



# ULN2001A-ULN2002A ULN2003A-ULN2004A

## SEVEN DARLINGTON ARRAYS

- SEVEN DARLINGTONS PER PACKAGE
- 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

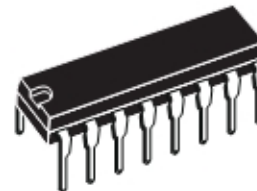
The ULN2001A, ULN2002A, ULN2003 and ULN2004A are high voltage, high current darlington arrays each containing seven open collector darlington pairs with common emitters. Each channel rated at 500mA and can withstand peak currents of 600mA. Suppression diodes are included for inductive load driving and the inputs are pinned opposite the outputs to simplify board layout.

The four versions interface to all common logic families :

ULN2001A	General Purpose, DTL, TTL, PMOS, CMOS
ULN2002A	14-25V PMOS
ULN2003A	5V TTL, CMOS
ULN2004A	6-15V CMOS, PMOS

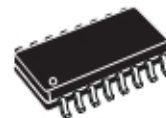
These versatile devices are useful for driving a wide range of loads including solenoids, relays DC motors, LED displays filament lamps, thermal print-heads and high power buffers.

The ULN2001A/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 ULN2001D/2002D/2003D/2004D.



DIP16

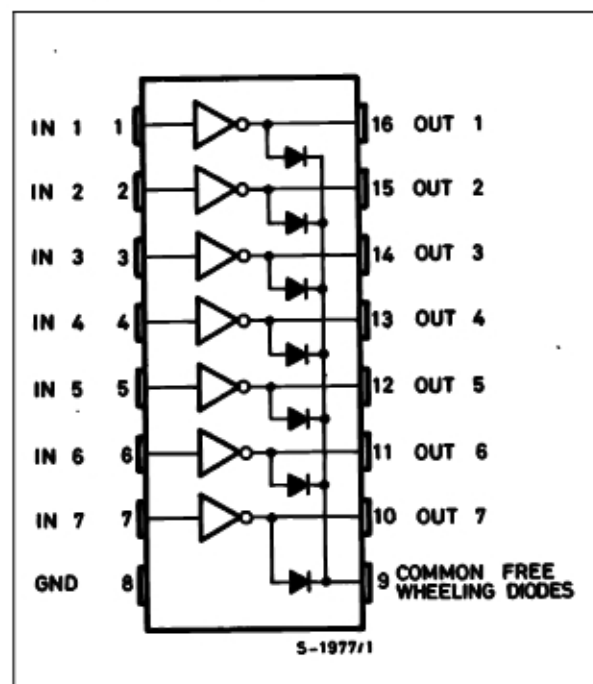
ORDERING NUMBERS: ULN2001A/2A/3A/4A



SO16

ORDERING NUMBERS: ULN2001D/2D/3D/4D

### PIN CONNECTION



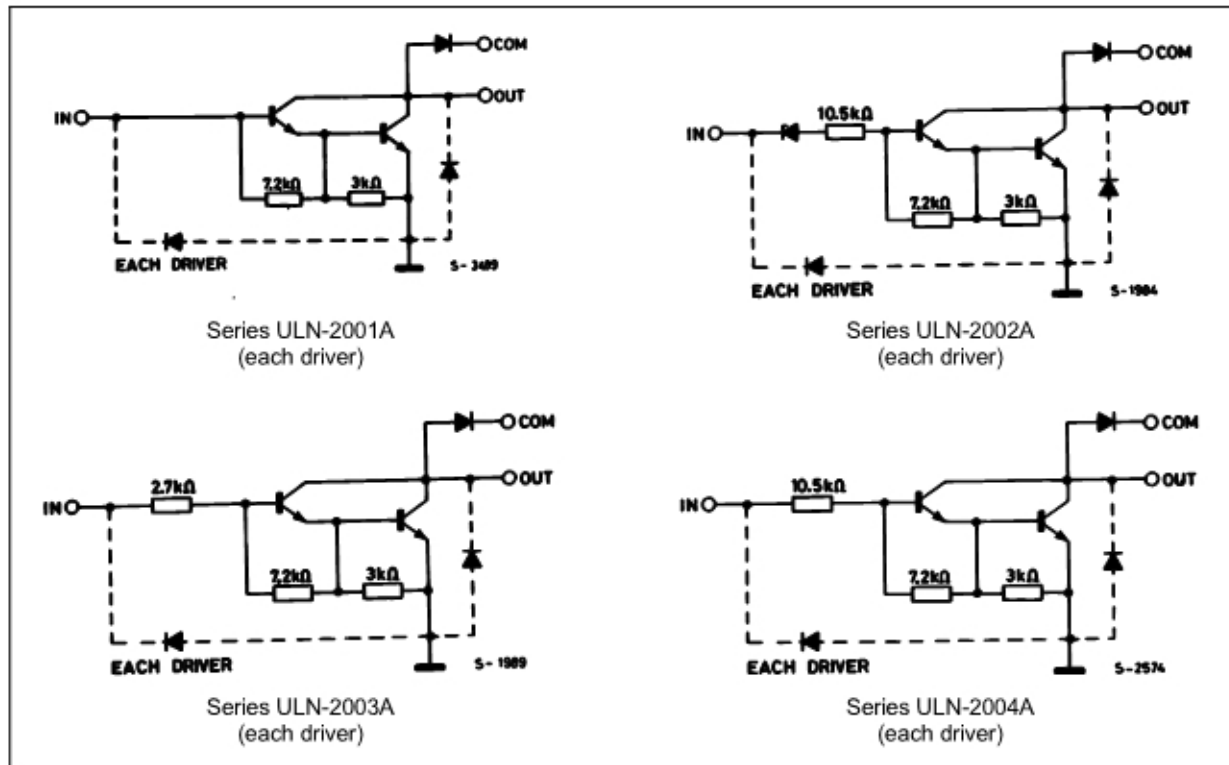
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## ULN2001A - ULN2002A - ULN2003A - ULN2004A

### SCHEMATIC DIAGRAM



### ABSOLUTE MAXIMUM RATINGS

Symbol	Parameter	Value	Unit
$V_o$	Output Voltage	50	V
$V_{in}$	Input Voltage (for ULN2002A/D - 2003A/D - 2004A/D)	30	V
$I_c$	Continuous Collector Current	500	mA
$I_b$	Continuous Base Current	25	mA
$T_{amb}$	Operating Ambient Temperature Range	- 20 to 85	°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

