

### 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 14-25 V 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**

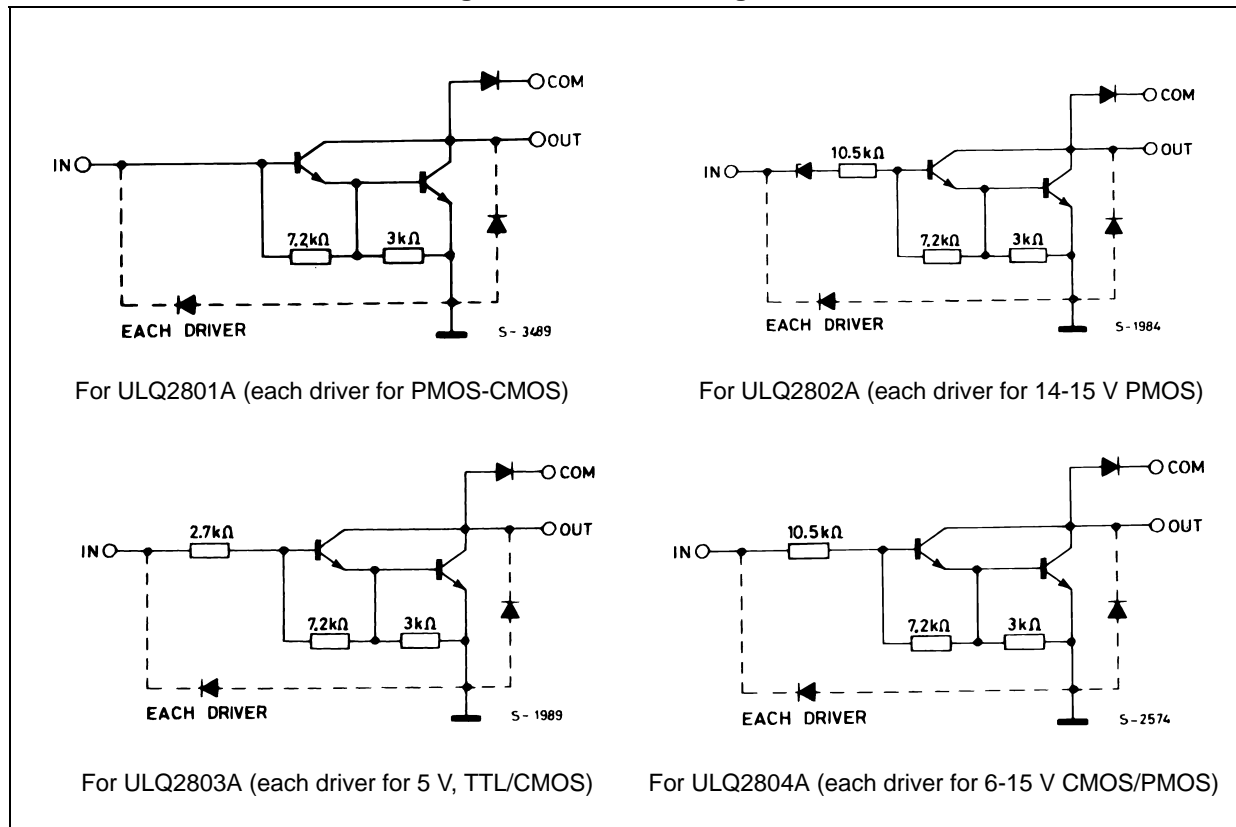
| Order codes | Package |
|-------------|---------|
| ULQ2801A    | DIP-18  |
| ULQ2802A    |         |
| ULQ2803A    |         |
| ULQ2804A    |         |

