



ULQ2001A - ULQ2003A ULQ2002A - ULQ2004A

SEVEN DARLINGTON ARRAYS

- SEVEN DARLINGTONS PER PACKAGE
- **EXTENDED TEMPERATURE RANGE**
(-40 to 105°C)
- OUTPUT CURRENT 500 mA PER DRIVER
(600 mA PEAK)
- OUTPUT VOLTAGE 50 V
- INTEGRAL SUPPRESSION DIODES FOR INDUCTIVE LOADS
- OUTPUTS CAN BE PARALLELED FOR HIGHER CURRENT
- TTL/CMOS/PMOS/DTL COMPATIBLE INPUTS
- INPUTS PINNED OPPOSITE OUTPUTS TO SIMPLIFY LAYOUT

DESCRIPTION

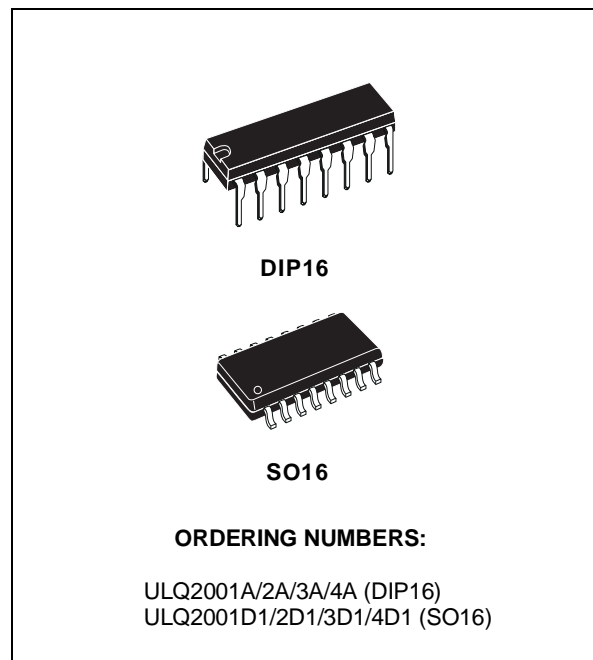
The ULQ2001A, ULQ2002A, ULQ2003 and ULQ2004A are high voltage, high current darlington arrays each containing seven open collector darlington pairs with common emitters. Each channel is rated at 500 mA and can withstand peak currents of 600 mA. Suppression diodes are included for inductive load driving and the inputs are pinned opposite the outputs to simplify board layout.

The four versions interface to all common logic families :

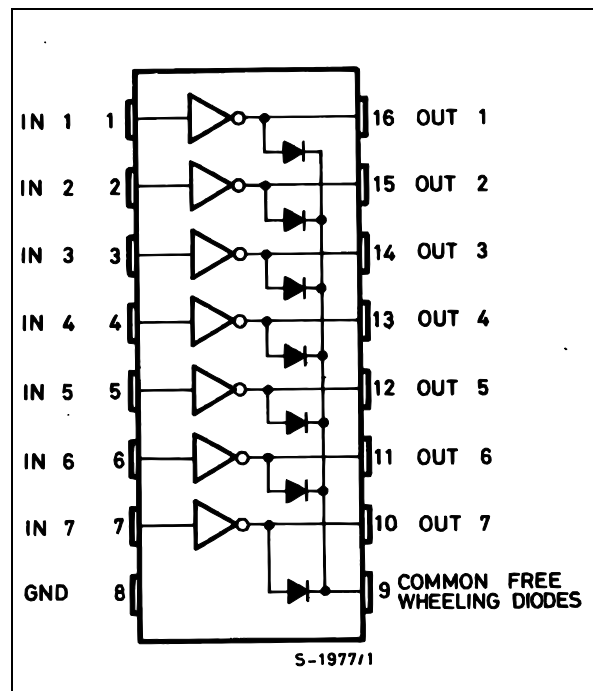
| | |
|----------|---------------------------------------|
| ULQ2001A | General Purpose, DTL, TTL, PMOS, CMOS |
| ULQ2002A | 14-25V PMOS |
| ULQ2003A | 5V TTL, CMOS |
| ULQ2004A | 6-15V CMOS, PMOS |

These versatile devices are useful for driving a wide range of loads including solenoids, relays DC motors, LED displays filament lamps, thermal print-heads and high power buffers.

