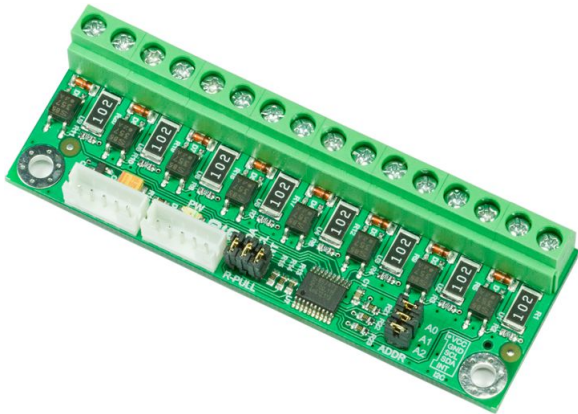# I2C-IN830S, I2C-IN830SA

I2C Bus 8-Input Optocouplers

Features

- PCF8574 and PCF8574A I2C bus chips
- Support 100kHz I2C bus frequency
- Selectable I2C bus pull-up resistors
- Address by 3 jumpers for use of up to 8 addresses
- Up to 16 boards on the same bus
- Interrupt output signal
- Selectable interrupt pull-up resistor
- Compatible with almost microcontrollers
- 8 Optically isolated digital input channels
- 3.0Vdc to 30Vdc input voltage
- More than 30Vdc can be accepted by adding external resistors
- 3700Vdc isolation input voltage
- Operating power supply voltage 2.5Vdc to 5.5Vdc
- Inverse polarity protection circuits
- Small board, PCB size 28x81.5mm

Description

This is a board for remote 8-input expander for I2C bus based on PCF8574 (PCF8574A for I2C-IN830SA). Making it ideal as an isolation input expander for I2C bus. It is designed to compatible with almost 2.5V to 5.5V microcontrollers.

The PCF8574 and the PCF8574A are the I2C bus expander chips which talk to microcontroller and then read status of input voltages from optocouplers. They support 100kHz bus frequency. And they can be connected to 2.5V to 5.5V of I2C port of microcontrollers. Normally the I2C bus needs pull-up resistors for pulling-up SDA and SCL lines. The board has these resistors and jumpers. These resistors can be enabled or disabled by the jumpers.

The board has an interrupt output signal. On this line, the board can inform the microcontroller if there is incoming voltage on its inputs. The interrupt pin is open-drain so it needs pull-up resistor. This resistor is presented on the board and it is enabled or disabled by a jumper.

The board has 8 optocouplers for input voltages. Each input supports high level logic 3.0Vdc to 30Vdc. However the inputs of the board can accept more than 30Vdc but they need external resistors.

The board is addressed by 3 jumpers to make 8 different addresses. So that 8 boards can be connected together on the same bus. Moreover 16 boards can be connected together on the same bus when they have 16 different addresses. So, 8 boards of the PCF8574 and 8 boards of the PCF8574A can be connected together on the same bus because the PCF8574 doesn't have the same address as the PCF8574A.

The board has inverse polarity protection circuits to prevent damage from a mistake of connection. Also the board has an LED to show status of the power supply input voltage.

The board is designed for small size. The size of PCB is 28x81.5mm.

The I2C-IN830S and I2C-IN830SA models differ only in their I2C chip which they also differ in slave address. The I2C-IN830S and I2C-IN830SA can replace the EI2C-9AG and the EI2C-9AGA respectively.
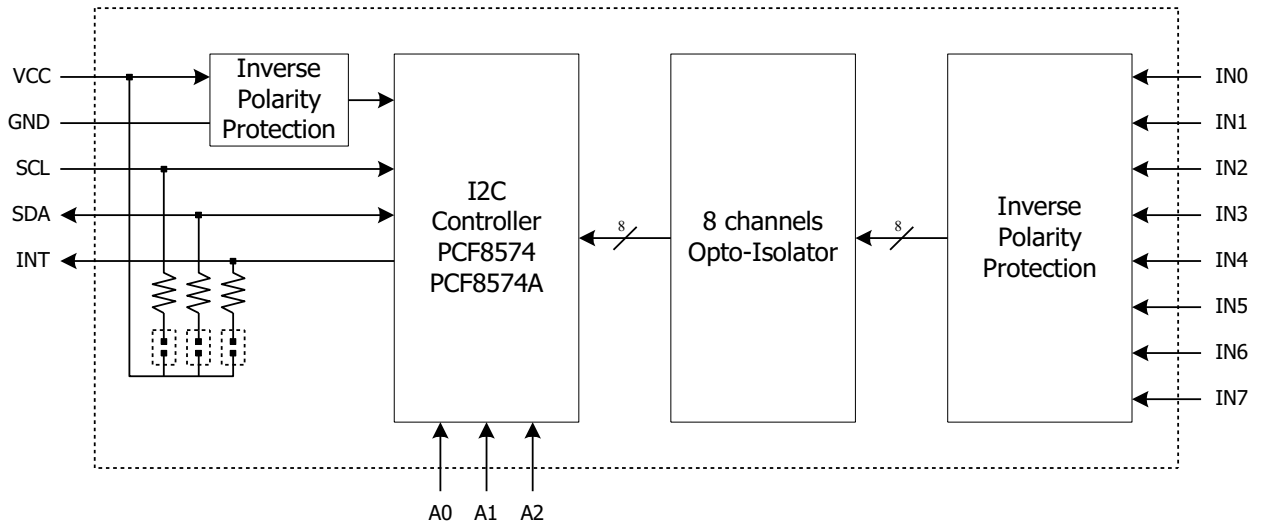
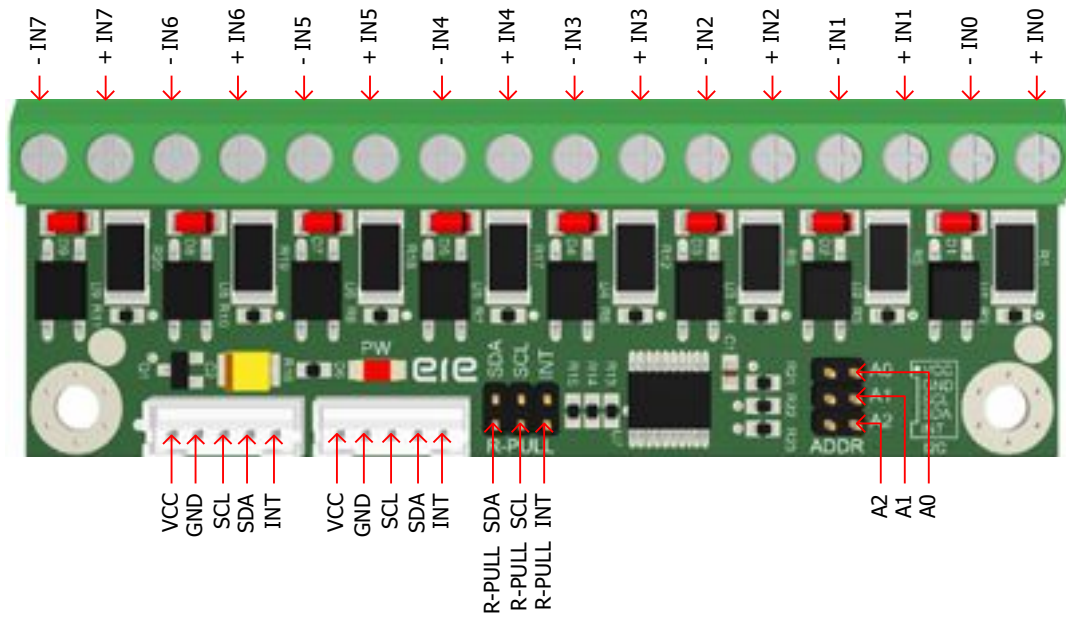**Board Diagram**

