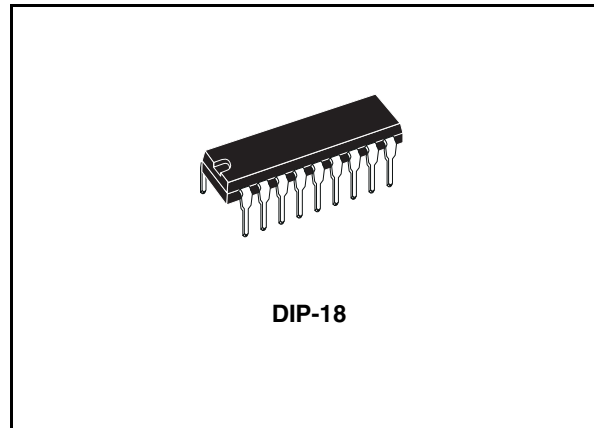


## Eight Darlington array

### 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 k $\Omega$  input resistor and zener for 14-25V PMOS; the ULQ2803A has a 2.7 k $\Omega$  input resistor for 5 V TTL and CMOS; the ULQ2804A has a 10.5 k $\Omega$  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**

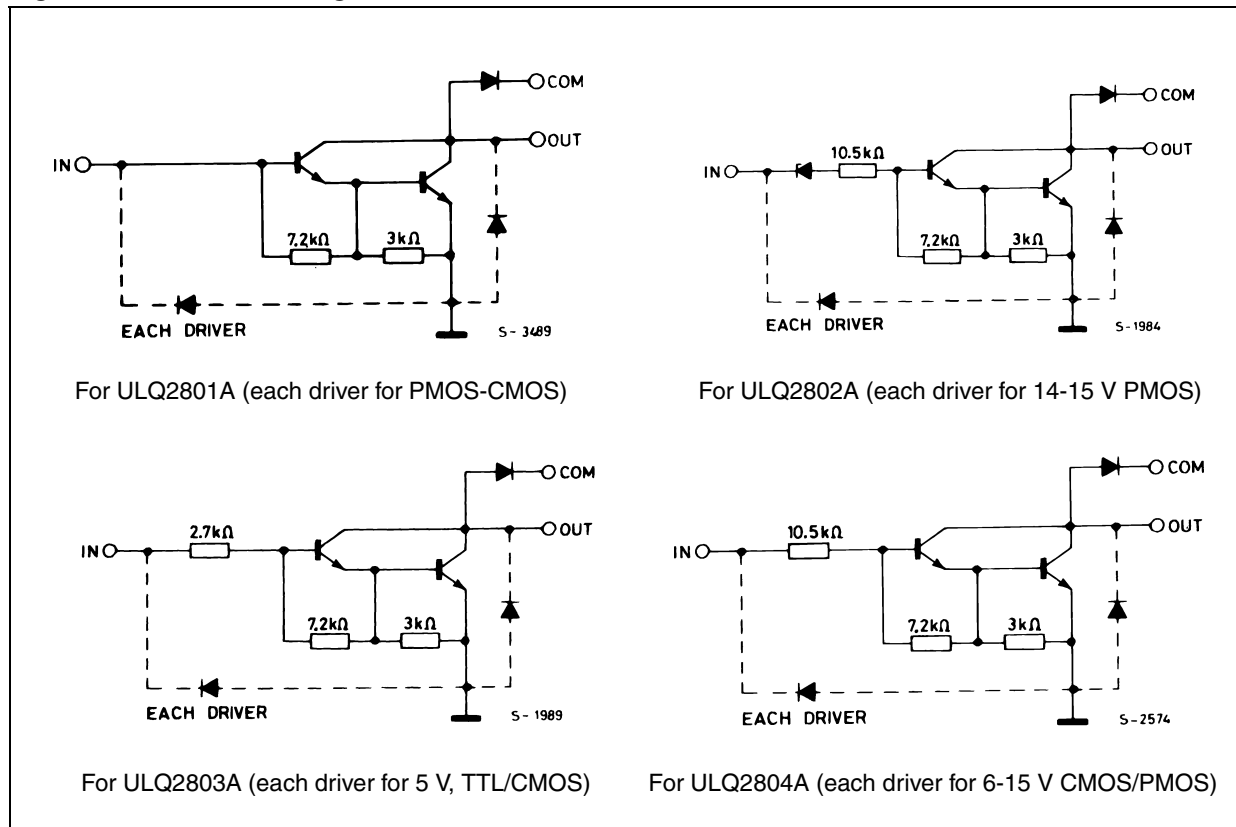
| Order codes | Package |
|-------------|---------|
| ULQ2801A    | DIP-18  |
| ULQ2802A    | DIP-18  |
| ULQ2803A    | DIP-18  |
| ULQ2804A    | DIP-18  |

