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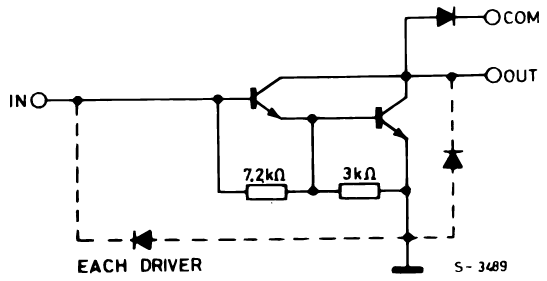
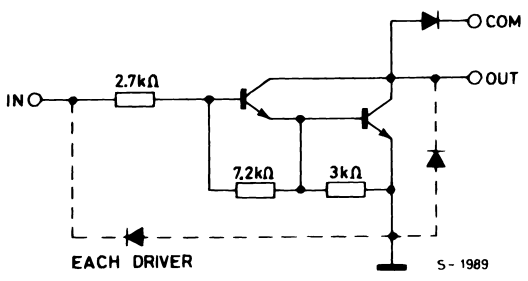
1 Diagram

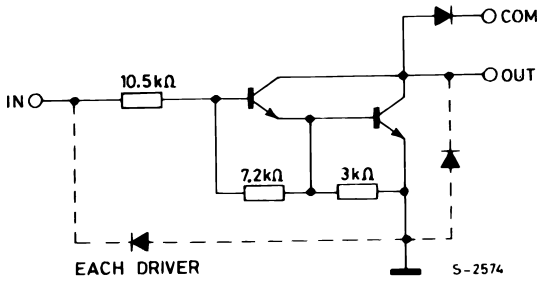
Figure 1. Schematic diagram



ULQ2001 (each driver)



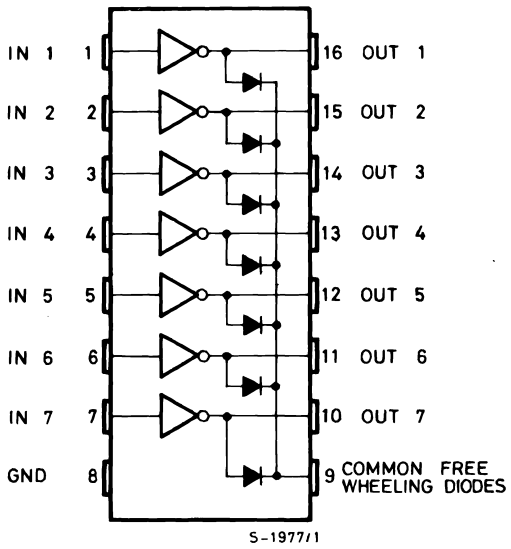
ULQ2003 (each driver)



ULQ2004 (each driver)

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_{IN}	Input voltage (for ULQ2003A/D1 - 2004A/D1)	30	V
I_C	Continuous collector current	500	mA
I_B	Continuous base current	25	mA
T_A	Operating ambient temperature range	-40 to 105	°C
T_{STG}	Storage temperature range	-55 to 150	°C
T_J	Junction temperature	150	°C

Table 3. Thermal data

Symbol	Parameter	DIP-16	SO16	Unit
R_{thJA}	Thermal resistance junction-ambient, max.	70	120	°C/W

4 Electrical characteristics

T_J = -40 to 105 °C for DIP16 unless otherwise specified,
T_J = -25 to 105 °C for SO16 unless otherwise specified.