**ELECTRICAL CHARACTERISTICS** ( $T_{amb} = 25^{\circ}\text{C}$  unless otherwise specified)

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit	Fig.
$I_{CEX}$	Output Leakage Current	$V_{CE} = 50\text{V}$ $T_{amb} = 70^{\circ}\text{C}$ , $V_{CE} = 50\text{V}$			50 100	$\mu\text{A}$ $\mu\text{A}$	1a 1a
		$T_{amb} = 70^{\circ}\text{C}$ for ULN2002A $V_{CE} = 50\text{V}$ , $V_i = 6\text{V}$ for ULN2004A $V_{CE} = 50\text{V}$ , $V_i = 1\text{V}$			500 500	$\mu\text{A}$ $\mu\text{A}$	1b 1b
$V_{CE(sat)}$	Collector-emitter Saturation Voltage	$I_C = 100\text{mA}$ , $I_B = 250\mu\text{A}$		0.9	1.1	V	2
		$I_C = 200\text{mA}$ , $I_B = 350\mu\text{A}$		1.1	1.3	V	2
		$I_C = 350\text{mA}$ , $I_B = 500\mu\text{A}$		1.3	1.6	V	2
$I_{i(on)}$	Input Current	for ULN2002A, $V_i = 17\text{V}$		0.82	1.25	mA	3
		for ULN2003A, $V_i = 3.85\text{V}$		0.93	1.35	mA	3
		for ULN2004A, $V_i = 5\text{V}$		0.35	0.5	mA	3
		$V_i = 12\text{V}$		1	1.45	mA	3
$I_{i(off)}$	Input Current	$T_{amb} = 70^{\circ}\text{C}$ , $I_C = 500\mu\text{A}$	50	65		$\mu\text{A}$	4
$V_{i(on)}$	Input Voltage	$V_{CE} = 2\text{V}$ for ULN2002A $I_C = 300\text{mA}$			13	V	5
		for ULN2003A $I_C = 200\text{mA}$			2.4		
		$I_C = 250\text{mA}$			2.7		
		$I_C = 300\text{mA}$			3		
		for ULN2004A $I_C = 125\text{mA}$			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	for ULN2001A $V_{CE} = 2\text{V}$ , $I_C = 350\text{mA}$	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	$\mu\text{s}$	
$t_{PHL}$	Turn-off Delay Time	$0.5 V_i$ to $0.5 V_o$		0.25	1	$\mu\text{s}$	
$I_R$	Clamp Diode Leakage Current	$V_R = 50\text{V}$			50	$\mu\text{A}$	6
		$T_{amb} = 70^{\circ}\text{C}$ , $V_R = 50\text{V}$			100	$\mu\text{A}$	6
$V_F$	Clamp Diode Forward Voltage	$I_F = 350\text{mA}$		1.7	2	V	7