# Contents

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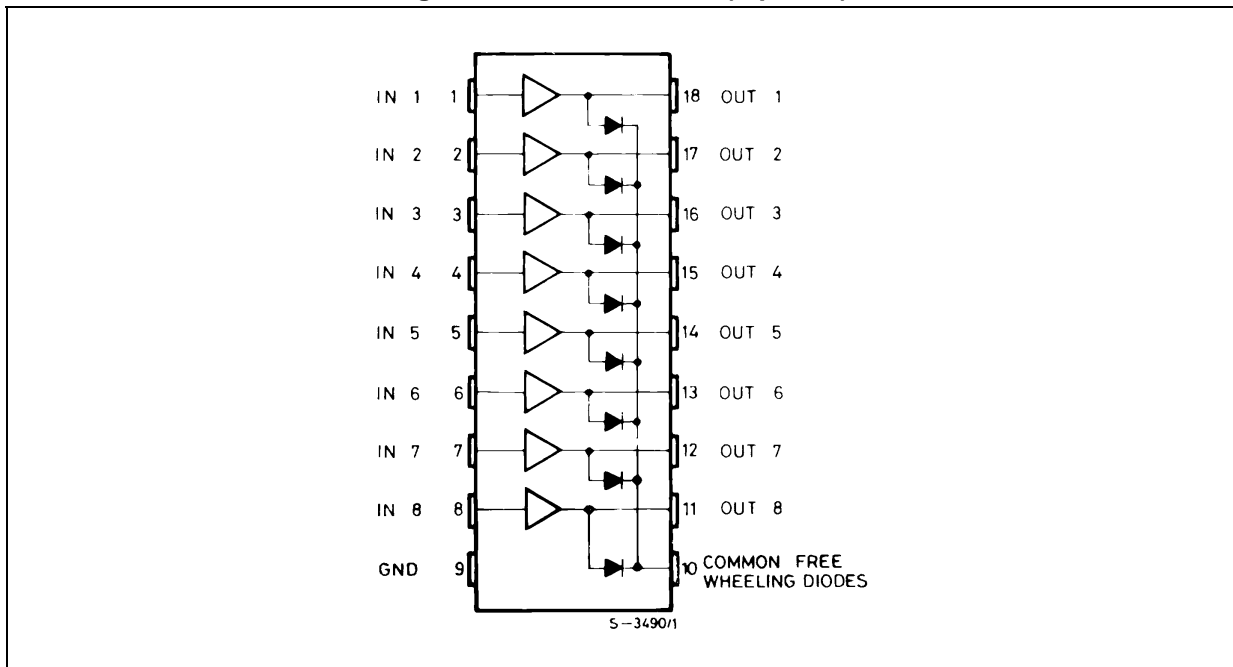
# 1 Diagrams