Table 4. Electrical characteristics

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
I_{CEX}	Output leakage current	V_{CE} = 50V, (*Figure 3*)			50	µA
		T_J = 105°C, V_{CE}= 50V (*Figure 3*)			100	
		T_J = 105°C for ULQ2004, 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 ULQ2003, V_I = 3.85V		0.93	1.35	mA
		for ULQ2004, V_I = 5V		0.35	0.5	
		for ULQ2004, V_I = 12V		1	1.45	
$I_{I(OFF)}$	Input current (*Figure 7*)	T_J = 105°C, I_C = 500µA	50	65		µA
$V_{I(ON)}$	Input voltage (*Figure 8*)	for ULQ2003 V_{CE}= 2V, I_C = 200mA V_{CE}= 2V, I_C = 250mA V_{CE}= 2V, I_C = 300mA for ULQ2004 V_{CE}= 2V, I_C = 125mA V_{CE}= 2V, I_C = 200mA V_{CE}= 2V, I_C = 275mA V_{CE}= 2V, I_C = 350mA			2.4 2.7 3 5 6 7 8	V
h_{FE}	DC forward current gain (*Figure 5*)	for ULQ2001, V_{CE} = 2V, I_C = 350mA	1000			
C_I	Input capacitance			15	25 (1)	pF
t_{PLH}	Turn-on delay time	0.5 V_I to 0.5V_O		0.25	1 (1)	µs
t_{PHL}	Turn-off delay time	0.5 V_I to 0.5V_O		0.25	1 (1)	µs
I_R	Clamp diode leakage current (*Figure 9*)	V_R = 50V			50	µA
		T_J = 105°C, V_R = 50V			100	
V_F	Clamp diode forward voltage (*Figure 10*)	I_F = 350mA		1.7	2	V

1. Guaranteed by design.

T_J = -40 to 125 °C for SO16 unless otherwise specified.

Table 5. Electrical characteristics for ULQ2003D1013TRY (Automotive Grade)

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
I_{CEX}	Output leakage current (*Figure 3*)	V_{CE} = 50V			50	µA
$V_{CE(SAT)}$	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*)	V_I = 3.85V		0.93	1.35	mA
$I_{I(OFF)}$	Input current (*Figure 7*)	I_C = 500µA	50	65		µA
$V_{I(ON)}$	Input voltage (*Figure 8*)	V_{CE} = 2V, I_C = 200mA V_{CE} = 2V, I_C = 250mA V_{CE} = 2V,I_C = 300mA			2.4 2.7 3	V
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
V_F	Clamp diode forward voltage (*Figure 10*)	I_F = 350mA		1.7	2	V

5 Test circuits

Figure 3. Output leakage current

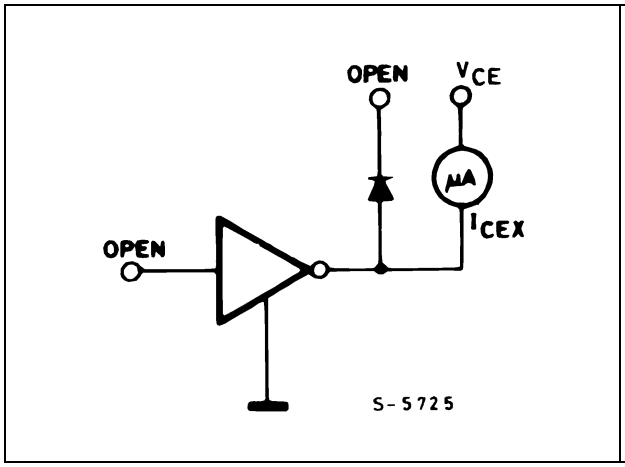


Figure 4. Output leakage current (for ULN2002 only)