## TEST CIRCUITS

Figure 1a.

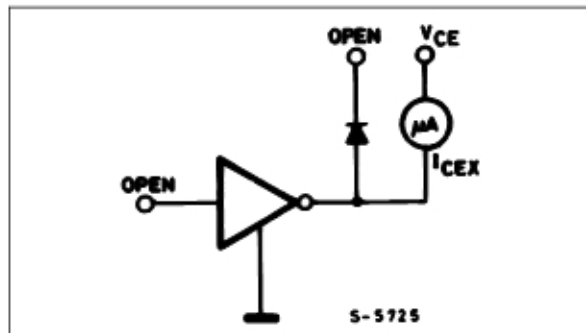


Figure 1b.

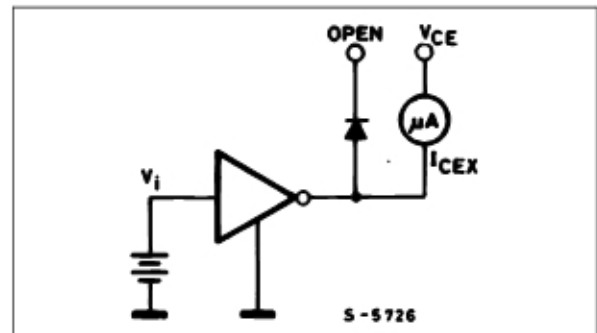


Figure 2.

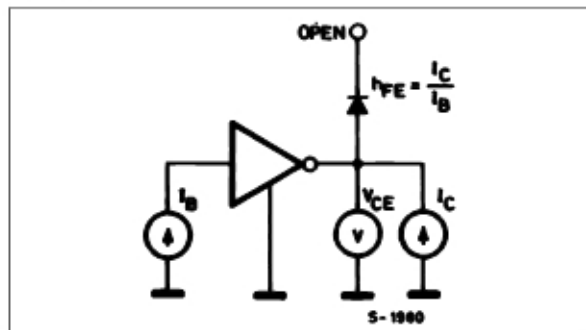


Figure 3.

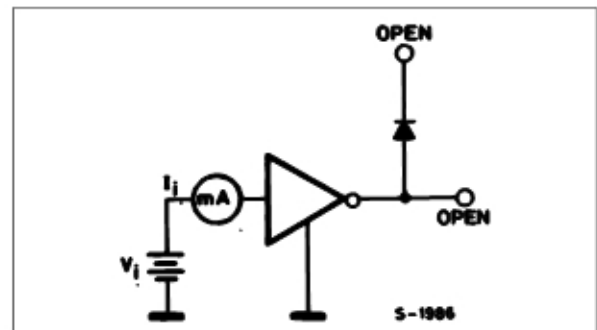


Figure 4.

