



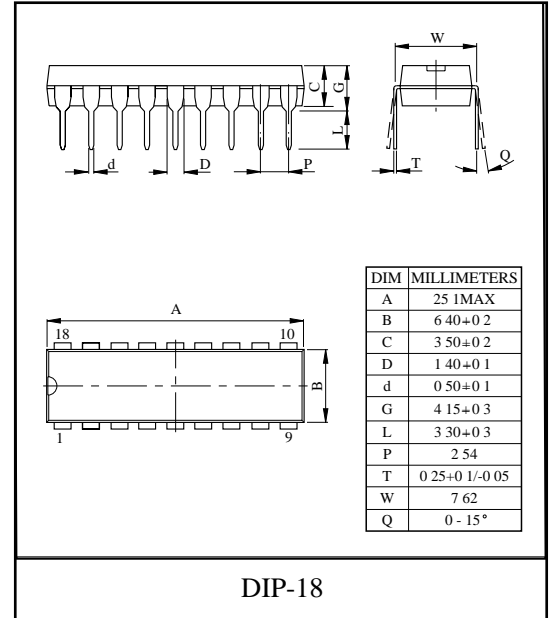
## 8 HIGH-VOLTAGE HIGH-CURRENT DARLINGTON TRANSISTOR ARRAYS

The ULN2803/4 are high-voltage, high-current darlington drivers comprised of eight NPN darlington pairs. All units feature integral clamp diodes for switching inductive loads. Applications include relay, hammer, lamp and display(LED) drivers.

### FEATURES

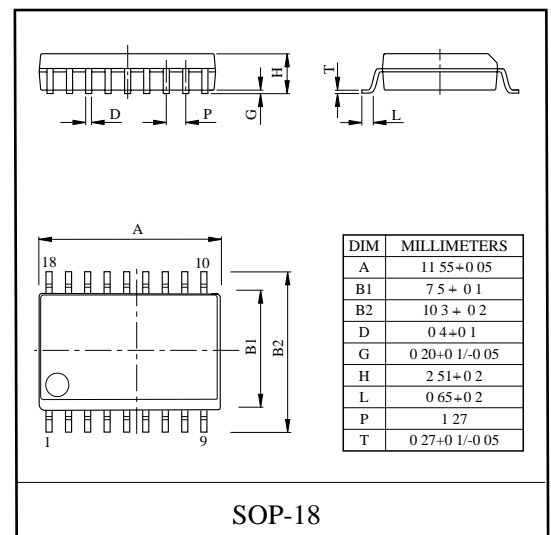
- Output Current (Single Output) : 500mA Max.
- High Sustaining Voltage Outputs : 50V Min.
- Output Clamp Diodes
- Inputs Compatible With Various Types of Logic.
- PKG Type, P : DIP-18
- PKG Type, F : SOP-18

TYPE	INPUT BASE RESISTOR	DESIGNATION
ULN2803	2.7kΩ	TTL, 5V C-MOS
ULN2804	10.5kΩ	6 ~ 15V P-MOS, C-MOS



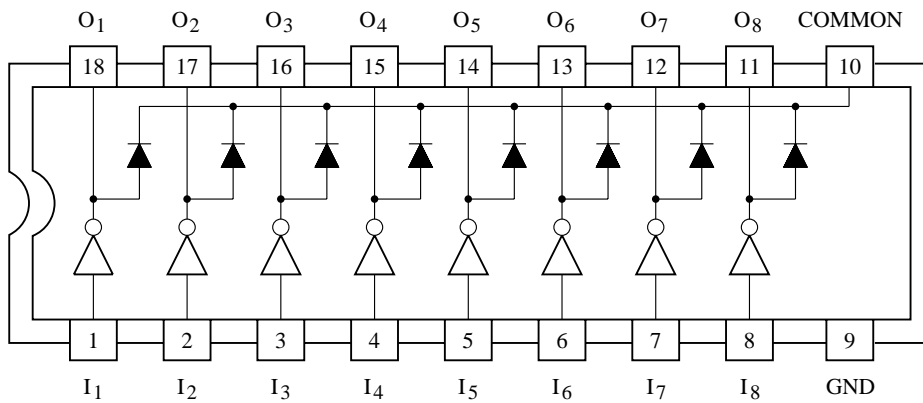
### MAXIMUM RATINGS (Ta=25°C, unless otherwise noted)

