#### TOSHIBA BIPOLAR DIGITAL INTEGRATED CIRCUIT SILICON MONOLITHIC

## ULN2803AP,ULN2803AFW,ULN2804AP,ULN2804AFW (Manufactured by Toshiba Malaysia)

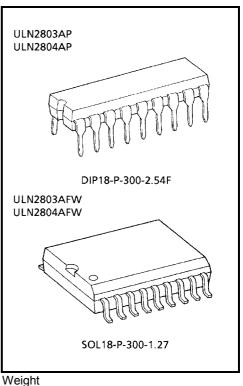
### 8CH DARLINGTON SINK DRIVER

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

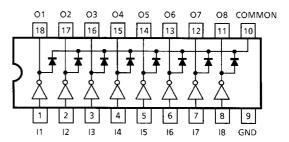
- Output current (single output) 500 mA (Max.)
- High sustaining voltage output 50 V (Min.)
- Output clamp diodes
- Inputs compatible with various types of logic.
- Package Type–AP : DIP–18pin
- Package Type–AFW : SOL–18pin



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

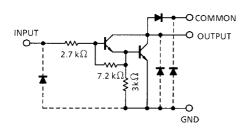
TYPE	INPUT BASE RESISTOR	DESIGNATION
ULN2803AP / AFW	2.7 kΩ	TTL, 5 V CMOS
ULN2804AP / AFW	10.5 kΩ	6~15 V PMOS, CMOS

#### **PIN CONNECTION (TOP VIEW)**

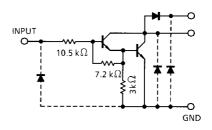


### SCHEMATICS (EACH DRIVER)

ULN2803AP / AFW







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 <sub>CE (SUS)</sub>	-0.5~50	V
Output Current		IOUT	500	mA / ch
Input Voltage		V <sub>IN</sub>	-0.5~30	V
Clamp Diode Reverse Voltage		V <sub>R</sub>	50	V
Clamp Diode Forward Current		١ <sub>F</sub>	500	mA
Power Dissipation	AP	D-	1.47	W
	AFW	PD	0.92 / 1.31 (Note)	vv
Operating Temperature		T <sub>opr</sub>	-40~85	°C
Storage Temperature		T <sub>stg</sub>	-55~150	°C

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

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

CHARAC	TERISTIC	SYMBOL	TEST CONDITION	MIN	TYP.	MAX	UNIT	
Output Sustaining Vo	ltage	V <sub>CE (SUS)</sub>		0	—	50	V	
Output Current	AP		T <sub>pw</sub> = 25 ms, Duty = 10%, 8 Circuits	0	_	347		
			T <sub>pw</sub> = 25 ms, Duty = 50%, 8 Circuits	0	_	123	mA / ch	
	AFW	- Iout	T <sub>pw</sub> = 25 ms, Duty = 10%, 8 Circuits	0	_	268		
	AFW		T <sub>pw</sub> = 25 ms, Duty = 50%, 8 Circuits	0	_	90		
Input Voltage		V <sub>IN</sub>		0	_	30	V	
Input Voltage (Output On)	ULN2803AP / AFW	VIN (ON)		3.5	_	30	v	
	ULN2804AP / AFW			8	_	30		
Clamp Diode Reverse Voltage		V <sub>R</sub>		_	_	50	V	
Clamp Diode Forward Current		١ <sub>F</sub>		—	—	400	mA	
Power Dissipation	AP		Ta = 85°C	_	—	0.76	w	
	AFW	– P <sub>D</sub>	Ta = 85°C (Note)	_	-	0.48	vv	

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

## ELECTRICAL CHARACTERISTICS (Ta = 25°C)

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

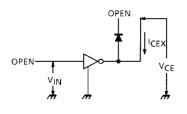
Note:  $V_R = V_R MAX$ .

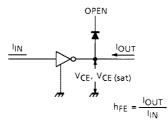
### **TEST CIRCUIT**

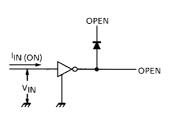
1. ICEX

### 2. V<sub>CE (sat),</sub> h<sub>FE</sub>

3. I<sub>IN (ON)</sub>



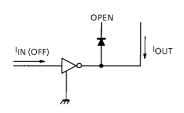


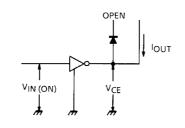


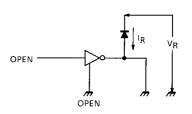
4. I<sub>IN (OFF)</sub>

5. V<sub>IN (ON)</sub>

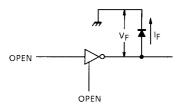






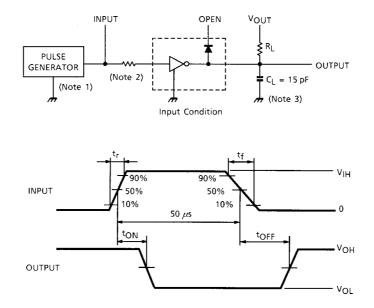


#### 7. V<sub>F</sub>



### 8. t<sub>ON</sub>, t<sub>OFF</sub>

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- Note 1: Pulse Width 50  $\mu$ s, Duty Cycle 10% Output Impedance 50  $\Omega$ , t<sub>f</sub> ≤ 5 ns, t<sub>f</sub> ≤ 10 ns
- Note 2: See below.