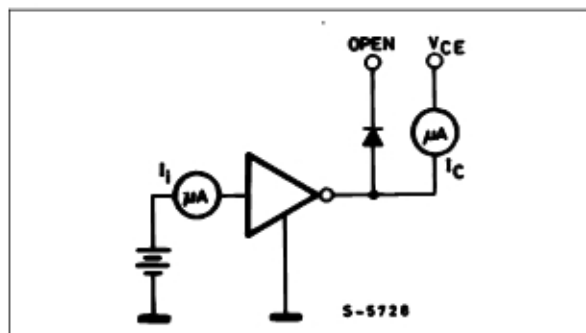


Figure 5.

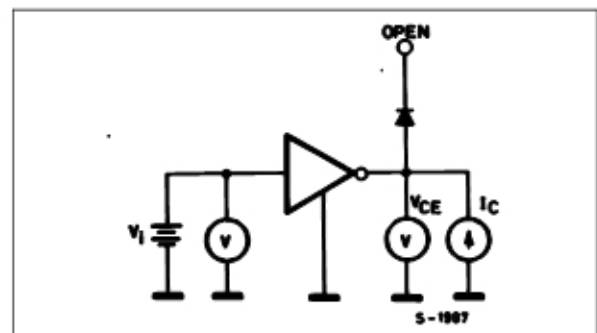


Figure 6.

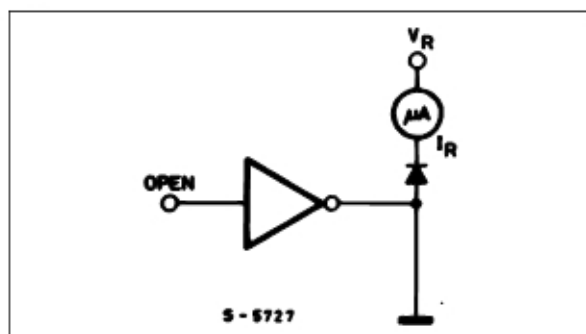
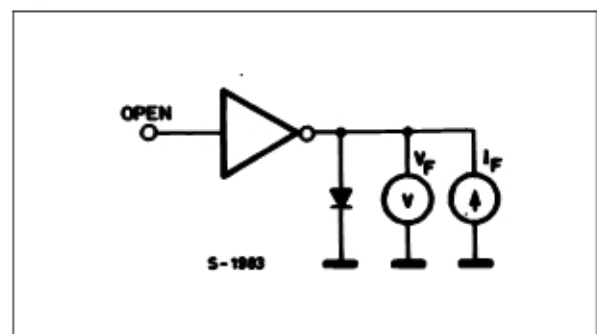
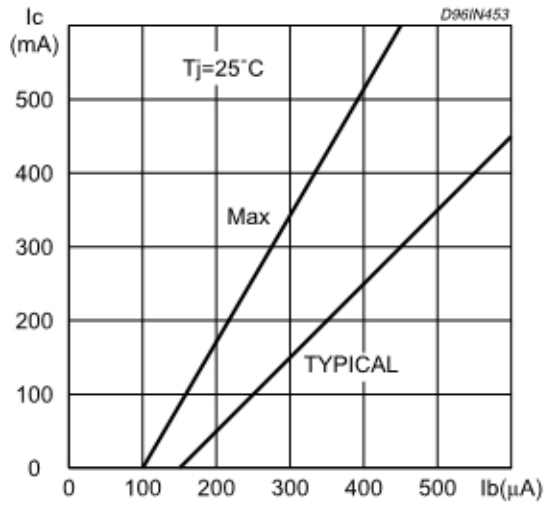