The ULQ2001A/2002A/2003A and 2004A are supplied in 16 pin plastic DIP packages with a copper leadframe to reduce thermal resistance. They are available also in small outline package (SO-16) as ULQ2001D1/2002D1/2003D1/2004D1.

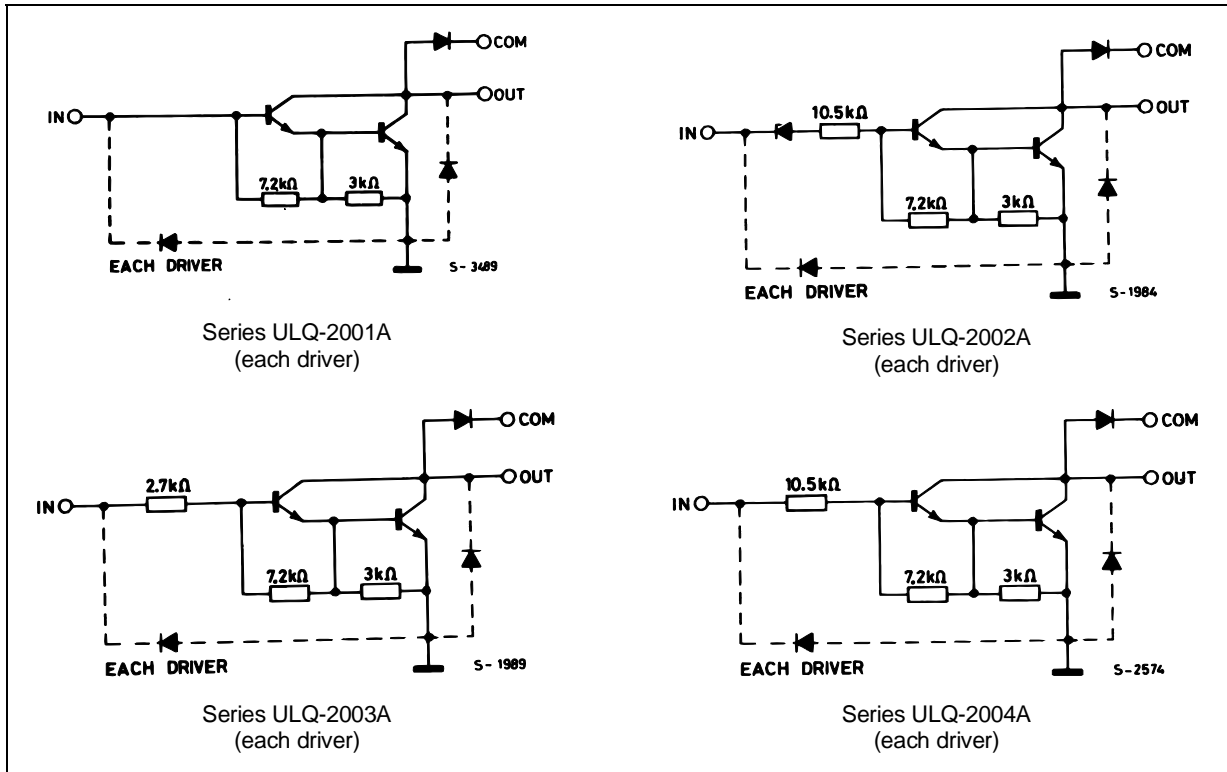


PIN CONNECTION



ULQ2001A - ULQ2002A - ULQ2003A - ULQ2004A

SCHEMATIC DIAGRAM



ABSOLUTE MAXIMUM RATINGS

| Symbol | Parameter | Value | Unit |
|-----------|---|------------|------|
| V_o | Output Voltage | 50 | V |
| V_{in} | Input Voltage (for ULQ2002A/D1 - 2003A/D1 - 2004A/D1) | 30 | V |
| I_c | Continuous Collector Current | 500 | mA |
| I_b | Continuous Base Current | 25 | mA |
| T_{amb} | Operating Ambient Temperature Range | -40 to 105 | °C |
| T_{stg} | Storage Temperature Range | -55 to 150 | °C |
| T_j | Junction Temperature | 150 | °C |

