

TOSHIBA BIPOLAR DIGITAL INTEGRATED CIRCUIT SILICON MONOLITHIC

ULN2803AP, ULN2803AFW, ULN2804AP, ULN2804AFW

8CH DARLINGTON SINK DRIVER

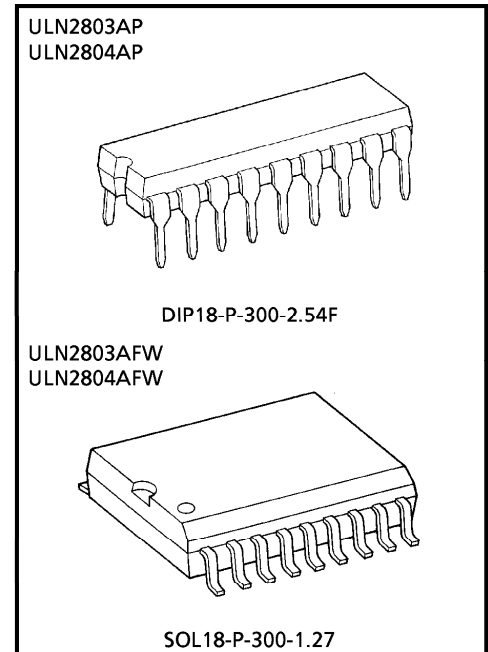
The ULN2803AP / AFW Series are high-voltage, high-current darlington drivers comprised of eight NPN darlington pairs.

All units feature integral clamp diodes for switching inductive loads.

Applications include relay, hammer, lamp and display (LED) drivers.

FEATURES

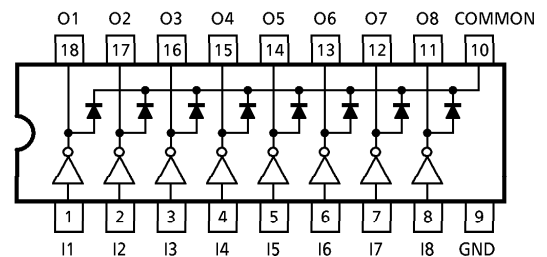
- Output current (single output)
500 mA (Max.) (ULN2803AP / AFW series)
- High sustaining voltage output
50 V (Min.) (ULN2803AP / AFW series)
- Output clamp diodes
- Inputs compatible with various types of logic.
- Package type-AP : DIP-18pin
- Package type-AFW : SOL-18pin



Weight
 DIP18-P-300-2.54F : 1.478 g (Typ.)
 SOL18-P-300-1.27 : 0.48 g (Typ.)

TYPE	INPUT BASE RESISTOR	DESIGNATION
ULN2803AP / AFW	2.7 kΩ	TTL, 5 V CMOS
ULN2804AP / AFW	10.5 kΩ	6~15 V PMOS, CMOS

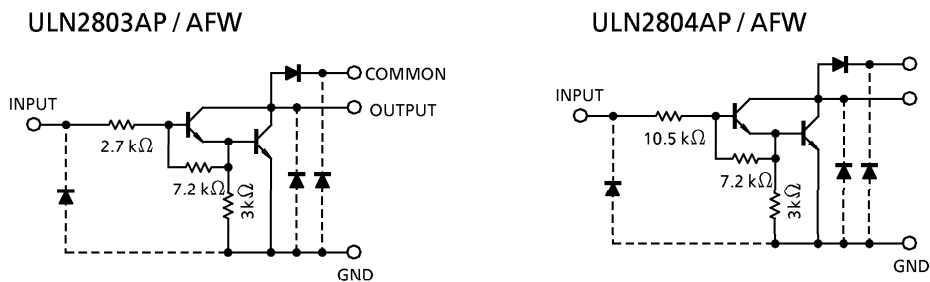
PIN CONNECTION (TOP VIEW)



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SCHEMATICS (EACH DRIVER)



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

MAXIMUM RATINGS (Ta = 25°C)

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
Clamp Diode Forward Current		I_F	500	mA
Power Dissipation	AP	P_D	1.47	W
	AFW		0.92 / 1.31 (Note)	
Operating Temperature		T_{opr}	- 40~85	°C
Storage Temperature		T_{stg}	- 55~150	°C