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

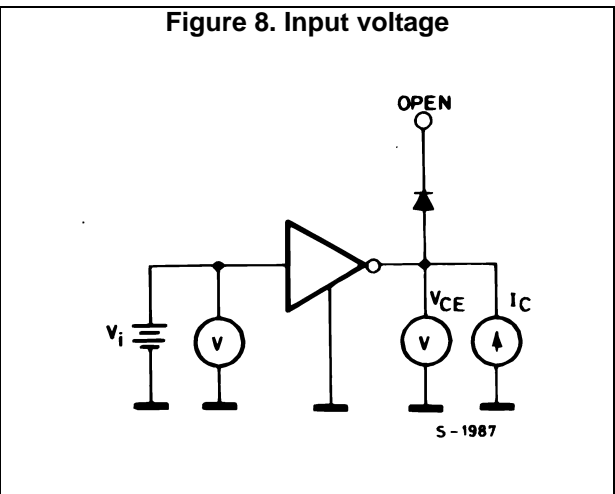
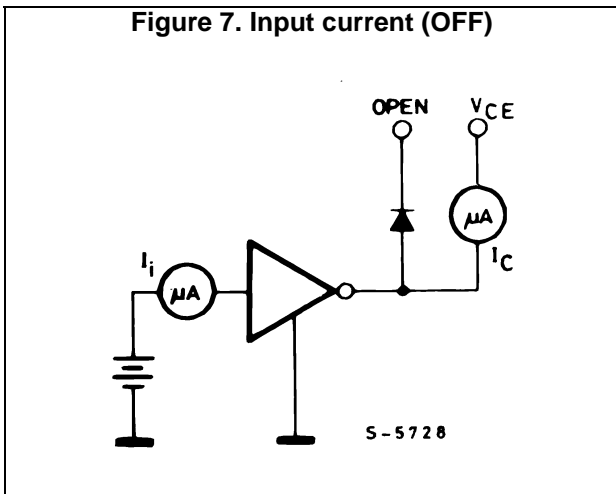
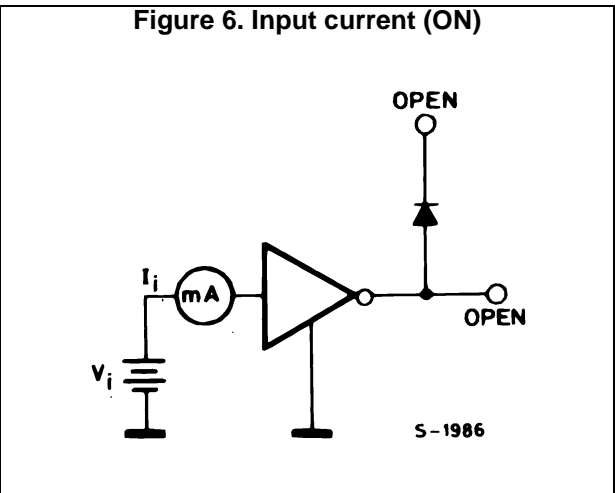
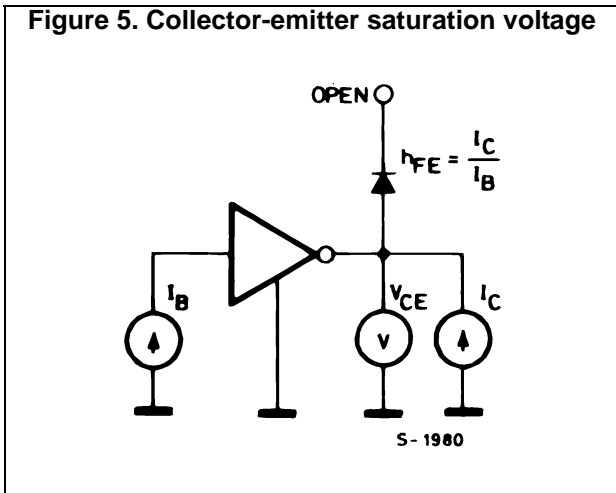
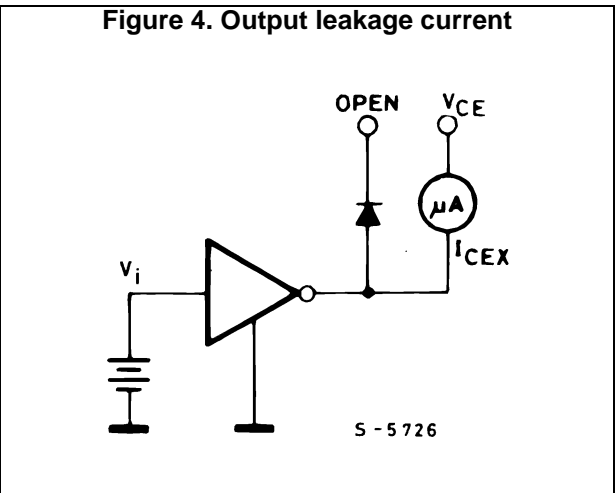
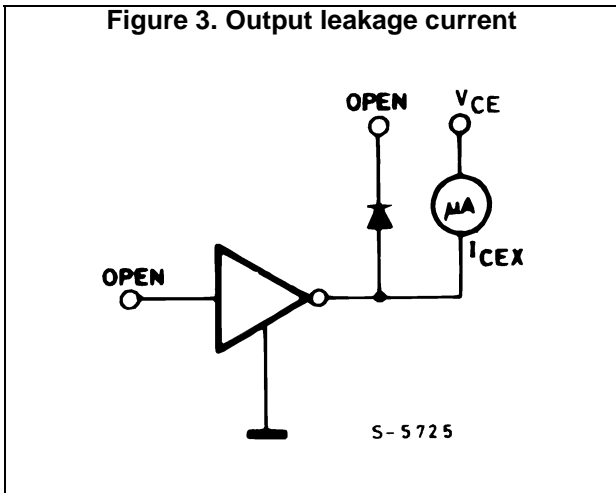
$T_A = 25\text{ °C}$  unless otherwise specified.