THERMAL DATA

| Symbol | Parameter | DIP16 | SO16 | Unit |
|-----------------|-------------------------------------|---------|------|------|
| $R_{th\ j-amb}$ | Thermal Resistance Junction-ambient | Max. 70 | 120 | °C/W |

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ELECTRICAL CHARACTERISTICS ($T_J = -40$ to 105°C for DIP16 unless otherwise specified)
 ($T_J = 25$ to 105°C for SO16 unless otherwise specified)

| Symbol | Parameter | Test Conditions | Min. | Typ. | Max. | Unit | Fig. |
|---------------|--------------------------------------|--|------|------|------------|--------------------------------|----------|
| I_{CEX} | Output Leakage Current | $V_{CE} = 50\text{V}$ $T_J = 105^\circ\text{C}$, $V_{CE} = 50\text{V}$ $T_J = 105^\circ\text{C}$ for ULQ2002A $V_{CE} = 50\text{V}$, $V_i = 6\text{V}$ for ULQ2004A $V_{CE} = 50\text{V}$, $V_i = 1\text{V}$ | | | 50 100 | μA μA | 1a 1a |
| | | | | | 500 500 | μA μA | 1b 1b |
| $V_{CE(sat)}$ | Collector-emitter Saturation Voltage | $I_C = 100\text{mA}$, $I_B = 250\mu\text{A}$ $I_C = 200\text{mA}$, $I_B = 350\mu\text{A}$ $I_C = 350\text{mA}$, $I_B = 500\mu\text{A}$ | | 0.9 | 1.1 | V | 2 |
| | | | | 1.1 | 1.3 | V | 2 |
| | | | | 1.3 | 1.6 | V | 2 |
| $I_{i(on)}$ | Input Current | for ULQ2002A $V_i = 17\text{V}$ for ULQ2003A $V_i = 3.85\text{V}$ for ULQ2004A $V_i = 5\text{V}$ $V_i = 12\text{V}$ | | 0.82 | 1.25 | mA | 3 |
| | | | | 0.93 | 1.35 | mA | 3 |
| | | | | 0.35 | 0.5 | mA | 3 |
| | | | | 1 | 1.45 | mA | 3 |
| $I_{i(off)}$ | Input Current | $T_J = 105^\circ\text{C}$, $I_C = 500\mu\text{A}$ | 50 | 65 | | μA | 4 |
| $V_{i(on)}$ | Input Voltage | for ULQ2002A $V_{CE} = 2\text{V}$, $I_C = 300\text{mA}$ for ULQ2003A $V_{CE} = 2\text{V}$, $I_C = 200\text{mA}$ $V_{CE} = 2\text{V}$, $I_C = 250\text{mA}$ for ULQ2004A $V_{CE} = 2\text{V}$, $I_C = 300\text{mA}$ $V_{CE} = 2\text{V}$, $I_C = 125\text{mA}$ $V_{CE} = 2\text{V}$, $I_C = 200\text{mA}$ $V_{CE} = 2\text{V}$, $I_C = 275\text{mA}$ $V_{CE} = 2\text{V}$, $I_C = 350\text{mA}$ | | | 13 | V | 5 |
| | | | | | 2.4 | V | 5 |
| | | | | | 2.7 | V | 5 |
| | | | | | 3 | V | 5 |
| | | | | | 5 | V | 5 |
| | | | | | 6 | V | 5 |
| | | | | | 7 | V | 5 |
| | | | | | 8 | V | 5 |
| h_{FE} | DC Forward Current Gain | for ULQ2001A $V_{CE} = 2\text{V}$, $I_C = 350\text{mA}$ | 1000 | | | – | 2 |
| C_i | Input Capacitance | | | 15 | 25 (*) | pF | – |
| t_{PLH} | Turn-on Delay Time | $0.5 V_i$ to $0.5 V_o$ | | 0.25 | 1 (*) | μs | – |
| t_{PHL} | Turn-off Delay Time | $0.5 V_i$ to $0.5 V_o$ | | 0.25 | 1 (*) | μs | – |
| I_R | Clamp Diode Leakage Current | $V_R = 50\text{V}$ $T_J = 105^\circ\text{C}$, $V_R = 50\text{V}$ | | | 50 | μA | 6 |
| | | | | | 100 | μA | 6 |
| V_F | Clamp Diode Forward Voltage | $I_F = 350\text{mA}$ | | 1.7 | 2 | V | 7 |

