

TOSHIBA Bipolar Digital Integrated Circuit Silicon Monolithic

ULQ2003AP, ULQ2003AFW (Manufactured by Toshiba Malaysia)

7-ch Darlington Sink Driver

The ULQ2003AP/AFW are high-voltage, high-current darlington drivers comprised of seven NPN darlington pairs.

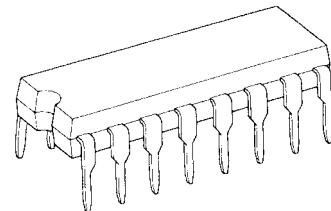
All units feature integral clamp diodes for switching inductive loads.

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

Features

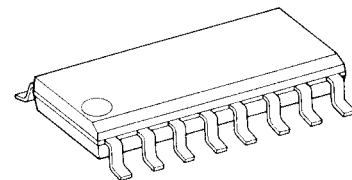
- Output current (single output): 500 mA max
- High sustaining voltage output: 50 V max
- Operating temperature: $T_a = -40$ to 105°C
- Output clamp diodes
- Inputs compatible with various types of logic
- Package type-AP: DIP-16pin
- Package type-AFW: SOL-16pin

ULQ2003AP



DIP16-P-300-2.54A

ULQ2003AFW



SOL16-P-150-1.27A

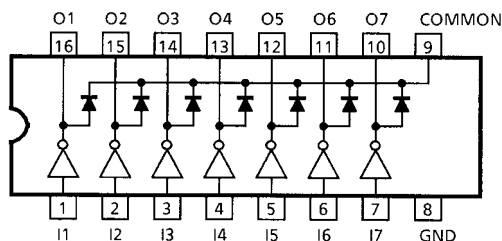
Weight

DIP16-P-300-2.54A : 1.11 g (typ.)

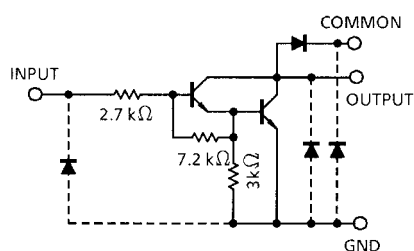
SOL16-P-150-1.27A : 0.15 g (typ.)

Type	Input Base Resistor	Designation
ULQ2003AP/AFW	2.7 k Ω	TTL, 5 V CMOS

Pin Connection (top view)



Schematics (each driver)



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

Maximum Ratings (Ta = 25°C)

Characteristics	Symbol	Rating	Unit
Output sustaining voltage	$V_{CE(SUS)}$	-0.5 to 50	V
Output current	I_{OUT}	500	mA/ch
Input voltage	V_{IN}	-0.5 to 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
	AFW		0.54/0.625 (Note)
Operating Temperature	T_{opr}	-40 to 105	°C
Storage Temperature	T_{stg}	-55 to 150	°C

Note: On glass epoxy PCB (30 × 30 × 1.6 mm Cu 50%)

Recommended Operating Conditions (Ta = -40 to 105°C)

Characteristics	Symbol	Test Condition	Min	Typ.	Max	Unit
Output sustaining voltage	$V_{CE(SUS)}$		0	—	50	V
Output current	I_{OUT}	$T_{pw} = 25\text{ ms}$ 7 Circuits $T_a = 105^\circ\text{C}$ $T_j = 120^\circ\text{C}$	Duty = 10%	—	200	mA/ch
					50	
			Duty = 50%	—	100	
					25	
Input voltage	V_{IN}		0	—	24	V
Input voltage (output on)	$V_{IN(ON)}$	$I_{OUT} = 400\text{ mA}$, $h_{FE} = 1000$	2.8	—	24	V
Input voltage (output off)	$V_{IN(OFF)}$		0	—	0.7	V
Clamp diode reverse voltage	V_R		—	—	50	V
Clamp diode forward current	I_F		—	—	350	mA
Power dissipation	AP	$T_a = 105^\circ\text{C}$	—	—	0.52	W
	AFW	$T_a = 105^\circ\text{C}$ (Note)	—	—	0.22	

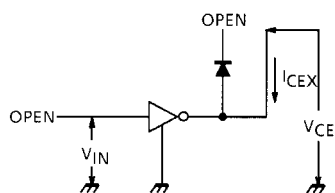
Note: On glass epoxy PCB (30 × 30 × 1.6 mm Cu 50%)

Electrical Characteristics (Ta = 25°C unless otherwise noted)