Figure 1: Block Diagram

Figure 2: Board Diagram

Table 1: Pins Description

Symbol	Description
VCC	Power supply input voltage 2.5Vdc to 5.5Vdc.
GND	Ground.
SCL	I2C bus serial clock signal.
SDA	I2C bus serial data signal.
INT	Interrupt output signal.
R-PULL SDA	A jumper for selecting 10K pull-up resistor of SDA signal.
R-PULL SCL	A jumper for selecting 10K pull-up resistor of SCL signal.
R-PULL INT	A jumper for selecting 10K pull-up resistor of INT signal.
A0	A jumper for selecting address of A0.
A1	A jumper for selecting address of A1.
A2	A jumper for selecting address of A2.
+IN0 … +IN7	Positive voltage terminals for Input0, Input1, Input2, Input3, Input4, input5, intpu6 and input7.
-IN0 … -IN7	Negative voltage terminals for Input0, Input1, Input2, Input3, Input4, input5, intpu6 and input7.

I2C Bus Pull-Up Registers

The I2C bus need resistors for pulling-up SCL and SDA lines. A board has two 10k pull-up resistors for this purpose. These resistors can be enabled by closing jumpers. These resistors have to be enabled if there is no pull-up resistor on microcontroller board.

When many boards are connecting together on the same bus. *Normally the only one board enables the pull-up resistors.* If many boards are enabled the . The pull-up resistors are strong.
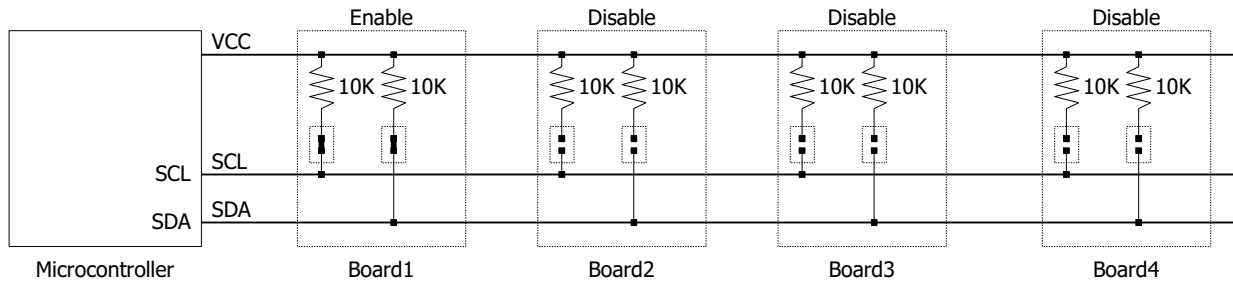

Figure 3: I2C bus pull-up resistors

Interrupt Signal

Interrupt output signal(INT) of board which can be connected to the interrupt input pin of microcontroller. The board sends an interrupt signal on this line. So the board can inform the microcontroller if there is incoming voltage on its inputs without having to poll over the I2C bus. The interrupt output pin is open-drain and it is connected to 10K pull-up resistor via a jumper.

When multiple boards are connected together on a same one interrupt line. *Normally the only one pull-up resister has to be enabled*. Each board takes logical OR to others, many interrupt signals can occur at the same time.
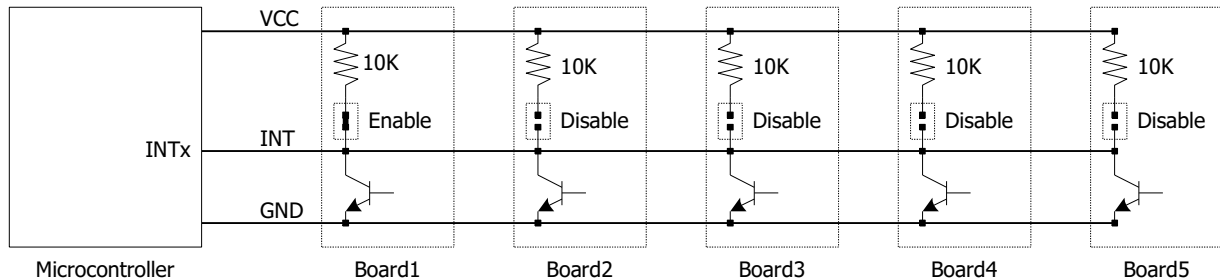

Figure 4: Logical OR interrupt signals

ERE Company Limited.