CHARACTERISTIC		SYMBOL	RATING	UNIT
Output Sustaining Voltage		$V_{CE(SUS)}$	-0.5 ~ 50	V
Output Current		$I_{OUT}$	500	mA/ch
Input Voltage		$V_{IN}$	-0.5 ~ +30	V
Clamp Diode	Reverse Voltage	$V_R$	50	V
	Forward Current	$I_F$	500	mA
Power Dissipation	AP	$P_D$	1.47	W
	AF		0.96	W
Operating Temperature		$T_{opr}$	-40 ~ 85	°C
Storage Temperature		$T_{stg}$	-55 ~ 150	°C

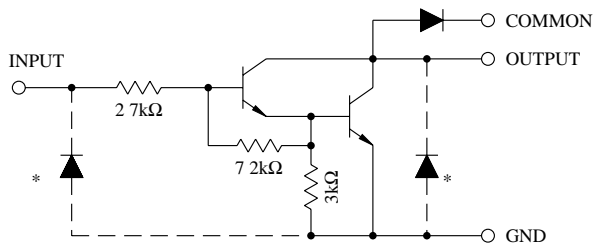


## PIN CONNECTION (TOP VIEW)

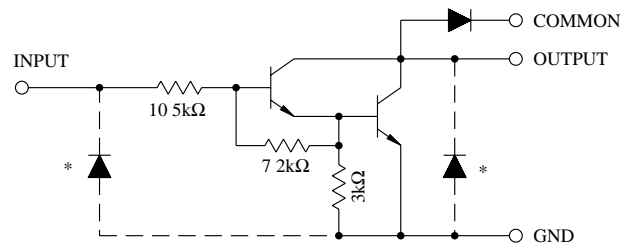
### SOP-18



ULN2803



ULN2804



( \* : Parasitic Diodes  
 ( NOTE. The input and output parasitic diodes cannot be used as clamp diodes. ) )



# ULN2803AP/AF    ULN2804AP/AF

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

CHARACTERISTIC		SYMBOL	CONDITION	MIN.	TYP.	MAX.	UNIT
Output Sustaining Voltage		$V_{CE(SUS)}$		0	-	50	V
Output Current	AP	$I_{OUT}$	$T_{PW}=25ms, Duty=10\%, 8 Circuits$	0	-	347	mA/ch
			$T_{PW}=25ms, Duty=50\%, 8 Circuits$	0	-	123	
	AF		$T_{PW}=25ms, Duty=10\%, 8 Circuits$	0	-	268	
			$T_{PW}=25ms, Duty=50\%, 8 Circuits$	0	-	90	
Input Voltage		$V_{IN}$		0	-	30	V
Input Voltage (Output ON)	ULN2803	$V_{IN(ON)}$		3.5	-	30	V
	ULN2804			8	-	30	
Clamp Diode Reverse Voltage		$V_R$		-	-	50	V
Clamp Diode Forward Current		$I_F$		-	-	400	mA
Power Dissipation	AP	$P_D$		-	-	0.52	W
	AF			-	-	0.35	



# ULN2803AP/AF ULN2804AP/AF

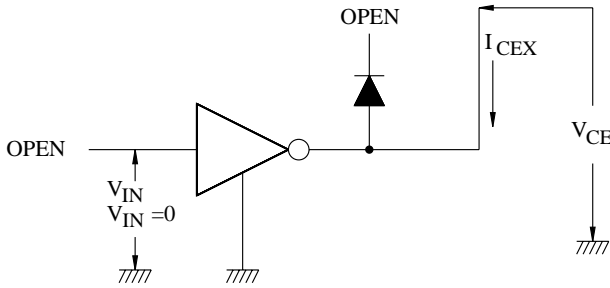
ELECTRICAL CHARACTERISTICS (Ta=25°C, unless otherwise noted)

