

## DESCRIPTION

The ULN2803/2804 series are high-voltage, high-current darlington arrays comprised of eight NPN darlington pairs. All units feature integral clamp diodes for switching inductive loads.

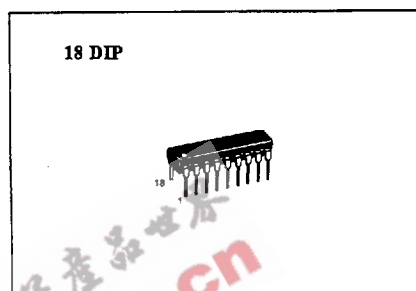
## FEATURES

- Output current.....500mA
- High Sustaining Voltage.....50V Min.
- Output Clamp Diode
- Inputs Compatible With Various Types of Logic

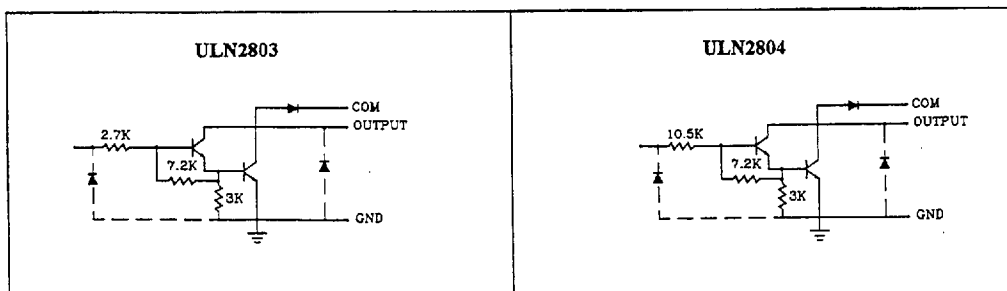
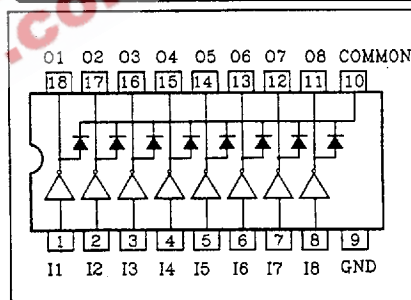
Type	Input Resistor	Designation
ULN2803	2.7K $\Omega$	TTL, 5V C - MOS
ULN2804	10.5K $\Omega$	6 ~ 15V P -MOS, C -MOS

## MAXIMUM RATING(Ta=25 $^{\circ}$ C unless otherwise)

Characteristic	Symbol	Rating	Unit
Output Sustaining Voltage	V <sub>CE(sus)</sub>	50	V
Output Current	I <sub>OUT</sub>	500	mA
Input Voltage	V <sub>IN</sub>	-0.5~+30	V
Input Current	I <sub>IN</sub>	25	mA
Clamp Diode	Reverse Voltage	V <sub>R</sub>	50 V
	Forward Current	I <sub>F</sub>	500 mA
GND Terminal Current	I <sub>GND</sub>	3.2	A
Power Dissipation	P <sub>D</sub>	1.47	W
Operating Temperature	T <sub>opr</sub>	-40~85	$^{\circ}$ C
Storage Temperature	T <sub>stg</sub>	-55~150	$^{\circ}$ C



## PIN CONNECTION (TOP VIEW)



**RECOMMENDED OPERATING CONDITIONS(Ta=-40-85 °C)**

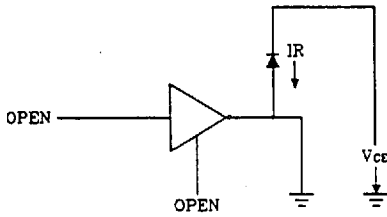
CHARACTERISTIC	SYMBOL	CONDITION	MIN.	TYP.	MAX.	UNIT
Output Sustaining Voltage	V <sub>CE(SUS)</sub>		0	-	50	V
Output Current	I <sub>OUT</sub>	T <sub>PW</sub> =25mS,DF=8%, 8 Circuits	0	-	400	mA
		T <sub>PW</sub> =25mS,DF=25% 8 Circuits	0	-	200	
Input Voltage	V <sub>IN</sub>		0	-	30	V
Clamp Diode Reverse Voltage	V <sub>R</sub>		-	-	50	V
Clamp Diode Forward Current	I <sub>F</sub>		-	-	400	mA
Power Dissipation	P <sub>D</sub>		-	-	0.52	W

