

## Seven darlington array

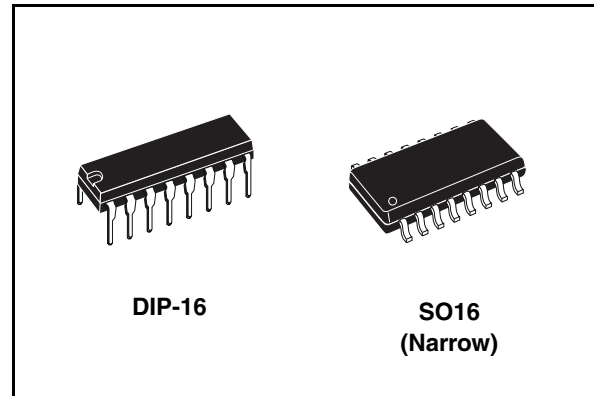
### Features

- Seven darlington pairs per package
- Extended temperature range:  
-40 to 105°C
- Output current 500mA per driver (600mA peak)
- Output voltage 50V
- Integrated 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 ULQ2001, ULQ2003 and ULQ2004 are high voltage, high current darlington arrays each containing seven open collector darlington pairs with common emitters. Each channel rated at 500mA and can withstand peak currents of 600mA. Suppression diodes are included for inductive load driving and the inputs are pinned opposite the outputs to simplify board layout.

The versions interface to all common logic families.



ULQ2001	General purpose, DTL, TTL, PMOS, CMOS
ULQ2003	5V TTL, CMOS
ULQ2004	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/2003A and 2004A are supplied in 16 pin plastic DIP packages with a copper lead-frame to reduce thermal resistance. They are available also in small outline package (SO-16) as ULQ2003D1/2004D1.

### Order codes

Part numbers	Packages
ULQ2001A	DIP-16
ULQ2003A	DIP-16
ULQ2004A	DIP-16
ULQ2003D1013TR	SO16 in Tape & Reel
ULQ2004D1013TR	SO16 in Tape & Reel