(Note) : On Glass Epoxy PCB (75 x 114 x 1.6 mm Cu 20%)

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

CHARACTERISTIC		SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Output Sustaining Voltage		V _{CE(SUS)}		0	—	50	V
Output Current	AP	I _{OUT}	T _{pw} = 25 ms, Duty = 10%, 8 Circuits	0	—	347	mA / ch
			T _{pw} = 25 ms, Duty = 50%, 8 Circuits	0	—	123	
	AFW		T _{pw} = 25 ms, Duty = 10%, 8 Circuits	0	—	268	
			T _{pw} = 25 ms, Duty = 50%, 8 Circuits	0	—	90	
Input Voltage		V _{IN}		0	—	30	V
Input Voltage (Output On)	ULN2803AP / AFW	V _{IN(ON)}		3.5	—	30	V
	ULN2804AP / AFW			8	—	30	
Clamp Diode Reverse Voltage		V _R		—	—	50	V
Clamp Diode Forward Current		I _F		—	—	400	mA
Power Dissipation	AP	P _D	Ta = 85°C	—	—	0.76	W
	AFW		Ta = 85°C (Note)	—	—	0.48	

(Note) : On Glass Epoxy PCB (75 x 114 x 1.6 mm Cu 20%)

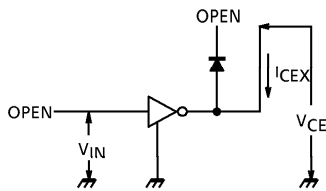
ELECTRICAL CHARACTERISTICS (Ta = 25°C)

CHARACTERISTIC		SYMBOL	TEST CIR-CUIT	TEST CONDITION		MIN.	TYP.	MAX.	UNIT
Output Leakage Current	ULN2804AP / AFW	I _{CEX}	1	V _{CE} = 50 V	Ta = 25°C	—	—	50	μA
				V _{CE} = 50 V	Ta = 85°C	—	—	100	
				V _{CE} = 50 V	V _{IN} = 1 V	—	—	500	
Collector-Emitter Saturation Voltage		V _{CE (sat)}	2	I _{OUT} = 350 mA, I _{IN} = 500 μA		—	1.3	1.6	V
				I _{OUT} = 200 mA, I _{IN} = 350 μA		—	1.1	1.3	
				I _{OUT} = 100 mA, I _{IN} = 250 μA		—	0.9	1.1	
Input Current	ULN2803AP / AFW	I _{IN (ON)}	2	V _{IN} = 3.85 V		—	0.93	1.35	mA
	ULN2804AP / AFW			V _{IN} = 5 V		—	0.35	0.5	
	ULN2804AP / AFW			V _{IN} = 12 V		—	1.0	1.45	
		I _{IN (OFF)}	4	I _{OUT} = 500 μA, Ta = 85°C		50	65	—	μA
Input Voltage (Output On)	ULN2803AP / AFW	V _{IN (ON)}	5	V _{CE} = 2 V, I _{OUT} = 200 mA		—	—	2.4	V
				V _{CE} = 2 V, I _{OUT} = 250 mA		—	—	2.7	
				V _{CE} = 2 V, I _{OUT} = 300 mA		—	—	3.0	
	ULN2804AP / AFW			V _{CE} = 2 V, I _{OUT} = 125 mA		—	—	5.0	
				V _{CE} = 2 V, I _{OUT} = 200 mA		—	—	6.0	
				V _{CE} = 2 V, I _{OUT} = 275 mA		—	—	7.0	
				V _{CE} = 2 V, I _{OUT} = 350 mA		—	—	8.0	
DC Current Transfer Ratio		h _{FE}	2	V _{CE} = 2 V, I _{OUT} = 350 mA		1000	—	—	
Clamp Diode Reverse Current		I _R	6	Ta = 25°C (Note)		—	—	50	μA
		Ta = 85°C (Note)		—	—	100			
Clamp Diode Forward Voltage		V _F	7	I _F = 350 mA		—	—	2.0	V
Input Capacitance		C _{IN}	—			—	15	—	pF
Turn-On Delay		t _{ON}	8	R _L = 125 Ω, V _{OUT} = 50 V		—	0.1	—	μs
Turn-Off Delay		t _{OFF}		R _L = 125 Ω, V _{OUT} = 50 V		—	0.2	—	

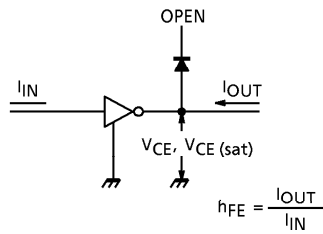
(Note) : V_R = V_R MAX.