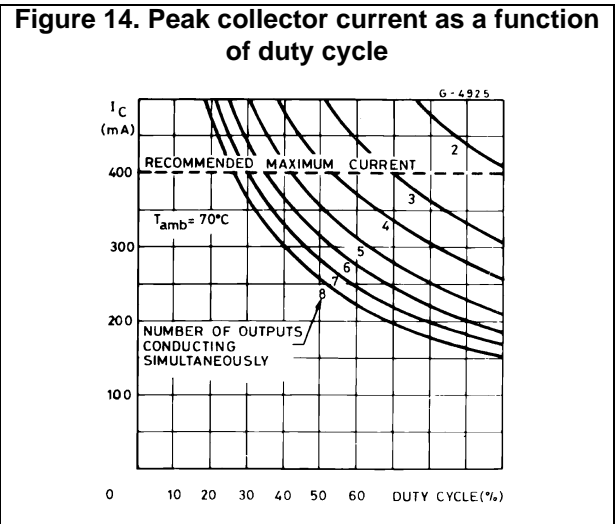
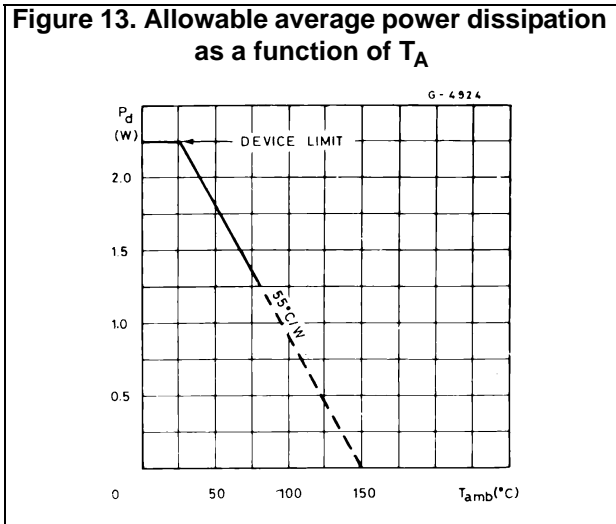
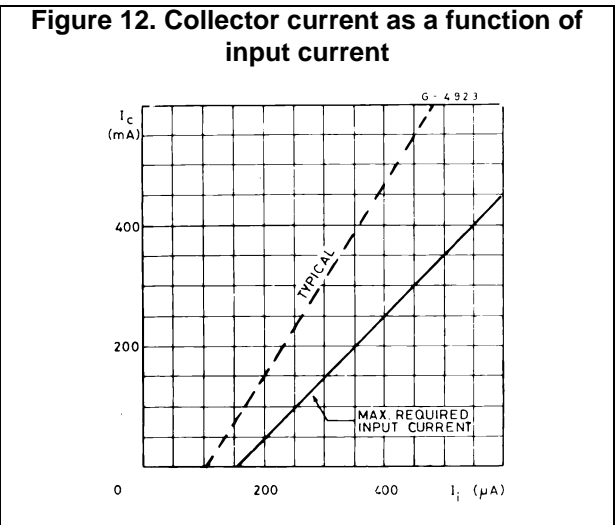
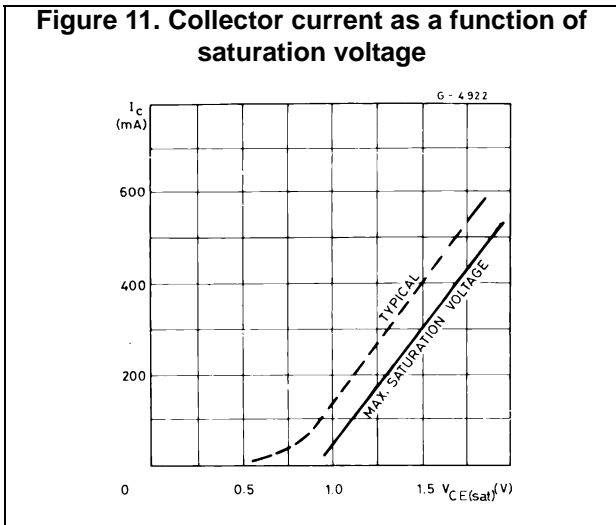
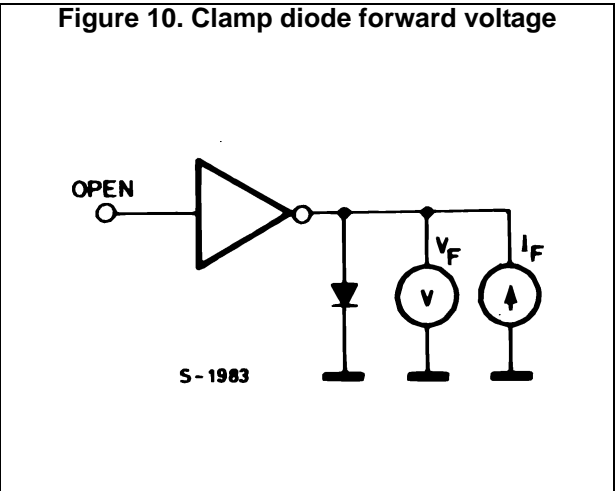
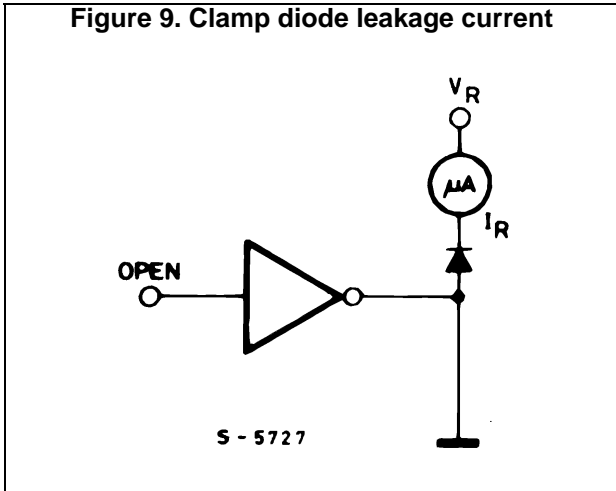
**Table 4. Electrical characteristics**

