

SOP-16 Plastic-Encapsulate Transistors

Features

- Darlington Amplifier
- Output Current (Single Output): 500mA (Max.)
- High Sustaining Voltage Output: 50V (Min.)
- Output Clamp Diodes
- Inputs Compatible With Various Types Of Logic

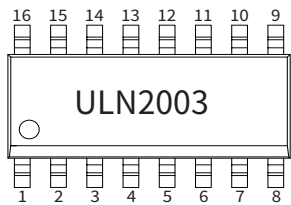
Applications

- Relay Drivers
- Hammer Drivers
- Lamp Drivers
- Line Drivers
- Logic Buffers
- Stepper Motors
- IP Camera
- HVAC Valve and LED Dot Matrix

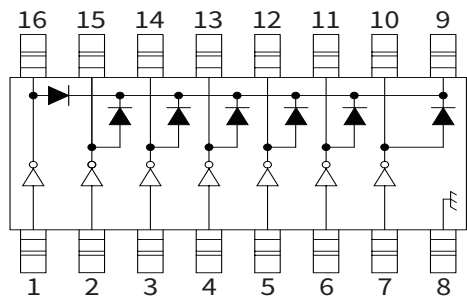
General Description

The ULN2003 are high-voltage, high-current darlington drivers comprised of seven NPN Darlington pairs. All units feature integral clamp diodes for switching inductive loads. Applications include relay, hammer, lamp and display (LED) drivers.

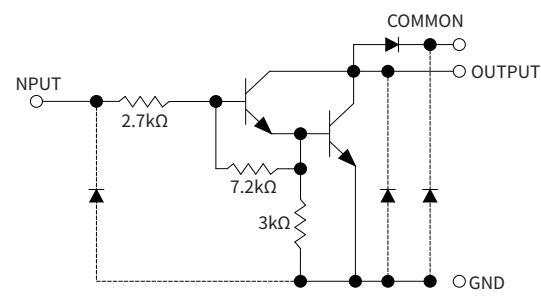
Reference News



Pin Connection



Block Diagram



Note: The input and output parasitic diodes cannot be used as clamp diodes.

Ordering Information

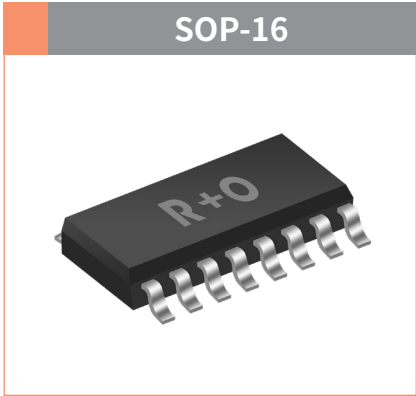
PACKAGE	PACKAGE CODE	UNIT WEIGHT(g)	REEL(pcs)	BOX(pcs)	CARTON(pcs)	DELIVERY MODE
SOP-16	R3	0.152	4000	8000	40000	13"

Output Sustaining Voltage

VOUT 50V(Min.)

Output Current

0.5 Ampere(Max.)



● **Maximum Ratings** (Ta=25°C Unless otherwise specified)

Parameter	Symbol	Unit	Value
Output Sustaining Voltage	V _{OUT}	V	-0.5~50
Input Voltage	V _{IN}		-0.5~30
Clamp Diode Reverse Voltage	V _R		50
Output Current	I _{OUT}	mA/ch	500
Clamp Diode Forward Current	I _F	mA	500
Power Dissipation ⁽²⁾	P _D	W	1.25
Storage temperature	T _{stg}	°C	-55 ~+150
Junction temperature	T _j	°C	+150
Operating Temperature	T _{OPR}	°C	-40 ~+85

Note:
(1) Absolute maximum ratings are those values beyond which the device could be permanently damaged. Absolute maximum ratings are stress ratings only and functional device operation is not implied.
(2) On PCB (Test Board: JEDEC 2s2p)

● **Recommended Operating Conditions**(Ta=-40~+85°C Unless otherwise noted)