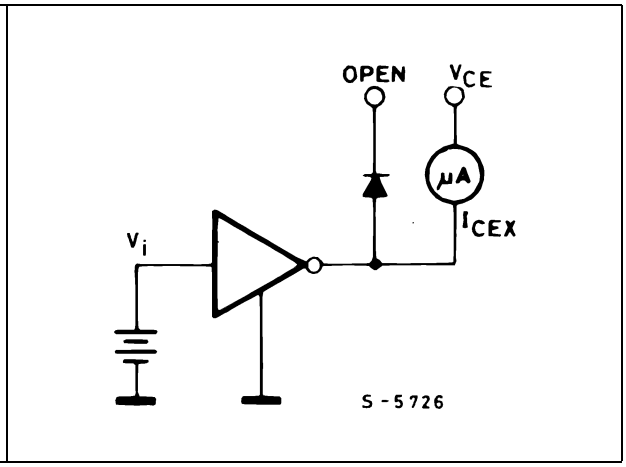


Figure 5. Collector-emitter saturation voltage

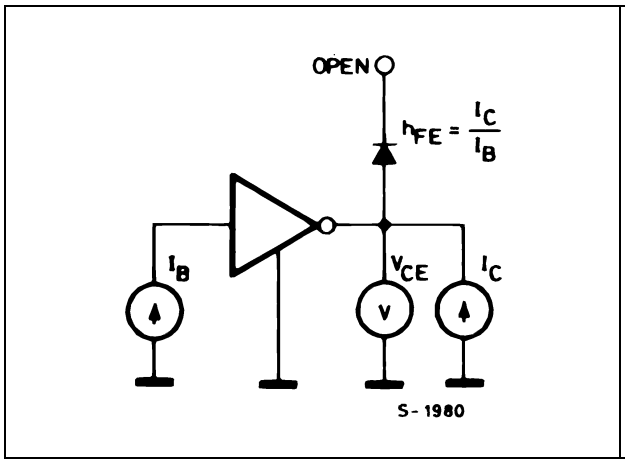


Figure 6. Input current (ON)

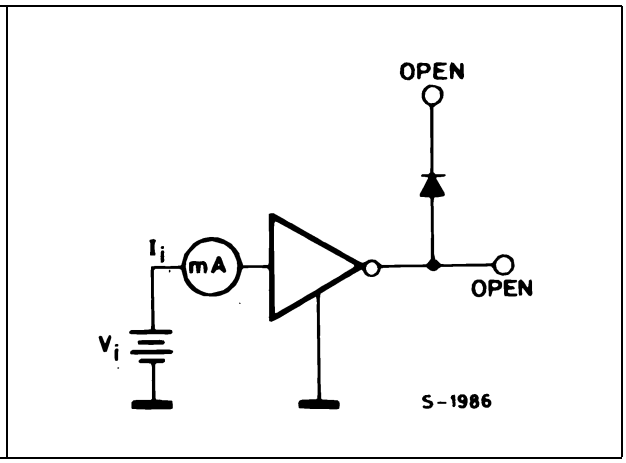


Figure 7. Input current (OFF)