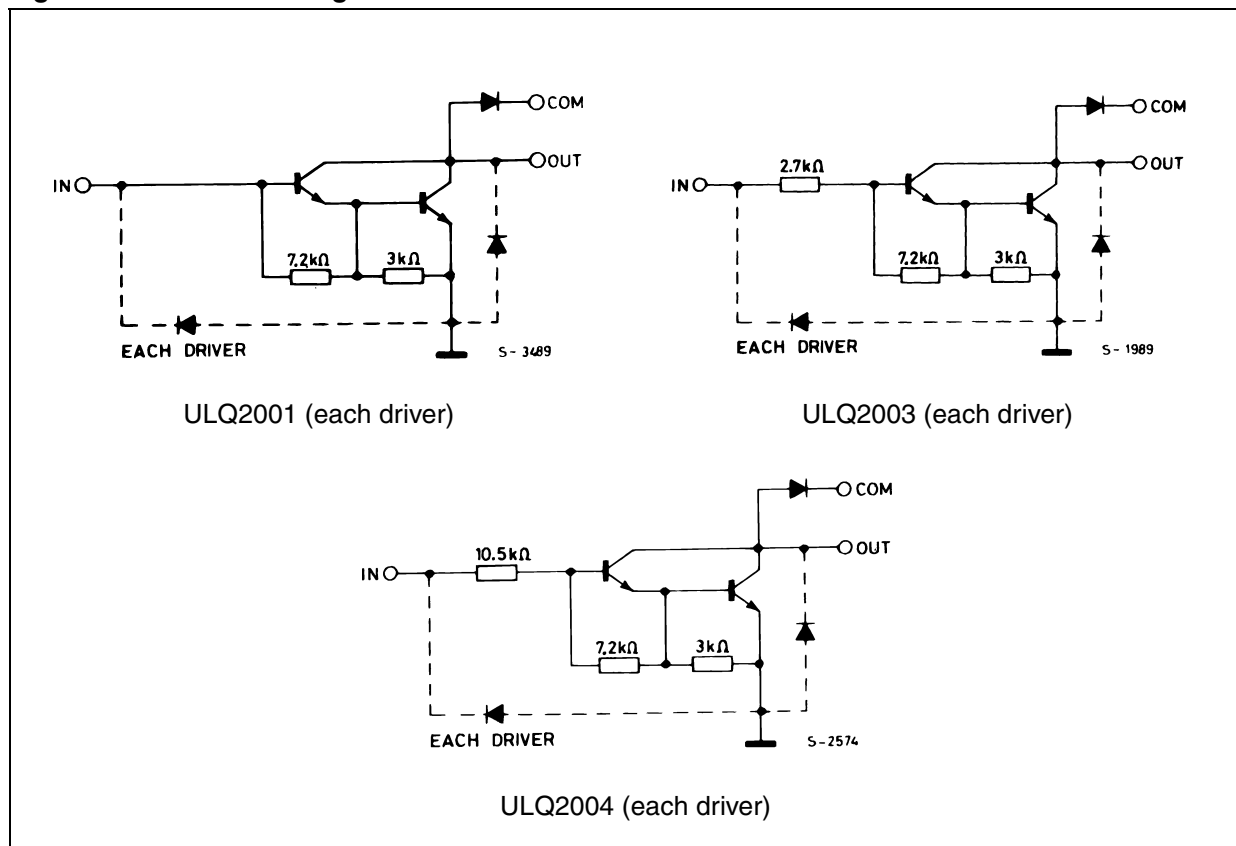
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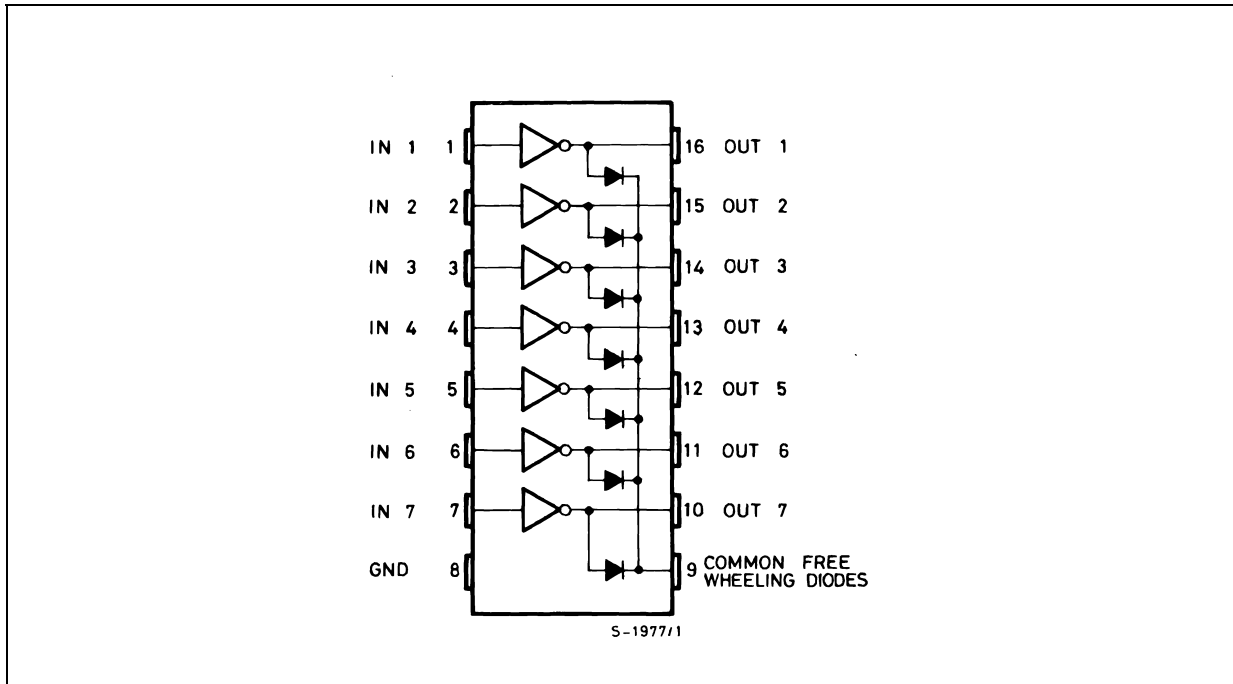
# 1 Diagram

