

## I/O 24 ULN2803 Switch Board

The I/O 24 ULN2803 Switch Board shown below in diagram 1 is a very useful accessory board that allows much higher voltage and current devices to be interfaced to the low level logic provided by the I/O24 modules.



Diagram 1

The board consists of a ULN 2803 and LED indicator setup to indicate which channels are currently active.

The ULN2803 consists of 8-bit TTL-input NPN darlington sink drivers. Each darlington driver can handle a maximum of 500mA continuous (when using a single channel only) and can withstand a maximum 50V in its off state. This makes the ULN2803 well suited to provide an interface between the low logic level interfaces and higher current/voltage devices such as relays, solenoids, motors and lamps.

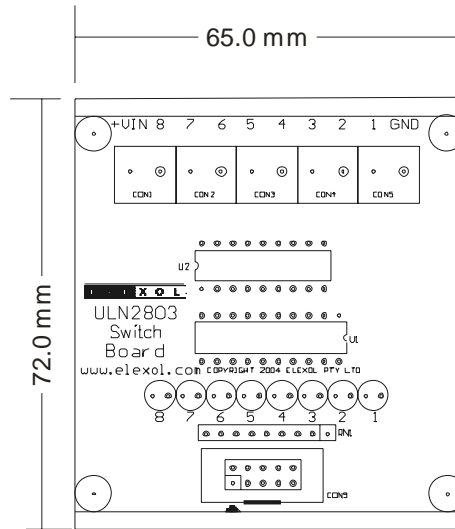
The connections to the board are by screw terminals that will accept cables 0.5 – 2mm<sup>1</sup>. The connection between the I/O24 module and the ULN2803 switch board is via a 30 cm IDC connection cable provided with the board.

The board has been designed to a 72mm standard width so that it can easily be mounted in DIN rail mounting modules.

### BOARD FEATURES

- 1 x ULN2803 High Voltage / High Current Transistor Array
- Indication LED's for channel status
- Screw Terminal Blocks for outputs
- Easy connection by 10-way box header to suit standard IDC connector for connection to the I/O port.
- 72mm Standard width for DIN Rail Modules

## BOARD LAYOUT AND PHYSICAL DIMENSIONS

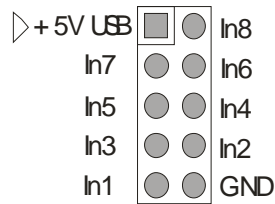


**Dimensions** – 2.6 X 2.8 X 1 inches (65 X 72 X 25.4mm)

## BOARD CONNECTIONS

### 10 pin Box Header Pin out

Shown in the diagram below is the I/O port Connector for each of the Ports on the module.



Note: Pin1 Marked on I/O Accessory with ▷

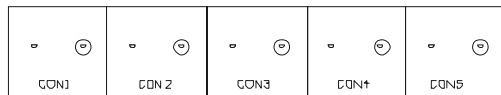
Listed in Table 1 below are the connections for the 10 Pin Box Header

PIN #	SIGNAL	TYPE	DESCRIPTION
1	+5V USB	PWR	+5V drawn from I/O module powers
2	In8	I	Input pin to control relay 8
3	In7	I	Input pin to control relay 7
4	In6	I	Input pin to control relay 6
5	In5	I	Input pin to control relay 5
6	In4	I	Input pin to control relay 4
7	In3	I	Input pin to control relay 3
8	In2	I	Input pin to control relay 2
9	In1	I	Input pin to control relay 1
10	GND	PWR	Ground signal USB BUS and all I/O

## ULN2803 CONNECTION TERMINALS

The connections for the channels are as follows:

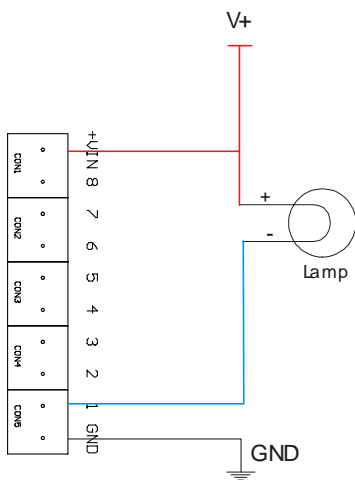
+VIN 8 7 6 5 4 3 2 1 GND



SIGNAL	TYPE	DESCRIPTION
+VIN	PWR	External Voltage to power output channels when switch via I/O 24
8	O	Output channel 8
7	O	Output channel 7
6	O	Output channel 6
5	O	Output channel 5
4	O	Output channel 4
3	O	Output channel 3
2	O	Output channel 2
1	O	Output channel 1
GND	PWR	Ground signal USB BUS and all I/O

## OPERATION

The following circuit configuration is provided as an example. It uses an Incandescent lamp other devices like relays could be used as an alternative.



To operate the ULN2803 board an external power supply (not exceeding maximum ratings) needs to be connected to the +VIN connection terminal and the positive terminal for the lamp. The negative terminal connects to the channel. When the channel is activated by the IO24 module the connection to the lamp will go low causing the lamp to turn on. The circuit can be modified to activate relays, solenoids etc.