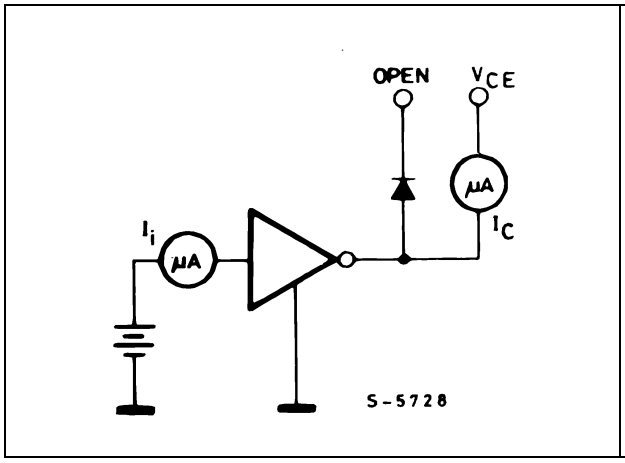


Figure 8. Input voltage

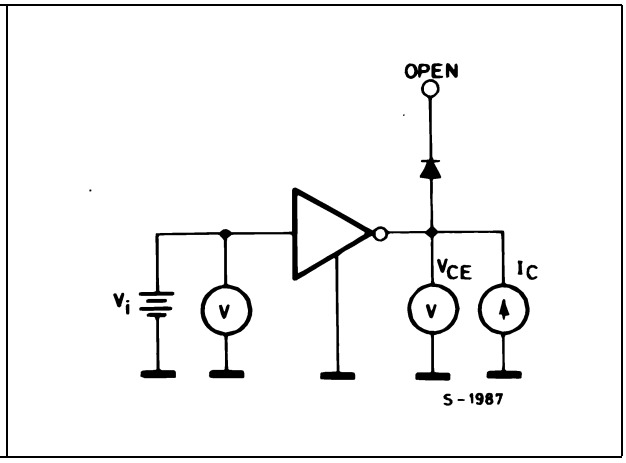


Figure 9. Clamp diode leakage current

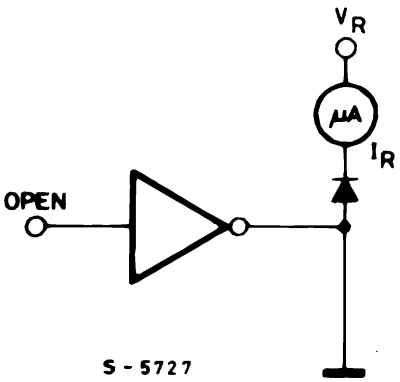
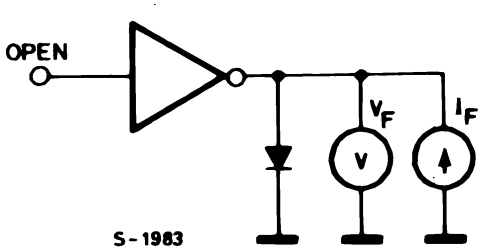


Figure 10. Clamp diode forward voltage

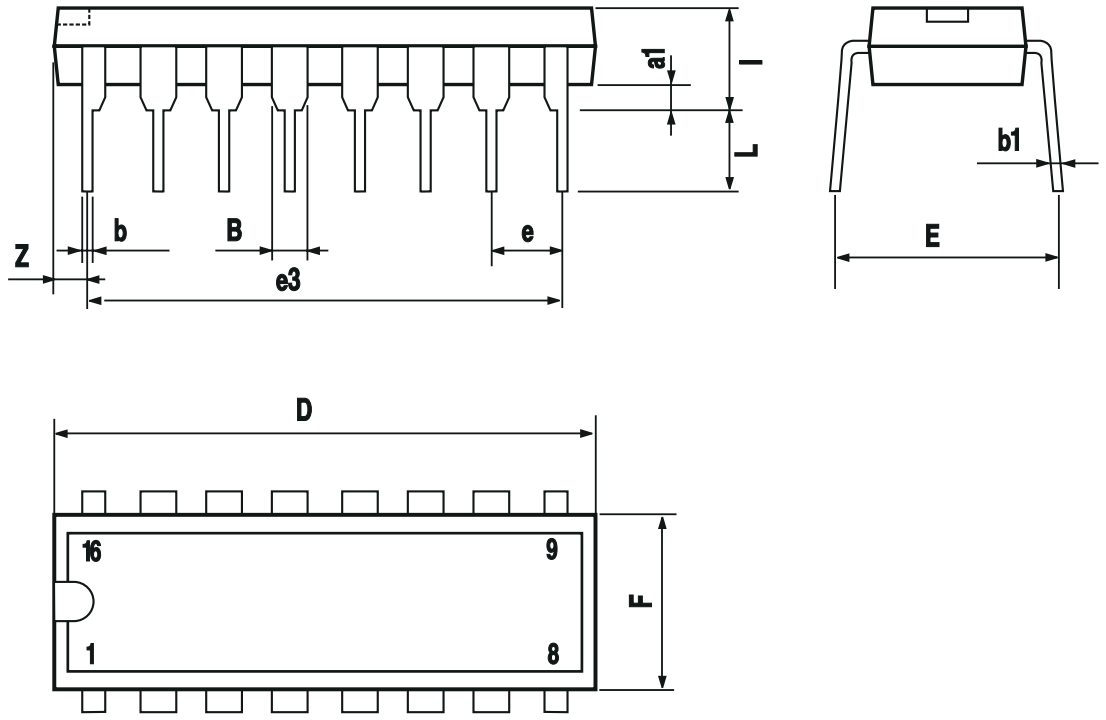


6 Package mechanical data

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.