(*) Guaranteed by design

TEST CIRCUITS

Figure 1a.

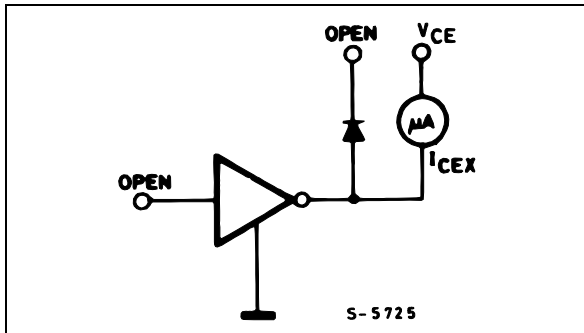


Figure 1b.

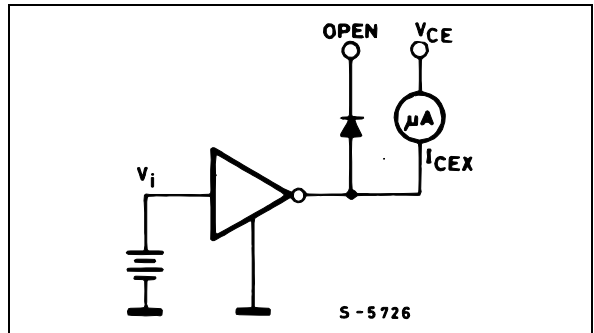


Figure 2.

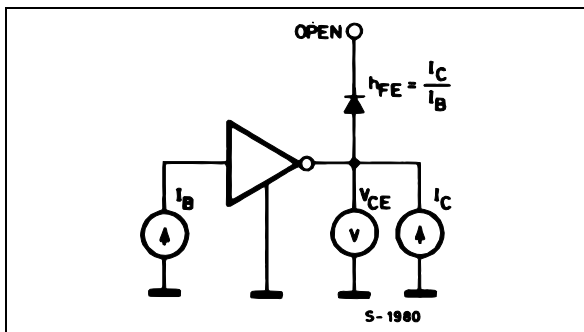


Figure 3.

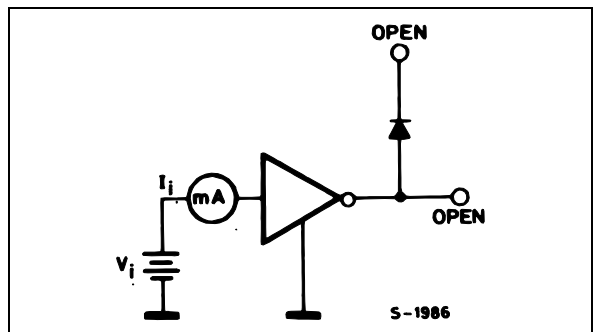


Figure 4.

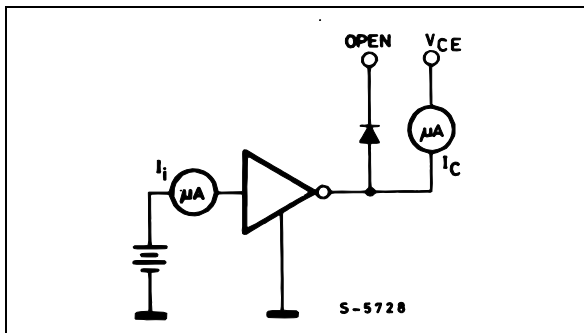


Figure 5.

