# Darlington array power drive integrated circuit

General Description

The ULN2003A is a high voltage, high current Darlington display made up of seven NPN Darlington tubes. All units share the emitter, and each unit uses an open collector for output. Each pair of Darlington is connected by a 2.7K base resistor, which is directly compatible with TTL and 5V CMOS circuits and can directly process data that previously required standard logic buffers. ULN2003A has high working voltage and large working current, the irrigation current can reach 500mA, and it can withstand 50V voltage in the off state. The output can also run in parallel under high load current, providing a good solution that requires multi-interface drive circuit.
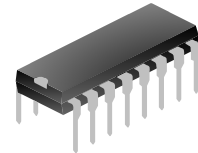
DIP-16-300-2.54
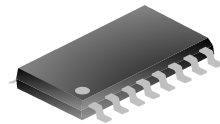
SOP-16-225-1.27

Features

- Wide operating voltage range
- Seven-way high-gain Darlington array
- High output voltage (up to 50V)
- High output current (up to 500mA)
- It can be directly connected with TTL, CMOS and PMOS
- Built-in clamp diode for sensitive load.

Applications

- Relay drive
- Dc lighting drive
- Stepper motor drive
- Solenoid valve
- Dc brushless motor drive

Block Diagram
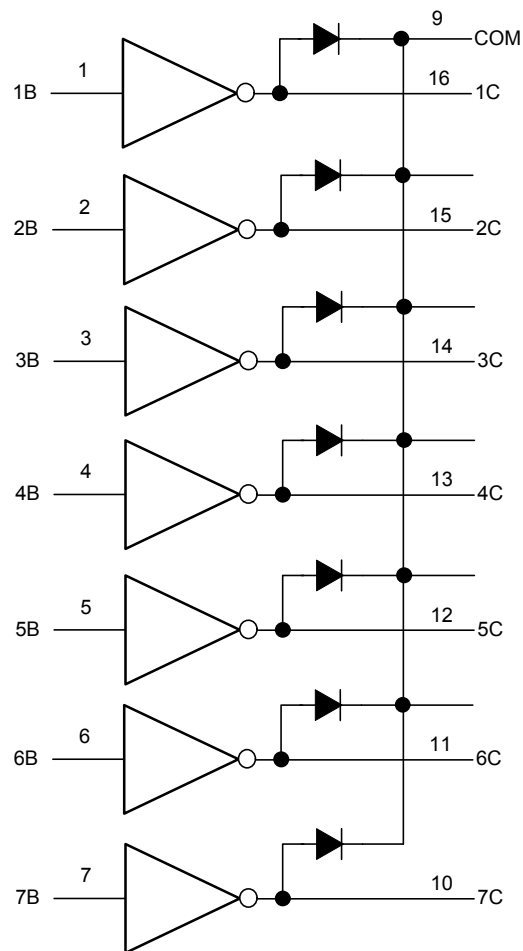
MAXIMUM RATINGS(Ta=25℃ unless otherwise noted)

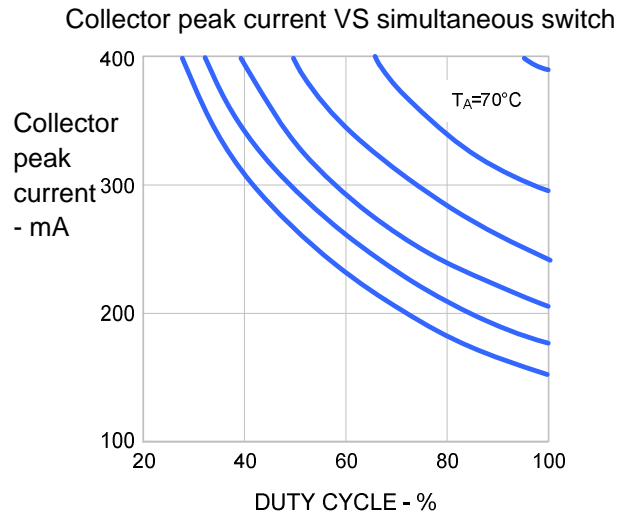| Parameter	Symbol	Value	Unit
Input voltage	V_{IN}	-0.5~30	V
Output voltage	V_{OUT}	-0.5~50	V
Clamp diode reverse voltage	V_R	50	V
Collector continuous working current	I_{OUT}	500	mA
Clamp diode forward	IF	500	mA
Temperature of storage	T_{STG}	-55~150	°C
Operating temperature	T_{OPR}	-40~85	°C
Junction temperature	T_J	-40~150	°C

