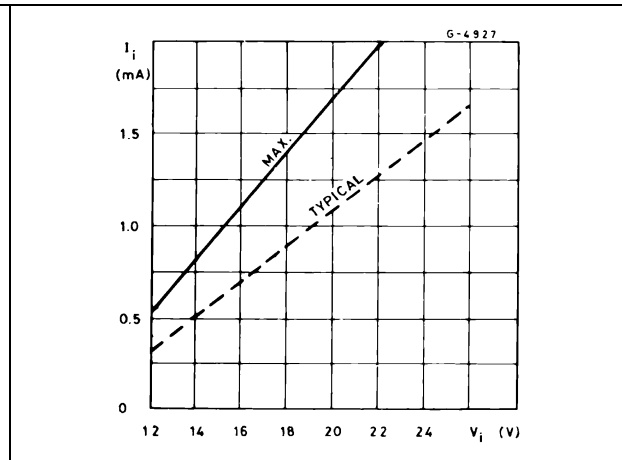


Figure 17. Input current as a function of input voltage (for ULQ2804A)

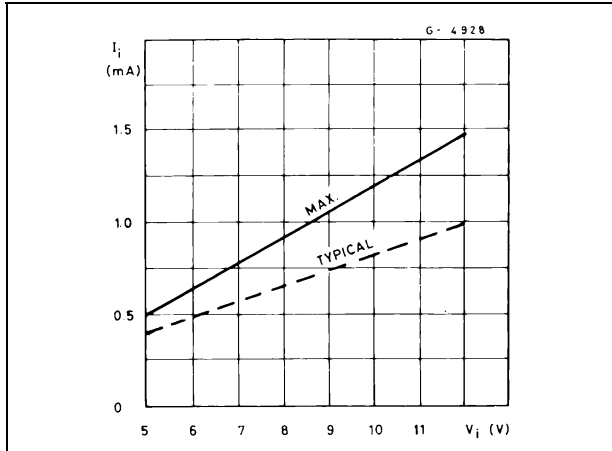
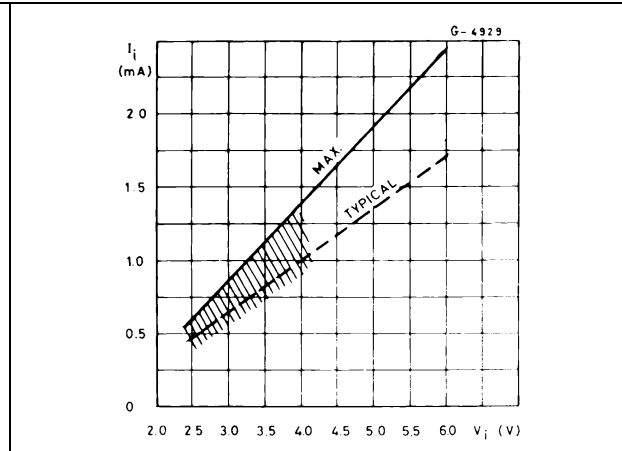


Figure 18. Input current as a function of input voltage (for ULQ2803A)