TEST CIRCUIT

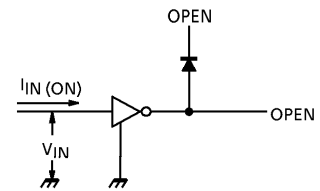
1. I_{CEX}



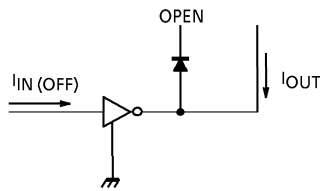
2. $V_{CE(sat)}$, h_{FE}



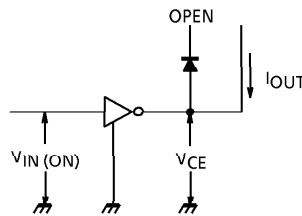
3. $I_{IN(ON)}$



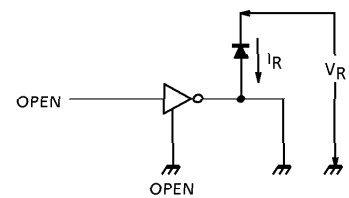
4. $I_{IN(OFF)}$



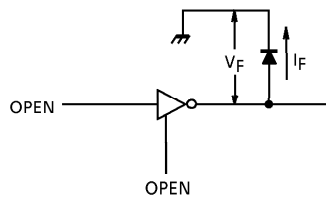
5. $V_{IN(ON)}$



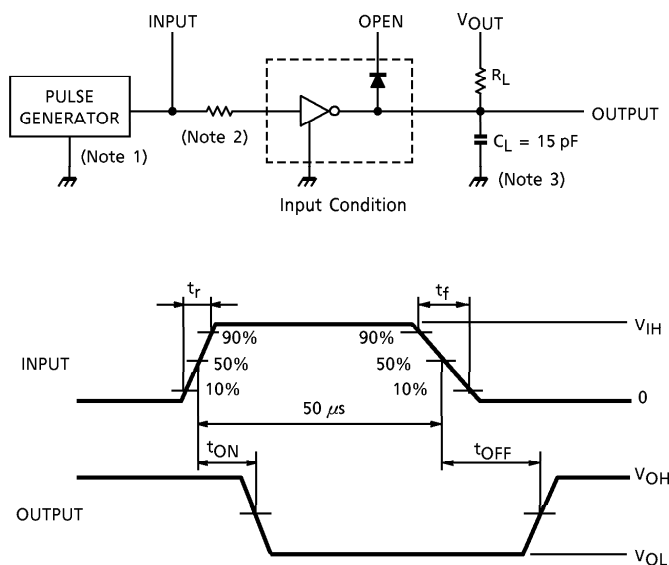
6. I_R



7. V_F



8. t_{ON} , t_{OFF}



- (Note 1) : Pulse Width 50 μ s, Duty Cycle 10%
Output Impedance 50 Ω , $t_r \leq 5$ ns, $t_f \leq 10$ ns
- (Note 2) : See below.