| Symbol                | Parameter                                       | Test condition  | Min. | Typ. | Max.              | Unit          |
|-----------------------|---|---|------|------|-------------------|---------------|
| $I_{CEX}$             | Output leakage current                          | $V_{CE} = 50\text{ V}$ , (Figure 7)   |      |      | 50                | $\mu\text{A}$ |
|                       |   | $T_A = 105\text{ °C}$ , $V_{CE} = 50\text{ V}$ (Figure 7)                                     |      |      | 100               |               |
|                       |   | $T_A = 105\text{ °C}$ for ULQ2802A, $V_{CE} = 50\text{ V}$ ,<br>$V_I = 6\text{ V}$ (Figure 8) |      |      | 500               |               |
|                       |   | $T_A = 105\text{ °C}$ for ULQ2804A, $V_{CE} = 50\text{ V}$ ,<br>$V_I = 1\text{ V}$ (Figure 8) |      |      | 500               |               |
| $V_{CE(SAT)}$         | Collector-emitter saturation voltage (Figure 9) | $I_C = 100\text{ mA}$ , $I_B = 250\text{ }\mu\text{A}$  |      | 0.9  | 1.1               | V             |
|                       |   | $I_C = 200\text{ mA}$ , $I_B = 350\text{ }\mu\text{A}$  |      | 1.1  | 1.3               |               |
|                       |   | $I_C = 350\text{ mA}$ , $I_B = 500\text{ }\mu\text{A}$  |      | 1.3  | 1.6               |               |
| $I_{I(ON)}$           | Input current (Figure 6)                        | for ULQ2802A, $V_I = 17\text{ V}$   |      | 0.82 | 1.25              | mA            |
|                       |   | for ULQ2803A, $V_I = 3.85\text{ V}$   |      | 0.93 | 1.35              |               |
|                       |   | for ULQ2804A, $V_I = 5\text{ V}$  |      | 0.35 | 0.5               |               |
|                       |   | $V_I = 12\text{ V}$   |      | 1    | 1.45              |               |
| $I_{I(OFF)}$          | Input current (Figure 7)                        | $T_A = 105\text{ °C}$ , $I_C = 500\text{ }\mu\text{A}$  | 50   | 65   |                   | $\mu\text{A}$ |
| $V_{I(ON)}$           | Input voltage (Figure 8)                        | $V_{CE} = 2\text{ V}$ , for ULQ2802A  |      |      | 13                | V             |
|                       |   | $I_C = 300\text{ mA}$   |      |      |                   |               |
|                       |   | for ULQ2803A  |      |      |                   |               |
|                       |   | $I_C = 200\text{ mA}$   |      |      | 2.4               |               |
|                       |   | $I_C = 250\text{ mA}$   |      |      | 2.7               |               |
|                       |   | $I_C = 300\text{ mA}$   |      |      | 3                 |               |
|                       |   | for ULQ2804A  |      |      |                   |               |
|                       |   | $I_C = 125\text{ mA}$   |      |      | 5                 |               |
| $I_C = 200\text{ mA}$ |   |   | 6    |      |                   |               |
| $I_C = 275\text{ mA}$ |   |   | 7    |      |                   |               |
| $I_C = 350\text{ mA}$ |   |   | 8    |      |                   |               |
| $h_{FE}$              | DC forward current gain (Figure 5)              | for ULQ2801A, $V_{CE} = 2\text{ V}$ , $I_C = 350\text{ mA}$                                   | 1000 |      |                   |               |
| $C_I$                 | Input capacitance                               |   |      | 15   | 25 <sup>(1)</sup> | pF            |
| $t_{PLH}$             | Turn-on delay time                              | $0.5\text{ V}_I$ to $0.5\text{ V}_O$  |      | 0.25 | 1 <sup>(1)</sup>  | $\mu\text{s}$ |
| $t_{PHL}$             | Turn-off delay time                             | $0.5\text{ V}_I$ to $0.5\text{ V}_O$  |      | 0.25 | 1 <sup>(1)</sup>  | $\mu\text{s}$ |
| $I_R$                 | Clamp diode leakage current (Figure 9)          | $V_R = 50\text{ V}$   |      |      | 50                | $\mu\text{A}$ |
|                       |   | $T_A = 105\text{ °C}$ , $V_R = 50\text{ V}$   |      |      | 100               |               |
| $V_F$                 | Clamp diode forward voltage (Figure 10)         | $I_F = 350\text{ mA}$   |      | 1.7  | 2                 | V             |