# Contents

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# 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                          | $V_{CE} = 50V$ , (Figure 7)  |      |      | 50                | $\mu A$ |
|               |   | $T_A = 105\text{ °C}$ , $V_{CE} = 50V$ (Figure 7)                          |      |      | 100               |         |
|               |   | $T_A = 105\text{ °C}$ for ULQ2802A, $V_{CE} = 50V$ , $V_I = 6V$ (Figure 8) |      |      | 500               |         |
|               |   | $T_A = 105\text{ °C}$ for ULQ2804A, $V_{CE} = 50V$ , $V_I = 1V$ (Figure 8) |      |      | 500               |         |
| $V_{CE(SAT)}$ | Collector-emitter saturation voltage (Figure 9) | $I_C = 100mA$ , $I_B = 250\mu A$   |      | 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 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 (Figure 7)                        | $T_A = 105\text{ °C}$ , $I_C = 500\mu A$                                   | 50   | 65   |                   | $\mu A$ |
| $V_{I(ON)}$   | Input voltage (Figure 8)                        | $V_{CE} = 2V$ , for ULQ2802A<br>$I_C = 300mA$                              |      |      | 13                | V       |
|               |   | for ULQ2803A<br>$I_C = 200mA$  |      |      | 2.4               |         |
|               |   | $I_C = 250mA$  |      |      | 2.7               |         |
|               |   | $I_C = 300mA$  |      |      | 3                 |         |
|               |   | for ULQ2804A<br>$I_C = 125mA$  |      |      | 5                 |         |
|               |   | $I_C = 200mA$  |      |      | 6                 |         |
|               |   | $I_C = 275mA$  |      |      | 7                 |         |
|               |   | $I_C = 350mA$  |      |      | 8                 |         |
| $h_{FE}$      | DC forward current gain (Figure 5)              | for ULQ2801A, $V_{CE} = 2V$ ,<br>$I_C = 350mA$                             | 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 (Figure 9)          | $V_R = 50V$  |      |      | 50                | $\mu A$ |
|               |   | $T_A = 105\text{ °C}$ , $V_R = 50V$  |      |      | 100               |         |
| $V_F$         | Clamp diode forward voltage (Figure 10)         | $I_F = 350mA$  |      | 1.7  | 2                 | V       |