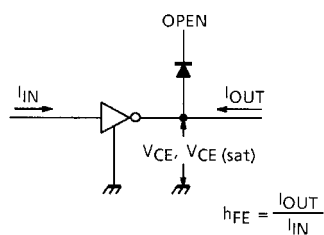
Characteristic	Symbol	Test Circuit	Test Condition	Min	Typ.	Max	Unit
Output leakage current	I_{CEX}	1	$V_{CE} = 50\text{ V}$, $T_a = 25^\circ\text{C}$	—	—	50	μA
			$V_{CE} = 50\text{ V}$, $T_a = 105^\circ\text{C}$	—	—	100	
Collector-emitter saturation voltage	$V_{CE(sat)}$	2	$I_{OUT} = 350\text{ mA}$, $I_{IN} = 500\text{ }\mu\text{A}$	—	1.3	1.6	V
			$I_{OUT} = 200\text{ mA}$, $I_{IN} = 350\text{ }\mu\text{A}$	—	1.1	1.3	
			$I_{OUT} = 100\text{ mA}$, $I_{IN} = 250\text{ }\mu\text{A}$	—	0.9	1.1	
DC current transfer ratio	h_{FE}	2	$V_{CE} = 2\text{ V}$, $I_{OUT} = 350\text{ mA}$	1000	—	—	
Input current (output on)	$I_{IN(ON)}$	3	$V_{IN} = 2.4\text{ V}$, $I_{OUT} = 350\text{ mA}$	—	0.4	0.7	mA
Input current (output off)	$I_{IN(OFF)}$	4	$I_{OUT} = 500\text{ }\mu\text{A}$, $T_a = 85^\circ\text{C}$	50	65	—	μA
Input voltage (output on)	$V_{IN(ON)}$	5	$V_{CE} = 2\text{ V}$ $h_{FE} = 1000$ $I_{OUT} = 350\text{ mA}$	—	—	2.6	V
			$I_{OUT} = 200\text{ mA}$	—	—	2.0	
Clamp diode reverse current	I_R	6	$V_R = 50\text{ V}$, $T_a = 25^\circ\text{C}$	—	—	50	μA
			$V_R = 50\text{ V}$, $T_a = 105^\circ\text{C}$	—	—	100	
Clamp diode forward voltage	V_F	7	$I_F = 350\text{ mA}$	—	—	2.2	V
Input capacitance	C_{IN}	—		—	15	—	pF
Turn-on delay	t_{ON}	8	$V_{OUT} = 50\text{ V}$, $R_L = 125\text{ }\Omega$ $C_L = 15\text{ pF}$	—	0.1	—	μs
Turn-off delay	t_{OFF}	8	$V_{OUT} = 50\text{ V}$, $R_L = 125\text{ }\Omega$ $C_L = 15\text{ pF}$	—	0.6	—	