ELECTRICAL CHARACTERISTICS (Ta=25℃ unless otherwise specified)

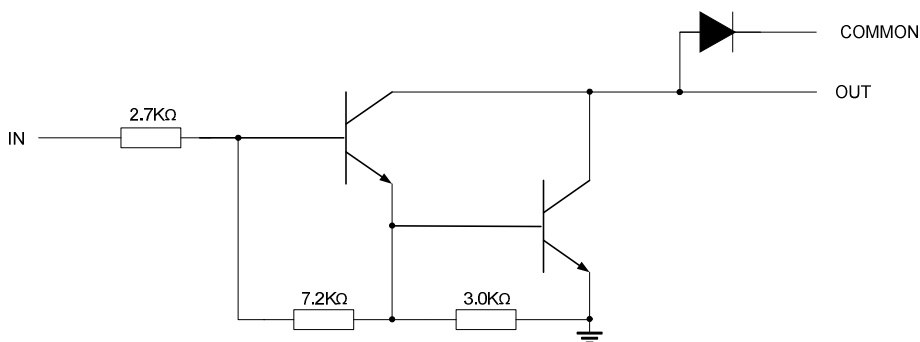| Parameter	Symbol	Test conditions	MIN	TPE	MAX	Unit
Output tube leakage current	I_{CEX}	T_A=25°C，V_{CE}=50V(figure1)			20	uA
		T_A=85°C，V_{CE}=50V(figure1)			100	
CE saturation pressure voltage	V_{CE}(sat)	I_{OUT}=350mA,I_{IN}=500 uA(figure3)		1.3	1.6	V
		I_{OUT}=250mA,I_{IN}=350 uA((figure3)		1.1	1.3	
		I_{OUT}=100mA,I_{IN}=250 uA((figure3)		0.9	1.1	
Open state current	$I_{I(ON)}$	V_I=3.85V(figure4)		0.93	1.35	mA
Off input current	$I_{I(OFF)}$	I_C=500uA(figure5)	50	100		uA
		T_A=+25°C	50	100		
		T_A=+85°C	25	50		
Open state input voltage	$V_{I(ON)}$	V_{CE}=2.0V,I_C=200mA(figure6)			2.4	V
		V_{CE}=2.0V,I_C=250mA(figure6)			2.7	
		V_{CE}=2.0V,I_C=300mA(figure6)			3.0	
Input capacitance	C_I			15	**30**	pF
Conduction delay time	t_{MH}	0.5V_I to 0.5 V_0			1.0	μS
Turn off the delay time	t_{ML}	0.5V_I to 0.5 V_0			1.0	
Leakage current	I_R	V_R=50V(figure7)				μA
		T_A=+25°C		5	10	
		T_A=+85°C		10	50	
Forward voltage	V_F	I_F=350mA(figure8)		1.7	2.0	V

Note :

1. The limit value refers to the possibility that the device may be damaged beyond the range, which is not the range of normal working conditions of the device.The electrical parameter table provides a range of operating conditions for the device;

2. Unless otherwise specified, all conditions apply to the Darlington array .

3. Under normal conditions, the continuous working current is 350mA when the pulse width is 20ms at 70° C and VCE (Sat)= 1.6V for each output.
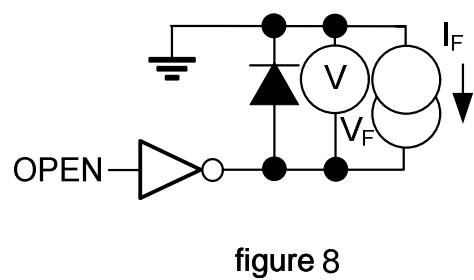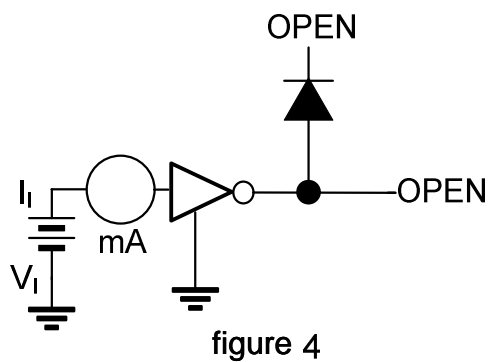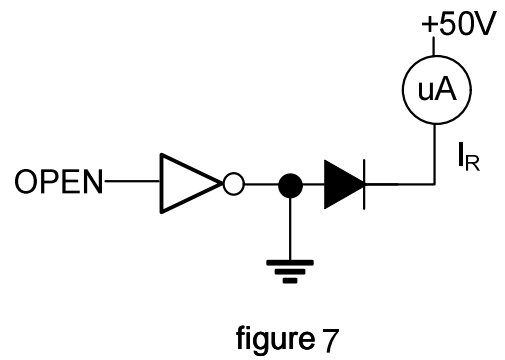
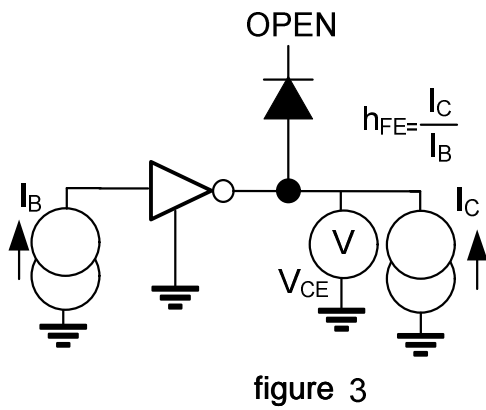## Typical Characteristics Curves