VCC GND SCL SDA INT

2.5V-5.5V

to another board

enable/disable R-PULLs for I2C-bus and interrupt
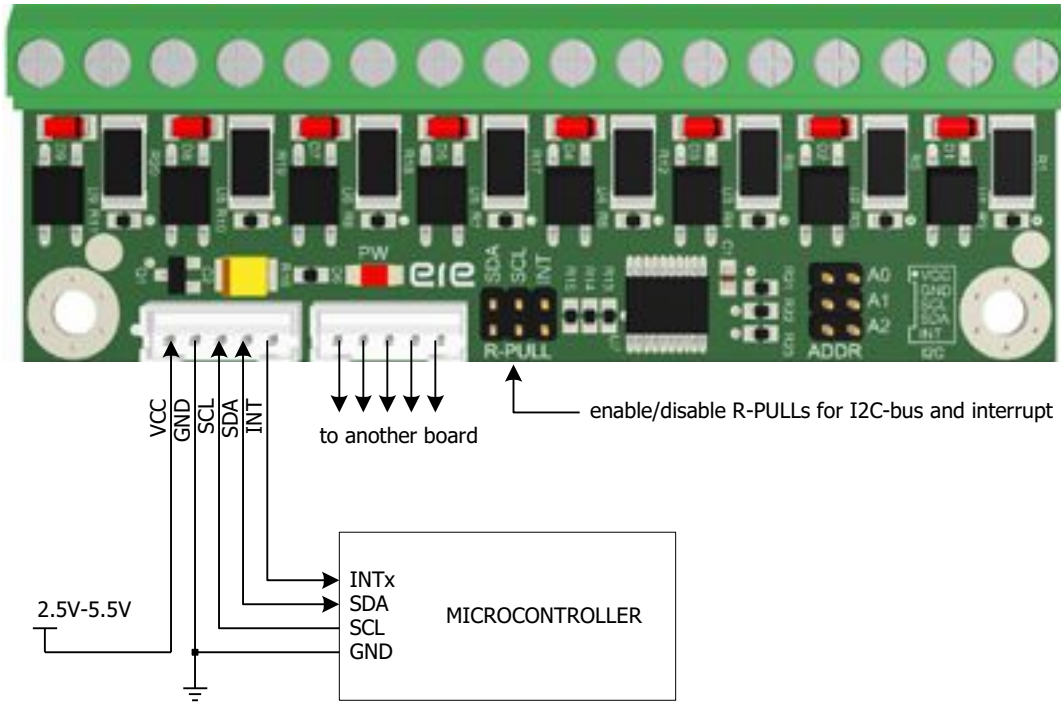
INTx
SDA   MICROCONTROLLER
SCL
GND

Figure 5: Interfacing

The boards can be connected all together up to 16 boards on the same bus by connecting 8 boards of I2C-IN830S and 8 boards of I2C-IN830SA. Because the I2C-IN830S use PCF8574 and the I2C-IN830SA use PCF8574A. The PCF8574 and the PCF8574A don't have the same address. Then the I2C-IN830S and the I2C-IN830SA can be defined 16 different addresses.
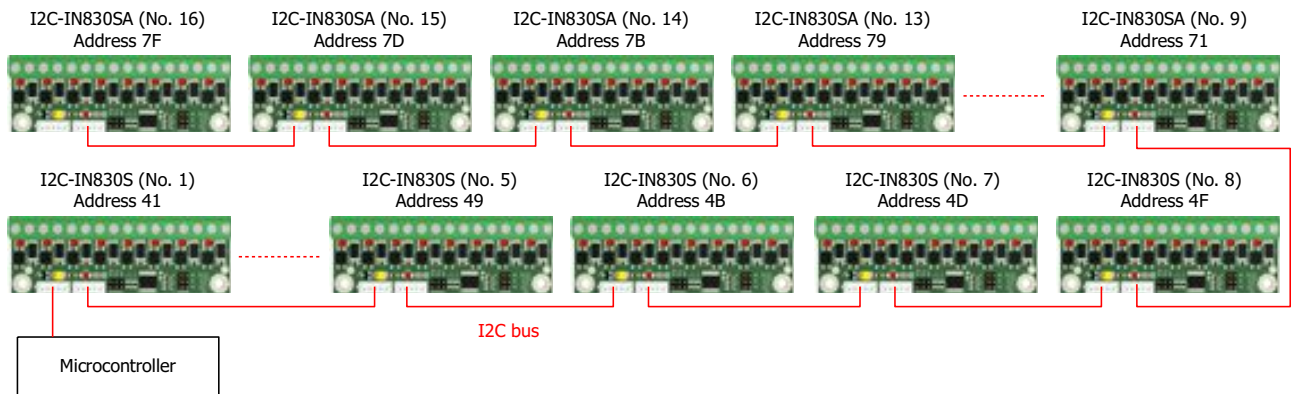

I2C-IN830SA (No. 16) Address 7F	I2C-IN830SA (No. 15) Address 7D	I2C-IN830SA (No. 14) Address 7B	I2C-IN830SA (No. 13) Address 79	I2C-IN830SA (No. 9) Address 71

I2C-IN830S (No. 1) Address 41	I2C-IN830S (No. 5) Address 49	I2C-IN830S (No. 6) Address 4B	I2C-IN830S (No. 7) Address 4D	I2C-IN830S (No. 8) Address 4F