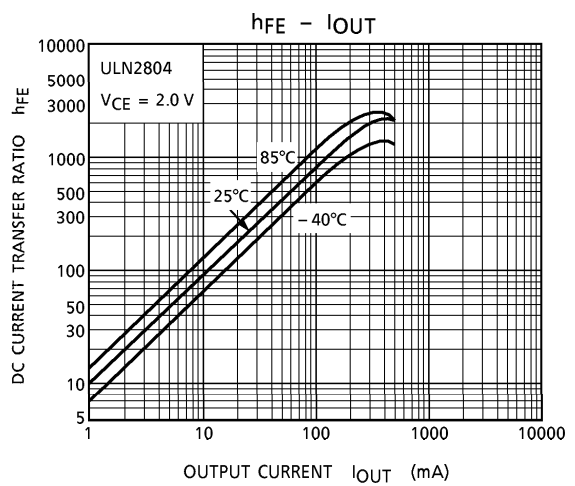
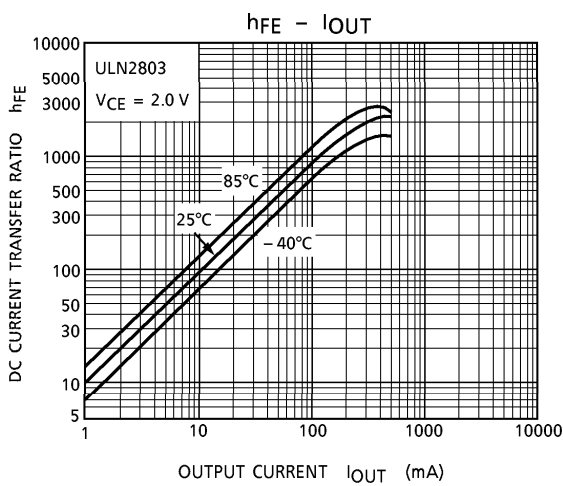
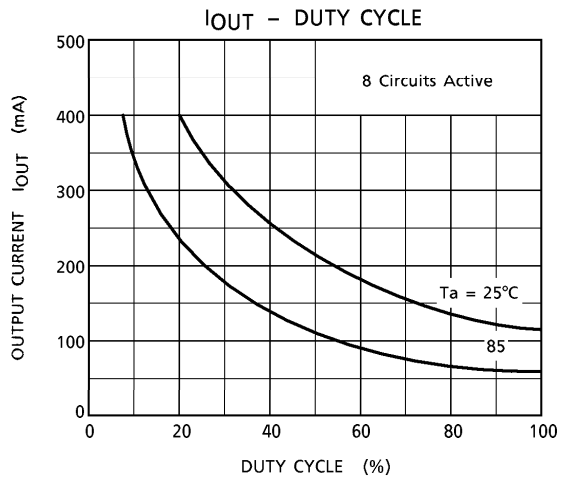
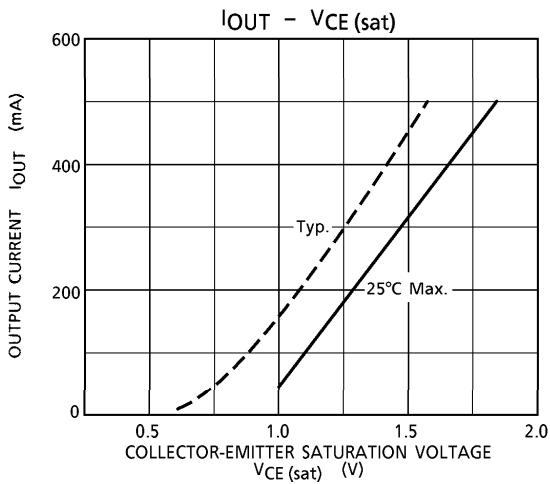
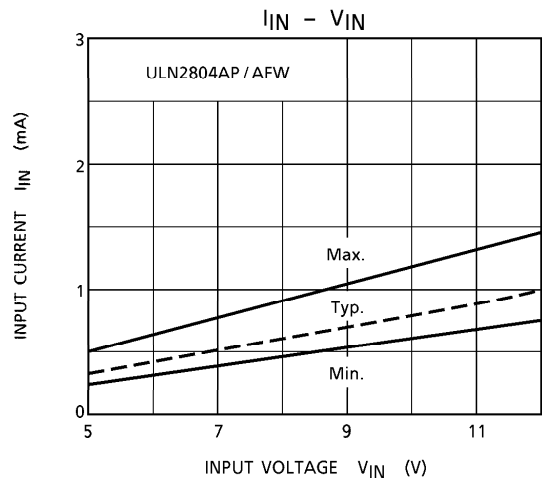
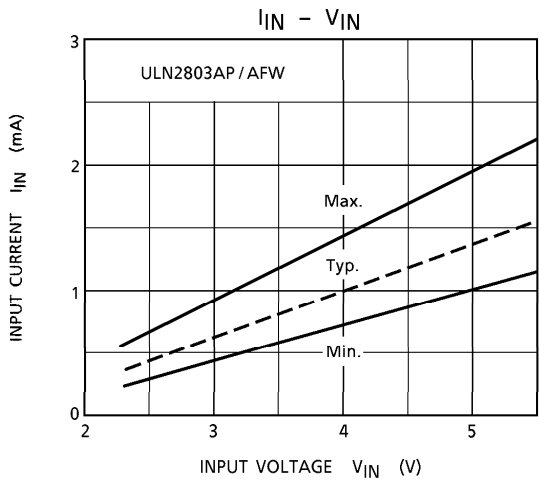
INPUT CONDITION