Figure 1. Schematic diagram



## 2 Pin configuration

Figure 2. Pin connections (top view)



### 3 Maximum ratings

**Table 1. 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 2. Thermal Data**

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

## 4 Electrical characteristics

**Table 3. Electrical characteristics**  
 ( $T_A = -40$  to  $105^\circ\text{C}$  for DIP16 unless otherwise specified)  
 ( $T_J = 25$  to  $105^\circ\text{C}$  for SO16 unless otherwise specified).

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$I_{\text{CEX}}$	Output leakage current	$V_{\text{CE}} = 50\text{V}$ , (Figure 3.)			50	$\mu\text{A}$
		$T_A = 105^\circ\text{C}$ , $V_{\text{CE}} = 50\text{V}$ (Figure 3.)			100	
		$T_J = 105^\circ\text{C}$ for ULQ2004, $V_{\text{CE}} = 50\text{V}$ , $V_I = 1\text{V}$ (Figure 4.)			500	
$V_{\text{CE(SAT)}}$	Collector-emitter saturation voltage (Figure 5.)	$I_C = 100\text{mA}$ , $I_B = 250\mu\text{A}$		0.9	1.1	V
		$I_C = 200\text{mA}$ , $I_B = 350\mu\text{A}$		1.1	1.3	
		$I_C = 350\text{mA}$ , $I_B = 500\mu\text{A}$		1.3	1.6	
$I_{\text{I(ON)}}$	Input current (Figure 6.)	for ULQ2003, $V_I = 3.85\text{V}$		0.93	1.35	mA
		for ULQ2004, $V_I = 5\text{V}$		0.35	0.5	
		$V_I = 12\text{V}$		1	1.45	
$I_{\text{I(OFF)}}$	Input current (Figure 7.)	$T_A = 105^\circ\text{C}$ , $I_C = 500\mu\text{A}$	50	65		$\mu\text{A}$
$V_{\text{I(ON)}}$	Input voltage (Figure 8.)	for ULQ2003			2.4	V
		$I_C = 200\text{mA}$			2.7	
		$I_C = 250\text{mA}$			3	
		$I_C = 300\text{mA}$			3	
		for ULQ2004			5	
		$I_C = 125\text{mA}$			6	
		$I_C = 200\text{mA}$			7	
$I_C = 275\text{mA}$			8			
$h_{\text{FE}}$	DC Forward current gain (Figure 5.)	for ULQ2001, $V_{\text{CE}} = 2\text{V}$ , $I_C = 350\text{mA}$	1000			
$C_I$	Input capacitance			15	25 <sup>(1)</sup>	pF
$t_{\text{PLH}}$	Turn-on delay time	$0.5 V_I$ to $0.5V_O$		0.25	1 <sup>(1)</sup>	$\mu\text{s}$
$t_{\text{PHL}}$	Turn-off delay time	$0.5 V_I$ to $0.5V_O$		0.25	1 <sup>(1)</sup>	$\mu\text{s}$
$I_{\text{R}}$	Clamp diode leakage current (Figure 9.)	$V_{\text{R}} = 50\text{V}$			50	$\mu\text{A}$
		$T_A = 105^\circ\text{C}$ , $V_{\text{R}} = 50\text{V}$			100	
$V_{\text{F}}$	Clamp diode forward voltage (Figure 10.)	$I_{\text{F}} = 350\text{mA}$		1.7	2	V

1. Guaranteed by design.

# 5 Test circuits

Figure 3.