CHARACTERISTICS		SYMBOL	TEST CIRCUIT	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Output Leak Current	ULN2803	I <sub>CEX</sub>	1	V <sub>CE</sub> =50V, Ta=25°C	-	-	50	μA
				V <sub>CE</sub> =50V, Ta=85°C	-	-	100	
	ULN2804			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> =500μA	-	1.3	1.6	V
				I <sub>OUT</sub> =200mA, I <sub>IN</sub> =350μA	-	1.1	1.3	
				I <sub>OUT</sub> =100mA, I <sub>IN</sub> =250μA	-	0.9	1.1	
Input Current	ULN2803	I <sub>IN(ON)</sub>	3	V <sub>IN</sub> =3.85V	-	0.93	1.35	mA
	ULN2804			V <sub>IN</sub> =5V	-	0.35	0.5	
				V <sub>IN</sub> =12V	-	1.0	1.45	
		I <sub>IN(OFF)</sub>	4	I <sub>OUT</sub> =500μA, Ta=85°C	50	65	-	μA
Input Voltage (Output On)	ULN2803	V <sub>IN(ON)</sub>	5	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	
				V <sub>CE</sub> =2V, I <sub>OUT</sub> =300mA	-	-	3.0	
	ULN2804			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 Transfer Ratio		h <sub>FE</sub>	2	V <sub>CE</sub> =2V, I <sub>OUT</sub> =350mA	1000	-	-	
Clamp Diode Reverse Current		I <sub>R</sub>	6	Ta=25°C (*1)	-	-	50	μA
				Ta=85°C (*1)	-	-	100	
Clamp Diode Forward Voltage		V <sub>F</sub>	7	I <sub>F</sub> =350mA	-	-	2.0	V
Input Capacitance		C <sub>IN</sub>			-	-	15	pF
Turn-On Delay		t <sub>ON</sub>	8	R <sub>L</sub> =125Ω, V <sub>OUT</sub> =50V	-	0.1	-	μs
Turn-Off Delay		t <sub>OFF</sub>			-	0.21	-	