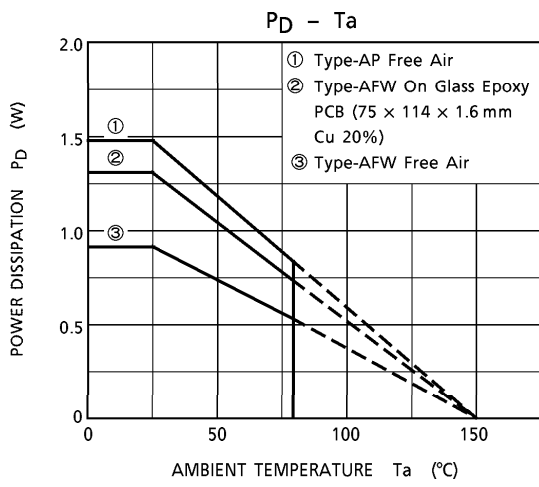
TYPE NUMBER	R1	V_{IH}
ULN2803AP / AFW	0 Ω	3 V
ULN2804AP / AFW	0 Ω	8 V

- (Note 3) : C_L includes probe and jig capacitance

PRECAUTIONS for USING

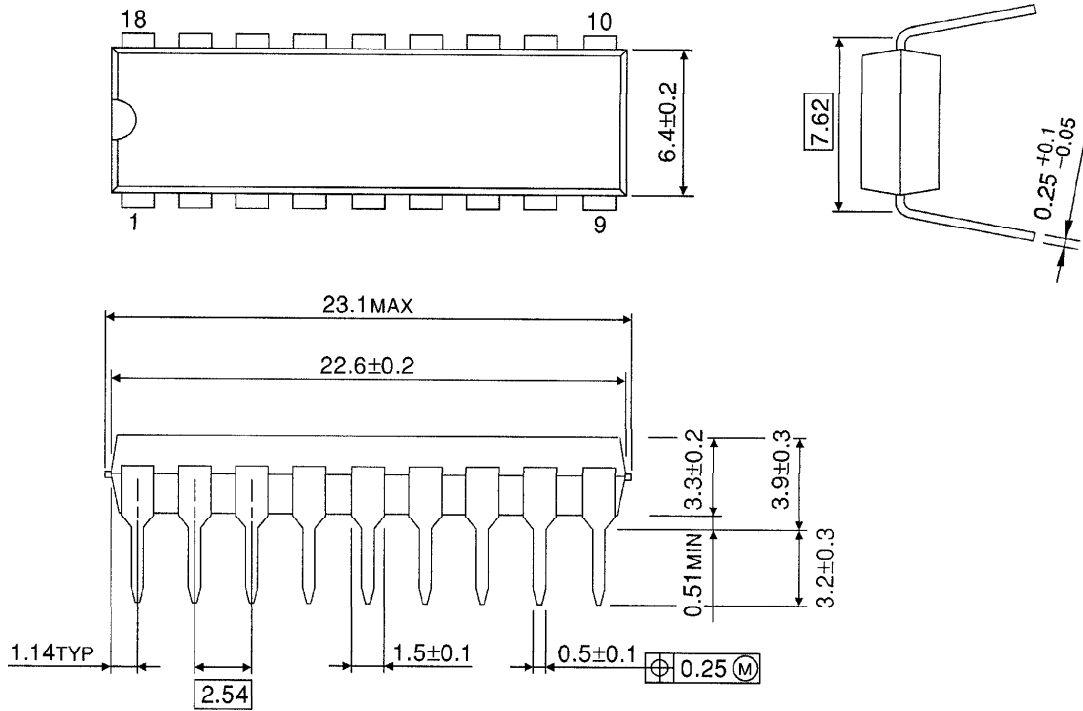
Utmost care is necessary in the design of the output line, COMMON and GND line since IC may be destroyed due to short-circuit between outputs, air contamination fault, or fault by improper grounding.