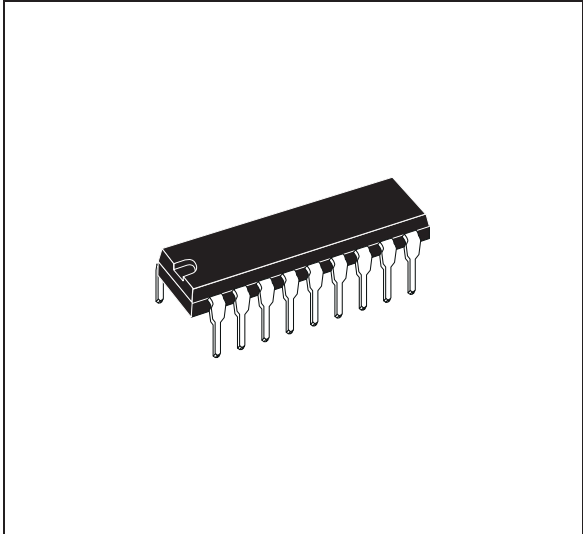


## 6 Package mechanical data

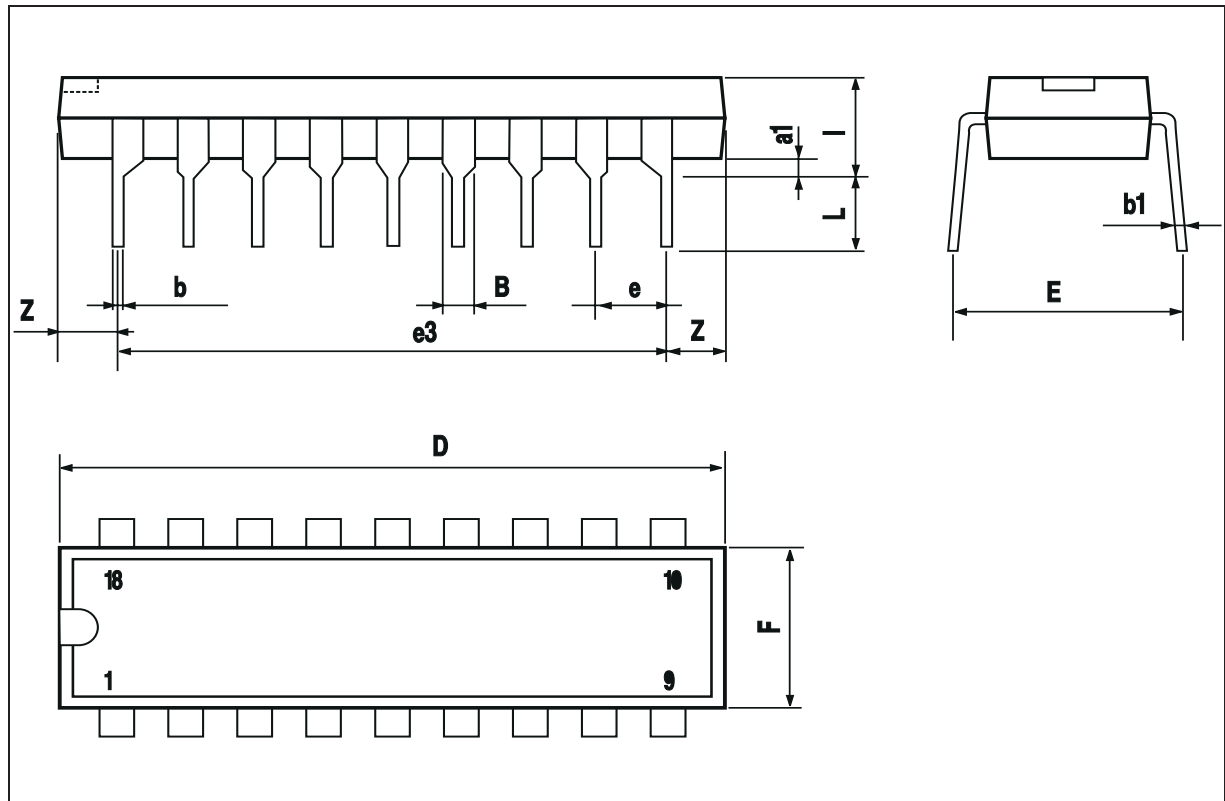
In order to meet environmental requirements, ST offers these devices in ECOPACK<sup>®</sup> packages. These packages have a lead-free second level interconnect. The category of second Level Interconnect is marked on the package and on the inner box label, in compliance with JEDEC Standard JESD97. The maximum ratings related to soldering conditions are also marked on the inner box label. ECOPACK is an ST trademark. ECOPACK specifications are available at: [www.st.com](http://www.st.com).