Test Circuit

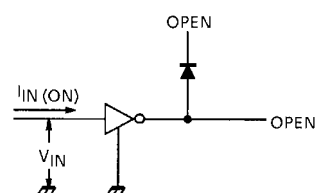
1. I_{CEX}



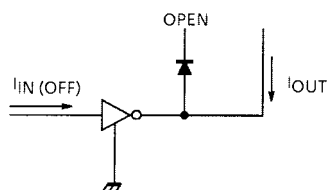
2. $V_{CE(sat)}$, h_{FE}



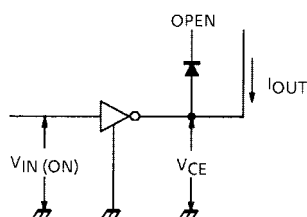
3. $I_{IN(ON)}$



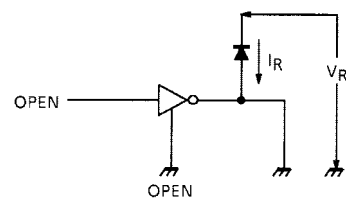
4. $I_{IN(OFF)}$



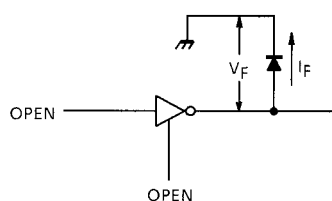
5. $V_{IN(ON)}$

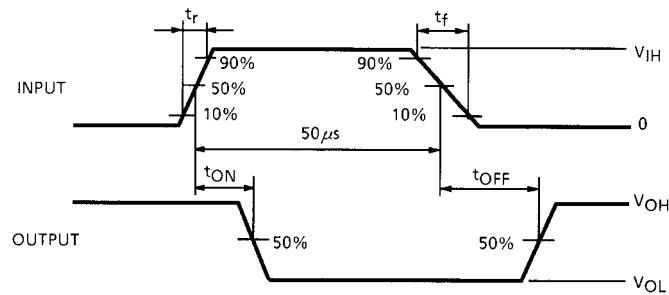


6. I_R



7. V_F



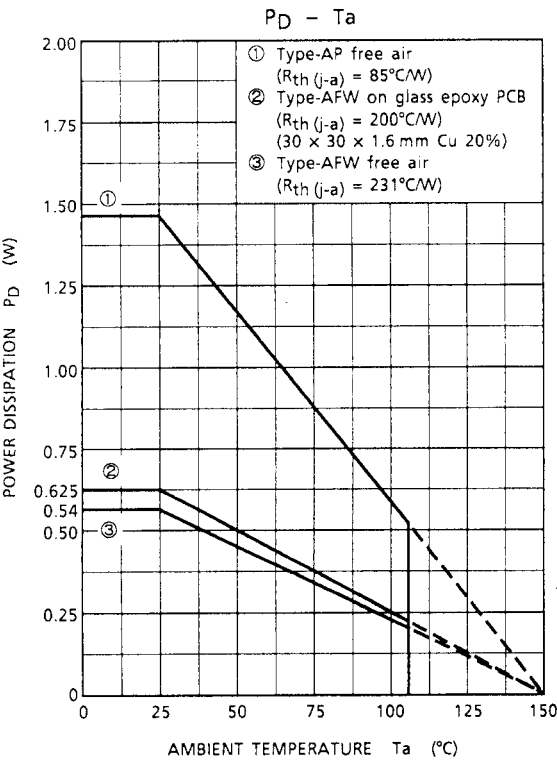


Note 2: See below

Type Number	R1	V _{IH}
ULQ2003AP/AFW	0	3 V

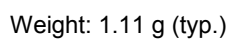
Precautions for Using

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.



DIP16-P-300-2.54A

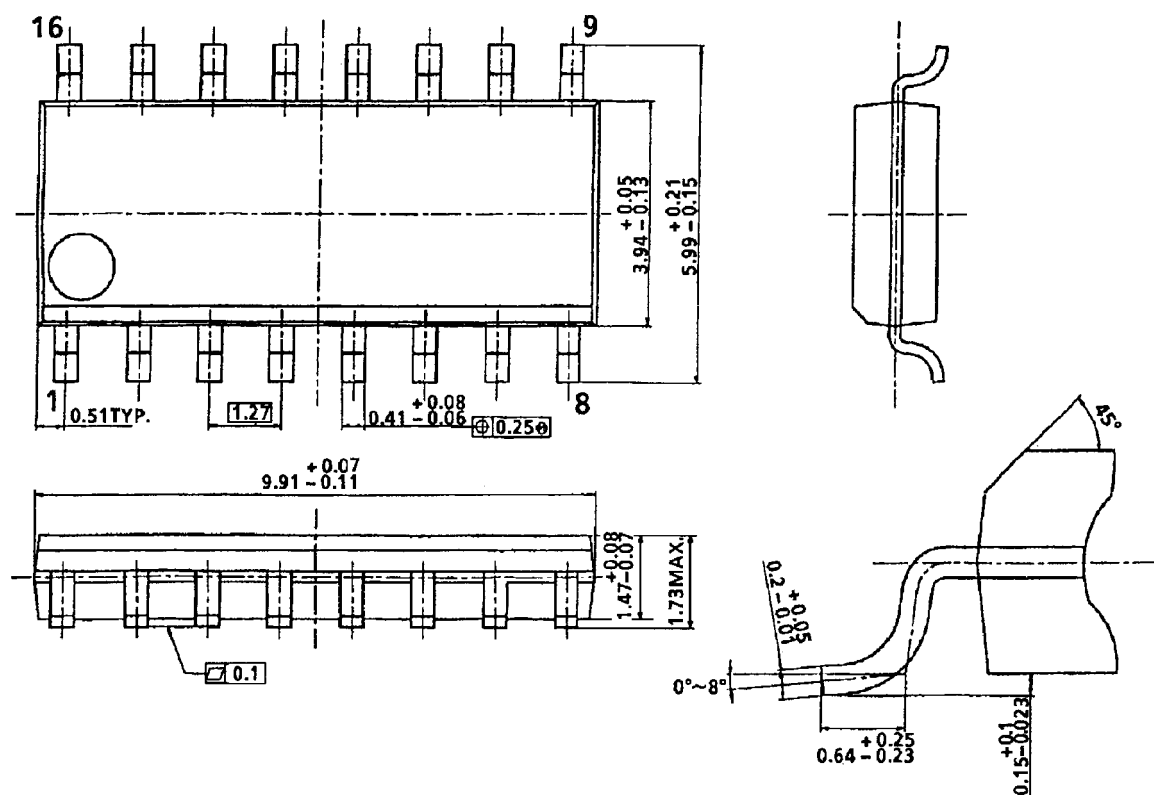
Unit : mm



Package Dimensions

SOL16-P-150-1.27A

Unit : mm



Weight: 0.15 g (typ.)

RESTRICTIONS ON PRODUCT USE

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