I2C bus

Microcontroller

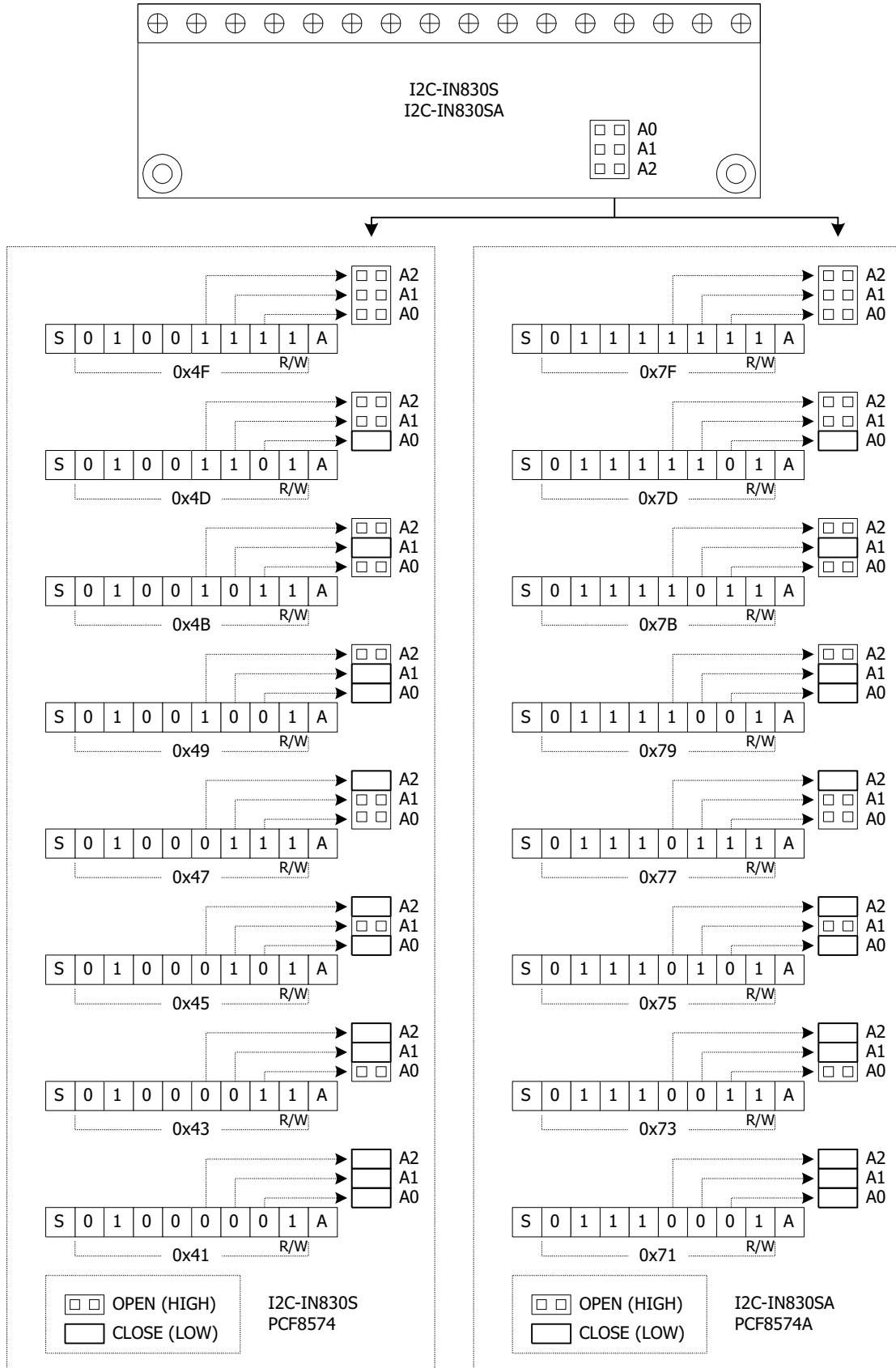Figure 6: 16 boards over the same bus

Figure 7: Addressing

Input Diagram

The board use optocouplers to isolate input signals from the I2C chip. Each input supports high logic voltage from 3.0Vdc to 30Vdc. All inputs have the inverse polarity protection circuits.
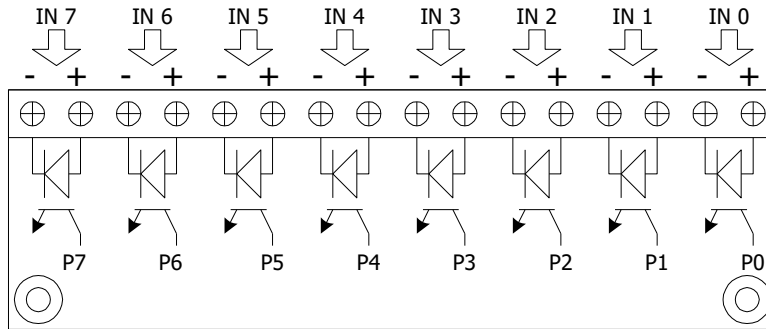

Figure 8: Input diagram

The board has a 1K resistor for each input channel and limits 30mA for maximum input current. So the board needs an additional resistor for each input if more than 30Vdc is applied into input of the board.

Example. If 48Vdc are applied to the inputs of board. The board needs 600ohm resistors for external input resistors. Then the current of each channel is about (48V/1.6K) 30mA. The power of the resistors can be known from (I x I x R). It is (30mA x 30mA x 600) 540mW. Select 600ohm, 1W for external input resistors.
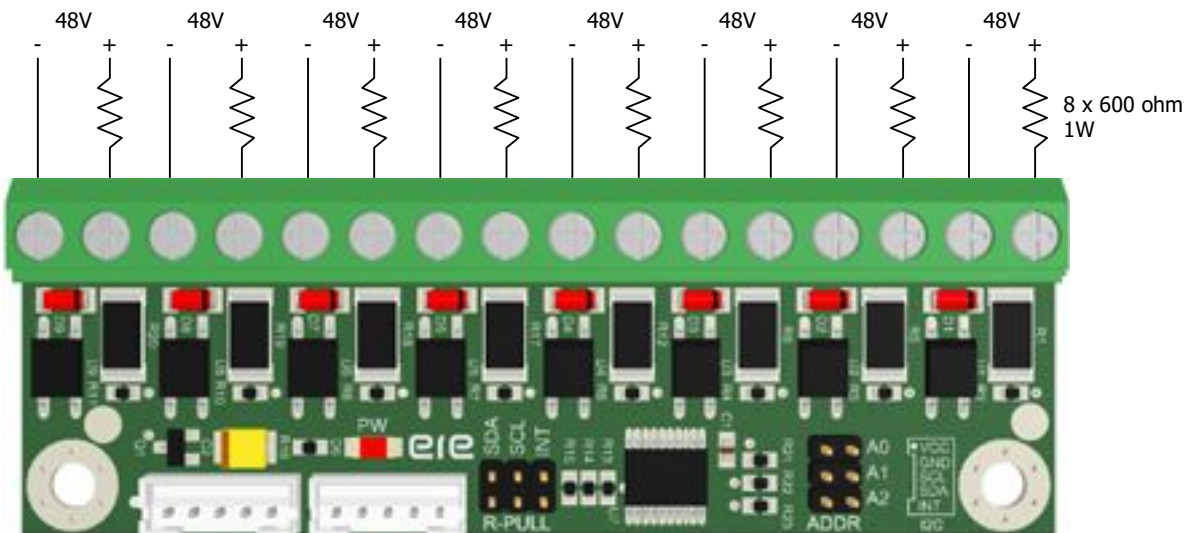
Figure 9: Over input voltages