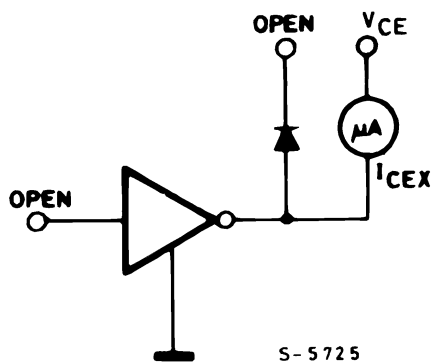


Figure 4.

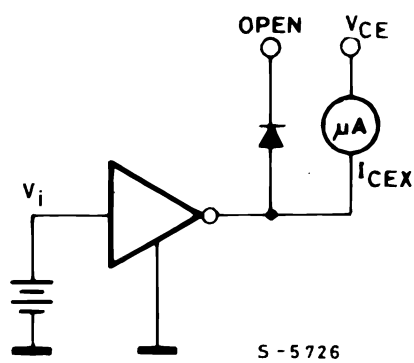


Figure 5.

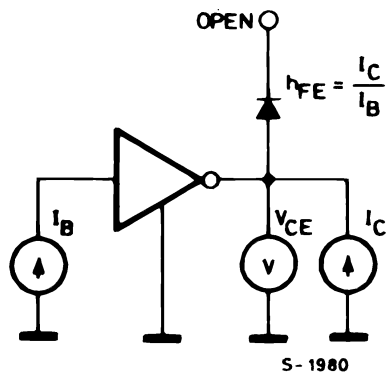


Figure 6.

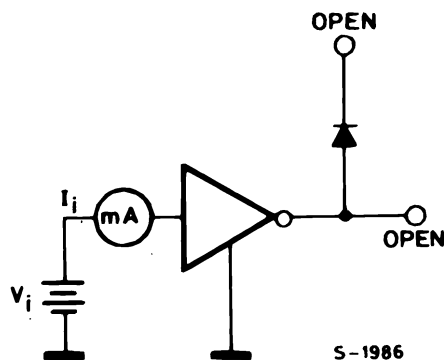


Figure 7.

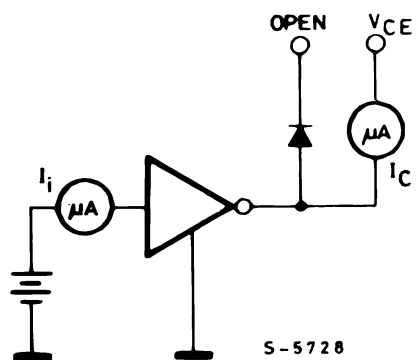


Figure 8.

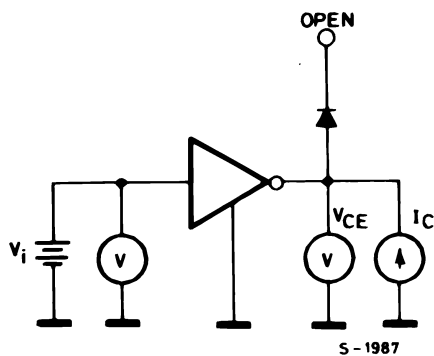


Figure 9.

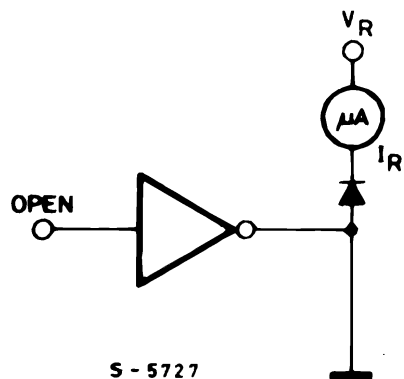
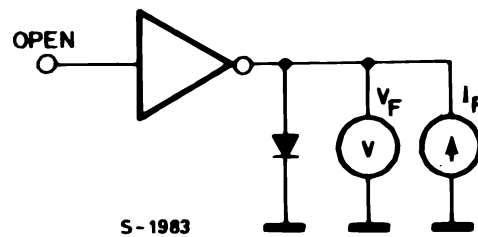


Figure 10.