1. Guaranteed by design.

# 5 Test circuits

Figure 3. Output leakage current

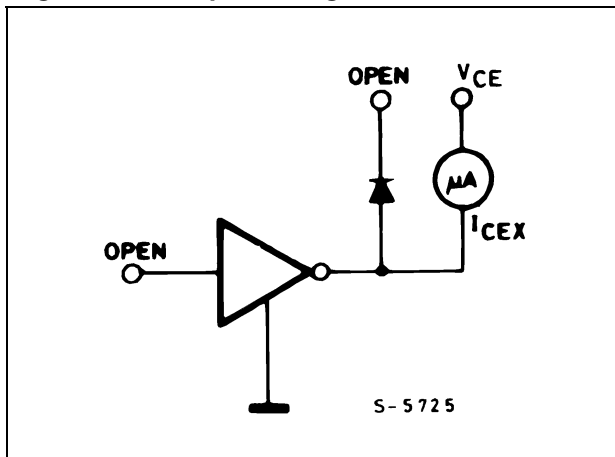


Figure 4. Output leakage current

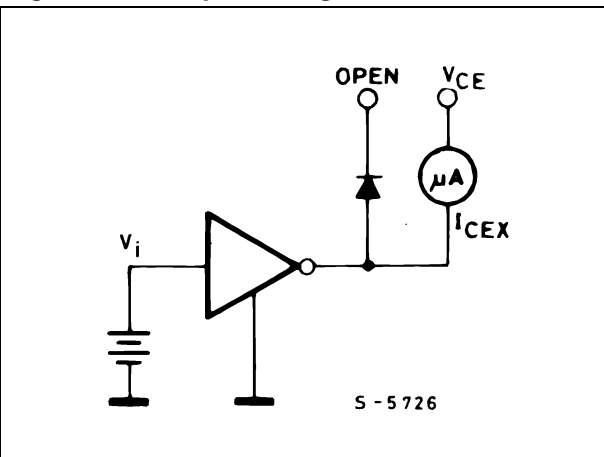


Figure 5. Collector-emitter saturation voltage Figure 6. Input current (ON)

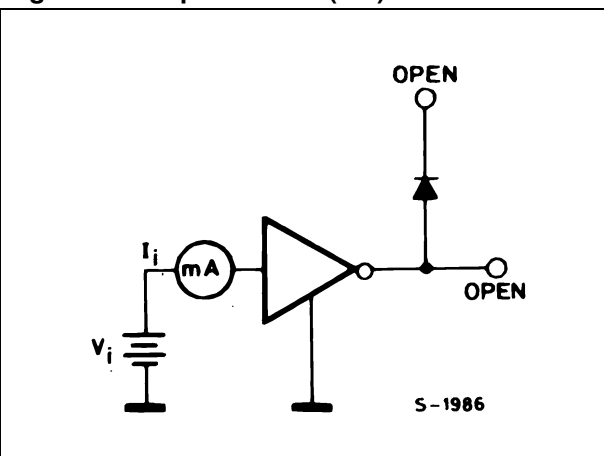
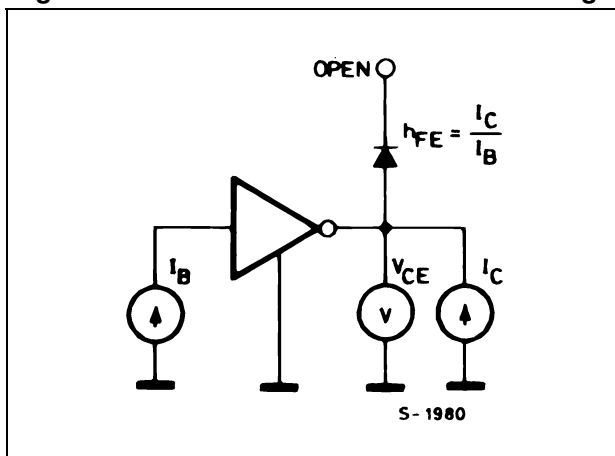


Figure 7. Input current (OFF)