When inputs of board are read via I2C bus. The logic of these inputs will be placed into data frame of I2C chip.
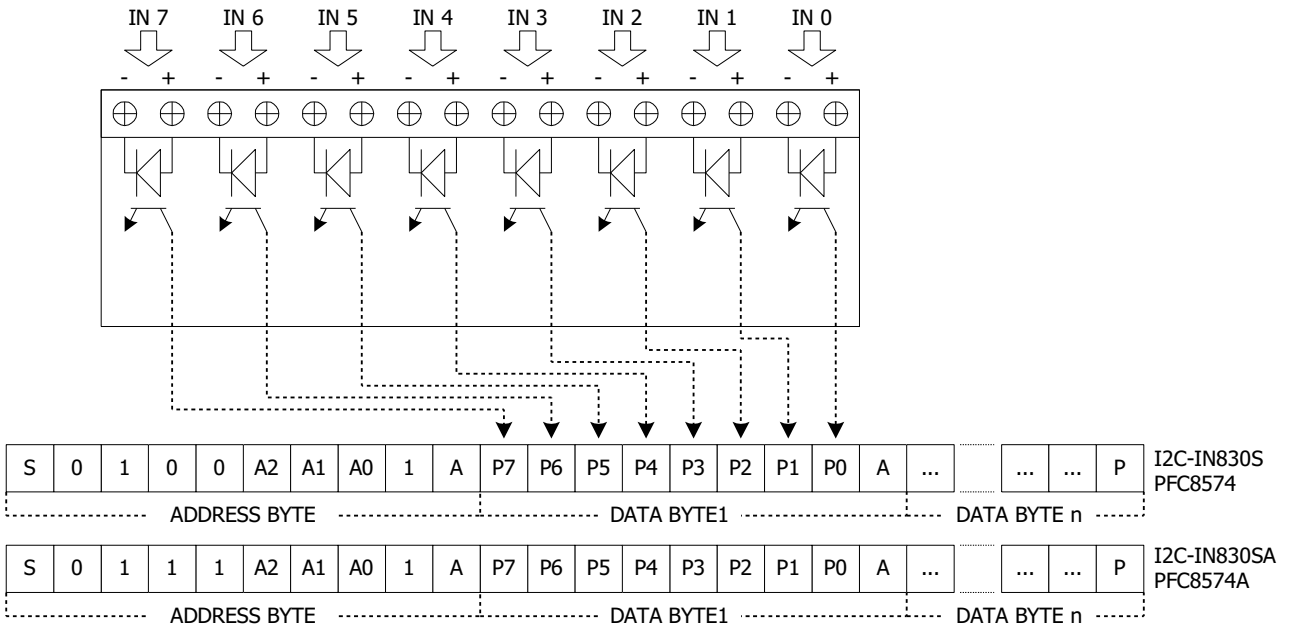

Figure 10: Input data frame

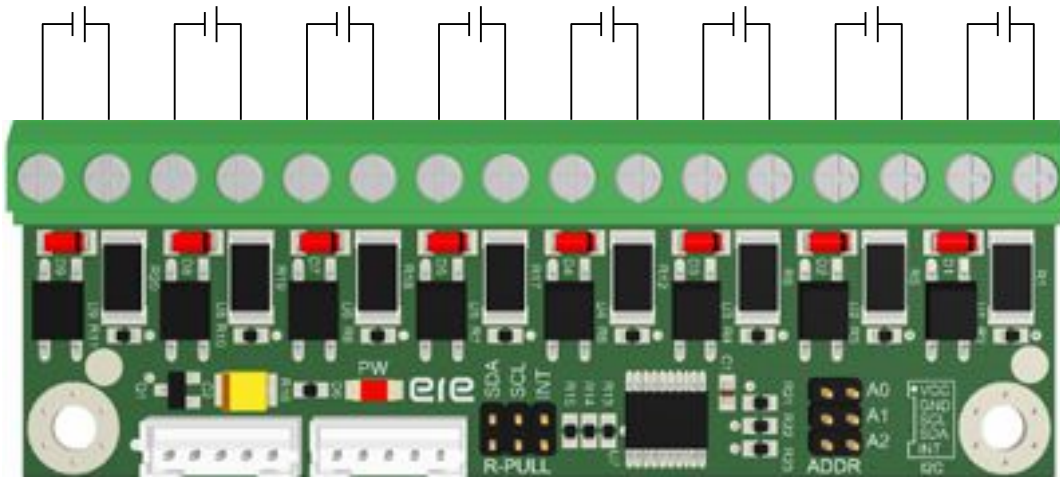**Application Note 1:** Constant voltage sources are applied into inputs.

Figure 11: Constant input voltages

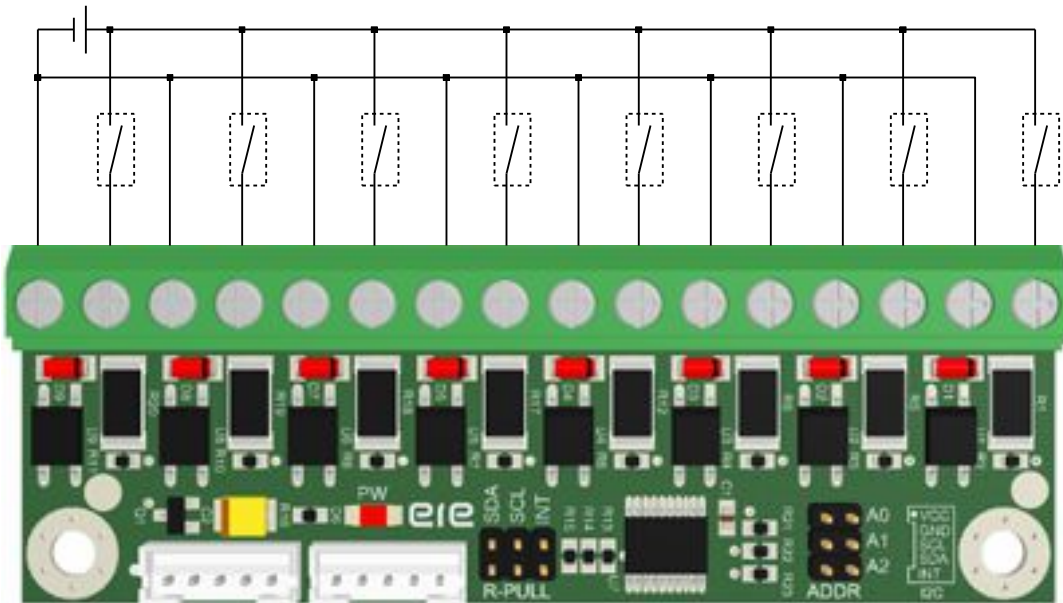**Application Note 2:** Switches are turning on/off positive voltage.