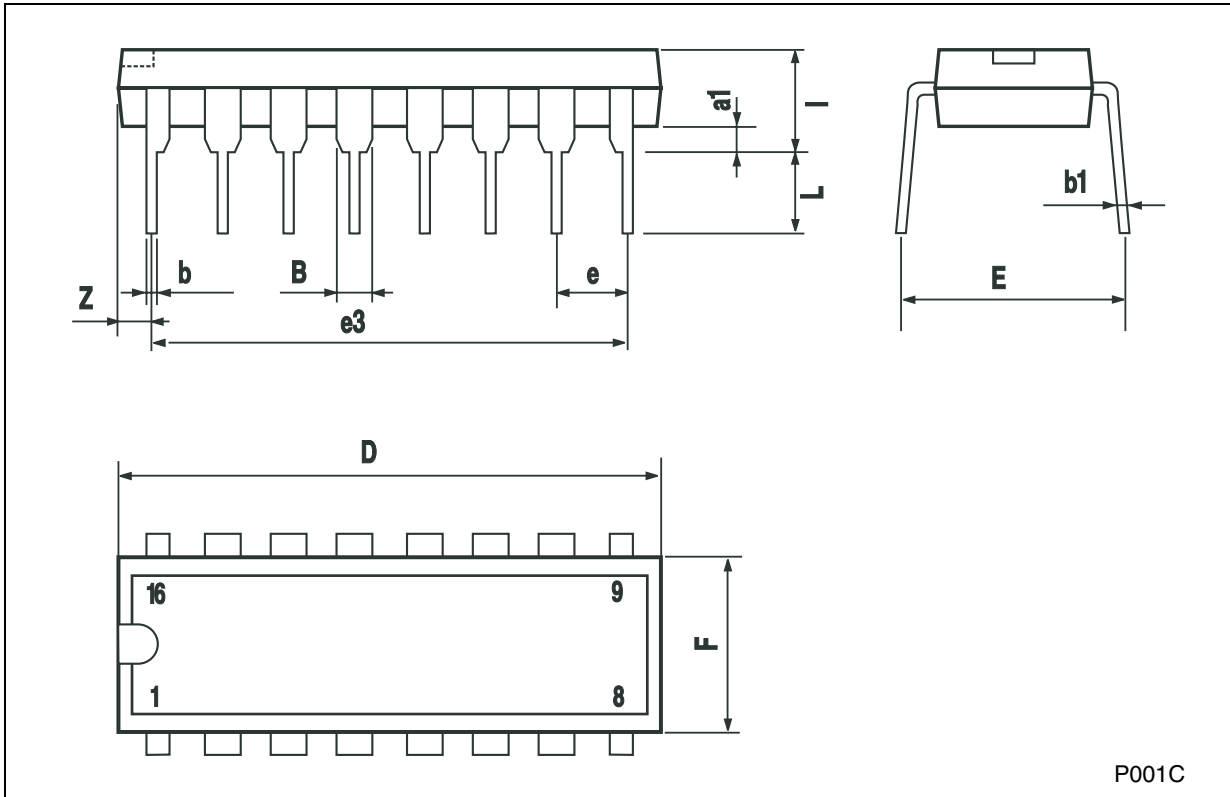


## 6 Package mechanical data

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).