Parameter	Symbol	Unit	Condition		Min	Typ	Max
Output Sustaining Voltage	V _{OUT}	V	—		0	—	50
Output Current	I _{OUT}	mA/ch	T _{PW} =25ms 7Circuit T _A =85°C T _J =120°C	Duty=10%	0	—	375
				Duty=50%	0	—	135
Input Voltage	V _{IN}	V	—		0	—	24
Input Voltage (Output On)	V _{IN(ON)}	V	I _{OUT} =400mA		2.8	—	24
Input Voltage (Output Off)	V _{IN(OFF)}	V	—		0	—	0.7
Clamp Diode Reverse Voltage	V _R	V	—		—	—	50
Clamp Diode Forward Current	I _F	mA	—		—	—	350
Power Dissipation	P _D	W	T _A =85°C (Note)		—	—	0.65

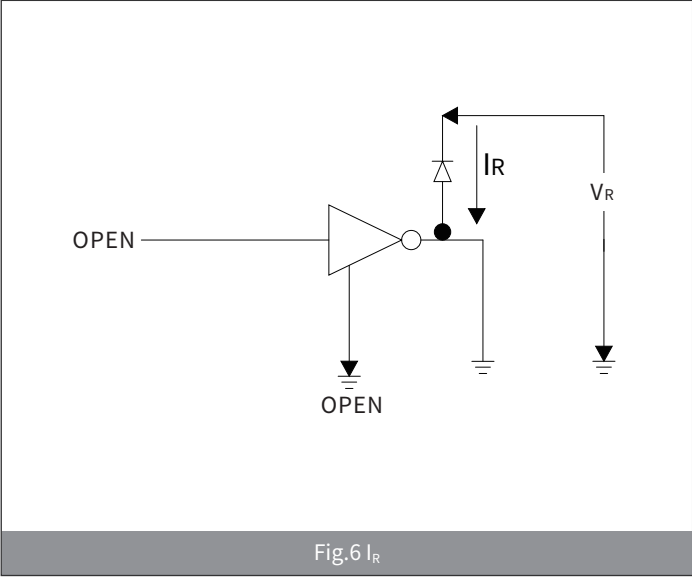
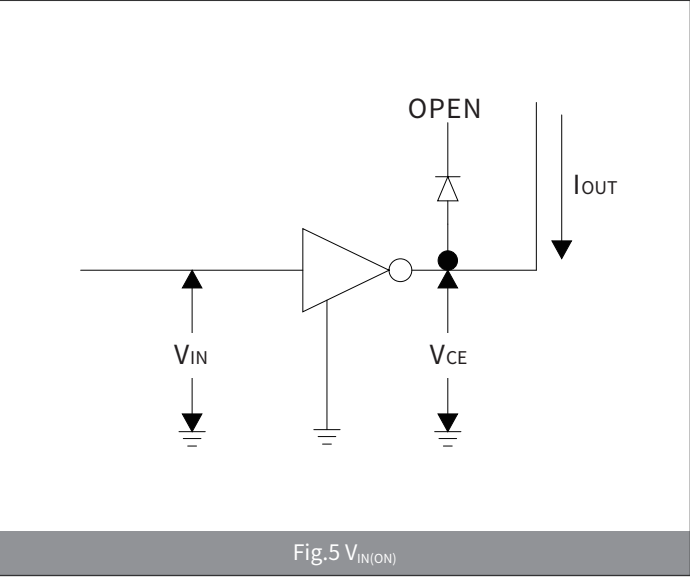
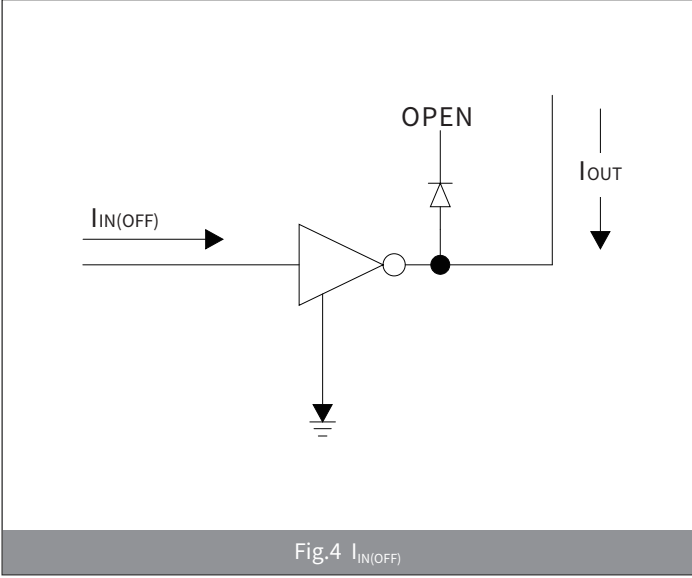
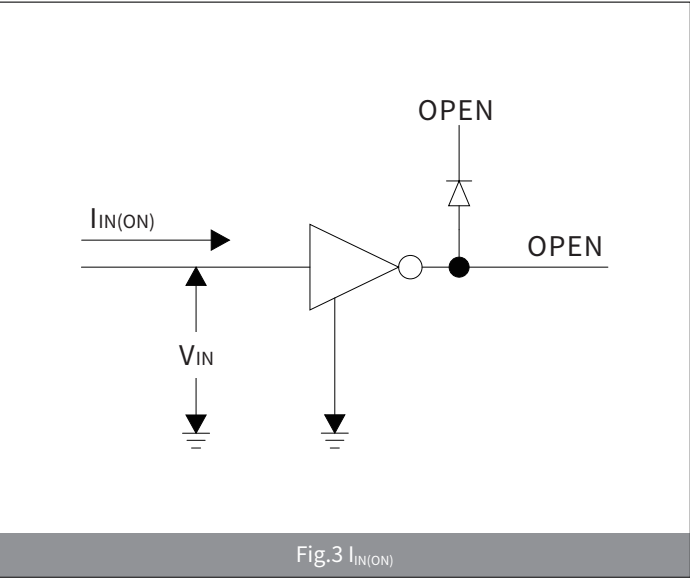
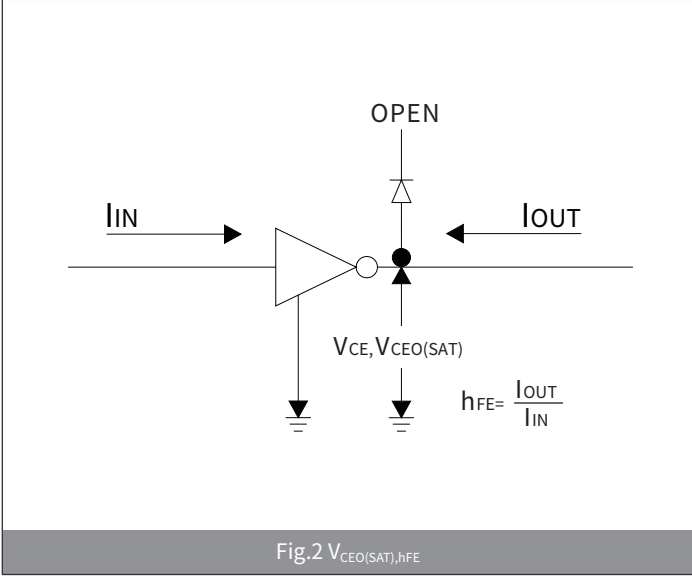
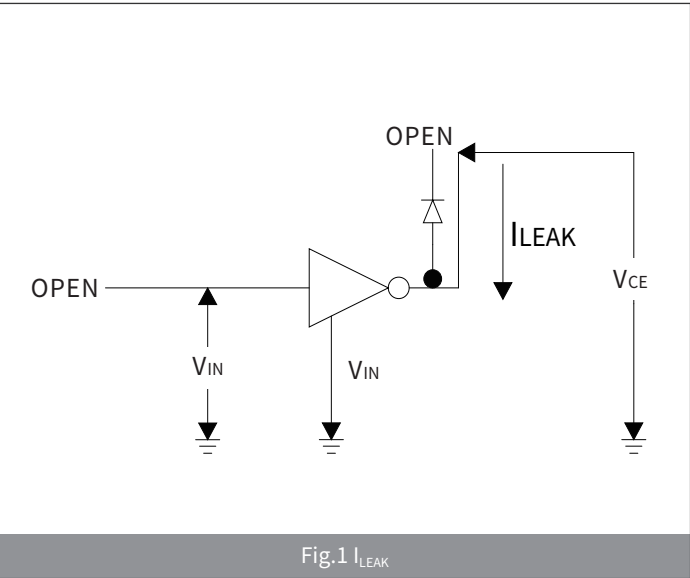
Note: On PCB (Test Board: JEDEC 2s2p)