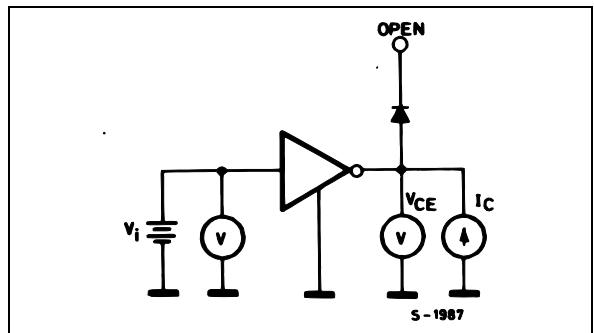


Figure 6.

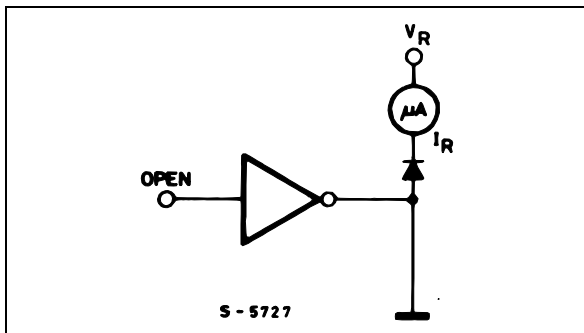
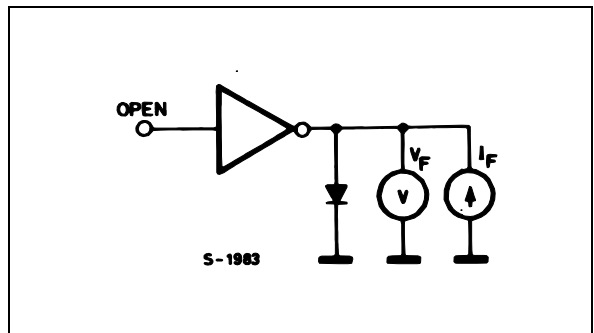
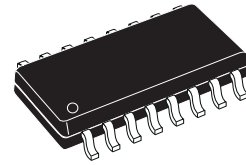


Figure 7.