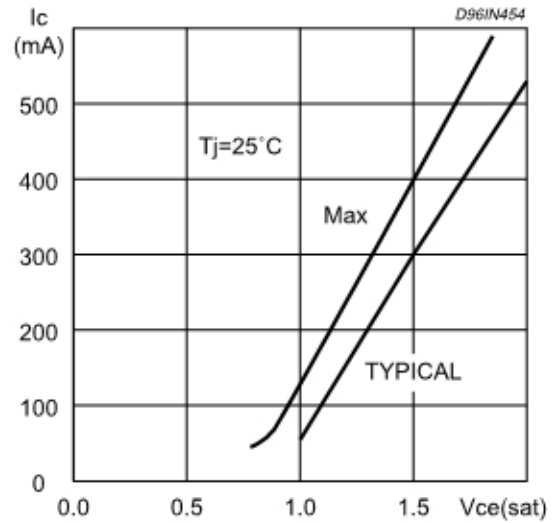
Figure 7.



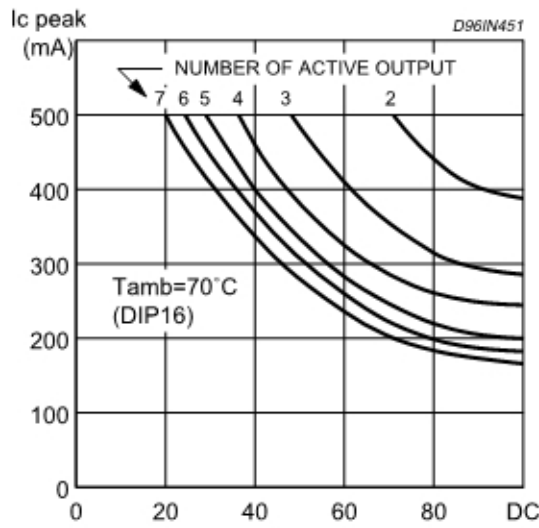
**Figure 8:** Collector Current versus Input Current



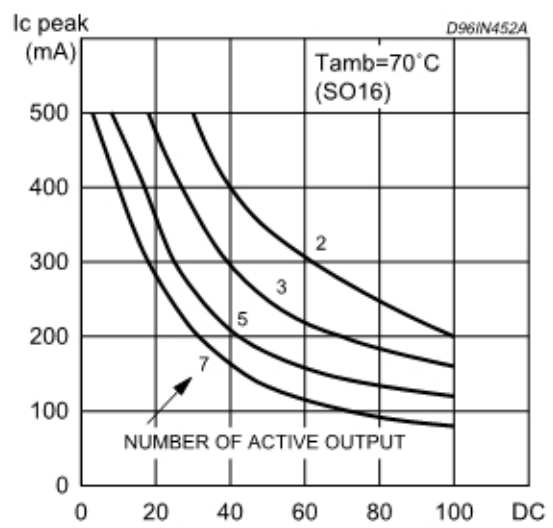
**Figure 9:** Collector Current versus Saturation Voltage