● **Electrical Characteristics** (Ta=25°C Unless otherwise noted)

Parameter	Symbol	Unit	Condition	Min	Typ	Max	Test Circuit
Output Leakage Current	I _{LEAK}	μA	V _{CE} =50V,T _A =25°C	—	—	50	1
			V _{CE} =50V,T _A =85°C	—	—	100	
Collector-Emitter Saturation Voltage	V _{CEO(SAT)}	V	I _{OUT} =350mA,I _{IN} =500μA	—	1.3	1.6	2
			I _{OUT} =200mA,I _{IN} =350μA	—	1.1	1.3	
			I _{OUT} =100mA,I _{IN} =250μA	—	0.9	1.1	
DC Current Transfer Ratio	h _{FE}	—	V _{CE} =2V,I _{OUT} =350mA	1000	—	—	2
Input Current (Output On)	I _{IN(ON)}	mA	V _{IN} =2.4V,I _{OUT} =350mA	—	0.5	0.7	3
Input Current (Output Off)	I _{IN(OFF)}	μA	I _{OUT} =500μA,T _A =85°C	50	65	—	4
Input Voltage (Output On)	V _{IN(ON)}	V	V _{CE} =2V	I _{OUT} =350mA	—	—	5
				I _{OUT} =200mA	—	—	
Clamp Diode Reverse Current	I _R	μA	V _R =50V,T _A =25°C	—	—	50	6
			V _R =50V,T _A =25°C	—	—	100	
Clamp Diode Forward Voltage	V _F	V	I _F =350mA	—	—	2.0	7
Input Capacitance	C _{IN}	pF		—	15	—	
Turn-On Delay	t _{ON}	μs	V _{OUT} =50V,R _L =125Ω,C _L =150pF	—	0.1	—	8
Turn-Off Delay	t _{OFF}		V _{OUT} =50V,R _L =125Ω,C _L =150pF	—	0.2	—	8

● Test Circuit

Components in the test circuits are used only to obtain and confirm the device characteristics. These components and circuits are not guaranteed to prevent malfunction or failure from occurring in the application equipment.