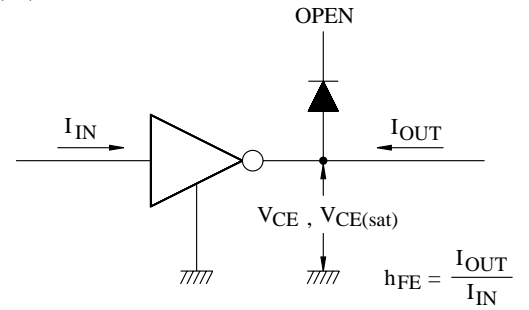
\*1 VR=VR MAX

## TEST CIRCUIT

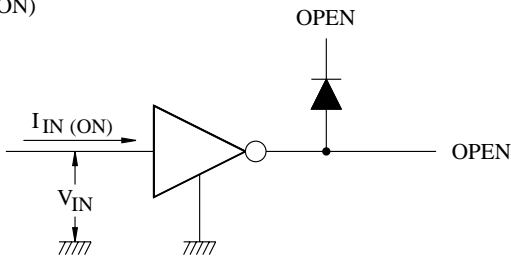
1.  $I_{CEX}$



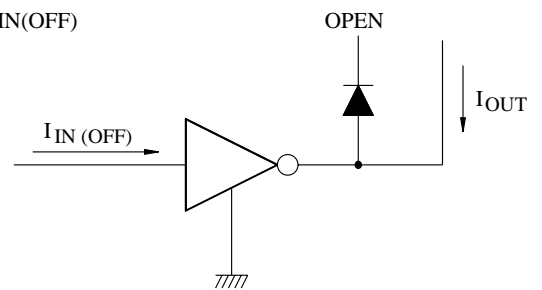
2.  $V_{CE(sat)}$ ,  $h_{FE}$



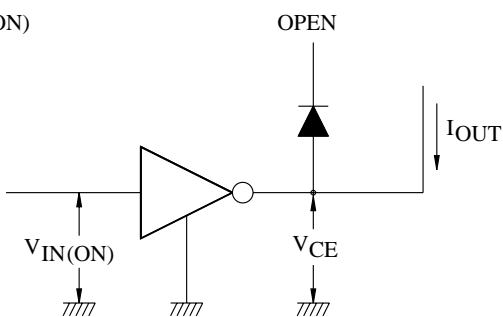
3.  $I_{IN(ON)}$



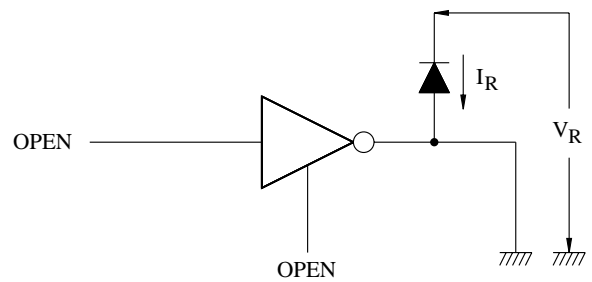
4.  $I_{IN(OFF)}$



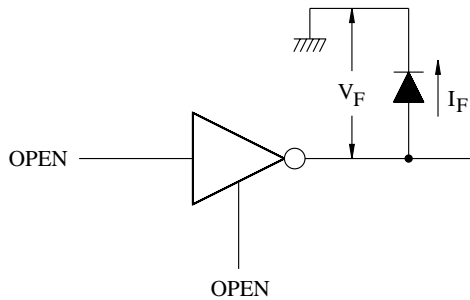
5.  $V_{IN(ON)}$



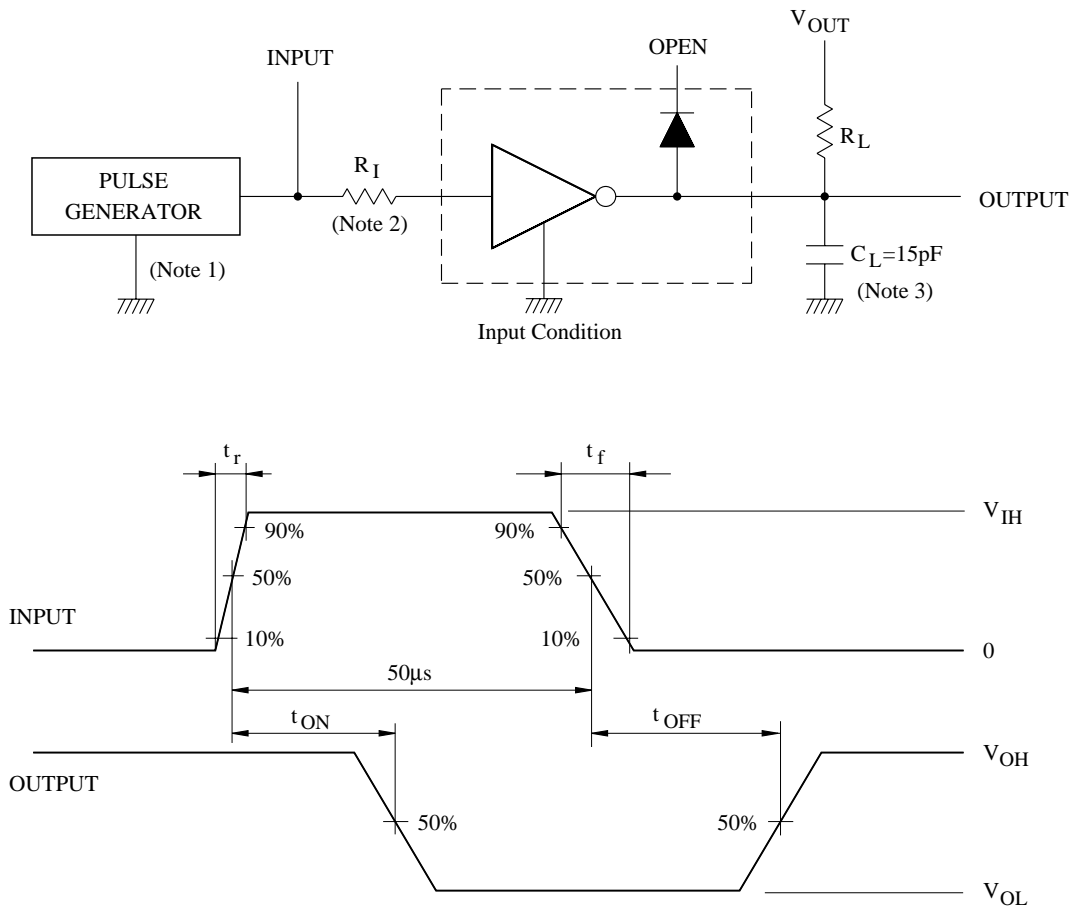
6.  $I_R$



7.  $V_F$



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



Notes : 1. Pulse Width  $50\mu\text{s}$ , Duty Cycle 10%  
Output Impedance  $50\Omega$ ,  $t_r \leq 5\text{ns}$ ,  $t_f \leq 10\text{ns}$