**Figure 10:** Peak Collector Current versus Duty Cycle

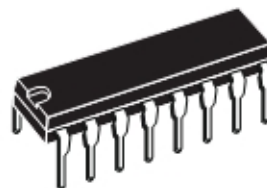


**Figure 11:** Peak Collector Current versus Duty Cycle

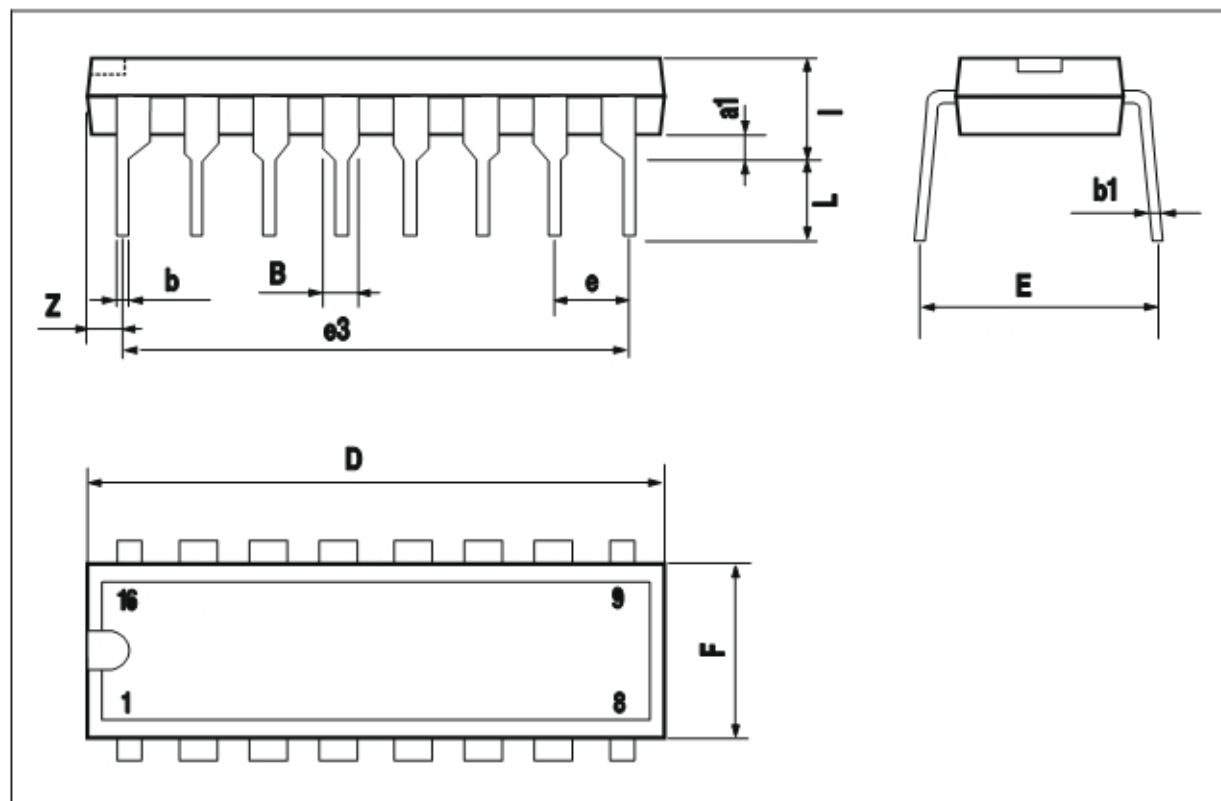


DIM.	mm			inch		
	MIN.	TYP.	MAX.	MIN.	TYP.	MAX.
a1	0.51			0.020		
B	0.77		1.65	0.030		0.065
b		0.5			0.020	
b1		0.25			0.010	
D			20			0.787
E		8.5			0.335	
e		2.54			0.100	
e3		17.78			0.700	
F			7.1			0.280
I			5.1			0.201
L		3.3			0.130	
Z			1.27			0.050