OUTLINE DRAWING
DIP18-P-300-2.54F

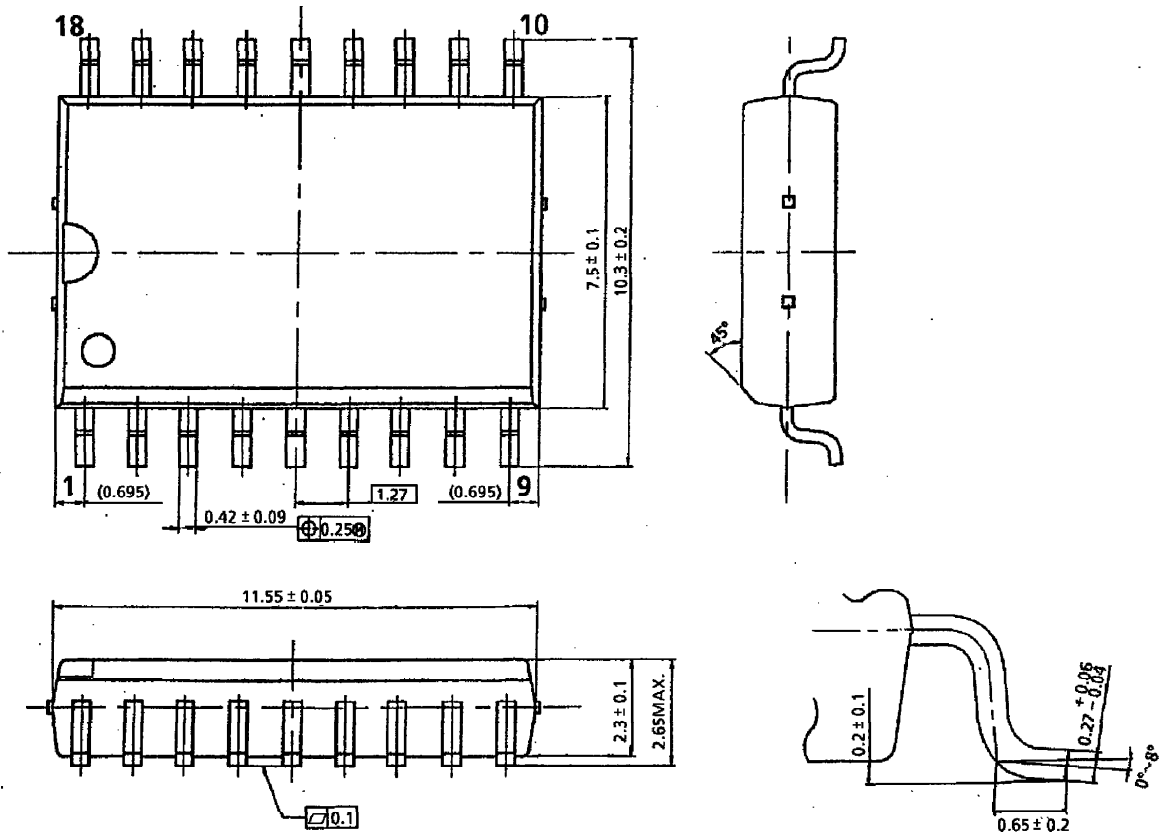
Unit : mm



Weight : 1.478 g (Typ.)

OUTLINE DRAWING
SOL18-P-300-1.27

Unit : mm



Weight : 0.48 g (Typ.)