DIM.	mm			inch		
	MIN.	TYP.	MAX.	MIN.	TYP.	MAX.
a1	0.254			0.010		
B	1.39		1.65	0.055		0.065
b		0.46			0.018	
b1		0.25			0.010	
D			23.24			0.915
E		8.5			0.335	
e		2.54			0.100	
e3		20.32			0.800	
F			7.1			0.280
I			3.93			0.155
L		3.3			0.130	
Z		1.27	1.59		0.050	0.063

**OUTLINE AND MECHANICAL DATA**



**DIP18**



## 7 Revision history

**Table 5. Document revision history**

Date	Revision	Changes
19-Sep-2003	1	First issue.
25-Jun-2008	2	Added: <a href="#">Table 1 on page 1</a> .

**Please Read Carefully:**

Information in this document is provided solely in connection with ST products. STMicroelectronics NV and its subsidiaries ("ST") reserve the right to make changes, corrections, modifications or improvements, to this document, and the products and services described herein at any time, without notice.

All ST products are sold pursuant to ST's terms and conditions of sale.

Purchasers are solely responsible for the choice, selection and use of the ST products and services described herein, and ST assumes no liability whatsoever relating to the choice, selection or use of the ST products and services described herein.

No license, express or implied, by estoppel or otherwise, to any intellectual property rights is granted under this document. If any part of this document refers to any third party products or services it shall not be deemed a license grant by ST for the use of such third party products or services, or any intellectual property contained therein or considered as a warranty covering the use in any manner whatsoever of such third party products or services or any intellectual property contained therein.

**UNLESS OTHERWISE SET FORTH IN ST'S TERMS AND CONDITIONS OF SALE ST DISCLAIMS ANY EXPRESS OR IMPLIED WARRANTY WITH RESPECT TO THE USE AND/OR SALE OF ST PRODUCTS INCLUDING WITHOUT LIMITATION IMPLIED WARRANTIES OF MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE (AND THEIR EQUIVALENTS UNDER THE LAWS OF ANY JURISDICTION), OR INFRINGEMENT OF ANY PATENT, COPYRIGHT OR OTHER INTELLECTUAL PROPERTY RIGHT.**

**UNLESS EXPRESSLY APPROVED IN WRITING BY AN AUTHORIZED ST REPRESENTATIVE, ST PRODUCTS ARE NOT RECOMMENDED, AUTHORIZED OR WARRANTED FOR USE IN MILITARY, AIR CRAFT, SPACE, LIFE SAVING, OR LIFE SUSTAINING APPLICATIONS, NOR IN PRODUCTS OR SYSTEMS WHERE FAILURE OR MALFUNCTION MAY RESULT IN PERSONAL INJURY, DEATH, OR SEVERE PROPERTY OR ENVIRONMENTAL DAMAGE. ST PRODUCTS WHICH ARE NOT SPECIFIED AS "AUTOMOTIVE GRADE" MAY ONLY BE USED IN AUTOMOTIVE APPLICATIONS AT USER'S OWN RISK.**

Resale of ST products with provisions different from the statements and/or technical features set forth in this document shall immediately void any warranty granted by ST for the ST product or service described herein and shall not create or extend in any manner whatsoever, any liability of ST.

ST and the ST logo are trademarks or registered trademarks of ST in various countries.

Information in this document supersedes and replaces all information previously supplied.

The ST logo is a registered trademark of STMicroelectronics. All other names are the property of their respective owners.

© 2008 STMicroelectronics - All rights reserved

STMicroelectronics group of companies

Australia - Belgium - Brazil - Canada - China - Czech Republic - Finland - France - Germany - Hong Kong - India - Israel - Italy - Japan - Malaysia - Malta - Morocco - Singapore - Spain - Sweden - Switzerland - United Kingdom - United States of America

[www.st.com](http://www.st.com)