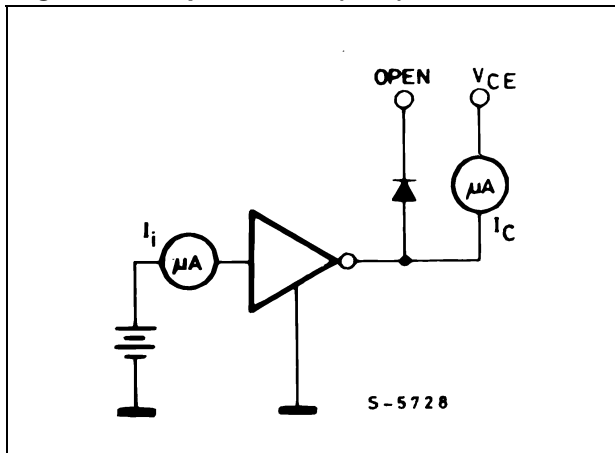


Figure 8. Input voltage

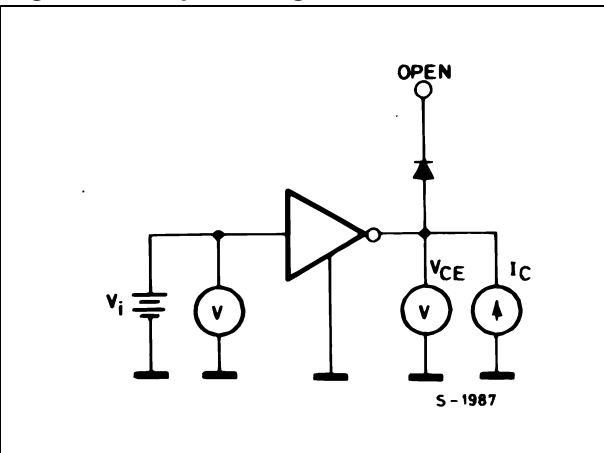


Figure 9. Clamp diode leakage current

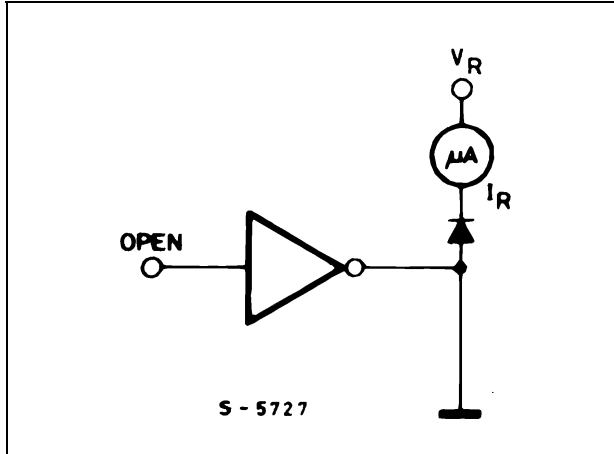


Figure 10. Clamp diode forward voltage

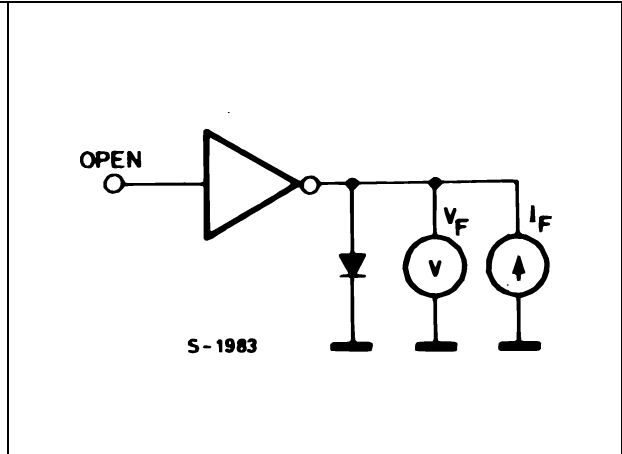


Figure 11. Collector current as a function of saturation voltage

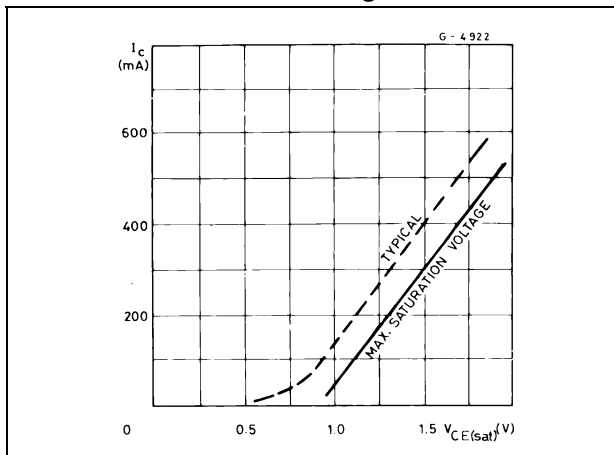


Figure 12. Collector current as a function of input current

