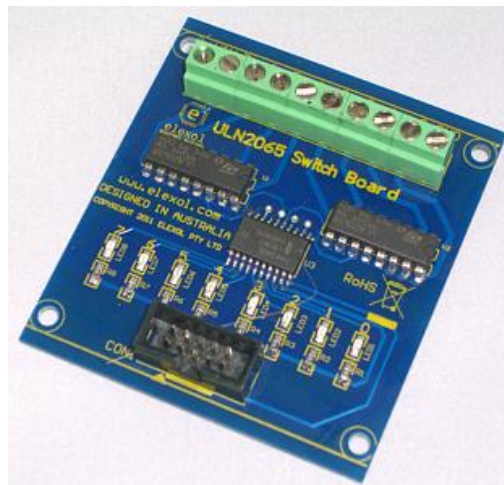


ULN2065B SWITCH BOARD

FEATURES

- 2 x ULN2065B(80V 1.5A Quad Darlington switches)
- Indication LEDs for the output status and input channels
- Screw Terminal Blocks for Relay outputs and opto input channels
- Easy connection to the I/O port via a 10-way box header that suits a standard IDC connector.



GENERAL DESCRIPTION

The ULN2065B Switch Board is an accessory board that allows the control of much higher voltages and currents via Darlington switches rather than the standard I/O's on the I/O 24.

The Darlington switches are controlled from a single port on the existing I/O 24 Range. The Elexol I/O 24 Range consists of Ether I/O 24 R, Ether I/O 24 DIP R, USB I/O 24 R and the USB I/O 24 DIP R.

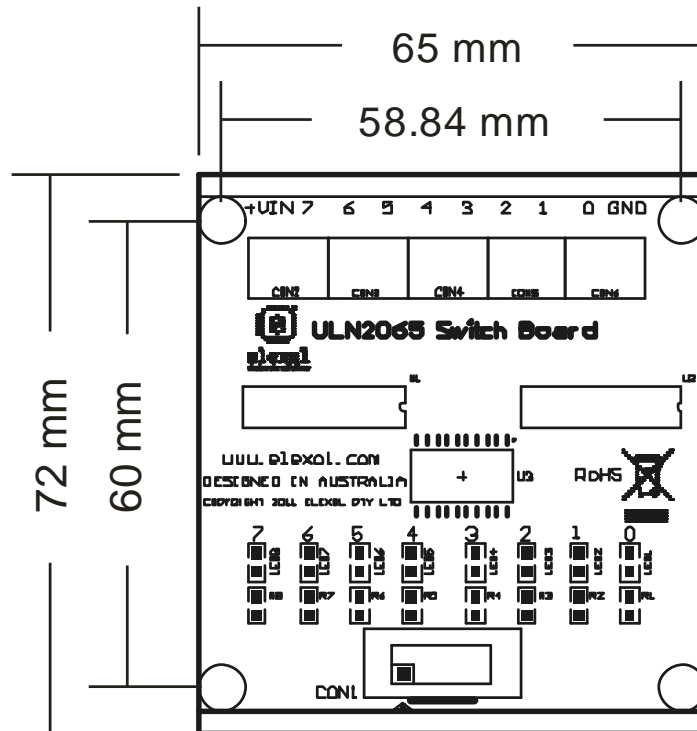
The board consists of 2 ULN2065B Quad Darlington Switches and LED indicator setup to indicate which channels are currently active.

The ULN2065B devices each contain four NPN Darlington switches delivering up to 1.5 A with a specified minimum breakdown of 50 V and a sustaining voltage of 35 V measured at 100 mA.

The channels output connections are by screw terminals that will accept cables 0.5 - 2mm. The connection between the I/O24 module and the Combo 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.

LAYOUT AND MECHANICALS



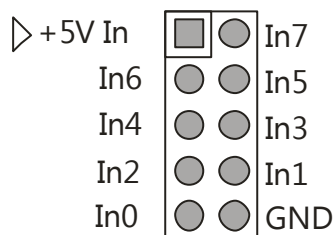
Dimensions: 2.56 X 2.8 X 1 inches (65 X 72 X 25.4mm)

PINOUTS AND BOARD CONNECTIONS

10 PIN BOX HEADER

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

I/O 24 ULN2065 Board Port Connection



Note: Pin1 Marked on I/O Accessory with ▷

Listed in the table below are the connections for the 10 Pin Box Header

PIN #	SIGNAL	TYPE	DESCRIPTION
1	+5V	PWR	+3.3V to +5V drawn from I/O module powers (Supplies power to the I/O Board)
2	IN7	I	Input pin to control Darlington switch
3	IN6	I	Input pin to control Darlington switch
4	IN5	I	Input pin to control Darlington switch
5	IN4	I	Input pin to control Darlington switch
6	IN3	I	Input pin to control Darlington switch
7	IN2	I	Input pin to control Darlington switch
8	IN1	I	Input pin to control Darlington switch
9	IN0	I	Input pin to control Darlington switch
10	GND	PWR	Ground signal from I/O module

ULN2065B TERMINAL CONNECTIONS

+VIN 7 6 5 4 3 2 1 0 GND



The connections for the output relay channels are as follows:

SIGNAL	TYPE	DESCRIPTION
+VIN	PWR	External Voltage to power output channels when switched via the I024
7	0	Switched control Darlington switch
6	0	Switched control Darlington switch
5	0	Switched control Darlington switch
4	0	Switched control Darlington switch
3	0	Switched control Darlington switch
2	0	Switched control Darlington switch
1	0	Switched control Darlington switch
0	0	Switched control Darlington switch
GND	PWR	Ground signal from I/O module