2. See below

Input Conditions

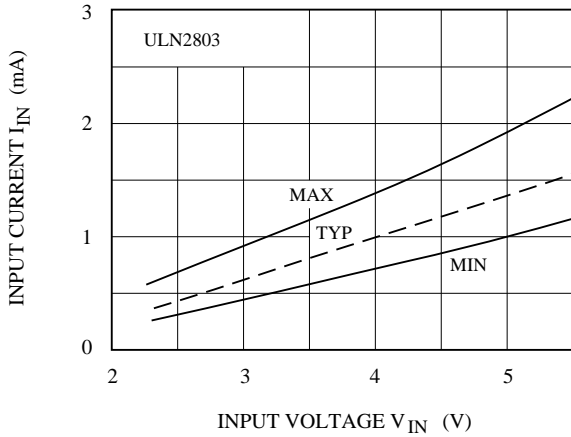
Type Number	$R_I$	$V_{IH}$
ULN2803	0	3V
ULN2804	0	8V

3.  $C_L$  includes probe and Jig capacitance.

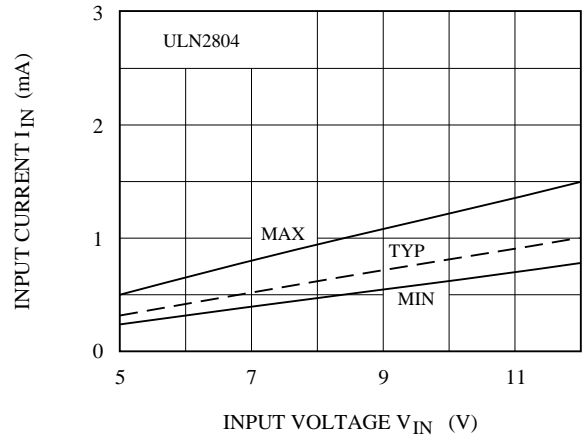


# ULN2803AP/AF    ULN2804AP/AF

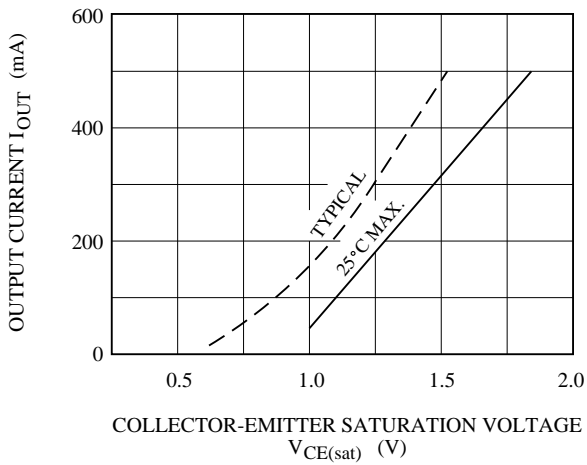
$I_{IN} - V_{IN}$



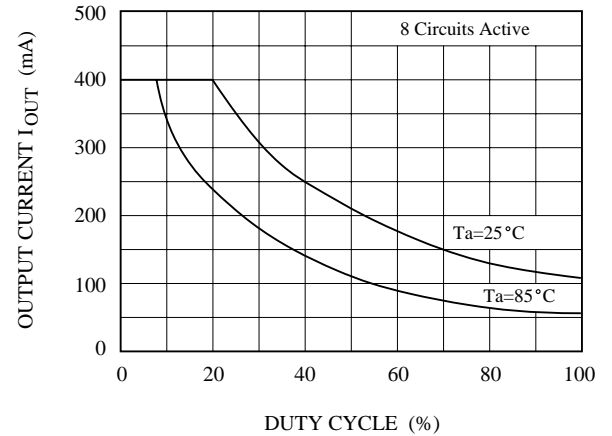
$I_{IN} - V_{IN}$



$I_{OUT} - V_{CE(sat)}$



$I_{OUT} - DUTY CYCLE$



$P_D - T_a$