Figure 12: Switch input voltages

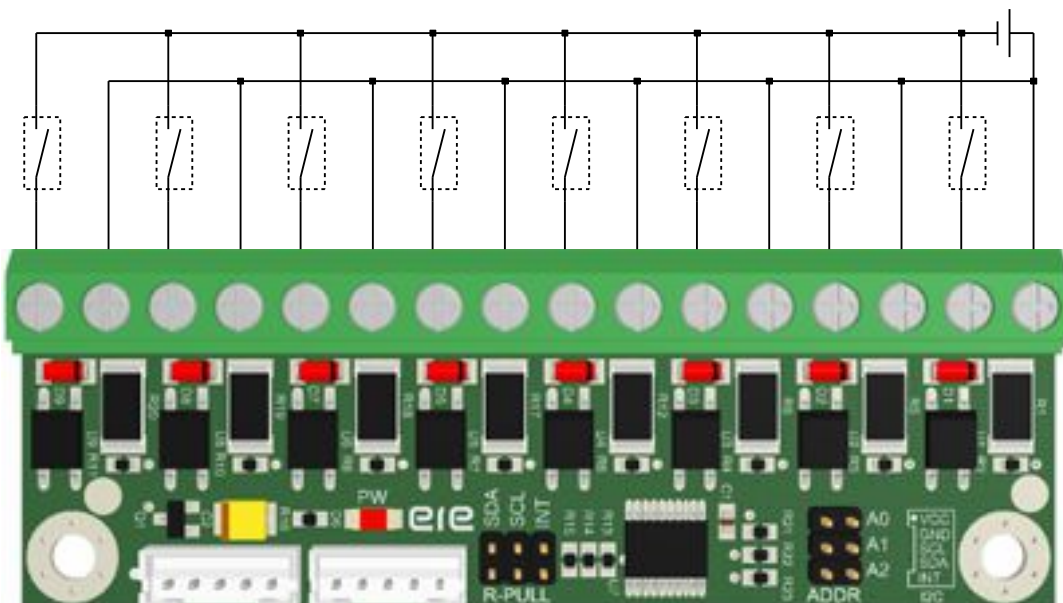**Application Note 3:** Switches are turning on/off ground.

Figure 13: Switch input ground

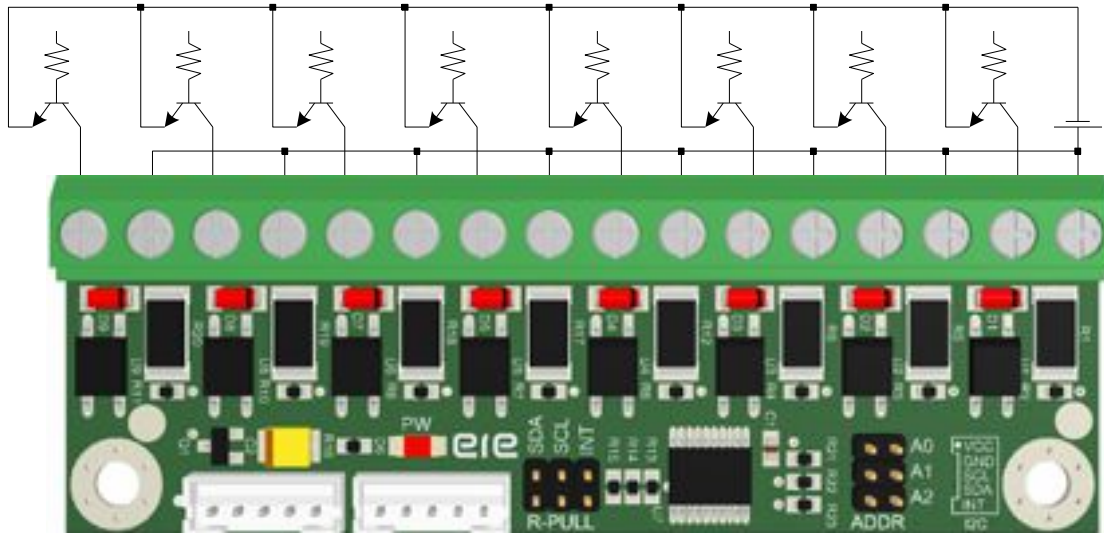**Application Note 4:** NPN transistors are turning on/off voltage, common emitter.

Figure 14: NPN Transistors, common emitter

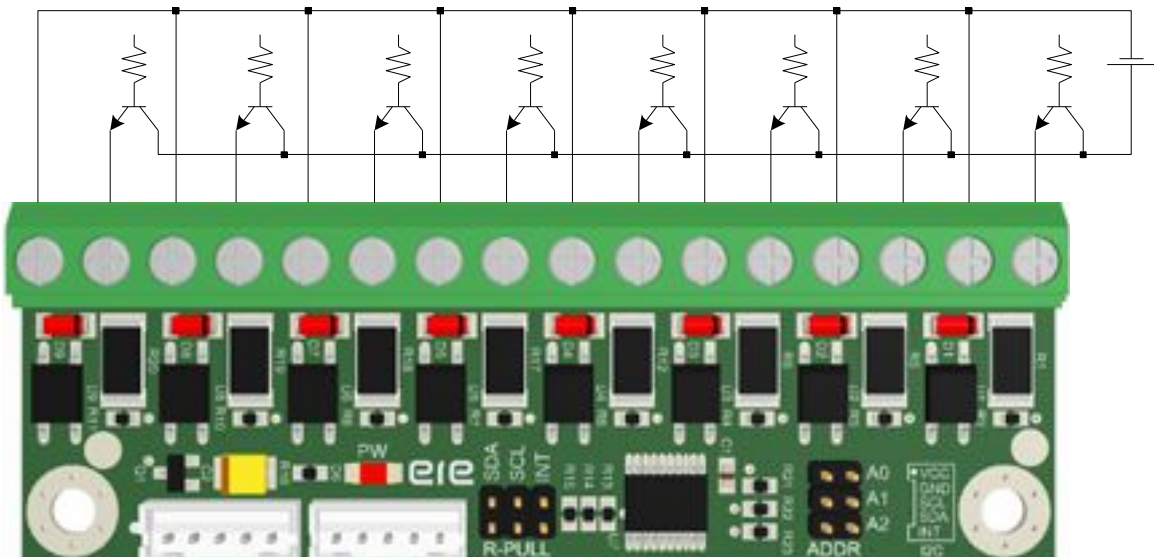**Application Note 5:** NPN transistors are turning on/off voltage, common collector.