Note: Care must be taken not to exceed the maximum specifications of the ULN2803. For more information in regards to the ULN2803 please refer to the datasheet.

## APPLICATIONS

Listed below are just a few applications the Relay board could be used for:

- Power Switching
- On/Off Control
- Home Automation
- Relays, Motors
- Solenoids, Solenoid valves
- Lamps etc

## SPECIFICATIONS

### Dimensions

6.1 X 2.8 X 1 inches (154.5 X 72 X 25.4mm)

### ULN2803 Characteristics

#### MAXIMUM RATINGS (Ta = 25°C)

CHARACTERISTIC		SYMBOL	RATING	UNIT
Output Sustaining Voltage		V <sub>CE(SUS)</sub>	-0.5~50	V
Output Current		I <sub>OUT</sub>	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		I <sub>F</sub>	500	mA
Power Dissipation	AP	P <sub>D</sub>	1.47	W
	AFW		0.92 / 1.31 (Note)	
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%)

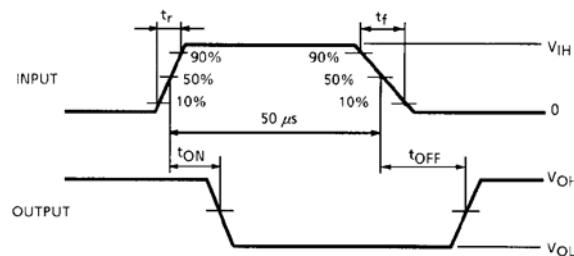
#### RECOMMENDED OPERATING CONDITIONS (Ta = -40~85°C)

CHARACTERISTIC		SYMBOL	TEST CONDITION	MIN	TYP.	MAX	UNIT
Output Sustaining Voltage		V <sub>CE(SUS)</sub>		0	—	50	V
Output Current	AP	I <sub>OUT</sub>	T <sub>pw</sub> = 25 ms, Duty = 10%, 8 Circuits	0	—	347	mA / ch
			T <sub>pw</sub> = 25 ms, Duty = 50%, 8 Circuits	0	—	123	
	AFW		T <sub>pw</sub> = 25 ms, Duty = 10%, 8 Circuits	0	—	268	
			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	V <sub>IN(ON)</sub>		3.5	—	30	V
	ULN2804AP / AFW			8	—	30	
Clamp Diode Reverse Voltage		V <sub>R</sub>		—	—	50	V
Clamp Diode Forward Current		I <sub>F</sub>		—	—	400	mA
Power Dissipation	AP	P <sub>D</sub>	Ta = 85°C	—	—	0.76	W
	AFW		Ta = 85°C (Note)	—	—	0.48	

**ELECTRICAL CHARACTERISTICS (Ta = 25°C)**

CHARACTERISTIC	SYMBOL	TEST CIRCUIT	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	
			V <sub>CE</sub> = 50 V, V <sub>IN</sub> = 1 V	—	—	500	
Collector–Emitter Saturation Voltage	V <sub>CE (sat)</sub>	2	I <sub>OUT</sub> = 350 mA, I <sub>IN</sub> = 500 μA	—	1.3	1.6	V
			I <sub>OUT</sub> = 200 mA, I <sub>IN</sub> = 350 μA	—	1.1	1.3	
			I <sub>OUT</sub> = 100 mA, I <sub>IN</sub> = 250 μA	—	0.9	1.1	
Input Current	I <sub>IN (ON)</sub>	2	V <sub>IN</sub> = 3.85 V	—	0.93	1.35	mA
			V <sub>IN</sub> = 5 V	—	0.35	0.5	
			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
Input Voltage (Output On)	V <sub>IN (ON)</sub>	5	V <sub>CE</sub> = 2 V, I <sub>OUT</sub> = 200 mA	—	—	2.4	V
			V <sub>CE</sub> = 2 V, I <sub>OUT</sub> = 250 mA	—	—	2.7	
			V <sub>CE</sub> = 2 V, I <sub>OUT</sub> = 300 mA	—	—	3.0	
			V <sub>CE</sub> = 2 V, I <sub>OUT</sub> = 125 mA	—	—	5.0	
			V <sub>CE</sub> = 2 V, I <sub>OUT</sub> = 200 mA	—	—	6.0	
			V <sub>CE</sub> = 2 V, I <sub>OUT</sub> = 275 mA	—	—	7.0	
			V <sub>CE</sub> = 2 V, I <sub>OUT</sub> = 350 mA	—	—	8.0	
DC Current Transfer Ratio	h <sub>FE</sub>	2	V <sub>CE</sub> = 2 V, I <sub>OUT</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>OUT</sub> = 50 V	—	0.1	—	μs
Turn–Off Delay	t <sub>OFF</sub>		R <sub>L</sub> = 125 Ω, V <sub>OUT</sub> = 50 V	—	0.2	—	

**Timing Diagram for ULN2803**



For further information regarding the release of this product please visit our website at <http://www.elexol.com> or contact us via email at [enquires@elexol.com](mailto:enquires@elexol.com)