● Test Circuit

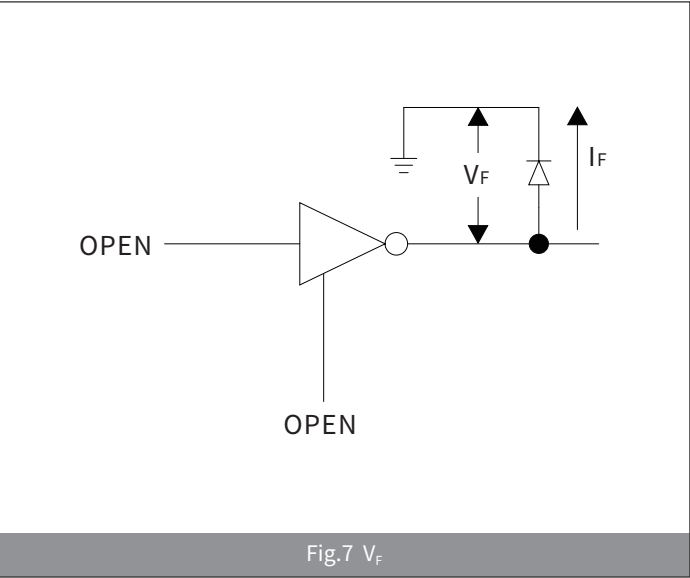


Fig.7 V_F

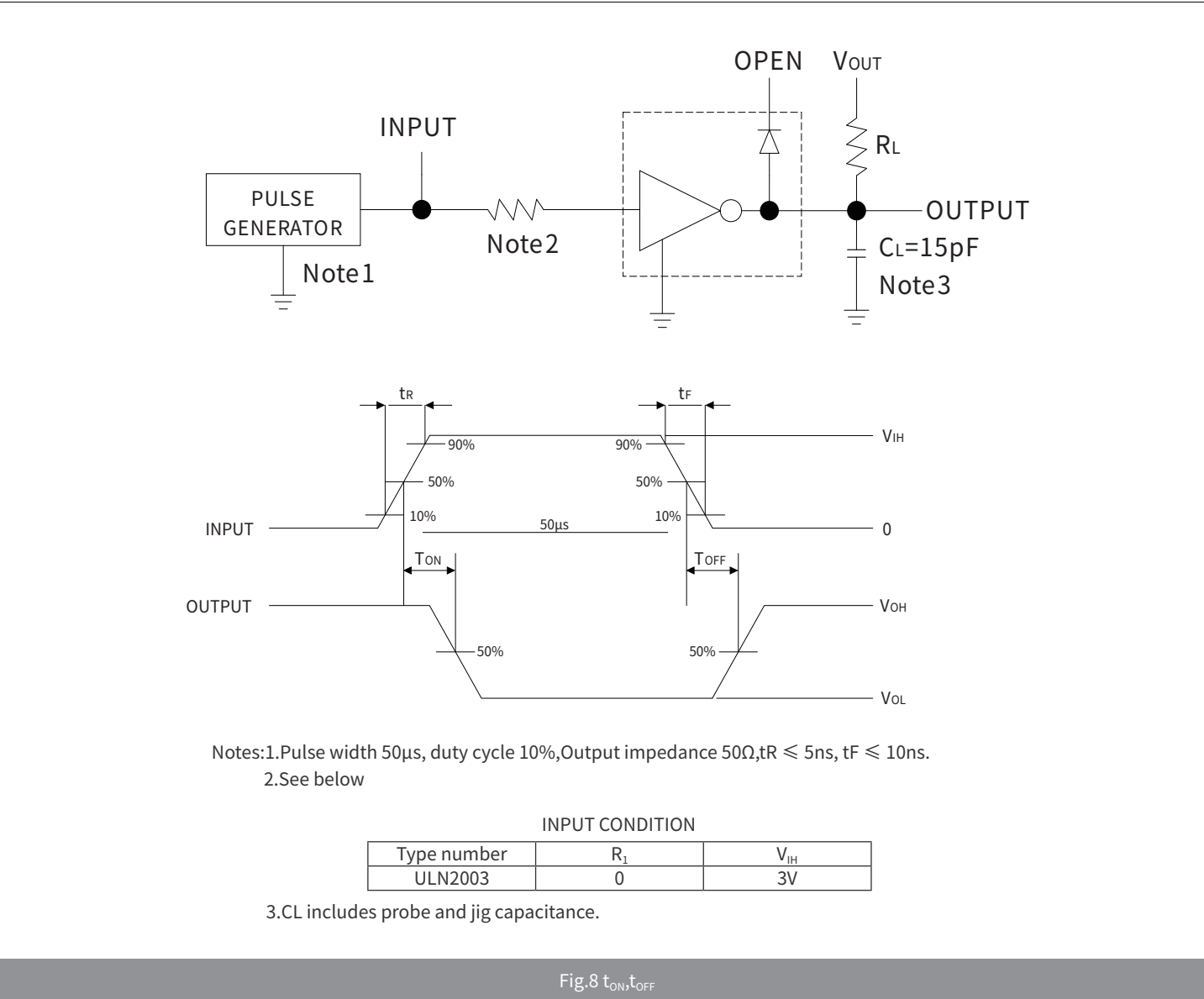


Fig.8 t_{ON}, t_{OFF}

● Package Outline Dimensions (SOP-16)

Symbol	Dimensions			
	Millimeters		Inches	
	Min.	Max.	Min.	Max.
A	1.25	1.65	0.049	0.065
B	9.19	9.39	0.362	0.370
C	0.10	0.30	0.004	0.012
D	9.70	10.10	0.382	0.398
T	1.40	1.80	0.055	0.071
L	1.17	1.37	0.046	0.054
F	0.30	0.50	0.012	0.020
G	3.70	4.10	0.146	0.161
H	5.80	6.20	0.228	0.244
E	1.05 ref		0.041 ref	
e	0.64 ref		0.025 ref	
o	0.35 ref		0.014 ref	
a	-	0.20		0.008
L	12°		12°	

● Suggested Pad Layout

Symbol	Dimensions			
	Millimeters		Inches	
	Min.	Max.	Min.	Max.
X	-	1.50	-	0.059
Y	-	0.80	-	0.031
N	-	1.27	-	0.050
M	-	7.75	-	0.305
M1	-	4.75	-	0.187