1. Guaranteed by design.

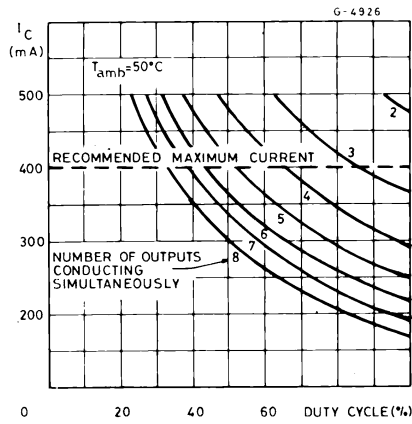
# 5 Test circuits



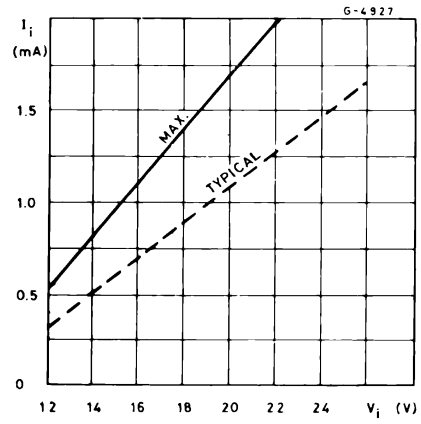




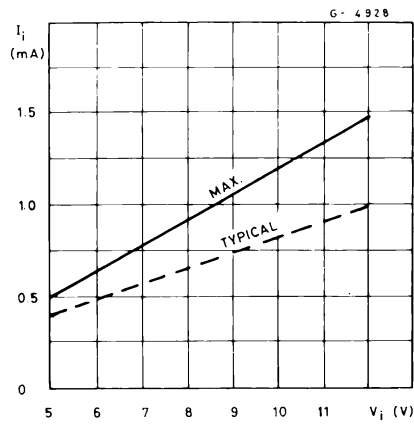
**Figure 15. Peak collector current as a function of duty**



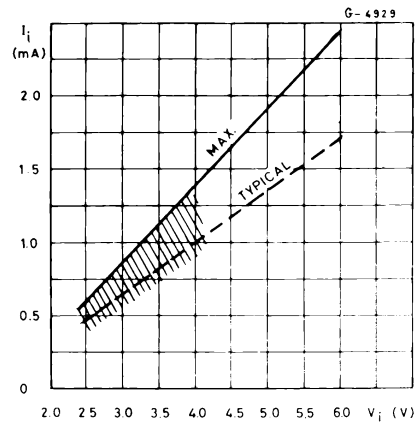
**Figure 16. Input current as a function of input voltage (for ULQ2802A)**