Figure 15: NPN Transistors, common collector

Application Note 6: PNP Transistors are turning on/off voltage, common emitter.
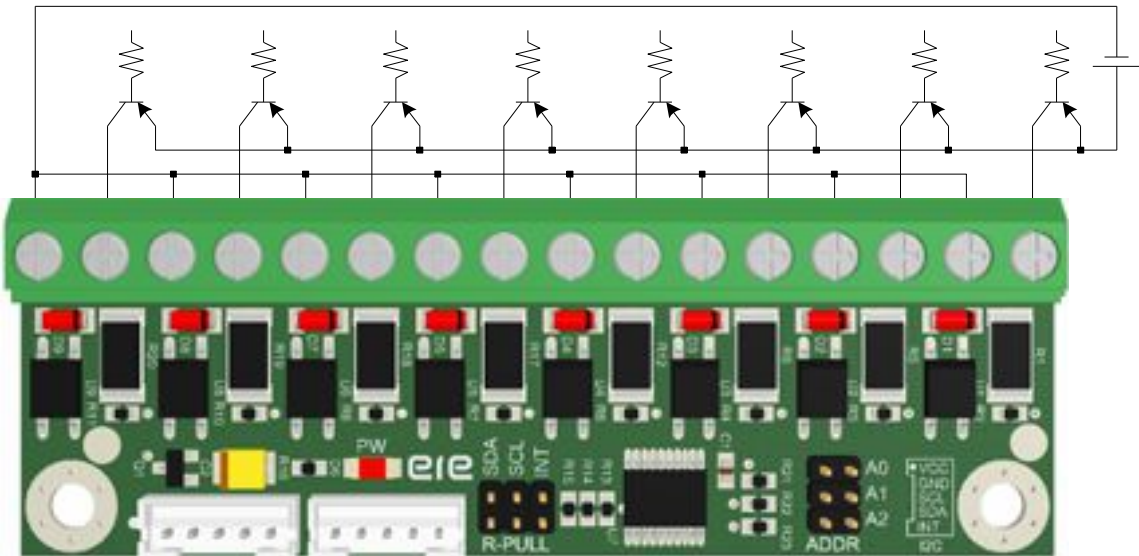

Figure 16: PNP Transistors, common emitter

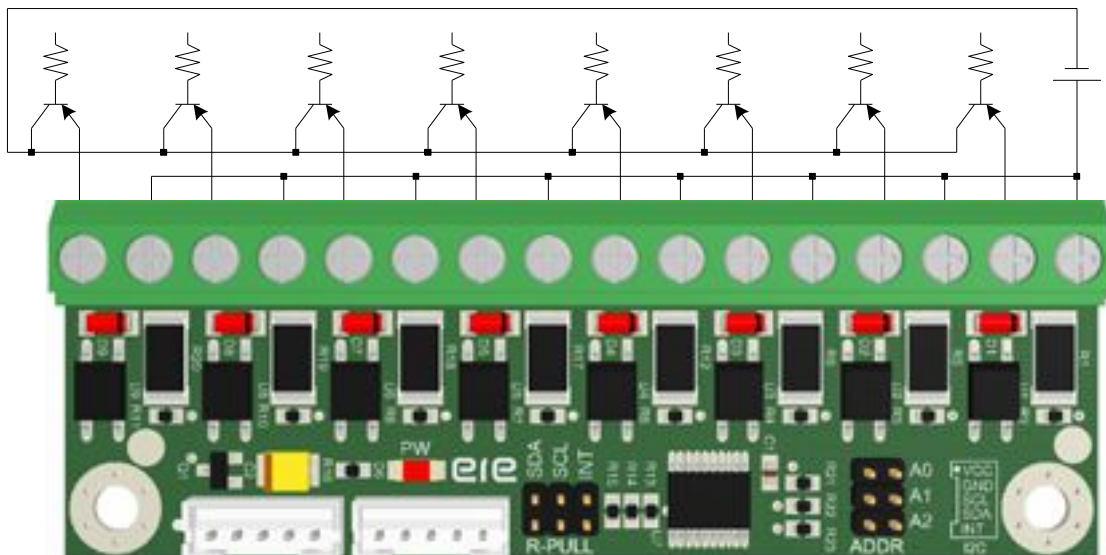**Application Note7:** PNP Transistors are turning on/off voltage, common collector.

Figure 17: PNP Transistors, Common collector

Application Note 8: Several input types are connecting to inputs of board (1).
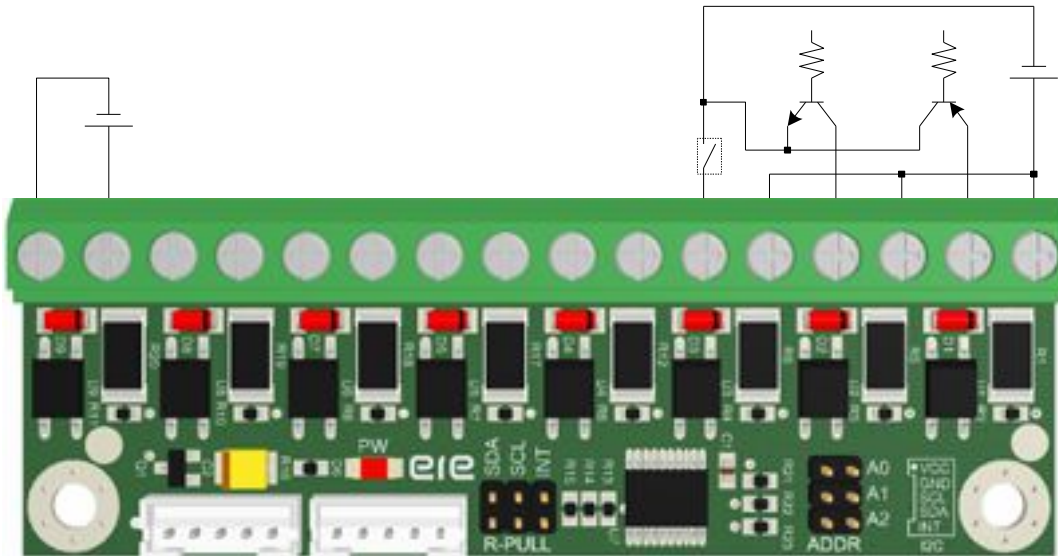