**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

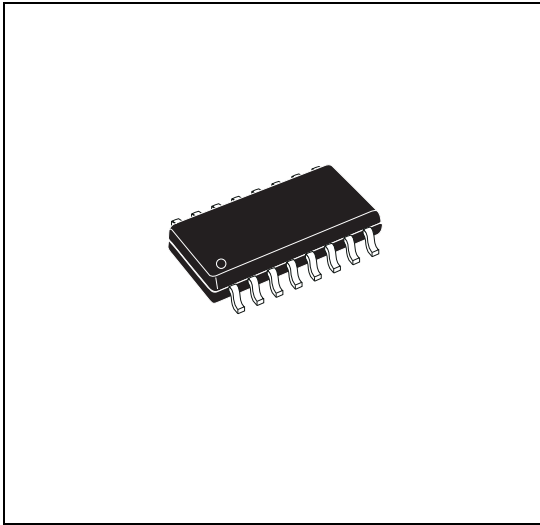


P001C

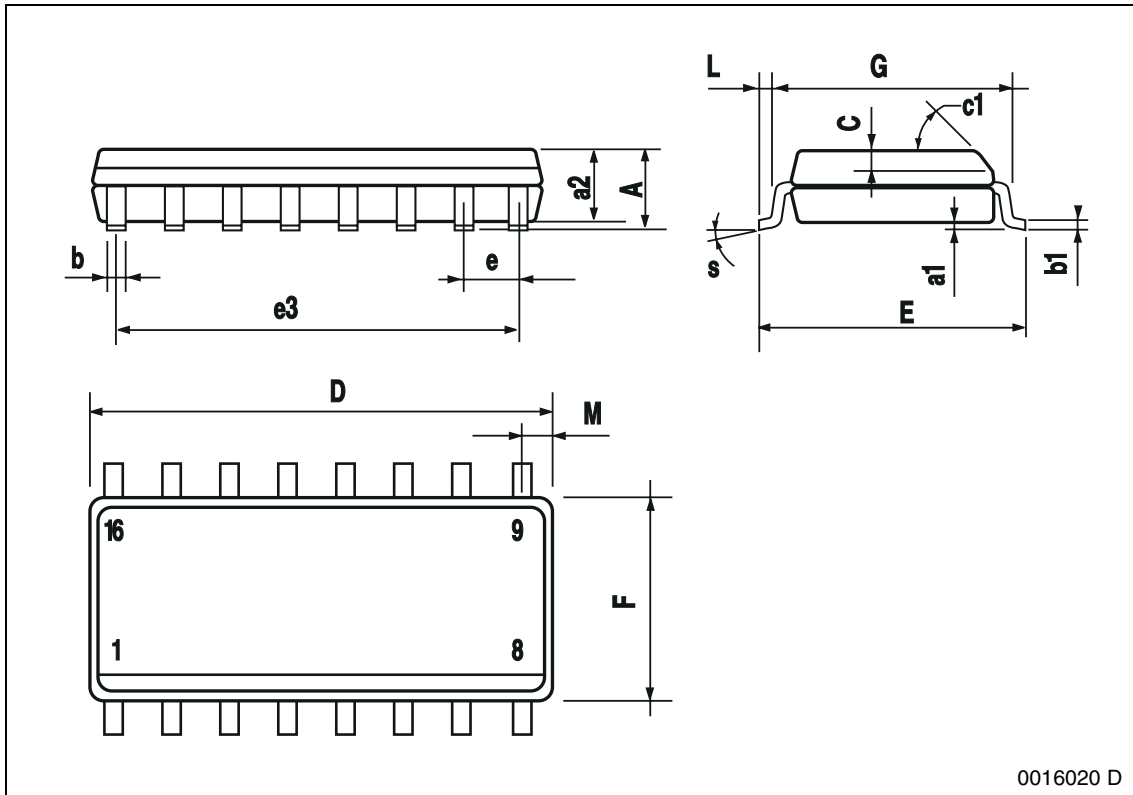
DIM.	mm			inch		
	MIN.	TYP.	MAX.	MIN.	TYP.	MAX.
A			1.75			0.069
a1	0.1		0.25	0.004		0.009
a2			1.6			0.063
b	0.35		0.46	0.014		0.018
b1	0.19		0.25	0.007		0.010
C		0.5			0.020	
c1			45°	(typ.)		
D <sup>(1)</sup>	9.8		10	0.386		0.394
E	5.8		6.2	0.228		0.244
e		1.27			0.050	
e3		8.89			0.350	
F <sup>(1)</sup>	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 4. Revision history**

Date	Revision	Changes
05-Dec-2006	2	Order codes has been updated and document has been reformatted.
23-May-2007	3	Order codes has been updated.

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