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



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

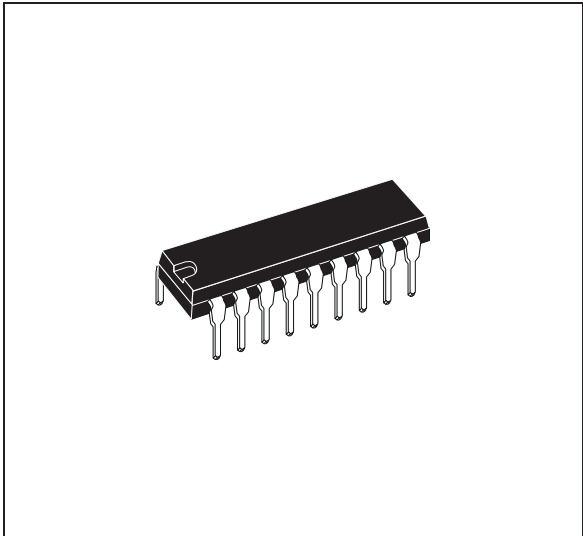


## 6 Package mechanical data

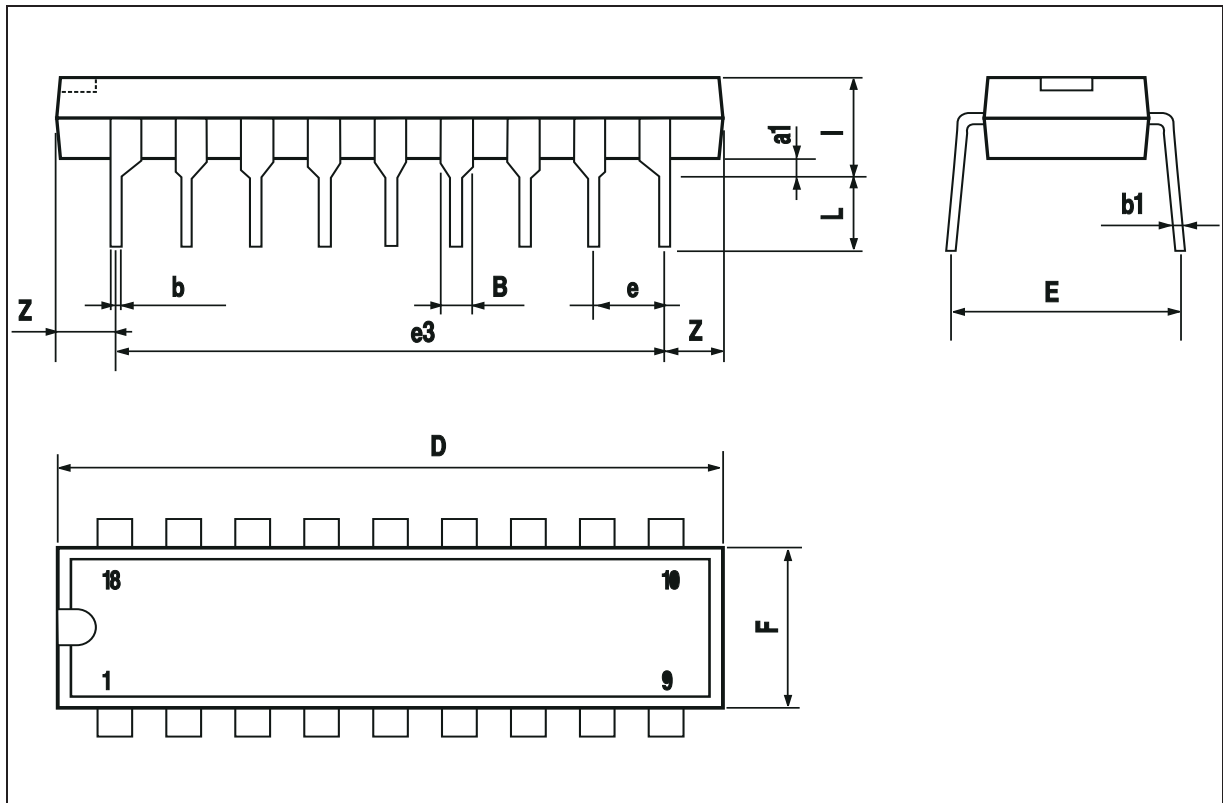
In order to meet environmental requirements, ST offers these devices in different grades of ECOPACK<sup>®</sup> packages, depending on their level of environmental compliance. ECOPACK<sup>®</sup> specifications, grade definitions and product status are available at: [www.st.com](http://www.st.com). ECOPACK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

| 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: Table 1 on page 1.  |
| 27-Jun-2018 | 3        | Updated: $I_{I(ON)}$ test condition in <a href="#">Table 4: Electrical characteristics</a> . |

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