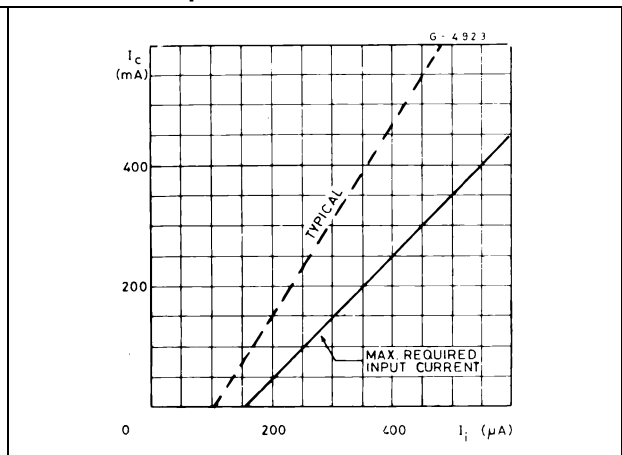


Figure 13. Allowable average power dissipation as a function of  $T_A$

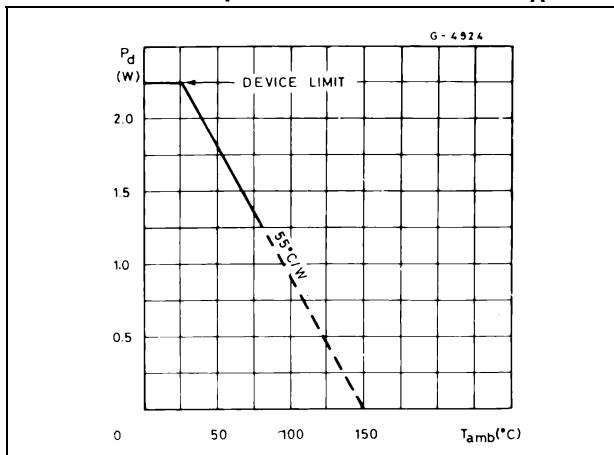


Figure 14. Peak collector current as a function of duty cycle

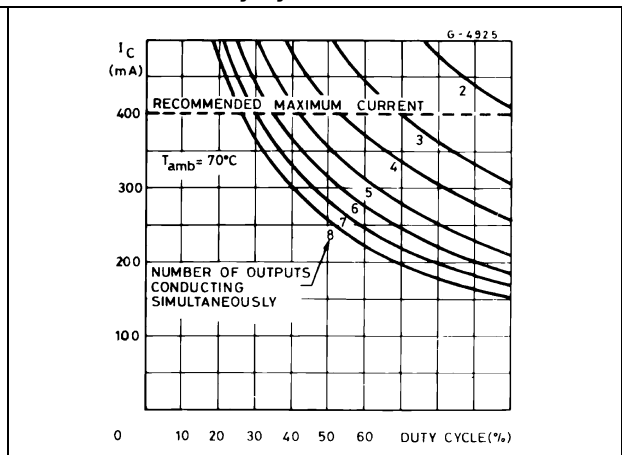




Figure 15. Peak collector current as a function of duty

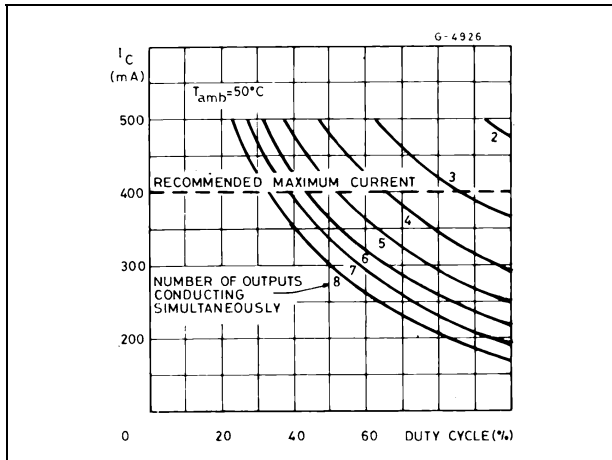


Figure 16. Input current as a function of input voltage (for ULQ2802A)