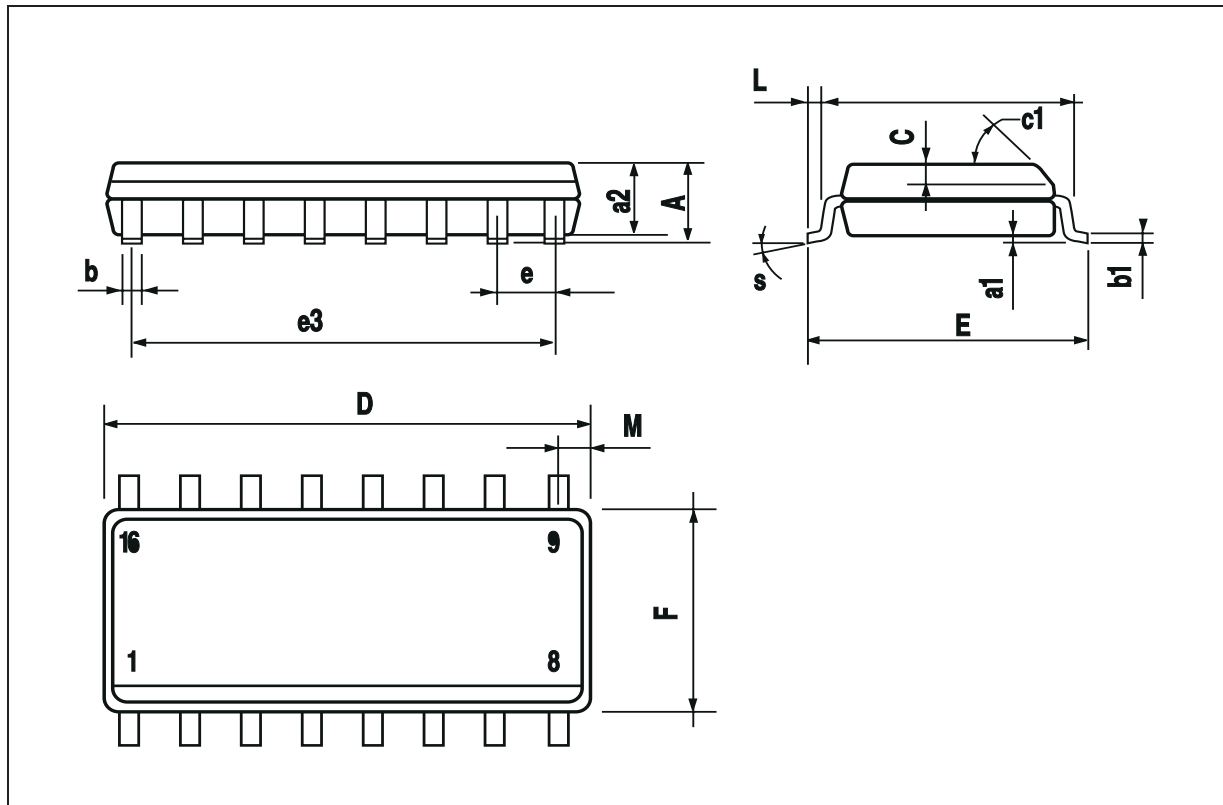
| DIM. | mm | | | inch | | |
|-------|------------|------|------|-------|-------|-------|
| | MIN. | TYP. | MAX. | MIN. | TYP. | MAX. |
| A | | | 1.75 | | | 0.069 |
| a1 | 0.1 | | 0.25 | 0.004 | | 0.009 |
| a2 | | | 1.6 | | | 0.063 |
| b | 0.35 | | 0.46 | 0.014 | | 0.018 |
| b1 | 0.19 | | 0.25 | 0.007 | | 0.010 |
| C | | 0.5 | | | 0.020 | |
| c1 | 45° (typ.) | | | | | |
| D (1) | 9.8 | | 10 | 0.386 | | 0.394 |
| E | 5.8 | | 6.2 | 0.228 | | 0.244 |
| e | | 1.27 | | | 0.050 | |
| e3 | | 8.89 | | | 0.350 | |
| F (1) | 3.8 | | 4 | 0.150 | | 0.157 |
| G | 4.6 | | 5.3 | 0.181 | | 0.209 |
| L | 0.4 | | 1.27 | 0.016 | | 0.050 |
| M | | | 0.62 | | | 0.024 |
| S | 8°(max.) | | | | | |

OUTLINE AND MECHANICAL DATA



SO16 Narrow

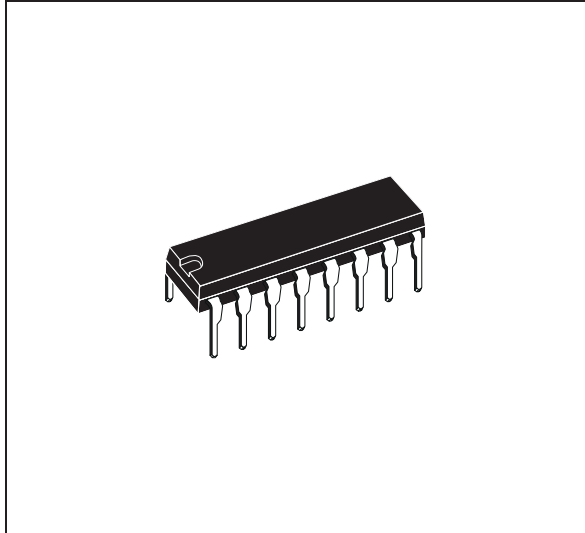
(1) D and F do not include mold flash or protrusions. Mold flash or protrusions shall not exceed 0.15mm (.006inch).