**ELECTRICAL CHARACTERISTICS(Ta=25 °C unless otherwise noted)**

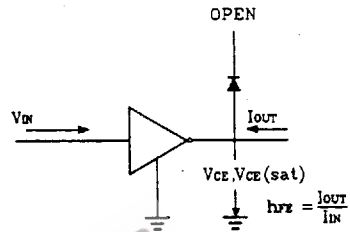
CHARACTERISTIC	SYMBOL	TEST CIRCUIT	CONDITION	MIN.	TYP.	MAX.	UNIT	
Output leak Current	I <sub>CEX</sub>	1	V <sub>CE</sub> =50V, Ta=25 °C	-	-	50	μ A	
			V <sub>CE</sub> =50V, Ta=85 °C	-	-	100		
			V <sub>CE</sub> =50V, V <sub>IN</sub> =1V	-	-	500		
Collector-Emitter Saturation Voltage	V <sub>CE(sat)</sub>	2	I <sub>OUT</sub> =350mA, I <sub>IN</sub> =500 μ A	-	1.3	1.6	V	
			I <sub>OUT</sub> =200mA, I <sub>IN</sub> =350 μ A	-	1.1	1.3		
			I <sub>OUT</sub> =100mA, I <sub>IN</sub> =250 μ A	-	0.9	1.1		
Input Current	I <sub>IN(on)</sub>	3	V <sub>IN</sub> =3.85V	-	0.93	1.35	mA	
			V <sub>IN</sub> =5V	-	0.35	0.5		
			V <sub>IN</sub> =12V	-	1.0	1.45		
Input Voltage	V <sub>IN(ON)</sub>	5	I <sub>OUT</sub> =500 μ A, Ta=85 °C	50	65	-	μ A	
			V <sub>CE</sub> =2V, I <sub>OUT</sub> =200mA	-	-	2.4		V
			V <sub>CE</sub> =2V, I <sub>OUT</sub> =250mA	-	-	2.7		
Input Voltage	V <sub>IN(ON)</sub>	5	V <sub>CE</sub> =2V, I <sub>OUT</sub> =300mA	-	-	3.0	V	
			V <sub>CE</sub> =2V, I <sub>OUT</sub> =125mA	-	-	5.0		
			V <sub>CE</sub> =2V, I <sub>OUT</sub> =200mA	-	-	6.0		
			V <sub>CE</sub> =2V, I <sub>OUT</sub> =275mA	-	-	7.0		
			V <sub>CE</sub> =2V, I <sub>OUT</sub> =350mA	-	-	8.0		
DC Current Transistor Ratio	h <sub>FE</sub>	2	V <sub>CE</sub> =2V, I <sub>OUT</sub> =350mA	1000	-	-		
Clamp Diode Reverse Current	I <sub>E</sub>	6	V <sub>R</sub> =50V, Ta=25 °C	-	-	50	μ A	
Clamp Diode Forward Voltage	V <sub>F</sub>	7	V <sub>R</sub> =50V, Ta=85 °C	-	-	100	V	
			I <sub>F</sub> =350mA	-	-	2.0		
Input Capacitance	C <sub>IN</sub>			-	15	-	pF	
Turn-On Delay	t <sub>ON</sub>	8	V <sub>OUT</sub> =50V, R <sub>L</sub> =163 Ω C <sub>L</sub> =15 pF	-	0.1	-	μ S	
Turn-Off Delay	t <sub>OFF</sub>			-	0.2	-		