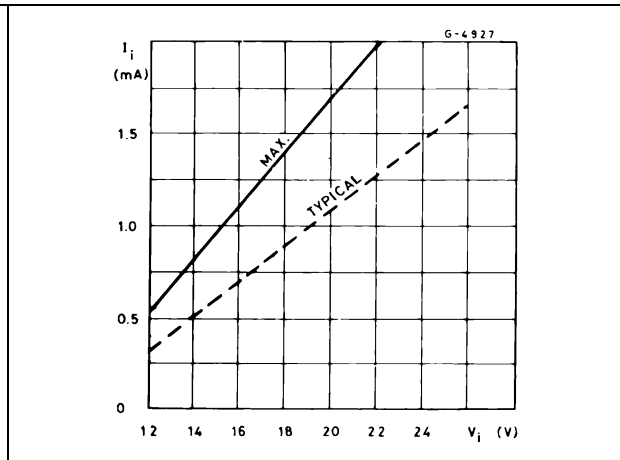


Figure 17. Input current as a function of input voltage (for ULQ2804A)

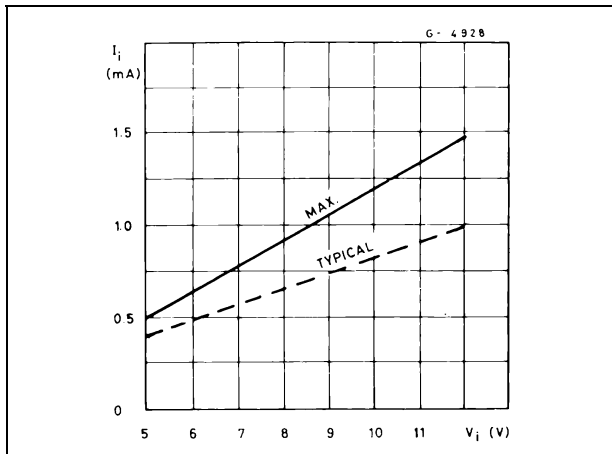
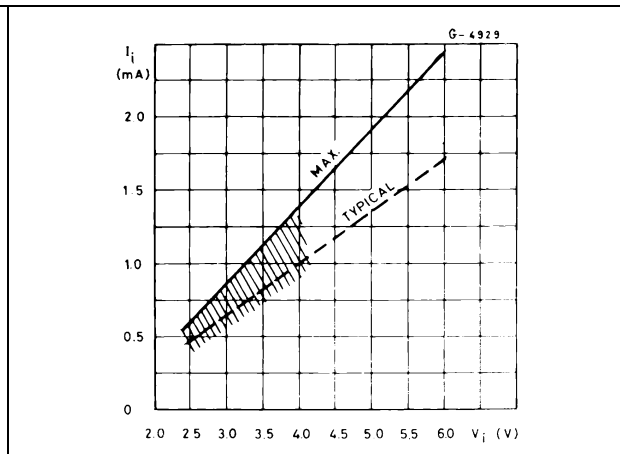


Figure 18. Input current as a function of input voltage (for ULQ2803A)