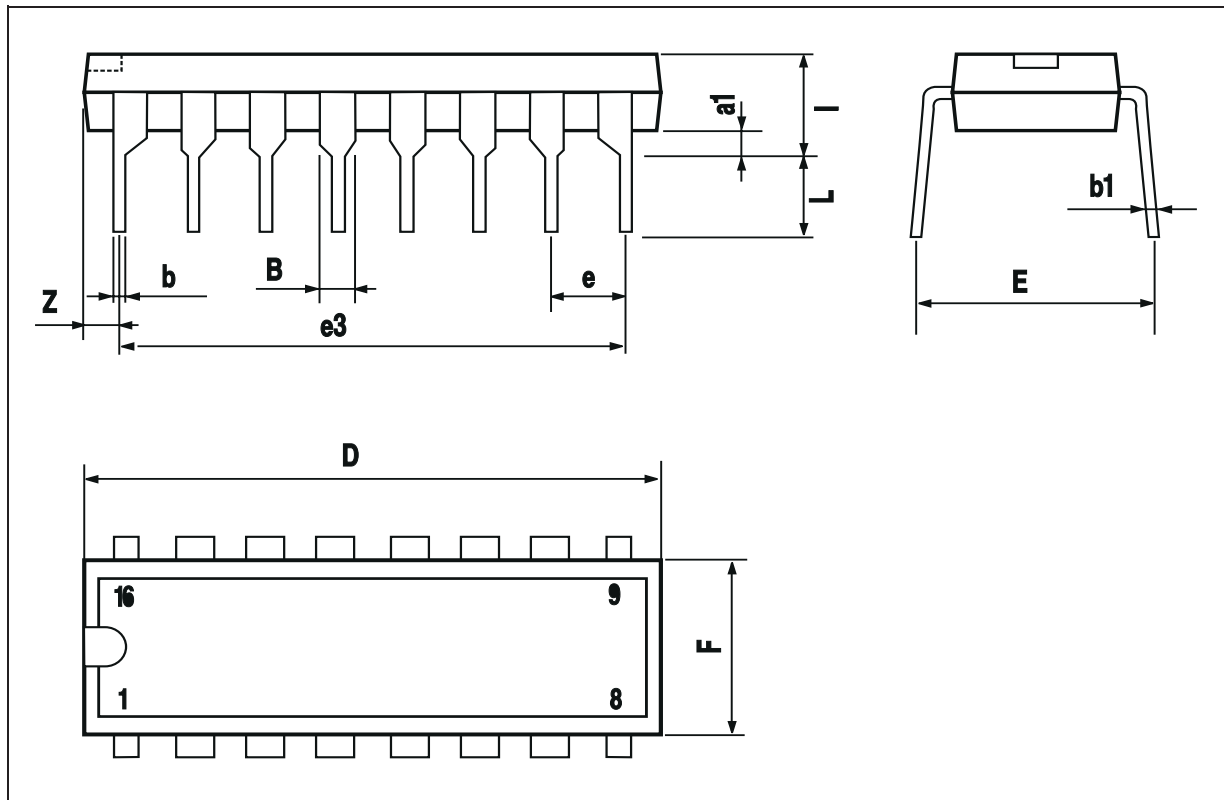
ULQ2001A - ULQ2002A - ULQ2003A - ULQ2004A

| DIM. | mm | | | inch | | |
|------|------|-------|------|-------|-------|-------|
| | MIN. | TYP. | MAX. | MIN. | TYP. | MAX. |
| a1 | 0.51 | | | 0.020 | | |
| B | 0.77 | | 1.65 | 0.030 | | 0.065 |
| b | | 0.5 | | | 0.020 | |
| b1 | | 0.25 | | | 0.010 | |
| D | | | 20 | | | 0.787 |
| E | | 8.5 | | | 0.335 | |
| e | | 2.54 | | | 0.100 | |
| e3 | | 17.78 | | | 0.700 | |
| F | | | 7.1 | | | 0.280 |
| I | | | 5.1 | | | 0.201 |
| L | | 3.3 | | | 0.130 | |
| Z | | | 1.27 | | | 0.050 |

OUTLINE AND MECHANICAL DATA



DIP16



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