Collector current vs. saturation voltage

Collector current - mA

- Typical（2 paralleled）
- Typical（Single Device）
- Limit

Saturation voltage - V

Collector current vs. input current

Collector current - mA

- Typical
- Max

Input current - uA

Input current vs. input voltage

Input current - mA

- Max
- Typical

Input voltage - V

Collector peak current VS simultaneous switch

Collector peak current - mA

T_A=70°C

DUTY CYCLE - %

Internal equivalent circuit diagram

IN

2.7KΩ

COMMON

OUT

7.2KΩ   3.0KΩ

Test circuit diagram

OPEN +50V

I_{CEX}

figure 1

I_I

OPEN +50V

uA I_C

figure 5

OPEN +50V

+6.0V

I_{CEX}

figure 2

OPEN

V_I

V_{CE} V I_C

figure 6

OPEN

$h_{FE} = \dfrac{I_C}{I_B}$

I_B I_C

V_{CE}

figure 3

+50V

uA

OPEN I_R

figure 7

OPEN

I_I

mA

V_I OPEN

figure 4

I_F

V V_F

OPEN

figure 8
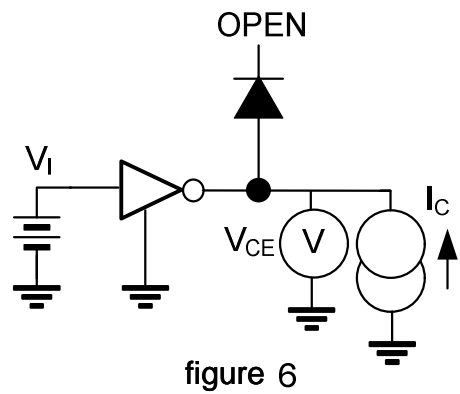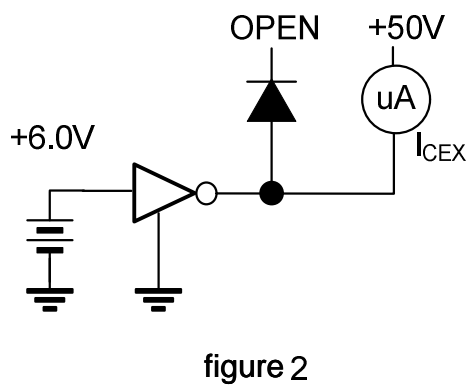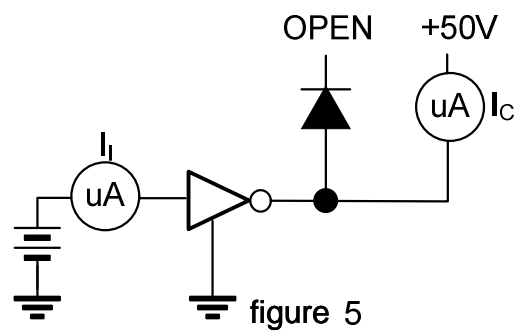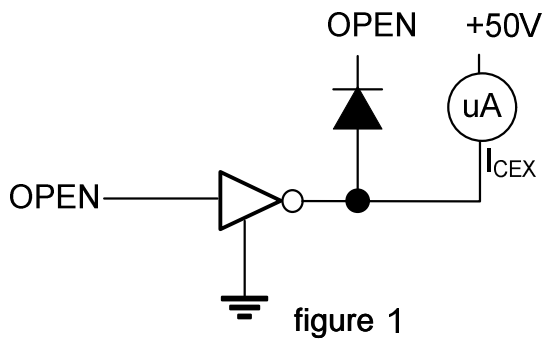
Package Outline