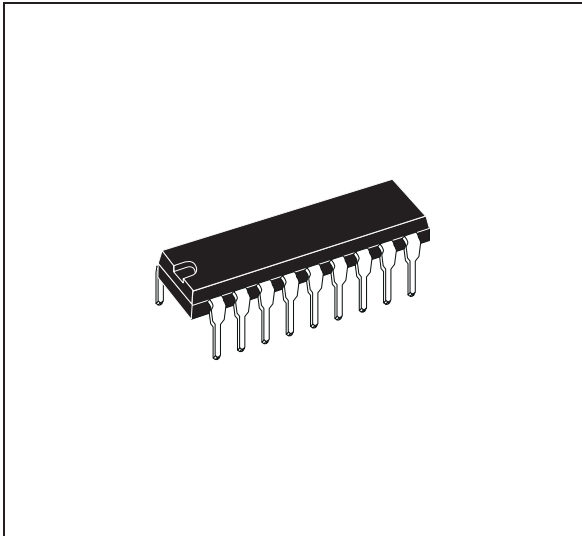


## 6 Package mechanical data

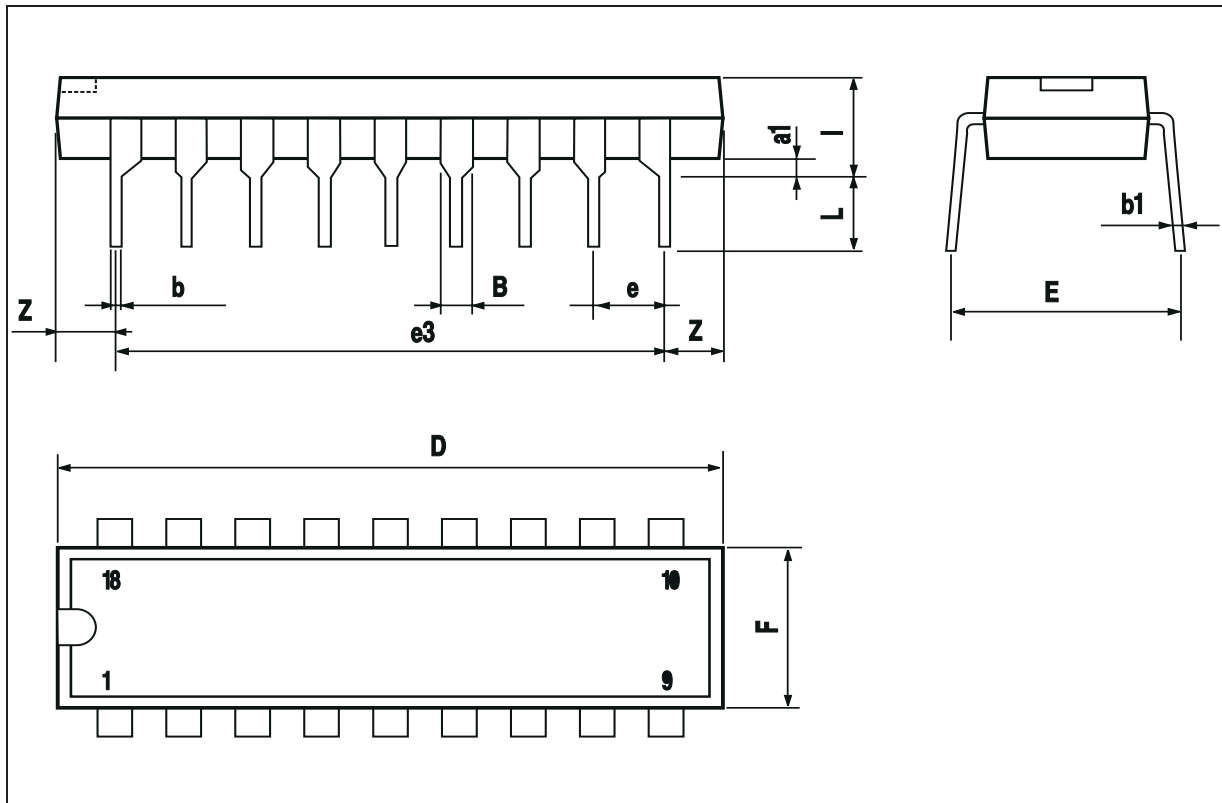
In order to meet environmental requirements, ST offers these devices in ECOPACK® packages. These packages have a lead-free second level interconnect. The category of second Level Interconnect is marked on the package and on the inner box label, in compliance with JEDEC Standard JESD97. The maximum ratings 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> . |

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