COMMUNICATIONS

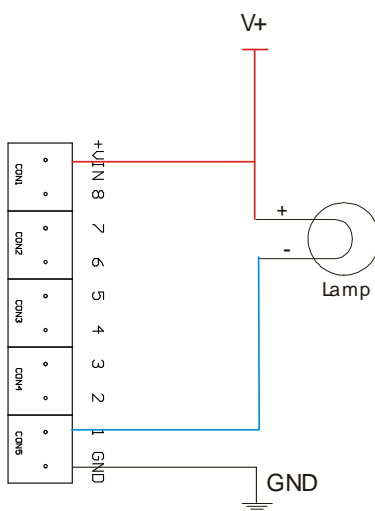
SETTING UP THE PORT ON THE I/O 24 TO OPERATE THE I/O 24 ULN2065B

The port on the I/O 24 will have to be set up for output. The direction of the port will have to be set to $0x00$ which will set the pins for output.

I/O 24 COMMAND	DESCRIPTION
!A $0x00$	Initialise PORT Direction on I/O 24
A $0xFF$	All Switches ON
A $0x00$	All Swtiches OFF

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 ULN2065 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 I024 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 ULN2065. For more information in regards to the ULN2065 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

CODING EXAMPLES

Coding examples of setting and controlling the ports on the I/O 24 modules are available for download from our website www.elexol.com

ULN2065B Characteristics

Table 2. Absolute maximum ratings

Symbol	Parameter	Value	Unit
V_{CEX}	Output voltage	80	V
$V_{CE(SUS)}$	Output sustaining voltage	50	V
I_O	Output current	1.75	A
V_I	Input voltage ULN2075B	60	V
	Input voltage ULN2067B	30	
	Input voltage ULN2065B - ULN2069B	15	
I_I	Input current	25	mA
V_S	Supply voltage for ULN2068B	10	V
P_{TOT}	Power dissipation at $T_{PINS} = 90^\circ\text{C}$	4.3	W
	Power dissipation at $T_{AMB} = 70^\circ\text{C}$	1	
T_{AMB}	Operating ambient temperature range	- 20 to 85	$^\circ\text{C}$
T_{STG}	Storage temperature	- 55 to 150	$^\circ\text{C}$

Table 3. Electrical characteristics ($T_A = 25^\circ\text{C}$ unless otherwise specified).

Symbol	Parameter	Test condition	Min.	Typ.	Max.	Unit
I_{CEX}	Output leakage current (Figure 3)	$V_{CE} = 80\text{V}$, $T_A = 25^\circ\text{C}$			100	μA
		$V_{CE} = 80\text{V}$, $T_A = 70^\circ\text{C}$			500	
$V_{CE(SUS)}$	Collector-emitter sustaining voltage (Figure 4)	$I_C = 100\text{mA}$, $V_I = 0.4\text{V}$	50			V
$V_{CE(SAT)}$	Collector-emitter saturation voltage (Figure 5)	$I_C = 500\text{mA}$, $I_B = 625\mu\text{A}$			1.1	V
		$I_C = 750\text{mA}$, $I_B = 935\mu\text{A}$			1.2	
		$I_C = 1\text{A}$, $I_B = 1.25\text{mA}$			1.3	
		$I_C = 1.25\text{A}$, $I_B = 2\text{mA}$			1.4	
		$I_C = 1.5\text{A}$, $I_B = 2.25\text{mA}$			1.5	
$I_{I(OH)}$	Input current (Figure 6)	for ULN2065B and ULN2075B $V_I = 2.4\text{V}$ $V_I = 3.75\text{V}$	1.4 3.3		4.3 9.6	mA
		for ULN2067B, $V_I = 5\text{V}$ $V_I = 12\text{V}$	0.6 1.7		1.8 5.2	
		for ULN2069B, $V_I = 2.75\text{V}$ $V_I = 3.75\text{V}$			0.55 1.0	
$V_{I(OH)}$	Input voltage (Figure 7)	$V_{CE} = 2\text{V}$, $I_C = 1\text{A}$ ULN2065B, ULN2075B, ULN2067B			2 6.5	V
		$V_{CE} = 2\text{V}$, $I_C = 1.5\text{A}$ ULN2065B, ULN2075B, ULN2067B ULN2069B			2.5 10 2.75	
I_S	Supply Current (Figure 10)	for ULN2069B, $V_I = 2.75\text{V}$, $I_C = 500\text{mA}$			6	mA
t_{PLH}	Turn-on delay time	$0.5 V_I$ to $0.5 V_O$			1	μs
t_{PHL}	Turn-off delay time	$0.5 V_I$ to $0.5 V_O$			1.5	μs
I_R	Clamp diode leakage current (Figure 8)	For ULN2065B - ULN2067B - ULN2069B, $V_R = 50\text{V}$ $T_A = 25^\circ\text{C}$ $T_A = 70^\circ\text{C}$			50 100	μA
V_F	Clamp diode forward voltage (Figure 9)	For ULN2065B - ULN2067B - ULN2069B $I_F = 1\text{A}$ $I_F = 1.5\text{A}$			1.75 2	V

Note: Input voltage is with reference to the substrate (no connection to any other pins) for the ULN2075B reference is ground for all other types.

Note: 1 Input current may be limited by maximum allowable input voltage.

ULN2065B Characteristics referenced from

STMicroelectronics, 2009 ULN2065B Datasheet.

http://www.st.com/internet/com/TECHNICAL_RESOURCES/TECHNICAL_LITERATURE/DATASHEET/CD00000178.pdf

DOCUMENT REVISION HISTORY

ULN2065B SWITCH BOARD DATASHEET – REVISION 1 created DECMEBER 2013