Figure 18: Multiple input Types (1)

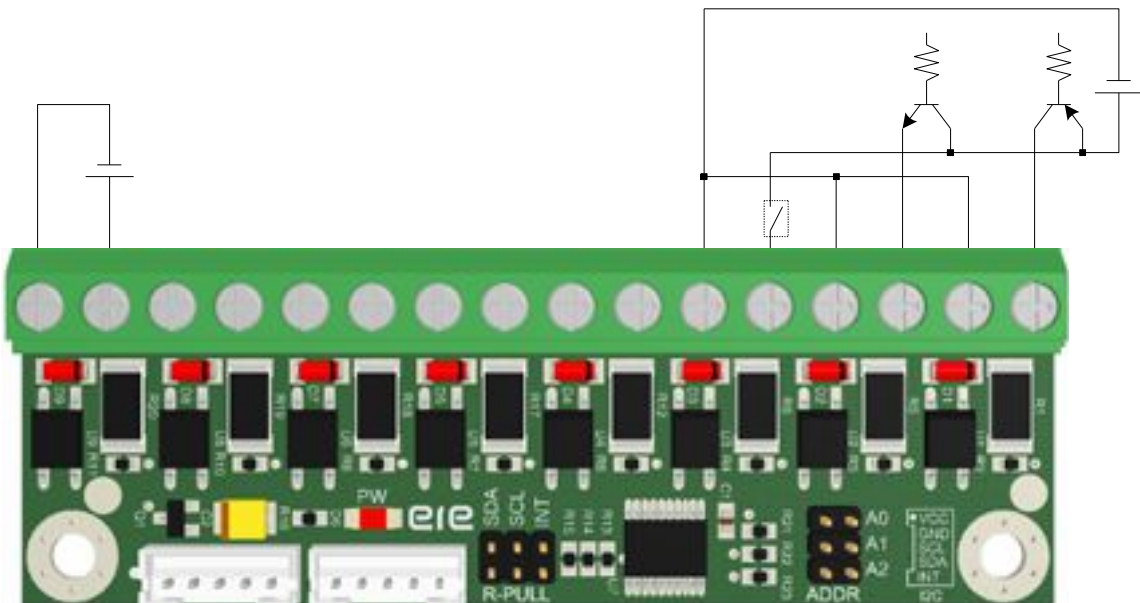**Application Note 9:** Several input types are connecting to inputs of board (2).

Figure 19: Multiple input types (2)

Table 2: Absolute maximum ratings

Max. bus frequency	100Khz	
Chips	PCF8574 and PCF8574A (*1)	
Bus logic voltage	2.5-5.5Vdc	
Max. boards on a bus	8(16) boards	
Min. Hi logic of input voltage	3.0Vdc (5% error)	
Max. Hi logic of input voltage	30Vdc (5% error) (*2)	
Optical isolated input voltage	3.7kVdc	
Input channels	8 channels	
Optical input currents	~1.8mA	input voltage = 3.0Vdc
	~3.8mA	input voltage = 5.0Vdc
	~10.8mA	input voltage = 12Vdc
	~28.8mA	input voltage = 30Vdc
Power supply input voltage	2.5– 5.5Vdc	
On board pull-up resistors	10Kohm (*3)	
Connector pins x pitch	5-pin x 2.00mm	

(*1) PCF8574 for I2C-IN830S, PCF8574A for I2C-IN830SA

(*2) more than 30Vdc, need external resistors.

(*3) Selectable by jumpers

Dimensions

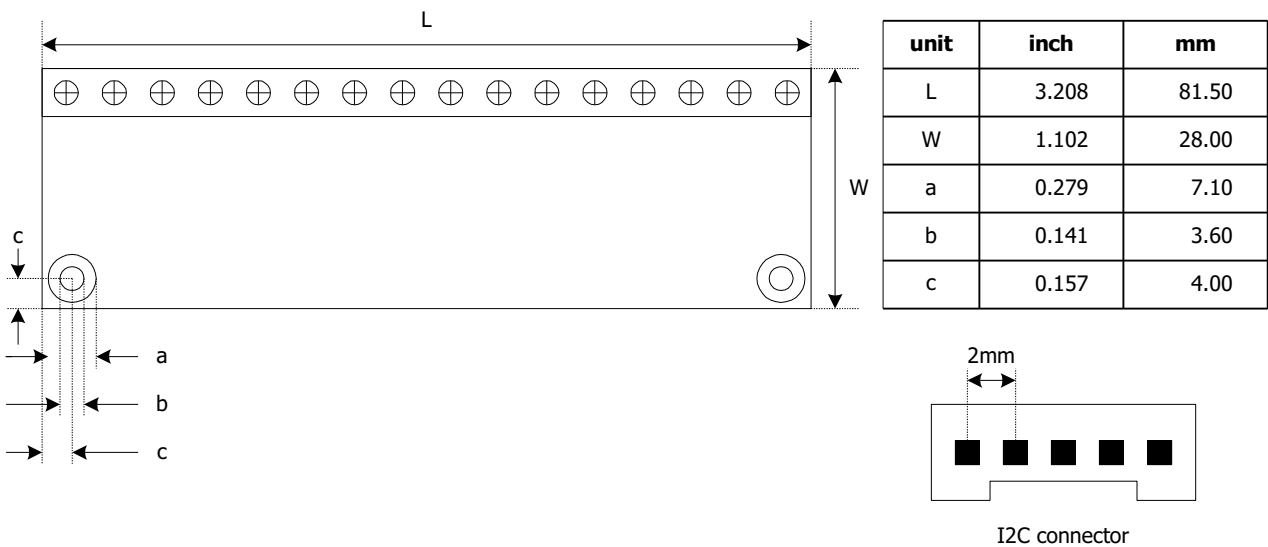| unit	inch	mm
L	3.208	81.50
W	1.102	28.00
a	0.279	7.10
b	0.141	3.60
c	0.157	4.00

I2C connector

Figure 20: Board dimensions