| DIP-16-300-2.54 | | | UNIT : MM |
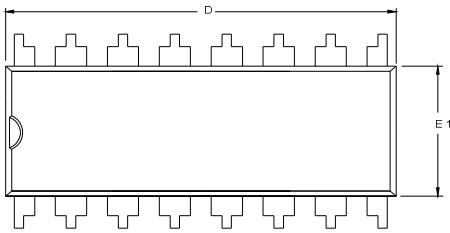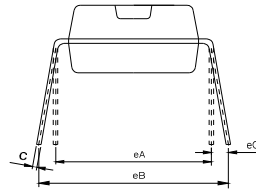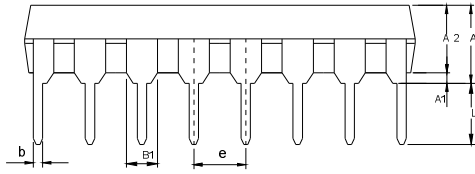
SYMBOL	MILLIMETER		
	MIN	NOM	MAX
A	—	—	4.45
A1	0.50	—	—
A2	3.20	—	3.70
b	0.38	0.46	0.54
B1	1.52BSC		
c	0.20	—	0.35
D	18.90	—	19.45
E1	6.15	—	6.60
e	2.54BSC		
eA	7.62BSC		
eB	7.62	—	9.30
eC	0	—	1.52
L	3.00	—	—

| SOP-16-225-1.27 | | | UNIT : MM |
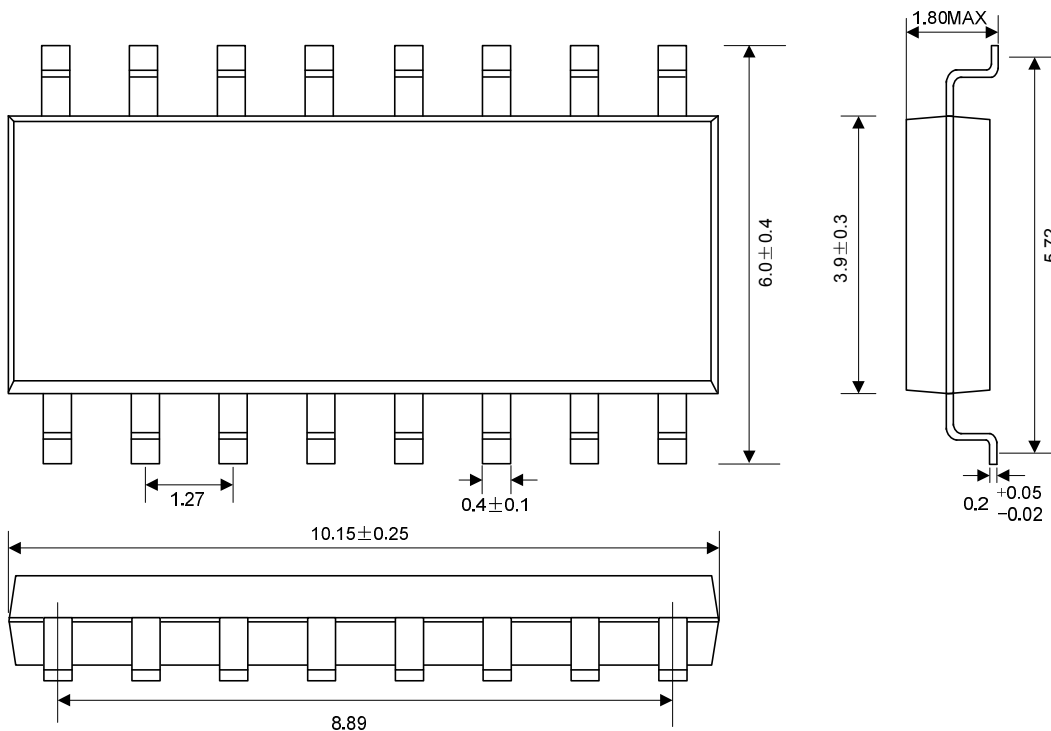
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