## OUTLINE AND MECHANICAL DATA

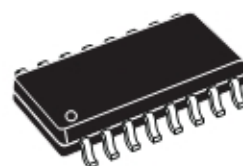


**DIP16**



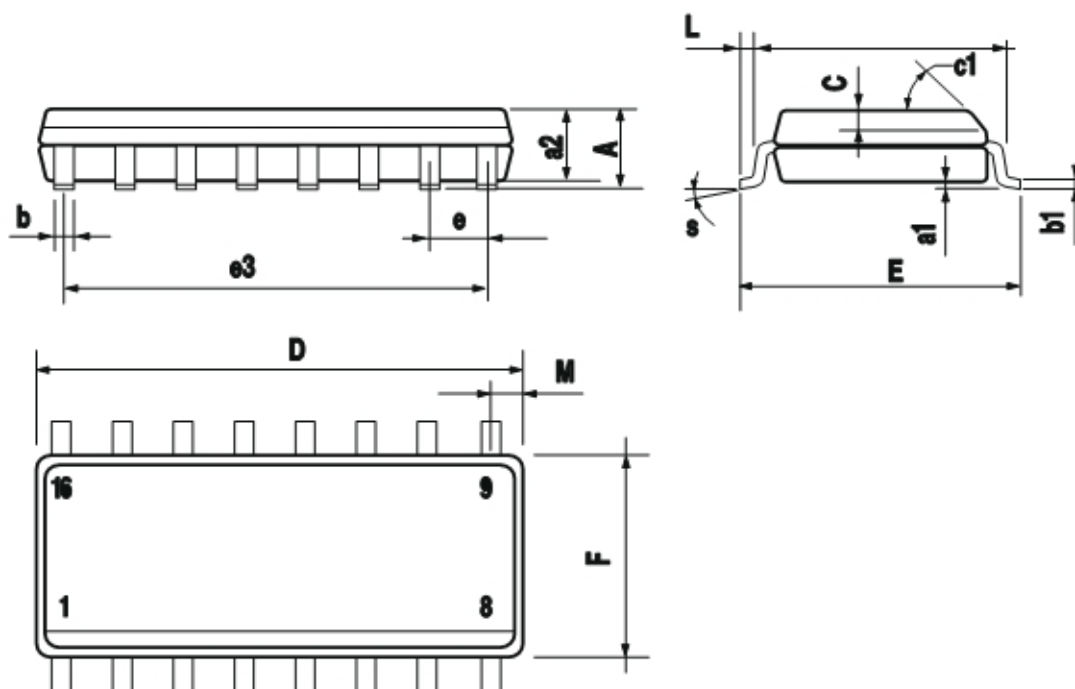
DIM.	mm			inch		
	MIN.	TYP.	MAX.	MIN.	TYP.	MAX.
A			1.75			0.069
a1	0.1		0.25	0.004		0.009
a2			1.6			0.063
b	0.35		0.46	0.014		0.018
b1	0.19		0.25	0.007		0.010
C		0.5			0.020	
c1	45° (typ.)					
D (1)	9.8		10	0.386		0.394
E	5.8		6.2	0.228		0.244
e		1.27			0.050	
e3		8.89			0.350	
F (1)	3.8		4	0.150		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).





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uln2003每包七达灵顿。每个驱动器输出电流500mA (600mA峰值)。输出电压50 V。集成抑制二极管感应负载。OUTPUTSCANBEPARALLELEDFORHIGHER电流。TTL / CMOS /办公室/迪泰兼容的输入。输入固定相反的输出以简化

LAYOUTDESCRIPTIONTheULN2001A,ULN2002A,ULN2003andULN2004A是高电压、高电流的达林顿阵列，每个阵列包含七个开放的集电极达林顿对和常见的发射器。每个沟槽的额定功率为500mA，能够承受600ma的峰值电流。抑制二极管包含在感应负载uln2003驱动中，输入与输出相对，以简化板的布局。这uln2003四个版本的接口适用于所有常见的逻辑

法:ULN2001AGeneral Purpose, DTL, TTL, PMOS,CMOSULN2002A14-25V PMOSULN2003A5V TTL, CMOSULN2004A6-15V CMOS, PMOSThese多功能设备，用于驱动包括电磁阀、继电器直流电机、LED显示灯丝灯、热打印头和高功率缓冲等多种负载。ULN2001A/2002A/2003A和2004A采用16引脚塑料浸包，采用铜框，以减少热阻。它们也可在小轮廓包(SO-16)

asULN2001D/2002D/2003D/2004D中获得原理图系列ULN-2001A(每个驱动)系列ULN-2002A(每个驱动)系列ULN-2003A(每个驱动)系列ULN-2004A(每个驱动)热数据无症状参数双参数

p16so16unitrth j- ambheat Resistance结- ambientmax。70120° C / WABSOLUTE最大

RATINGSSymbolParameterValueUnitVoOutput Voltage50VVinInput电压(ULN2002A / D - 2003 a / D - 2004 a / D)30 viccontinuous收集器Current500mA IbContinuous基地

uln2003Current25mATambOperating环境温度范围- 20到85° CTstgStorage温度范围- 55到150°

CTjJunction Temperature150° C本文件中的信息仅与ST产品有

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