Plastic DIP-16 (0.25) mechanical data

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

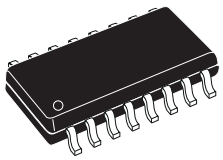


P001C

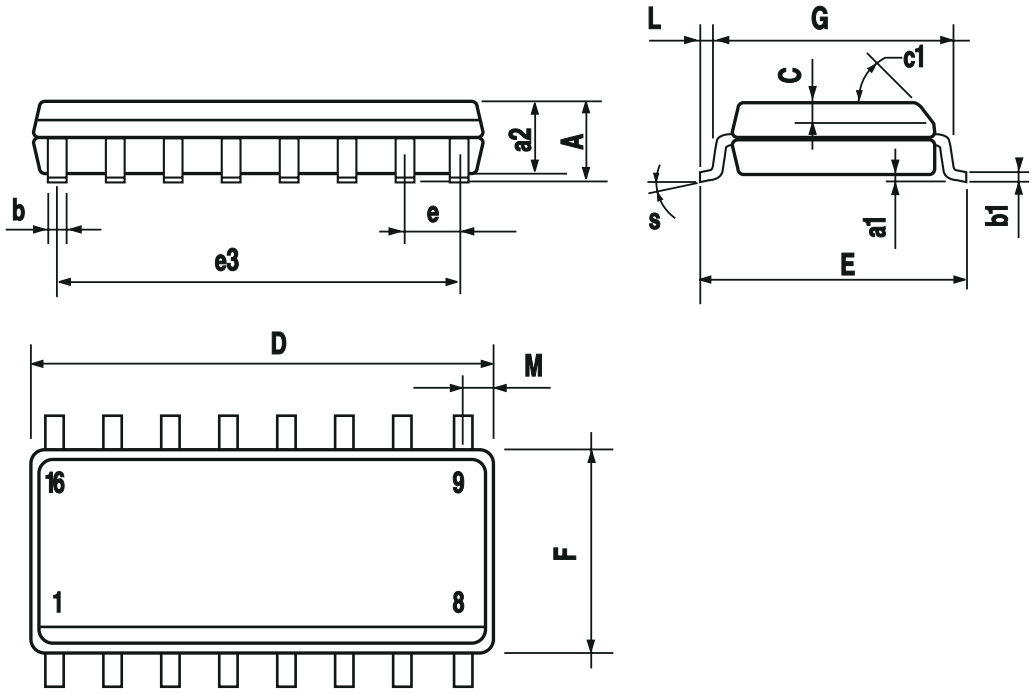
DIM.	mm			inch		
	MIN.	TYP.	MAX.	MIN.	TYP.	MAX.
A			1.75			0.069
a1	0.1		0.25	0.004		0.009
a2			1.6			0.063
b	0.35		0.46	0.014		0.018
b1	0.19		0.25	0.007		0.010
C		0.5			0.020	
c1			45°	(typ.)		
D(1)	9.8		10	0.386		0.394
E	5.8		6.2	0.228		0.244
e		1.27			0.050	
e3		8.89			0.350	
F(1)	3.8		4.0	0.150		0.157
G	4.60		5.30	0.181		0.208
L	0.4		1.27	0.150		0.050
M			0.62			0.024
S	8 ° (max.)					

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

OUTLINE AND MECHANICAL DATA



SO16 (Narrow)



0016020 D

7 Revision history

Table 6. Document revision history

Date	Revision	Changes
05-Dec-2006	2	Order codes updated.
23-May-2007	3	Order codes updated.
17-Apr-2008	4	Added new order codes for Automotive grade products see *Table 1 on page 1*.
25-Aug-2008	5	Modified: *Table 4 on page 6* and *Table 5 on page 7*.
11-Feb-2011	6	Modified: T_J = -25 to 105 °C *Table 4 on page 6*.