**TEST CIRCUIT**

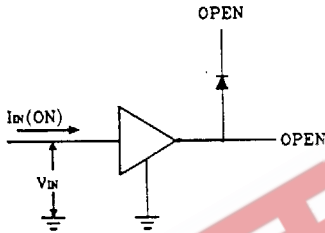
1.  $I_{CEX}$



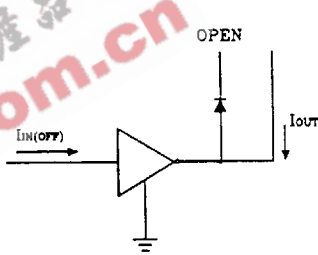
2.  $V_{CE(sat)}$ ,  $h_{FE}$



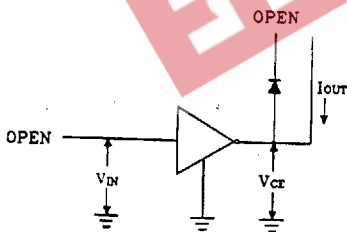
3.  $I_{IN(ON)}$



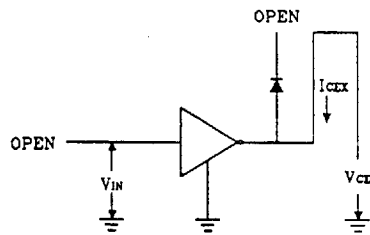
4.  $I_{IN(OFF)}$



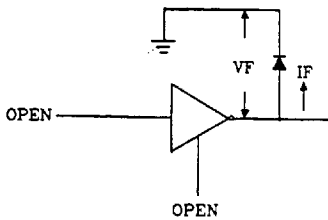
5.  $V_{IN(ON)}$



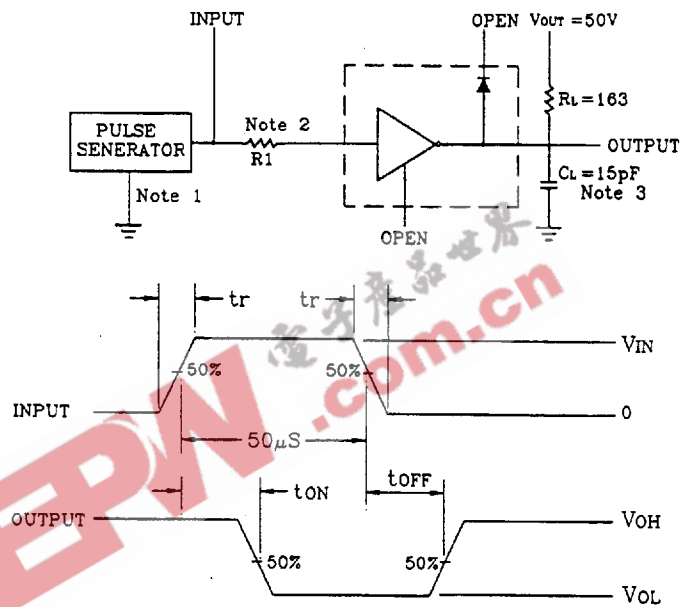
6.  $I_R$



7.  $V_F$



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



Notes: 1. Pulse Width  $50\mu s$ , Duty Cycle 10%

Output Impedance  $50\Omega$

$t_r \leq 5ns$ ,  $t_f \leq 10ns$

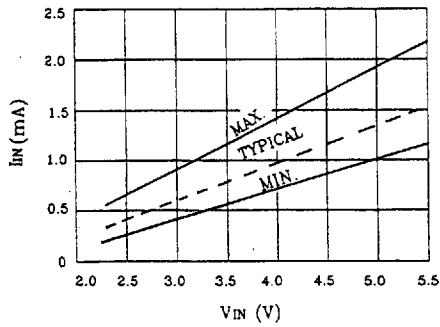
2. See below

Input Conditions

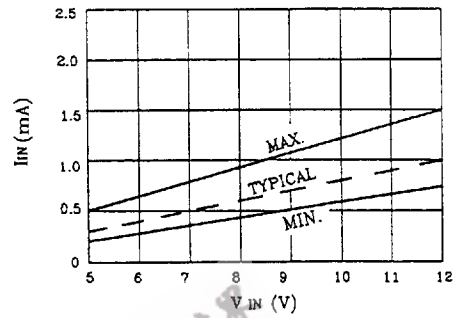
TYPE NUMBER	$R_I$	$V_{IH}$
ULN2803	0	3V
ULN2804	0	8V

3.  $C_L$  includes prob and jig capacitance.

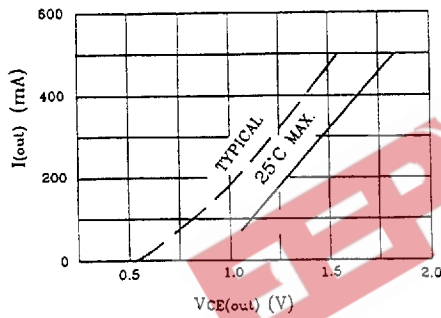
**ULN2803  $I_{IN} - V_{IN}$**



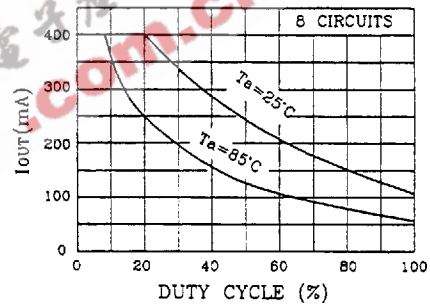
**ULN2804  $I_{IN} - V_{IN}$**



**$F_D - T_a$**



**$I_{OUT} - V_{CE(out)}$**



**$I_{OUT} - DUTY CYCLE$**