#### INPUT CONDITION

TYPE NUMBER	R1	V <sub>IH</sub>
ULN2803AP / AFW	0Ω	3 V
ULN2804AP / AFW	0Ω	8 V

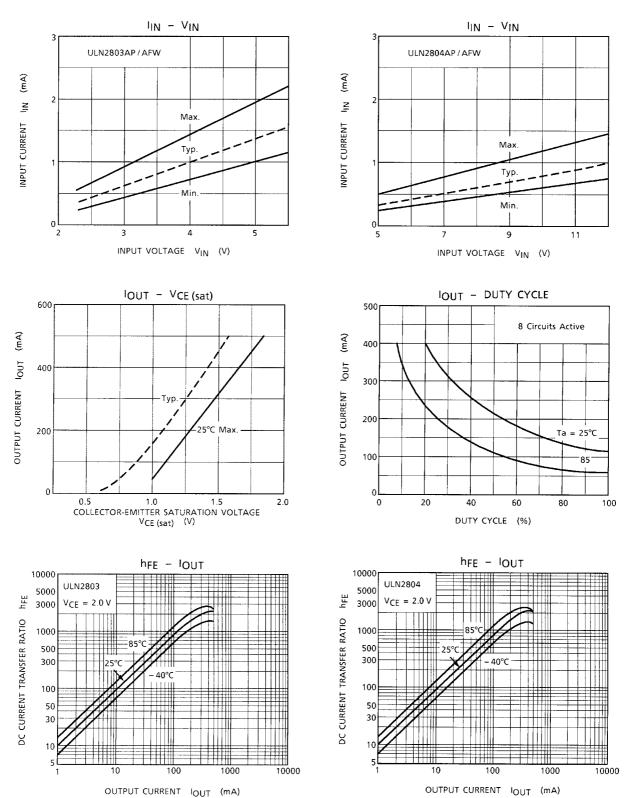
Note 3: CL includes probe and jig capacitance

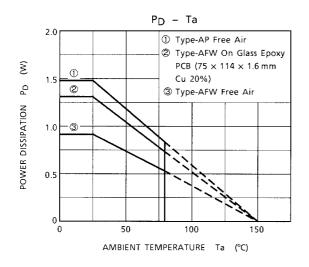
#### **PRECAUTIONS for USING**

This IC does not integrate protection circuits such as overcurrent and overvoltage protectors.

Thus, if excess current or voltage is applied to the IC, the IC may be damaged. Please design the IC so that excess current or voltage will not be applied to the IC.

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.

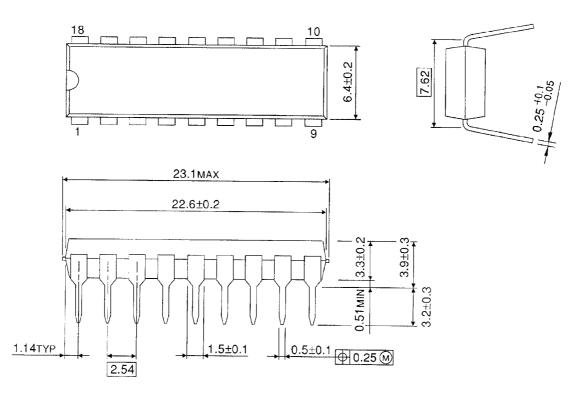




#### PACKAGE DIMENSIONS

DIP18-P-300-2.54F

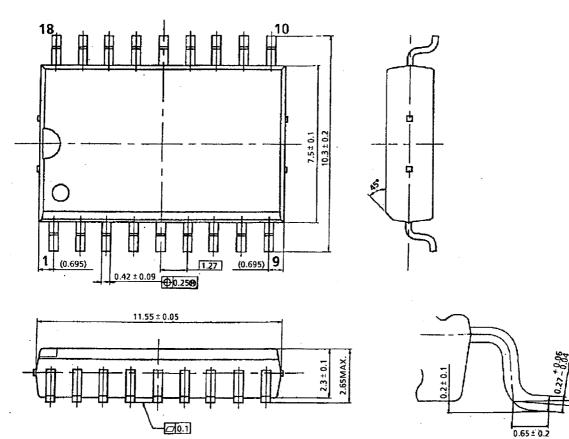
Unit: mm



Weight: 1.478 g (Typ.)

#### PACKAGE DIMENSIONS

SOL18-P-300-1.27



Weight: 0.48 g (Typ.)

Unit: mm

#### **RESTRICTIONS ON PRODUCT USE**

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